Report on the eel stock, fishery, and other impacts in:

Lithuania

2023

Note to the reader – this document accompanies a series of spreadsheet tables that provide the bulk of the data in a format most suitable for the working practices of WGEEL. Summaries of these data are provided in this document.

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Contribution to the report: L. Ložys and J. Dainys did the latest update of the assessment of eel stock in Lithuania, provided information on most other parts of the report and edited the text. A. Švagždys provided information and results on eel sampling implemented by Klaipeda University (produced chapter 5.3 and contributed to 5.4)

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We express our sincere gratitude to Dr. Willem Dekker for his help in 2018 and 2020 with assessments of Lithuanian eel stock.

Contents

1 Summary of national and international stock status indicators

1.1 Escapement biomass and mortality rates

The most recent data (2023) on assessed areas and stock indicators for Lithuanian national EMU are presented in Table 1. Source: Ložys & Dainys (2023).

Table 1. EMP Progress Report (2023) summary table for stock indicators for 2007-2023 (Ložys & Dainys 2023).

Table 1. Stock indicators of silver eel escapement, biomass and mortality rates, and assessed habitat area.

Year	EMU_code	Assessed Area (ha)	B_0 (kg)	B_{curr} (kg)	B_{best} (kg)	Bcurr/B_0 (%)	∑F	∑H	∑A
2007	LT_Lith	116854	87000	30529	39650	35,1	18,5%	4,5%	23,0%
2008	LT_Lith	116854	87000	21309	29954	24,5	22,3%	6,6%	28,9%
2009	LT_Lith	116854	87000	22675	28491	26,1	13,0%	7,4%	20,4%
2010	LT_Lith	116854	87000	15141	31234	17,4	44,3%	7,2%	51,5%
2011	LT_Lith	116854	87000	23772	34029	27,3	23,3%	6,9%	30,1%
2012	LT_Lith	116854	87000	25608	34024	29,4	18,3%	6,4%	24,7%
2013	LT_Lith	116854	87000	16073	30496	18,5	41,2%	6,1%	47,3%
2014	LT_Lith	116854	87000	16324	24659	18,8	26,2%	7,6%	33,8%
2015	LT_Lith	116854	87000	12022	18571	13,8	27,7%	7,5%	35,3%
2016	LT_Lith	116854	87000	4405	13898	5,1	62,2%	6,1%	68,3%
2017	LT_Lith	116854	87000	1115	11226	1,3	85,7%	4,4%	90,1%
2018	LT_Lith	116854	87000	1158	10099	1,3	82,7%	5,8%	88,5%
2019	LT_Lith	116854	87000	6253	9569	7,2	28,9%	5,8%	34,7%
2020	LT_Lith	116854	87000	4939	8850	5,7	39,0%	5,2%	44,2%
2021	LT_Lith	116854	87000	1223	7781	1,4	80,1%	4.2%	84,3%
2022	LT_Lith	116854	87000	0	6936	0	100%	2,9%	100%
2023	LT_Lith	116854	87000	2490	7441	3,2	65%	1,5%	66,5%

Key:

EMU_code = Eel Management Unit code (see Table 2 for list of codes); B_0 = the amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the stock (kg); B_{curr} = the amount of silver eel biomass that currently escapes to the sea to spawn (in the assessment year) (kg); B_{best} = the amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the current stock (kg); ∑F = mortality due to fishing, summed over the age groups in the stock (rate); ∑H = anthropogenic mortality excluding the fishery, summed over the age groups in the stock (rate); ∑A = all anthropogenic mortality summed over the age groups in the stock (rate); Assessed area (ha) = combined area total (ha) of transitional and inland waters.

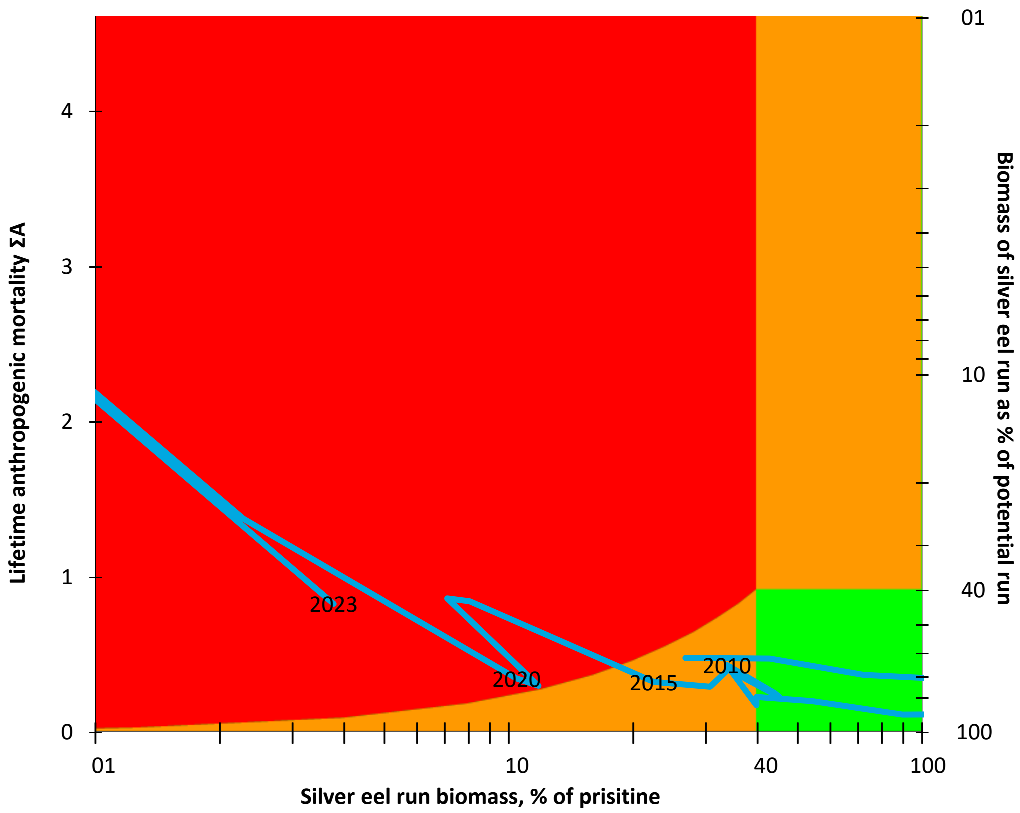

Fig. 1.1. Precautionary diagram for the Lithuanian eel stock in inland waters

1.2 Recruitment time series

Eels recruit to Lithuanian coastal waters at yellow eel stage and presumably in very low numbers nowadays. Recruitment is not monitored; therefore, there is no data on the recruitment level. Inland stock is of the restocked origin.

2 Overview of the national stock and its management

2.1 Describe the eel stock and its management

2.1.1 Eel stock in Lithuania

Typical eel habitats in Lithuania are lakes, ponds, Curonian lagoon and coastal waters of the Baltic Sea. Rivers, especially small, in Lithuania are not considered as typical eel habitats (Anon. 2008); however, in some rare cases single eels are caught in rivers during research surveys or by anglers. According to dr. T. Virbickas (pers. com. 2008 and 2016) in Lithuania only single eels are caught during electrofishing surveys in rivers and in all cases in close distance from stocked lakes. On the other hand, in recent years some eels were stocked to large rivers (especially large numbers were stocked to large rivers in December 2023; 5.2 mln. eels in total were stocked in Lithuania in 2023) and of course rivers serve as ways for eel, including silver eel, migration.

It is known that eels in the inland waters are of stocked origin (Anon. 2008). However, according to otolith microchemical analyses, eels in the Curonian Lagoon and the Baltic Sea coastal waters 80% and 98% respectively are of natural origin and 20% and 2% are stocked (Shiao et. al. 2006 and Lin et. al. 2007).

Even in the past when eel stock was in good condition in all range of species distribution and stocking was not launched yet, large eel fishery was known in the Curonian lagoon, while there is no data on specialized fishery for eels in the inland waters. Study done on eel otoliths in 2015 suggests that 94% of eels caught in the Curonian lagoon were of stocked and only 6% of natural origin. However, most of caught and analysed eels (80%) were at silver eel stage and caught during autumn, i.e. likely migrated from lakes for spawning in the Atlantic Ocean.

According to historical data (Shiao et al. 2006) first stockings in Lithuanian inland waters were performed during 1928-1939 in Vilnius region (currently part of the stocked lakes belongs to Belarus). Stocking of lakes resulted in later rise of eel fishery in continental part of Lithuania. Commercial catches until the beginning of sixties were registered almost only in water bodies of Vilnius region where eels were stocked during 1928-1939, while in the rest part of the country fishery for eels did not exist or was negligible. After first post-war stockings (starting from 1956), eel catches during 1970-1991 reasonably increased in the entire territory of Lithuania. It is evident, that inland stock and its‘ abundance directly depends on stocking; natural eel stocks in the Curonian lagoon and coastal waters of the Baltic Sea are in steep decline due to overall decline of the stock and recruitment in all range of the species distribution.

2.1.2 EMU and EMP

ICES estimated eel stock to be outside safe biological limits and continuously (1999-2006) recommended to take urgent international measures to protect the stock by reducing fishery mortality as much as possible until plan to protect and restore eel stock will be developed. As the result EC prepared a Communication entitled "Development of a Community Action Plan for the management of European Eel (COM(2003) 573 final)" in 2003. In 2005 EC announced the initial proposal for a Council Regulation establishing measures for the recovery of the stock of European eel. The final decision concerning the Council Regulation has been approved in 2007 ((EC) No 1100/2007). The Regulation obligates Member States to define the current state of their stocks, identify measures necessary for the recovery of stocks, implement these measures and assess the effectiveness of these actions.

Even though eels in Lithuania are not abundant and the national fishery accounted for 0.1-0.2% of the total European eel catch only, the country, abiding by the principle of solidarity, participated in the discussions for the preparation of the Council Regulation, initiated scientific research on eels and took the first preventive measures to minimise the impact on fishing of stocks prior to the entry into force of the Regulation.

Despite the lack of detailed information on the past state of eel stocks in the country, Lithuania sought, in developing the Eel Management Plan, to collect the most accurate information possible about the past and current state of eel stocks in the country and, taking into account the information available, to take adequate measures for preventing the decline, to seek the recovery in the future and to establish a system for monitoring of the stock.

Lithuania has designated **one Management Unit for the national EMP** based on Council Regulation (EC) 1100/2007 where Article 2(1) stipulates such a possibility and developed one EMP for the whole territory of the country. Following assumptions were considered:

The commercial catch is low and eels are not abundant in Lithuania (around 15 t annually over the past 10 years prior preparation of the EMP),

The Nemunas RBD comprises 74% of the territory of Lithuania and 81% of eel habitats,

About 99% of eels were stocked to the Nemunas RBD since 1983,

About 99% of eel catch and stocks are attributed to the Nemunas RBD,

The Nemunas RBD includes 96% of lakes and reservoirs from which eels can escape unaffected by turbines or at least through fish-passes installed on HPP dams,

Although the Daugava RBD comprises a fairly large part of lakes and reservoirs (11.6%), escapement to the sea is restricted by three large HPs in Latvia,

Conditions in the other RBDs are similar (except for the different impacts of HPPs), thus no specific measures for implementation of the plan in the other basins are needed.

The EMP Management Unit has been designated according to Lithuania's division into RBDs under Directive 2000/60/EC (Fig. 2.1). The EMP also includes the Baltic Sea coastal zone.

Lithuania submitted national EMP to EC at the end of 2008 and after positive evaluation by experts the EMP was approved by the decision C(2009)10244/F1 on 22/12/2009. Implementation of the EMP was started at the beginning of 2011; first and second reports on the implementation of the EMP were submitted to EC in 2012, 2015, 2018 and 2021 accordingly.

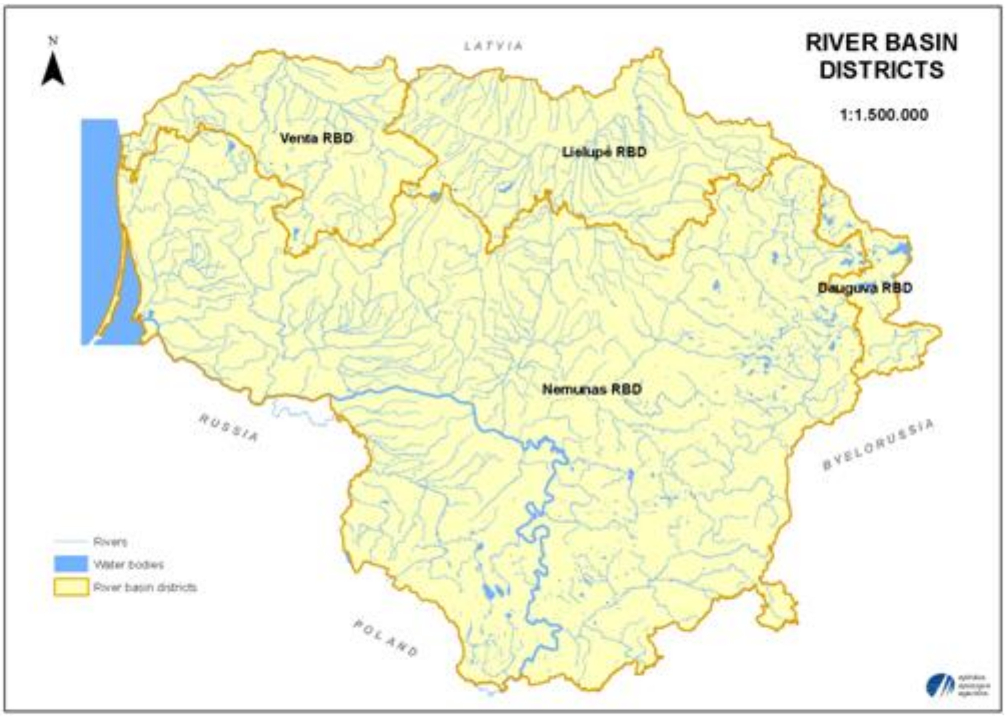

Fig. 2.1. Lithuanian River Basin Districts (map produced by Environmental Protection Agency).

2.1.3 Management authorities

Management authorities in the fisheries sector in Lithuania are:

***The Ministry of Agriculture*:** creates and implements Lithuanian fisheries policy, conducts management of the fisheries sector, implements the fisheries policy according to the European Union regulations, measures related to conservation of fish stocks and controls fishery in maritime waters. The Ministry regulates commercial fishery in maritime waters; owns and uses a fisheries data information system (sea catches, fishery companies, economic and biological data, etc.). The Fisheries Service under the Ministry of Agriculture of the Republic of Lithuania implements Lithuanian Eel Management Plan and eel recovery activities in Lithuania. Until 2018 the Fisheries Service was responsible for the collection of the eel data under the National data collection programme. As of 2019 the Klaipėda University has been appointed as responsible organisation for the collection of eel data under the programme in cooperation with Fisheries Service.

***The Ministry of Environment*:** is responsible for inland fish stock conservation and control policy, conducts management of the fisheries sector in country's inland water bodies. The Ministry regulates commercial and recreational fisheries in inland water bodies; manages and uses a data system of fisheries in inland water bodies (catches, fishery companies, etc.). The Ministry of Environment is responsible for the exploitation of fish stocks in inland water bodies, including the Curonian Lagoon.

The Eel Regulation contains the obligation to prepare and implement the EMP (in the eel case especially for inland waters), both ministries assume the responsibility for implementation of the EMP. In addition, conservation measures for protected fish species, their habitats and migratory routes (including the eel) is area of responsibility of the Ministry of Environment. The activities related to improving aquaculture, reproduction and migration pathways of protected fish species is area of responsibility of the Ministry of Agriculture. Fish stocking programmes for state water bodies (including eel stocking) are approved by both Ministries.

2.1.4 Regulations

The fishery for eels has been regulated in several ways in Lithuania. Licensing for particular number of fishing sites on streams/rivers goes through auction performed by the Fisheries Service; the commercial fishery is restricted to two and half month per year (from mid-March till the end of May), commercial eel fishery in lakes is banned. In the Curonian lagoon number of fishing gears (fykenets) is reduced (eels are caught as minor by-catch). All companies operating in commercial fishery must have licenses and fill in log-books daily. Daily bag limit in recreational fishery is reduced to 3 eels per fishing trip. In the Baltic Sea commercial fishery is not allowed to target eel, and practically is banned (see additional details related to fishery restrictions in chapter 2.1.5).

2.1.5 Management actions

Preparing national EMP some practical precautionary measures were planned and included into the EMP aiming to reduce anthropogenic mortality in order to stop stock decline and to ensure stock recovery: to introduce some restrictions for eel fishery in the Curonian Lagoon and the Baltic Sea, to shorten overall fishing season in the inland waters, to restrict fishing season for yellow eels to 3 months/year, to introduce restrictions related to long-line fishery, to reduce bag limit in recreational fishery (i. e. angling) and etc.

Aiming to reduce silver eel mortality the Ministry of Environment reduced number of fishing sites for migrating eels on small rivers by 43% in 2009 (however, later increased, and reduction from the starting point has been 34% currently), and banned specialized eel fishery using eel fykenets in lakes and ponds for period from 15 of March until 30 of June. In addition, aiming to improve protection of migrating fish commercial fishery was banned in three northernmost fishing sectors of the Curonian Lagoon (closest to the Klaipeda Strait). Bag/day limit in recreational fishery (angling) was reduced from 5 eels to 3; from 2013 recreational angling in marine waters was banned.

Season for migrating (silver) eel commercial fishery was considerably shortened to two months from 2010: it is allowed from 1 of April until 1st of June; autumn season for the fishery has been banned (used to be from 1 of September to 31 of October). Aiming to reduce bycatch of young eels it was banned to use earth worms in long-line fishery.

In 2015 in Lithuanian inland waters commercial fishery has been banned by the Ministry of Environment, however, fishery for migrating eels, lake smelt, vendace and river lamprey is still allowed. However, specialized fishery for eels using fykenets and long-lines is actually banned and only fishery for migrating eels in rivers allowed from 15th of March until 1st of June. In 2023, the number of sites for fishing migrating eels on streams has been further reduced, and the spring commercial fishery for silver eels is currently allowed in 18 streams only (compared to 38 previously); it is expected that the last fishing season will be 2025 and in 2026 total closure will be achieved.

Number of fyke-nets was reduced by 46% in the Curonian Lagoon: from 413 in 2008 to 223 currently. In the Baltic Sea specialized eel fishery is banned. It is complicated to estimate extent of illegal fishery for migrating eels in rivers, however, despite very high fines (in 2020 increased from 290 to 480 euro per fish) it still might take place and make some impact on the stock.

Since the beginning of the EMP implementation bag limit has been reduced from 5 to 3 eels in recreational fishery (under the definition „recreational fishery“ falls not only angling using hook but also spearfishing). In 2022 recreational fishing is also banned in the Curonian lagoon from 1st of October until 31st of December, at the end of 2022 recreational fishing in the Curonian lagoon was completely banned. Spearfishing was allowed in 11 water bodies (12 in 2012) but now number has been reduced to 7 (6 lakes and coastal waters of the Baltic Sea). However, in case if waterbody is rented, owner of a lake personally decides to allow spearfishing or not. Impact of recreational fishery is not well known, and still is under discussion among experts despite some attempts to make such estimation.

After EMP was approved by EC first stockings were performed in 2011 and until 2023 160 water bodies (mostly lakes) were stocked with 14,5 million of young eels, i. e. 1,1 million annually on average during the period from 2011 to 2023. Due to unsuccessful public tender in 2017 stocking has not been done, although, in 2018 1,65 million, in 2019 1,60 million, in 2020 1,37 million of on-grown (OG) eels where stocked. In 2021 due to unsuccessful public tender again stocking has not been done, however 1,7 million of for short period on-grown eels were stocked again in 2022. 5,2 million eels were stocked in 2023.

According to the national EMP, eels in Lithuania should not be stocked to basins upstream hydropower.

2.2 Significant changes since last report

There are no significant changes since last report.

3 Impacts on the national stock

3.1 Fisheries

3.1.1 Glass eel fisheries

There is no fishery for glass eels in Lithuania.

3.1.2 Yellow eel fisheries

According to eel fishery statistics during last ~two decades (1997-2022), eel landings marginally increased in the inland waters (most eels fished are silver eels, c. 1/4 yellow; Dainys 2017) but at the same time it was steep decline of catches in the Curonian Lagoon. Most eels fished in the Curonian lagoon were yellow eels, however, proportion of silver eels is increasing recently due to decline in natural local stock and migrating eels from inland waters through the Lagoon (fig. 3.1).

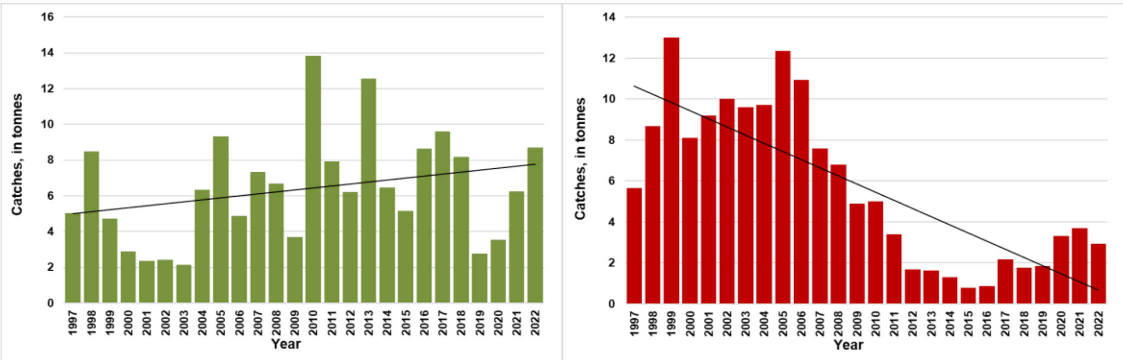

Fig. 3.1. Eel catches in commercial fishery in inland water bodies (green colour) and the Curonian Lagoon (red colour) during 1997-2022.

However, tendencies of the decline of eel landings in the Curonian Lagoon (mostly natural recruits) started at the end of sixties or beginning of seventies (fig. 3.3), while landings from inland waters fishery (stocked eels) seems to be more stable (fig. 3.2)

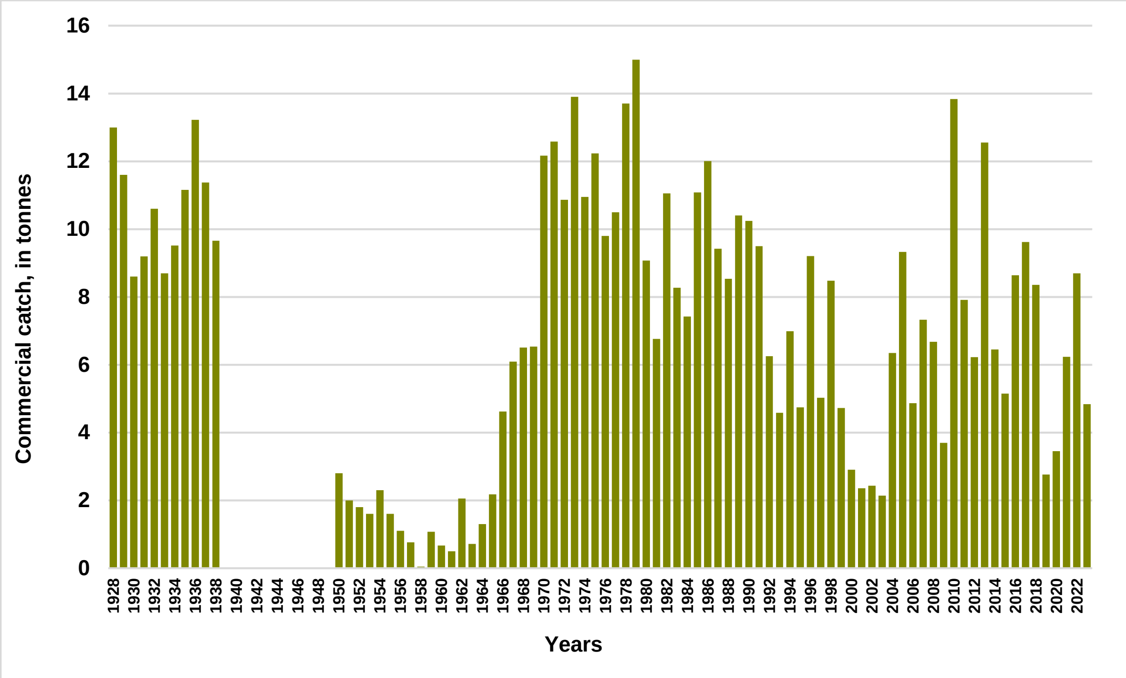

Fig. 3.2 Time trend in the reported catches from the inland fishery since 1950 to 2023 (without the Curonian lagoon; no data for 1939-1949).

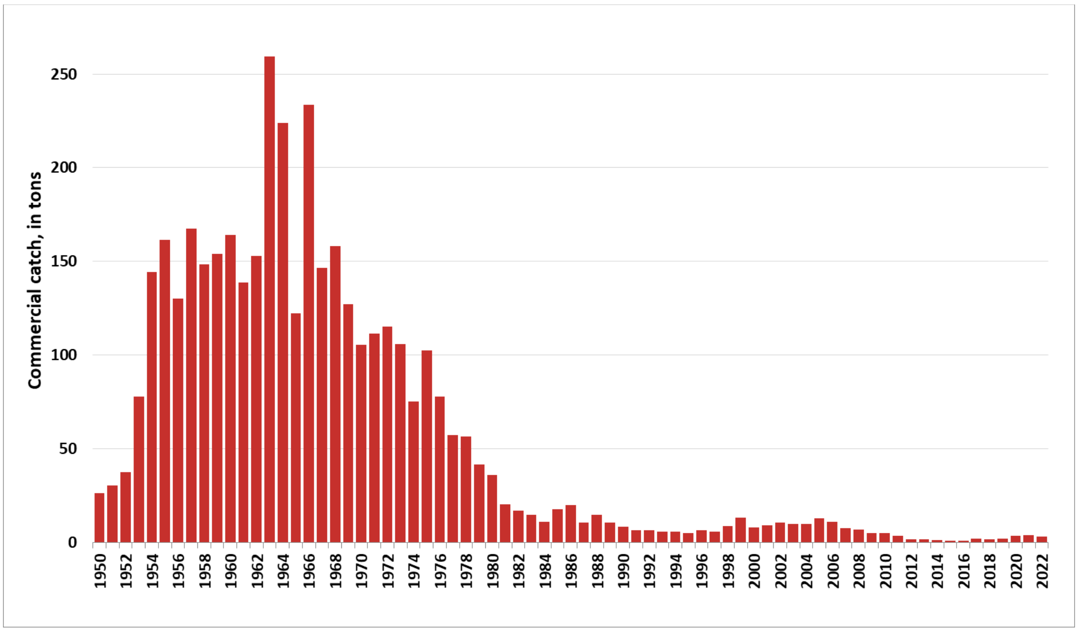

Fig. 3.3 Time trend of reported catches from the Curonian lagoon fishery since 1950 to 2022 (only Lithuanian part of the Lagoon, c. ¼ of total area, except Russian part of the lagoon).

3.1.3 Silver eel fisheries

In Lithuania eel fishery is mixed (yellow and silver) (see chapter 3.1.2).

3.2 Restocking

Stocking of Lithuanian waters with glass eels started in Vilnius region during 1928 and lasted until 1939. During that period approximately 3.2 million glass eels were released (Mačionis, 1969). Subsequent stocking with glass eels (originating from France or Great Britain) was carried out in the post-war period during 1956–2007. According to official data, a total of 148 lakes and ponds were stocked with 50 million glass and on-grown eels (on average 1.25 million per year) (Ložys et al., 2008). The most intensive stocking period was during 1960–1986 (in total 33.2 million eels were released), while later stocking activities became irregular and only in low numbers. The last considerable stocking, prior to implementation of the Lithuanian Eel Management Plan, was made in 2004 when 70.1 thousand eels were released into Lithuanian water bodies.

After EMP was approved by EC first stockings were performed in 2011 and until 2023 160 water bodies (mostly lakes) were stocked with 14,5 million of young eels, i. e. 1,1 million annually on average during the period from 2011 to 2023. Due to unsuccessful public tender in 2017 stocking has not been done, although, in 2018 1,65 million, in 2019 1,60 million, in 2020 1,37 million of on-grown (OG) eels where stocked. In 2021 due to unsuccessful public tender again stocking has not been done, however 1,7 million of for short period on-grown eels were stocked again in 2022. 4,4 million eels were stocked in 2023.

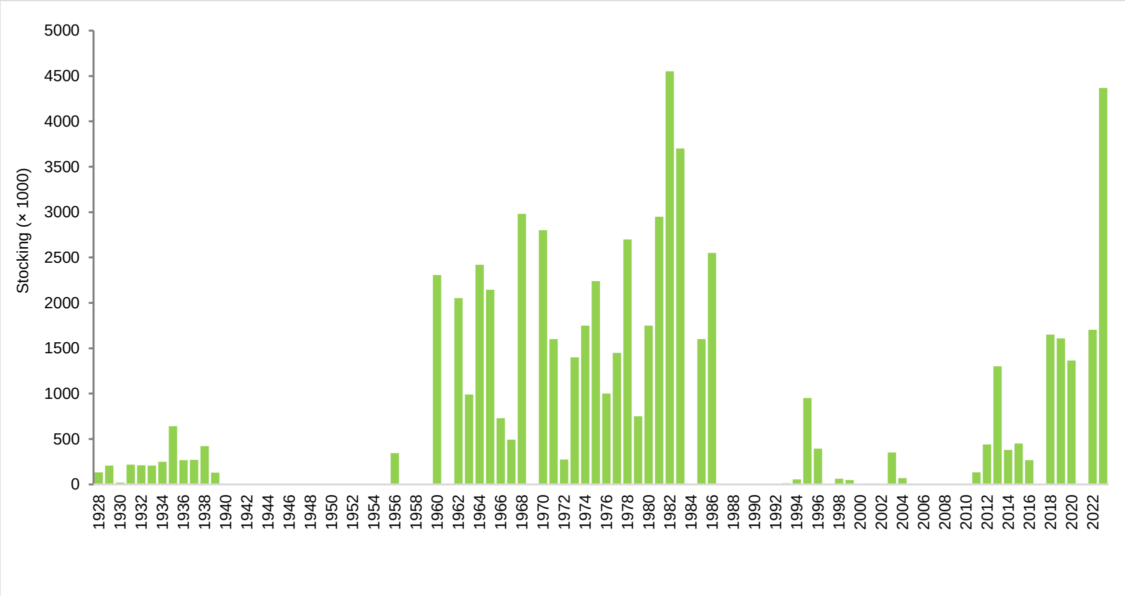

Fig. 3.4 Stocking of inland water bodies with ongrown and glass eels in the period 1928 to 2023 (thousand individuals).

Table 3.1. Eel stocking activity in Lithuanian inland waters carried out by the Fisheries Service during 2011 – 2023*.

Year	Released eels, in numbers	Stocked eels, weight in g	Country of origin
2011	134 000	10-11	UK, LT
2012	440 000	2.5	DK, PL
2013	1 300 000	0.3-1	FR
2014	380 500	1-1.2	UK
2015	449 400	0.8-1.4	FR
2016	265 700	0.8-1.4	UK
2017	-	-	-
2018	1 650 000	0.8	UK
2019	1 590 000	1	UK
2020	1 366 700	0.8	UK
2021	-	-	-
2022	1 702 000	0.9	FR
2023	4 367 000	0.3-1	FR

* *Fisheries Service under the Ministry of Agriculture of the Republic of Lithuania data*

3.3 Aquaculture

In Lithuania, eels were farmed by one company since 1998. In 2016, three companies have been farming eels and reported their production in recirculation systems (Table 3.2). However, during 2017 - 2021 only one aquaculture company reported on production of farmed eels. Therefore, the information is confidential and can't be provided according to EU legislation.

Table 3.2. Eel production in aquaculture during 1998–2021.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Production, in kg	2000	2000	1000	5000	17000	20000	9000	8000	12000	13000	10600	12000

	2010	2011	2012	2013	2014	2015	2016	2017-2023
Production, in kg	8300	12600	3500	3466	7148	205	36400	*

* *Since only one company has been farming eels in aquaculture in Lithuania, according to recent EU legislation data are confidential, and therefore not provided. Overall the capacity of the company is estimated to be from 70 to up to 170 tonnes of eels/year.*

3.4 Entrainment

A database on hydropower plants was created based on information available at the „Rivers, lakes and ponds cadastre of The Republic of Lithuania", booklet issued by Lithuanian hydropower association "Hydropower in Lithuania" (2011) and "Small hydroenergetics" (Bilys et al.

2017). In most cases detailed information on ownership of hydropower plants, turbine types and capacity, location and year of construction or reconstruction is available.

Stocking of eels in Lithuania during 1950-2009 (before the implementation of National eel management plan), was carried without aim to allow later migration to the sea for spawning, thus significant part of stocked eels had to pass HPP turbines during their downstream migrations (Fig. 3.5). Eel stockings carried during 2011-2023 were performed in accordance with approach of the Lithuanian EMP: eels were stocked to water bodies from which eel migration route to the sea is free or HPP's, if any, has fish pass.

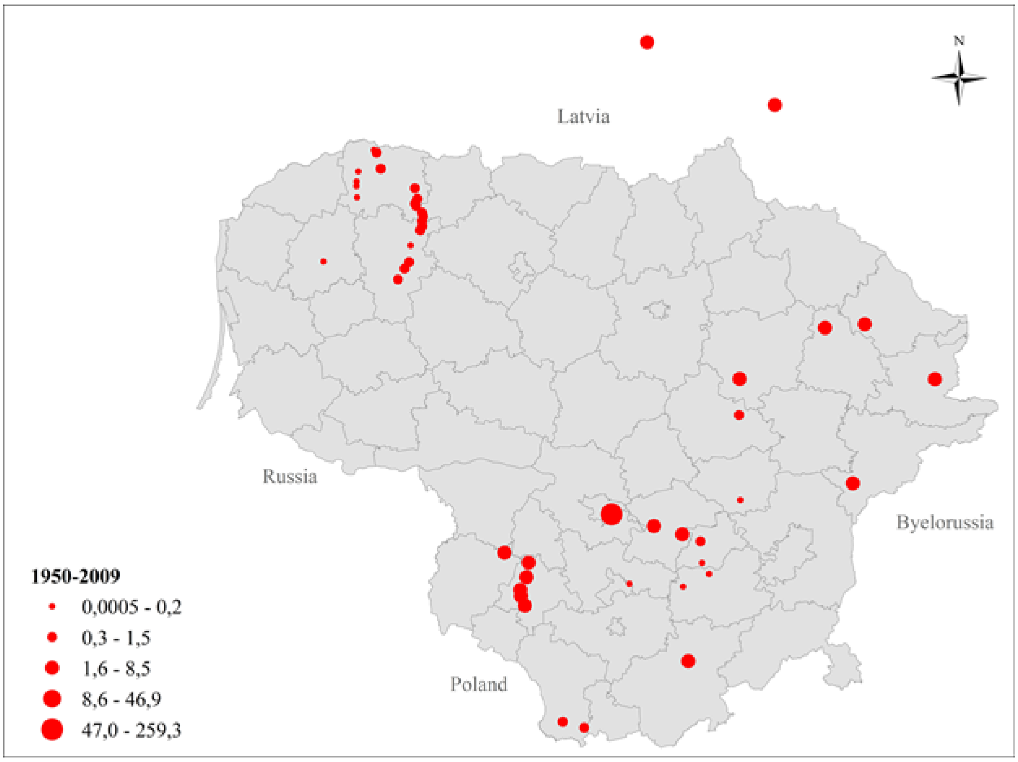

Fig. 3.5 Spatial distribution of the HPPs having an eel stock upstream (stockings were carried during 1950-2009, before the implementation of the Lithuanian EMP). The size of the symbols in this figure is proportional to the number of eels (in million) stocked upstream of each station.

Most of the eels were stocked to the water bodies that are free from HPP impact, and eel migration routes to the sea goes in free-flowing rivers or river sections. However, in some cases a HPP had been built or reconstructed downstream the water body which was previously stocked with eels. Such situation occurred after the Ramučiai pond was stocked in 2012 (this pond was identified as without HPP downstream in the Lithuanian EMP). According to the data of the „Rivers, lakes and ponds cadastre of The Republic of Lithuania" and "Small hydroenergetics" (Bilys et al. 2017) Tūbausiai HPP was equipped with Kalpan turbine and started operating in 2012 (the same situation occurred in 6 other cases, see table 6.1). In 2012 the Plateliai lake was stocked with the eels, although in Lithuanian EMP this lake was assigned to the water bodies upstream of HPP (Gondingos HPP was built in 1961 and reconstructed in 2000; Table 3.3). According to Lithuanian hydropower association (Bilys et al., 2017), Plungė HPP was reconstructed in 2011 and one 37 kW turbine was installed. In other stocking cases eels were released to HPP-free water bodies, or HPPs downstream stocked lake were equipped with fish pass. According to guidelines set in Lithuanian EMP, eel stocking in such waters is possible, however study by Dainys et al. (2018) demonstrated that only one third of all downstream migrating eels migrate through the fish pass. Therefore, more effective eel protection measures are needed to be implemented. According to the assessment of the HPP impacts in Lithuania (Ložys & Dainys 2023), in 2017, 2018, 2019, 2020, 2021, 2022 and 2023 accordingly 4,4%, 5,8%, 5,8%, 5,2%, 4,2%, 2,9% and 1,5% of silver eels produced in Lithuanian inland waters were estimated to be killed in HPP installations.

Table 3.3. Eel stockings to the lakes upstream HPP without fish pass.

Stocked water body	Year of stocking	Year of HPP (re)construction	HPP name	Water body status given in Lithuanian EMP (year 2008)
Janušonių Pond	2012	2010	Janušonių	No HPP downstream
Lake Karklėnų	2012	2013	Kelmės	No HPP downstream
Lake Pikeliškių	2012	2012	Liubavo	No HPP downstream
Lake Gauštvinis	2012	2012	Pagryžuvio	No HPP downstream
Pajiesio Pond	2012	2008	Pajiesio	No HPP downstream
Lake Plateliai	2012	2011	Plungės	Upstream HPP
Ramučių Pond	2012	2012	Ramučių	No HPP downstream
Tūbausių Pond	2012	2011	Tūbausių	No HPP downstream
Antalieptės Pond	2012 2013 2014	1961 (2001)	Antalieptės	HPP with fish pass

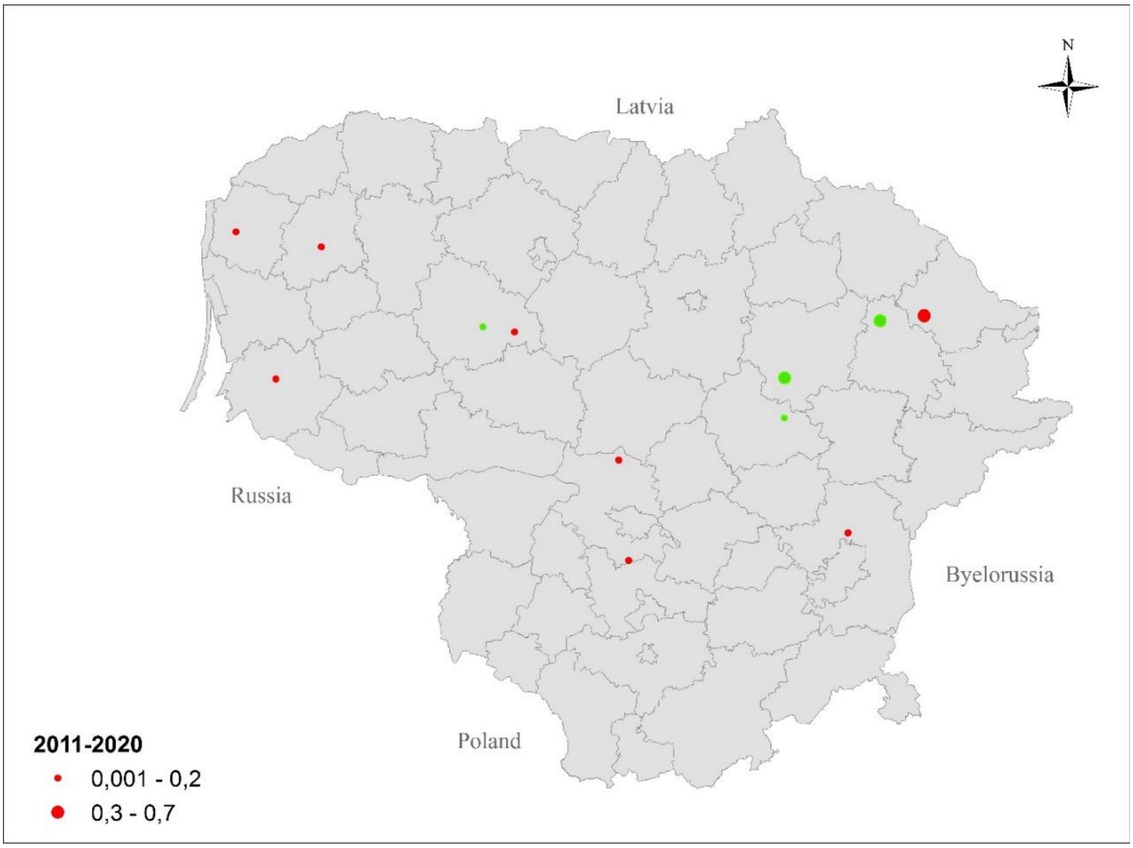

Fig. 3.6 Spatial distribution of the HPPs having an eel stock upstream (stockings were carried during 2011-2023 after start of the implementation of the Lithuanian EMP). The size of the symbols in this figure is proportional to the number of eels (in million) stocked upstream of each station (green colour indicates HPPs with installed fish pass).

3.5 Habitat Quantity and Quality

There are numerous, different in size, lakes and rivers well suited for eel production in Lithuania. The restricted restocking in combination with migration obstacles are the limiting factors. Hydropower turbines are the limiting factor for restocking to inland lakes and water reservoirs. According to estimations of the national EMP, in total, 75.8% of lakes and reservoirs (by area) are located upstream hydropower plants. 15.3% (out of the 75.8%) of the water bodies are situated in basins upstream hydropower plants with passes for fish. Hence, it is most limiting factor for the restocking. According to most recent estimation, 15,3% of lakes (larger than 0,5 ha) could be reached from the sea without any human made obstacles if eel migration upstream would occur.

3.6 Other impacts

No available data

4 National stock assessment

4.1 Description of Method

In Lithuanian inland waters most anthropogenic interactions with the eel stock happen to relate to either the youngest (glass eels and elvers) or the oldest stages (silver eel, or yellow eel close to the silver eel stage) due to fishery (F) and hydropower (H) related mortality – impacts during the long growing stage are much more infrequent. Developing a simple conversion between the youngest and the oldest stages, the silver eel production over the past seven decades is reconstructed based on eel restocking (import from abroad), in a spatially explicit reconstruction. Subtracting the fishing harvest and down-sizing for the mortality incurred when passing hydropower stations, an estimate of the biomass of silver eel escaping to the sea is derived.

A reconstruction of the silver eel production from historical data on their youngest ages, requires an extrapolation over many years, assumptions on growth and mortality, and a comparison between reconstructed (production) and actually observed (catch) variables. Though this makes the best use of the available information, it might not reflect the results to be fully reliable in all detail. Production estimates for individual lakes in specific years will certainly be much less reliable than nation-wide estimates, or decadal averages, and so forth. Hence, the presentation of results will be restricted to nation-wide averages.

4.1.1 Data collection

Statistics of commercial catch and eel restocking, specifying year, quantity (number), life stage (glass eels), destination location (name of the lake/river) have been collected in various Lithuanian archives and covered years since 1928, but in some cases detailed time series are not complete or data are missing. Data series of higher reliability start in 1950 and continue until nowadays. However, even during this period part of total catches and part of stocked eels was not possible assign to exact water body, thus in the analysis this part of commercial catch or stocked eels was assigned to “unidentified water body”. However, for some water bodies, continuous data series exist since the beginning of eel fishery or stocking in the particular water body, and these series are considered to be complete and highly reliable. To increase reliability of the further analysis, historical records of catches/stockings were merged into the smaller sets of lakes (in total 80 groups) that allowed unique assignment of all data based on river basin and HPP's that are affecting those water bodies. These data represent eel catches and stockings only in inland waters (without the Curonian lagoon).

The current assessment reconstructed the production of silver eel available to the fishery by lake and year, from information on restocking. For the eel derived from restocking, the release location is known (lake/river name); it is assumed that within-river migration has not notably altered the spatial distribution – or more often, that downstream migration in the silver eel stage brought the eel back to the lake from which it had migrated upstream after stocking.

A database of hydropower plants was made based on information available at the „Rivers, lakes and ponds cadastre of The Republic of Lithuania“, book issued by Lithuanian hydropower association ″Hydropower in Lithuania″ (2011) and ″Small hydroenergetics″ (Bilys et al. 2017). In most cases detailed information on ownership, turbine types and capacity, location and year of construction or reconstruction was available. The mortality of eel passing a hydropower station depends on type and size of the turbine, thus mortality rate of eels passing different turbines was based on previous studies carried in Lithuania and neighbour countries (Dainys et. al. 2018; Larinier and Travade, 2002; Dêbowski et. al. 2016). If migrating eels had po pass 6 or more HPP's during their downstream migration it is assumed that mortality of these eels is 100% regardless of what turbine type is installed in each HPP.

For all locations where eel had been stocked, the route towards the sea was traced and the list of HPPs on that route derived. Individual routes pass from 0 up to 14 HPPs. For each HPP, the biomass of the escaping silver eel was reduced by a certain percentage. Summing the biomasses over all HPP gives an estimate of the total hydropower related mortality (ΣH), while the remaining biomass gives an estimate of the escapement towards the sea.

As consistent sampling of eels from Lithuanian waters (water bodies of different trophic level; eels of different age groups and etc.) started in 2017 only, the conversion from glass eels to silver eels, eel length-weight relation and eel "silvering at age" was estimated as described by Dekker (2015). However, further sampling of eels for length, weight, maturity and age analysis is continuing on a regular basis in order to obtain silvering curves for eels stocked into Lithuanian water bodies.

There are no studies on natural eel mortality (M) in Lithuania. However, we assume that M in Lithuanian and Swedish waters should be very similar. For that reason, we refer to Dekker (2015) where M=0.10.

4.1.2 Analysis

Given the time series of restocking, silver eel production is derived from the growth, silvering pattern and natural mortality:

$$Production = f(stocking, growth, mortality, maturation\ )$$

The fisheries are targeting this migrating eels (ΣF), resulting in an effective silver eel run of:

$$Silver\_eel\_run = Production - Catch$$

Passing hydropower generation stations reduces the silver eel run to:

$$Escapement = Silver\_eel\_run \times exp^{-\Sigma H}$$

The hydropower-related mortality $\sum H$ is summed over all hydropower stations on the route towards the sea - which is a different sum for each location (and year) - and Escapement is the silver eel biomass escaping towards the sea, on their route towards the spawning places. It is assumed that – other than fisheries and hydropower – no other mortality during the migration towards the sea occurs.

Rearranging the above yields:

$$\begin{aligned} Escapement &= (Production - Catch) \times exp^{-\sum H} \\ &= Production \times exp^{-\sum H} - Catch \times exp^{-\sum H} \end{aligned}$$

The latter splits the production data (first term) from the fishery data (latter term) and post-hoc sums them up; this allows processing different spatial entities for different data sets (e.g. point-locations for release of recruits versus lake-totals for fisheries).

Recent restocking will contribute to the escapement of silver eels about fifteen years from now, but some slow-growers or late-maturing eels may be found for up to twenty-five years or more. By that time, the stock will be dominated by year-classes that have not been stocked yet and will be under the influence of management measures taken in coming years. That is: the effect of today's actions can only be assessed by analysing their effect in the future, but future trends are also influenced by yet unknown actions. Not knowing those future trends and actions, the result of today's actions are assessed by extrapolating the status quo indefinitely into the future. It is assumed that future stocking is equal to the average observed value during 2011-2020 and that future fisheries and hydropower generation have an impact equal to the most recent estimate (constant mortality rate). Keeping the status quo unchanged, results for future years will express the expected effect of today's actions but will not provide an accurate prediction of the real developments (continued upward or downward trends, extra actions, and autonomous developments).

4.1.3 Reporting

Results of the assessment were reported to the Fisheries Service under Ministry of Agriculture and the European Commission in 2018, 2021-2022 and 2023 as country report on the implementation of national EMP.

4.1.4 Data quality issues and how they are being addressed

During the implementation of the EMP and evaluation of the progress of eel stock restoration in Lithuania some new data for improvement of the estimations (and reduction of biases) of eel stock in the country were collected. However, aiming to improve it further, it is needed to improve knowledge about mortalities in recreational fishery (particular study is needed) as it is still under discussion. It is also not well known about silver eel mortality in the Curonian Lagoon fishery during their migration from lakes to the sea. There are no detailed studies on predation, despite it is not likely to be very high. These additional data would allow to adjust the model built for this assessment and more precisely estimate production of silver eels in the context of measures taken under EMP and effects of natural or anthropogenic factors. But most essential: aiming to improve assessment of all EMPs in the Baltic region it is urgently needed pan-Baltic standardized and internationally recognized/approved methodologies.

4.2 Trends in Assessment results

Overall predicted silver eel production was relatively low during 1950-1970, on average 15 t/year. Later silver eel production sharply increased and in 1998 reached its maximum of 366 t. However, since 2000 silver eel production started decreasing and during 2011-2023 it was on average 16,7 t per year. If stocking intensity will remain same as it was since the beginning of EMP implementation, silver eel productions is expected to increase up to c. 127 tons in 2030-2040 (Fig. 4.1., table 4.1).

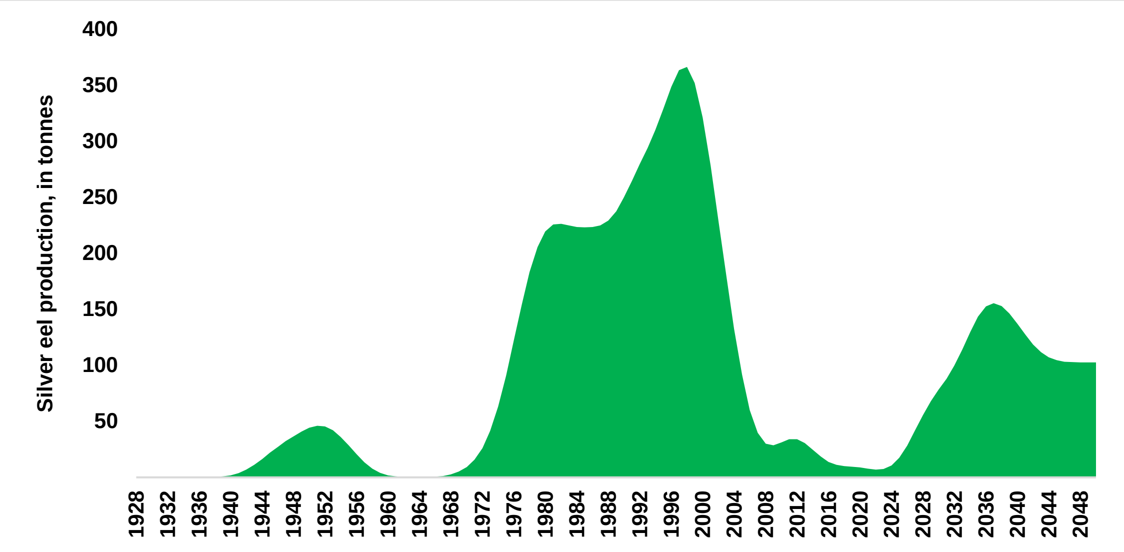

Fig. 4.1. Production of silver eel by year: the estimated total production in inland waters before the impact of fishery and hydropower (1928-2050). For these results, a natural mortality rate of M=0.10 was assumed. Future forecast is made on the assumption that stocking will be carried at the same intensity as during 2011-mid 2023 (0.8 million of glass eels stocked per year).

For the fishery in inland waters, catch varied between ~0,05 t (in 1958) and 15 t (in 1979). This is on average 31% of the production, with rather high variation over the years from 1 to more than 100% (Fig. 4.2. – 4.3.). For the period from 1961 to 1971, an extremely high (more than 100%) fishery mortality rate was calculated. If true, this might reflect intense commercial fishery on yellow eels in lakes using e.g. fykenets, longlines, electrofishing and other fishing gears, in the years before those eels would have become silver. Data on commercial catch of silver and yellow eels were pooled, and it was impossible to separate them out as of today. The assessment, however, assumes that all eels were caught as silver eels, which in later years was true. For this reason, "earlier" catch of silver eels artificially increases the estimates of fishery mortality.

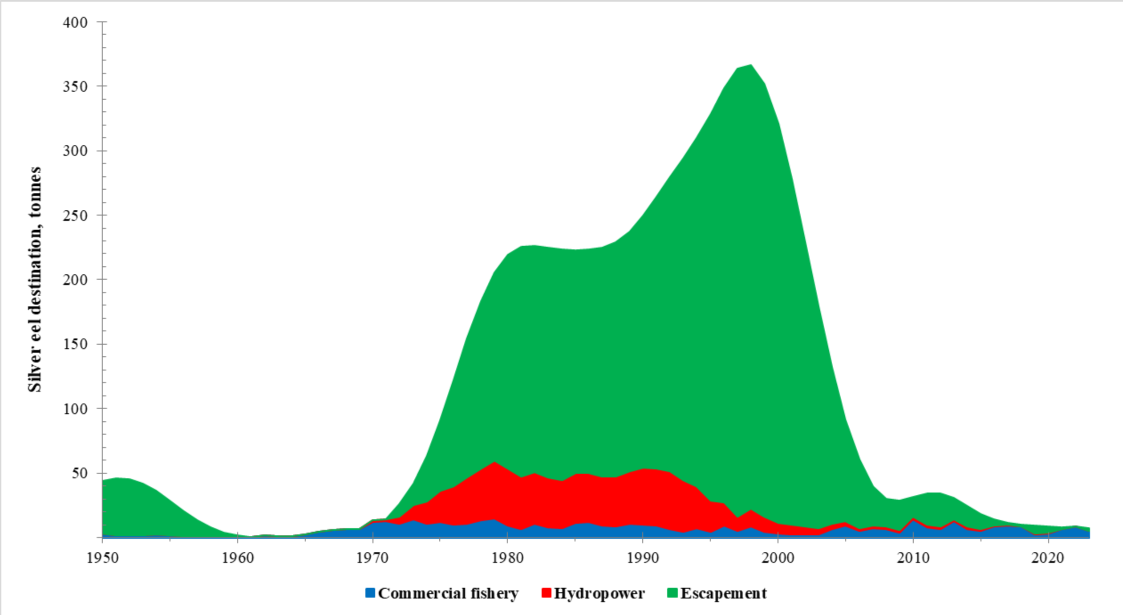

Fig. 4.2 Time trends in the destination of the silver eel produced in Lithuanian inland waters (1950-2023).

For the hydropower, the estimated impact varied between close to 0 t (in 1950-1970) and 34 t (in 1992), that is approximately 8,7% of the total production (range 0% - 27%). The estimated impact in 2020 was 0,5 t (5,2%) and 0,3 t (4,2%) in 2021. It is estimated that just over 0.1 tonnes (1.5%) of silver eels will be killed by hydroelectric turbines in 2023 (0,2 t and 2,9% in 2022).

In some cases, negative hydropower mortalities were calculated (erroneously indicating that eels were produced by hydropower plants). This happens when the estimated eel production is below the reported eel catch e.g. stocking data are missing. This is clearly an unrealistic situation. In order to minimise under- or over-estimation of eel mortalities, these "negative" data were omitted from further analysis.

Predicted escapement of silver eel ranged from 0 t (e.g. in 1962-1970) to 346 t (in 1997), on average 64% of the total production (range 0% - 99%). The estimated amount of silver eels that would escape for spawning in 2023 was 2,5 tones, with an average of 8.9 tons per year over the period of implementation of Lithuania's EMP (2011-2023) (Fig. 4.3).

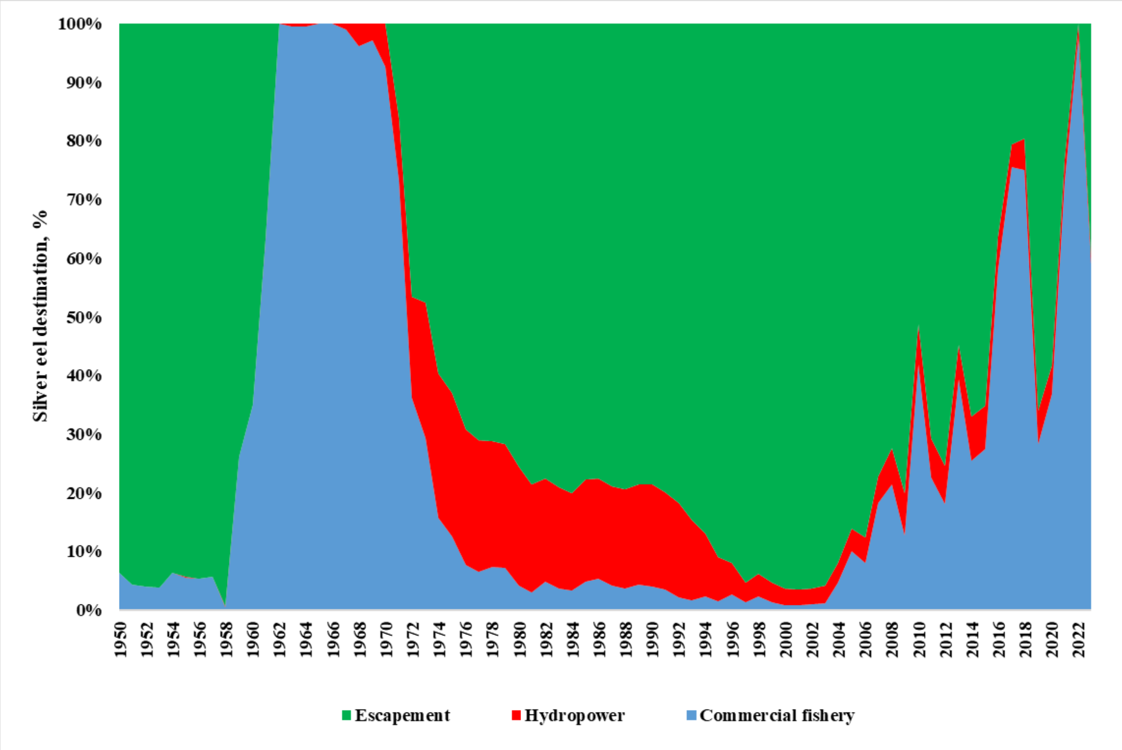

Fig. 4.3 Time trend in the estimated anthropogenic mortality and escapement, expressed in percentage impacts on the silver eel production in 1950-2023.

Table 4.1. Stock indicators of silver eel escapement, biomass and mortality rates, and assessed habitat area.

Year	EMU_code	Assessed Area (ha)	B_0 (kg)	B_{curr} (kg)	B_{best} (kg)	Bcurr/B_0 (%)	∑F	∑H	∑A
2007	LT_Lith	116854	87000	30529	39650	35,1	18,5%	4,5%	23,0%
2008	LT_Lith	116854	87000	21309	29954	24,5	22,3%	6,6%	28,9%
2009	LT_Lith	116854	87000	22675	28491	26,1	13,0%	7,4%	20,4%
2010	LT_Lith	116854	87000	15141	31234	17,4	44,3%	7,2%	51,5%
2011	LT_Lith	116854	87000	23772	34029	27,3	23,3%	6,9%	30,1%
2012	LT_Lith	116854	87000	25608	34024	29,4	18,3%	6,4%	24,7%
2013	LT_Lith	116854	87000	16073	30496	18,5	41,2%	6,1%	47,3%
2014	LT_Lith	116854	87000	16324	24659	18,8	26,2%	7,6%	33,8%
2015	LT_Lith	116854	87000	12022	18571	13,8	27,7%	7,5%	35,3%
2016	LT_Lith	116854	87000	4405	13898	5,1	62,2%	6,1%	68,3%
2017	LT_Lith	116854	87000	1115	11226	1,3	85,7%	4,4%	90,1%
2018	LT_Lith	116854	87000	1158	10099	1,3	82,7%	5,8%	88,5%
2019	LT_Lith	116854	87000	6253	9569	7,2	28,9%	5,8%	34,7%
2020	LT_Lith	116854	87000	4938	8850	5,7	39,0%	5,2%	44,2%
2021	LT_Lith	116854	87000	1224	7781	1,4	80,1%	4.2%	84,3%
2022	LT_Lith	116854	87000	0	6936	0	100%	2,9%	100%
2023	LT_Lith	116854	87000	2490	7441	3,2	65%	1,5%	66,5%

Key:

EMU_code = Eel Management Unit code (see Table 2 for list of codes); B_0 = the amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the stock (kg); B_{curr} = the amount of silver eel biomass that currently escapes to the sea to spawn (in the assessment year) (kg); B_{best} = the amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the current stock (kg); ∑F = mortality due to fishing, summed over the age groups in the stock (rate); ∑H = anthropogenic mortality excluding the fishery, summed over the age groups in the stock (rate); ∑A = all anthropogenic mortality summed over the age groups in the stock (rate); Assessed area (ha) = combined area total (ha) of transitional and inland waters.

Table 4.1. Trends over time (2011-2021) in eel stock indicators (in kg and % or rate (table below)).

	B_0	B_{TARGET}	B_{BEST}	$B_{CURRENT}$	ΣF	ΣH	ΣA
2011	87 000	35 000	34029	23772	23,3%	6,9%	30,1%
2012	87 000	35 000	34024	25608	18,3%	6,4%	24,7%
2013	87 000	35 000	30496	16073	41,2%	6,1%	47,3%
2014	87 000	35 000	24659	16324	26,2%	7,6%	33,8%
2015	87 000	35 000	18571	12022	27,7%	7,5%	35,3%
2016	87 000	35 000	13898	4405	62,2%	6,1%	68,3%
2017	87 000	35 000	11226	1115	85,7%	4,4%	90,1%
2018	87 000	35 000	10099	1158	82,7%	5,8%	88,5%
2019	87 000	35 000	9569	6253	28,9%	5,8%	34,7%
2020	87 000	35 000	8850	4938	39,0%	5,2%	44,2%
2021	87 000	35 000	7781	1224	80,1%	4.2%	84,3%
2022	87 000	35 000	6936	0	100%	2,9%	100%
2023	87 000	35 000	7441	2490	65%	1,5%	66,5%

	B_0	B_{TARGET}	B_{BEST}	$B_{CURRENT}$	ΣF	ΣH	ΣA
2011	87 000	35 000	34029	23772	0,265	0,052	0,32
2012	87 000	35 000	34024	25608	0,202	0,071	0,27
2013	87 000	35 000	30496	16073	0,531	0,026	0,56
2014	87 000	35 000	24659	16324	0,303	0,070	0,37
2015	87 000	35 000	18571	12022	0,325	0,093	0,42
2016	87 000	35 000	13898	4405	0,972	0,000	0,97
2017	87 000	35 000	11226	1115	1,944	0,000	1,94
2018	87 000	35 000	10099	1158	1,754	0,000	1,75
2019	87 000	35 000	9569	6253	0,341	0,056	0,40
2020	87 000	35 000	8850	4938	0,495	0,000	0,50
2021	87 000	35 000	7781	1224	1,613	0,000	1,368
2022	87 000	35 000	6936	0	9,071	0,000	1,74
2023	87 000	35 000	7441	2490	1,052	0,000	0,821

5 Other data collection for eel

Lithuanian waters are not recruited by eels at glass eel stage; yellow eel recruitment to coastal areas currently is very low and is not monitored.

Under DCF/EU MAP data collection and other survey programs 414 yellow eels were sampled in Lithuania for length, weight, age and other parameters in 2020 using longlines, small fyke-nets and electrofishing in lakes, trapnets in streams or were obtained from fishery in the Curonian Lagoon. 399 migrating silver eels were sampled for the analyses using trapnets in streams or were obtained from fishery in the Curonian Lagoon. Sampling was done by Fisheries Service, Klaipėda Universty and State research institute Nature Research Centre.

5.1 Yellow eel abundance surveys

There are no yellow eel abundance surveys carried out in Lithuania (except one case mark-recapture study in 2014). Regular yellow eel sampling in some lakes is focused on collection of biological data. In 2020 yellow eel sampling was done in 6 inland lakes: Ūkojas, Kretuonas, Rubikiai, Kertuojai, Balsys and in Krokų Lanka lake-estuary (close and connected to the Curonian Lagoon). Eels were caught and analysed by age, length, weight, and other parameters (N=414).

5.2 Silver eel escapement surveys

After stocked eels mature and reach silver eel stage, they start migrating downstream towards the sea or ocean. During these migrations substantial mortality can drastically reduce the number of successful spawners. Success of Eel Management Plans and restoration activities is gauged in the context of EU Regulations by determining in the numbers of silver eels leaving inland waters to spawn. Barriers, especially hydropower installations, are considered to be one of the major threats for eels' downstream spawning migration. First attempt to evaluate silver eel migration success from Lithuanian inland water bodies was carried in 2014. The results of this study are presented by Dainys et al. (2017).

A total of 63 silver eels were caught in four rivers in the Eastern Lithuania during their spawning migrations using fykenets of 16–20 mm mesh size and tagged with Vemco acoustic tags in spring and autumn of 2014. After implantation of acoustic tags eels were released back to three free-flowing and one dammed river. Eel migration was tracked using four Vemco VR2W receivers that were installed in the vicinity of the Kaunas HPP water intake to detect eels entering turbines and four receivers were installed just below the Kaunas HPP to detect those eels that had passed through. To detect eels that successfully migrated downstream, four receivers were installed on navigational buoys in the Nemunas Delta and four in the Klaipėda Strait (Fig. 5.1.).

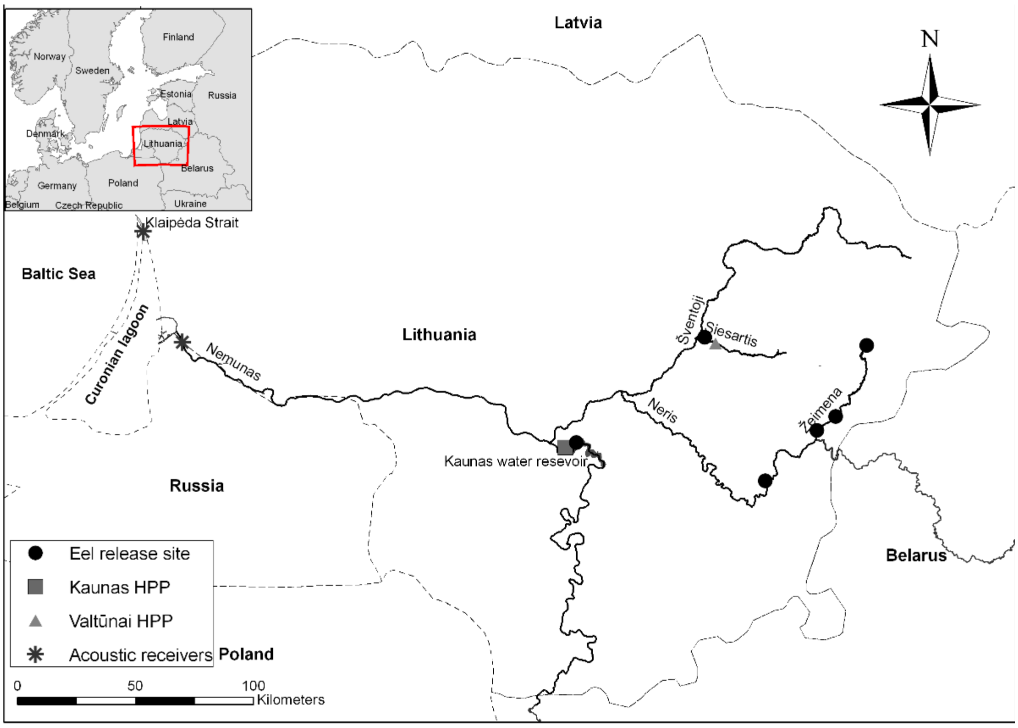

Fig. 5.1. Release sites of tagged eels.

Eighteen out of the 38 silver eels released into free-flowing rivers of the Eastern Lithuania during May – June 2014 were never detected post-release, consequently their fate is unknown. The remaining 20 eels successfully migrated downstream and reached the Nemunas Delta (Migration Success = 53%).

Out of 25 eels released upstream of the Kaunas HPP, 21 (84%) moved downstream through the turbines and were detected below the HPP. Twelve eels migrated within 24 hours after release, while nine eels delayed passing through by one to 47 days. Four tagged eels did not migrate downstream and stayed in the Kaunas Reservoir until at least when the transmitter battery became discharged. Their fate remains unknown. Absence of a fish ladder at HPP means that all eels must pass directly through the turbines. Out of the 21 eels which migrated through the HPP, 11 were detected in the Nemunas Delta (Migration Success = 52.4%).

In the rivers of Eastern Lithuania, most of the tagged eels (N = 54, 86%) were released during late May - early June and nine eels (14%) were released in September. Thirty-one eels (49.2% of all eels released) were detected migrating through the Nemunas River Delta: one eel (3%) arrived in May, five eels (16%) were detected in June, eight (26%) in July and one (3%) in September. The majority (N = 15, 49%) were detected in October and the one remaining (3%) was detected in November.

Out of 31 eels, which were detected entering the Curonian Lagoon, at least four (13%) were caught in fykenets by fishermen. Until the end of transmitter battery operation, 22 eels (Migration Success = 71%) were detected in Klaipėda Strait prior to entering the Baltic Sea, while the fate of the remaining 5 eels (16%) remains unknown.

The peak period of eels entering the Baltic Sea was observed during late fall: 18 eels (82%) were detected in the Klaipėda Strait during October-November while the remaining four eels were detected once each in June, July, December and January, respectively.

Overall migration success (including HPP effect) of all tagged and released eels in Lithuanian rivers and the Curonian Lagoon was 35%.

Second project on evaluation of silver eel migration patterns and success from Lithuanian inland water bodies started in 2019. In total 50 silver eels were tagged with acoustic transmitters and released into two rivers (Žeimena and Šventoji). Their migration is tracked by receivers installed in eel migration route towards the sea. At time of the reporting 22 eels out of 50 successfully escaped to the Baltic sea through the Klaipeda strait. The project will end and final results on eel migration patterns and migration success will be available at the end of 2021.

5.3 Life-history parameters

All eels handled, recently are analysed with respect to size, weight, sex, stage, age, in some cases subsample for the prevalence and infection intensity of parasites. Fat is measured only occasionally.

As part of DCF/EU MAP data collection eels from a number of commercially fished streams/rivers and the Curonian lagoon were sampled since 2010.

As part of DCF/EU MAP data collection eels from a number of commercially fished streams/rivers and the Curonian lagoon were sampled in 2010 – 2016 by Fishery Service and in 2017 - 2023 by Klaipeda University (Table 5.1, bellow).

Table 5.1. Eels from the Curonian lagoon and some Inland lakes were sampled in 2017 - 2023 by Klaipeda University.

Lake/year	Total N	Mean length (mm)	Mean weight (g)	Mean age (year)	Growth rate (mm year-1)	Aged (N)
Alausas						
2020(16 mm trap nets)	24	716	671	18	38	24
2021(16mm trap nets)	47	693	651	17.2	42.8	45
2022(16mm trap nets)	52	711	685	22.3	33.4	51
2023 (16mm trap nets)	37	723	667	19.9	38.2	37
Kertuoja						
2020(16 mm trap nets)	35	743	739	17.5	40.1	33
2021(16 mm trap nets)	57	678	577	15.5	46.7	56
2022(16 mm trap nets)	33	733	683	18.9	40.9	33
2023 (16mm trap nets)	41	659	515	16.3	43.1	41
Rubikiai						
2020(12 mm trap nets)	15	477	234	7.7	60.7	15
2021(12 mm trap nets)	38	656	578	12.1	59.1	38
2022(12 mm trap nets)	25	588	413	11.7	54.9	25
Curonian Lagoon						
2020 (12 mm trap nets)	41	544	291	7.7	70.1	41
2021(12 mm trap nets)	52	492	232	6.5	89.5	52
2022(12 mm trap nets)	38	563	329	8.0	80.4	38
2023(12 mm trap nets)	11	567	344	6.8	59.3	11
2017(20 mm fyke nets)	100	776	966	16.8	44.6	77
2018(20 mm fyke nets)	100	740	904	11.8	62	94
2019(20 mm fyke nets)	110	704	789	9.6	73.7	110
2020 (20 mm fyke nets)	116	701	782	10.3	67.8	115
2021(20 mm fyke nets)	145	691	740	10.4	73.4	144
2022(20 mm fyke nets)	116	693	692	10.4	73.7	116
2023(20 mm fyke nets)	91	698	734	9.8	79.3	91
Siesartis						
2019(16 mm trap nets)	30	727	707	19.9	34.8	29
2020(16 mm trap nets)	82	681	524	21.6	29.7	82
2022(16 mm trap nets)	40	694	601	18.0	40.8	40
2023(16 mm trap nets)	34	67.3	554	17.4	41.0	34
Paežerys						
2017	58	524	299	10.6	47.2	54
Stirnė						
2018	100	737	721	18.5	38.1	98
Ukojas						
2017	100	560	340	14.8	35.5	97
Aisetas						
2017	100	537	315	12.6	40.3	97
Baluošas						
2017	100	655	487	15.2	41.2	97
2023	7	766	861	19.4	46.8	7

Sampling for silver and yellow eel growth was performed by Klaipėda University in 2023 in the Curonian lagoon (N=59 yellow and N=41 silver eels) and Inland lakes in Eastern part of Lithuania (Balausas, Kertuoja, Siesartis, Baluošas; N=45 yellow and N=71 silver eels).

5.4 Diseases, Parasites & Pathogens or Contaminants

Eel viruses and diseases have not been monitored in Lithuania. No large-scale or long-term studies on eel parasites and pathogens were carried out in Lithuania. Consistent sampling of eels from Lithuanian waters (water bodies of different trophic level; eels of different age groups and etc.) has started in 2017 only, thus since then eels were analysed at the Nature research centre and/or the Fisheries Service under the Ministry of Agriculture of the Republic of Lithuania are screened by the naked eye for *Anguillicola crassus*. Most of analysed eels in 2017 were infected with *A. crassus*. Infection intensity was relatively low: usually ranging between 1 and 4 nematodes (highest observed intensity was 23 parasites for one eel). Additionally, two other parasite species (*Diplostomum spathaceum* and *Pseudodactylogyrus* sp.) were found in analysed eels in 2017 (analysis was carried by the Fisheries Service).

Since 2019, Klaipėda University has started checking eels for Anguillicola crassus. In 2019 80% (N=75) and 88% (N=33) of eels accordingly from the Curonian lagoon and lake in Eastern part of Lithuania (Siesartis) were infected. Infection intensity was found to be on average 3,4 and 4,4 nematodes respectively in the lagoon and lake. In 2020 312 eels were screened for *Anguillicola crassus* at Klaipeda University. 71% (N=111) and 86% (N=135) of eels accordingly from the Curonian lagoon and lakes in Eastern part of Lithuania (Siesartis, Alausas, Rubikiai, Kertuoja) were infected. Infection intensity was found to be on average 2,3 and 3,9 nematodes respectively in the lagoon and lakes. In 2021 312 eels were screened for *Anguillicola crassus* at Klaipeda University. 72% (N=165) and 75% (N=188) of eels accordingly from the Curonian lagoon and lakes in Eastern part of Lithuania (Alausas, Rubikiai, Kertuoja) were infected. Infection intensity was found to be on average 2,4 and 3,8 nematodes respectively in the lagoon and lakes. In 2022 286 eels were screened for *Anguillicola crassus* at Klaipeda University. 74% (N=137) and 79% (N=149) of eels accordingly from the Curonian lagoon and lakes in Eastern part of Lithuania (Alausas, Rubikiai, Siesartis, Kertuoja) were infected. Infection intensity was found to be on average 5.5 and 4.4 nematodes respectively in the lagoon and lakes. In 2023 216 eels were screened for *Anguillicola crassus* at Klaipeda University. 74% (N=100) and 72% (N=117) of eels accordingly from the Curonian lagoon and lakes in Eastern part of Lithuania (Alausas, Baluošas, Siesartis, Kertuoja) were infected. Infection intensity was found to be on average 3.2 and 3.2 nematodes respectively in the Lagoon and lakes.

6 New Information

Three shipments of about 66 tonnes in total of European eel as cooked fillets “kabayaki” (frozen) were arrested at customs in Klaipeda port in 2020. These shipments from China were supposed to go to Belarus. The cases of these arrests were still pending in courts in 2021, however, transit to eastern countries of eel “kabayaki” through Lithuania is stopped.

In 2017 PhD thesis on eels was defended: Dainys J. 2017. Migration of stocked European eels (*Anguilla anguilla* L.) in Lithuania and potential contribution to spawning stock restoration. Vilnius, 98 p.

In 2024 Lithuania updated and submitted to European Comission updated national EMP.

Most recent publications of studies on eels in Lithuania:

- Dainys J., Stakėnas S., Gorfine H., Ložys L. 2018. Mortality of Silver Eels Migrating Through Different Types of Hydropower Turbines in Lithuania. River Research and Applications, 34: 52–59. DOI: 10.1002/rra.3224
- Dainys J., Gorfine H., Šidagytė E., Jakubavičiūtė E., Kirka M., Pūtys Ž., Ložys L. 2018. Are Lithuanian Eels Fat Enough To Reach The Spawning Grounds? Environmental Biology of Fishes, 101: 127:136. DOI: 10.1007/s10641-017-0686-y
- Dainys J., Stakėnas S., Gorfine H., Ložys L. 2017. Silver eel, *Anguilla anguilla* (Linnaeus, 1758), migration patterns in lowland rivers and lagoons in the North-Eastern region of their distribution range. Journal of Applied Ichthyology, 33: 918–924. DOI: 10.1111/jai.13426
- Dainys J, Gorfine H., Šidagytė E., Jakubavičiūtė E., Kirka M., Pūtys Ž., Ložys L. 2017. Do young on-grown eels, *Anguilla anguilla* (Linnaeus, 1758), outperform glass eels after transition to a natural prey diet? Journal of Applied Ichthyology, 33:361–365. DOI: 10.1111/jai.13347.

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