

# Stocks and Stock Structure

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# Overview

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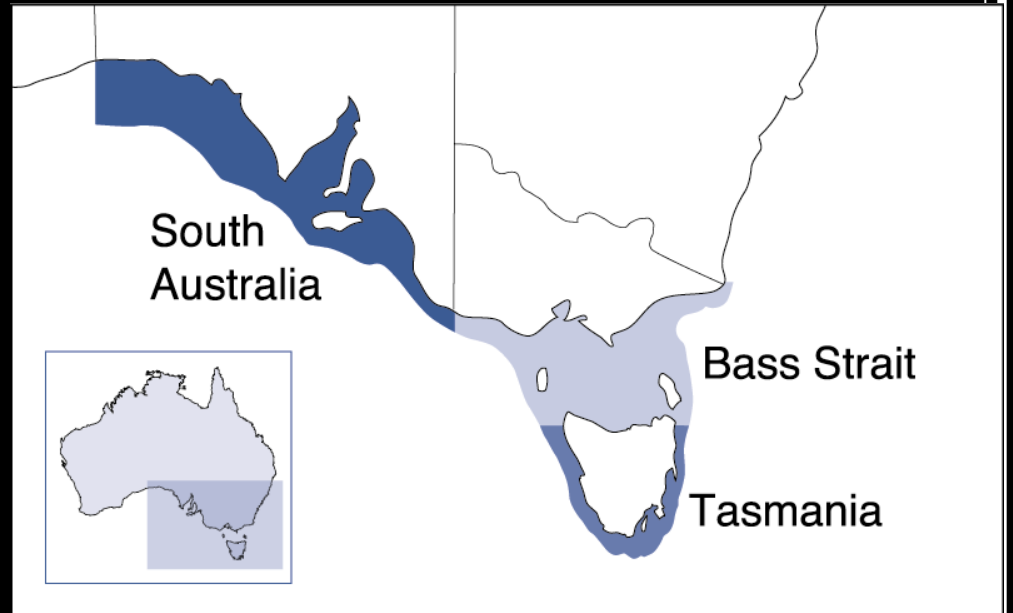
- Stock-structured stock assessments
  - Gummy shark
  - School shark
  - NZ Hoki
- MSE (and stock structure)
  - NP minke whales
  - Rock lobsters off Victoria
  - TOSSM

# Stock Structured Stock Assessments

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Stock assessments which incorporate multiple stocks when there are no genetic differences among areas / “stocks”.

# Australia's Southern Shark Fishery



Two main species:

School shark: *Galeorhinus galeus*

Gummy shark: *mustelus antarcticus*

# Gummy Shark

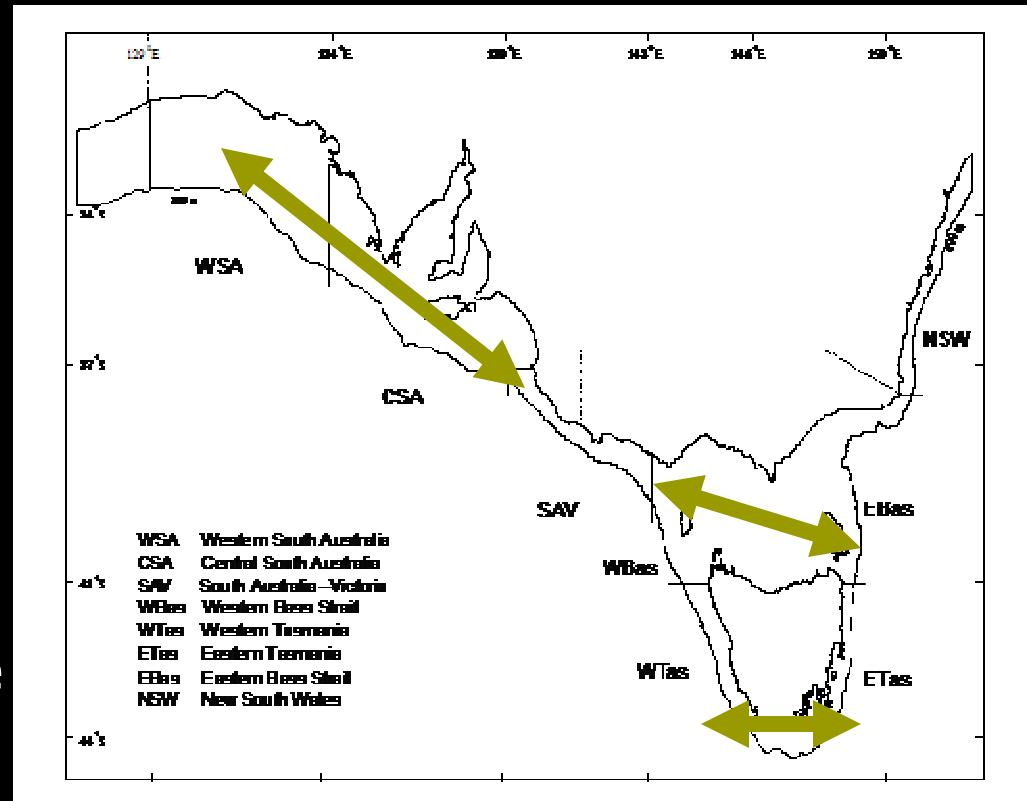
(Multiple stocks linked by common parameters)

## Biological characteristics:

- Little evidence for long distance movement.
- (Apparent) differences in pupping frequency (SA vs. BS).

## Solution:

Separate assessments of three "regions" (NSW ignored).



Note: Some parameters (M, "steepness") shared among stocks

# School Shark

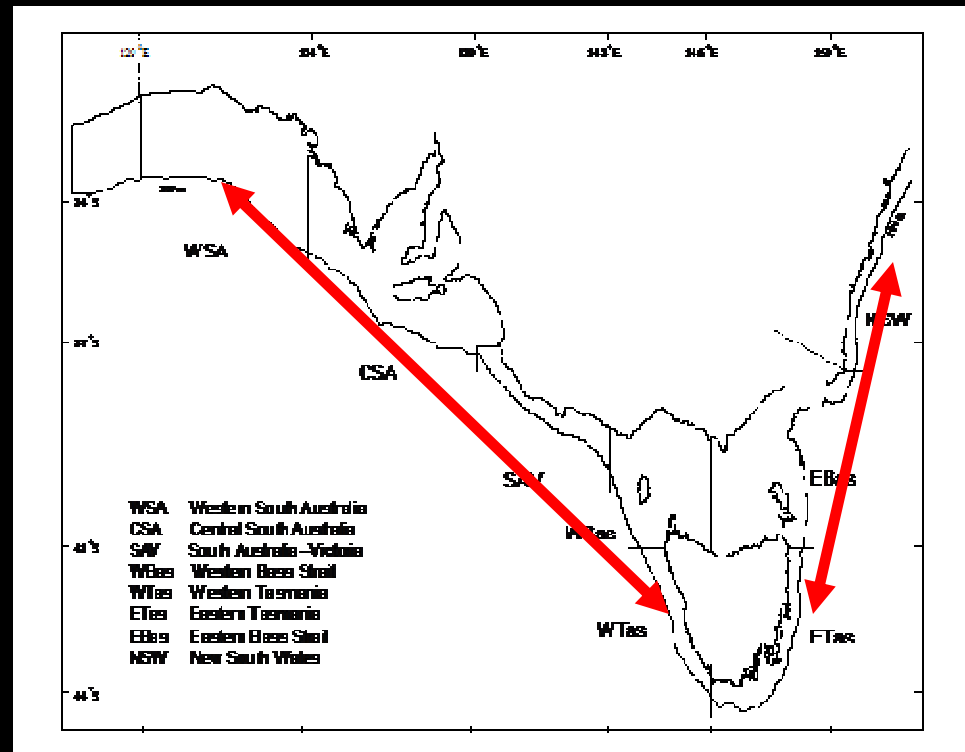
(Two stocks which overlap in space)

## School shark: Evidence of:

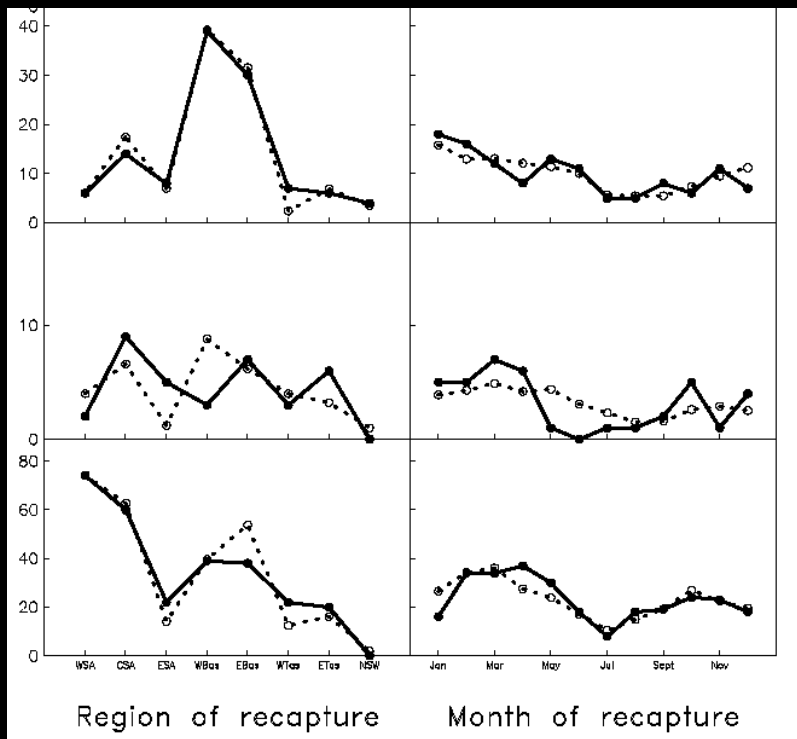
- + Long-distance movement
- + Pupping grounds in the east but not the west
- + Serial depletion (almost no fish left in NSW)

## Solution:

Eight regions.  
Two stocks.  
Movement modelled.

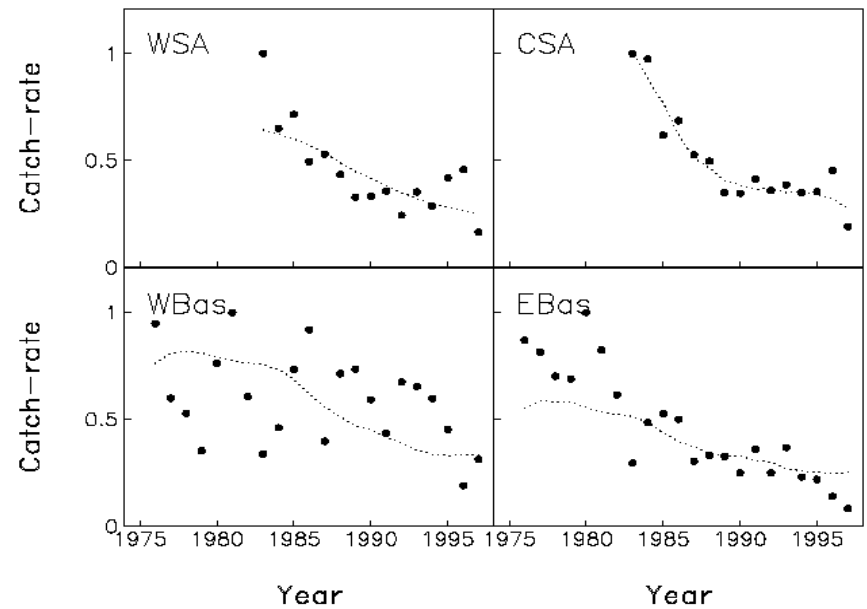


# Example fits



Tagging data

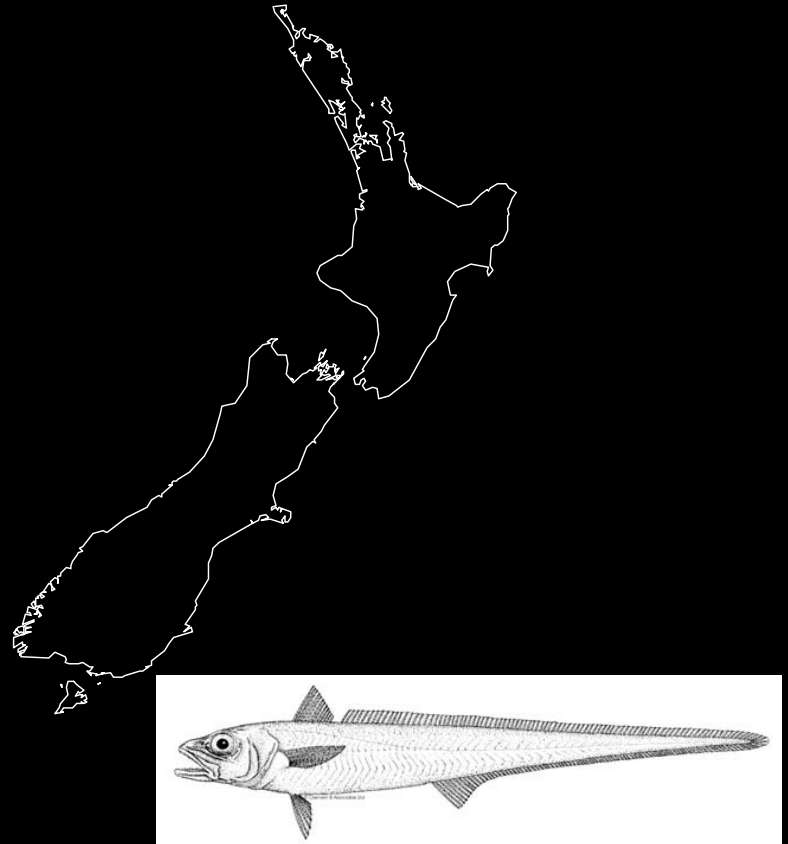
## Spatial catch-rate trends



# NZ hoki

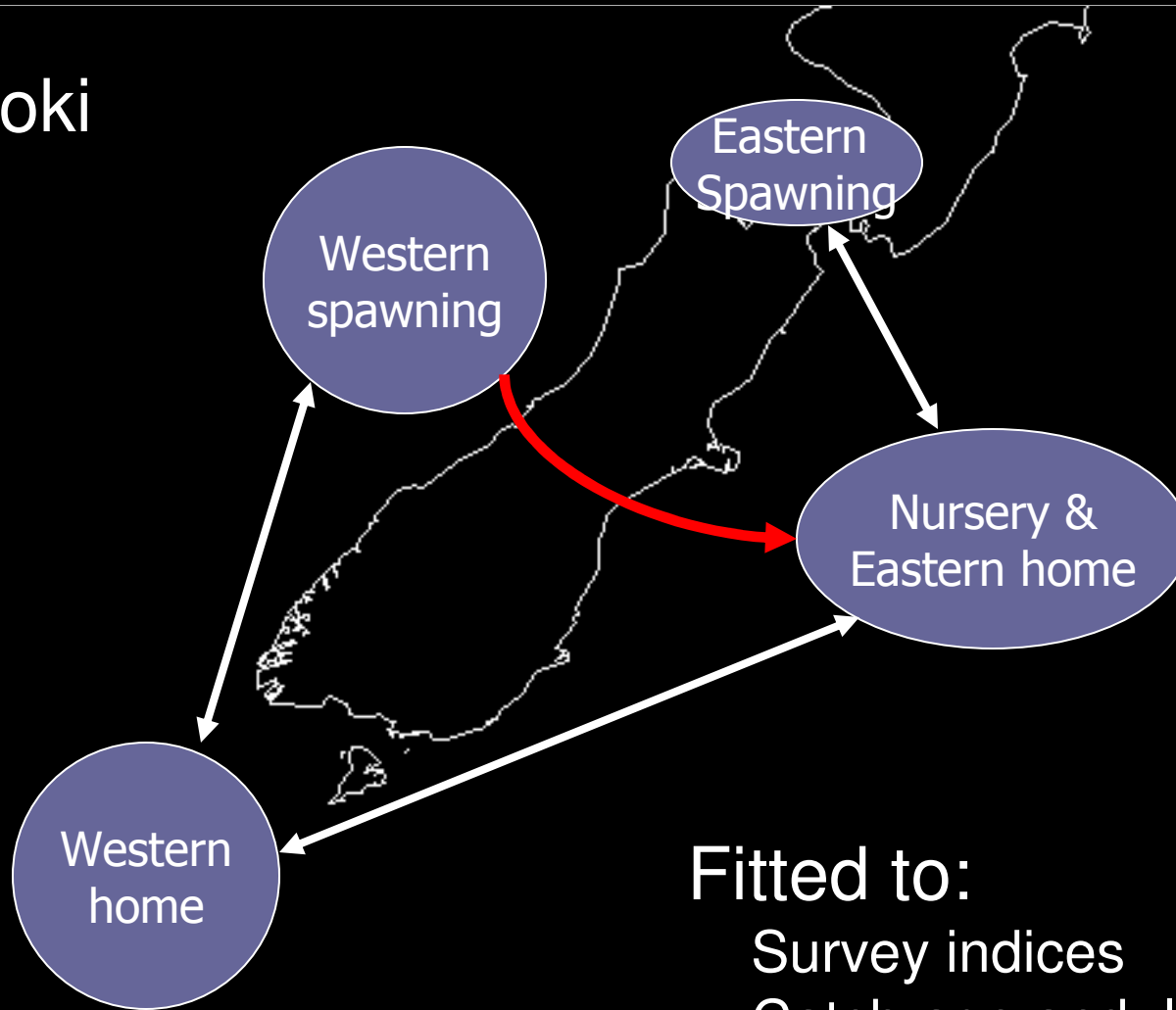
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- Largest yield of any NZ fishery
- MSC certified
- Two spawning areas (but also shared areas)
- “western” “stock” appears more depleted.





# NZ hoki



Fitted to:

Survey indices

Catch-age and -length data

No tagging data

# Management Strategy Evaluation

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How to manage in the face of  
uncertainty about stock structure

# IWC management scheme

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Area 1  
TAC 1

Area 2  
TAC2

Area 3  
TAC3

Area 1+2+3  
TAC1-3

## Catch capping

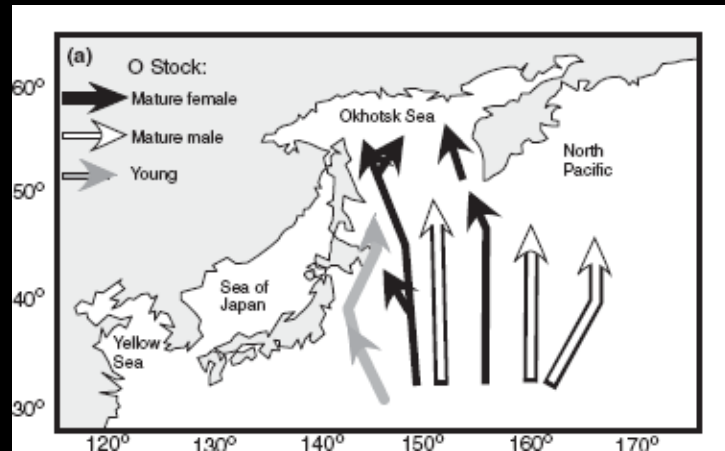
TAC1, 2 and 3 are bounded above by TAC1-3

## Catch cascading

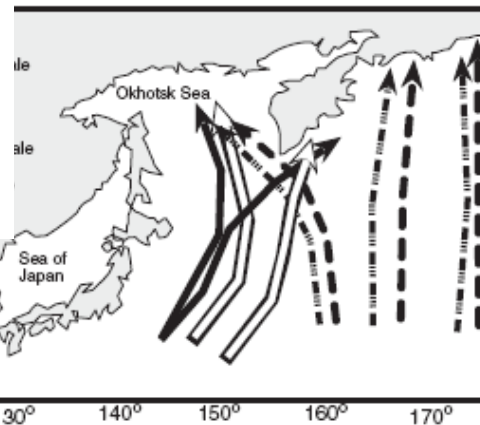
TAC1-3 is sub-divided among areas 1-3 based survey data

TACs are computed using an NPFMC Tier I-like decision rule.

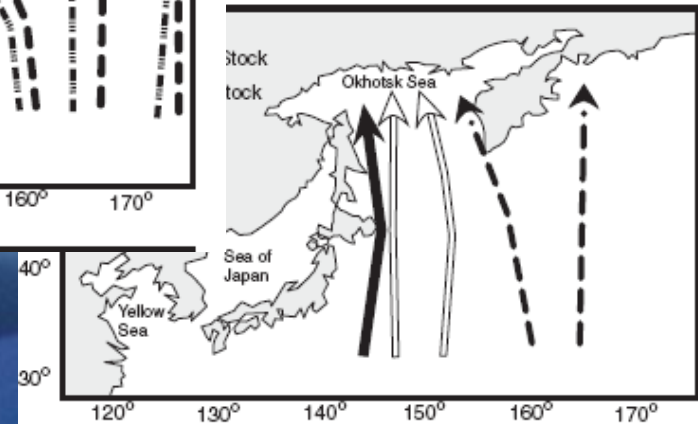
# North Pacific minke whales



Multiple inshore stocks

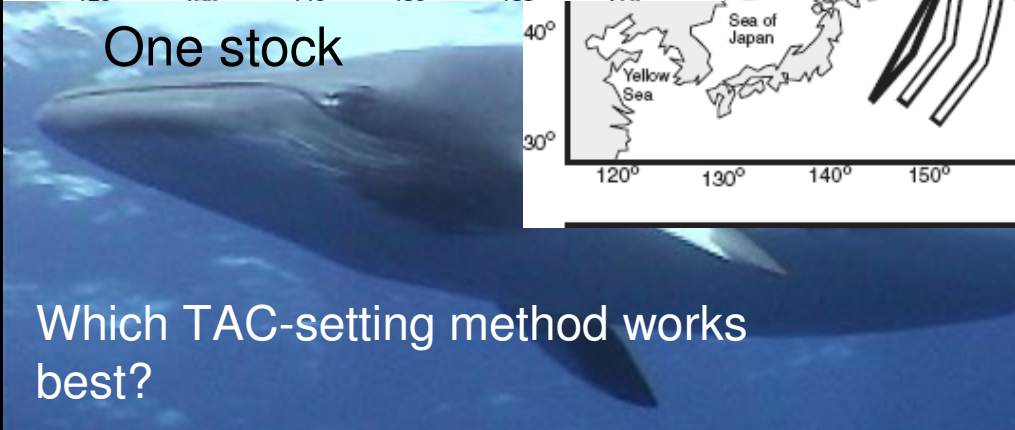


Two stocks with a cline

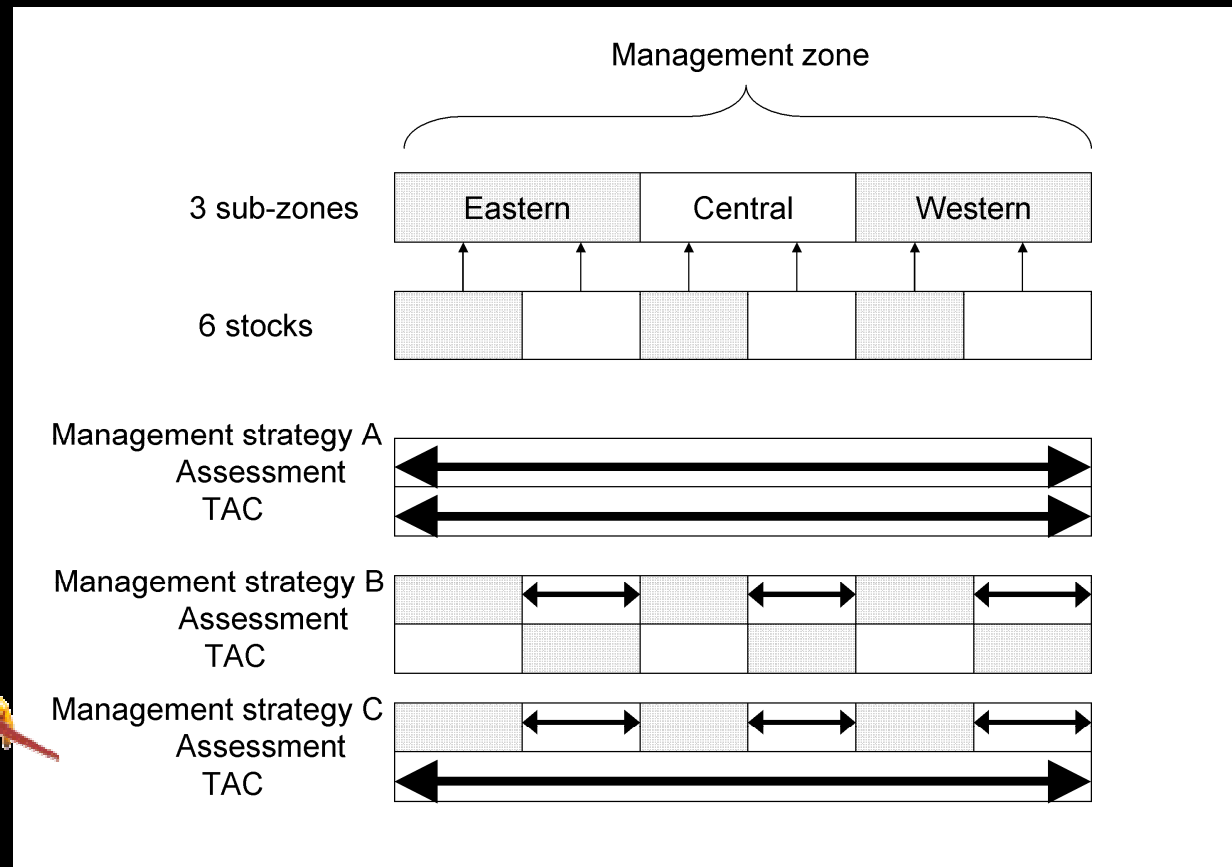


One stock

Which TAC-setting method works best?



# Victorian Rock Lobsters

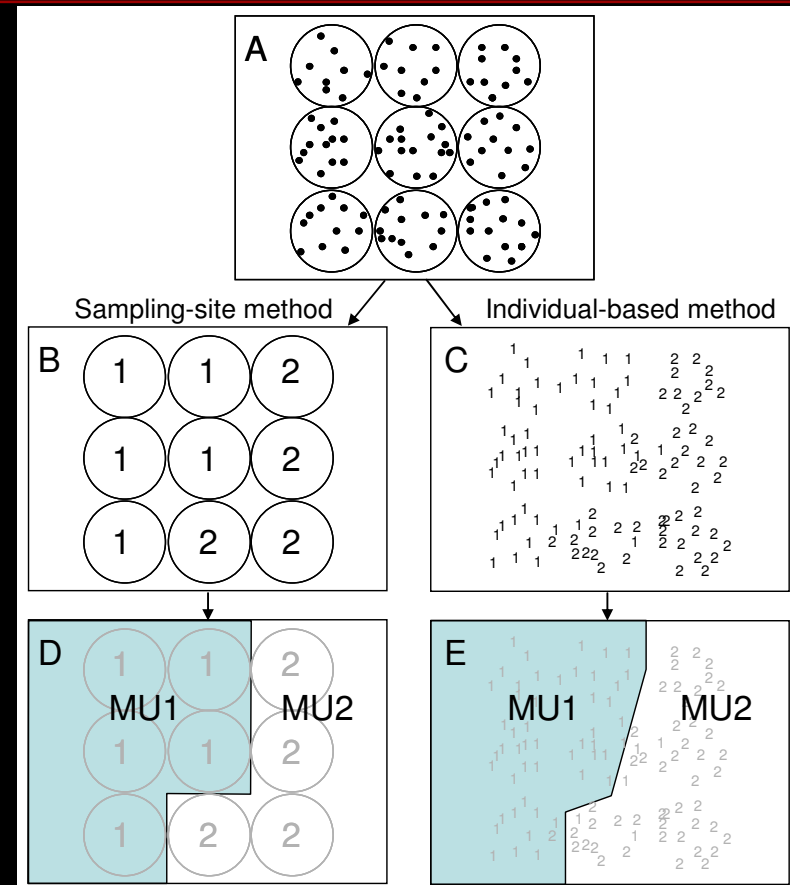
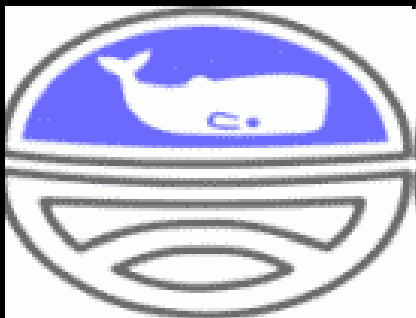


# TOSSM

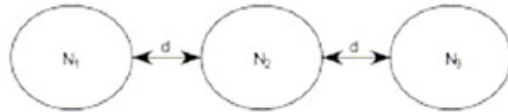
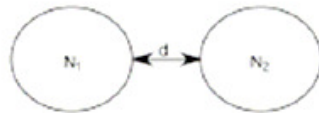
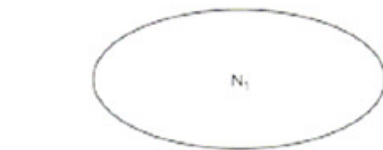
## (Testing of Spatial Structure Methods)

Evaluating the combination of stock structure methods and TAC setting systems.

How take a set of (genetic) samples and select “management unit” boundaries.



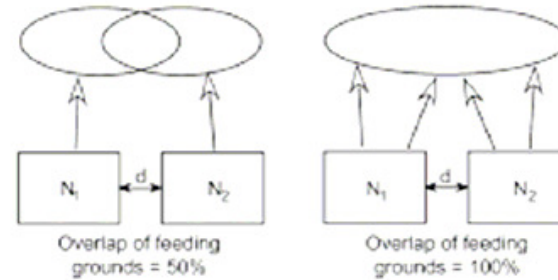
# TOSSM (Archetypes)



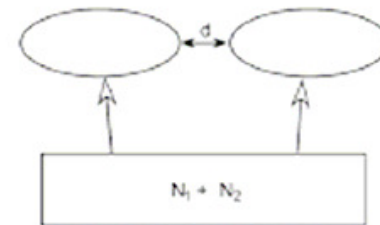
(b) Archetype II



(c) Archetype III



(d) Archetype IV



(e) Archetype V