Changing management principles disrupted natural fish fauna in Norwegian lakes

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Aim

We wanted to investigate and describe how varying management goals over the last 160 years have contributed to the greatly modified distribution of fish species and the fish community structure of lakes in southern Norway. Our example is coregonid fishes (whitefish; *Coregonus lavaretus*, and vendace; *C. albula*).

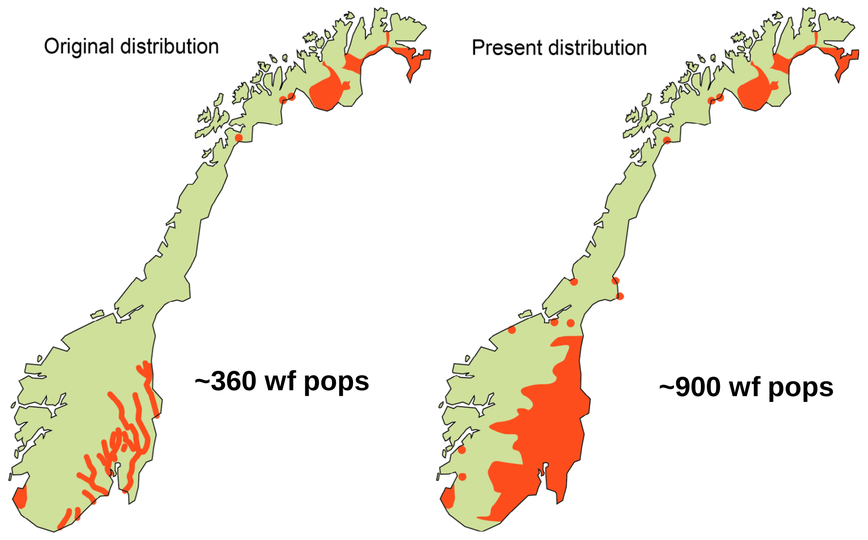
This poster is a summary of a recently published paper on this subject (Sandlund et al. 2013).

Shifting management goals

- **Before the 1940s the potential for producing food (i.e., biomass extracted through subsistence fishing) was the predominant management goal.**
- **Eventually subsistence fishing became less and recreational fishing more important, i.e., species and size of fish more important.**
- **Since the 1970s, the anglers' perspective have been dominant, i.e. large sized brown trout and Arctic charr most valued.**
- **Since the 1990s, conservation of aquatic biodiversity, including genetic diversity of fishes have become an important consideration.**

Reflected in shifting legislation

- **Royal decree 1870: Government owned fishless mountain lakes leased cheaply to private persons – provided they stocked them with fish.**
- **1964: Inland Fish and Salmon Act. No mention of fish translocation or introductions.**
- **1992: Inland Fish Act stating that moving fish between watersheds and introduction of non-native species is illegal.**
- **2009: This principle was reinforced in the Nature Diversity Act.**



Maps showing the natural and present distributions of whitefish (wf, red areas) in Norway.

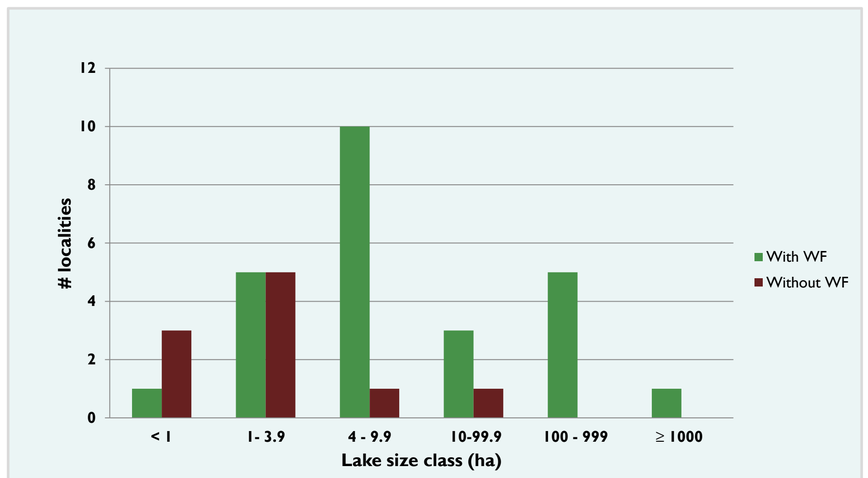


Fig. 2. *Size distribution (by surface area) of lakes in the Røros area of Norway for which documented introductions of whitefish exist, differentiated into those presently with and without whitefish (WF).*

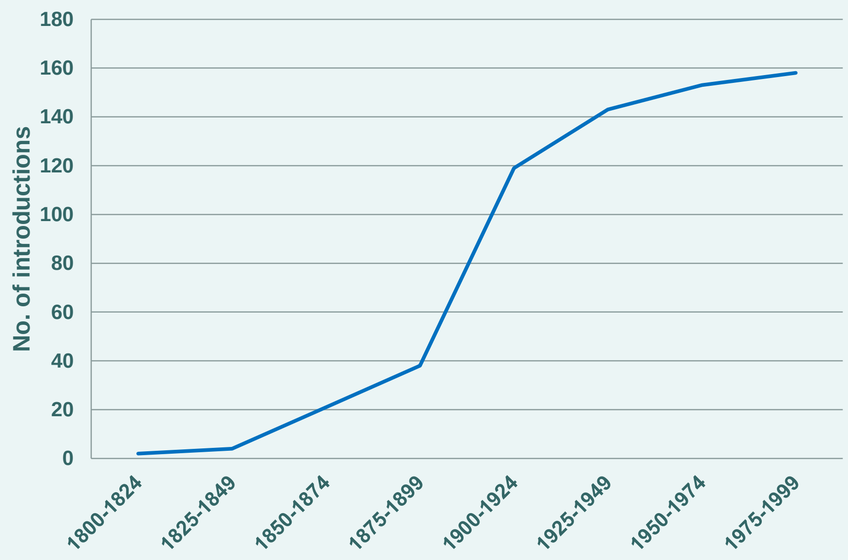


Fig. 1. *Cumulative number of documented introductions of whitefish in lakes in Norway from 1800 to 1999.*

Management activities

- **Economic support to the construction of hatcheries for inland fish.**
- **Promoting introduction of whitefish in fishless lakes as well as lakes with other fish species .**

Which resulted in:

- **Successful introductions: in some areas up to 70 % of attempts resulted in viable populations (fig. 2).**
- **Secondary spreading caused the number of whitefish lakes to increase by up to 20 times in some regions (fig. 3).**
- **Overall number of whitefish localities in Norway increased by approx. 250%. Only one vendace pop. established (of ~20 known attempts).**
- **Negative impacts on native fauna and water quality in fishless lakes.**
- **Negative impact on some native fish species.**

Summary

- **Intentions to increase harvestable fish stocks fulfilled, the number of whitefish populations increased by 200-300%**
- **Successful introductions and extensive secondary spreading of whitefish.**
- **A number of negative biodiversity impacts according to present management priorities:**
  - **(1) Specific invertebrate fauna in fishless lakes modified or extinguished, probably accompanied by water quality decline**
  - **(2) Good Arctic charr populations brought close to extinction**
  - **(3) Value of lake fisheries greatly reduced according to present public opinion**

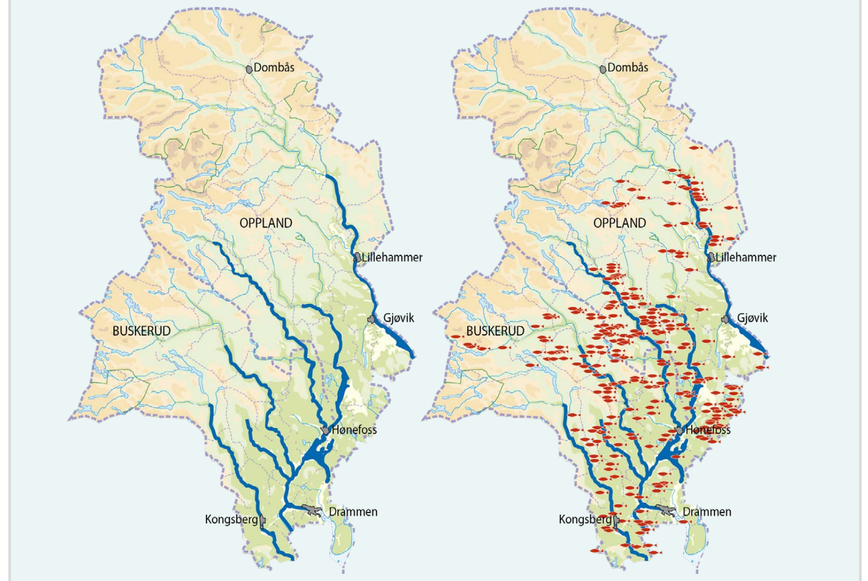


Fig. 3. *Original (in blue, along main rivers, incl. 6-10 lakes) and present (red fish symbols, ~230 lakes) occurrence of whitefish in the counties of Buskerud and Oppland in south-east Norway. .*

Reference: Sandlund, O.T., Hesthagen, T. & Brabrand, Å. 2012. Coregonid introductions in Norway: well-intended and successful, but destructive. Advances in Limnology 63: in press.