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# First steps in the ecological flow determining for Latvian rivers

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## ABSTRACT

This study analyses the impact of small hydropower plants (HPP) on fish in three Latvian transboundary river basin districts. The MesoHABSIM habitat simulation model was applied to seven Latvian lowland rivers regulated by HPP, four of which belong to the salmonid river type and three to the cyprinid type. Daily stream flow time series for 1961–2018 were used for flow regime calculations in reference (unimpacted) and altered (impacted by HPP operation) flow conditions. Conditional habitat suitability model/criteria for fish were used to assess a potentially available habitat at different flow conditions. Brown trout (*Salmo trutta*) for salmonid rivers and chub (*Squalius cephalus*) for cyprinid rivers were selected as case examples to show habitat suitability for different stream types. The authors found significant differences in habitat availability for salmonid and cyprinid rivers, indicating that ecological flows must be calculated separately for fast- and slow-flowing rivers. This study is the first attempt in Latvia to set ecological flow values not only using hydrological calculations but also biological data as an indicator of ecological changes.

**Key words:** ecological flow, hydromorphology, hydropower plants, MesoHABSIM

## HIGHLIGHTS

- A new approach for ecological flow calculations based on fish data and suggestions for a flow regime instead of one single flow value.
- A better understanding of habitat differences between cyprinid and salmonid rivers.
- Although a relatively small country, hydromorphological differences based on hydrological regions were found in Latvia.

## INTRODUCTION

European rivers belong to ecosystems most impacted by hydromorphological alterations (EEA 2018), and without hydromorphological measures, it is not possible to achieve at least good ecological status which is the main purpose of the Water Framework Directive (WFD) 2000/60/EC (European Commission 2000). An unaltered hydrological regime is an important factor for the development of a healthy lotic environment (Sakaris 2013) and ecological flows must be determined in regulated rivers. According to the WFD CIS guidance document No. 31 (European Commission 2015), ecological flows are: 'The amount of water required for the aquatic ecosystem to continue to thrive and provide the services we rely upon'. The relationship between biotic and abiotic factors in natural streams is still too poorly understood (Erba *et al.* 2006) and it also affects knowledge about the effects of disturbance in regulated streams. Although historically eutrophication has been considered a major pressure on European rivers, hydromorphological degradation today plays a major role (Baattrup-Pedersen *et al.* 2015). About 150 small hydropower plants (HPP) are operating on Latvian rivers and hydromorphological alterations are one of the most significant pressures within water bodies. According to the third-cycle Latvian River Basin Management Plans (LEGMC 2021), about 45% of river water bodies are affected by hydromorphological alterations and 30% of them are under significant hydromorphological pressure due to HPP. Of all biological quality elements recommended by WFD, fish is one of the most sensitive to hydromorphological alterations (Poff & Zimmerman 2010), including water level fluctuations (Schmutz *et al.* 2015). To achieve a better understanding of in-stream ecological processes, morphological indices, traditionally more widely used in river basin management plans, must be combined with indices sensitive to hydrological stressors caused by HPP (Schinegger *et al.* 2016). The scale of the study is challenging as it should be sufficient to assess not only the hydrological pressure but also the biota response where the catchment level may be insufficient. Studies have shown (Vezza *et al.* 2014; Wolter *et al.* 2016) that the mesohabitat scale is suitable to assess fish response to hydromorphological pressure and establish ecological flows. One of the approaches to link biology with hydrological alterations is to use meso-scale habitat models (Parasiewicz 2007) which simulate changes in habitat suitability for fish. Mesohabitat simulation system method MesoHABSIM is one of the most fully established mesohabitat simulation platforms (Wegscheider *et al.* 2020) which is most widely used in Central (Parasiewicz *et al.* 2018) and Southern Europe (Vezza *et al.* 2012), and the model has been tested also in the Baltic region (Virbickas *et al.* 2020; Akstinas *et al.* 2021).

Latvian legislation does not have a clear definition on what is an ecological flow and in what way it must be calculated. The definitions of ecological flow and minimum guaranteed flow in different legislation acts are sometimes contradictory. The concept of minimum guaranteed flow is more commonly used and it is mostly defined as a minimum or average of summer 30-day period low flow with 95% probability. This threshold is also mainly used to calculate ecological flow. Although ecological flow rate must be obligatory determined for hydroelectric power plants, in practice, in many cases, it is set equal to the minimum guaranteed flow rate. When a new permit is issued, ecological flow is recalculated, but there may be some cases where the ecological flow is missing or debatably calculated in the old permits. Hydropeaking is not regulated by Latvian legislation and was not addressed in this study. However, the water level monitoring results show its frequency and amplitude that are critical in terms of ecosystem and river banks erosion process.

The first efforts of the application of MesoHABSIM in Latvia started in 2017 and by now it has been applied to seven rivers.

The aim of this study is to analyse the results of MesoHABSIM modelling in these rivers, estimate the recommended ecological flows and compare them with the ecological flow currently stated in water use permits.

## STUDY AREA AND DATA

### Study area

Seven rivers representing three of four Latvian river basin districts were selected as case studies and examples of MesoHABSIM model application and ecological flow calculation in Latvia. The territory of Latvia is divided into four river basin districts (RBD) named after the largest rivers: Daugava, Gauja, Lielupe and Venta (Figure 1). All of the studied sites belong to the lowland stream type with altitude below 200 m a.s.l. and are located in the 15th Ecoregion – Baltic province. Although the territory of Latvia is physiographically relatively homogeneous, these river basin districts vary by the hydrological regime. Polar maritime air masses of the North Atlantic origin determine the climate properties in the Venta RBD (Ciecere, Eda and Vanka rivers). The natural hydrological regime in the rivers of Venta RBD is characterised by spring floods, autumn and winter rainfall floods and summer drought. Kurzeme Upland is a natural barrier that protects Lielupe RBD against moist maritime polar air masses from the North Atlantic. Therefore, the central part of Lielupe RBD (Auce, Berze and Islice rivers) is characterised by the least amount of annual precipitation and higher air temperatures within Latvian territory. The hydrological regime here is characterised by high spring flood, summer-autumn rainfall flood, summer drought and winter low flow period interrupted by thaws. The middle and upper parts of the Gauja RBD are located on the Vidzeme upland but lower rivers cross the Gulf of Riga lowland. The hydrological regime in the Gauja RBD (Vaidava River) is characterised by spring floods, summer-autumn rain floods, and summer and winter droughts. To demonstrate ecological differences, streams were grouped into two types, based on river type and fish communities: salmonid and cyprinid fish waters which are defined in Cabinet Regulation No. 118 'Regulations Regarding the Quality of Surface Waters and Groundwaters'. Vanka River is not included in this regulation and river type was determined using expert judgement based on a field survey. Salmonid waters usually belong to fast-flowing rithral type and are more intolerant to deterioration of river physical–chemical quality and water level alterations. Overall, eight sites in seven rivers were investigated, totally covering about 4.5 km of the investigated river length.

### Hydrological data

Water flow data series for the period 1961–2018 were used for the assessment of hydrological regime regulation by HPP during different seasons as well as for the river habitat modelling. Two daily flow data series (in reference and altered conditions) are required in the modelling procedures. Water flow data series before HPP construction is used to calculate flow in the reference conditions. The station-analogue flow data series were used for the ungauged rivers. Flow data series of rivers located in similar hydromorphological and climatological conditions (terrain, river feeding, watershed area, amount of precipitation, etc.) were taken as the analog flow. In this case, flow data of ungauged river are modelled on the base of analog

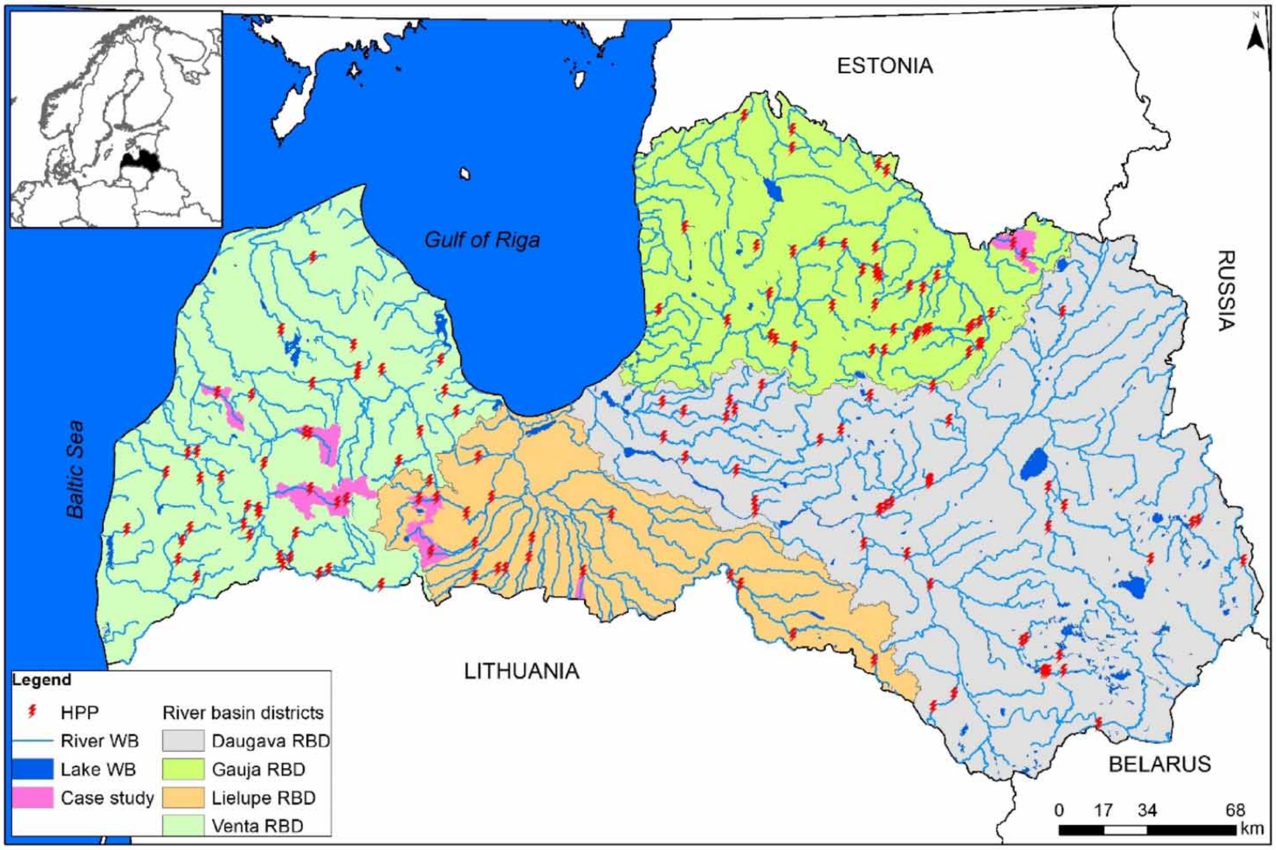


**Figure 1** | Location of case study catchments.

river' data, using the ratio of basin areas of pilot rivers and river-analog. For calculation of altered flow, information about HPP daily hydropower production was used. This calculation is based on the power equation: $H*Q*9.81*k$, where W – power, kW; H – Head, m; Flow – l/s, 9.81 m/s$^2$ gravity constant; K – combined turbine and generator efficiency (approximately 0.6). The studied river site and HPP characteristics are given in Table 1.

## Selection of fish species for modelling

Two rheophilic fish species potentially vulnerable to alterations of hydrological regime were selected for modelling of ecological flow – sea trout/brown trout *Salmo trutta* for salmonid waters and chub *Squalius cephalus* for cyprinid waters. Trout is

**Table 1** | River and hydropower plant characteristics at studied rivers

| River | HPP name | River type | Distance from the mouth (km) | Catchment area (km$^2$) upstream from HPP | River bed slope (m/km) | Dam height (m) | Installed capacity (kW) |
|---|---|---|---|---|---|---|---|
| Vaidava | Karva | Salmonid | 40 | 275 | 1.8 | 11.1 | 480 |
| Vaidava | Grube | Salmonid | 23 | 558 | 1.8 | 6 | 250 |
| Ciecere | Pakuli | Salmonid | 28 | 445 | 1.4 | 7.8 | 400 |
| Eda | Skede | Salmonid | 9 | 111 | 1.5 | 5.9 | 97 |
| Vanka | Edole | Salmonid | 12 | 62 | 0.8 | 5.5 | 48 |
| Auce | Bene | Cyprinid | 59 | 114 | 1.2 | 6.4 | 190 |
| Berze | Bikstu-Palejas | Cyprinid | 73 | 280 | 0.9 | 4 | 130 |
| Islice | Rundale | Cyprinid | 18 | 584 | 0.9 | 7.3 | 325 |

abundant species in small- and middle-sized salmonid streams while chub – in middle-sized and large cyprinid rivers (Birzaks 2013). Both species have also been captured in all salmonid or cyprinid rivers analysed in this paper (unpublished data of institute 'BIOR').

## METHODS

Meso-scale habitat simulation model MesoHABSIM was used for habitat suitability calculations at different flows. It is based on habitat availability for selected fish species during different hydrological conditions (Vezza *et al.* 2012).

MesoHABSIM consists of three separate sub-models:

1. Fish conditional model: fish habitat model which describes relationships between the abundance of selected fish species and the abiotic environment of the river (depth, stream velocity, substrate composition, presence of boulders, woody debris or in-stream vegetation, etc.).
2. Hydrological data: flow time series in reference (natural) and altered (impacted by HPP) conditions.
3. Hydromorphic unit (HMU) data: HMU as polygons and hydromorphological data as points based on field measurements, including river depth, channel substrate and stream velocity.

Sim-Stream computer model tool in QGIS (Zanin *et al.* 2016) was used to implement MesoHABSIM model. Sim-Stream software combines all three parts of MesoHABSIM (fish model, hydrological data series and HMU) and simulates physical habitat suitability at different flow conditions.

For more details about MesoHABSIM model application, please see other articles (Parasiewicz 2007; Parasiewicz *et al.* 2018).

Fish conditional models – used in this study – were developed in Interreg V-A Latvia–Lithuania Programme 2014–2020 project 'Ecological flow estimation in Latvian – Lithuanian Transboundary river basins (ECOFLOW)', LLI-249.

Habitat flow-rating curves and habitat suitability maps were done using SimStream software tool in QuantumGIS. Fish sampling was done at the studied river reaches but no direct habitat suitability validation measures were done within this study.

### Hydromorphological unit mapping

Hydromorphological unit mapping and field works were done in 2017 (Venta RBD), 2018 (Lielupe RBD) and 2019 (Vaidava River). Surveys were done between March and October, no surveys were done in the winter season due to the ice. Hydromorphological type-specific, meso-scale river stretches were selected downstream of each studied HPP. Depending on river size, these river stretches were 100–500 m long. Only natural sites without channelisation were selected in order to assess the ecological impact of water level alterations below HPP. Each river stretch was divided into hydromorphological units (HMU), which were mapped at multiple flow conditions. HMU can be described as lotic mesohabitats (riffles, rapids, glides, pools). HMU was mapped as polygons, which allows assessing changes in habitat areas under different water levels. Flow velocity, water depth and channel substrate were measured at least in seven points within each HMU. Depending on river size and the number of HMU units, 40–100 measurements were done at each site. Field cartography was done using a field computer, a TruPulse 360 range finder and ESRI ArcPad software. Rivers were surveyed four times during different flow conditions: summer low flow minimum ($Q_{30\_min}$), low flow average ($Q_{30\_avg}$), low flow maximum ($Q_{30\_max}$) and annual average flow ($Q_{annual\_avg}$).

## RESULTS

During this study, only Ciecere River had an automatic water gauging station directly below the studied HPP and these data were chosen to show typical differences, observed also in other studied rivers, in daily water levels under natural and altered conditions (Figure 2). The natural hydrograph was smoother and without sudden level peaks. Typical altered hydrograph was more uneven and with episodes of a rapid rise in water level even during the low flow period.

Each river was surveyed under four different discharges and hydromorphological measurements were conducted in each of them. In total, salmonid rivers had a relatively high diversity of hydromorphological units and seven units were distinguished (Figure 3), mostly indicating fast-flowing conditions. Except for Eda River, the diversity of HMU was higher during low discharges. Vaidava River has the largest slope and at certain discharge rapids took up to 20% of the studied river stretch.

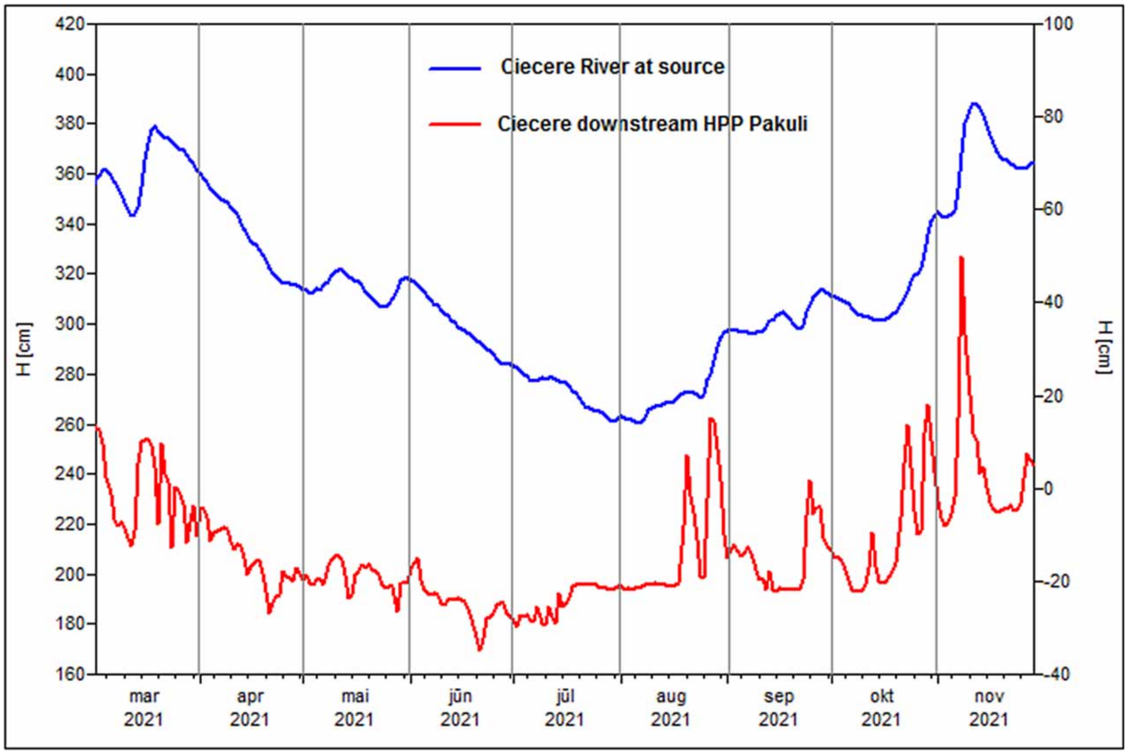


**Figure 2** | Example of Ciecere River daily water level at reference (Ciecere River source at Lake Cieceres) and altered (Ciecere River-below Pakuli HPP) conditions for period 01.03.2021–31.11.2021.

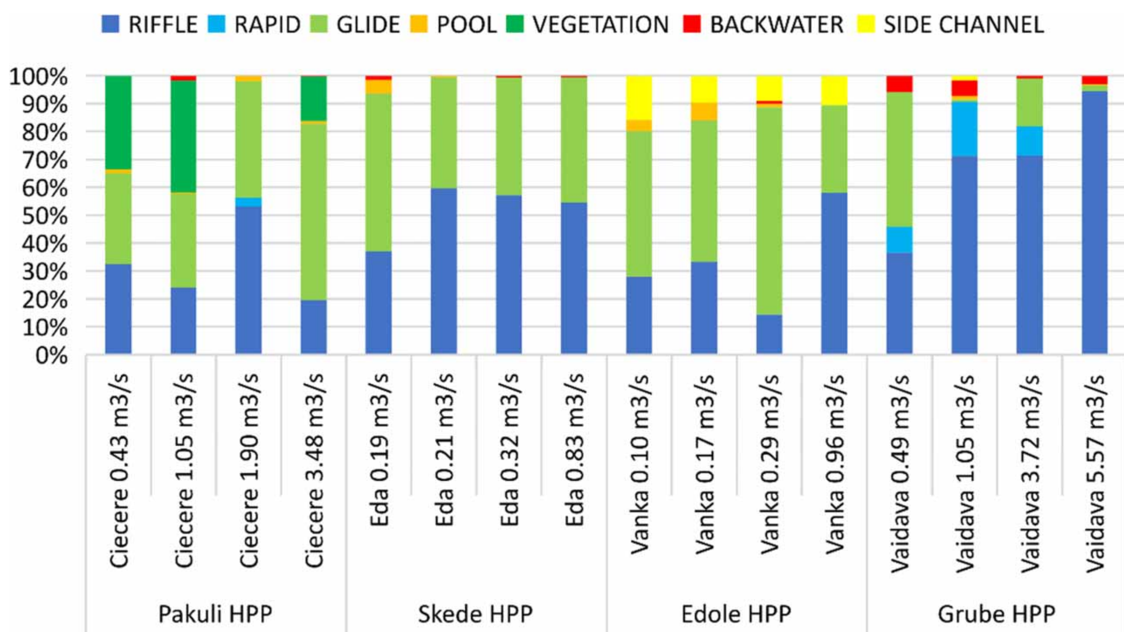


**Figure 3** | Distribution of hydromorphological units (HMU) in rivers within salmonid rivers in Venta and Gauja RBDs.

Slow-flowing cyprinid rivers had smaller diversity of hydromorphological units and five HMUs were distinguished, three of which occupied the largest area (Figure 4). Particularly high homogenisation of habitats was observed in the Berze River, where the combination of two HMUs took more than 90% of the assessed stretch. Glides were the most dominant HMU

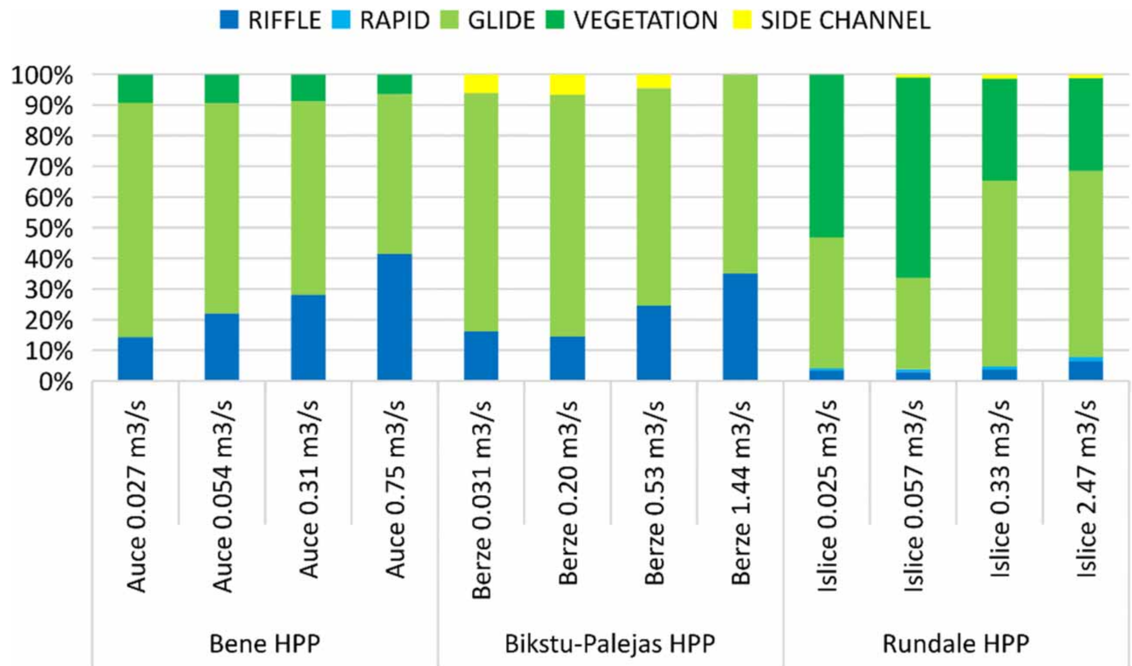


**Figure 4** | Distribution of hydromorphological units (HMU) in cyprinid rivers within Lielupe RBD.

for all three rivers, although in Islice River aquatic vegetation also took large areas. In these slow-flowing rivers, low HMU diversity was observed even at low flows representing typical habitats of cyprinid and eutrophic rivers.

Habitat suitability under four water discharges differs in salmonid rivers in Venta RBD (Figure 5(a)–(c)) and Vaidava River (Figure 5(d)). The results obtained downstream of both HPP on the Vaidava River were very similar to each other and we chose only Grube HPP, located closer to the river mouth, to display the results. For both cases, we can see that as the flow increases, so does the available (sum of suitable and optimal) habitat area for brown trout. In all three rivers in Venta RBD, the suitability for brown trout responded to flow changes in a similar way and a suitability increase from 2 to 30% was observed between $Q_{30\_min}$ and $Q_{30\_avg}$, mostly because of increased stream velocity. When discharge was similar to summer low flow maximum discharge ($Q_{30\_max}$), we observed a stronger increase in habitat suitability and the available habitat area increased up to ~90% of the studied river stretch. When discharge was close to the annual average, we mostly observed only a small increase of habitat suitability. Different habitat suitability tendency was observed in the Vaidava River in Gauja RBD. Small differences were observed between $Q_{30\_min}$ and $Q_{30\_avg}$ when the optimal habitat area increased from 56 to 67% of the studied stretch. When discharge increased to $Q_{30\_max}$, habitat suitability continued to increase and a total of 95% of assessed stretch was available for brown trout. Optimal habitat started to decrease and became less favourable when discharge was close to $Q_{annual\_avg}$ ($Q = 5.57$ m$^3$/s) when only 2% of habitats were optimal and 94% were suitable. Compared to all three rivers in Venta RBD, the Vaidava River has a larger slope and discharge which at a certain threshold becomes too large and unsuitable for fish.

Figure 6 shows a habitat availability example for cyprinid rivers. Habitat suitability typically is relatively high even at low flows and at $Q_{30\_avg}$ 90% of studied reach was available for adult chub in Berze River and 85% in Islice River. Only small habitat availability differences were observed when discharge increased to low flow maximum flow meaning that water flow already had reached its ecologically meaningful target. A similar trend was observed also for Islice River. During low flows, Auce River was unsuitable for adult chub and habitat suitability started to increase only at annual average discharge (Figure 4(c)).

Habitat flow-rating curves show how the area of an available habitat (suitable and optimal) changes in response to the flow (Figures 7 and 8). Optimum flow ($Q_{optimum}$) was chosen as a baseline for ecological flow in the modelled river stretches. We defined $Q_{optimum}$ as a river flow value, at which the area of available habitat reaches its maximum or insignificant habitat suitability increase can be observed. As we can see in Figures 7 and 8, salmonid and cyprinid fish rivers have different requirements for optimum flow. We observed regional variations for salmonid rivers. In general, all three rivers within Venta RBD

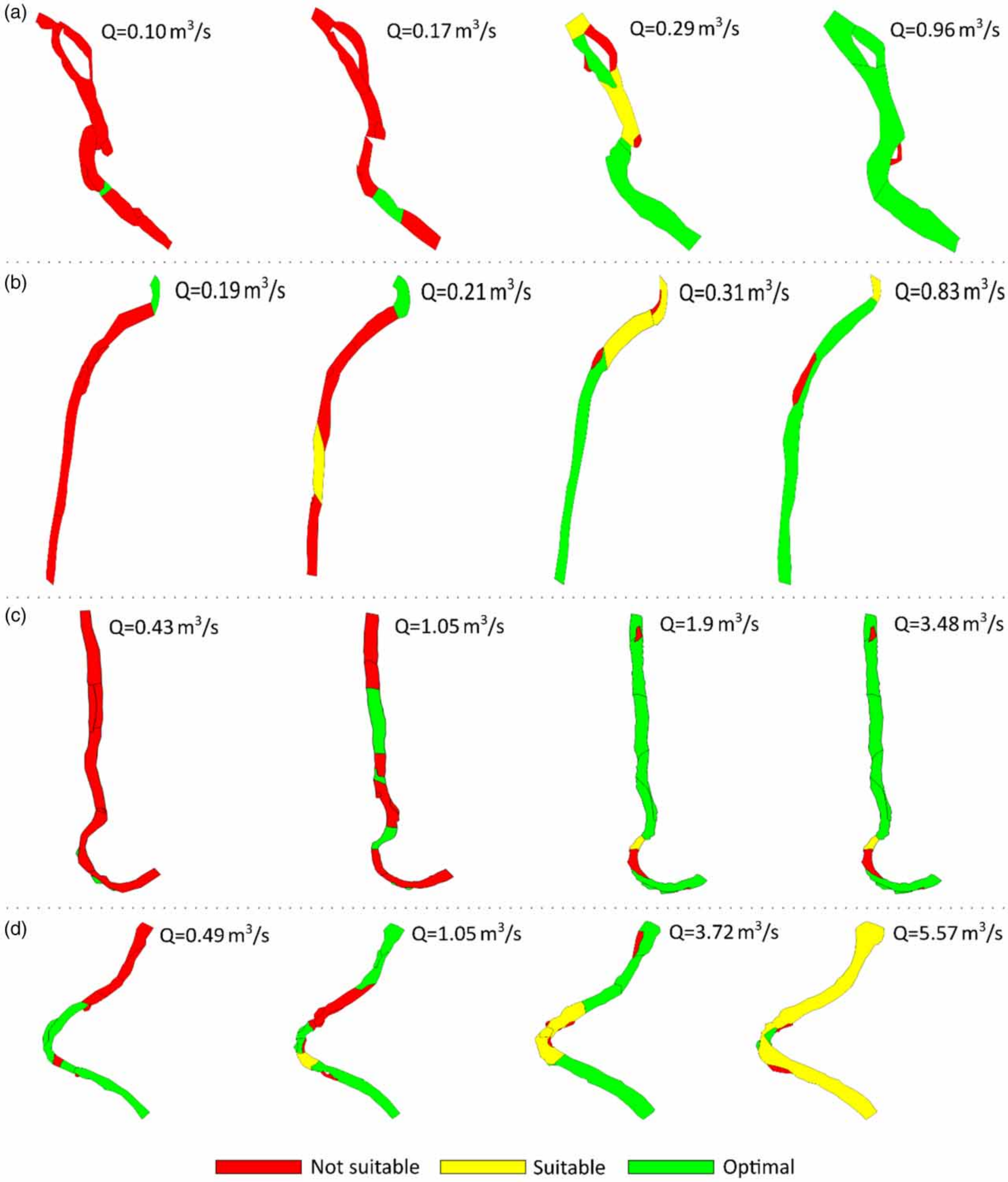


**Figure 5** | Habitat suitability maps of adult brown trout *Salmo trutta* in Vanka River – Edole HPP (a), Eda River – Skede HPP (b), Ciecere River – Pakuli HPP (c), Vaidava River – Grube HPP (d).

(Figure 5(a)–(c)) have similar habitat – flow-rating curves with rapid habitat increase when discharge was close to $Q_{30\_max}$. Maximum suitable habitat area and water discharge were smaller for juveniles than for adults. Results of Vaidava River in Gauja RBD revealed different habitat–flow-rating curves. Optimal flow for adults reached its maximum at $Q_{30\_max}$ and started to decrease when discharge continued to increase. The optimum flow for adults was larger than for juveniles for all analysed HPP in studied river basin districts.

Different habitat–flow-rating curves were observed for cyprinid fish rivers. Optimal flow was achieved at lower flows, corresponding to $Q_{30\_avg}$ (Figure 7). We did not observe any habitat decrease trends with increasing water discharge and flow velocity, because chub is relatively tolerant to an increase of stream velocity and water depth is the most limiting factor.

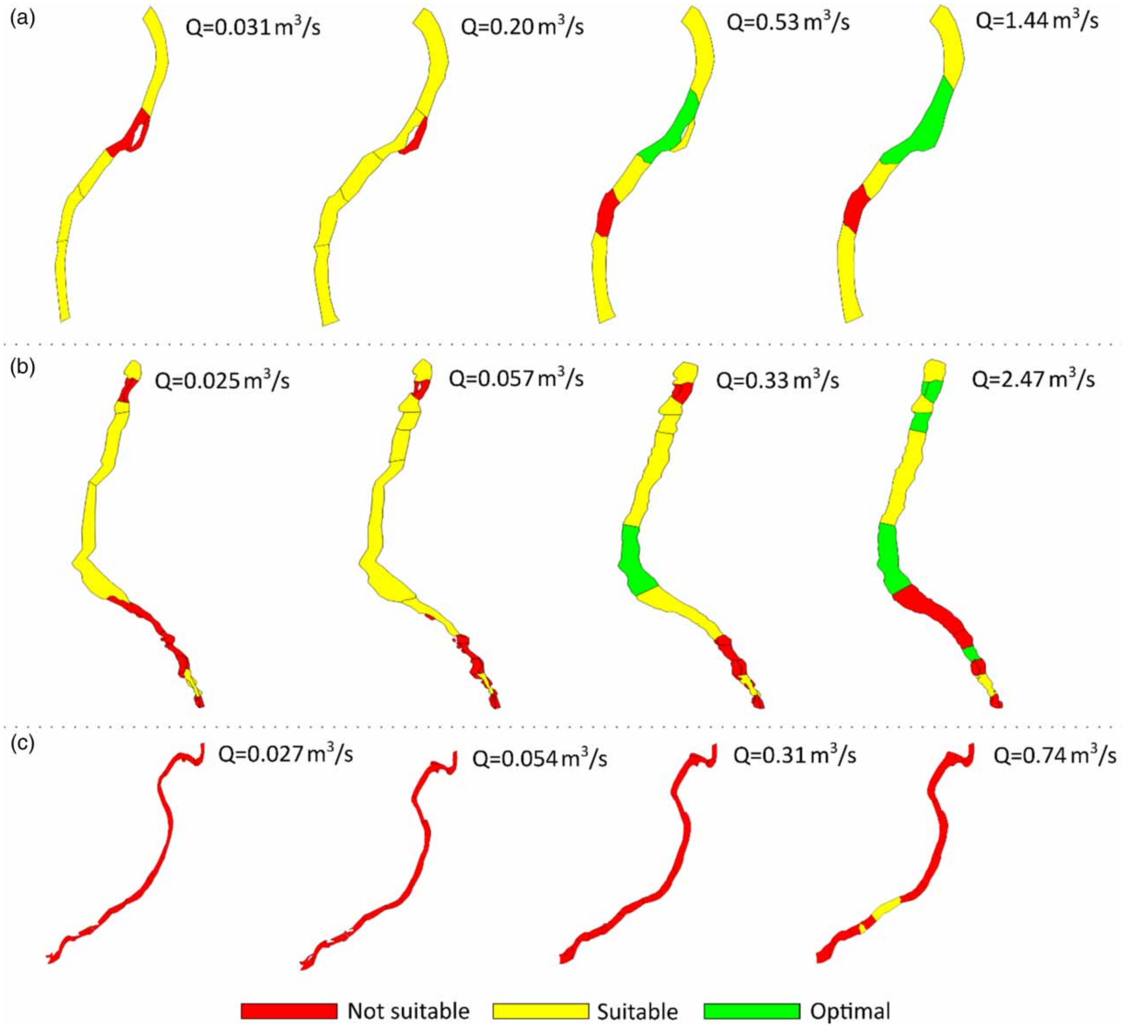


**Figure 6** | Habitat suitability maps of juvenile chub *Squalius cephalus* in Berze River – Bikstu-Palejas HPP (a), Islice River – Rundale HPP (b), Auce River – Bene HPP (c).

Auce River was relatively unsuitable for chub because modelled habitat suitability requires that water depth is at least 30 cm for juveniles and 60 cm for adults. Because of HPP operation and water storage, it was only possible to assess this river in mostly low flow conditions.

## DISCUSSION

This research is the first attempt in Latvia to set biologically significant type-specific ecological flow values using fish as bio-indicators. Our results show that different fish species have different modelled responses to hydromorphological alterations due to operating HPP. In accordance with typical type-specific river fish communities found in Latvia (Birzaks 2013), we chose brown trout and chub as examples for determining ecological flow. In the future, other fish species than chub must be used because this large-body fish may not be found in upstream sites of rivers. Because of its large size, chub is also very sensitive to water shortage and below HPP it may be replaced with smaller-body fish (Kubecka *et al.* 1997). As shown in Figures 7 and 8, habitat availability differs significantly in salmonid and cyprinid rivers indicating that ecological flows in Latvia must be calculated separately for different regions and river types. We found regional differences in habitat suitability trends in salmonid rivers which are in line with hydrological districts in Latvia. In comparison to examples from Venta RBD, our calculations show that Vaidava River has a larger bed slope and discharge, which is too large and unsuitable for fish communities when reaching a certain threshold. Due to the limited number of studied sites, it was not possible to

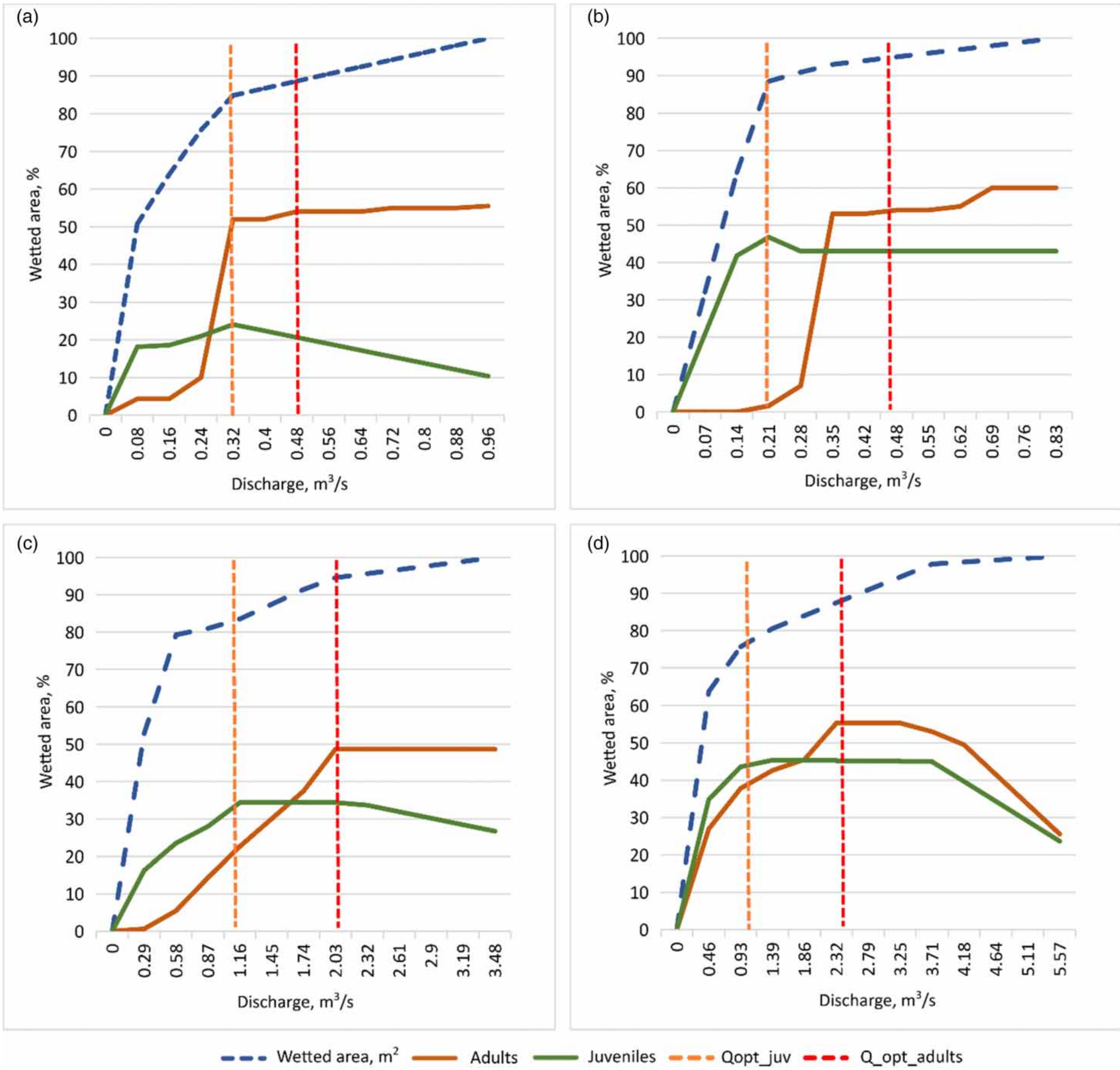


**Figure 7** | Habitat flow-rating curves for brown trout *Salmo trutta* at studied salmonid rivers ((a) – Vanka River – Edole HPP, (b) – Ēda River – Skede HPP, (c) – Ciecere River – Pakuli HPP, (d) – Vaidava River – Grube HPP).

analyse possible regional differences for cyprinid river types. The optimum flow obtained for cyprinid rivers is very close to the average low flow which can be used as a threshold to define ecological flows for cyprinid rivers. A similar approach was proposed also in Lithuania (Virbickas *et al.* 2020). For salmonid rivers, the optimum flow was higher and closer to low flow maximum flow which can be used as a threshold for salmonid rivers. On average, the ecological discharge must be raised more than three times (Table 2), leading to significant energy losses but no estimations are available about biodiversity losses due to a too low water flow below HPP. According to the third-cycle Latvian River Basin Management Plans (LEGMC 2021), the implementation of proposed ecological flows may cost about 1% of the long-term profit of HPP.

In general, ecological flows calculated in our study significantly differ from ecological or guaranteed flows specified in HPP water use permits (Table 2). The main difference between the two thresholds is that in water use permits ecological flow values were determined using only hydrological calculations, but in this study ecological flow values were set using fish's ecological response to changing water levels. All studied HPP have ecological flows specified in water use permits, but for three

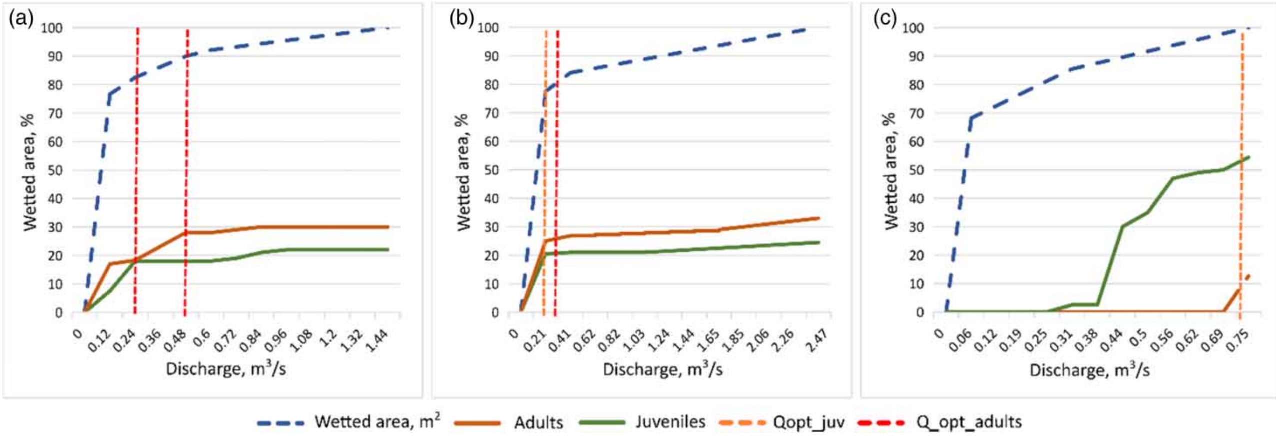


**Figure 8** | Habitat flow-rating curves for chub *Squalius cephalus* at studied cyprinid rivers ((a) – Berze River, (b) – Islice River, (c) – Auce River).

**Table 2** | Comparison of ecological and guaranteed flows specified in water permits and ecological flow range calculated by MesoHABSIM

| River | HPP name | Qecol ($m^3$/s) in permits | Qguaranteed ($m^3$/s) in permits | Qecol ($m^3$/s) proposed, adults | Qecol ($m^3$/s) proposed, juveniles | Relative increment (%) for Qecol, adults | Relative increment (%) for Qecol, juveniles |
|---|---|---|---|---|---|---|---|
| Vaidava | Karva | 0.94 | 0.56 | 2.32 | 0.66 | 247 | Achieved |
| Vaidava | Grube | 0.57 | 0.57 | 2.41 | 0.71 | 423 | 125 |
| Ciecere | Pakuli | 0.30 | 0.32 | 2.10 | 1.05 | 700 | 350 |
| Ēda | Skede | 0.18 | 0.049 | 0.50 | 0.25 | 278 | 139 |
| Vanka | Edole | 0.058 | 0.058 | 0.50 | 0.29 | 862 | 500 |
| Auce | Bene | 0.15 | 0.007 | 0.19 | 0.09 | 127 | Achieved |
| Bērze | Bikstu-Palejas | 0.16 | 0.031 | 0.43 | 0.22 | 269 | 138 |
| Īslīce | Rundale | 0.16 | 0.16 | 0.25 | 0.12 | 156 | Achieved |

of them, ecological flow is equal to guaranteed flow which is very low water discharge. Only three HPP (Karva, Grube and Rundale HPP) have an existing ecological flow which partly is in line with the ecological flow calculated within this study. The ecological flow of the Vanka River is extremely low and, according to our results, it should be increased at least five times to provide suitable habitat for fish. Although current legislation theoretically regulates the calculation of ecological flow, in practice the calculation approaches are different. The ecological flow rate is most often determined by fisheries expertise and has been calculated as half of the average flow rate during the two months of summer low flow (Abersons & Jekabsone 2018). The results of this study show that in most cases the currently used ecological flow approach does not guarantee the achievement of the objectives of WFD.

Our proposal is to calculate the ecological flow regime, not to set only one ecological flow value. This approach is proposed also in Spain where optimum flow is calculated separately for juveniles and adults (Jalon 2003). Using a flow regime instead of a single ecological flow value has several advantages. The flow regime takes into account fish bioperiods: adult spawning in winter (from November to May) and juvenile growing in summer (from June to October). The flow regime may provide an ecologically friendly environment not only for fish but also for other aquatic organisms like freshwater mussels (Sousa *et al.* 2020). The results of this study are also in line with other studies (Ceola *et al.* 2018; Parasiewicz *et al.* 2018), indicating that ecological flows possibly can be calculated at the regional level using the grouping of rivers with comparable hydromorphological features.

Lielupe river basin district is the most hydromorphologically impacted region in Latvia (LEGMC 2021) and rivers usually have multiple pressures (channelisation, eutrophication, dams) affecting them which may cause a problem to determine where hydrological pressures caused by operating HPP are the most important. Additional site-specific studies must be done in these heavily impacted and modified rivers (Parasiewicz *et al.* 2018) to validate our findings and set necessary thresholds to achieve at least good ecological status or potential. Two of our cyprinid case studies (rivers Islice and Auce) are heavily impacted by eutrophication which may affect fish assemblages (Sutela *et al.* 2010) and results of ecological response to water level alterations.

## CONCLUSION

The currently existing ecological flows, provided in water use permits, do not completely support the sustainability of aquatic ecosystems for most of the studied rivers. Although Latvia is a small country in terms of area, regional differences can be observed in the hydrological regime of rivers. That potentially affects the calculation of the ecological flow. For salmonid and cyprinid rivers, the ecological flow regime must be calculated differently because salmonid rivers are more vulnerable to artificial low flows. Different fish live stages have different requirements for flow intensity and therefore ecological flow regime must be calculated as a range, taking into account flow preferences for juveniles and adults. Additional research must be conducted in all four river basin districts, taking into account salmonid and cyprinid fish waters.

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## AUTHOR CONTRIBUTIONS

JJ, KA, TK conceived of the presented idea; JJ, KA, TK, MT helped supervise the field works; JJ, KA, TK analysed the data; JJ, KA wrote the original draft; JJ, KA, TK, MT reviewed and edited the article. All authors have read and agreed to the published version of the manuscript.

## DATA AVAILABILITY STATEMENT

Data cannot be made publicly available; readers should contact the corresponding author for details.

## CONFLICT OF INTEREST

The authors declare there is no conflict.

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