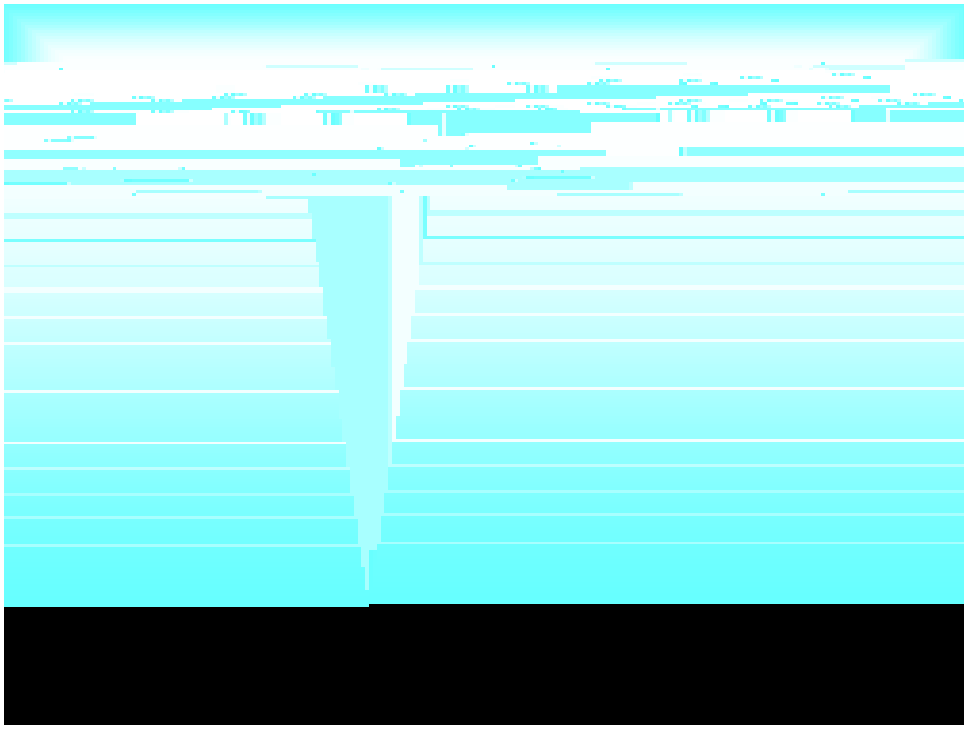


Seek simplicity, but distrust it

-
-

Difficulties & hopelessness in ecosystem modeling

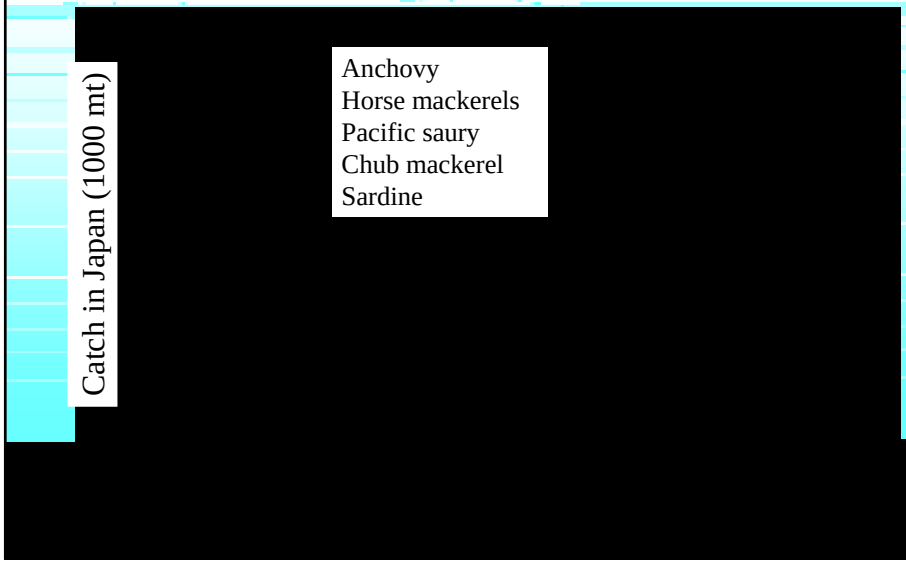
- We need

http://risk.kan.ynu.ac.jp/matsuda/2006/060612UN.ppt

Notes on Demystifying Ecosystem Approaches

- I still encourage adaptive population management.
- MSY theory is not based on EA
- Understand difficulty of EA (Indeterminacy in indirect effects; Mystifying approach)
- Target switching is robust and efficient
- Make a falsifiable prediction
- Adaptive management may not work in EA

Species Replacement of Pelagic Fishes



Target switching of multispecies fisheries (Katsukawa & Matsuda, Fish.Res. 2002)

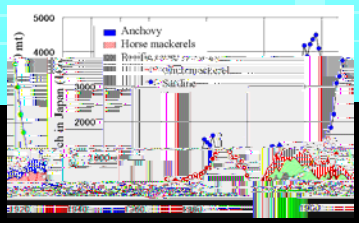
Policy 1 (no switching; NSF)

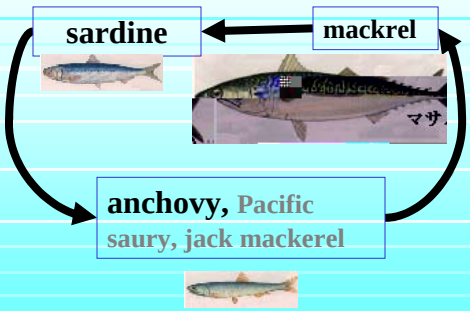
Fishing effort $E_i = e_i/3$ (constant)

Or $E_i = E_i(x_i$

Cyclic Advantage Hypothesis based on ecosystem approach (species interaction)

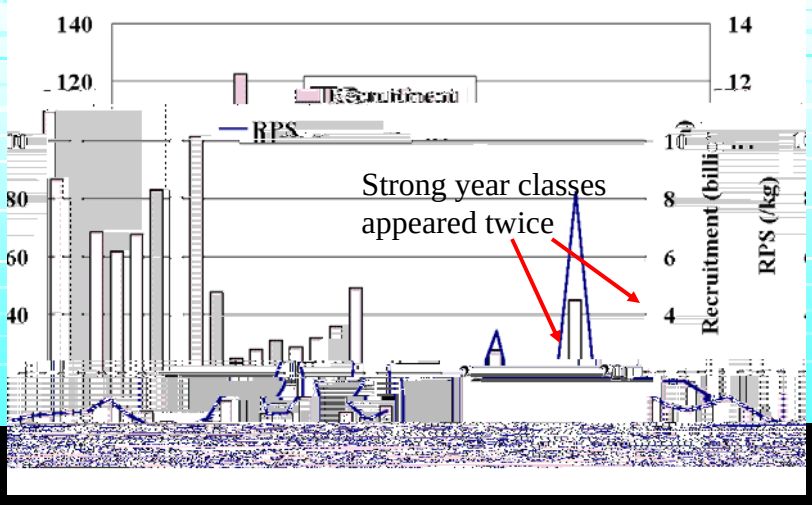
The next dominant to sardine is anchovy –
Yes! As I predicted
The second next is chub mackerel
Many people agree now





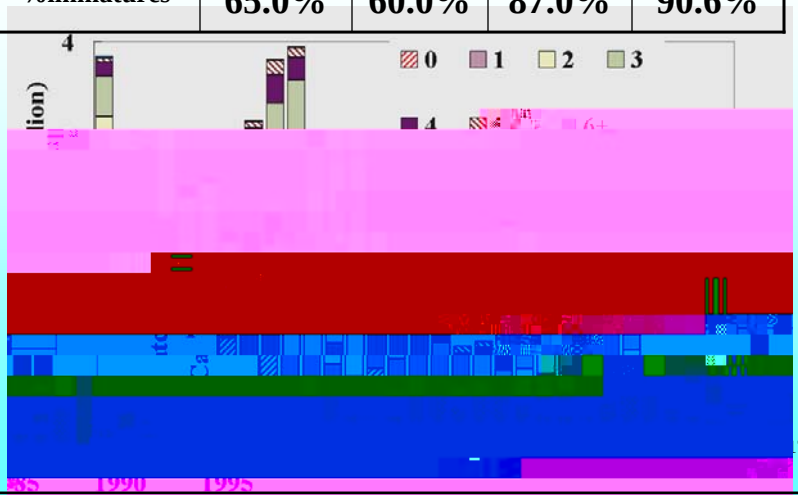
Matsuda et al. (1992) Res. Pop.

Large fluctuation of recruitment in chub mackerel (Kuroshio stock)



Immatures were heavily caught before the age at maturity

	1970s	1980s	1990s	1993-
%immatures	**65.0%**	**60.0%**	**87.0%**	**90.6%**



Future of Pelagic Fish Populations in the north-western Pacific:

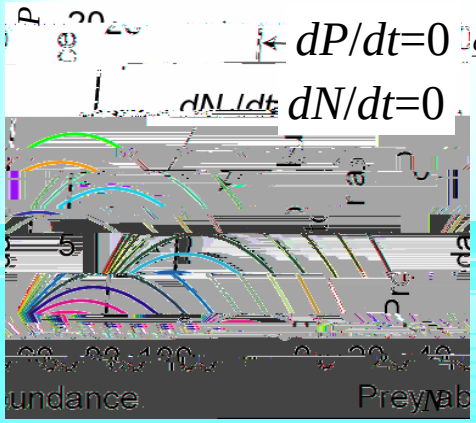
- If overfishing of immatures continues,
  - –chub mackerel will not recover forever.
  - –Fishers did not agree to my recommendation.
- If cyclic replacement hypothesis is true,
  - –sardine will not recover forever either.
- Do not catch immatures too much!
  - –The overfishing is an **experiment** for my hypothesis. (adaptive mismanagement)
  - –In 2003, fishers agreed to stock recovery plan!

http://risk.kan.ynu.ac.jp/matsuda/2006/060612UN.ppt

Notes on Demystifying Ecosystem Approaches

- I still encourage adaptive population management.
- MSY theory is not based on EA
- Understand difficulty of EA (Indeterminacy in indirect effects; Mystifying approach)
- Target switching is robust and efficient
- Make a falsifiable prediction
- Adaptive management may not work in EA

If prey is exploited and fishing effort is feedback control, ...(Matsuda & Abrams in prep.)



$$\frac{dN}{dt} \quad r\,1 \quad \frac{N}{K} \quad N \quad \frac{fCN}{1 \quad hCN} P \quad qCEN$$

$$\frac{dP}{dt} \quad d \quad gP \quad \frac{bfCN}{1 \quad hCN} P$$

no adaptation (*C* is constant)

$dE/dt = U(N\text{-}N^*)$

predator *P* **fishery *E***

sardine *N*

12/6/06 21

Fishing effort must be controlled by the predator density *P*

- $dE/dt = U(P$ – Target predator density)
- $E = E(N, P)$, $E/$