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**Management actions to mitigate the effect of  
climate change on salmon – Norway**

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Photo: Bjørn Barlaup





Photo: NINA



# Warmer, wetter and wilder – what can salmon management do?

- Get an overview over likely implications
  - Asked the Scientific advisory committee for advice twice (2011 and 2022)
    - Not all populations likely to be affected in the same way
    - Better knowledge on likely impacts in fresh-water than at sea
    - Adverse effects on salmon populations more likely south of Norway than in Norway. Norway will likely have a larger proportion of Europe's salmon stock in the future

# What can be done (apart from reducing greenhouse gas emissions)?

- Larger proportion of the European salmon stocks in northern areas than today.
  - Norway responsibility for salmon may increase
- At sea survival of salmon may decrease further (very uncertain prediction)
  - Ensure that smolt production in rivers are not reduced
- Adaptation to changed environmental conditions will require genetic variability
  - Maintain genetic integrity by reducing introgression from fish farm escapees
  - Critically evaluate the use of stocking, as stocking may lead to loss of genetic variation

# What can be done (apart from reducing greenhouse gas emissions)?

- More water in rivers regulated for hydropower production
  - New rules for water management in regulated rivers should take salmon into account
- Increased sea-water temperature may increase sea-lice emissions from aquaculture
  - Should be taken into account when new aquaculture facilities are planned
- Increased freshwater temperature may lead to younger and smaller smolts. May also lead to earlier smolt migration. These smolts may be more susceptible to adverse effects of sea-lice.
  - Should be taken into account when mitigation measures against sea-lice are planned in sea-cages.

# What can be done (apart from reducing greenhouse gas emissions)?

- More frequent and larger floods are expected in the future
  - Mitigation measures to protect infrastructure against floods should take the living conditions of salmon and other aquatic organisms into account.
  - Give the rivers more room
  - Riparian vegetation may protect infrastructures from flood and reduce erosion in addition to providing shade and food for aquatic organisms
  - Avoid building houses close to riverbanks

# What has been done?

- Fishing regulations
  - Fishing regulations in rivers is based on salmon stocks in most recent years
  - Closure of rivers with low salmon returns in recent years
  - Fishing rules are adjusted mid-season to allow for fluctuations in number of salmon among years
  - Most Norwegian rivers (approximately 80%) reach their CL's
- Stocking
  - Only local brood-stock is used
  - Evaluation of stocking practice in rivers has led to stricter regulations



# What has been done?

- Revision of hydropower regulations
  - Many old regulations up for revisions in coming years. New regulations may put more emphasis on conditions for aquatic life
  - Norwegian authorities are aiming to implement standard regulation rules for all hydropower regulations that currently lack such rules
- Restauration of watercourses
  - National strategy for restauration for the period 2021-2030
    - Goal: Restore more rapidly than watercourses deteriorates
    - Restore at least 15 % of deteriorated watercourses before 2030
- Aquaculture
  - Lice mitigation adapted to periods with high predicted smolt migration
  - Culling of escaped farmed salmon in rivers with high numbers of escaped farmed salmon (OURO)
  - Reduced number of reported escapees, and lower proportion of escaped farmed salmon in catches

# Conclusion

- The most important mitigation measure is to ensure that salmon populations obtain their conservation limits (CL)
- Ensure enough water in regulated rivers
- Reduce the effects of other threats than climate change on salmon populations