Comisión Interamericana del Atún Tropical
Inter-American Tropical Tuna Commission

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Discussion on Management Objectives and Performance Metrics

1st IATTC Tropical Tuna MSE Workshop, San Diego, California (USA), December 9-10 2019

Management Objectives

- Stated explicitly, specifically and unequivocally
  - Social (e.g. jobs, food access)
  - Economical (e.g. profitability)
  - Biological (e.g. low risk of collapse)
  - Ecosystem (e.g. bycatch, diversity)
  - Political (e.g. allocation)

Performance Metrics

"I want it all, and I want it now…"

Freddie Mercury

- Long-term total catch
- Long-term average catch
- Long-term variability in catch
- Short-term variability in catch

- Long-term average CPUE
- Long-term average effort (fishing days)

- Probability of falling below reference points
- Probability of stock recovery
- Many more!

Tradeoffs

"You can't always get what you want…"

Mick Jagger

Long-term vs short-term considerations on:

- Maximize catch & High Catch Rate
- Maximize catch & low *Probability* fall below reference points
- Maximize catch & Large fish in catch
- High Catch Rate & Catch Variability
- Long-term effort & *Probability of* stock recovery

Risk

- Risk metrics
  - Probability of overfishing/overfished
  - Probability of collapse (economical o biological)
  - Probability of closures (spatially or temporally)

- Behavior towards risk
  - Risk Averse (avoidance)
  - Risk Prone (seeking)
  - Risk Neutral (indifferent)

Types of Management Objectives

- **Status:** To maximize the probability of maintaining the stock in the green zone of a fishery's Kobe plot (i.e., not overfished, no overfishing).
- **Safety:** To minimize the probability that the stock will fall below the biomass limit reference point or B_{LIM}.
- **Yield:** To maximize catch (or effort) across regions and/or fishing gears.
- **Abundance:** To maximize catch rates to enhance fishery profitability.
- **Stability:** To maximize stability in catches to reduce commercial uncertainty by minimizing variability in catch from year to year.

Indian Ocean Tuna Commission, "Report of the 2nd IOTC Management Procedure Dialogue" (April 2015)

Types of Management Objectives

Table 1. Performance statistics suggested for the evaluation of management procedures.

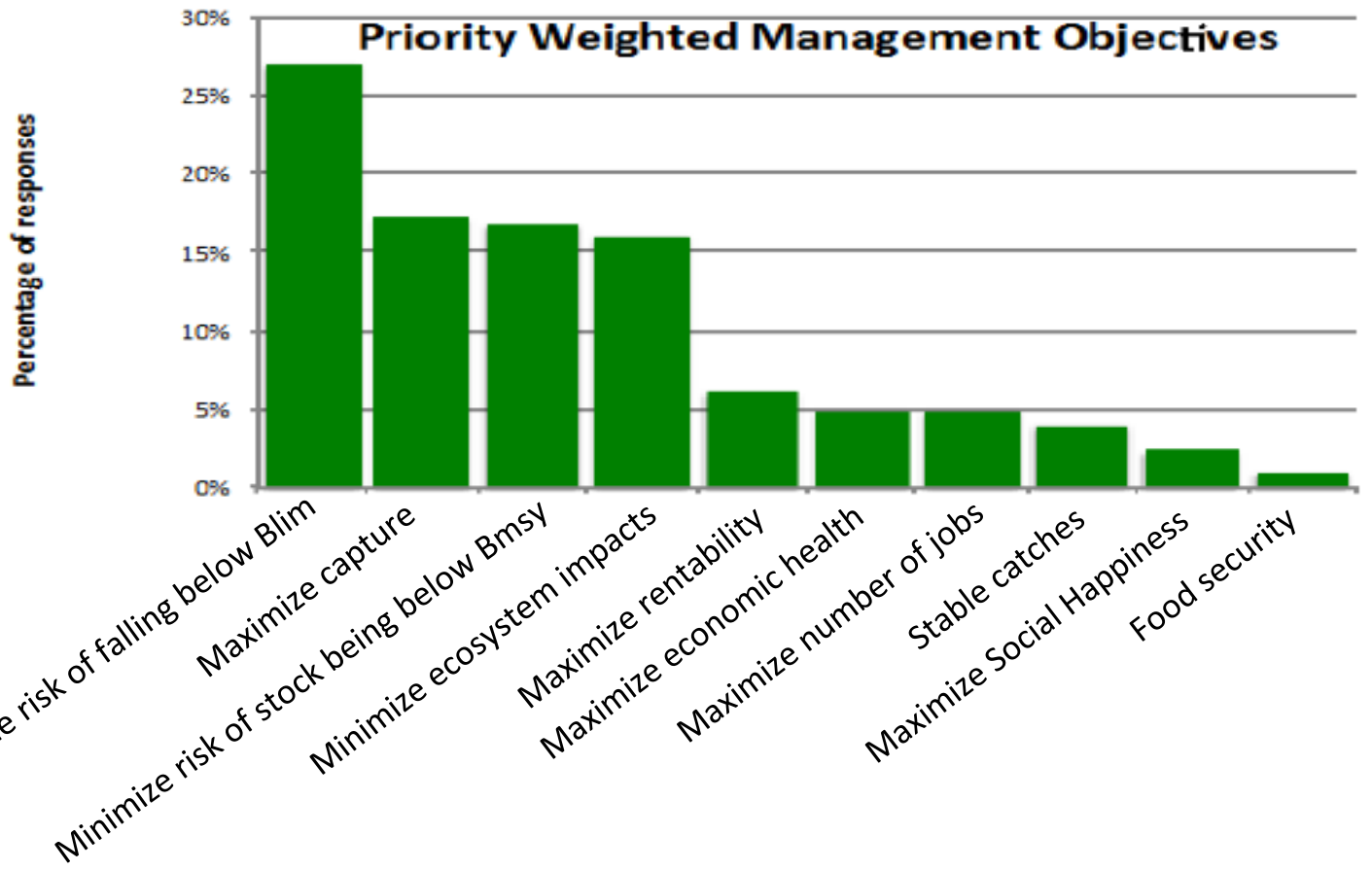
Management objective and associated performance statistics	Performance measure/s	Summary statistic
Status : maximize probability of maintaining stock in the Kobe green zone		
Mean spawner biomass relative to unfished	$B/B0$	Geometric mean over years
Minimum spawner biomass relative to unfished	$B/B0$	Minimum over years
Mean spawner biomass relative to *Bmsy*	$B/Bmsy$	Geometric mean over years
Mean fishing mortality relative to target	$F/Ftar$	Geometric mean over years
Mean fishing mortality relative to *Fmsy*	$F/Fmsy$	Geometric mean over years
Probability of being in Kobe green quadrant	B,F	Proportion of years that $B \geq Btar \& F \leq Ftar$
Probability of being in Kobe red quadrant	B,F	Proportion of years that $B < Btar \& F > Ftar$
Safety : maximize the probability of the stock remaining above the biomass limit		
Probability that spawner biomass is above 20% of $B0$	B	Proportion of years that $B > 0.2B0$
Yield : maximize catches across regions and gears		
Mean catch	C	Mean over years
Mean catch by region and/or gear	C	Mean over years
Abundance: maximize catch rates to enhance fishery profitability		
Mean catch rates by region and gear	A	Geometric mean over years
Stability: maximize stability in catches to reduce commercial uncertainty		
Mean absolute proportional change (MAPC) in catch	C	Mean over years of $\text{abs}(C_t/C_{t-1}-1)$
Variance in catch	C	Variance over years
Probability of shutdown	C	Proportion of years that $C=0$

Indian Ocean Tuna Commission, “Report of the 2nd IOTC Management Procedure Dialogue” (April 2015)

Examples of other objectives (CICCA – ICCAT)

- Results of questionnaire during the Second Meeting of the*Standing Working Group to Enhance Dialogue Between Fisheries Scientist and Managers* (ICCAT):

"List one or more objectives important to you."



Source: 2015-SWGSM- Report

Management objectives for NP albacore MSE

OBJECTIVE	Quantity	Performance Indicators	Example Output
1. Maintain spawning biomass above the limit reference point	• $20\%SSB_{CURRENT, F=0}$ • $14\%SSB_{CURRENT, F=0}$ (calculated as (1-M)*SSB20%) • $SSB_{0.5R0}$, where h = 0.75 (IATTC)	• SSB for each projected year / SSB-based LRP	• % of runs in which ratio ≥1 for 29/30, 27/30, 24/30; • Each run = 30 years
2. Maintain total biomass, with reasonable variability, around historical average depletion of total biomass	• Historical depletion is estimated as the depletion level of total biomass for 2006-2015	• Depletion of projected total biomass over 30 yrs /minimum historical depletion of total biomass (min. of 2006 - 2015)	• % of runs in which ratio ≥1 for 29/30, 27/30, 24/30; • Each run = 30 years
3. Maintain harvest ratios by fishery (fraction of fishing impact with respect to SSB) at historical average	• Historical harvest ratio by fishery estimated as the average of 2006 – 2015 • Historical variability in harvest ratio estimated from 2006 – 2015	• Harvest ratio (H) by fishery (i) for each year is calculated as $(1-SPR_i)/1-SPR_{total}$ • Projected harvest ratio by fishery over 30 yrs >= minimum historical harvest ratio by fishery (minimum of 2006 - 2015) and <= max. hist. harvest ratio by fishery (maximum of 2006 - 2015)	• % of runs within minimum and maximum for 29/30, 27/30, 24/30; • Each run = 30 years

Management objectives for NP albacore MSE

OBJECTIVE	Quantity	Performance Indicators	Example Output
4. Maintain catches by fishery above average historical catch	• Average catch by fishery over the 30 year period, 1981-2010.	• Total catch of each projected year / average total historical catch (1981 – 2010) • Catch by fishery of each projected year / average historical catch of the fishery (1981 – 2010) • Projected catch by fisheries over 30 yrs /lower 25% of historical catch (1981 - 2010) • Projected catch by fisheries over 30 yrs /upper 25% of historical catch (1981 - 2010)	• % of runs in which ratio ≥1 for 29/30, 27/30, 22/30, 15/30; • Each run = 30 years;
5. If a change in total allowable effort and/or total allowable catch occurs, the rate of change should be relatively gradual		• % change in TAE and/or TAC between years (separate increases vs decreases)	• Median ± 5 and 95% percentiles of maximum % change in TAE and/or TAC for all years over all runs • Median ± 5 and 95% percentiles of % of projected years where change (0-15%, 15-30%, >30%) in TAE and/or TAC for all years over all runs

Management objectives for NP albacore MSE

OBJECTIVE	Quantity	Performance Indicators	Example Output
6. Maintain F at the target value with reasonable variability	• Various potential target values previously suggested by NC	• F-ratio-target = F-based TRP/ F of each projected year	• Median ± 5 and 95% percentiles of median of F-ratio-target over all runs • Median ± 5 and 95% percentiles of 10%, 95% of F-ratio-target over all runs
7. Maximize economic returns of existing fisheries (FUTURE WORK)			
8. Maintain interests of artisanal, subsistence and small-scale fishers, including limiting the regulatory impact on these fisheries (FUTURE WORK)			

Management Objectives: N. Albacore (ICCAT)

THE INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS (ICCAT) RECOMMENDS THAT:

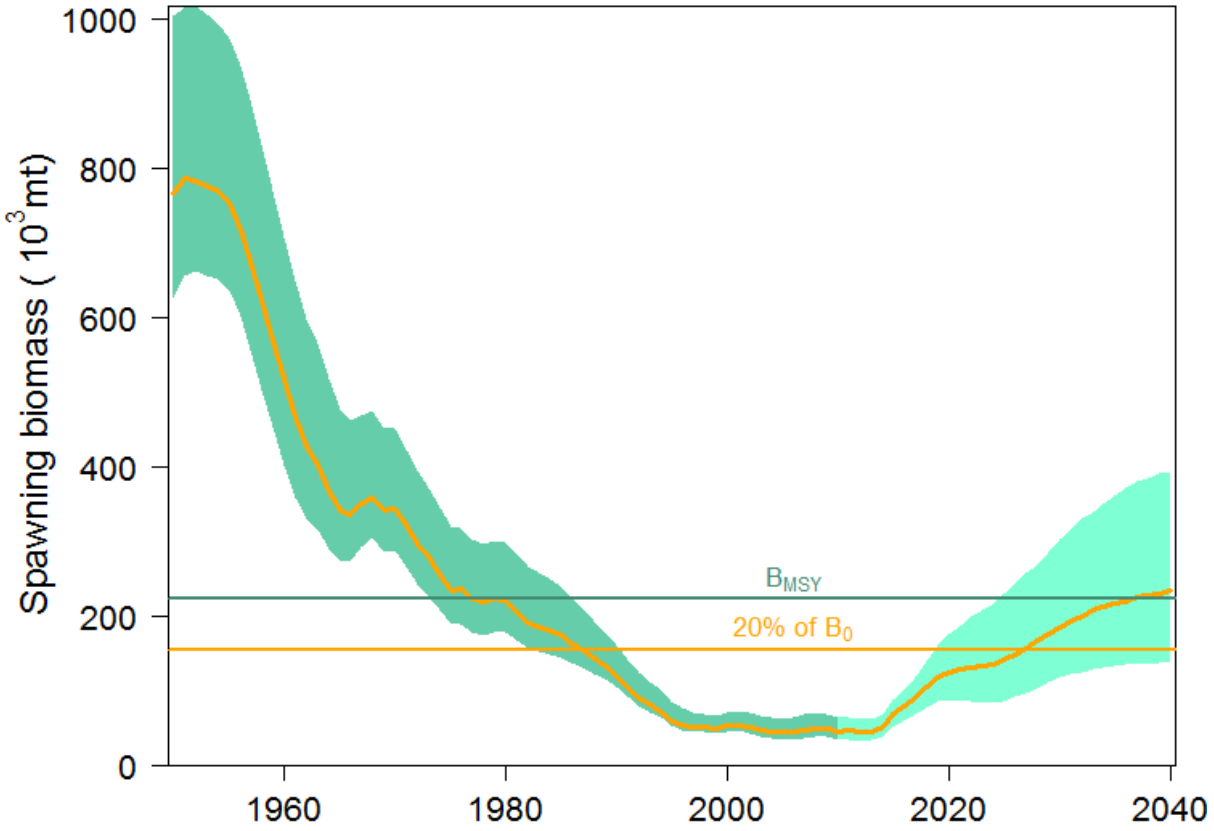
1. The management objective for northern albacore stock is
   a) to maintain the stock in the green zone of the Kobe plot, with at least a 60% probability, while maximizing long-term yield from the fishery, and

   b) where the spawning stock biomass (SSB) has been assessed by the SCRS as below the level capable of producing MSY (SSBMSY), to rebuild SSB to or above SSBMSY, with at least a 60% probability, and within as short time as possible, by 2020 at the latest, while maximizing average catch and minimizing inter-annual fluctuations in TAC levels.

https://www.iccat.int/Documents/Meetings/Docs/2016_PA2_Report_ENG.pdf

Management Objectives: S. Bluefin tuna (CCSBT)

- To rebuild the stock to an interim target of 20% B_0 by 2035, with a 70% probability
- Reduce inter-annual variability in TACs
  - set TAC in blocks of 3 years
  - limit TAC changes to 3000 tonnes



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Questions?