

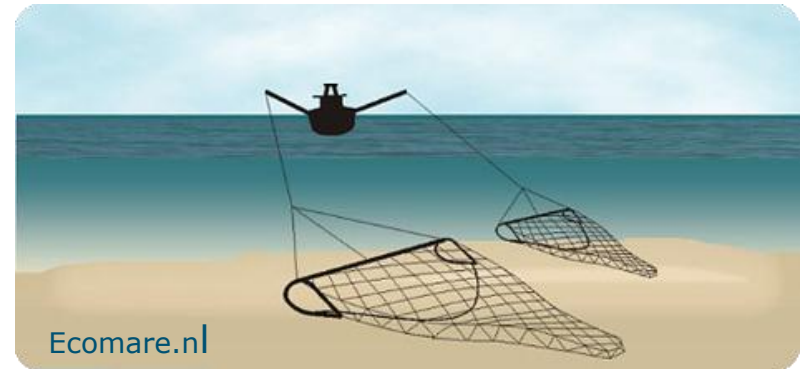
# Community consequences of bottom trawl fisheries in demersal food webs

Tobias van Kooten

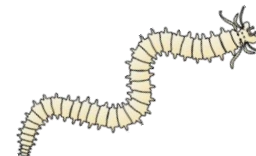


# Bottom trawl fishery

- Fishery affects both fish (target) and benthic (non-target) organisms
  - Direct impact
  - Long term impact

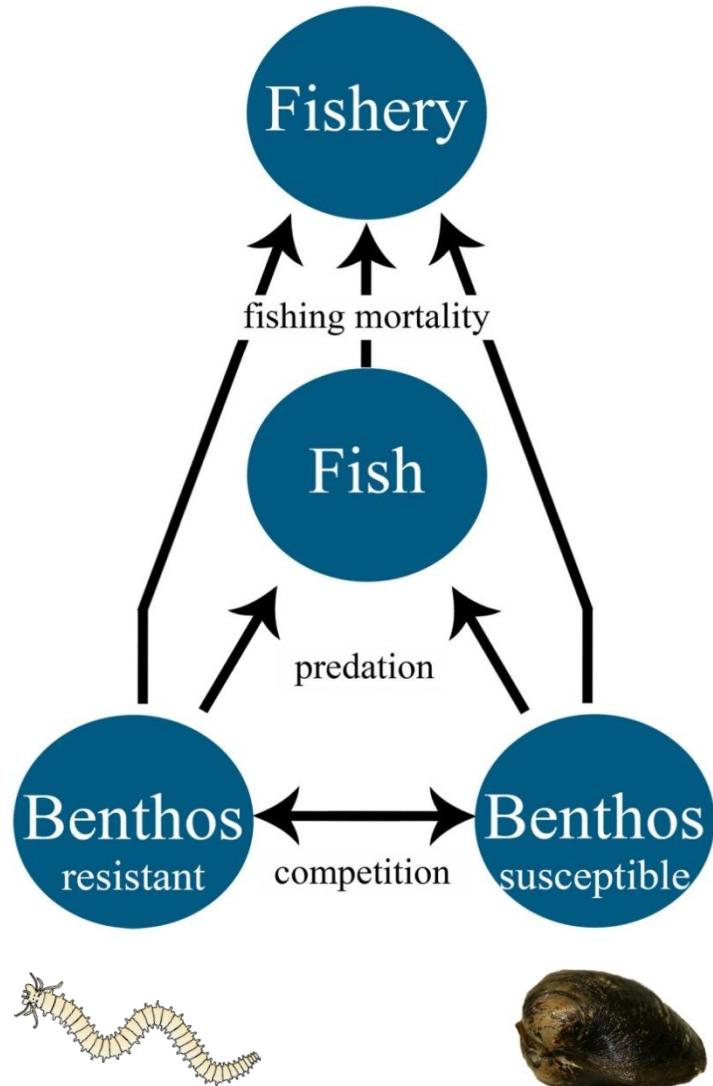


- Shift in benthic community:
  - Large, hard-bodied species to small and opportunistic species



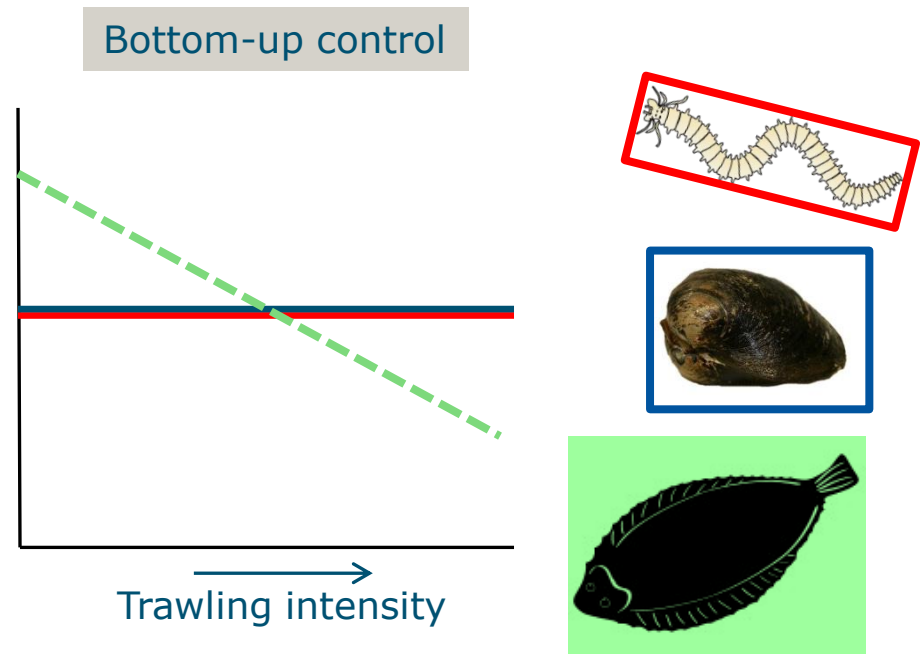
- Management plans to reduce impact of trawling on benthos

# Simple food web model

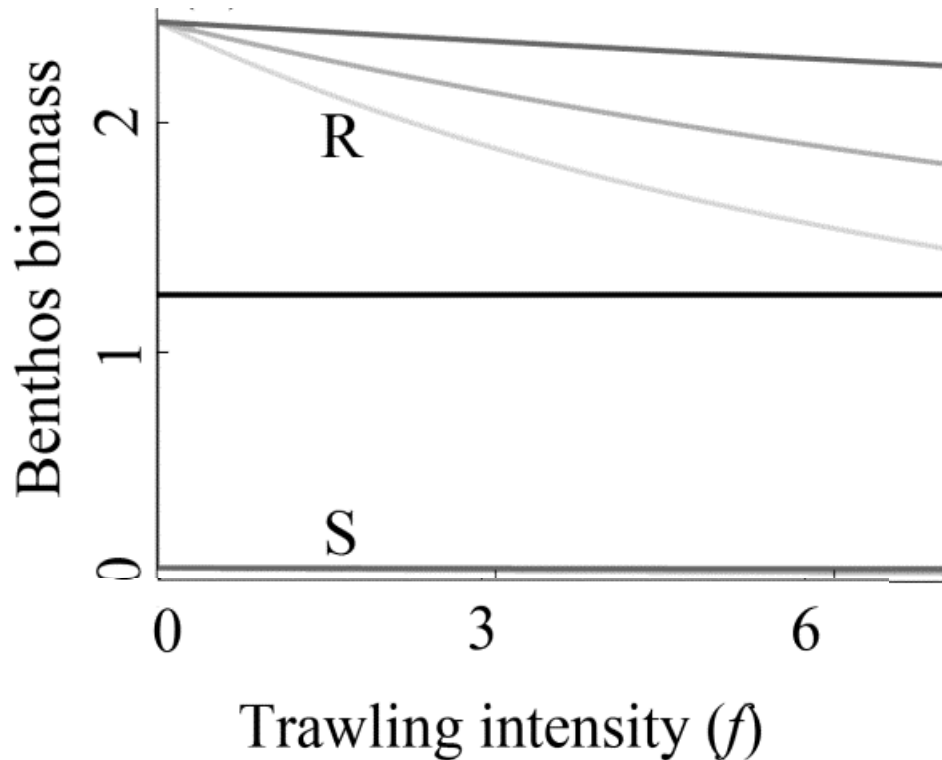


# What determines benthos abundance?

or competition?



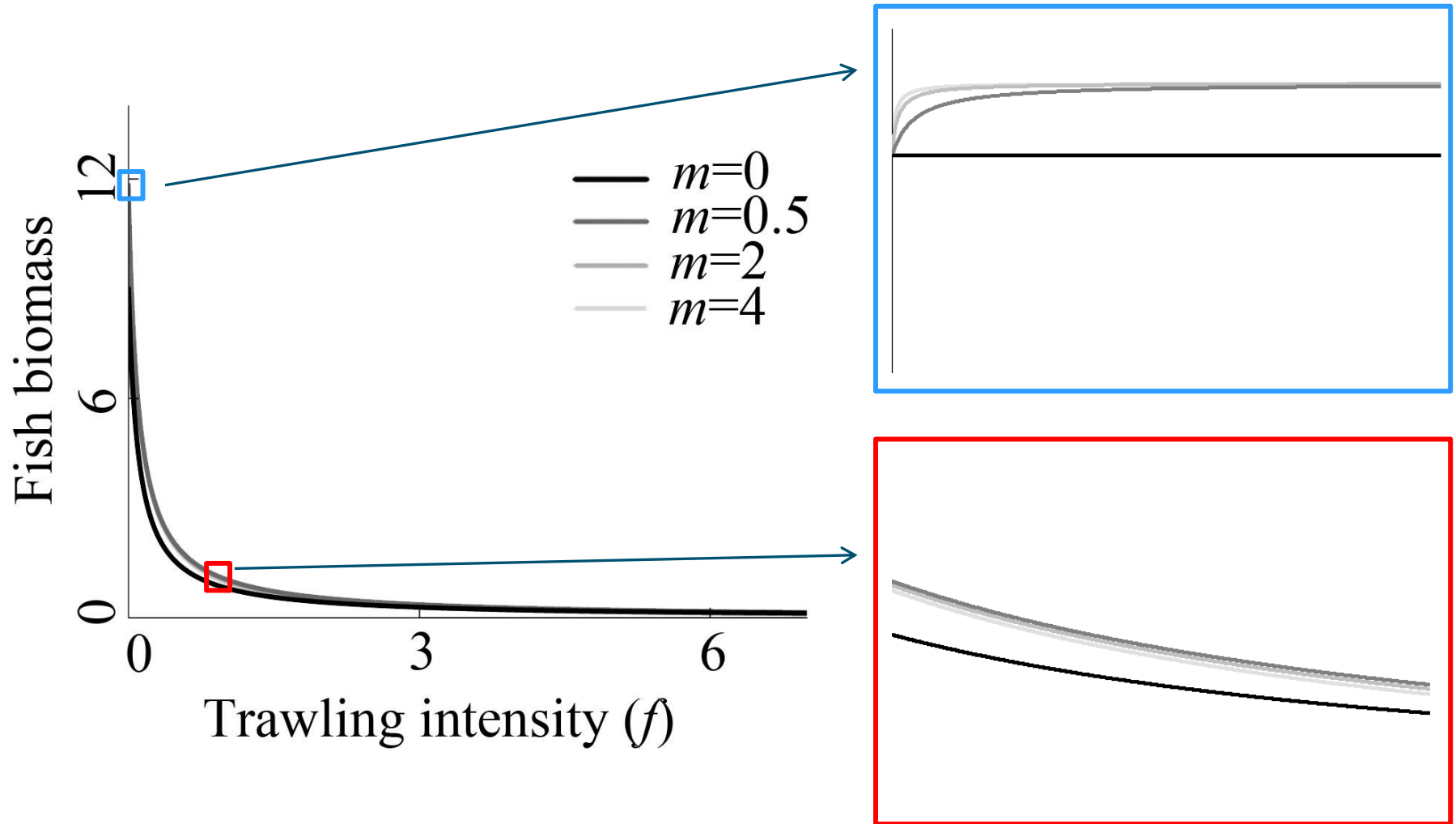
# Bottom-up control: Benthos



- Competition drives down the susceptible benthos
- Resistant benthos profits strongly, despite additional mortality

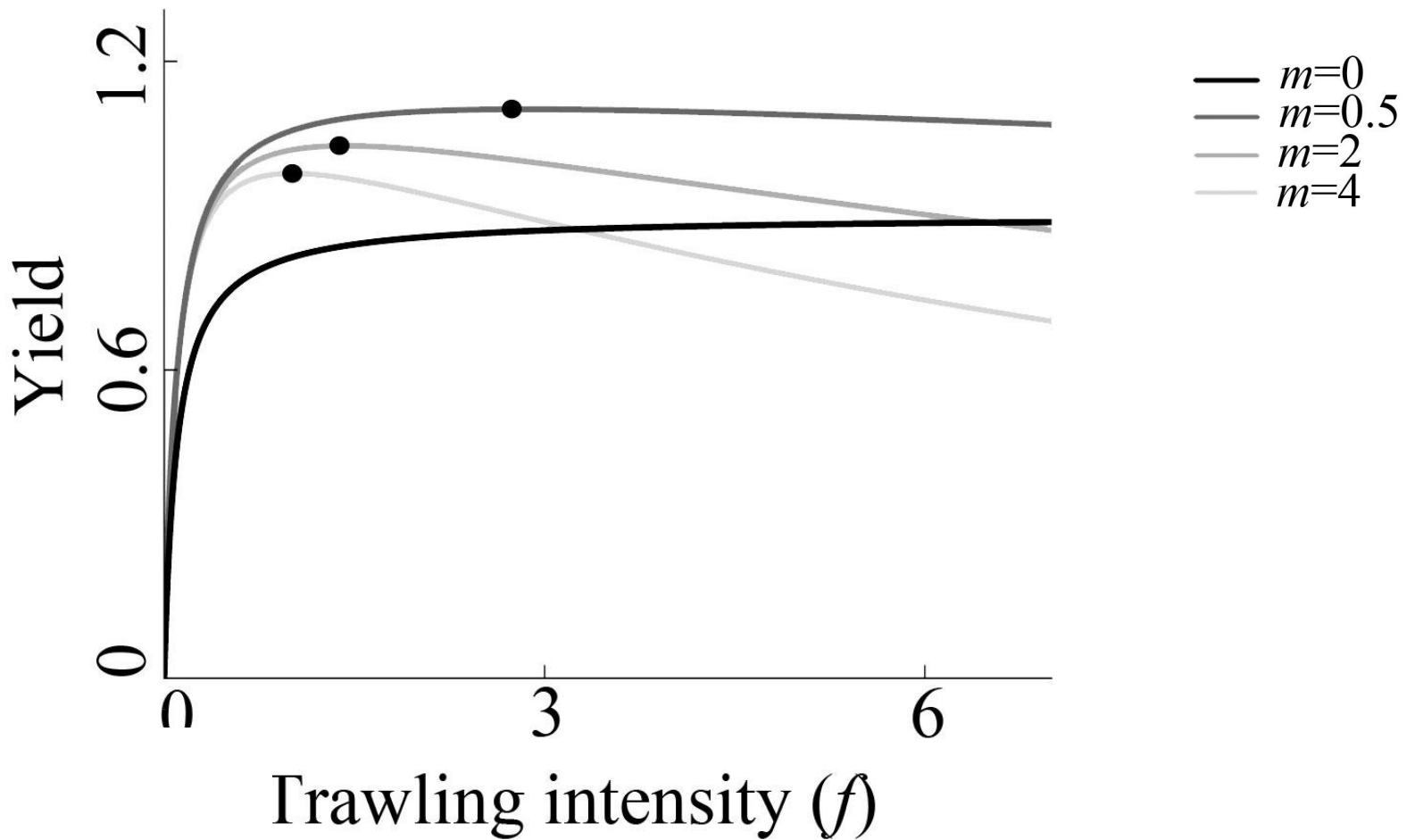
# Bottom-up control: Fish

Resistant benthos also the best fish food



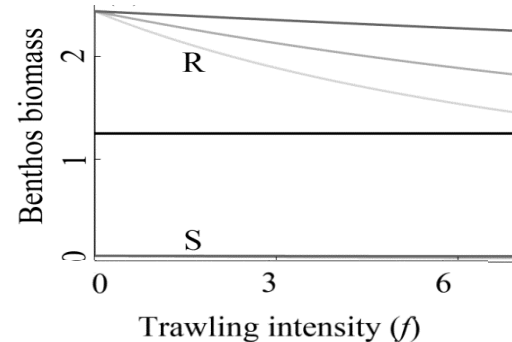
# Bottom-up control: Yield

Resistant benthos also the best fish food

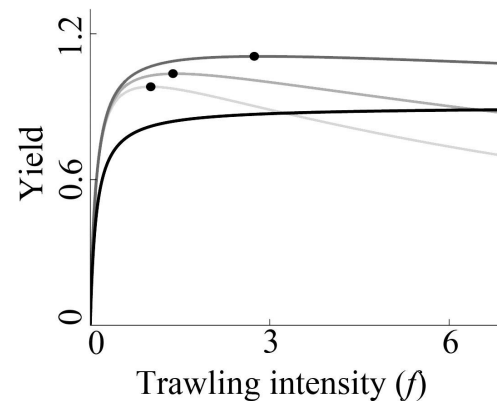
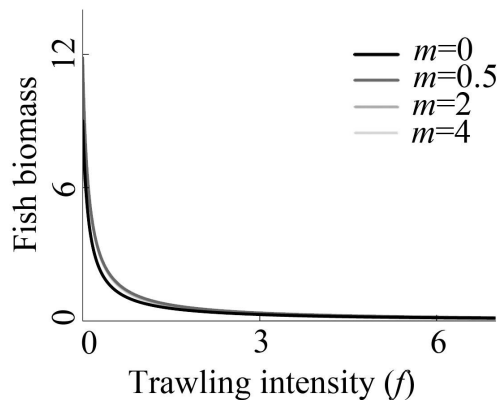


# Bottom up controlled benthos

- Competition can reverse effect of trawling mortality for resistant types of benthos



- Benthos-damaging gears lead to more fish in the water and higher fishery yield, **but only when the resistant benthos is the best fish food.**

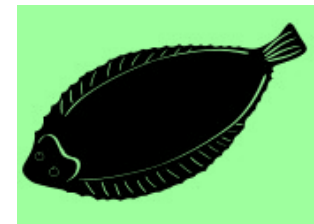
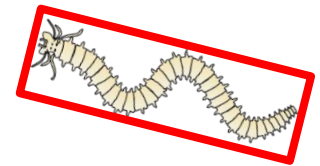
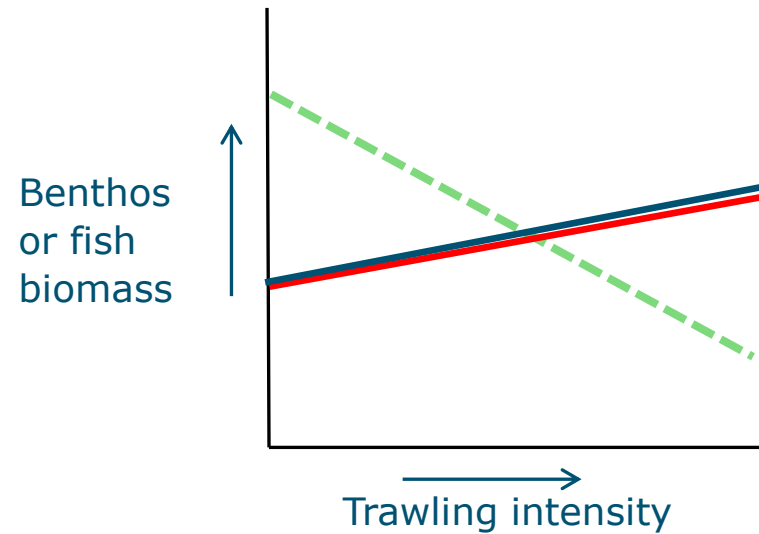




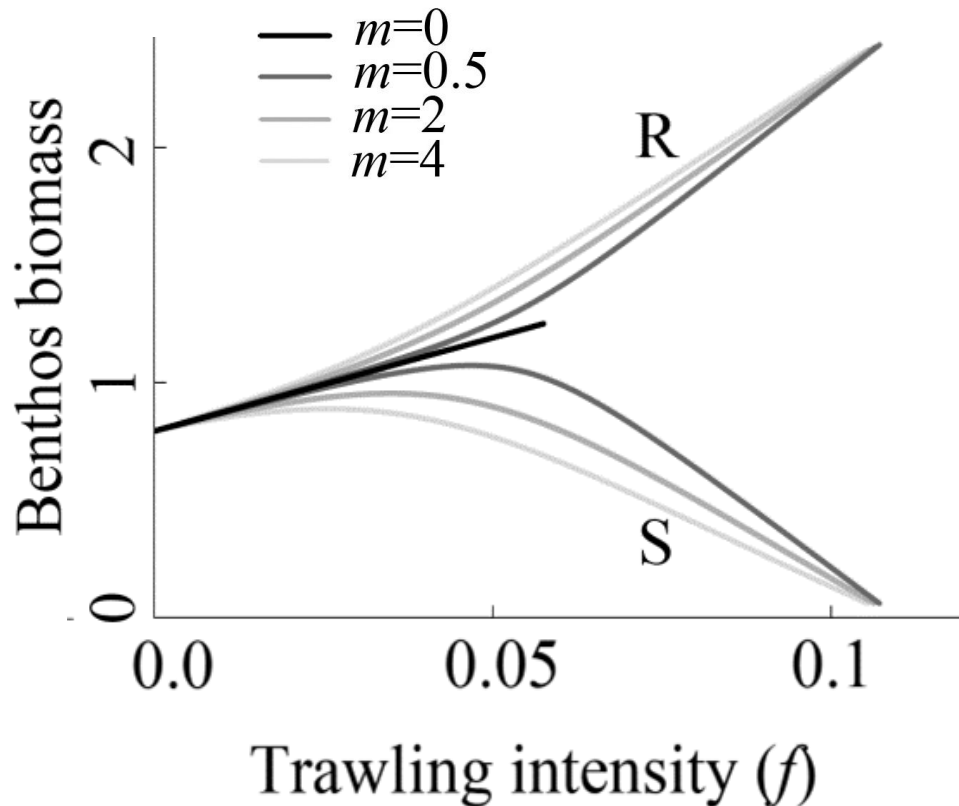
# What determines benthos abundance?

## Predation

Top-down control



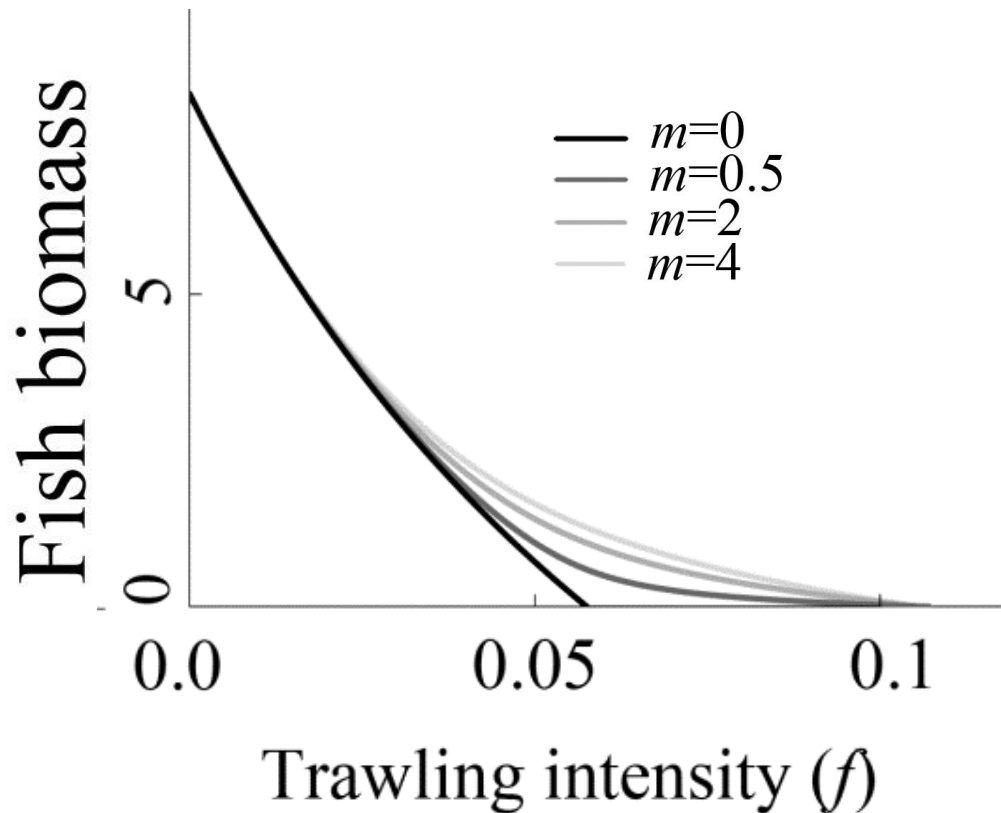
# Top-down control: Benthos



- At low fishing intensity, all benthos profits from reduced predation
- Competition drives down the susceptible benthos
- Resistant benthos profits, despite additional mortality
- Effects on benthos damped compared to bottom-up system

# Top-down control: Fish

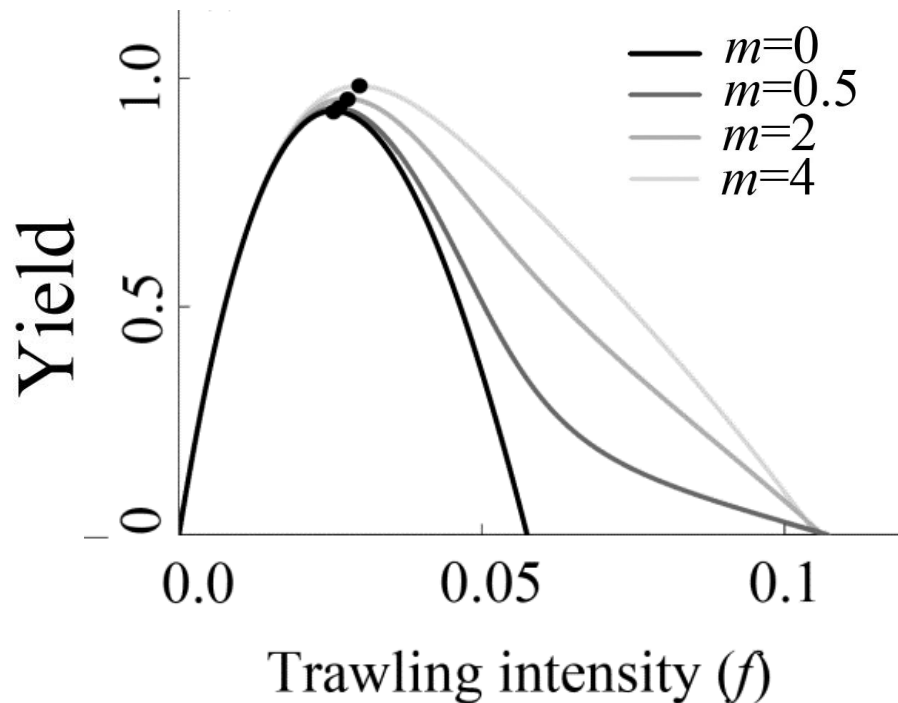
Resistant benthos is the best fish food



- Gear effects lead to more fish at high fishing intensity
- Gear effects on benthos enhance persistence of fish

# Top-down control: Yield

Resistant benthos is the best fish food



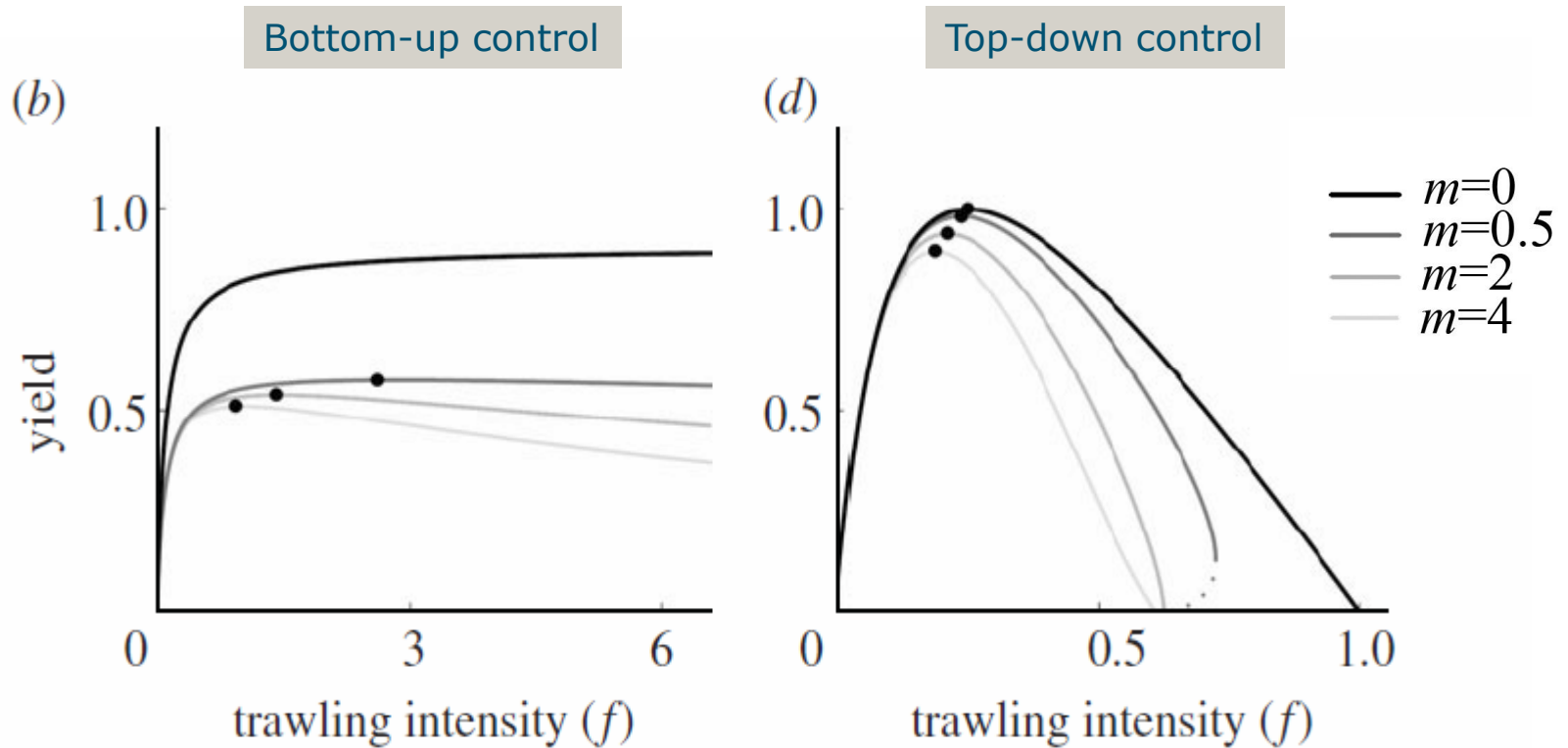
- No effect at low fishing intensity
- Increased yield at intensity  $> F_{MSY}$
- MSY itself relatively unaffected (depending on other parameters)

# Top-down control

Resistant benthos is the best fish food

- Effects of fishing on benthos are a balance between reduced feeding from fish and direct mortality from gear.
- Direct effects of gear on benthos can enhance yield and persistence of fish at high fishing intensity.

# When susceptible benthos is the most profitable prey



**The gear effects of trawling on benthos reduce food availability for fish...**

# Implications

Depending on what is the best fish food:

- Gear mortality on benthos may enhance fish persistence and fishery yield.
- Gear mortality on benthos accelerates the decline of fish and reduces yield.



*Can there be successful management without understanding and taking into account the ecological relationships?*

