



HAL
open science

Atlantic salmon index rivers: their contribution to management

Etienne Prévost

► **To cite this version:**

Etienne Prévost. Atlantic salmon index rivers: their contribution to management. Morfish Conference, Mar 2015, Wareham, United Kingdom. 31 diapos. hal-01901351

HAL Id: hal-01901351

<https://hal.science/hal-01901351>

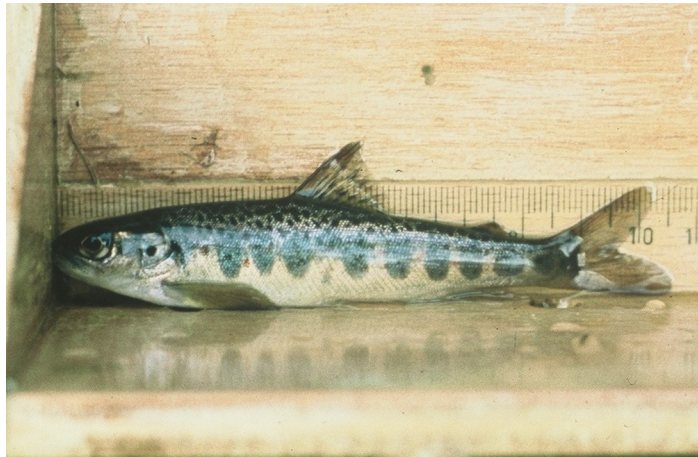
Submitted on 5 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Atlantic Salmon Index Rivers: Their contribution to management

Etienne Prévost
INRA - UMR Ecobiop
Saint-Pée-sur-Nivelle - France



What is an Index River?

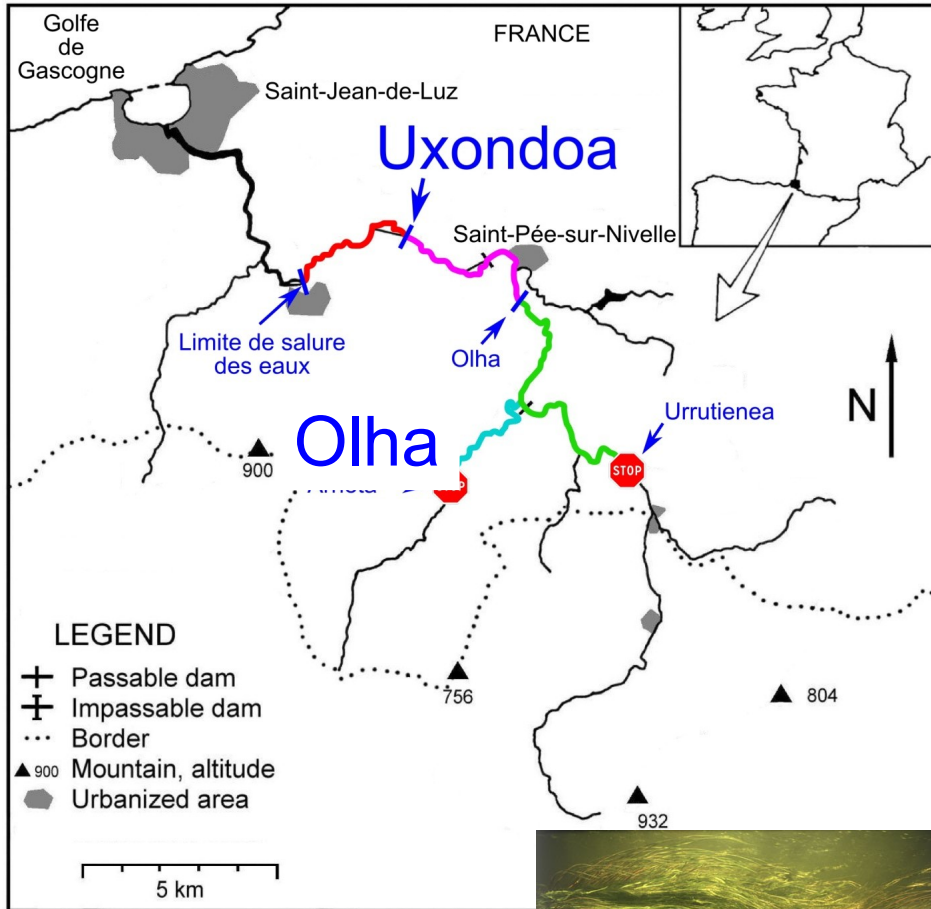
- Salmon population abundance (biological traits) monitored
 - (Anadromous) Adult (returns + catches), parr, smolts...
 - Survival rates (freshwater, marine)
- Over long term
 - Several decades
- Used by ICES NASWG to assess the status A. Salmon stocks
 - Both sides of the Atlantic Ocean
- For providing scientific management advice
- ~ 30 Index Rivers: 50/50 each side of the Atlantic
 - In Europe: From France → Iceland
 - Morfish Rivers (Scorff, Oir, Frome): members of the club...



Why are Index Rivers useful?

- Abundance data series from Index Rivers are used to derive Biological Reference Points
 - Abundance benchmarks against which population status can be assessed
- Conservation Limits: abundance level above which population should be maintained
 - If falling below, remedial management action should be taken
- NASCO Conservation Limit: spawning escapement producing MSY
 - Derived from Stock-Recruitment analysis
- An illustration using the Nivelles R. data series

The Nivelle R.: the southernmost Index River in Europe



Uxondoa trapping station



Redd counts

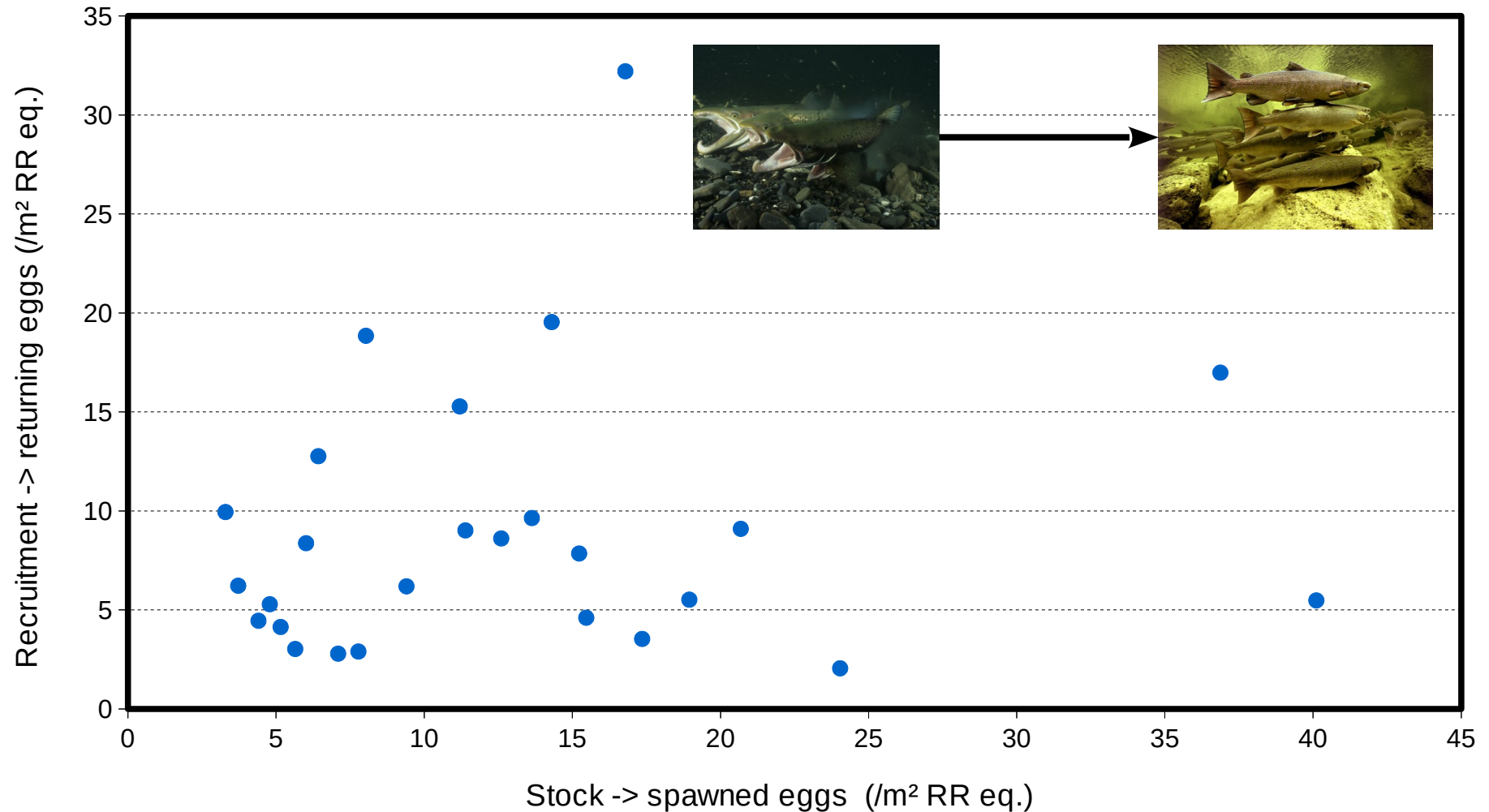


Olha trapping station

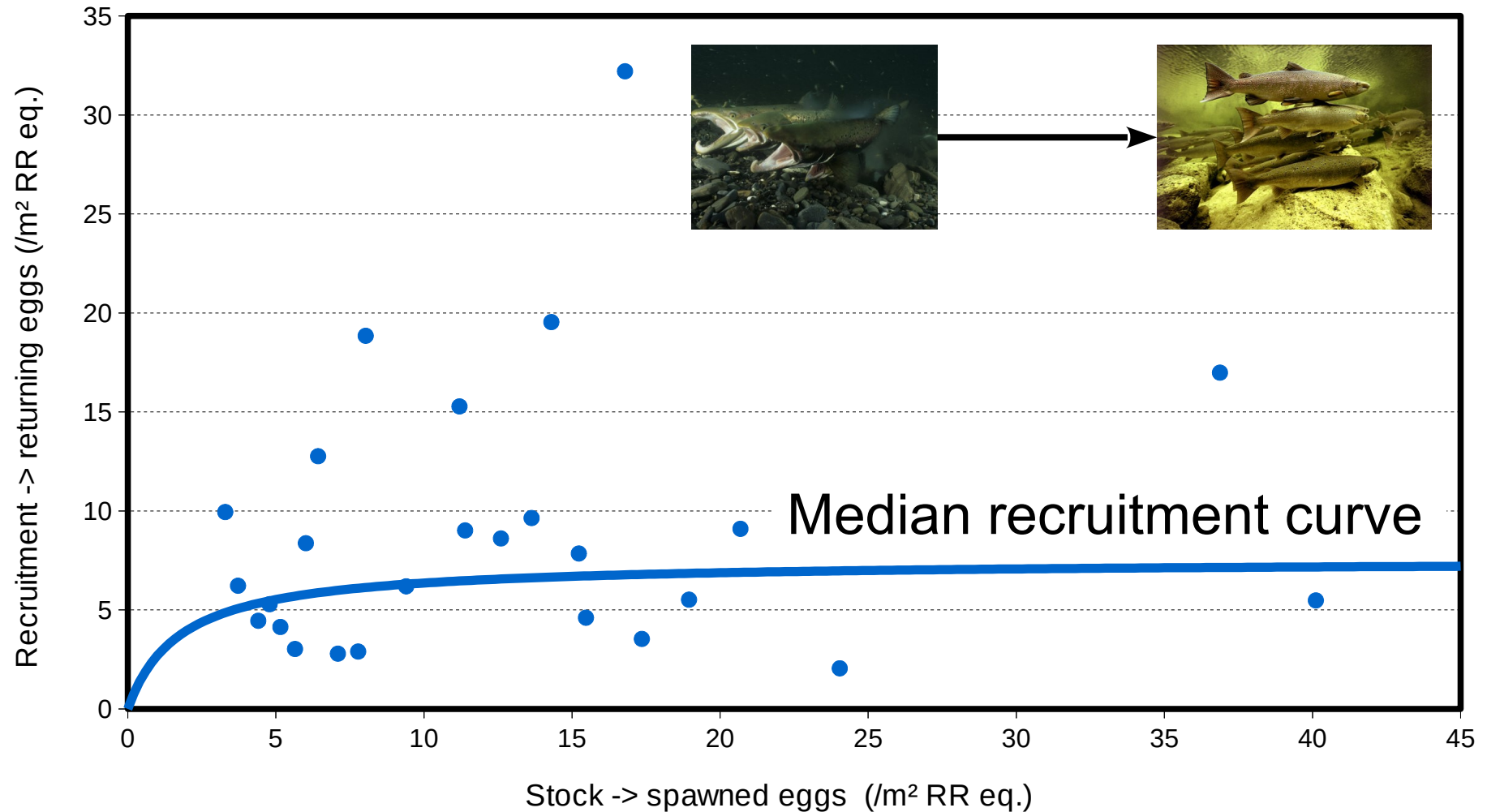
Adult returns estimation



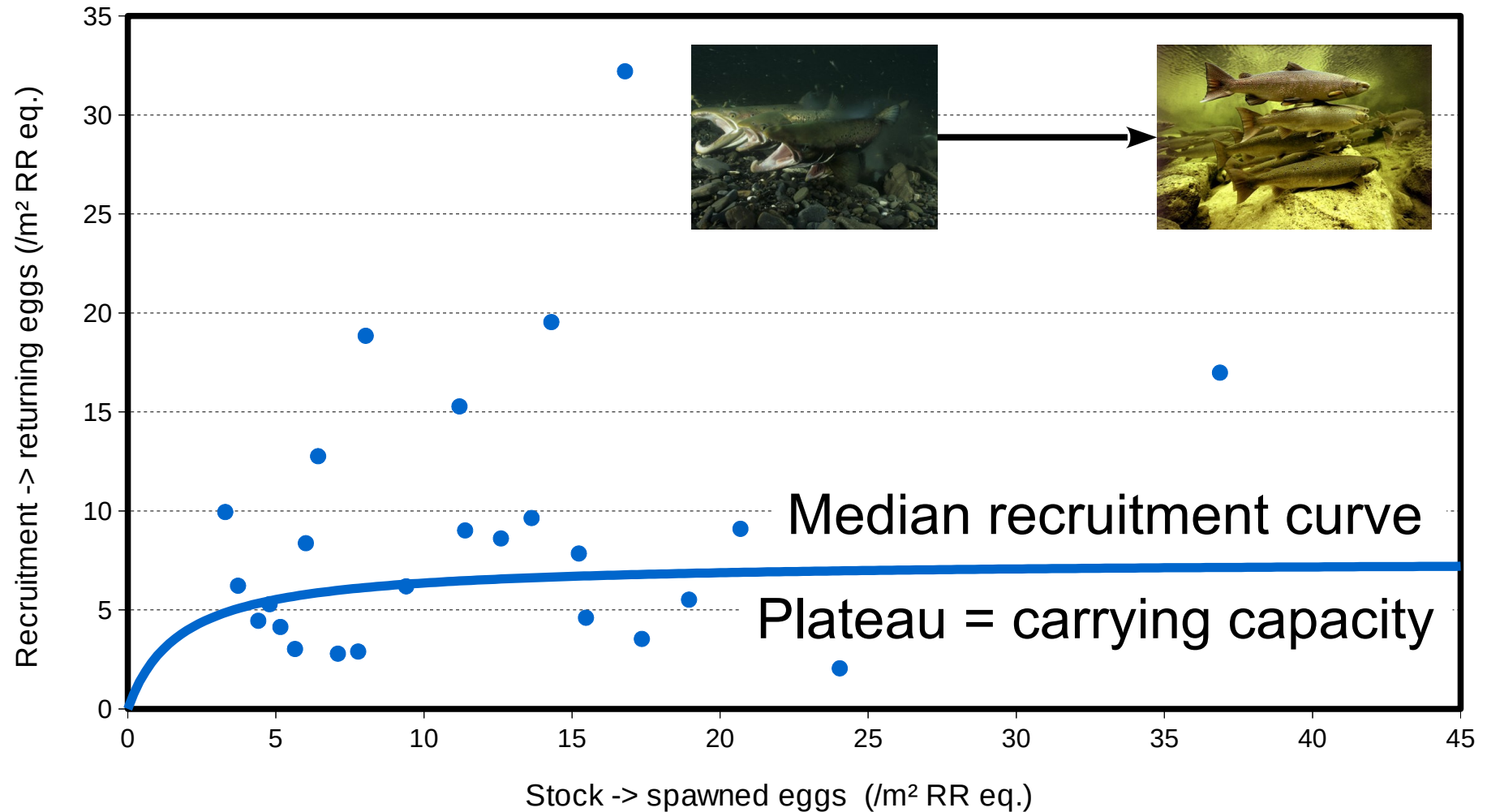
The egg-to-egg Stock/Recruitment series of the Nivelles R.



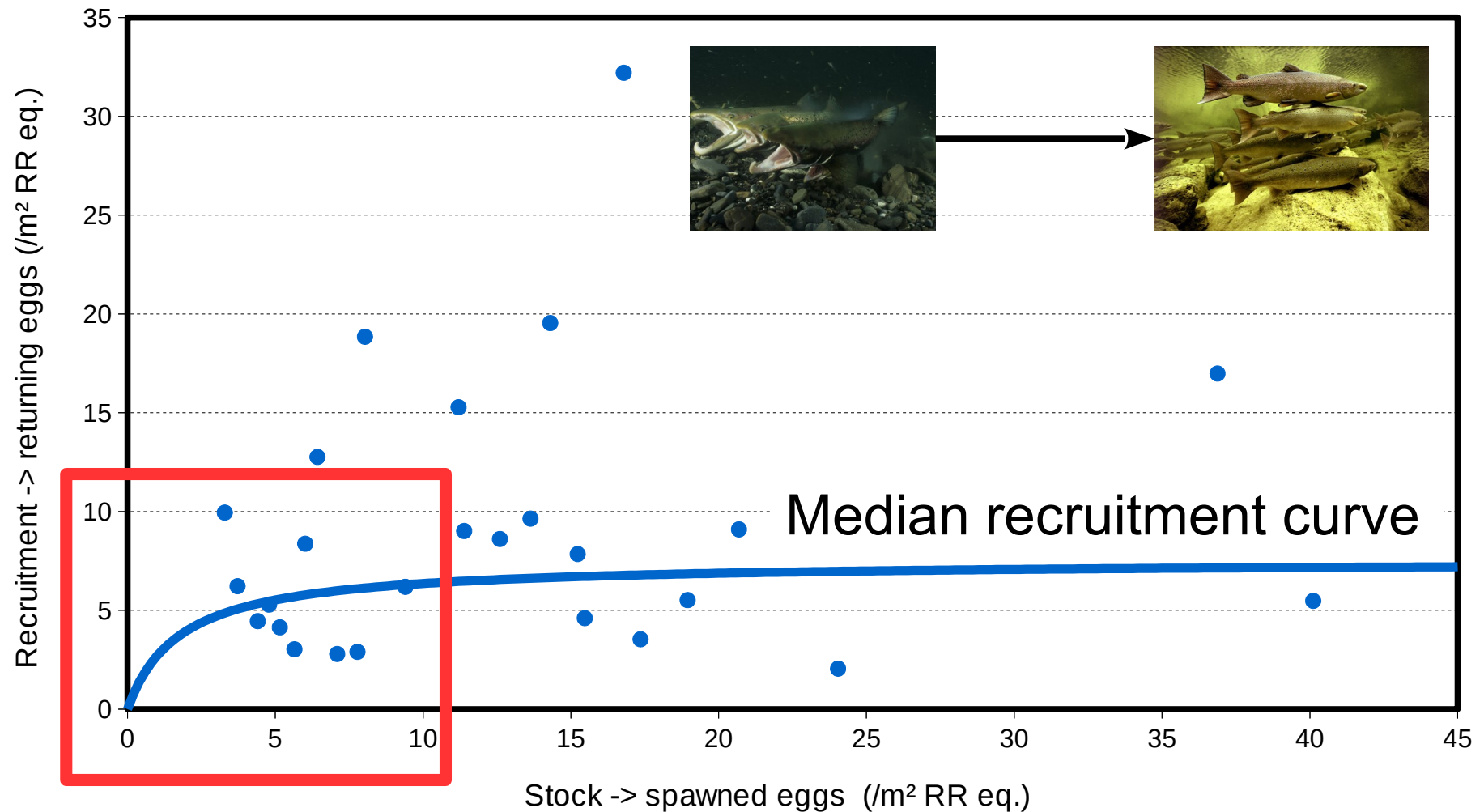
The egg-to-egg Stock/Recruitment series of the Nivelles R.



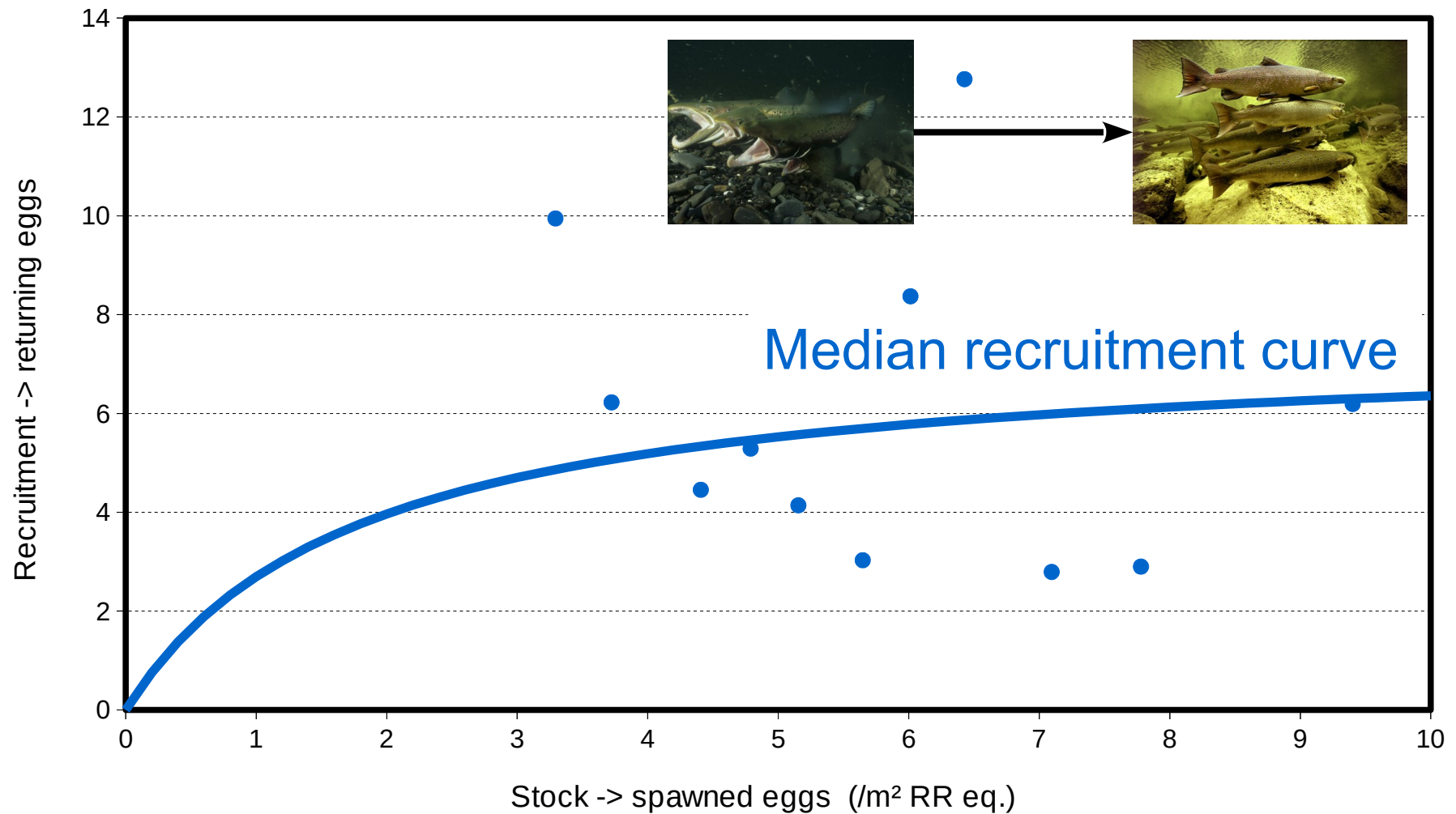
The egg-to-egg Stock/Recruitment series of the Nivelles R.



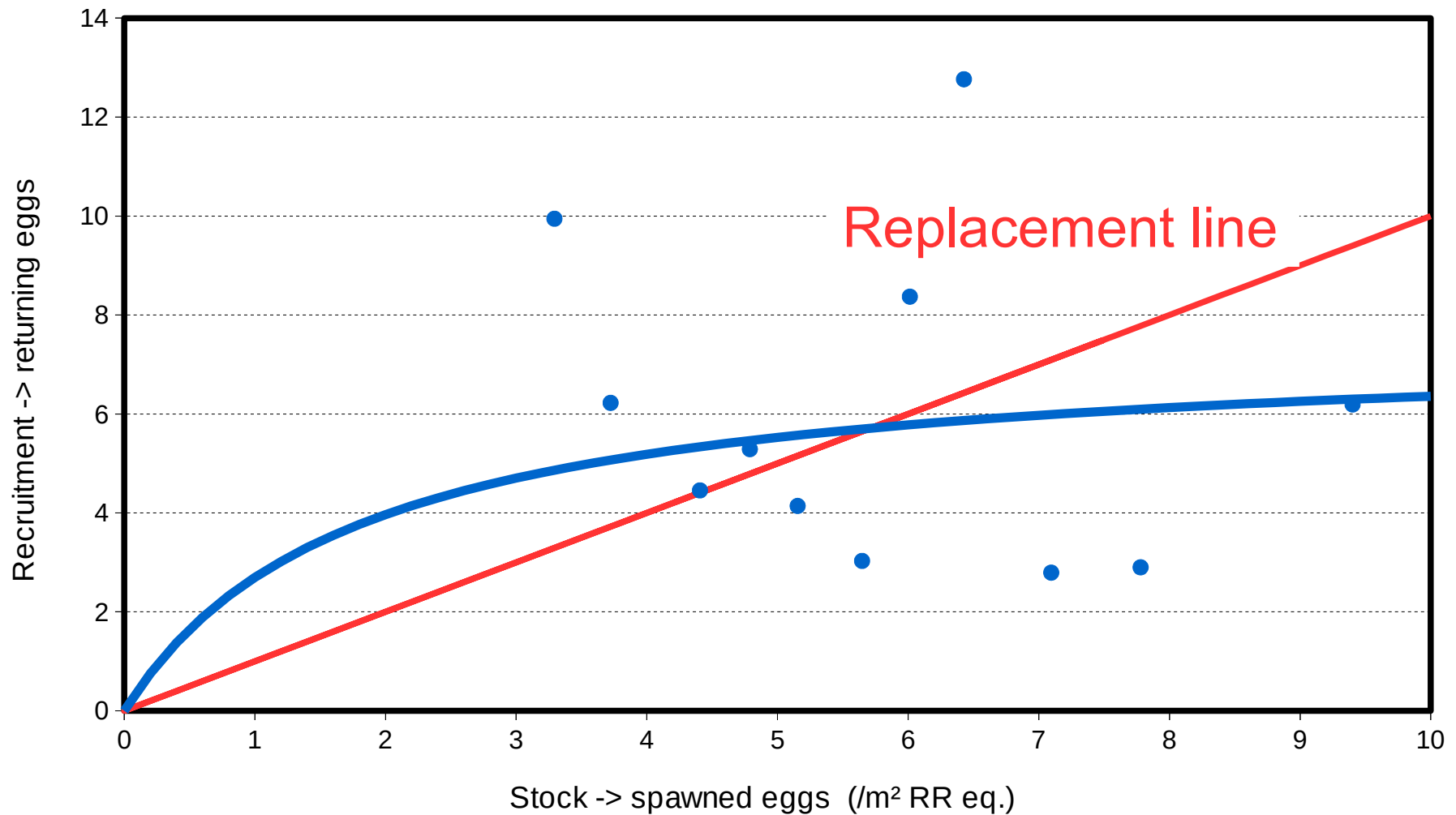
The egg-to-egg Stock/Recruitment series of the Nivelles R.



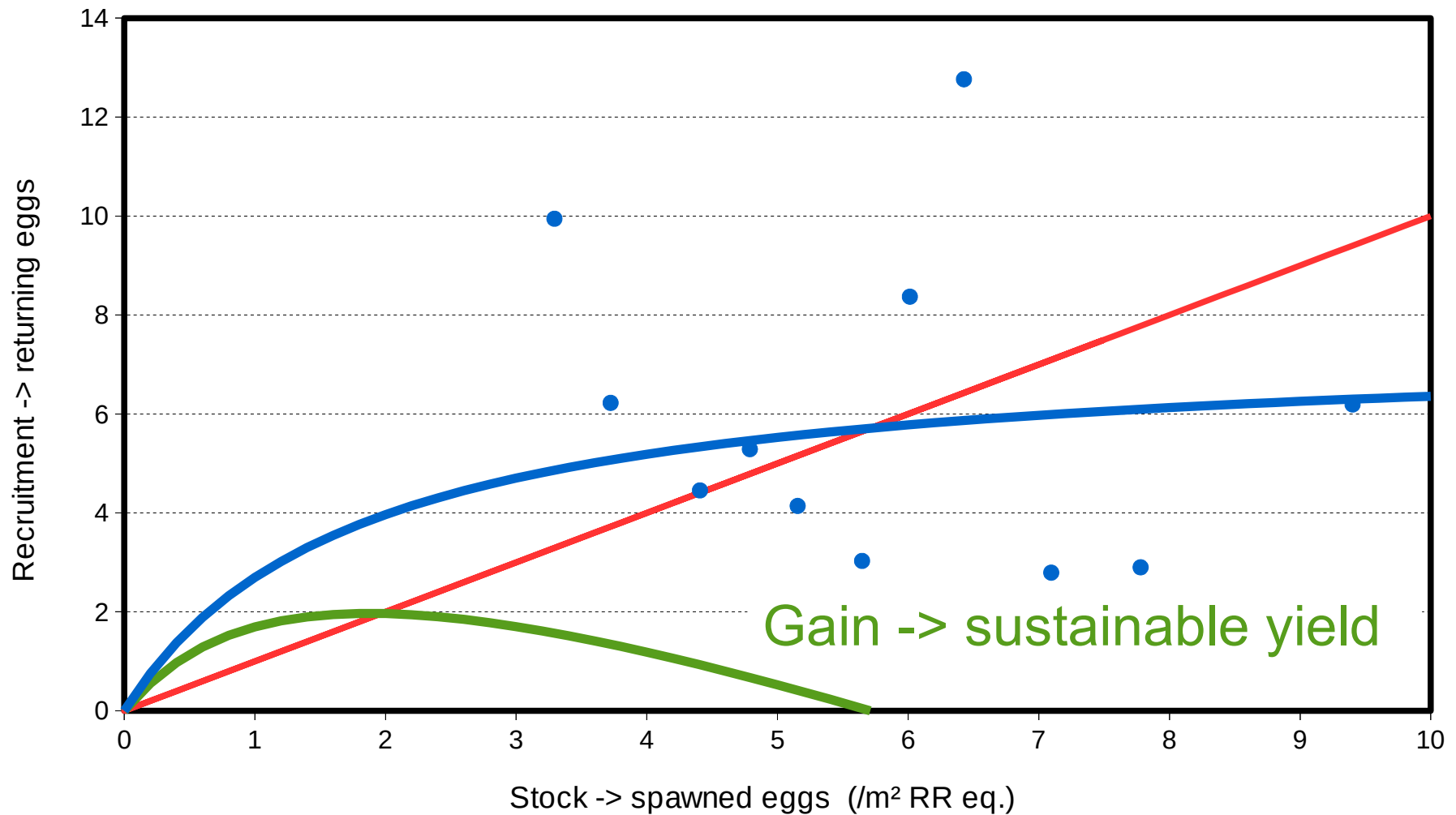
The egg-to-egg Stock/Recruitment series of the Nivelles R.



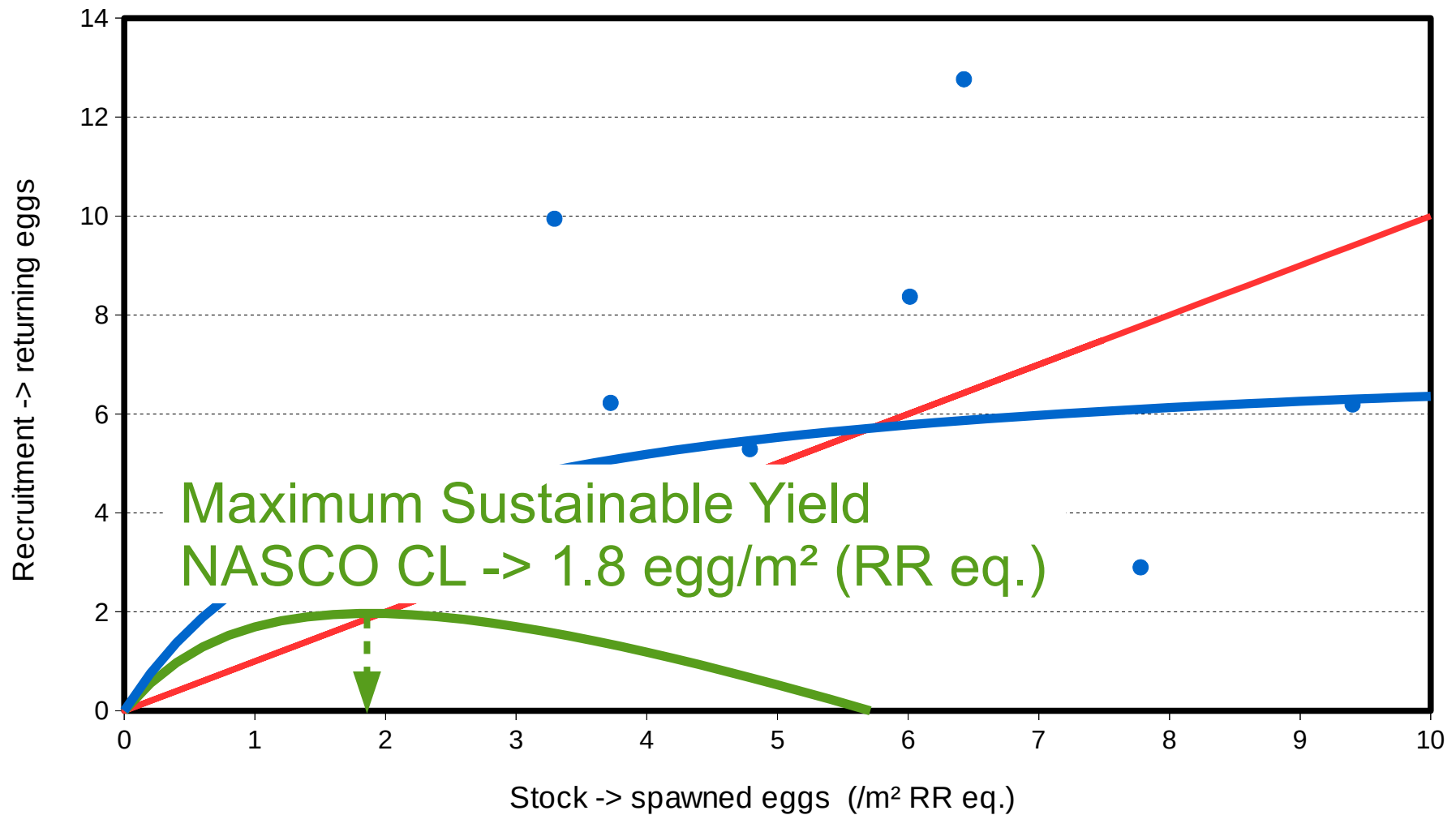
The egg-to-egg Stock/Recruitment series of the Nivelles R.



The egg-to-egg Stock/Recruitment series of the Nivelles R.



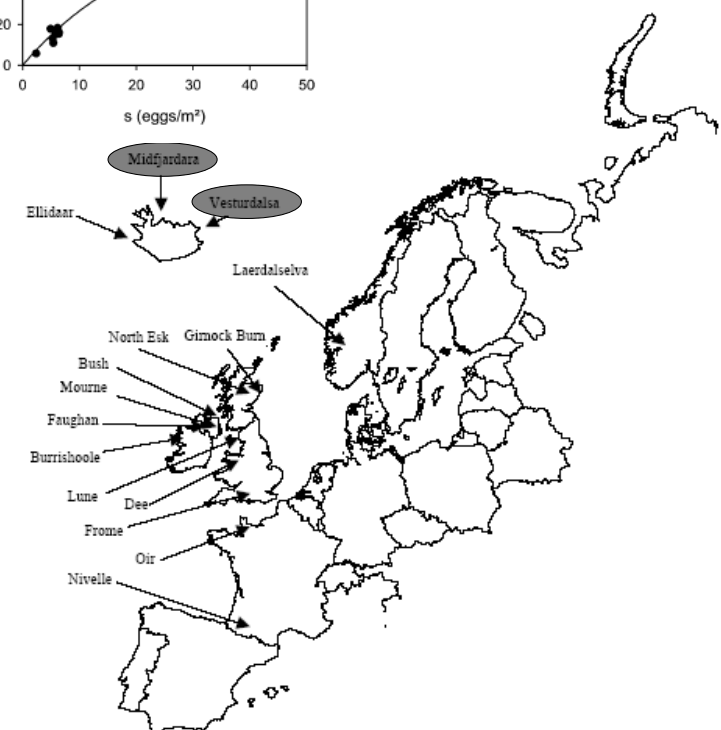
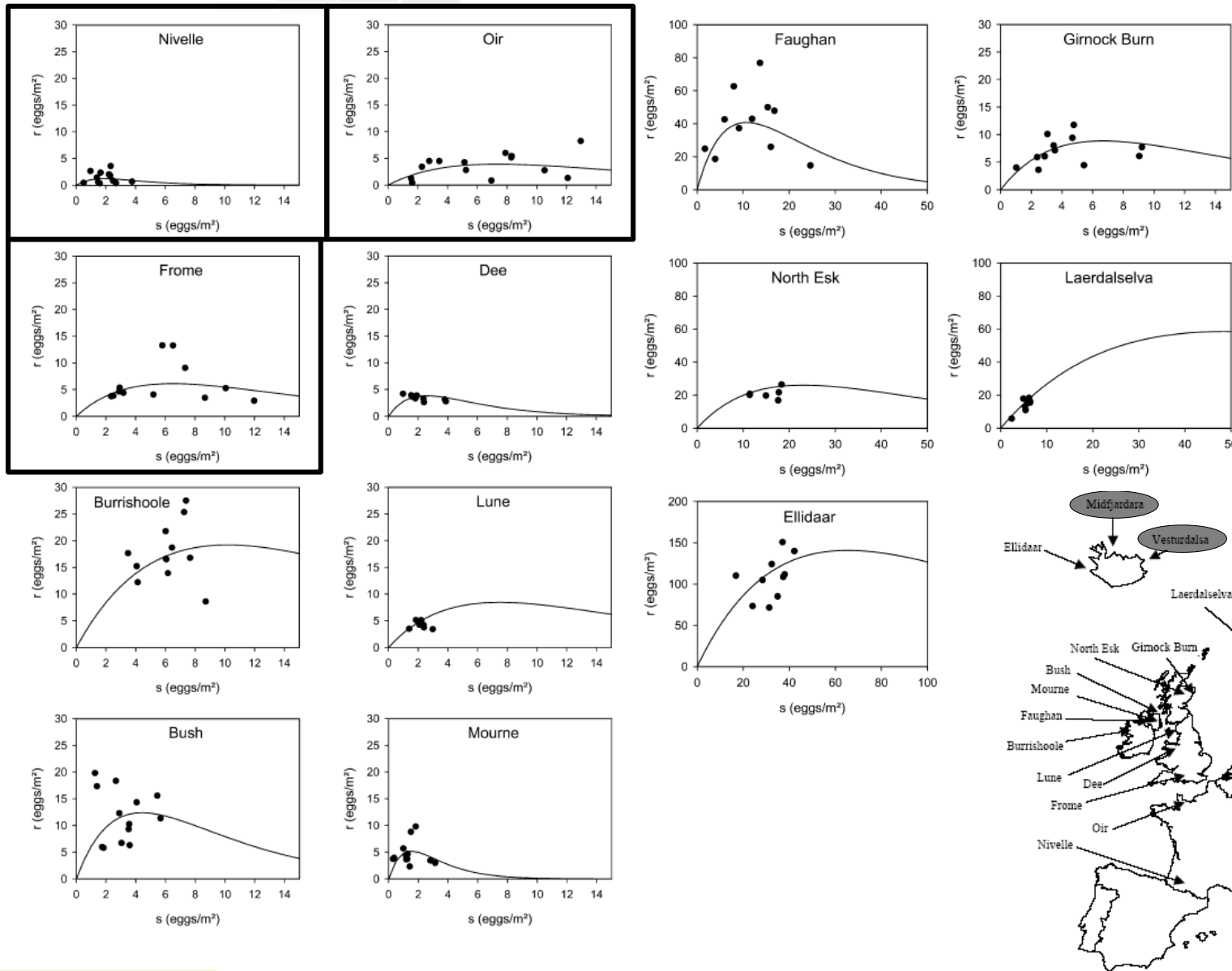
The egg-to-egg Stock/Recruitment series of the Nivelles R.



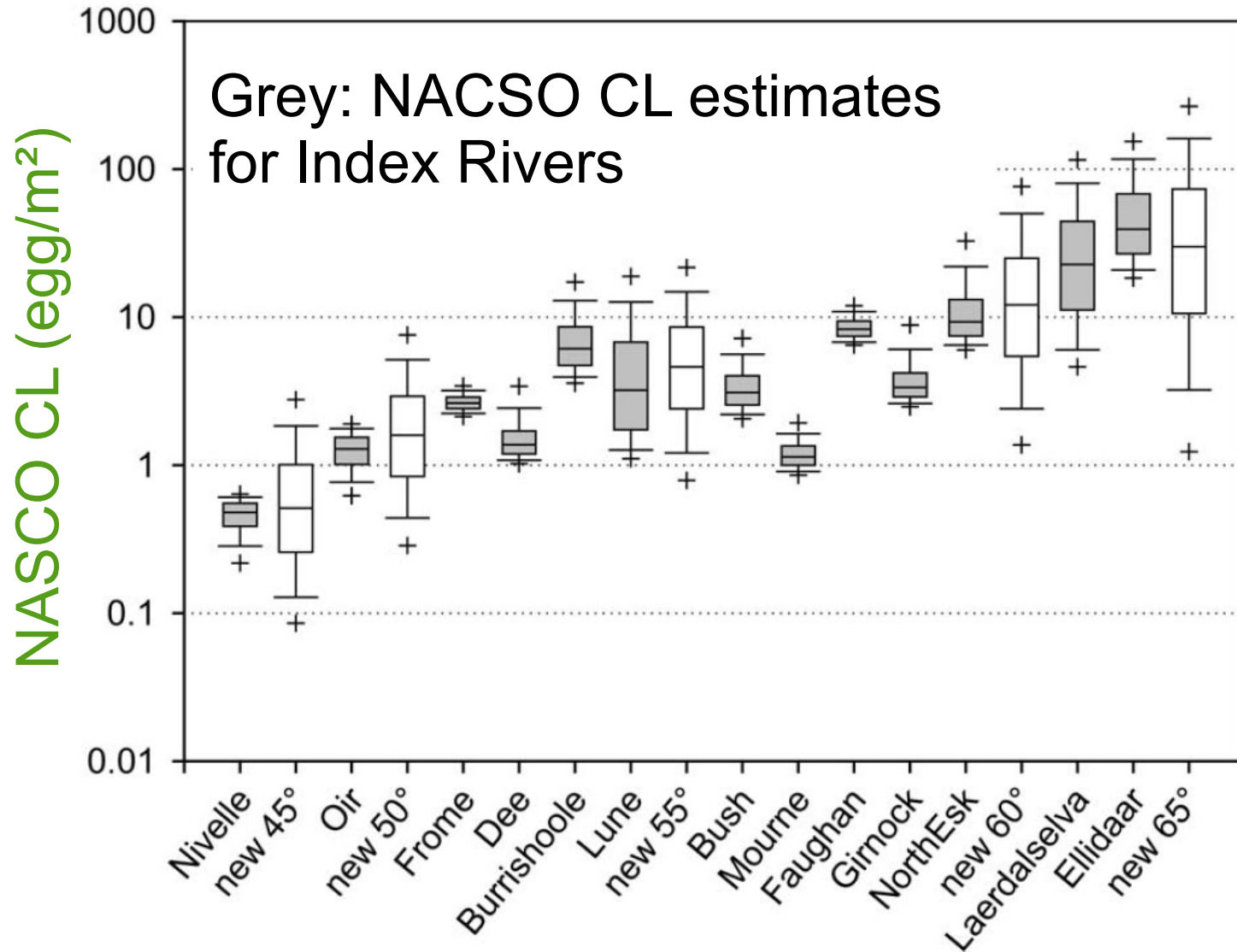
What about non-Index Rivers?

- A handful of Index Rivers but several 100's salmon rivers
- How can we transfer our knowledge about CLs from data-rich Index Rivers to data-poor non-Index Rivers?
- Modern statistical modeling techniques (Bayesian Hierarchical Analysis): a formal and rigorous framework for carrying out this extrapolation (Prévost et al. 2001)
 - Accounting of the associated uncertainty
 - Taking into account environmental variables explaining variations in productivity and carrying capacity between salmon rivers
- A brief illustration from the EU Salmodel project (Prévost et al. 2003)
 - Also conducted for the rivers of Atlantic Canada (Québec, Maritime Provinces and Newfoundland)

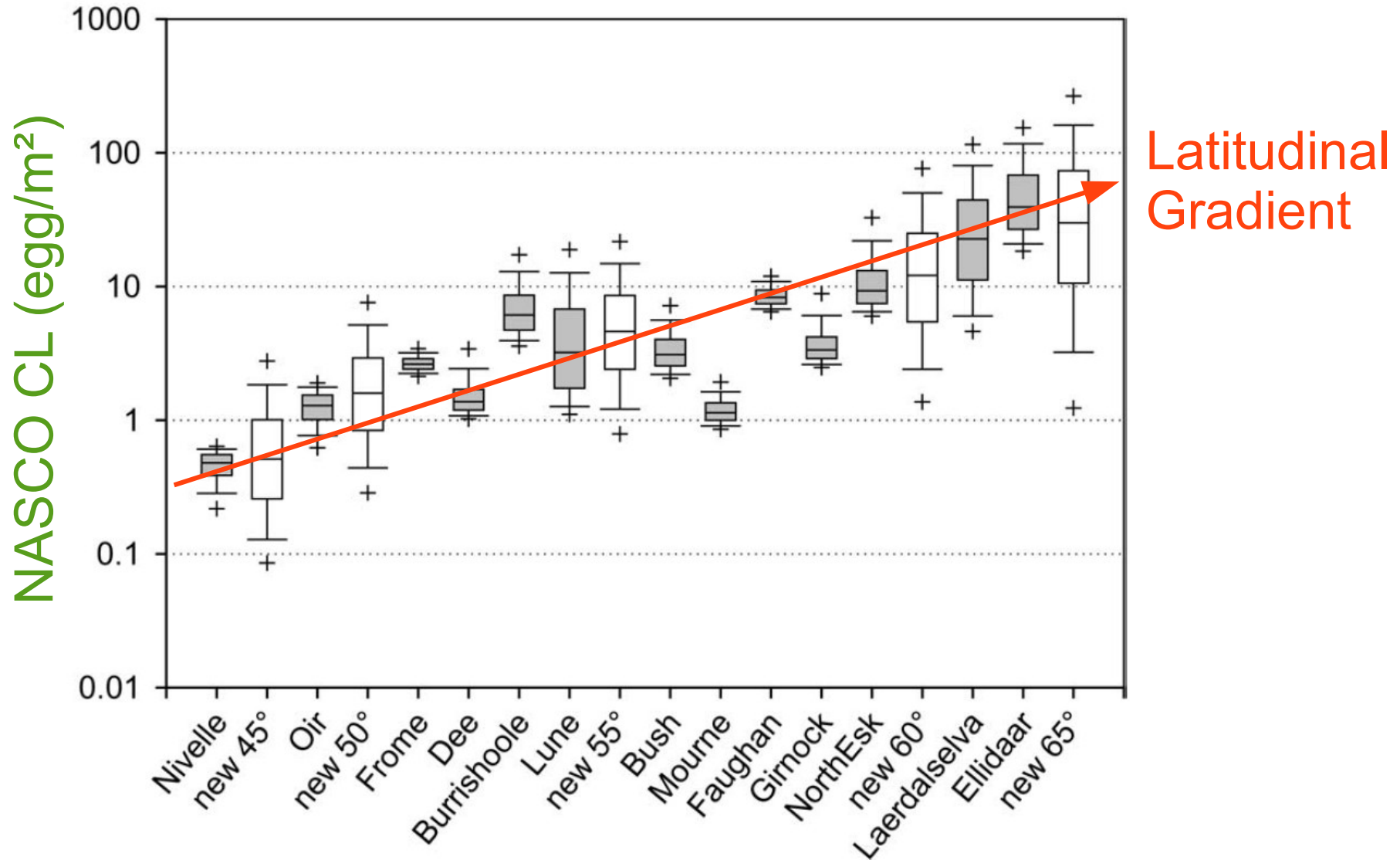
SALMODEL: a joint SR analysis of 13 Index Rivers



SALMODEL: estimation of NASCO CL for any salmon river in Western Europe

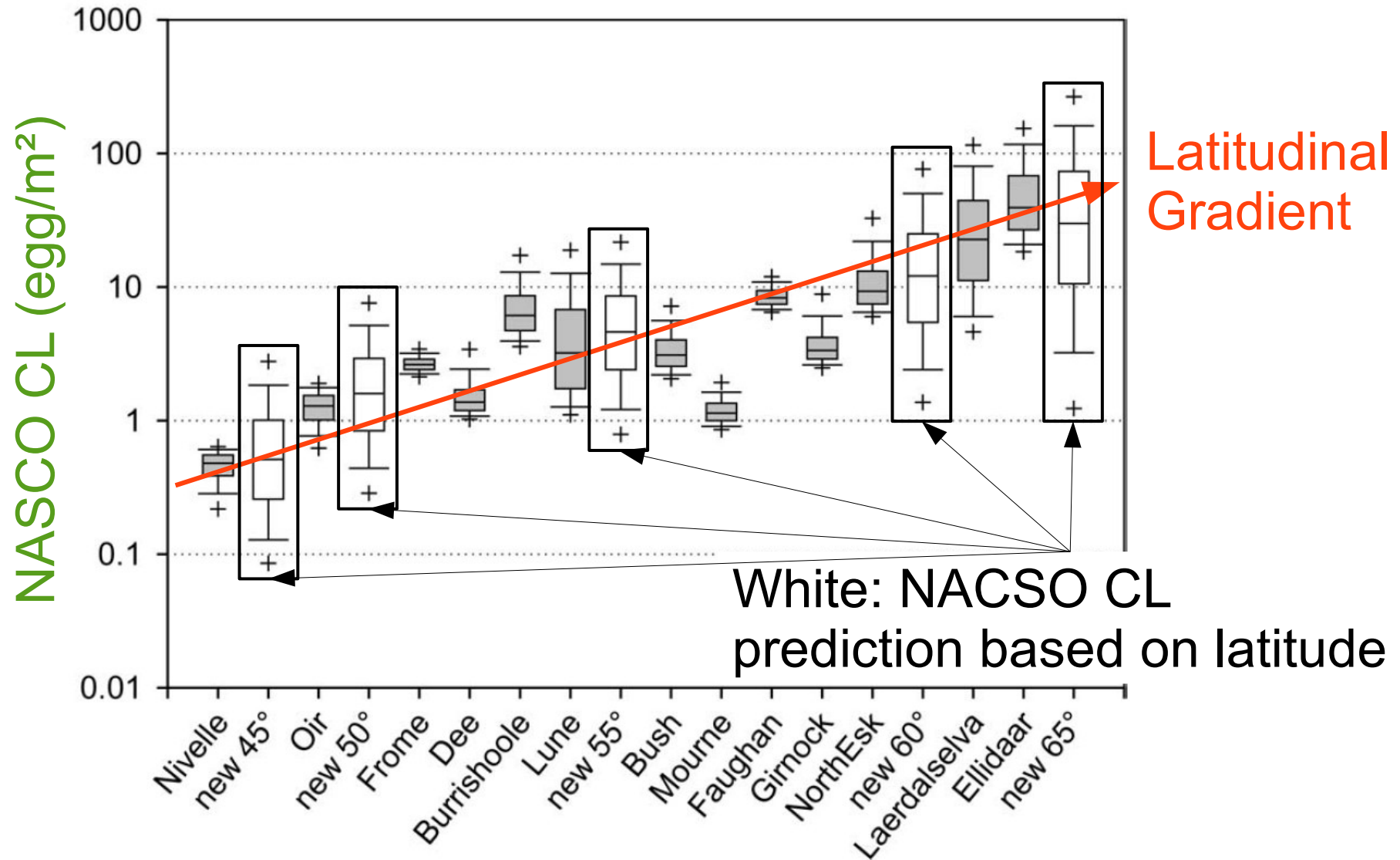


SALMODEL: estimation of NASCO CL for any salmon river in Western Europe



Latitudinal Gradient

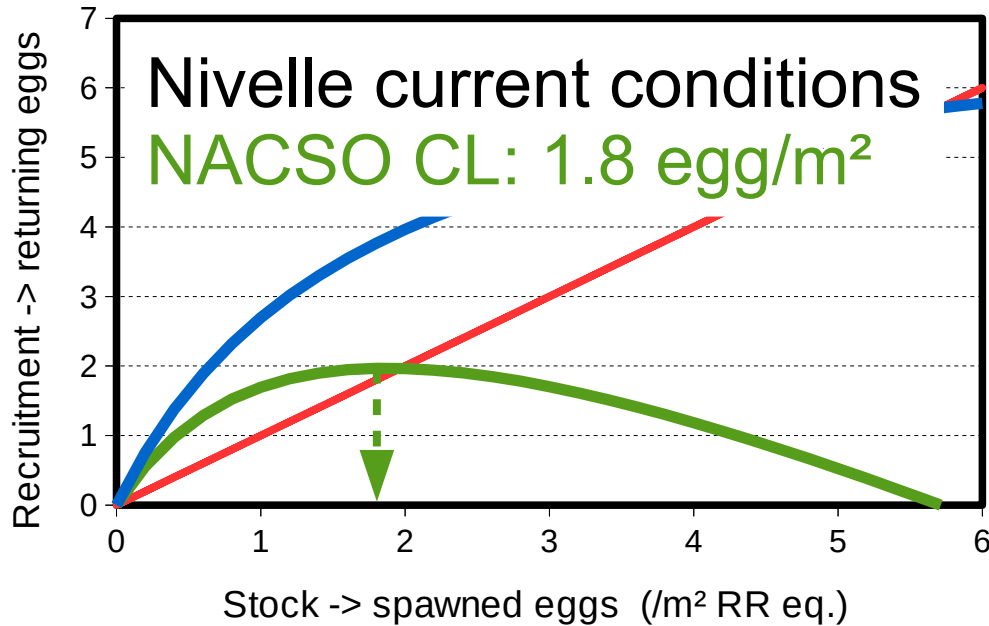
SALMODEL: estimation of NASCO CL for any salmon river in Western Europe



Troubles with NASCO CL definition

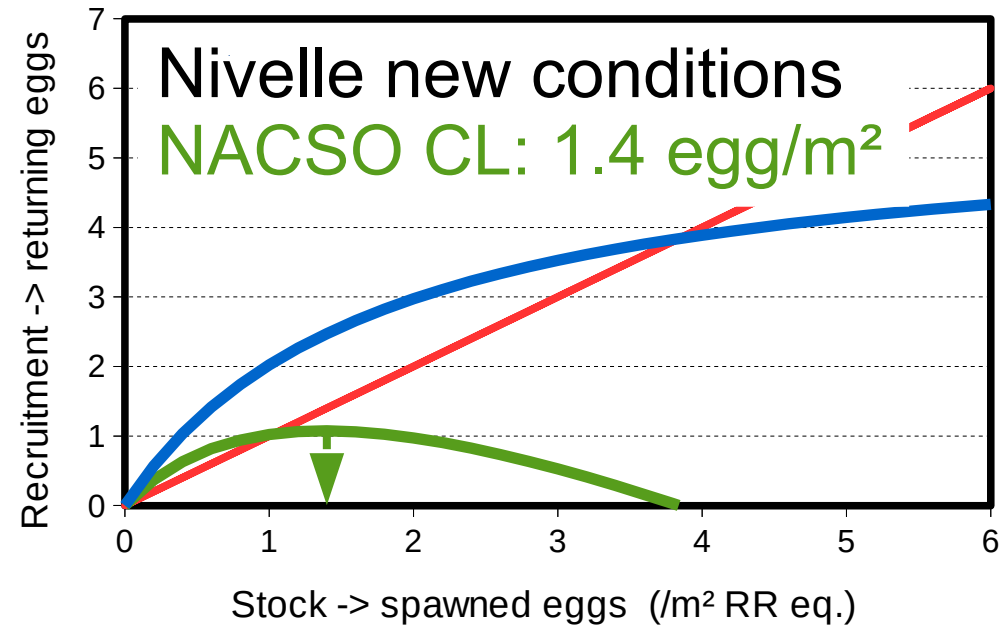
- Assume catches (at sea and in rivers) are well known or negligible
 - Generally not true
 - E.g. in the Nivelle: significant but unknown coastal exploitation
- Spawning stock producing MSY: is this relevant to conservation?
 - Rather aims at fisheries exploitation optimization
- What if survival (e.g. at sea) drops?

Evolution of NASCO CL if sea survival drops



Recruitment curve flattens
→ NACSO CL decreases

Sea survival drops by 25%



CL definition: time for a change?

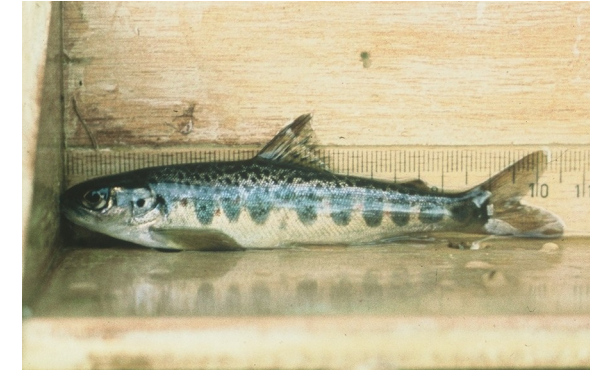
- NASCO CL: based on fisheries optimization principle
 - when times become harder for salmon CL should be revised downward
- Fisheries optimization \neq Conservation
- But how can we define Conservation?
- An operational (and partial) proposal: conservation should ensure that wild juvenile recruitment does not fall too low
- Associated CL definition: spawning escapement threshold that ensure wild juvenile recruitment does not fall too low

The Nivelles R.: the southernmost Index River in Europe

Uxondoa
trapping
station



Spawning



Juvenile
(0+ parr in the fall)
recruitment

Redd
counts



escapement

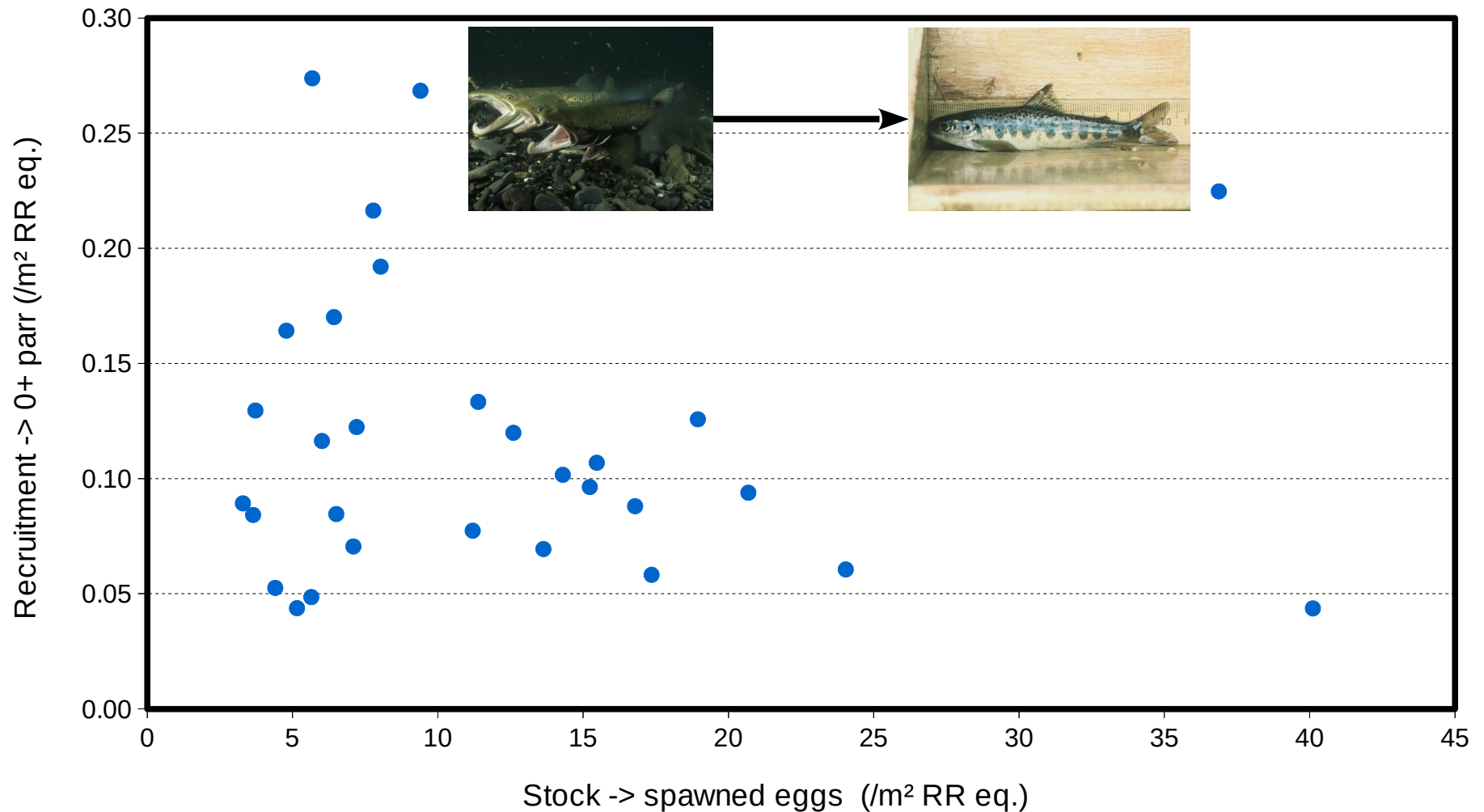


Electrofishing

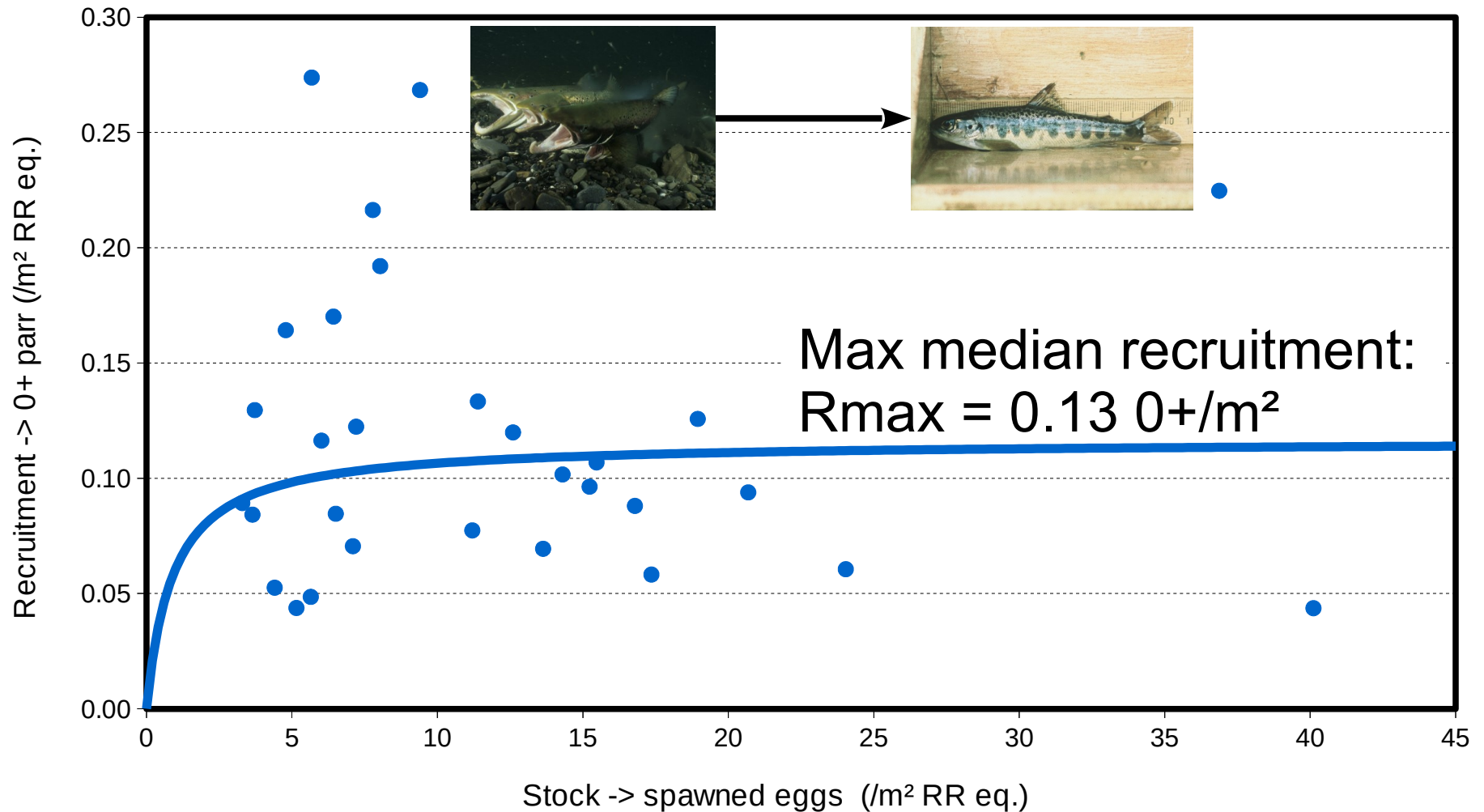
Olha
trapping
station



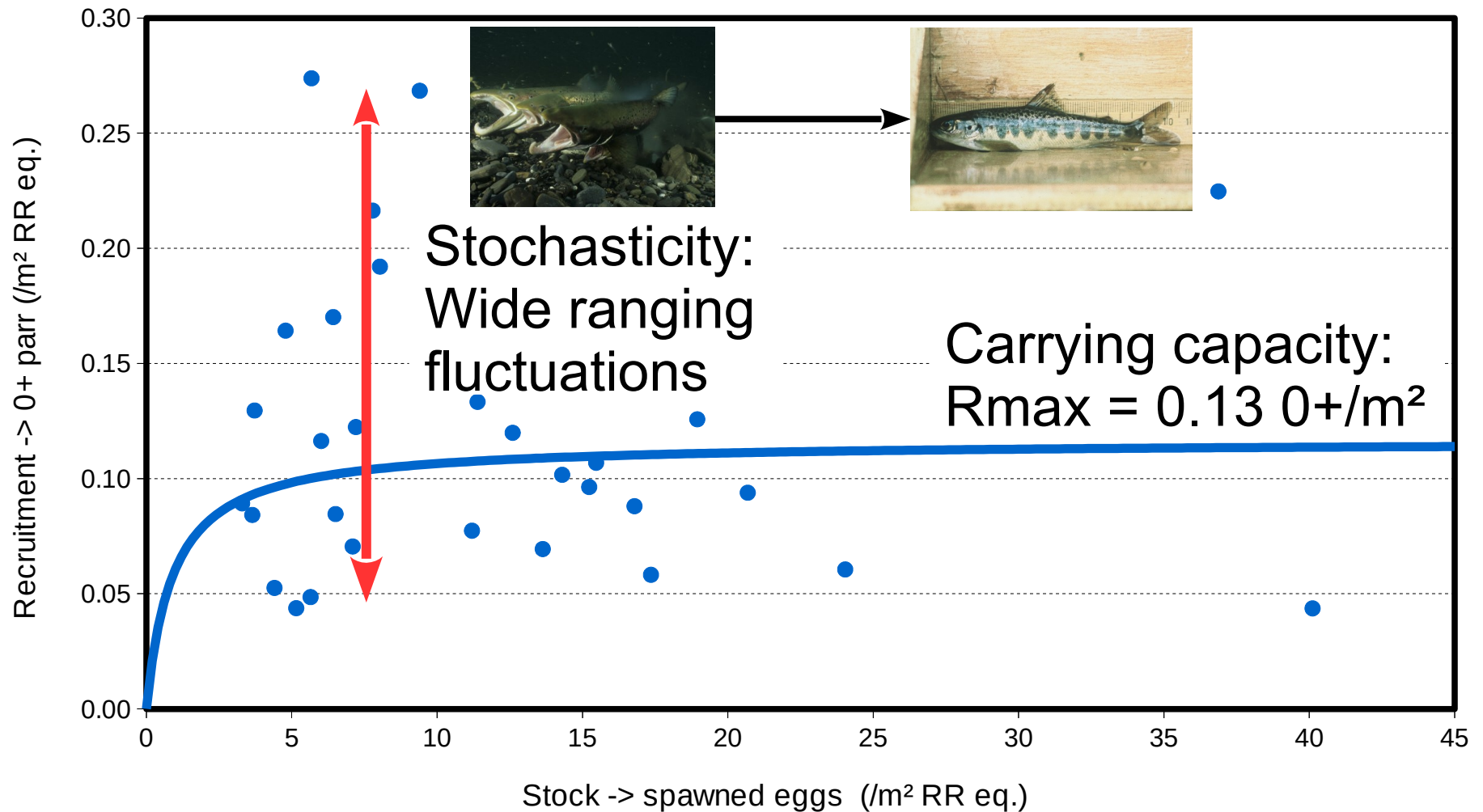
The egg-to-0+ parr Stock/Recruitment series of the Nivelles R.



The egg-to-0+ parr Stock/Recruitment series of the Nivelles R.



The egg-to-0+ parr Stock/Recruitment series of the Nivelles R.

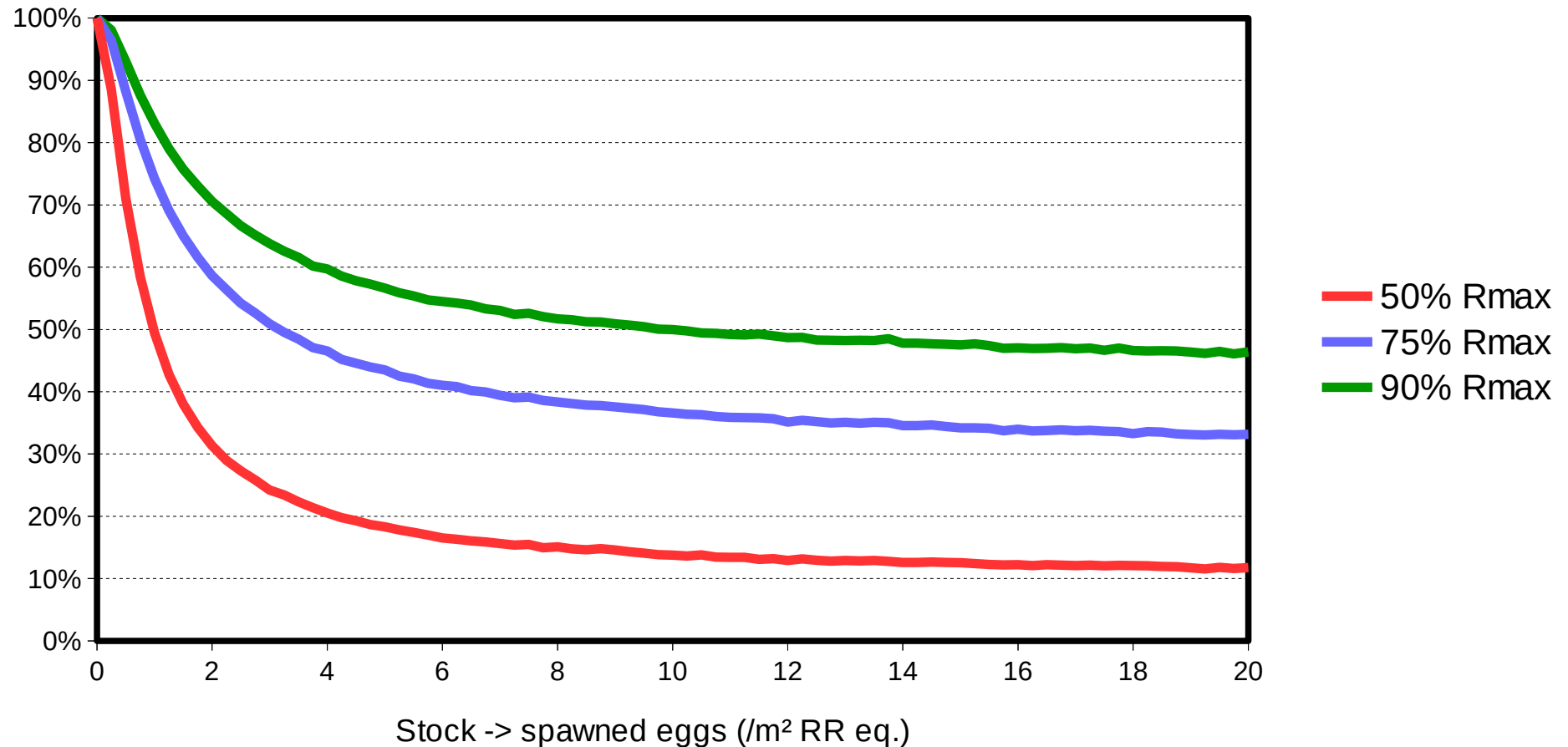


CL definition: time for a change?

- Acknowledge recruitment stochasticity (uncertainty)
- Modified CL definition: spawning escapement threshold that ensure a low probability of wild juvenile recruitment falling too low
 - Conservation aims at controlling the risk of low recruitment
- But what is low recruitment?
 - A management decision
 - An operational proposal: set as a proportion of the carrying capacity (R_{max})
- And what is low probability?
 - A management decision
- Scientific advice: produce (risk) plots that help management decision

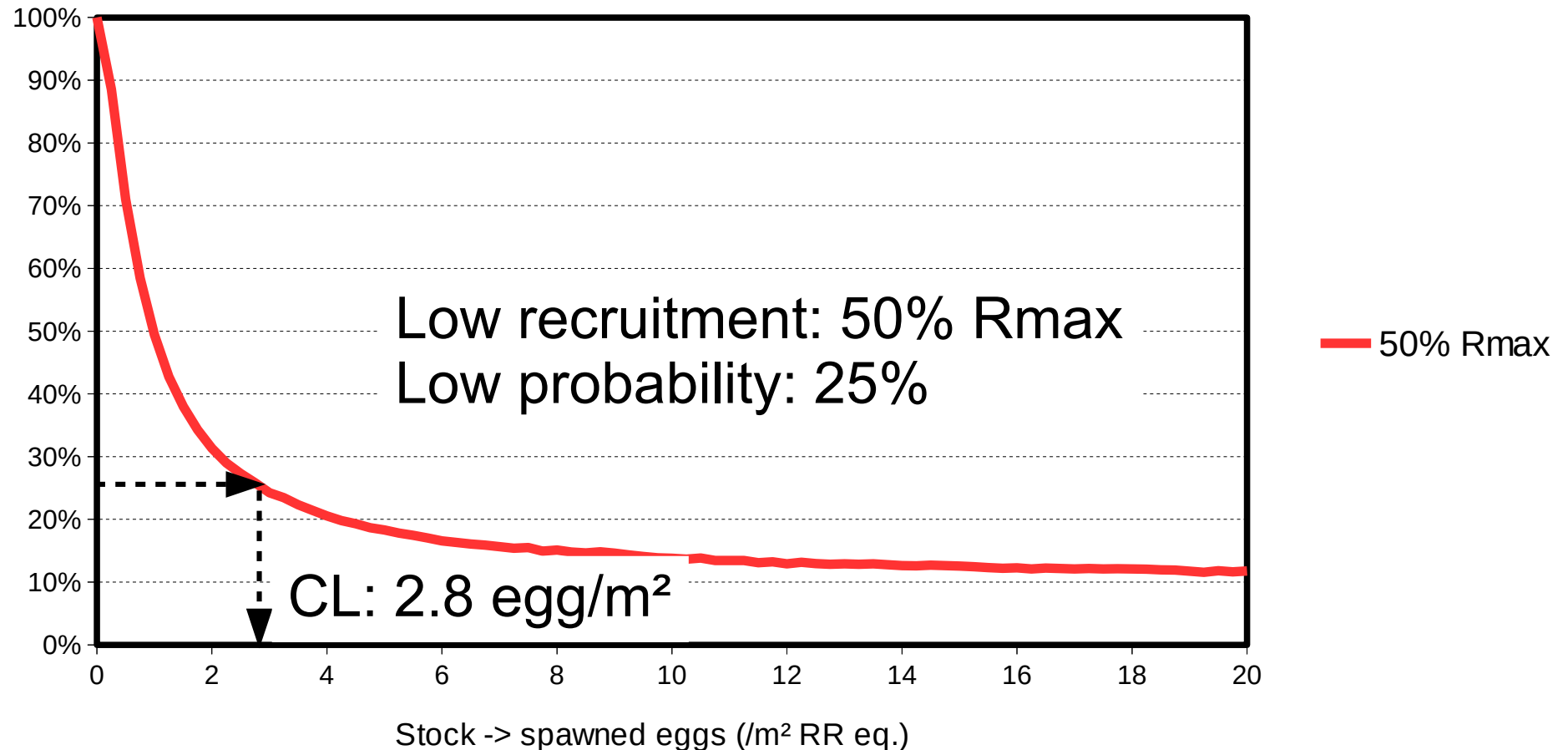
Risk plot for 3 options of low recruitment level

Risk: $\text{Proba}(\text{Recruitment} < X\% \text{ of } R_{\text{max}})$



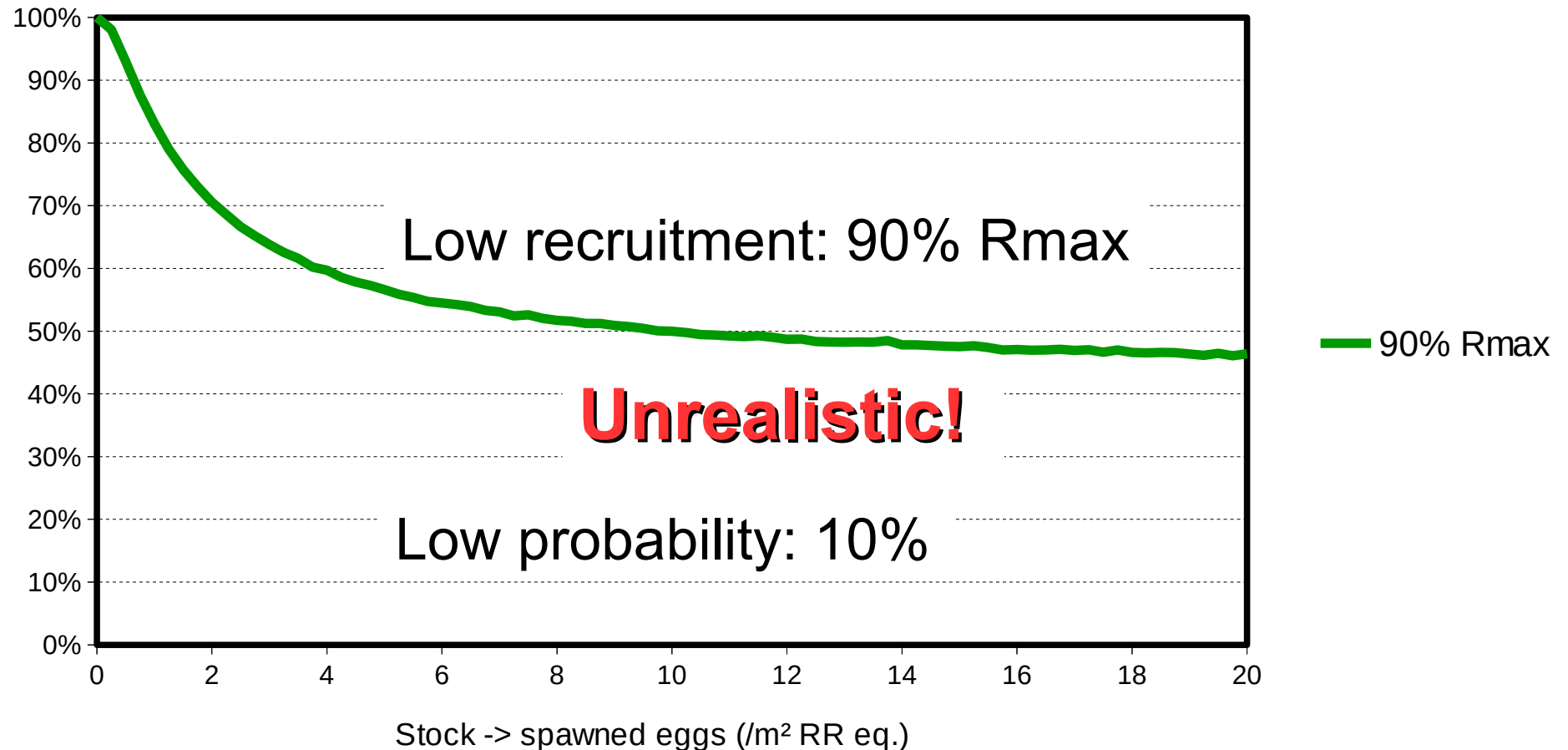
Risk plot: an example of management decision

Risk: $\text{Proba}(\text{Recruitment} < X\% \text{ of } R_{\text{max}})$



Risk plot: being too risk averse is not realistic

Risk: $\text{Proba}(\text{Recruitment} < X\% \text{ of } R_{\text{max}})$



New CL approach: pros & cons

- PROs

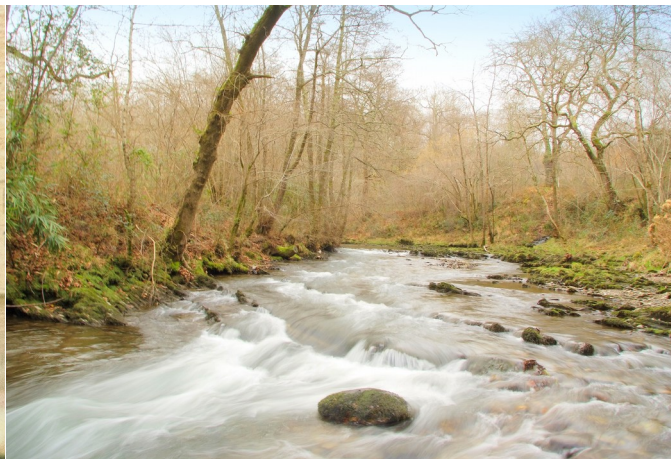
- Based on a conservation principle/definition in a risk control context
- Identify the risk of low recruitment level as a management decision
 - Easier to communicate to management stakeholders (?)
- Uses scientific and fisheries independent data only
- Not sensitive to changes in density independent mortality (e.g. at sea)
- Transferable from Index Rivers to non-Index Rivers (as NASCO CL)

- CONs

- CL estimation sensitive to recruitment rate at low spawning escapement
 - A quantity usually difficult to estimate from SR data
- Do not take into account potential density dependence of survival after the juvenile recruitment stage considered

Atlantic Salmon Index Rivers: Their contribution to management

- Major contribution : provide the scientific data basis for ecological research and innovation applied to management of Atlantic salmon



Thanks for your attention

