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CNL(24)76

Using eDNA to estimate the distribution of pink salmon

Frode Fossøy
Senior Research Scientist

What is eDNA?

- «Conservation in a cup of water»

What is eDNA?

eDNA results and inference

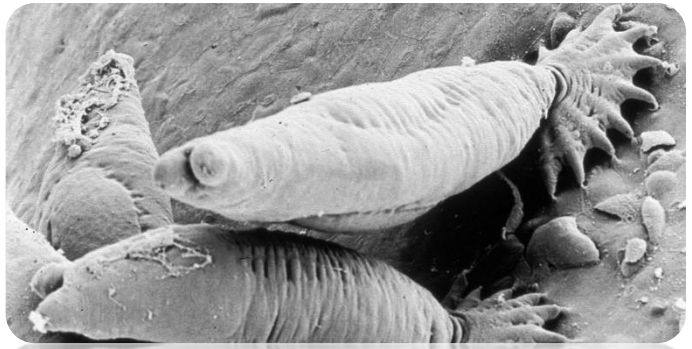
1. Presence (NOT absence!)
   - Rivers with unknown or uncertain status
2. Distribution
   - Upper limit
   - Tributaries
3. Abundance
   - Changes over time?

X Population size, age structure, sex ratio

NINA and eDNA

River pearl mussel

Gyrodactylus salaris



Northern pike

Bees and pollination

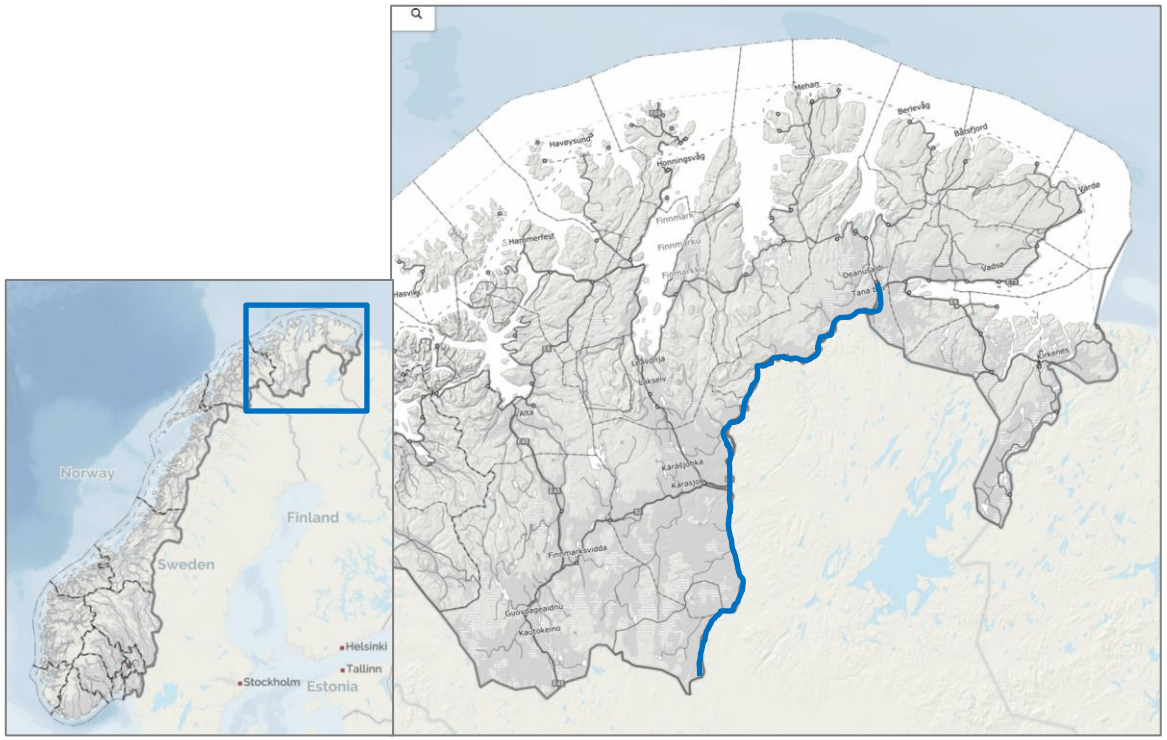
Reindeer and CWD

Great-crested newts

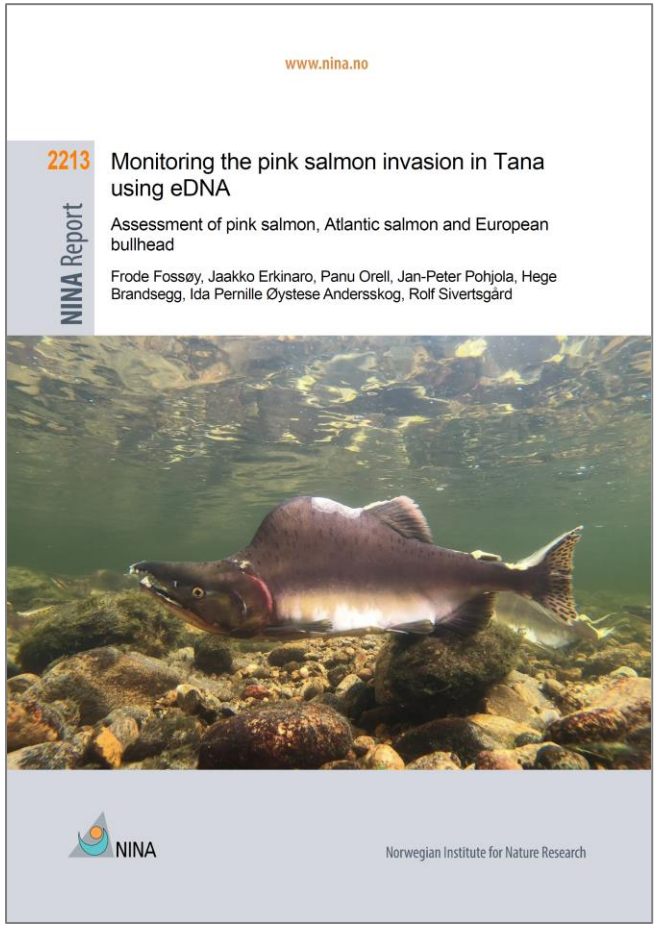
Insects

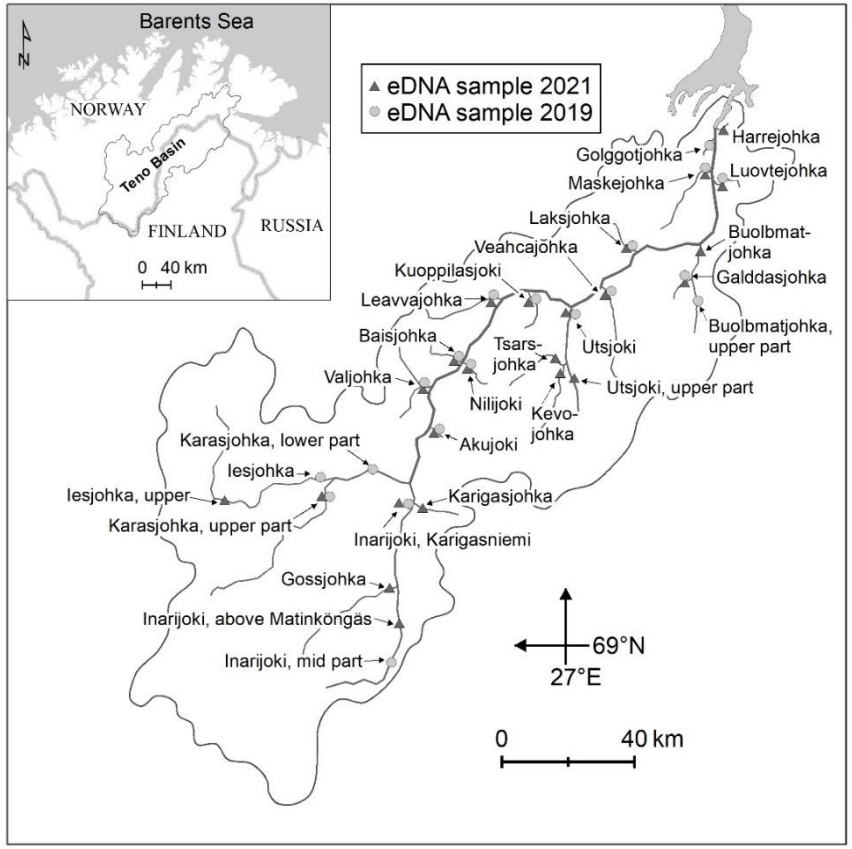
Pink salmon and eDNA

1. eDNA in the Tana River, Norway
2. PINKTRACK



Tana eDNA sampling





Statsforvalteren i Troms og Finnmark
County Governor of Troms and Finnmark

Luke
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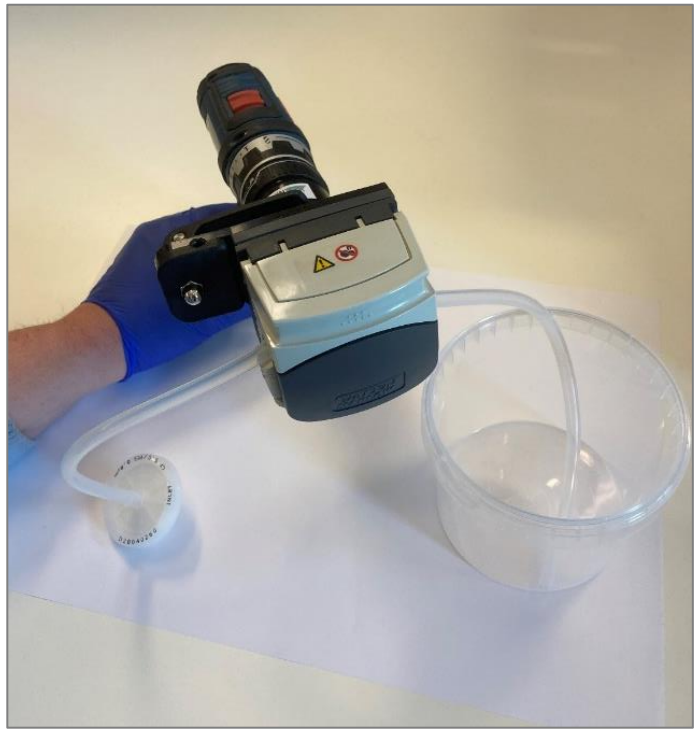
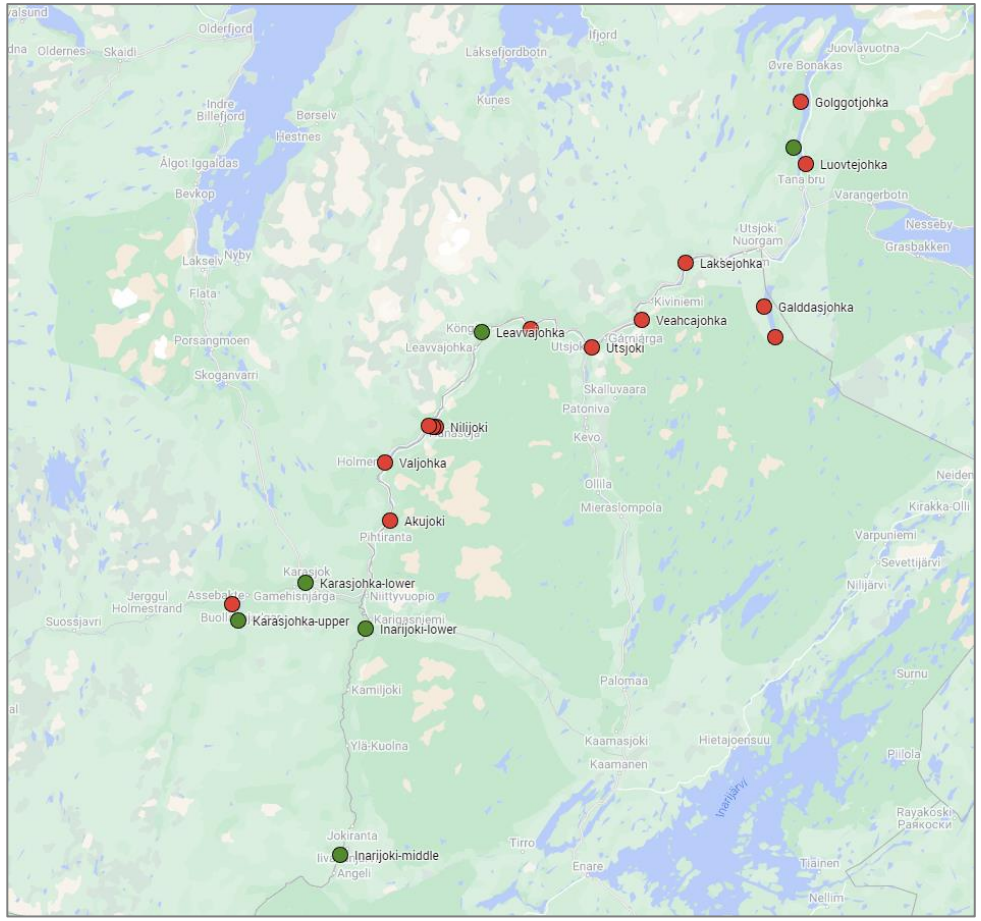
Tana eDNA sampling



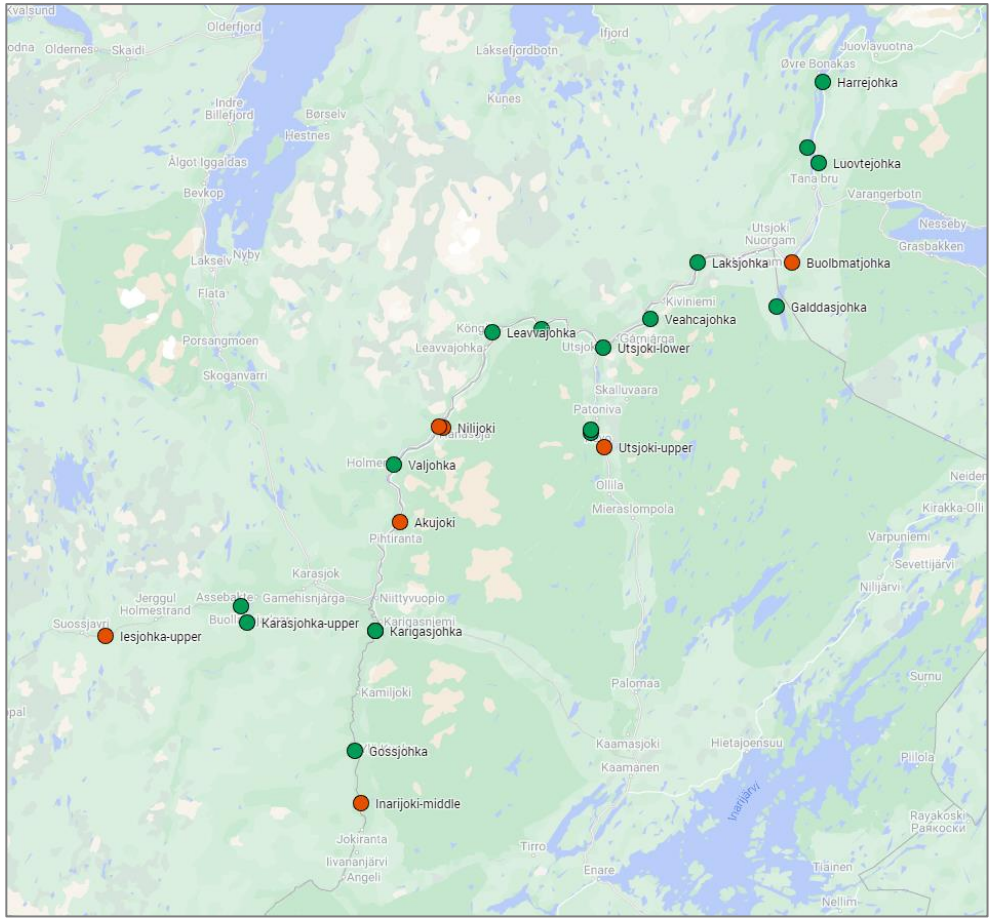
Year	Date	Water volum (L) mean (range)	Temperature (°C) mean (range)
2019	August 12-14	4.9 (3.5-5)	11.1 (8.6-13.8)
2021	August 9-13	5.0	15.2 (11.5-17.7)
2022	August 24-29	4.3 (1.5–5)	12.6 (9.6-15.8)
2023	August 8-17	4.0 (2.5-5)	15.5 (11.9-18.5)

Tana river – Pink salmon

2019

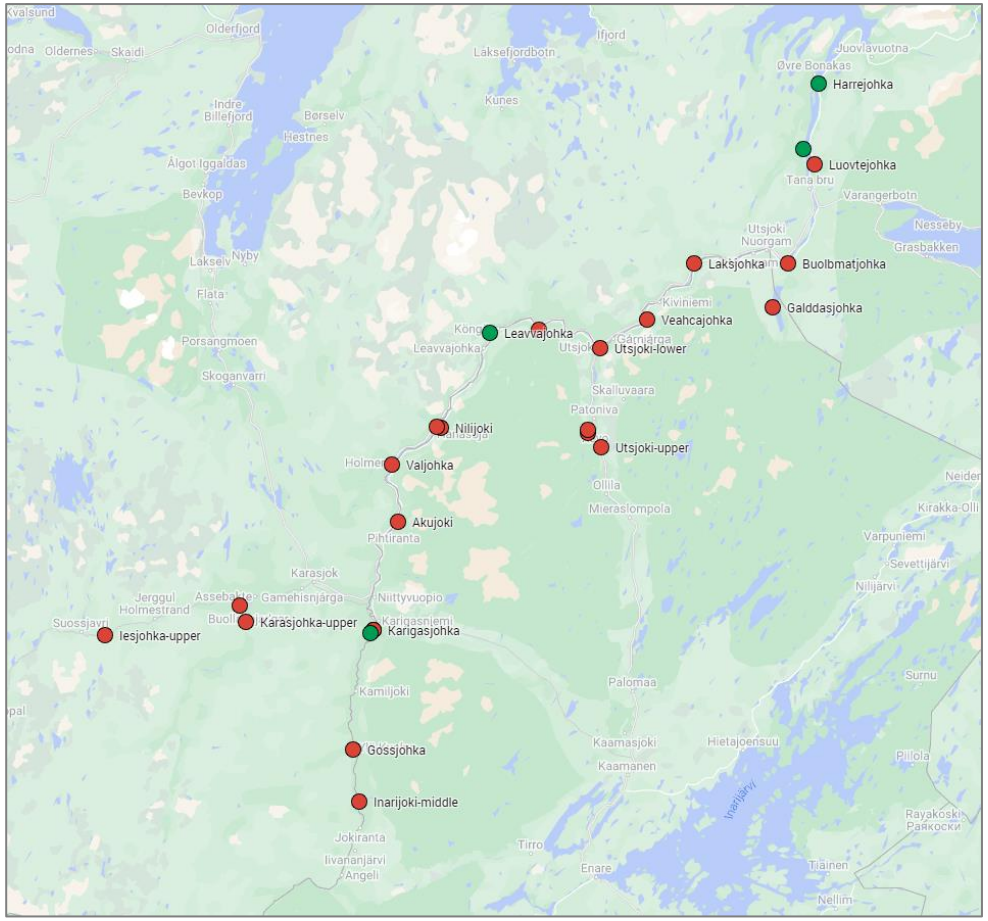


2021

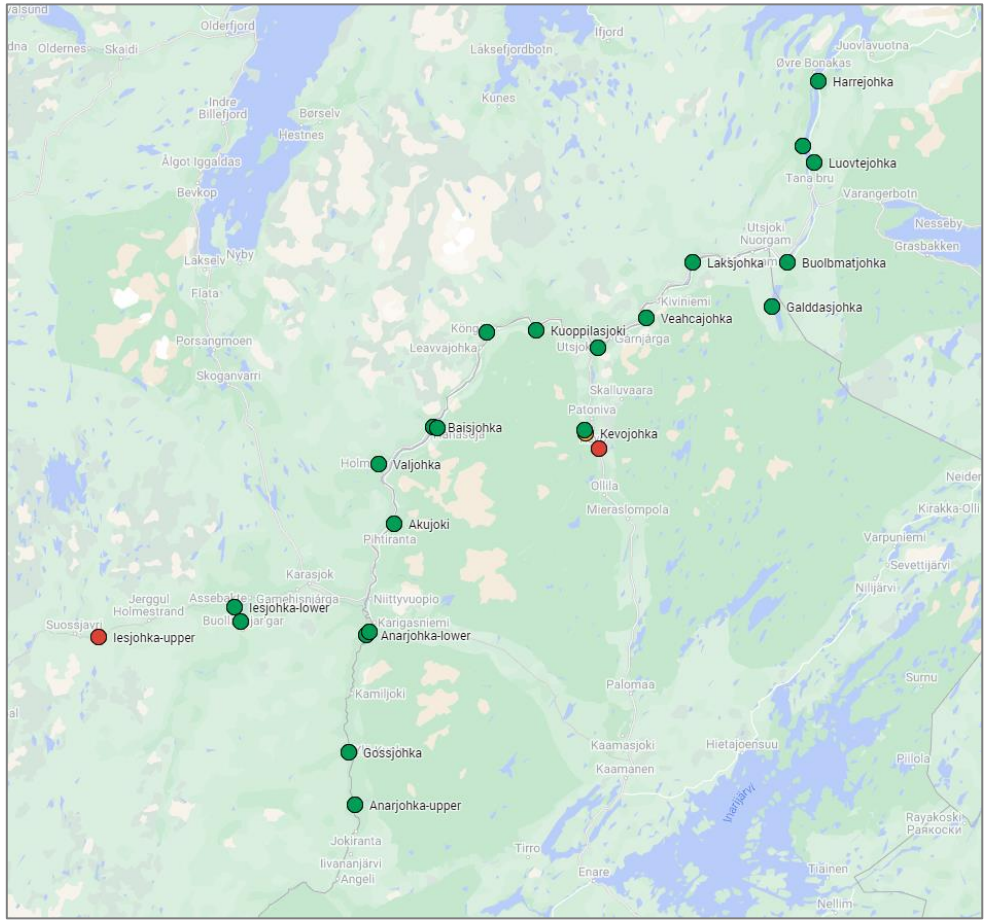


Tana river – Pink salmon

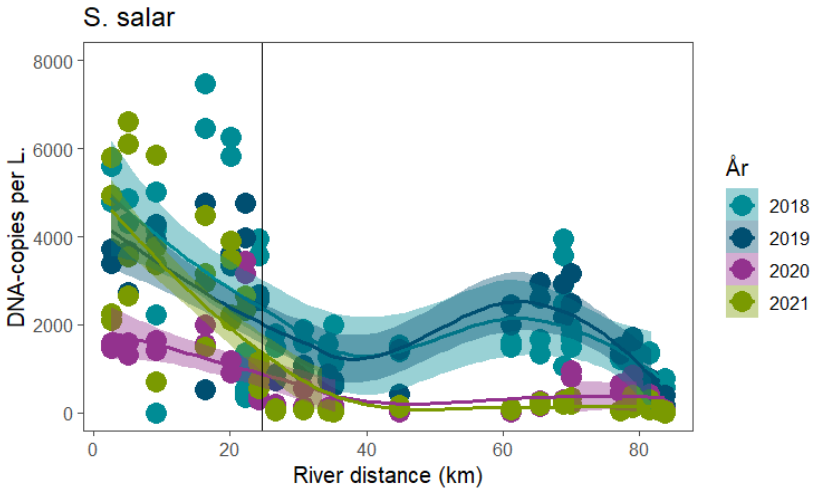
2022

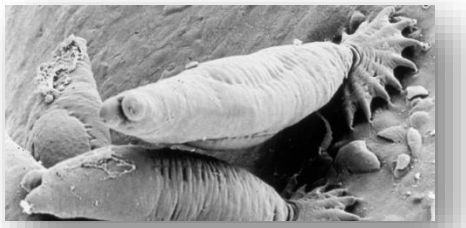


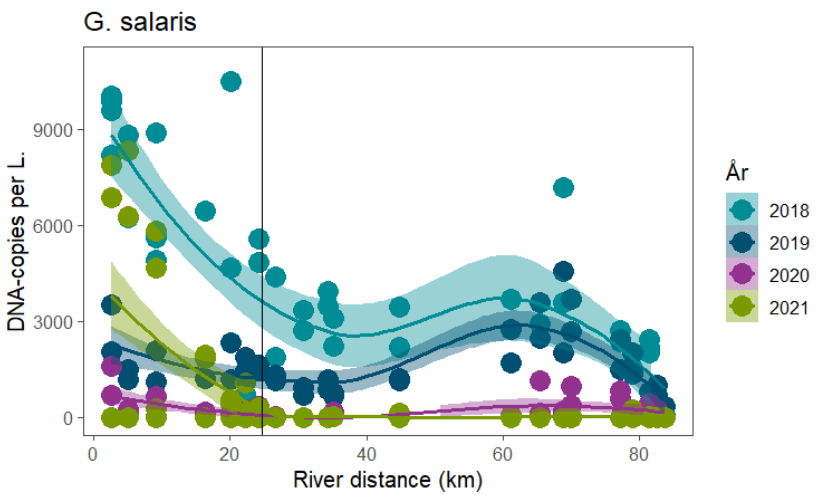
2023

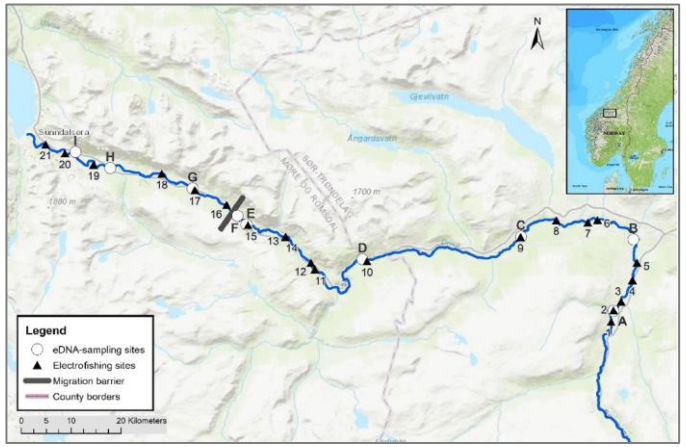


eDNA and biomass in river Driva

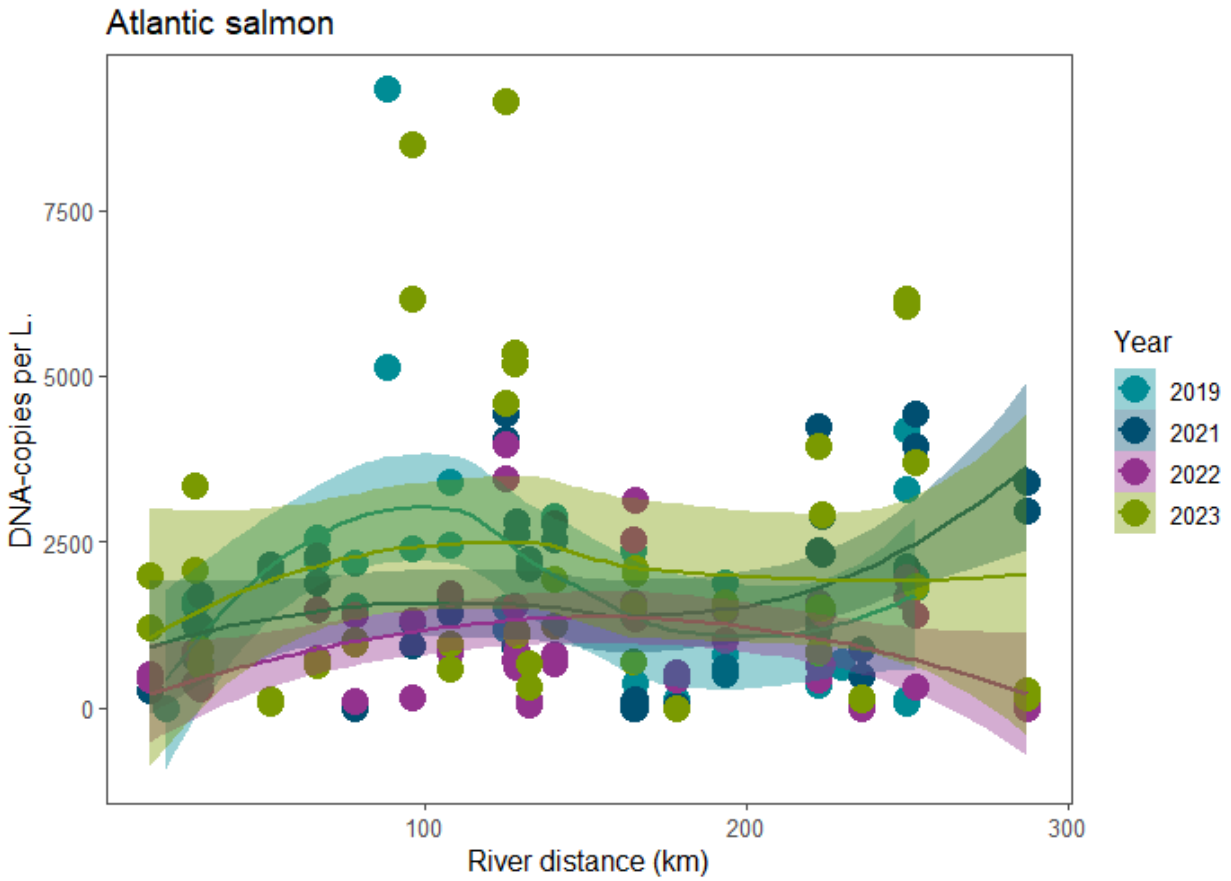




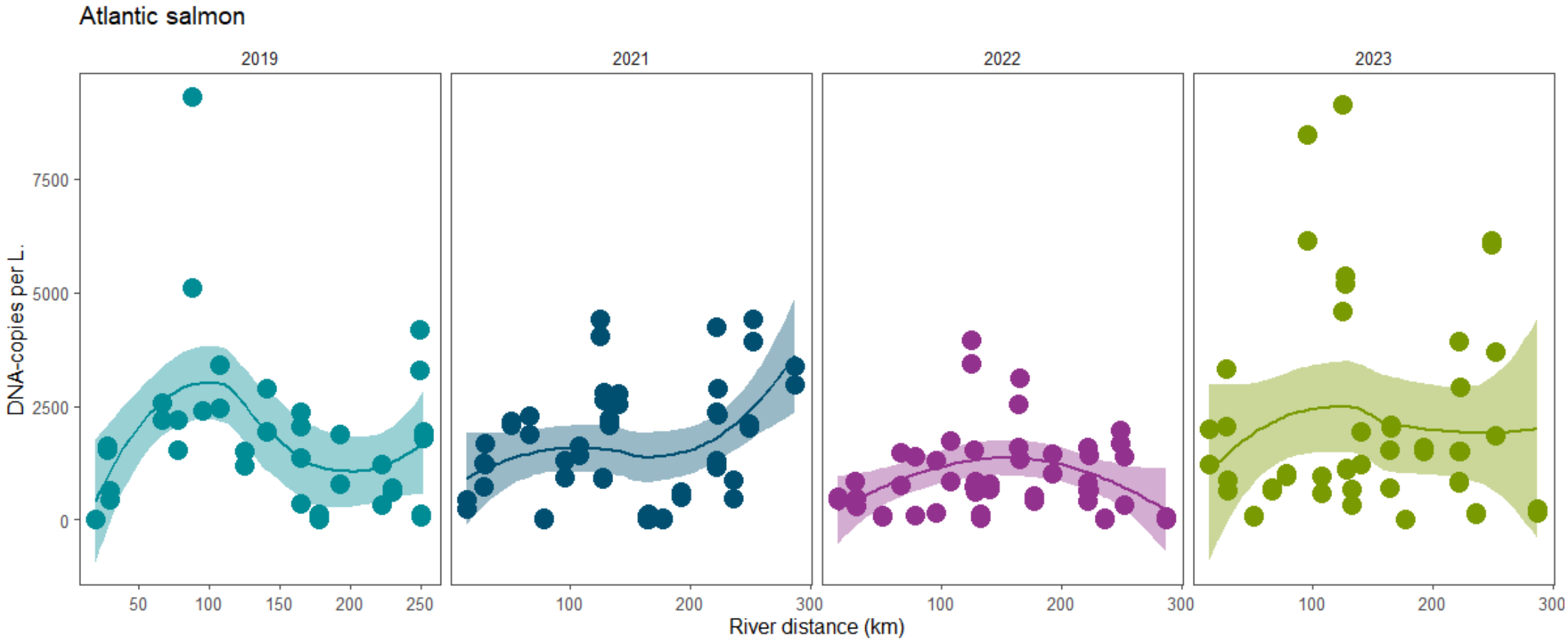




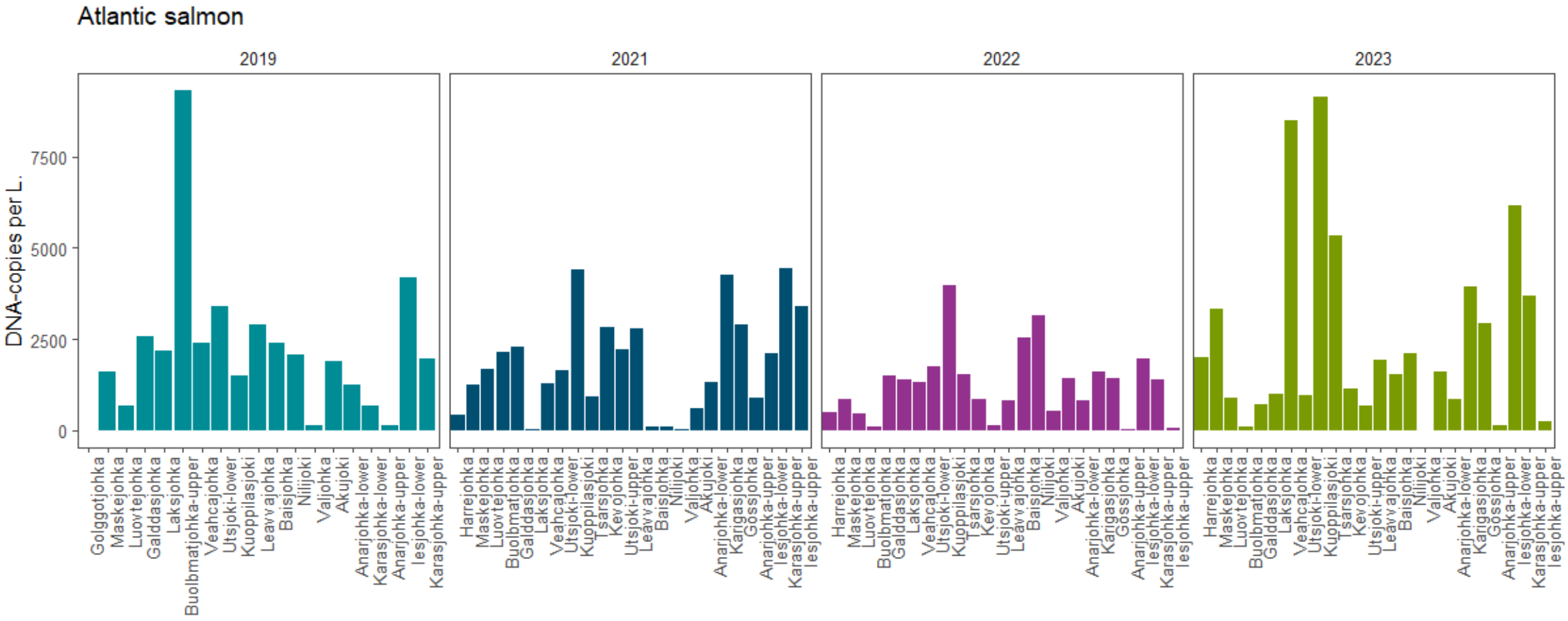
Tana river – Atlantic salmon



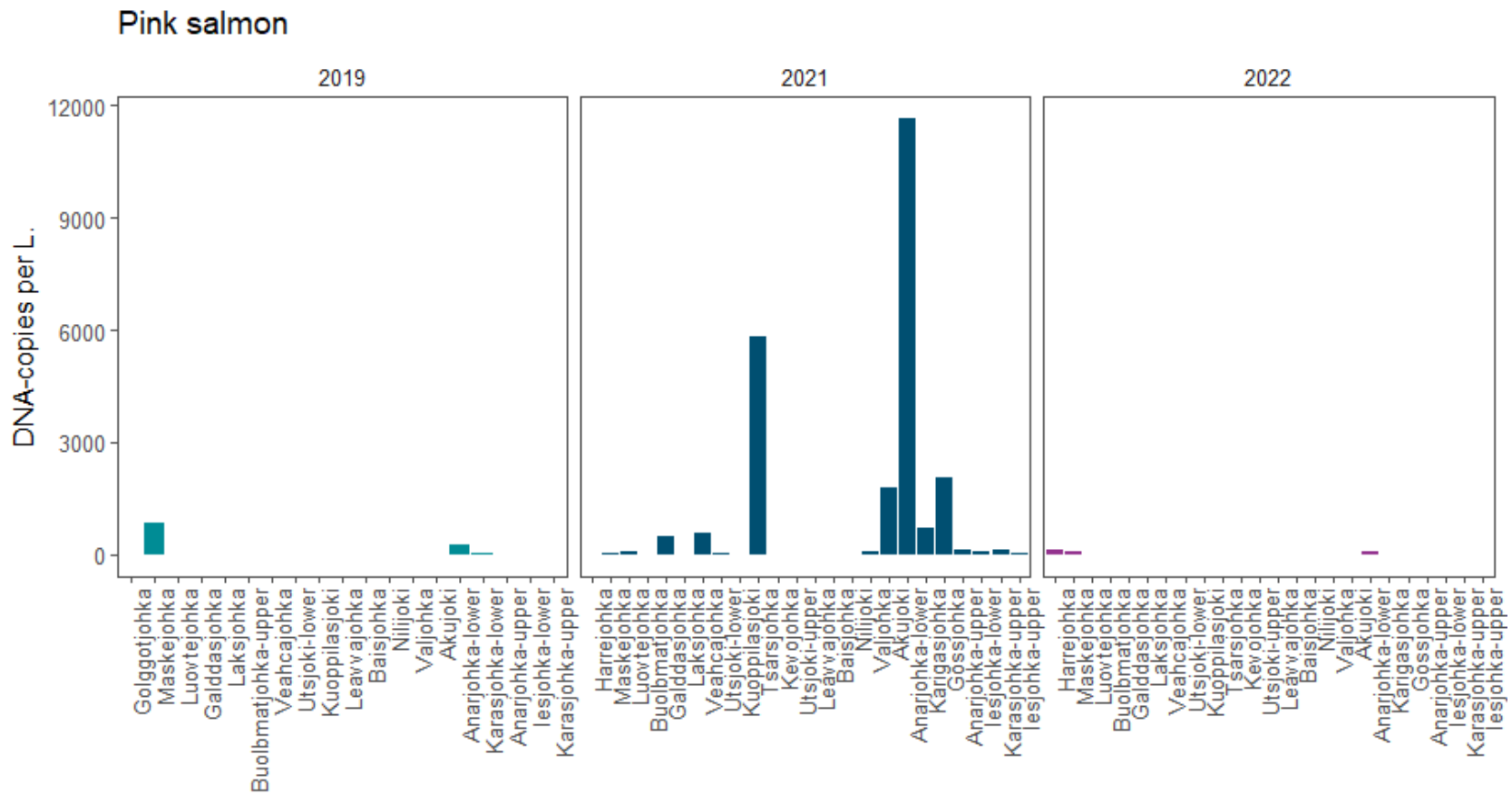
Tana river – Atlantic salmon



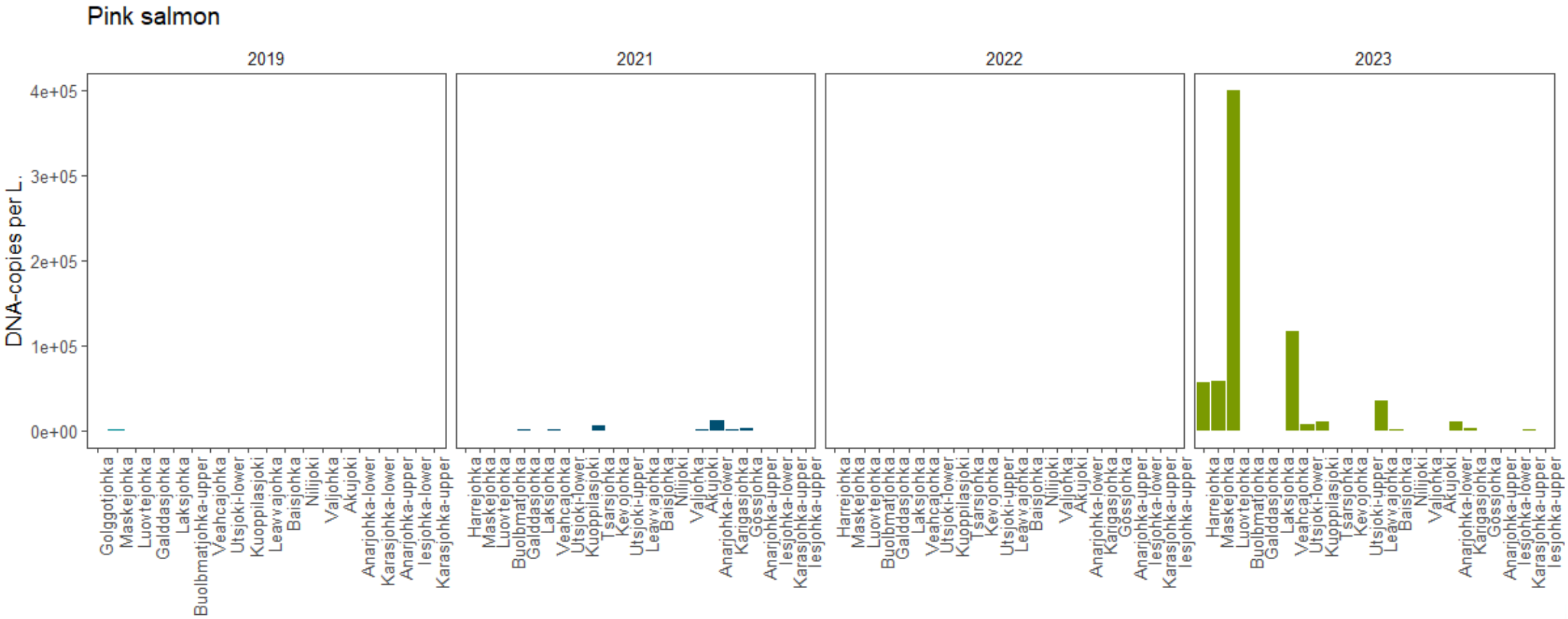
Tana river – Atlantic salmon



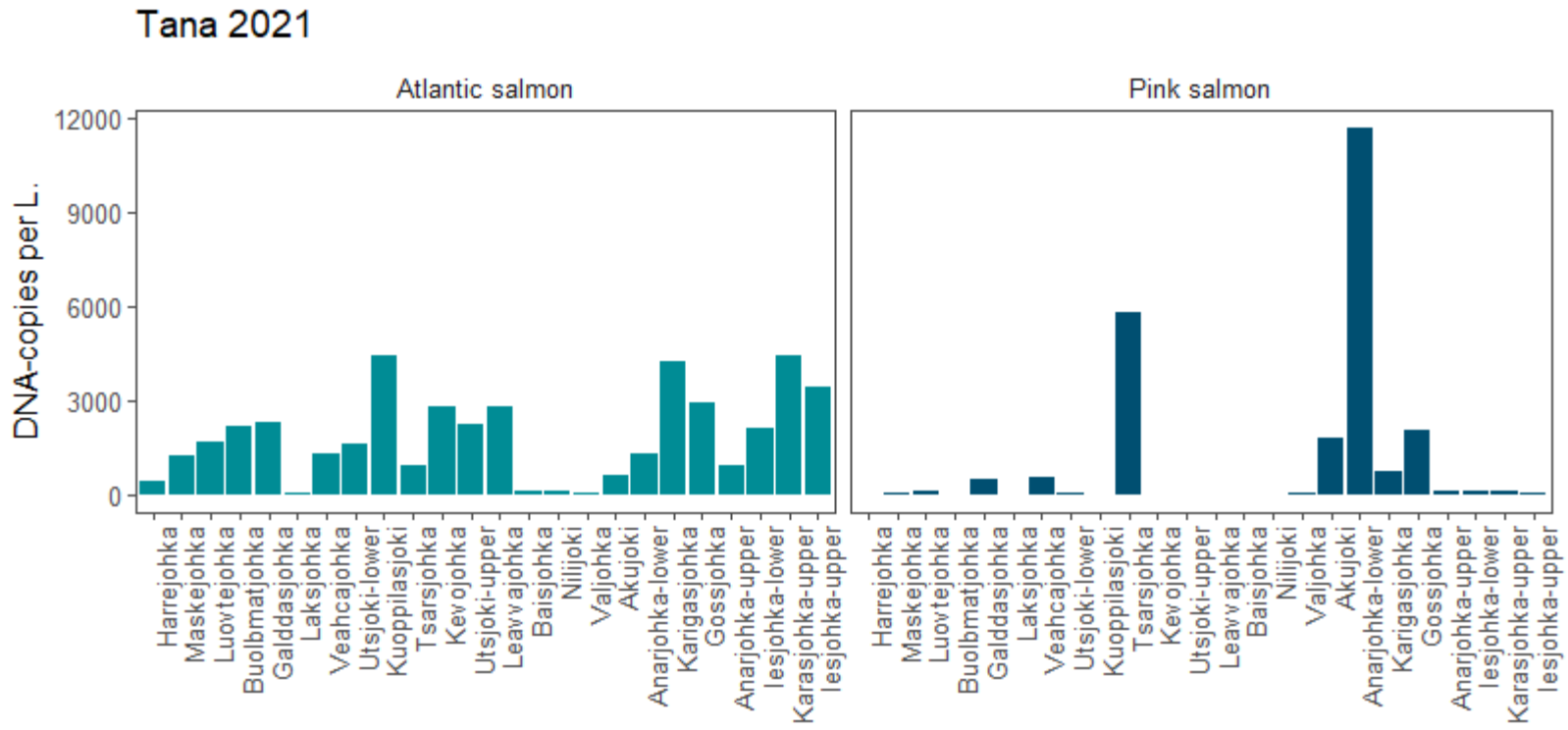
Tana river – Pink salmon



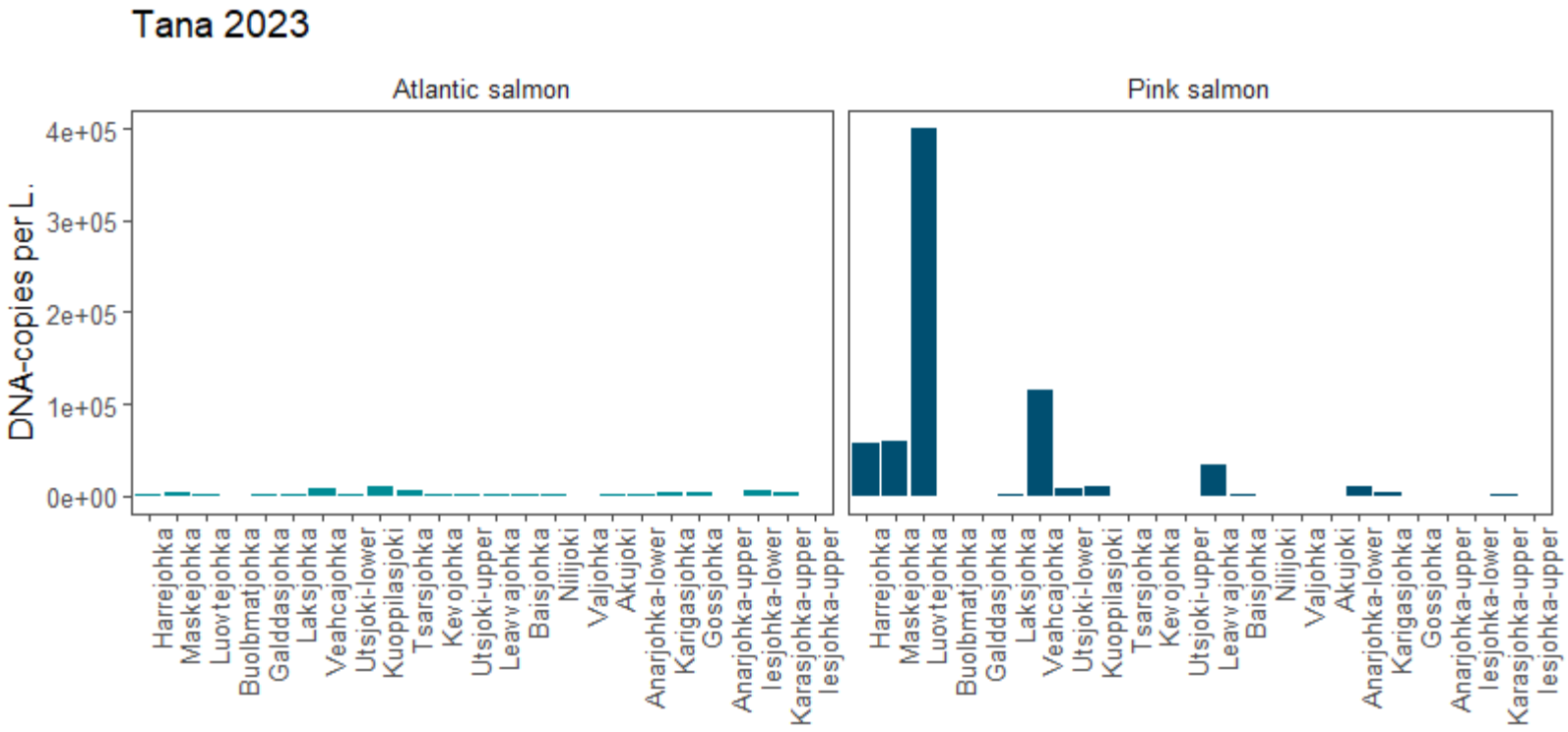
Tana river – Pink salmon



Tana river – eDNA



Tana river – eDNA



PINKTrack

- Co-ordinated environmental DNA (eDNA) surveillance programme for pink salmon in the EU

Country Nominations
France: Laurent Beaulaton
Sweden: Thomas Staveley
Germany: Marko Freese
Denmark: Niels Jepsen
Finland: Jaakko Erkinaro
Ireland: Michael Millane

Experts:
Norway: Frode Fossøy
Ireland: Jens Carlsson

Observers:
Portugal: Isabel Flores Figueira
Spain: Julián García Baena

Cathal Gallagher
Michael Millane

PINKTrack

- Objective 1 (Work Package 1: eDNATrack)
  - Development of standardised protocols for eDNA sampling and standardised approaches for the analyses of eDNA samples for the detection of pink salmon in EU MS with the intention that such methods can continue to be utilised in routine national monitoring programmes after the project concludes. This includes preparatory work to evaluate different approaches to sampling and analyses and their effect on the results for detection. Establishment of a repository of eDNA samples collected during the project and in subsequent years to provide valuable material for future assessments as analytical technologies develop.

PINKTrack

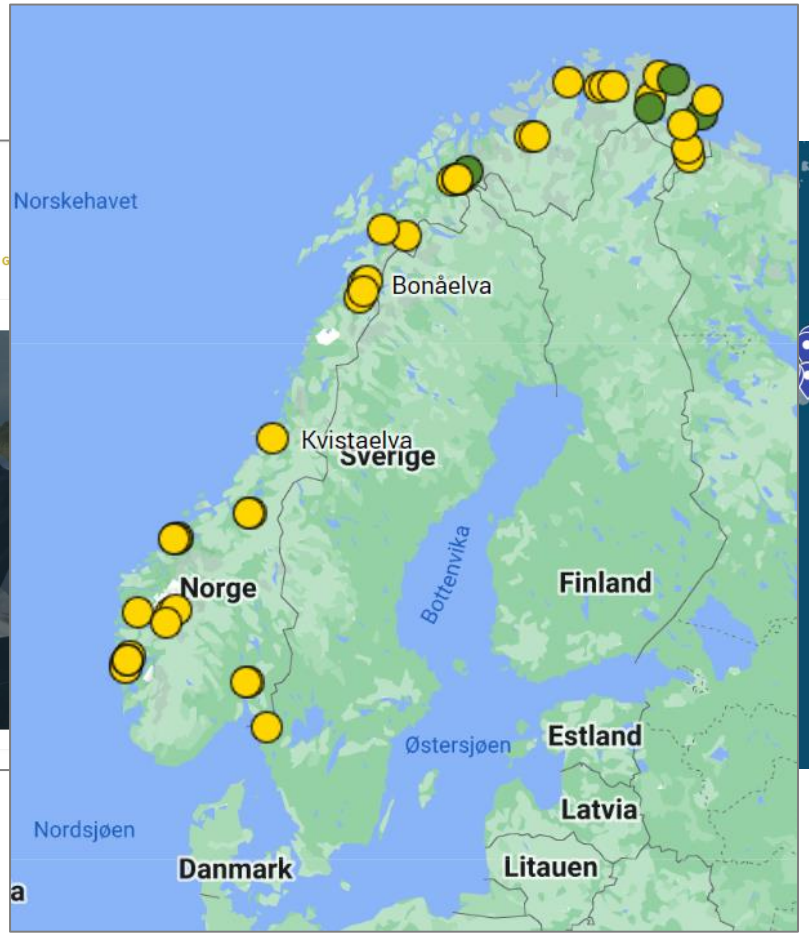
- Objective 2 (Work Package 2: SurveillTrack)
  - Establishment and undertaking of an eDNA sampling programme for detection of pink salmon in EU MS in order to elucidate temporal and geographic patterns of spread and provide an ‘early warning system’ of their presence to inform appropriate management responses with the intention that this programme of work can provide a basis for continued routine national programmes after the project concludes.

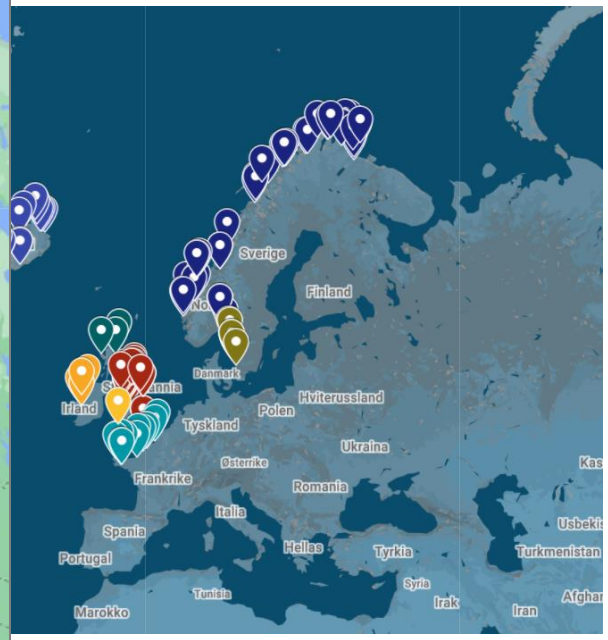
PINKTrack

- Objective 3 (Work Package 3: ProjectTrack)
  - Organisation and hosting of a two day virtual project workshop after project commencement, where partners will meet and discuss the development and execution of the sampling programme, protocols and methodologies for sampling and analyses and the dissemination of results. NASCO staff will be encouraged to participate to discuss how NASCO can participate in the dissemination activities. A project wrap-up virtual workshop will also be held as the project concludes to review outputs and inform their further adoption by EU MS.

1000 rivers project – citizen science

www.1000rivers.net





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Gyrodactylus salaris in Driva

- eDNA occupancy modelling

Filtertype	*G. salaris*			*G. derjavinoides*		
	psi	theta	P	psi	theta	p
0.45 µm	0.84 (0.55-0.98)	0.93 (0.71-0.99)	0.78 (0.64-0.88)	0.82 (0.51-0.99)	0.83 (0.52-0.99)	0.48 (0.31-0.68)
2.0 µm	0.84 (0.56-0.98)	1.0 (1.0-1.0)	0.95 (0.85.0.99)	0.85 (0.56-0.99)	0.90 (0.70-0.98)	0.94 (0.82-0.99)

1 L water

10 L water

ORIGINAL ARTICLE

Environmental DNA

WILEY

Monitoring presence and abundance of two gyrodactylid ectoparasites and their salmonid hosts using environmental DNA

Frode Fossøy | Hege Brandsegg | Rolf Sivertsgård | Oskar Pettersen | Brett K. Sandercock | Øyvind Solem | Kjetil Hindar | Tor Atle Mo

PINKTrack - filtertest

2024:

- Objective 1 (Work Package 1: eDNATrack)
  - Development of standardised protocols for eDNA sampling and standardised approaches for the analyses of eDNA samples for the detection of pink salmon

Filter type	Pore size	Membrane
Sterivex	0.45	PES
Merck millipore glassfiber	2.0	Glass fiber
Waterra	1.2	PES
Sylphium	0.8	PES
Sylphium	5.0	PES
Smith-Root glassfiber	1.5	Glass fiber
Smith-Root self preserving	1.2	PES

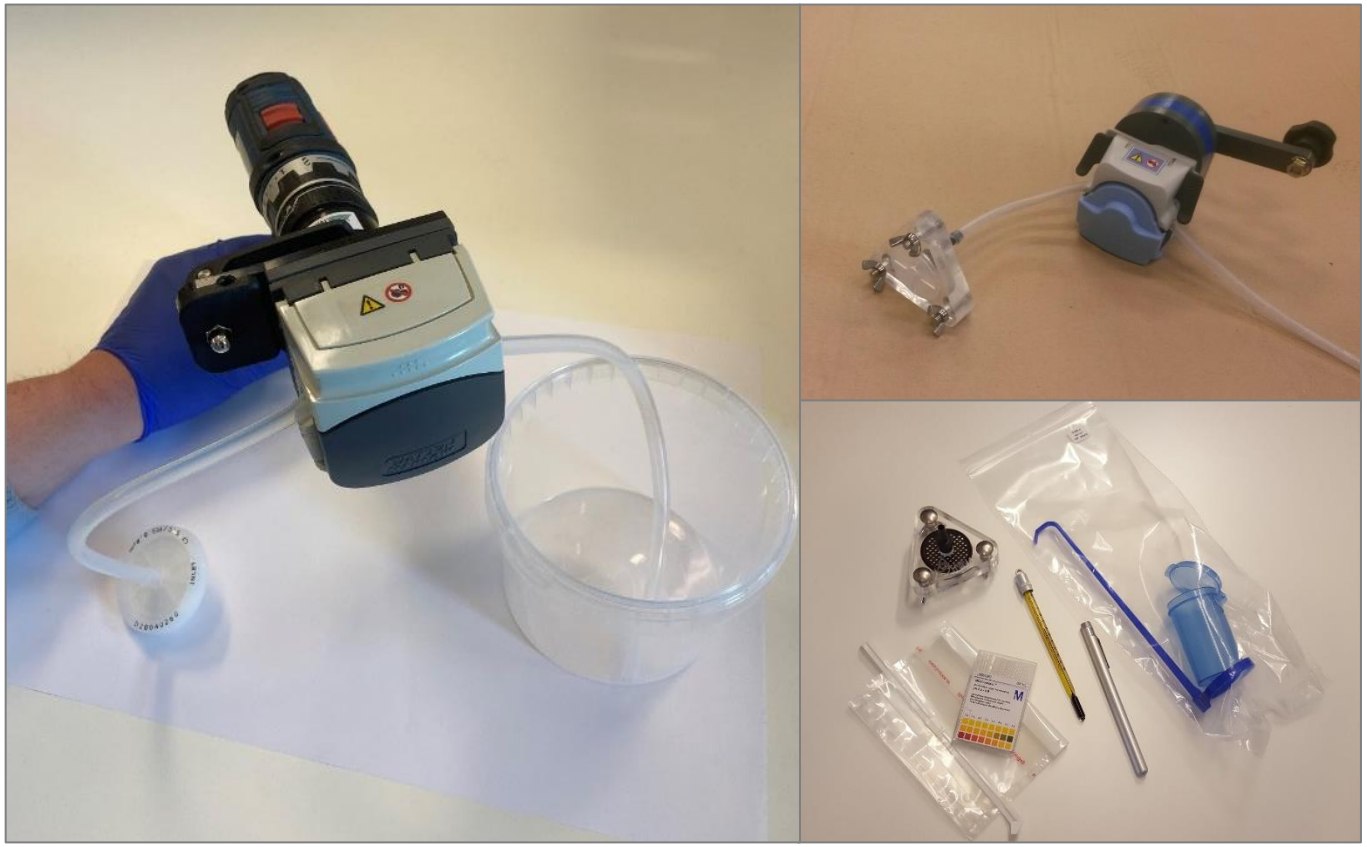
PINKTrack - filtertest

- 6 countries
  - Norway, Sweden, Denmark, Ireland, Germany and France
- 2 rivers and 4 samples per filter per country
- 7 filter types: 24 filters per type across 6 countries
- 3 labs analysing the samples from 2 countries each

PINKTrack - filtertest

- DNA detection and concentration will be modelled
  - Filter type
  - Country/river
  - Lab
  - River size and flow
  - Water volume
  - Water turbidity
  - Water temperature
  - Water pH

NINA eDNA kit



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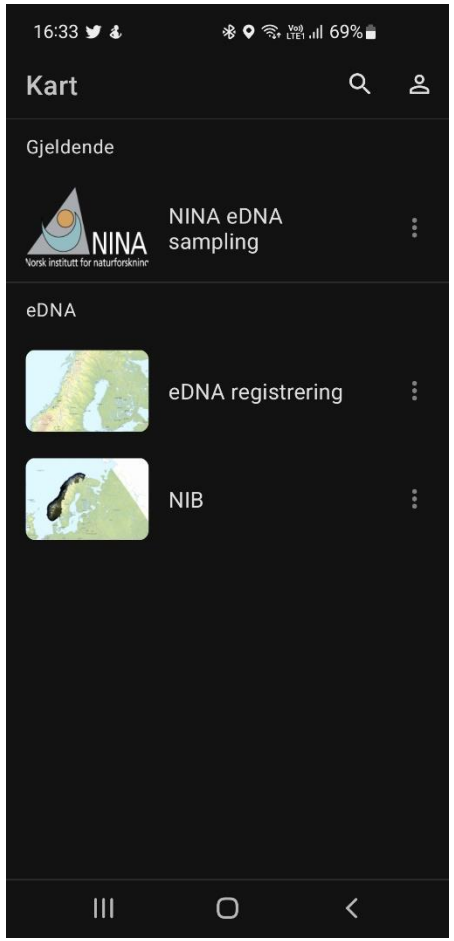
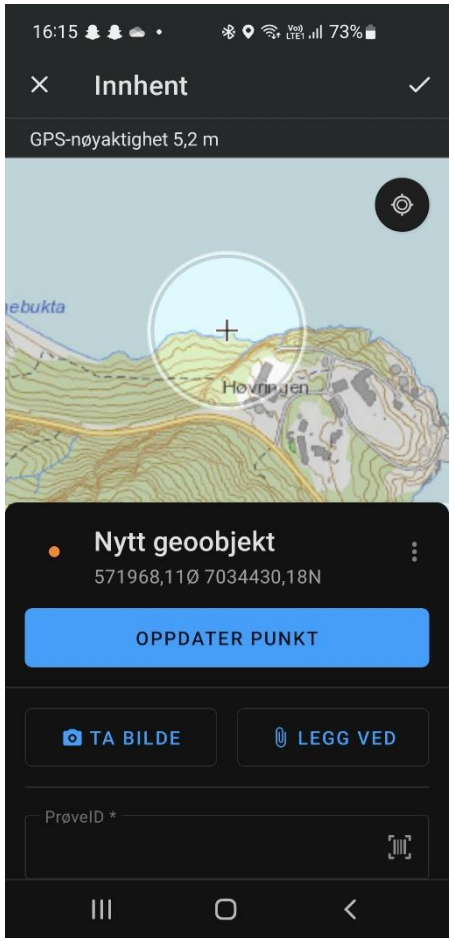
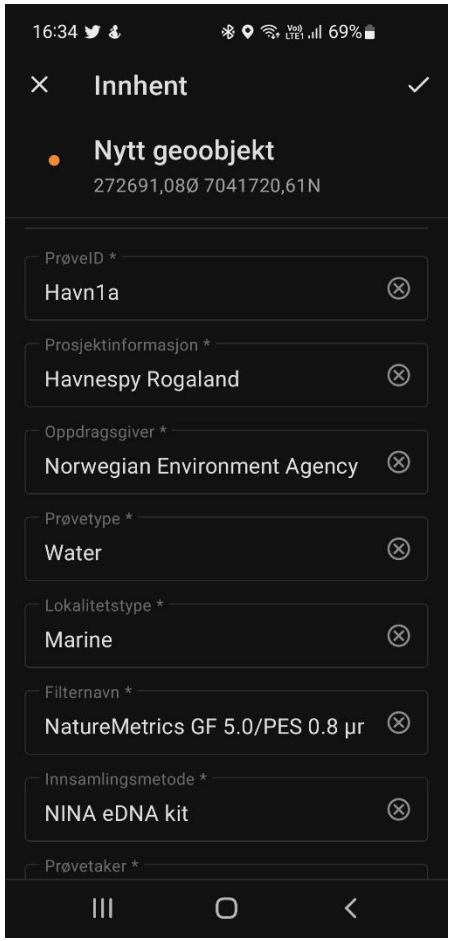
NINA eDNA phone app







PINKTrack future prospects

- Move from monitoring status to consequence
  - eDNA samples are time-capsules of biodiversity
- Ecological status – reuse eDNA samples
  - Fish diversity
  - Benthic macro-invertebrates
  - Benthic algae
  - Key species such as freshwater pearl mussels

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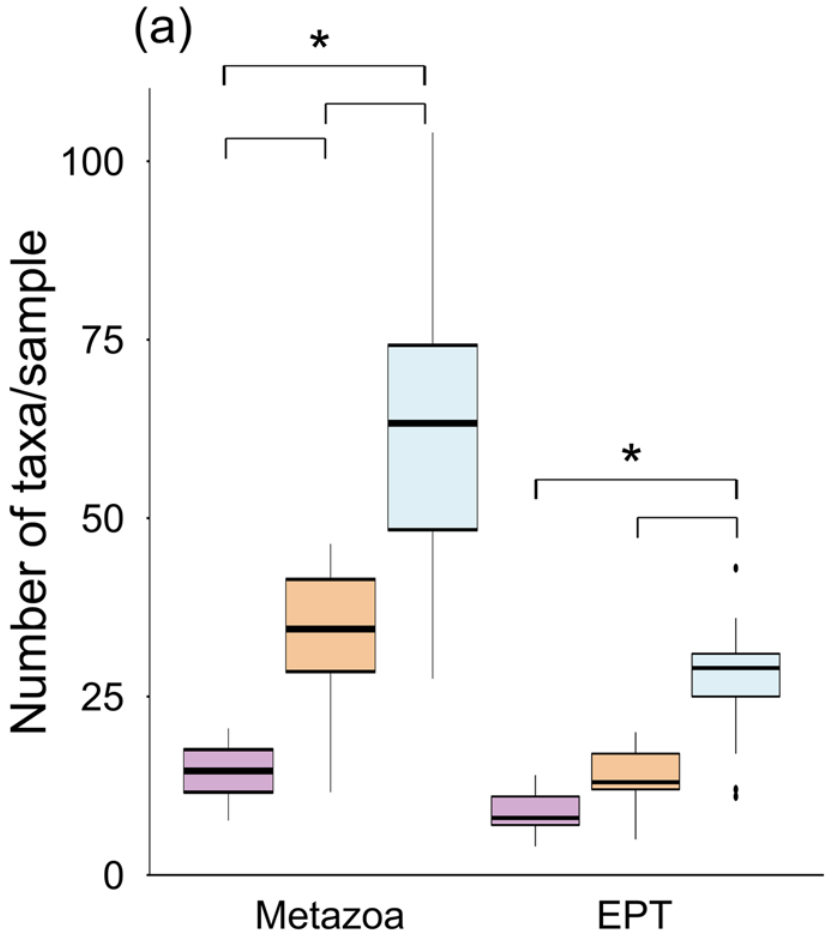
PINKTrack future prospects



Hydrobiologia
https://doi.org/10.1007/s10750-023-05448-4

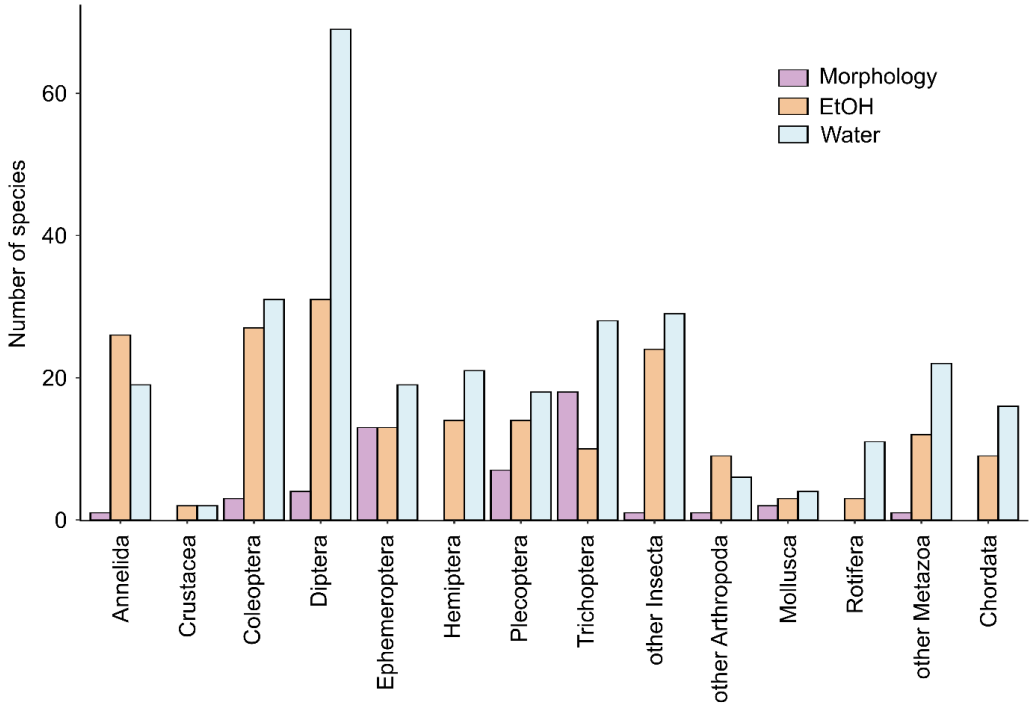
PRIMARY RESEARCH PAPER

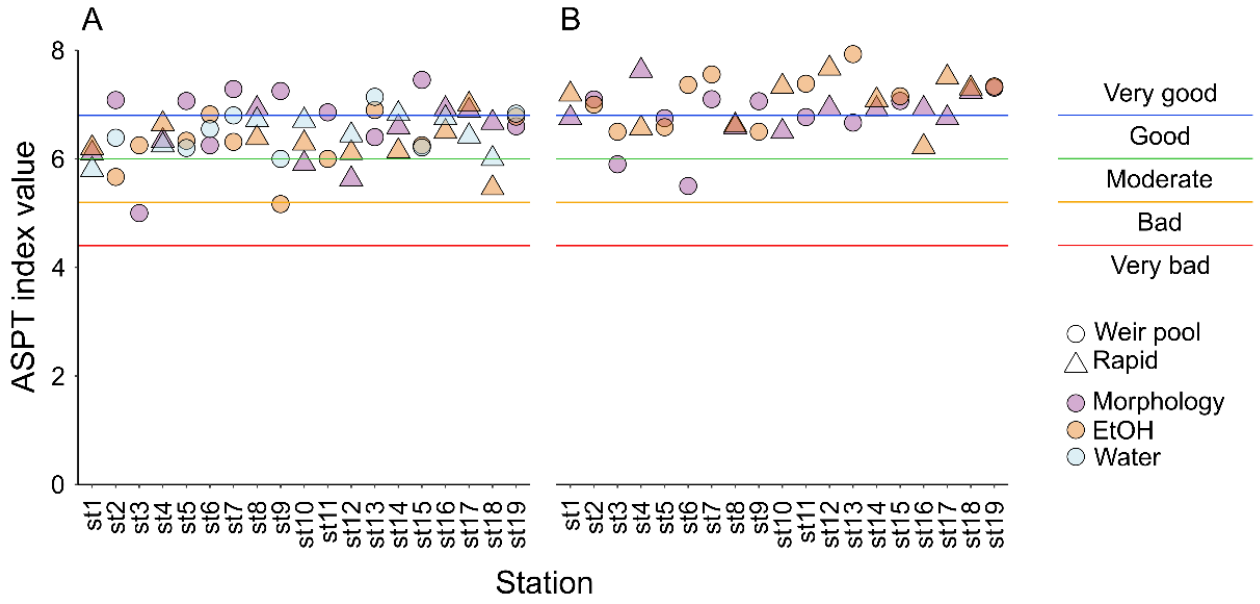
Check for updates

Comparing methods and indices for biodiversity and status assessment in a hydropower-regulated river

Markus Majaneva · Line Elisabeth Sundt-Hansen · Hege Brandsegg · Rolf Sivertsgård · Terje Bongard · Frode Fossøy

PINKTrack future prospects





PINKTrack future prospects

ASPT

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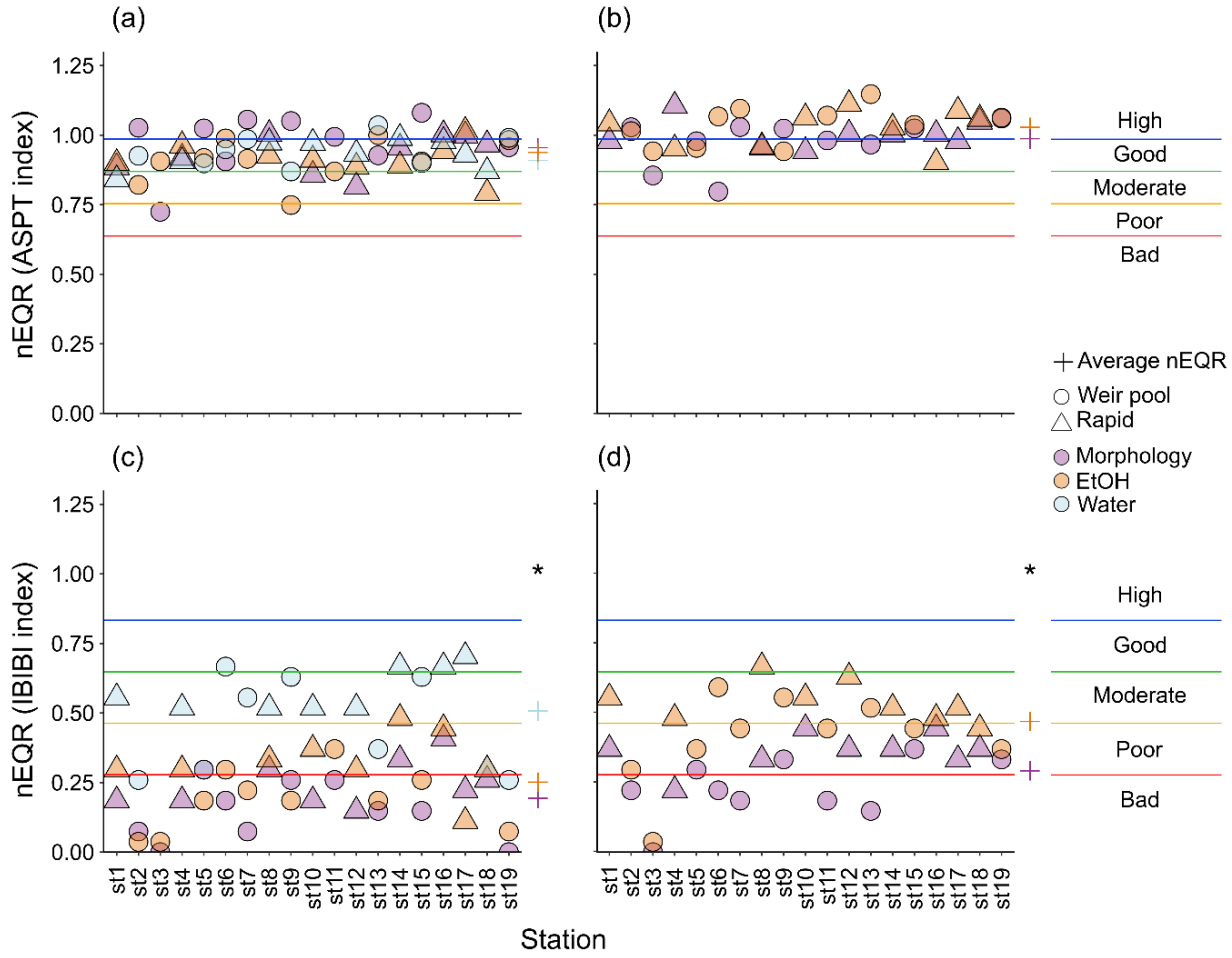

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