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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