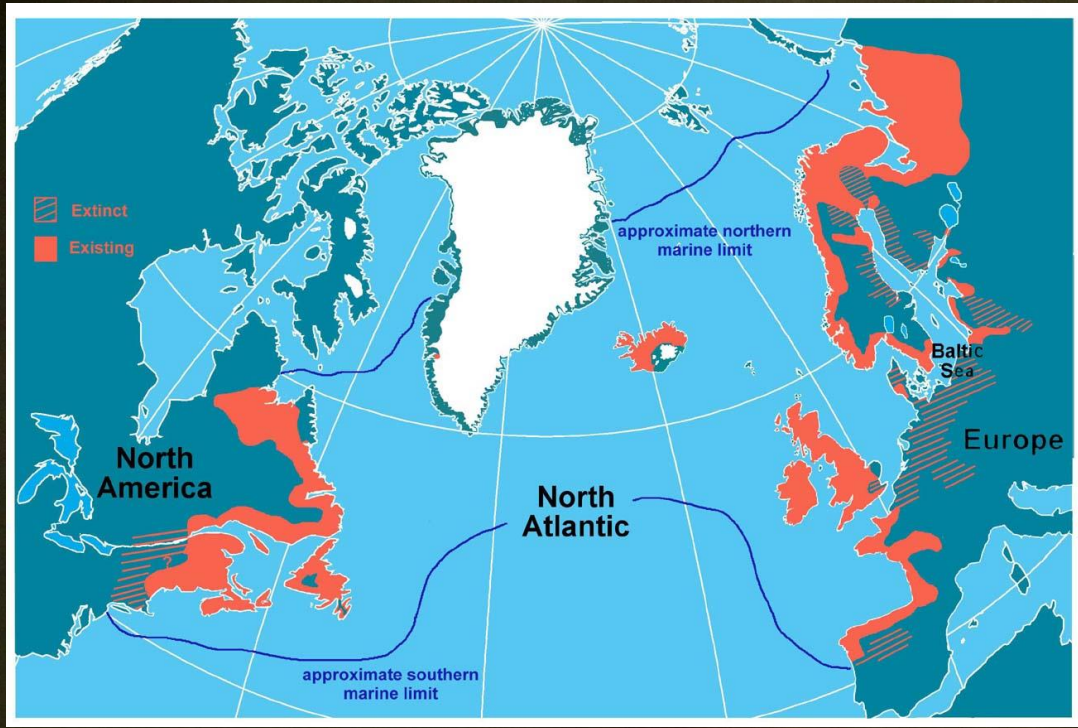
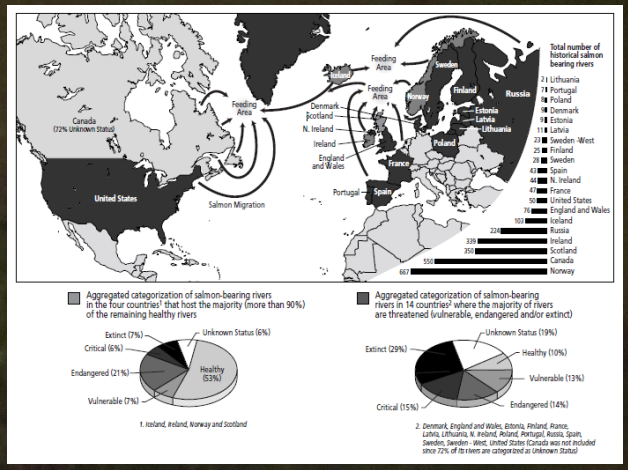
Retour d ’expérience sur la restauration de populations de salmonidés en Europe

Professor Eric Verspoor

Inverness College
University of the Highlands and Islands

Atlantic salmon restoration: overview of challenge



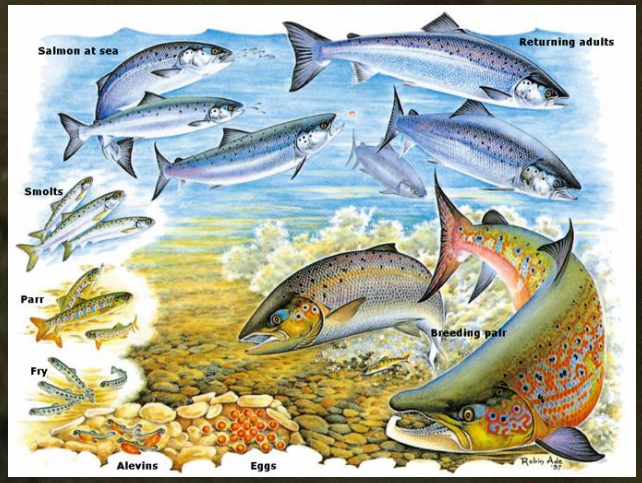


Many populations with reduced abundance or changed character

Many restoration programmes - few successes… uncertain knowledge of how to succeed.

Two requirements for success:

Scientific Understanding



Political will and popular support

SCIENTIFIC UNDERSTANDING: Population Adaptation

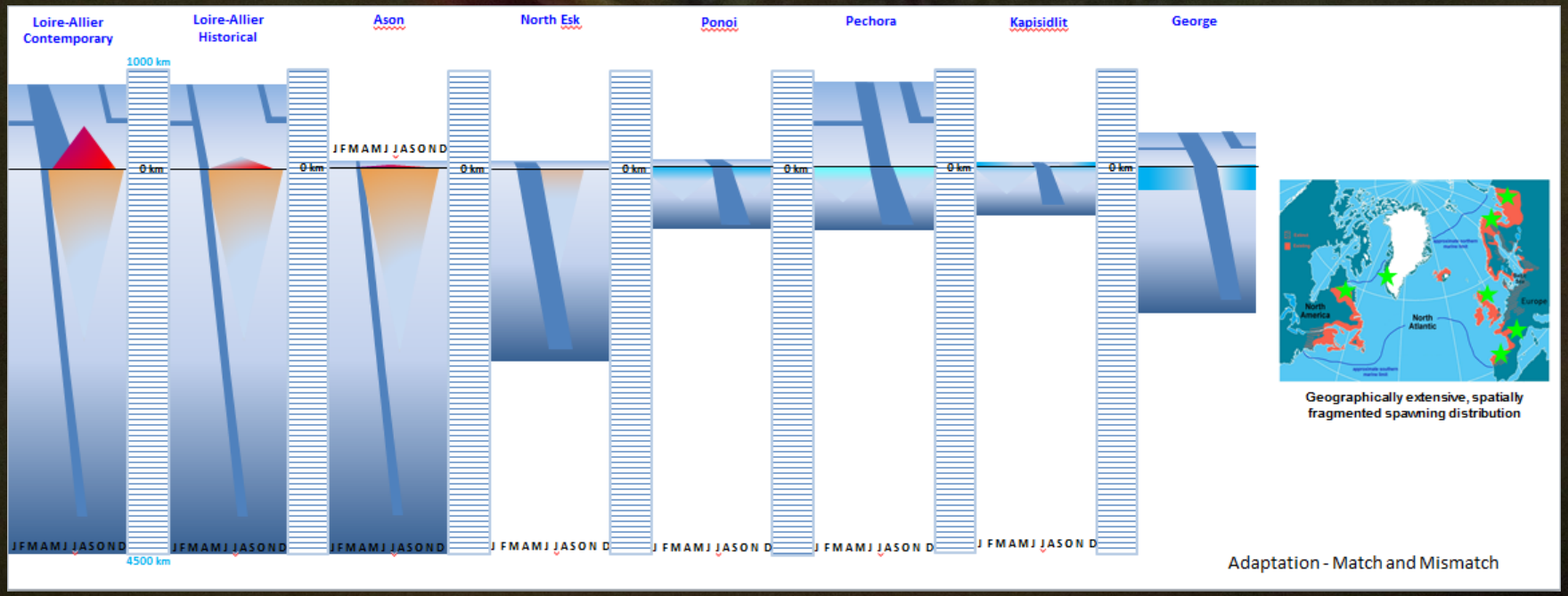
	Anadromous	Non-anadromouss
Natural Evolved Gene Pool (DNA)		
+	+	+
Natural Evolved Environment	 	
=	=	=
Healthy Population		

SCIENTIFIC UNDERSTANDING: Population Adaptation

Each population is evolved to be more or less uniquely adapted:

- **It has a more or less unique set of environmental circumstances**
- **It has a more or less unique gene pool**

Variation in migrations among anadromous stocks



General Understanding: POPULATION MALADAPTATION

Change of Gene Pool

Right Environment

Right Gene Pool

Wrong Gene Pool

Atlantic salmon

No or few salmon

General Understanding: POPULATION MALADAPTATION

Change of Environment

Right DNA

+

Right Environment

=

Atlantic salmon

+

Wrong Environment

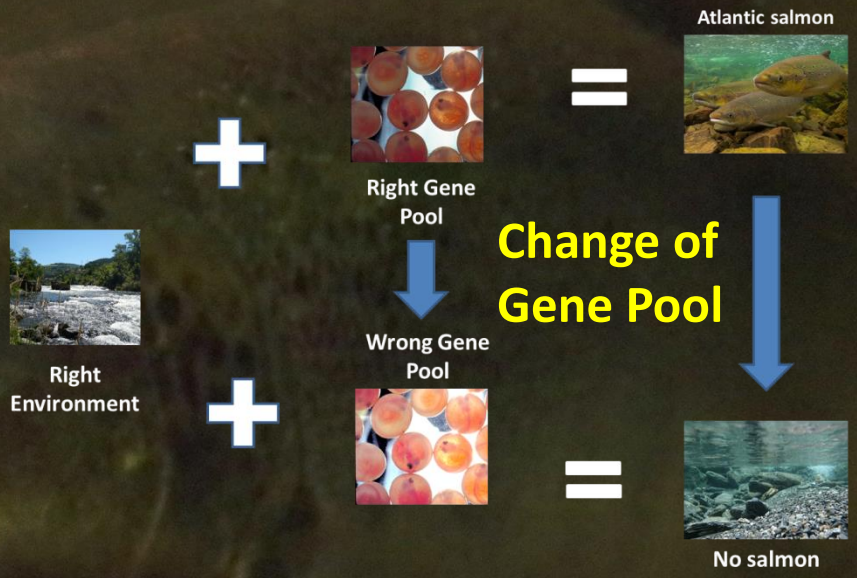
=

No salmon

MANAGEMENT OPTIONS: change of gene pool

Causes: deliberate or inadvertent introductions of non-native fish, fish with low variability, or reduction of population to only small numbers of breeders for many years

Ability to diagnose problem: limited largely to inferences from non-genetic observations; direct evidence difficult and expensive to collect



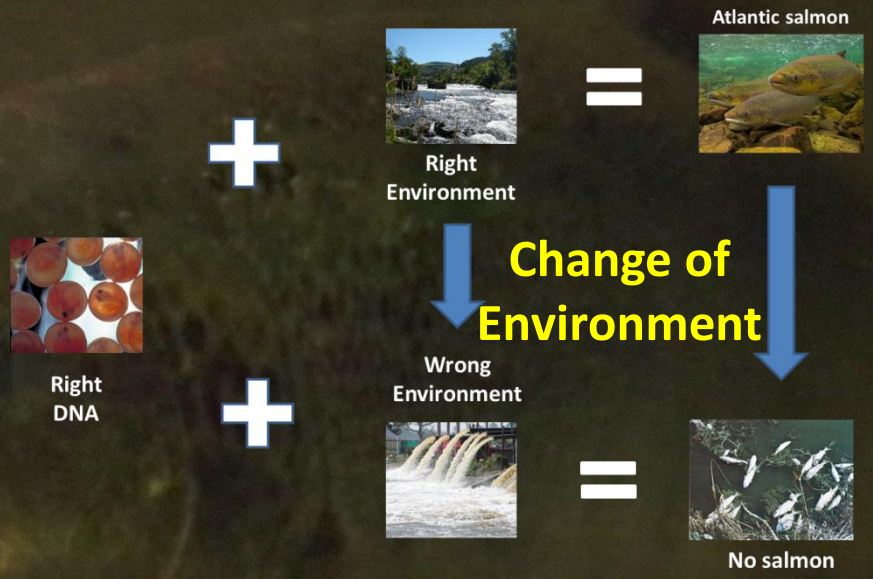
Current Options: in almost all cases limited to eliminating causes and allow natural recovery; generally few if any actions possible with reasonable probability of reversing changes.

Future Options: should become possible to assess and monitor adaptive changes; ability to "engineer" solutions will increase but still be quite limited.

MANAGEMENT OPTIONS: change of environment

Causes: potentially numerous and, at least, in rivers and lakes, often obvious, though not always; in the marine environment uncertain and speculative

Ability to diagnose problem: reasonable ability in freshwater but much more limited in the marine environment



Current Options: identify and reverse all environmental changes causing reduced survival; solving some problems and not others may have not discernible positive impact.

Future Options: will increase to some extent as knowledge of environmental factors expands but will be most affected by political will and community engagement.

Advancing Understanding: adaptation research

ADAPTATION RESEARCH: changing gene pools

McGinnity and co-workers Burrishole River Ireland 2004, McGinnity et al. unpublished

Non-native

Native

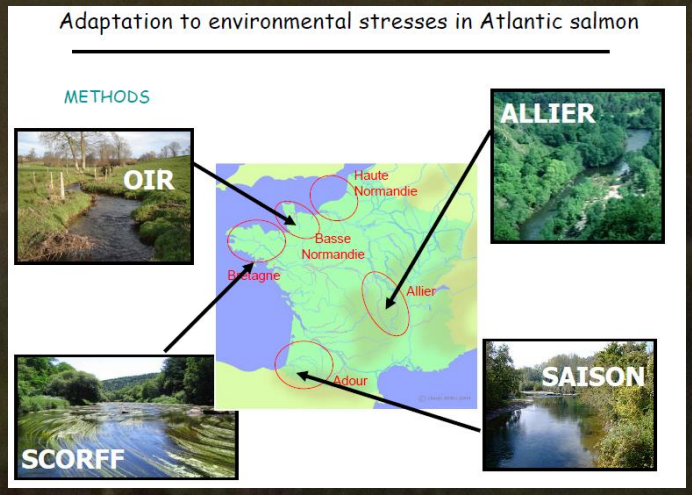
Native salmon had superior life-time fitness to a neighbouring non-native salmon population; hybrids were intermediate but closer overall to the non-native population

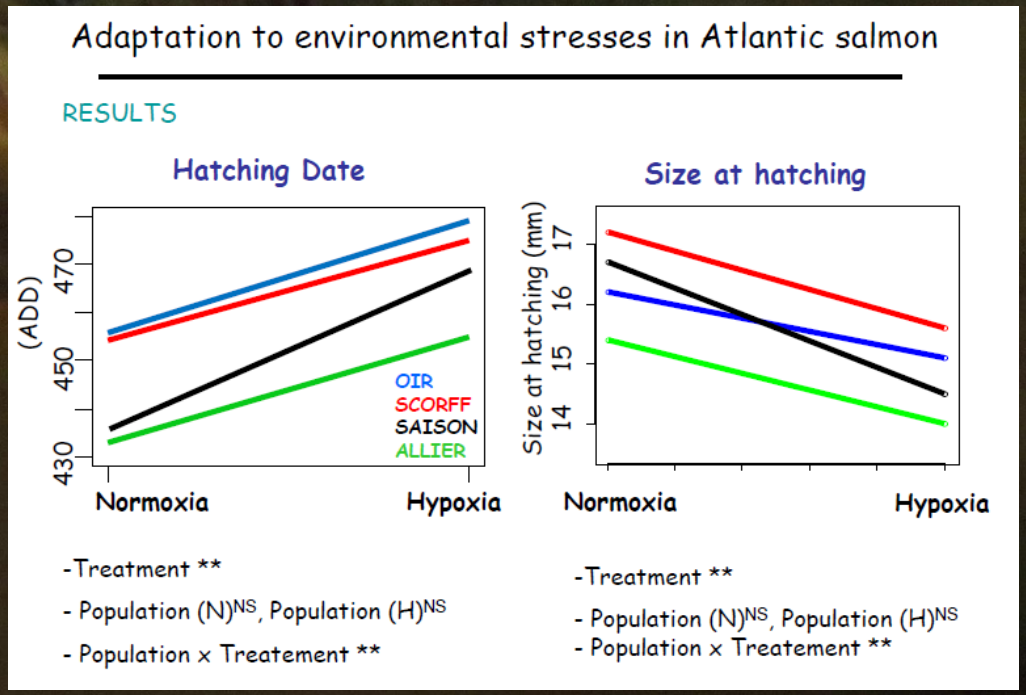
Genetic Type	Egg-Smolt	Smolt-Adult	Lifetime success
Native	1.0	1.0	1.0
Hybrid 1	0.81	0.32	0.26
Hybrid 2	0.66	0.59	0.39
Non -native	1.18	0.18	0.22

ADAPTATION RESEARCH: changing of environment

Evano and co-workers various rivers, France Published 2012 (Cote et al.)

Results reveal a high degree of plasticity in salmon populations but significant differences their adaptive potential in relation to hypoxic stress





Advancing Understanding: case studies

"…recovery and rebuilding programmes for Atlantic salmon…. few have thoroughly reviewed and evaluated … results..."

"A review of successes and failures …could lead to a classification of activities which could be recommended ….would …benefit .. management tasked with rebuilding and restoration actions."

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

WGERAAS

Working Group on Effectiveness of Recovery Actions for Atlantic Salmon

2013

Advancing Understanding: case studies

SALARC Atlantic Salmon Adaptation Research Consortium

Two Recent Case Studies:

1. Norway – recovery from acidification

2. Denmark – recovery from habitat degradation and non-native stocking

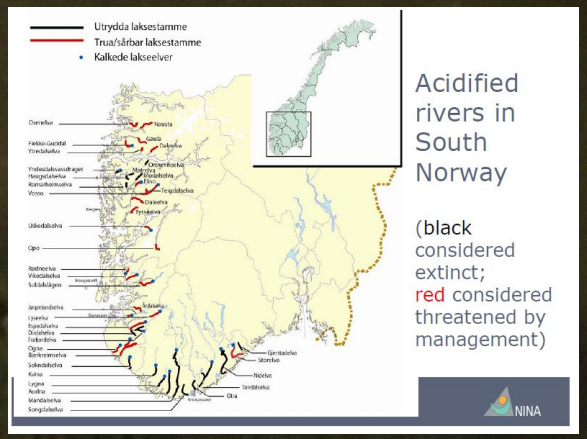
presented at June 2013 SALARC meeting

Case Study: recovery from acidification

Strategies for re-colonisation of salmonid populations (of formerly acidified rivers)

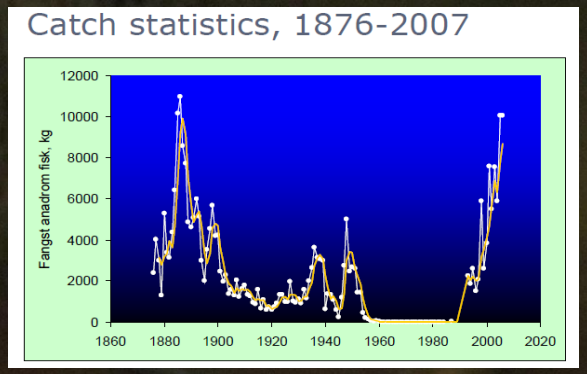
Kjetil Hindar
Norwegian Institute for Nature Research (NINA)
Trondheim, Norway

- Southern Norway: acidification and liming
  - Acidification a major environmental problem
  - Liming of two main rivers from 1997 onwards
  - River Tovdalselva and R Mandalselva
- Characterisation of salmon – before and after
- Where do (or should) fish come from?
  - Strategy for re-colonisation
- Some tests of origin and performance



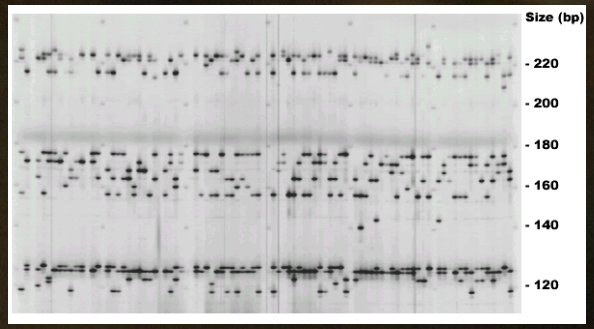
Acidified rivers in South Norway

(black considered extinct; red considered threatened by management)



Summary

1. Overwhelmed by natural re-colonisation in one river
2. Governed/assisted re-colonisation in the other river (early release + waterfalls)



Case Study: habitat improvement and stocking

The Skjern River salmon

Einar Eg Nielsen, DTU-Aqua, Silkeborg

Early Questions

- Were there any indigenous salmon left in the Skjern River?
- If so, did the few remaining salmon have low genetic variability and potentially suffering from inbreeding?

Conclusions

- *"...the descendants of the indigenous population, ... adapted to the ...environment in the river"*
- *"...not inbred or suffering from low ...genetic variability. ...comparable to other populations in western Europe (low end)"*

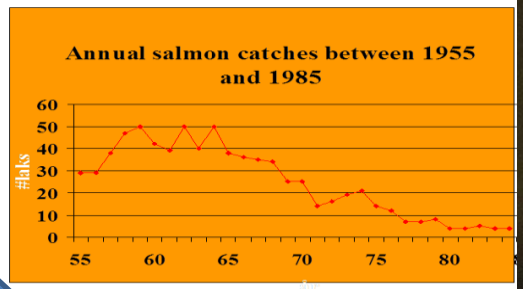
Changes in management

- Only supportive breeding of *Skjern River salmon*® in Skjern River
- Skjern River designated as EU habitat for salmon
- Protection of the salmon in the river as well as the estuary
- Very restricted quotas for angling
- "National Management plan for Salmon" (2004)
- Major habitat improvement programme: spawning grounds, barrier removal, restoration of natural river bed

Progress

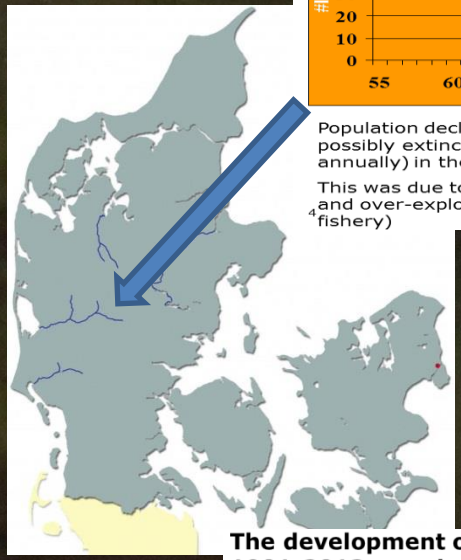
- Professional supportive breeding program
- Spawning run >4000 adult salmon (2012)
- Natural reproduction in most of main stem and most tributaries
- >1/3 of smolts from natural reproduction (2008)

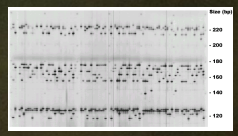
Recent history



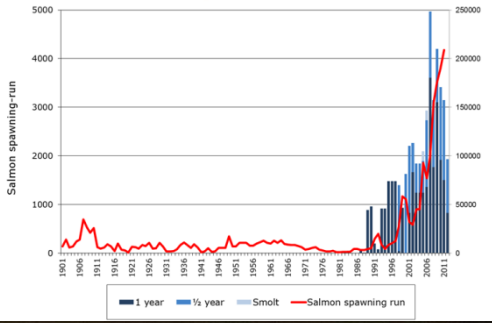
Population declined from low in the 1950's to possibly extinct (only around five salmon caught annually) in the 1980's

This was due to habitat destruction, damming and over-exploitation (smolts caught in herring fishery)





The development of the spawning run from 1901-2012, number and age of stocked fish



Advancing Understanding: useful initiatives

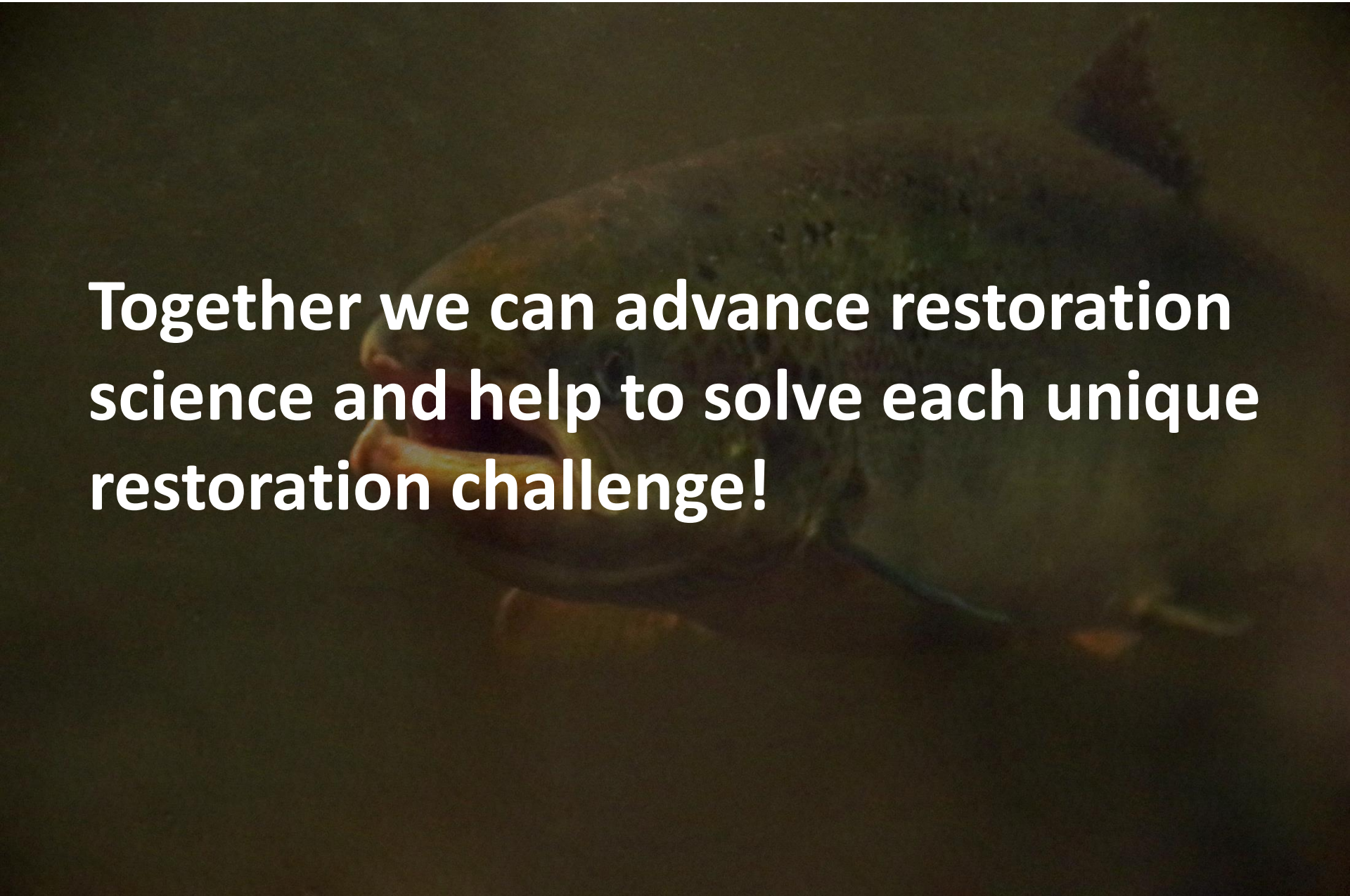
- Promotion of trans-European, collaborative research projects on population adaptation in Atlantic salmon and its implications for stock restoration

SALARC **Atlantic Salmon Adaptation Research Consortium**

- reviewing existing restoration programmes and what they tell us, or not, about the most effective management practises

WGERAAS **ICES Working Group on Effectiveness of Recovery Actions for Atlantic Salmon**

Relevance to Loire-Allier salmon Restoration?



Merci pour votre attention.

Inverness College
University of the
Highlands and Islands