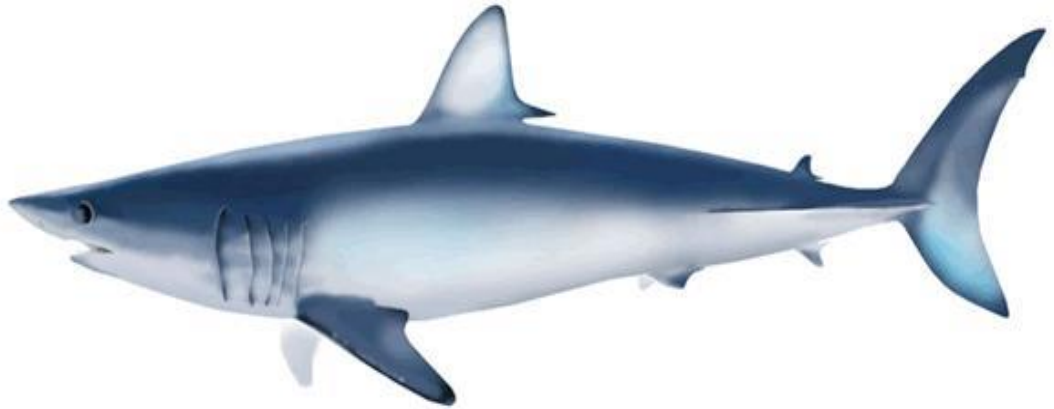
STOCK ASSESSMENT OF NORTH PACIFIC SHORTFIN MAKO THROUGH 2016



ISC Shark Working Group

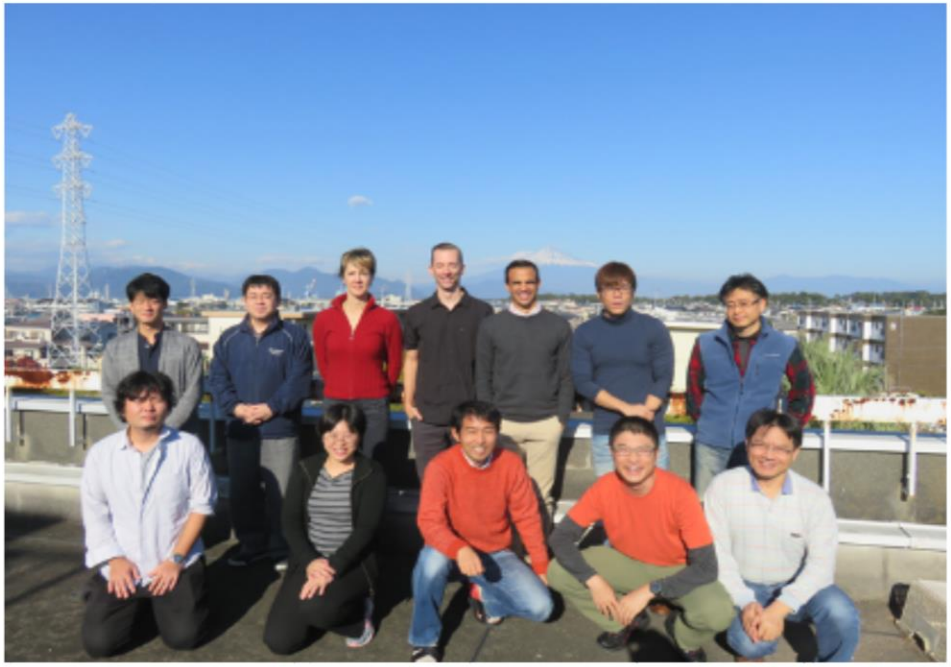
WCPFC SCIENTIFIC COMMITTEE

FOURTEENTH REGULAR SESSION

8 – 16 August, 2018

ISC 2018 SFM stock assessment

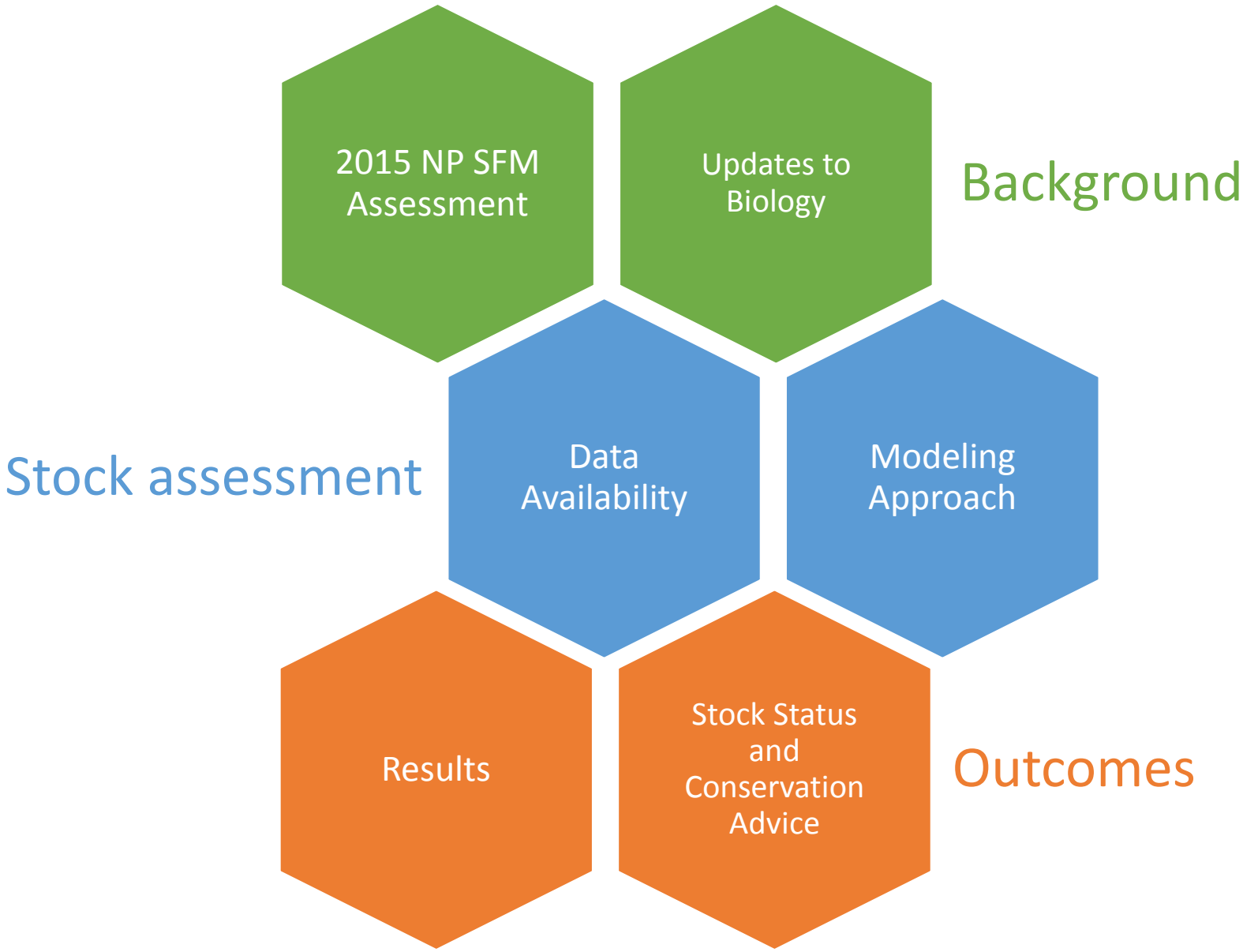
Data preparation	Webinar	Modelers only meeting	SA meeting
November 2017 (7 days)	December 2017 (2 days)	February 2018 (3 days)	April 2018 (10 days)



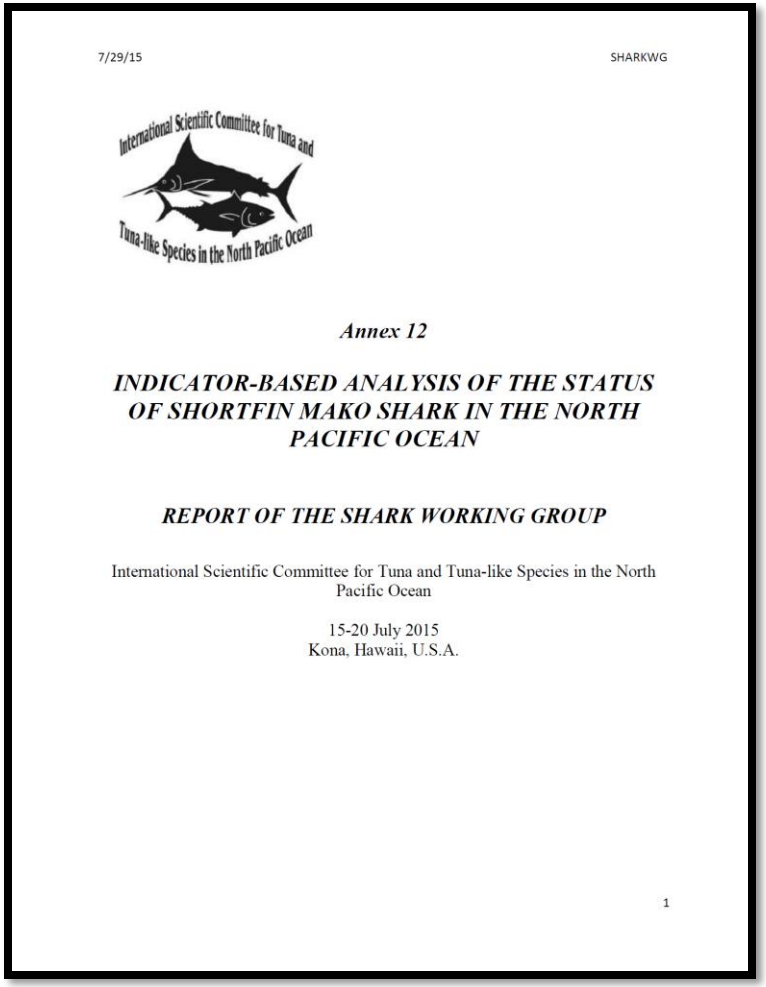
Shimizu (Japan) – November 2017

San Diego (USA) – April 2018

Outline


2015 NP SFM Assessment
Updates to Biology
Background
Stock assessment
Data Availability
Modeling Approach
Results
Stock Status and Conservation Advice
Outcomes

NP SFM 2015 stock assessment



7/29/15 SHARKWG

International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

Annex 12

INDICATOR-BASED ANALYSIS OF THE STATUS OF SHORTFIN MAKO SHARK IN THE NORTH PACIFIC OCEAN

REPORT OF THE SHARK WORKING GROUP

International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

15-20 July 2015
Kona, Hawaii, U.S.A.

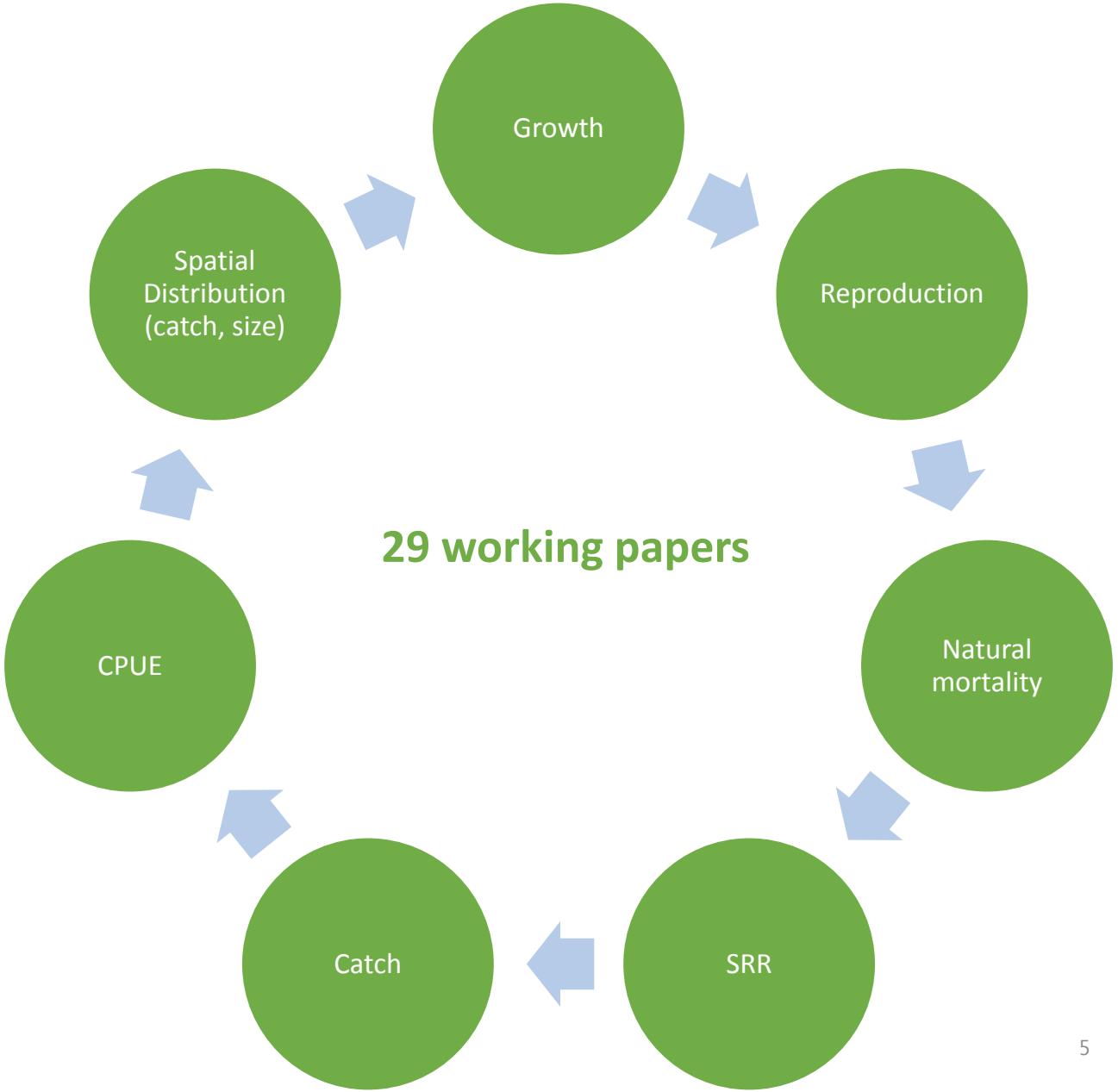
1

Shortfin mako is a data poor species. Recognizing that information on important fisheries is missing, the untested validity of indicators for determining stock status, and conflicts in available data, stock status (overfishing & overfished) could not be determined.

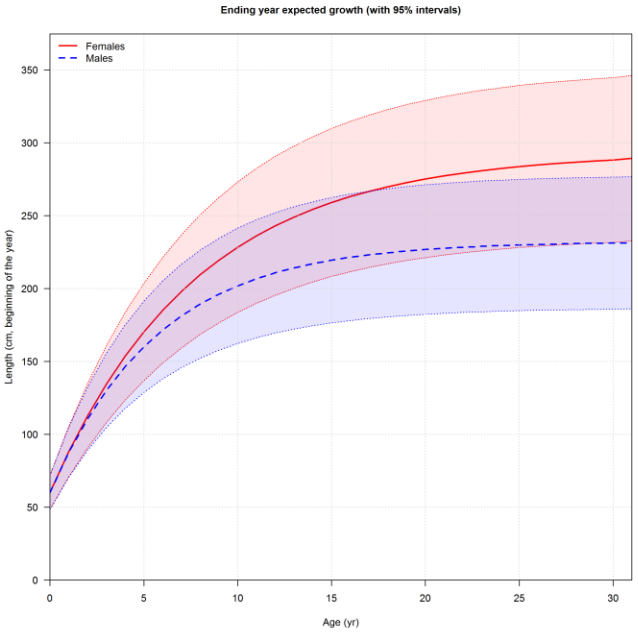
The SHARKWG reviewed a suite of information to determine the stock status of shortfin mako shark in the North Pacific. Of the three indices considered to have the greatest value in providing stock status information, abundance trends in two of the series appear to be stable or increasing, while the abundance trend in the third series appears to be declining.

It is recommended that data for missing fleets be developed for use in the next stock assessment scheduled for 2018 and that available catch and CPUE data be monitored for changes in trends. It is further recommended that data collection programs be implemented or improved to provide species-specific shark catch data for fisheries in the North Pacific.

Advancing biological and fishery knowledge

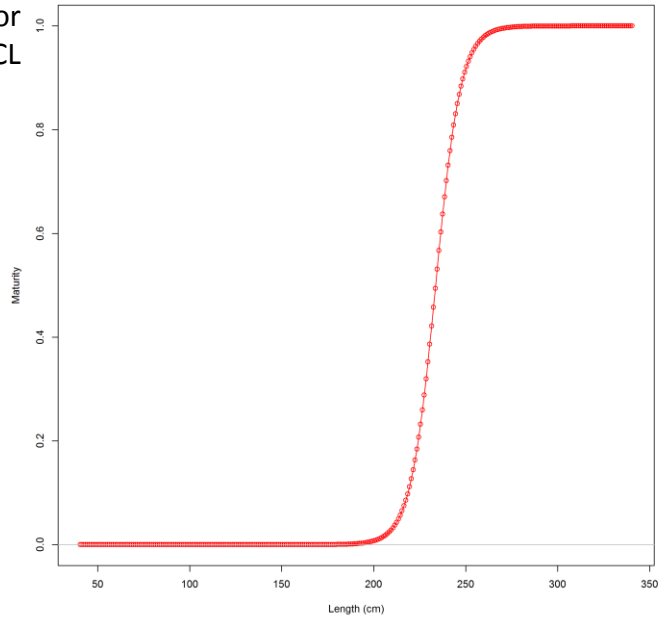


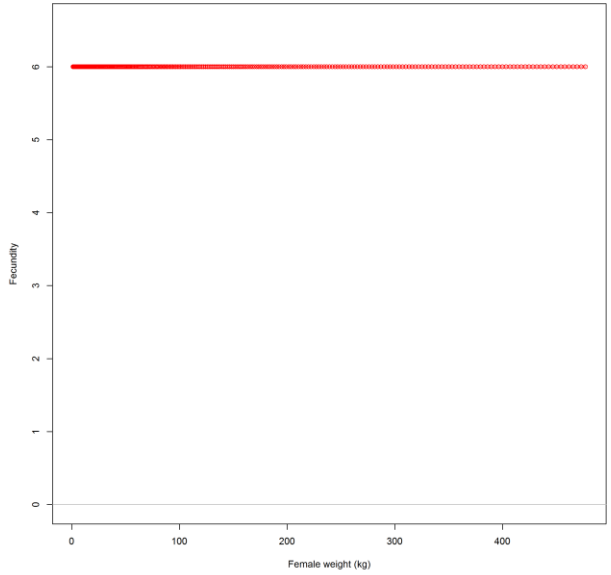
Biology



- Growth curve generated from meta analysis of age and growth data from Japan, Mexico, Taiwan, and USA.

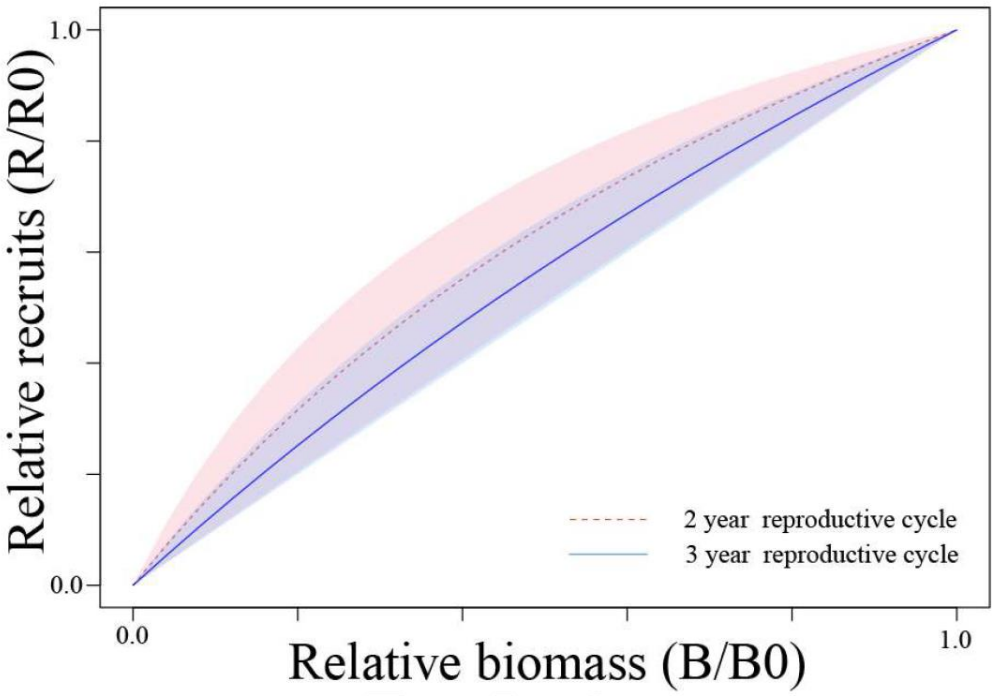
- Size-at-50% maturity for females equal to 233.6 PCL in cm.





- Pup production was fixed at 12 and obtained assuming a two-year reproductive cycle.

Biology

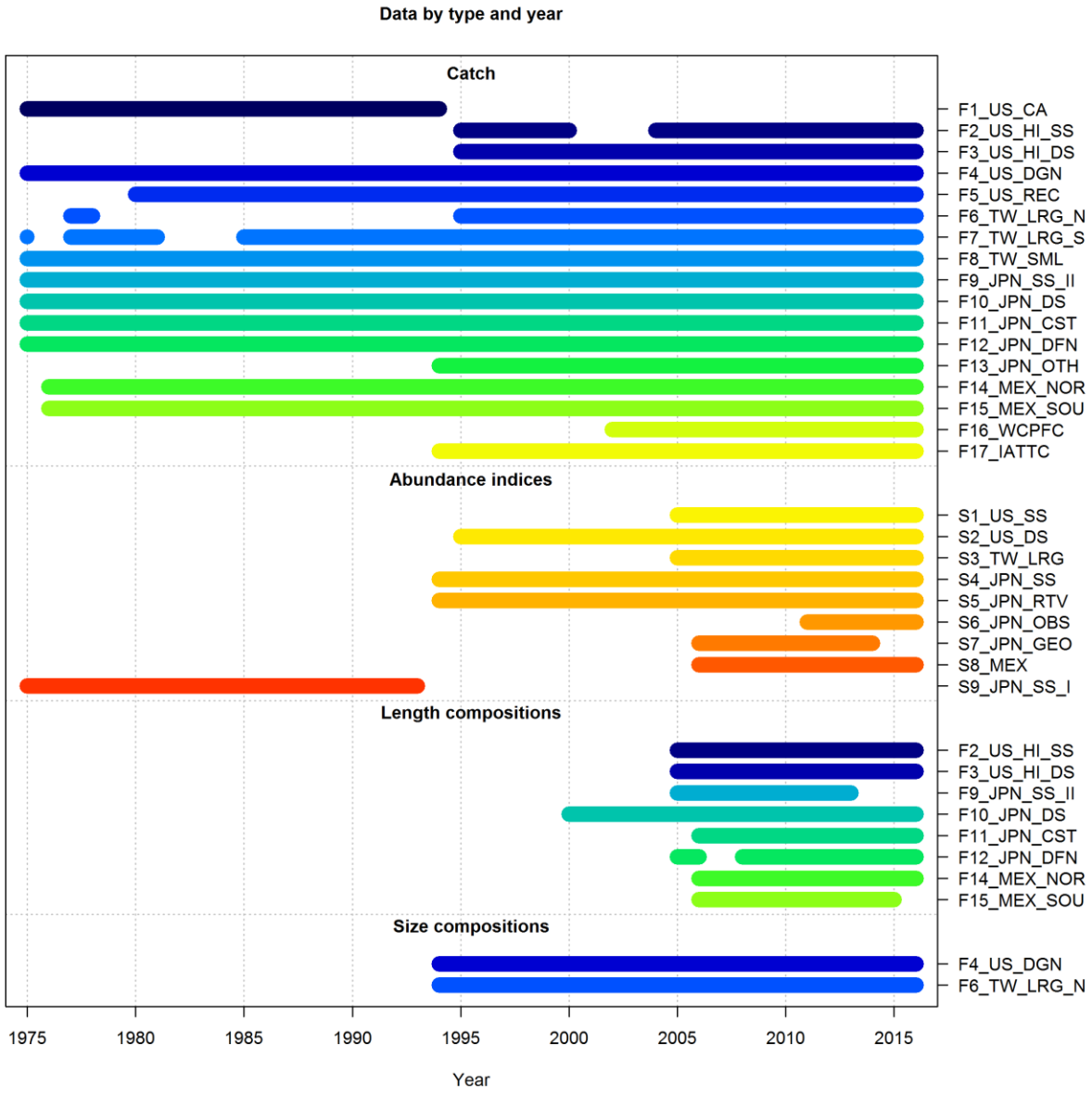


- Steepness parameter from Beverton-Holt model:
  - 2 years cycle = 0.317 (0.057, SD)
  - 3 years cycle = 0.252 (0.039, SD)

Stock Synthesis model

Years	Pop. structure	Fishery Structure I	Fishery Structure II
• 1975-2016 • Annual (Jan – Dec)	• Two sex • Age classes 1-31+ • Beverton-Holt model	• Regional fleets • Sex-specific selectivity	• Double normal selectivity assumed

Data available for 2018 NP SFM stock assessment

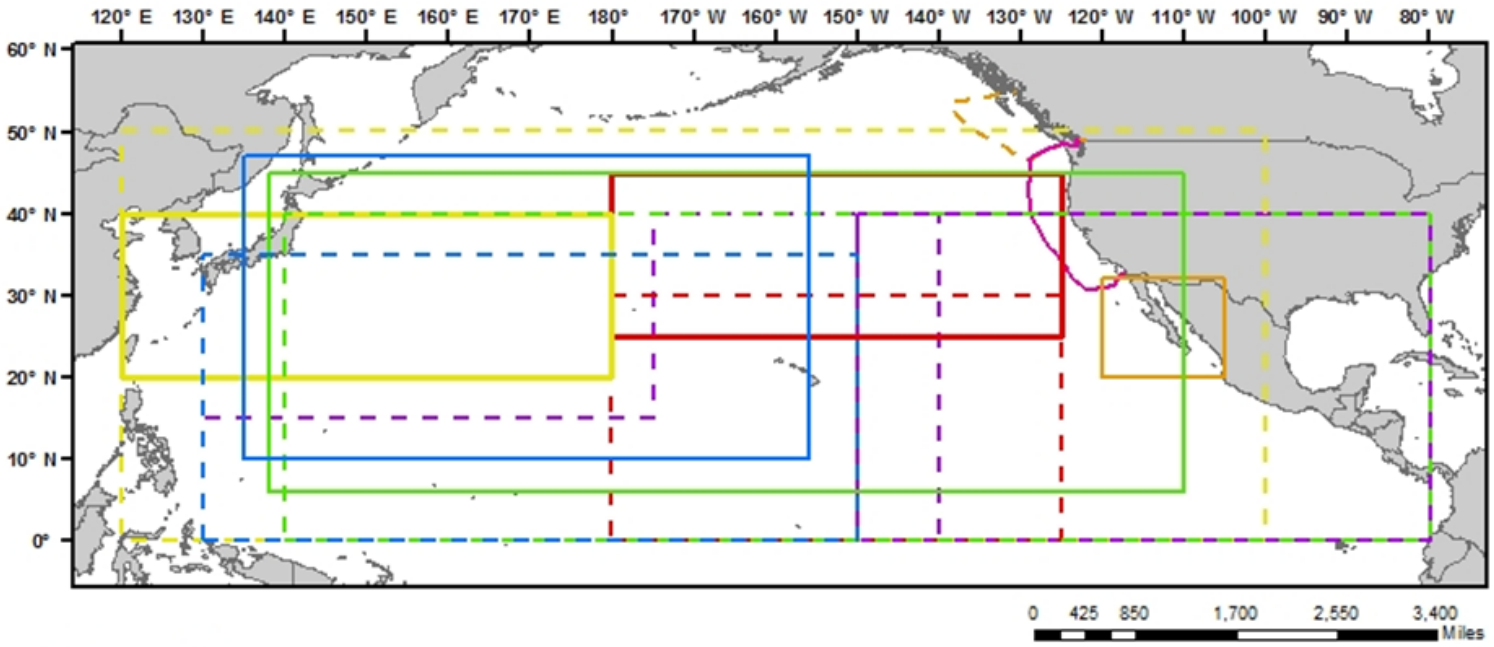


Catch Data - Sources (1975 – 2016)

Total Dead Removals for 17 Fleets

Nation	N (description)
Mexico	2 (North and South all fisheries)
Taiwan	3 (2 x LL, and coastal LL)
Japan	5 (3xLL, DFN, others)
WCPFC	1 (Non ISC data)
USA	5 (3 x LL, DGN, Rec)
IATTC	1 (purse seine)

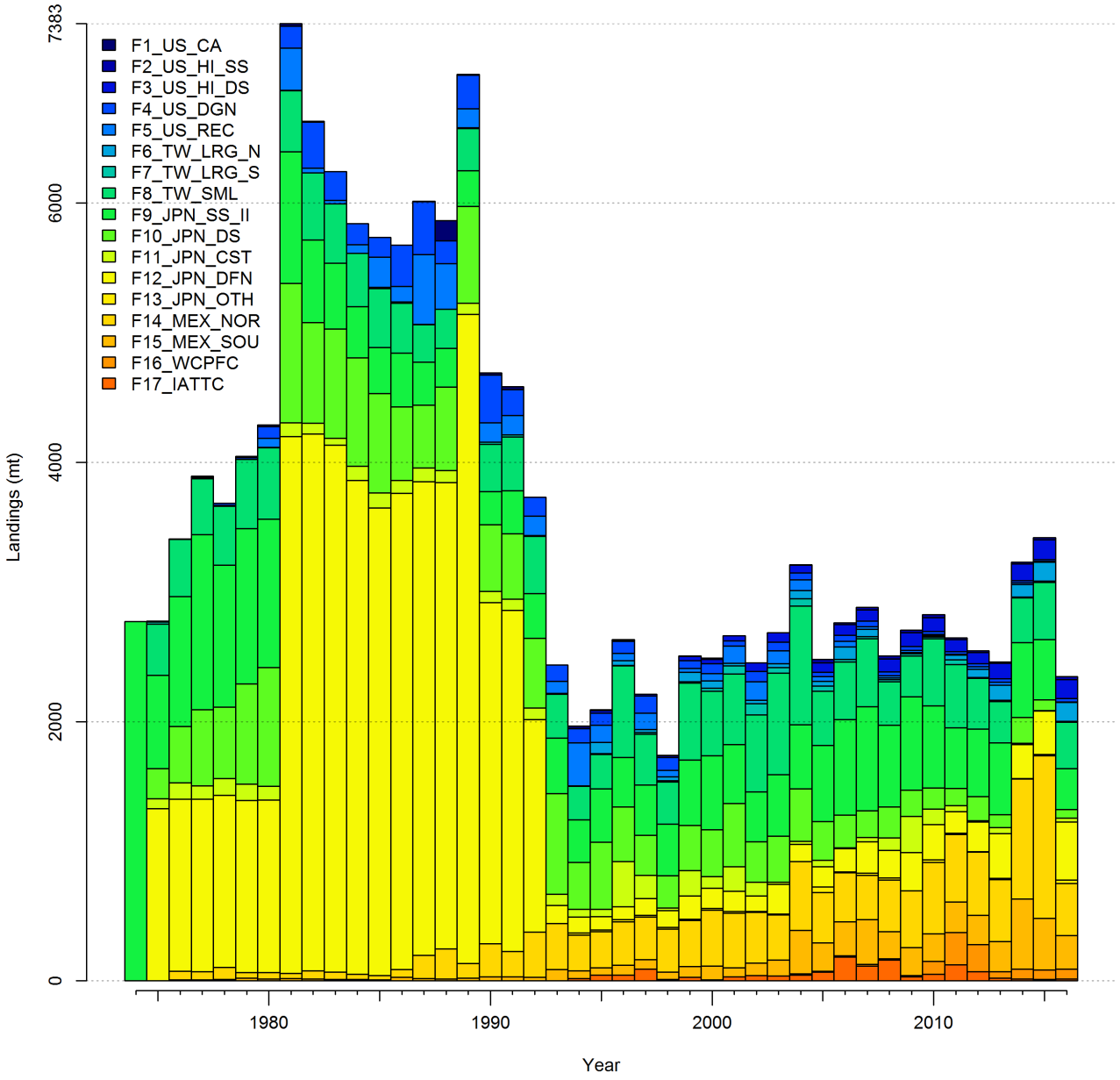
Catch Data – Spatial Extent



Legend

- Japan Kinkai shallow longline
- Japan Kinkai deep longline
- Japan Enyo shallow longline
- Japan Enyo deep longline
- Taiwan small-scale longline
- Taiwan distant-water longline
- Mexico longline/driftnet
- Hawaii shallow longline
- Hawaii deep longline
- USA drift gillnet
- SPC non-member longline
- IATTC member purse seine

Catch Data – by Fleet

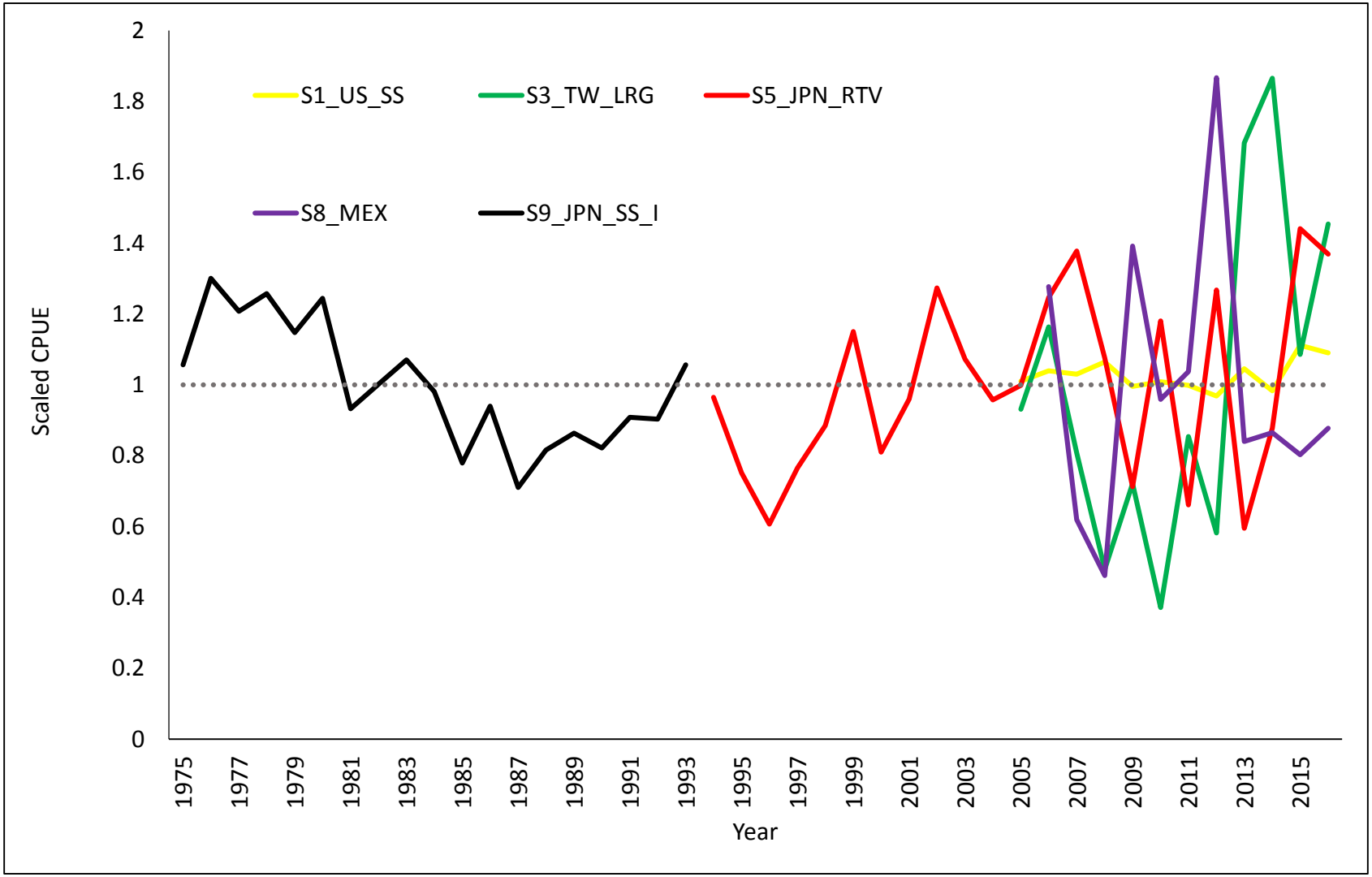


Catch – Abundance Indices I: Criteria

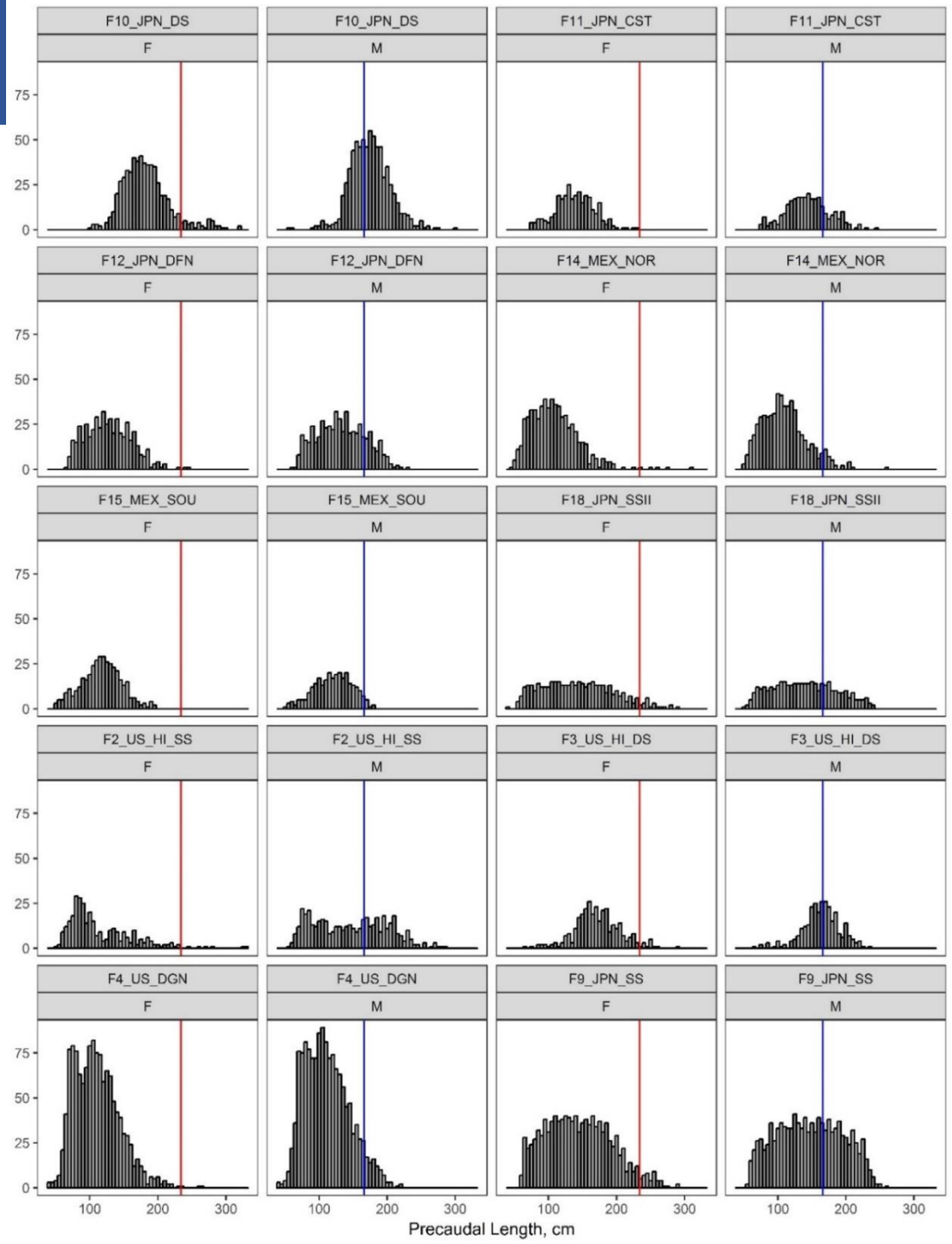
Index Selection Criteria

- Quality of observations
- Spatial distribution
- Size/age distribution
- Statistical soundness
- Temporal coverage
- Q changes?
- Relative catch contribution

Abundance Indices



Size Compositions

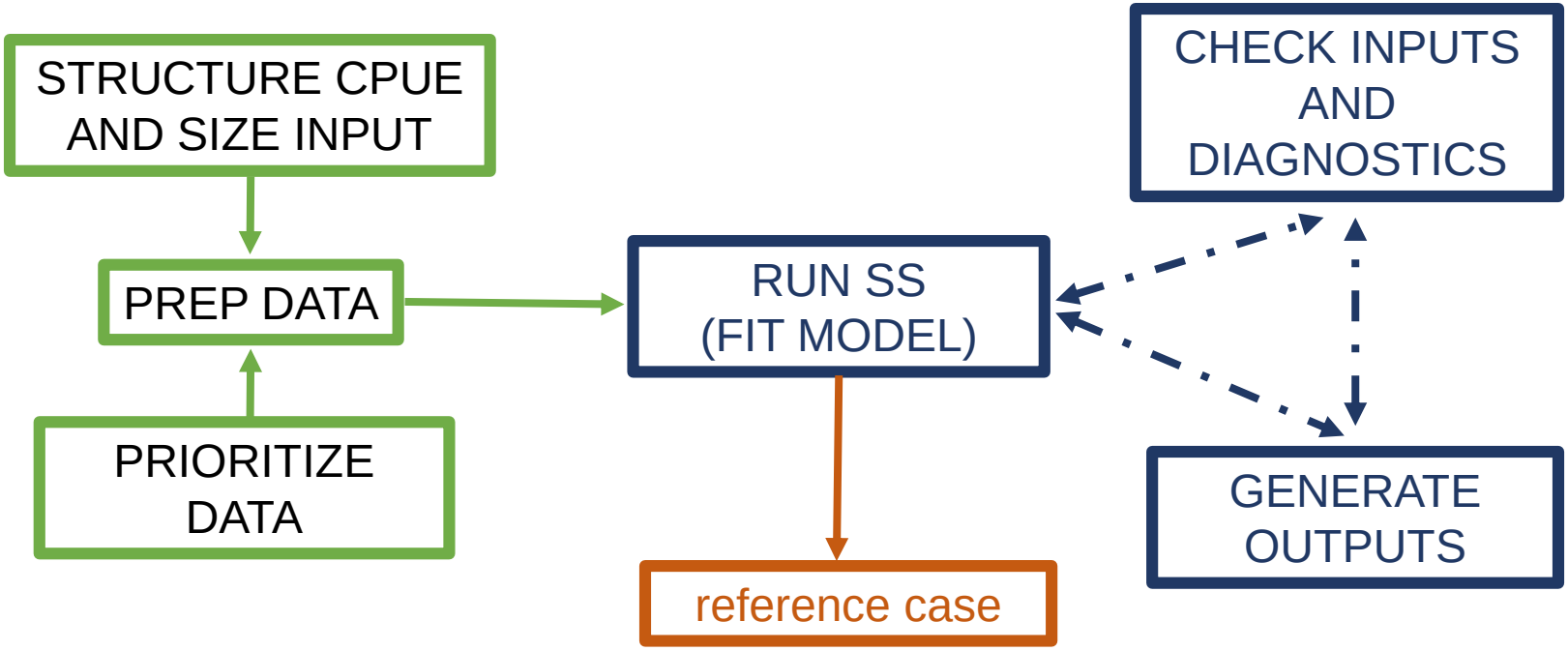


Stock assessment strategy

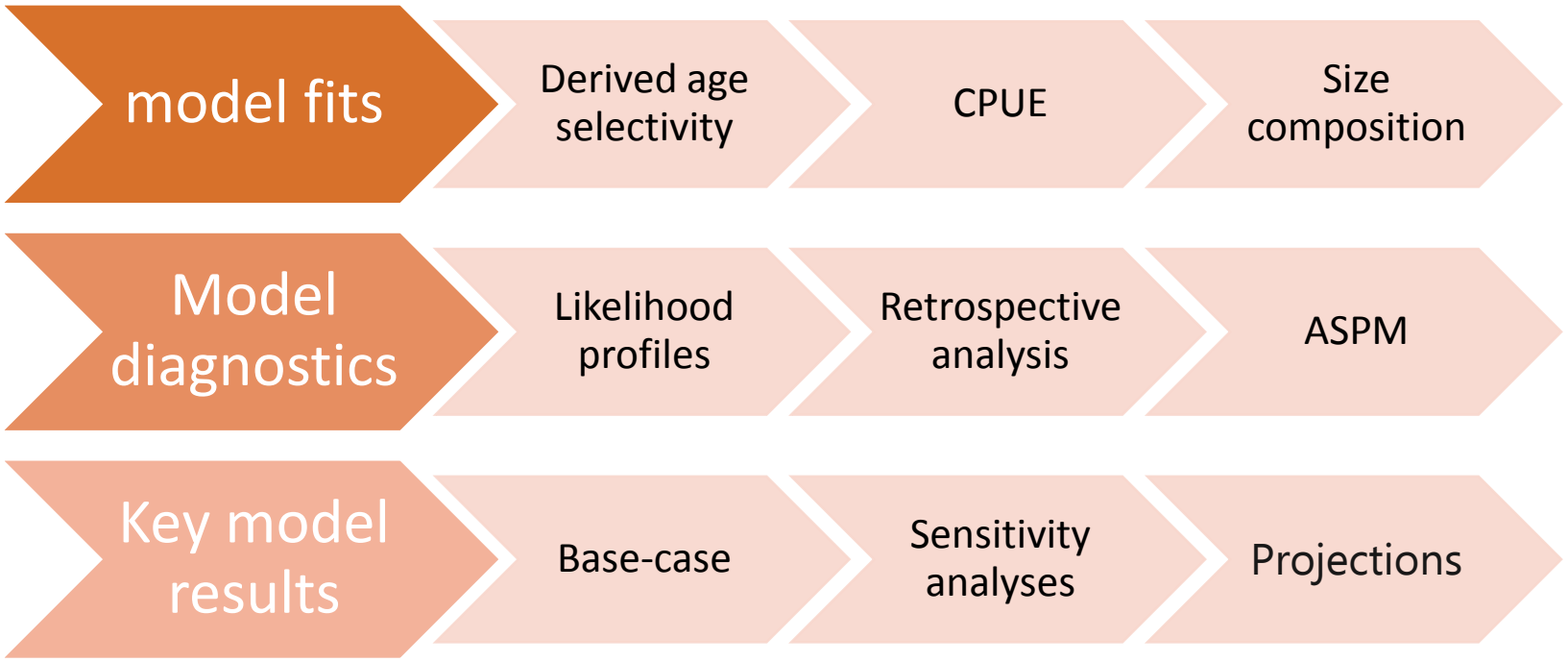
CAPAM

Center for the Advancement of Population Assessment Methodology

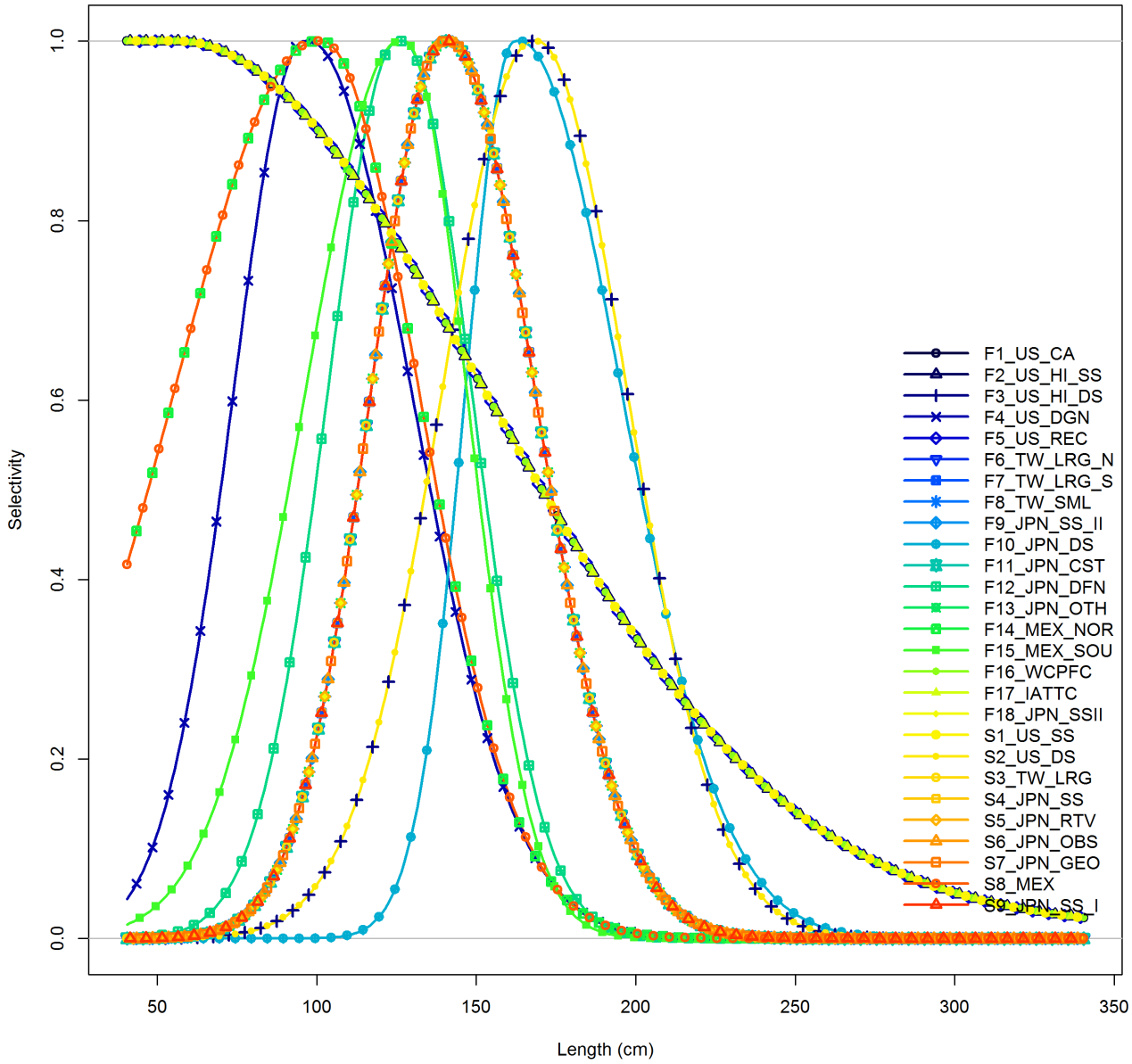
Modeling workflow



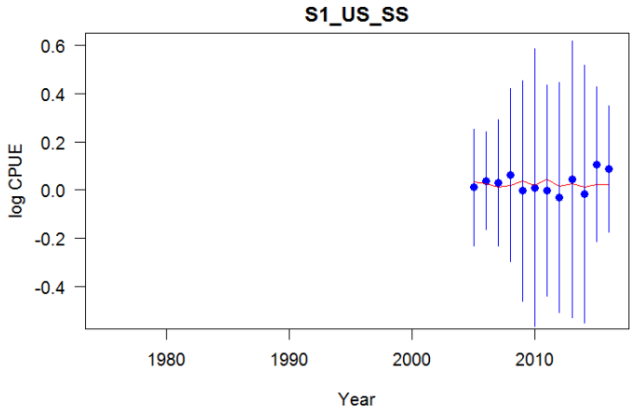
Results

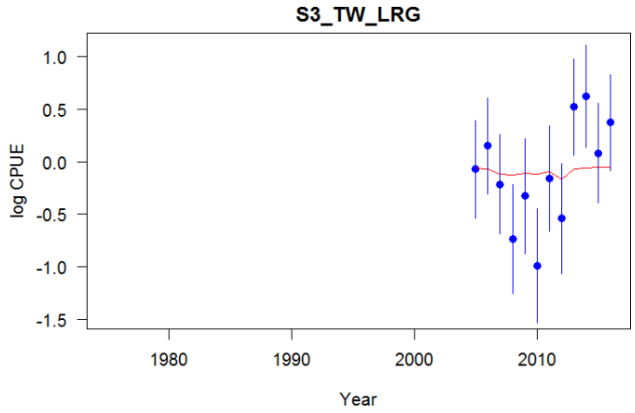

model fits
Derived age selectivity
CPUE
Size composition
Model diagnostics
Likelihood profiles
Retrospective analysis
ASPM
Key model results
Base-case
Sensitivity analyses
Projections

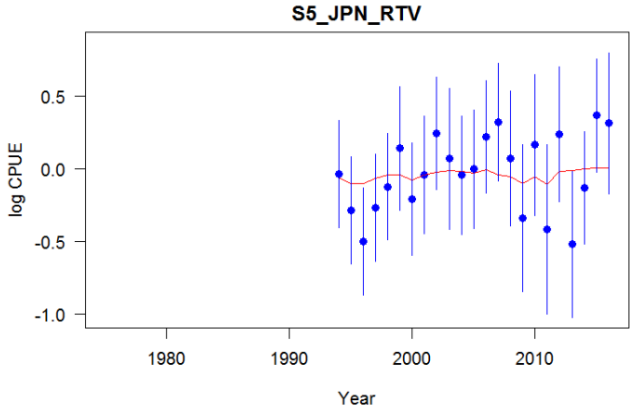
Derived fishery-specific selectivity

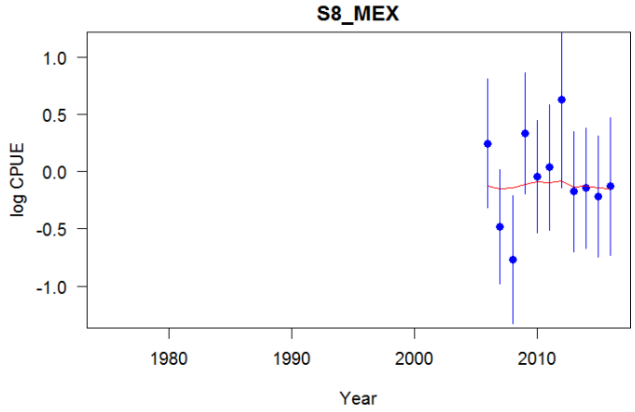


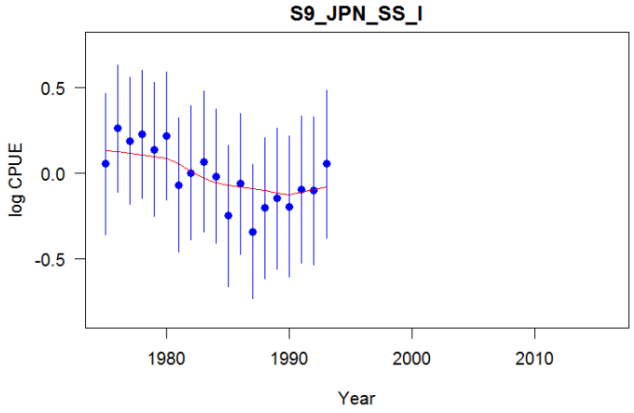
Fits to the Data: CPUE



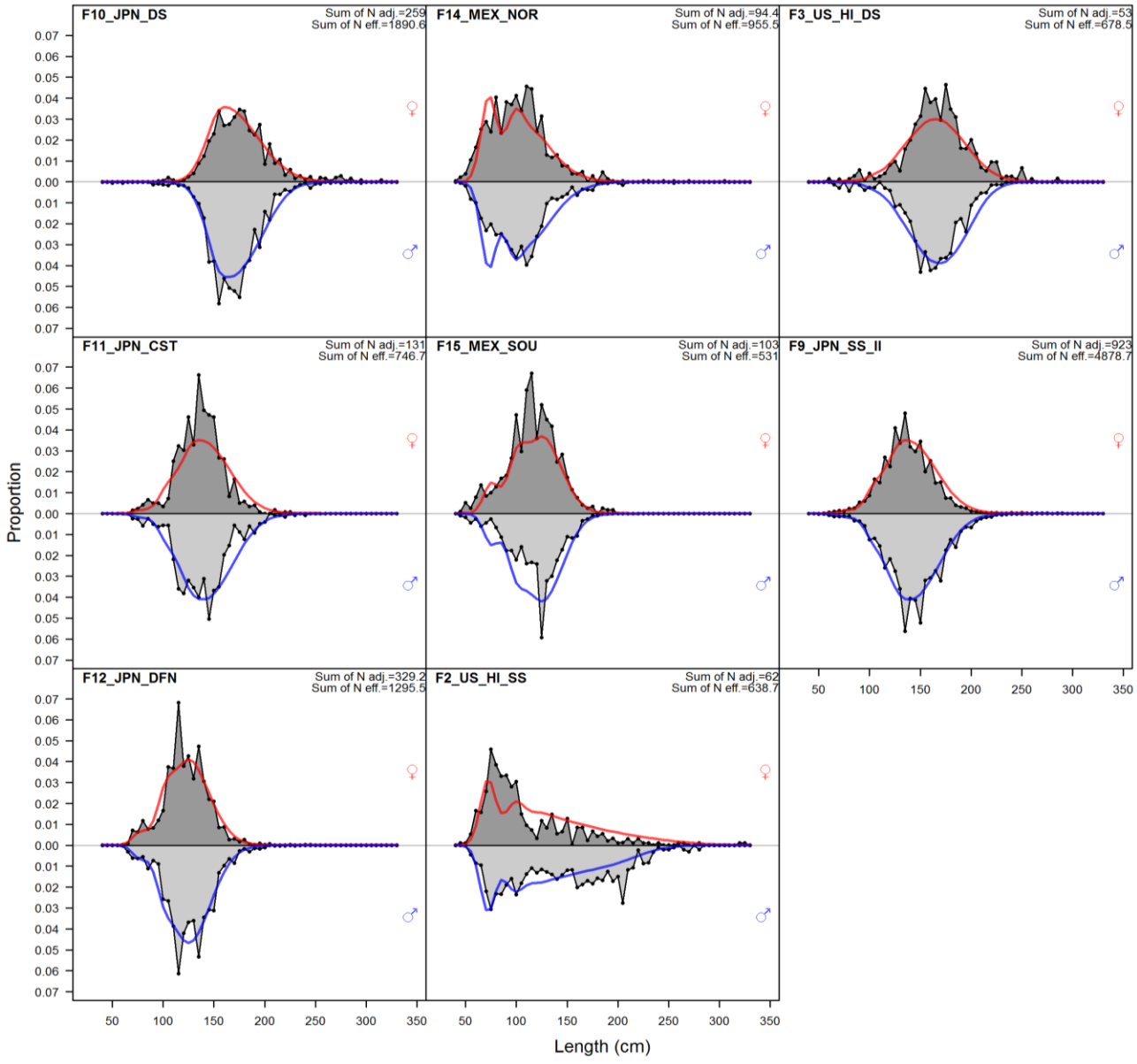




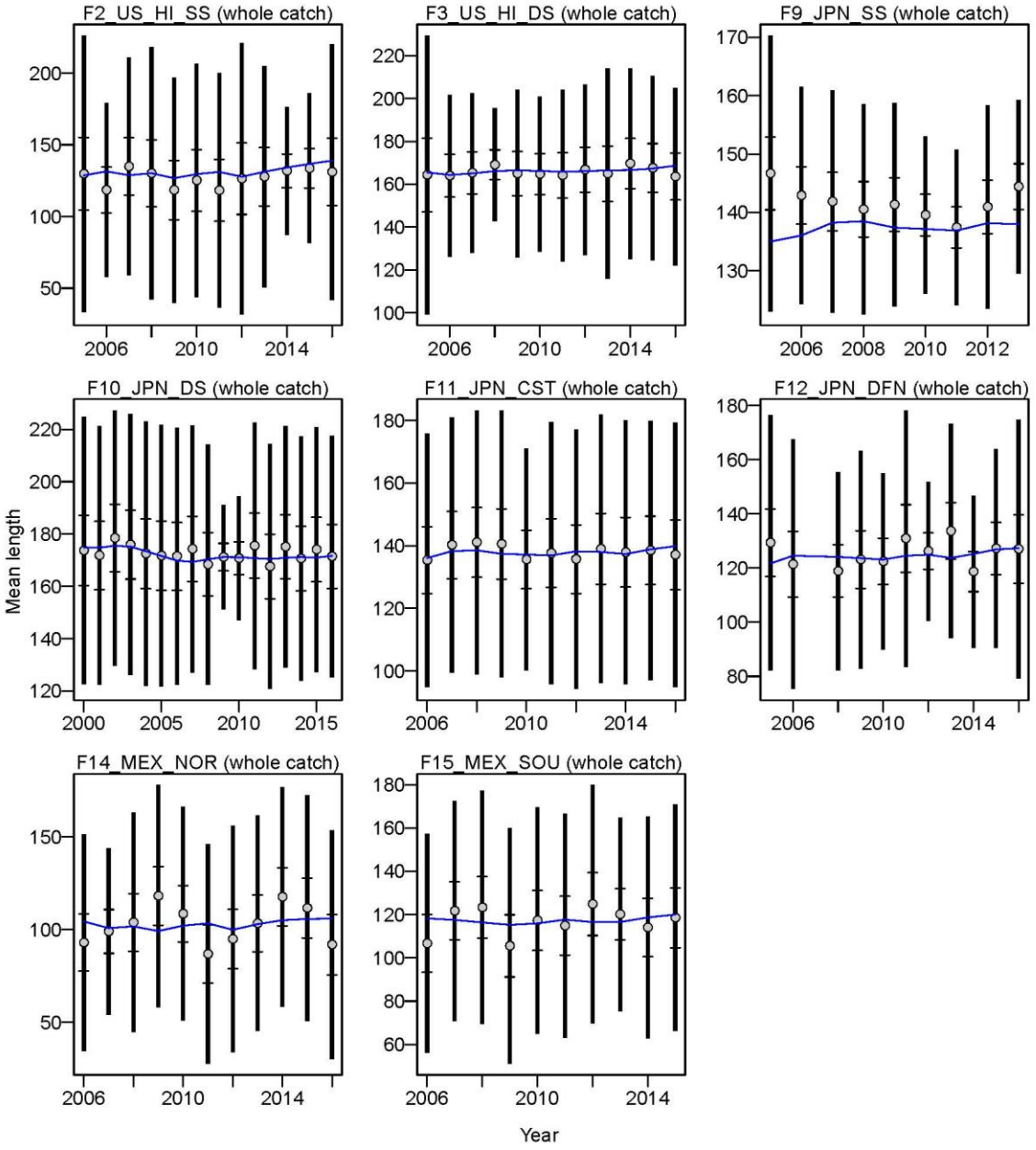




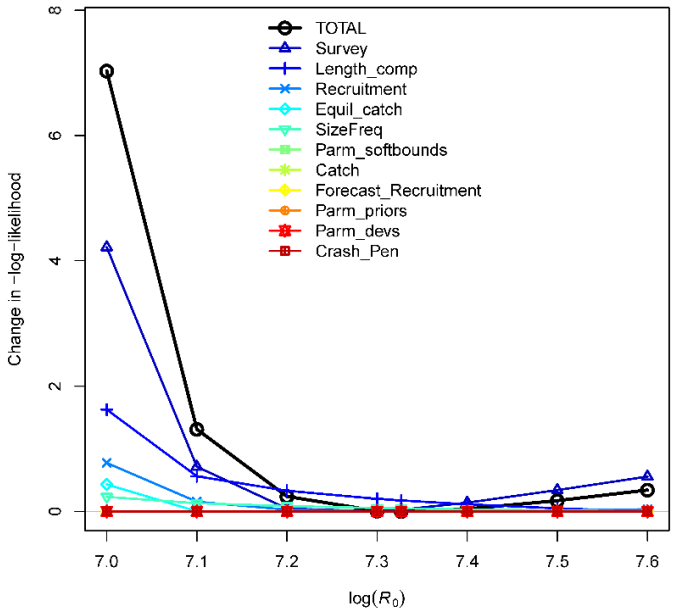
Fits to the Data: Size Composition

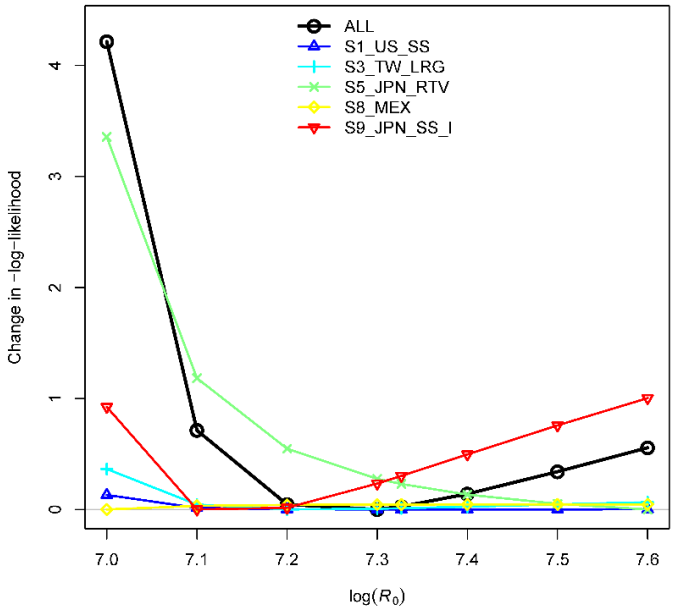


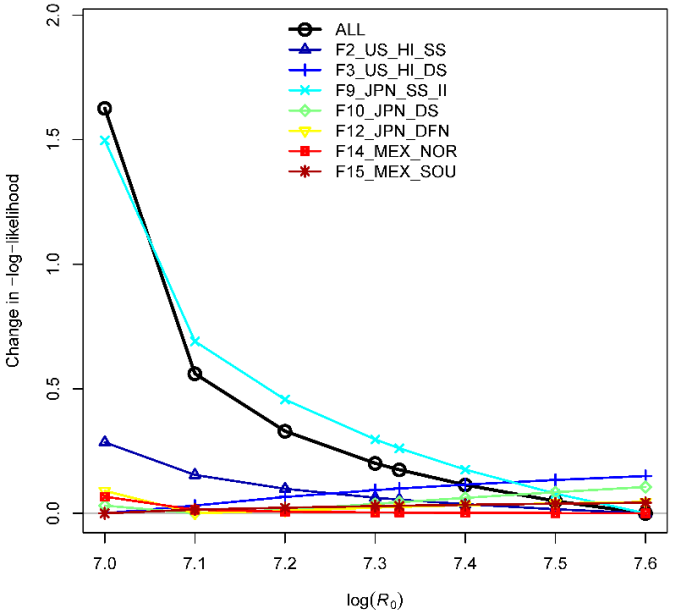
Fits to the Data: Size Composition



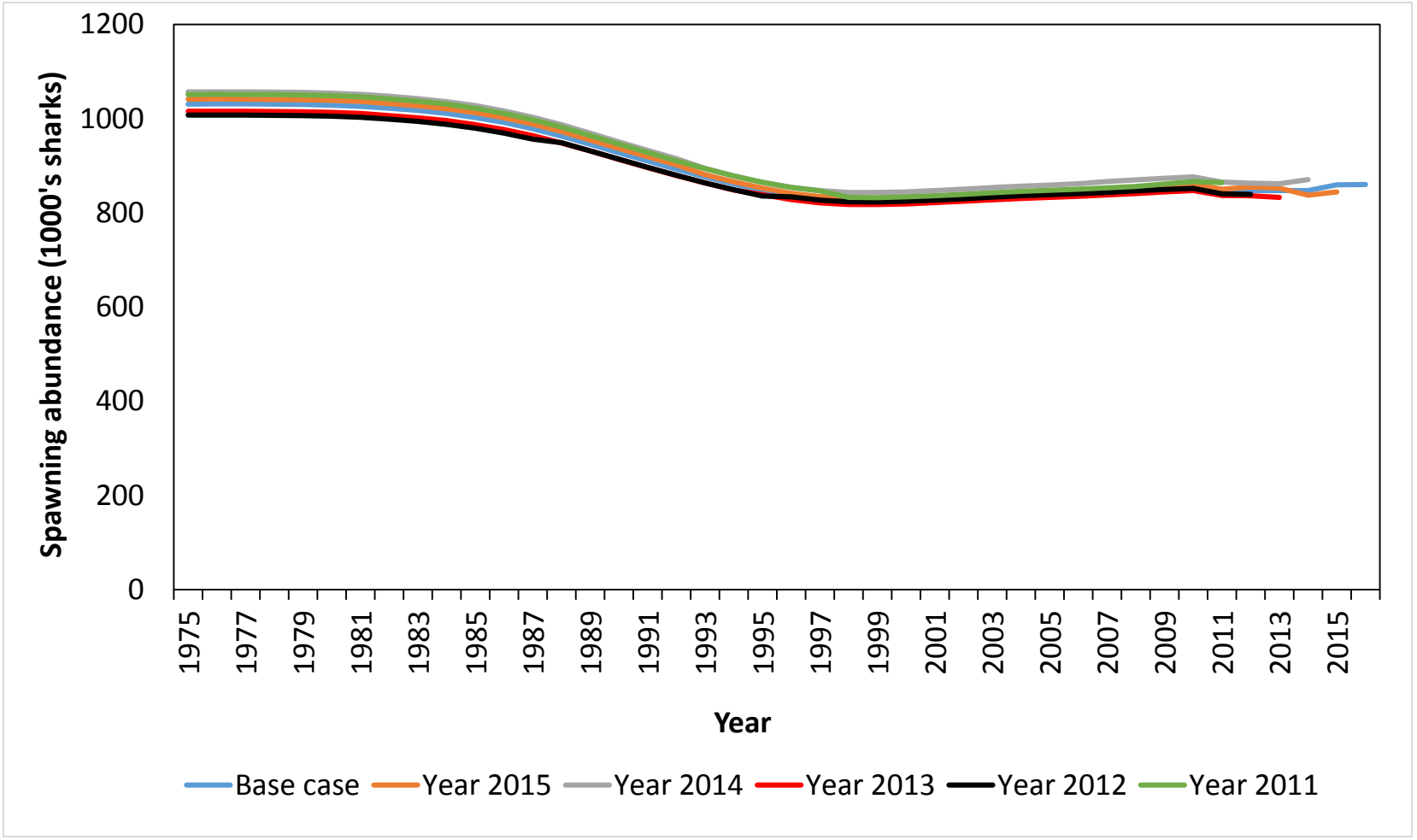
Negative Log-likelihood Profiles



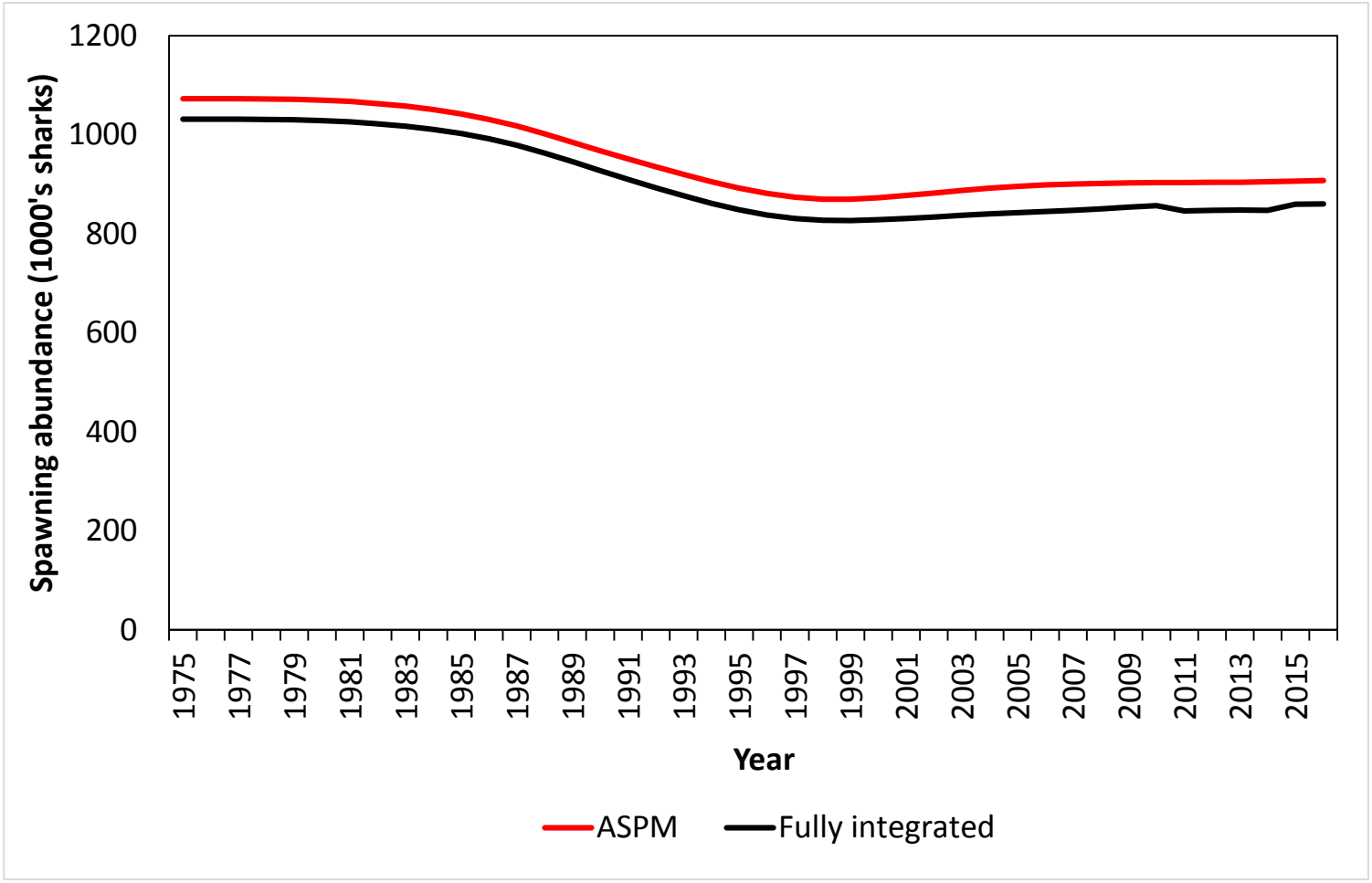




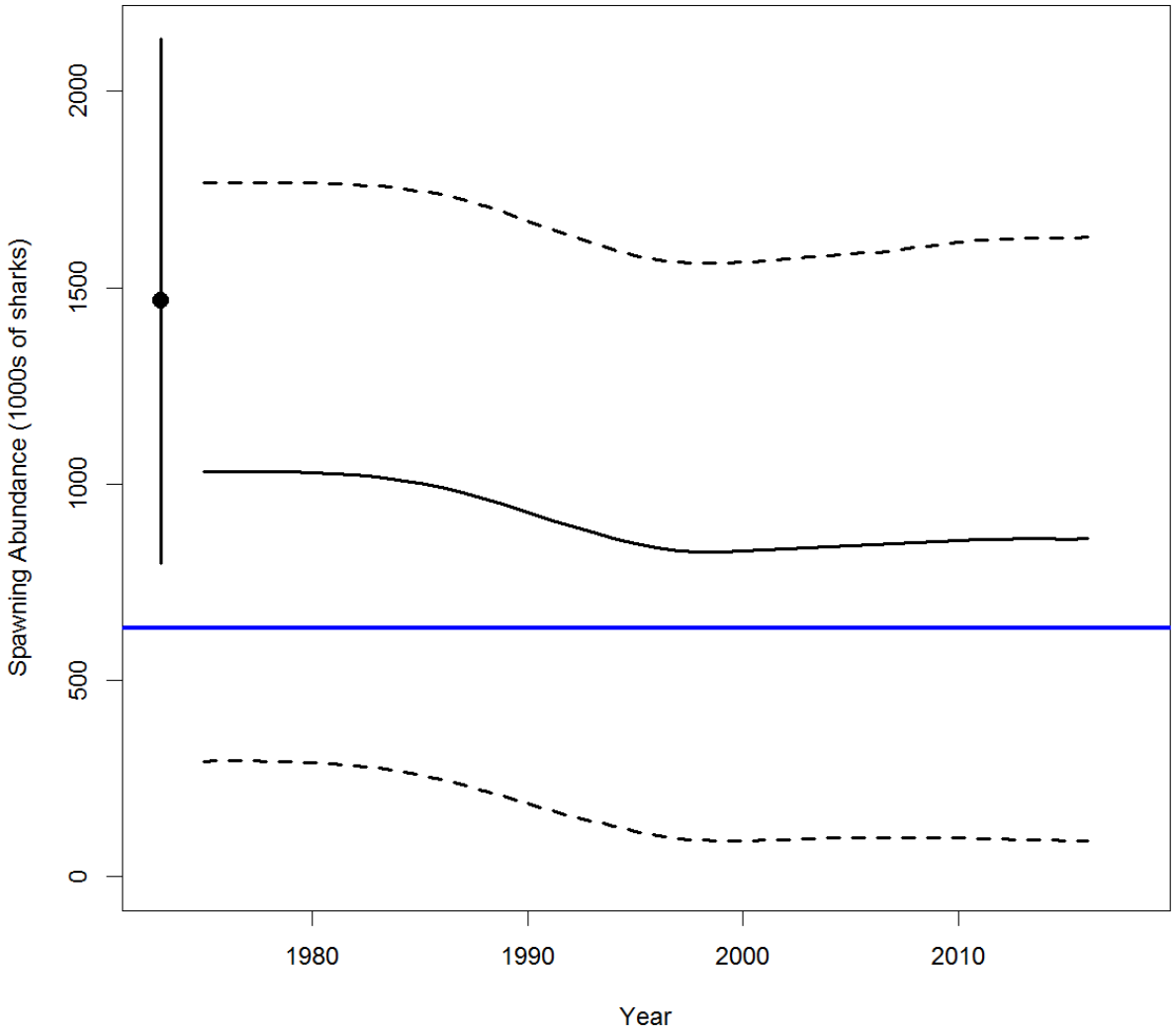
Retrospective Analysis



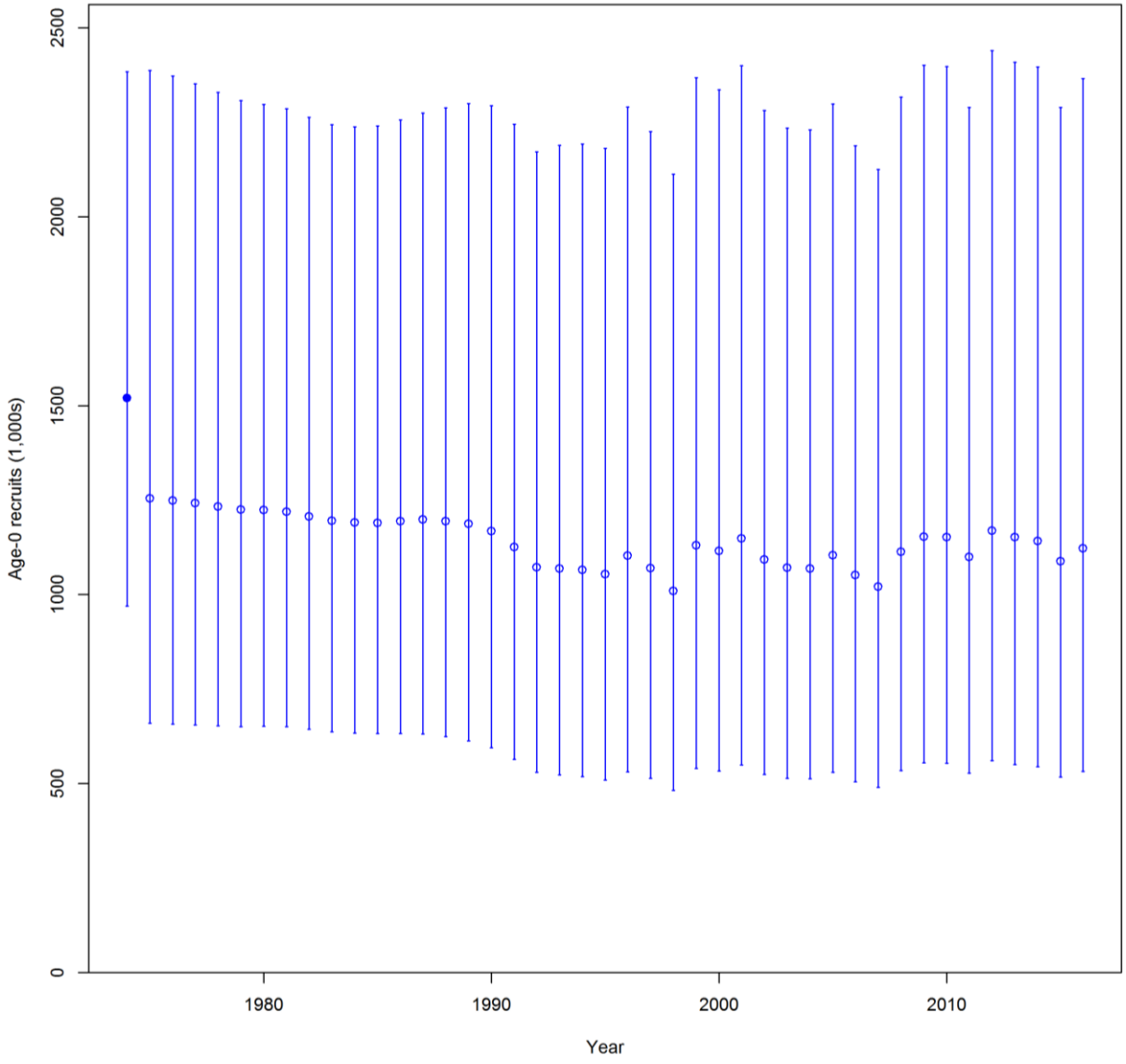
Age-Structured Production Model (ASPM)



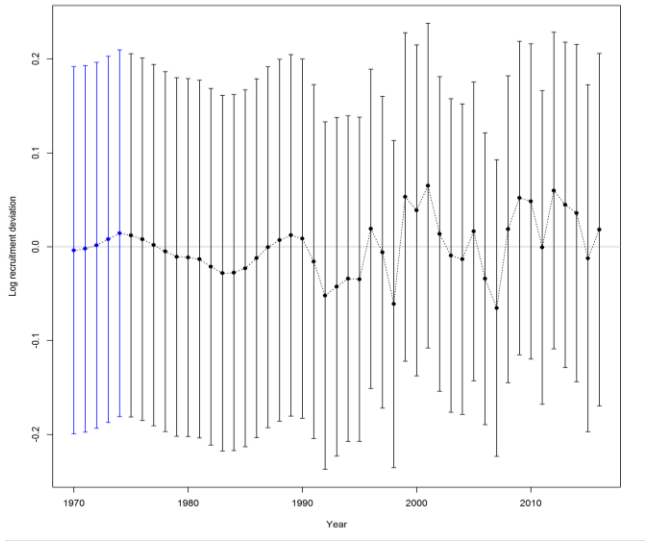
Key Model Results

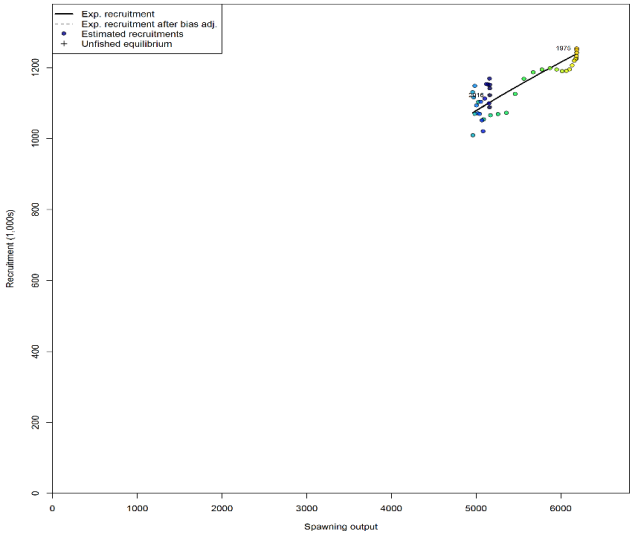


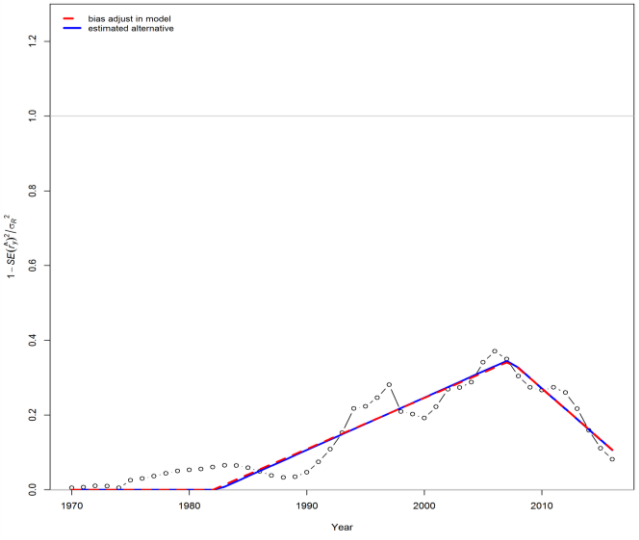
Key Model Results



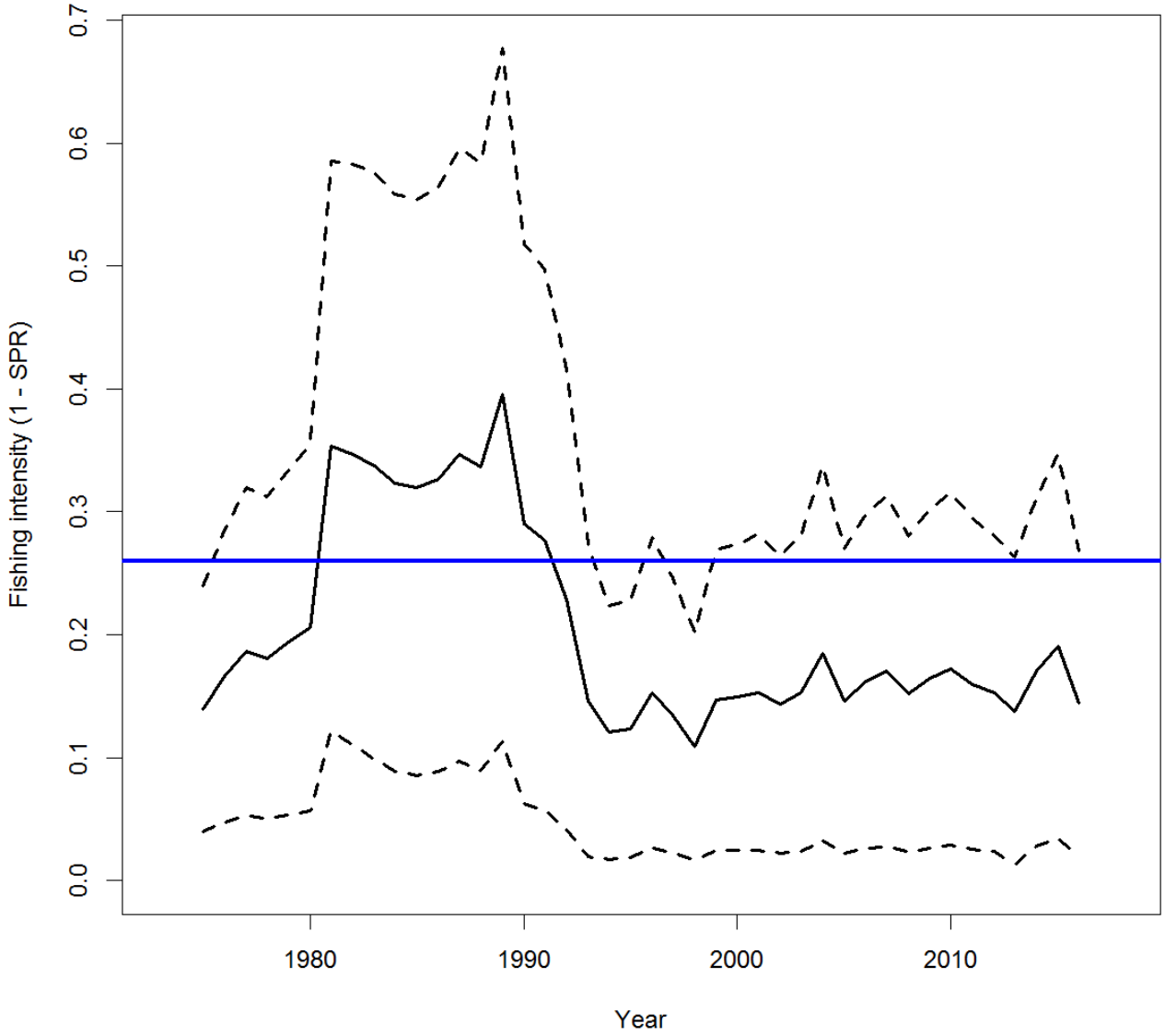
Key Model Results



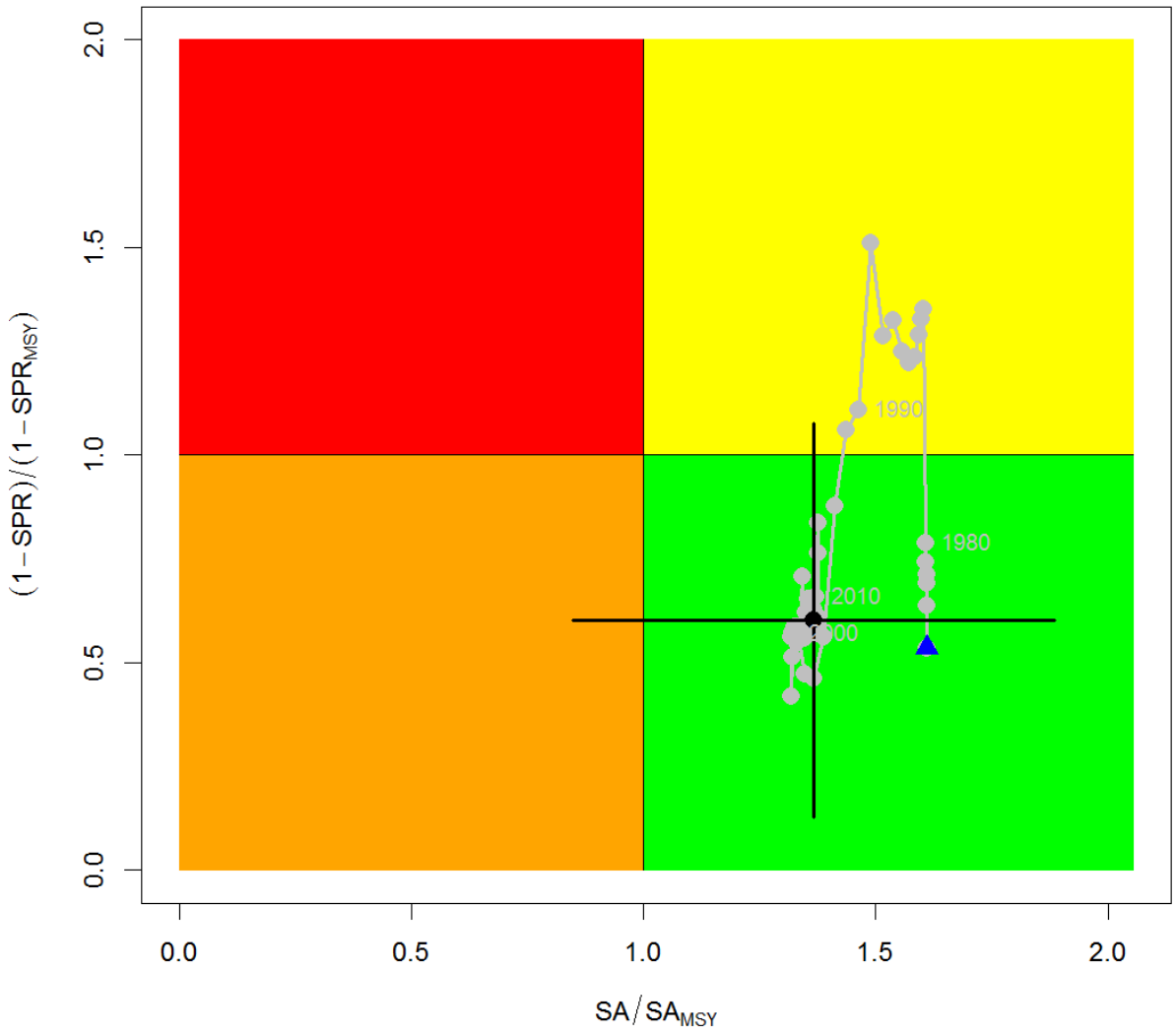




Key Model Results



Kobe Plot – Historical Stock Condition

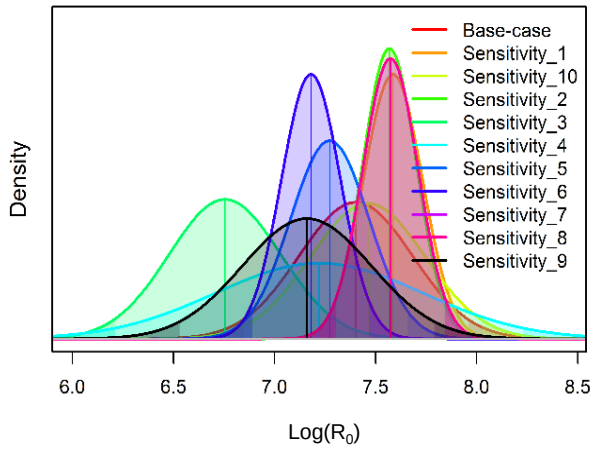


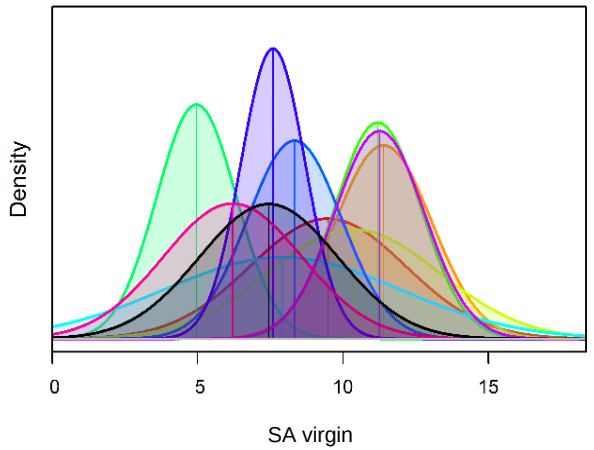
Sensitivity Analyses

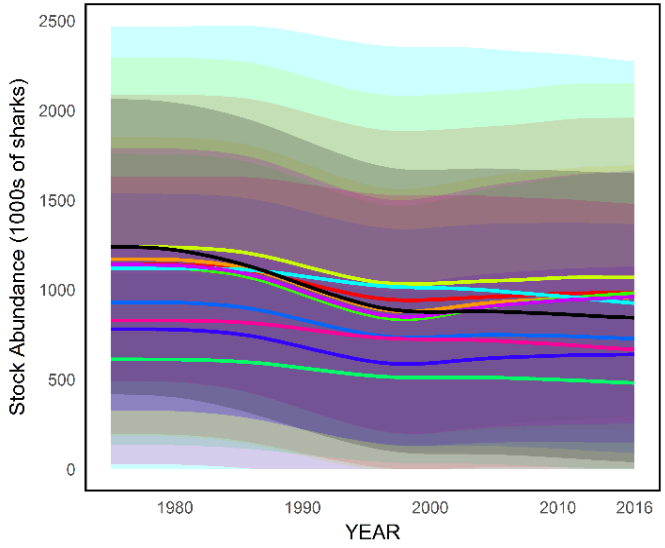
The SHARKWG identified four major groups of sensitivity analyses to examine the effects of:

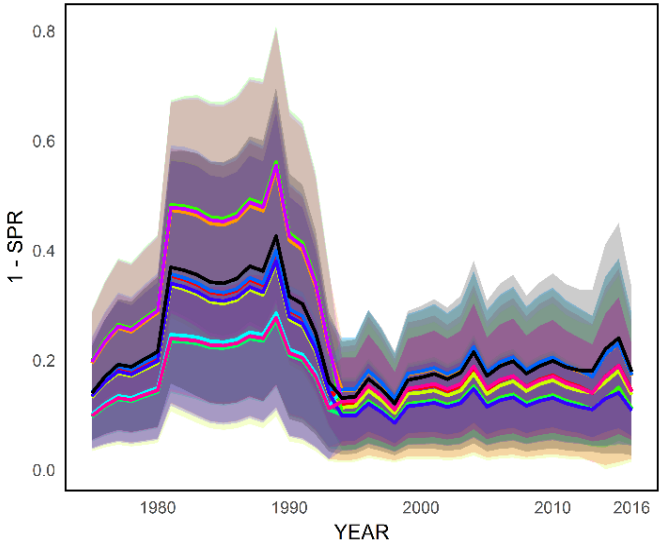
1) uncertainty in total catch estimates and initial conditions;
2) the use of a single CPUE index in combination with S9;
3) uncertainty in biological assumptions; and
4) stock assessment period on the assessment results.

Uncertainty in catch estimates and initial conditions

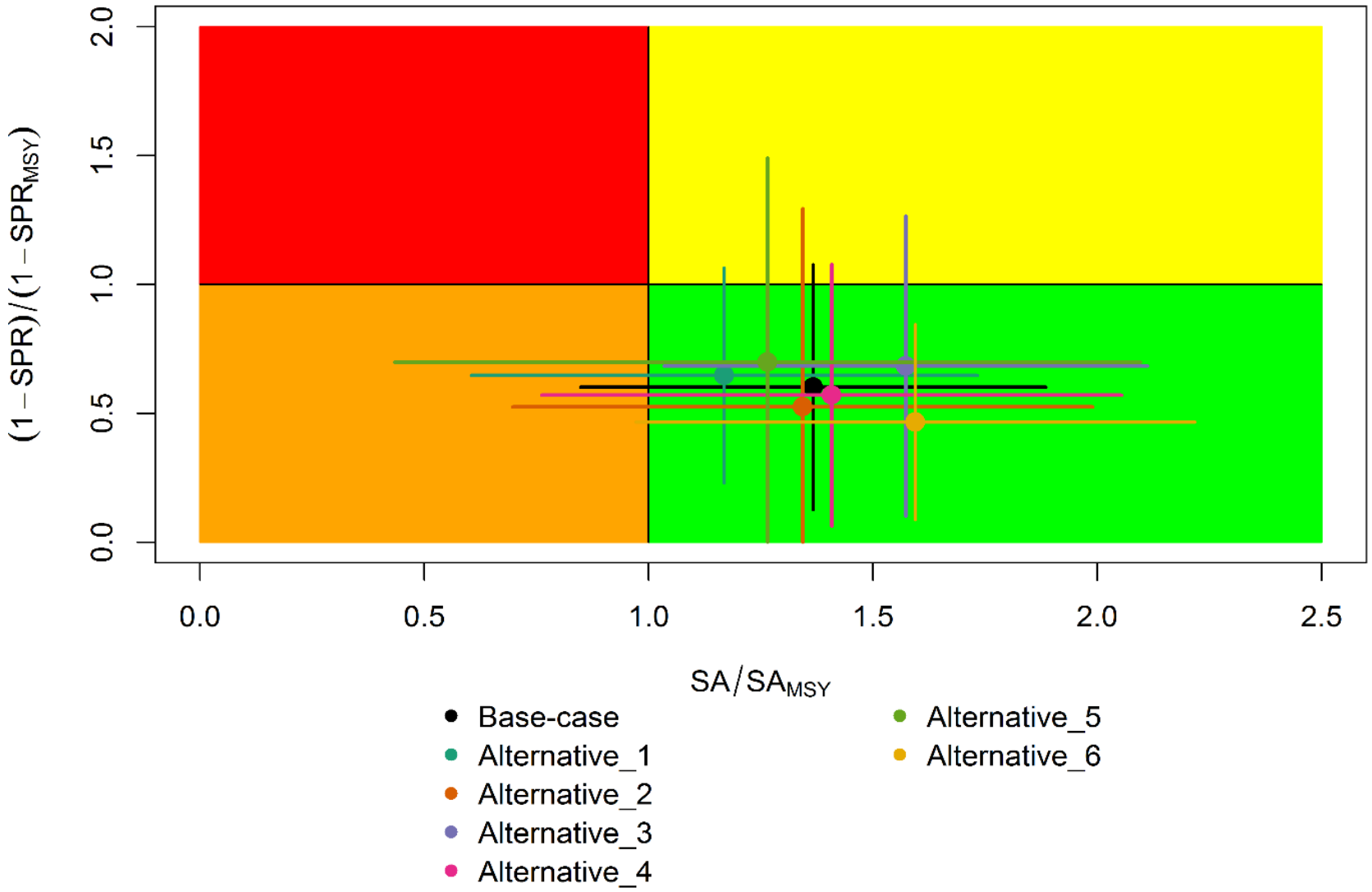




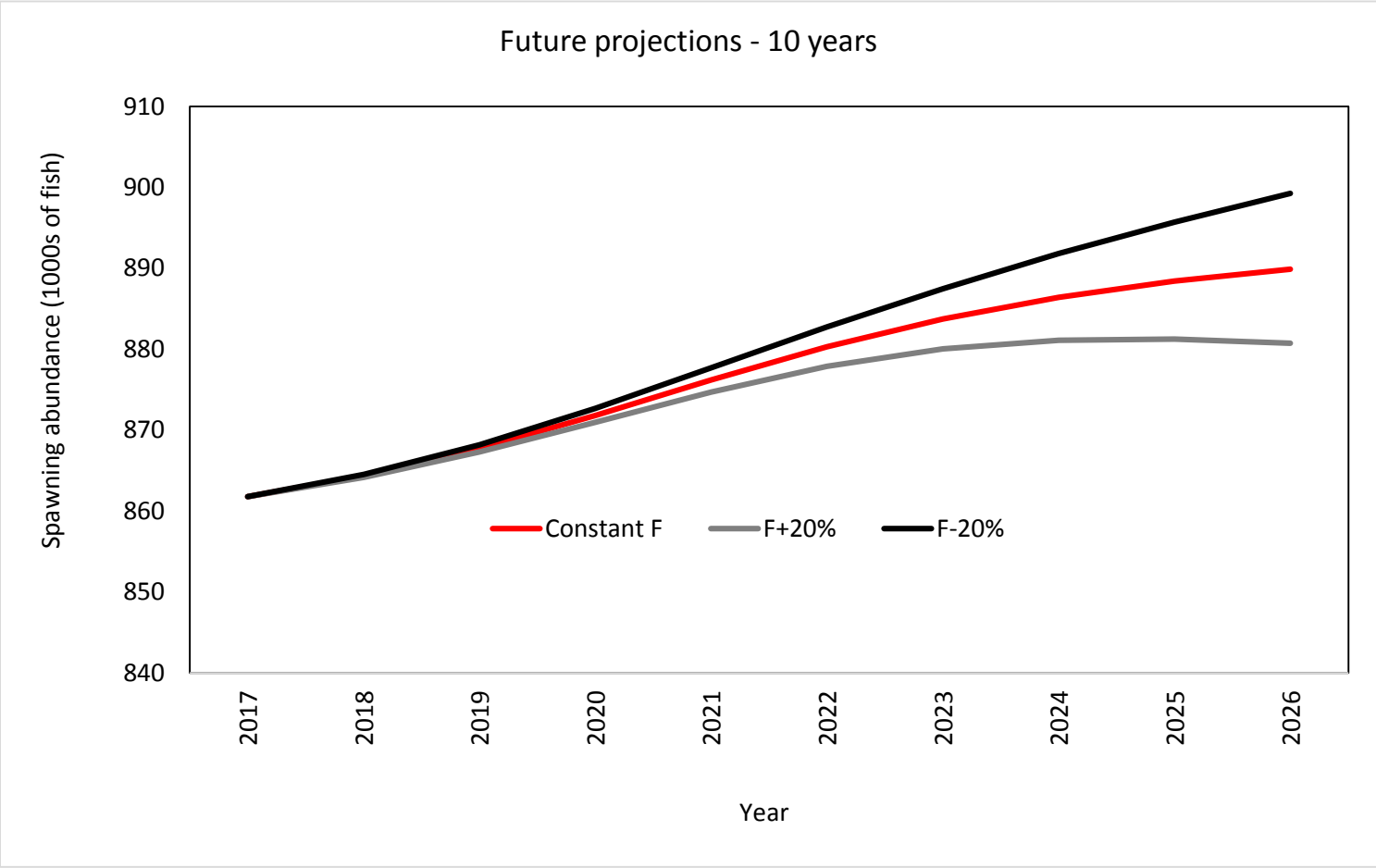




Key uncertainties



Results: Future projections – 10 years



- Based on these future projections the number of adult females is expected to increase gradually under Constant F and F-20%, however in F+20% spawning abundance slightly drops in the final year of the projection.

Stock Status

- Results from this assessment should be considered with respect to the management objectives of the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC), the organizations responsible for management of pelagic sharks caught in international fisheries for tuna and tuna-like species in the Pacific Ocean.
- Target and limit reference points have not yet been established for pelagic sharks in the Pacific. In this assessment stock status is reported in relation to maximum sustainable yield (MSY).
- The results from the base case model suggest that, relative to MSY, the North Pacific mako shark stock is likely (>50%) not in an overfished condition and overfishing is likely (>50%) not occurring.

Stock Status II

- Besides the base case model, stock status was also examined under six alternative states of nature that represented the most important sources of uncertainty in the assessment.
- Results of these models with alternative states of nature were consistent with the base case model and showed that, relative to MSY, the stock is likely (>50%) not in an overfished condition and overfishing is likely (>50%) not occurring.