Evolutionary Fisheries Management

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Fishing as a Driving Force of Evolution

- ✓ A key determinant of life-history diversity is the trade-off between fitness gains in early and late life
  - ➢ Example: **growing big** requires sacrificing early reproduction in favour of growth
    Benefits of growing big: 👍 outgrowing natural predators 👍 big fish are highly fecund
    Costs of growing big: 👎 loss of reproduction in early life 👎 chance of dying before reproduction
    - ➢ **Fishing reduces the benefits** and **increases the costs** of growing big → fishing favours faster life

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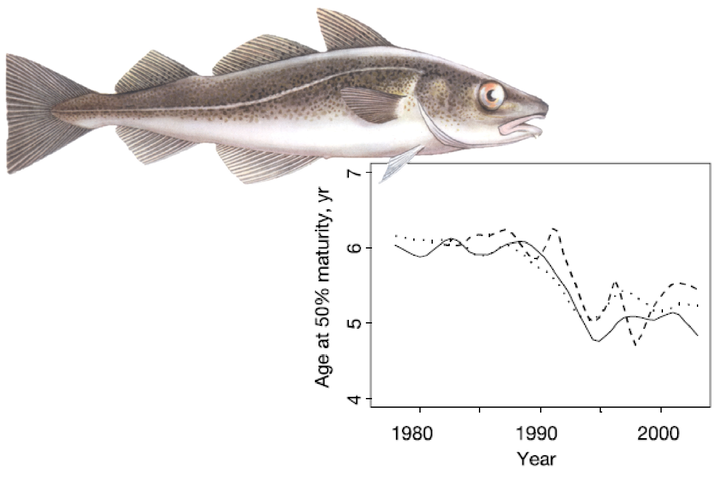

Period of heavy exploitation coincided with declining age at maturation in northern cod (Olsen et al. 2004)

Evidence

- ✓ Trends towards earlier maturation are ubiquitous in heavily exploited fish stocks
  - ➢ In agreement with predicted fisheries-induced evolution
  - ➢ Other explanations are possible
- ✓ Method developed at IIASA helps to disentangle explanations (Heino et al. 2002)
  - ➢ Applied now in 13 species, representing >30 cases
  - ➢ Most cases suggest that fisheries-induced evolution has occurred

Jørgensen et al. 2007 *Science*

Fisheries-induced evolution
→ ecosystem services

- ➢ Supporting services
- ➢ Provisioning services
- ➢ Regulating services
- ➢ Cultural services

Consequences

- ✓ Fish adapted to fishing:
  - ☺ tolerate more overfishing
  - 😐 may be more sensitive to long-term fluctuations?
  - ☹ are less productive
  - ☹ are on average smaller
- ➢ Fisheries-induced evolution can diminish the value of fish as a resource

Evolutionary Impact Assessment

- ✓ We need to assess costs and benefits:
  - ➢ ongoing fisheries-induced evolution
  - ➢ mitigating actions
- ✓ New framework: the Evolutionary Impact Assessment (EvoIA)
  - ➢ **Quantify** the consequences of fisheries-induced evolution on **utility** of a fish population under alternative management **actions**, including the status quo
    ☞ Jørgensen et al. 2007, Laugen et al. 2012

References

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