



Atlantic salmon index rivers: their contribution to management

Etienne Prévost

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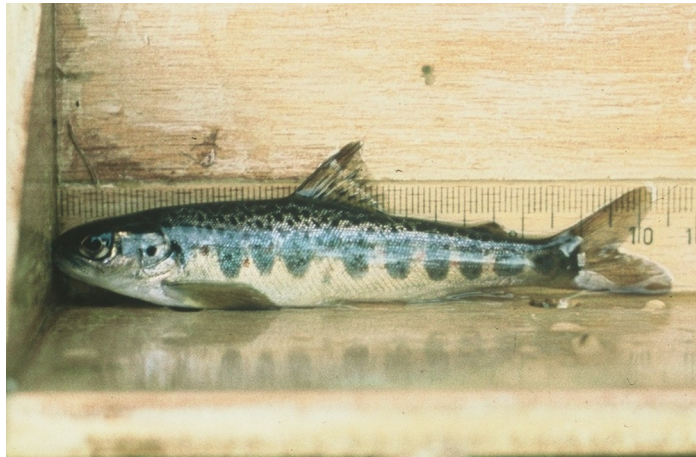
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Atlantic Salmon Index Rivers: Their contribution to management

Etienne Prévost

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What is an Index River?

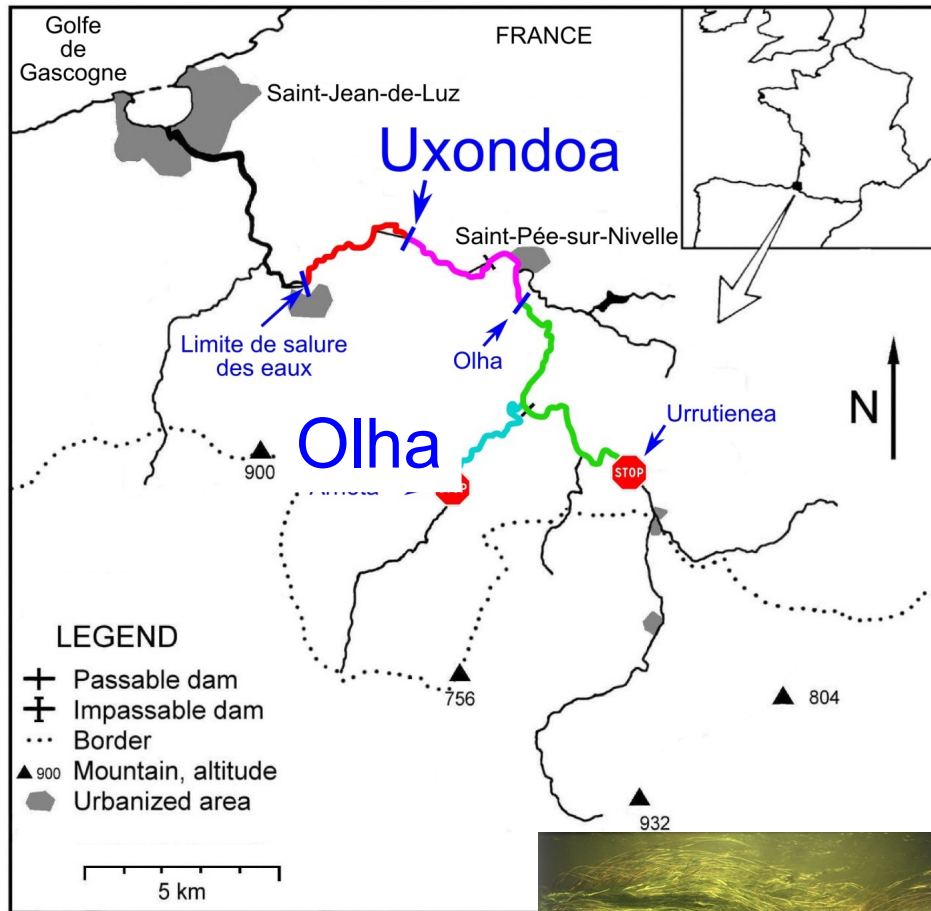
- Salmon population abundance (biological traits) monitored
 - (Anadromous) Adult (returns + catches), parr, smolts...
 - Survival rates (freshwater, marine)
- Over long term
 - Several decades
- Used by ICES NASWG to assess the status A. Salmon stocks
 - Both sides of the Atlantic Ocean
- For providing 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 Nivelle R. data series

The Nivelle R.: the southernmost Index River in Europe



Adult returns
estimation



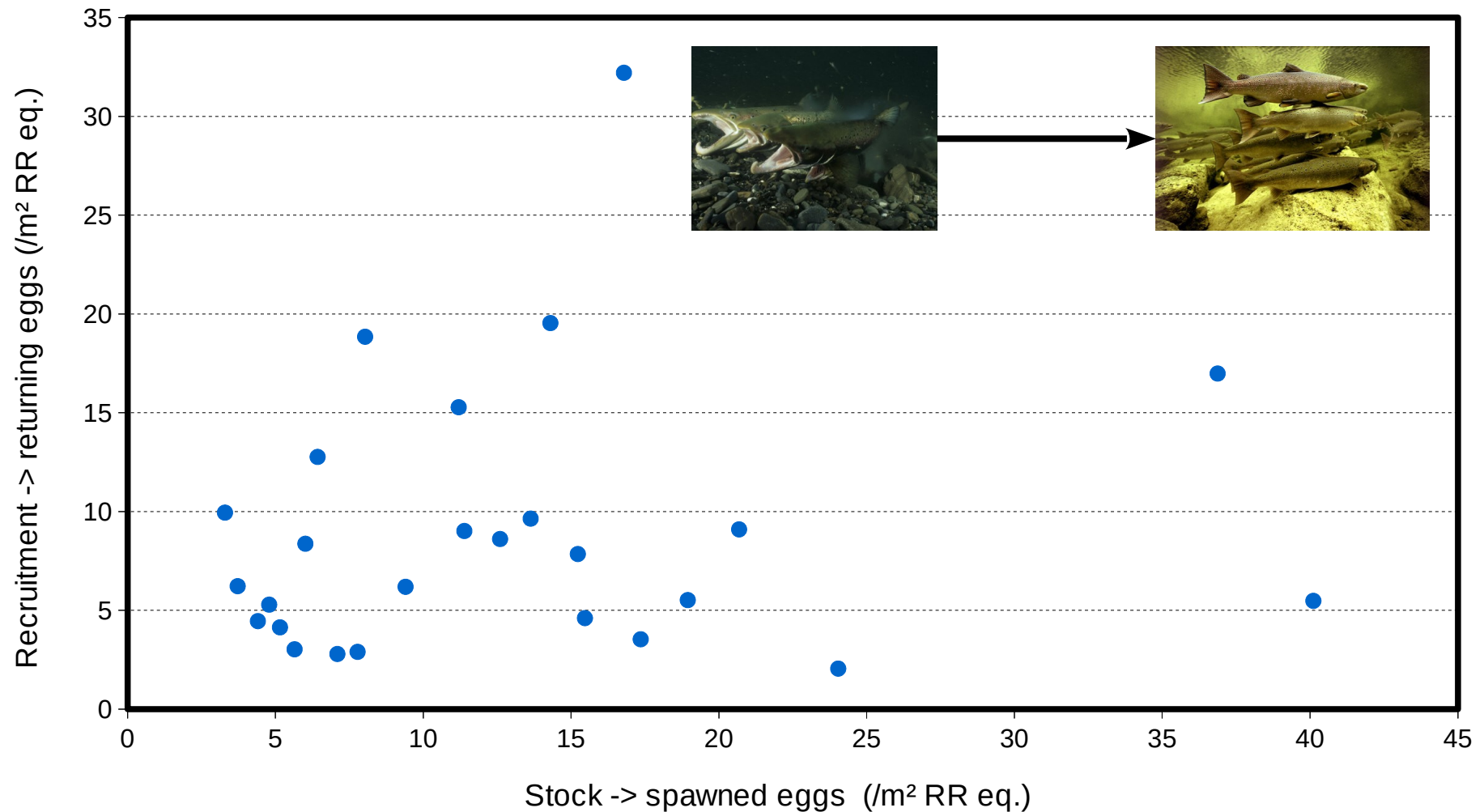
Uxondoa
trapping
station

Redd
counts

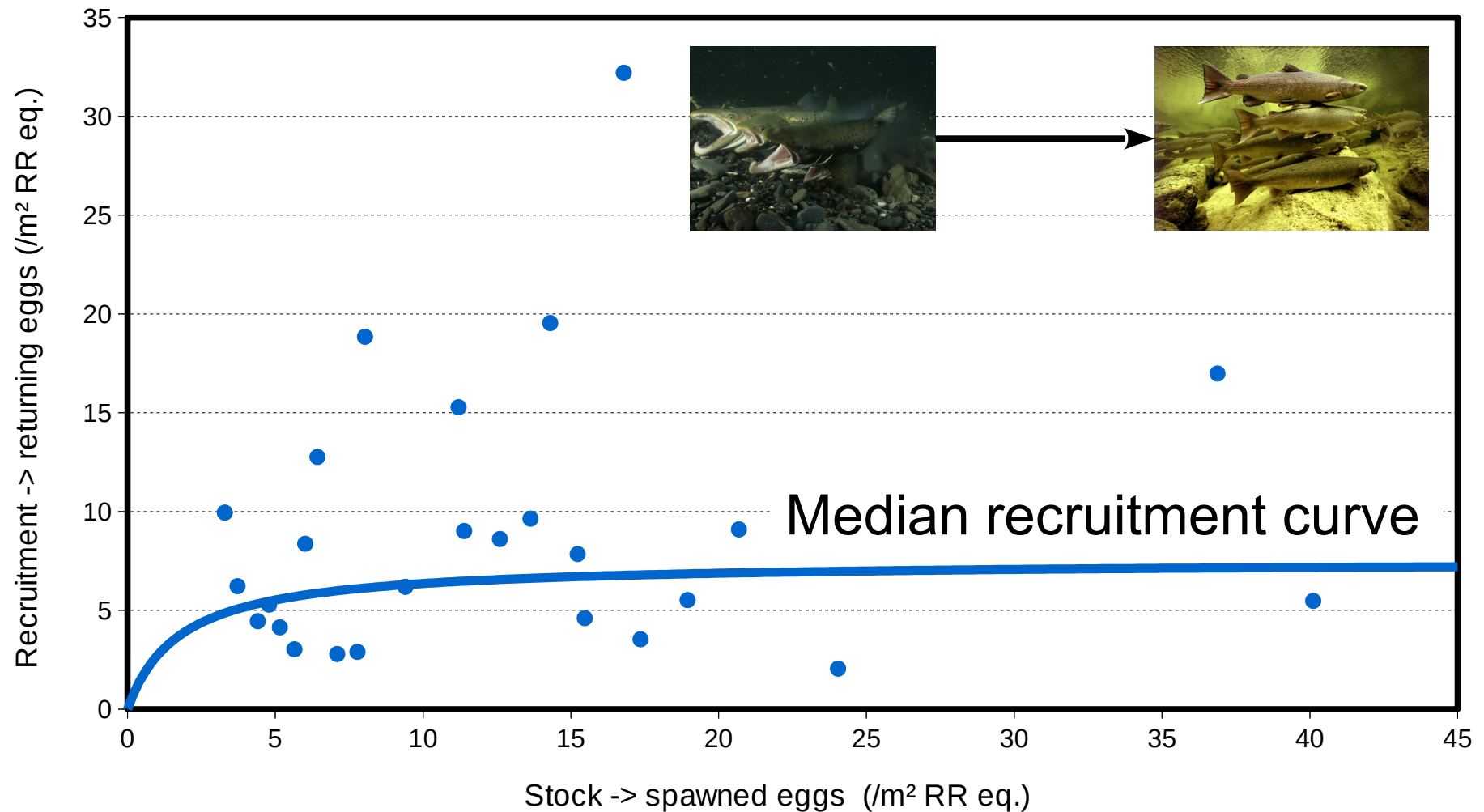


Olha
trapping
station

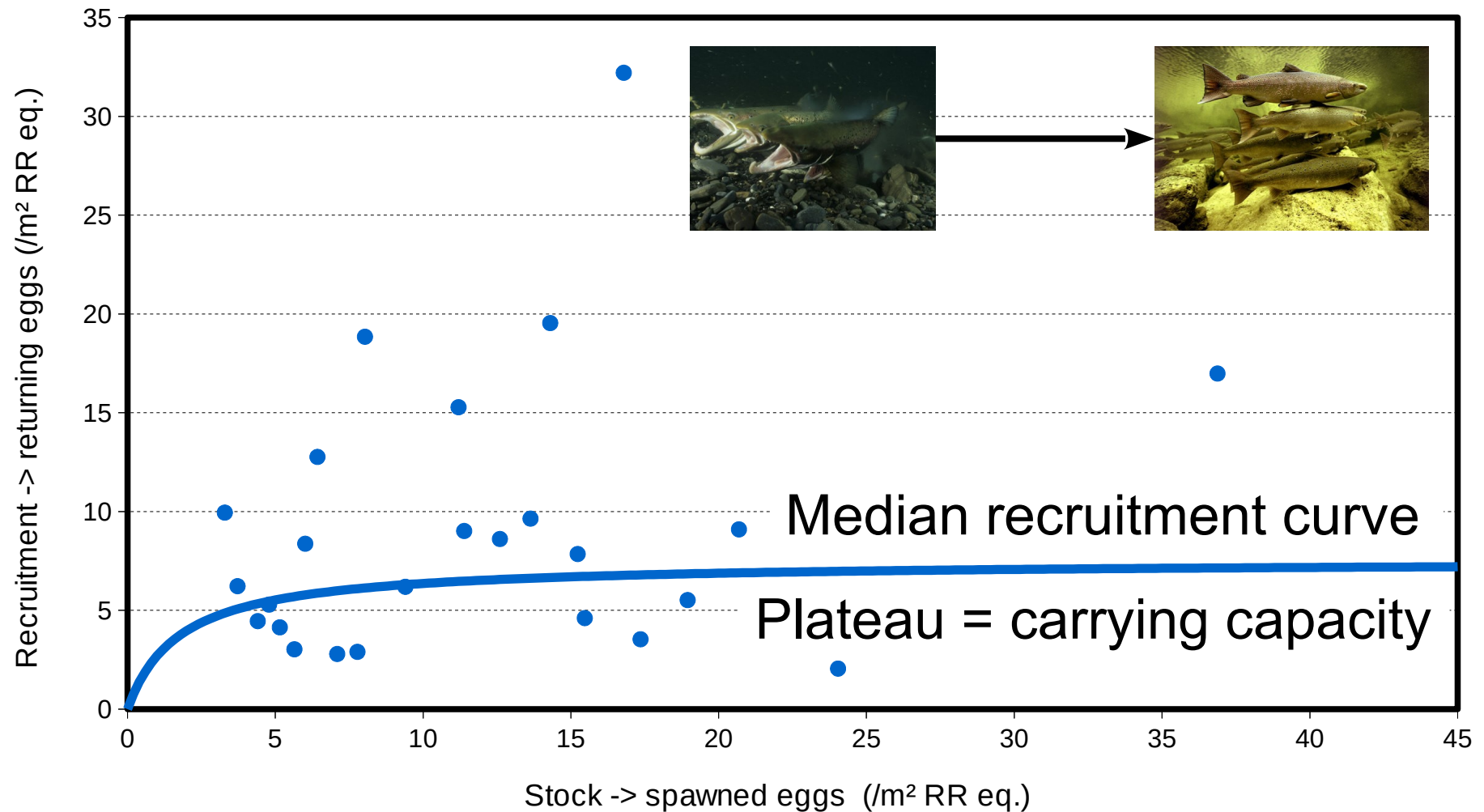
The egg-to-egg Stock/Recruitment series of the Nivelle R.



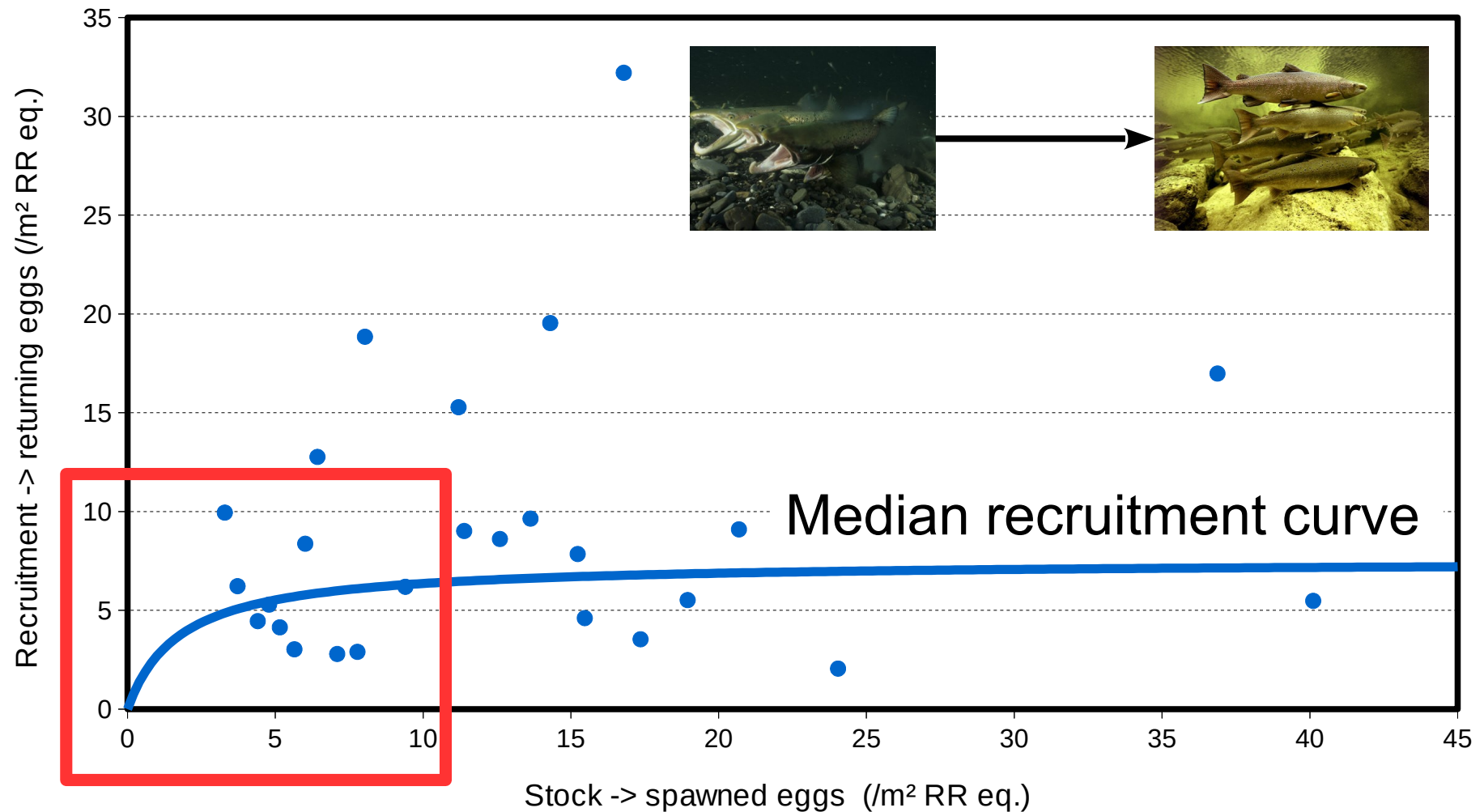
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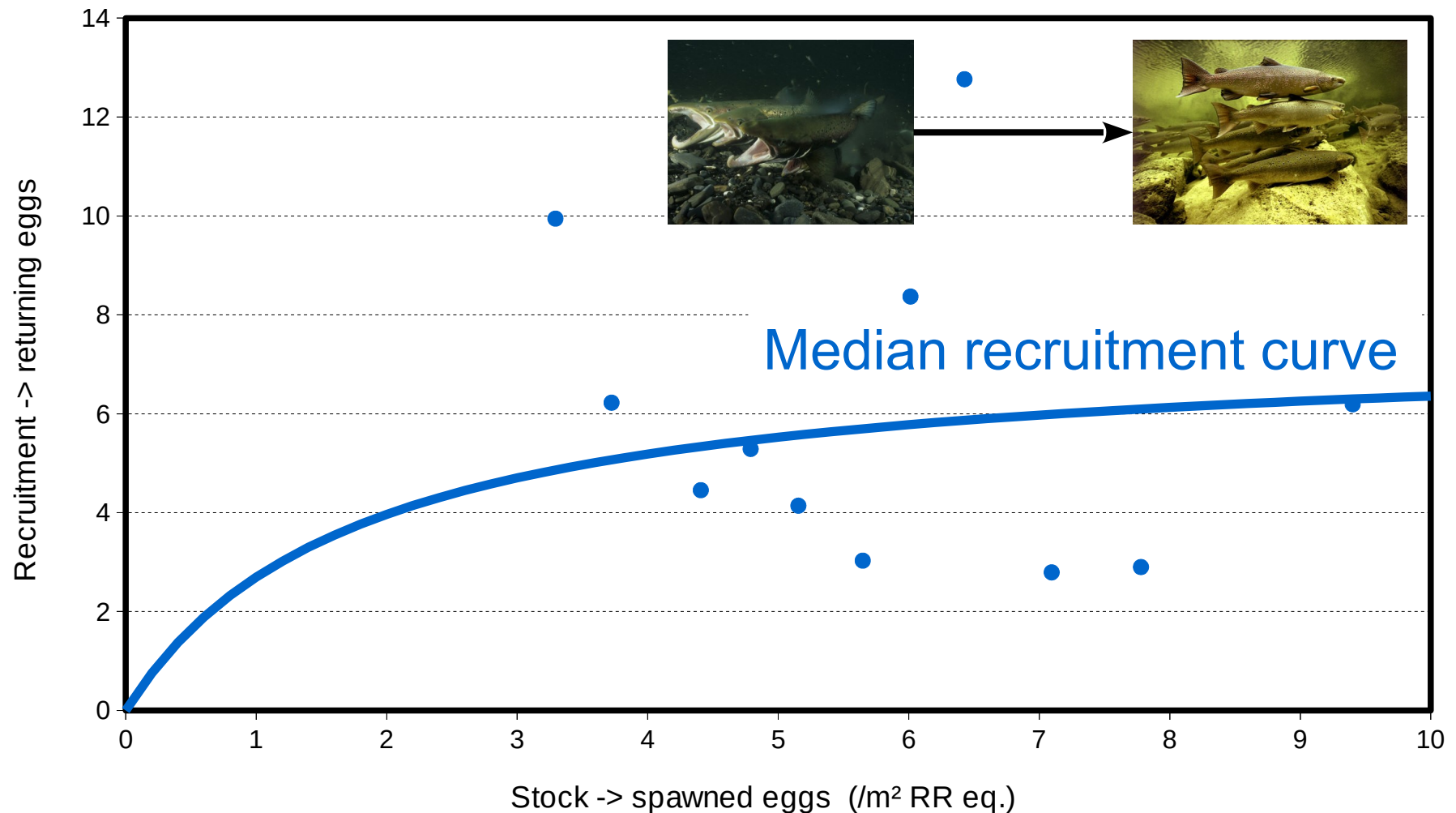
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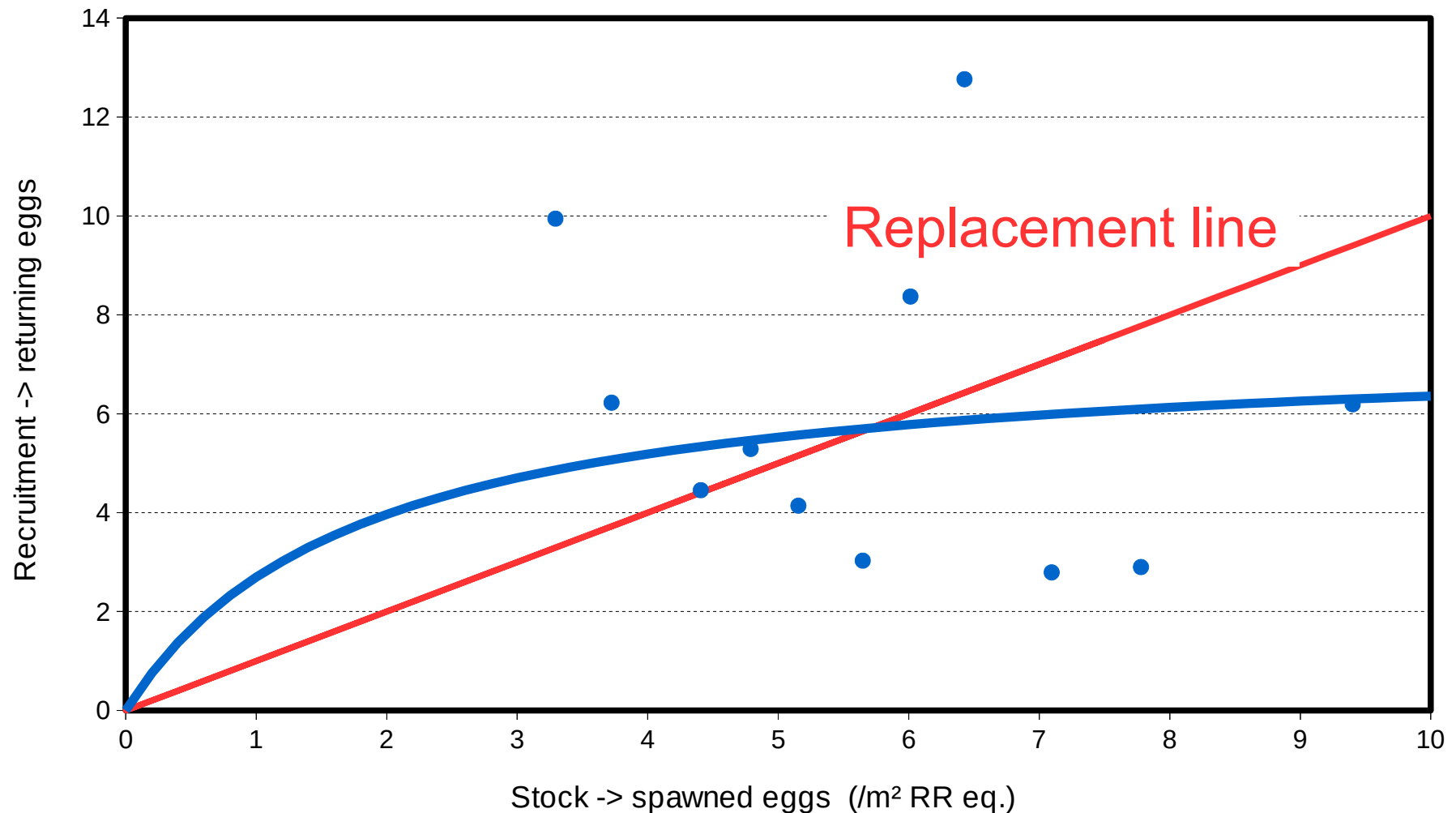
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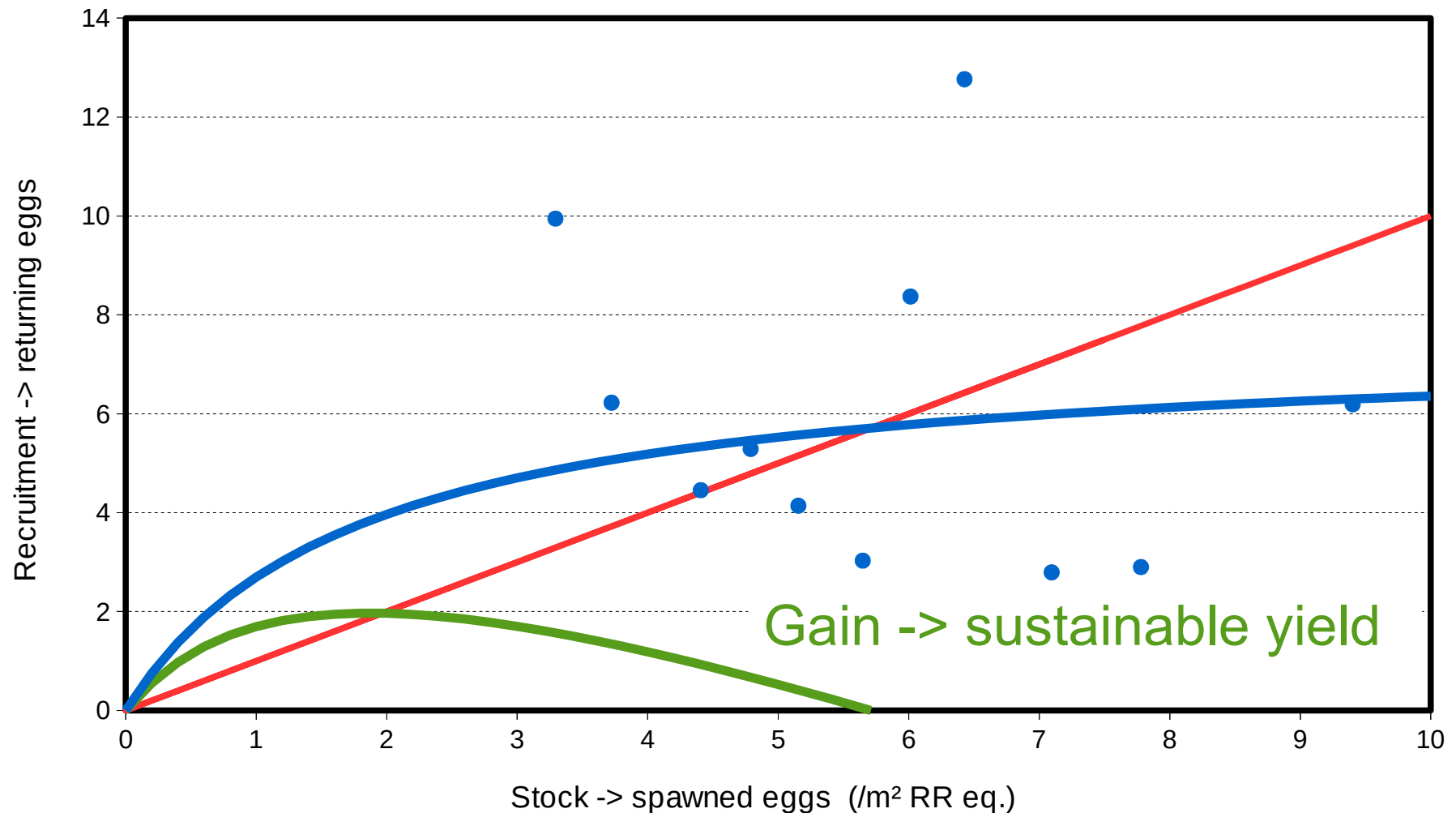
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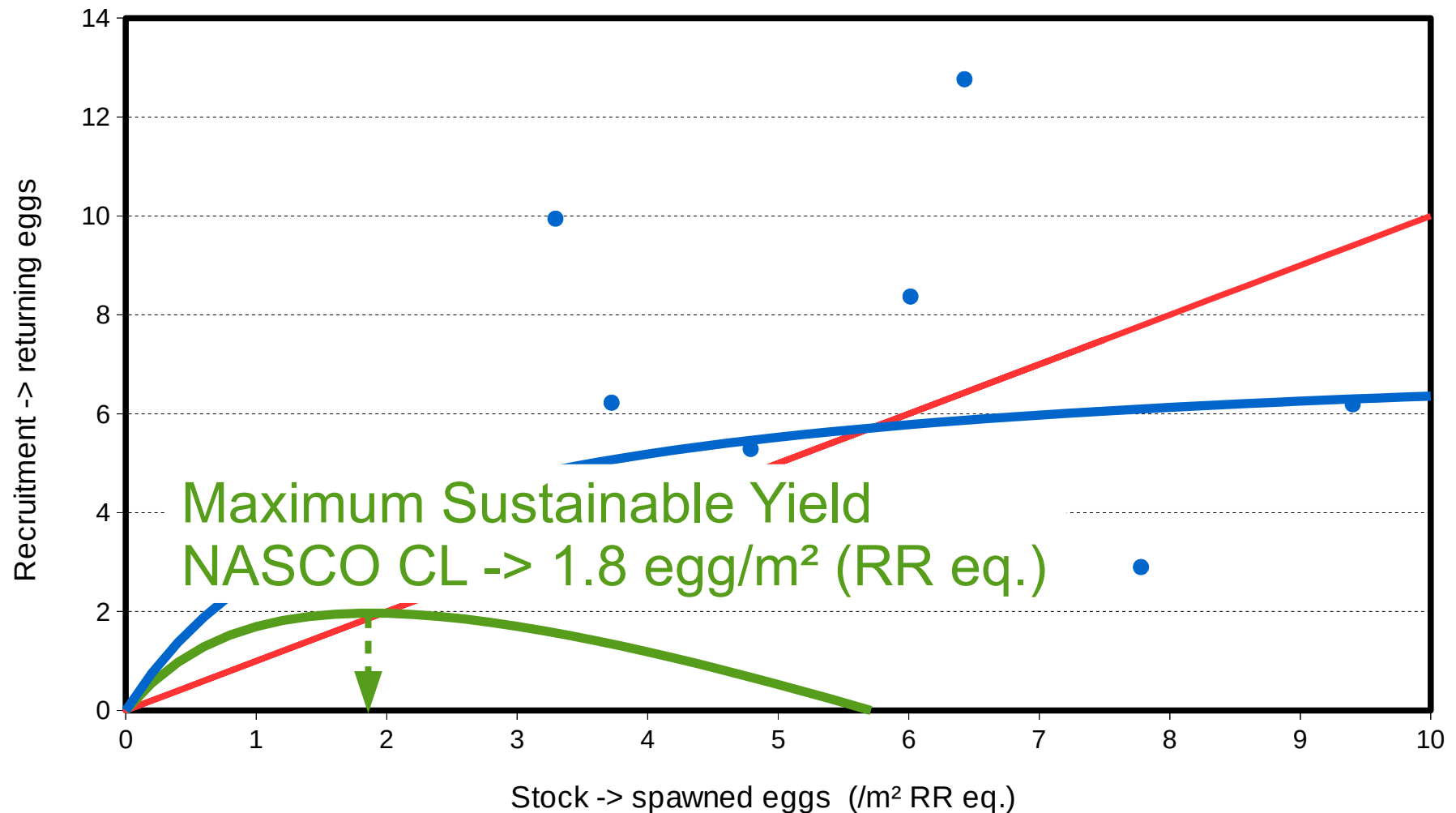
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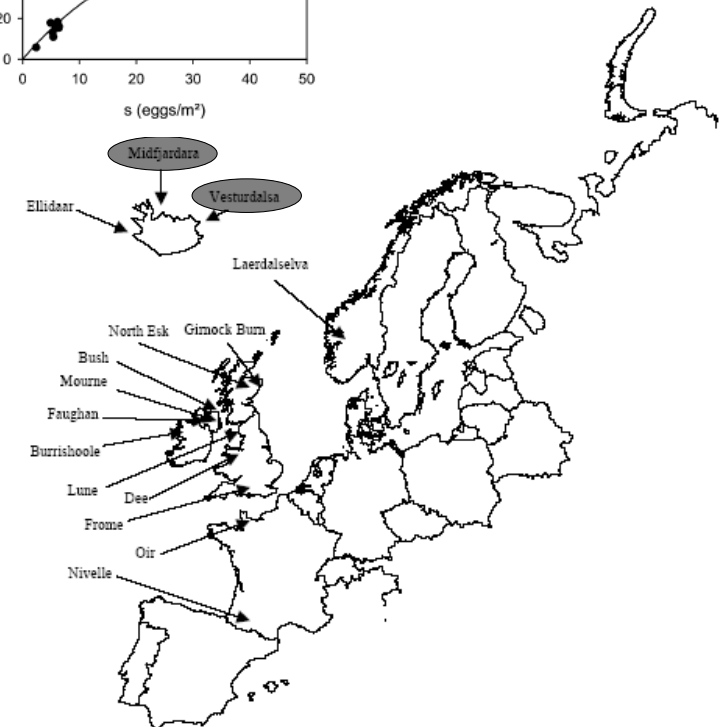
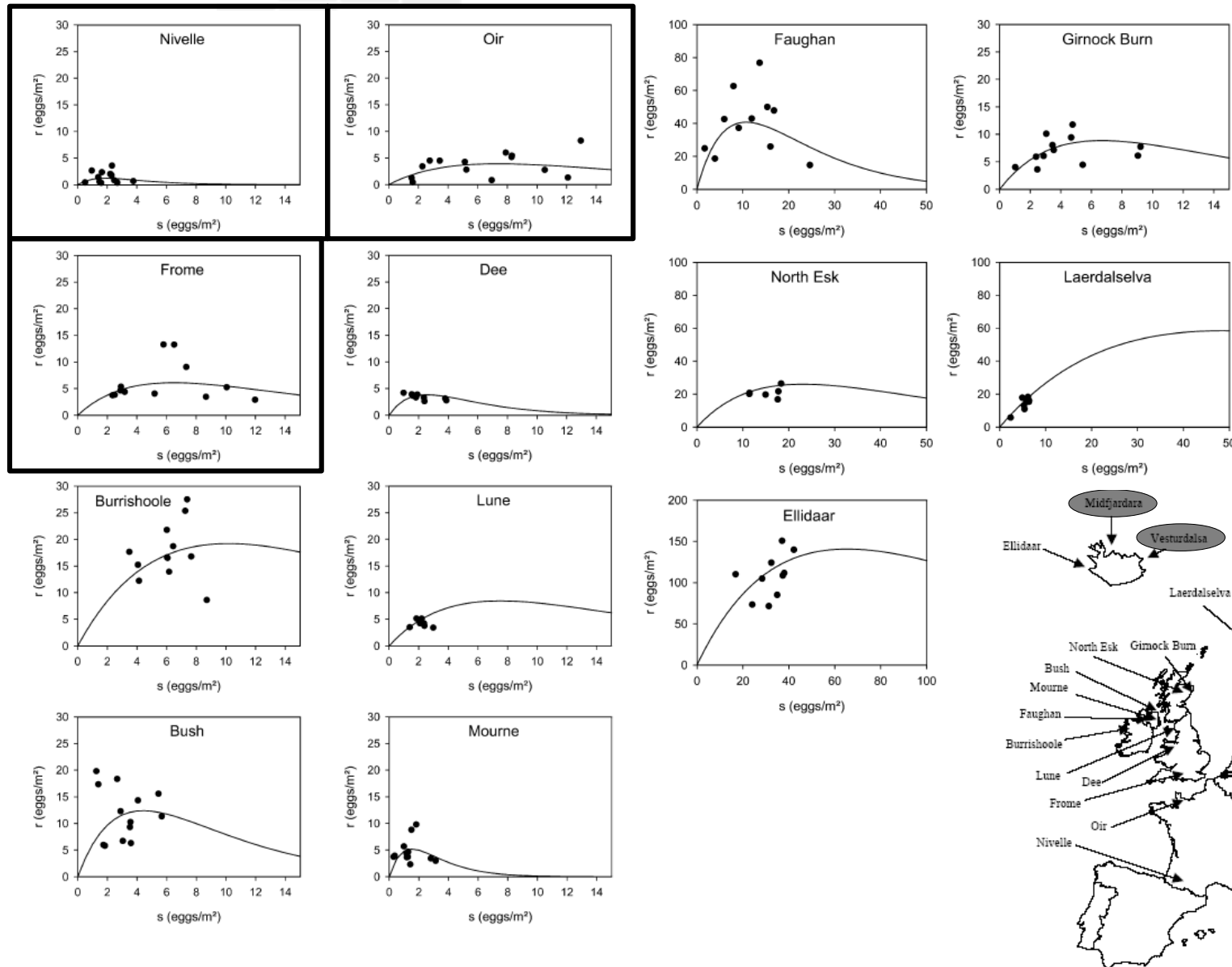




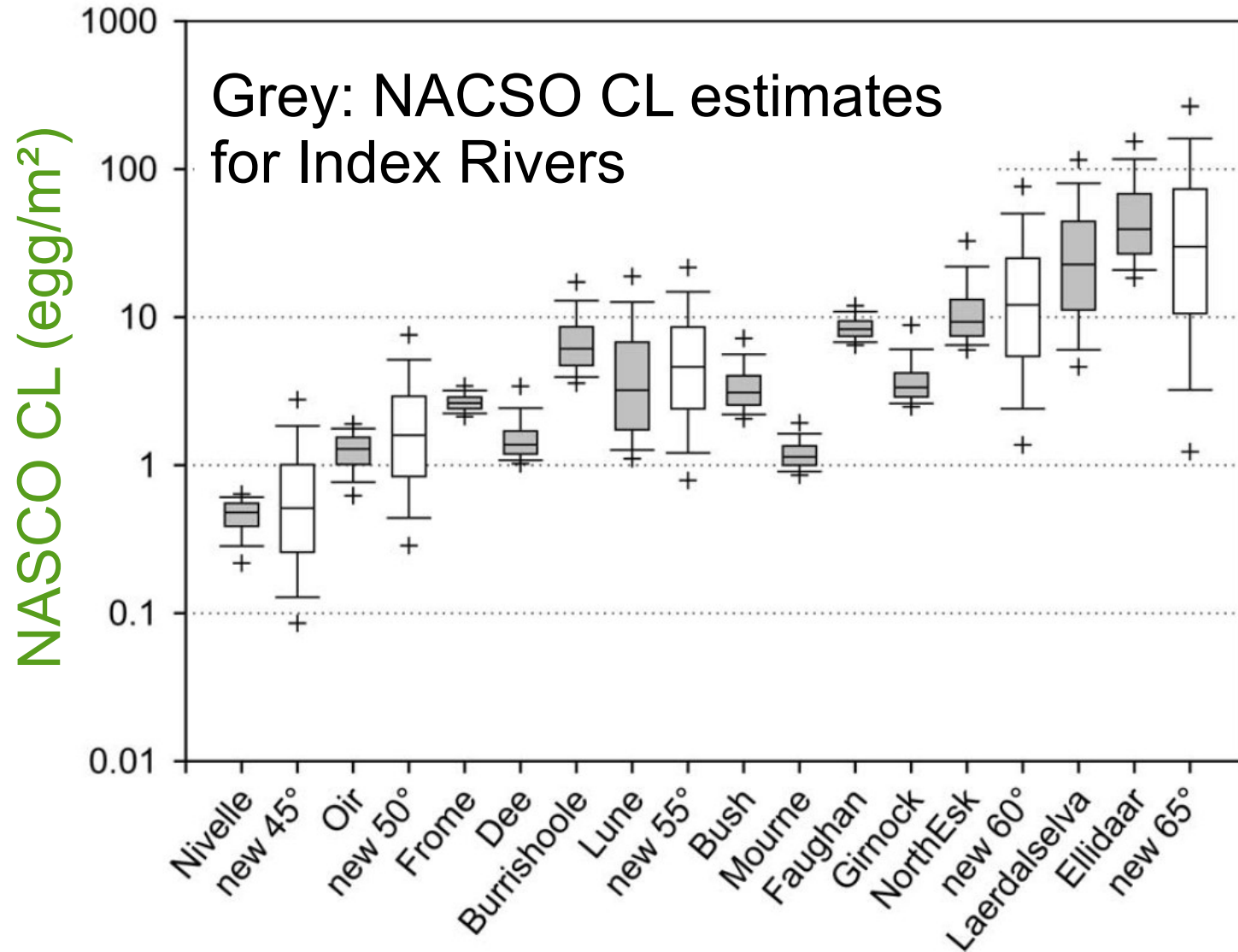
What about non-Index Rivers?

- 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)

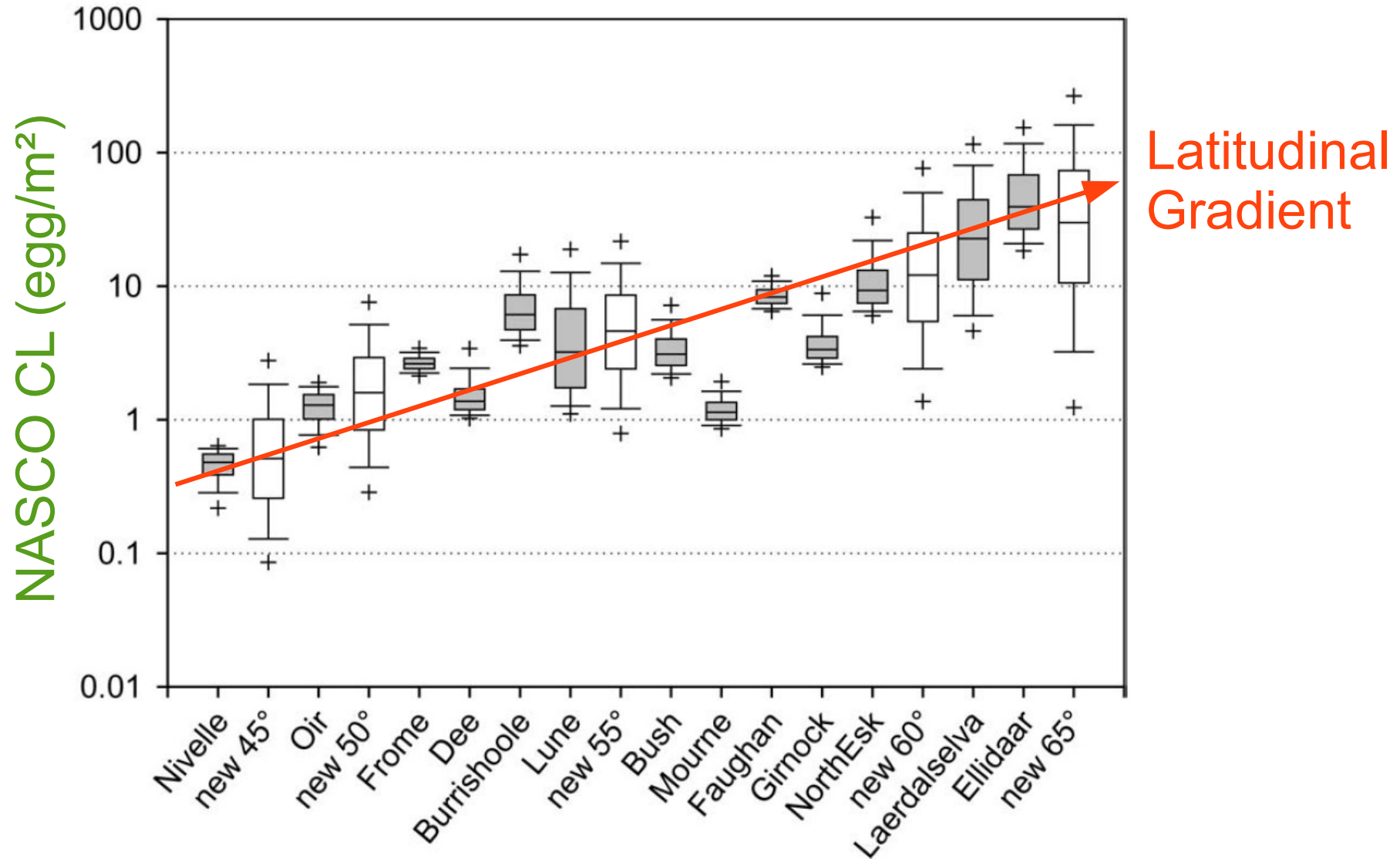
SALMODEL: a joint SR analysis of 13 Index Rivers



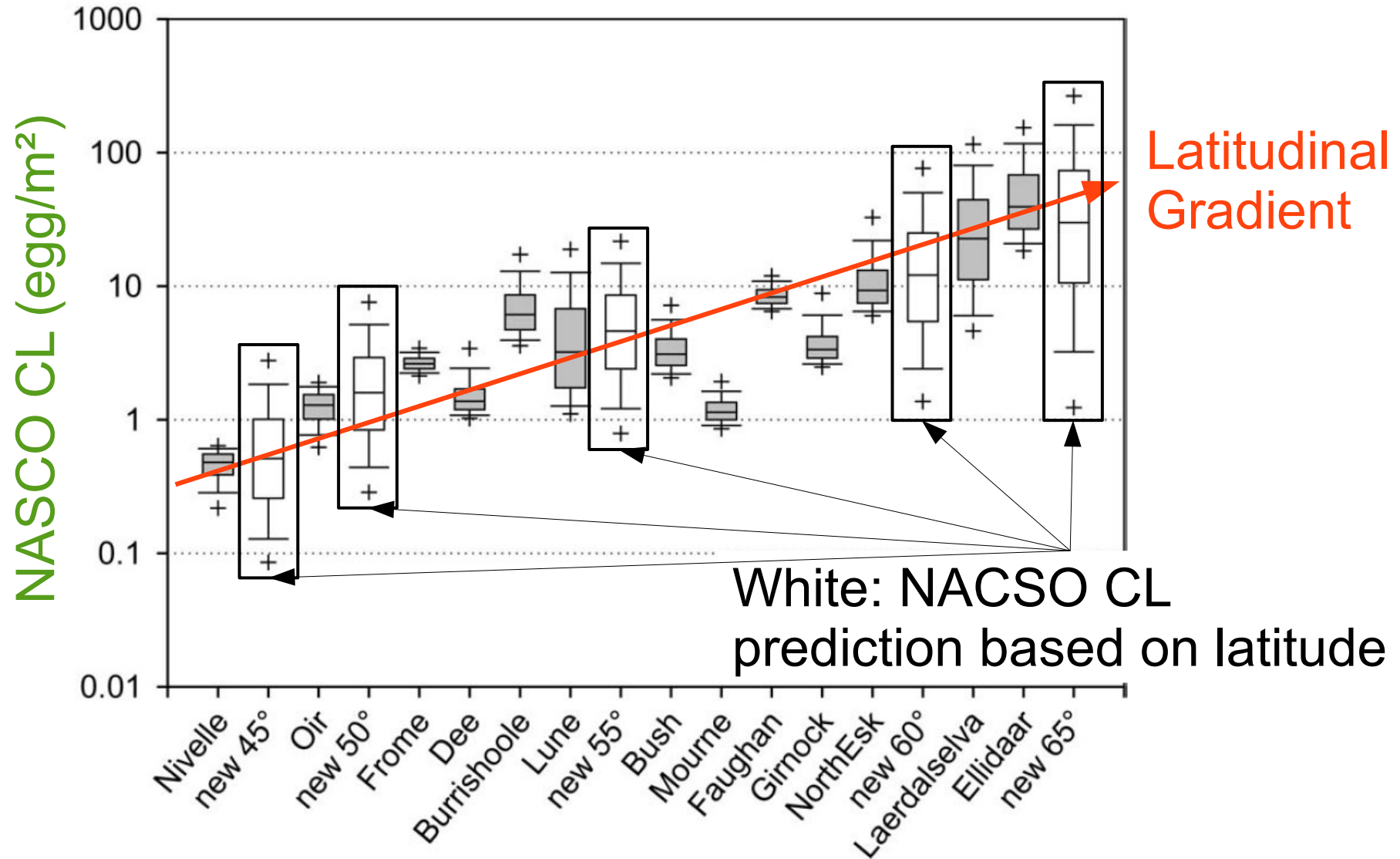
SALMODEL: estimation of NASCO CL for any salmon river in Western Europe



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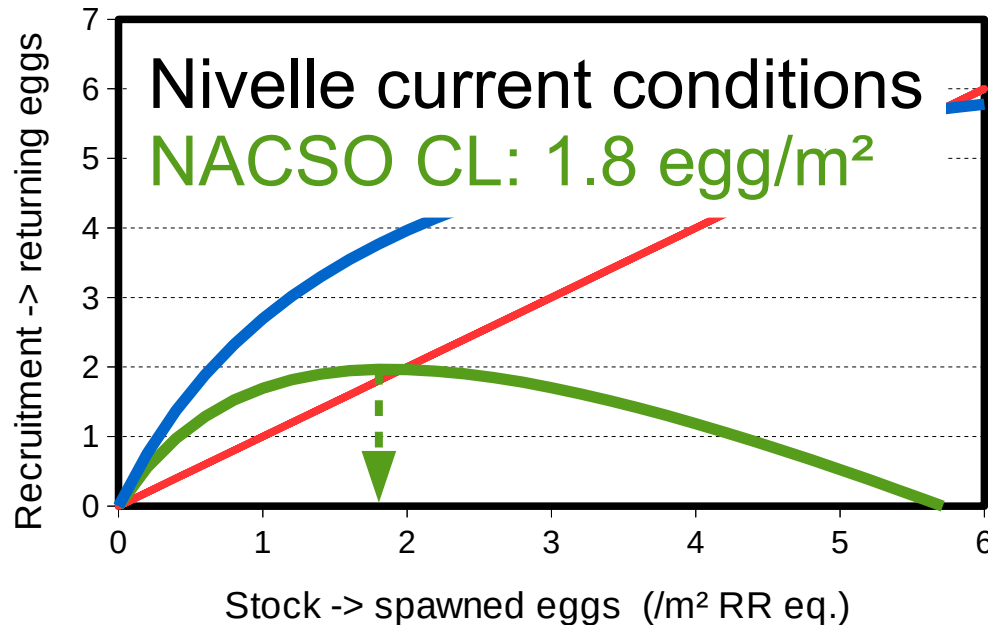
SALMODEL: estimation of NASCO CL for any salmon river in Western Europe



Troubles with NASCO CL definition

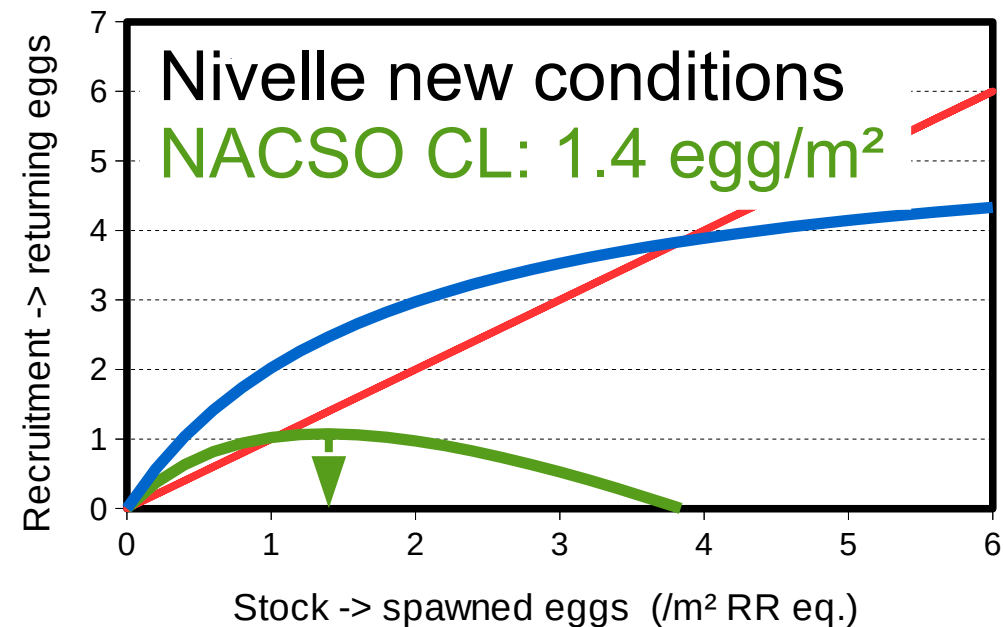
- Assume catches (at sea and in rivers) are well known or negligible
 - Generally not true
 - E.g. in the Nivelle: significant but unknown coastal exploitation
- Spawning stock producing MSY: is this relevant to conservation?
 - Rather aims at fisheries exploitation optimization
- What if survival (e.g.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

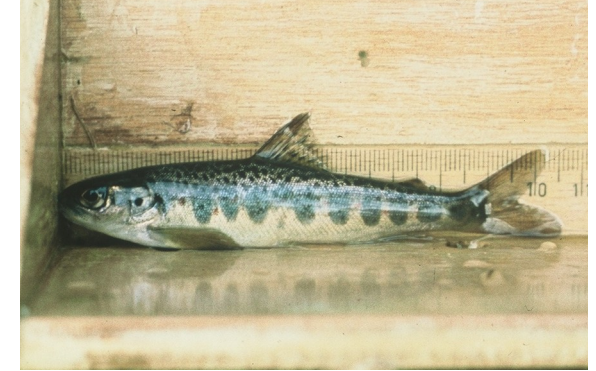
- NASCO CL: based on fisheries optimization principle
 - when times become harder for salmon CL should be revised downward
- Fisheries optimization \neq Conservation
- But how can we define Conservation?
- An operational (and partial) proposal: conservation should ensure that wild juvenile recruitment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

The Nivelle R.: the southernmost Index River in Europe

Uxondoa
trapping
station



Spawning



Juvenile
(0+ parr in the fall)
recruitment

Redd
counts



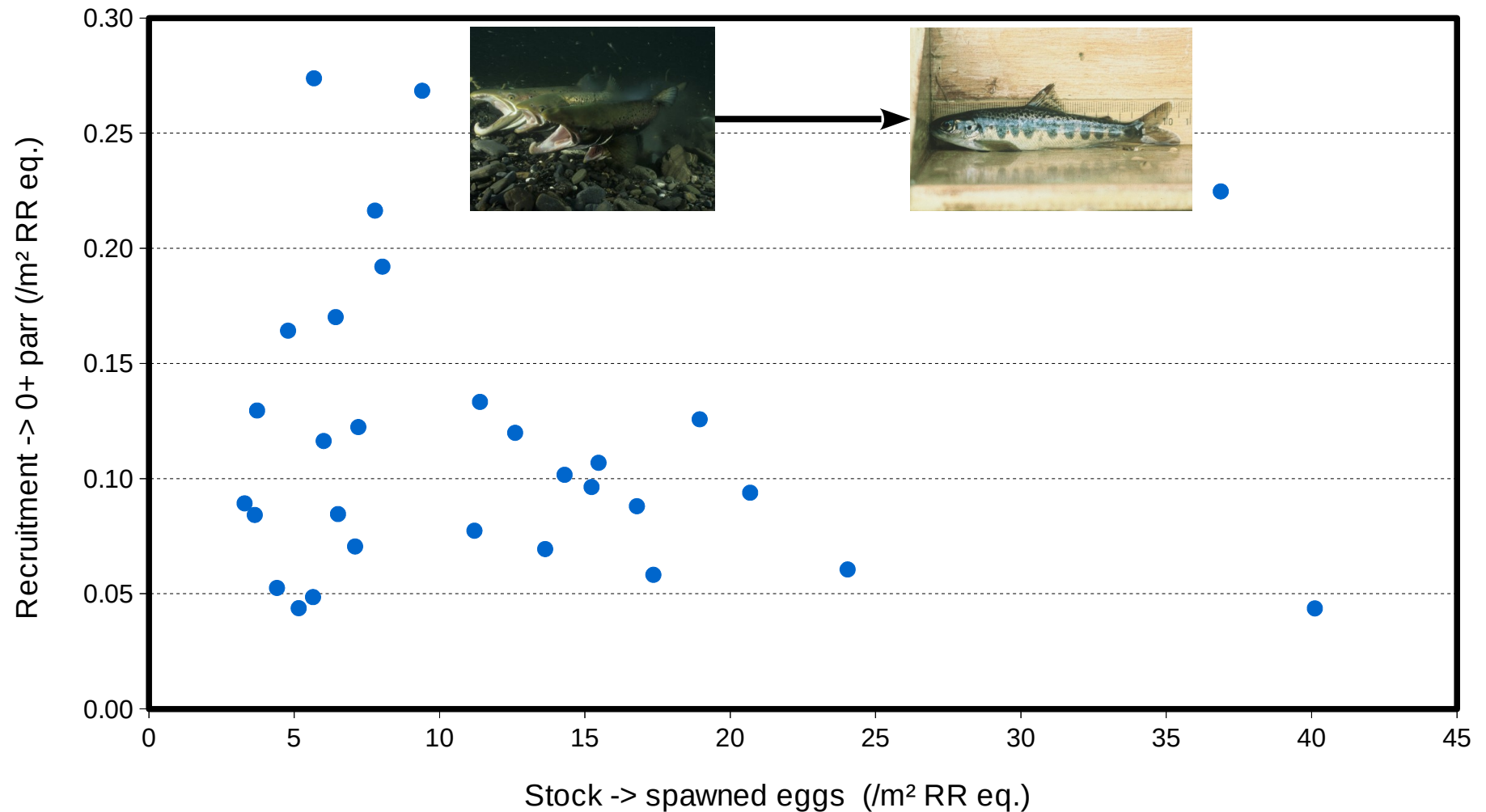
escapement

Olha
trapping
station

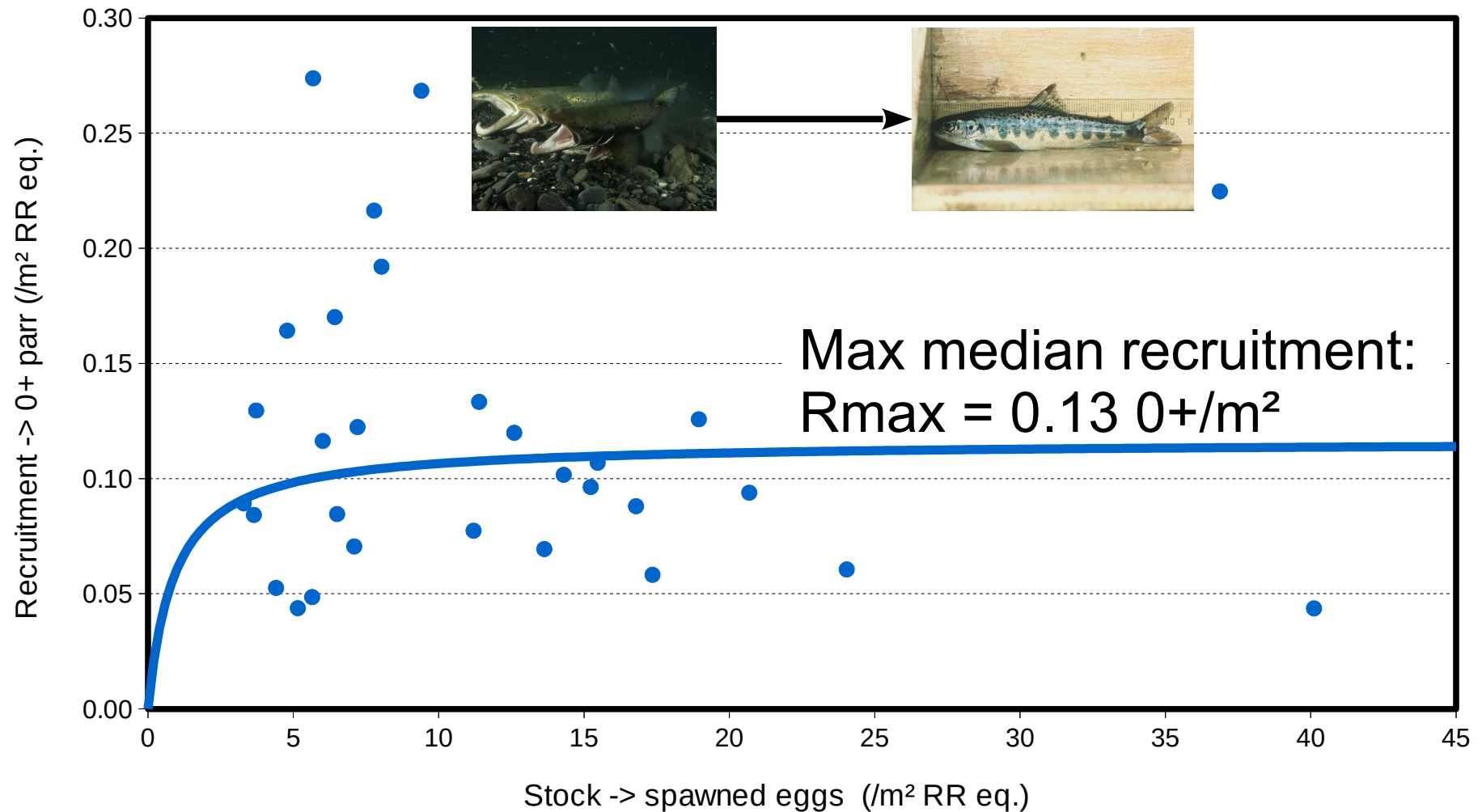


Electrofishing

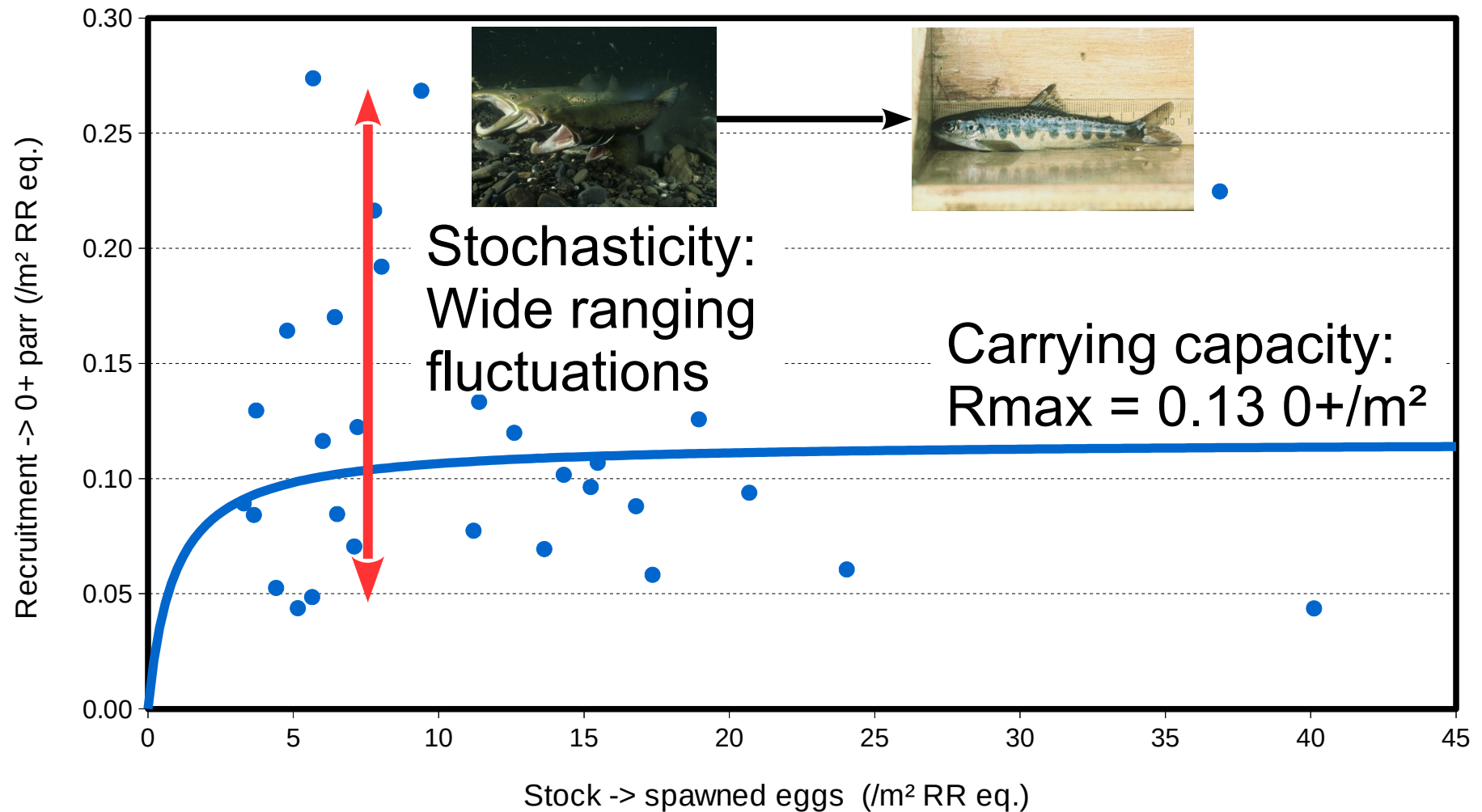
The egg-to-0+ parr Stock/Recruitment series of the Nivelle R.



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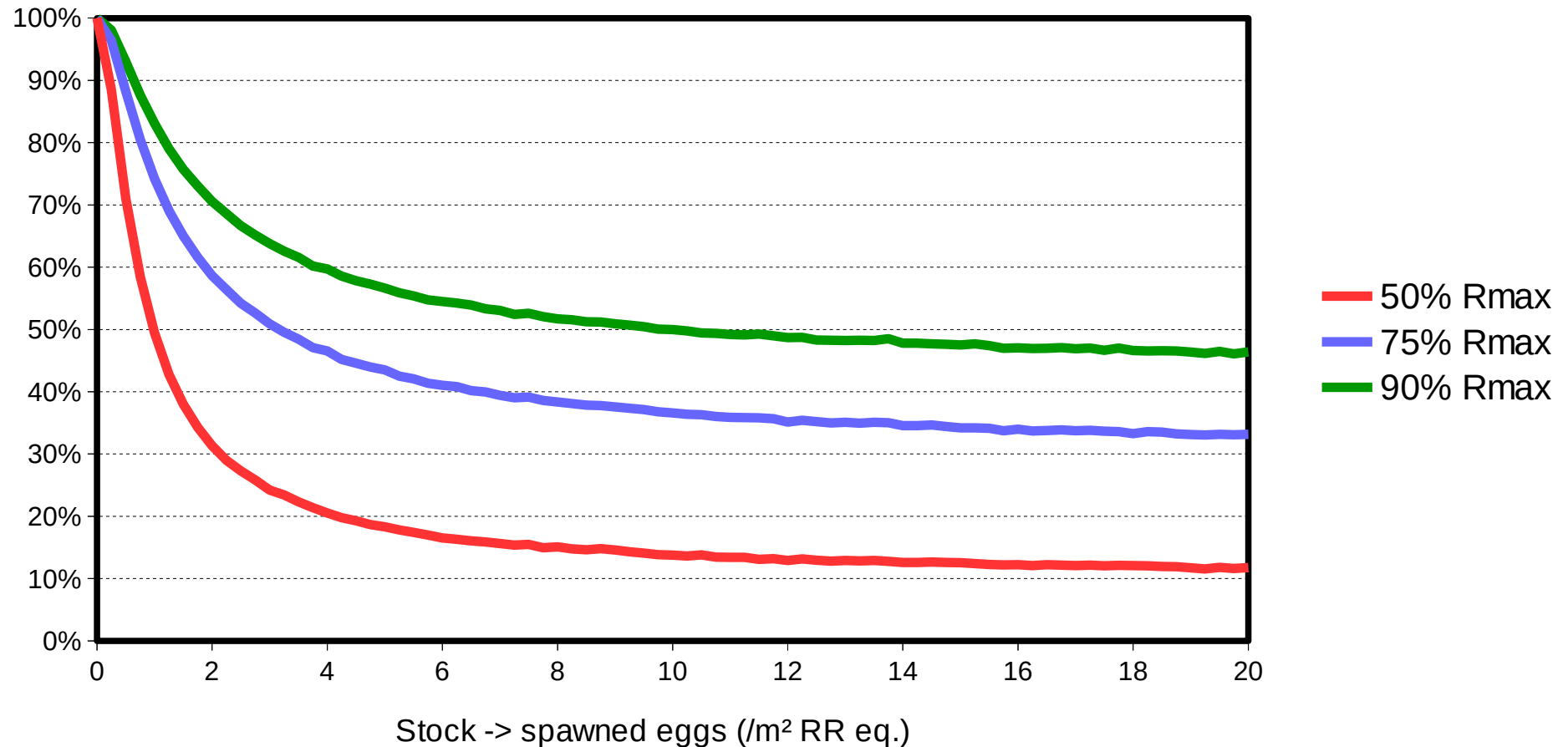


CL definition: time for a change?

- 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

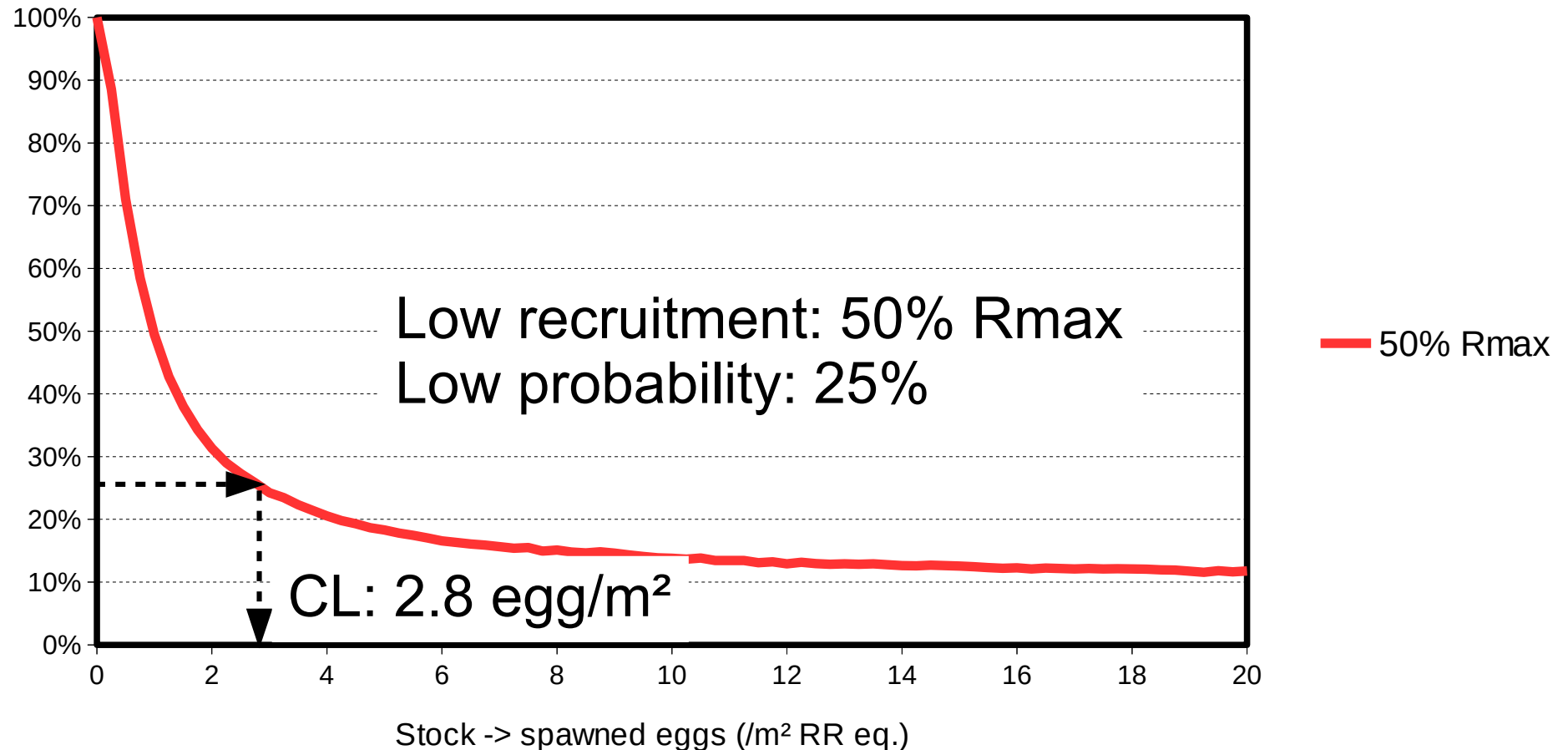
Risk plot for 3 options of low recruitment level

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



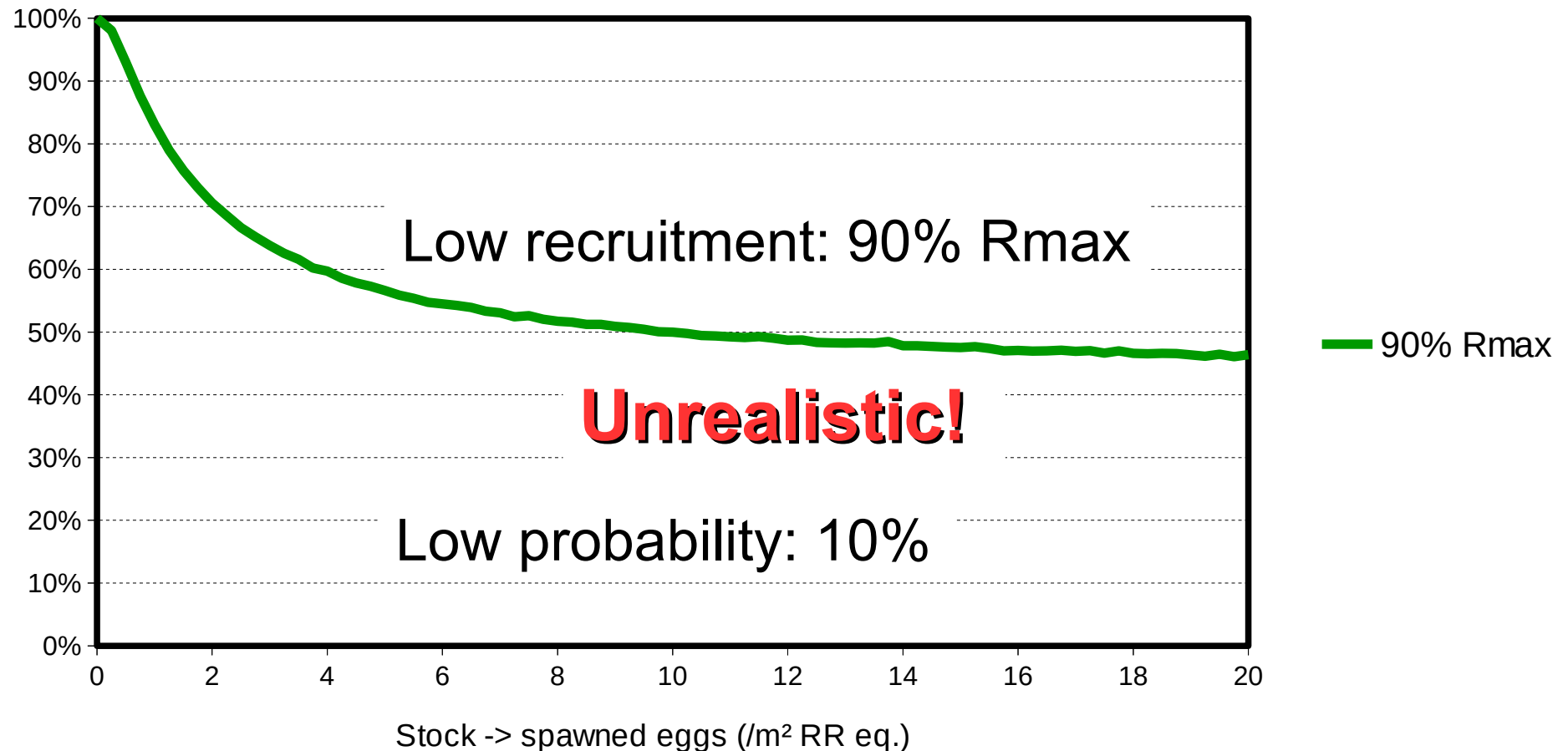
Risk plot: an example of management decision

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

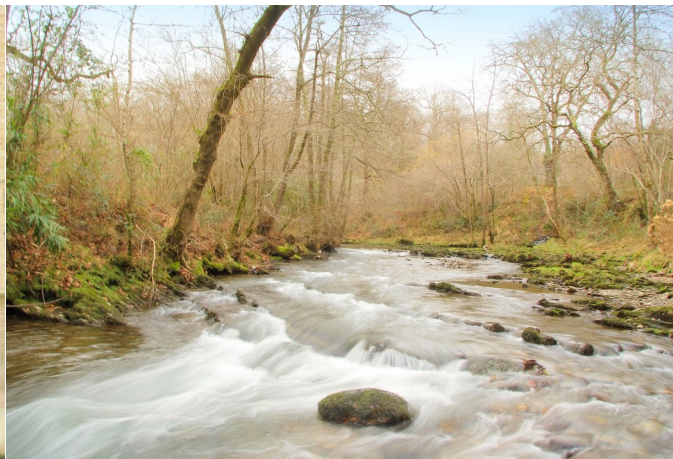
- Based on a conservation principle/definition in a risk control context
- Identify the risk of low recruitment level as a management decision
 - Easier to communicate to management stakeholders (?)
- Uses scientific and fisheries independent data only
- Not sensitive to changes in density independent 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

