Science-based fisheries management in the South Pacific Regional Fisheries Management Organization (SPRFMO) area

James Ianelli & Niels Hintzen

www.sprfmo.int

SPRFMO

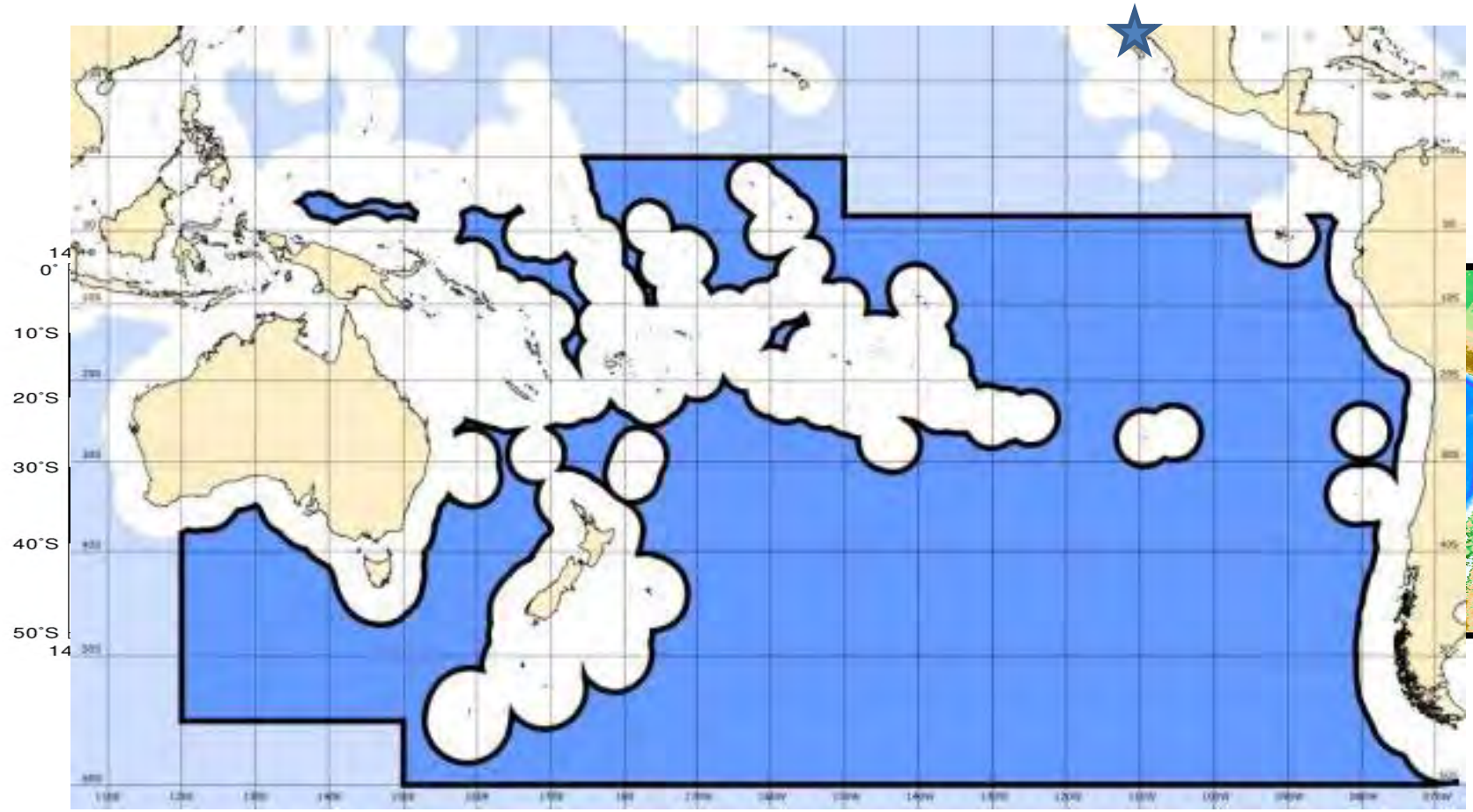
5th Scientific Committee Meeting of SPRFMO
September 2017, Shanghai China

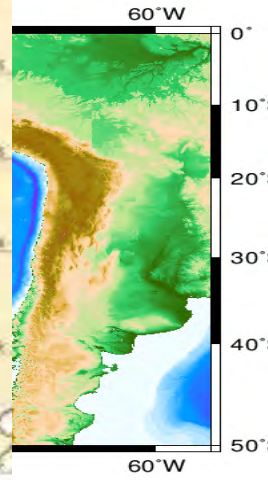
SPRFMO

69-participants from 13 member countries

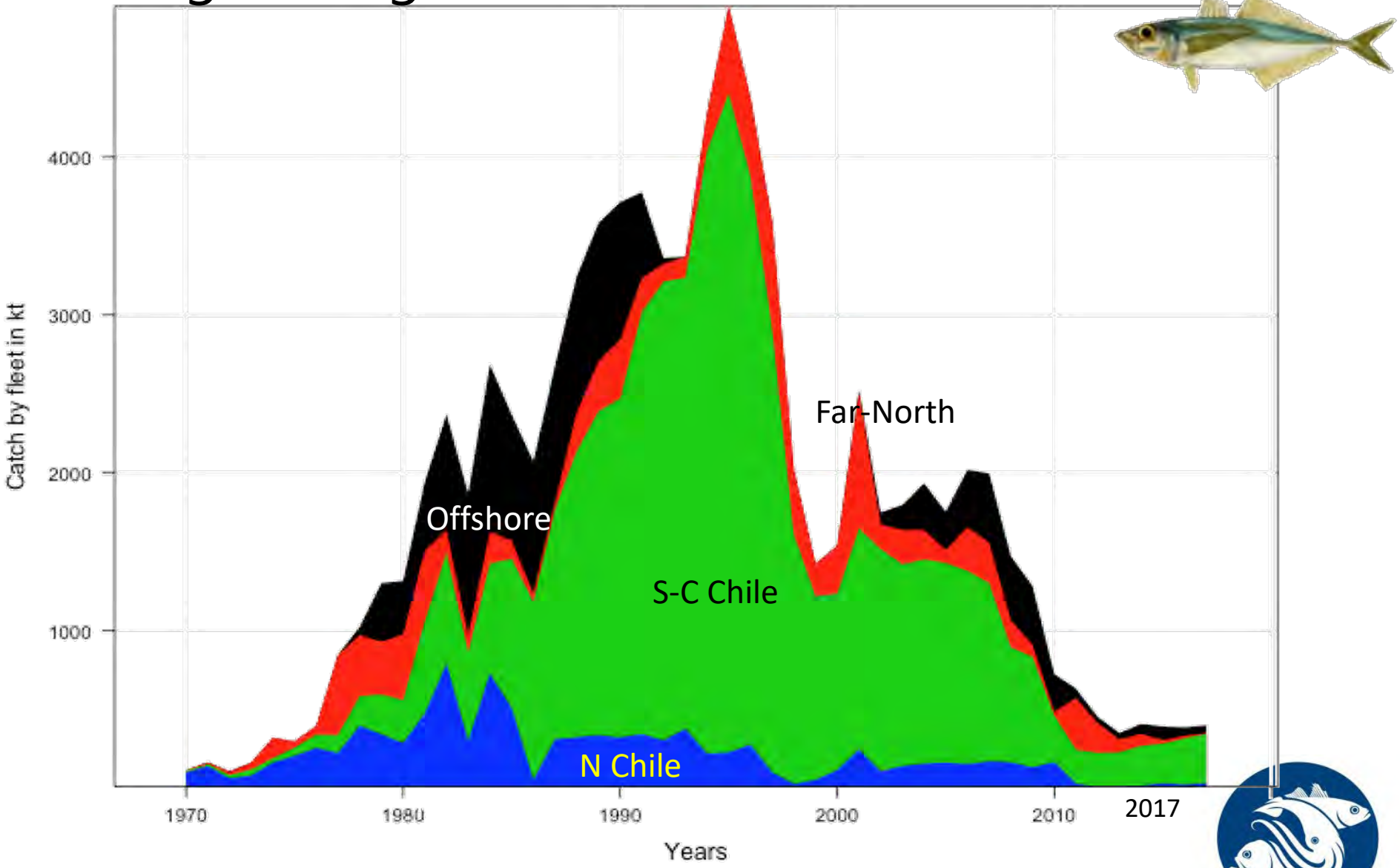
https://www.sprfmo.int/meetings/sc5/

The South Pacific Regional Fishery Management Organization…





Jack mackerel fishery: one of main management challenges assigned of SPRFMO



Nearly 5 million tons in mid-1990s

The South Pacific Regional Fishery Management Organization timeline

Science

2008 FAO Jack mackerel workshop Santiago

Feb 2006 1st international consultation in Wellington NZ

7 more consultations

…

2	Hobart, Australia	Nov 2006
3	Renaca, Chile	May 2007
4	New Caledonia	Sep 2007
5	Guayaquil, Ecuador	Mar 2008
6	Canberra, Australia	Oct 2008
7	Lima, Peru	May 2009
8	New Zealand	Nov 2009

11 Science working group meetings

Assessment methods simulation testing

2010, 1st "Prep Con" (preparatory conference)

Assessment and Rebuilding Plan

2012, 3rd and last PrepCon

SPRFMO 1st Meeting Auckland NZ 2013

Admin/Organizational

SPRFMO Science-management interface…

Article 10 of Convention:

a) plan, conduct and review **scientific assessments**…

b) provide **advice** and **recommendations** to the Commission …based on such assessments

c) provide advice …on the **impact of fishing on the marine ecosystems**

d) encourage and **promote cooperation** in scientific research…

Perceptions…early 2012

Looting the Seas III

Fishing nations fail to stop plunder in the South Pacific

Allowable catch would

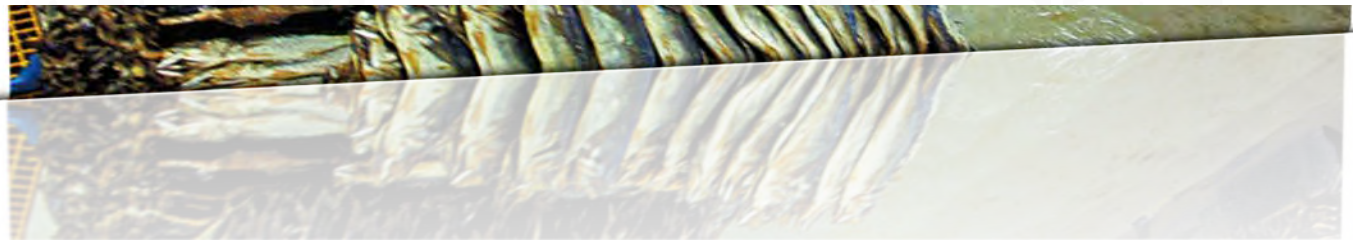
Jack mackerel disappearing in the South Pacific, other species next

WORLDWIDE
Thursday, January 26, 2012, 02:30 (GMT + 9)

Jack mackerel stocks have plummeted from an estimated 30 million tonnes to less than 3 million in 20 years. An eight-country investigation of the fishing industry in the southern Pacific by the International Consortium of Investigative Journalists (ICIJ) shows that this phenomenon foreshadows progressive collapse of fish populations across the world's oceans.

Daniel Pauly, University of British Columbia oceanographer, considers jack mackerel in the southern Pacific a startling indicator.

"This is the last of the buffaloes", he warned, *iWatch News* reports. "When they're gone, everything will be gone ... This is the closing of the frontier."



Jack mackerel Conservation and Management Measure
1st Commission meeting, early 2013

Recognizing that a primary function of the Commission is to adopt conservation and management measures to achieve the objective of the Convention, including, as appropriate, conservation and management measures for particular fish stocks;

Affirming its commitment to rebuilding the stock of *Trachurus murphyi* and ensuring its long term conservation and sustainable management in accordance with the objective of the Convention,

Recognizing the need for effective monitoring and control and surveillance of fishing for *Trachurus murphyi* …

In 2013 the total catch of *Trachurus murphyi* in the area to which this CMM applies in accordance with paragraph … **shall be limited to 360,000 tons.**

How smart science stopped a Pacific fishery's collapse

BY AMY MCDERMOTT • MARCH 23, 2018

kerel rebounded from the brink, thanks to international science-based management.
EANA I Eduardo Sorensen

Jack mackerel were in deep trouble 20 years ago. Off the coast of Chile, where the mackerel congregate in **one of two Southeast Pacific populations**, fishermen caught millions of tons throughout the 1990s, peaking **near 5 million tons** in 1995.

"That was a lot of fish," said James Ianelli, a biologist with the United States National Marine Fisheries Service, or NOAA Fisheries. By the mid to late-2000s, the stocks were badly overfished and headed for collapse. For fisheries scientists, jack mackerel had become a **symbol** of plundered oceans.

But that was then. In the intervening years, a radical change in fishery management, both in Chile and internationally, brought the mackerel back. Today, these fish represent the power of smart science and policy to get a population back on its feet, or rather, its fins.

THE SANTIAGO TIMES

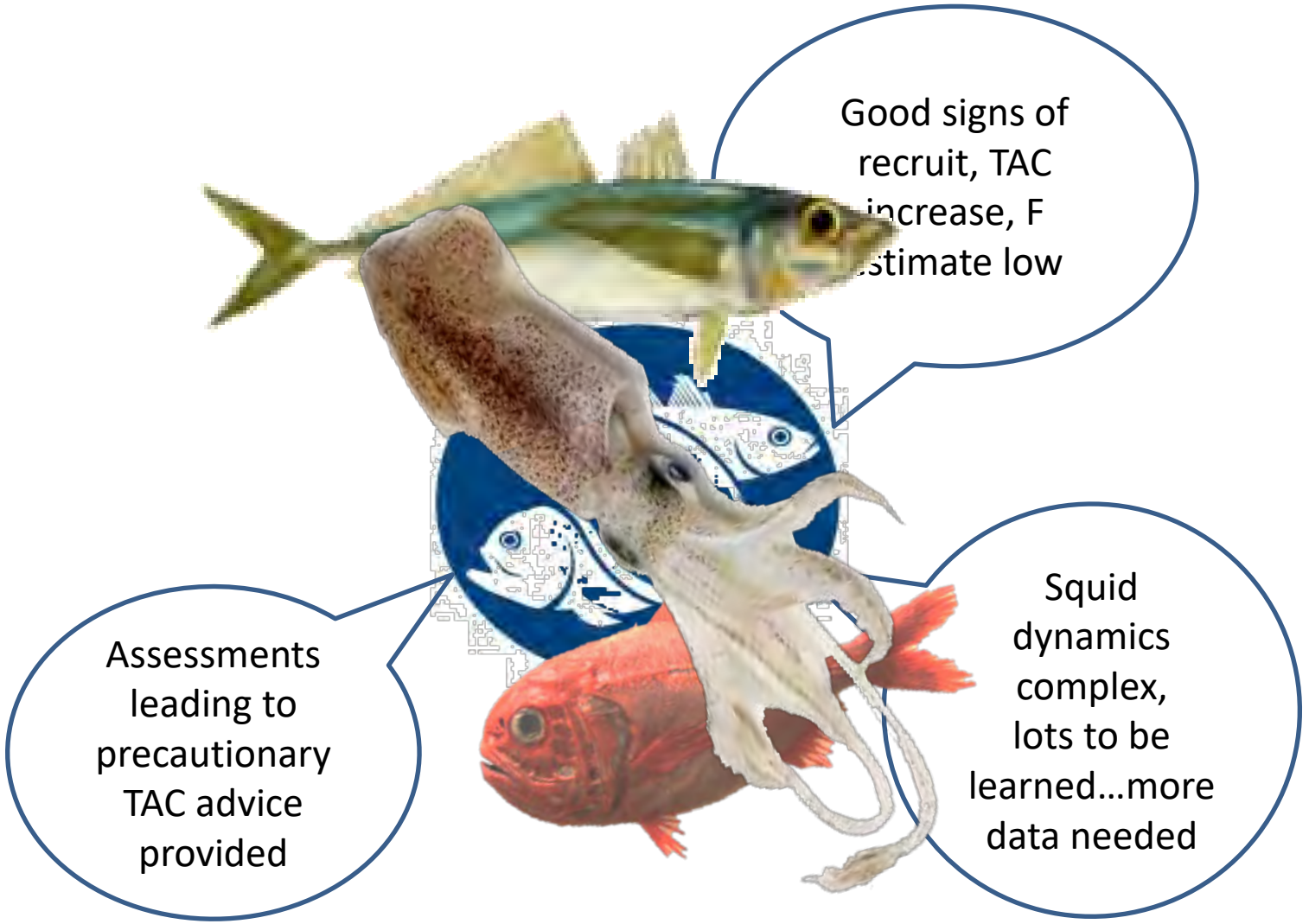
Since 1991

Oceana lauds SPRFMO decision

SANTIAGO – Marine conservation organization Oceana has appreciated the recommendation made by the Scientific Committee of the South Pacific Regional Fisheries Management Organization (SPRFMO), which did not substantially increase the global quota for jack mackerel, in spite of this resource's recovery.

"This recommendation goes hand in hand with the precautionary approach that must be adopted to maintain and recover the desirable state of fisheries", said Liesbeth van der Meer, Executive Director of Oceana Chile.

"The Scientific Committee of the SPRFMO has consistently applied the precautionary approach in its recommendations and that's why we now have the jack mackerel fishery fully exploited", she added.


Good signs of recruit, TAC increase, F estimate low
Assessments leading to precautionary TAC advice provided
Squid dynamics complex, lots to be learned…more data needed

Good signs of recruit, TAC increase, F estimate low

Assessments leading to precautionary TAC advice provided

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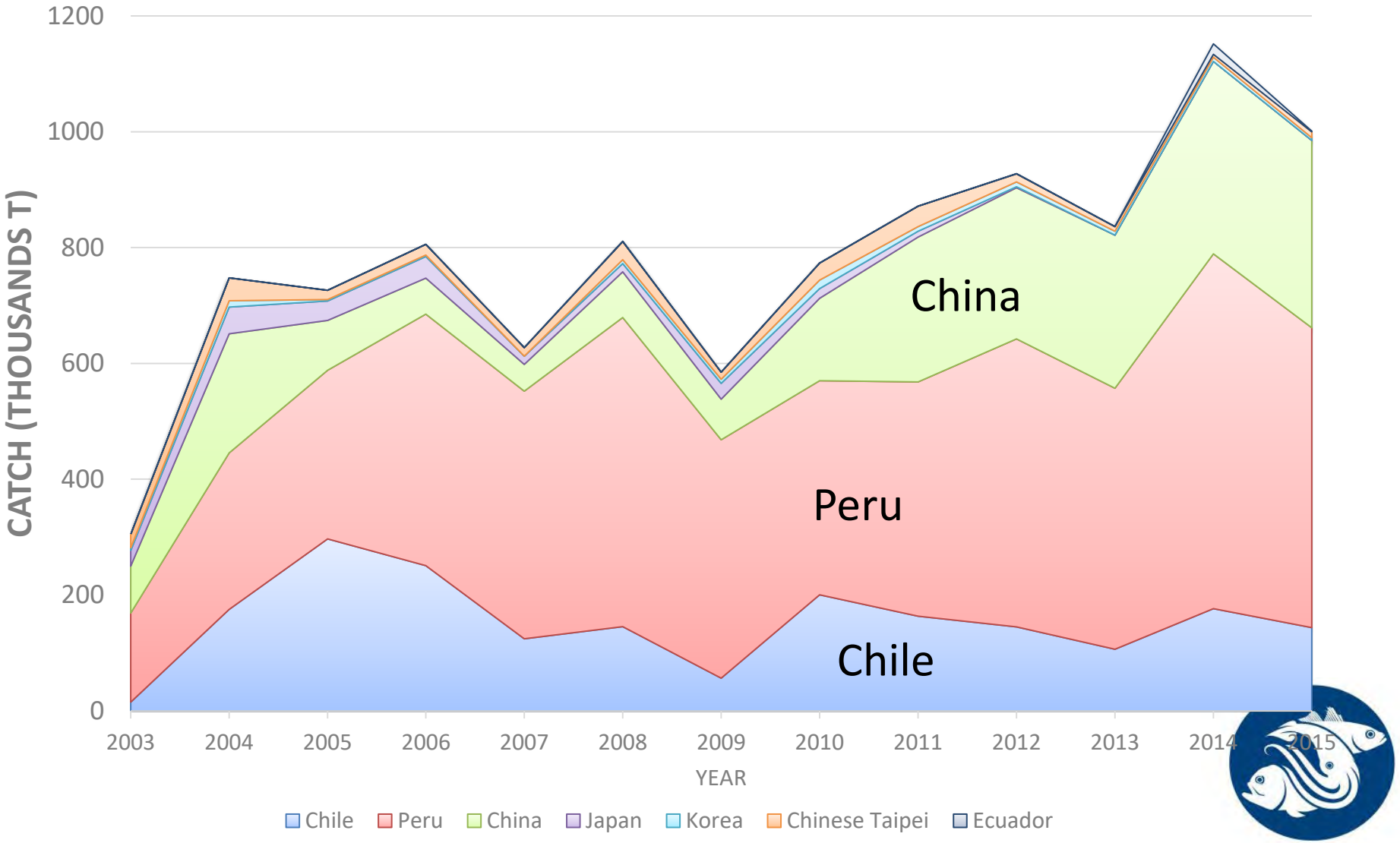
Jumbo squid catches



SPRFMO members squid research priorities

- Squid fishing effects on ecosystem
  - Predator and prey
- Population structure and distribution
- Reproductive processes
  - environmental factors
- Recruitment and escapement

SC5-SQ09 Observer report on Jumbo Flying Squid Jigging in the SPRFMO Convention Area.pdf
SC5-SQ08 Proposals on research programme and data sharing for Jumbo flying squid.pdf
SC5-SQ07_rev1 Distribution Size Stock structure and Assessment for Jumbo flying squid.pdf
SC5-SQ06 Impacts of climate variability on habitat suitability of jumbo flying squid.pdf
SC5-SQ05 Sexual niche partitioning of jumbo squids in Southeast Pacific.pdf
SC5-SQ04 Mophological variation and stock clas...f Jumbo flying squid based on statolith shape.pdf
SC5-SQ03 Spatial differences in elemental signatures within Jumbo flying squid statoliths.pdf
SC5-SQ02 Stock assessment for jumbo flying squid in SE Pacific (2017).pdf
SC5-SQ01 Squid information held by the Secretariat.pdf

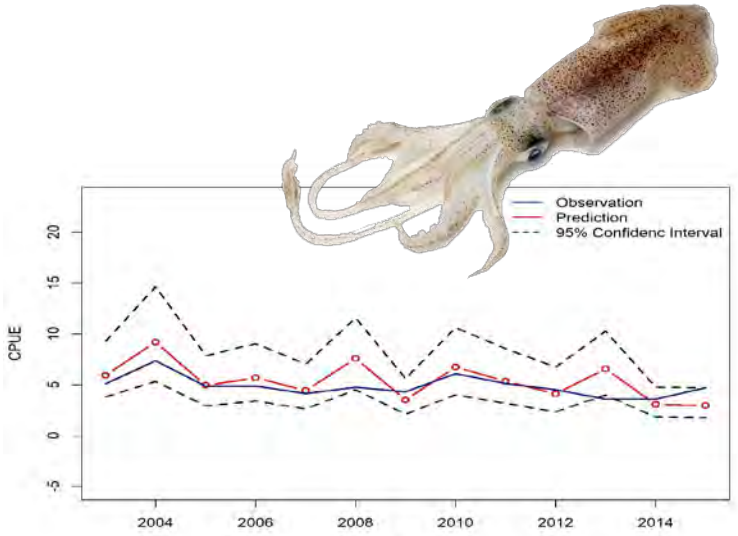
Stock assessment of the jumbo flying squid (*Dosidicu gigas*) in Southeast Pacific Ocean

Luoliang Xu1,2, Bai Li2, Gang Li1, Xinjun Chen1, Yong Chen2,1

Sexual niche partitioning and trophic morphology of a pelagic cephalopod

Yunkai Li1,2, Yi Gong1,2, Rocio I. Ruiz-Cooley3, Mary E. Hunsicker4, Xinjun Chen1,2 **

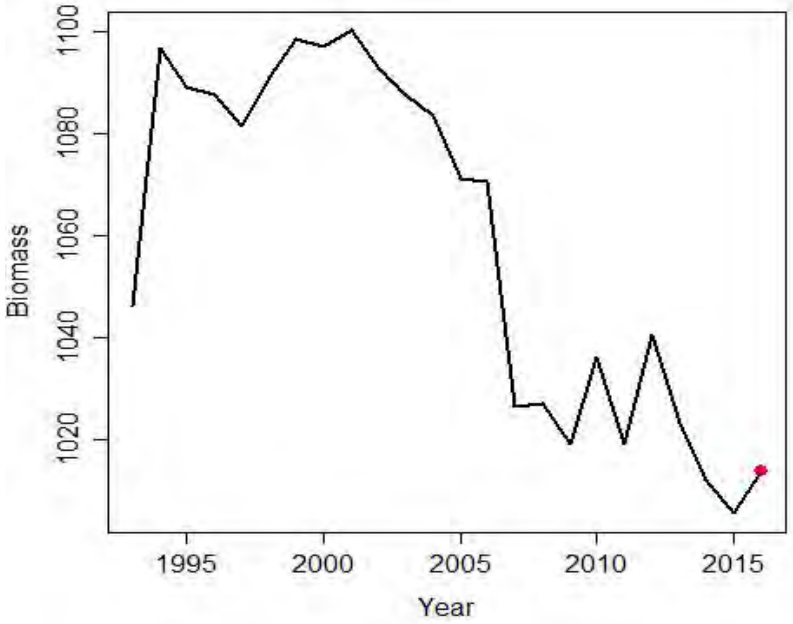
State-space surplus production model

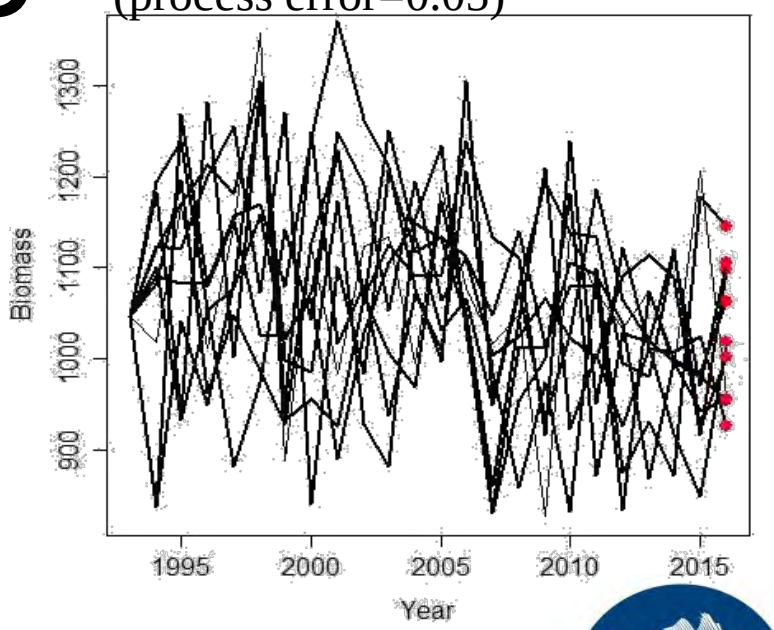


Conventional surplus production model

VS

State-space model (process error=0.05)





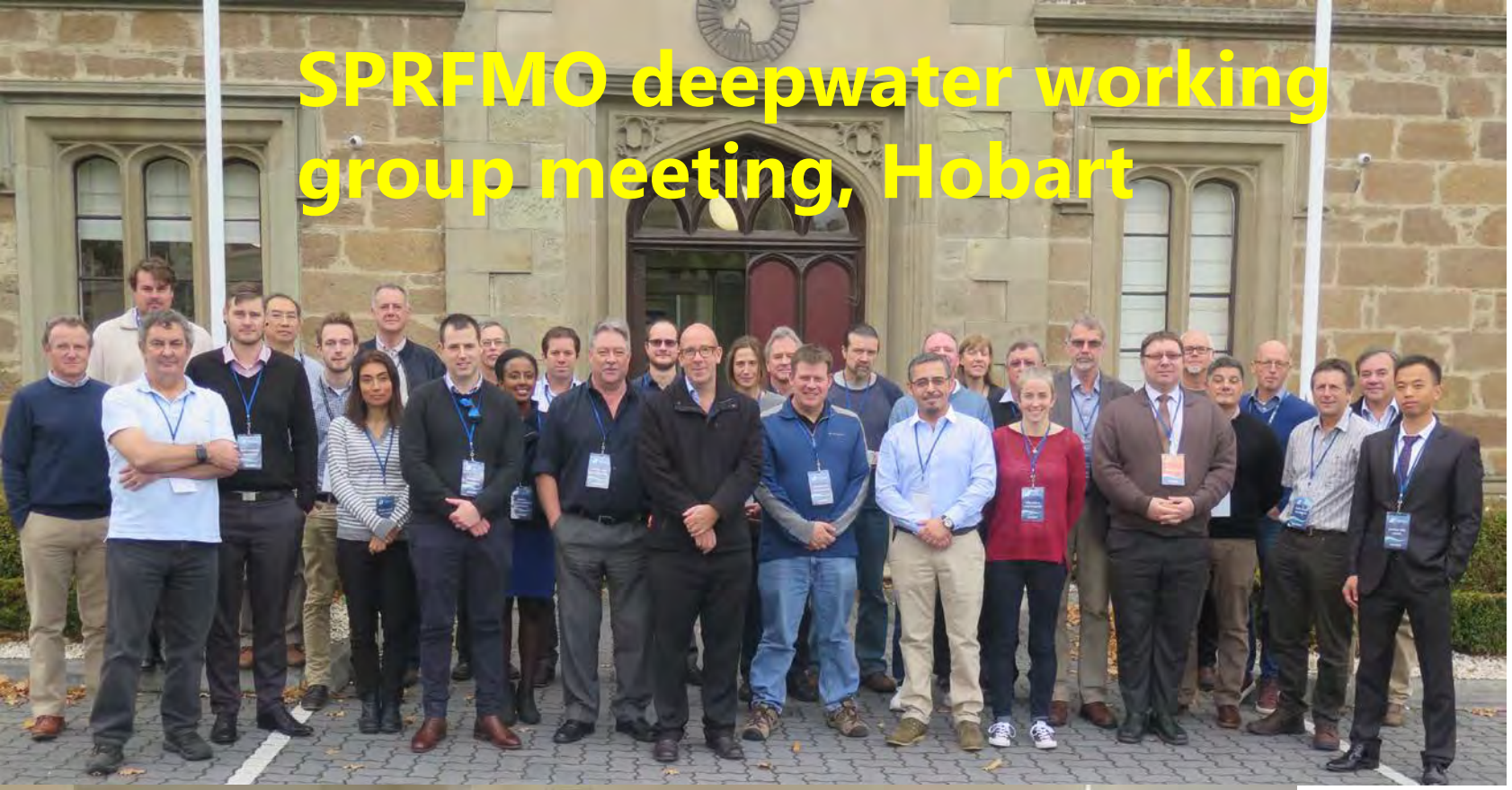
**Virgin Biomass = 1100;*
Intrinsic growth rate = 1.0647;
Catch are derived from FAO database

Good signs of recruit, TAC increase, F estimate low

Assessments leading to precautionary TAC advice provided

Squid dynamics complex, lots to be learned…more data needed

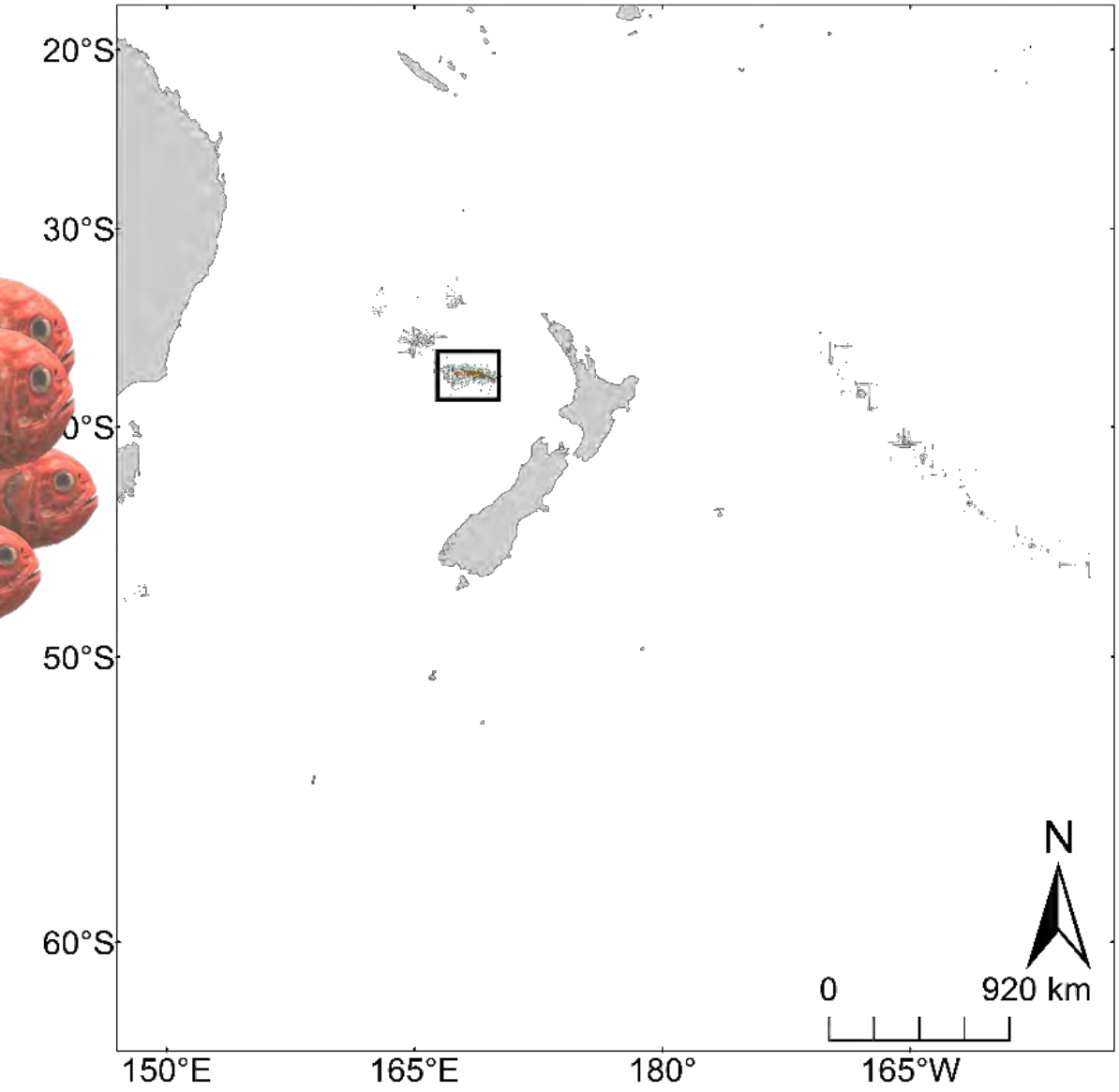
SPRFMO deepwater working group meeting, Hobart

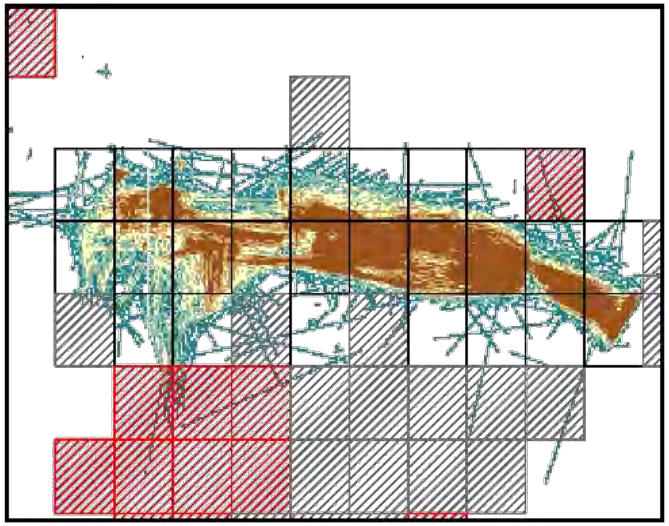


Deep Water working group, Hobart agenda

1. Welcome & Introductions
   - a. Workshop arrangements
   - b. Adoption of Agenda
   - c. Reporting arrangements
2. Stock Assessment Theme
   - a. Consistency with member national policies
   - b. Influence of data quality and availability and species life-history on choice of stock assessment method
   - c. Data and Assessment uncertainties and sensitivities
   - d. Biological data and use of independent estimates of biomass
   - e. Interpretation and advice that can be drawn from different tiers of analyses
   - f. Reference points, harvest control rules, and harvest strategies
   - g. Assessment Framework
3. Vulnerable Marine Ecosystems Theme
   - a. Habitat and VME mapping
   - b. Spatial decision support tools
   - c. Bottom Fishing Impact Assessment Standard
   - d. General discussion of VME theme
4. Future research and Workplan
5. Recommendations
   - a. Stock Assessment Theme Recommendations
   - b. VME recommendations
6. Meeting closed
7. Appendices
   - 7.1. List of Participants
   - 7.2. Provisional Annotated Agenda (revised)
   - 7.3. Draft of skeletal agendas for the stakeholder workshops
   - 7.4. 2017 Scientific Committee workplan on Deep Water fisheries and proposed Deep Water Working Group Research workplan for 2018.
   - 7.5. Stock assessment options and its considerations to be taken into account in the Assessment Framework

NZ Stakeholder workshops





Naturalness

0 - 0.2

0.2 - 0.4

0.4 - 0.6

0.6 - 0.8

0.8 - 1.0

Fishing footprints

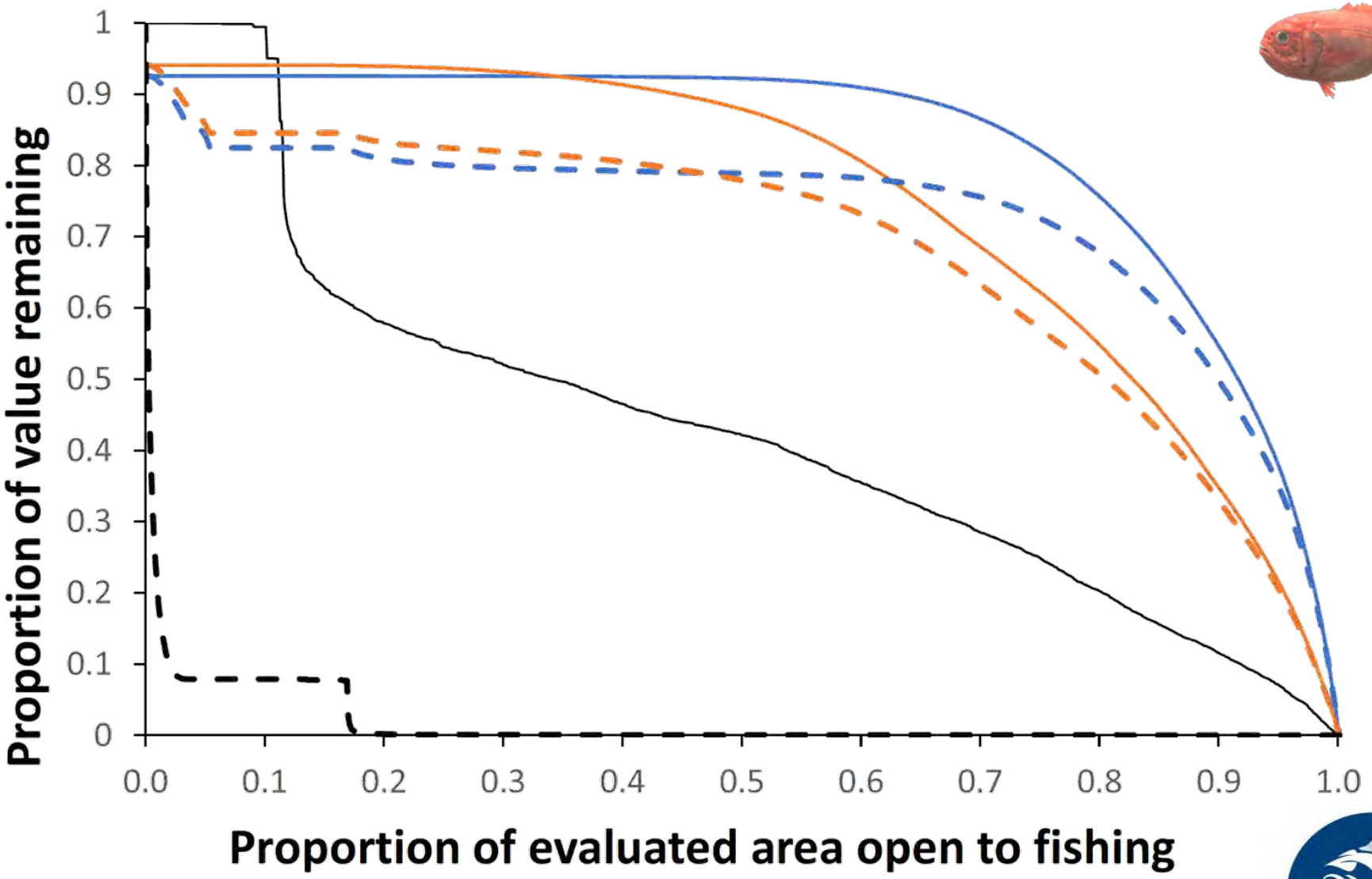
Closed

Move-on - Trawl

Open - Line

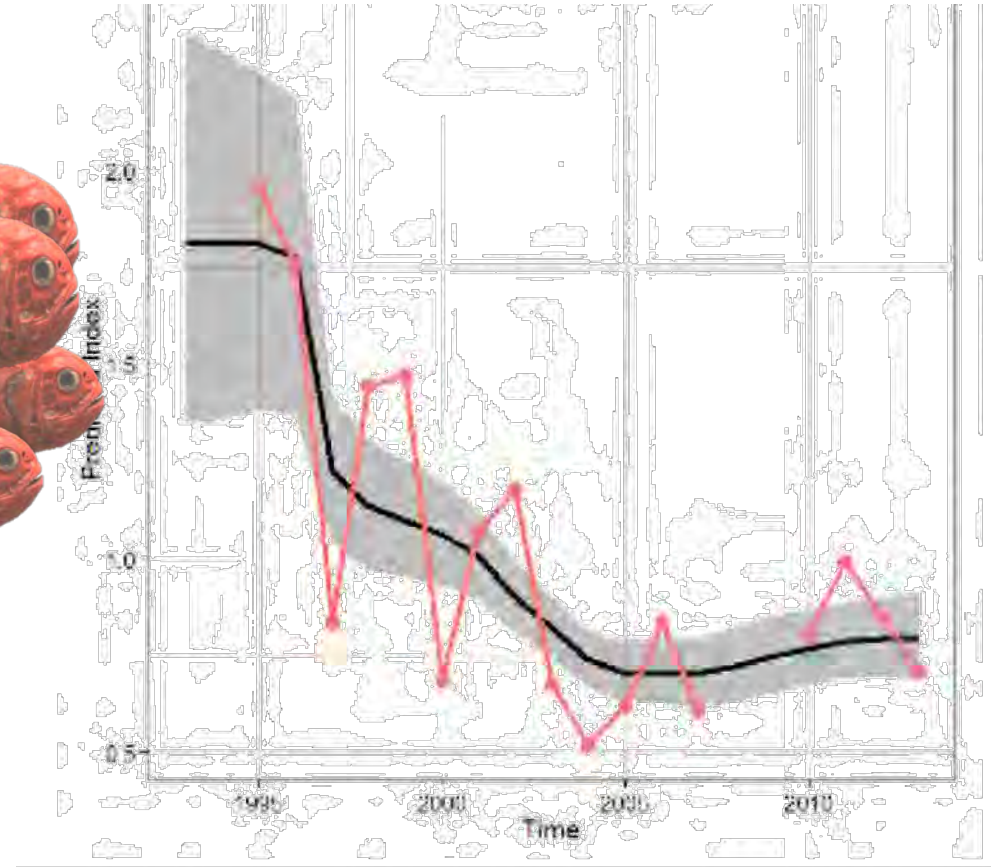
Open - Trawl

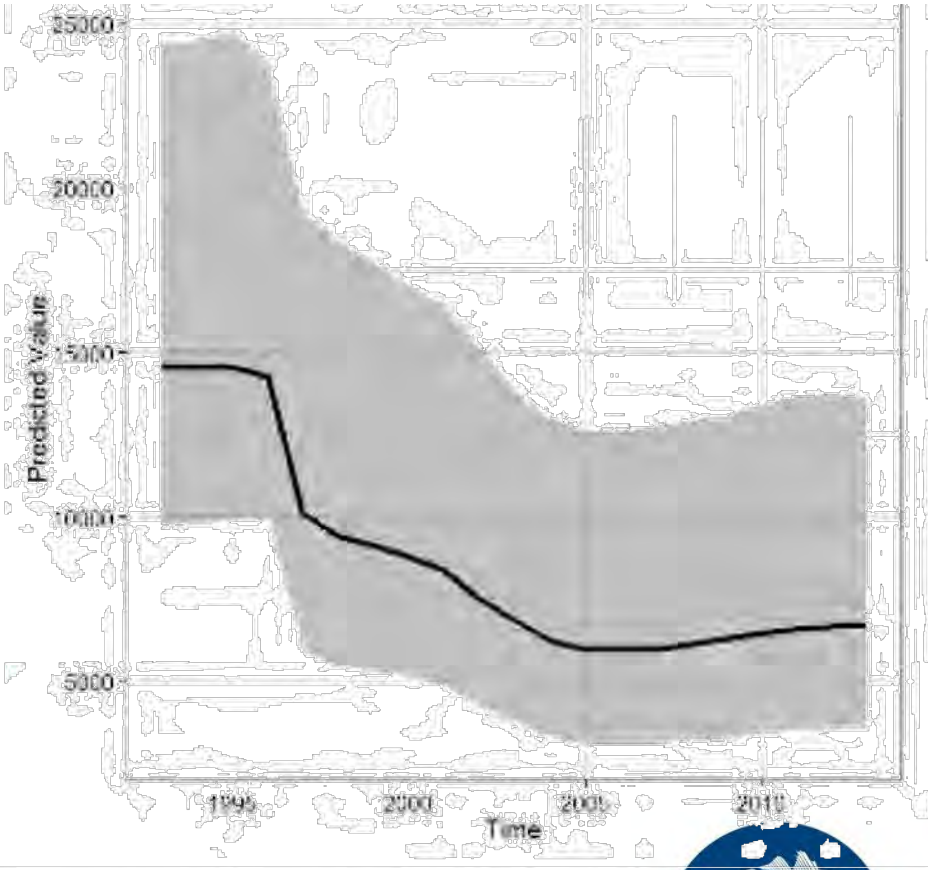
Zonation benefits curve



Deepwater species assessments

Orange roughy





Good signs of recruit, TAC increase, F estimate low

Assessments leading to precautionary TAC advice provided

Squid dynamics complex, lots to be learned…more data needed

Assessment data

Table A8.18. Years and types of information used in the JJM assessment models.

Fleet	Catch-at-age	Catch-at-length	Landings	CPUE	Acoustic	DEPM
North Chile purse seine	1975-2015	-	1970-2016	-	Index: 1984-1988; 1991; 2006-2015 Age comps: 2006-2015	Index: 1999-2008 Age comps: 2001-2008
South-central Chile purse seine	1975-2016	-	1970-2016	1983-2016	1997-2009 Age comps: 1997-2009	-
FarNorth	-	1980-2016	1970-2016	2002-2009, 2011-2013	1986-2013	-
International trawl off Chile	1979-1991	2007-2015*	1970-2016	China (2001-2015); EU, Korea & Vanuatu (2003-2016); Russian (1987-1991, 2008-09, 2011)	-	-

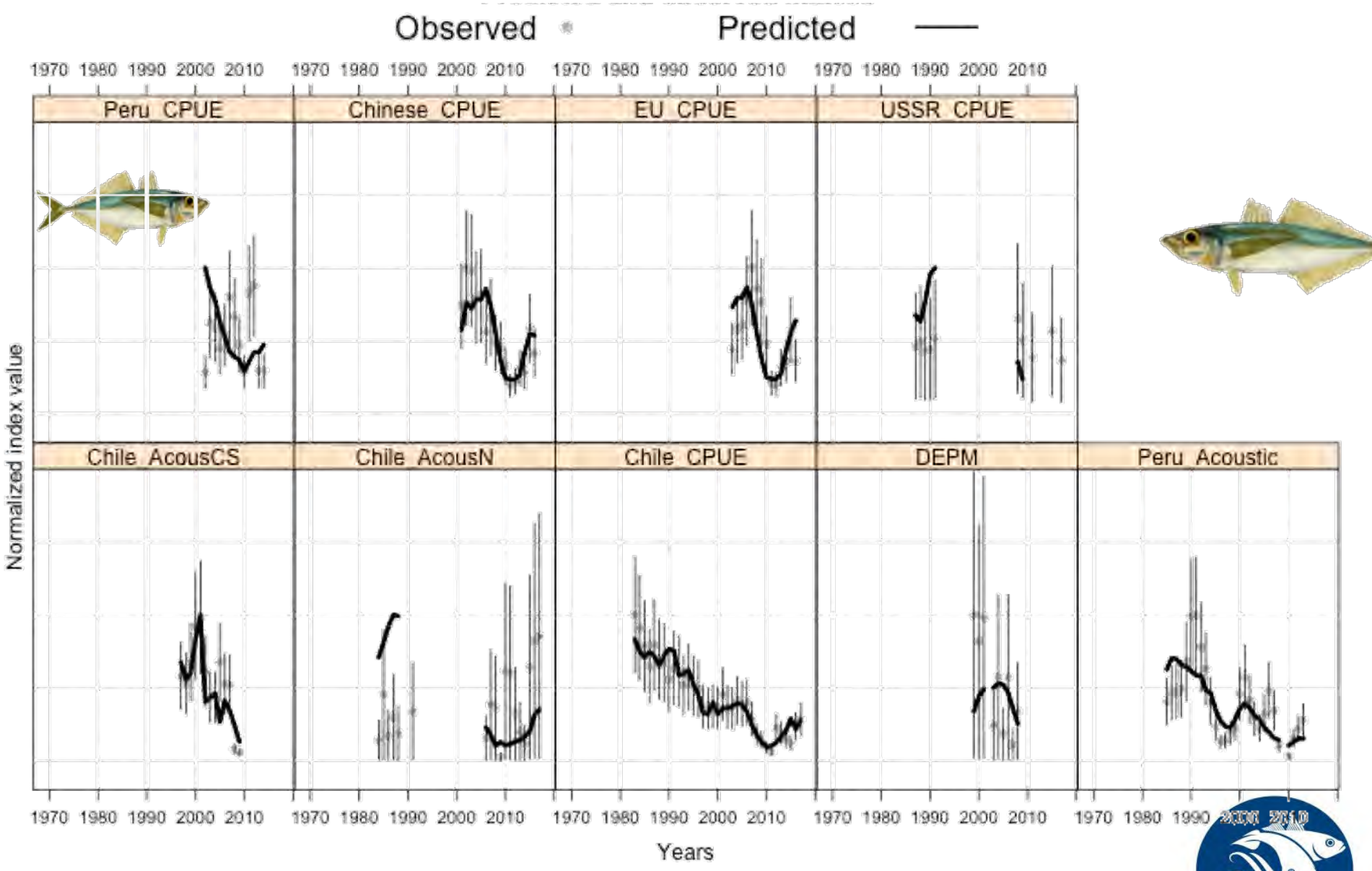
4 "Fleets"

Catch at age or length

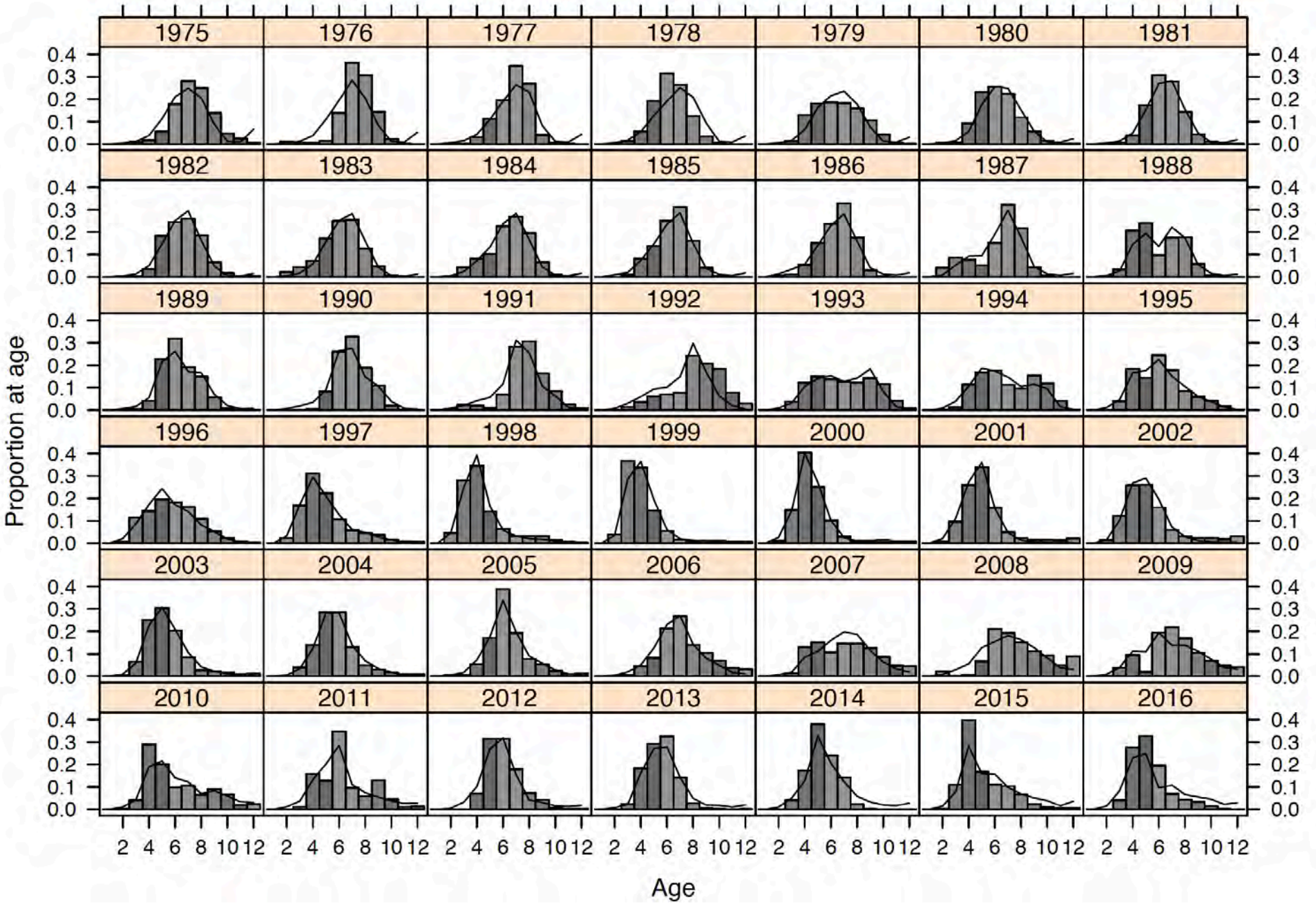
Landings all years

Abundance Indices

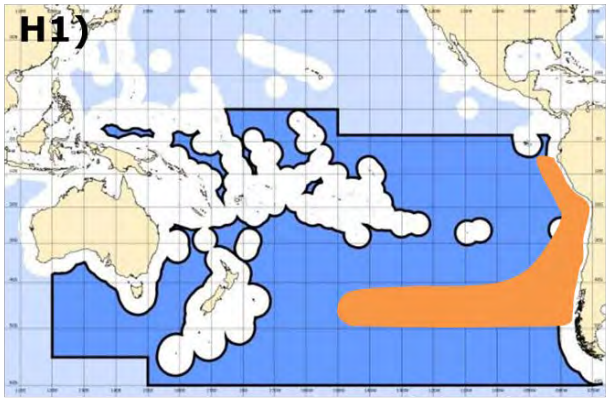
Model fit to CPUE and survey abundance indices

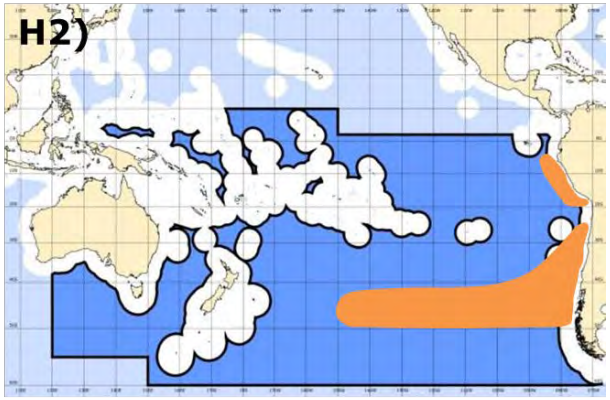


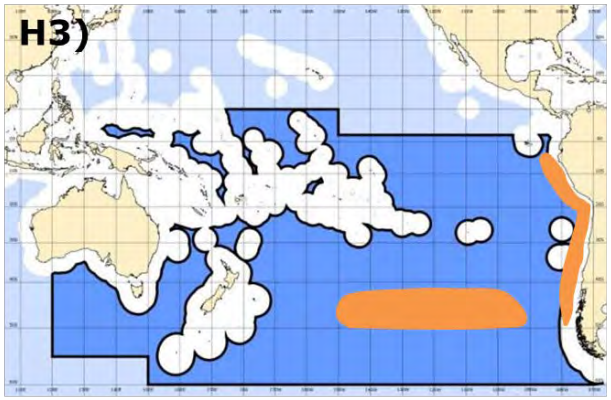
Fits to age data (S-C Chilean fleet)

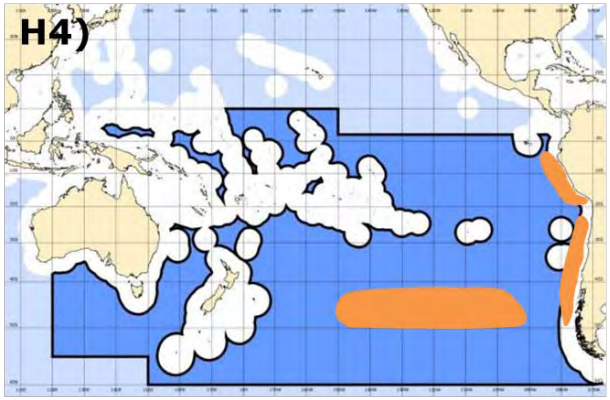


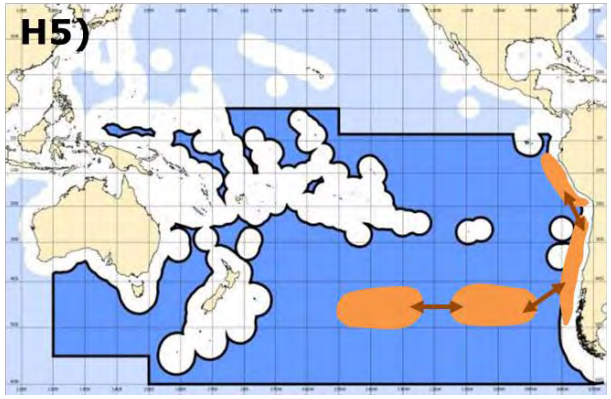
Working hypotheses on population structure (from 2008 conference)

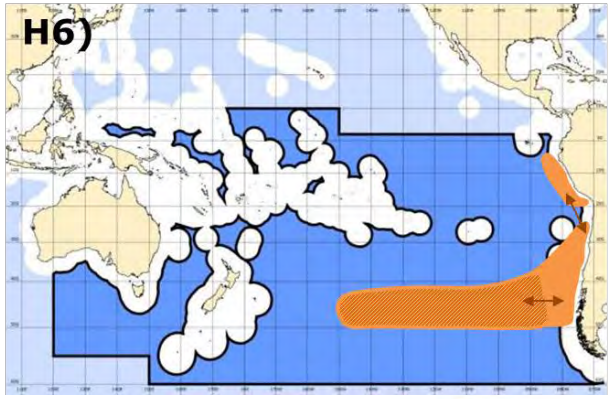


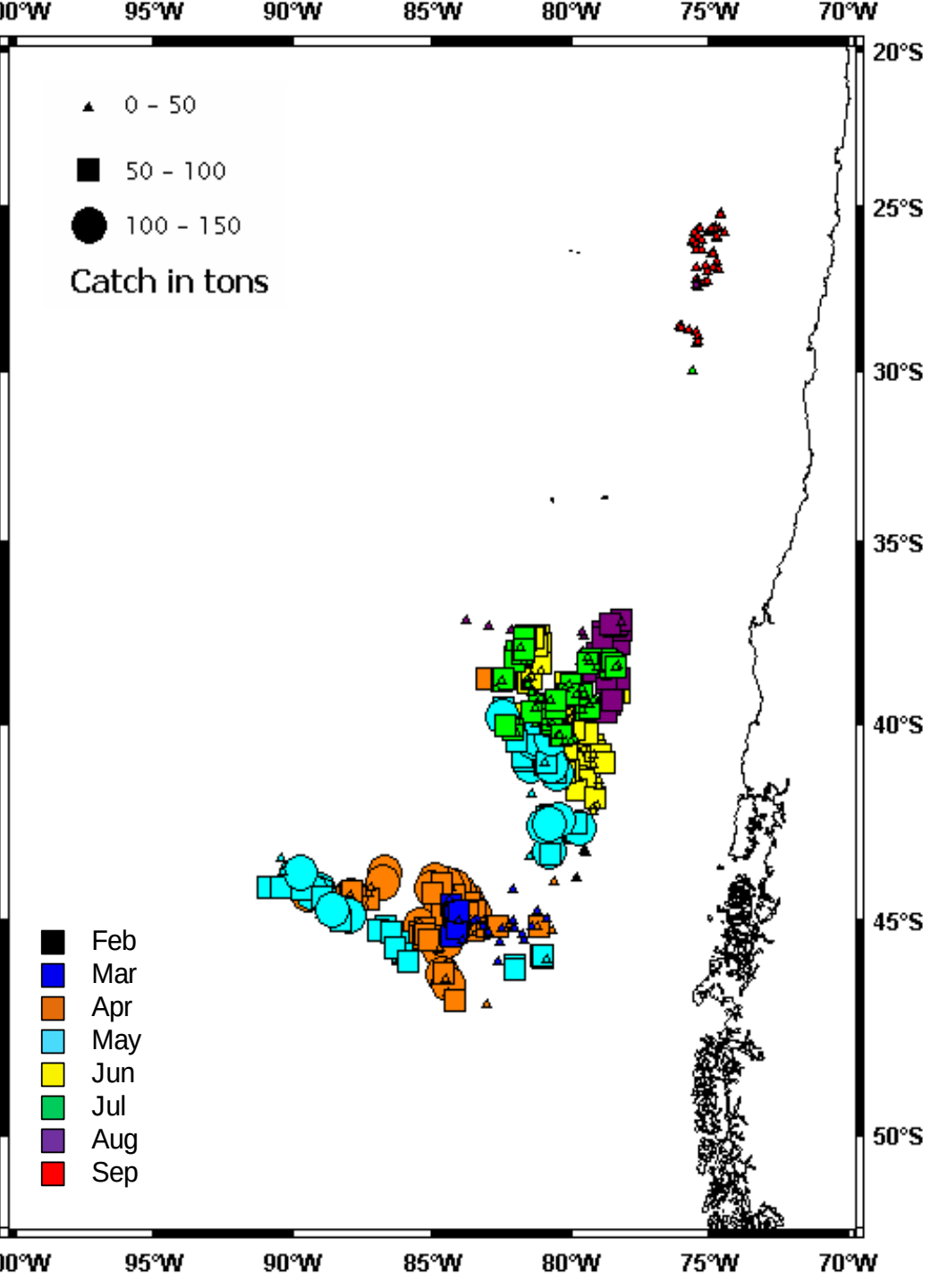








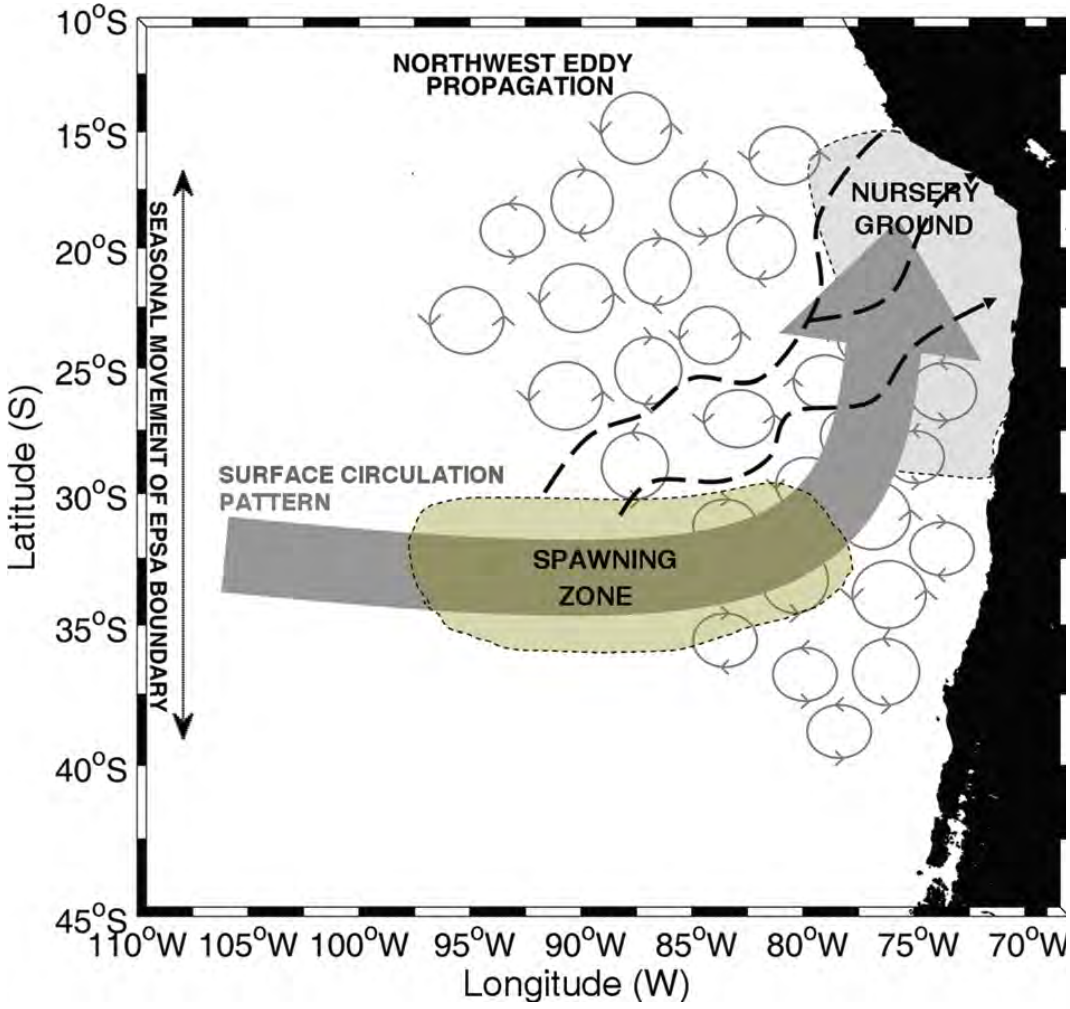


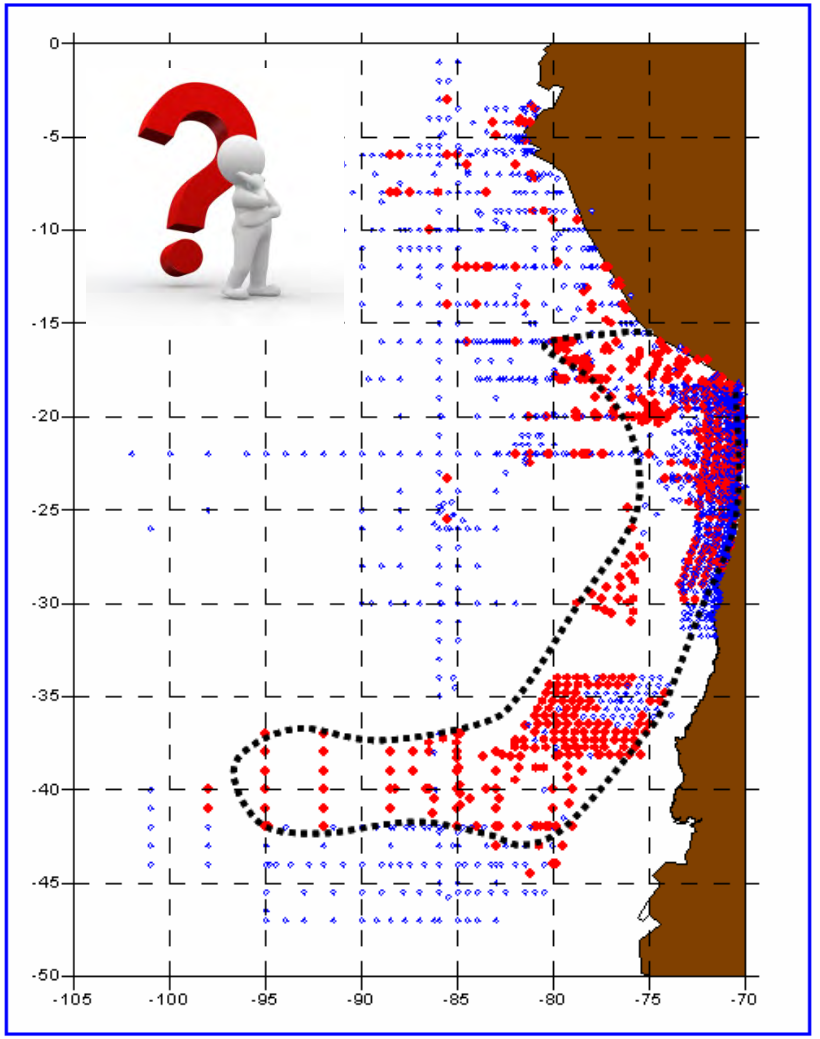


Example monthly Jack mackerel catch patterns

Chinese fleet

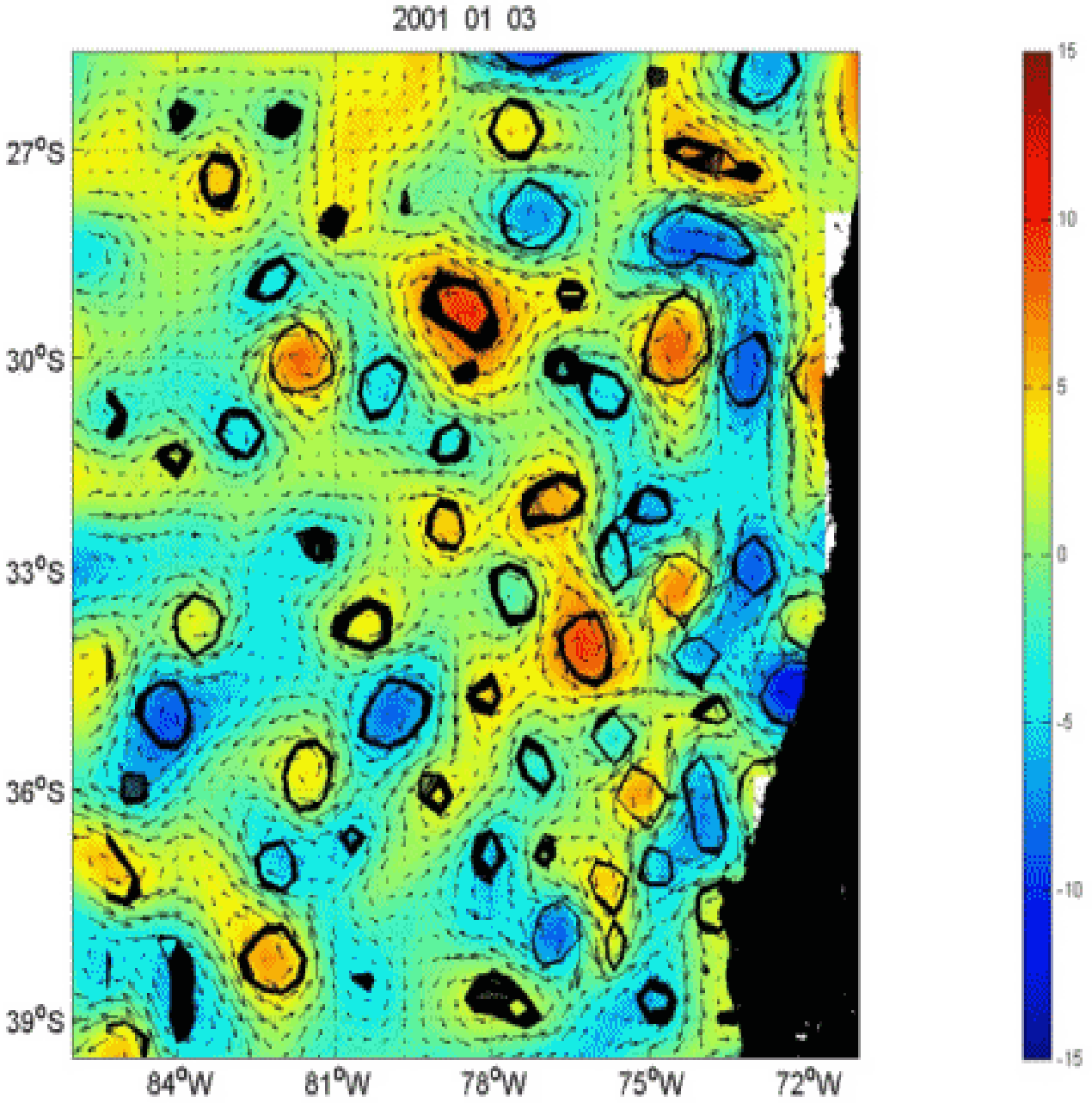
Conceptual model of connectivity





Ocean Circulation Model

Resolves eddies



Source: INPESCA

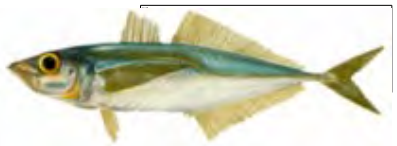
SPRFMO Jack mackerel assessment

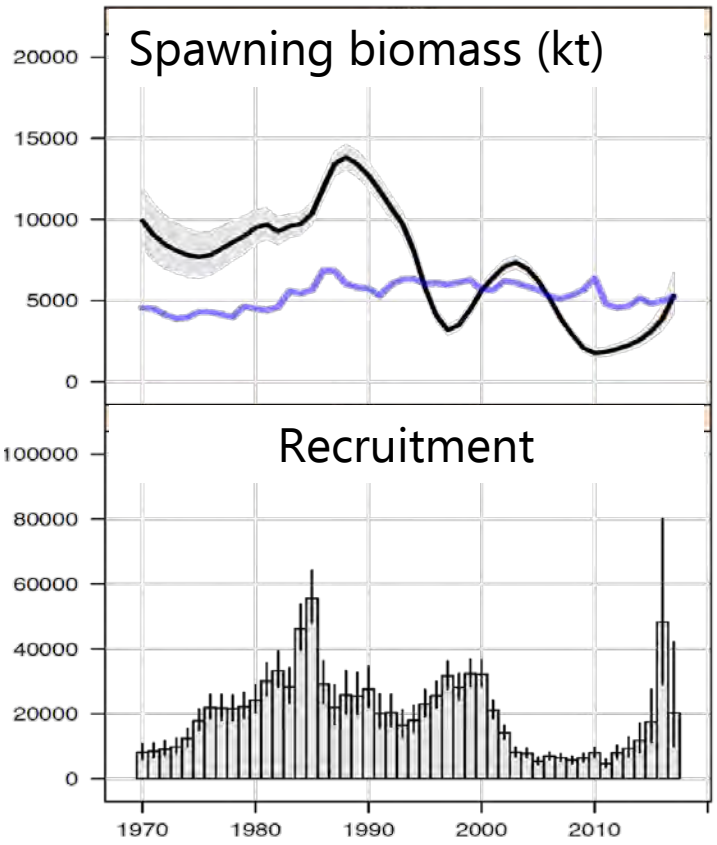
Stock structure hypotheses

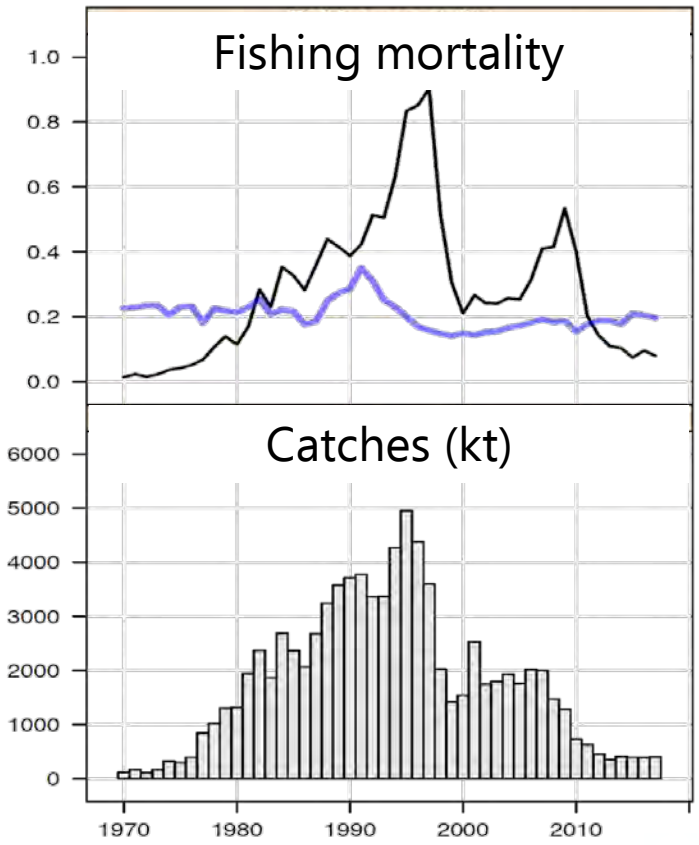
Hypothesis	Stock	Fleets
Hypothesis 1 (multiple stocks)	Northern Stock	Far north
	Southern Stock	Northern Central-South Offshore fleet
Hypothesis 2	Single stock	Far north Northern Chile Central-South Chile Offshore fleet

*Hypotheses as presented from the 2008 SPRFMO/FAO meeting

Stock summary
Single stock







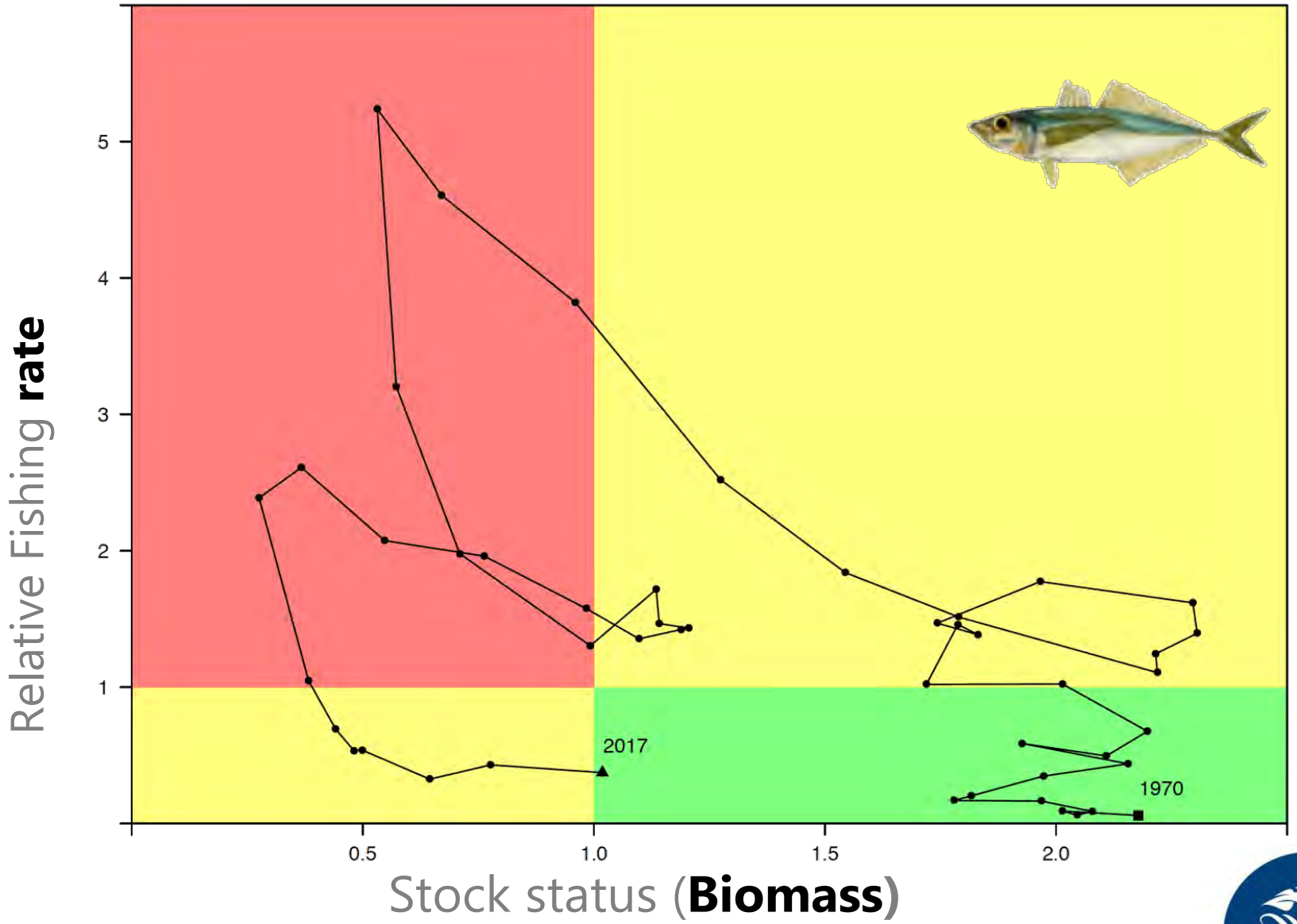
Jack mackerel
Science Advice summary

Given current stock status, the second tier of the Jack mackerel rebuilding plan could be applied, thereby substantially increasing the potential catch. Considering the uncertainties in the assessment however, the Scientific Committee adopts a precautionary approach and advises to **maintain 2018 catches for the entire Jack mackerel range in the southeast Pacific at or below 576 kt**.

Stock status

		2015	2016	2017
Fishing mortality in relation to	F_{MSY}	Below	Below	Below
Spawning stock biomass in relation to	B_{MSY}	Below	Below	Below

Stock status and history



Jack mackerel assessment **challenges**

Growth

- Large variability between regions
  - And methods for age determination

Productivity

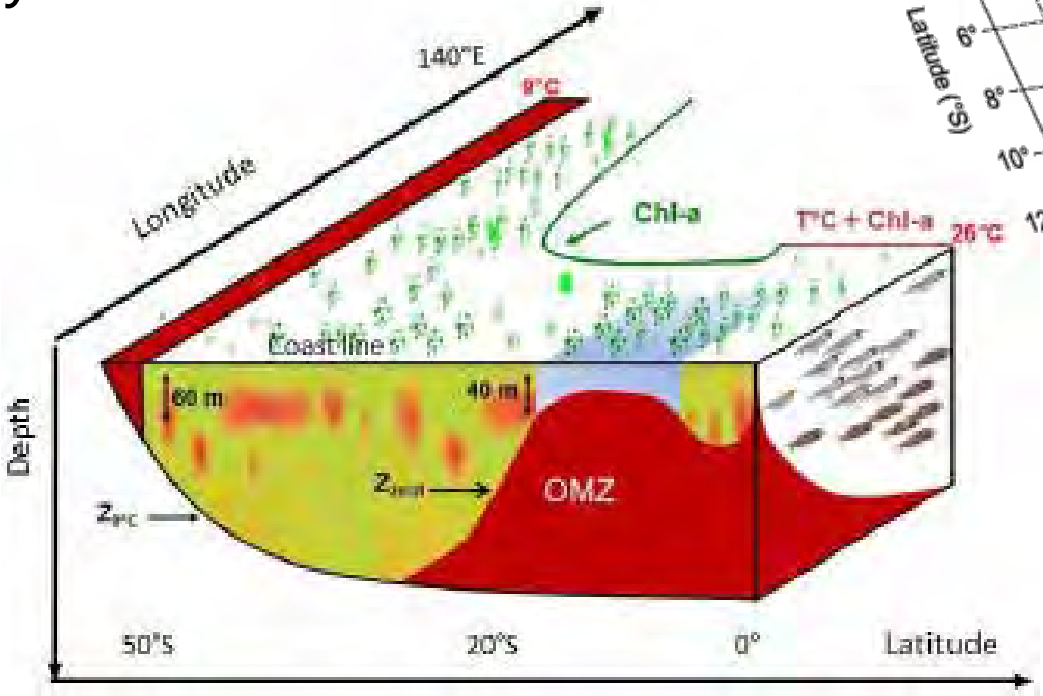
- Current stock status advice conservative
  - Recent low recruitment for projections
  - Target reference points based on full time series
  - Affects rebuilding plan

Spatial considerations

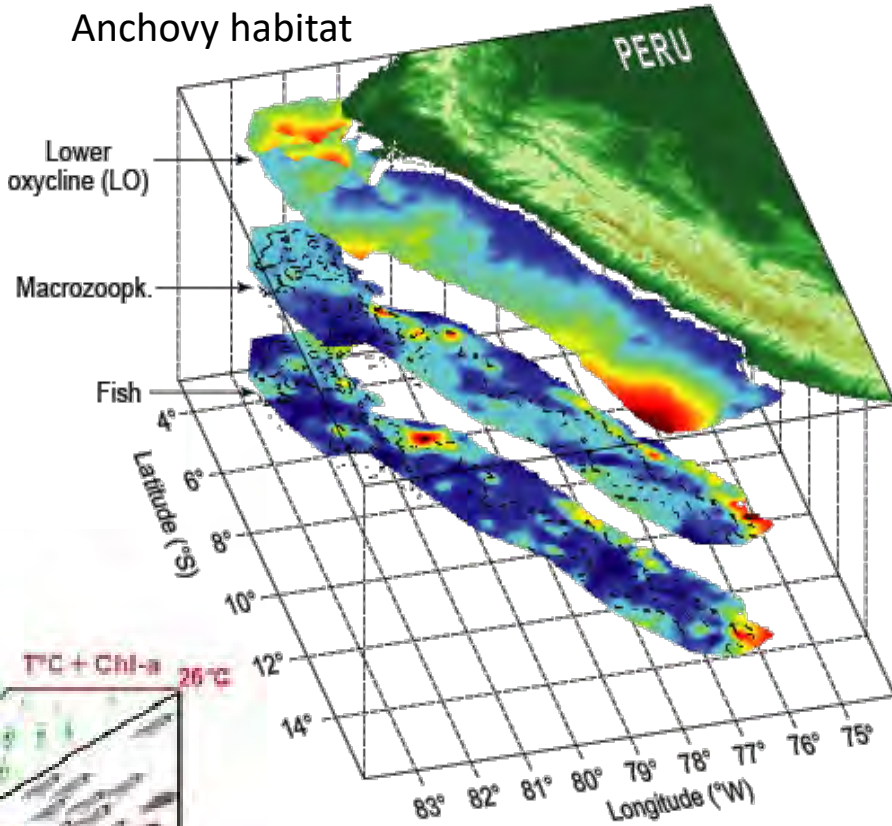
- Desire to tie catch limits to relative spatial distributions
- Higher order problem (not to mention politics)

Task team on ecosystem and habitat monitoring

- SPRFMO proposal
  - Working group on "Habitat Monitoring"
  - Jack Mackerel as a first case study



Anchovy habitat



Acknowledgements

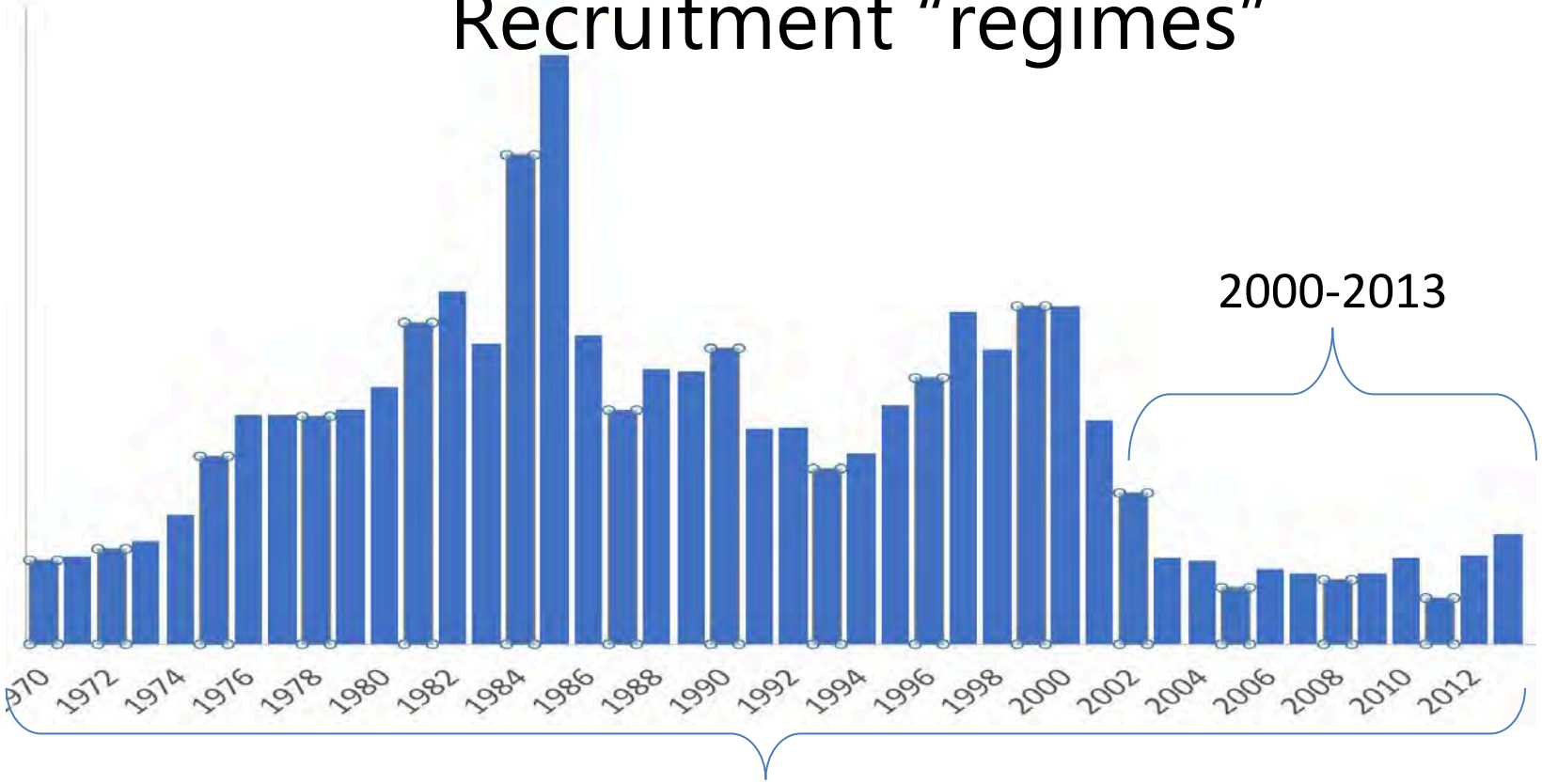
NMFS Pacific Islands Regional office for SPRFMO Commission work

Member country and other participating scientists

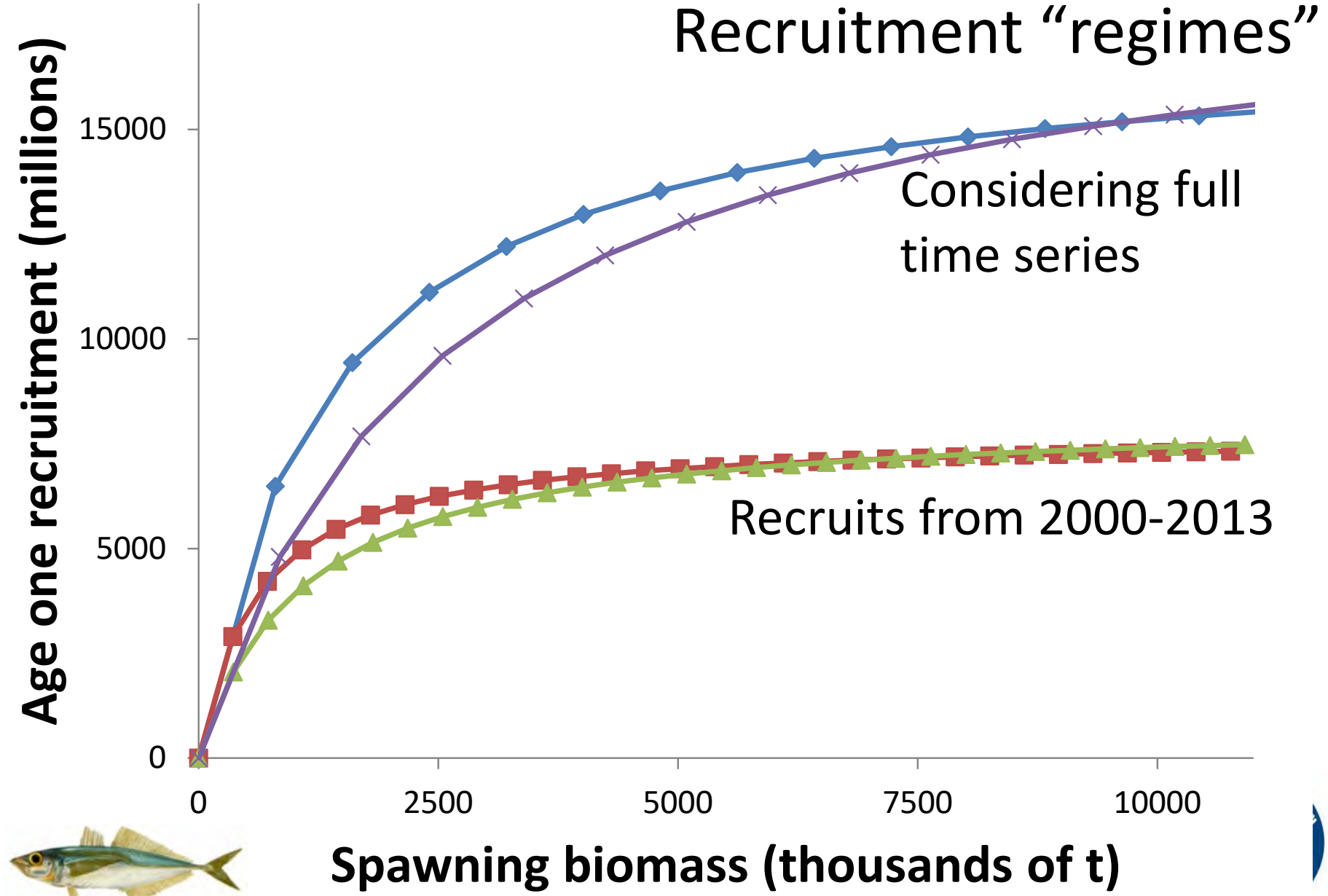
(at Scientific Committee)

SC stock status indicators

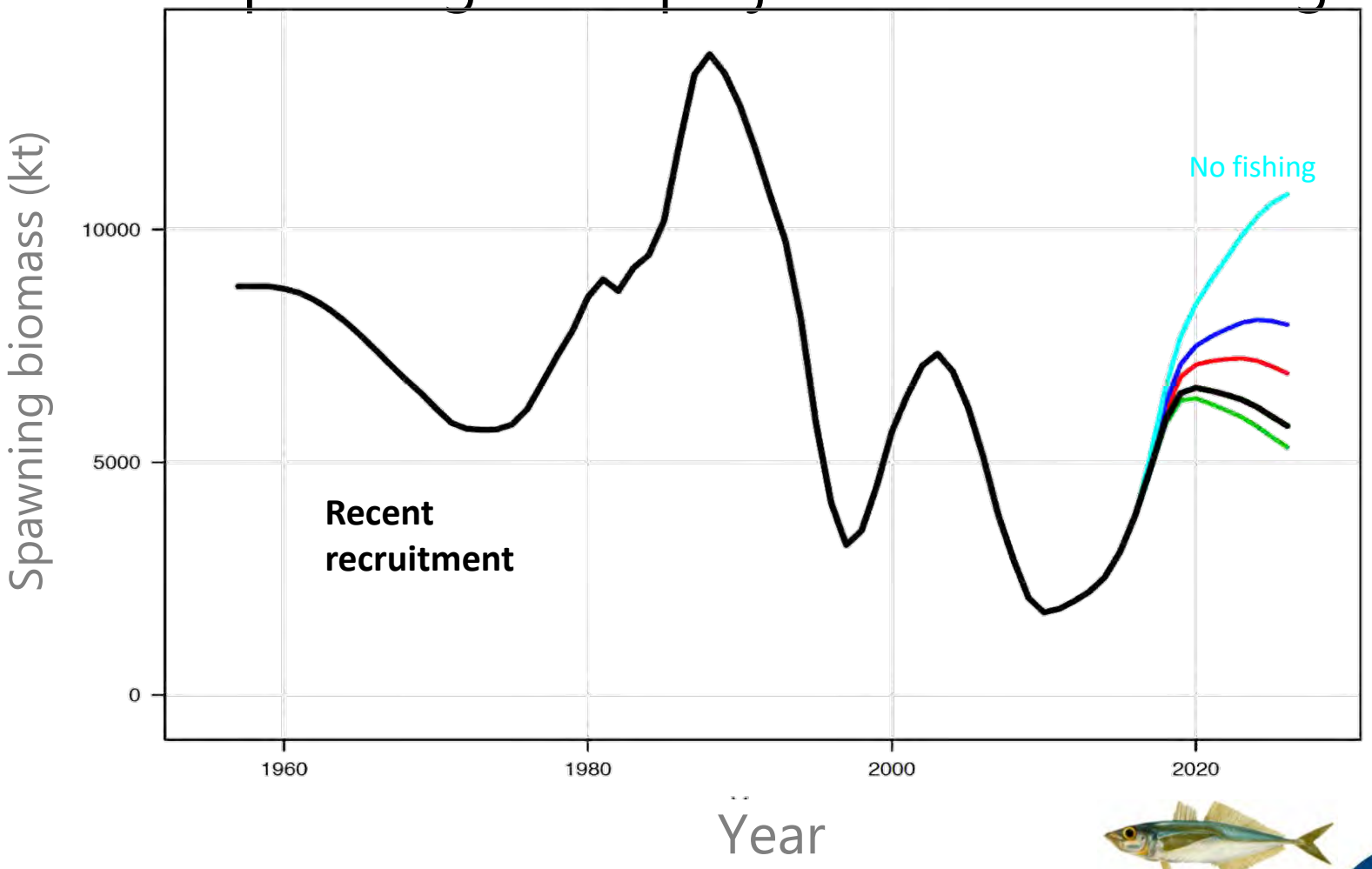
Recruitment “regimes”



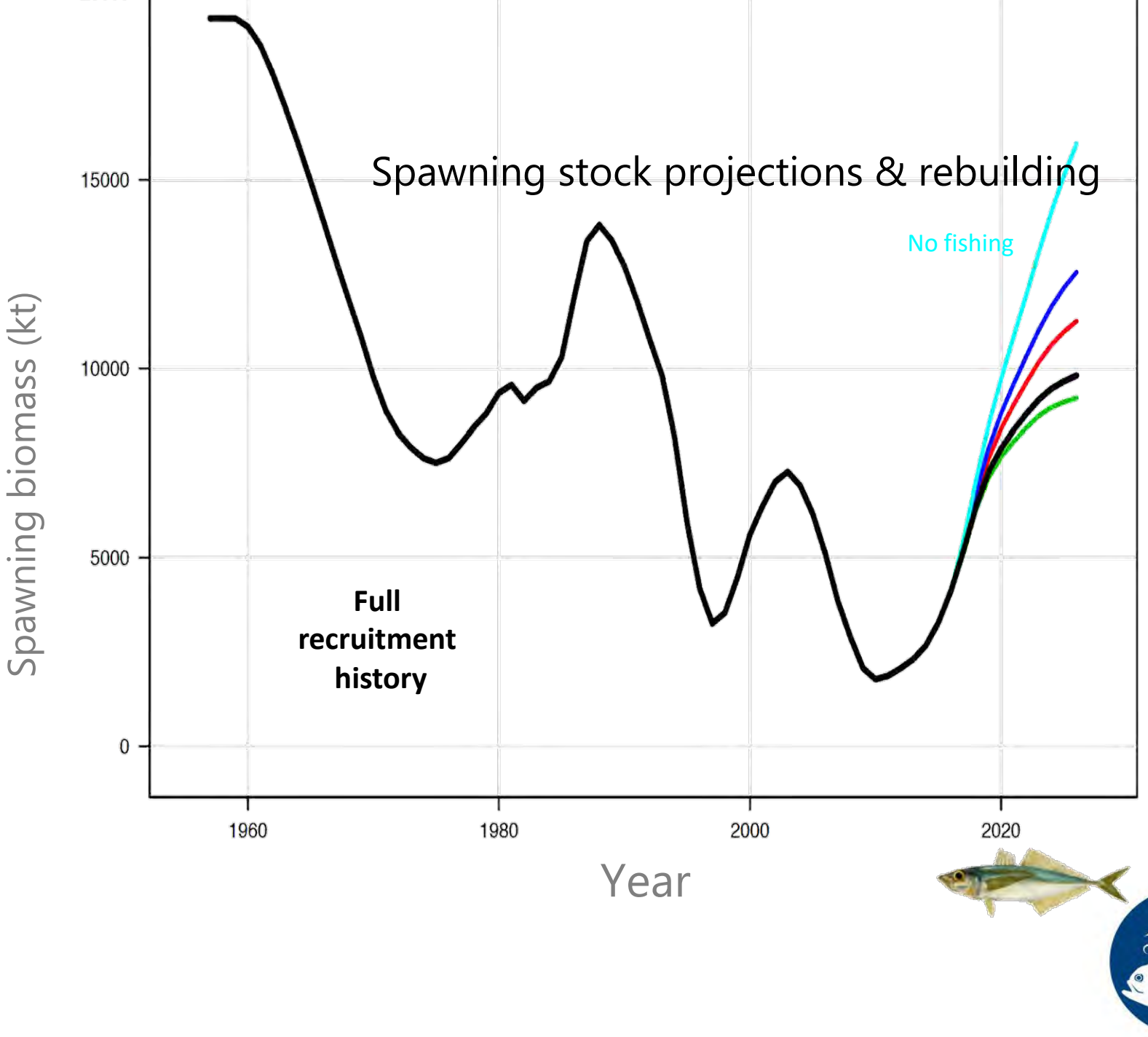
Stock status considerations



Spawning stock projections & rebuilding



Over different future fishing mortality rates



Over different future fishing mortality rates

Acknowledgements

Continued…

Our new puppy…named
The Murphy Ianelli
(or T. murphyi for short)