Blue Reef

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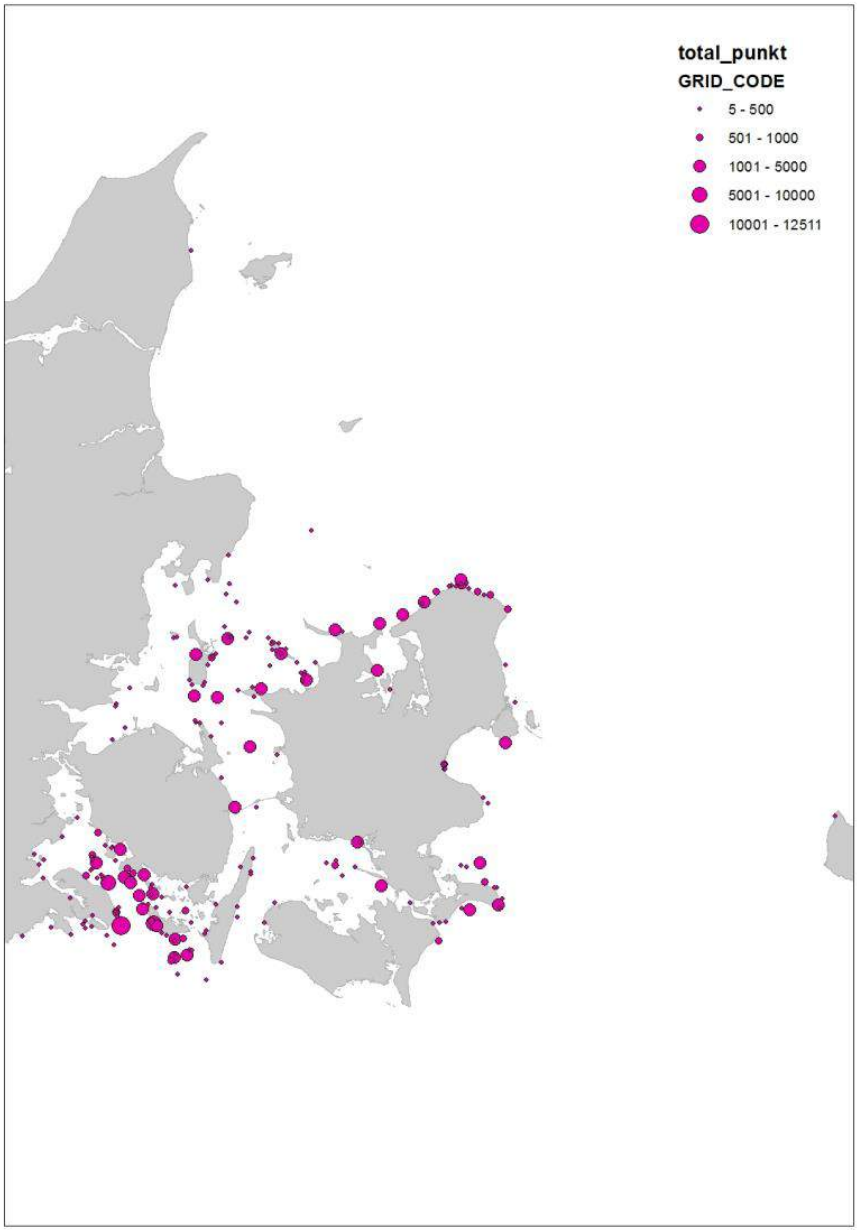
DTU Aqua
National Institute of Aquatic Resources

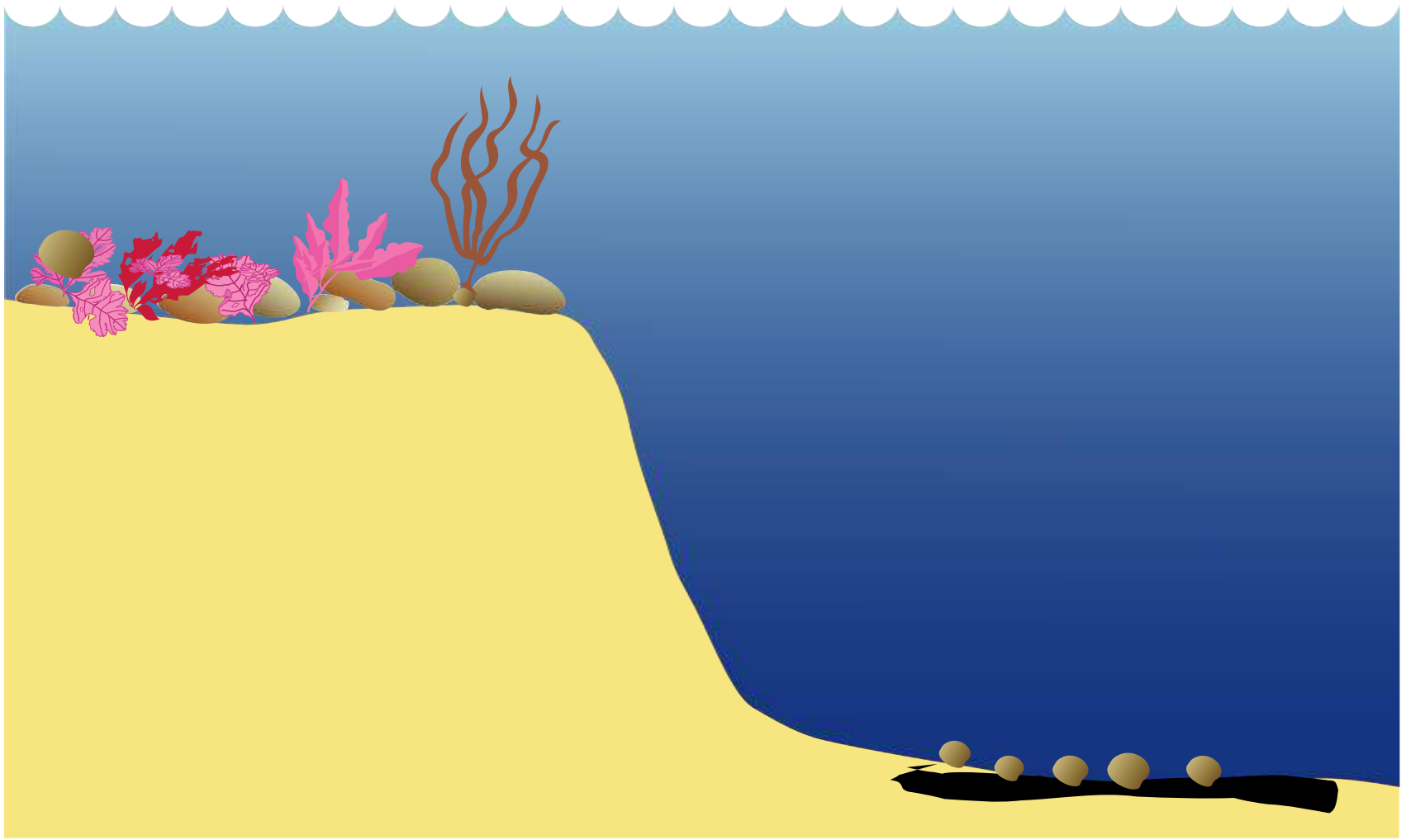
DCE, Århus University
Danish Center for Environment and Energy

Why do we need to restore shallow cavernous reefs in Danish waters?

Map from <u>one</u> fisher involved in boulder extraction

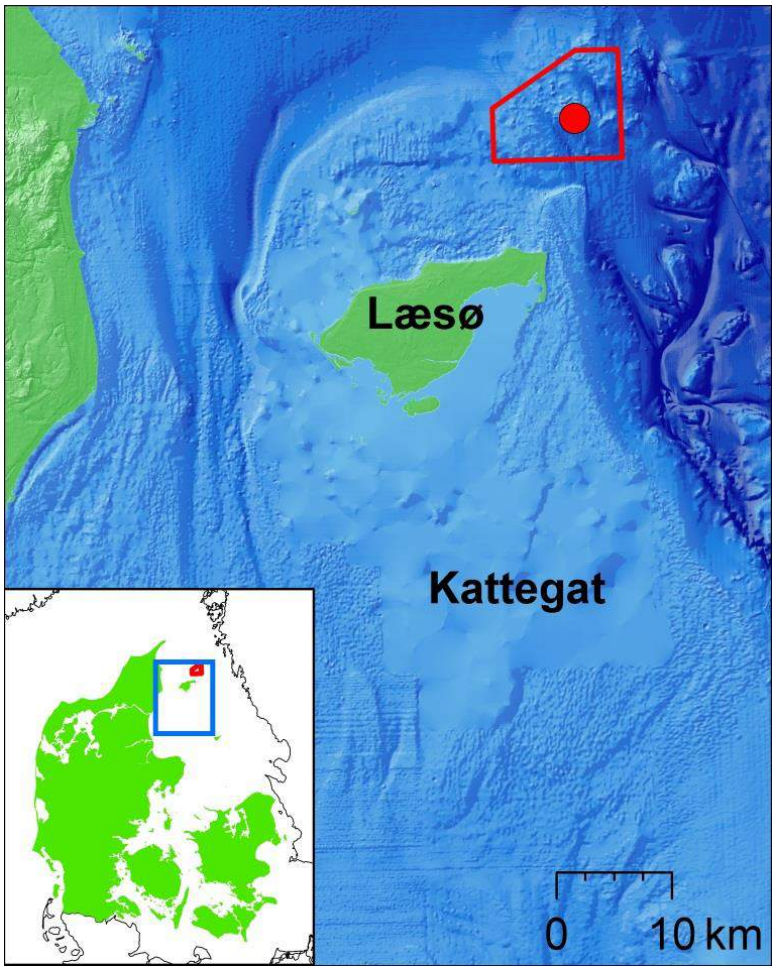


What happens when large boulders are removed from reef areas?



Project aims:

- To restore/improve the nature quality status for Læsø Tindel reef.
- Document the effect on biological communities
  - General flora and fauna (AAU)
  - Fish communities (DTU Aqua)



Blue Reef: 2006-2013

Photo: Karsten Dahl

Document

– **Stop further erosion**

Photo: Karsten Dahl

Document

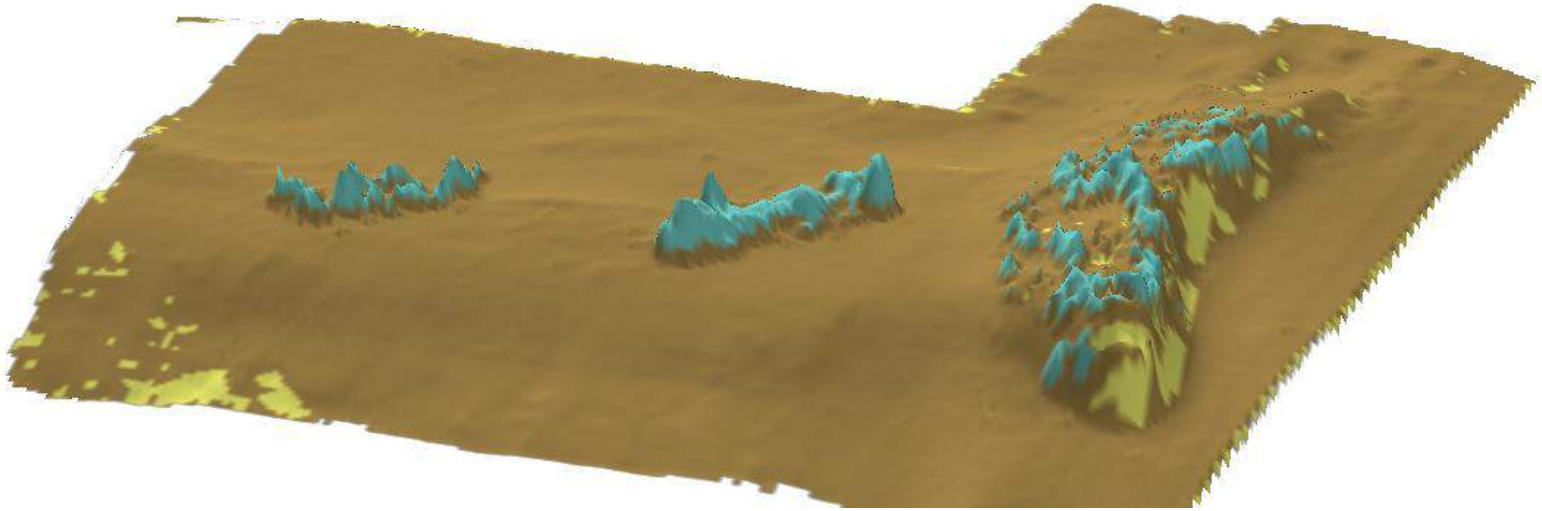
– **Re-establish original depth of ~1.2 m (now at ~4 m)**

Photo: Karsten Dahl

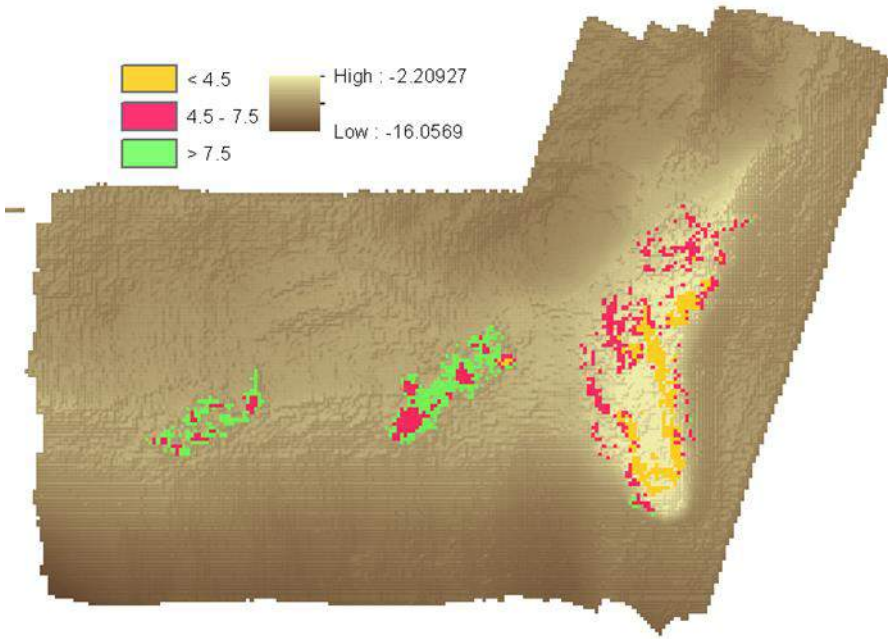
Document

- **Restore perennial vegetation and bottom fauna**
- **Ensure good habitat for fish and shellfish**

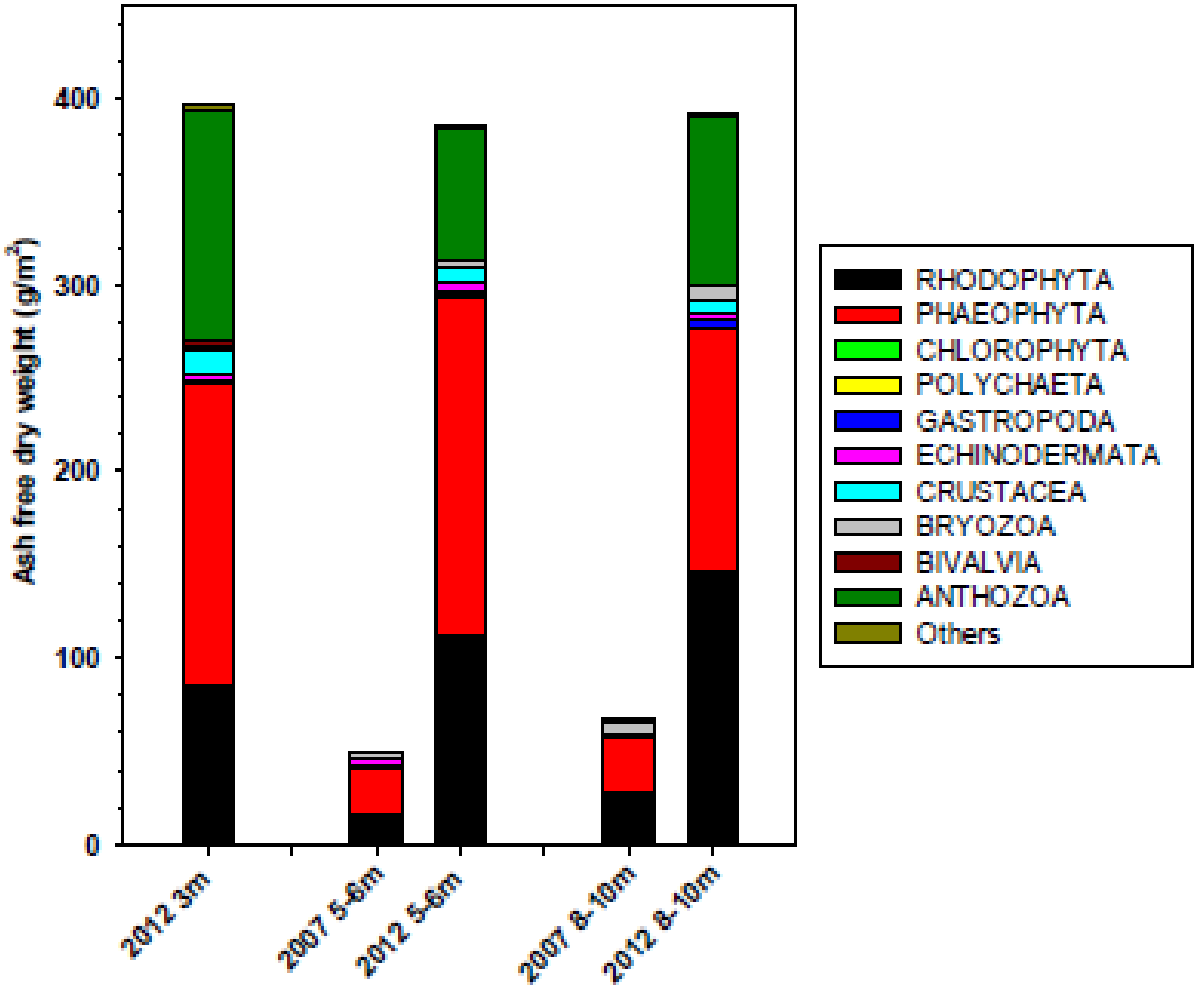
Photo: Karsten Dahl



- **New stone areas at depth intervals:**
  - **1½-4½m - 7 175 m²**
  - **4½-7½m - 11 725 m²**
  - **7½-10m - 8 500 m²**



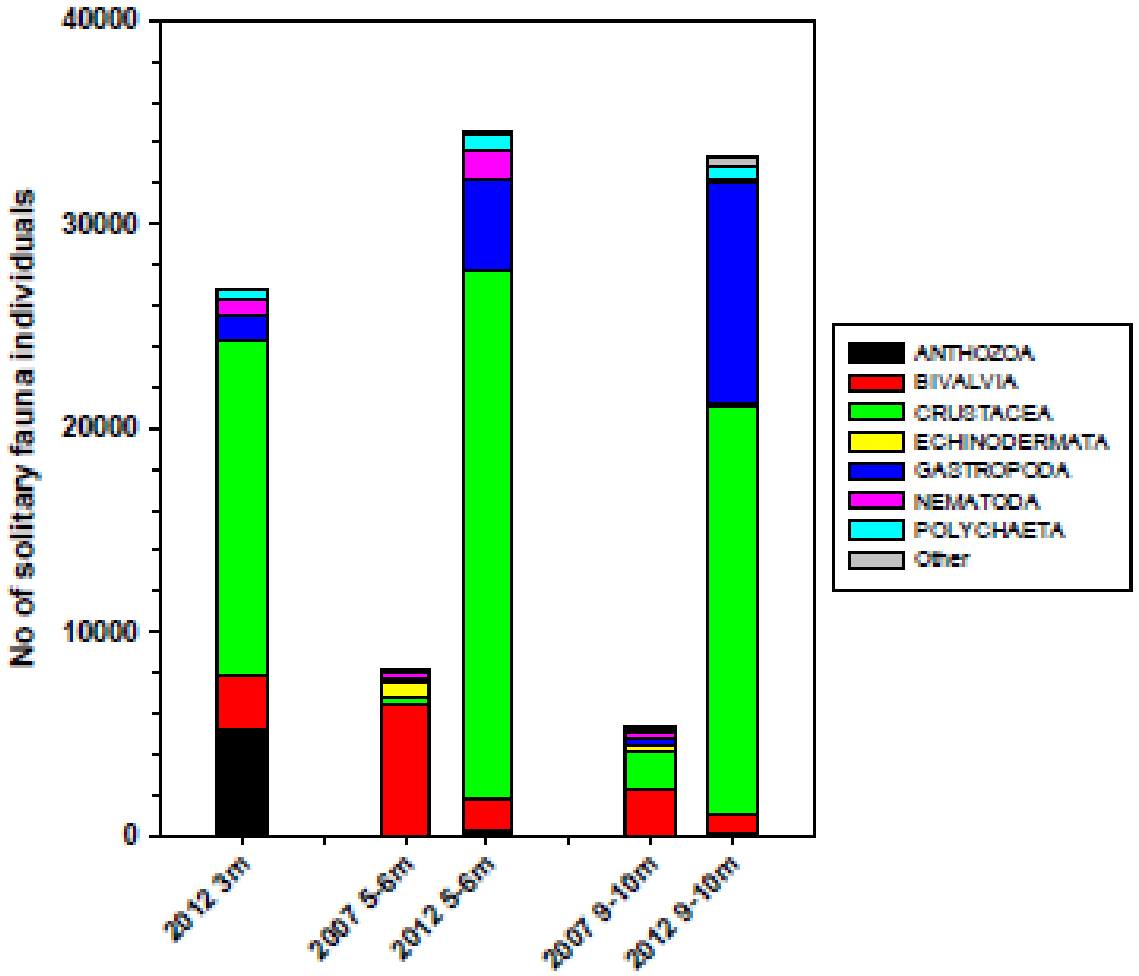

2012


Ash free dry weight (g/m²)
400
300
200
100
0
2012 3m
2007 5-6m
2012 5-6m
2007 8-10m
2012 8-10m
RHODOPHYTA
PHAEOPHYTA
CHLOROPHYTA
POLYCHAETA
GASTROPODA
ECHINODERMATA
CRUSTACEA
BRYOZOA
BIVALVIA
ANTHOZOA
Others

Bivalves (red) in 2007 replaced in part by crustaceans (green)

and some gastropods

(blue)



What is the netto increase in biological biomass?

- **What was lost in Ash-Free Dry Weight (the ”old” bottom – now buried)**
  - **Fauna** **220 kg**
  - **Algal vegetation** **1.280 kg**
  - **Total** **1.480 kg (< 3% infauna)**

- **What was gained – so far?**

Estimated **gain** of:

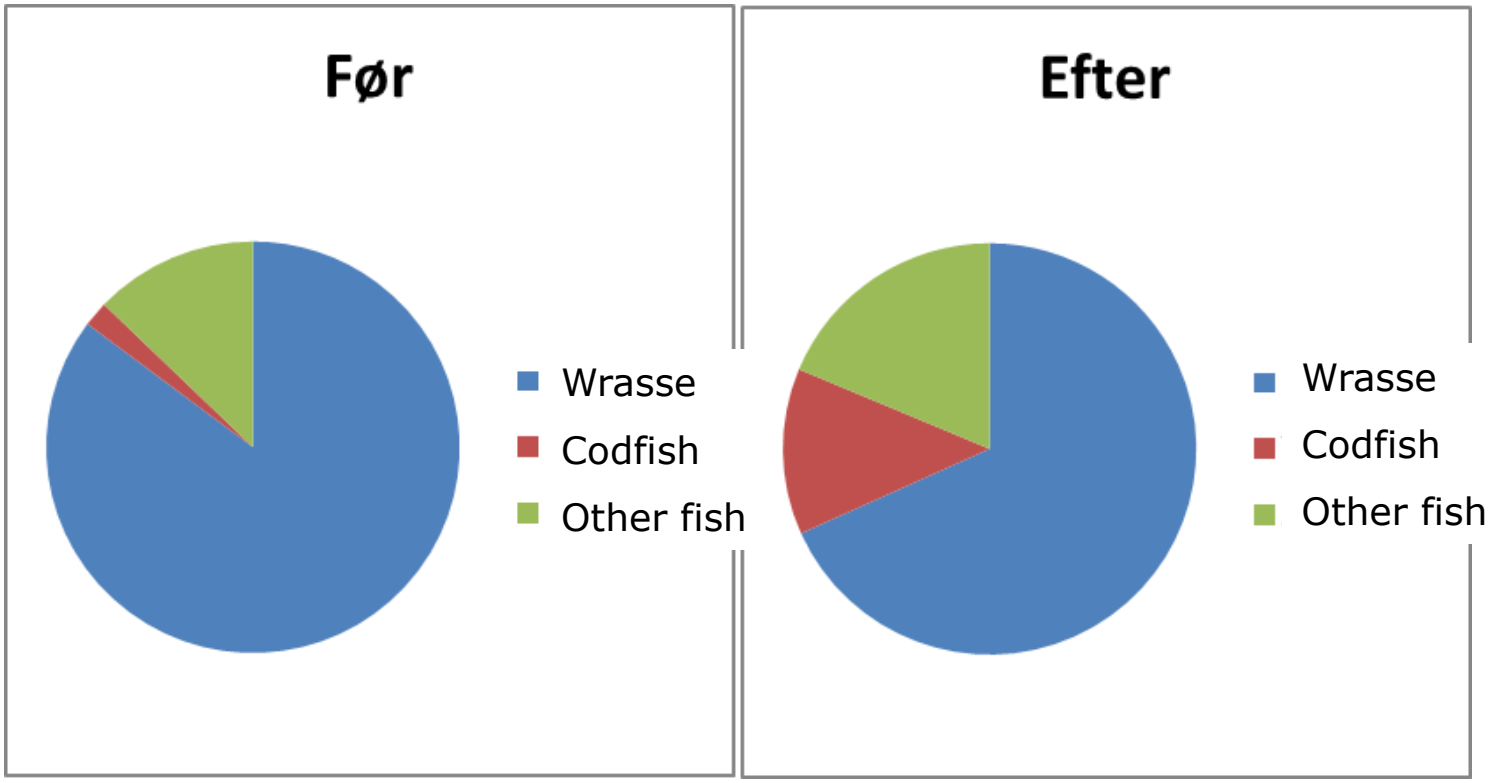
6100 kg ASFD algal biomass

2850 kg fauna biomass

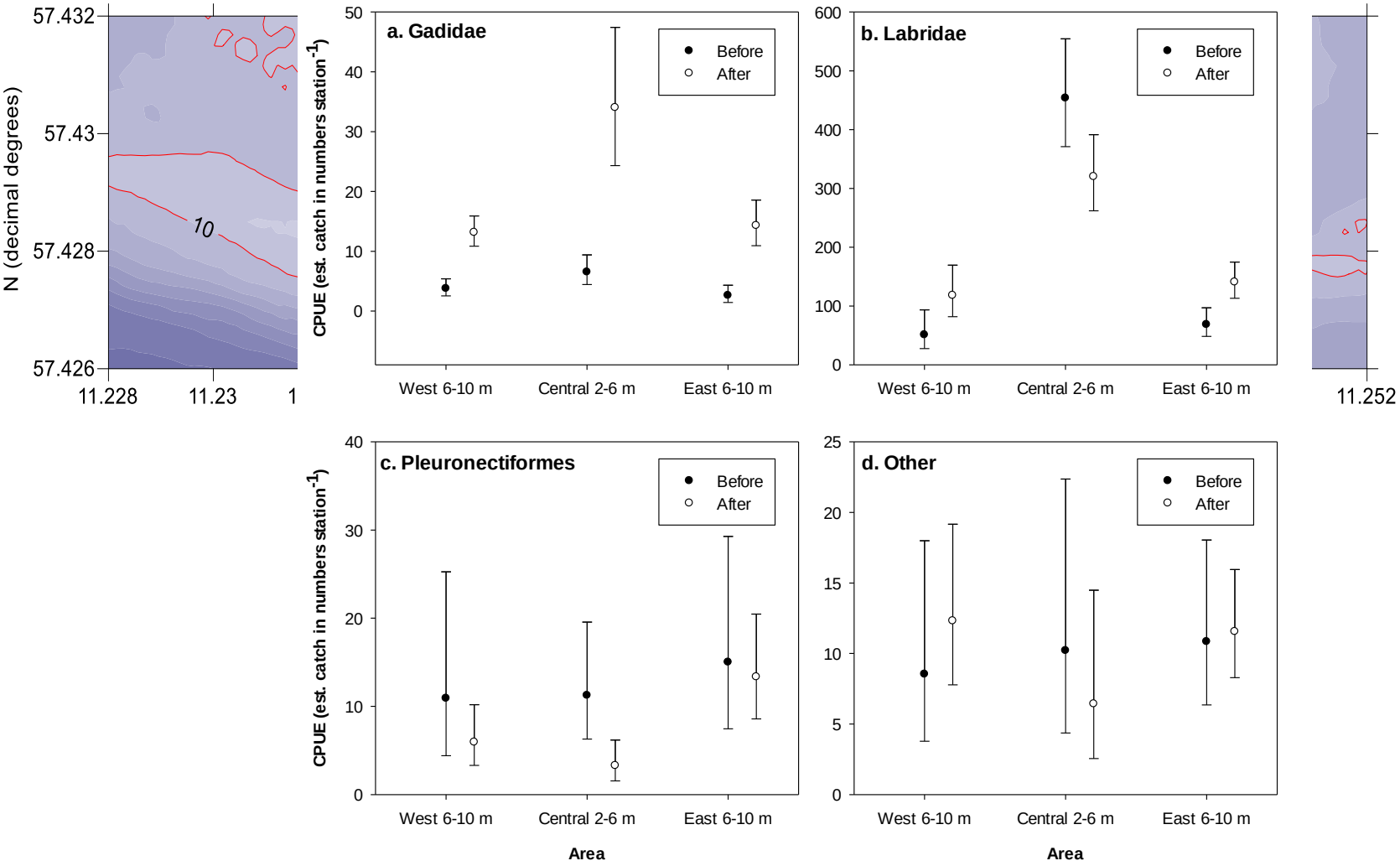
For more detail:

Stenberg, Støttrup et al. 2015.

Relative abundance of wrasses (Labridae), cod-fish (Gadidae) and Other fish in the multi-mesh gillnets

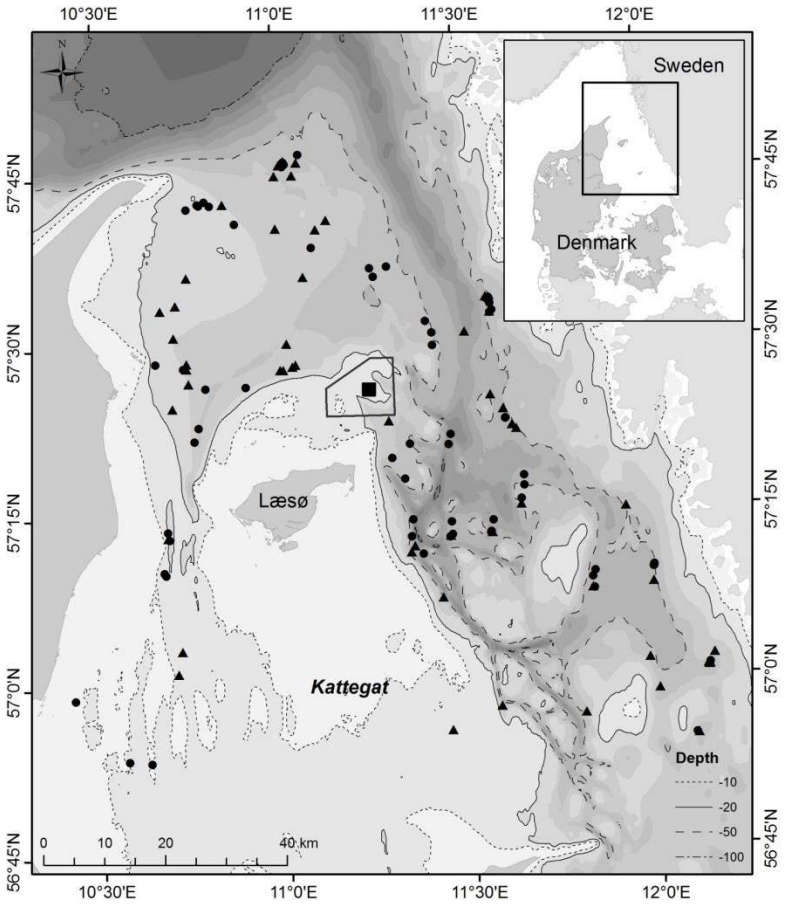


Abundance of codfish, wrasses, flatfish and other fish in multi-meshed gillnets, before and after the restoration of the reef.



Støttrup et al. 2014

Not a full BACI - Lack of a control site



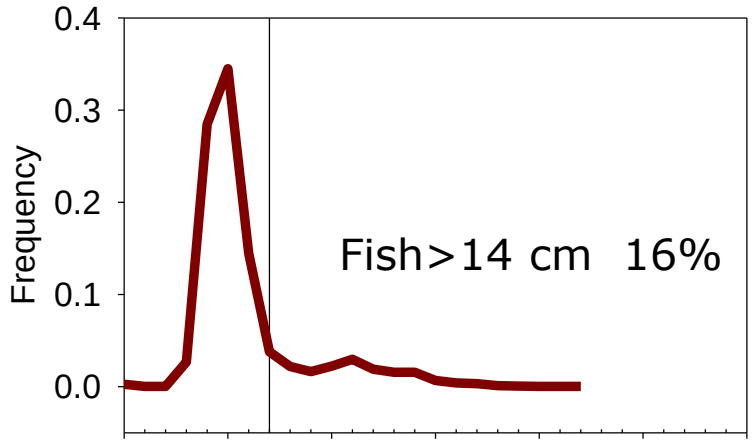
CPUE from research trawl surveys (BITS) within 50 km distance from reef.

Cod data: no increase in abundance Before (2005-2007) to After (2010-2012).

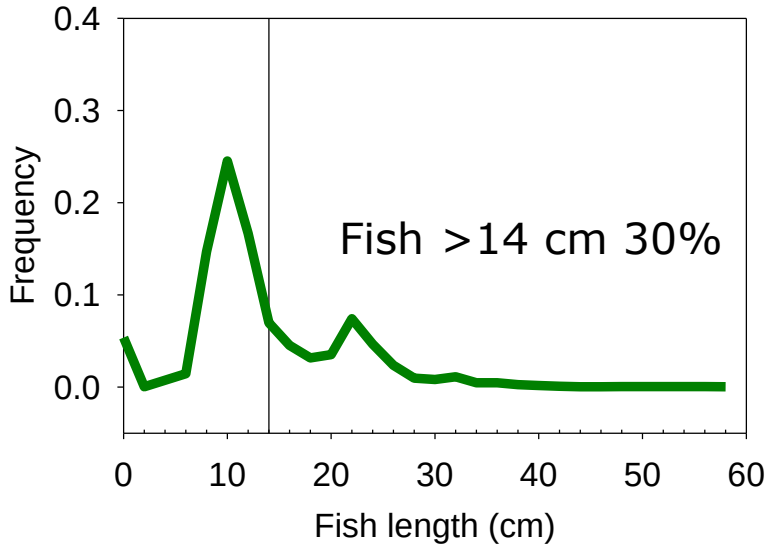
Støttrup et al. 2014

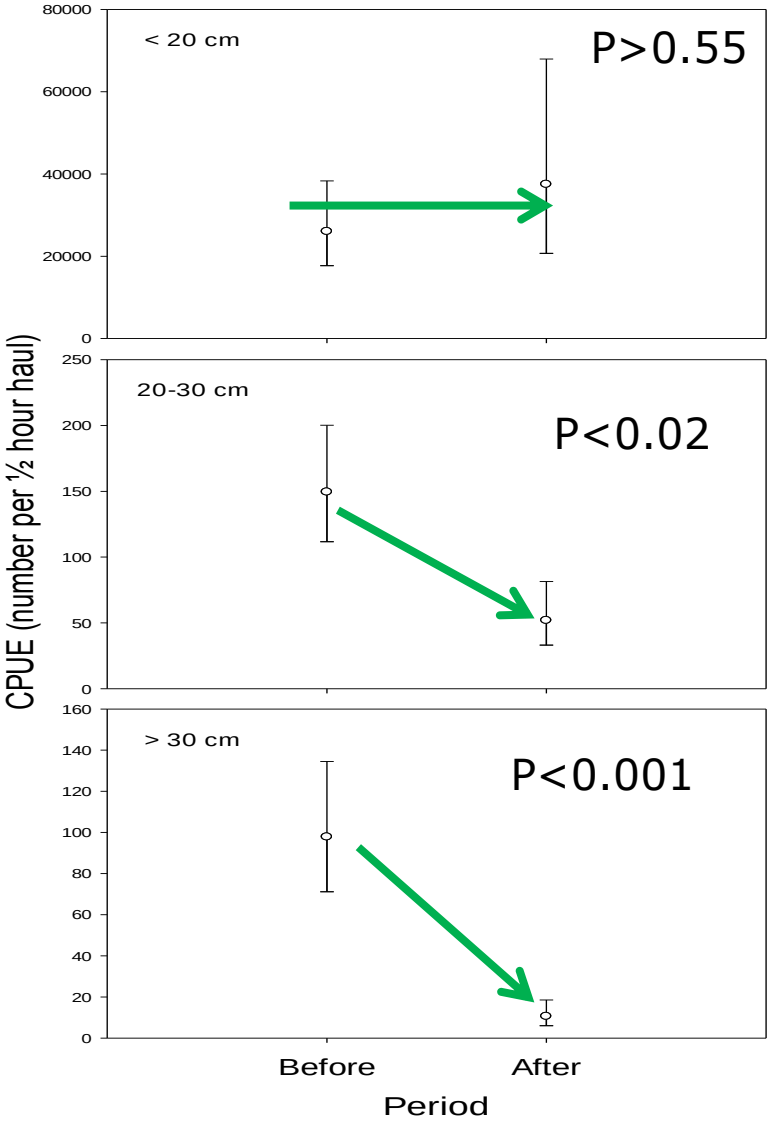
Change in overall size distribution of fish

Before



After





On **Blue Reef:**

Cod < 20 cm; p<0.0001

Cod 20-30 cm; p=0.0001

Cod >30 cm; p=0.0004

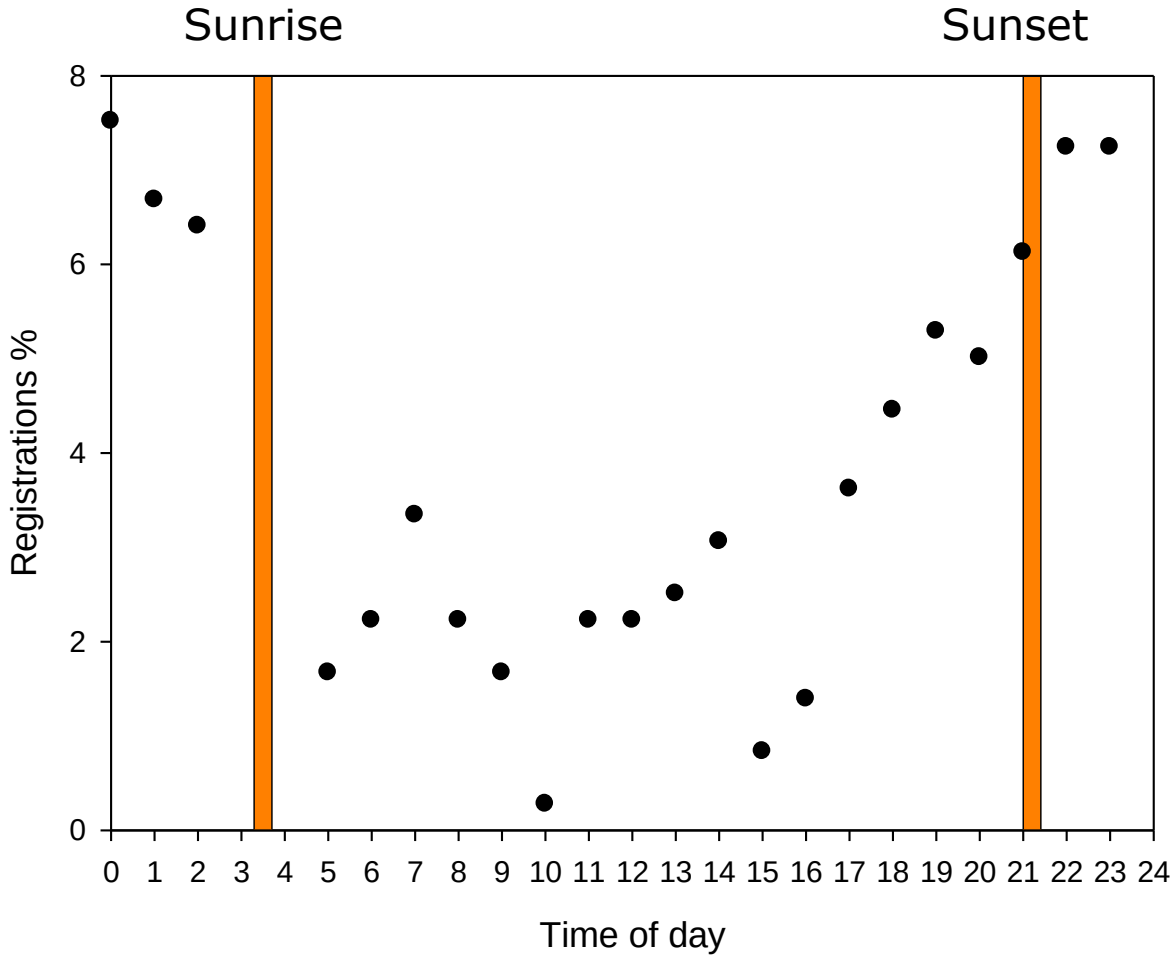
CPUE from research trawl surveys

Before = 2005-2007

After = 2010-2012

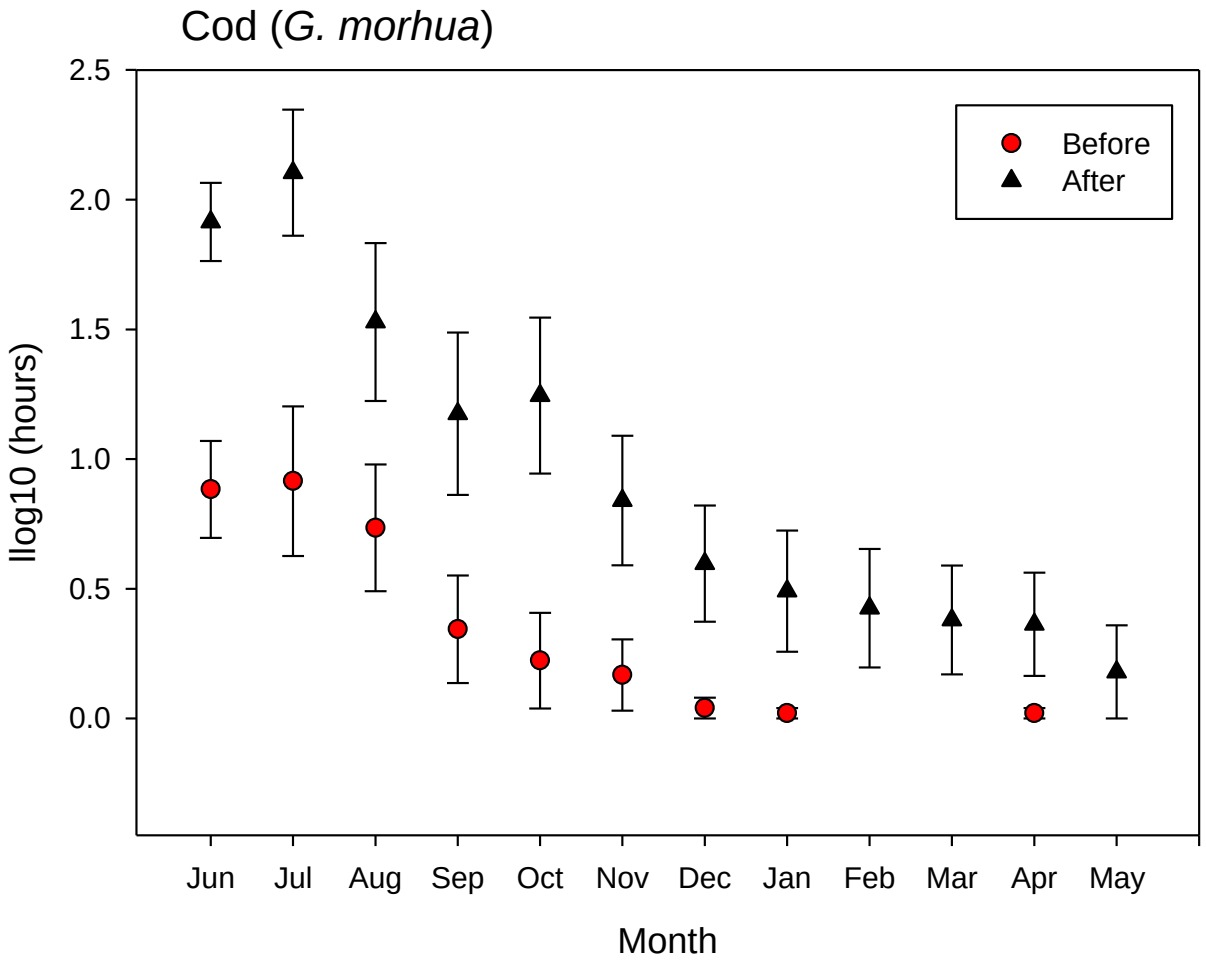
Støttrup et al. 2014

Tracking cod throughout the day/night in July 2007 – one cod data

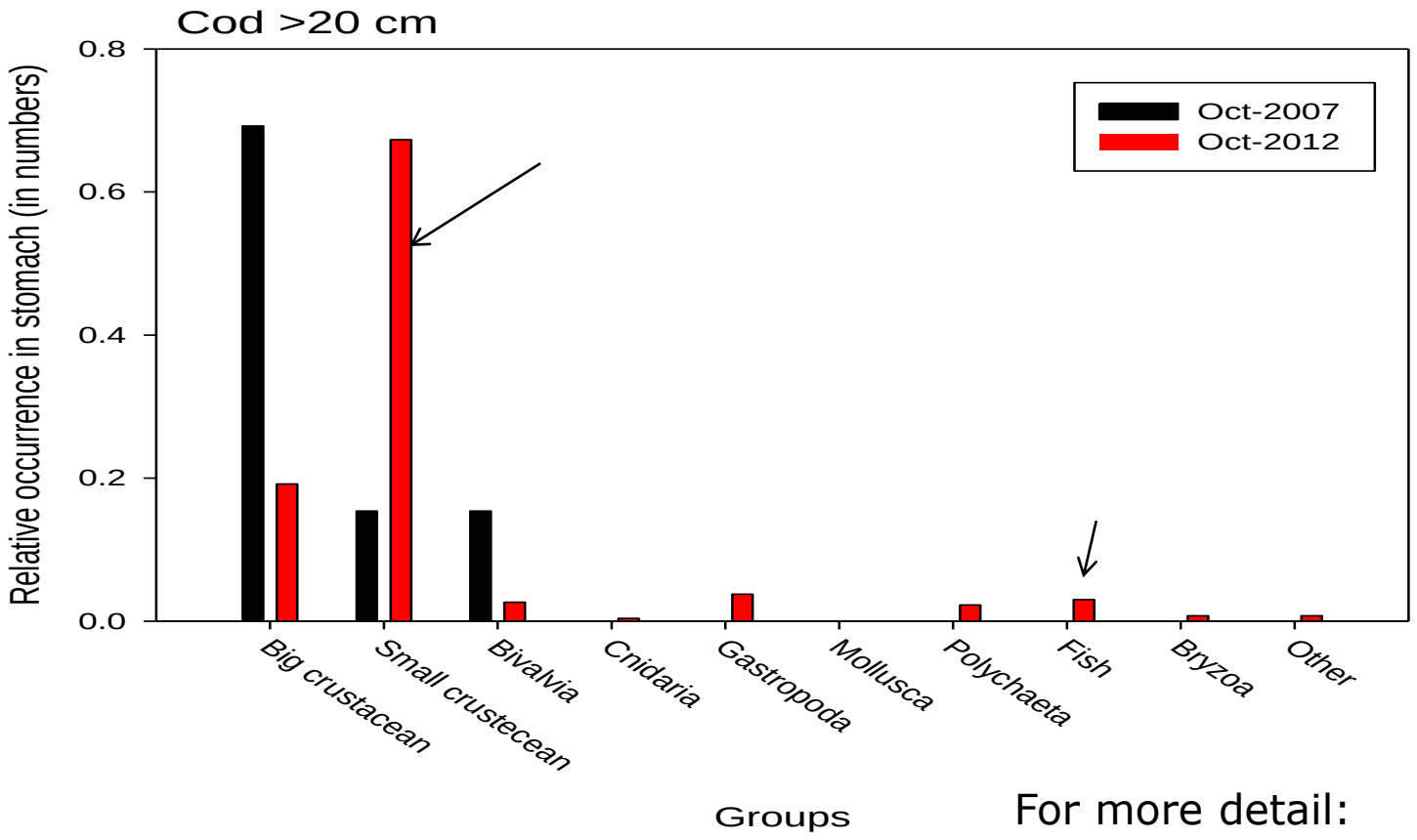


Stenberg, Støttrup et al. 2015.

Average number of hours/month per tagged cod spent on the reef at Læsø Trindel before and after the restoration.



Stomach content of cod > 20 cm



For more detail:

Stenberg, Støttrup et al. 2015.

Blue Reef:
Restoration of the stone reef attracts purpoises

Mikkelsen et al. 2013.

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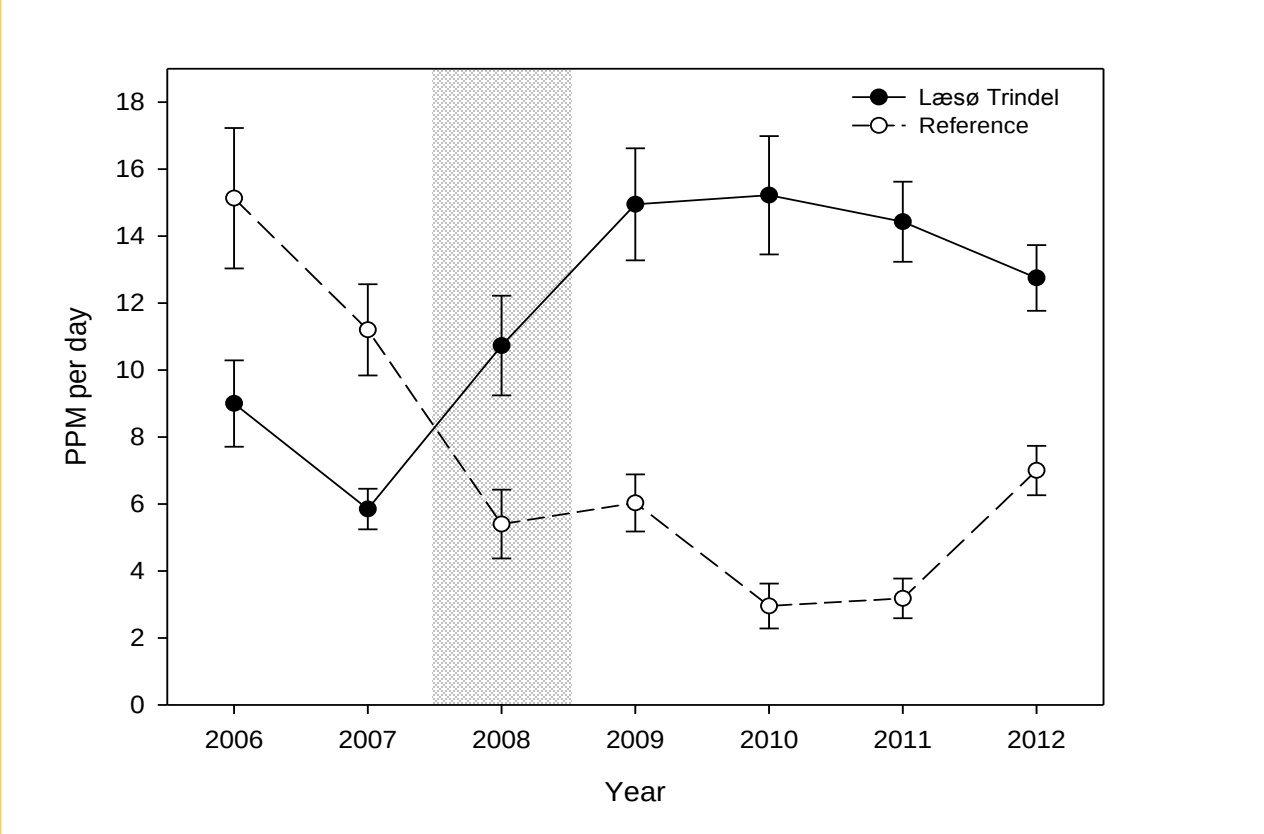
Results



PPM (Porpoise Positive Minute)

Mikkelsen et al. 2013.

www.bluereef.dk

Best Practice for Reef restoration:

http://naturstyrelsen.dk/media/nst/Attachments/Bestpracticestonereefenglishversion.pdf

See **Video** at:

http://lifevideos.eu/videos/?id=LIFE06_NAT_DK_000159_01_EN_HABIT.mp4

Conclusions

- Reef stabilised and shallow part restored
- Significant increase in benthic macrophyte and bottom fauna biomasses
- Fish fauna **Before / After** was dominated by species belonging to the wrasse family (Labridae).
- Cod and saithe (Gadidae) were **Before** infrequent but increased significantly **After** (factor 3-4).
- A full BACI may have given more conclusive results as to whether the increase in cod was due to the restored reef.

Conclusions

- Size distribution patterns in fish changed to include larger individuals (relative occurrence of fish >14 cm increased by a factor 2)
- Higher frequency of larger cod in restored reef area relative to surrounding area
- Activity of cod on the reef showed a clear daily rhythm (active on shallow parts during the night and passive in deeper parts during the day). Activity on reef increased **After.**
- Porpoises spent more time on Blue Reef **After** restoration

Acknowledgements

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