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Data collection, eel from elver traps in Swedish watercourses

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This document describes, in brief, data collection of elvers that is carried out in Sweden with the help of elver traps. The document contains background and brief history, implementation, data collection, end users, and quality assurance.

The European eel (*Anguilla anguilla*) hatches in the Sargasso Sea and as small leptocephalus larvae they are then transported by the ocean currents towards the European continent. During transport, the larvae develop into transparent glass eels. Once on the coast of Europe, the glass eels begin to develop pigment and when they find their way up into the watercourses along the coast, they are called elvers. The migration of elvers to Swedish watercourses takes place mostly along the Swedish west and south coasts, but some eels stay in the coastal band, continue their migration into the Baltic Sea or make their way up into watercourses on the east coast. Data on how many elvers migrate up into Swedish watercourses is collected using several different methods, such as electric fishing and elver traps.

Background and brief history

Elver traps have historically been installed at migration barriers for eels at various types of water activities such as hydroelectric power plants, dam facilities and pulp mills. An elver trap usually consists of a chute with some kind of substrate and water (elver guide) that the elver can climb up into and then end up in a water-supplied collection container (sump). The collection has been governed by latent or mandatory requirements according to conditions in the water operations' water court decisions or by decisions on environmental monitoring of biological recipient controls, as the activities have affected the natural migration of eels. Since the eel can no longer swim up the systems on their own due to the migration barriers, the collected elvers have usually been moved to lakes or streams further up the system.

The Swedish Board of Fisheries began collecting catch data from a number of elver traps in Swedish watercourses in the late 1970s and early 1980s (including historical data if it was documented), by requesting data from water operations that had active elver traps at the time. Practitioners have never been obliged to report the number/amount of eel collected. The collection of data is still ongoing today (2024), now under the auspices of SLU Aqua. The number of years and time period with catch data elver traps varies between watercourses. In some cases, new water court decisions have given hydropower companies the opportunity to buy and restock imported glass eel instead of moving elvers collected on site. In several catchment areas, so-called eel plans have been developed through collaboration between, for example, all water activities in the area, the Swedish Agency for Marine and Water Management, county administrative boards and municipalities, which has resulted in joint collections of elvers instead of individual collections at each water activity. In other cases, the elver trap has no longer collected eel, for example due to new migration barriers downstream or if migration barriers has been torn out or changed via, for example, fishways and bypasses.

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Implementation and data collection

The elver traps are active during the period of the year when elvers normally migrate up into the watercourses. Since the migration is affected by water temperature, the period varies in different parts of the country, but generally the traps open in April-June and close again during September-October when catches decrease. In Ljusnan, elvers have been collected with pot traps designed for lampreys instead of an elver trap, since 2005. In general, the date of collection, total weight and/or number of eels are recorded. Since the start of the data collection, both the former Swedish Board of Fisheries and the current SLU Aqua have requested both information on number and weight, but rarely received both. In some cases, e.g. when large numbers of elvers have migrated up into the traps, only the total weight has been registered. Other times, the average weight per elver has also been recorded (calculated from a random sample). In other cases, only the total number of eels has been recorded (actually counted or calculated from samples). From some elver traps, the water temperature is also noted and whether it is glass eels, newly pigmented elvers or larger and older eels (i.e. small yellow eels) that have migrated up into the collector. As a rule, digital copies of catch records are sent to the contact person at SLU Aqua when the trap has been closed for the season. The protocols are stored on a server and the capture data is imported and stored in the database Sötebasen which is managed by the Freshwater Laboratory at SLU Aqua.

At most, data has been reported from 24 elver traps from the same year (Table 1). For 2023 (the last year with data when this document was produced), data from eight elver traps were reported; Dalälven, Helge å, Kävlingeån, Lagan, Ljusnan, Motala ström, Nyköpingsån and Viskan. The type of data (number of elvers and/or biomass (weight)) collected and reported has often varied over time both within and between sites (Table 1). It is likely that catch data reported as "number of eels" have a greater uncertainty than data reported as biomass/total weight, as numbers have sometimes been estimated based on samples. There is also some uncertainty in the catch data for some years when, for example, the trap has not worked properly throughout the period or has been completely out of function for various reasons.

Table 1. Information regarding catch data of eel in elver traps for the watercourses where SLU Aqua has received catch data. Active elver traps (data up to and including 2023) are marked in bold.

Watercourse	Active	Time span	N years with catch data	N years with number of eels	N years with total weight
Alsterån		1960-1991	29	28	6
Botorpsströmmen		1922-1930, 1951-1992	39	14	28
Dalälven	**Yes**	**1951-2023**	**70**	**70**	**69**
Emån		1967-1990	23	23	1
Gavleån		1920-1990	55	51	7
Göta Älv- Olidan		1900-2017	103	7	101
Helge å	**Yes**	**1952-2023**	**71**	**21**	**57**
Kilaån		1948-1990	21	21	1
Kävlingeån	**Yes**	**1991-2023**	**33**	**33**	**32**
Lagan	**Yes**	**1925-2023**	**99**	**0**	**99**
Ljungan		1951-1980	27	26	10
Ljusnan	**Yes**	**1950-2023**	**70**	**46**	**44**
Motala ström	**Yes**	**1942-2023**	**82**	**24**	**82**
Mörrumsån		1960-2018	59	14	59
Nissan		1947-1990	43	1	43
Nyköpingsån	**Yes**	**1922,1958-2023**	**63**	**40**	**23**
Ramsjökanalen (Morupsån)		1950-1990	39	2	37
Råån		1946-1975	28	28	0
Rönne å		1917-2019	71	19	67
Skräbeån- Gonarp		1947-1982	29	20	23
Suseån		1988-1993	4	2	4
Tvååker Canal		1948-1990	26	2	26
Viskan	**Yes**	**1971-2023**	**53**	**14**	**53**
Ätran		1932-2014	60	18	46

From the elver traps in the various watercourses, some eels are also collected from selected sites for extended individual sampling (dissection) at SLU Aqua, Institute of Freshwater Research, to obtain additional biological data. For economic reasons and the 4R principles, the sampling has been done since the early 2000s from the watercourses according to a rolling schedule, and thus not from all

watercourses every year. The sampling scheme has not been consistent over the years, but in principle eels are sampled from a watercourse until a sample of 50–100 eels has been reached before the rolling schedule continues. Sampling can sometimes last for several years from a watercourse to achieve a sample of >50 eels. The sampled elvers are frozen and then sent to SLU Aqua, Institute of Freshwater Research with frozen transport. Staff at SLU Aqua carry out the individual sampling where weight, length and number of the swim bladder parasite *Anguillicola crassus* are noted. Each individual's otoliths are picked out and stored in marked sample bags in the biological archive at SLU Aqua, Institute of Freshwater Research, to enable future analysis of age and chemical composition of the otolith. Individual data is stored in the database Sötebasen, which is managed by SLU Aqua. Some control is done when entering individual data to Sötebasen as the database has set limit values for some parameters and warns in case of extreme values.

Other manuals concerning the collection of eel with elver traps are manuals for dissection, age reading, chemical analysis and the biological archive's quality assurance. These can be found on the SLU Quality Assurance website: https://www.slu.se/qualityassurance, or on *https://www.slu.se/institutioner/akvatiska-resurser/kontakt/forskningsinfrastuktur/biologiskt-arkiv/*

End user

Catch data from eel collectors reported to SLU Aqua are reported in the Fish Barometer (www.fiskbarometern.se) (formerly the resource overview report *Fisk- och skaldjursbestånd i hav och sötvatten* until 2021) and in the national stock assessment of eel in Swedish waters, which is carried out by SLU Aqua on behalf of the Swedish Agency for Marine and Water Management every three years, in accordance with the Swedish Eel Management Plan (van Gemert et al., 2024). Catch data is also delivered to the International Eel Working Group, WGEEL, via annual data calls where data is used for different stock assessments for the European eel. The data is also used by other end users such as county administrative boards and researchers.

Quality assurance

Data collection of eel recruits through elver traps is partly funded by the EU and takes place within the framework of the EU's Data Collection Framework (DCF). Within DCF, three-year work plans are written (Swedish Work Plan 2022–2024) which include quality assurance of the data collected (Annex 1.1 in the Swedish Work Plan 2022–2024). As part of improving the process of quality assurance, all points in Annex 1.1 are listed here with an accompanying comment describing the issue and quality assurance (Table 2).

Table 2: Quality assurance of data from elver traps according to Annex 1.1 the Swedish national work plan within DCF (Swedish Work Plan 2022–2024).

Category	Question	Comment
Summary	Target species and sampling area	European eel (*Anguilla anguilla*). Individuals from selected watercourses all over Sweden.
	Population sampled	Juvenile eels are sampled (juveniles and yellow eels) from watercourses with power plants, dams and/or locks with an installed elver trap.
	Population unreachable for sampling	For economic and practical reasons, not all watercourses where juvenile eels may be found are sampled. Sites are chosen based on the lack of data on recruitment from other sources and on the potential to host the target population.
	Stratification	Watercourses without elver trap are not sampled. Some are instead sampled with electrofishing.
Sampling - design and protocol	Sampling design description	Watercourses without elver trap are not sampled. Some are instead sampled with electrofishing.
	Compliance with the 4S principle	NA
	Regional coordination	Work on regional coordination for eels is ongoing but has not been decided.
	Documentation of sampling design	This document.
	Design compliance with international recommendations	International recommendations from WGEEL for data collection on recruitment are followed.
	Documentation of sampling protocols	This document.
	Protocol compliance with international recommendations	International recommendations from WGEEL for data collection on recruitment are followed.
Sampling - implementation	Recording of refusal rate	NA
	Sampling progress	Data on the number of recruits is sent to SLU when the elver trap is closed for the season. A reminder is sent to the actor if the delivery of data is missing.
Data capture	Means of data capture	No material is needed since the hydropower plants handle the material for the elver traps via legal requirements (water court judgement). A sub-sample of eels are kept and later dissected to collect additional biological data.
	Data capture documentation	This document
	Documentation of quality checks	This document. Primary data cannot be checked by SLU.
	National database	Data is stored on SLU Aqua's database "Sötebasen"
	International database	Processed data is delivered to ICES via WGEEL Data Calls and stored in the WGEEL database.

Category	Question	Comment
Data Storage	Quality checks and data validation documentation	This document (and work in progress). Primary data cannot be checked by SLU.
Sample storage	Sample storage	A subsample is dissected, and biological data is collected immediately. Otoliths are stored for later age-and chemistry analysis in the Biological archive at SLU, Drottningholm. The samples are placed in a fireproof archive and handled according to SLU's routines for quality assurance.
	Sample analysis	Manuals for dissection, age reading and chemical analysis can be found on SLU Aqua's webpage for quality assurance.
Data Processing	Evaluation of data accuracy (bias and precision)	This document (and work in progress).
	Editing and imputation methods	This document (and work in progress).
	Quality documents associated to a dataset	No
	Validation of the final dataset	Processed data is validated within Data Calls and the annual ICES WGEEL working group meetings.

References

ANNEX 1.1 - Quality report for biological data sampling scheme. Del av: Swedish Work Plan 2022–2024. Swedish Work Plan for data collection in the fisheries and aquaculture sectors. Regulation (EU) 2017/1004 of the European Parliament and of the Council of 17 May 2017 on the establishment of a Union framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the common fisheries policy and repealing Council Regulation (EC) No 199/2008 (recast). https://dcf.ec.europa.eu/wps-and-ars/work-plans_en

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