Interreg Latvija-Lietuva
European Regional Development Fund

EUROPEAN UNION

Trans WAT

Joint management of Latvian – Lithuanian transboundary river and lake water bodies (TRANSWAT)

HABITAT MODELLING RESULTS E-FLOW ESTIMATION METHOD

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Tatjana Kolcova / *Project manager*

Project Conference, Rigas 6 September 2022

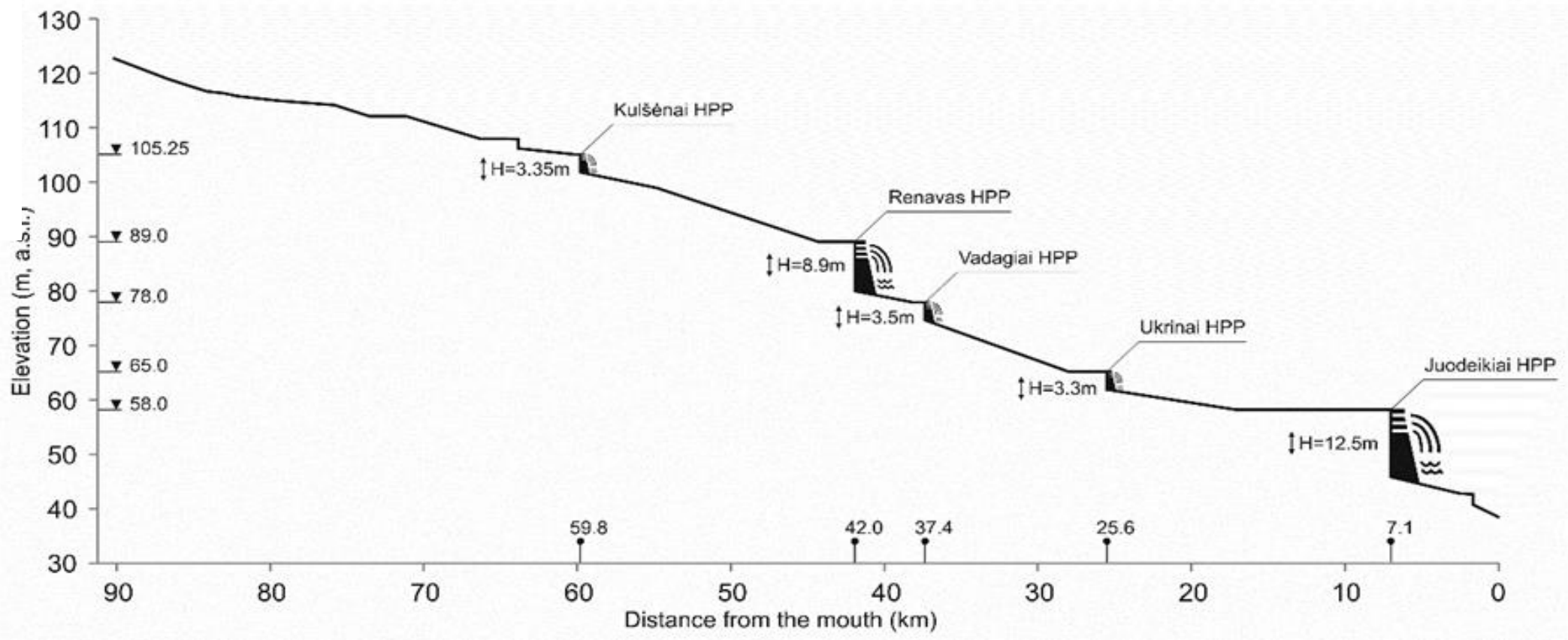
LVĢMC

BIOR
PĀRTIKAS DROŠĪBAS, DZĪVNIEKU VESELĪBAS UN VIDES ZINĀTNISKAIS INSTITŪTS

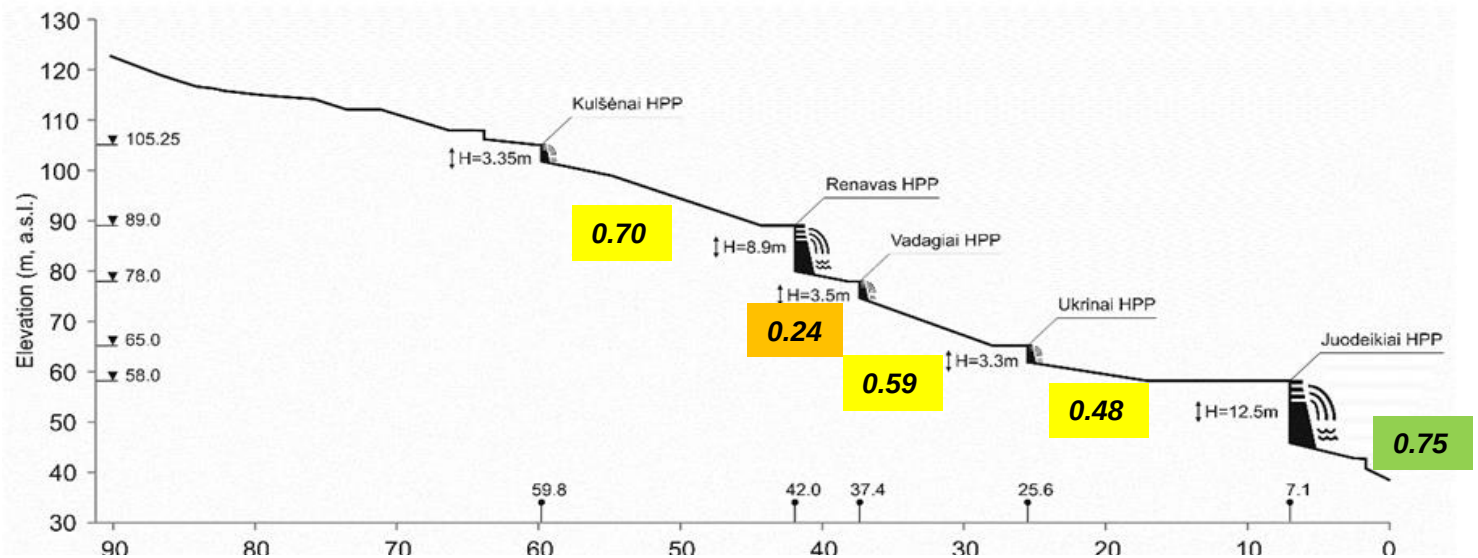
NATURE RESEARCH CENTRE

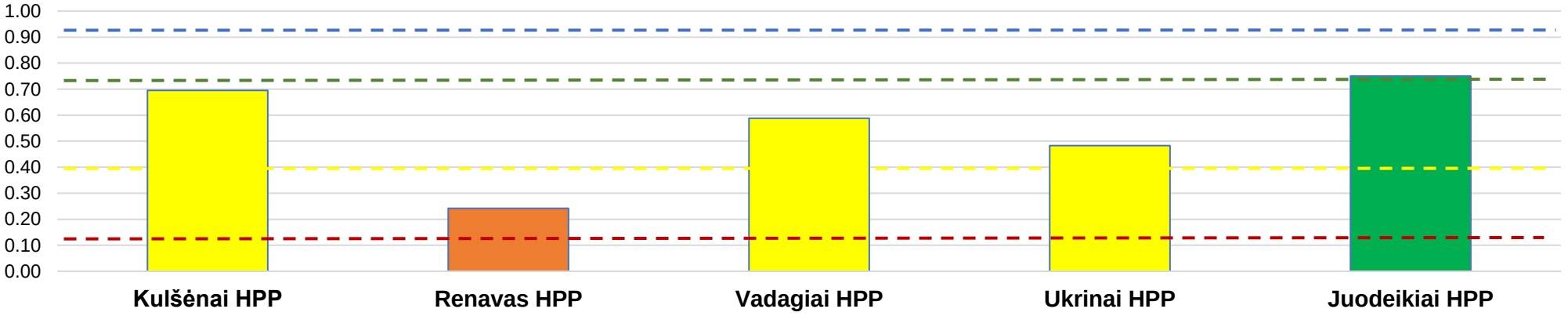
UNIVERSITY OF LATVIA

Varduva River HPPs cascade (Lithuania)



Fish indices

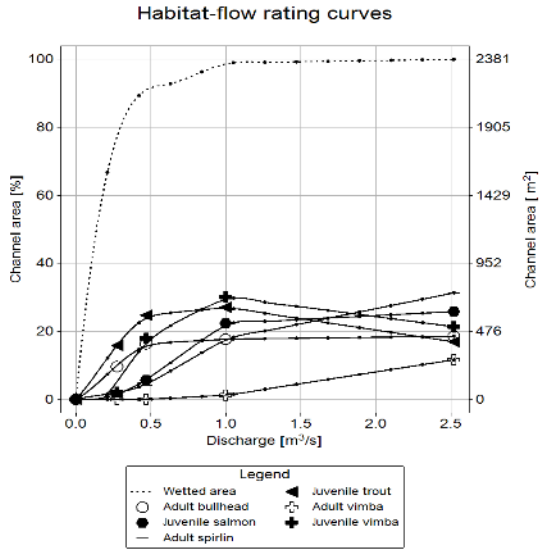


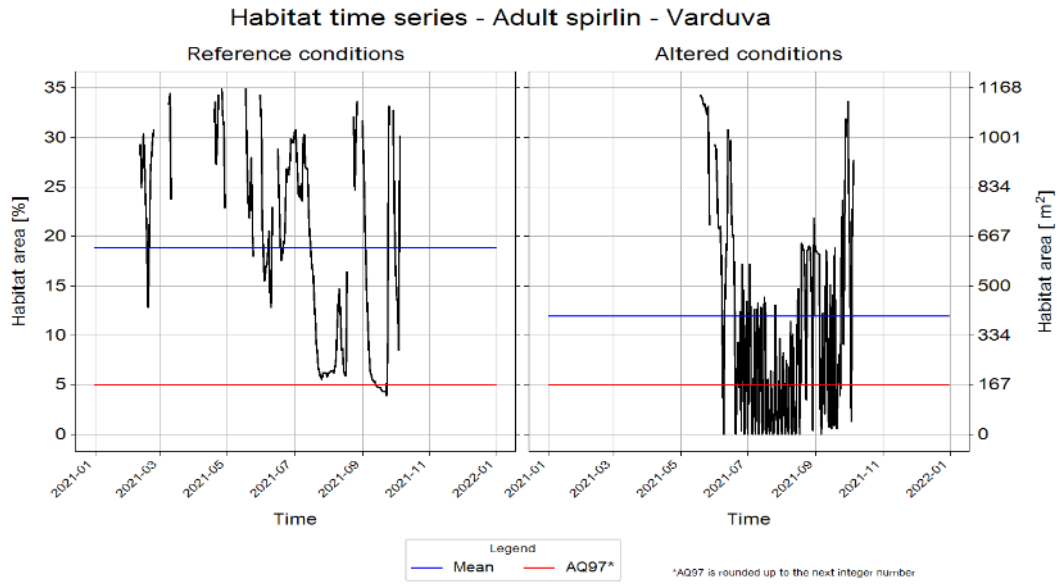


Kulšėnai HPP	Renavas HPP	Vadagiai HPP	Ukrinai HPP	Juodeikiai HPP
• Uppermost	• Middle	• Middle	• Middle	• Lowermost
• Operates	• Operates	• Doesn‘t operate in summer	• Operates	• Operates
• Long distance to next	• Short distance to next	• Medium distance to next	• Medium distance to next	• No downstream obstacles
• No access	• No access	• No access	• No access	• Free access from downstream

MesoHABSIM physical habitat modelling system:

Physical habitat component ⟷ Biological component requirements for *in situ* physical habitat characteristics



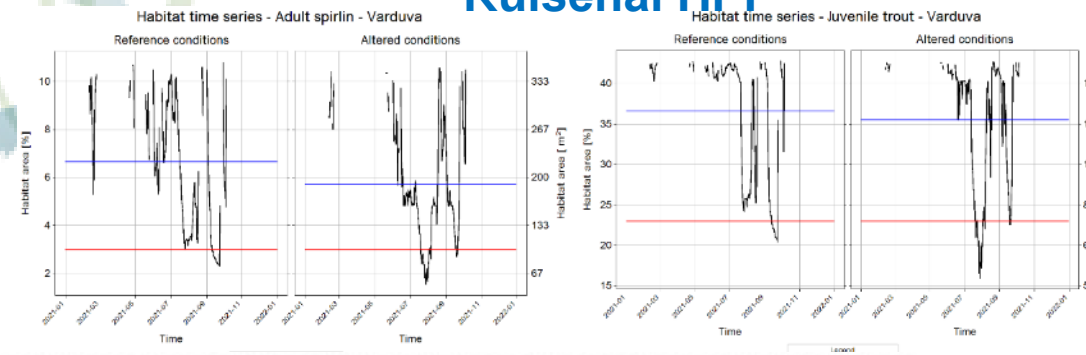


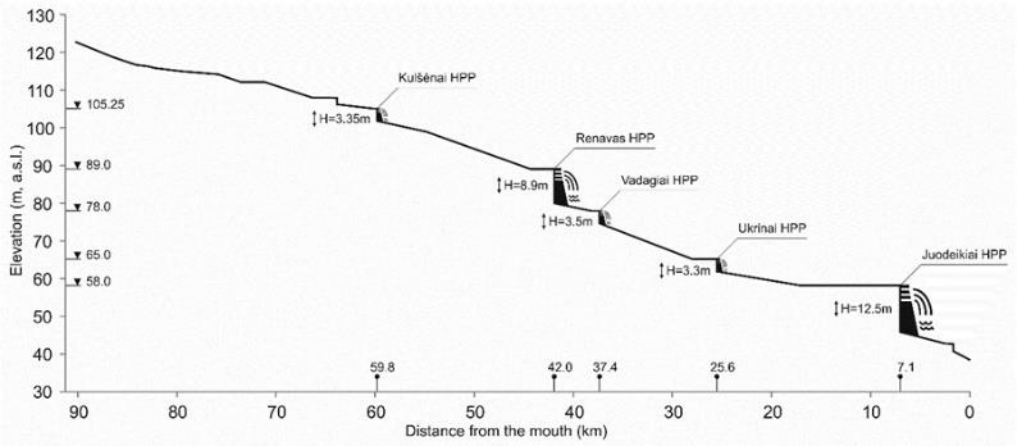
River type specific fish species modelled in Varduva River:

- Intolerant (disturbance-sensitive) and/or migratory: salmon (*Salmo salar*), trout (*Salmo trutta*), vimba (*Vimba vimba*), spirlin (*Alburnoides bipunctatus*), bullhead (*Cottus gobio*)
- Tolerant: roach (*Rutilus rutilus*), bleak (*Alburnus alburnus*), perch (*Perca fluviatilis*)

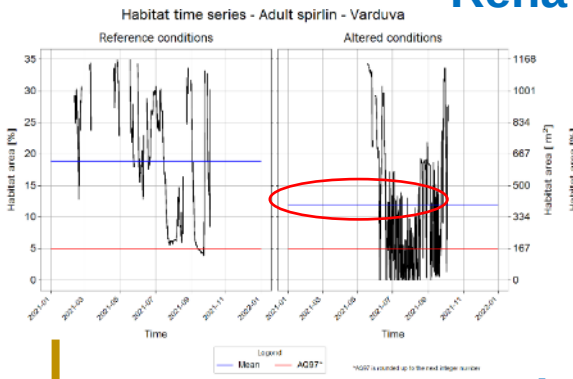
Habitat time series for Adult spirlin and Juvenile trout in Varduva River

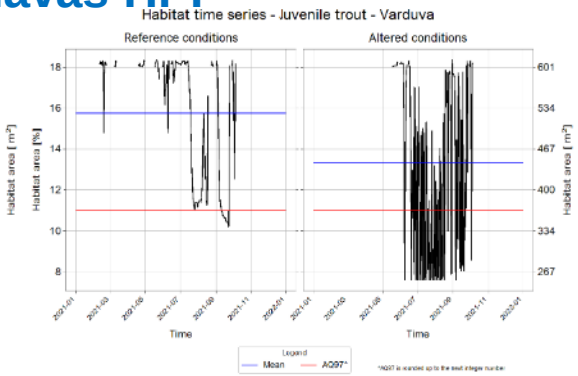
Kulšėnai HPP



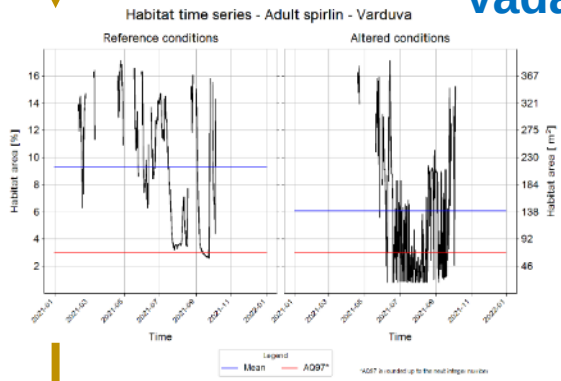


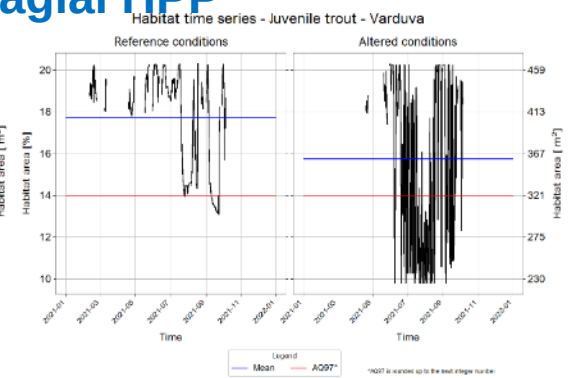
Renavas HPP



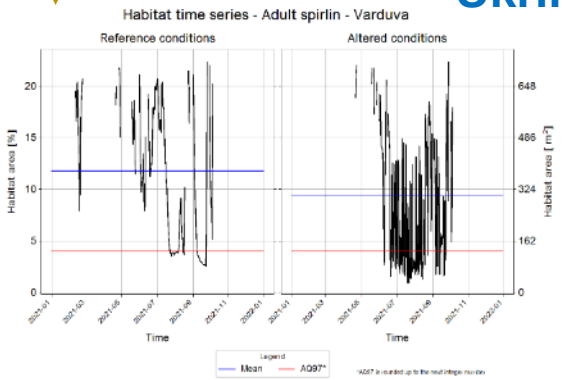


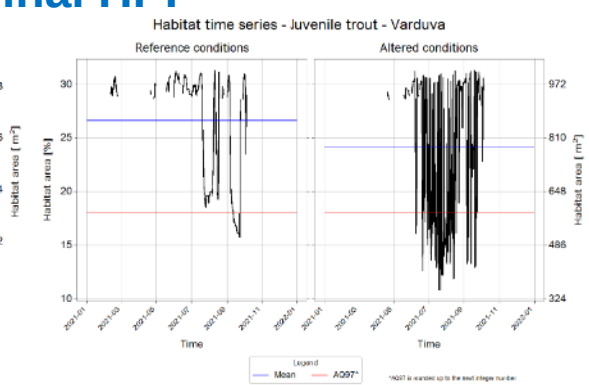
Vadagiai HPP



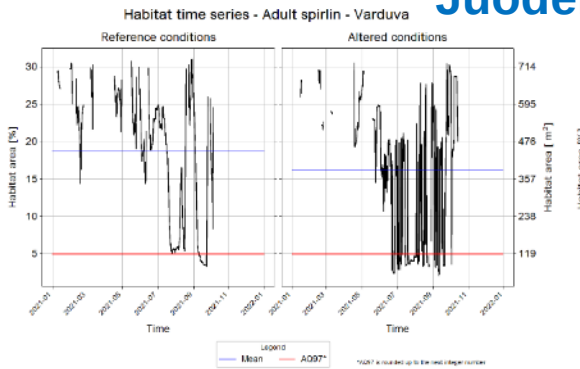


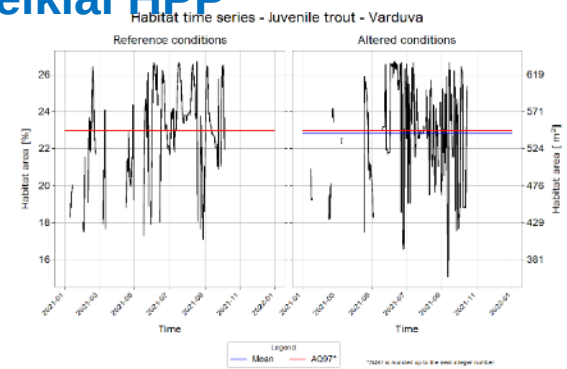
Ukrinai HPP





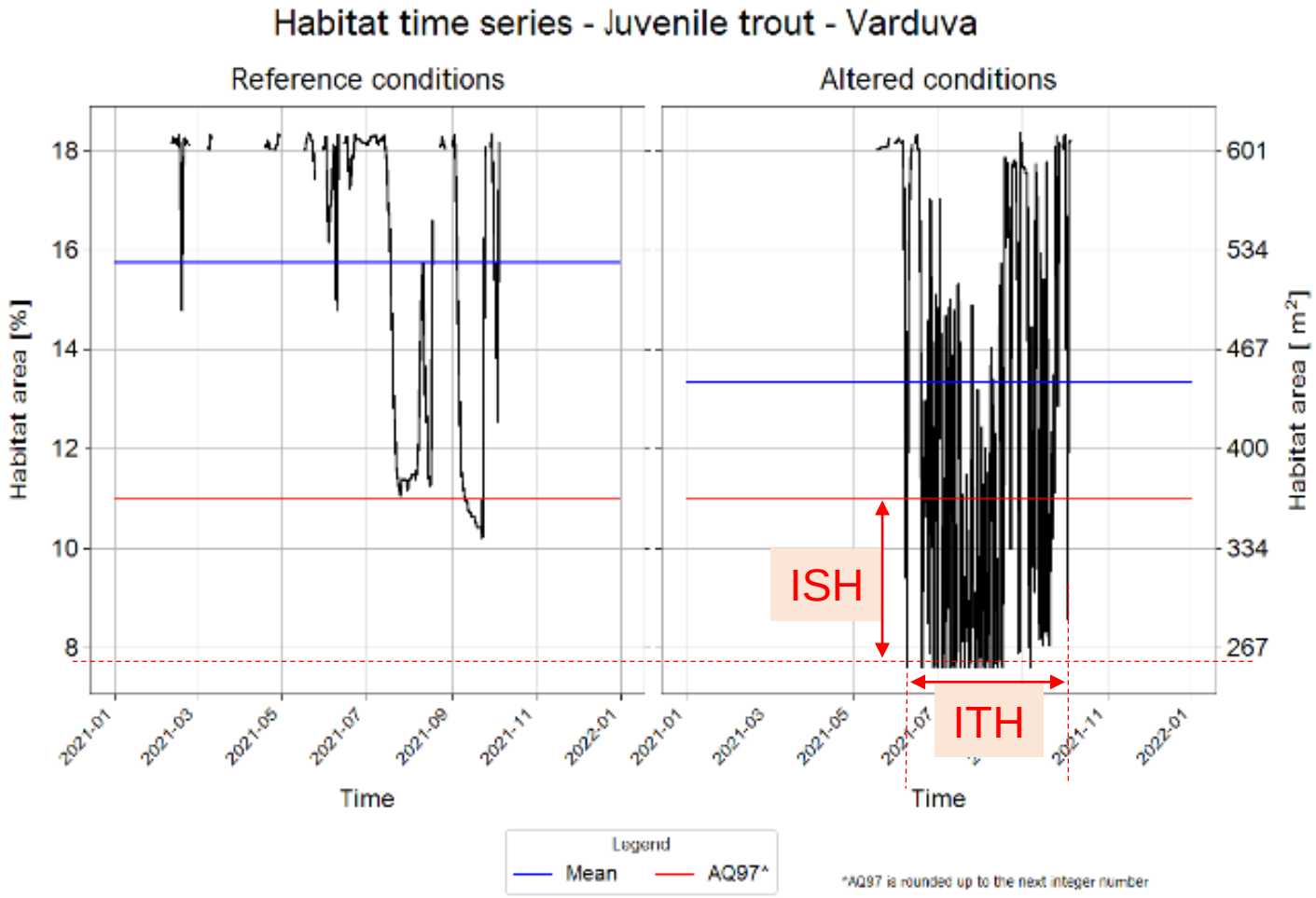
Juodeikiai HPP



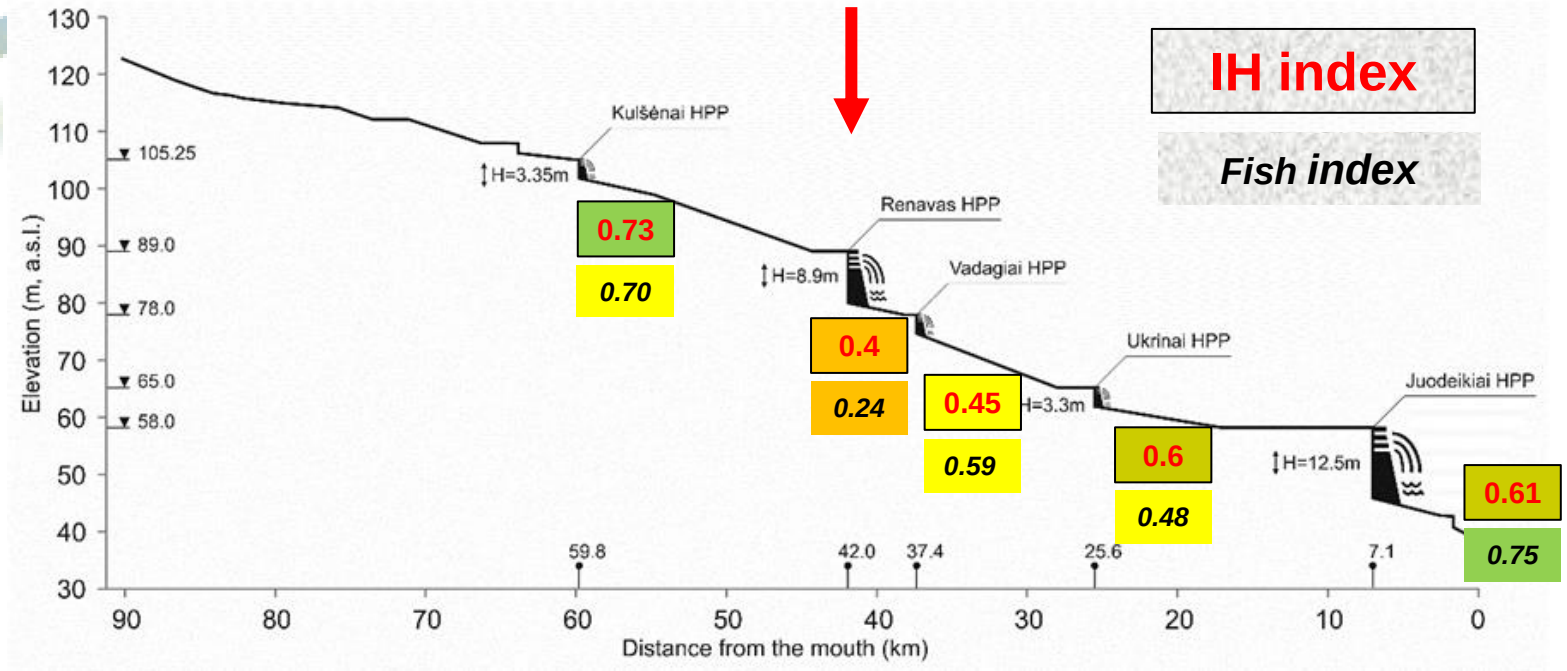


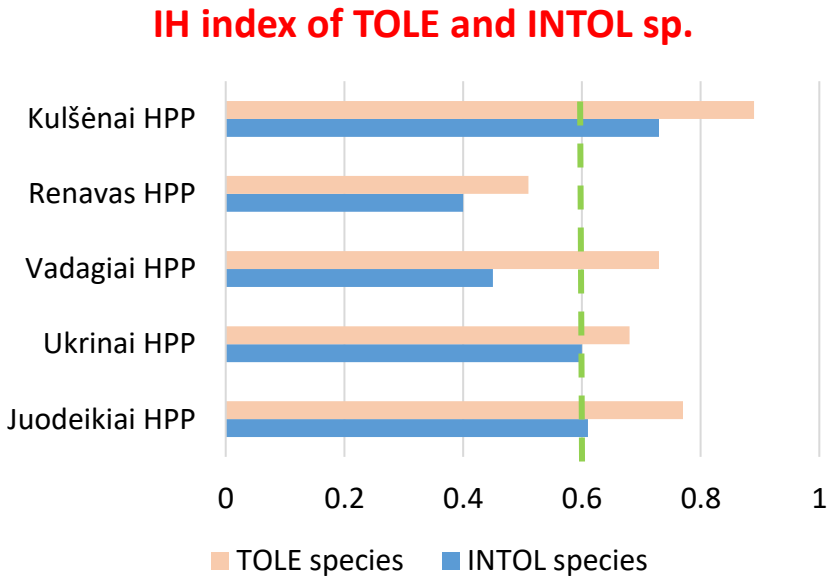
IH – Index of Habitat availability: IH = min (ISH , ITH)

- ISH – Index of Spatial Habitat availability;
- ITH – Index of Temporal Habitat availability.



Integrity indices



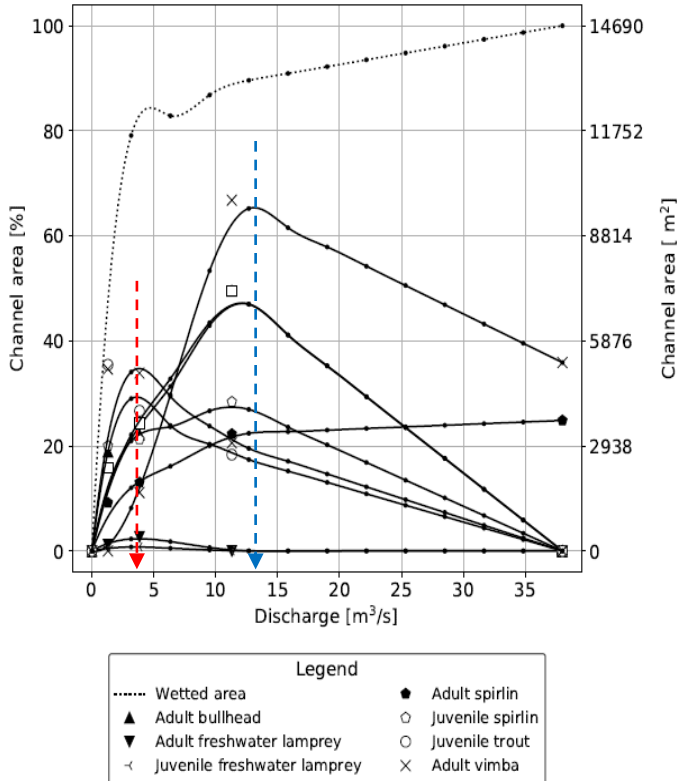


- The uppermost Kulšėnai HPP has a low impact on the availability of suitable habitats for fish.
- Renavas HPP has the highest impact, which is passed on to the HPPs downstream, so ensuring the ecological flow downstream of this HPP is of primary importance.

E-flow estimation

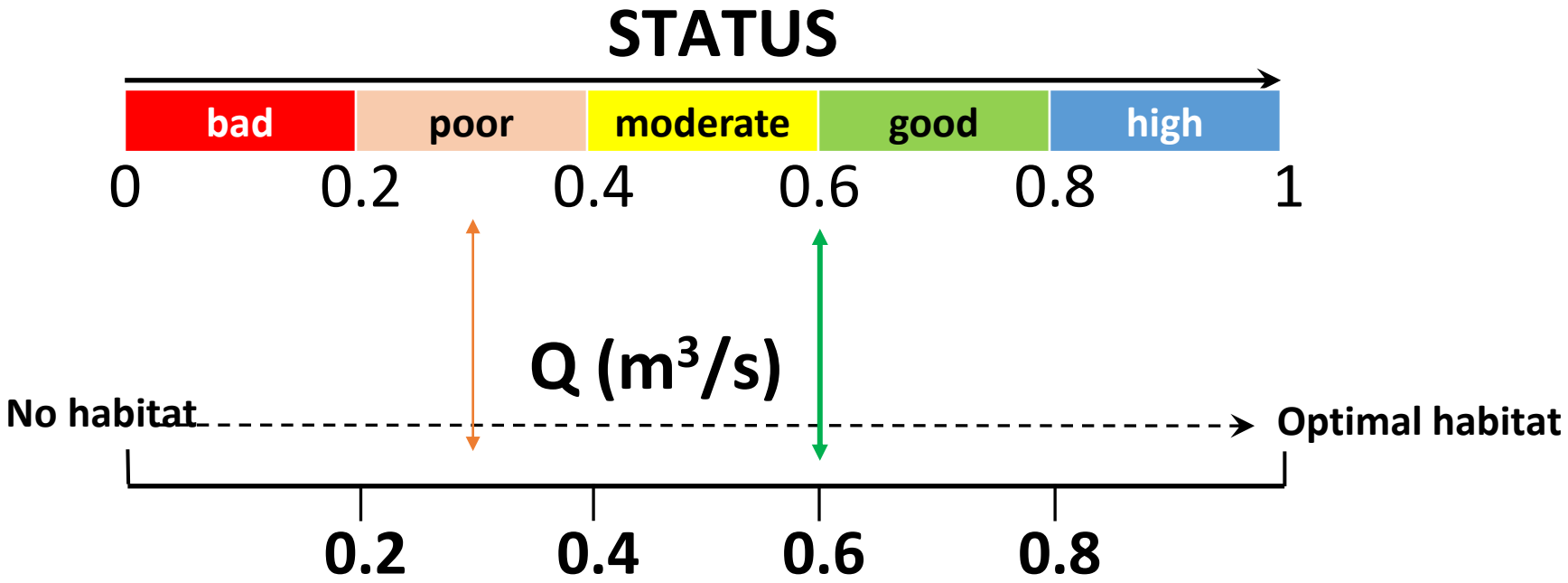
IH	Class
IH ≥ 0.80	High
0.60 ≤ IH < 0.80	Good
0.40 ≤ IH < 0.60	Moderate
0.20 ≤ IH < 0.40	Poor
IH < 0.20	Bad

Habitat-flow rating curves



It is unrealistic to carry out hydromorphological measurements and sampling of fish in each river stretch below HPP, and determine e-flows which are essential for the target fish species.

A simplified methodology should be developed (ECOFLOW project).



E-flow estimation

Ecological flow - the flow that ensures the long-term existence of viable populations (*Guidance on Environmental Flows. 2019. World Meteorological Organisation*)

The flow, which corresponds to the concept of ecological flow, has been determined earlier in the projects ECOFLOW (Interreg V-A Latvia-Lithuania project "Ecological flow estimation in Latvian - Lithuanian trans-boundary river basins"; LLI-249) and ECODAM (National Science Programme "Sustainability of agro-, forest and aquatic ecosystems" supported by the Lithuanian Science Council, project "Assessment of the impact of hydraulic structures on the river discharge and sustainable management of water resources for conservation and restoration of aquatic ecosystems"; Project registration No. SIT-20-3), based on:

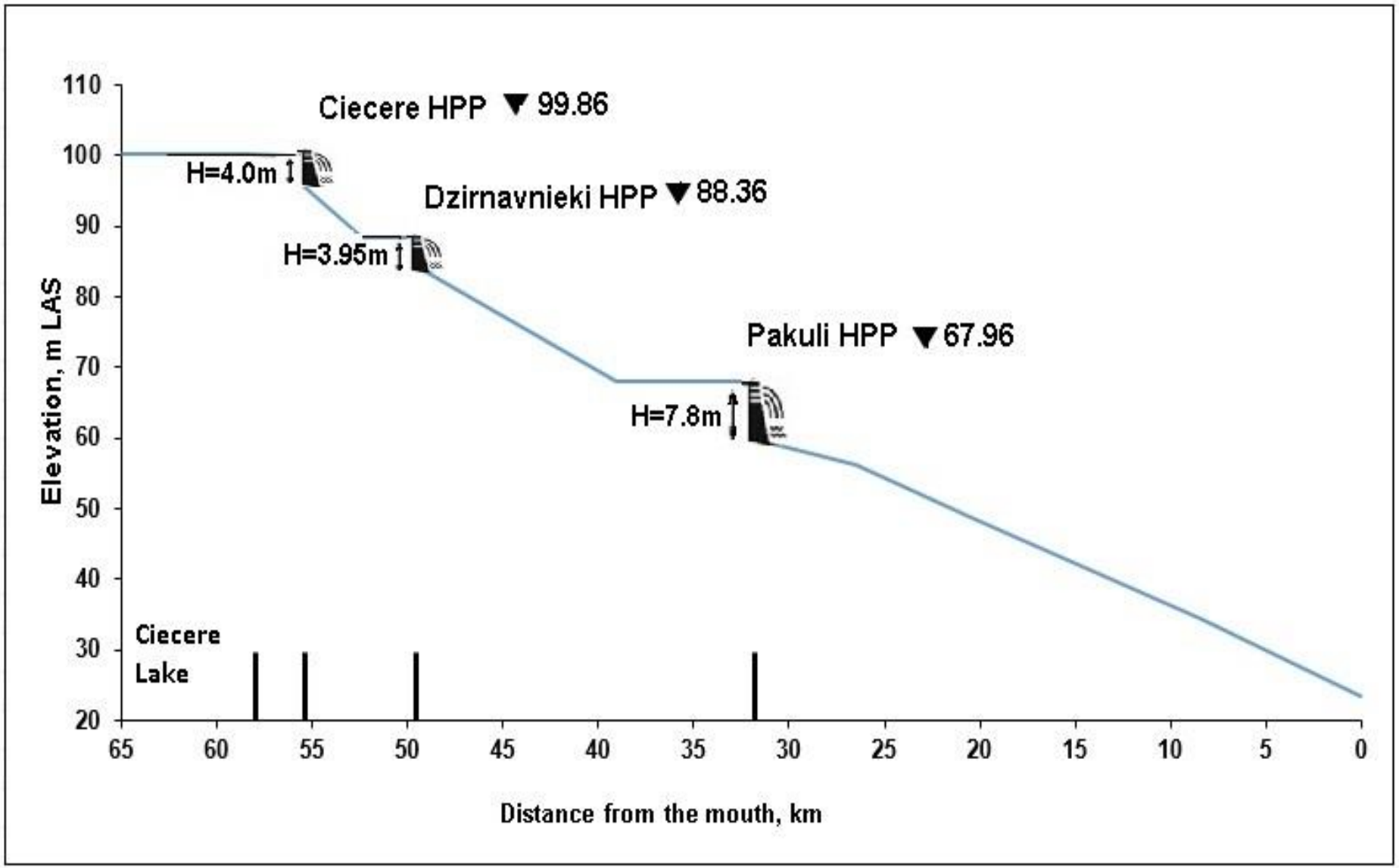
- analysis of Habitat-flow rating curves (permissible deviation from the habitat area, which is available at Q_optimal (Vezza et al. 2012));
- analysis of Uniform Continuous Under Threshold curves (UCUT)(Parasiewicz 2008; Parasiewicz et al. 2018).

Low flow season **E-flow = ~ Q_{30_avg}**

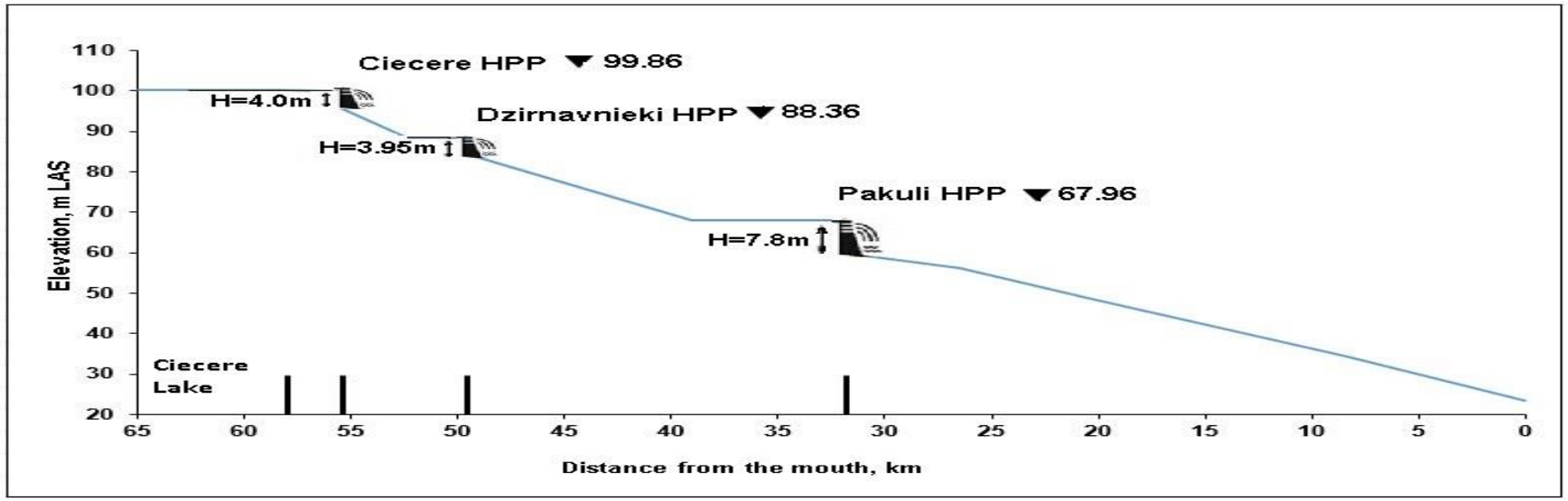
In other seasons E-flow = ~ Q_{30_max} (in LT - preliminary; still lacking well-based validation)

Parasiewicz, P. 2008. Habitat time series analysis to define flow augmentation strategy for the Quinebaug River, Connecticut and Massachusetts, USA. *River Research and Applications* 24:439-452. DOI:10.1002/rra.1066
Parasiewicz, P., Prus, P., Suska, K., Marcinkowski, P. 2018. "E = mc2" of Environmental Flows: A Conceptual Framework for Establishing a Fish-Biological Foundation for a Regionally Applicable Environmental Low-Flow Formula. *Water* 10 (11), 1501. https://doi.org/10.3390/w10111501
Vezza, P., Parasiewicz, P., Rosso, M., Comoglio, C. 2012. Defining minimum environmental flows at regional scale: application of mesoscale habitat models and catchments classification. *River Research and Applications* 28:717–730. https://doi.org/10.1002/RRA.1571

Ciecere River HPPs cascade (Latvia)



River type specific fish species modelled in Ciecere River:



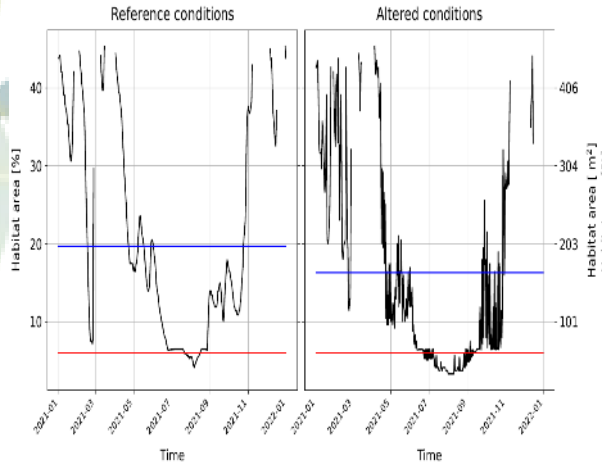
Adult bullhead (Cottus gobio),
Juvenile brown trout (Salmo trutta),
Adult stone loach (Barbatulus barbatulus).
Adult common dace (Leuciscus leuciscus),

Juvenile brown trout (Salmo trutta),
Adult bullhead (Cottus gobio),
Adult stone loach (Barbatulus barbatulus).
Adult and juvenile chub (Squalius cephalus),

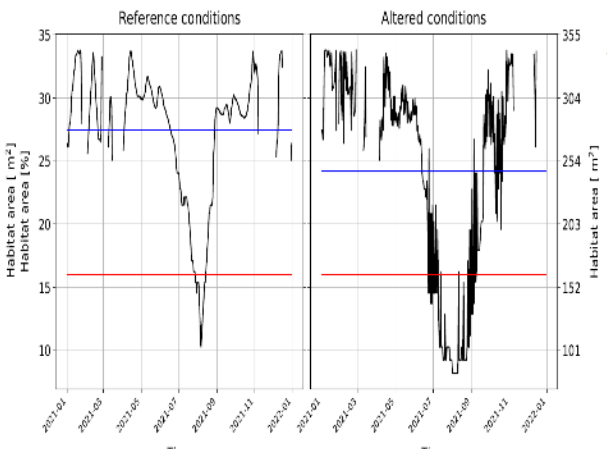
Juvenile brown trout (Salmo trutta),
Adult bullhead (Cottus gobio).
Adult stone loach (Barbatulus barbatulus),
Adult chub (Squalius cephalus),
Adult spirlin (Alburnoides bipunctatus),

Habitat time series for Adult bullhead and Juvenile trout in Ciecere River

Ciecere HPP

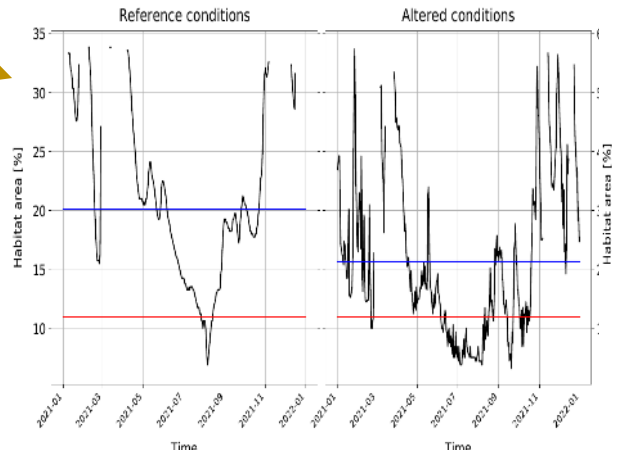


Habitat time series of the adult bullhead

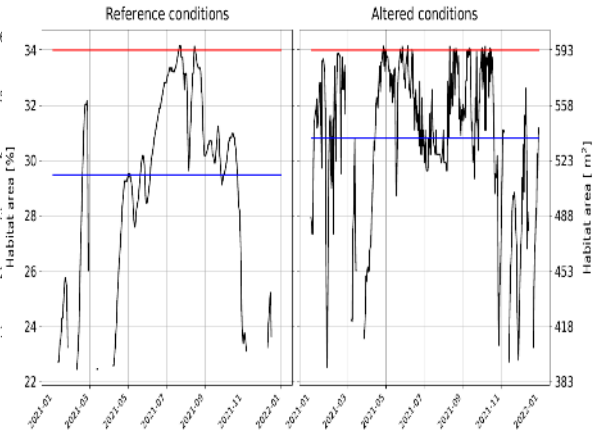


Habitat time series of the juvenile brown trout

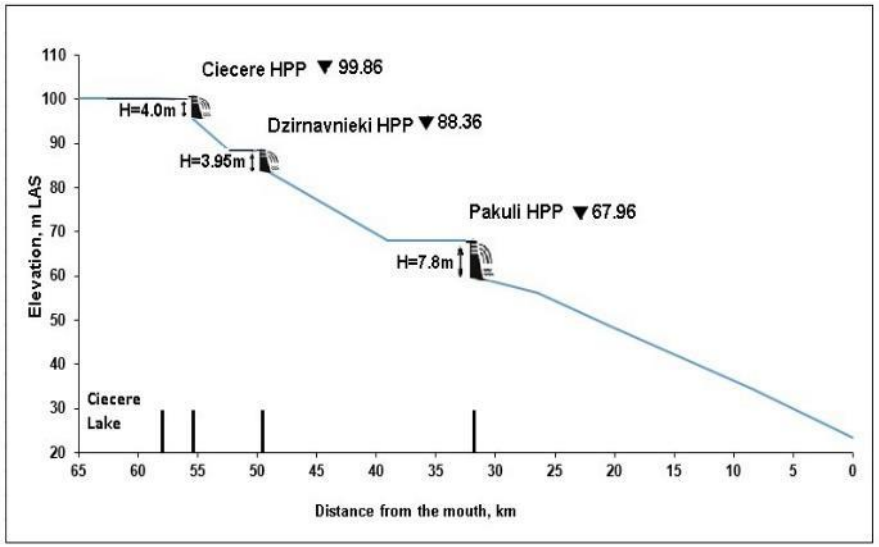
Dzirnavnieki HPP



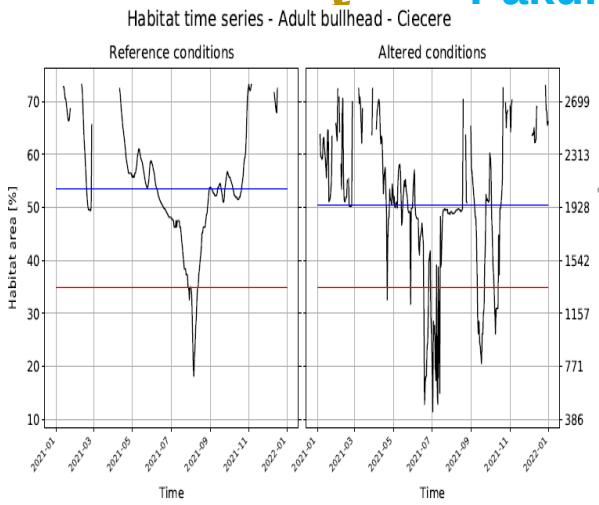
Habitat time series of the adult bullhead



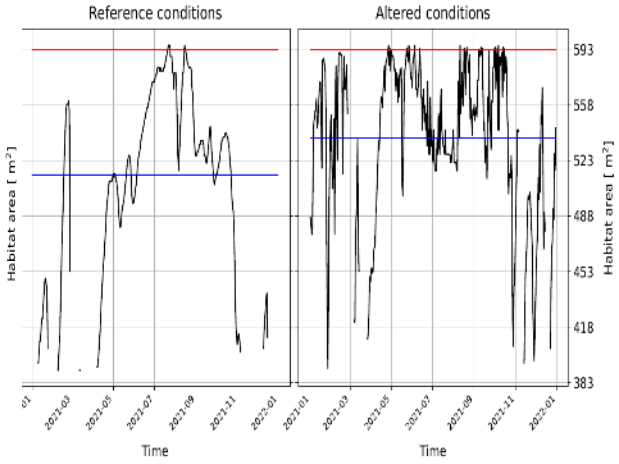
Habitat time series of the juvenile brown trout



Pakuli HPP

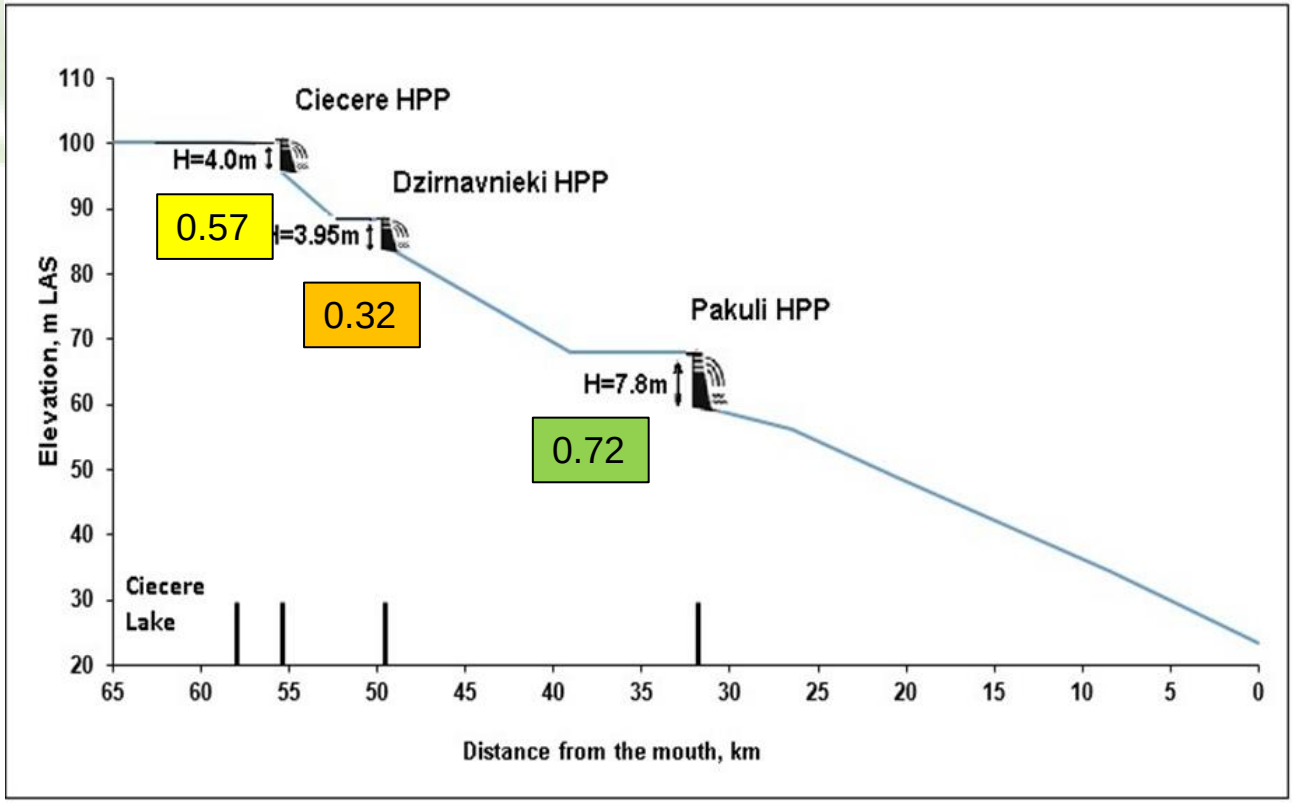


Habitat time series of the adult bullhead

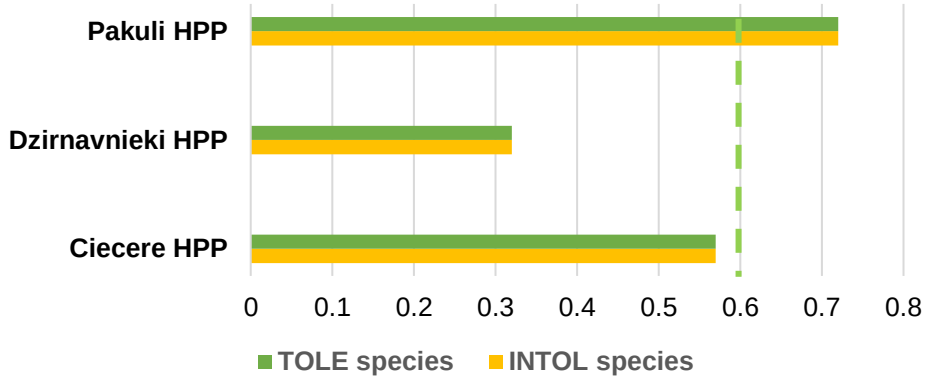


Habitat time series of the juvenile brown trout

Integrity indices

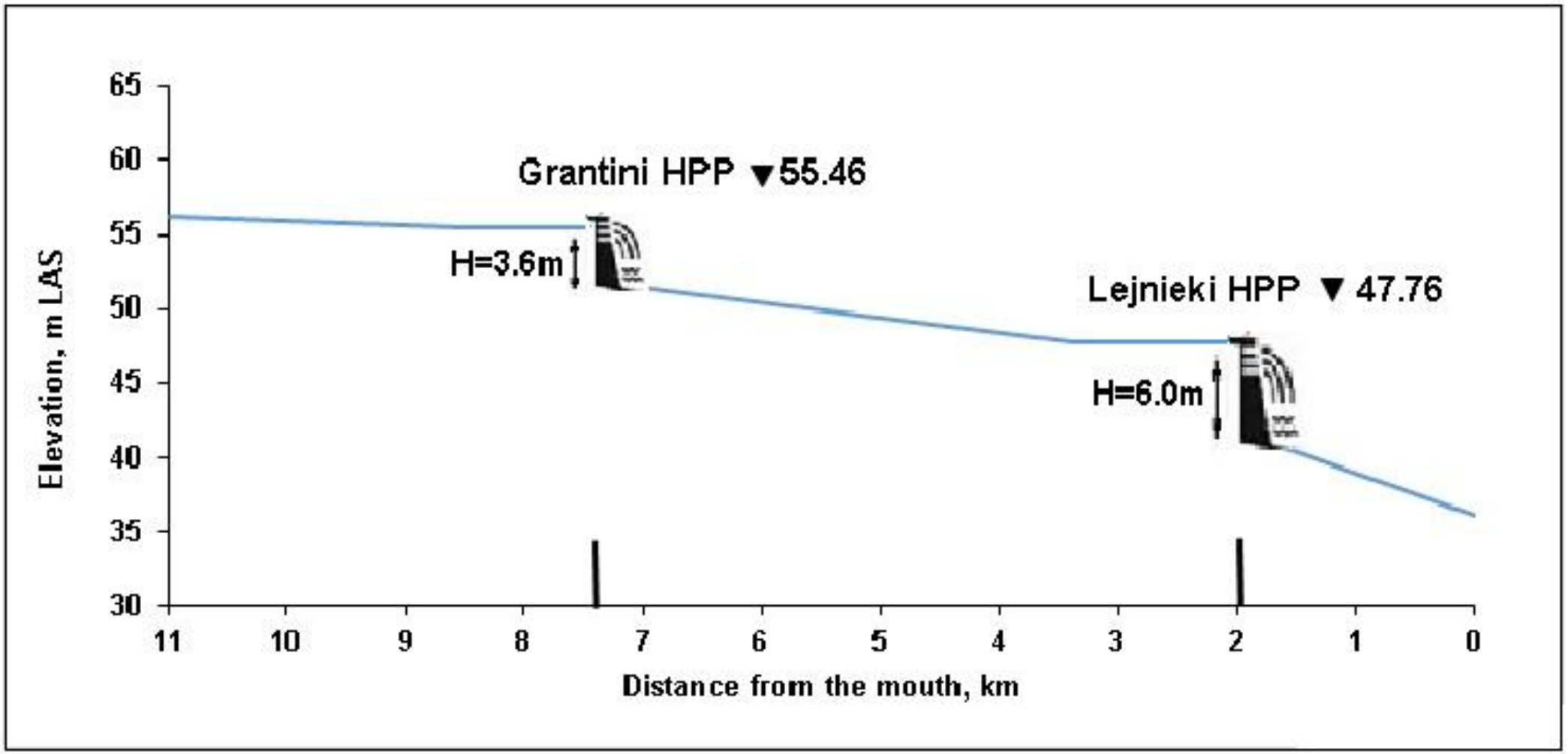


IH for TOLE and INTOLE species

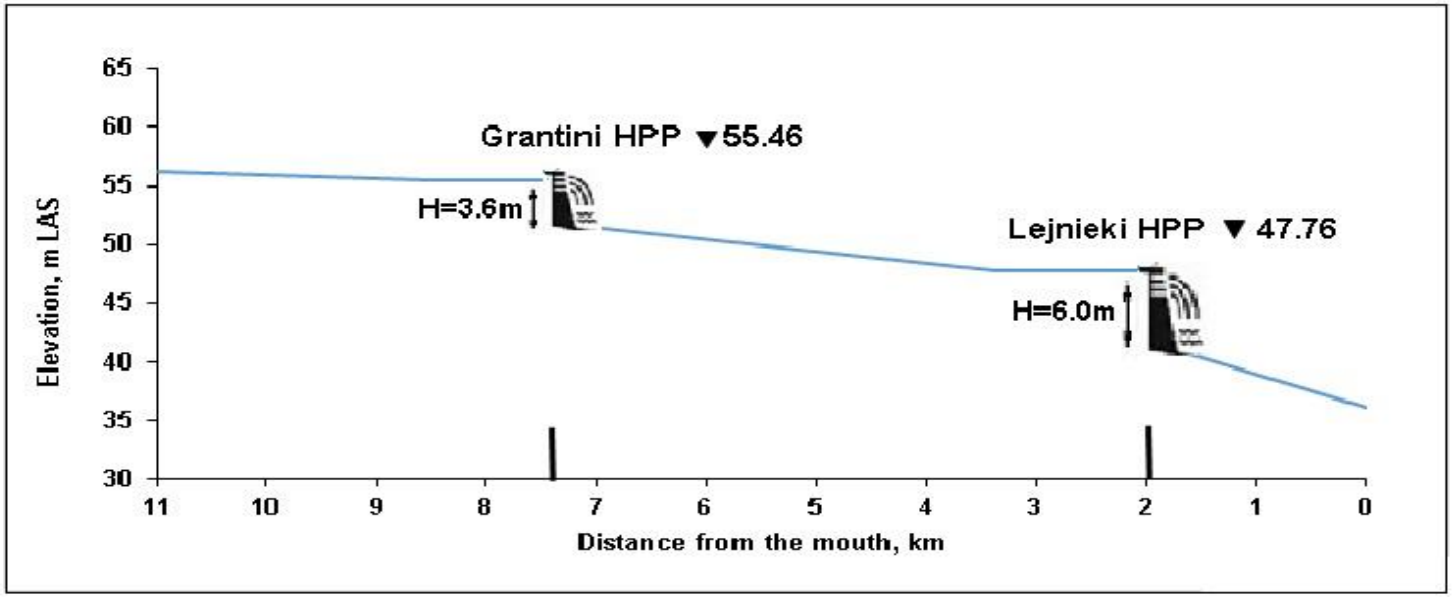


- The lowest Pakuli HPP has a low impact on the availability of suitable habitats for fish.
- Dzirnavnieki HPP has the highest impact, which is passed on to the HPPs downstream, so ensuring the ecological flow downstream of this HPP is of primary importance.

Losis River HPPs cascade (Latvia)



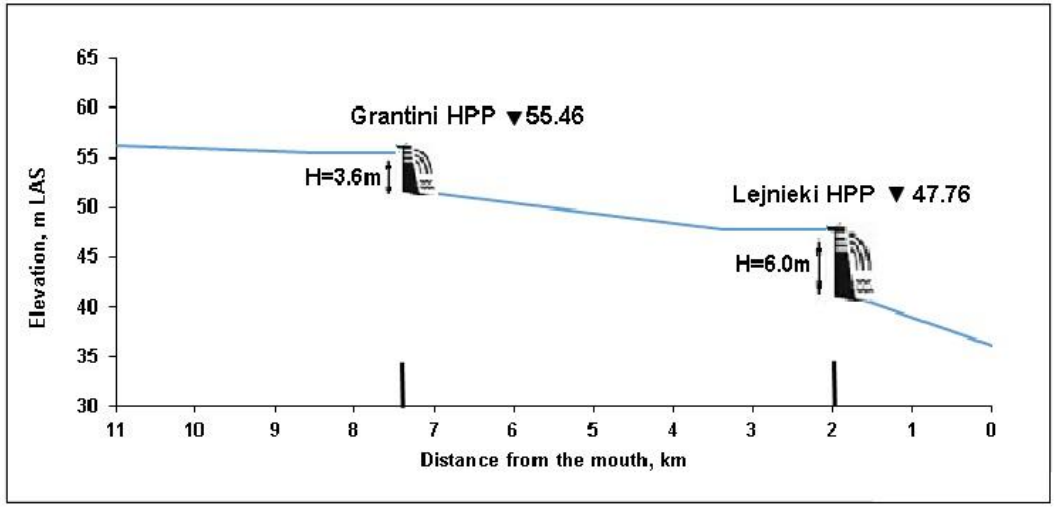
River type specific fish species modelled in Losis River:



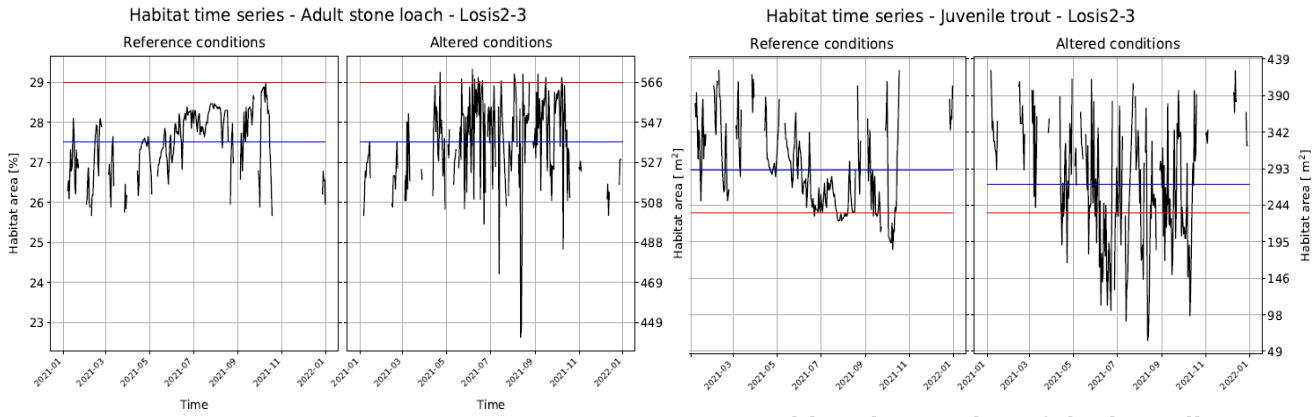
Juvenile brown trout (*Salmo trutta*),
Adult bullhead (*Cottus gobio*),
Adult chub (*Squalius cephalus*),
Adult common dace (*Leuciscus leuciscus*),
Adult stone loach (*Barbatulus barbatulus*)

Juvenile brown trout (*Salmo trutta*),
Adult bullhead (*Cottus gobio*),
Adult chub (*Squalius cephalus*),
Adult common dace (*Leuciscus leuciscus*),
Adult stone loach (*Barbatulus barbatulus*)

Habitat time series for Adult bullhead and Juvenile trout in Losis River



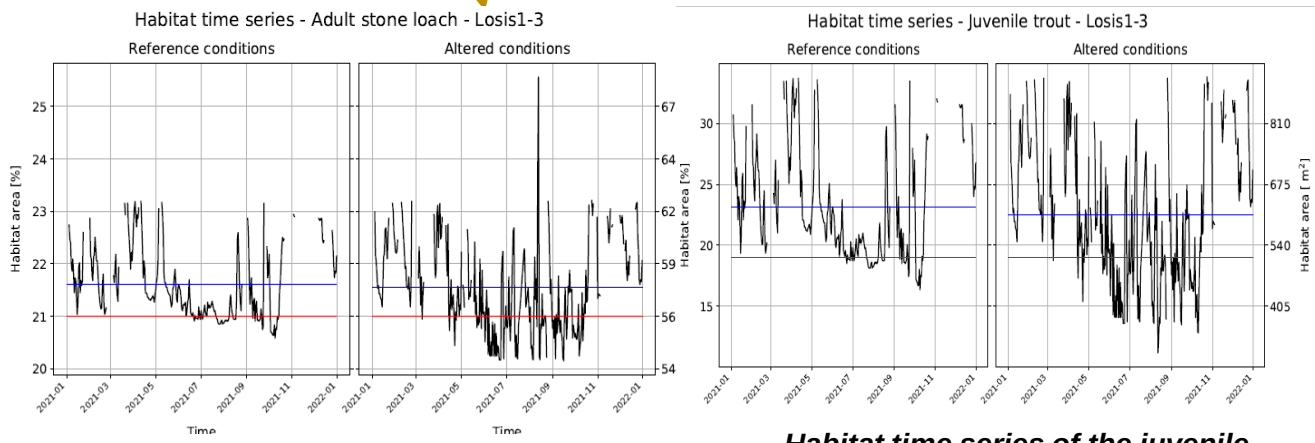
Grantinii HPP



Habitat time series of the stone loach

Habitat time series of the juvenile brown trout

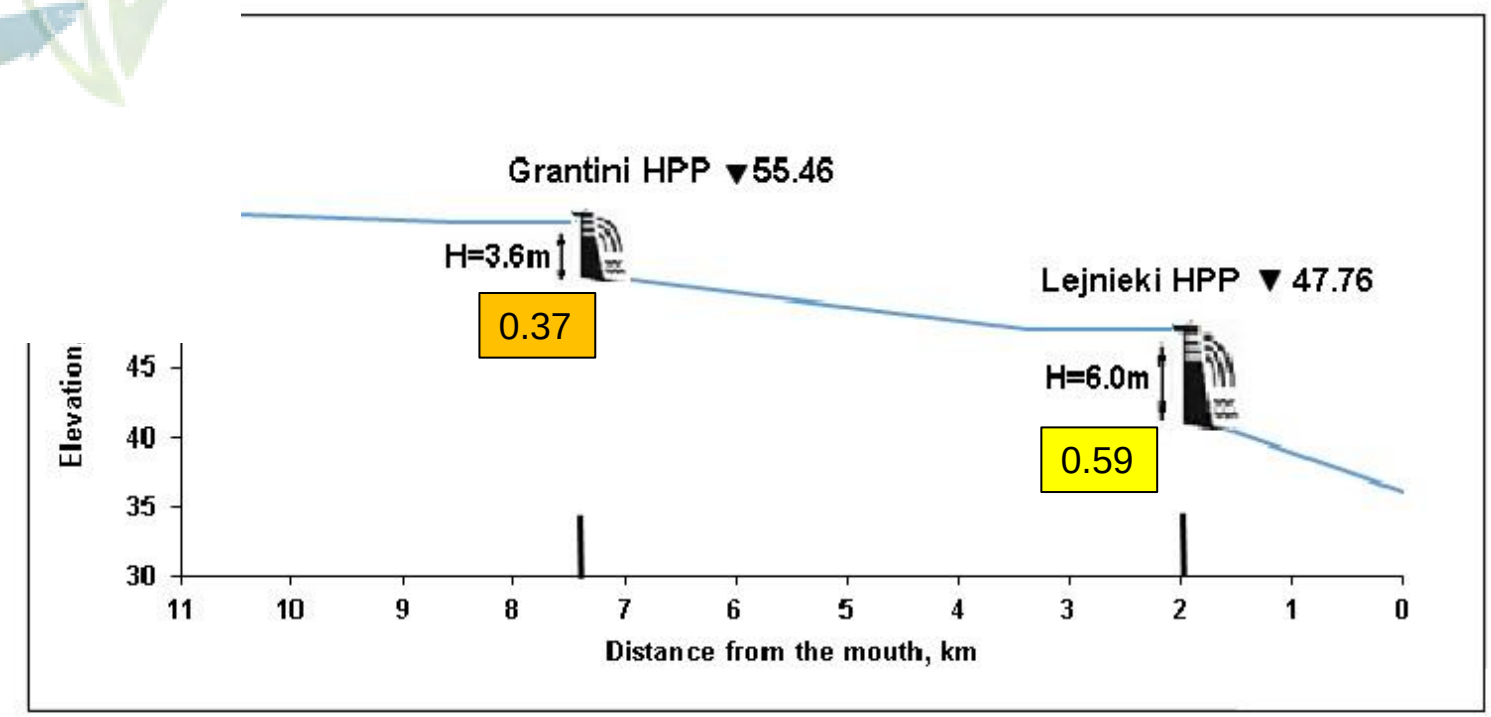
Lejnieki HPP



Habitat time series of the stone loach

Habitat time series of the juvenile brown trout

Integrity indices



IH for TOLE and INTOLE species

- The lowest Lejnieki HPP has a low impact on the availability of suitable habitats for fish.
- Grantini HPP has the highest impact, which is passed on to the HPPs downstream, so ensuring the ecological flow downstream of this HPP is of primary importance.

E-flow estimation

The flow, which corresponds to the concept of ecological flow, has been determined earlier in the projects ECOFLOW (Interreg V-A Latvia-Lithuania project "Ecological flow estimation in Latvian - Lithuanian trans-boundary river basins"; LLI-249), based on:

- analysis of Habitat-flow rating curves (permissible deviation from the habitat area, which is available at Q_optimal (Vezza et al. 2012));
- analysis of Uniform Continuous Under Threshold curves (UCUT)(Parasiewicz 2008; Parasiewicz et al. 2018).

Low flow season **E-flow = ~ Q_{30_avg}**

In other seasons **E-flow = ~ Q_{30_max}**

E-flow estimation

Thank you for attention!

Write us:

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tatjana.kolcova@lvgmc.lv

LATVIJAS VIDES, ĢEOLOĢIJAS UN METEOROLOĢIJAS CENTRS

LITHUANIAN ENERGY INSTITUTE

UNIVERSITY OF LATVIA

BIOR
INSTITUTE OF FOOD SAFETY, ANIMAL HEALTH AND ENVIRONMENT

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