Accounting for predators in ecosystem-based management of herring fisheries

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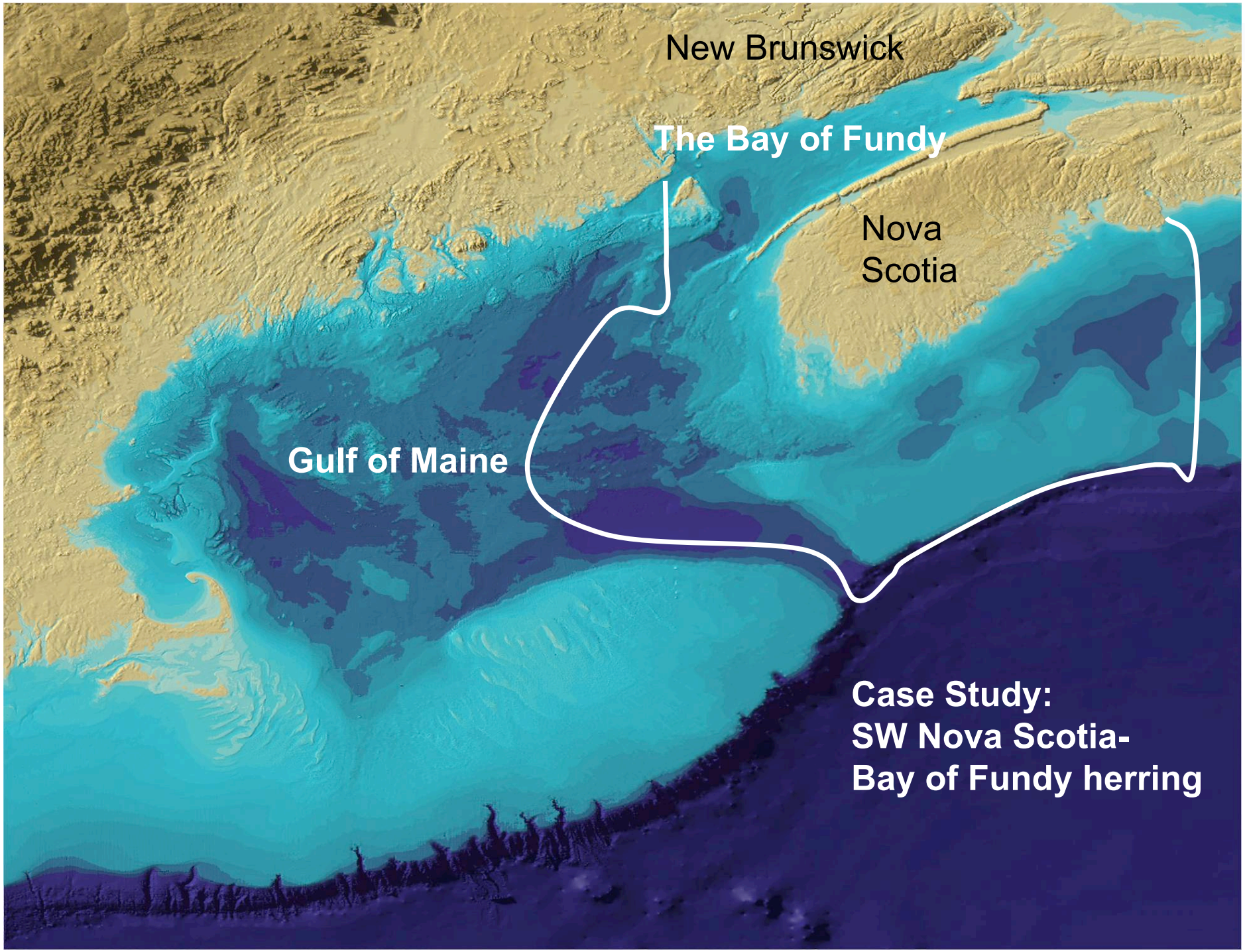

New Brunswick
The Bay of Fundy
Nova
Scotia
Gulf of Maine
Case Study:
SW Nova Scotia-
Bay of Fundy herring

Objectives

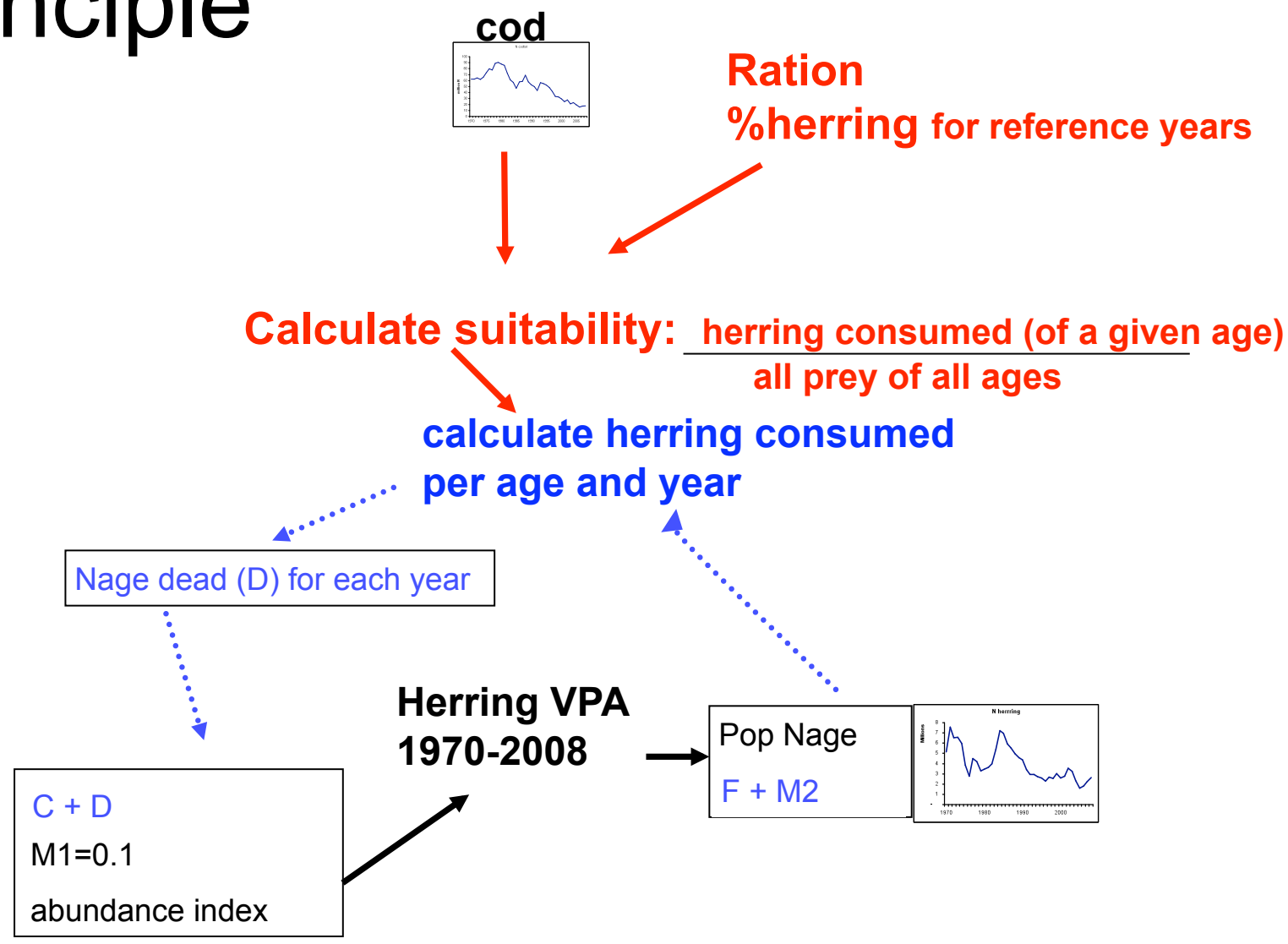
- quantify herring predation relative to fishing
- evaluate management scenarios to preserve herring biomass for predation

Using:

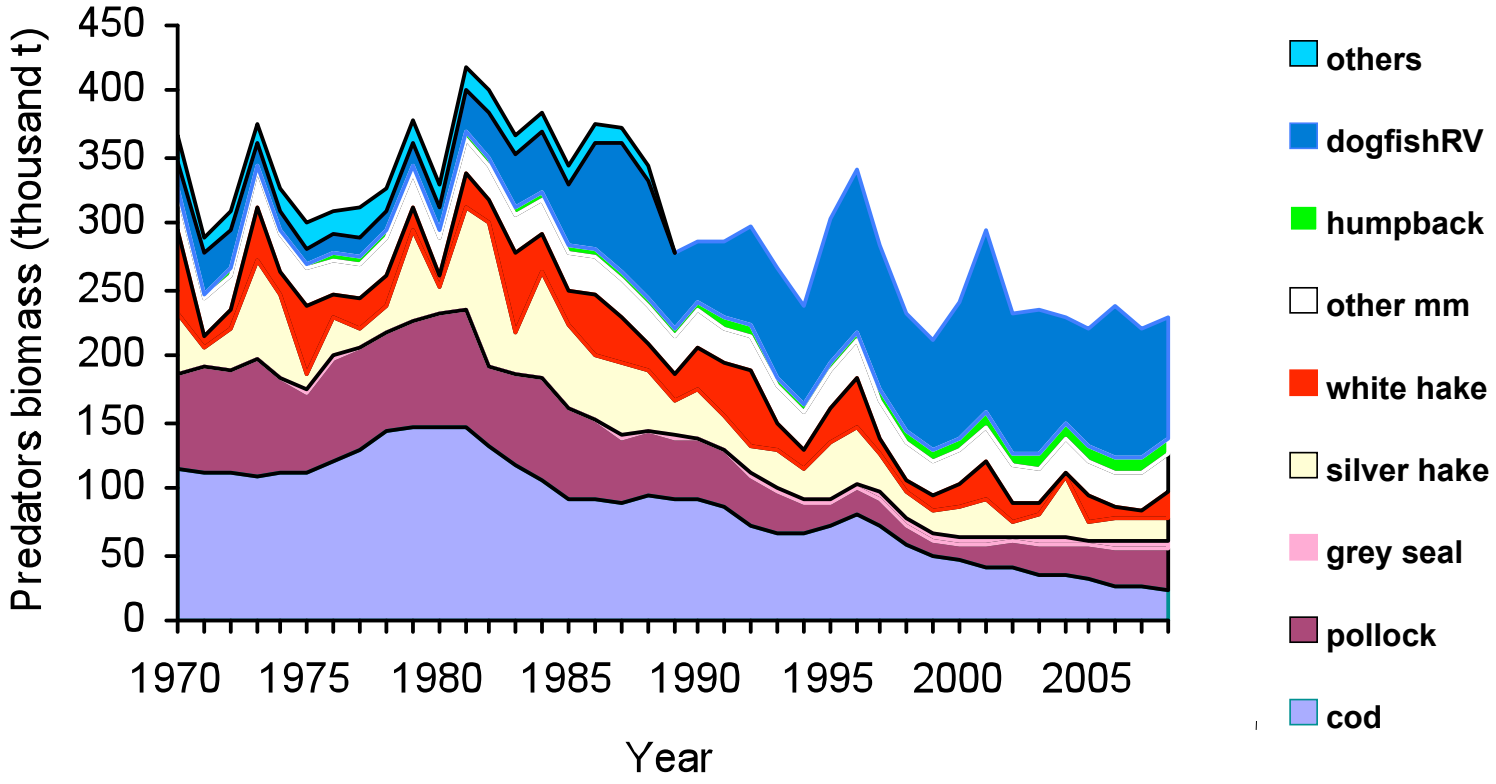
simple MSVPA centrered on herring

1970-2006

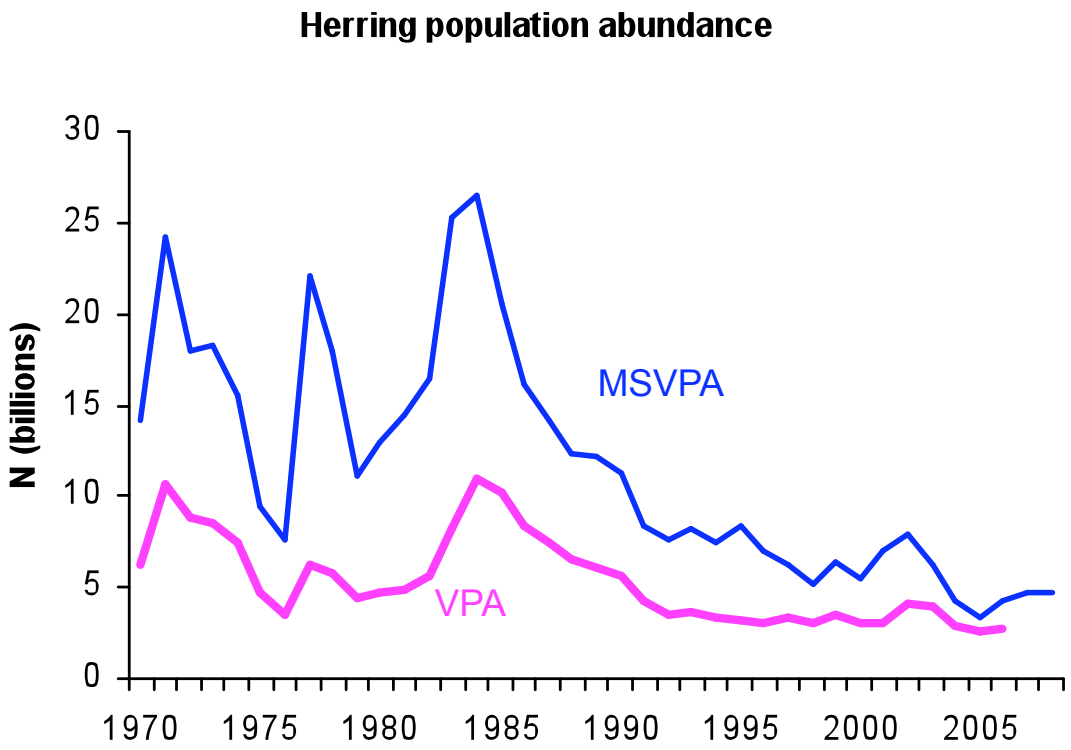
Principle


cod
Ration
%herring for reference years
Calculate suitability: herring consumed (of a given age) / all prey of all ages
calculate herring consumed per age and year
Nage dead (D) for each year
C + D
M1=0.1
abundance index
Herring VPA 1970-2008
Pop Nage
F + M2
N herring

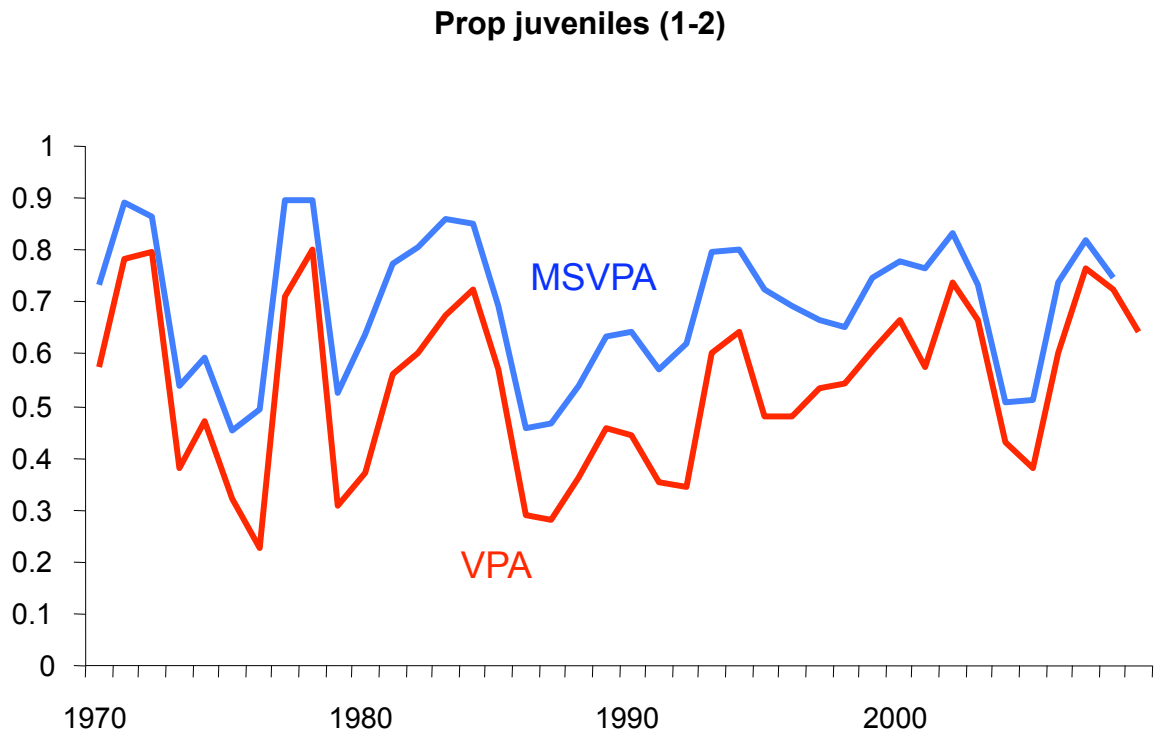
Predators biomass



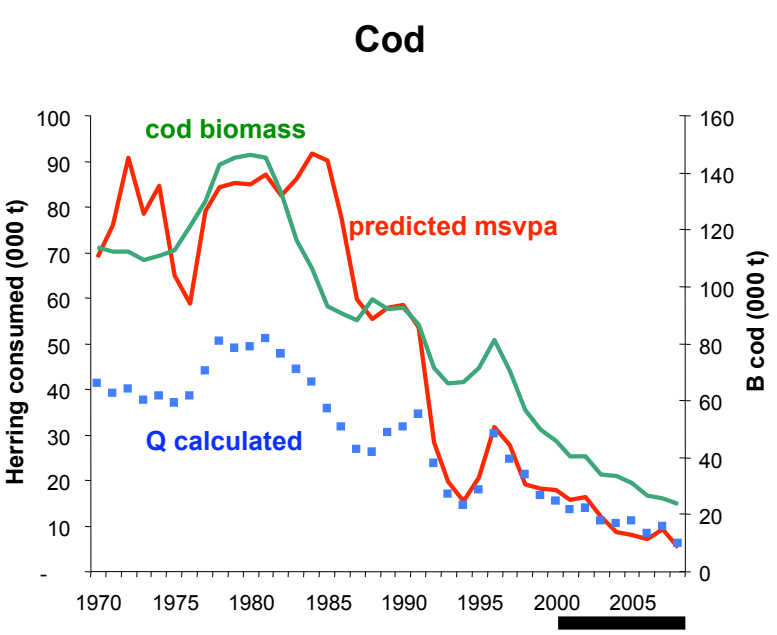
comparison with VPA

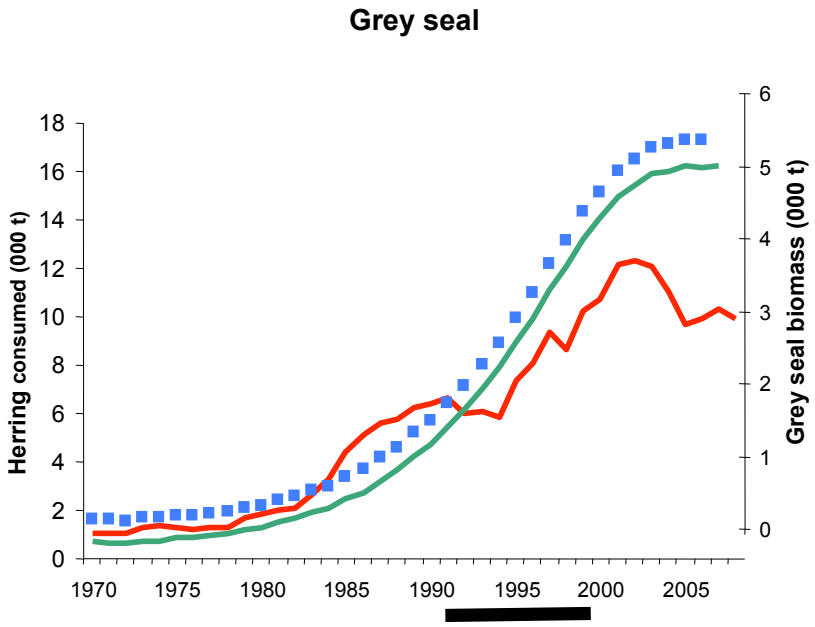


% juveniles

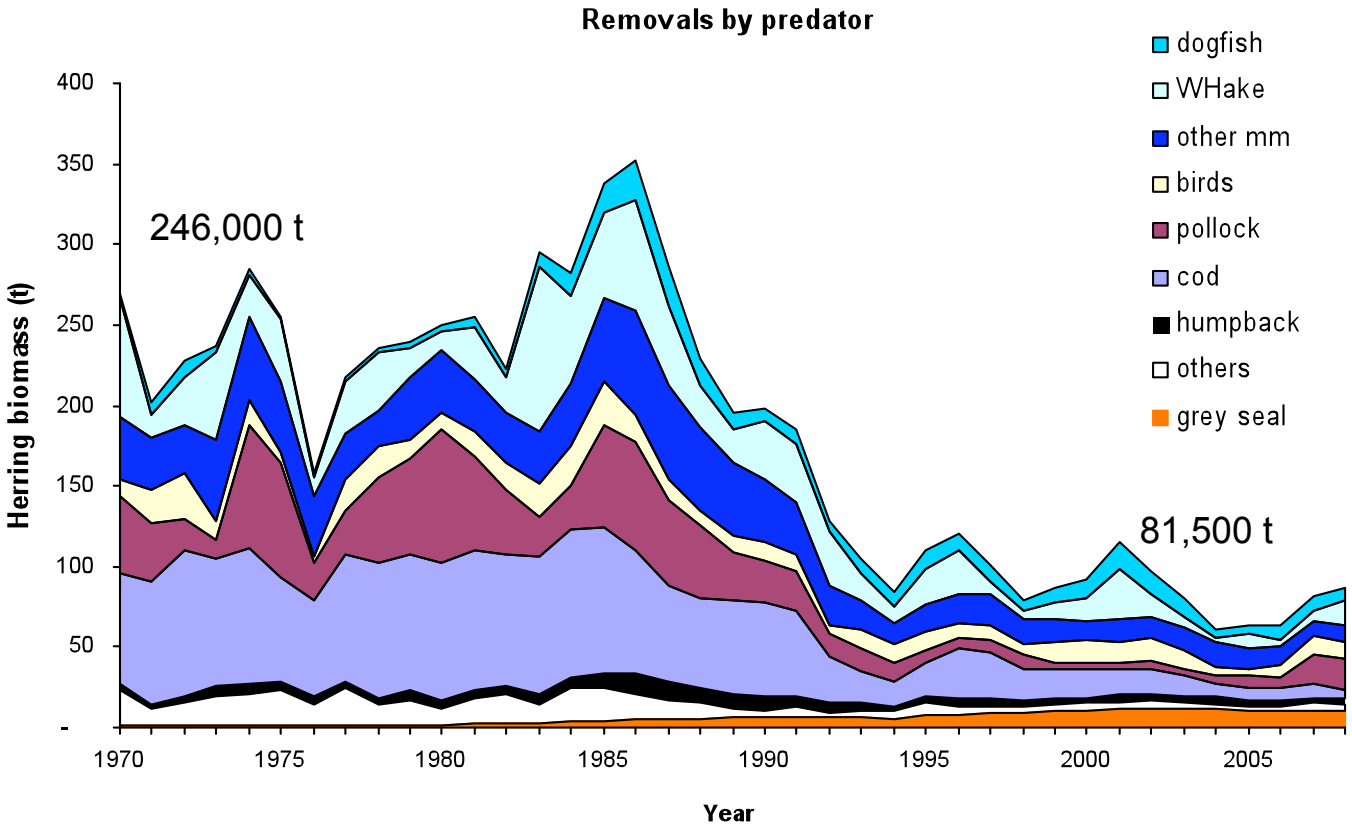

Prop juveniles (1-2)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1970
1980
1990
2000
MSVPA
VPA

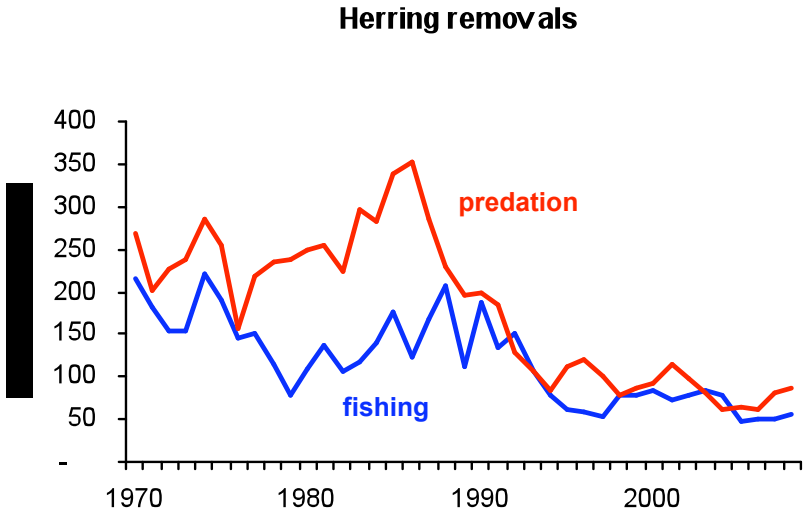
Consumption predicted

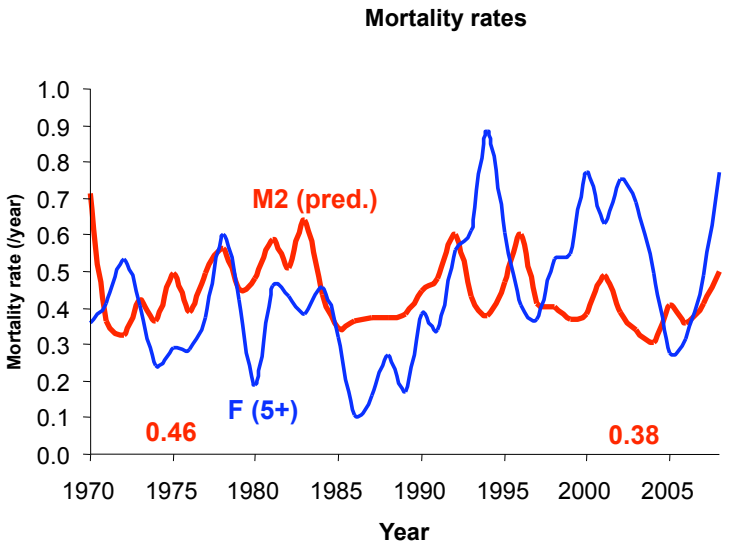


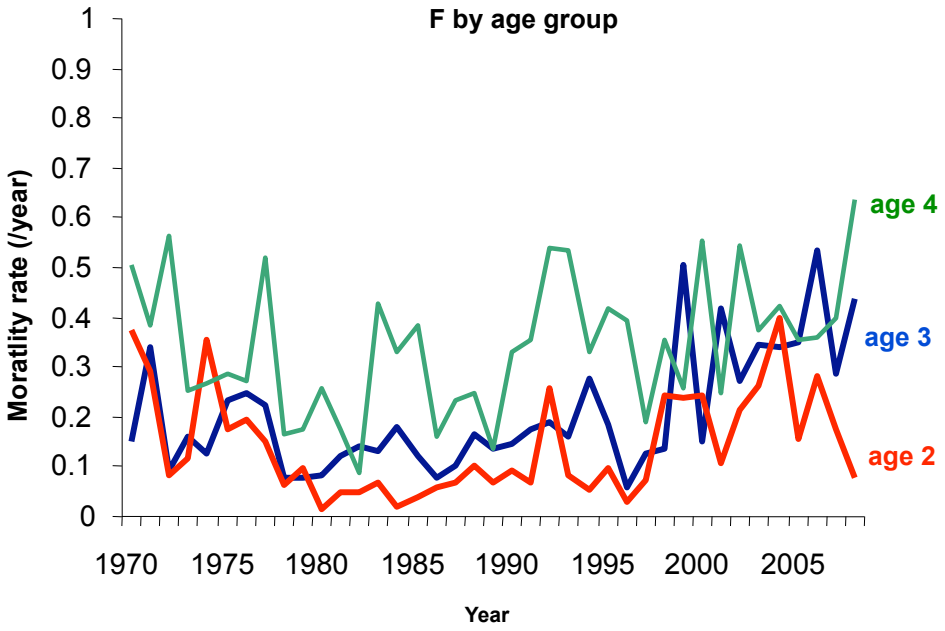


Consumption by predators




Herring removals
400
350
300
250
200
150
100
50
-
predation
fishing
1970
1980
1990
2000


Mortality rates
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Mortality rate (/year)
M2 (pred.)
F (5+)
0.46
0.38
1970
1975
1980
1985
1990
1995
2000
2005
Year


F by age group
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Moratlity rate (/year)
age 4
age 3
age 2
1970
1975
1980
1985
1990
1995
2000
2005
Year

Predation mortality (M2)

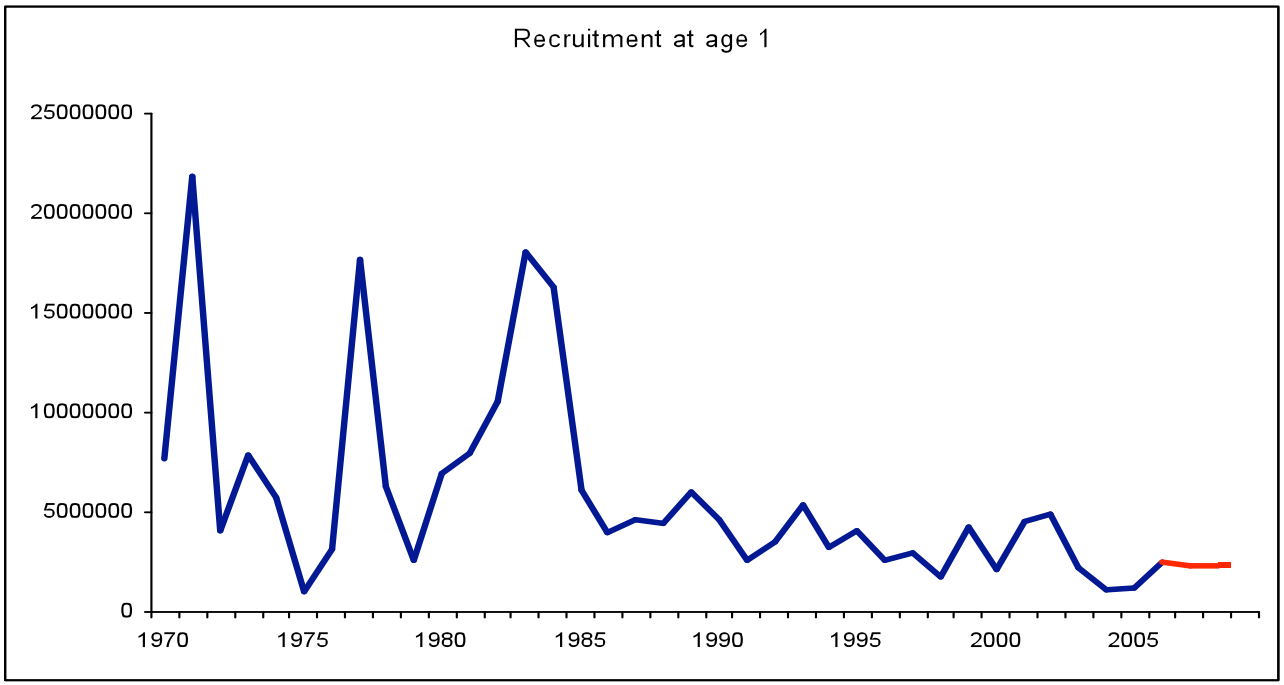
	ages 1-2	3+
avg 5yrs	0.42	0.26
overall avg	0.53	0.27

plus 0.1 residual mortality (M1)

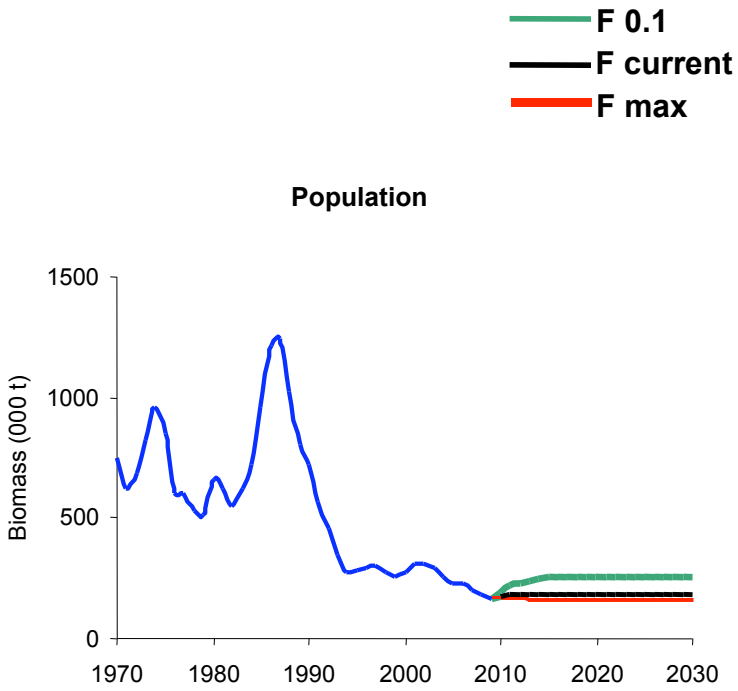
What should we do?

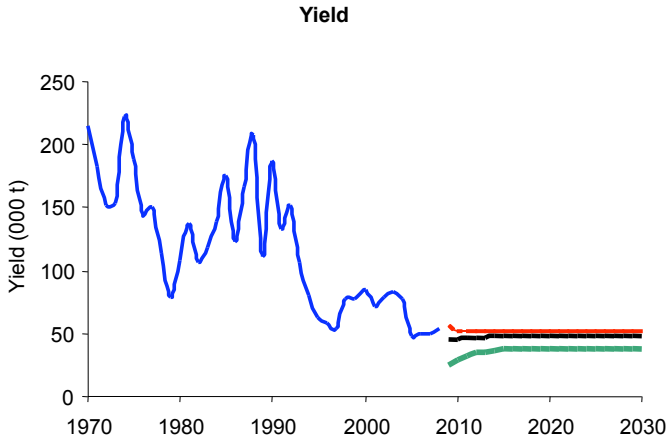
- goal:
  - rebuild the stock
  - maintain or increase herring for predation (63,000t)
- used YPR model
  - 2004-2006 rates

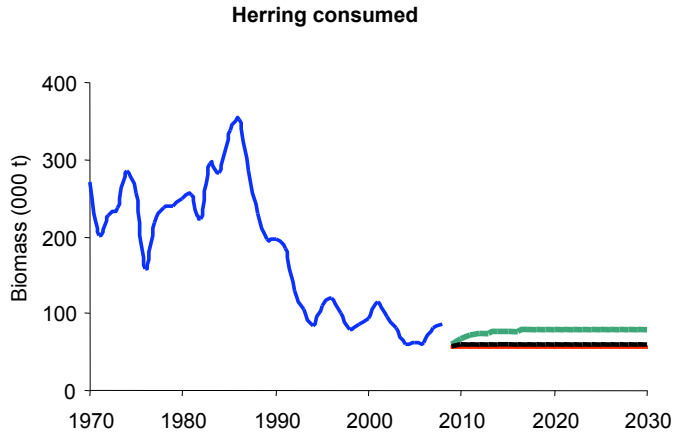
Recruitment



Projections







Impact of decrease in herring

- how do predators react?
  - change prey?
    - quantity vs quality
    - prey similar in fat: sandlance, euphausids and?
  - change feeding grounds
    - humback, sei whales
    - cod?

Management

- predation as high as fishery
- M (0.2) vs M2 (0.44)
- best management scenario: F0.1
  - despite best intentions, goal not achieved in 20 years
  - still the best scenario given low R
- what if recruitment increase?
  - need explicit management rule


Thank you
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