Standardization of CPUE for bigeye (*Thunnus obesus*) and yellowfin (*Thunus albacares*) tunas of Korean longline fishery in the Indian Ocean

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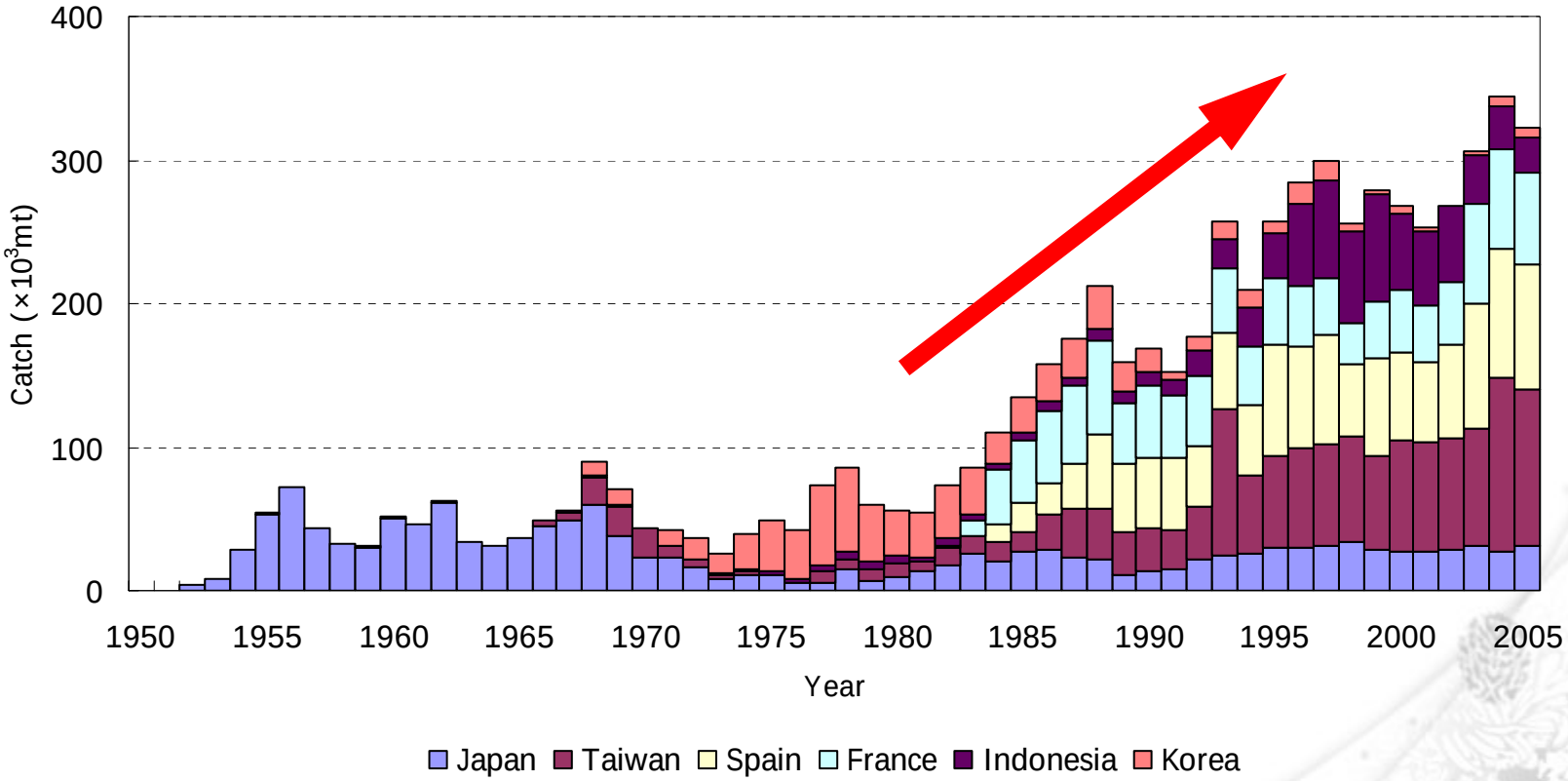
Contents

- Background
  - Status of the Indian Ocean
  - Korean longline fishery
- Data and method
  - Used fishery data
  - Generalized linear model
- Results and discussion
  - Nominal CPUE vs Standardized CPUE
  - Maximum sustainable yield
- Summary

Background

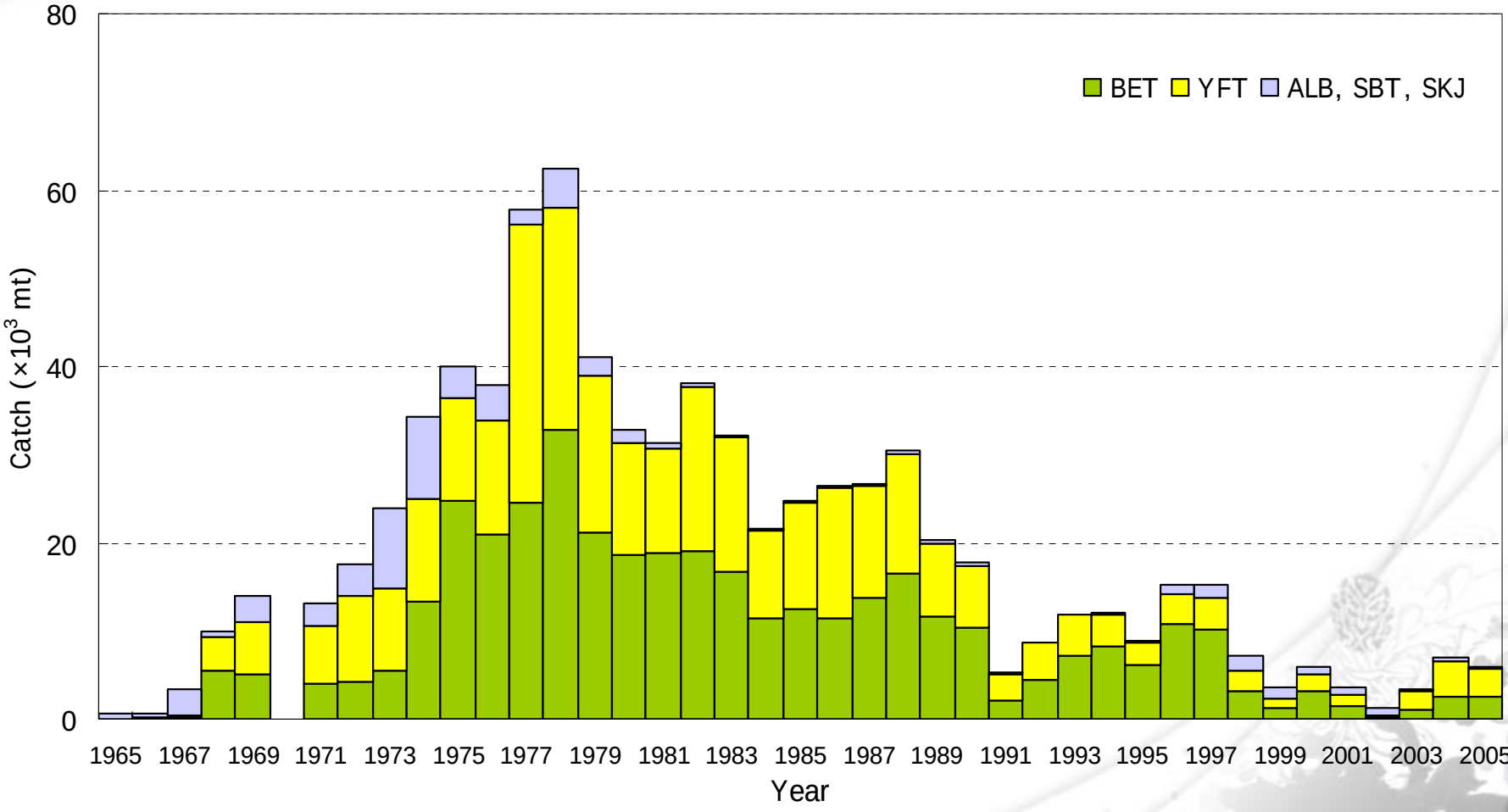
Annual catches of bigeye and yellowfin tunas



FAO, 2007

Background

Korean longline fishery



FAO, 2007

Objective

- Used Japanese and Taiwanese fishery data for stock assessment

Offer a standardized CPUE of Korean longline for stock assessment in the Indian Ocean

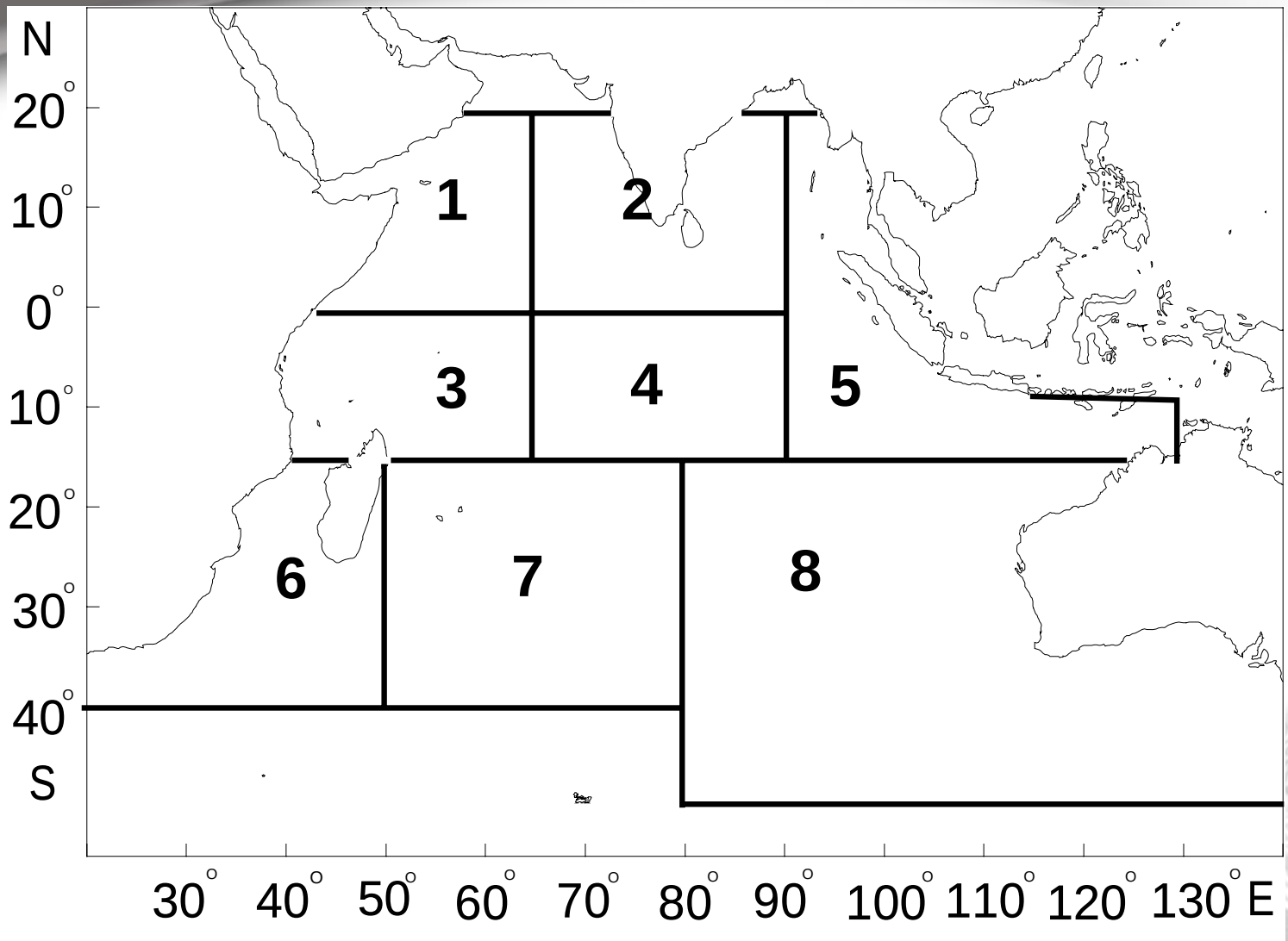
DATA

- Fishery: Korean longline
- Period: 1987 – 2006
- Year/quarter
- 5×5 latitude/longitude
- Area
- Number of hooks between float (HBF)

  < 10: 1, 10 - 15: 2, 16 - 20: 3, 20 < : 4

- Environmental factors

Regional structure

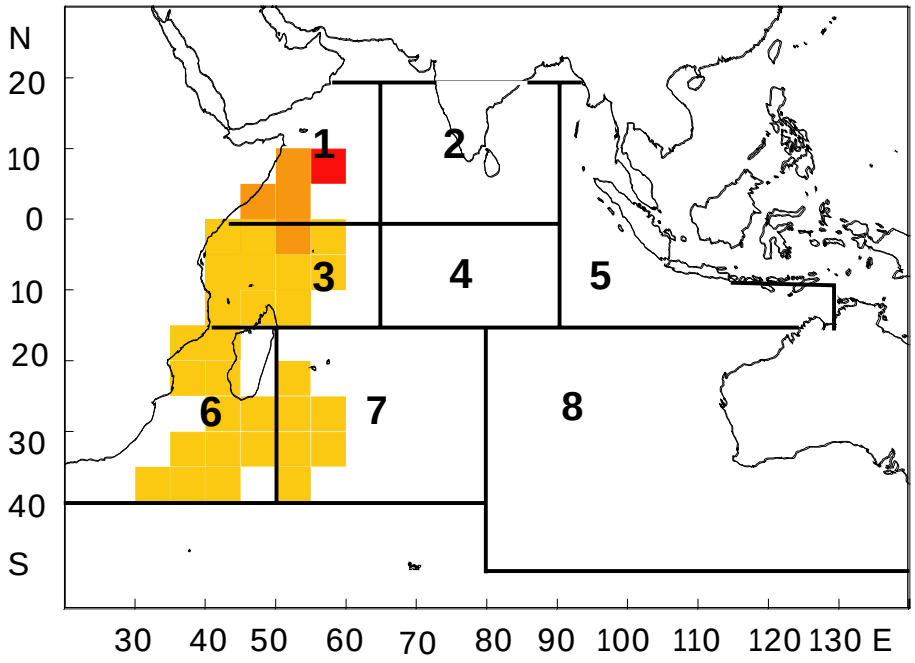


Modified from Okamoto and Shono, 2006

Spatial distribution of annual CPUE

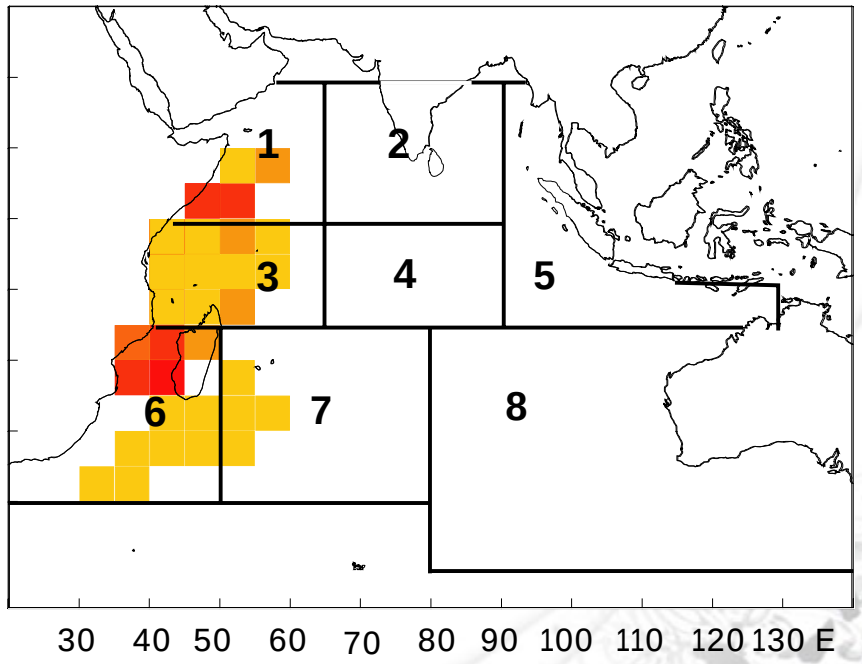
Bigeye tuna

2006



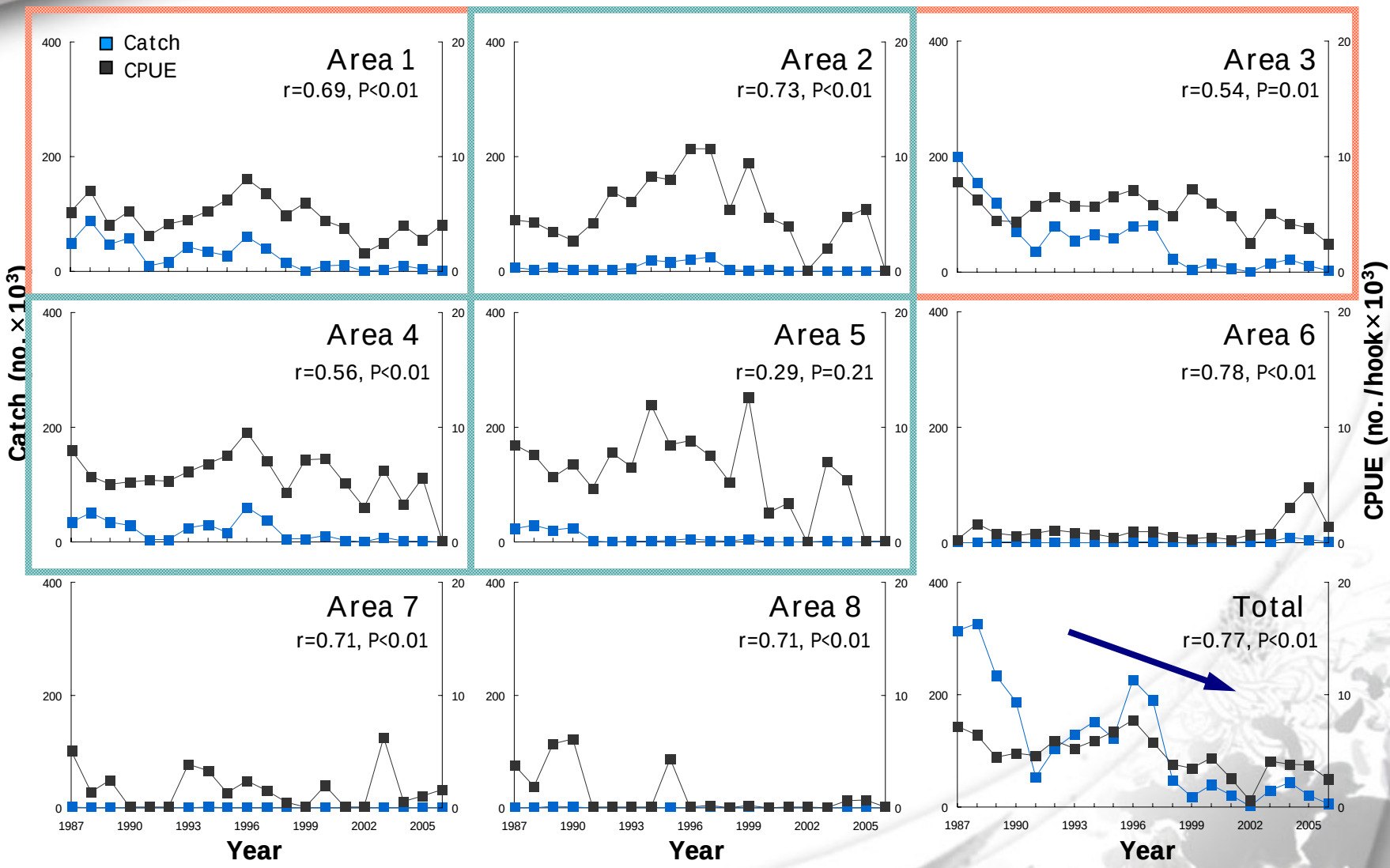
Yellowfin tuna

2006



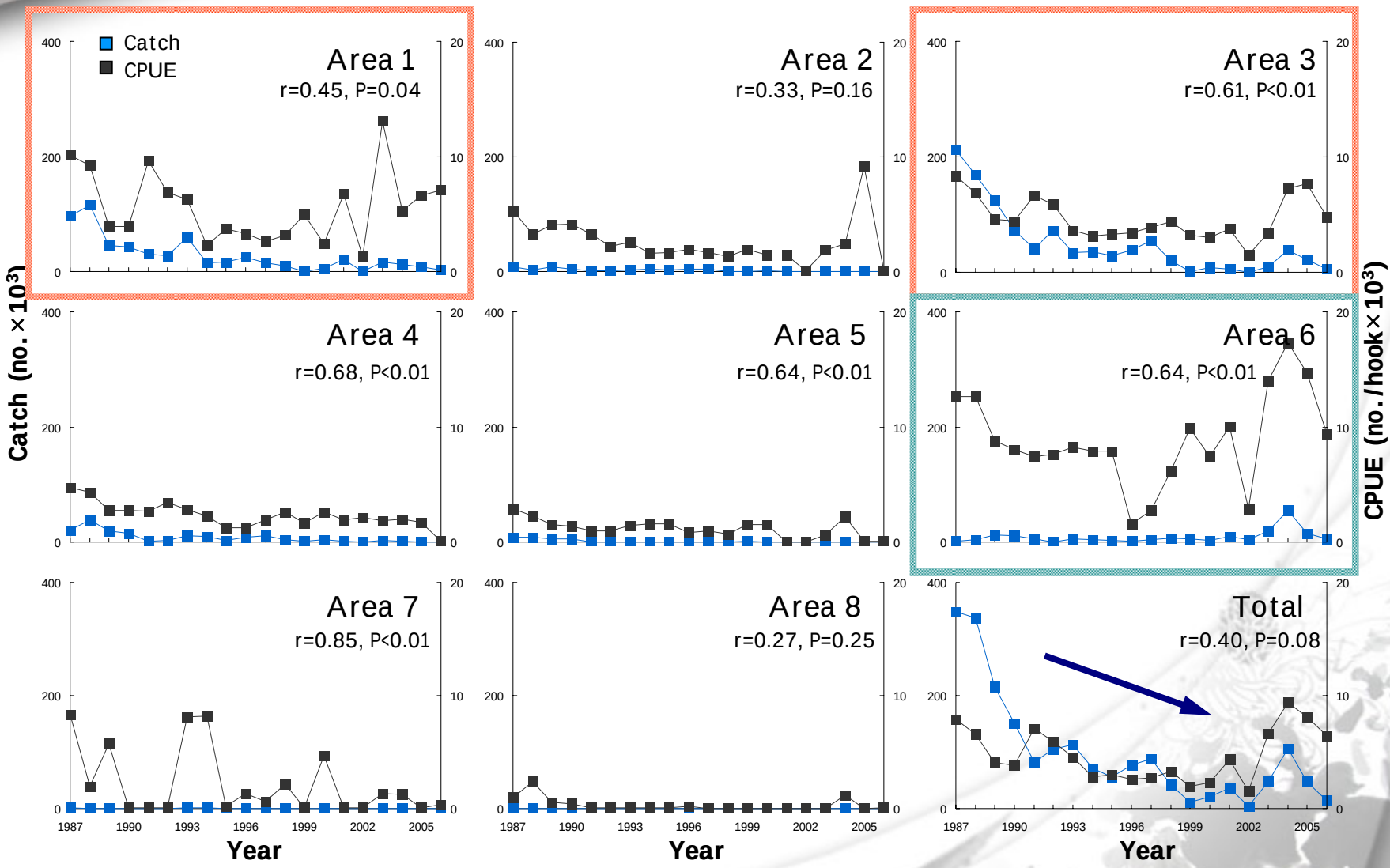
Annual catch and CPUE by sub-area

Bigeye tuna



Annual catch and CPUE by sub-area

Yellowfin tuna



Generalized Linear Model

$$\log(CPUE_{ijk} + c) = \mu + YRQTR_{(i)} + AREA_{(j)} + HBF_{(k)} + environmental\ factor + interactions$$

CPUE: catch in number of fish per 1000 hooks,
c: 10% of overall mean of CPUE,
μ : intercept,
YRQTR: effect of year quarter,
AREA: effect of sub-area and
HBF: effect of number of hooks between float

Generalized Linear Model

Case I

$$\log(CPUE+0.1)=\mu+YRQTR+AREA+HBF+SST+(YRQTR\cdot AREA+YRQTR\cdot HBF+YRQTR\cdot SST+AREA\cdot HBF+AREA\cdot SST+HBF\cdot SST)$$

Case II

$$\log(CPUE+0.1)=\mu+YRQTR+AREA+SST+(YRQTR\cdot AREA+YRQTR\cdot SST+AREA\cdot SST)$$

Case III

$$\log(CPUE+0.1)=\mu+YRQTR+AREA+HBF+(YRQTR\cdot AREA+YRQTR\cdot HBF+AREA\cdot HBF)$$

Generalized Linear Model

Standardized CPUE

$$U_y = \frac{\sum_{a=1}^{8} YRQTR_{y,a} \cdot w_a}{\sum_{a=1}^{8} w_a}$$

U_y: standardized CPUE for year y

$YRQTR_{y,a}$: standardized CPUE for year y and area a

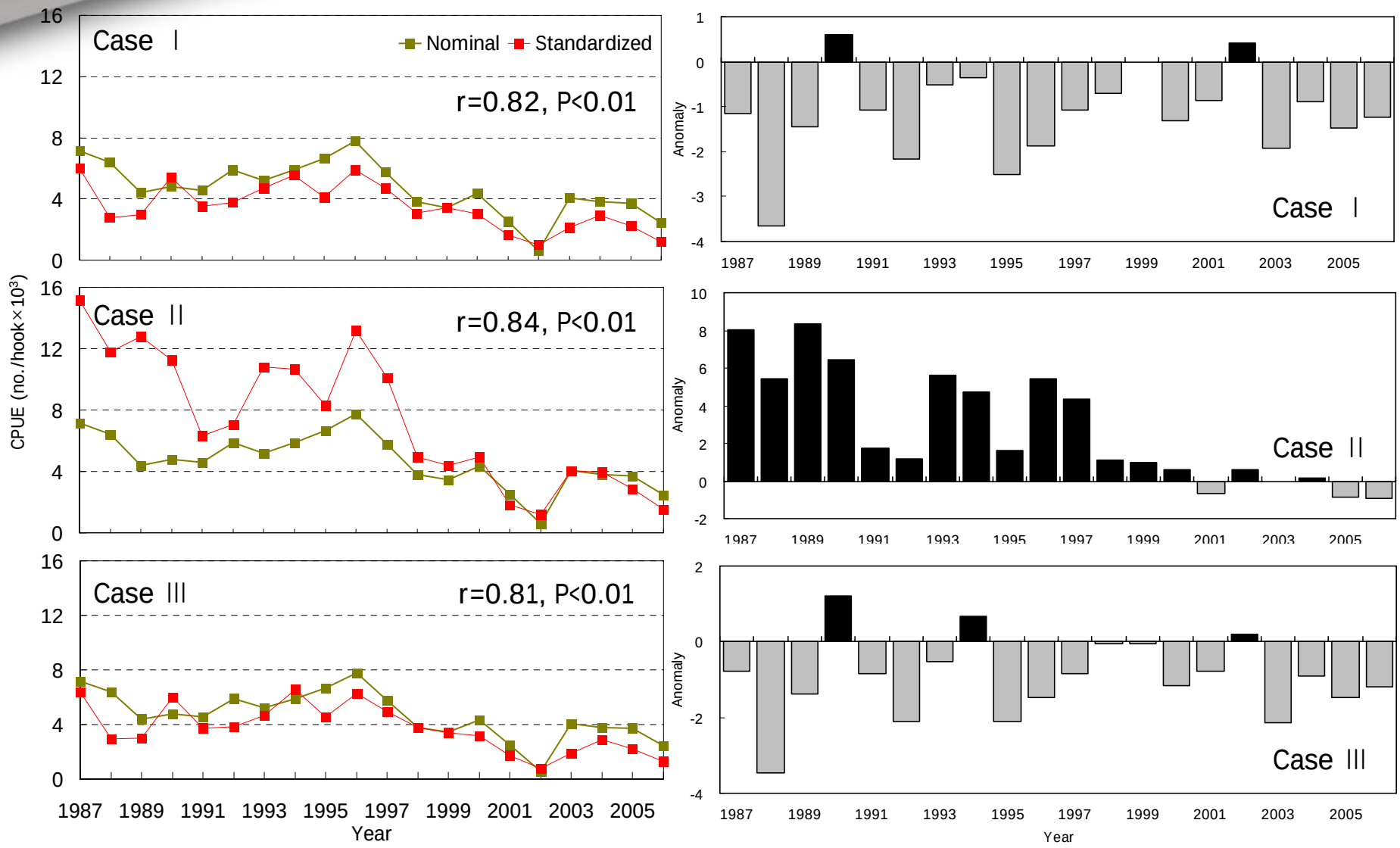
w_a: relative size of area a to the overall studied area a

Relative size of area

Area	1	2	3	4	5	6	7	8
Relative size	0.57	0.85	0.73	0.78	1.02	0.85	3.64	1.56

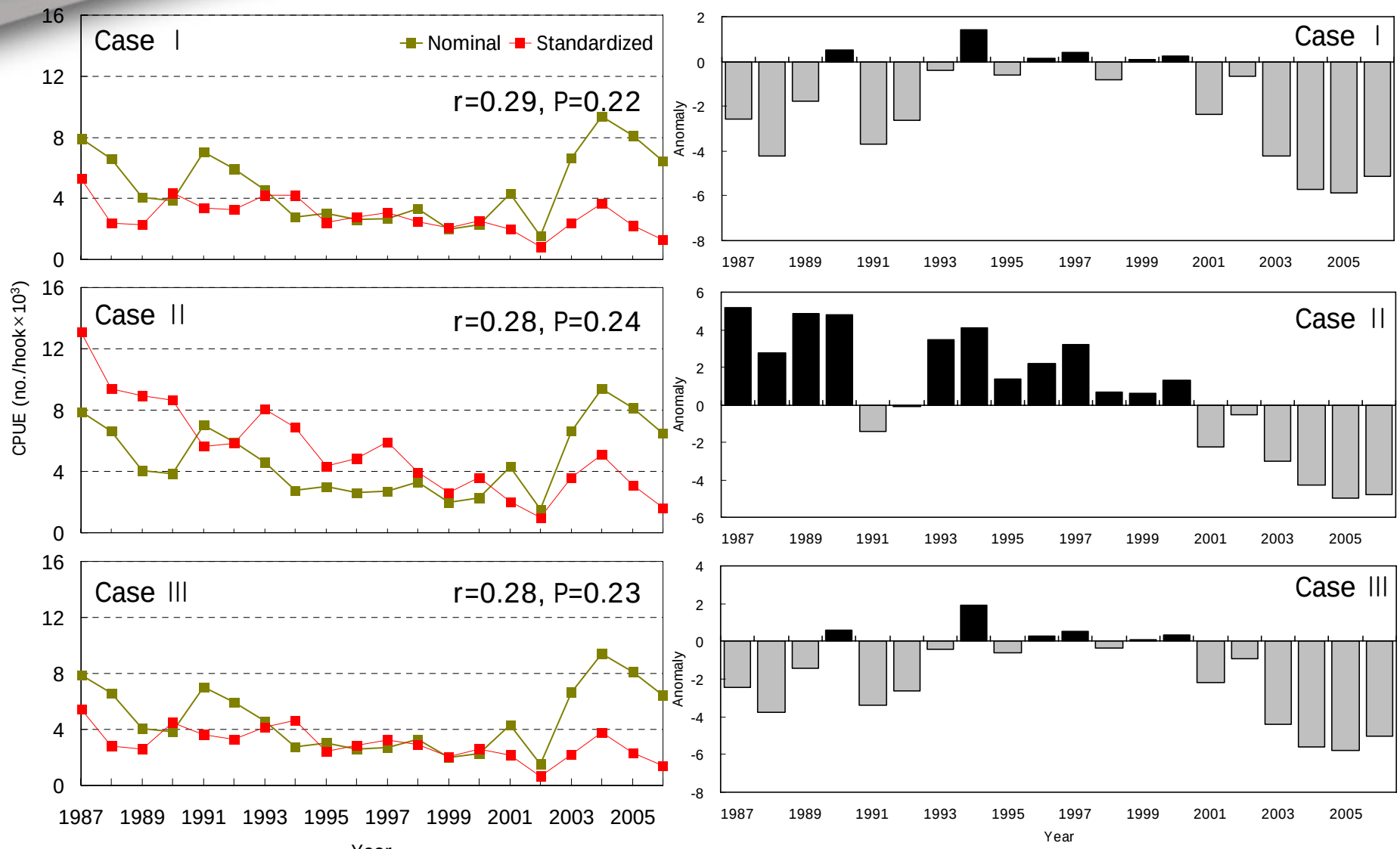
Standardized CPUE

Bigeye tuna



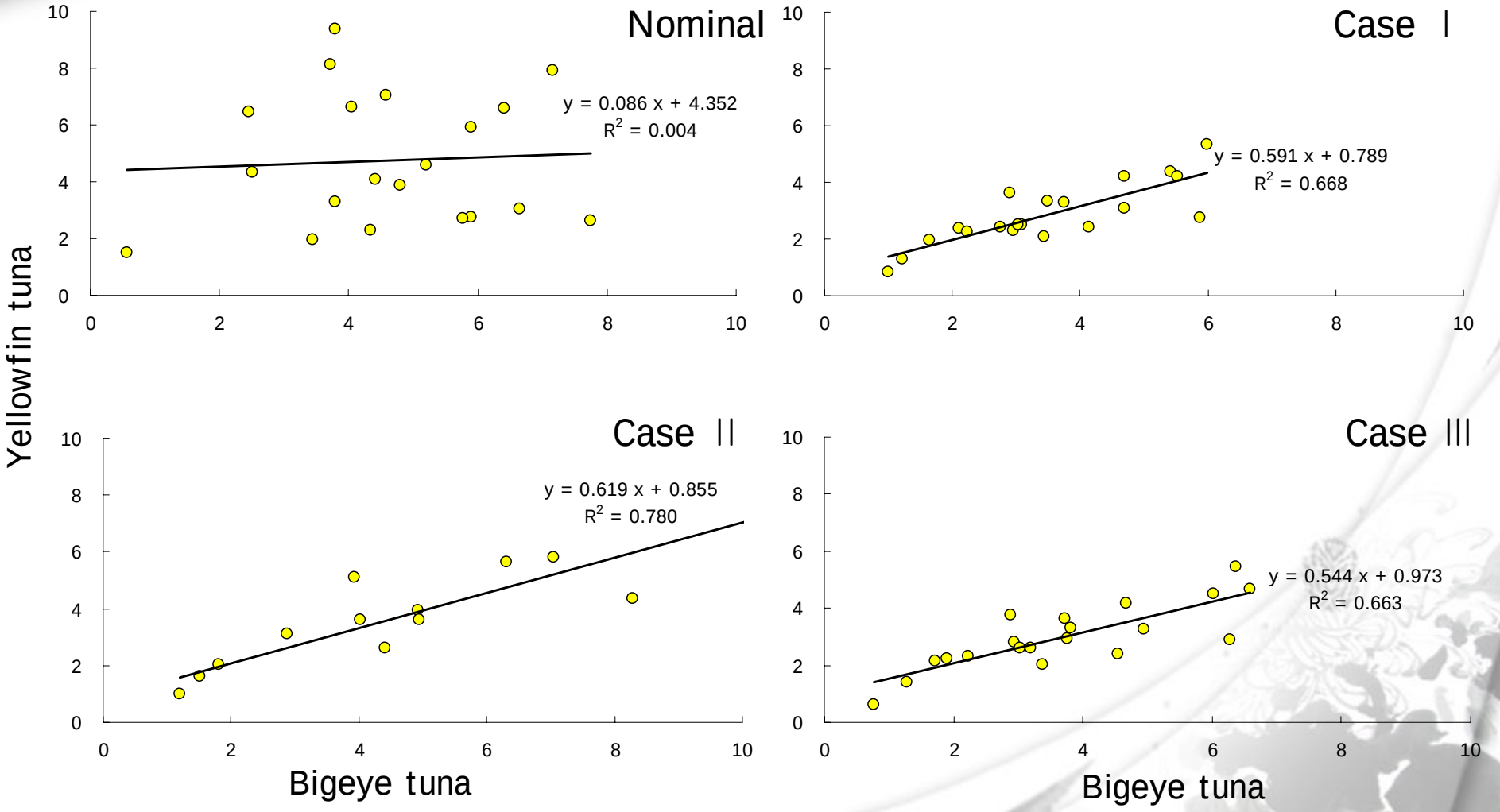
Standardized CPUE

Yellowfin tuna



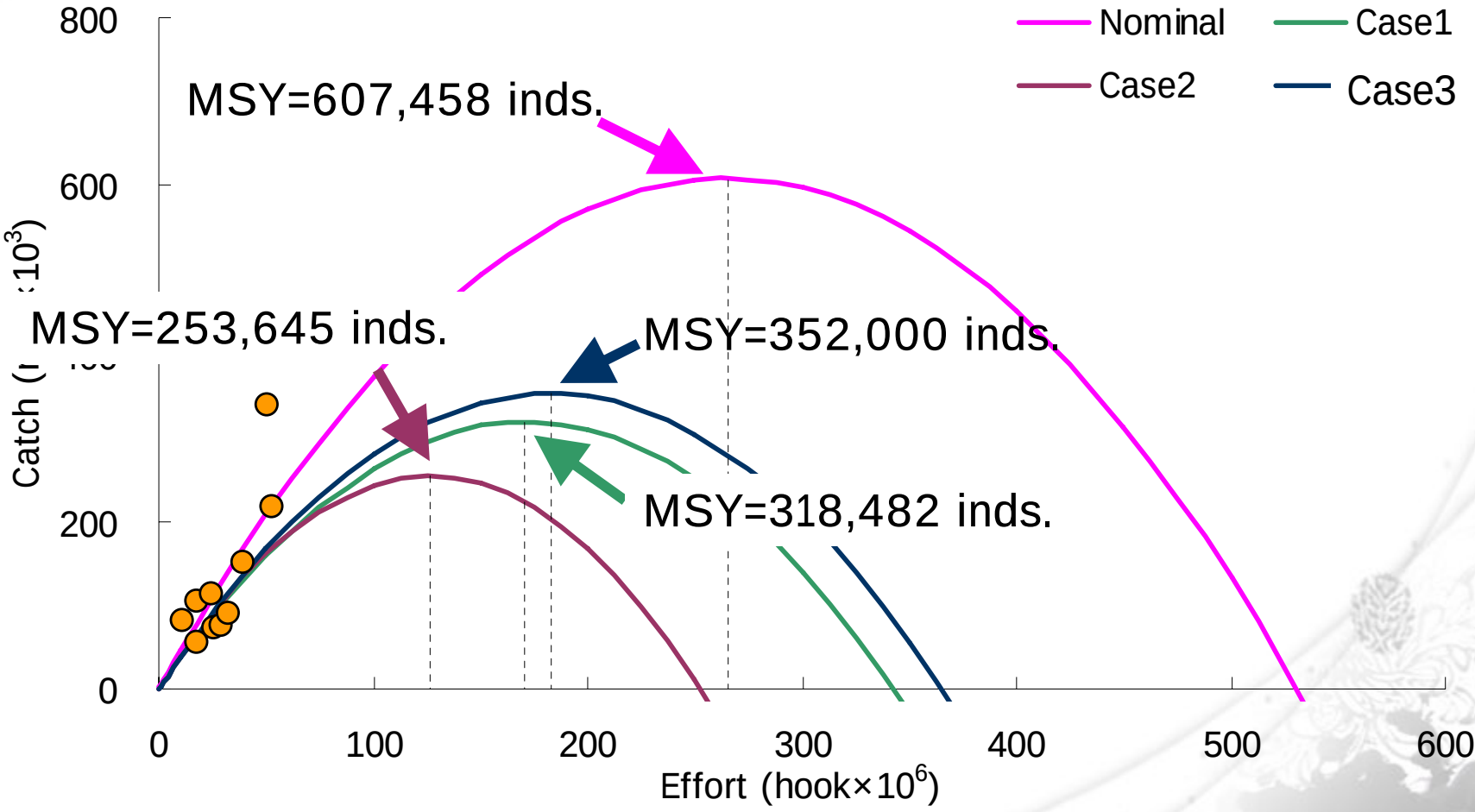
Standardized CPUE

Bigeye vs Yellowfin



Maximum Sustainable Yield

Yellowfin tuna



Summary

- Decrease of annual CPUE, continually
- HBF would be an important variable in CPUE standardization by GLM
- Estimated high MSY from nominal CPUE

- Ecological interactions such as spatial competition or prey availability between bigeye and yellowfin tunas would be considered to standardize CPUE