

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT B  
STRUCTURAL AND COHESION POLICIES



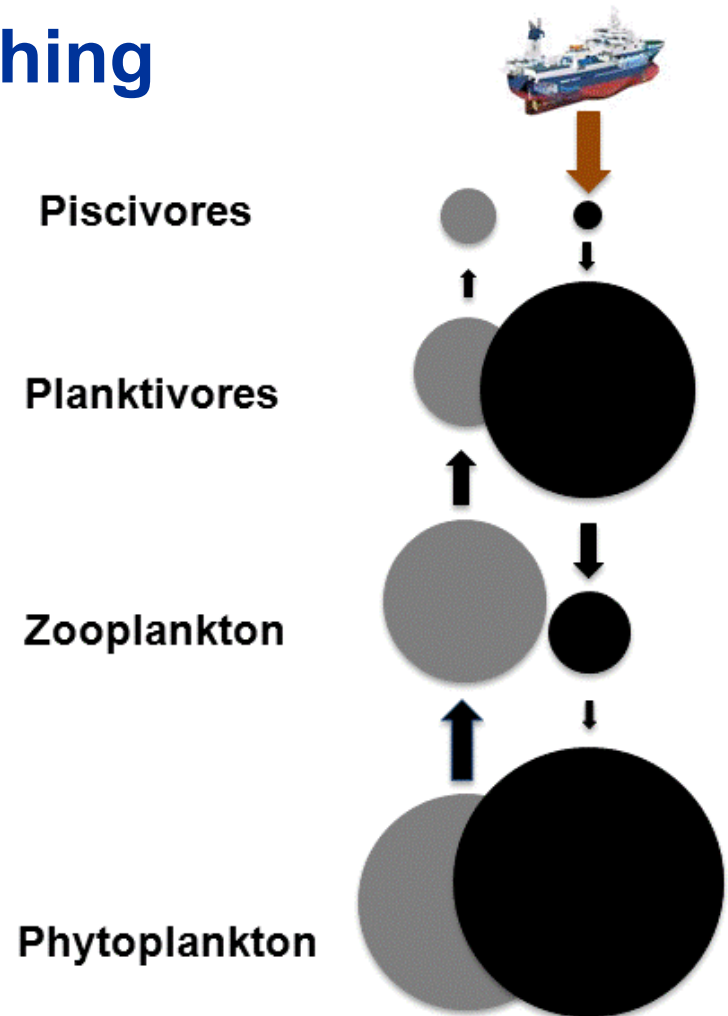
# DOES OVERFISHING PROMOTE ALGAL BLOOMS?

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## Algae are influenced by Fishing through Trophic cascades!

- Overfishing change predator-prey relations  
= increases in smaller fish  
= decreases in herbivores  
= increases in algae

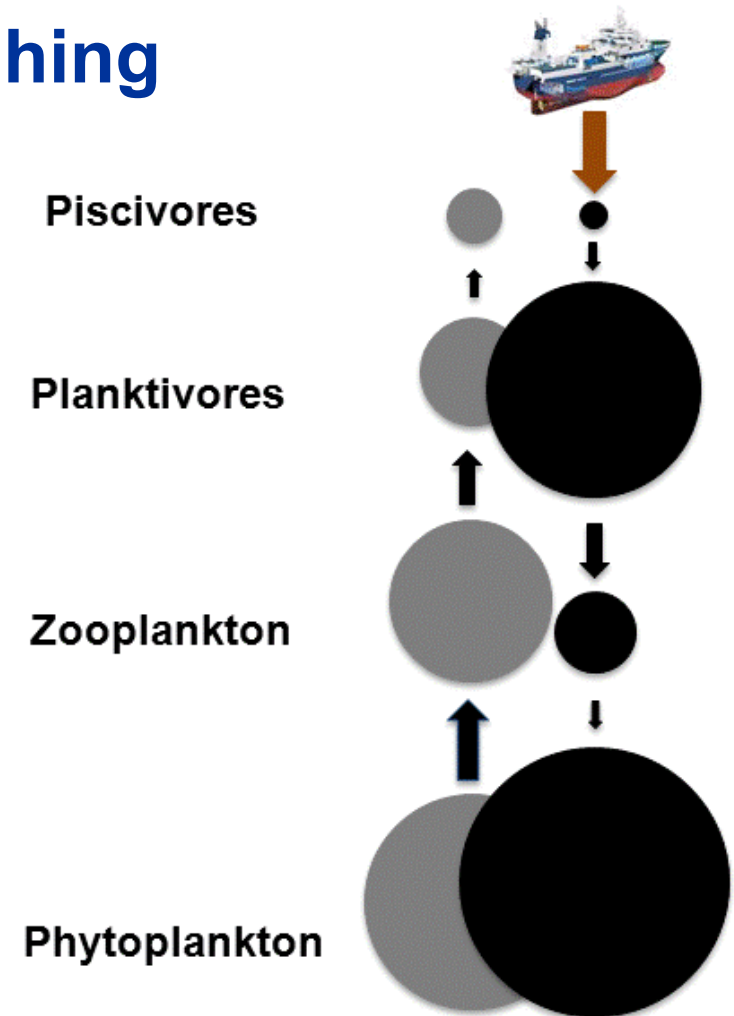


Source: Möllman 2011

## Algae are influenced by Fishing through Trophic cascades!

- Overfishing change predator-prey relations
  - = increases in smaller fish
  - = decreases in herbivores
  - = increases in algae

**Does overfishing promote algal blooms?**



Source: Möllman 2011

## Key findings

- Harmful algal blooms have negative effects on fisheries in Europe
- Overfishing contributes to algal blooms
- Overfishing and eutrophication create synergistic effects, together promoting algal blooms
- Offshore fishing can increase coastal blooms



## Algal blooms

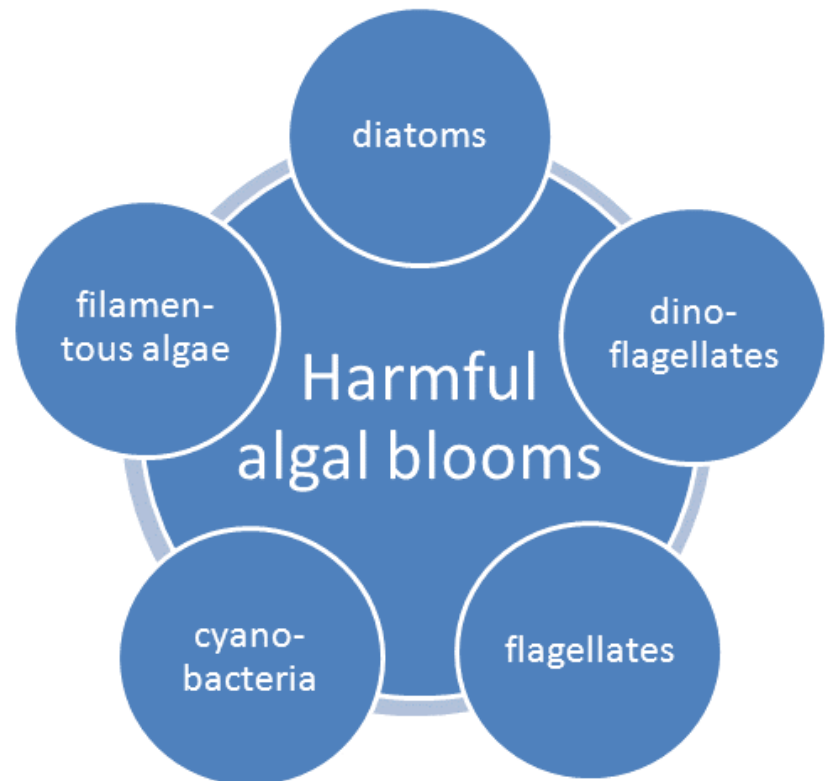
- Rapid excessive growth of algae and/or photosynthesizing bacteria
- Wide variety of organisms that cause a wide variety of problems = harmful algal blooms (HABs)
- Total cost of HABs in Europe estimated to at least 865 million euro per year

Source: Ecoharm 2003



## Harmful algal blooms

- Mostly microscopic organisms
- Two main groups of harmful blooms:
  1. Toxic blooms
  2. High density blooms

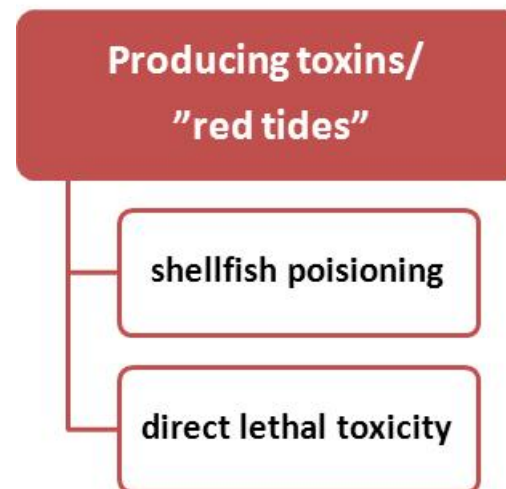


Source: Graneli and Turner 2006

## Harmful algal blooms

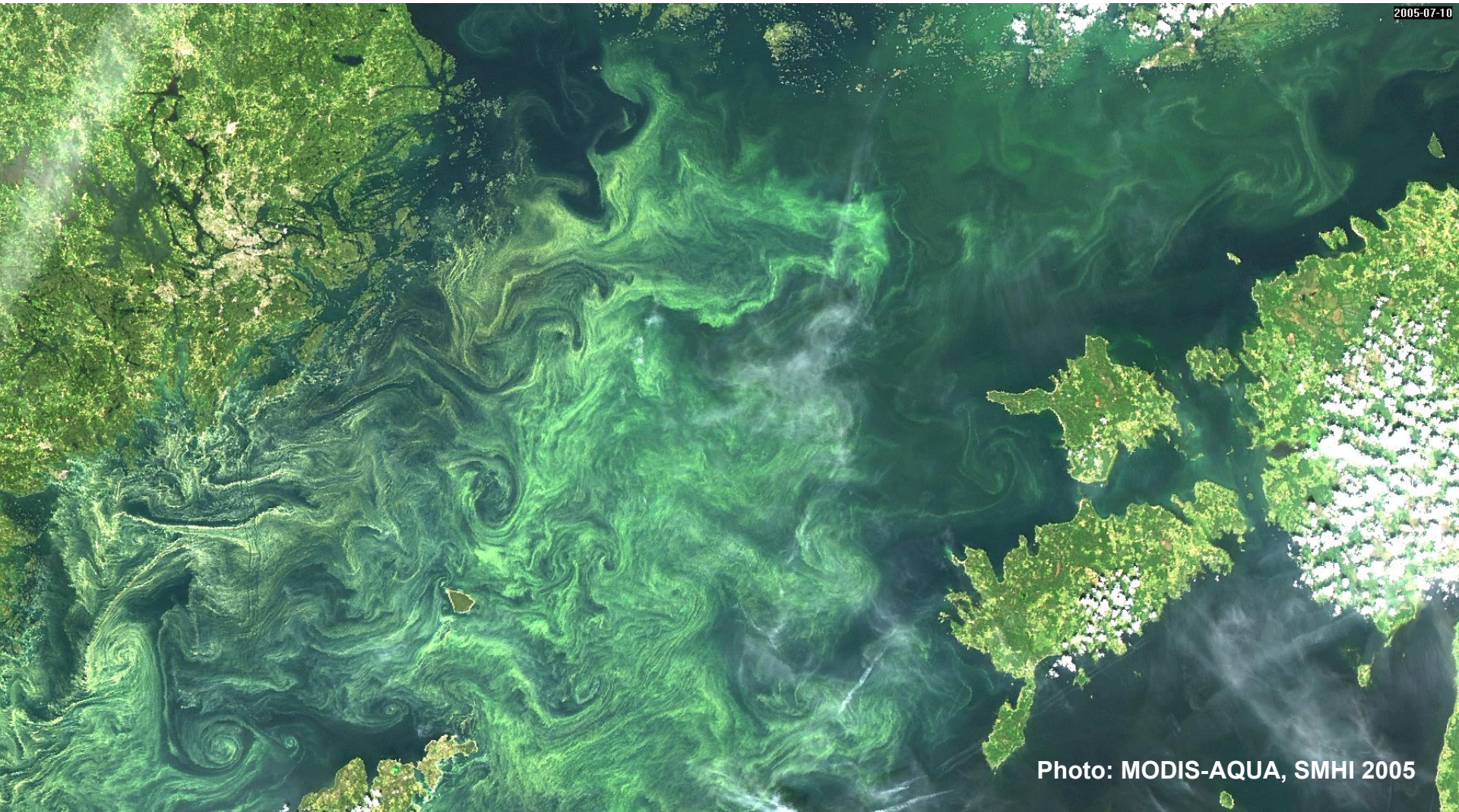
Toxin producing blooms:

- Seafood toxin blooms
- Fish killing blooms





# Harmful algal blooms



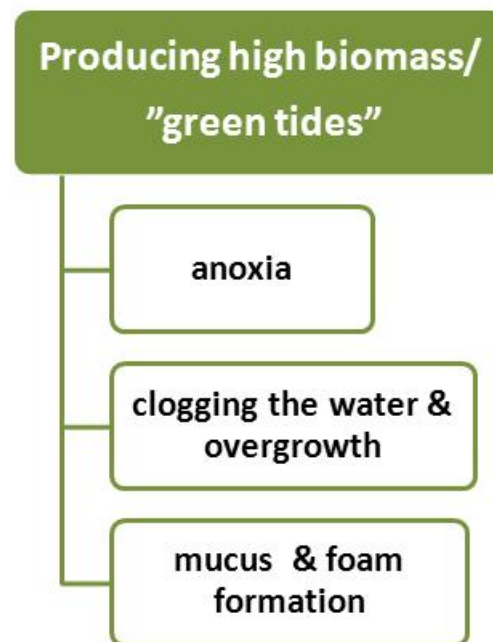
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Photo: MODIS-AQUA, SMHI 2005

# Harmful algal blooms

## High density blooms:

- Anoxia
  - one event killed 10 million kg mussels in the Netherlands in 2001
- Overgrowth & Mucus formation
  - loss of recruitment habitats
  - economic loss due to clogging and impairment of gear







## Harmful algal blooms

### High density blooms:

- Anoxia
  - one event killed 10 million kg mussels in the Netherlands in 2001
- Overgrowth & Mucus formation
  - loss of recruitment habitats
  - economic loss due to clogging and impairment of gear

60 % of seagrass beds on the Swedish west coast have disappeared due to overgrowth

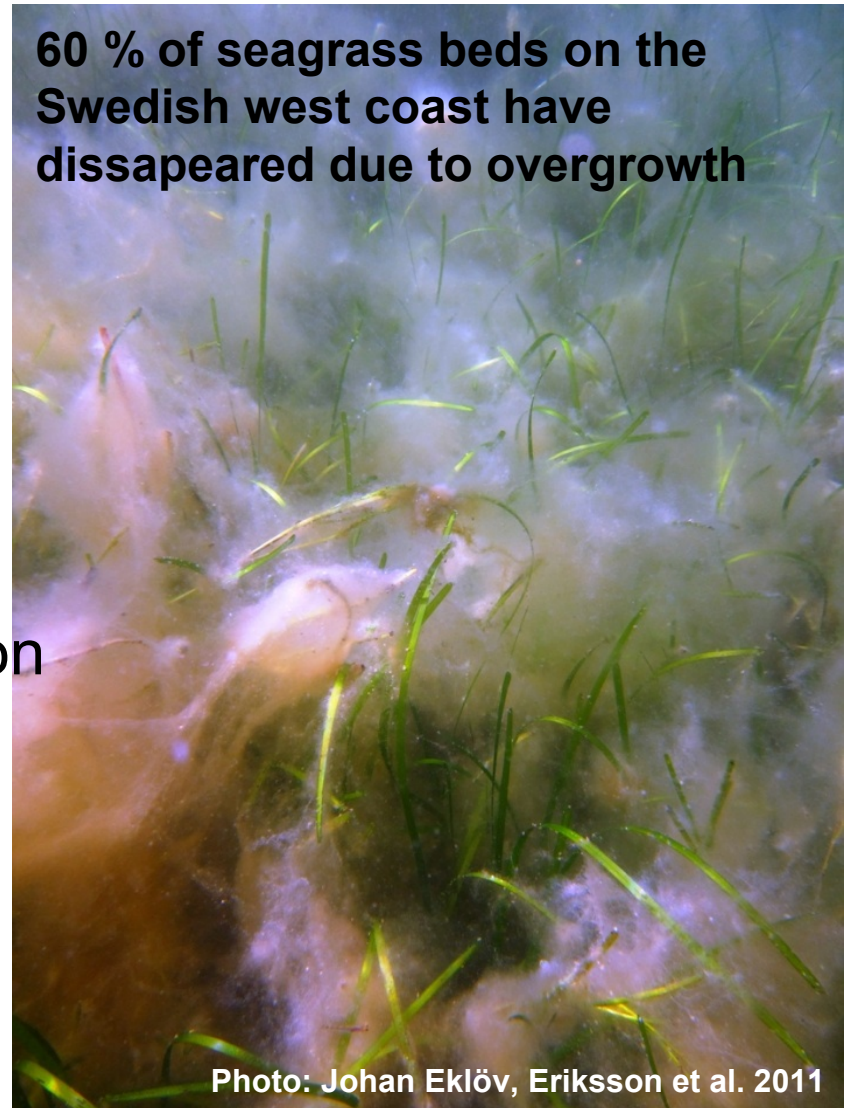


Photo: Johan Eklöv, Eriksson et al. 2011



# Mucilage formation in the Marmara Sea









**Heavy mucilage blooms  
deleted 91 % of the profit  
in 2007-2008**



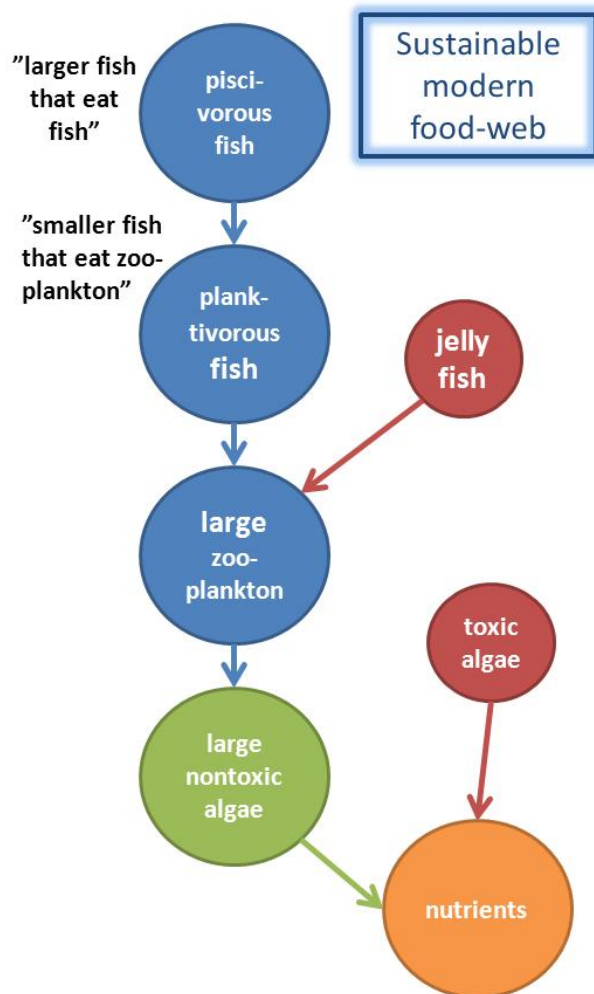


## Harmful algal blooms

- Total cost of HABs for commercial fisheries in Europe estimated to at least 177 million euro per year

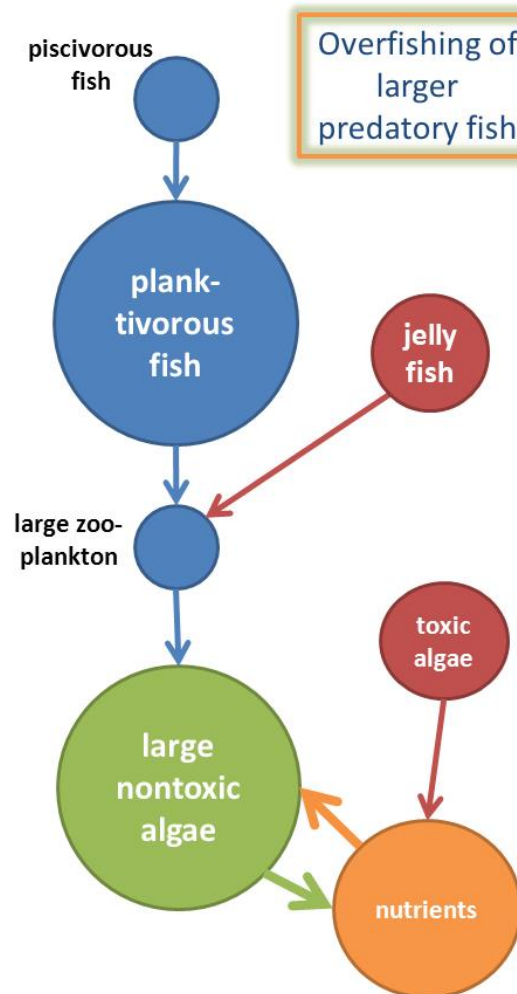
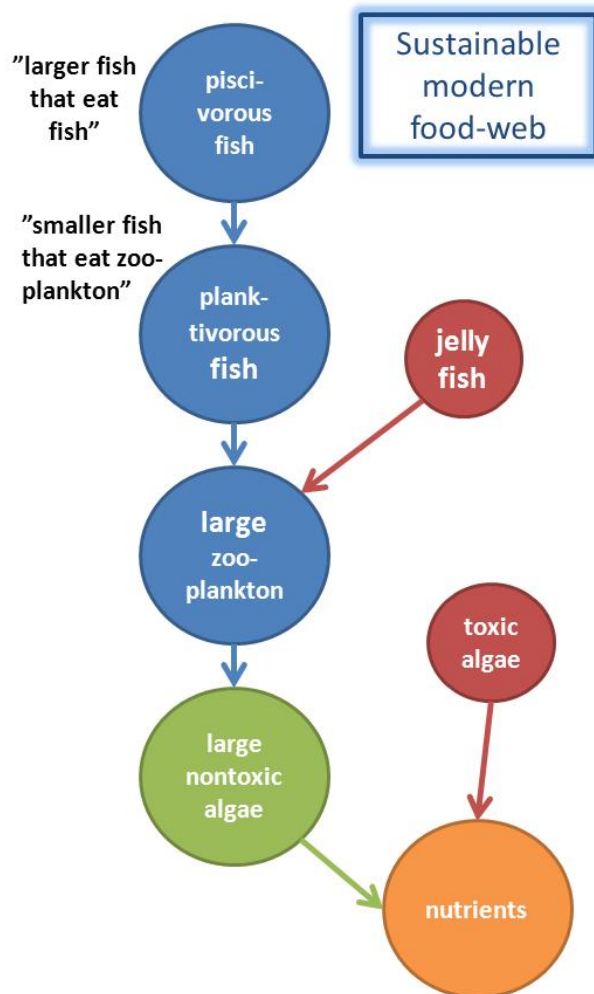
Source: Ecoharm 2003

# Predicting effects of overfishing on harmful algal blooms



- Network analysis using food web relations from temperate pelagic systems
- Parameterized using real North Sea data
- 3 general harmful groups:
  1. Algae that form high density blooms (e.g. *Phaeocystis*, diatoms)
  2. Toxic algae
  3. Jelly fish

Source: Vasas et al 2007

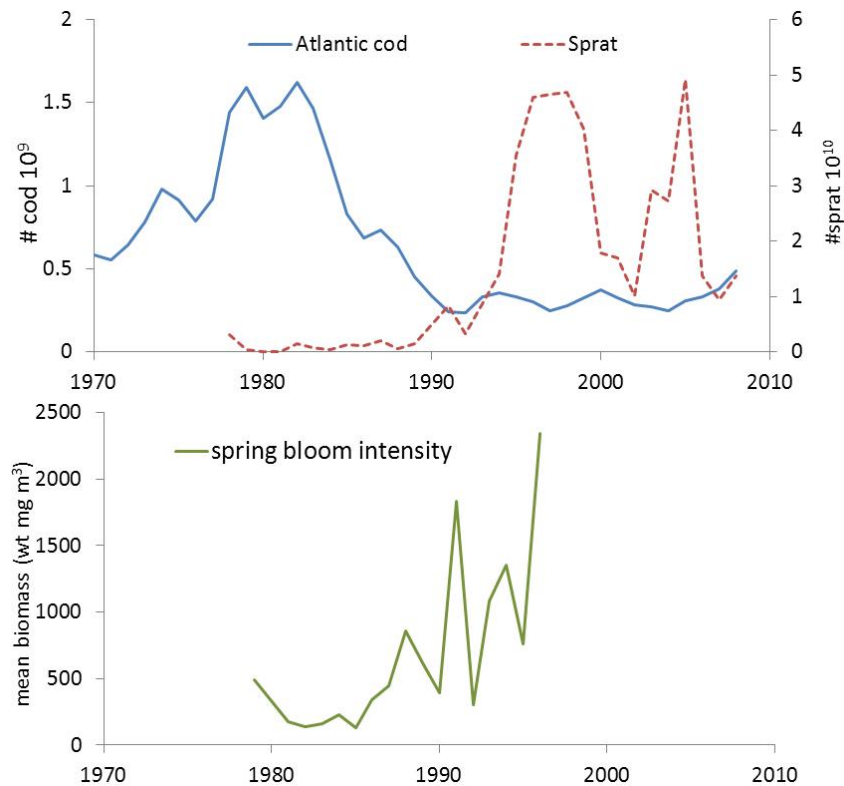


Decreasing larger predatory fish predicts an increase in large nontoxic algae!

But only together with increasing nutrient loads = eutrophication

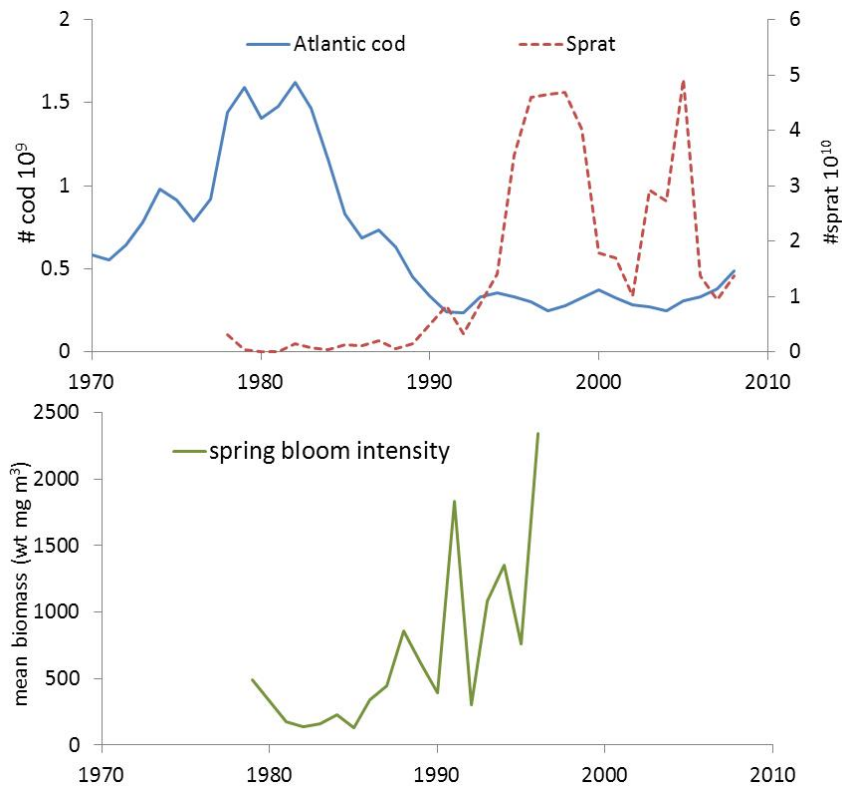
Source: Vasas et al 2007

## Baltic Sea



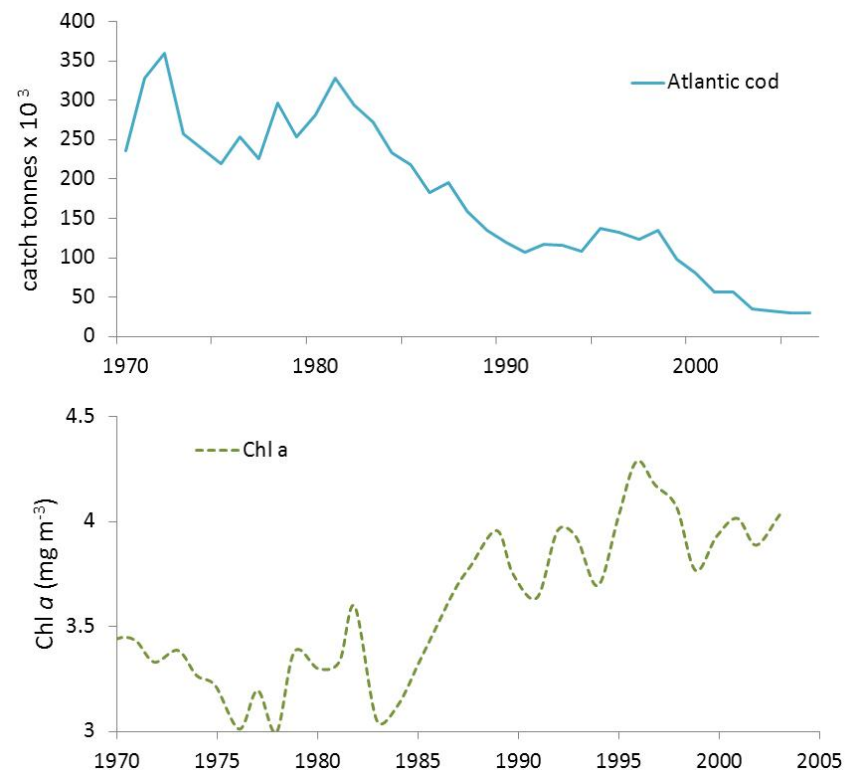
Source: seaaroundus.org  
Wasmund et al. 2008

## Baltic Sea

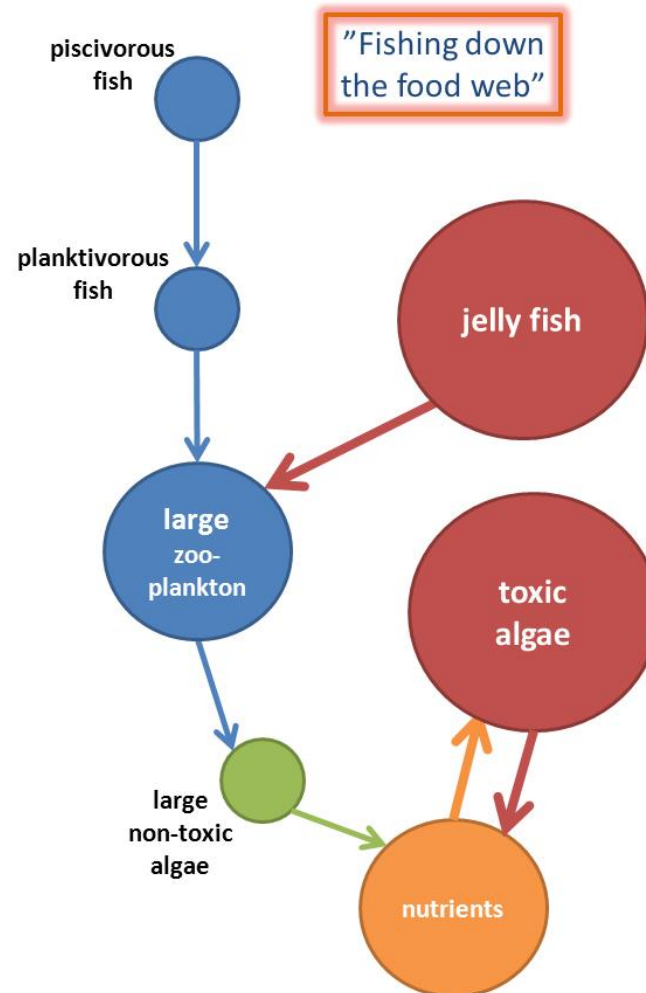
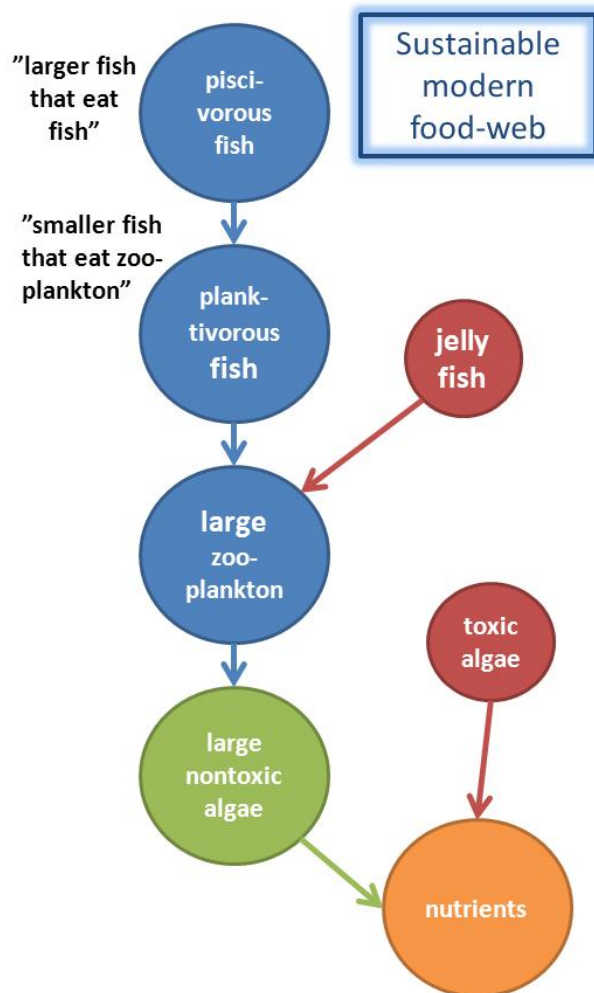


Source: seaaroundus.org  
Wasmund et al. 2008

## North Sea



Source: seaaroundus.org  
McQuatters-Gollop 2007



Decreasing smaller fish predicts an increase in toxic algal blooms and jelly fish!

Described for the Black Sea

Source: Vasas et al 2007



## Predicting effects of overfishing on harmful algal blooms

- Network analyses of food web data predicts that overfishing of top predators should increase the probability of high density algal blooms
- More intensive fishing should promote toxic algal blooms
- This predicted pattern corresponds very well to events described for the Baltic and the Black Sea, but are also indicated in the North Sea

# Baltic Sea

Experimental evidence of link between offshore decline in cod and coastal blooms of filamentous algae

Increase both in sprat and stickleback (*Gasterosteus aculeatus*)

Offshore-coastal link

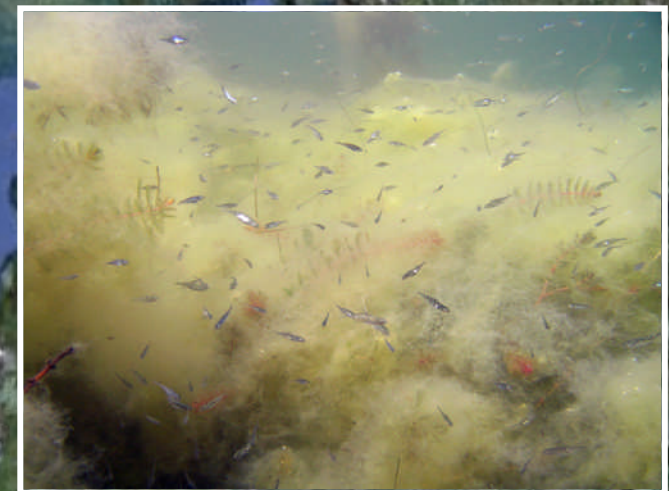
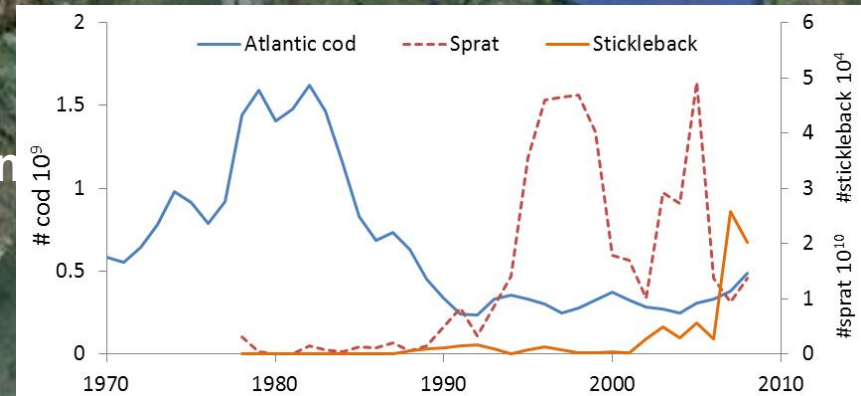
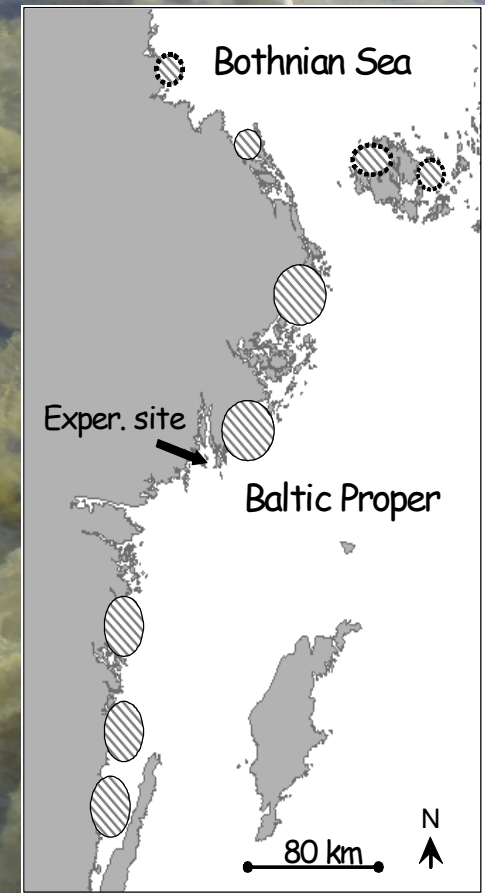


Photo: Ulf Bergström, Eriksson et al. 2011



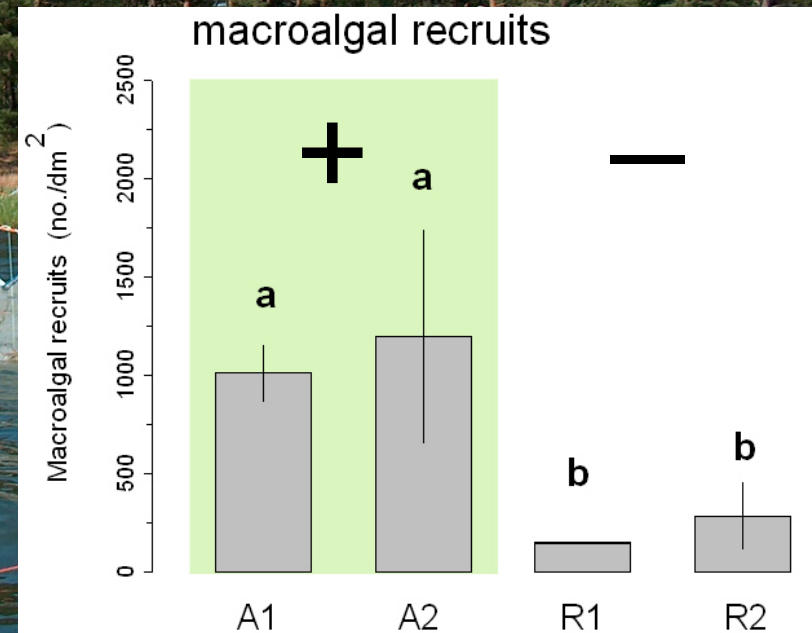
# There is a connection between stickleback loads and blooms of filamentous algae!

- Field study of 57 bays in the Baltic Sea, nine larger areas
- In areas dominated by sticklebacks, 50 % of the bays were overgrown by algae
- In other areas only 10 % were overgrown





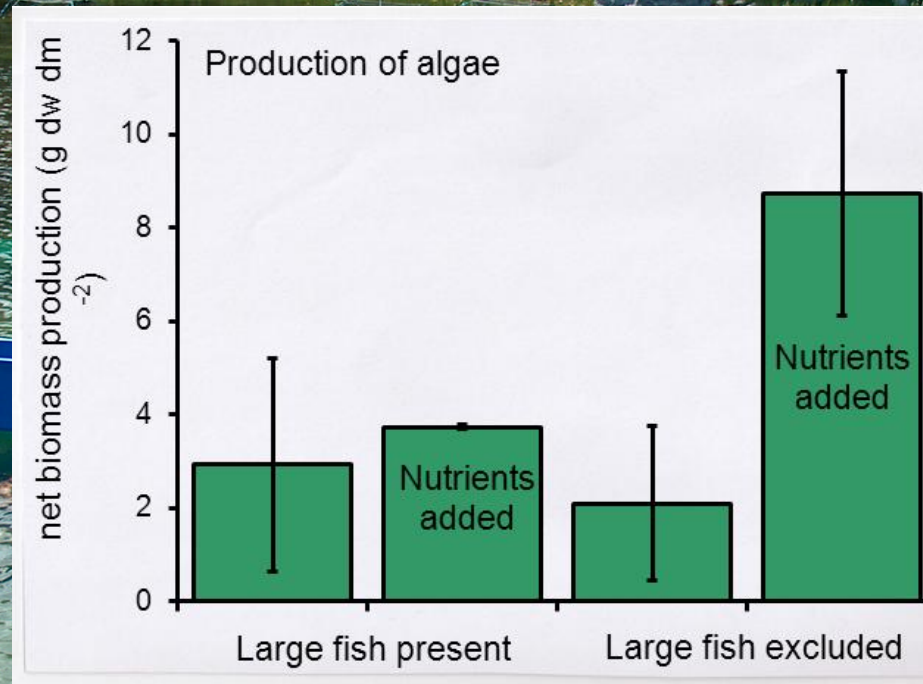
- If we add small fish to bays: algae increase!



Source: Sieben et al. 2011



- If we remove larger predatory fish:  
small fish and the cover of algae increase!



Source: Eriksson et al 2009, Sieben et al. 2011

## Key findings

- Harmful algal blooms have negative effects on fisheries in Europe
- Overfishing contributes to algal blooms
- Overfishing and eutrophication create synergistic effects, together promoting algal blooms
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Look out for:

- Predator communities dominated by few highly exploited species
- Non-toxic high density blooms, especially in coastal areas