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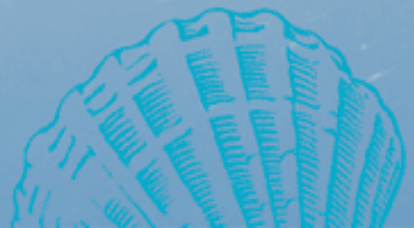

Mackerel predation on herring larvae during summer feeding in the Norwegian Sea

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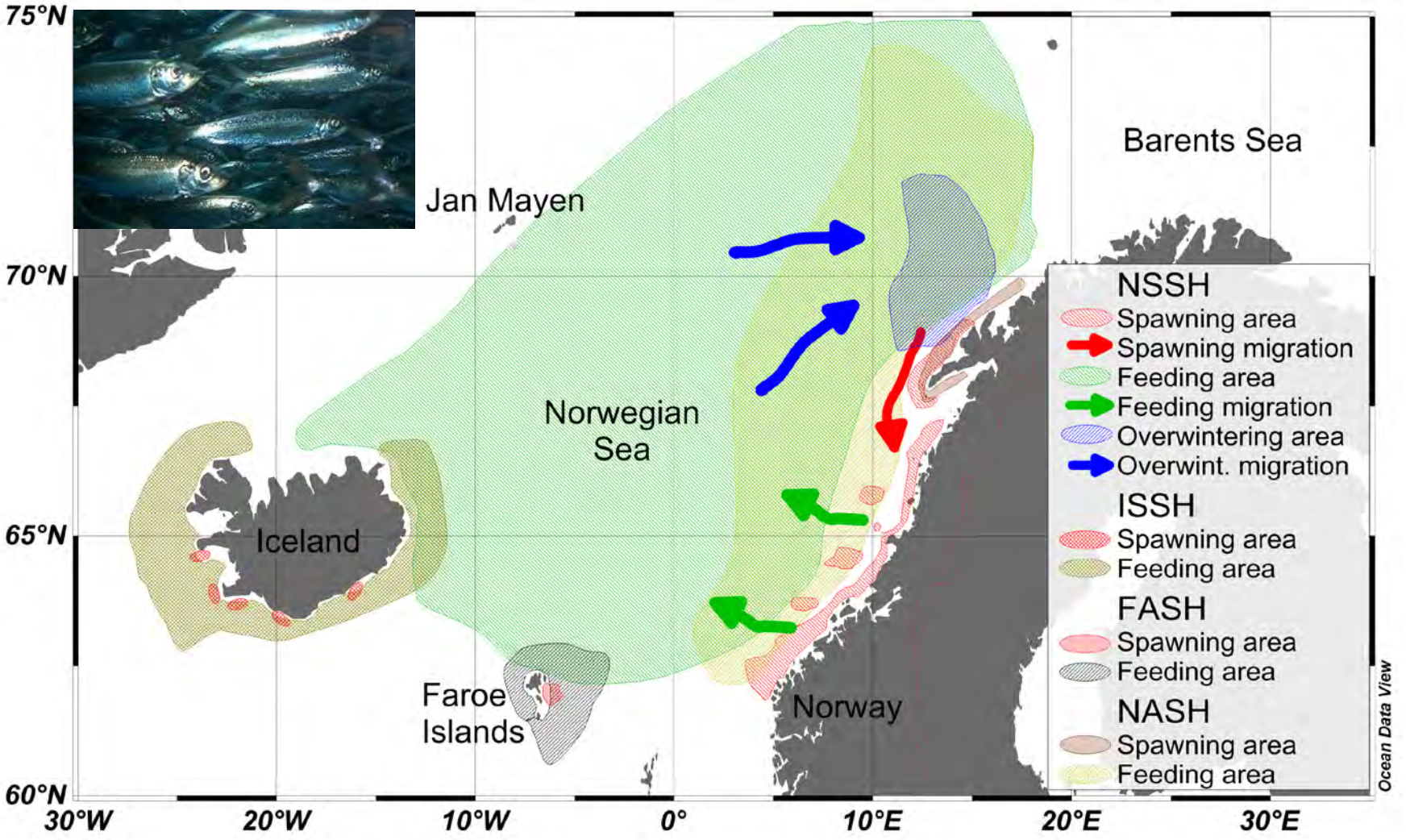
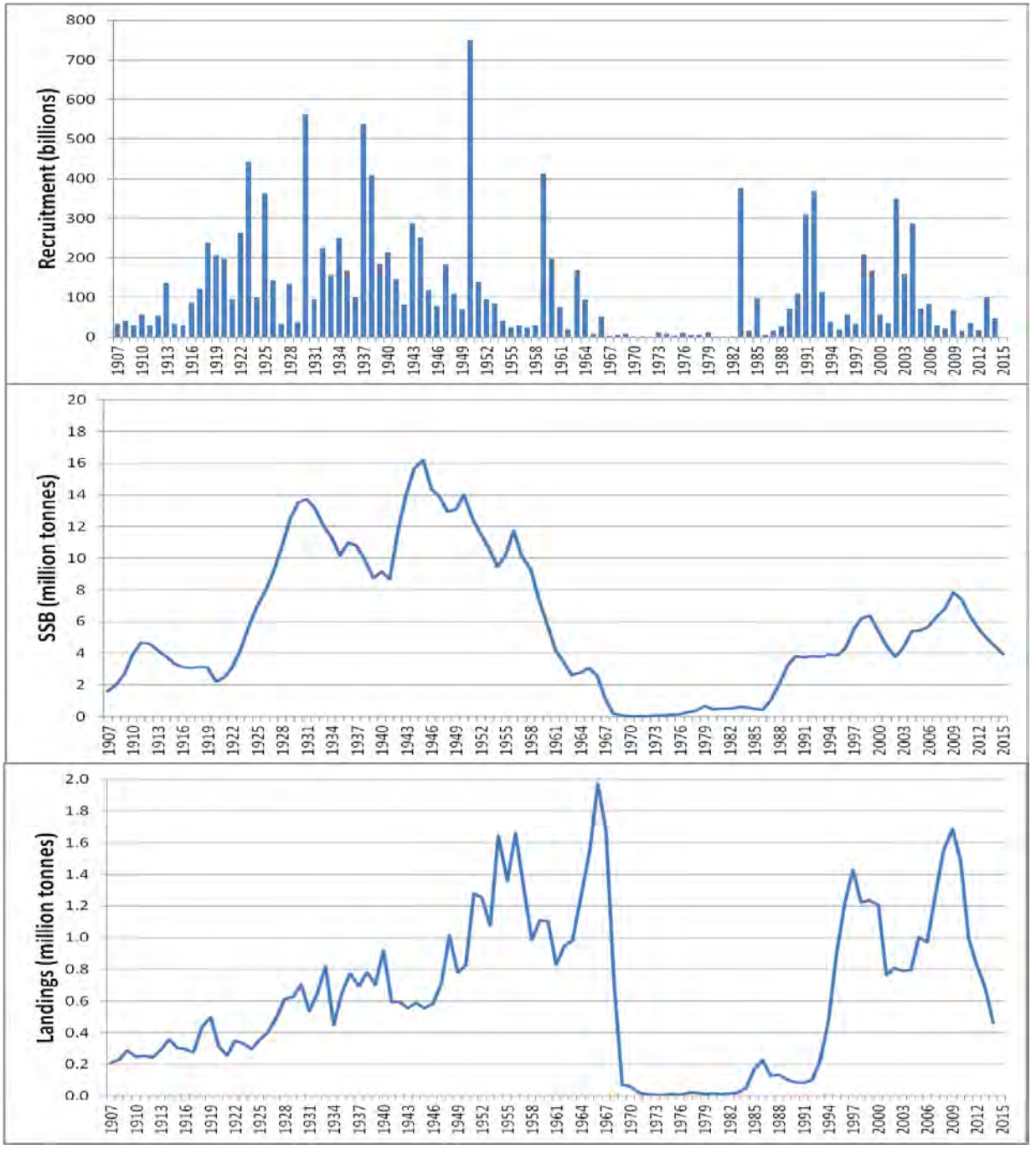
Distribution/migration pattern



Pampoulie et al. 2015

Stock history NSSH

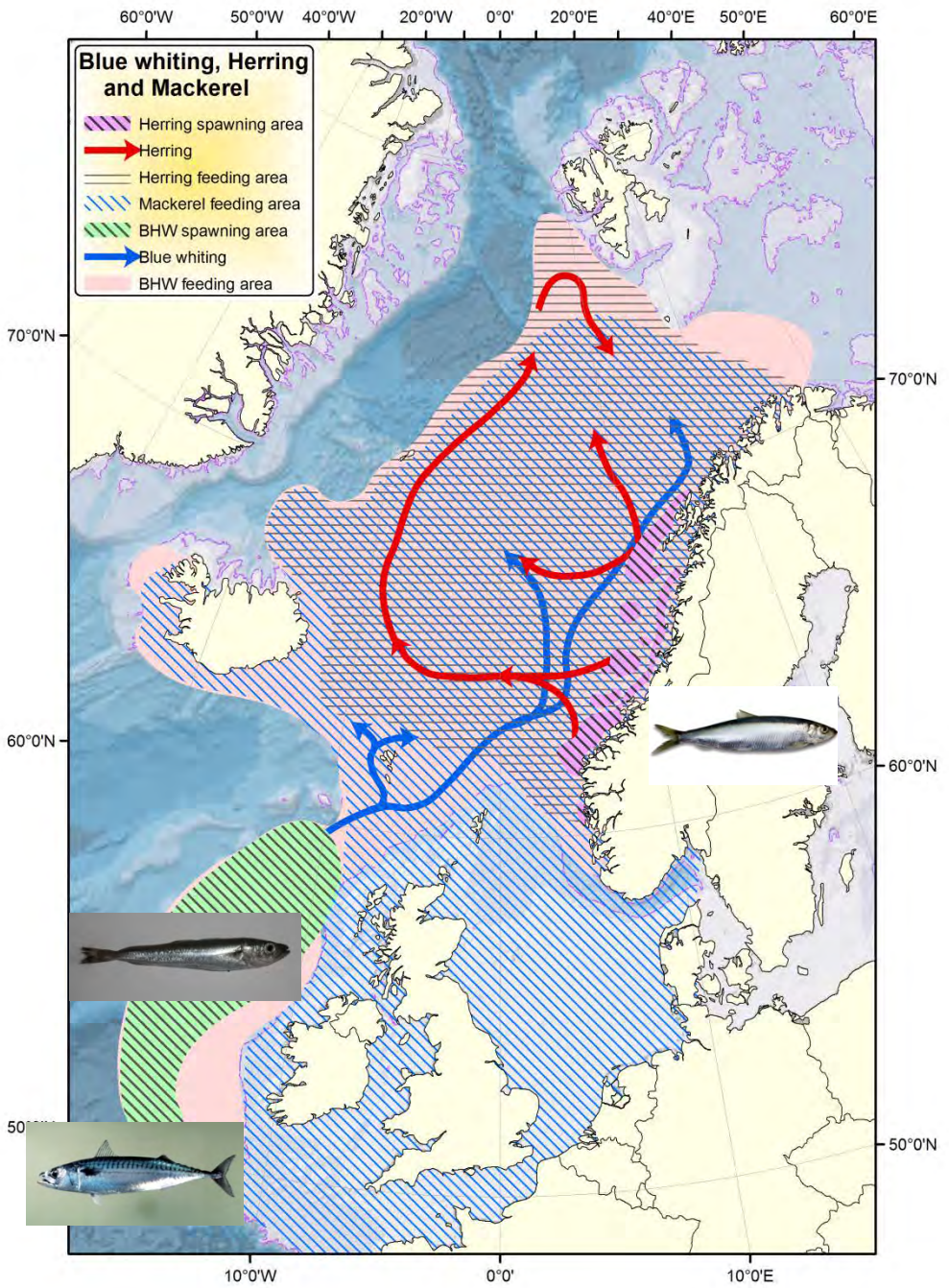


Pelagic species in the Norwegian Sea

Atlantic herring (*Clupea harengus*)

Atlantic mackerel (*Scomber scombrus*)

Blue whiting (*Micromesistius poutassou*)



Rationale

- Long history of research on NSSH recruitment
  Hjort (1914)
- Previous focus on match between herring larvae and their prey
- Less focus on predation
- Mackerel expanding and increasing overlap with NSSH larvae
- Observations of mackerel predation from fishermen

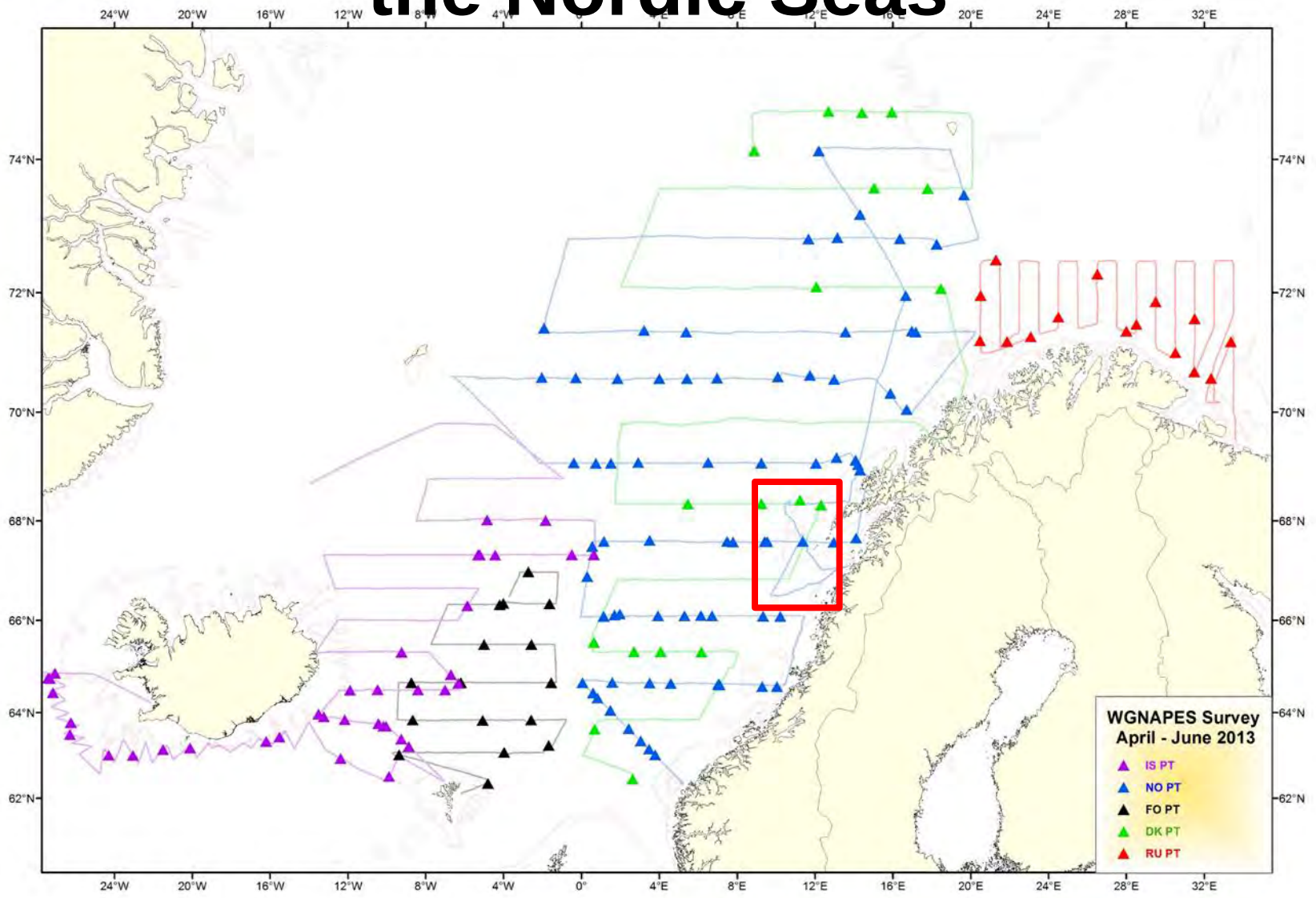
Mackel as predator

- Mackerel is an important predator on herring, sandeel and norway pout in the North Sea (Dahhl and Kirkegaard, 1986)
- Mackerel feed on a range of fish and zooplankton in the Norwegian Sea basin (Langøy et al., 2012)
- Pepin et al. (1987) showed positive size selection of mackerel preying on fish larvae

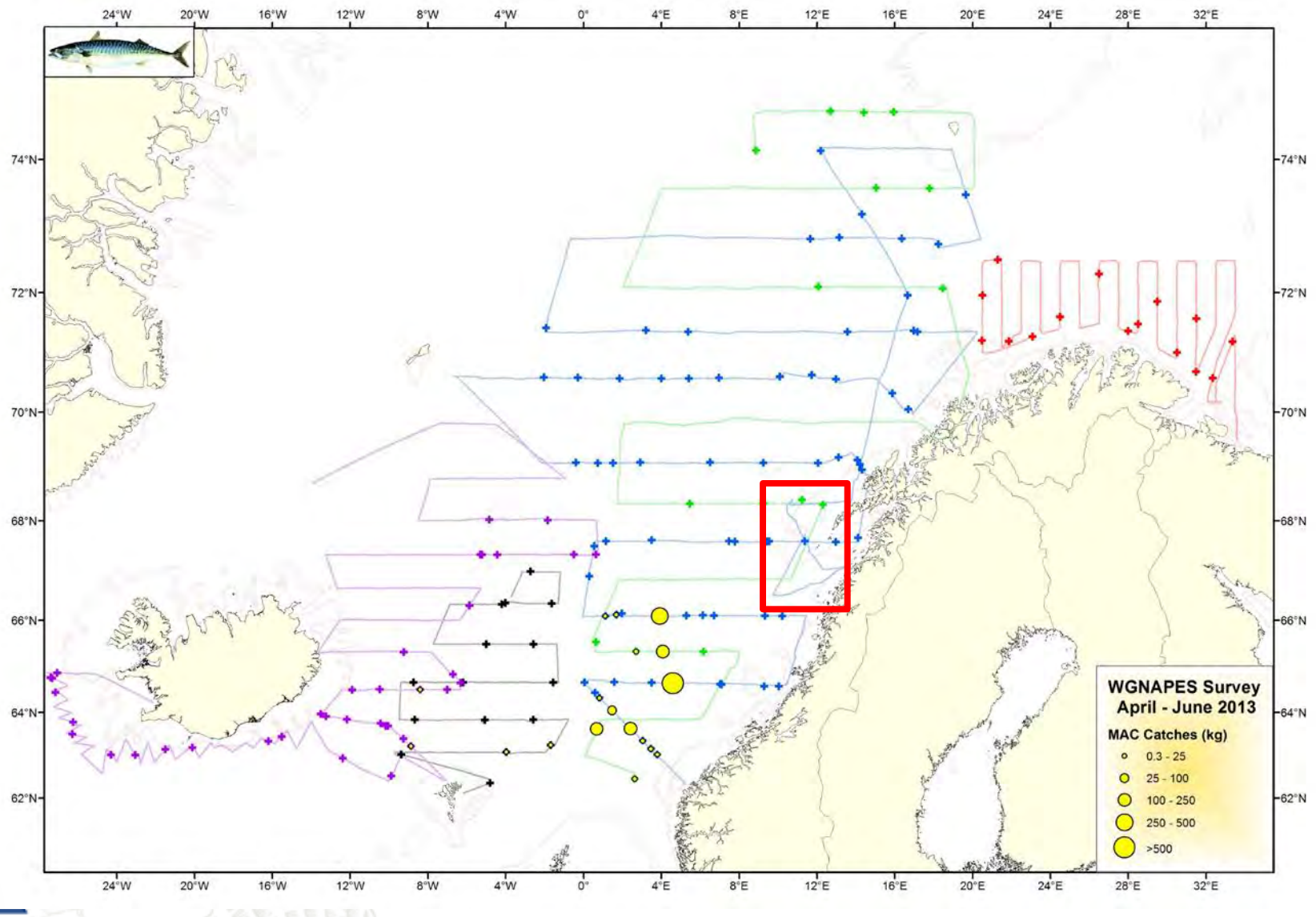
Objective

- Investigate the predation on herring larvae by mackerel during expected spatial and temporal overlap

International Ecosystem Survey in the Nordic Seas



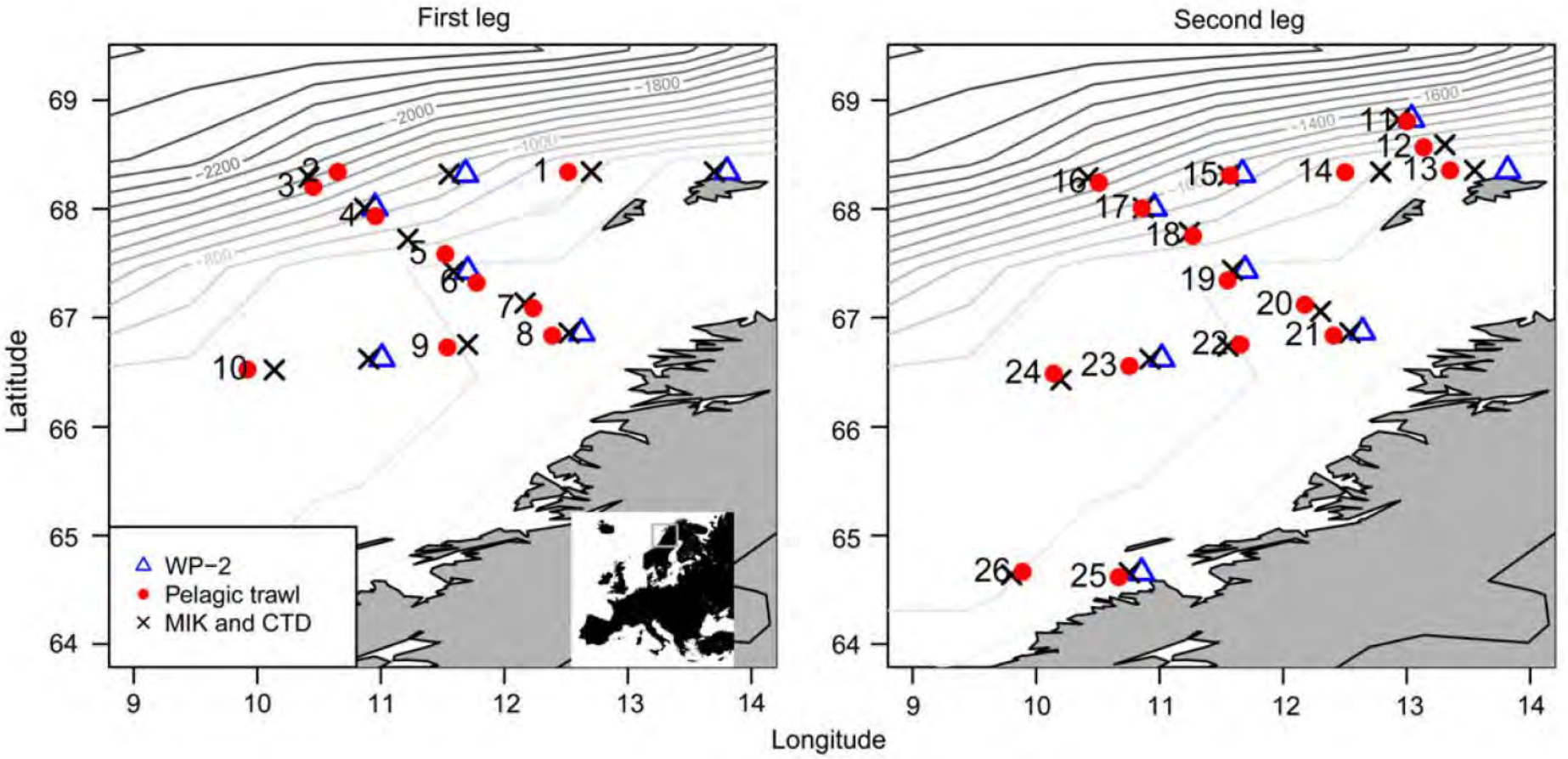
Mackerel catches in the trawl



Survey

- RV Johan Hjort 30th May – 8th June 2013
- Sampling at predefined locations 20 nm apart
- Two coverages
  - CTD
  - Methot Isaac Kid (herring larvae)
  - WP II (plankton)
  - Multpelt 832 pelagic trawl (mackerel)

Sampling grid

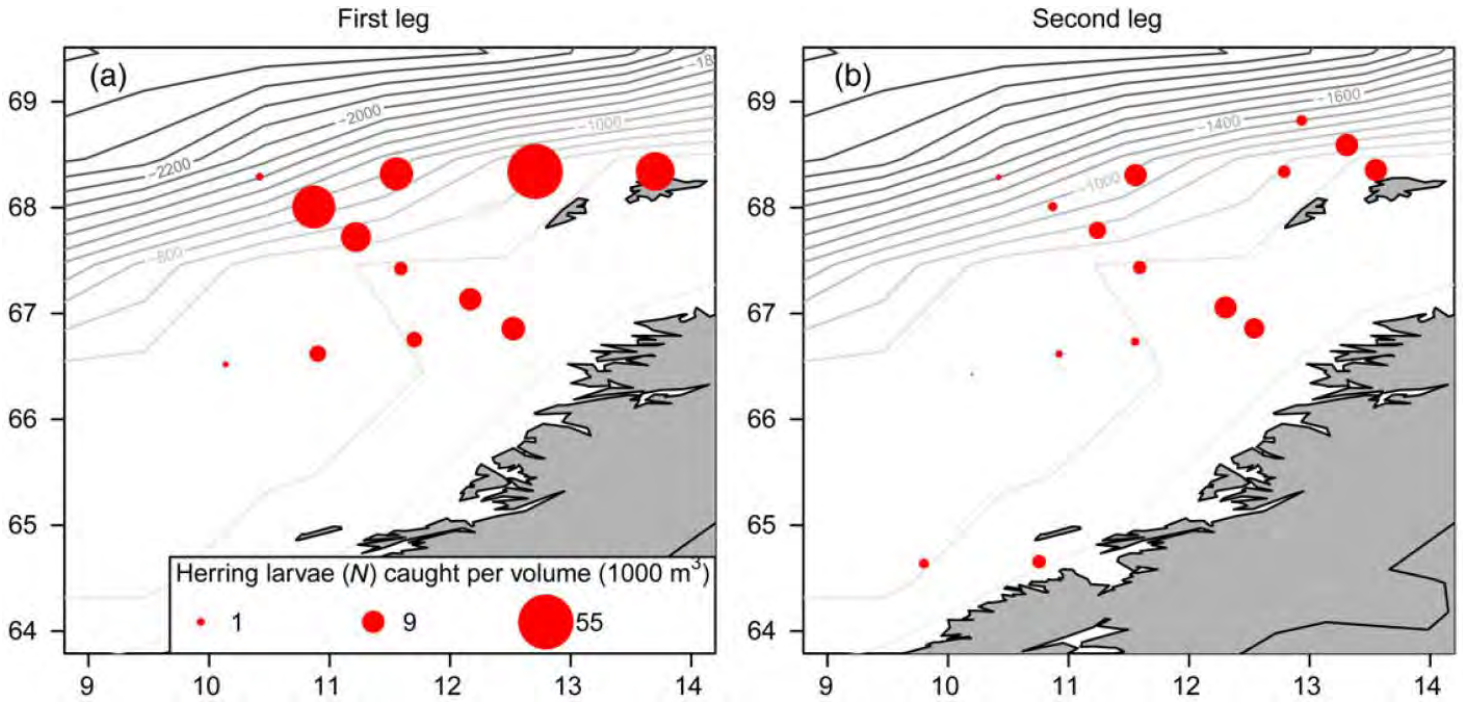


Analyses

- Stomach analysis of mackerel
- Spatial overlap index (Williamson, 1993) to assess the ovelap between larvae and mackerel
- GLM to investigate relationship between herring in stomachs and herring larvae abundance
- Otolith analyses to test for size selective predation

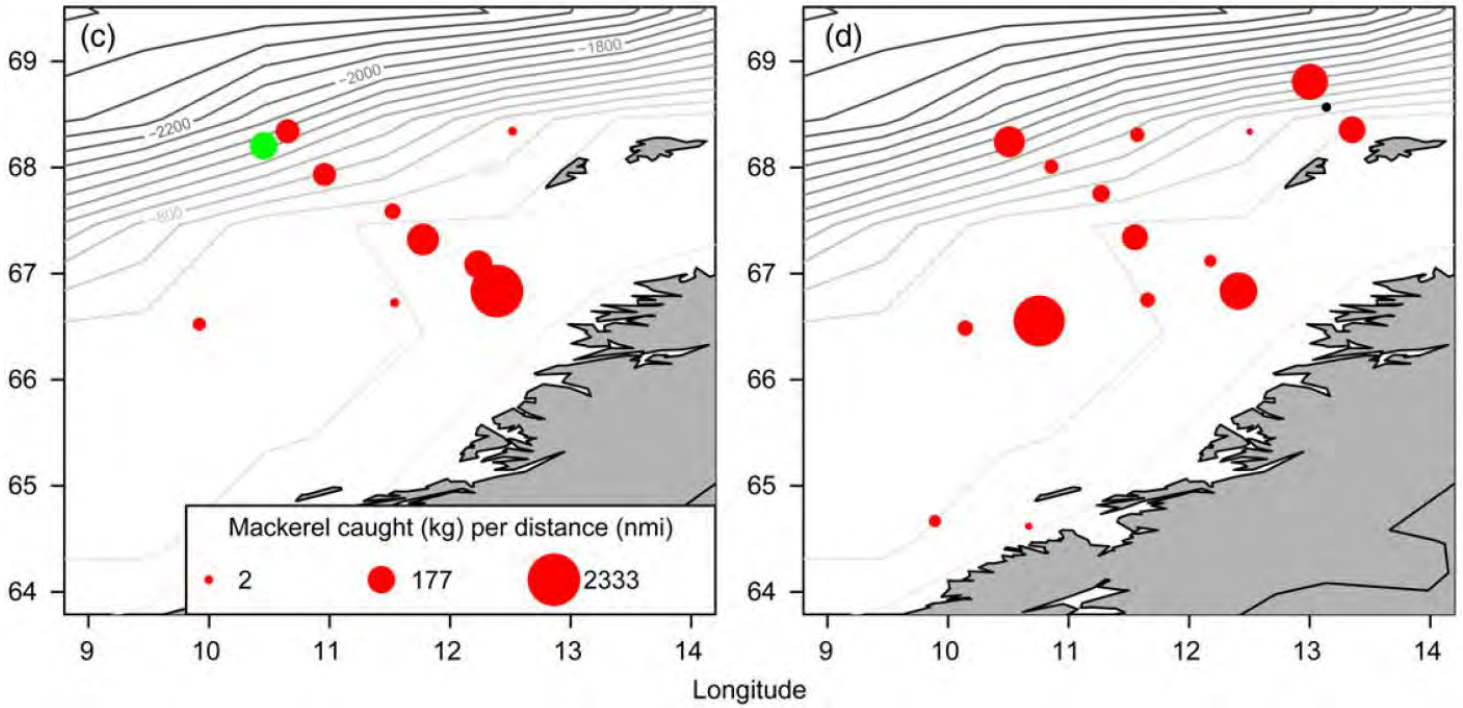
Results

Herring larvae



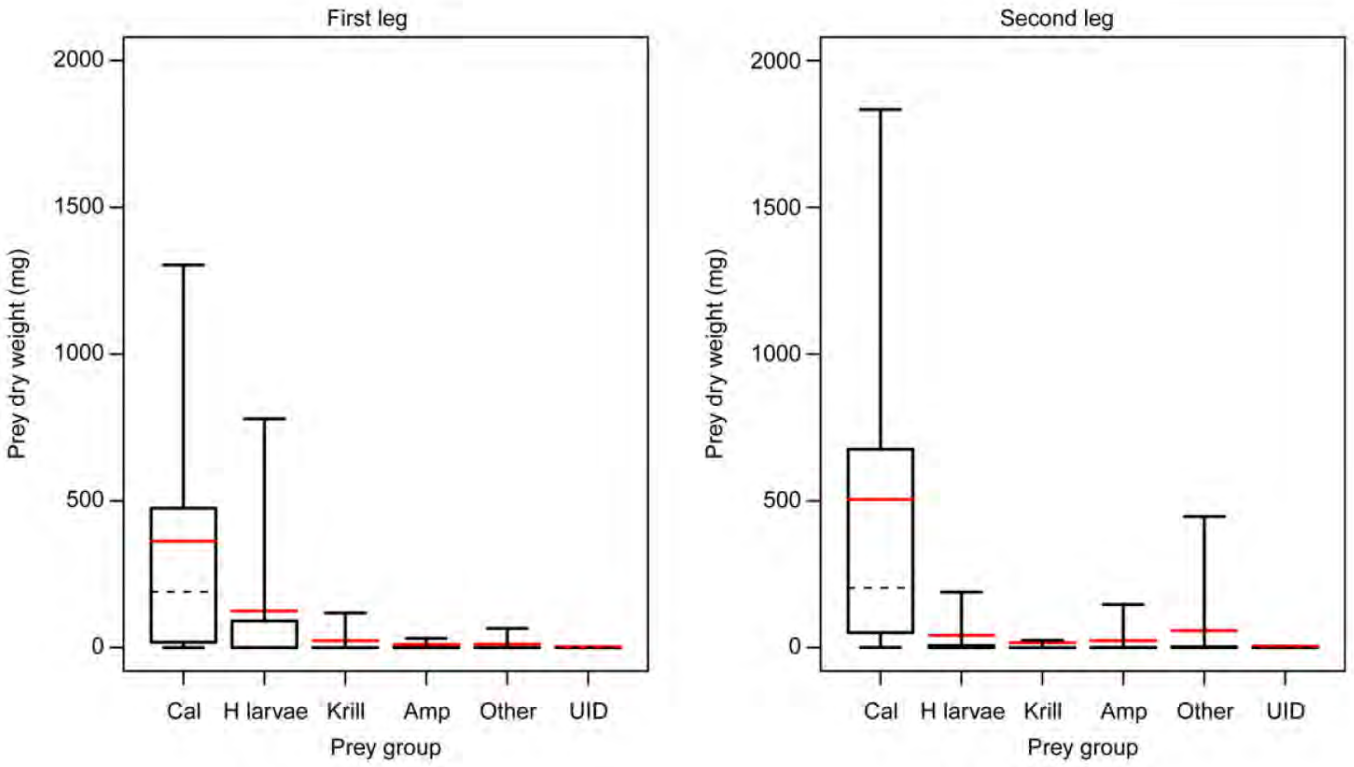
- Herring larvae were obtained in all MIK hauls
- Lower concentrations during the second leg
- Average length was 21.6 mm

Mackerel catches



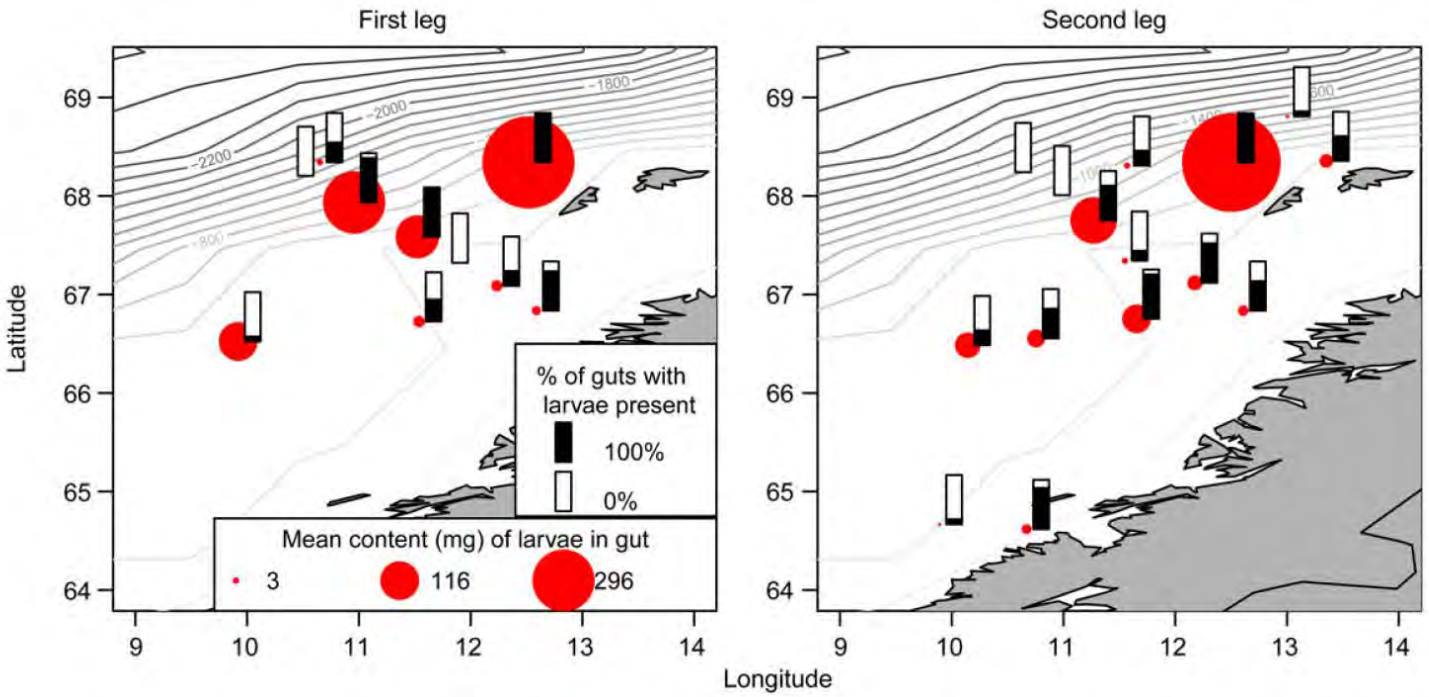
- Mackerel were caught in all but one haul
- Maximum catch of 2.3 tonnes per nm
- Acoustic recordings suggested showed little mackerel in deeper layers

Mackerel stomach content



- Calanoids (*C. finmarchicus*) dominated the diet
- Herring larvae were found in 45% of the stomachs
- Maximum of 225 larvae in one gut

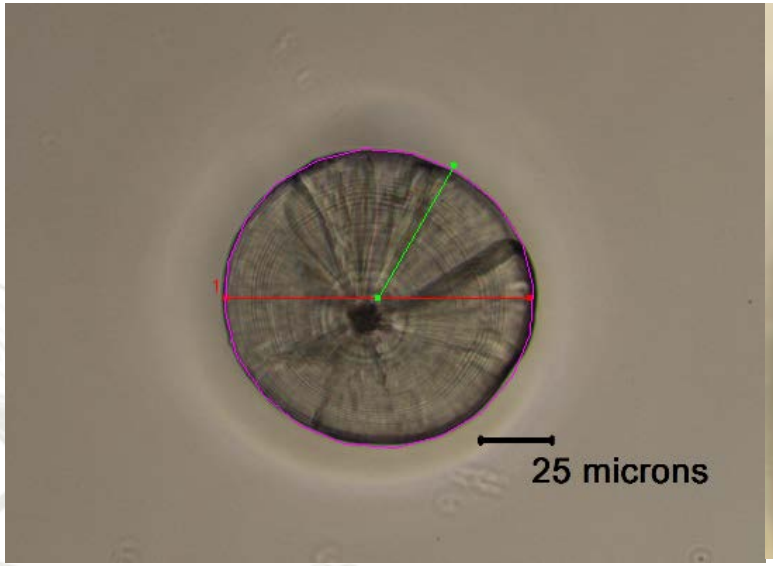
Herring larvae in mackerel guts

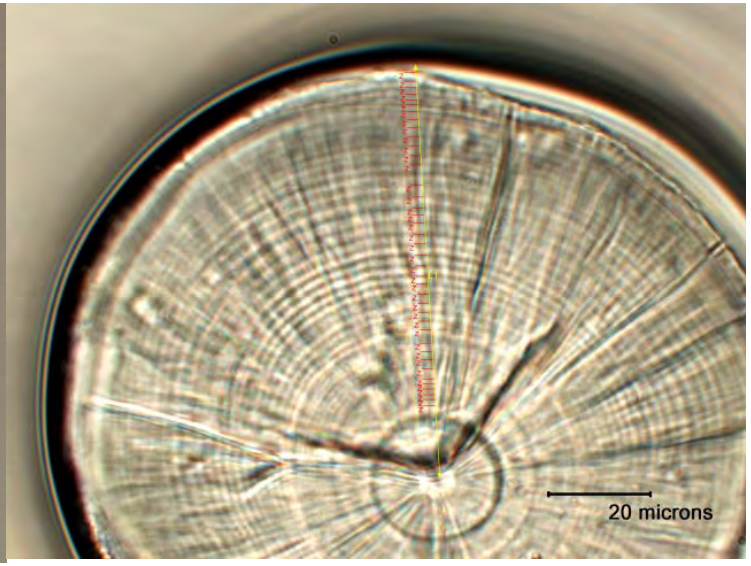


- Maximum of 225 larvae in one gut
- No spatial relationship
- Incidents of guts containing larvae and quantity of larvae increased at higher larval abundance

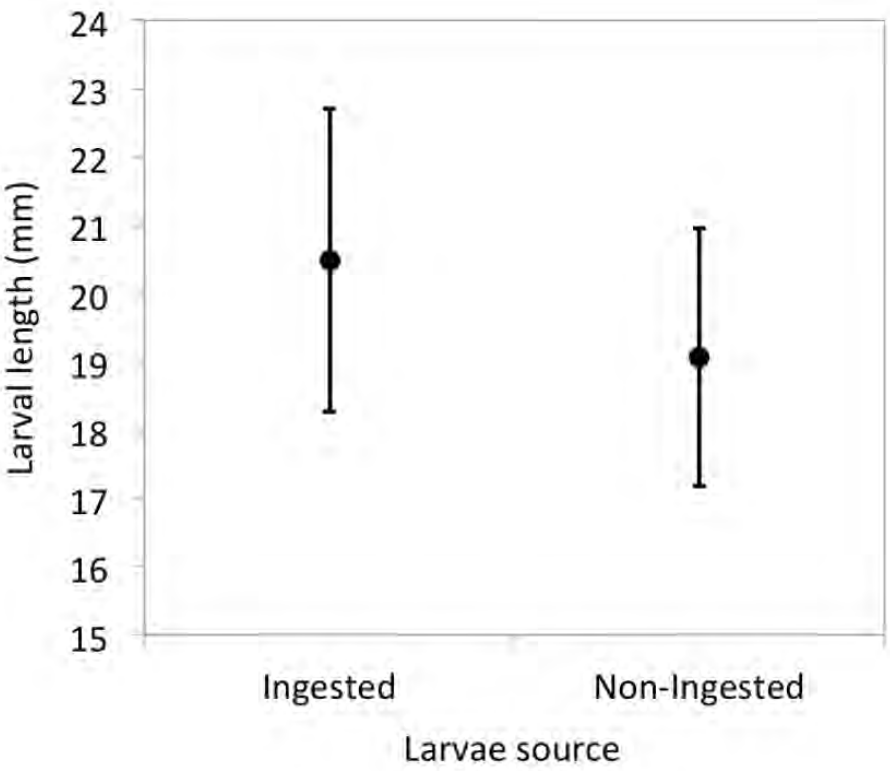
Size selective predation?

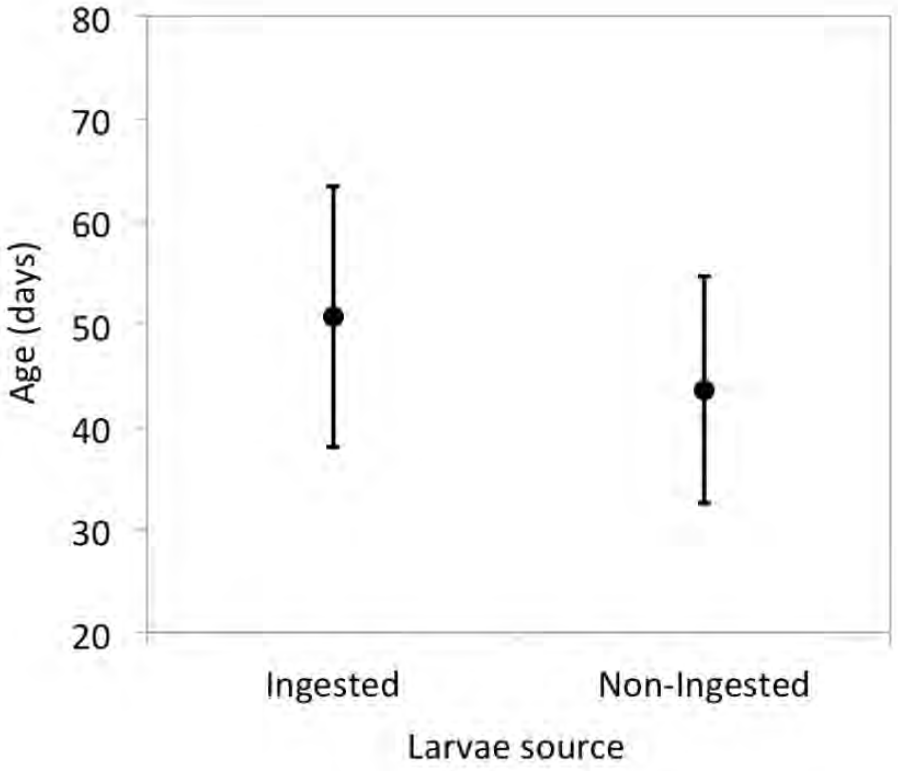
- Compared larvae from MIK samples to larvae (otoliths) in mackerel stomachs





Results





- Ingested herring larvae estimated to be significantly bigger and older then larvae caught in the MIK

Main findings

- Considerable spatial overlap
- Mackerel predated on herring larvae
- No spatial relationship indicating opportunistic feeding
- Increased abundance of larvae resulted in increased feeding incidents
- Spatial overlap is a useful predictor of the degree of predator–prey interaction between mackerel and herring larvae
  - Timing!

Main findings

- Areal projections of mackerel predation
  - Suggest the mackerel in the area would be capable of preying down the larvae in our survey area in the course of 6–7 d.
- Bigger was not better in this case

Acknowledgement

Norges sildesalgslag is thanked for its financial contribution to the field effort