

# Arctic charr *Salvelinus alpinus* squeezed in a complex fish community dominated by perch *Perca fluviatilis*

Odd Terje Sandlund<sup>1</sup>, Eivind Haugerud<sup>2</sup>, Sigurd Rognerud<sup>3</sup> & Reidar Borgstrøm<sup>2</sup>

<sup>1</sup> Norwegian Institute for Nature Research (NINA), P.O. Box 5685, NO-7485 Trondheim, Norway ([odd.t.sandlund@nina.no](mailto:odd.t.sandlund@nina.no))

<sup>2</sup> Department of Ecology and Natural Resource Management, Norwegian University of Life Sciences, NO-1432 Ås, Norway

<sup>3</sup> Norwegian Institute for Water Research (NIVA), Sandvikavegen 59, NO-2312 Ottestad, Norway

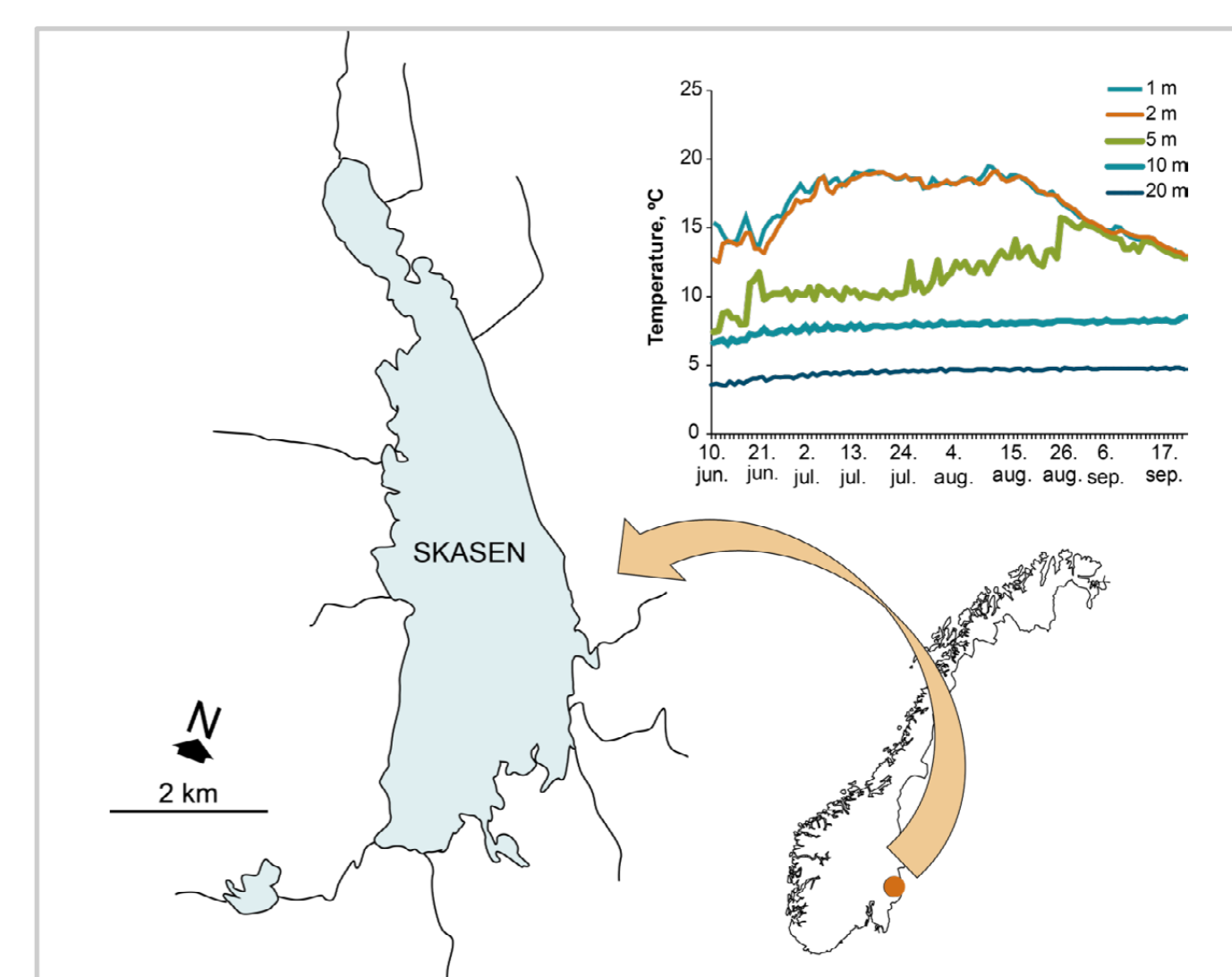


## Aim

Arctic charr populations on the southern margins of distribution seem to continually be on the brink of extinction. This case study is a contribution to understand the possible mechanisms causing the vulnerable status of marginal charr populations.

## Conclusions

In this marginal Arctic charr lake, charr are squeezed, in the sense that it is confined to the deep, low-productive waters. Newly hatched charr fry in the littoral zone and also juvenile charr will probably face heavy predation risk in particular from the large sized perch. In addition, competition for zooplankton between Arctic charr, roach and small perch may exclude Arctic charr from the upper pelagic zone. One reason for the decline in the Arctic charr population may be the presently almost non-existent exploitation of perch and roach.



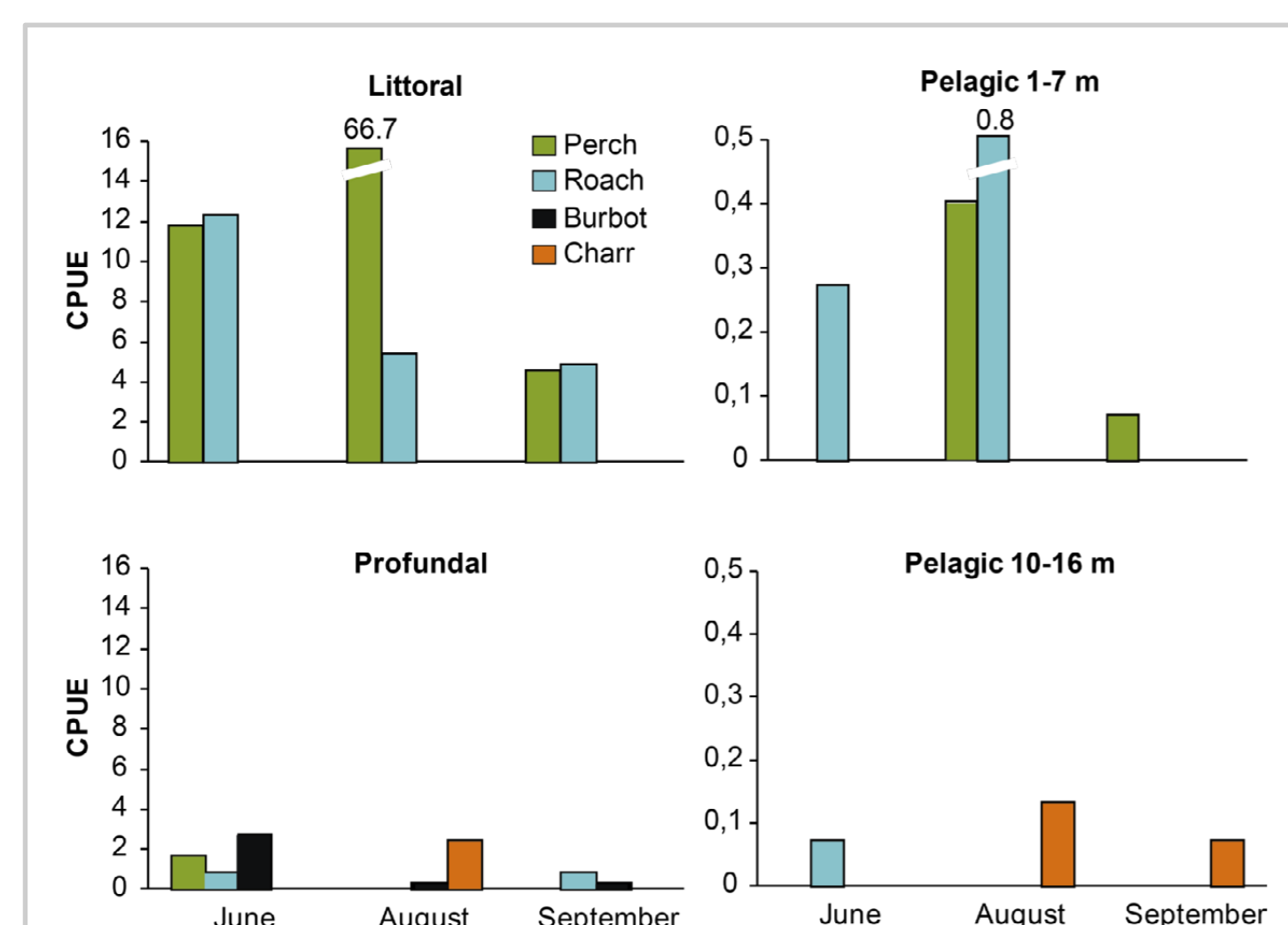
## The lake

Lake Skasen (266 m a.s.l., surface area 13.35 km<sup>2</sup>, max. depth 50 m, Secchi depth 4-6 m) situated in southeastern Norway, is inhabited by perch, roach, European minnow, pike, burbot, Arctic charr, and brown trout. Exploitation of the fish stock has been greatly reduced since the 1960s. Presently, only some angling and very little gill-netting still occur.

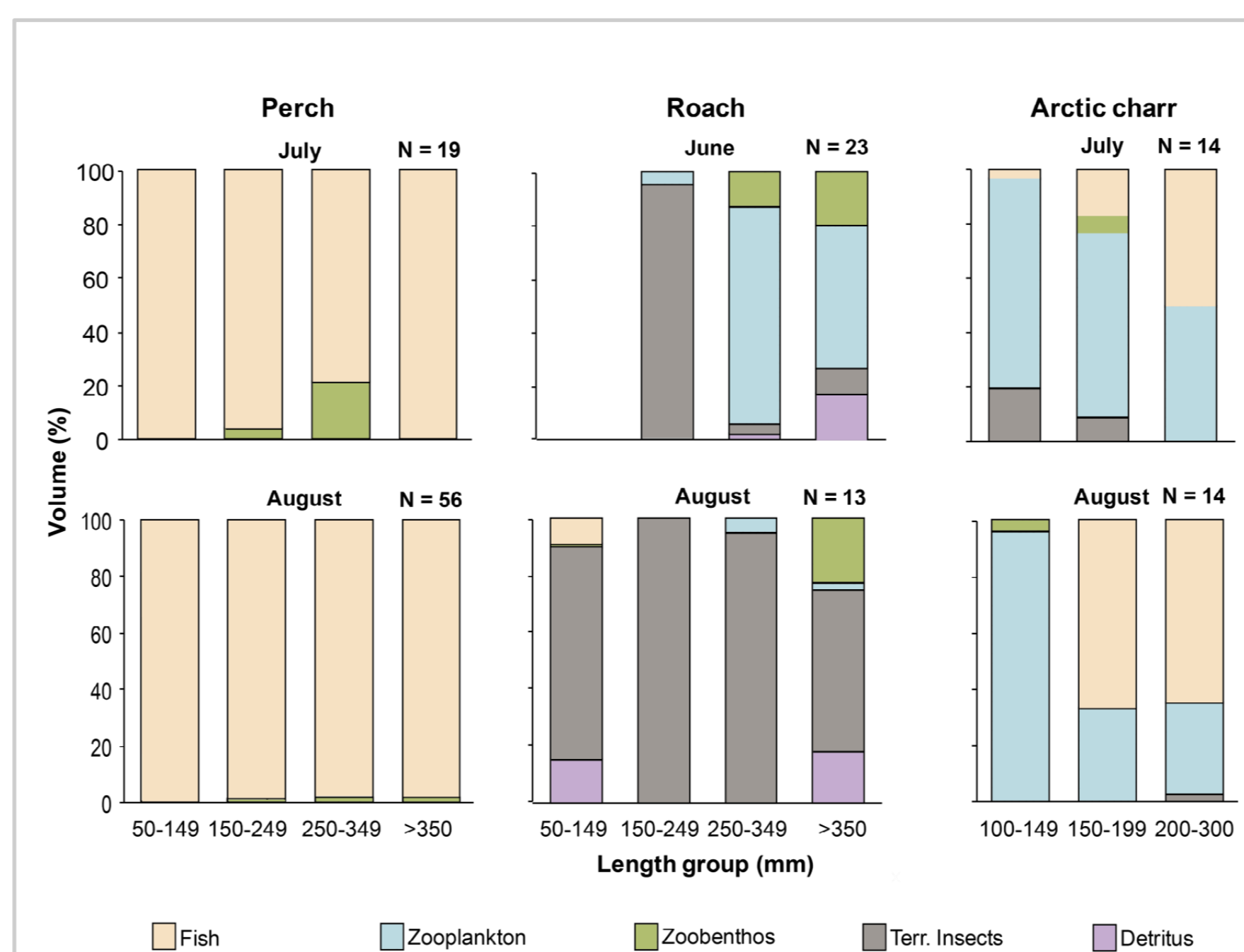
## Sampling methods

Sampling was performed by fleets of gillnets set in the littoral, pelagic and profundal zone of the lake in June through September. The fish were sized and aged, and samples analyzed for diet. Stable C- and N-isotopes were analyzed in fish muscle tissue and invertebrates.

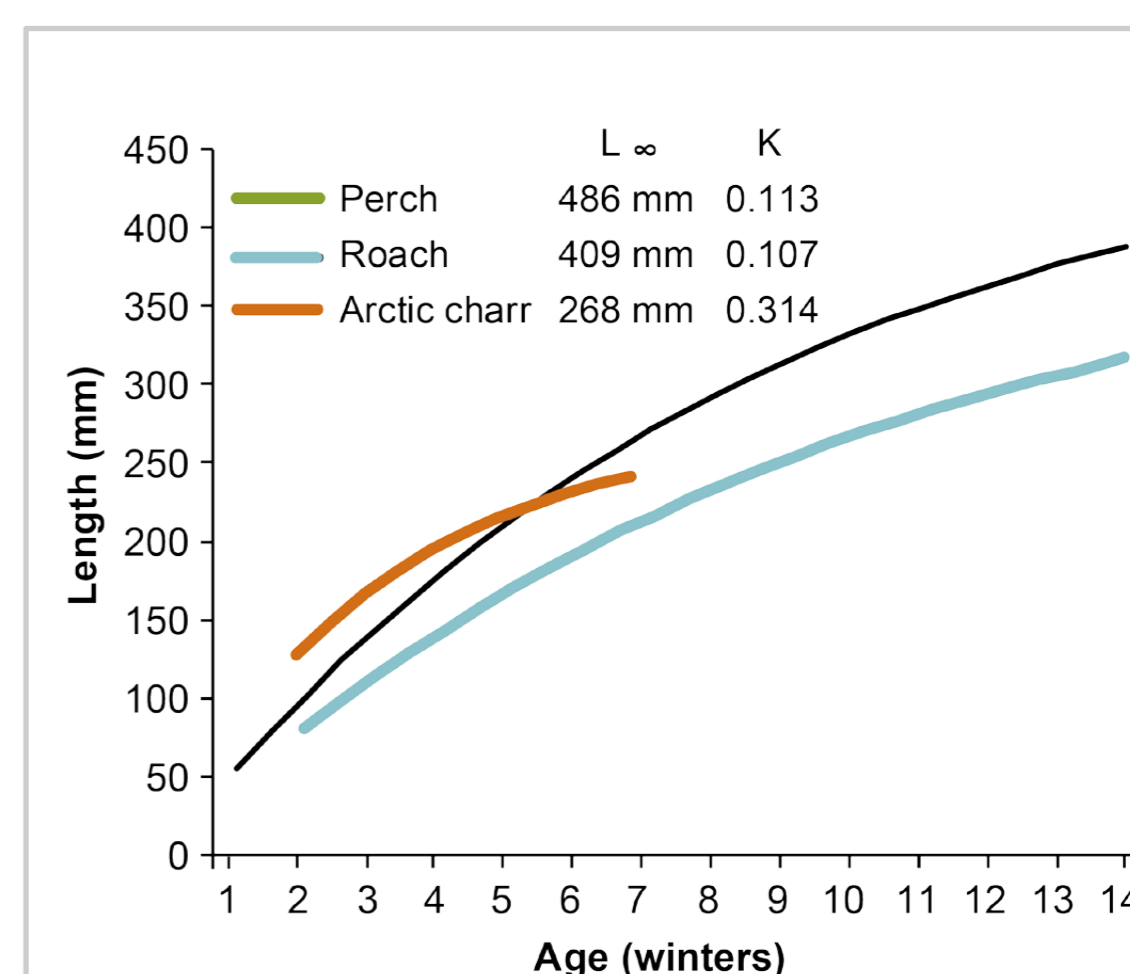
## Results



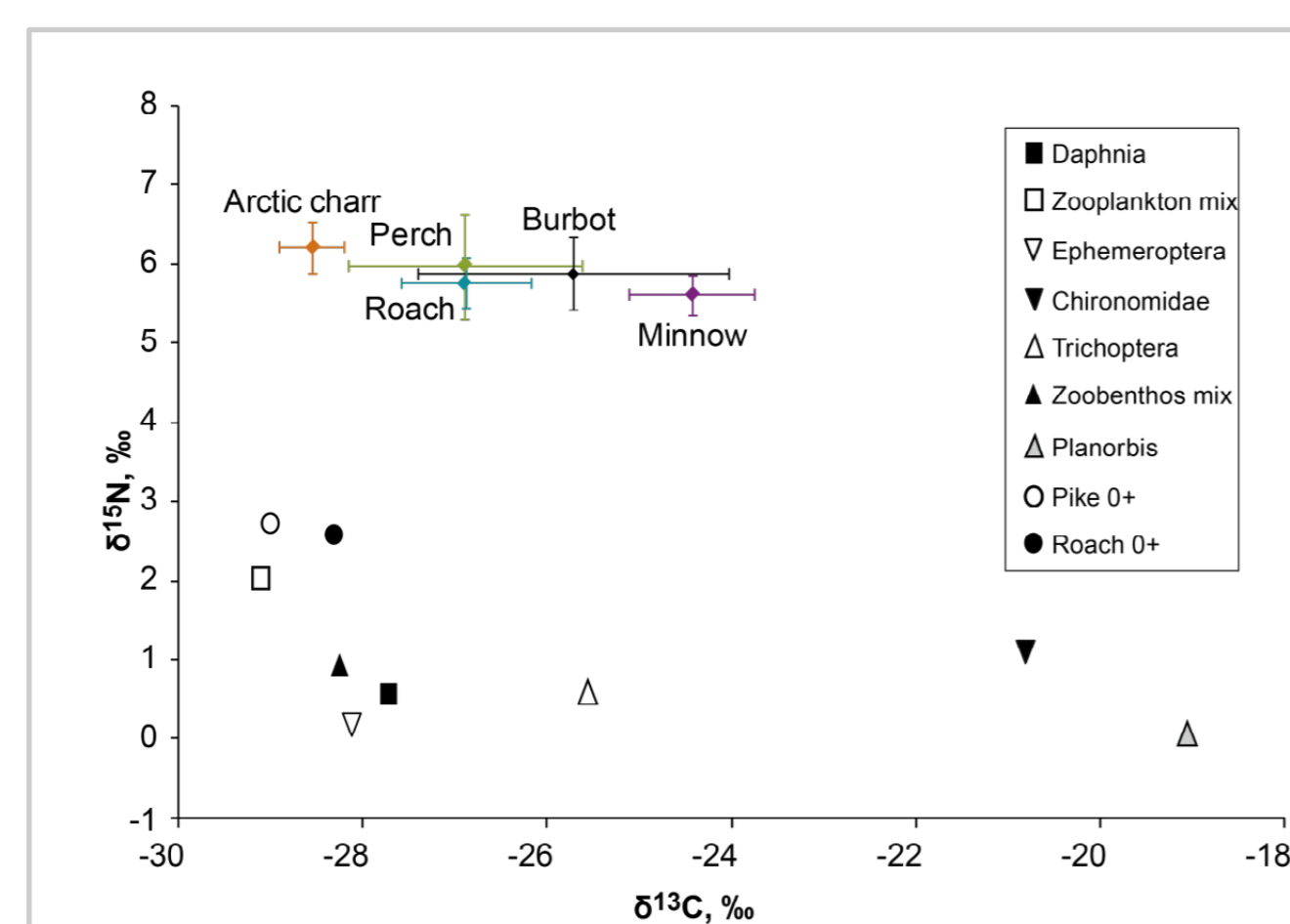
Arctic charr were caught in very low numbers, and only in the profundal and deep pelagic zone. The profundal habitat was shared with burbot. The catches in the littoral and upper pelagic zone were completely dominated by perch and roach. Arctic charr spawn in the shallow littoral areas in October.



Arctic charr diet was dominated by crustacean zooplankton and age-0 fish (roach & perch). Roach stomachs contained mainly zooplankton and surface insects, whereas perch had eaten mainly fish.



The growth curves of Arctic charr, perch and roach (according to the von Bertalanffy growth model) indicate that while roach and perch may reach lengths of 41 and 49 cm, respectively, Arctic charr grow to only 27 cm.



Stable C- and N-isotope signatures indicate that Arctic charr had a very narrow trophic niche, mainly depending on pelagic/profundal sources of energy. Perch and roach had a more intermediate position on the δ<sup>13</sup>C-gradient, indicating a mixture of littoral and pelagic sources of energy. Burbot and minnow were both positioned more towards the littoral end of the δ<sup>13</sup>C-gradient. The δ<sup>15</sup>N-signatures of the fish species indicate that Arctic charr and perch were at the highest trophic level, but all species had nearly the same mean δ<sup>15</sup>N-signatures. The relative position of fish compared to zooplankton, zoobenthos and fish fry (3-5‰) is in accordance with the diet analysis, i.e. predatory invertebrates and fish fry may be major food items.