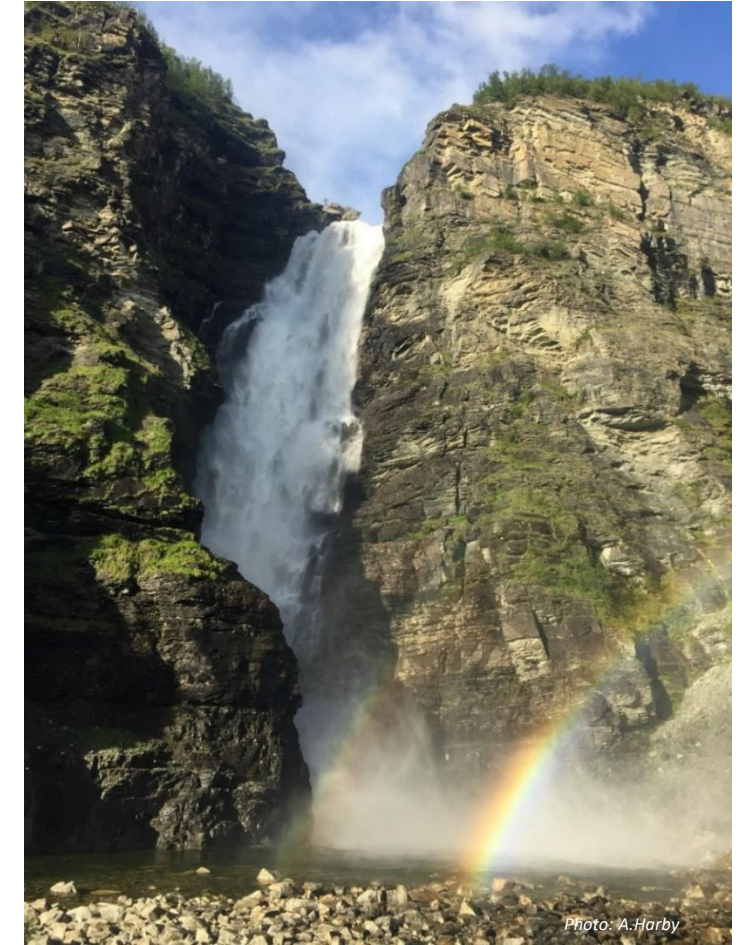


License to operate - Environmental design of hydropower

Atle Harby, SINTEF Energy Research



...from the perspective of:



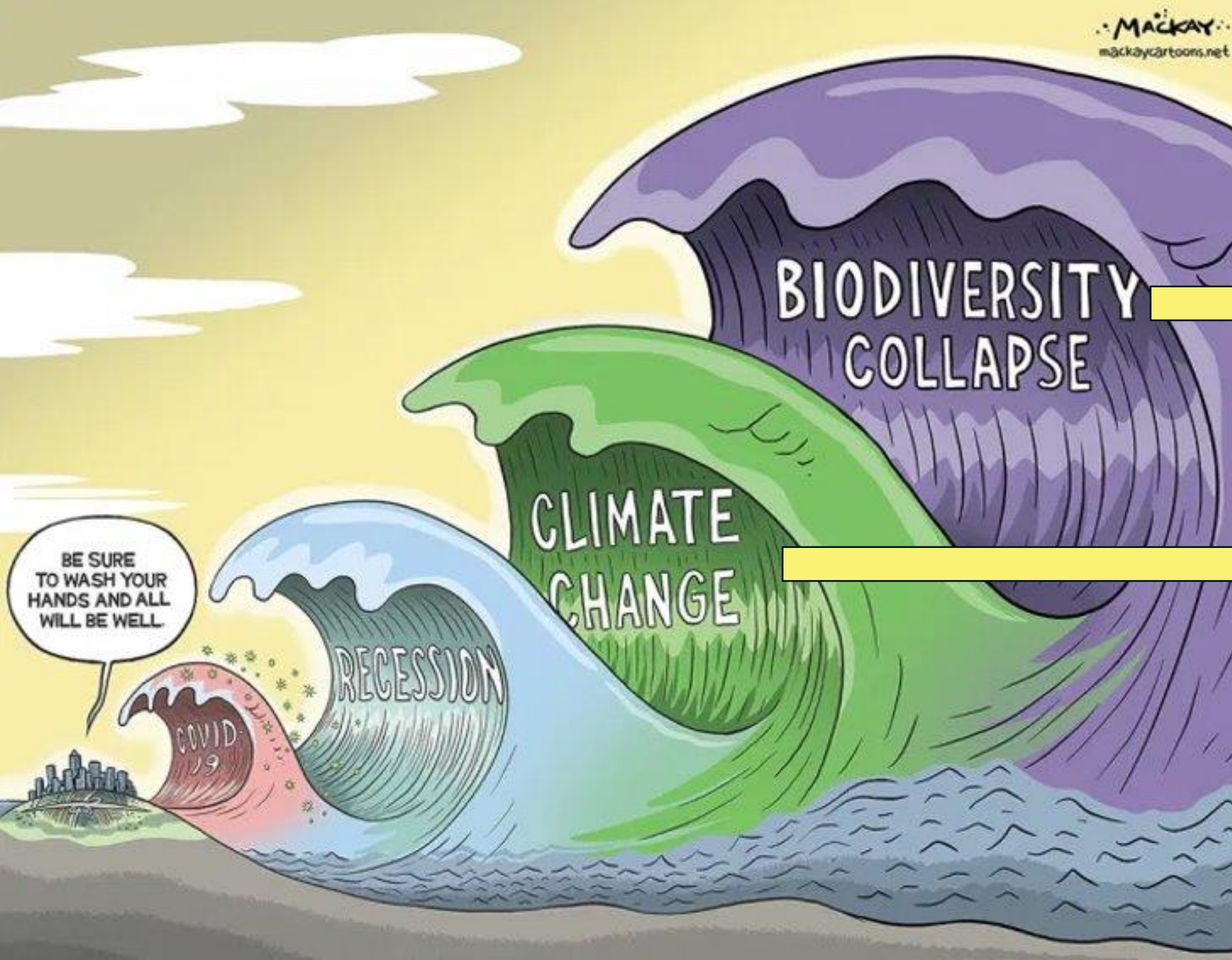
biodiversity



people



regulations

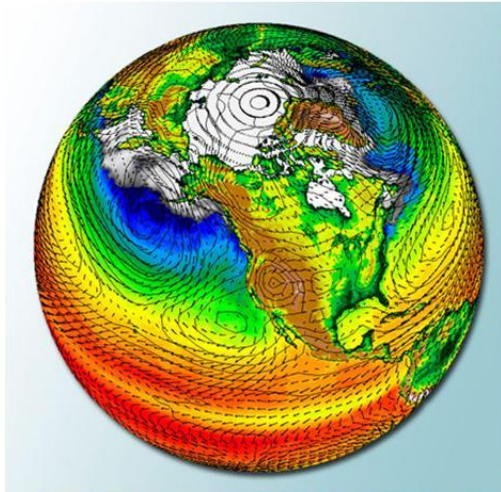


By 2030:

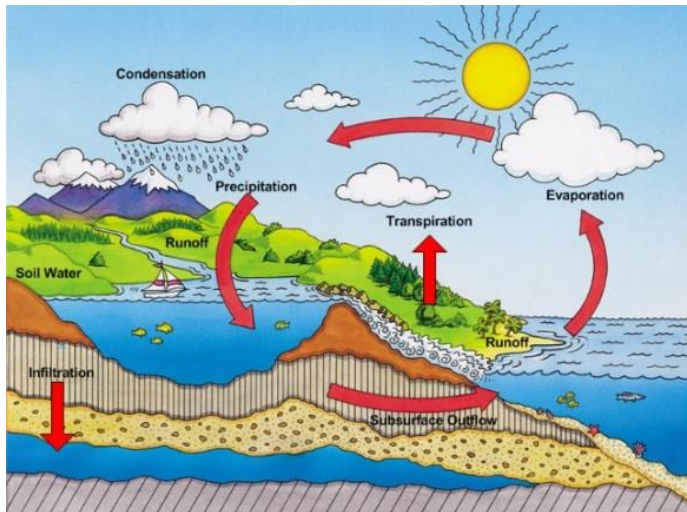
Protect 30 % and
restore 30 % of
nature on land
and sea

Stop emitting CO₂
Increase use of
electricity
Carbon neutral by
2050

Climate change



Impacting hydrology



Mitigation



Replacing fossil energy
with low-carbon sources



Can we prove it?

Adaptation



Flood protection and
drought management



State-of-the-art for nature in Norway

**4957 species on the Red List (21%),
and half of all nature types....
Norwegian nature index < 0.5**



**None of Aichi-targets
fulfilled. OECD: Decision-
making does not consider
nature, climate and the
environment sufficiently**

Global biodiversity status

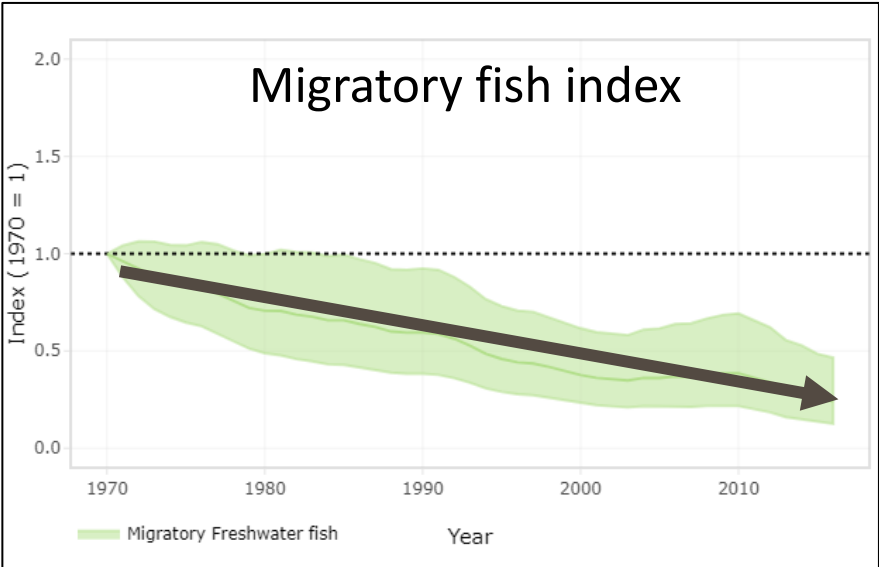
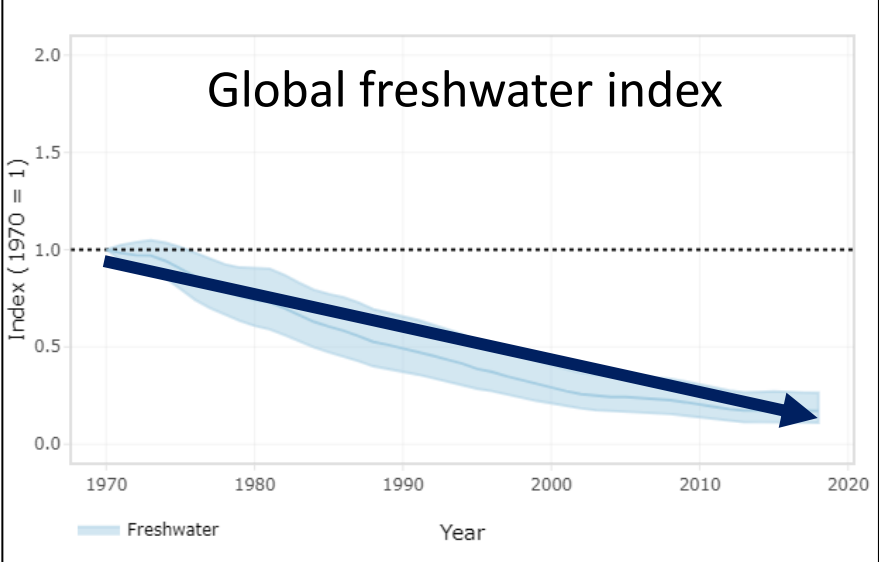
More than 44,000 species
are threatened with extinction

That is still 28% of all assessed species.



Take action Help us make The IUCN Red List a more complete barometer of life.

from IUCN Red List of Threatened Species



from WWF Living Planet Index

Increasing electricity generation with renewables

Onshore wind



Offshore wind



Solar PV



Hydropower:

- New developments
- More and larger reservoirs
- Refurbishment and modernisation for more capacity

Hydropower impacts





Eco Hydrology

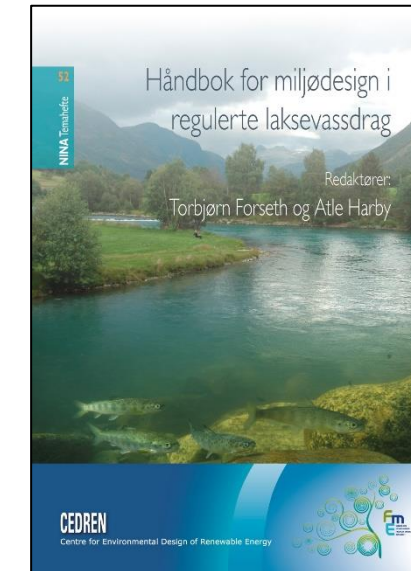
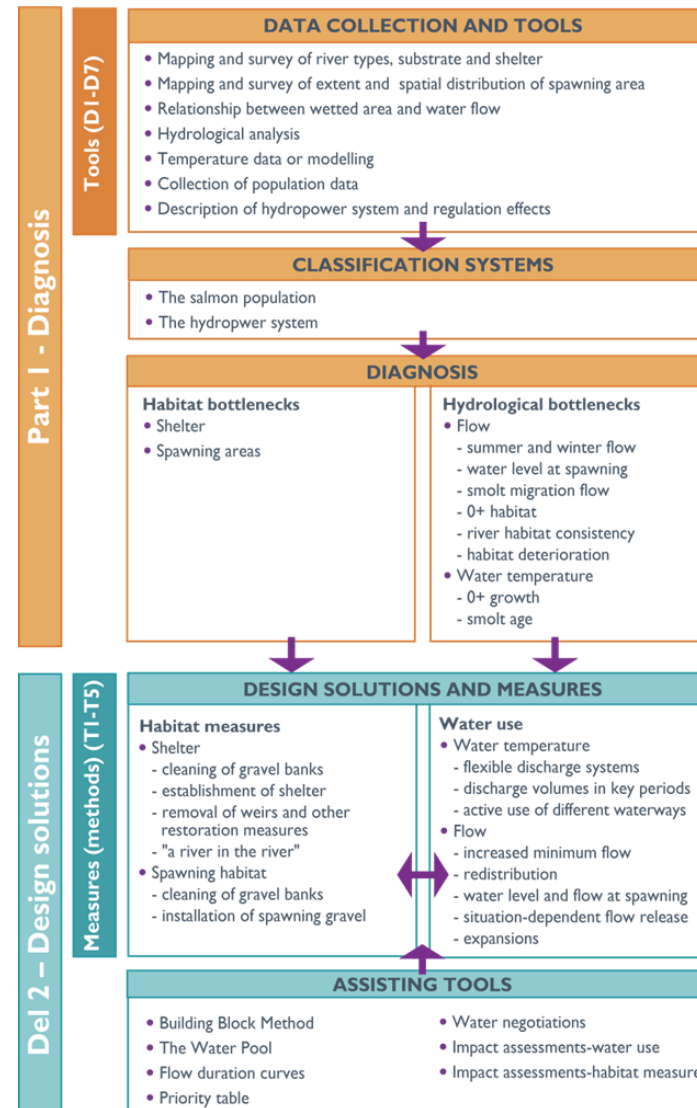
Environmental design



Hydropower

Environmental design – what is it?

- A **method** to consider power production, societal needs and the environment
- A **systematic approach** combining recognized and new knowledge
- **Handbook**, course and a set of tables and graphs for hydropower and salmon
- Under further **development** to include other species, biodiversity, recreation and other services

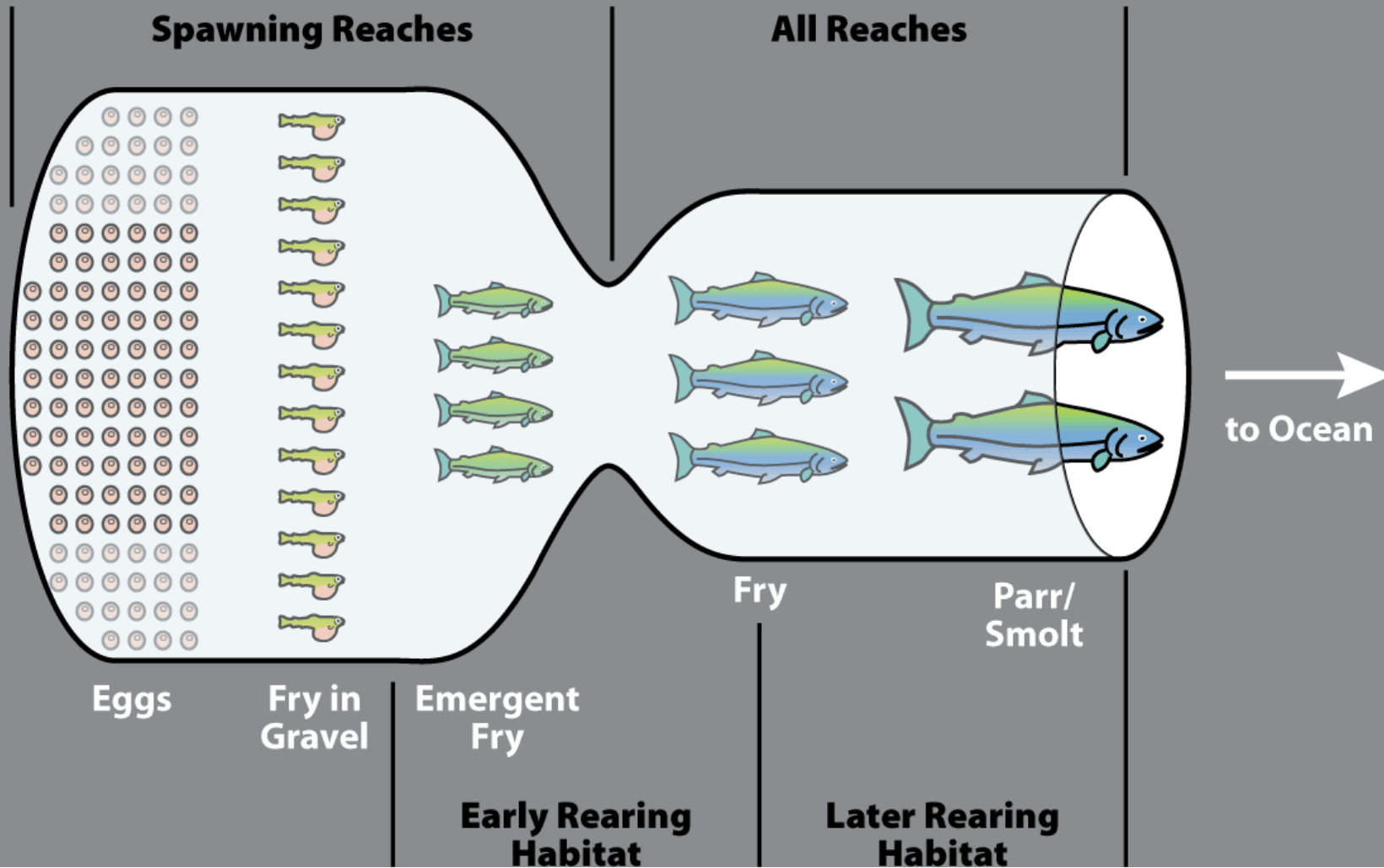


- Methods for Atlantic salmon
- These methods also applicable for other species and services
- Printed and pdf available in English, Norwegian and Chinese

Free download at:
www.cedren.no

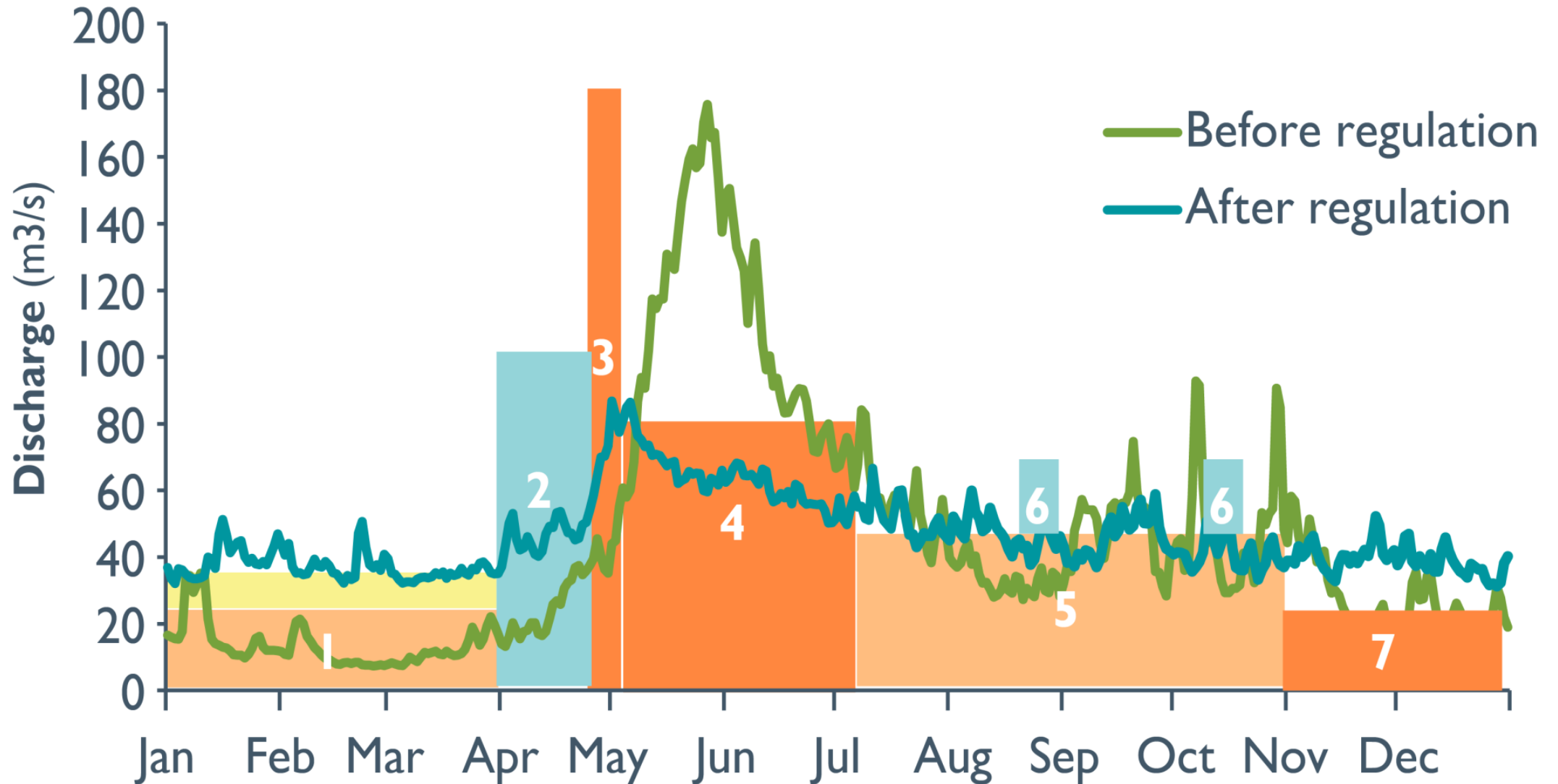


HABITAT BOTTLENECK



Fish dies only once!

Design solutions – how to use water?



Mitigation measures – design solutions



Environmental flow release



Stable temperature and ice cover



Introduce "a river in the river"
when water is withdrawn



Two-way migration solutions



Improving habitats



"Water bank"

Species, activities and services



Other species and habitats



Flood protection



Energy services



Recreation and tourism



		Extent of spawning habitat as a percentage of river area.			
		Small (<1%)	Moderate (1-10%)	Large (>10%)	
Distance between spawning habitats (across all segments)	Large (>500 m)	Small	Small	Moderate	
	Medium (200-500 m)	Small	Moderate	Large	
	Small (<200 m)	Moderate	Large	Large	

Reach	Length (m)	Depth (m)	Population reproductive value	Habitat suitability	Spawning area (km²)		River conditions (km²)		River conditions (km²)		River conditions (km²)	
					Per reach (km²)	Per reach (km²)	Per reach (km²)	Per reach (km²)	Per reach (km²)	Per reach (km²)		
1 4000	1	800	Pr	Spaw	1	3	2	0	3	2	0	1
	2	1000	Pr	Spaw	1	3	2	0	3	2	0	1
	3	600	Pr	Spaw	1	3	2	0	3	2	0	1
	4	900	Pr	Spaw	1	3	2	0	3	2	0	1
	5	700	Pr	Spaw	1	3	2	0	3	2	0	1
2 2000	6	600	Pr	Spaw	1	3	2	0	3	2	0	1
	7	600	Pr	Spaw	1	3	2	0	3	2	0	1
	8	800	Pr	Spaw	1	3	2	0	3	2	0	1
	9	500	Pr	Spaw	1	3	2	0	3	2	0	1
	10	600	Pr	Spaw	1	3	2	0	3	2	0	1
3 2000	11	800	Pr	Spaw	1	3	2	0	3	2	0	1
	12	600	Pr	Spaw	1	3	2	0	3	2	0	1
	13	800	Pr	Spaw	1	3	2	0	3	2	0	1
tot					13	39	26	0	39	26	0	13

Guidance, methods and tools

Societal acceptance



All stakeholders must be heard

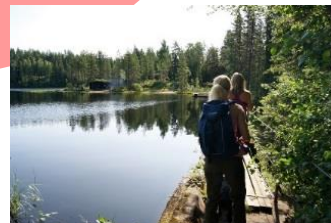


The image of hydropower ?



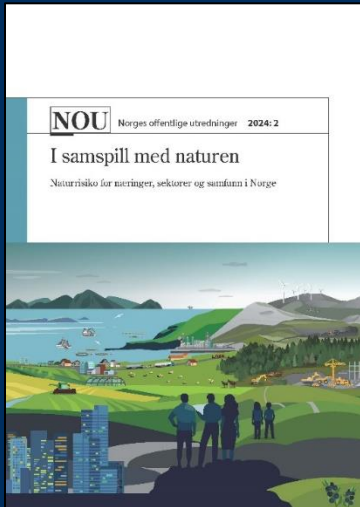
What's in it for me?

Balancing between interests



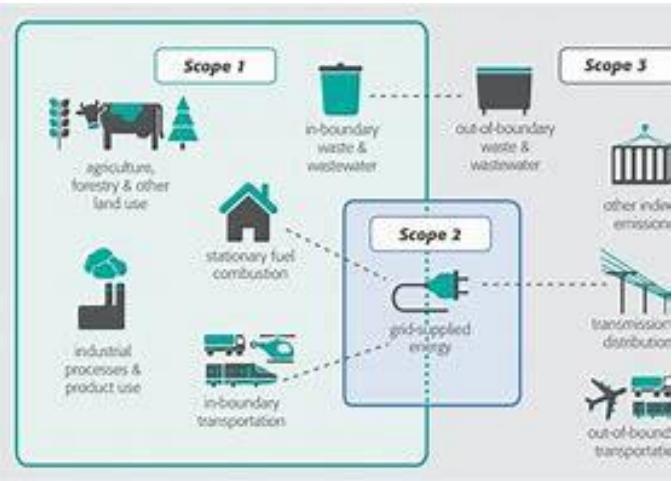
Consider that
this balance
may change
rapidly

*Our economy
and well-being is
completely
dependent
on nature. At the
same time, we
are harming it*



NOU 2024:2





INSTRUCTIONS

1) The DPs reported in ESRS E4 are subject to Materiality Assessment.

2) With the exception of DPs in IRO1 [E4.IRO_1_01-16] that are to be disclosed irrespective of the outcome of its materiality assessment [ESRS 1 par. 29], none of these DPs is applicable if the topic is not material.

3) Not all DPs are to be reported if the undertaking has not adopted the respective policies, implemented the respective actions or set the respective targets in relation to a sustainability matter that has been assessed to be material [see ESRS 1 par. 33].

4) Undertakings or groups *not exceeding on their balance sheet dates the average number of 750 employees during the financial year* (on a consolidated basis where applicable) *may omit all the DPs* reported in ESRS E4 [other than IRO 1] for the first 2 years of preparation of their sustainability statement [see ESRS 1 Appendix C: List of phased-in Disclosure Requirements]. If E4 is material, the undertaking shall nevertheless disclose DPs reported under par. 17-892 of ESRS 2.

5) Column I identifies DPs subject to phased-in [see Appendix C of ESRS 1].

6) Metrics to be disclosed, in addition to the ones explicitly required by ESRS, also include entity-specific ones, as well as those arising from other legislation or standard.

ID	ESRS	DR	Paragraph	Related AR	Name	Data Type	Conditional or alternative DP	Max [V]	Appendix B - ESRS 2 (SFDR - Pillar 3 - Benchmark - C)	Appendix C - ESRS 1 DPs subject to phasing-in provisions	Appendix C - ESRS 1 DPs subject to phasing-in provisions
E4.IRO_1_01	E4	E4.IRO_1_01	16.1		List of material climate change risks	qualitative					
E4.IRO_1_02	E4	E4.IRO_1_02	16.1		Disclosure of activities regarding climate biodiversity activities	qualitative					
E4.IRO_1_03	E4	E4.IRO_1_03	16.1		Disclosure of list of material climate change risks based on results of identification and assessment of climate change risks	qualitative					
E4.IRO_1_04	E4	E4.IRO_1_04	16.1		Disclosure of biodiversity activities and impacts	qualitative					
E4.IRO_1_05	E4	E4.IRO_1_05	16.1		Material negative impacts with regard to land degradation, desertification or soil sealing have been identified	qualitative					
E4.IRO_1_06	E4	E4.IRO_1_06	16.1		Climate change risks have been identified	qualitative					
E4.IRO_1_07	E4	E4.IRO_1_07	16.1		Climate change risks have been identified	qualitative					
E4.IRO_1_08	E4	E4.IRO_1_08	16.1		Climate change risks have been identified	qualitative					
E4.IRO_1_09	E4	E4.IRO_1_09	16.1		Climate change risks have been identified	qualitative					
E4.IRO_1_10	E4	E4.IRO_1_10	16.1		Climate change risks have been identified	qualitative					
E4.IRO_1_11	E4	E4.IRO_1_11	16.1		Climate change risks have been identified	qualitative					
E4.IRO_1_12	E4	E4.IRO_1_12	16.1		Climate change risks have been identified	qualitative					
E4.IRO_1_13	E4	E4.IRO_1_13	16.1		Climate change risks have been identified	qualitative					
E4.IRO_1_14	E4	E4.IRO_1_14	16.1		Climate change risks have been identified	qualitative					
E4.IRO_1_15	E4	E4.IRO_1_15	16.1		Climate change risks have been identified	qualitative					
E4.IRO_1_16	E4	E4.IRO_1_16	16.1		Climate change risks have been identified	qualitative					
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E4.IRO_1_24	E4	E4.IRO_1_24	16.1		Climate change risks have been identified	qualitative					
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E4.IRO_1_100	E4	E4.IRO_1_100	16.1		Climate change risks have been identified	qualitative					

Requires hydropower companies report on nature, climate, sustainability, GHG emissions, land use, environmental impacts....



CSRD, ESRS, Taxonomy and other requirements

- Lack of guidance
- Lack of practice
- Hard to find data
- How to measure impact on nature (climate = CO₂-eq)
- Competence in auditing
- Feedback and collaboration



- **Identify** where you impact nature



- **Analyse** where you depend on and/or impact nature



- **Assess** where you are vulnerable to nature risk



- **Report** on significant nature risk

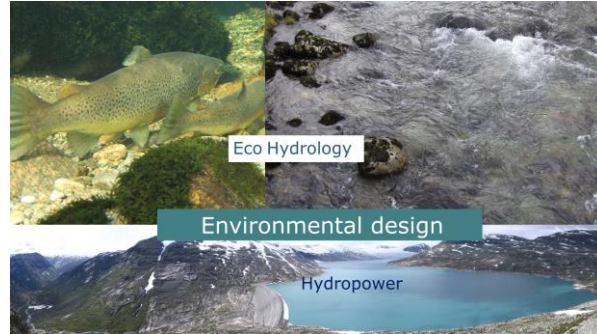


- **Decisions** in specific cases and courses of action

Licence to operate



Licence to operate



Avoid, minimize, mitigate, compensate

Hydropower that provides energy, water management for all users and interests and contributes to welfare



Take care of societal needs

We need much more flexible energy and other services from hydropower for energy transition and climate change adaptation



Thank you for your attention!

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