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Indian Ocean Tuna Commission (IOTC): Data needed and approaches used in Stock Assessments

Overview

- Legal requirements of reporting data
- Data types used in Assessments
- The Scientific Process / Stock Assessment Approaches

Summary of IOTC Resolutions

IOTC Resolutions: IOTC and main shark species

- *IOTC Resolution 10/02* ***Mandatory statistical requirements*** *for IOTC Members and Cooperating Non-Contracting Parties (CPC's)*
  - **Minima requirements for the reporting of statistics to the IOTC**
- *IOTC Resolution 13/08 Procedures on a* ***fish aggregating devices*** *(FADs) management plan*
  - **Minima requirements for the collection and reporting of data on FADs, drifting or anchored, used by Purse seine and pole-and-line fisheries**
- *IOTC Resolution 13/03 On the recording of* ***catch and effort*** *data by fishing vessels in the IOTC Area of Competence*
  - **Minima data requirements for the collection of CATCH-AND-EFFORT data**
- *IOTC Resolution 11/04 On a Regional* ***Observer Scheme***
  - **Minima requirements sampling of catches in land and at-sea**

Summary of IOTC Resolutions (cont.)

IOTC Resolutions: Main sharks and other bycatch species

- *IOTC Resolution 05/05 Concerning the conservation of **Sharks** caught in association with fisheries managed by IOTC*
  - **Minima requirements for the reporting of data on sharks caught on IOTC fisheries**

- **Other Resolutions on sharks: Ban on catch retention and reporting requirements for:**
  - **Oceanic whitetip shark**: *IOTC Resolution 13/06*
  - **Thresher sharks**: *IOTC Resolution 12/09*
  - **Whale sharks**: *IOTC Resolution 13/05* **(purse seine fisheries)**

- *IOTC Resolution 10/06 On reducing the incidental bycatch of **Seabirds** in longline fisheries*
  - Minima requirements for the reporting of interactions with seabirds (longline)

- *IOTC Resolution 12/04 On **Marine Turtles***
  - Minima requirements for the reporting of interactions with marine turtles

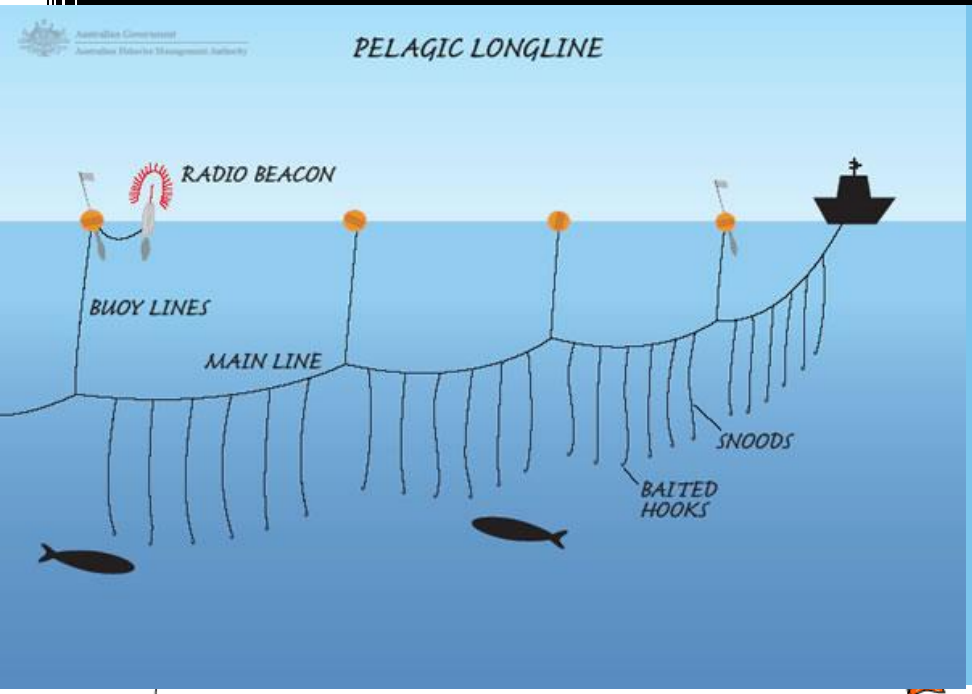
- *IOTC Resolution 13/04 On the conservation of **Cetaceans***

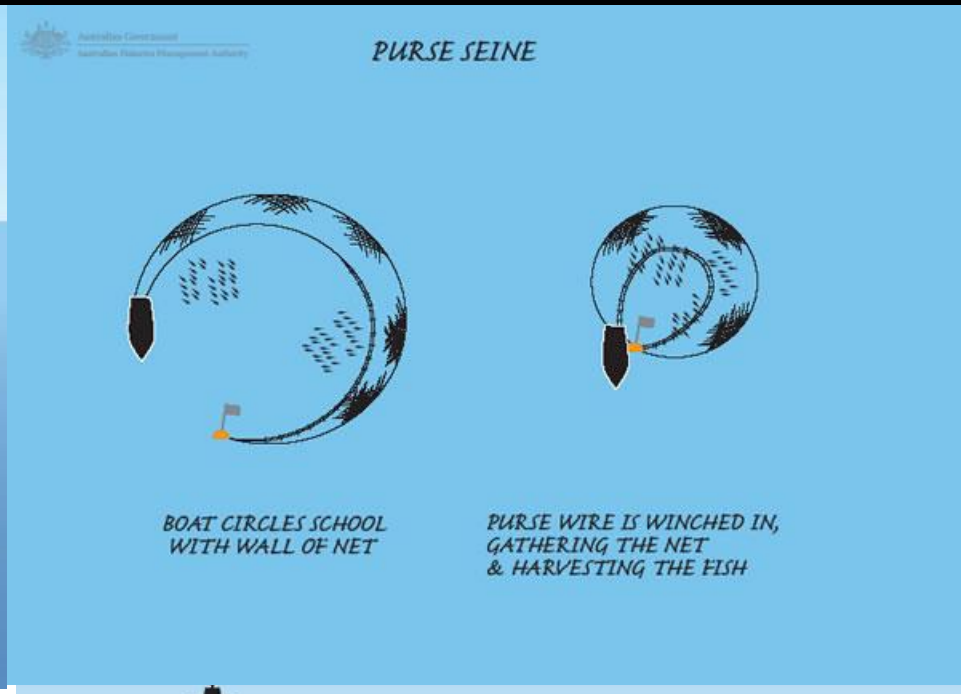
Data requirements at a glance

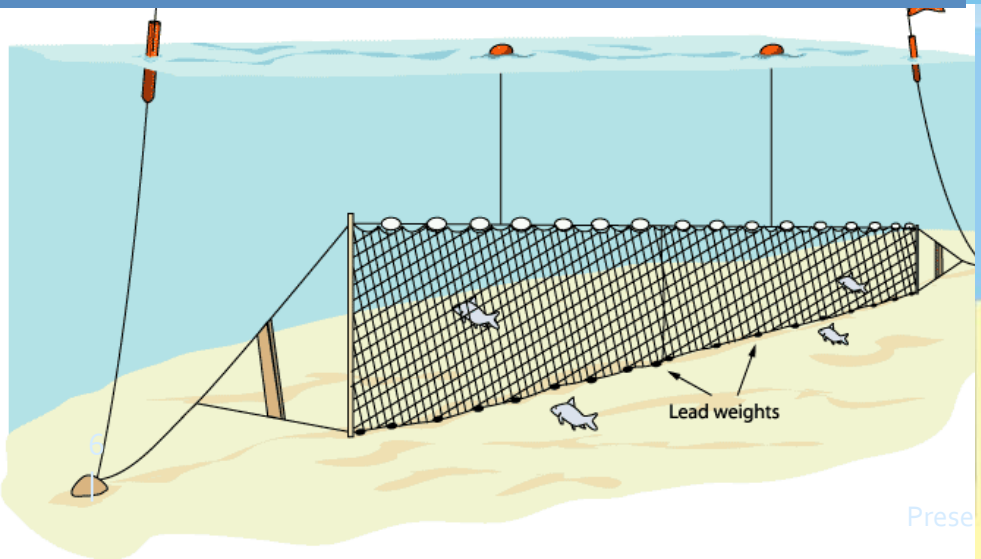
Types of fisheries data for which the Commission has set [data collection] and reporting standards; and data resolution requested by the Commission:

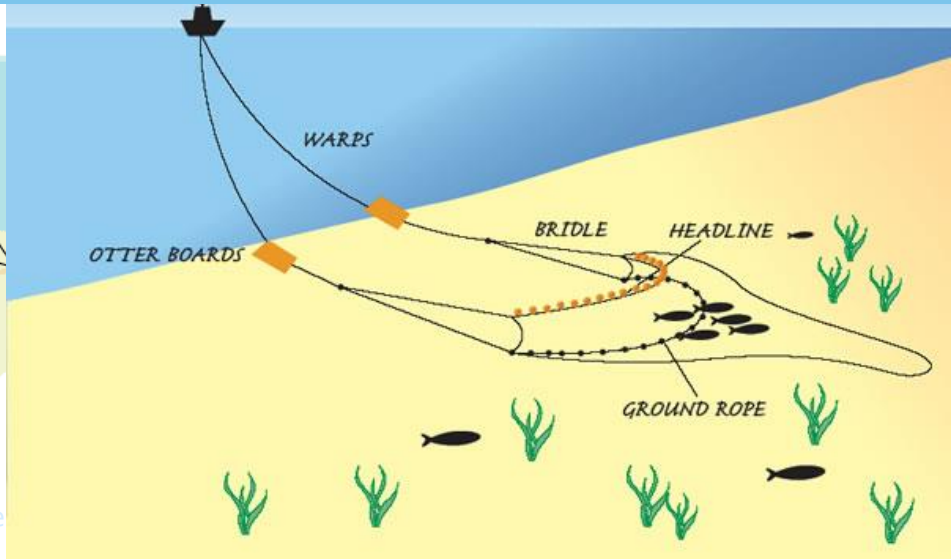
Statistical Requirements Summary	Coastal fleets	Industrial surface and longline fleets		
	EEZ vessels less than 24 m LOA	Vessels with LOA ≥ 24 m and all high seas vessels		
Annual catches (NC+DI)	Nominal catches (weight) of IOTC Species, main species of pelagic sharks, and other bycatch, per IOTC Area, gear, species and Year			
	Discard levels IOTC species, sharks, seabirds, marine turtles, Cetaceans per IOTC Area, gear, species and Year (in number of weight)			
Active Crafts (FC)	Number of fishig craft per boat-gear type category per year	Individual vessel data for all fishing ships catching IOTC species		
Catch-and-Effort (CE)	CE Data by fishery (type of boat-gear), area and period	Surface fisheries: CE by fishery, 1° grid and month	#FADs [Anchored & Drifting: CE by 1° grid and month (PS-BB)]	Supply vessels Purse seine fishery: Effort 1° grid and month
		Longline fisheries: CE by fishery, 5° grid and month		
Size data (SF)	Individual lengths of IOTC species sampled, by fishery, species, 5° grid, and month			
Scientific observer data	Sample of catches in land to cover at least 5% vessel activities	Sample of catches at-sea to cover at least 5% fishing operations		
Socio-economic data	No standards have been set as yet			
Foreign fleets EEZ catch	Not applicable	CE data for foreign licensed fishing vessels (above CE standards)		

Applications to gear types

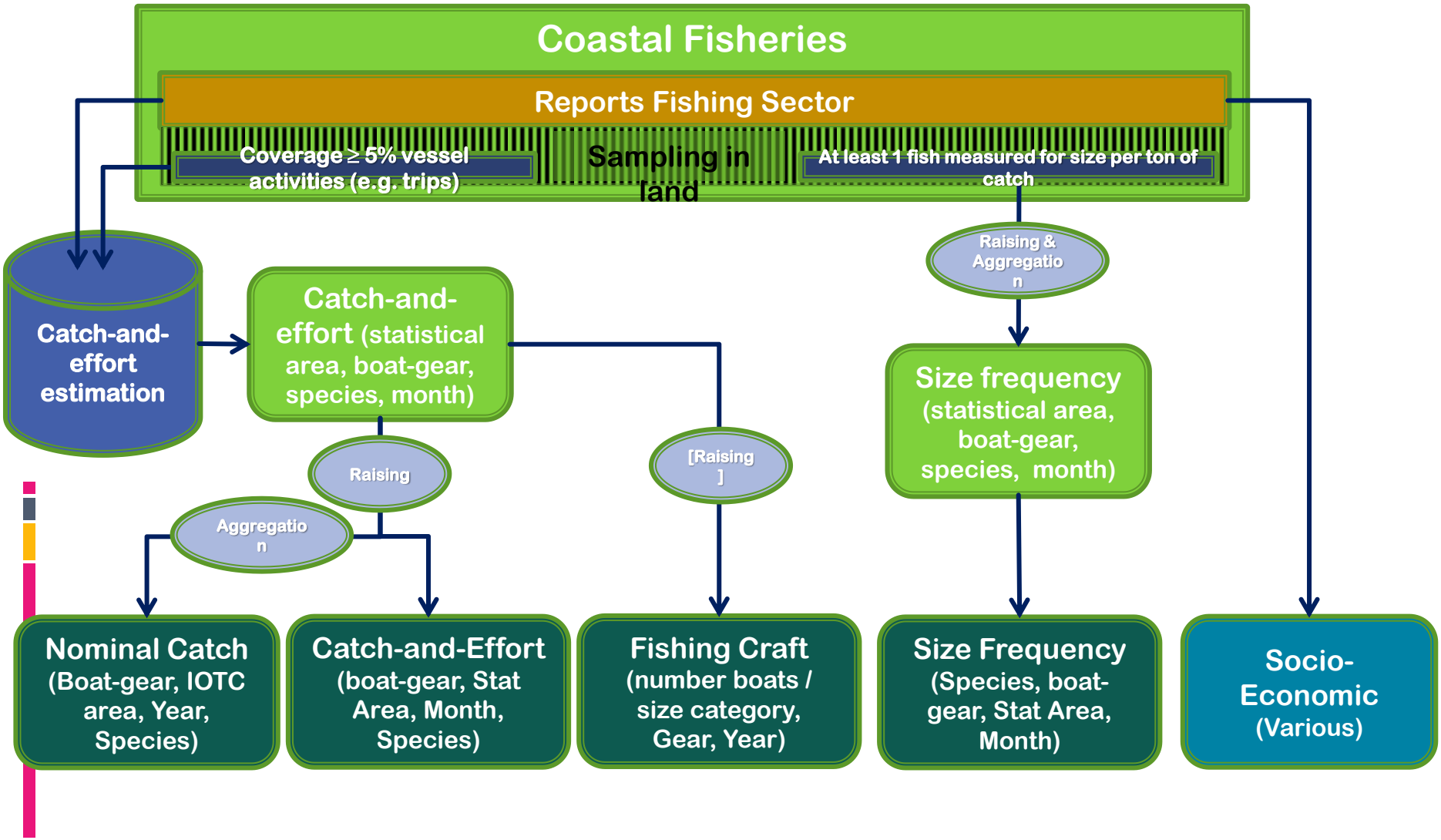




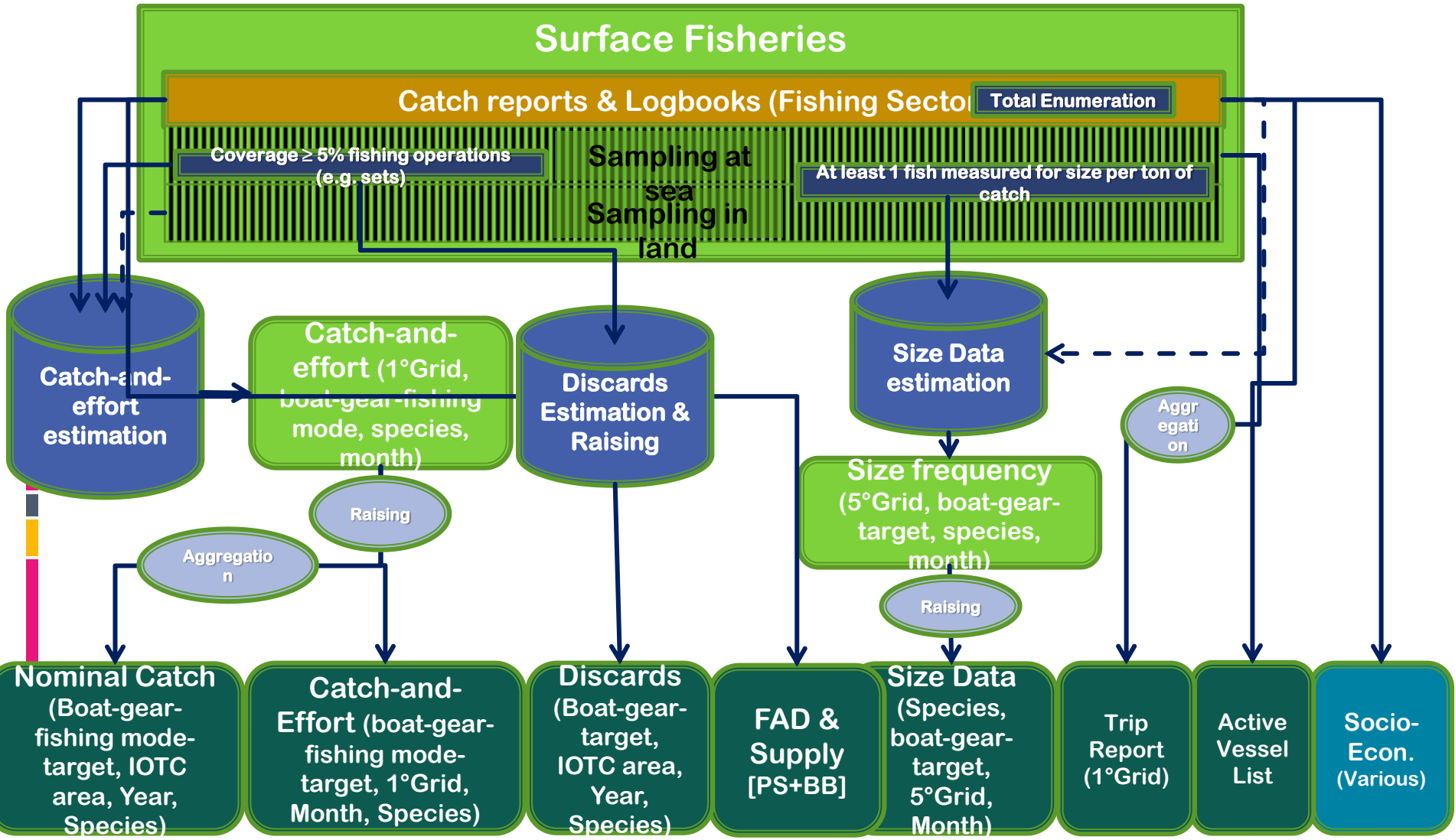




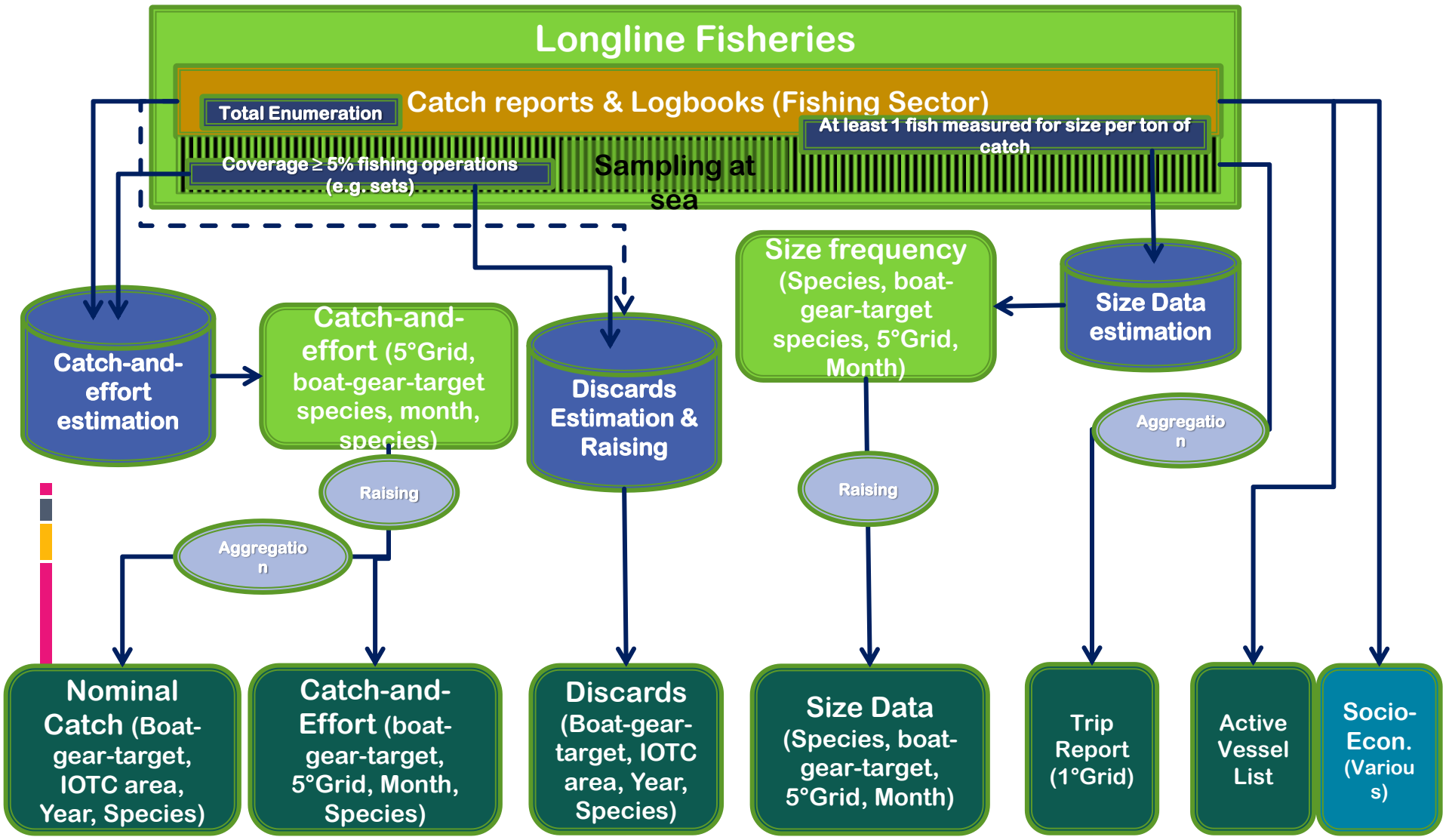
Full Compliance: Coastal Fisheries



Full Compliance: Surface Fisheries



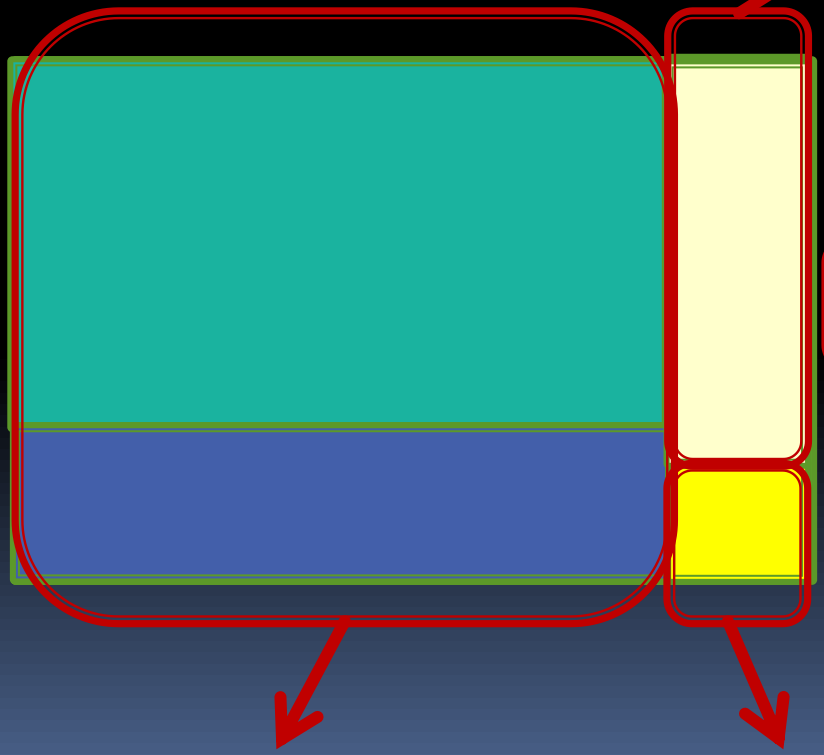
Full Compliance: Longline Fisheries



Dissection of catch for a Fishing Trip

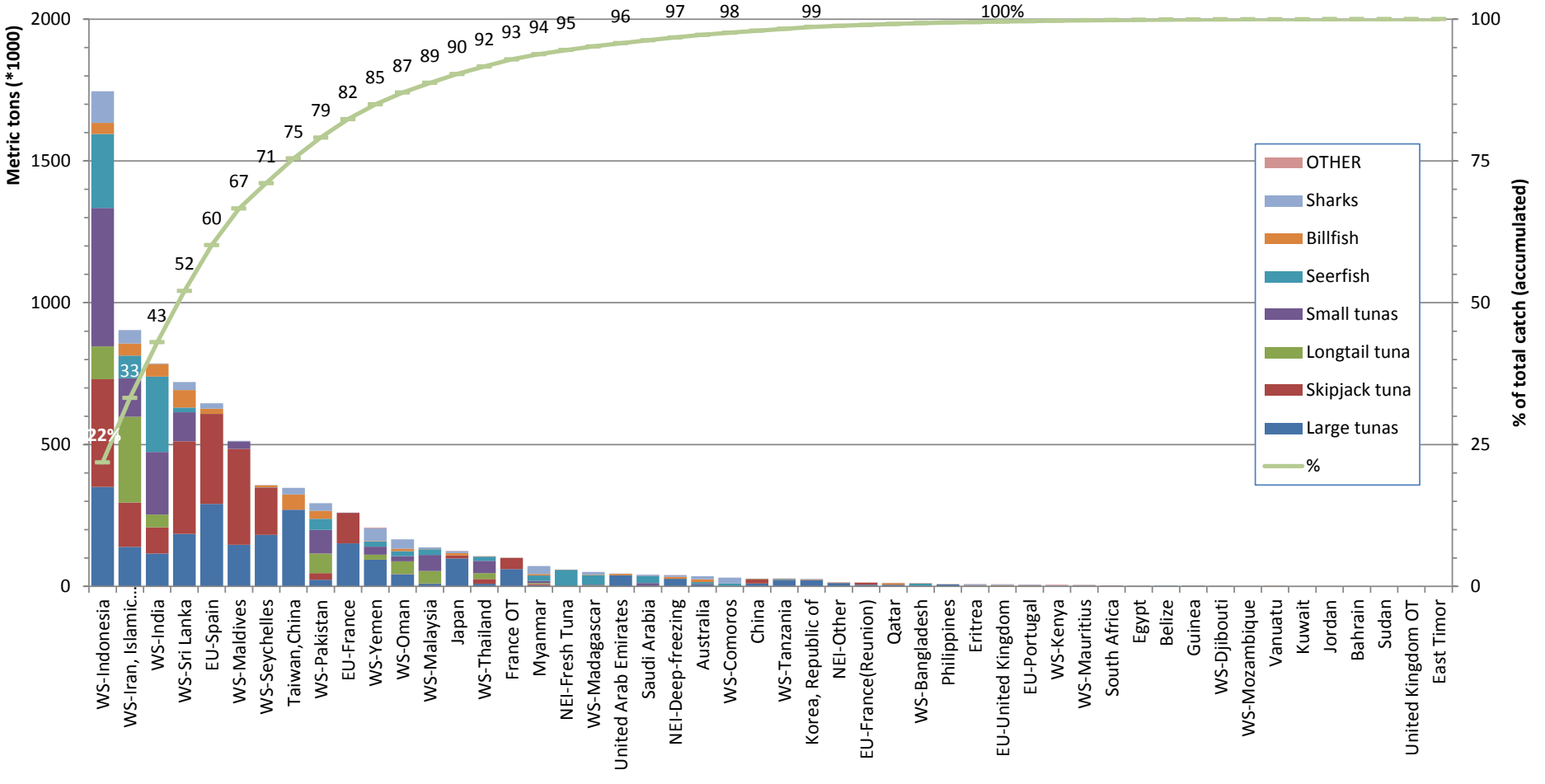
The IOTC definitions for nominal catches, bycatch, and discards may differ from those used in other areas

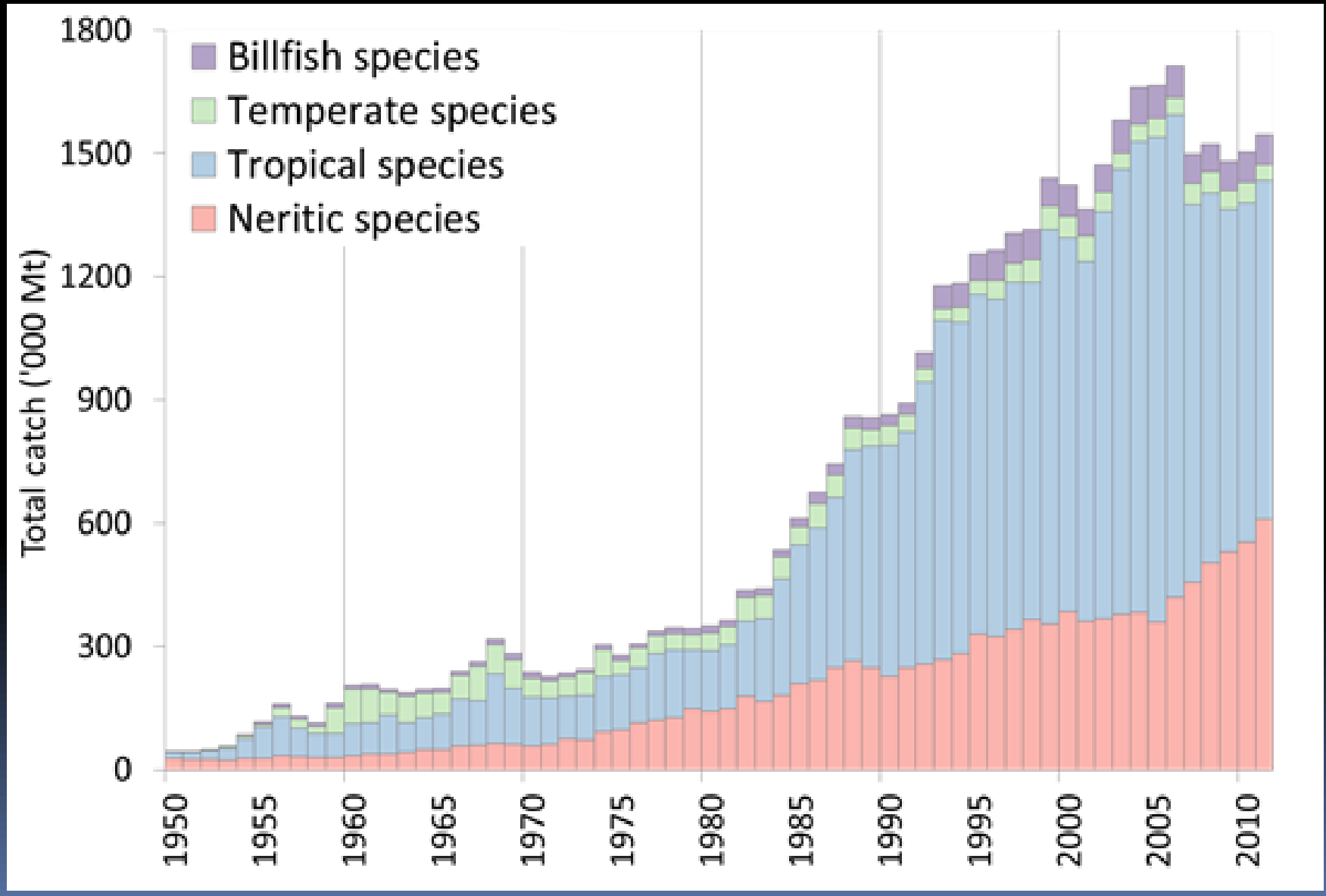
Catch-and-effort and size data shall be collected for IOTC species and the main species of sharks, as identified by the Commission, from both, nominal catches and discards



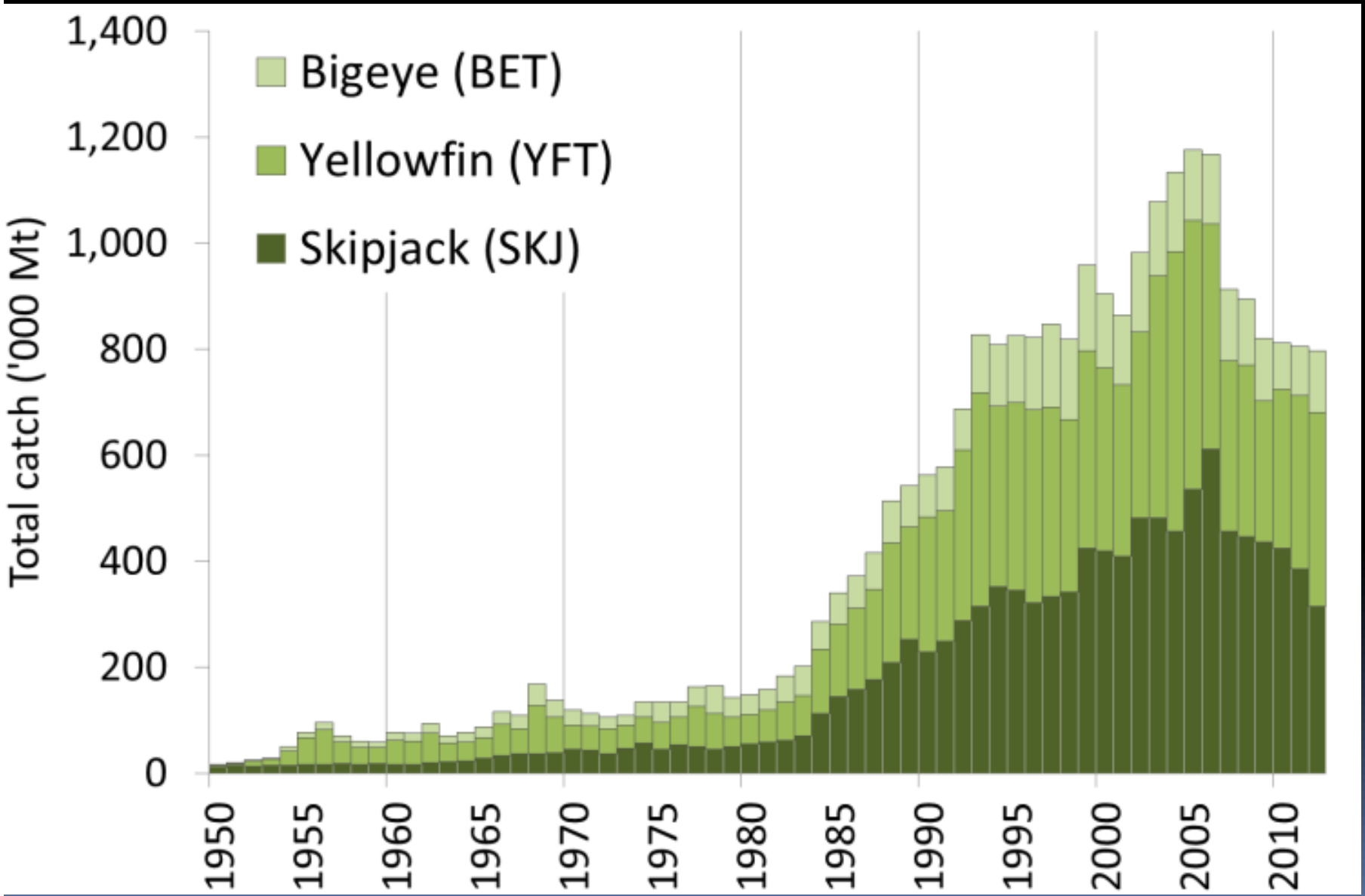
Importance of IOTC fisheries (2008-2012)

Indonesia, **Iran**, **India**, and **Sri Lanka** caught **over 50%** of the total catches (2008-12)




Billfish species
Temperate species
Tropical species
Neritic species
Total catch ('000 Mt)
1800
1500
1200
900
600
300
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010

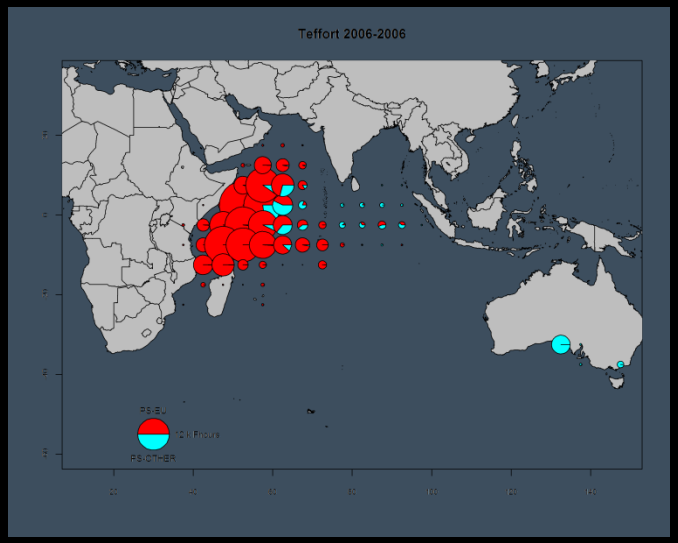
Tropical Tuna Catch Series

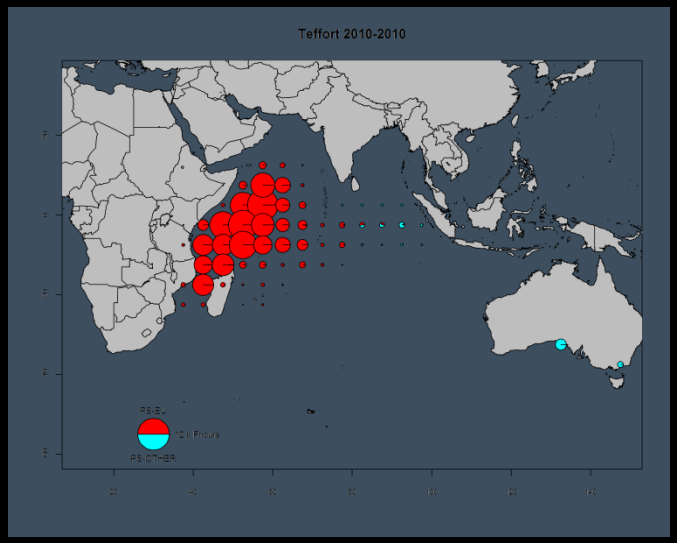


The fishing areas

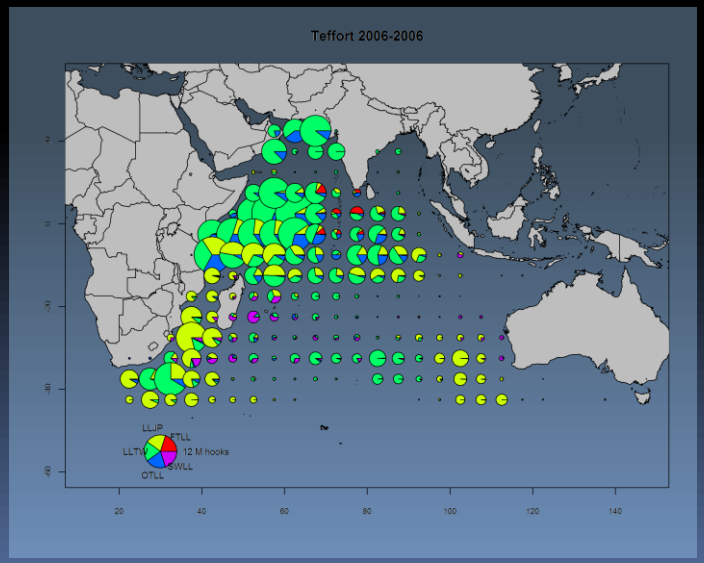
2006

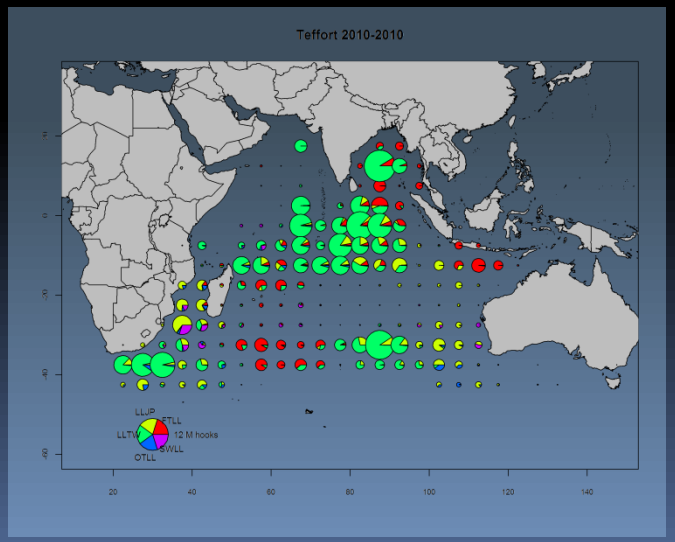
2010





Purse-seine



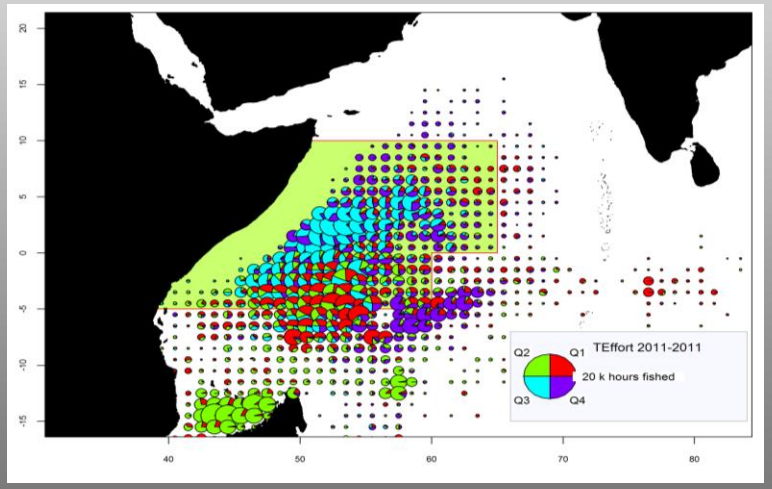


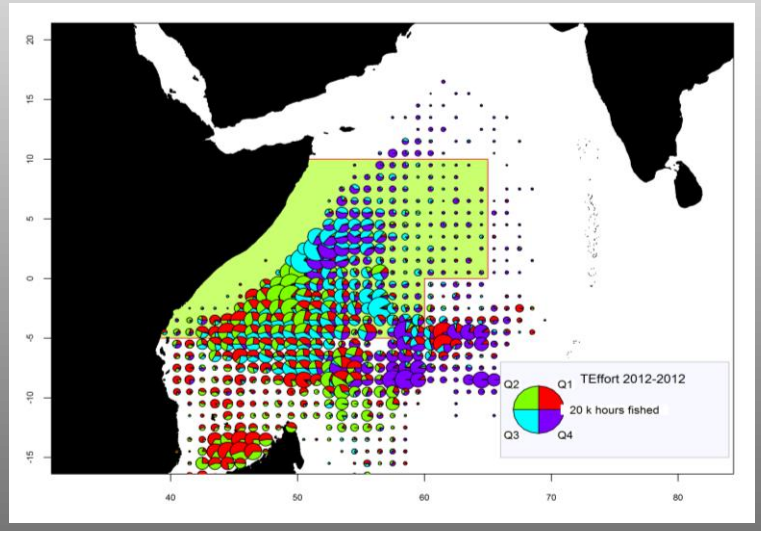
Longline

The fishing areas-Most Recent

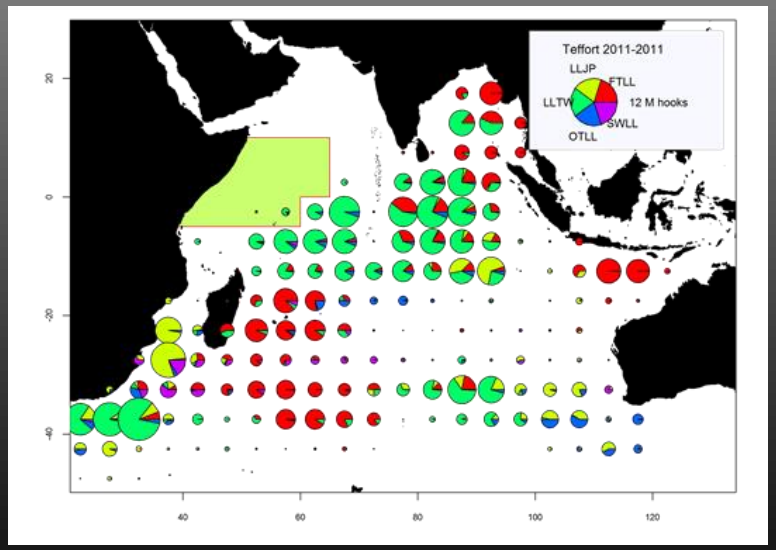
2011

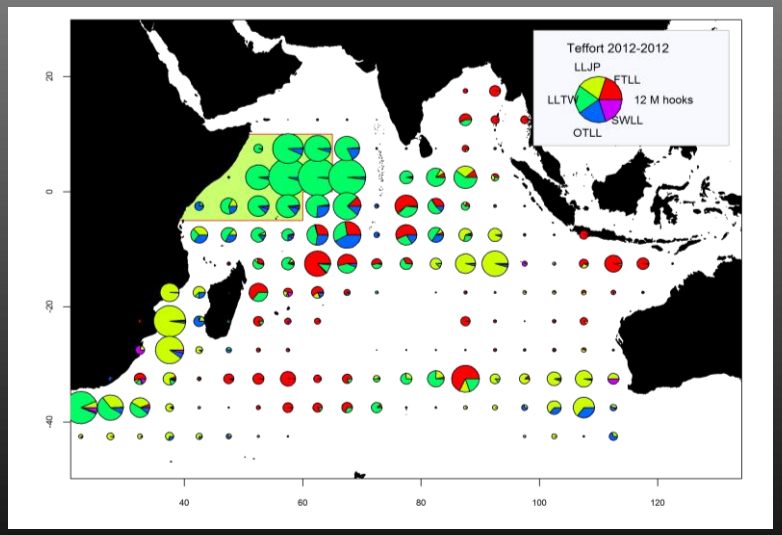
2012





Purse-seine





Longline

Building blocks of Tuna stock assessments

Routine Data Collection

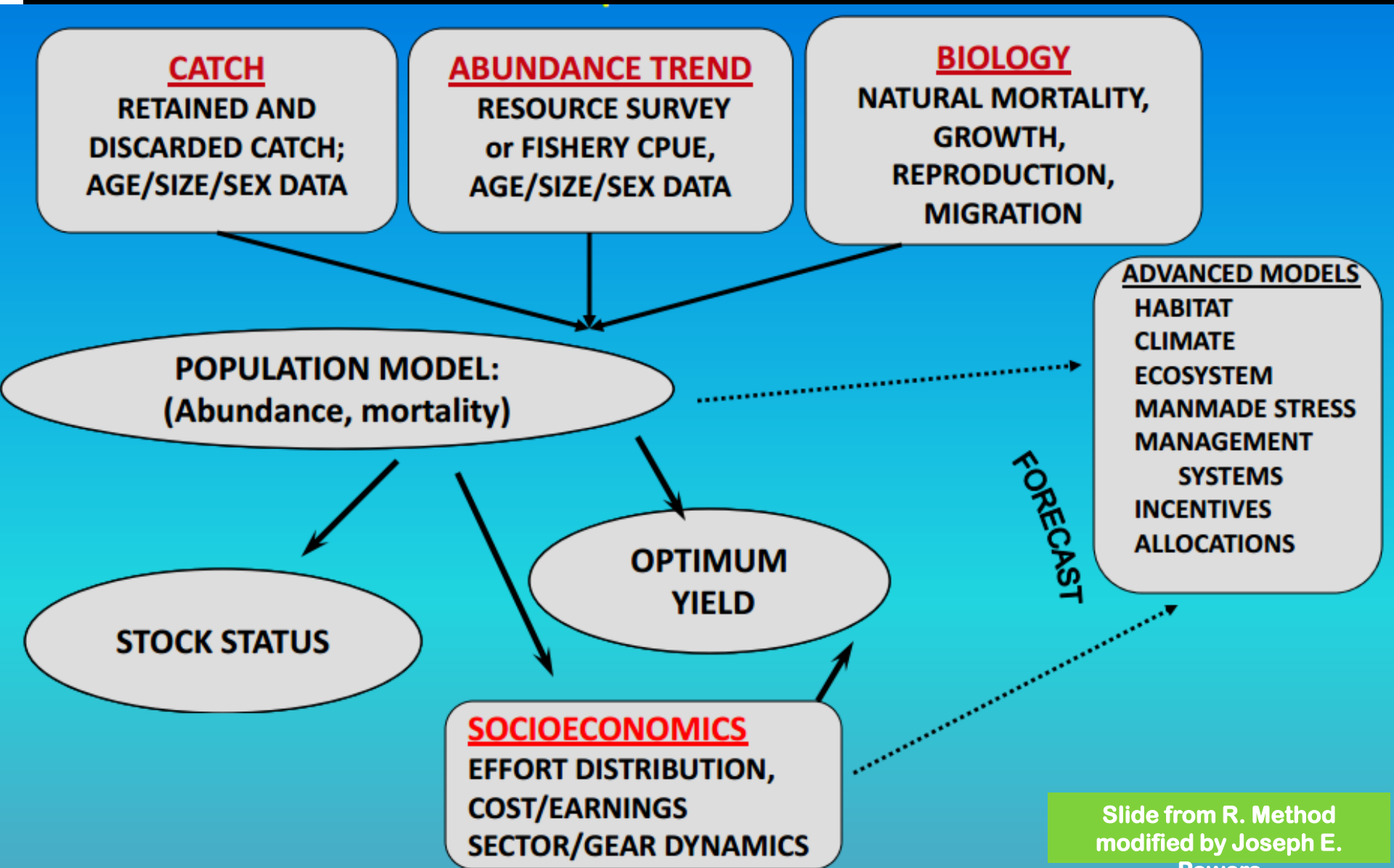
- Catch-and-effort data
  - Landed (Nominal) catch (sale slips; sampling)
  - Discard levels (observers; logbooks)
  - Effort (logbooks; sampling)
  - Size/age composition (sampling; tagging)
- Abundance trends
  - Fishery CPUE (fine-scale operational data from logbooks)
  - [Size/age/sex composition (logbooks; sampling; tagging)]

Spatial and seasonal patterns

Data Collection through specific projects (updated regularly)

- Exploitation rates (tagging)
- Life history information
  - Longevity/natural mortality (tagging; otoliths)
  - Growth (tagging; otoliths)
  - Maturation (biological samples)

Building blocks of management advice



Slide from R. Method modified by Joseph E. Powers

Input files prepared for the assessments

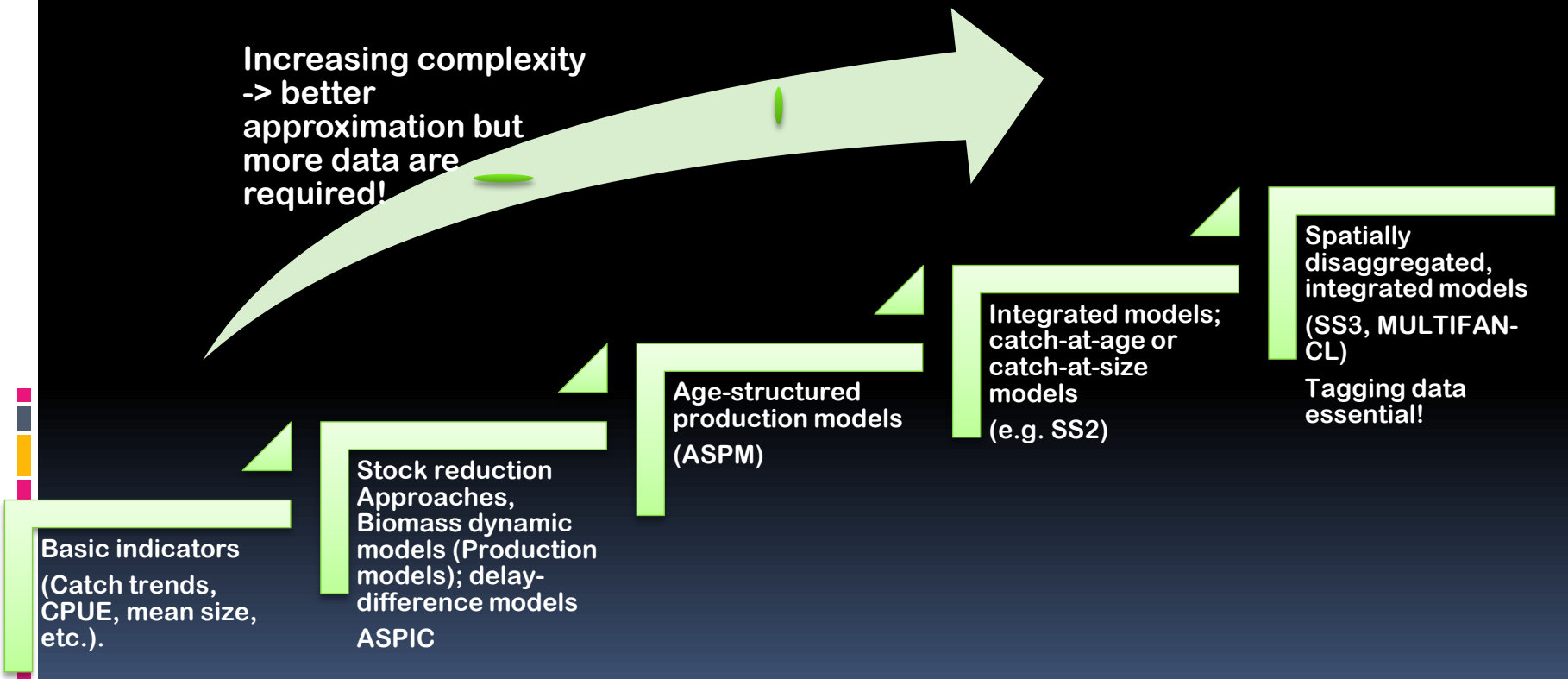
IOTC SECRETARIAT

- Catch [and effort] data by species, time-period (usually quarter), fishery (groups of Flag-Gear combinations depending on the selectivity) and areas (depending on the dynamics of the fleets and species for assessment)
- Number of fish sampled by species, size bin, time-period… (as above)
- Length-weight, growth, and other functions used for each species
- Life history information

FLAG STATES

- Indices of abundance (from as many fleets as possible); estimated using fine-scale operational data (logbooks)

Assessment tools and models used by the IOTC scientific community



How do we deal with Uncertainty?

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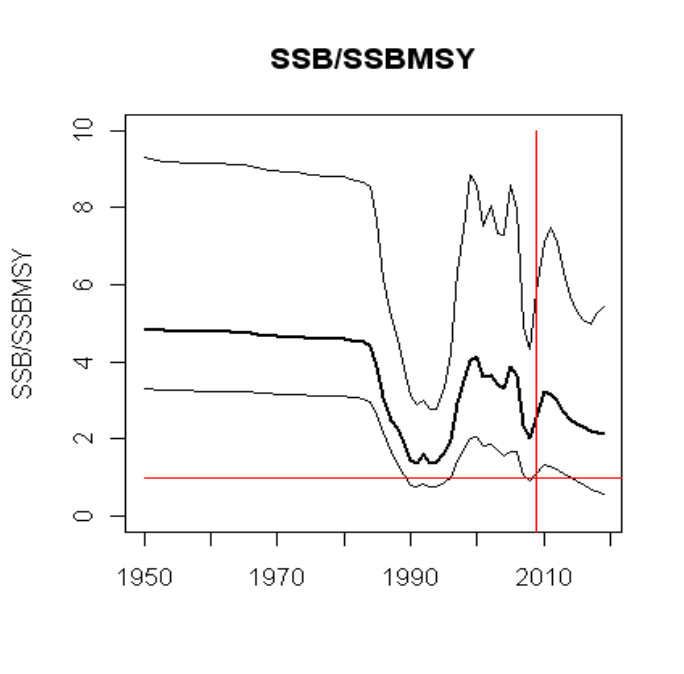
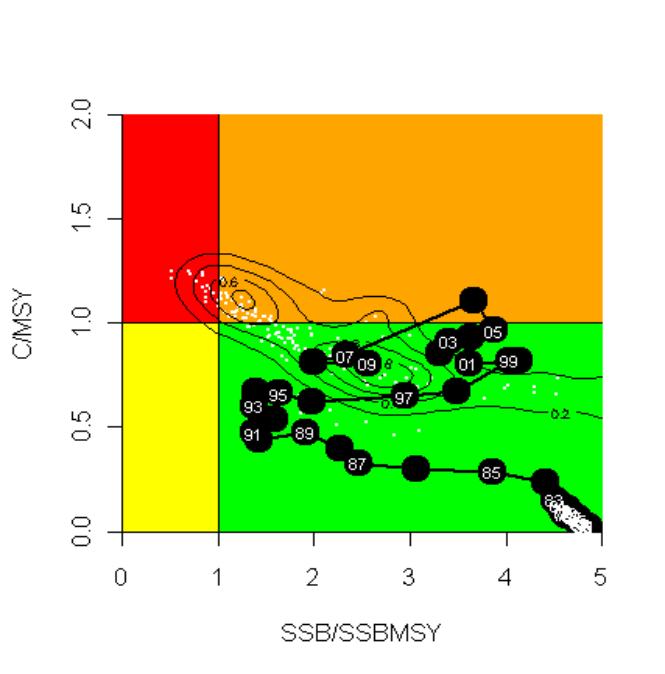
- 4 Approaches
  - Parameter Uncertainty (assumptions on parameter choice).
  - Data uncertainty (weights, inverse variance)
  - Model uncertainty (e.g. Spatial assumptions, time varying selectivity).
  - Derived parameter uncertainty, i.e. estimation error (MCMC Runs).
- Projections (Kobe II): So far use the above framework with deterministic projections at varying catches.

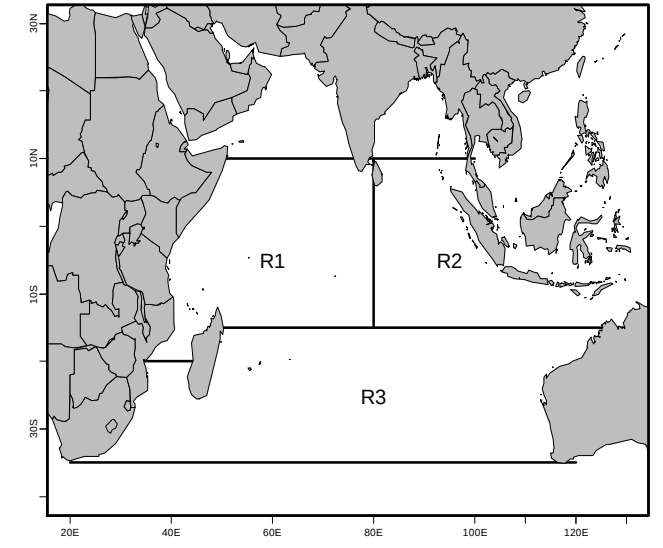
Skipjack-Parameter Uncertainty -I

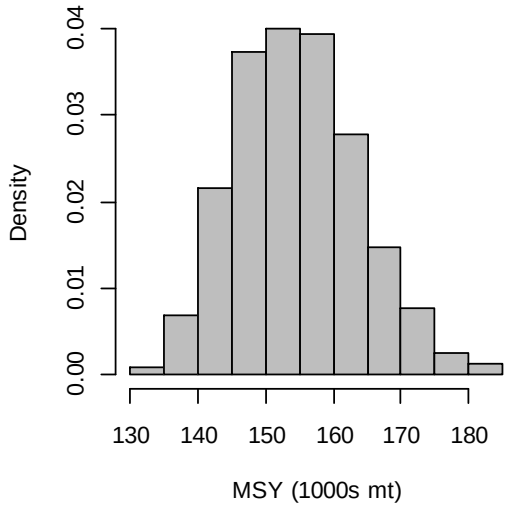


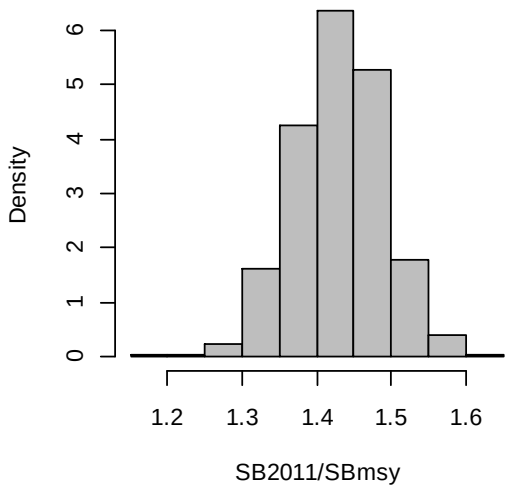
Skipjack-Parameter Uncertainty -II

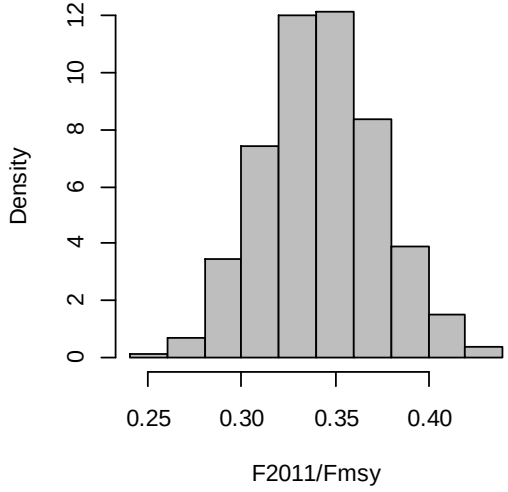


Bigeye-Spatial uncertainty





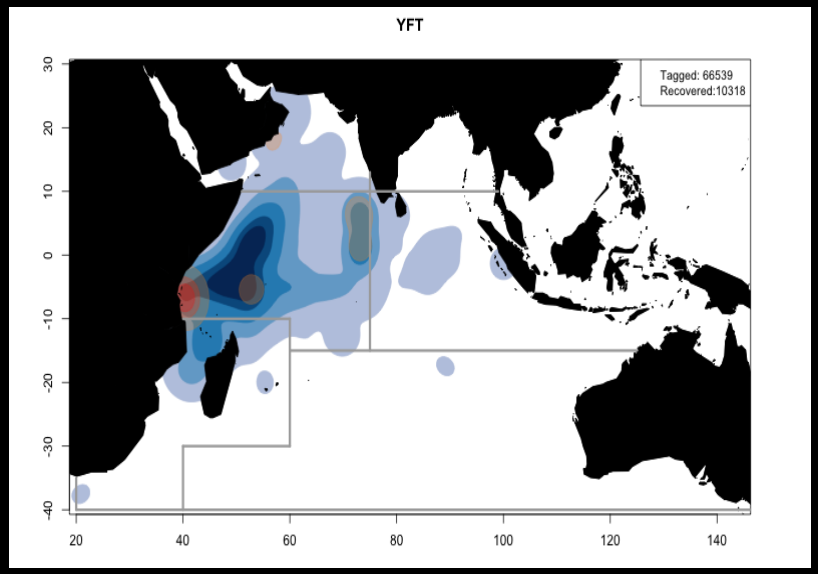


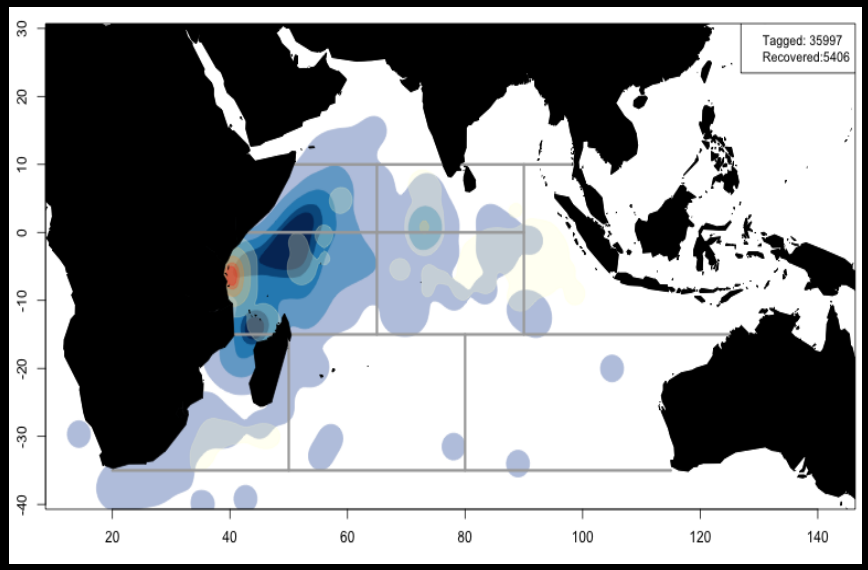


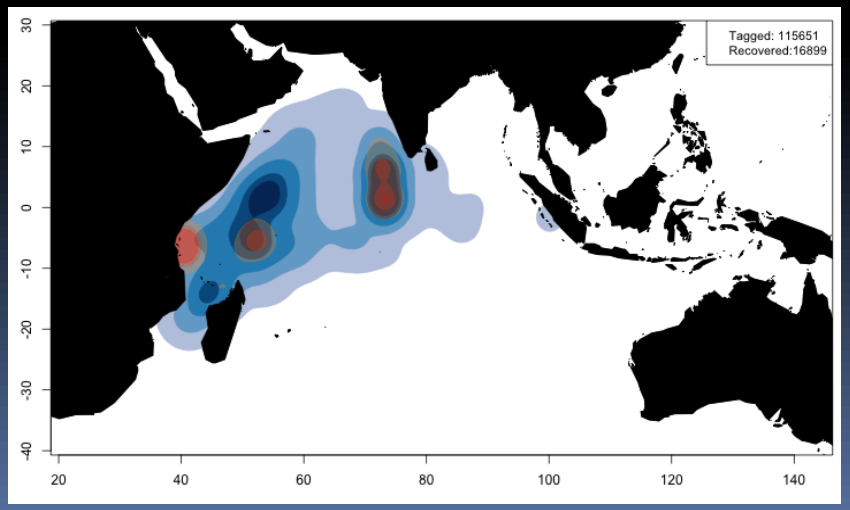
Bigeye-

Derived Parameter Uncertainty using MCMC

Tunas as a highly migratory species in the Indian Ocean: the case from tagging

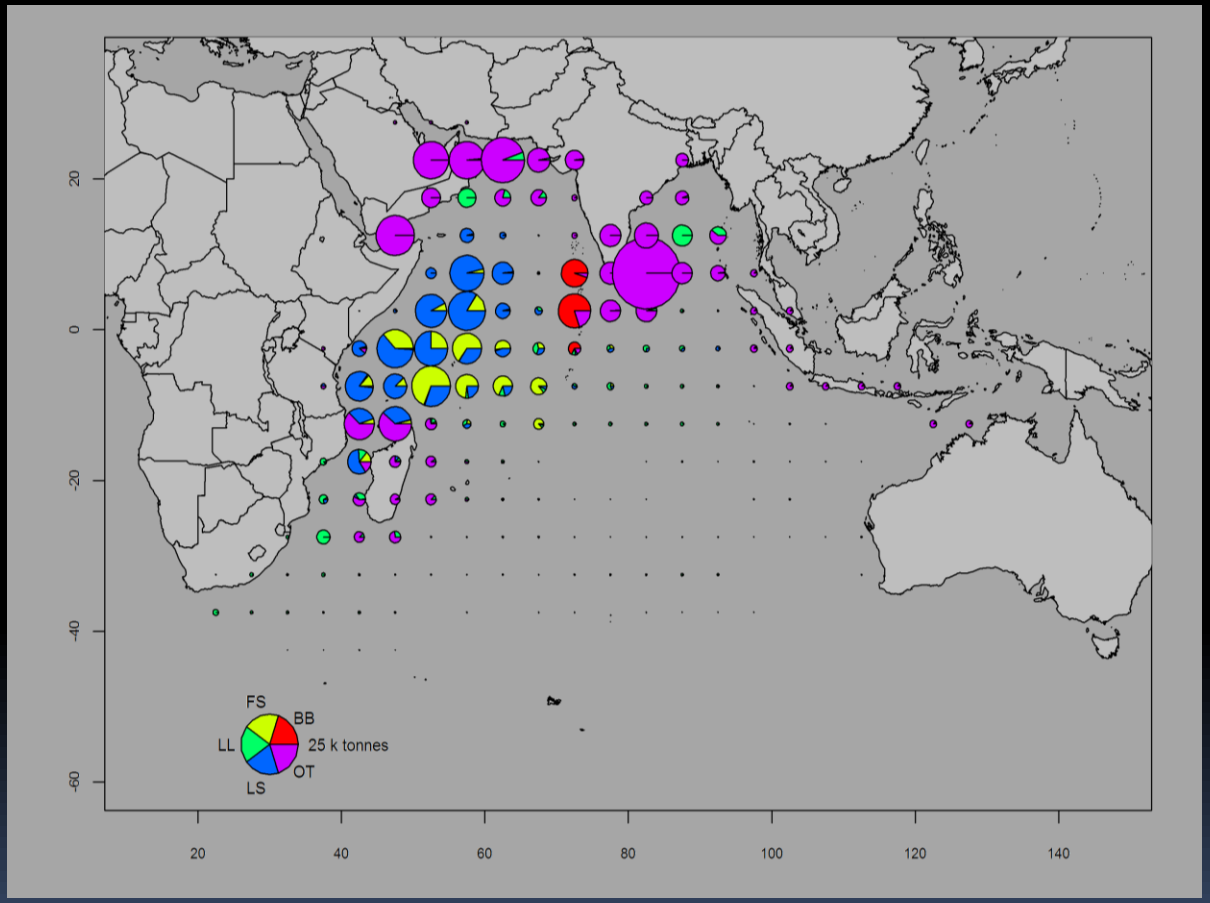






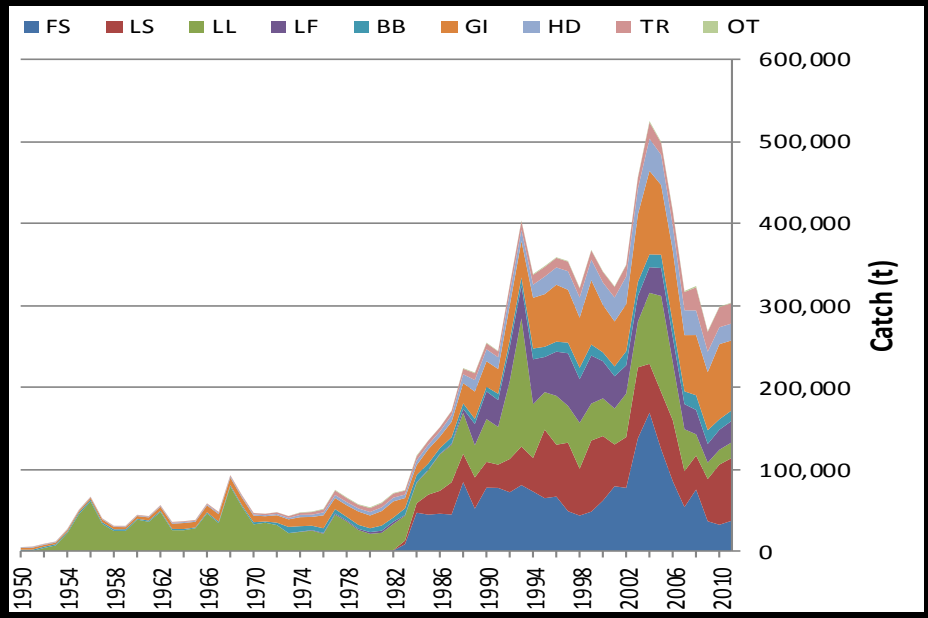
Yellowfin tuna:

- Half the catch from small-scale and artisanal fisheries
- Large percentage of catches from the high-seas
- Important catches from FAD's for purse-seine
- Distribution of purse-seine effort less affected by piracy than longline

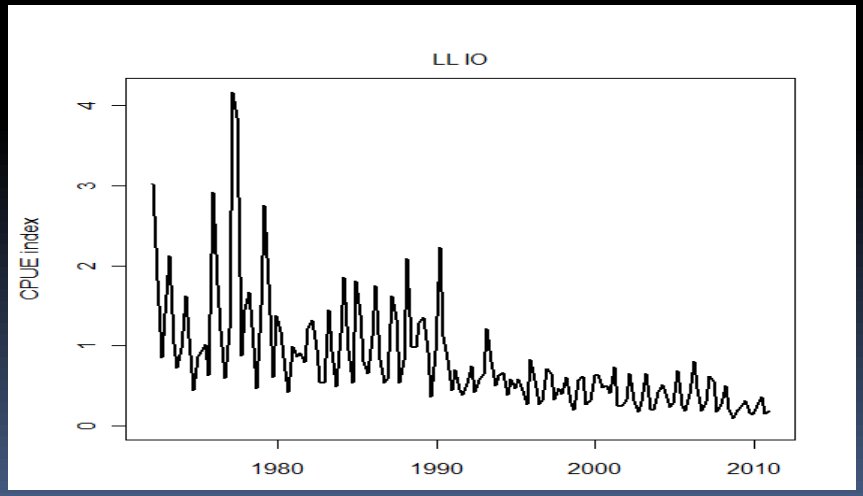


Yellowfin tuna: the history

- Catch history

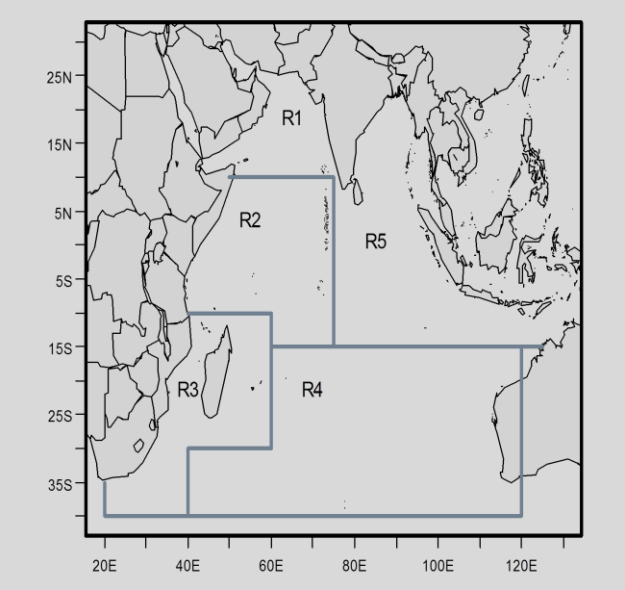


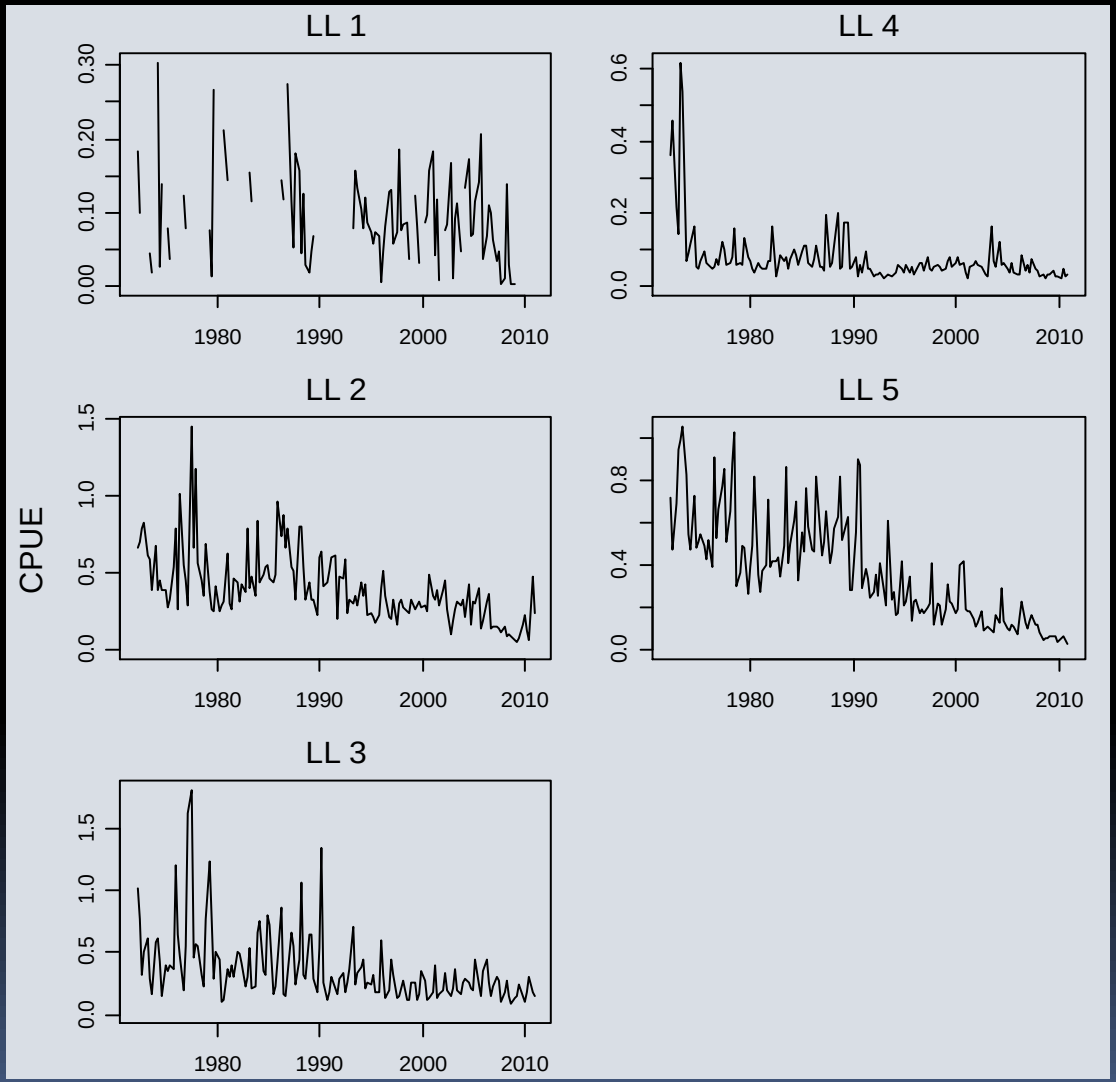
- CPUE history



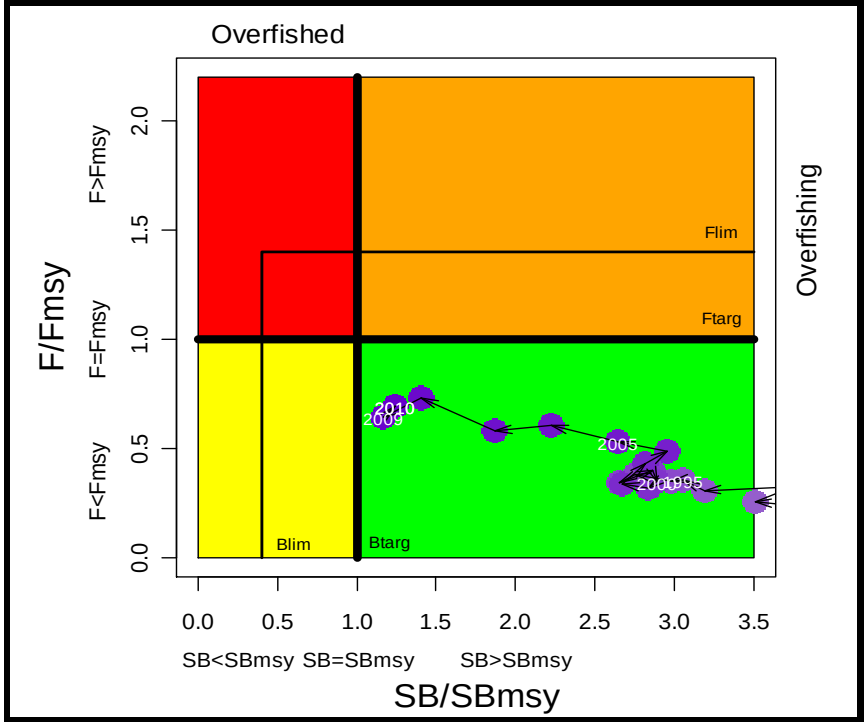
Yellowfin tuna: the history

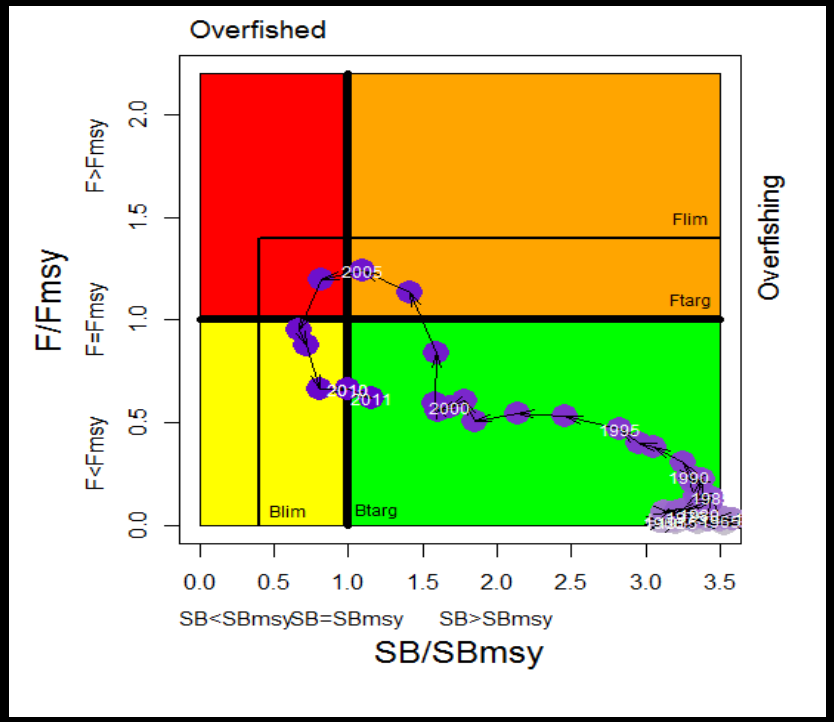
- CPUE history





Yellowfin tuna: the assessment





Model feature **MFCL**

Population spatial structure / areas 5

Uses Catch-at-length Yes

Tagging data Yes

Age-structured Yes

Model feature **ASPM**

Population spatial structure / areas 1

Uses Catch-at-length Yes

Tagging data No

Age-structured Yes

Yellowfin Summary

Catch 2011: 368,663 t
Average catch 2008–2012: 317,505 t
MSY (in thousands): 344 t (290-453)

F_{2010}/F_{MSY} (80% CI): 0.69 (0.59–0.90)
SB_{2010}/SB_{MSY} (80% CI): 1.24 (0.91–1.40)
SB_{2010}/SB_{1950} (80% CI): 0.38 (0.28–0.38)

The decrease in longline and purse seine effort in recent years has substantially lowered the pressure on the Indian Ocean stock as a whole, indicating that **current fishing mortality has not exceeded the MSY-related levels in recent years**. As the security situation in the western Indian Ocean has improved, a rapid reversal in fleet activity in this region may lead to **an increase in effort which the stock might not be able to sustain, as catches would then be likely to exceed MSY levels. Catches increased by 68 Kt in 2012 as compared to 2011, warranting a new assessment soon.**

Situation of other IOTC species

Neritic Tunas

- Essential for the economy of the IOTC coastal States
- Status still unknown for most species, but analyses are progressing in the past two years.
- Status on Longtail (overfishing) and likely the same for Kawakawa.

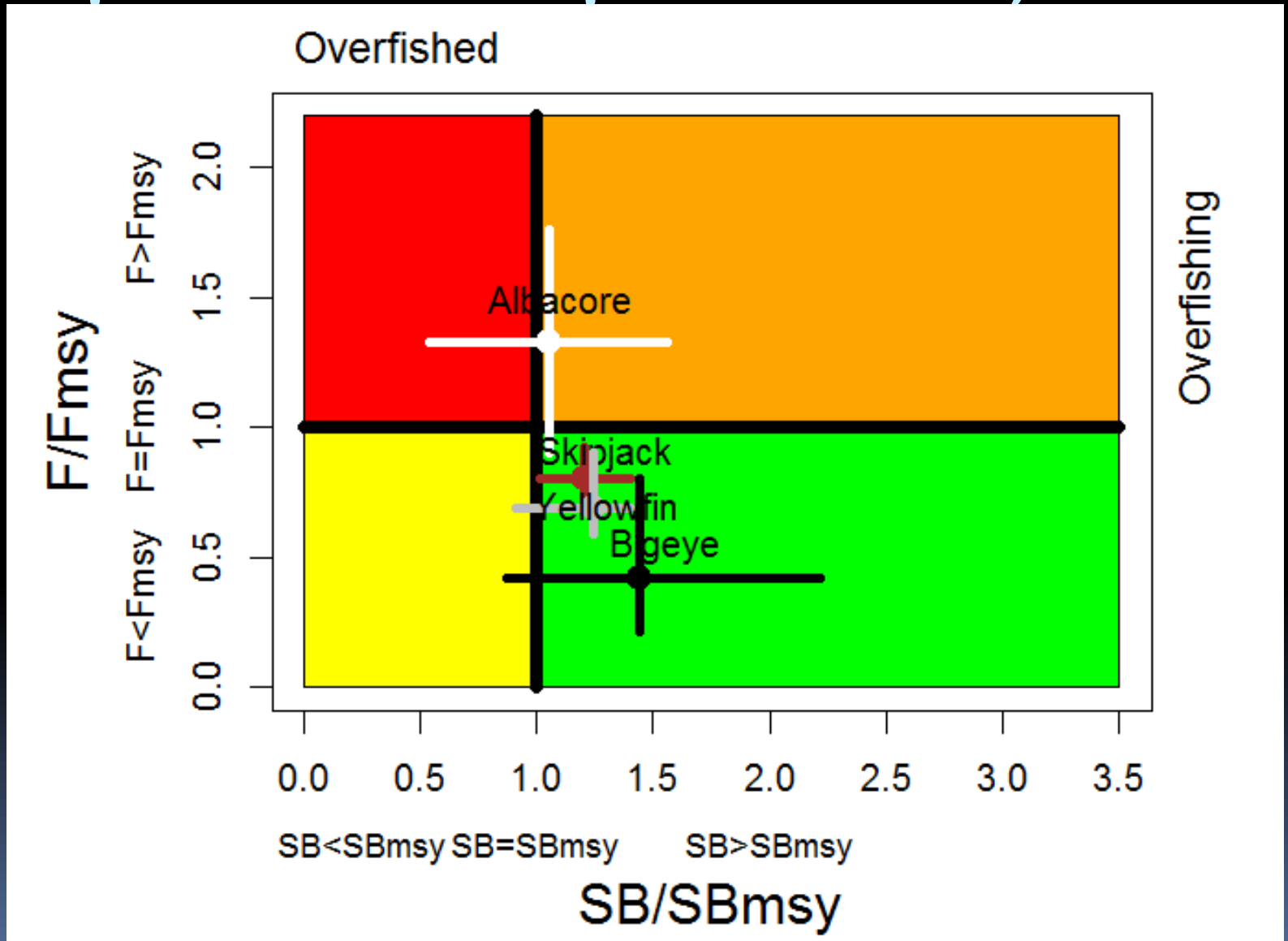
Other billfish (Marlins, sailfish and spearfish)

- Not targeted by tuna-fishing vessels
- Status unknown although concern exists about apparent declines

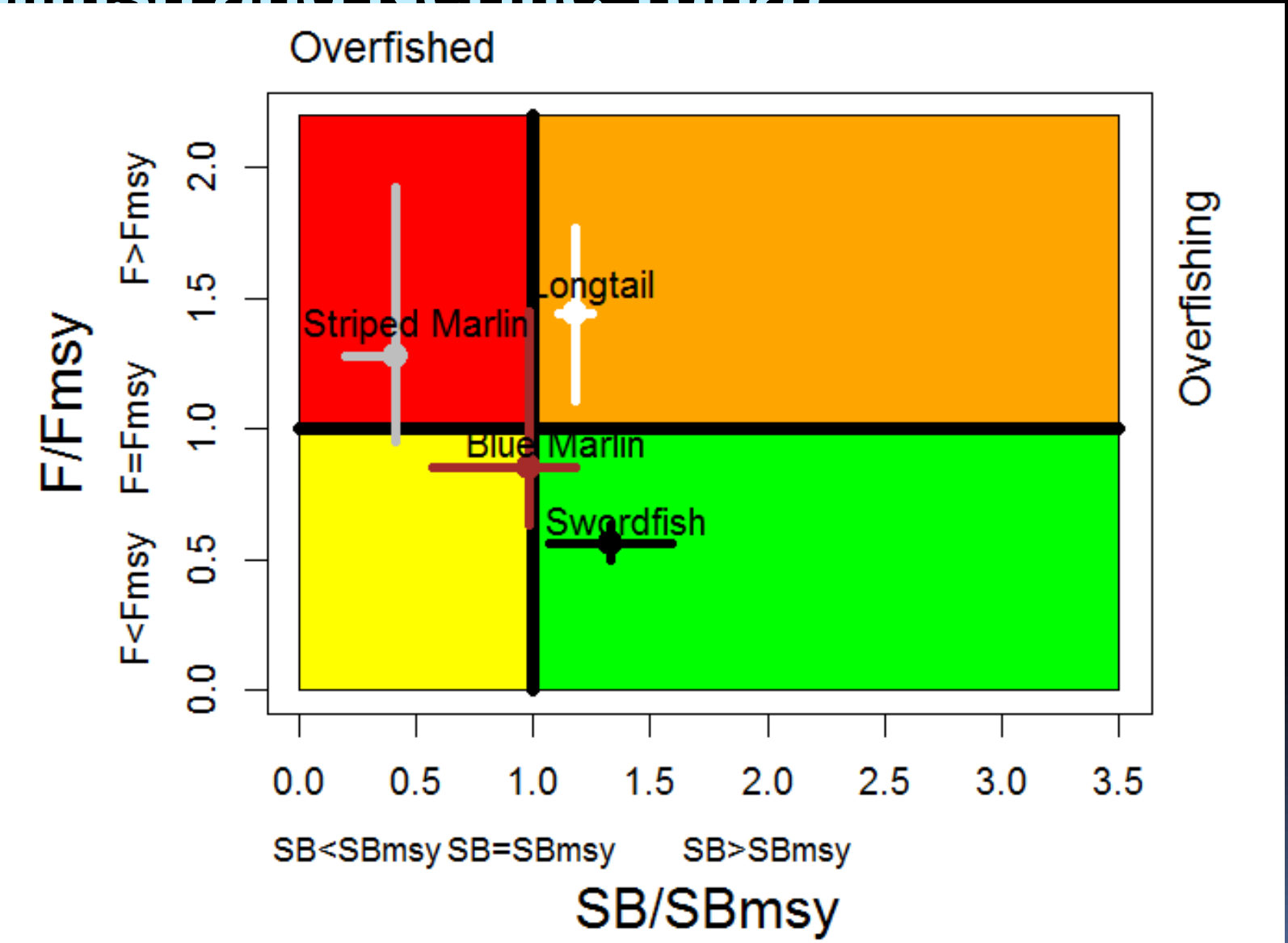
Sharks

- A growing concern as they are target species for several fleets that also catch tunas
- Apparent declines in oceanic whitetip and silky sharks
- Thresher under protection but still being caught

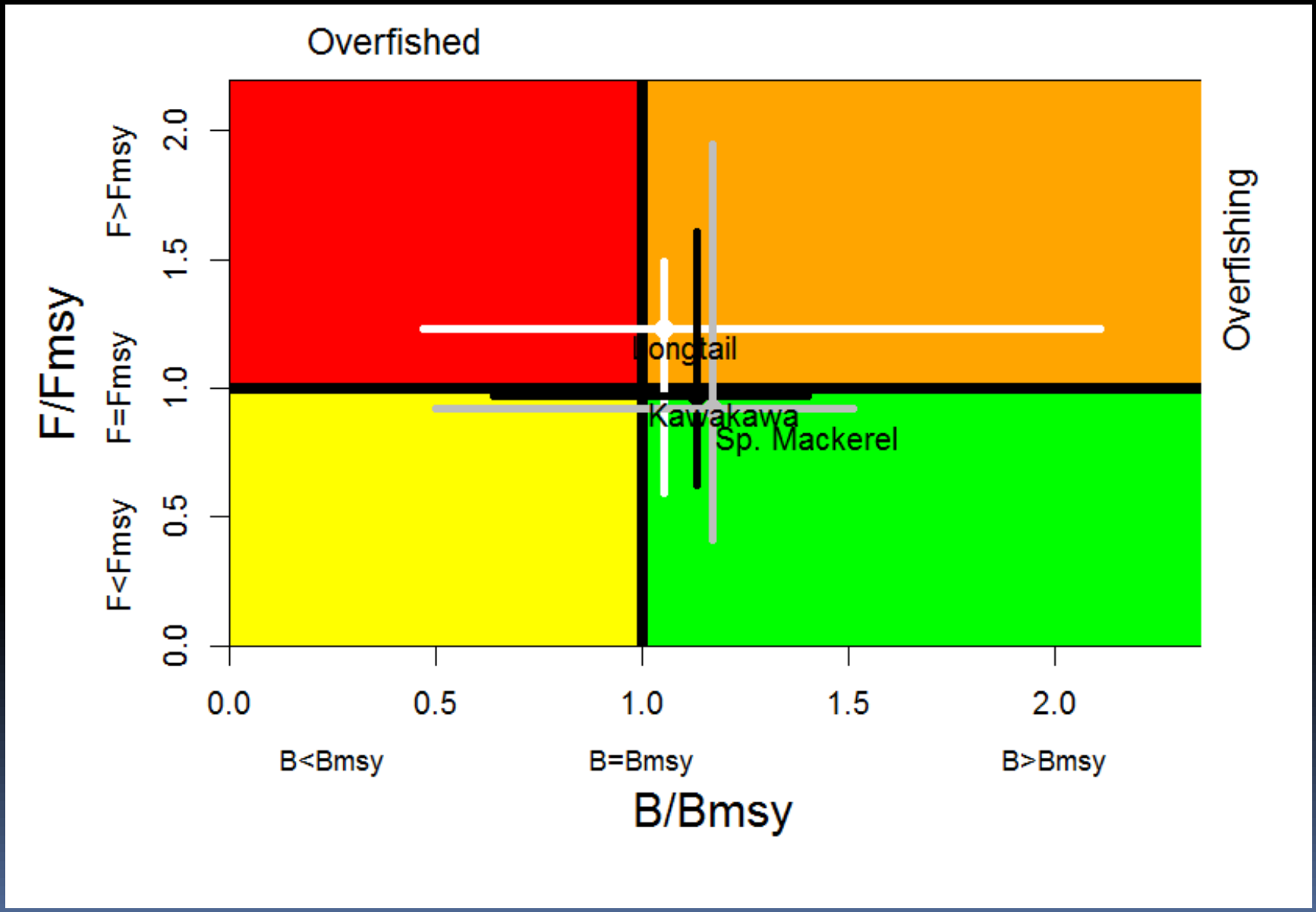
IOTC Stock Status Overview (Tropical and Temperate Tuna)



IOTC Stock Status Overview (Billfish and Neritic Tuna)



Neritic Tuna



Stock status

Stocks under IOTC mandate are in relatively good shape (at optimal utilization), but no room for further fleet expansion.

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Stock	Indicators	Advice
Bigeye	F_{2012}/F_{MSY}= 0.42 (0.21–0.80) $SB_{2012}SB_{MSY}$= 1.44 (0.87–2.22)	Probably not overfished, and overfishing is probably not occurring. Probably near full utilization
Yellowfin	$F_{2010/}F_{MSY}$=0.69 (0.59–0.90) $SB_{2010/}SB_{MSY}$= 1.24 (0.91–1.40)	Probably not overfished, and overfishing is probably not occurring. Probably near full utilization
Skipjack	$F_{2011/}F_{MSY}$= 0.8 (0.68-0.92) $SB_{2011/}SB_{MSY}$= 1.2 (1.01-1.4)	Highly productive species and robust to overfishing.
Albacore	$F_{2010/}F_{MSY}$ = 1.33 (0.9–1.76) $SB_{2010/}SB_{MSY}$=1.05 (0.54–1.56)	F above MSY levels. Further declines likely due to effort displacement (piracy). Almost exclusively LL.
Swordfish	$F_{2010/}F_{MSY}$= 0.79 (0.58-0.84) $SB_{2010/}SB_{MSY}$= 1.31 (1.13-1.46)	The overall stock size and fishing pressure are estimated to be within acceptable limits
Striped Marlin	$F_{2011/}F_{MSY}$= 1.28 (0.95–1.92) $B_{2011/}B_{MSY}$= 0.416 (0.2–0.42)	Stock is overfished, though maybe recovering due to recent decline in catch levels.
Blue Marlin	$F_{2011/}F_{MSY}$= 0.85 (0.63–1.45)	The overall stock size is optimal. Fishing rates

Current and Future work

- Albacore operational model set up for MSE.
- Skipjack operational model set up for MSE.
- Eventually, have a model that incorporates all Tropical Tuna Species and develop MSE procedures simultaneously.
- Dialogue initiated on identifying clear management objectives.


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