

The monitoring possibilities of Arctic freshwaters using Arctic tadpole shrimp (*Lepidurus arcticus*) as an indicator species

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Hanna-Kaisa Lakka

hanna-kaisa.lakka@helsinki.fi

Department of Environmental Sciences, University of Helsinki, Finland

Arctic Tadpole Shrimp (Skjoldkreps)

Lepidurus arcticus (Branchiopoda; Notostraca)

True Arctic
species



ECOLOGY

- Habitat: Freshwater ponds and lakes (rivers dispersal routes)
- Wide distribution: High Arctic, Arctic and Subarctic regions
- Living fossil
- Omnivore
- Top predator in fishless ponds
- Max. size: 39.4 mm
- Lifespan: 1 year

TYPICAL HABITAT IN SVALBARD

COLD

- Ponds located in lowland areas between the Arctic Ocean and glaciers
- Permafrost
- Water temperature **0.2 – 5.4 °C**, (July-September)
- Sediment temperature **-1.9 – 4.9 °C**
- Late ice break-up
- Ponds can freeze solid in the winter

OLIGOTROPHIC

- Clear and nutrient-poor water

→ Low productivity

SHORT GROWING SEASON

- 1–3 months

Extreme
environment

Why *Lepidurus arcticus* is an important species?



Dunlin (*Calidris alpina*)



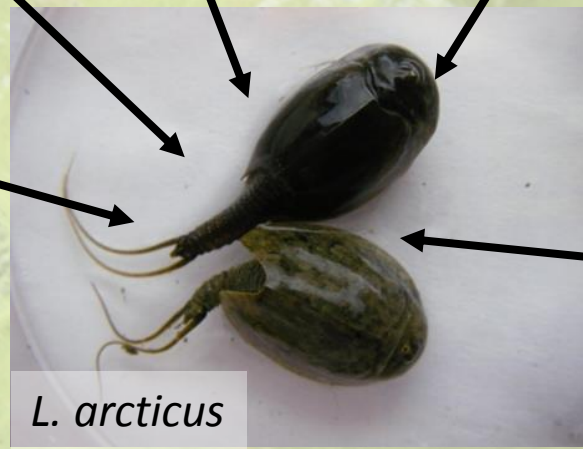
Purple sandpiper (*Calidris maritima*)



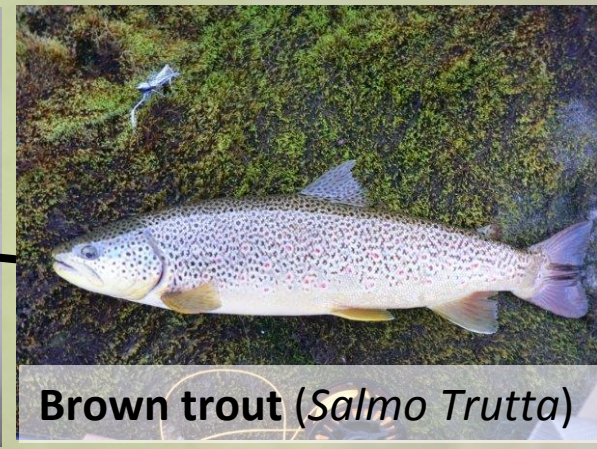
Arctic tern (*Sterna paradisaea*)



Arctic char (*Salvelinus alpinus*)



L. arcticus



Brown trout (*Salmo Trutta*)

→ An important food item for birds and fishes

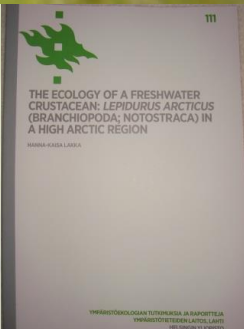
Why *Lepidurus arcticus* is a good indicator species?

1. **Wide distribution:** High Arctic, Arctic and Subarctic regions
2. **Sensitivity to environmental factors:** pH, temperature and salinity

	Occurs	Reduced	Extinct
pH	> 7	7–6.1	< 6.1
Temperature (°C)	0.8–19	16.5–20	> 20
O ₂ (μmol/l)	> 315	> 258	≤ 258
Salinity	0–1 ‰	1–2 ‰	> 2 ‰

L. arcticus can be used as an indicator species of climate change and acidification in the Arctic region

L. arcticus is clearly a species that requires high oxygen concentration and cool water.



Why *Lepidurus arcticus* is a good indicator species?

3. Experimental data are available

- pH, temperature & salinity tolerance

Good indicator species
of the on-going habitat
and climate change

4. Information on *L. arcticus* is available from late 1800s to present

5. Sensitivity to invasive species

→ Minnow or great diver (*Dytiscus*) can eat all *L. arcticus* individuals



Harmful invasive species in Subarctic



Minnow (*Phoxinus phoxinus*)

- High dispersal ability
- Effective predator for juvenile *L. arcticus*



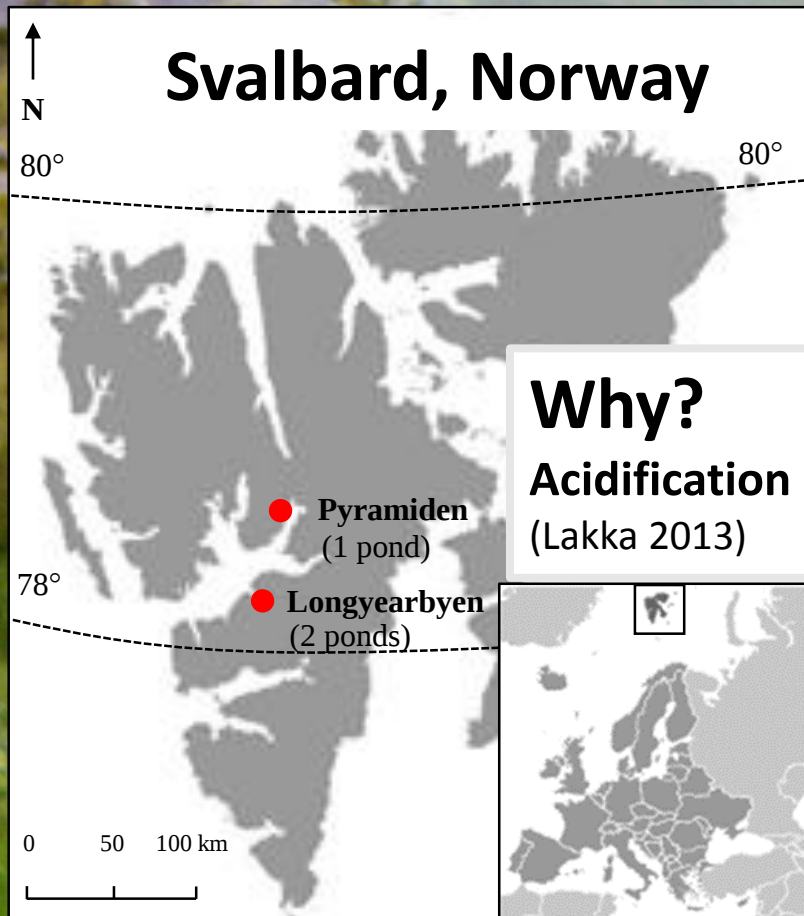
Great diver (*Dytiscus*)

- High dispersal ability
- Effective predator for adult *L. arcticus*
- Large body size

Minnow

- 1.) Fishermen use minnows as live baits especially to catch *L. arcticus* predators like brown trout and Arctic charr.
- 2.) Accidentally introduced together with brown trout into large number of lakes.

Endangered:



Small: **0.4-0.12 ha**

Shallow: **max 3 m**

pH: **6.3-7.0** (limiting value 6.1)

Mining (Coal mine drainage pH 2.4–3.9)

Regionally extinct:

Finland

Čuovgijávri

69°21'N, 21°30'E

Small: **0.018 ha**

Shallow: **max 4 m**
750 m a.s.l.

Why?

Invasive species: **Great diver** (*Dytiscus*)
(Järvinen et al. 2014)



THREATS:

Global warming

- **Rising temperature**
Too hot water
- **Faster evaporation**
 - 1.) Lost of water = lost of habitat
 - 2.) Rising salinity = lost of population

Acidification

- **Mining**
Coal mine drainage pH 2.4–3.9
- **Dog kennels**
Acid dog faeces should not be placed close to water bodies
- High local extinction risk in three populations in Svalbard
- **Wet and dry deposition**

Invasive species



Extensive stocking of fish (Hessen et al. 2004)

Optimal water quality:



Temp < **16.5 °C**



Salinity < **2‰**



pH > **6.1**

Fishless ponds and lakes are important refuges for *Lepidurus arcticus*

TAKE HOME MESSAGE

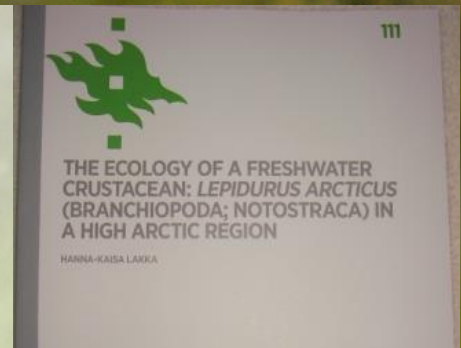
- *Lepidurus arcticus* is an important indicator species of the ongoing habitat and climate change in freshwaters



THANK YOU FOR YOUR INTEREST
TUSEN TAKK

More information: Lakka 2013

The ecology of a freshwater crustacean:
Lepidurus arcticus (Branchiopoda; Notostraca) in
a High Arctic region



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