Provisional results of 1st round of MSE and proposed workplan for North Pacific albacore tuna

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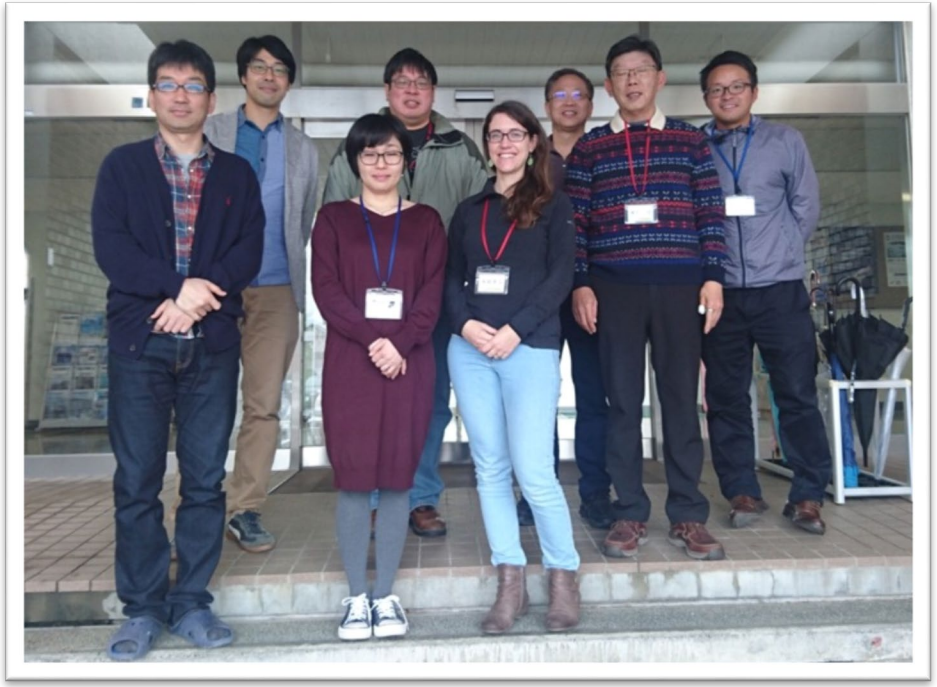
2019 IATTC Science Advisory Committee Meeting

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

ISC ALBWG Workshop

- ISC ALBWG workshop in Shizuoka, Japan (Feb 26 – Mar 4, 2019)
- Scientists from Canada, Chinese-Taipei, Japan & USA
- Review preliminary results from 1st round of MSE
- Prepare for MSE workshop
- Model improvements for stock assessment in 2020



MSE Workshop for Managers & Stakeholders

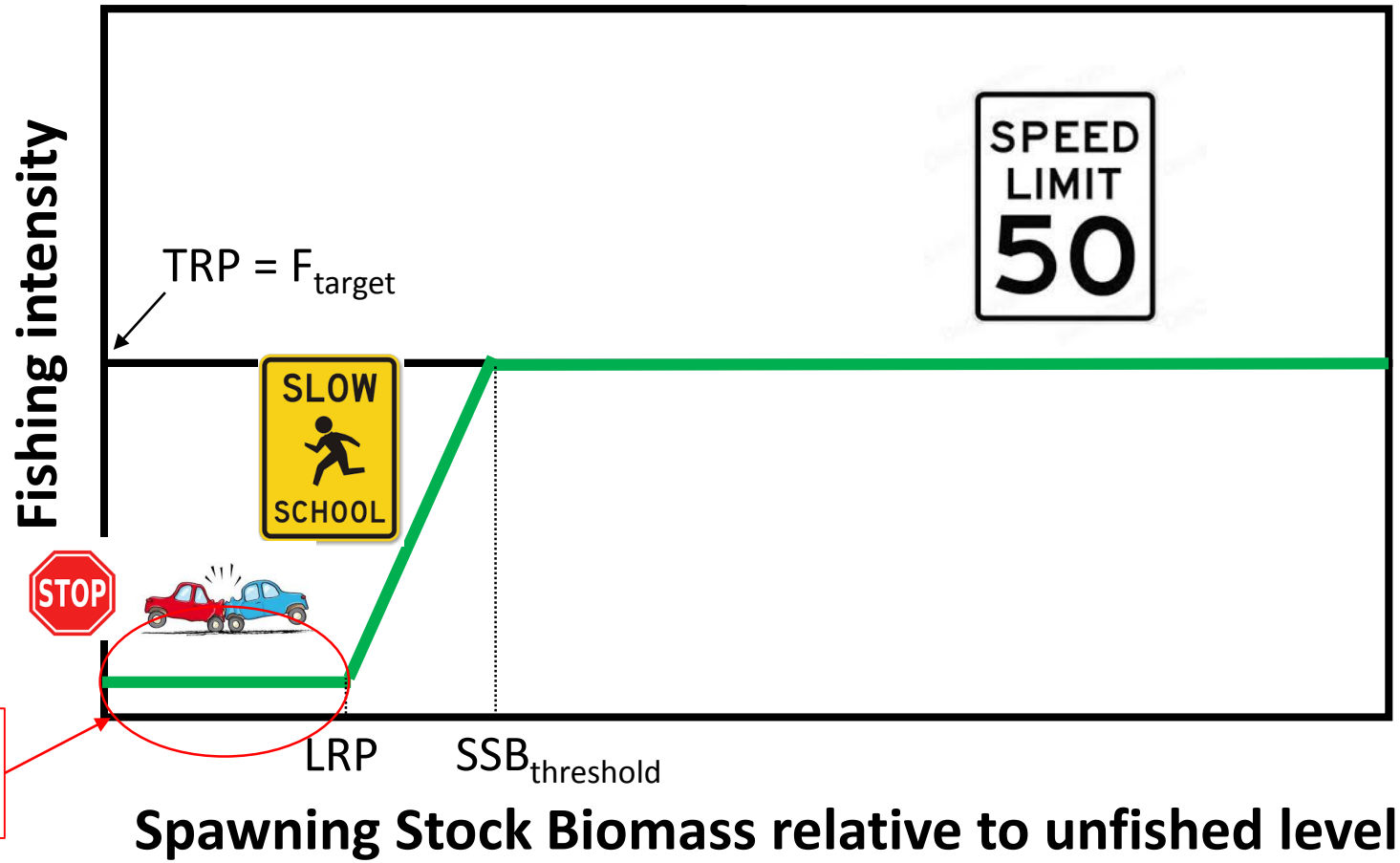
- MSE workshop in Yokohama, Japan (Mar 4 – 7, 2019)
- Managers, NGOs, scientists & stakeholders
- Examine preliminary results from 1st round of MSE
- Feedback from managers & stakeholders on improvements
- Recommendations
  - ~~NPALB management proposals~~
  - 2nd round of MSE
  - Presentation of MSE results
  - Management objectives
  - Candidate harvest strategies, reference points, & control rules

What is Management Strategy Evaluation?

- MSE is a process to evaluate the **trade offs** and **performance** of **candidate management strategies** under a range of **scenarios** and **uncertainties** using computer simulations
- Flight simulator for fisheries management but with a lot more uncertainty
- If a management strategy does not perform adequately in a computer simulation, we should not expect it to work in the real world
- Difference between forward projections and MSE is that MSE uses a feedback loop

Harvest Control Rules Tested in NPALB MSE

Example HCR for Harvest Strategy 3 (HS3)



For initial MSE,
F=0 when SSB<SSB_{limit}

Conclusions

1. A lower fishing intensity TRP (i.e. F50), maintains the population at a higher level than F40 and F30, requiring less management intervention and resulting in lower catch variability between years. However, lower fishing intensity results in lower overall catch.
2. HCRs with a TRP of F40 have less closures and higher catch stability as compared to a TRP of F30, resulting in comparable or higher catch despite lower fishing intensity.
3. An LRP and threshold reference point closer to the TRP results in a higher frequency of management interventions, fishery closures and lower catch stability.
4. HS3 showed lower catch stability than HS1, but had less fishery closures.
5. Harvest strategies with Total Allowable Effort (TAE) control performed better than ones with Total Allowable Catch (TAC) control across all performance metrics.

Limitations of 1st Round of MSE

- Effort not explicitly modeled, but implicitly via a fishing intensity
- TAE control may be more effective in the simulation than in the real world and is assumed to be implemented as effectively as TAC control
- TAE/TAC control can be effectively achieved for all fleets – targeting and not targeting
- TAE/TAC is always achievable – no limits on fleet capacity
- Allocation constant to 1999-2015 average

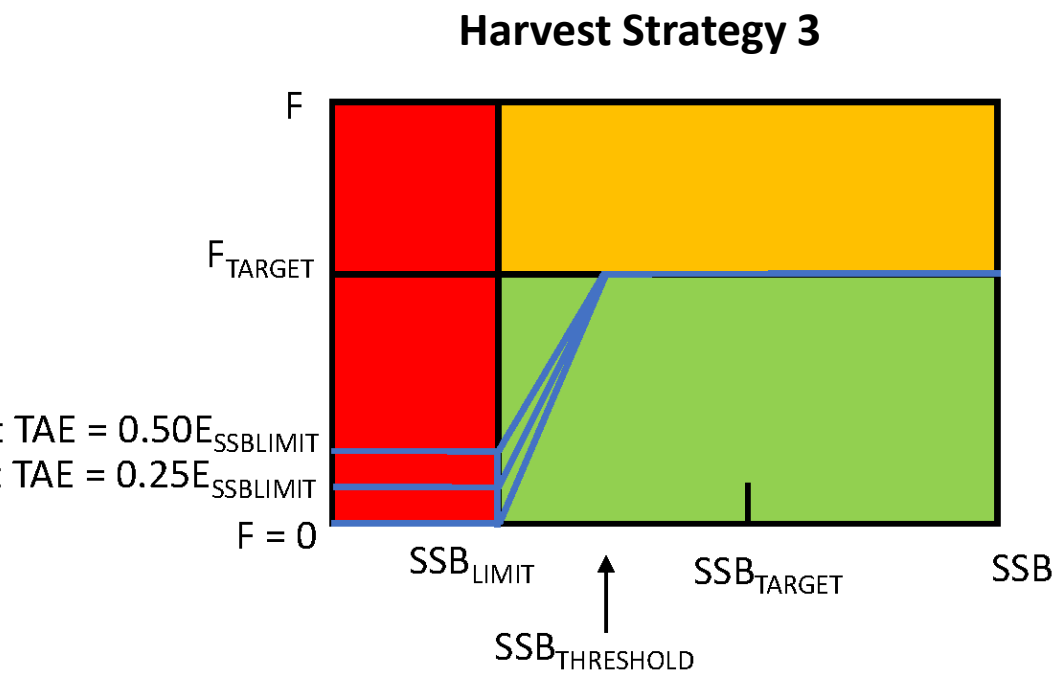
Limitations of 1st Round of MSE

- Only one rebuilding plan (fishery is closed) was tested
- When determining stock status, only the probability of SSB being higher than the LRP or threshold reference point at a 50% level was tested
- Movement processes are not explicitly modeled
- Simulations are conditioned on data from 1993 onwards. Therefore, they may not include the full range of uncertainty in the population dynamics of NPALB going back to the 1960's.

Main Recommendations: 4th MSE Workshop (Yokohama)

- No management recommendations for WCPFC and IATTC
- Results from 2nd round of MSE to be presented at 5th MSE Workshop in late 2020 – early 2021
- Smaller, more focused list of RPs and HCRs
- Stricter risk level (80 or 90%) used to evaluate risk of breaching candidate LRPs
- Evaluate 2 candidate levels of control if LRP breached
- Evaluate option where fleets not under control if $SSB \geq SSB_{THRESHOLD}$
- Use historical (1997 – 2015) fishing intensity or mortality levels to represent available fishing effort

Candidate Harvest Control Rules for 2nd MSE round



Mixed control is TAE for Japan pole-and-line and EPO surface, and TAC for all other fleets

	Control-type	F_{TARGET}	$B_{THRESHOLD}$	B_{LIMIT}
1	TAE, TAC, Mixed	$F_{50\%}$	30%SSB	20%SSB
2	TAE, TAC, Mixed	$F_{50\%}$	30%SSB	14%SSB
3	TAE, TAC, Mixed	$F_{50\%}$	30%SSB	7.7%SSB
4	TAE, TAC, Mixed	$F_{50\%}$	20%SSB	14%SSB
5	TAE, TAC, Mixed	$F_{50\%}$	20%SSB	7.7%SSB
6	TAE, TAC, Mixed	$F_{40\%}$	20%SSB	14%SSB
7	TAE, TAC, Mixed	$F_{40\%}$	20%SSB	7.7%SSB
8	TAE, TAC, Mixed	$F_{40\%}$	14%SSB	7.7%SSB

Potential Future Fishery Effort Scenarios

- Increased effort & catches in the north Pacific – new entrant to fishery but catch is known to the assessment and under HCR – ramp in catch of 2,400 t per year up to 50,000 t
- Increased effort & catches in the north Pacific – new entrant to fishery but catch is not known to the assessment and is not under HCR – ramp in catch of 2,400 t per year up to 50,000 t

Proposed Workplan for ISC ALBWG

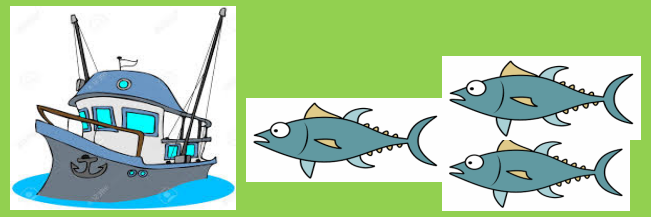
Dates	Task/Event
13 - 17 May 2019	Preliminary 1st round of MSE results presented to IATTC Science Advisory Committee
11 – 15 Jul 2019	ISC Plenary reviews 1st round of MSE results
August 2019	1st round of MSE results presented to WCPFC Scientific Committee
2 – 6 Sep 2019	1st round of MSE results presented to WCPFC NC
12 – 18 Nov 2019	Data preparation for NPALB stock assessment (Shimizu, Japan)
16 – 23 March 2020	Next NPALB stock assessment (La Jolla, USA)
Late 2020 – early 2021	5th ISC MSE workshop to examine results of 2nd round of MSE (location to be determined)

Questions?

Extra Results Slides

Management Objectives for North Pacific Albacore

MANAGEMENT OBJECTIVES



1. Have infrequent management intervention
2. Maintain biomass
3. Maintain equitable share of catch among different fisheries
4. Maintain catch
5. Have stability in catch
6. Fish at the target level set by management

MANAGEMENT OBJECTIVES
1. Maintain SSB above the limit reference point (LRP)
2. Maintain depletion of total biomass around historical average depletion
3. Maintain harvest ratios by fishery at historical (2006-2015) average
4. Maintain catches above average historical catch
5. Change in total allowable catch between years should be relatively gradual
6. Maintain fishing intensity (F) at the target value with reasonable variability

Total of 11 different Harvest Control Rules for HS1 and HS3

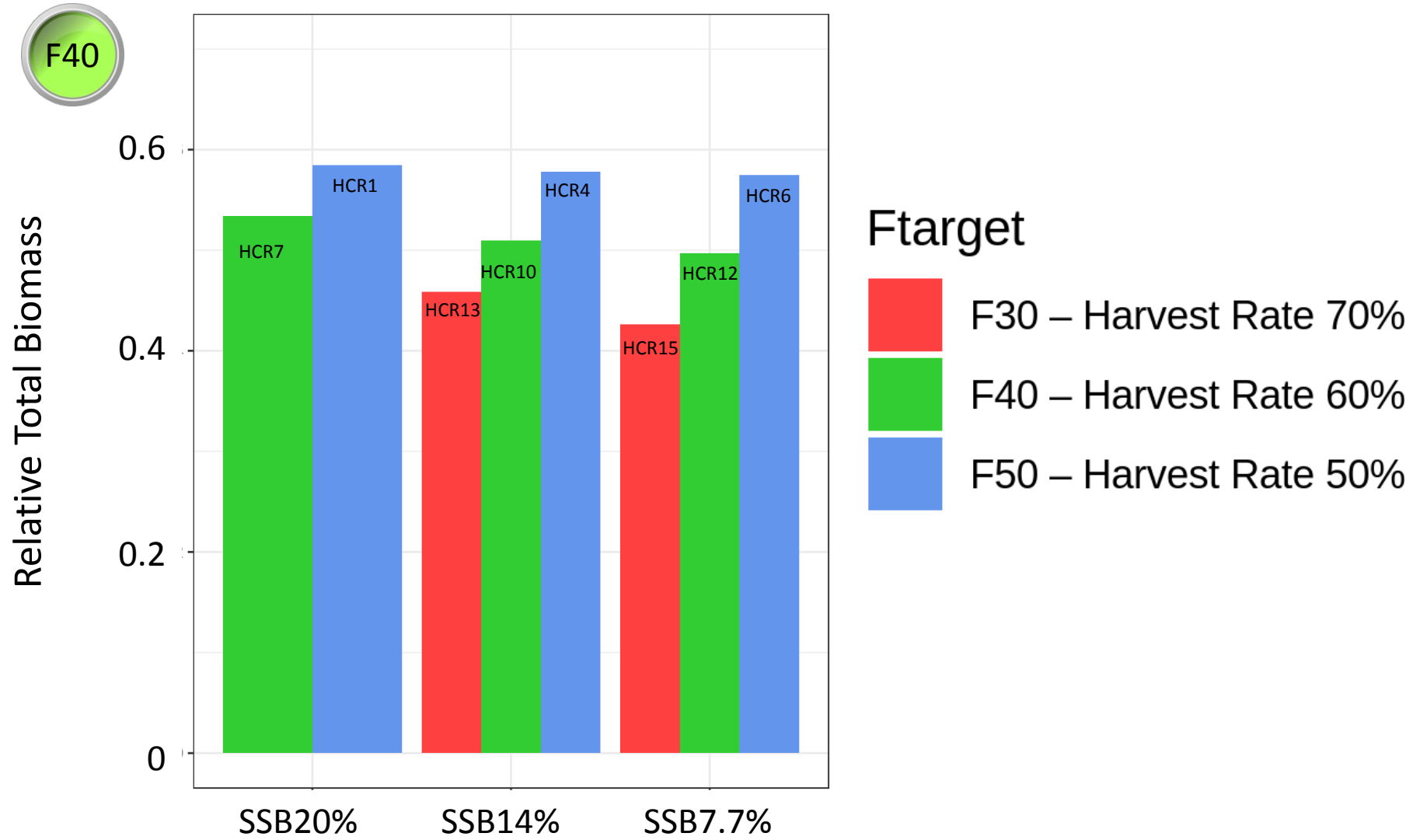
Harvest strategy	Output control	Harvest control rule	Ftgt	SSBthr	SSBlim
1 or 3	TAC or TAE	1	F50	30%SSB	20%SSB
1 or 3	TAC or TAE	4	F50	20%SSB	14%SSB
1 or 3	TAC or TAE	6	F50	14%SSB	7.7%SSB
1 or 3	TAC or TAE	7	F40	30%SSB	20%SSB
1 or 3	TAC or TAE	10	F40	20%SSB	14%SSB
1 or 3	TAC or TAE	12	F40	14%SSB	7.7%SSB
1 or 3	TAC or TAE	13	F30	20%SSB	14%SSB
1 or 3	TAC or TAE	15	F30	14%SSB	7.7%SSB
1 or 3	TAE	16	F0204	30%SSB	20%SSB
1 or 3	TAE	17	F0204	20%SSB	14%SSB
1 or 3	TAE	18	F0204	14%SSB	7.7%SSB


Results

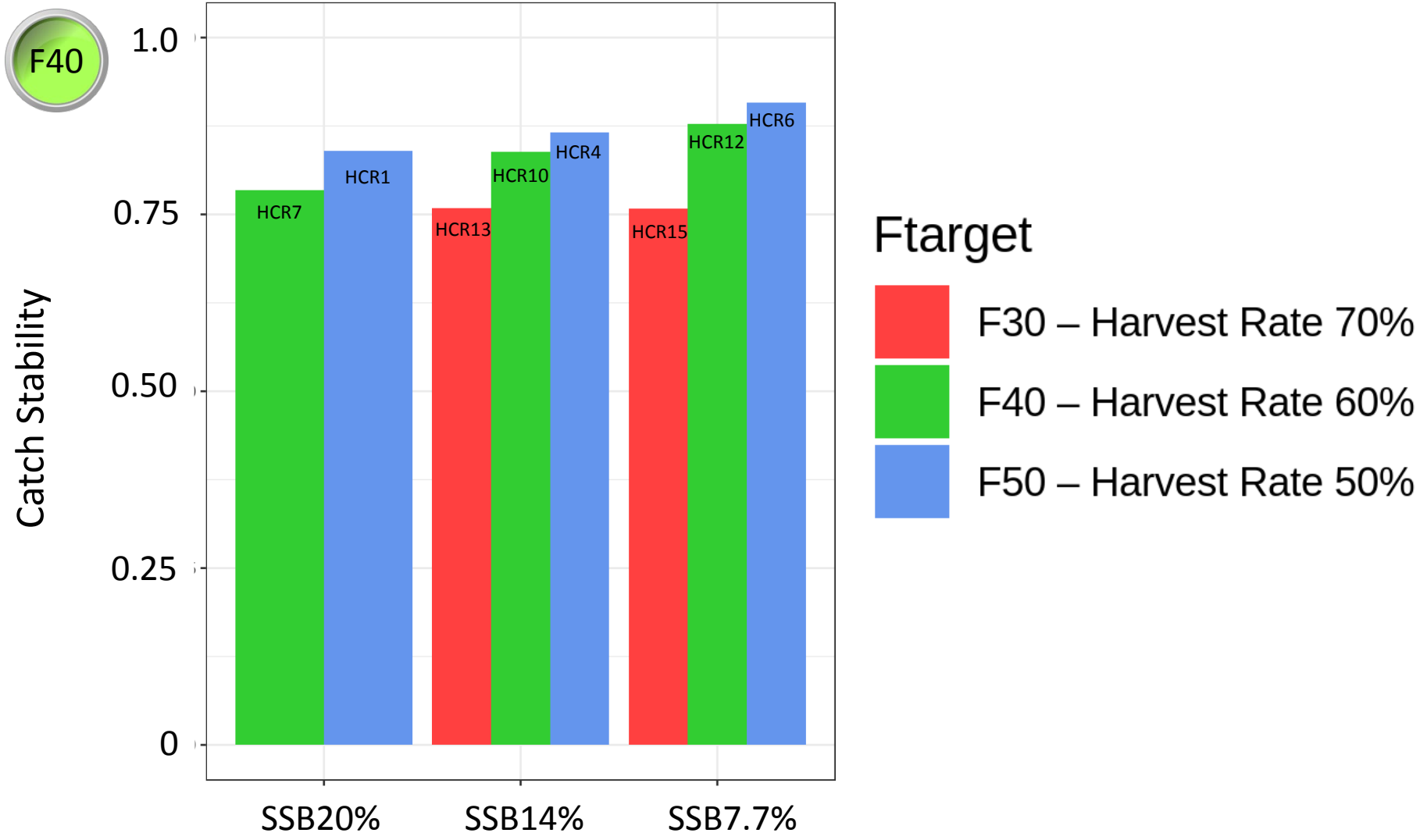
Management Objectives and Performance Indicators

Management Objective	Label	Performance Indicator
1. Maintain SSB above the limit reference point (LRP)	Odds of no fishery closure	Probability that SSB in any given year of the MSE forward simulation is above the LRP
2. Maintain depletion of total biomass around historical average depletion	Relative Total Biomass	Probability that depletion in any given year of the MSE forward simulation is above minimum historical (2006-2015) depletion
4. Maintain catches above average historical catch	Relative Total Catch	Probability that catch in any given year of the MSE forward simulation is above average historical (1981-2010) catch
5. Change in total allowable catch between years should be relatively gradual	Catch Stability	Probability that a decrease in TAC between years is < 30%. Calculated excluding years TAC=0.
6. Maintain fishing intensity (F) at the target value with reasonable variability	F_{TARGET}/F	F_{TARGET}/F

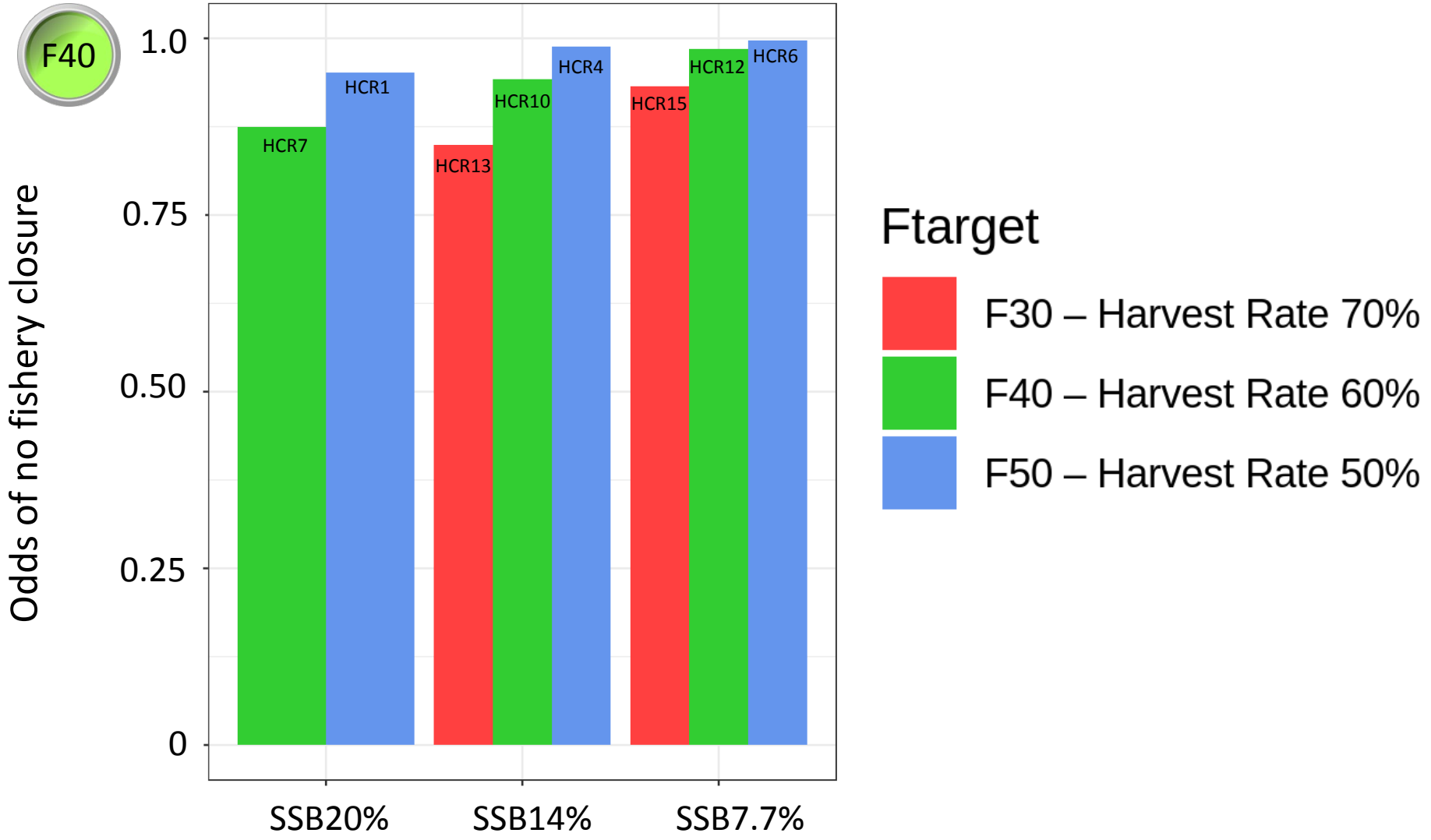
A lower fishing intensity TRP results in higher biomass



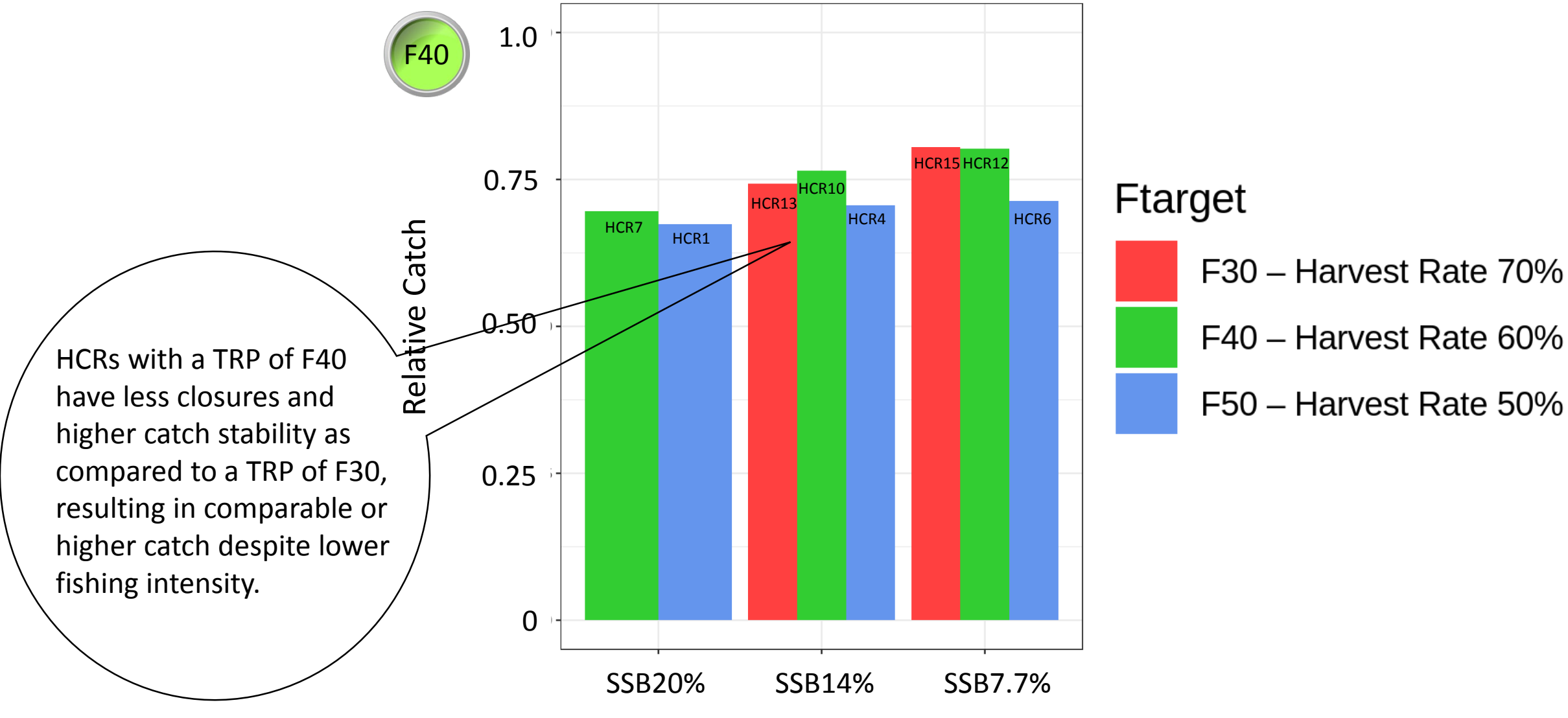
A lower fishing intensity TRP results in higher biomass, higher catch stability



A lower fishing intensity TRP results in higher biomass, higher catch stability, and less management intervention

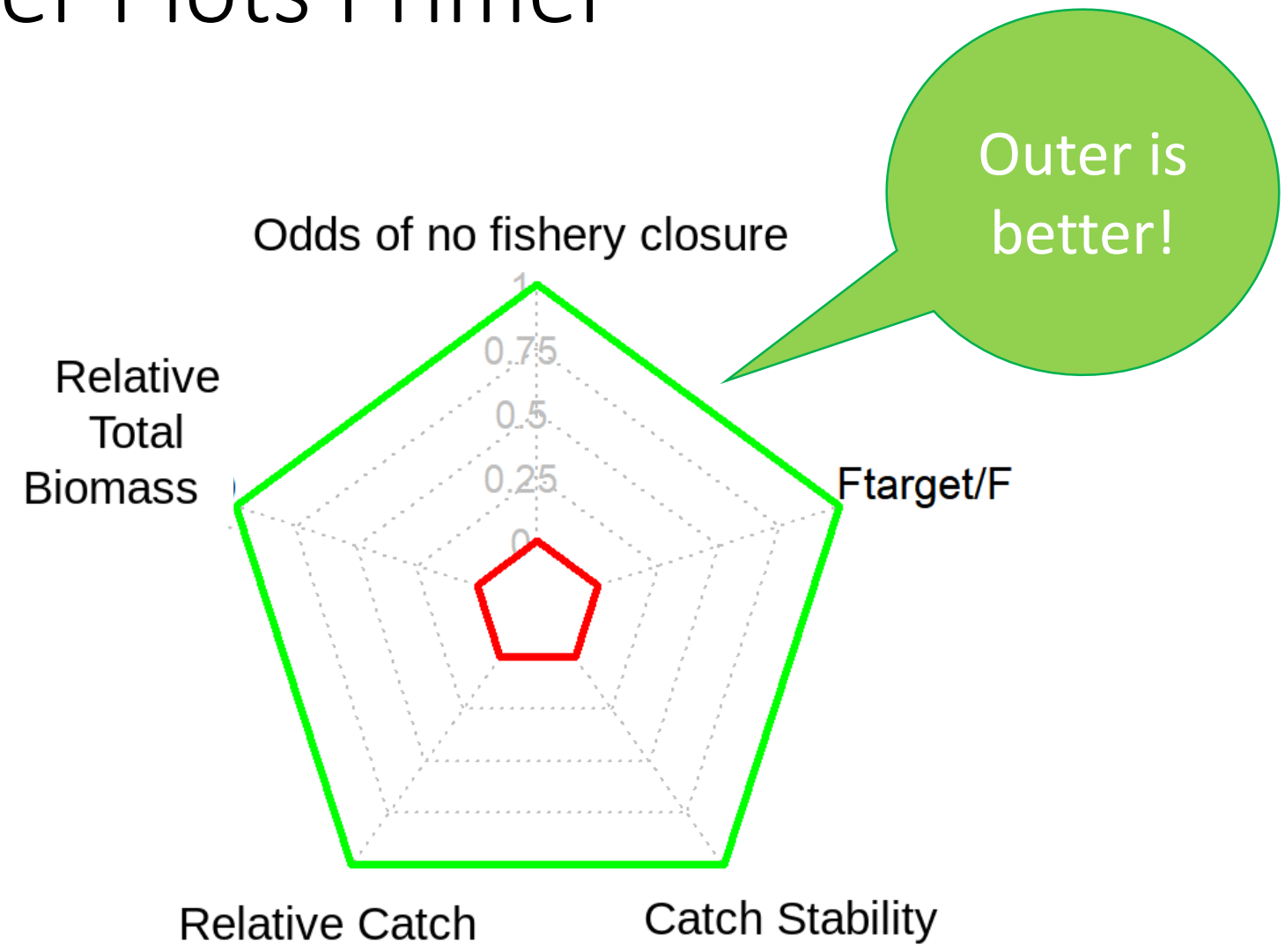


A lower fishing intensity TRP results in higher biomass, higher catch stability, and less management intervention. However, this stability comes at a cost of lower overall catch.



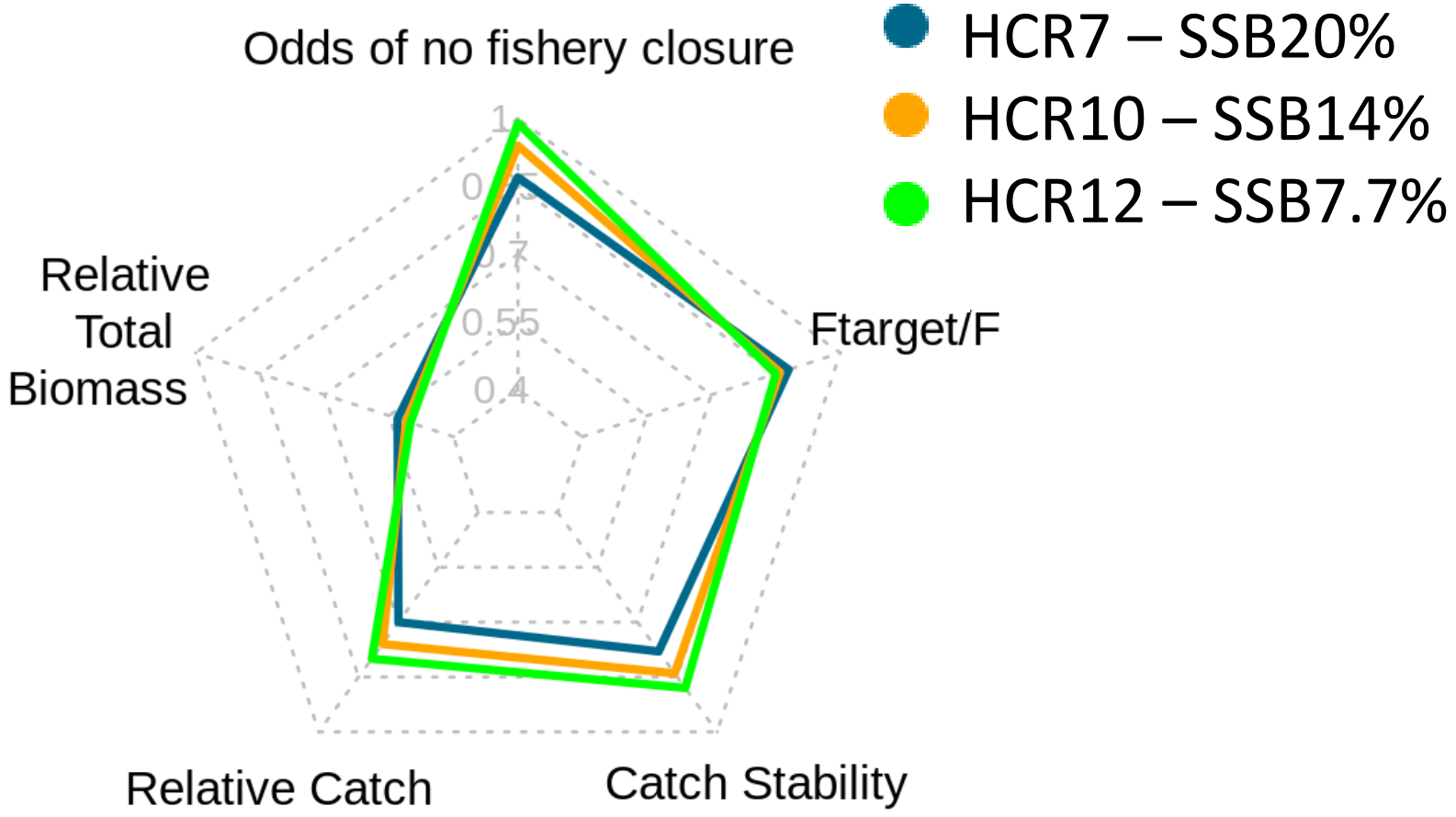
HCRs with a TRP of F40 have less closures and higher catch stability as compared to a TRP of F30, resulting in comparable or higher catch despite lower fishing intensity.

Spider Plots Primer



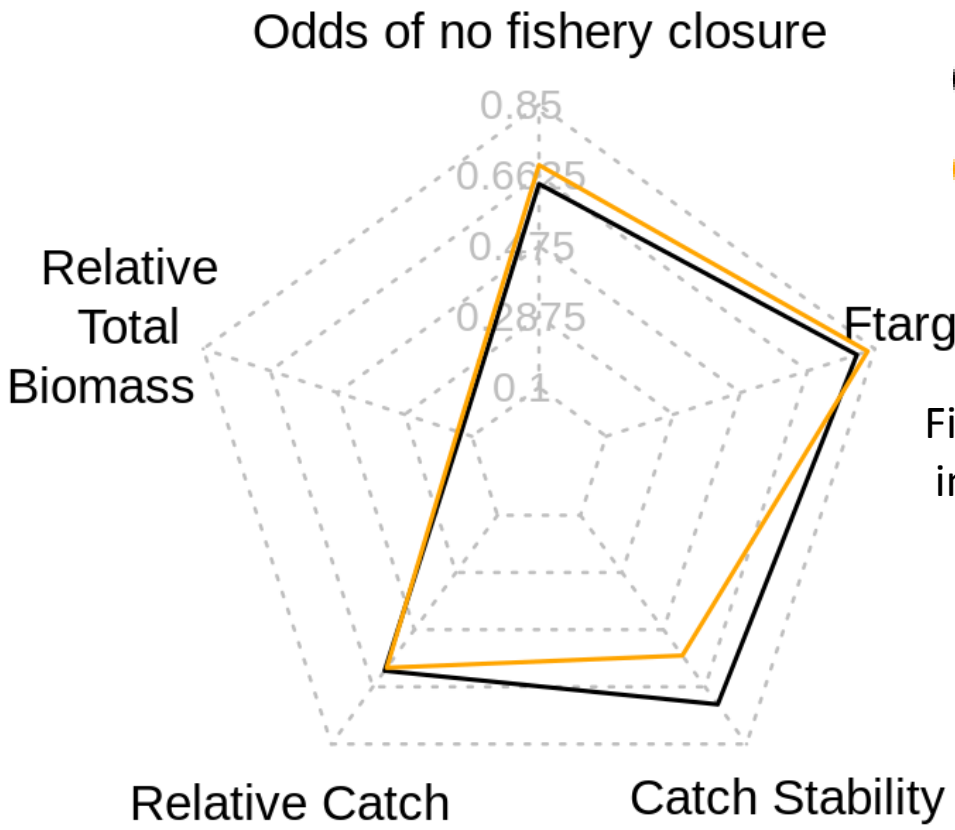
An LRP and threshold reference point closer to the TRP results in a higher frequency of management interventions and lower catch stability.

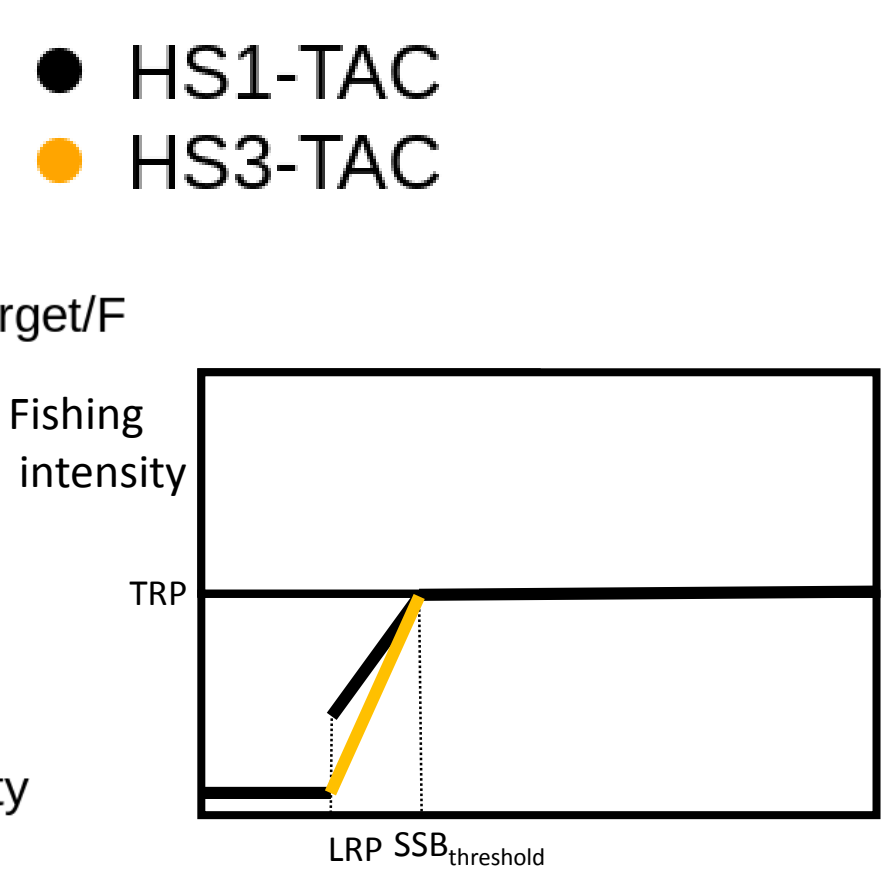
TRP = F40



HS3 showed lower catch stability than HS1, but had less fishery closures.

HCR = HCR13
TRP=F30
LRP=SSB14%
Low Productivity Scenario





Harvest strategies with TAE control performed better than ones with TAC control across all performance metrics.

HCR = HCR13 (TRP=F30, LRP=SSB14%)

- Given the 3 years assessment frequency, the TAC is maintained constant over a 3-year period.
- However, TAE can respond to changes in biomass.
- If biomass is reduced because of nature, under TAC control, fishing intensity can increase, requiring management intervention.