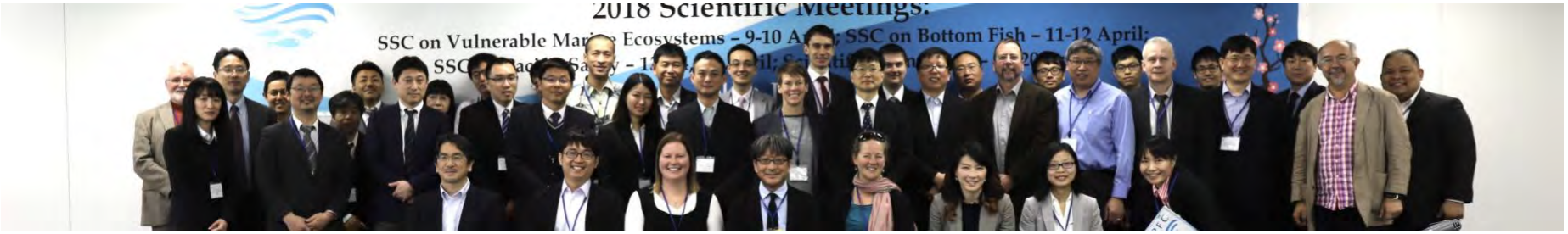
Stock assessment for Pacific saury, considering some marine environmental factors

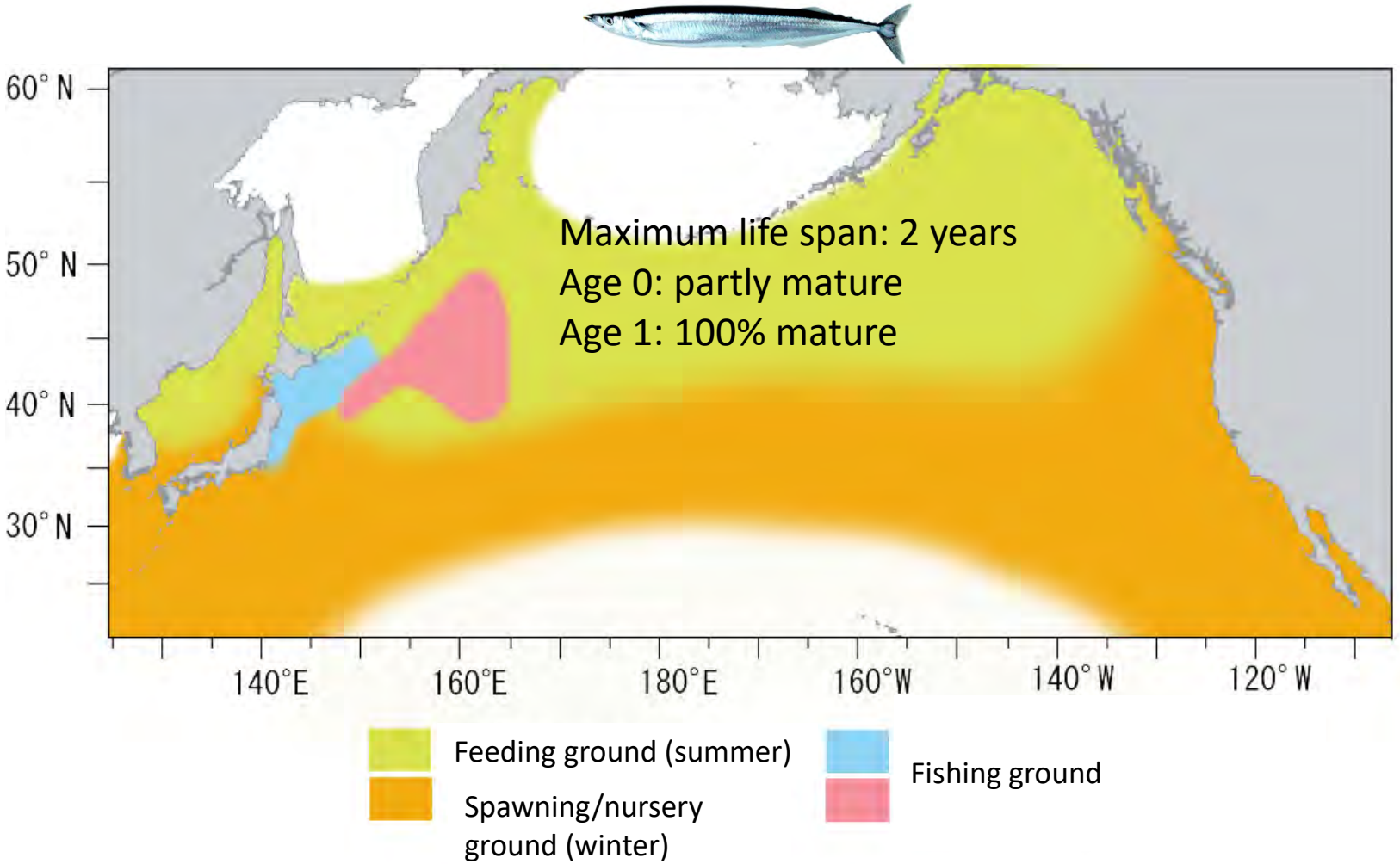
PICES PTA symposium
(S-2)
24, April 2018
La Paz, Mexico



Toshihide Iwasaki

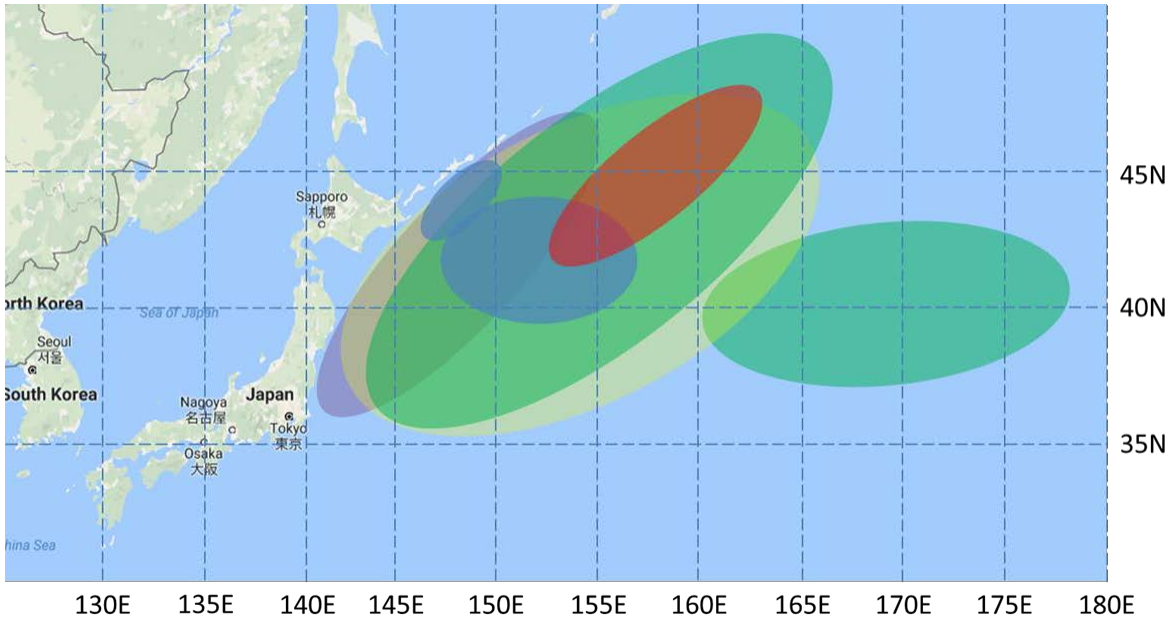
(Chair for Small Scientific Committee on Pacific saury, NPFC)

Ecology of Pacific saury



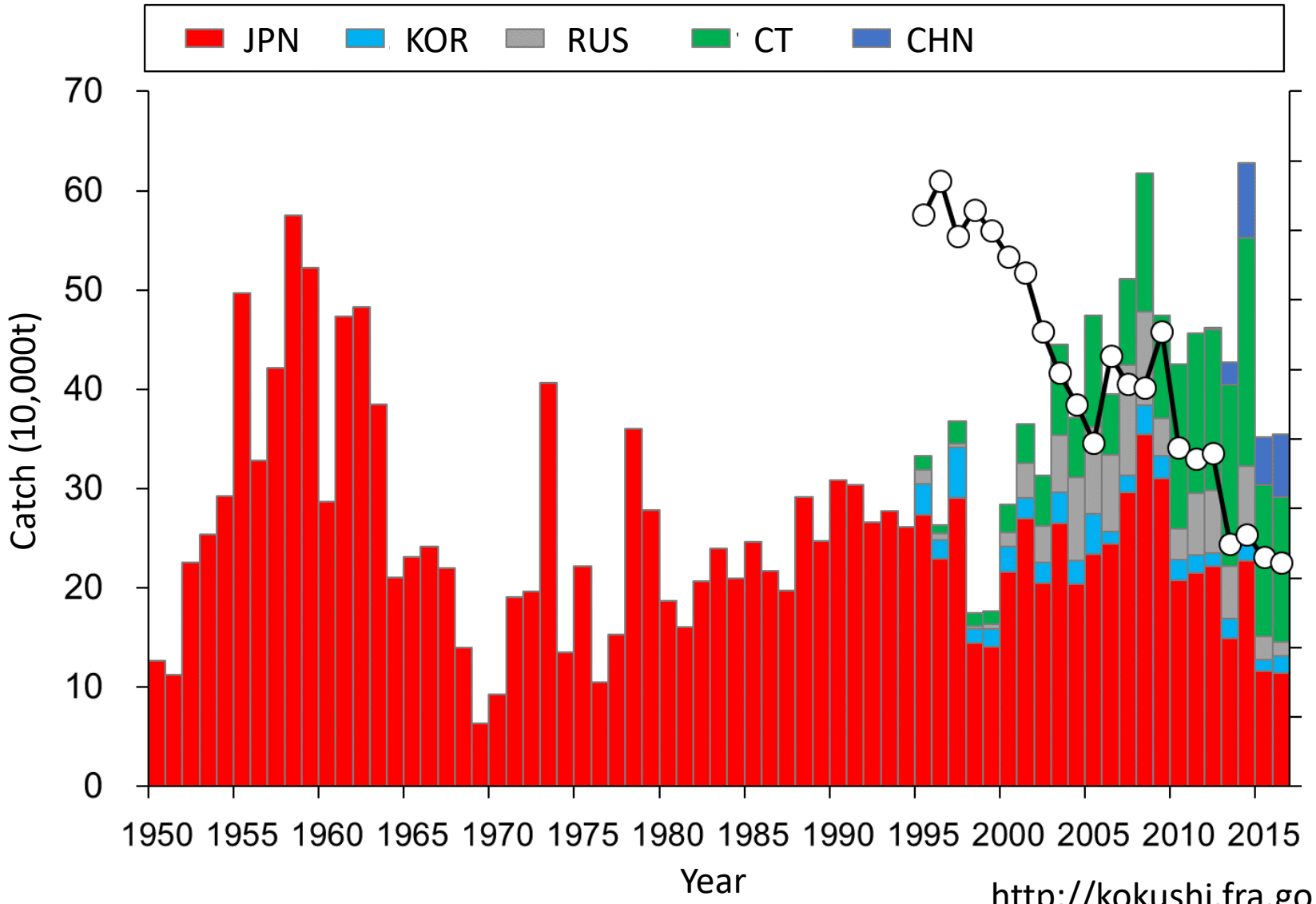
http://kokushi.fra.go.jp/H29/H29_75.html

PS fishing ground (in detail)



Main fishing grounds for the Pacific saury by fishing country in the Western North Pacific Ocean. This figure was compiled based on the National reports of fishing members of NPFC (NPFC-2017-TWG PSSA01-Final Report).

Global PS catch (1950-2016)



http://kokushi.fra.go.jp/H29/H29_75.html

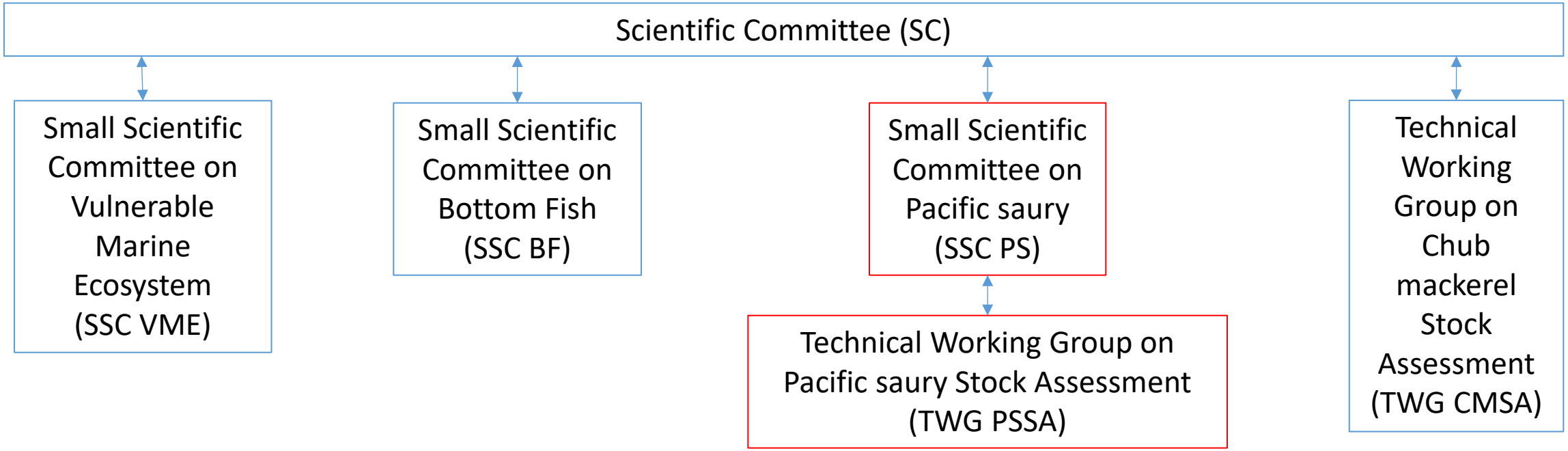
Fishing vessel and type of gear

Japanese fishing vessels

Russian fishing vessel

(NPFC-2017-TWG PSSA01-Final Report)

North Pacific Fisheries Commission (NPFC) with reference to Scientific Committee (SC)



- Came into force on 19th July 2015
- Present members: Canada, China, Japan, ROK, Russia, Chinese Taipei, USA and Vanuatu (Red: PS fishing members).

Road map of PS stock assessment

- In 2015, NPFC Commission recommended SC to complete PS stock assessment by 2017.
- In 2016, SSC PS agreed to conduct “provisional ” stock assessment using age aggregated production model (common data among fishing members were limited).
- SSC PS formed Technical Working Group for Pacific saury stock assessment (TWG PSSA) to work intersessionally.
- TWG PSSA held two meetings to complete “provisional” stock assessment in Busan, December 2016 and Yokohama, February 2017.
- SC agreed “provisional” stock assessment results in April, 2017.

“Provisional” stock assessment model

- Bayesian state-space biomass dynamic model
- Data used:

  #Total catch (1980-2015)

  #Standardized CPUEs by Japan, Korea, Russia and Chinese Taipei (-2015)

  #Fishery-independent biomass survey data (2003-2015)

$$B_t = B_{t-1} + rB_{t-1}\left(1 - \left(\frac{B_{t-1}}{K}\right)^M\right) - C_t$$

where B_{t-1} and C_{t-1} denote biomass and catch (landings), respectively, for year t-1.

Carrying capacity, K, is the biomass of the population at equilibrium prior to commencement of the fishery;

r is the intrinsic population growth rate; and M ($= Z, = s$) is the production shape parameter.

Consideration of marine environmental factors

- Water temperature was incorporated as marine environmental factor to standardize CPUEs by GLM.
- In our biomass dynamic model, other marine environmental factors were not considered.
- Environmental changes over long period were not considered (assuming constant carrying capacity and MSY over the assessment period 1980-2015).

Base case scenarios performed

- Base case 1: Including four sets of CPUEs and fishery-independent biomass survey data with survey catchability (q) prior defined from 0 to 1
  $0<q<1$

- Base case 2: Including four sets of CPUEs and fishery-independent biomass survey data with survey catchability (q) prior being fixed at 1
  $q=1$

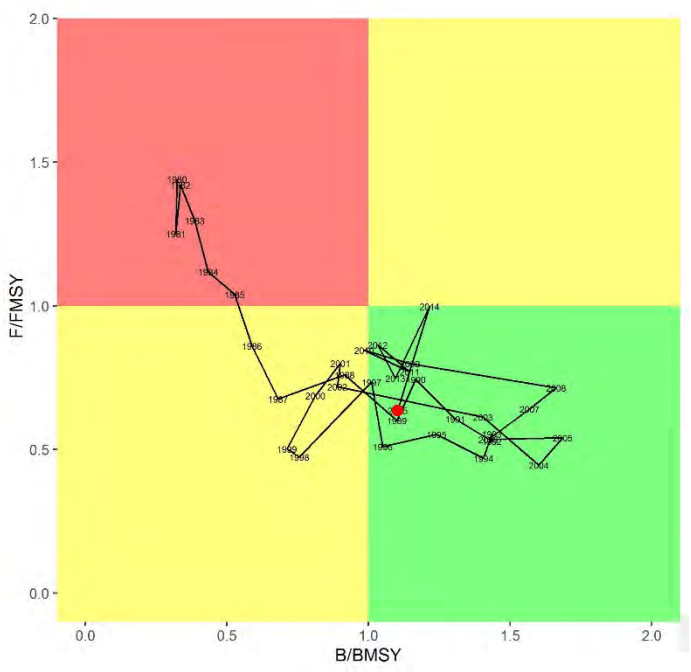
- Base case 3: Including four sets of CPUEs and fishery-independent survey data with survey catchability (q) prior being defined from 0 to larger than 1
  Free q

Summary Table of PS stock assessment results (example for base case 1)

Scenarios	Parameters	China		Japan		Chinese Taipei	
		mean	median	mean	median	mean	median
S1 (q 0-1)	K (10,000 mt)	790.26	704.00	579.4	511.2	462.80	444
	r	1.03	0.77	0.965	0.704	0.73	0.61
	Shape (s, Z, M)	0.57	0.32	0.729	0.569	0.99	0.79
	B_{1980}/K	0.14	0.32	0.185	0.175	0.19	0.18
	MSY (10,000 mt)	59.35	57.07	62.2	59.5	60.67	58.34
	F_{MSY}	0.19	0.18	0.251	0.248	0.33	0.32
	B_{MSY} (10,000 mt)	346.66	310.1	265.5	237.1	224.8	216.70
	B_{1980} (10,000 mt)	105.98	97.91	102.7	91.8	88.38	82.92
	B_{2015} (10,000 mt)	356.63	333.1	364.9	328.5	307	292.60
	F_{1980}	0.25	0.24	0.269	0.259	0.36	0.34
	F_{2015}	0.11	0.11	0.108	0.110	0.13	0.13
	q5 (Biomass)	0.77	0.79	0.779	0.815	0.82	0.85
	B_{2016}/K	0.51	0.52	0.702	0.680	0.7	0.7
	B_{2016}/B_{MSY}	1.16	1.18	1.529	1.463	1.44	1.44
	F_{2015}/F_{MSY}	0.64	0.58	0.522	0.433	0.43	0.4

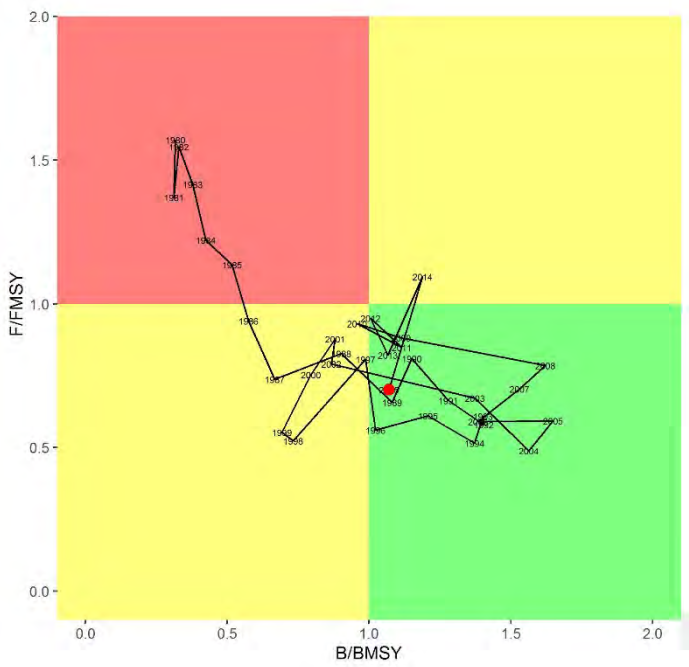
Kobe plots by China

q<1



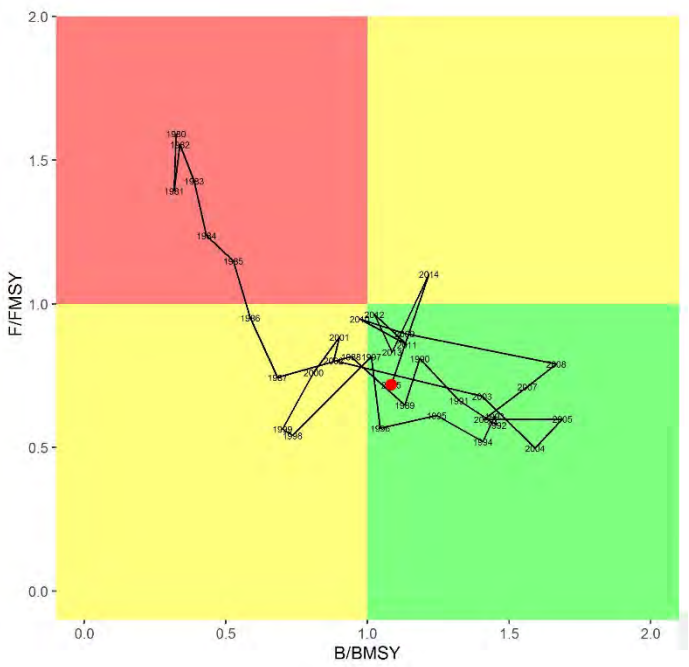
Base case 1 (CHN)

q=1



Base case 2 (CHN)

Free q (resulted in 1<q)

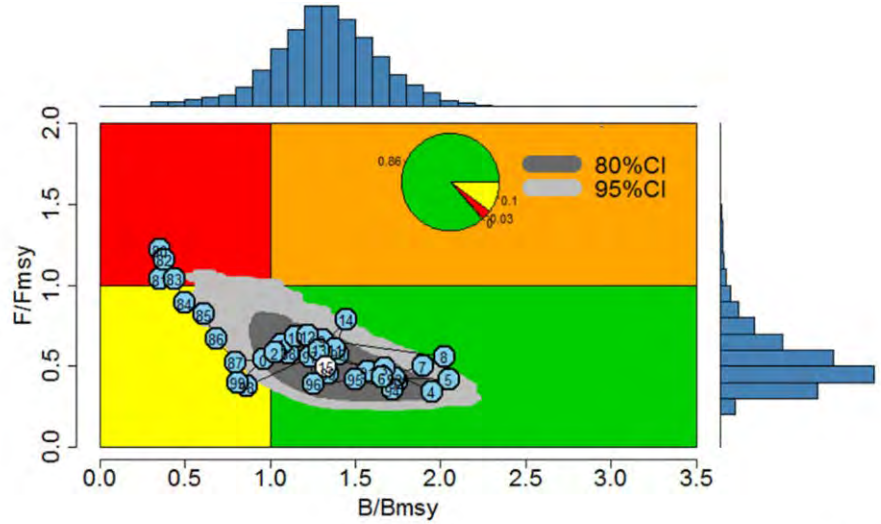


Base case 3 (CHN)

(NPFC-2017-TWG PSSA01-Final Report)

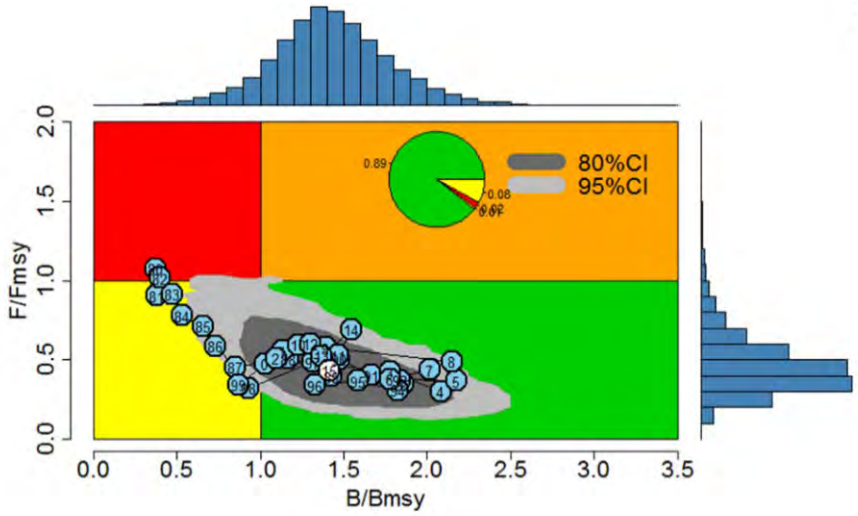
Kobe plots by Japan

q=1



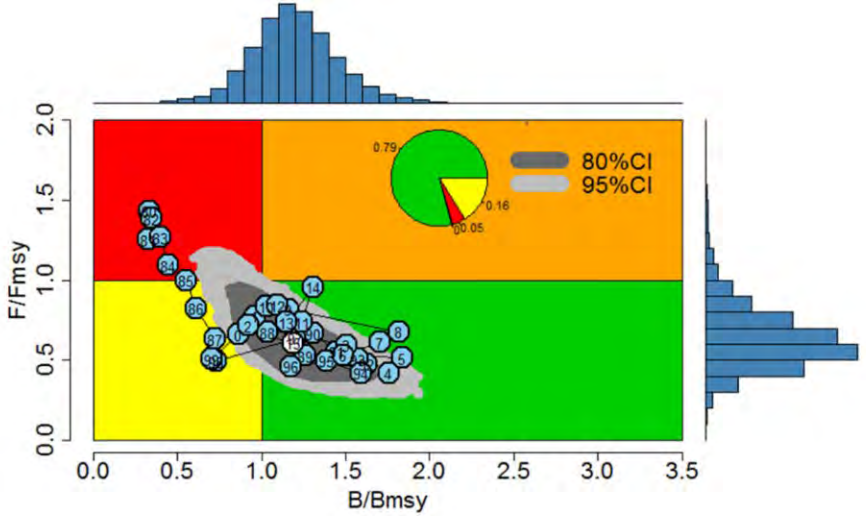
Base case 2 (JPN)

q<1



Base case 1 (JPN)

Free q (resulted in 1<q)

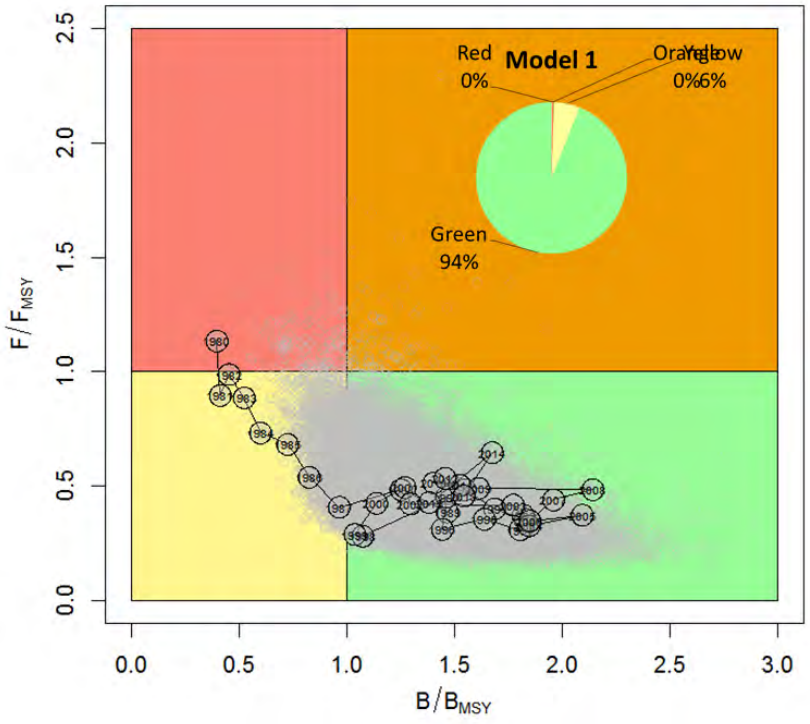


Base case 3 (JPN)

(NPFC-2017-TWG PSSA01-Final Report)

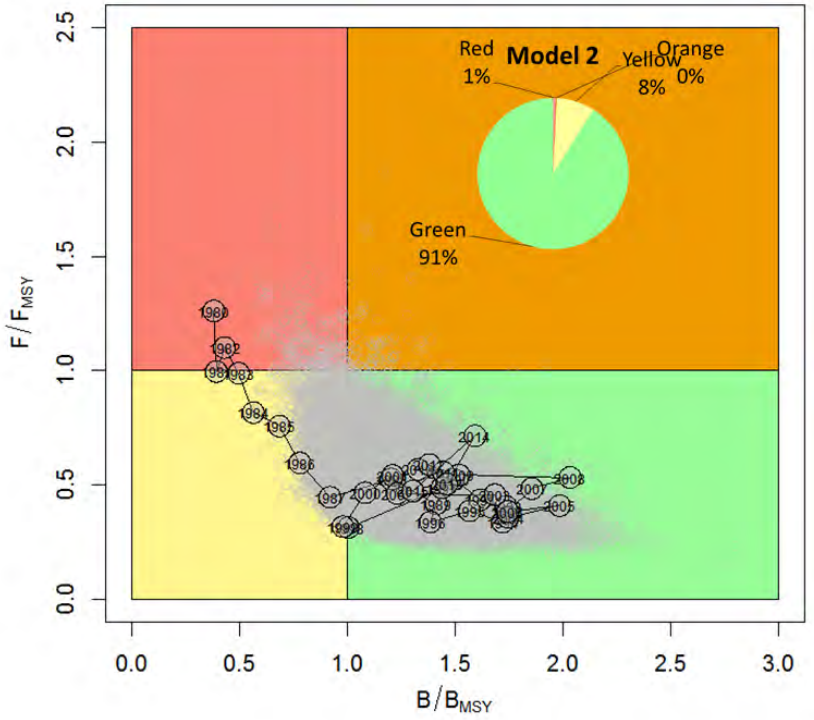
Kobe plots by Chinese Taipei

q<1



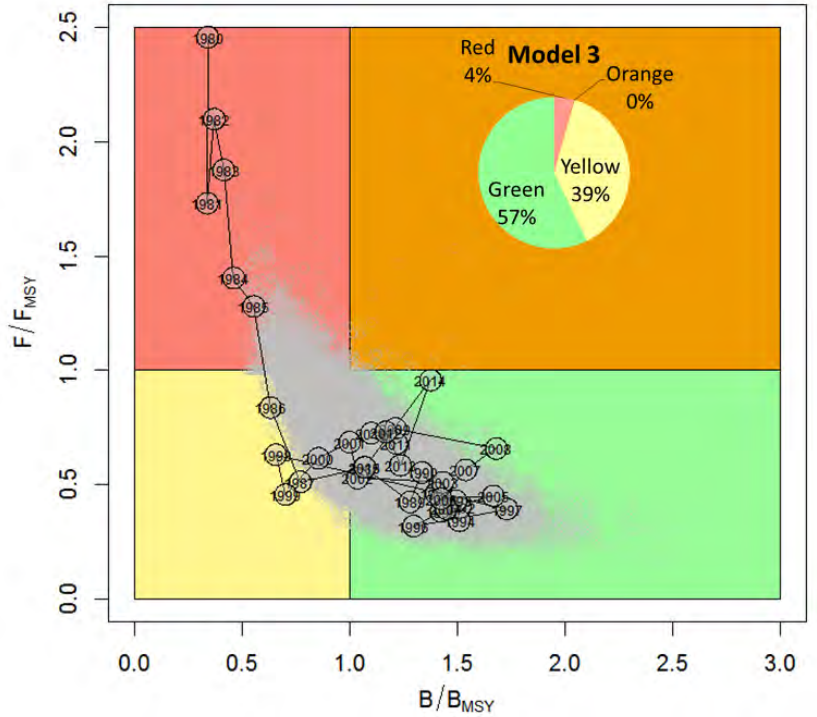
Base case 1 (CT)

q=1



Base case 2 (CT)

Free q (resulted in 1<q)



Base case 3 (CT)

(NPFC-2017-TWG PSSA01-Final Report)

Pacific saury stock status agreed by SSC PS in April 2017

"The SSC PS concluded that despite small variations among the three stock assessments and among the three base-case scenarios it is likely that the Pacific saury stock is not overfished with median B2016/BMSY varying from 1.16 to 1.46 and it is likely that overfishing is not occurring with median F2015/FMSY varying from 0.40 to 0.69. The sensitivity run, which excludes the survey data, also supports this conclusion with median B2016/BMSY varying from 1.19 to 1.34 and median F2015/FMSY varying from 0.50 to 0.65." (NPFC-2017-SSC PS02-Final Report)

Status of Pacific saury fishery after 2015

PS catch during 2015-2017 (includes some provisional figures)

Year	China	Japan	Korea	Russia	Chinese Taipei	Vanuatu
2017	48,458	84,528	15,353	6,315	106,544	4,437
2016	63,016	113,828	16,828	14,623	146,025	7,331
2015	48,503	116,243	11,204	24,047	152,271	6,616

NPFC Annual Report

Catch by several fishing members decreased after 2015.

Next attempt by NPFC

- SSC PS/TWG PSSA will update “provisional” PS stock assessment adding the latest data (CPUEs and biomass estimates after 2015).
- SSC PS/TWG PSSA will also initiate to establish “future” PS stock assessment models (e.g. age structured models), which may also incorporate marine environmental factors within its model structure.
- Collaboration works with PICES scientists will help NPFC to understand the significant role of marine environmental factors on PS stock.

Thank you for your attention!