

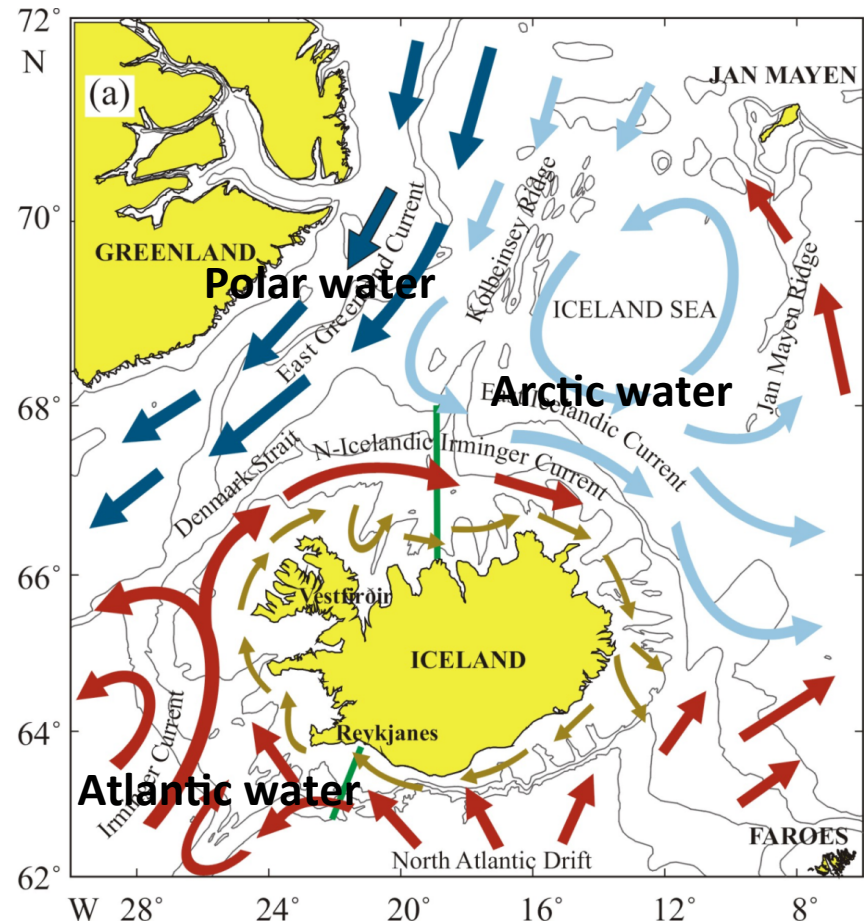
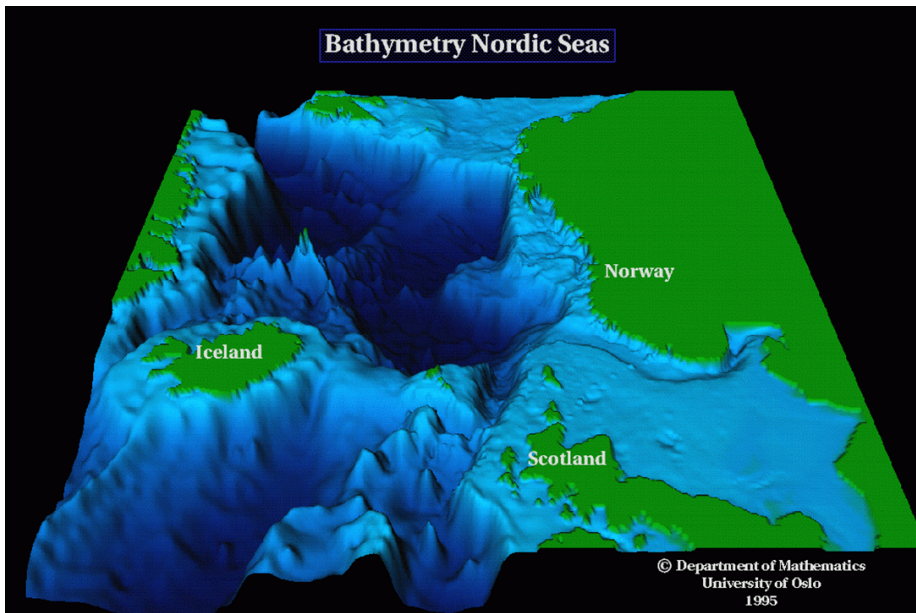
# Implementing EA in the Icelandic LME

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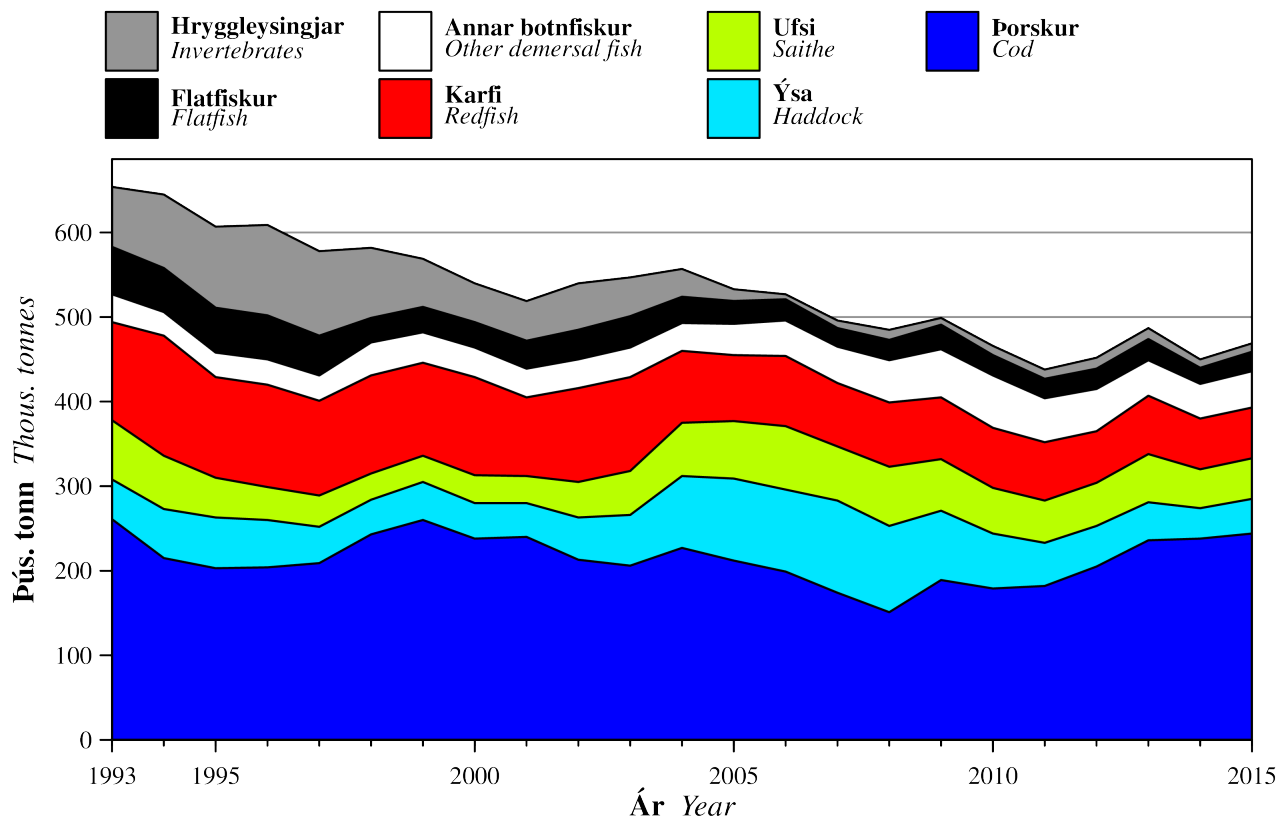
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# Topography, currents and water masses

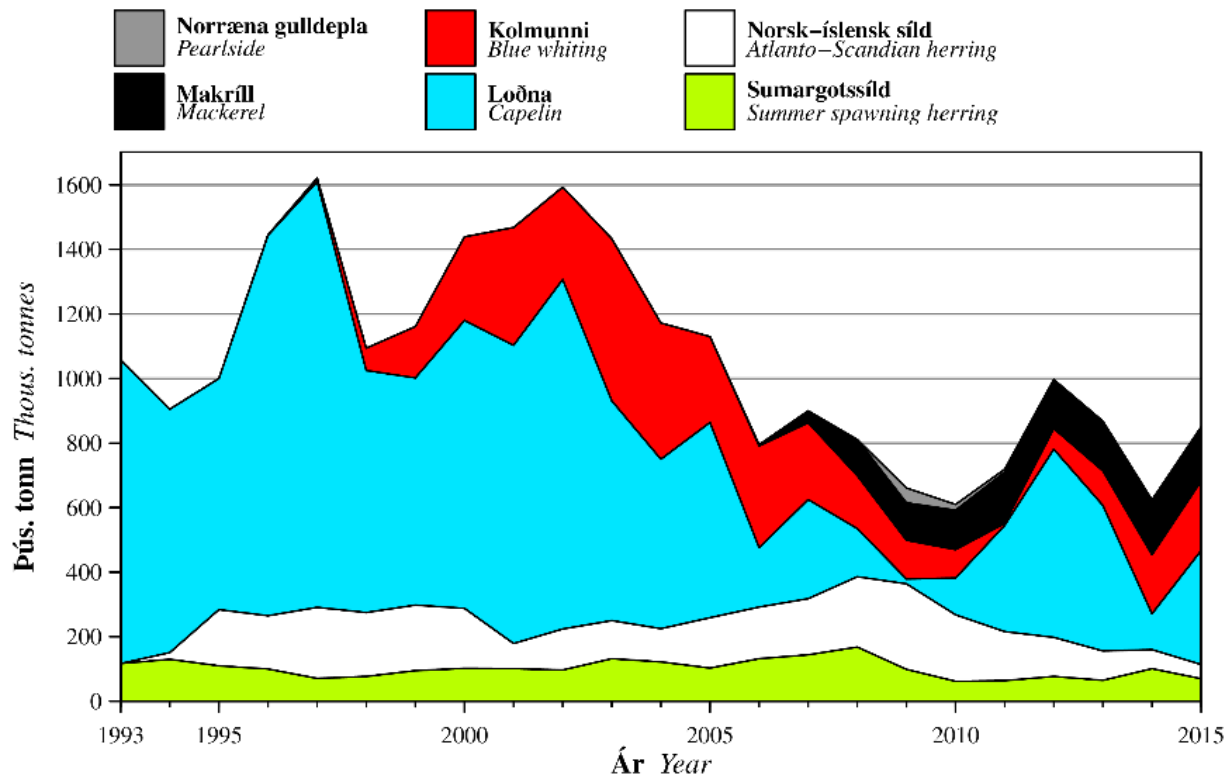


Vilhjalmsson, 1997

# Icelandic fishery: Main demersal fish and invertebrates



# Icelandic fishery: Main pelagic fish



# Single species advice with an ecosystem reference

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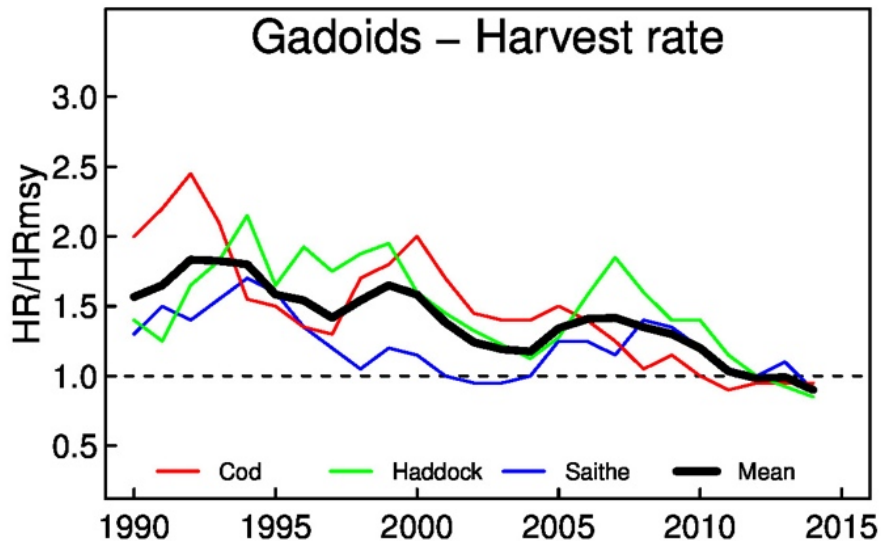
- The fisheries research, advice and management has first and foremost considered status and production of individual stocks but nevertheless with a reference to EA
- Large part of research related to EA, e.g. monitoring of environment,  $1^0$  and  $2^0$  production, habitat mapping, fishing gear and behaviour, and predator-prey interactions
- Management policy also has sustainability goals, e.g. area closures to protect small fish, spawning areas and coral fields, gear specifications
- The advice is based on HCR's (Harvest Control Rule), aims at achieving MSY through integration of EA and PA. Similar underlying principles as to ICES adviceory framwork

# Management plans and Harvest Control Rules (HCR)

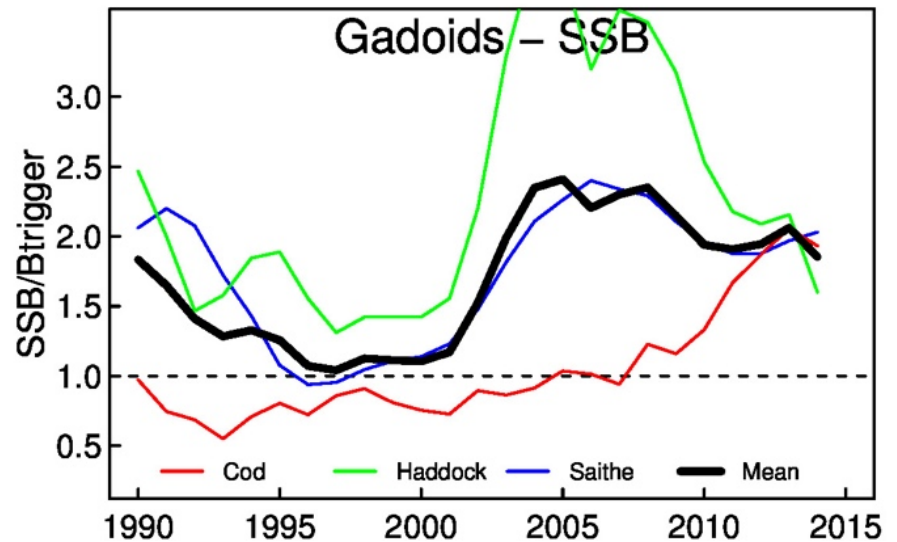
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- The development of HCR's are important prerequisite towards EBM, particularly in ecosystems where fisheries have large impact on stock development
- Recently HCR have been developed for some of the main Icelandic exploited fish stocks (i.e. cod, haddock, saithe, golden redfish and capelin)
- The HCR's have been evaluated against international standards on sustainability by ICES and subsequently adopted by authorities
- Authorities have followed HCR's for TAC advice, which in addition to fishing sustainability secures socio-economic benefits (stable industry, job security, steady market supply)
- Other stocks (ling, tusk, Atlantic wolffish, summer spawning herring) are being tested with respect to precautionary standpoints and sustainable exploitation
- For some of these species HCR should be completed by 2017

# Reduced pressure > larger stocks



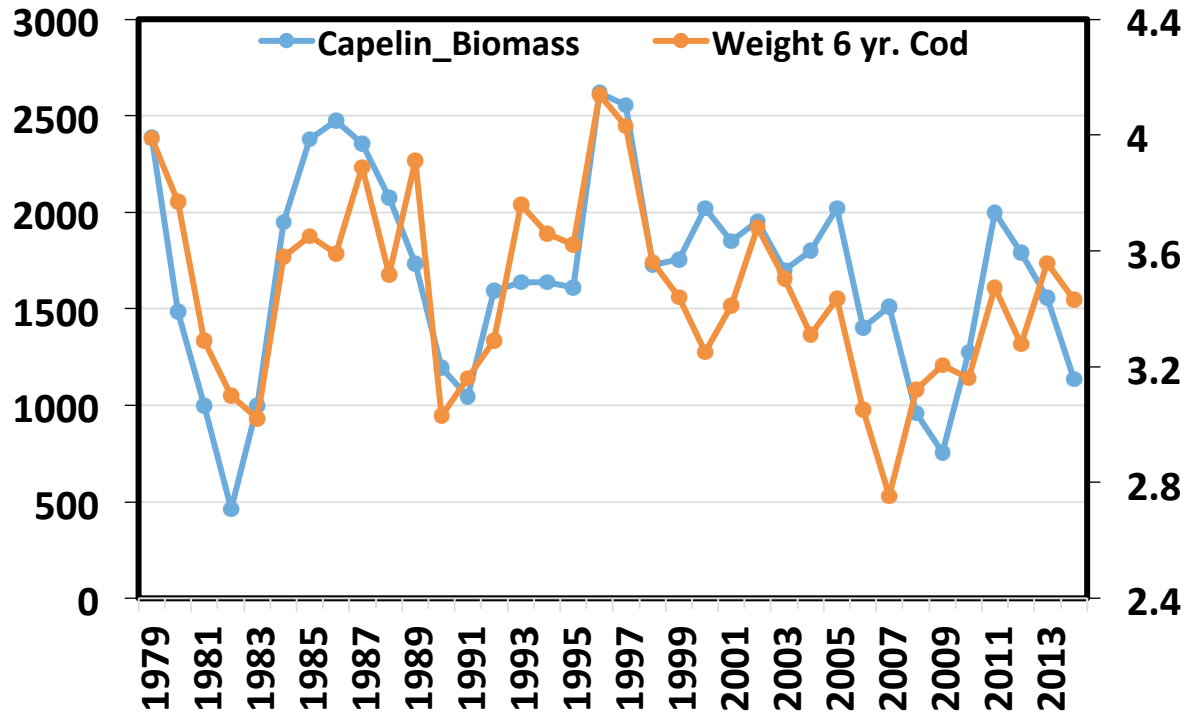
Exploitation rate has declined and is now near targeted HRmsy



Spawning stocks have been increasing and are above Btrigger

# Capelin biomass and cod weight

Capelin biomass, thousand tonnes

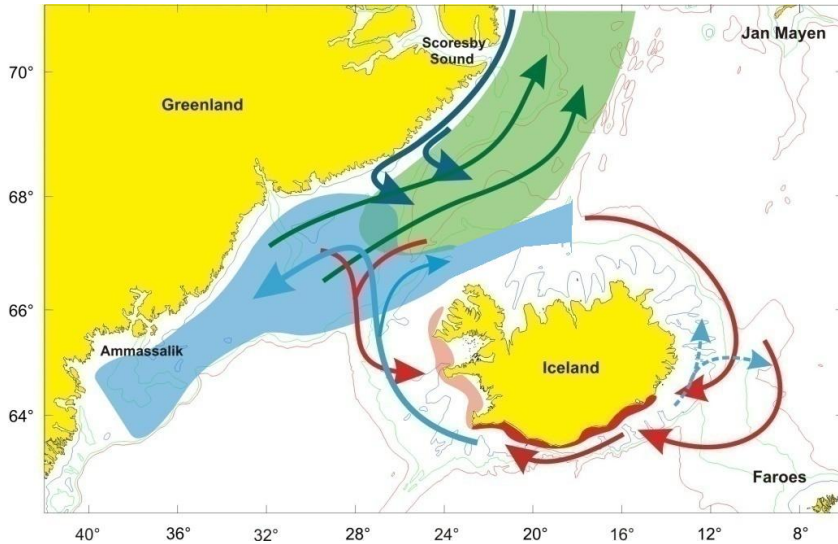


Mean weight 6 yr cod

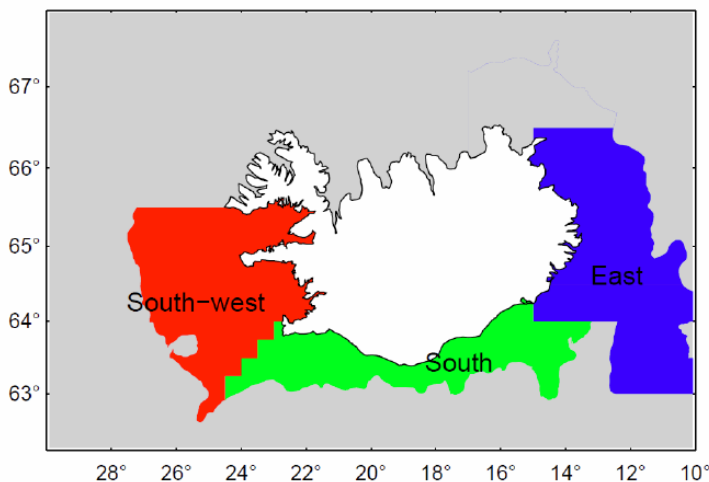




# Capelin HCR takes account of predation



- Capelin supports extensive fishery and is also a prey for many other species
- The fishery is conducted on pre-spawning capelin as the fish migrates to the spawning grounds

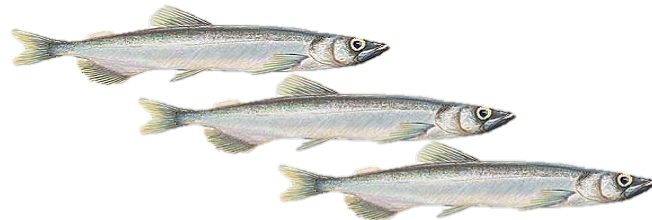


Abundance and distribution of cod, haddock and saithe is estimated and then potential consumption

# Capelin HCR

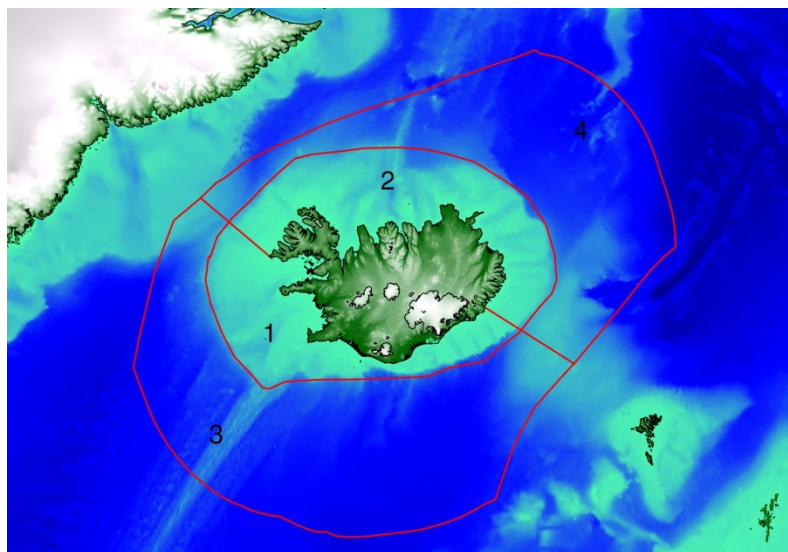
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- Takes account of uncertainty in the acoustic assessment of capelin
- It includes a predation model by demersal fish (cod, haddock, saithe)
- Leaves 150 000 tonnes ( $B_{lim}$ ) for spawning with 95% probability
- **Advised TAC** is the fish remaining after having the outcome from above



# The Icelandic ecoregion

## Ecosystem overview



Description of system , human induced pressures and how they impact on ecosystem  
EO an important step towards EBM

**Ecoregion description, 4 sub regions**

**Key signals within ecosystem**

**Human pressures**

Extraction of species/fishing

Abrasion

Contaminating compounds

Other anthropogenic activity

**State of ecosystem**

Habitat: benthic, pelagic

Phytoplankton, Zooplankton

Benthos and shellfish

Fish

Seabirds

Marine mammals

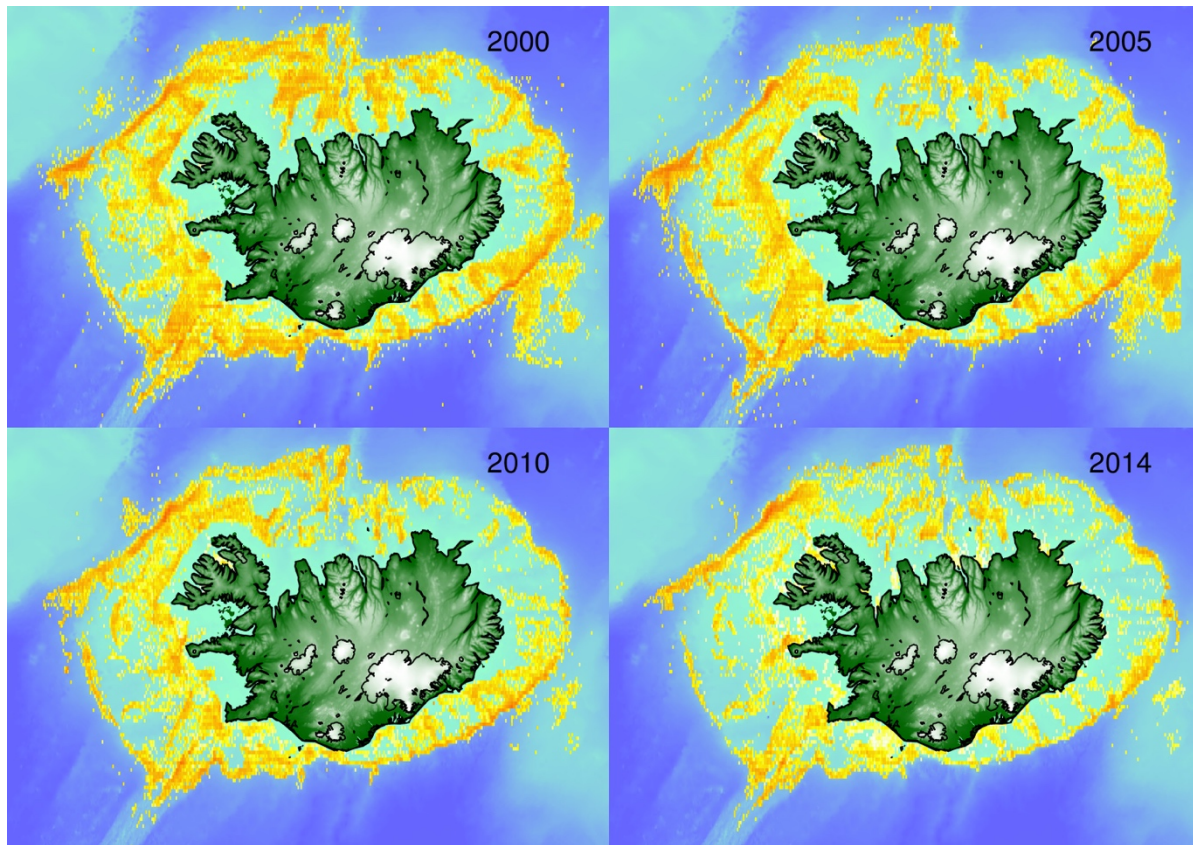
Non-indigenous species

Threatened/declining species and habitats

# Spatial distribution of bottom-trawl effort

## Log book data from fishery

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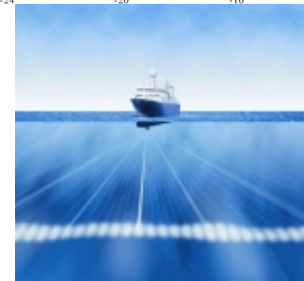
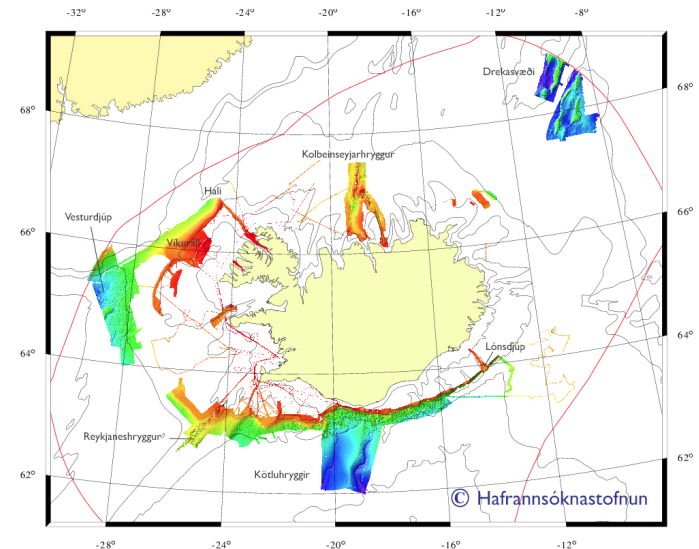


Reduced carbon foot print

Total effort reduced by 40% from 2000 to 2014

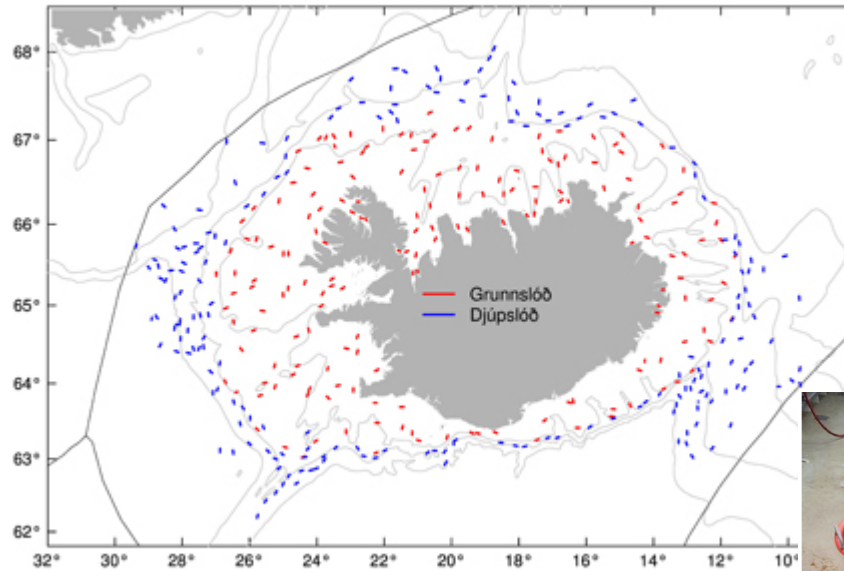
# Seabed and habitat mapping Plan for 2017-30

- Seabed mapping important in context of EA
- Only 12% Icelandic EEZ hitherto mapped
- Extensive mapping program of EEZ will start in 2017 and work is to be completed in 2030
- Secured support of 2.5 million US \$ annually
- Multi-beam mapping, sub-bottom measurements, gravity measurements, magnetic measurements
- Habitat and benthic community mapping



# Benthic megafauna mapping

- Pilot project started in 2015 to evaluate feasibility of making a benthic invertebrate by-catch investigation an integral part of the Icelandic Autumn Groundfish Survey
- Ca 400 stations within Icelandic EEZ on shelf edge to 1500 m
- Preliminary results:
  - Cold water ( $<0^{\circ}\text{C}$ ) average:  $<15$  species/haul
  - Warmer water ( $>0^{\circ}\text{C}$ ) average:  $>19$  species
  - Total species/taxons: 160



Blue (megafauna sampling stations)



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## To close

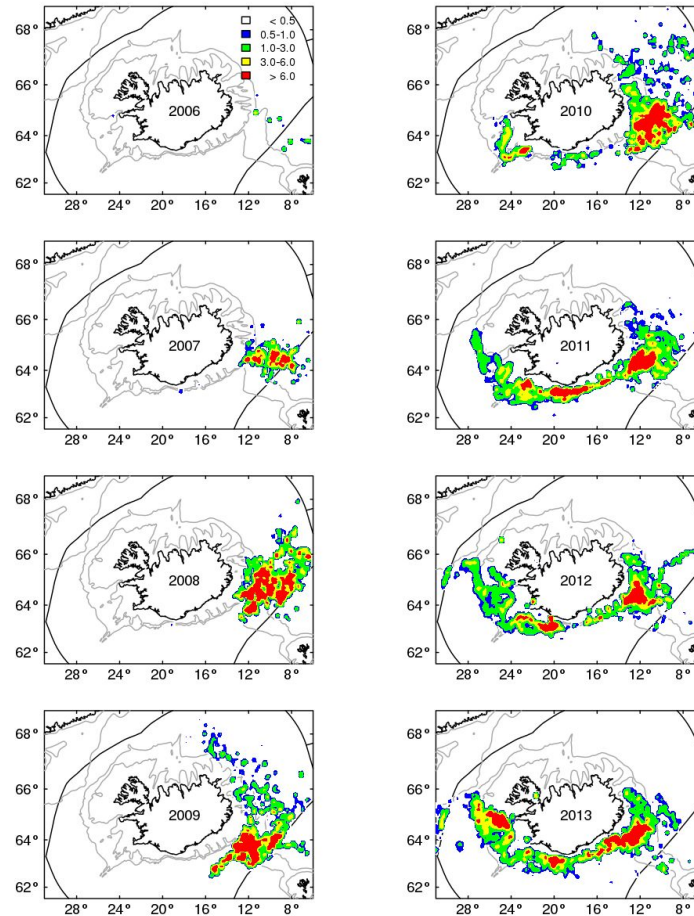
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- EA to management will only be advanced through step wise work and at multiple scales
- Important to begin through simplified approach such as systematic evaluation of most important elements and informing authorities and stakeholders on new thinking
- HCR's for different species a real step towards EA
- The fisheries advice provided by MFRI is based on achieving MSY through integration of EA and PA approaches
- MFRI will in coming years emphasize this part in the advice and link it to the single species advice of past years

# Mackerel fishery in Icelandic EEZ

## Times are changing

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# MFRI Annual advice, revised presentation: Short concise text and graphical presentation

- Annual advice on 42 stocks of 37 species of fish, invertebrates and mammals
- Revision of presentation in 2016
- Concise chapter on each species
- Detailed introduction
  - Ecosystem and precautionary approach, Advice on TAC
- Overview on ecosystem
  - Ecoregion definition, sub-areas
  - Key signals, environment, ecosystem
  - Human pressures
  - State of ecosystem
- Overviews on fisheries
  - Fleet
  - Catches
  - Effort by gear type
  - Management

