Case Study: Improving Vulnerability Assessments for Data-limited Bycatch Species Caught in Eastern Pacific Ocean Tuna Fisheries Using the EASI-Fish Approach

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1st Workshop on improvements in data collection and provision: Industrial longline fishery
9-11 January 2023

Ecological sustainability

- IATTC mandated to ensure ecologically sustainability of its fisheries
  - Antigua Convention, specific IATTC Resolutions (e.g., sharks, rays, turtles, dolphins)

To ensure the "*long-term conservation and sustainable use of the stocks of tunas and tuna-like species and other associated species of fish taken by vessels fishing for tunas and tuna-like species in the eastern Pacific Ocean (EPO)*"

Article VII. "…*adopt, as necessary, conservation and management measures and recommendations for species belonging to the same ecosystem and that are affected by fishing for, or dependent on or associated with, the fish stocks covered by this Convention, with a view to maintaining or restoring populations of such species above levels at which their reproduction may become seriously threatened*"

Ecological sustainability

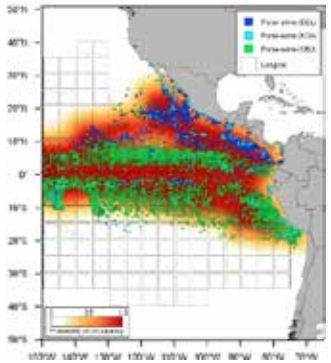
- But demonstrating we meet these mandates is challenging
- EPO fisheries interact with >100 species
- Some caught infrequently, little value, poor reporting (e.g. “sharks”)
- Lack basic biological and ecological data for traditional assessment
- Alternative assessment approaches used and developed by IATTC

EASI-Fish

- Similar PSA “Productivity” and “Susceptibility” components
- **Susceptibility** component estimates the proportion of the population potentially impacted by fishery *x* to estimate fishing mortality ($\tilde{F}$ yr^{-1})
- **Productivity** component is a length-based per-recruit model
- **Vulnerability status** determined by traditional biological reference points
- Designed to be user-friendly and flexible for data-poor species/fisheries
  - See paper SAC-13-11 complete methodology, data inputs, and assumptions

EASI-Fish – an overview

Susceptibility - "Volumetric overlap"



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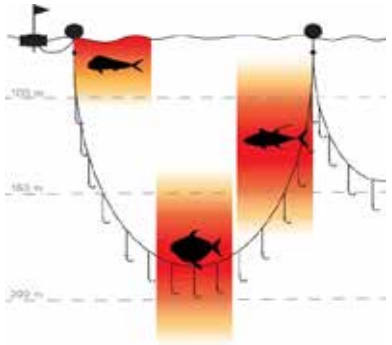

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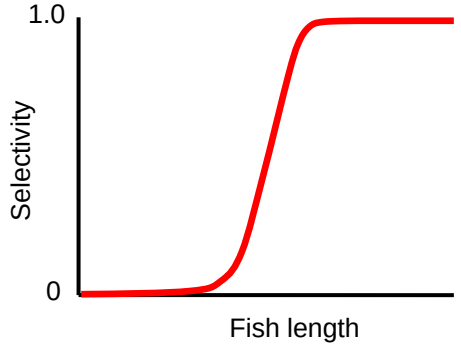
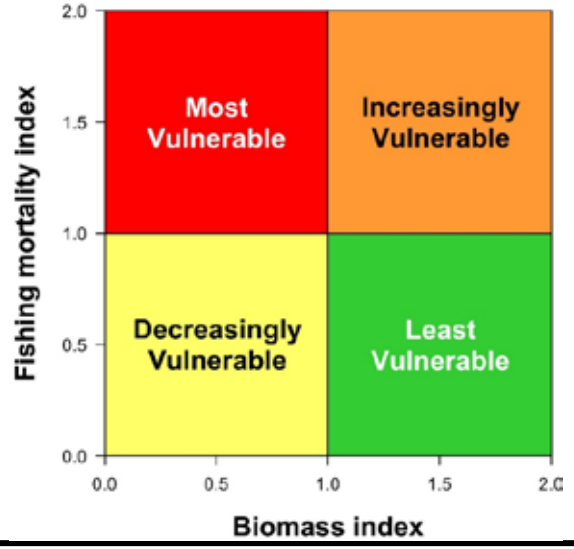


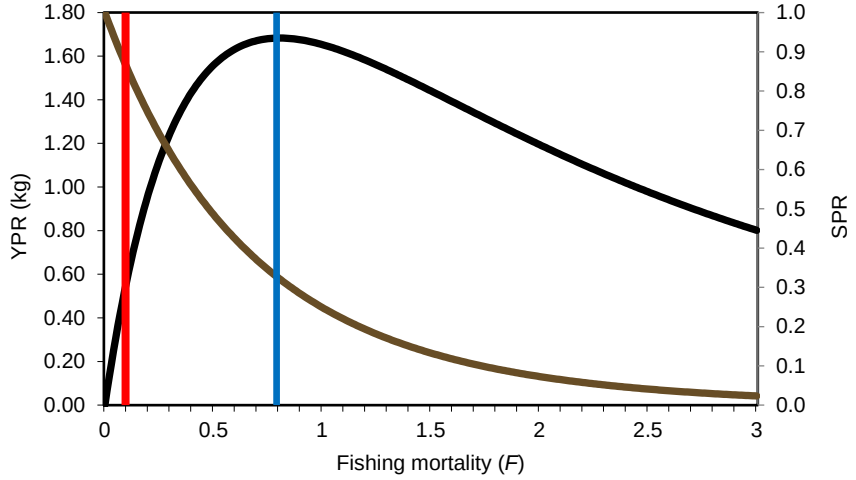
+ Post-Release Mortality = Fishing Mortality ($\widetilde{F}$ yr^{-1})

Vulnerability status



BRP values ($F_{40\%}$ and $SBR_{40\%}$)

Productivity – YPR & SBR



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  - Use of large circle hooks
  - Use of fish bait
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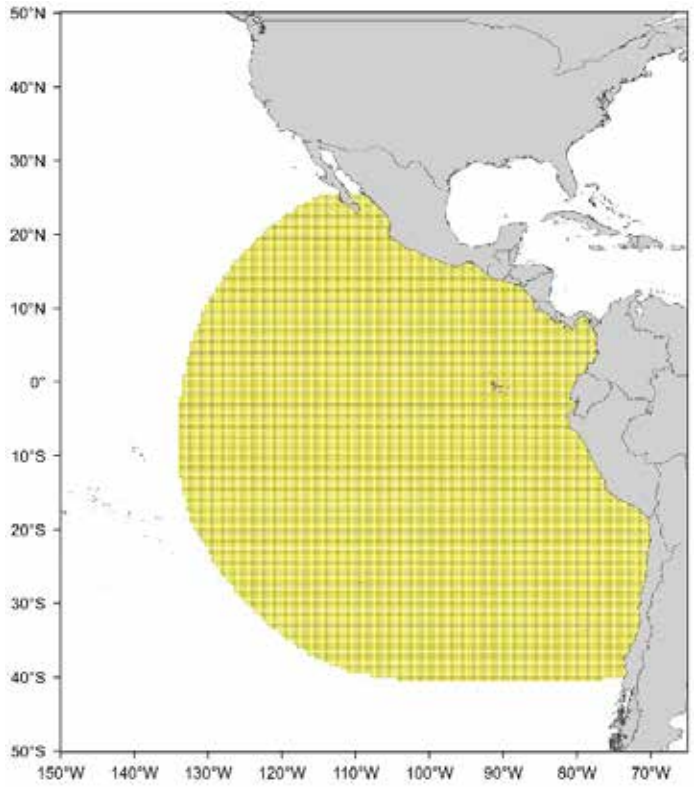
  - 2022 final assessment (improved SDM and artisanal fishing effort data)
- Demonstrate how assessment outcomes change by improving:
  - Simple catch (i.e. presence/absence) and fishing effort data resolution
  - Length-frequency data to improve gear selectivity ogives

2020 leatherback assessment

- SDM assumed to be the generic Regional Management Unit boundary (Wallace et al. 2010)
- Based on expert opinion due to rarity of recorded catches



2020 leatherback assessment

- 8 “pelagic” EPO fisheries included in the assessment
  - Industrial longline (Task II - 5°)
  - Artisanal longline (Not available – mosaic of published records)
  - Artisanal driftnet/gillnet (Not available – mosaic of published records)
  - Purse-seine (Class 6) (NOA, OBJ, DEL) (AIDCP observer data)
  - Purse-seine (Class 1-5) (NOA, OBJ) (Task II - 0.5° or 1°)

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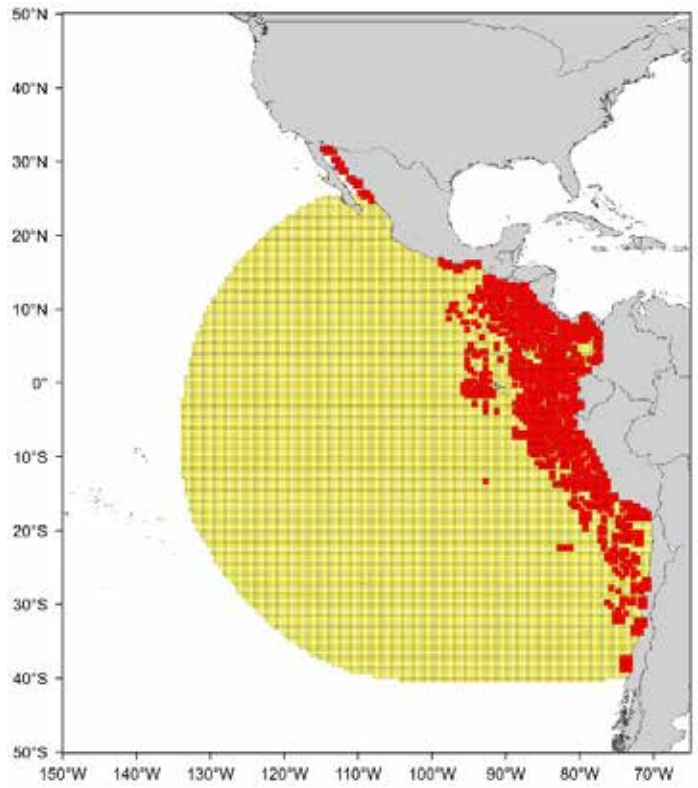
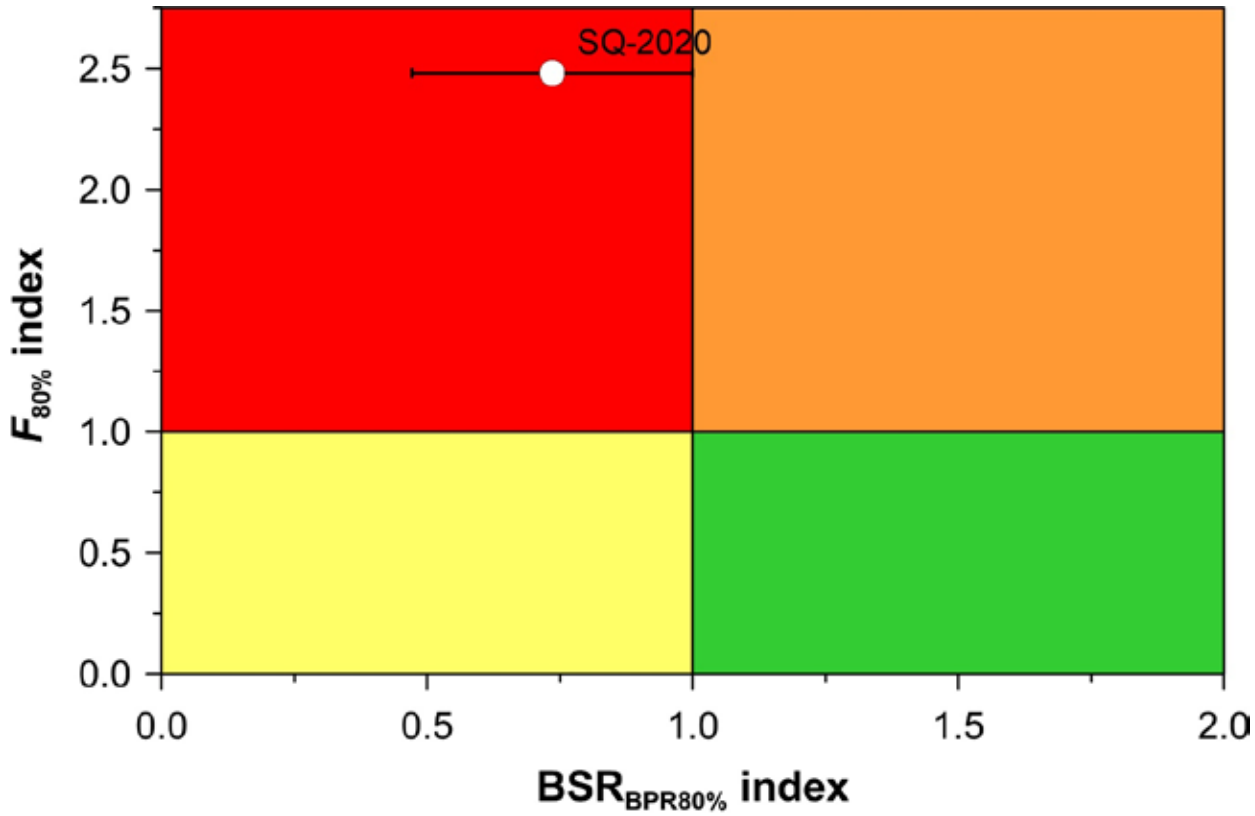
- Focus on artisanal longline and gillnet



2020 leatherback assessment

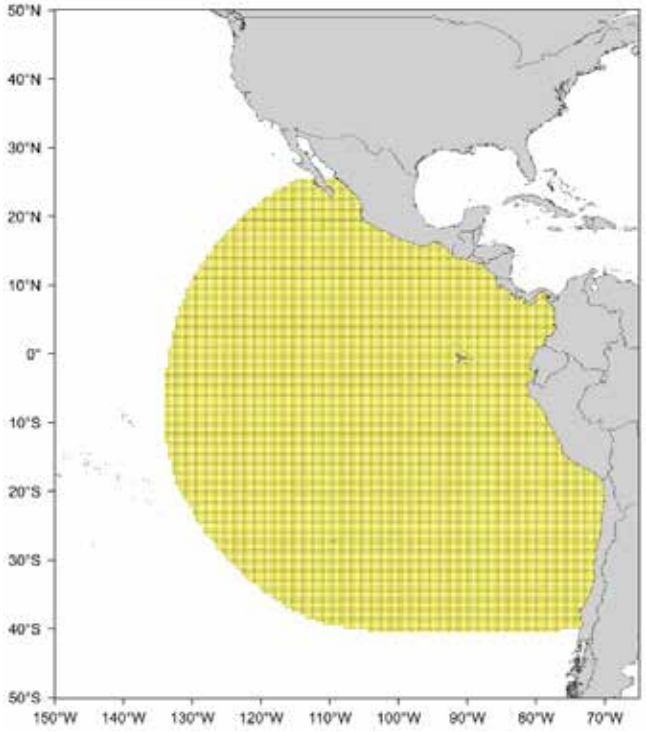
- Assessment showed the vulnerability was “most vulnerable”
  - F_{2019} estimated to be 248% $F_{80\%}$
  - Breeding stock biomass per recruit (BSR) 74% of $BSR_{80\%}$



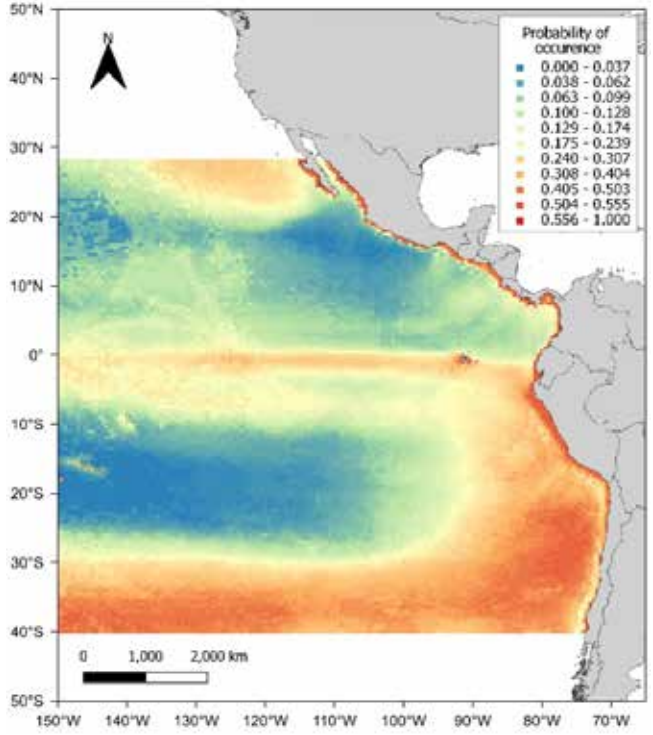
2022 leatherback assessment

- Species presence data derived from unreported catch and survey data from EPO coastal states and NGOs
- New data combined with cutting-edge SDM modelling approaches produced a significantly improved SDM

Old SDM



New SDM



2022 leatherback assessment

- Updated EPO fisheries included in the assessment
  - Artisanal longline (0.5° or 1° from ABNJ project and coastal states)
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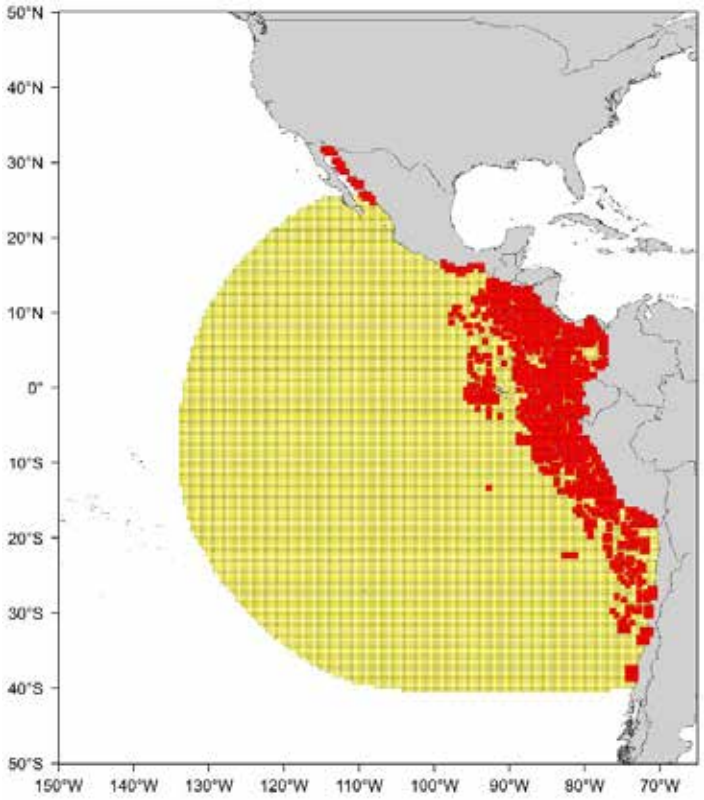

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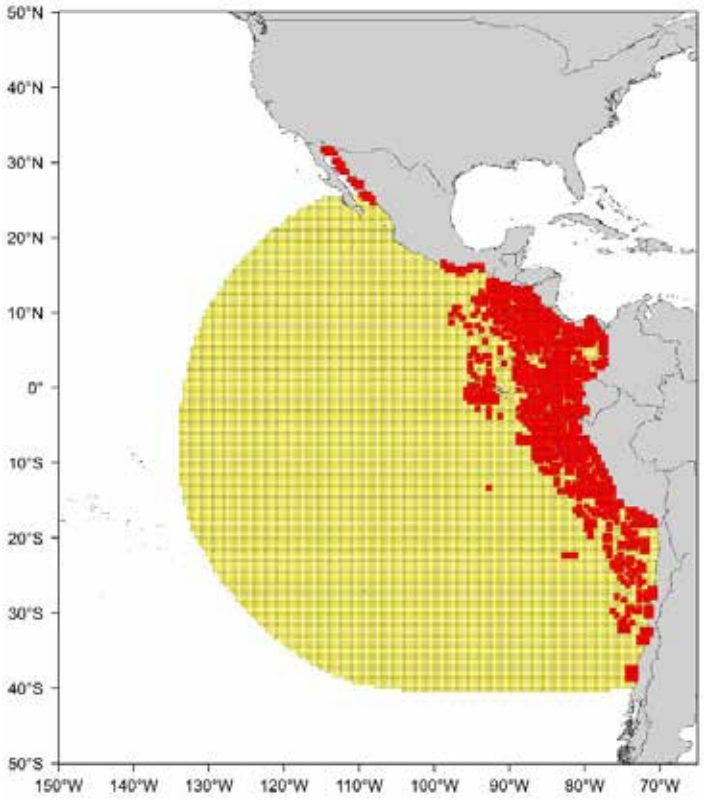

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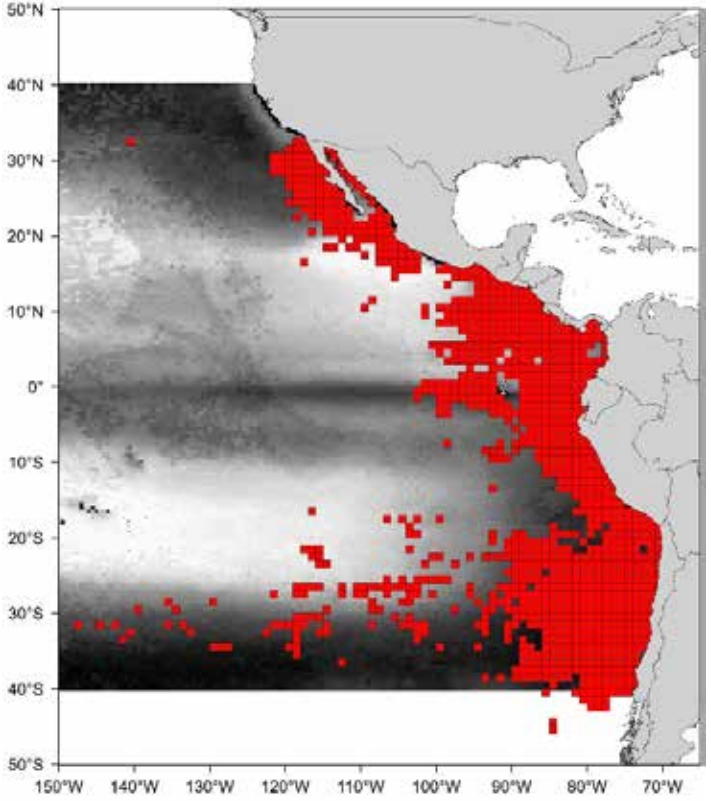
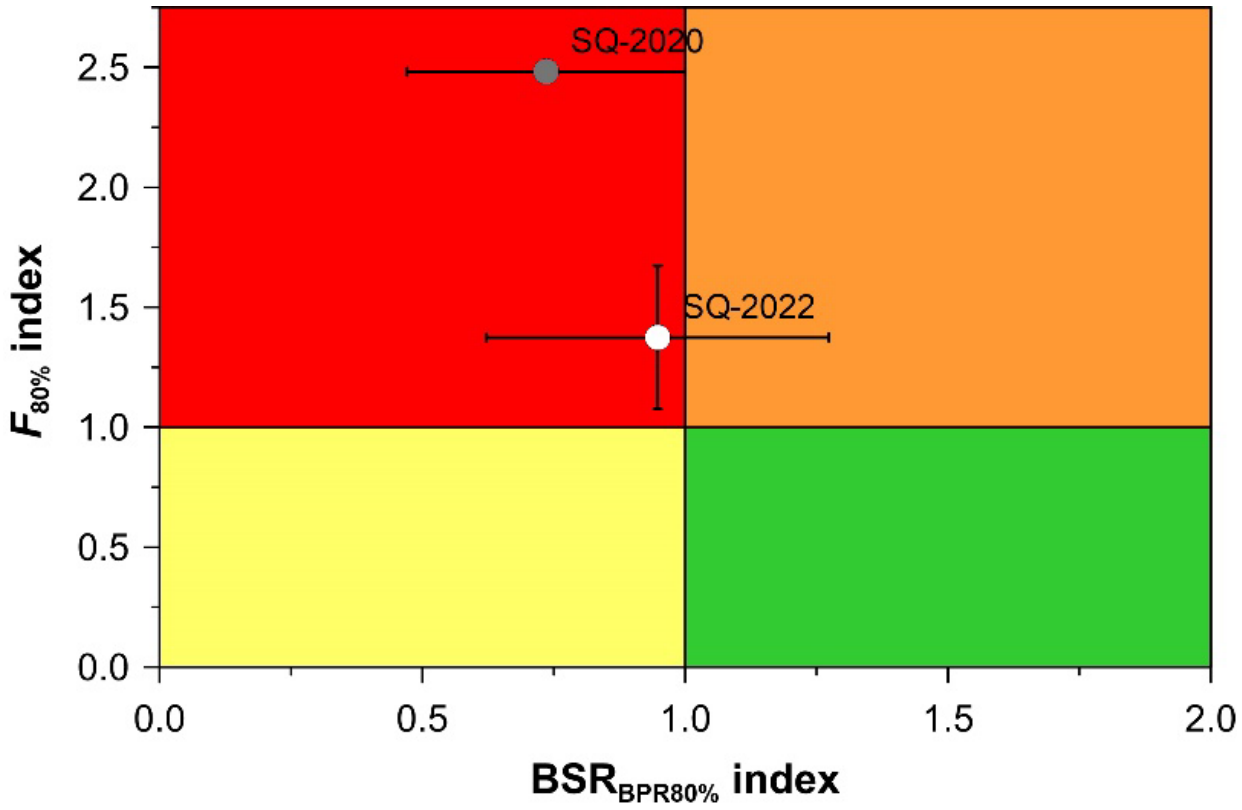


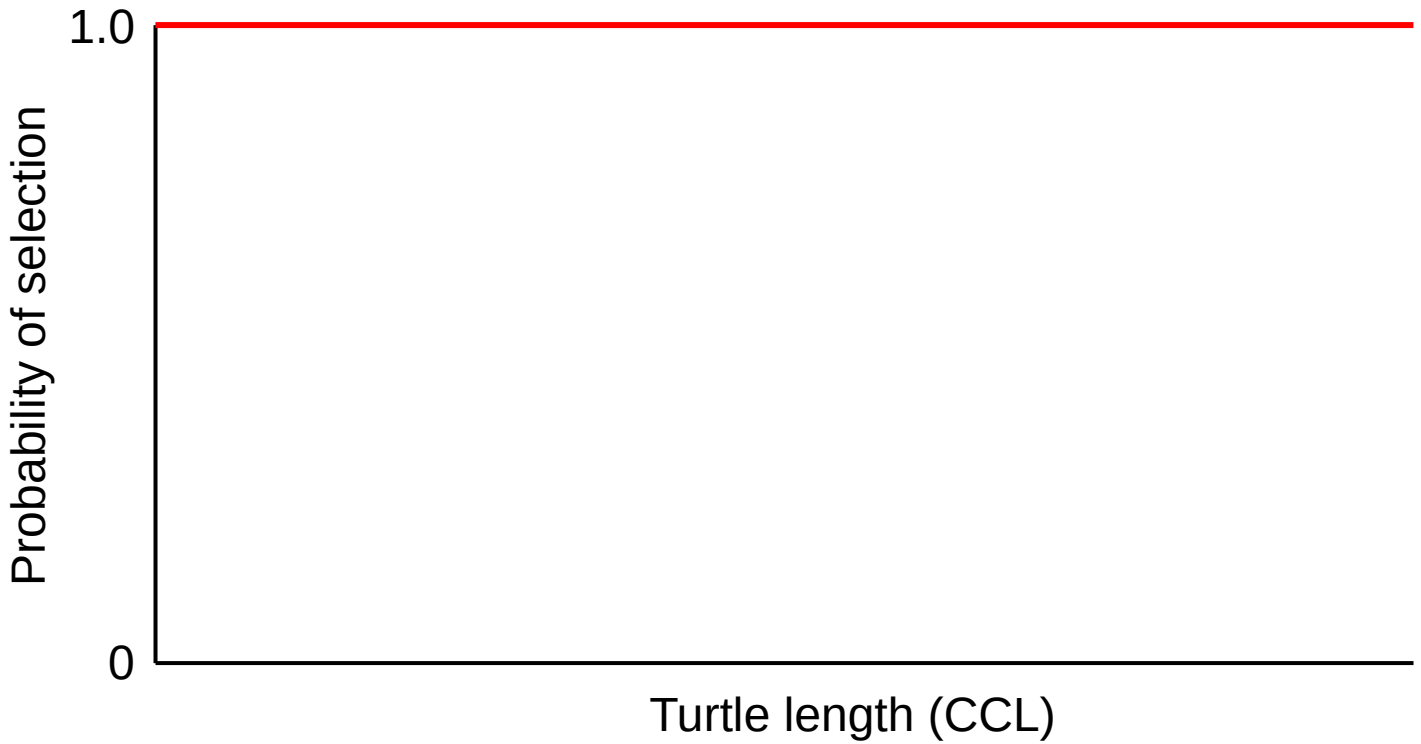
2022 leatherback assessment

- Significantly more optimistic vulnerability status
  - § F_{2019} reduced from 248% to 137% of $F_{80\%}$
  - § Breeding stock biomass per recruit (BSR) increased from 74% to 95% of $BSR_{80\%}$



Changes to selectivity assumptions

- 2020 assessment - two selectivity assumptions explored for industrial LL
  - Little/unreliable length data – precautionary fully realized selectivity for all size classes



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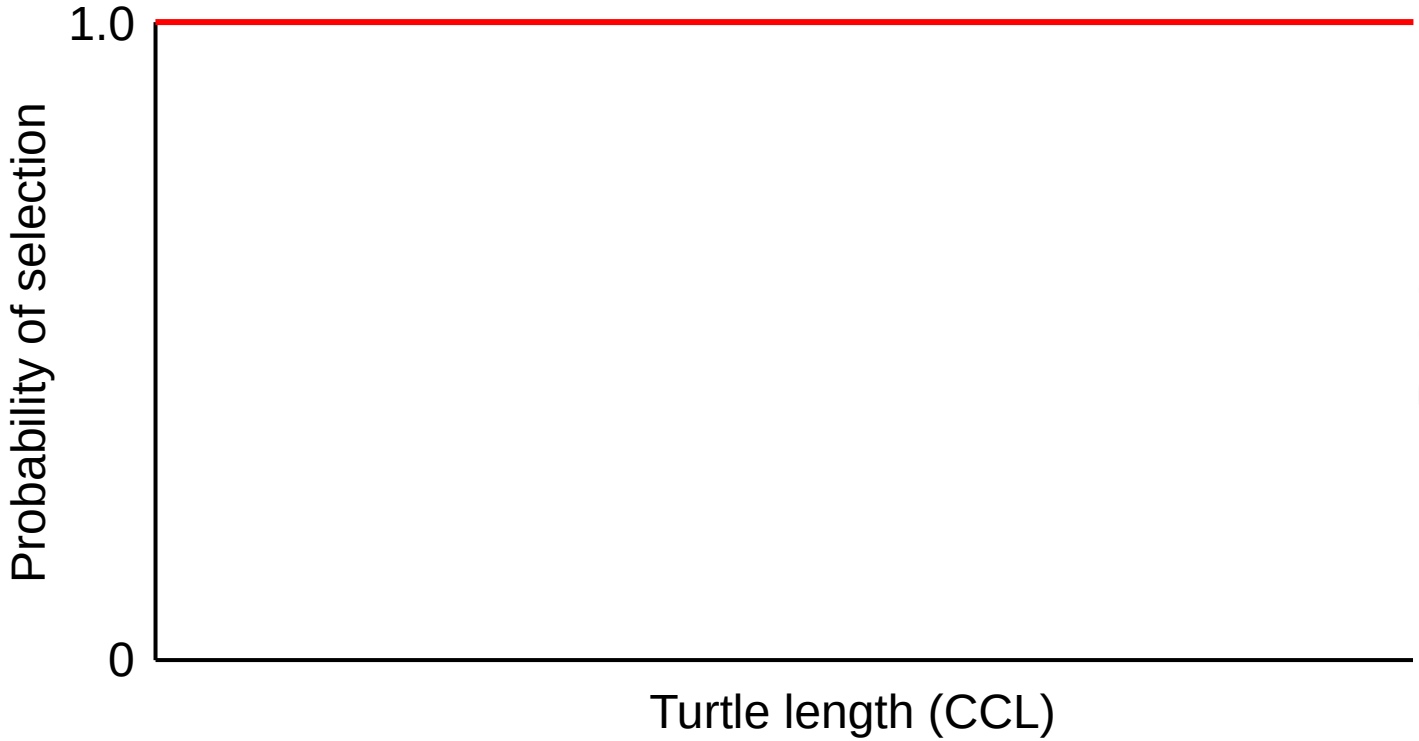

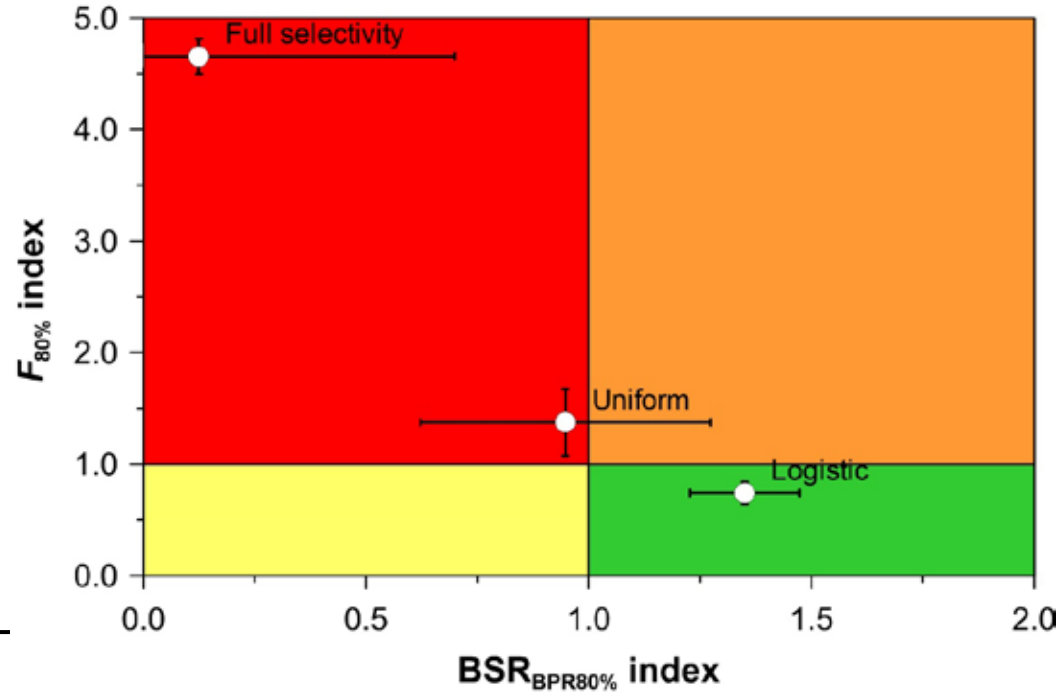

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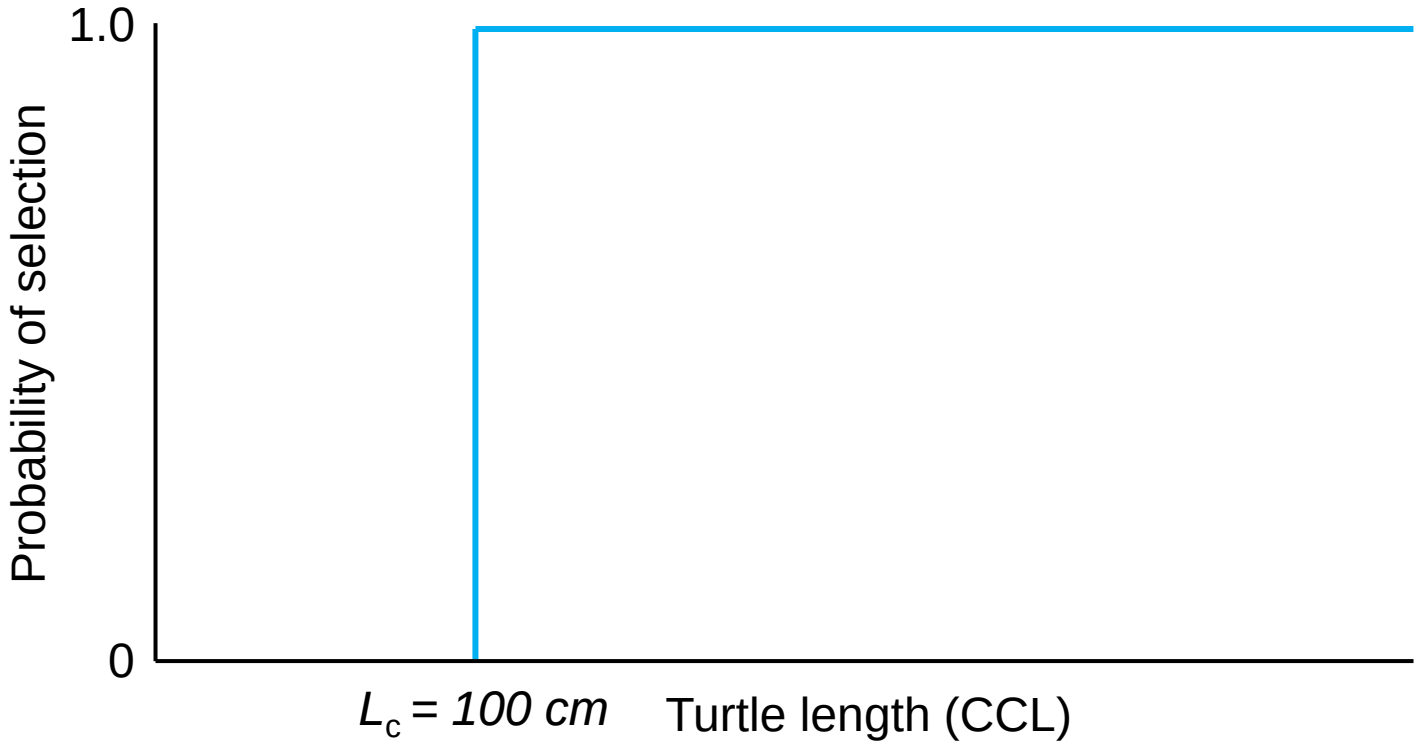
  - Experts believed larger animals caught in offshore areas, so knife-edge selectivity assumed from 100 cm
  - Resulted in a significantly more optimistic vulnerability status



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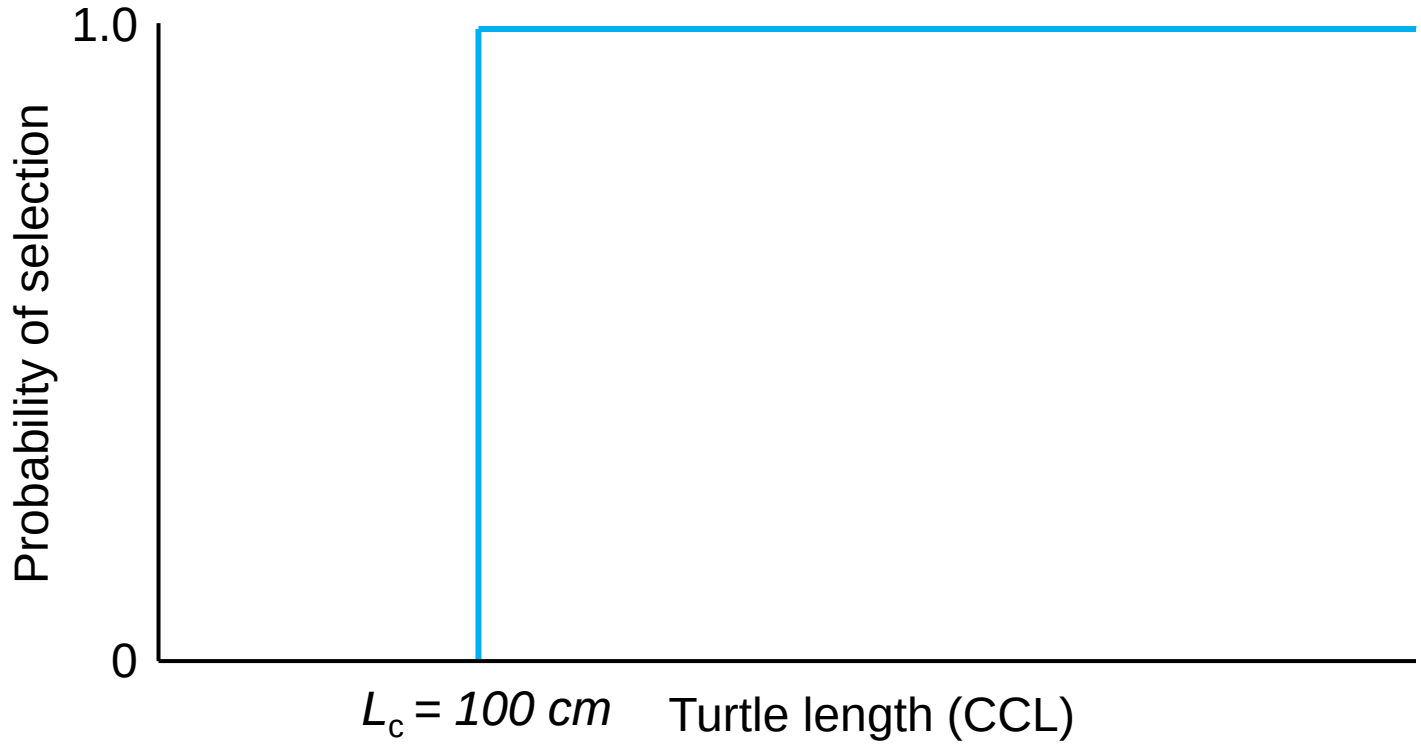

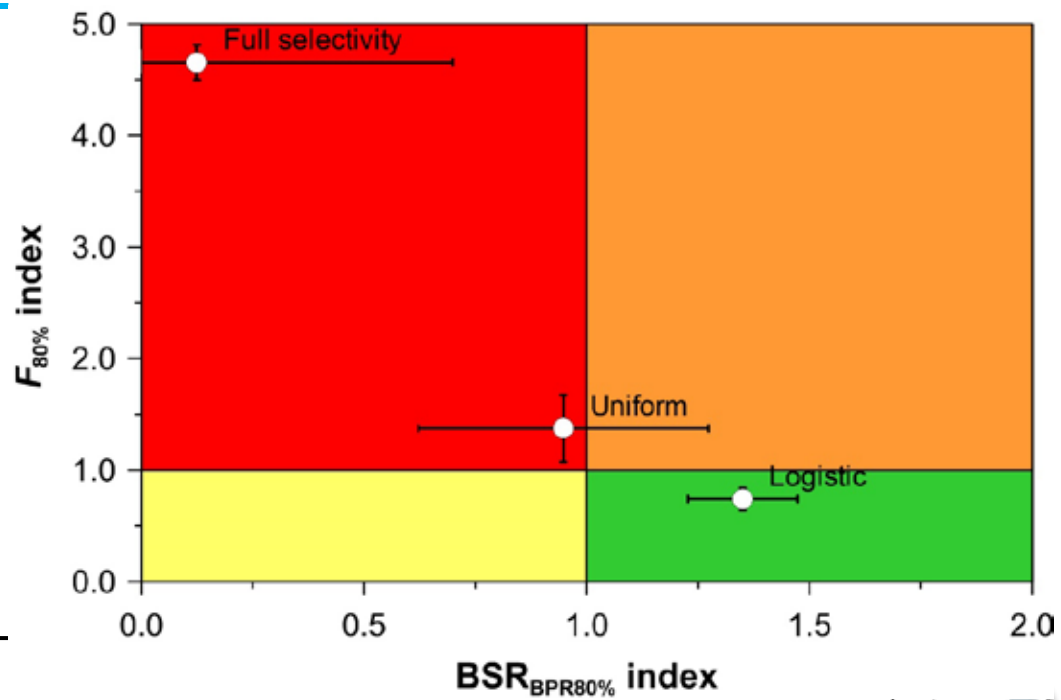

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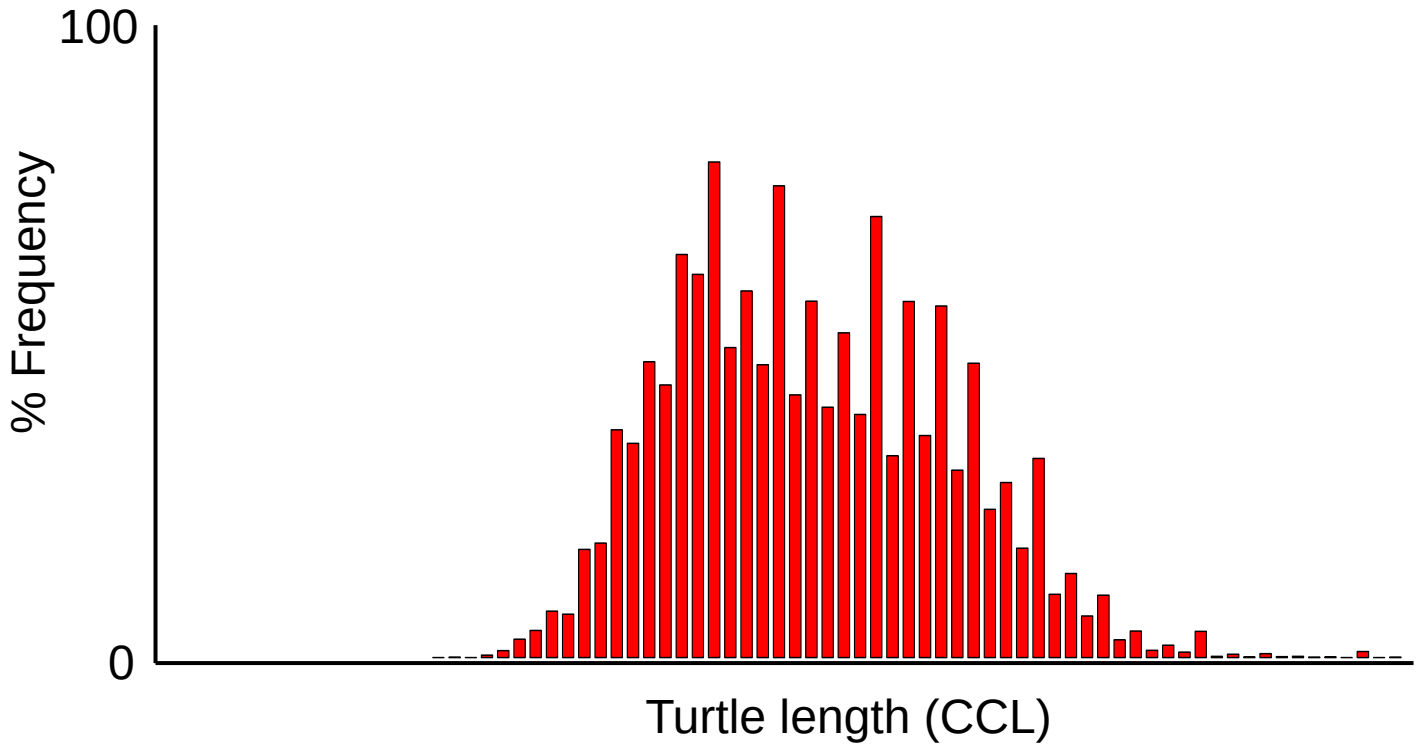

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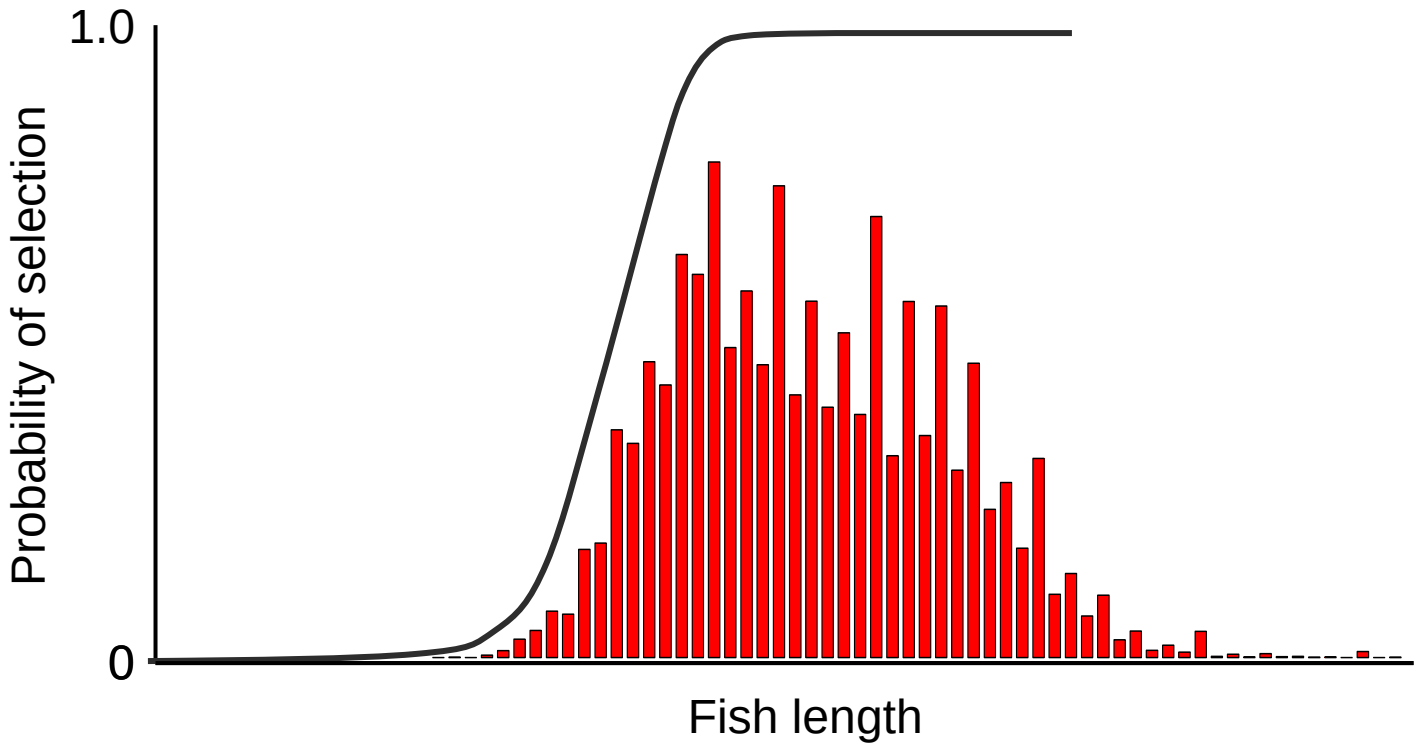

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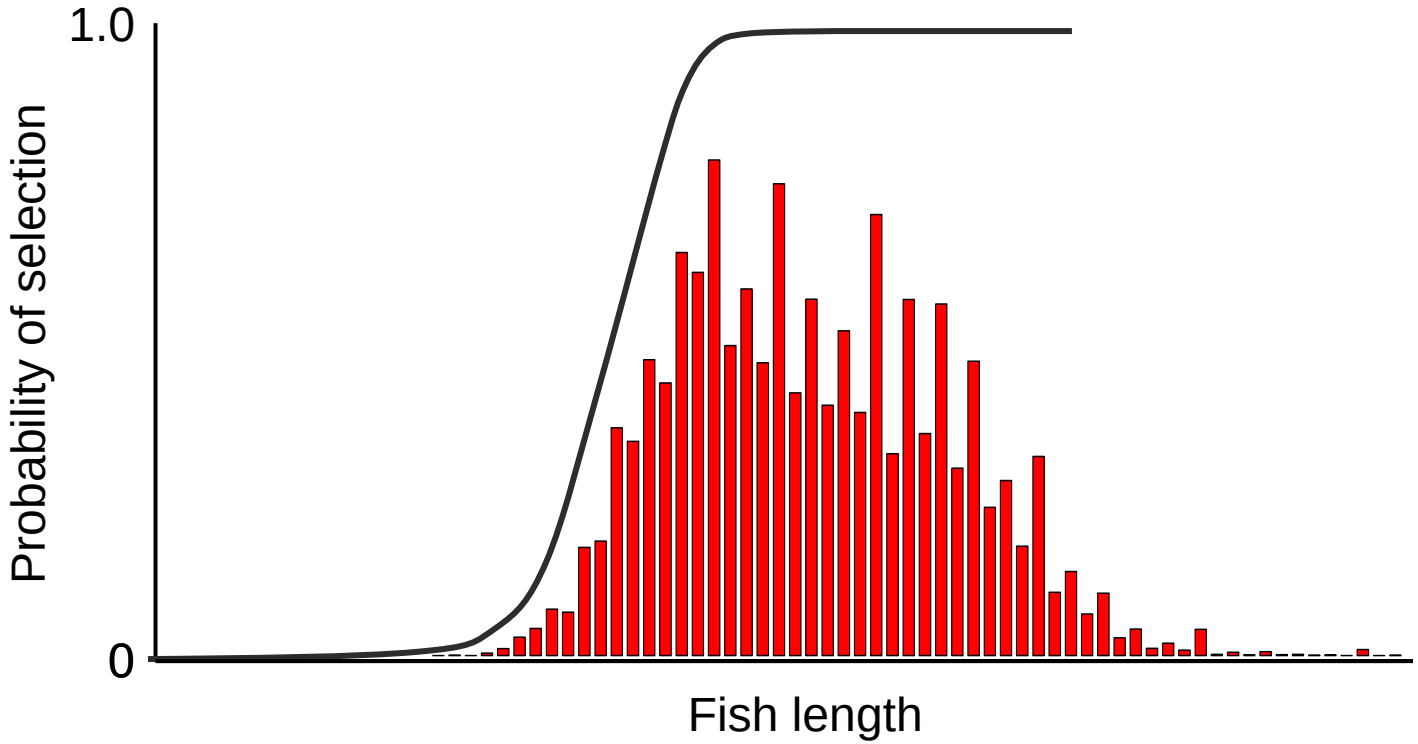

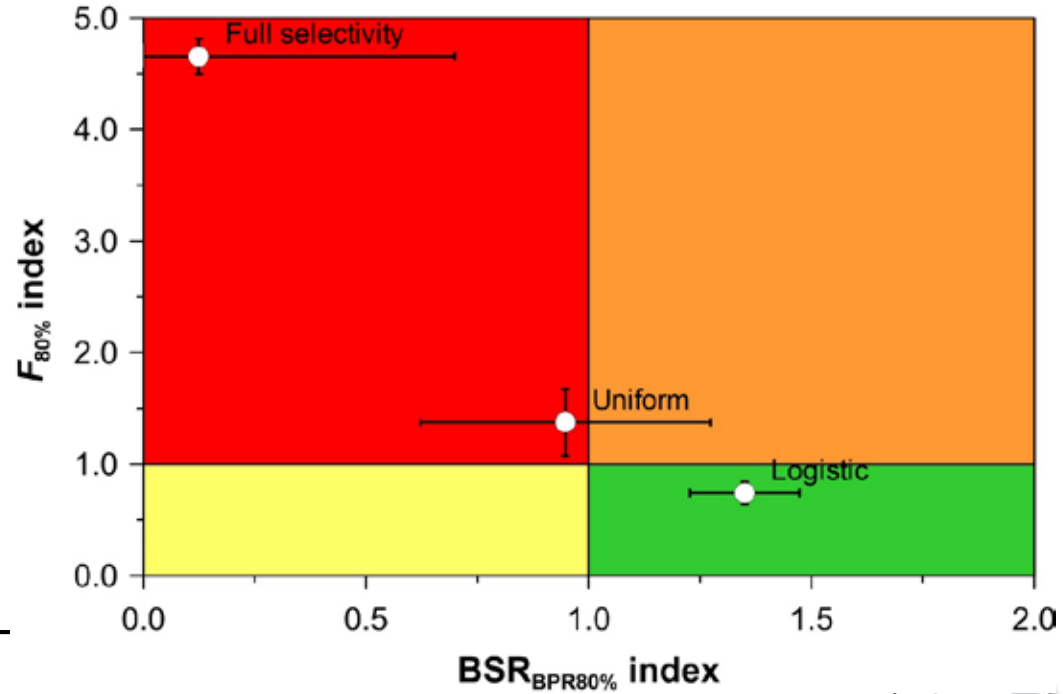

Summary

- Assessment methods to prioritize and assess data-poor bycatch species have significantly improved
- Only small improvements to data reporting significantly improves the reliability of results, which may change management advice
- Simple examples were shown for improving spatial resolution of catch/effort and size data reporting
- Other data field requests for industrial LL will further improve assessment quality (e.g. HPB, length of floatline)
- HPB and other gear characteristics may allow sets to be identified as shallow or deep sets where catchability can be better determined
- EASI-Fish currently can only assume a ‘worst case’ the all sets are deep, possibly resulting in an overestimate of fishery impact.

Questions?