NOAA FISHERIES

NMFS/SEFSC
Sustainable
Fisheries Division

Modeling Discards and ABC Determination

October, 2023 SAFMC SSC Meeting

Erik H. Williams
Chief, Atlantic Fisheries Branch

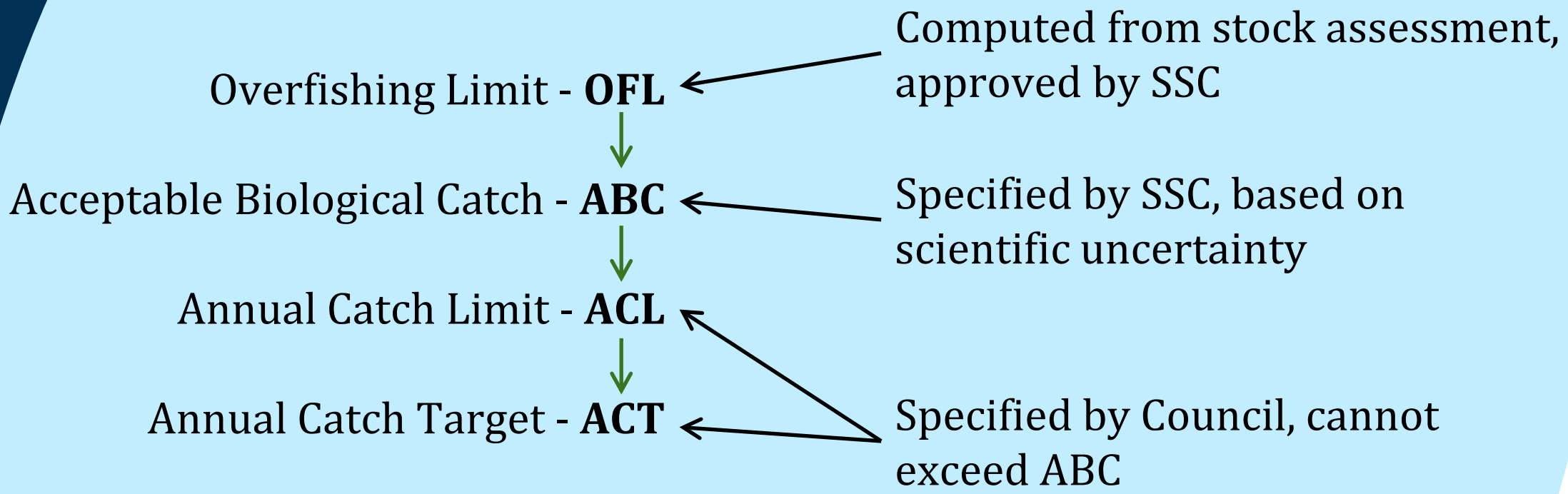
Request to SEFSC

The Council has requested an evaluation of how discards are addressed in applying sector allocations to develop ABC and ACL. Specifically, the Council is interested in allocating total stock removals to each sector to develop sector specific ABCs, and then subtracting sector-specific dead discards to provide sector ACLs expressed in landings.

To support this evaluation, Council requests, A presentation to the SSC in October 2023 on the recent paper describing pros and cons of developing sector ABCs with landings and discards and ACLs for landings, as mentioned during the June 2023 Council.

NOAA FISHERIES

ABC and the rest



NOAA FISHERIES

Ideal Path to ABCs

Stock Assessment Projections

↓

OFL_T based on benchmark (F_{MSY})

↓

SSC recommended ABC_T

↓

$ABC_L = ABC_T * \Phi$

$ABC_D = ABC_T * (1-\Phi)$

Where, ABC_T is ABC for total removals, ABC_L is ABC for landed catch, ABC_D is ABC for discarded catch (dead discards), and Φ is the proportion of landings to total removals

NOAA FISHERIES

Ideal Path to ABCs - Complications

Stock Assessment Projecti

OFL_T based on benchmark

SSC recommended ABC_T

$ABC_L = ABC_T * \Phi$

$ABC_D = ABC_T * (1-\Phi)$

Where, ABC_T is ABC for total removal
discarded catch (dead discards), and

Removals measured in different ways (e.g. numbers or weight)

F_{MSY}, ABC, and Φ are all conditional on:

- Selectivity
- Ratios of fleets
  - commercial:recreational
  - landings:discards

Management actions and/or natural variation can change the conditions

NOAA FISHERIES

Review of Benchmarks and Projections

Benchmarks (e.g. F_{MSY}) from stock assessments:

- Based on last 3 years in the stock assessment
- Sets the selectivity pattern for each fleet
  combined F-weighted selectivity used for benchmark
- Sets the fleet ratios
  ratio of commercial to recreational
  ratio of landings to discards
- Selectivity and fleet ratios fixed in projection analyses

<u>A basic fleet construct in our stock assessments:</u>

✓ Commercial landings fleet
✓ Commercial discard fleet
✓ Recreational landings fleet
✓ Recreational discard fleet

NOAA FISHERIES

Review of Benchmarks and Projections

Benchmarks (e.g. F_{MSY}) from stock assessments:

- Based on last 3 years in the stock assessment
- Sets the selectivity pattern for each fleet
  - combined F-weighted selectivity used for benchmark
- Sets the fleet ratios
  - ratio of commercial to recreational
  - ratio of landings to discards
- Selectivity and fleet ratios fixed in projection analyses

Conditional on these settings (assumptions)

<u>A basic fleet construct in our stock assessments:</u>

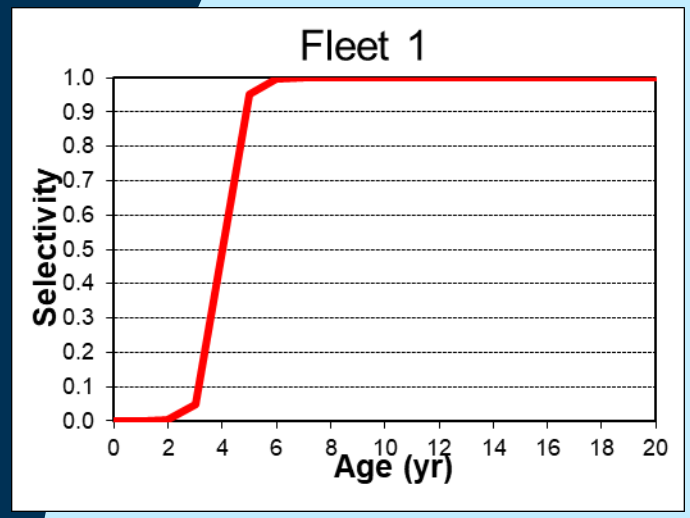
- ✓ Commercial landings fleet
- ✓ Commercial discard fleet
- ✓ Recreational landings fleet
- ✓ Recreational discard fleet

Typically our fleet structure is more complicated that this (e.g. recreational often broken down into for-hire and private boat)

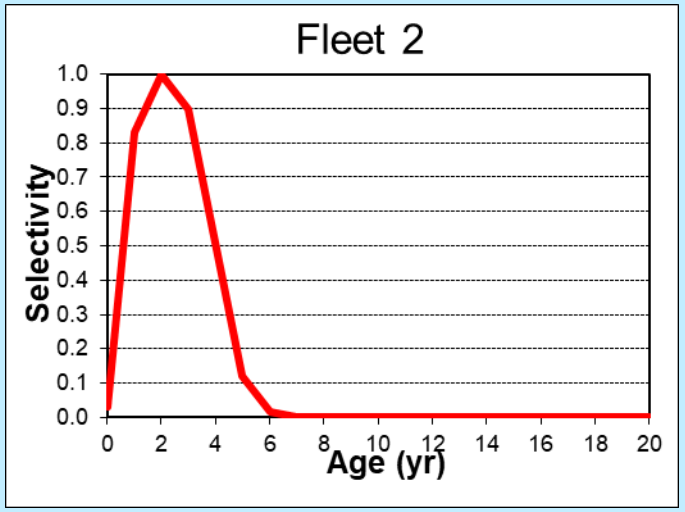
NOAA FISHERIES

Selectivity and Ratios Affect Benchmarks

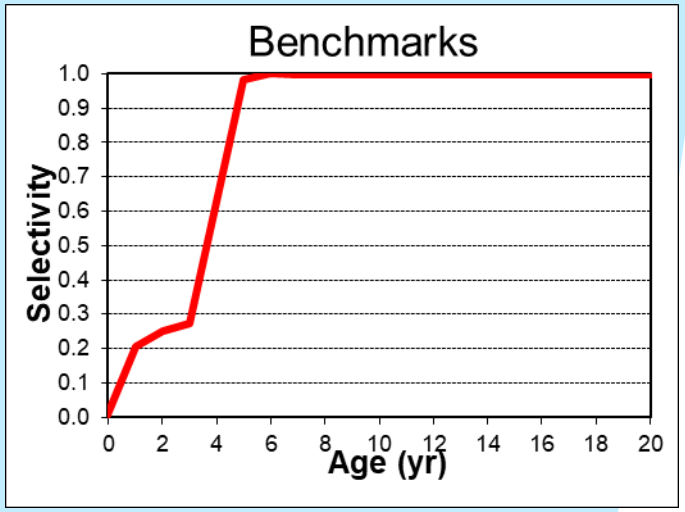
$F = 0.2$



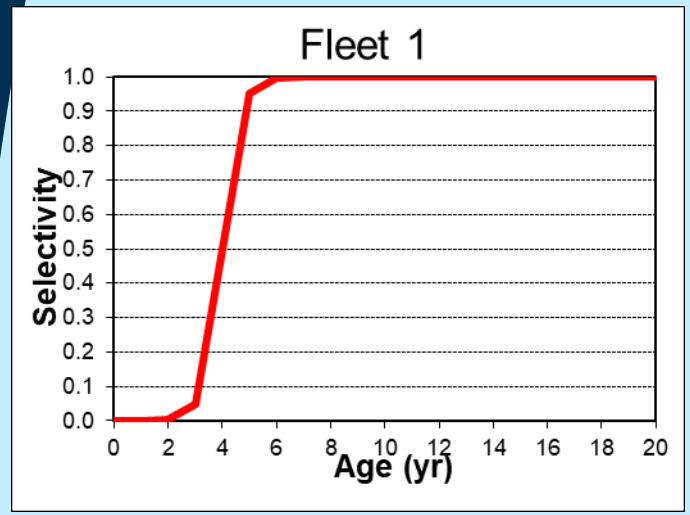
$F = 0.05$



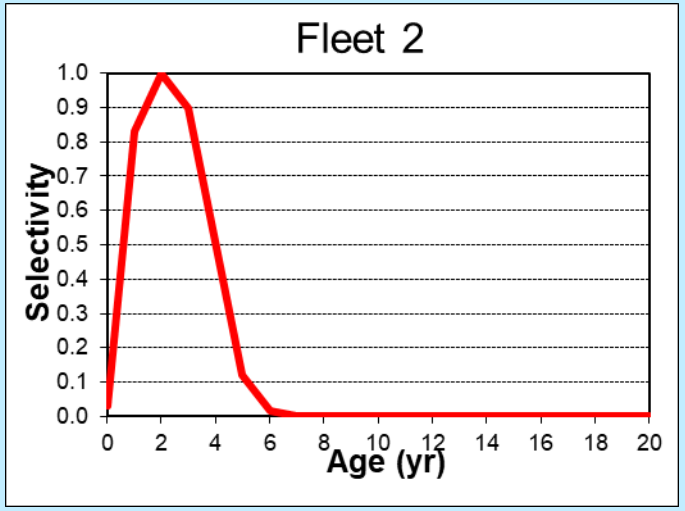
Selectivity re-scaled to max=1.0

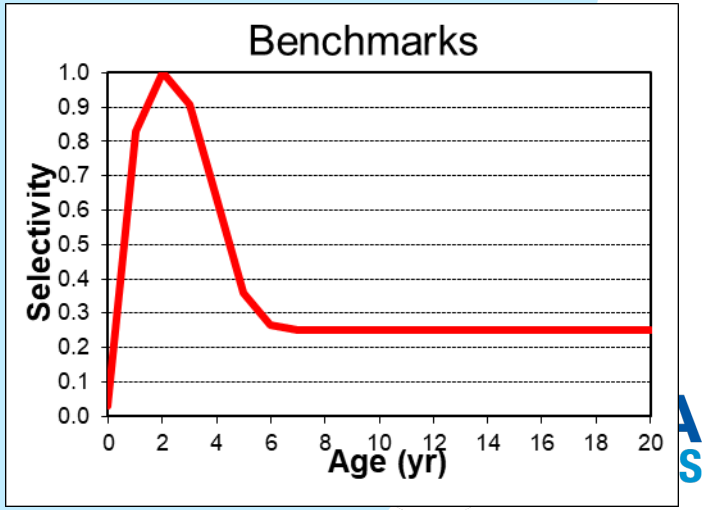


$F = 0.05$



$F = 0.2$





Landings and discards management

Implicitly linked

Management action controls landings only

- Set an ABC_L only (assumes L:D ratio unchanged)
- Set an ABC_T (assumes L:D ratio unchanged)

Explicitly managed separately

Management action controls landings and discards

- Set separate ABC_L and ABC_D

total removals (T), landed catch (L), and discarded catch (dead discards) (D)

NOAA FISHERIES

Landings and discards management

The preferred/current method used in South Atlantic

Implicitly linked

Management action controls landings only

- Set an ABC_L only (assumes L:D ratio unchanged)

Management action controls landings, but monitors total removals

- Set an ABC_T (assumes L:D ratio unchanged)

Explicitly managed separately

Management action controls landings and discards

- Set separate ABC_L and ABC_D

total removals (T), landed catch (L), and discarded catch (dead discards) (D)

NOAA FISHERIES

Landings and discards management

Current practice:

- Set an ABC_L only

<u>Problem with this approach</u>

Disjoint between projection analyses and management effects

Unaccounted and uncontrolled discards

Not modelled correctly in projection analyses

No input controls for open access recreational effort

NOAA FISHERIES

Assessment projections and management

Recent assessment projections are too simplistic:

- Assume total fishing mortality (F) will be reduced equally across all fleets, including discards
  - partly because we do not know what management is planned
  - partly because TORs for stock assessments call for projections at P* or 75%F_{MSY} (i.e. target ABC), but do not specify how

Management actions have effects that can change the assumptions implied by the assessment projections and benchmarks.

NOAA FISHERIES

Fisheries management effects

Cutting back landed catch on a single species in a multi-species fishery is not likely to impact recreational effort when other member species remain open to fishing.

Restricting landings without reducing fishing effort will likely shift landed fish to discards, thus discards will increase with all else being equal.

Implementing a new restrictive minimum size limit or bag limit will likely increase discards.

Closing an area or season to fishing will likely result in effort shifting, dependent on size/duration of closure.

Small enough bag limits will likely induce high grading.

NOAA FISHERIES

Fisheries management effects (cont'd)

Fishing effort typically does not magically go away, it shifts. Fishers have investments in their boat/equipment and this induces pressure to catch fish – they will find a way.

<u>What does this mean for our population projections?</u>

Better predictions needed of changes in fishing

- better communications with management to know input controls
- predict changes to targeting/discarding (e.g. selectivity)
- predict shifts in effort (e.g. F ratios)

NOAA FISHERIES

Deviations from assumptions

<u>When do benchmarks need to be re-computed?</u>

- An area for further analysis to determine when selectivity or fleet ratios change enough to warrant re-calculation of benchmarks

<u>How can we make projections match management action?</u>

- Need to understand what management actions are being considered when projection analysis is being set-up
- Need to better understand and model fleet responses to management actions
    - Research into past actions and responses could be useful

NOAA FISHERIES

Review of Bohaboy et al (2022)

Fisheries Research 250 (2022) 106268

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

A simulation framework to assess management trade-offs associated with recreational harvest slots, discard mortality reduction, and bycatch accountability in a multi-sector fishery

Erin C. Bohaboy [a,b,*], Daniel R. Goethel [c,d], Shannon L. Cass-Calay [c], William F. Patterson III [a]

[a] Fisheries and Aquatic Sciences, School of Forest Resources and Conservation, University of Florida, 7922 NW 71st Street, Gainesville, FL 32653, United States
[b] National Marine Fisheries Service, Pacific Islands Fisheries Science Center, 1845 Wasp Boulevard, Building 176, Honolulu, HI 96818, United States
[c] National Marine Fisheries Service, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, FL 33149, United States
[d] National Marine Fisheries Service, Alaska Fisheries Science Center, 17109 Point Lena Loop Road, Juneau, AK 99801, United States

ARTICLE INFO

Handled by Dr Niels Madsen

Keywords:
Harvest slots
Discard mortality
Management
Simulation
Recreational fisheries

ABSTRACT

We developed a simulation framework to explore the combined effects of harvest slot regulations, reductions in recreational discard mortality rate, and alternate bycatch accountability approaches on fishery management performance measures representing a broad range of stakeholder interests in a multi-sector marine fishery. Simulation results indicated reductions in recreational discard mortality rate, alone or combined with harvest slot regulations, may result in longer recreational fishing seasons, increased recreational catch rates, reduced dead discarded biomass, and an increase in the population of reproductively valuable older fish. Based on application to Gulf of Mexico red snapper (*Lutjanus campechanus*), we demonstrate the trade-offs among competing management objectives and illustrate how reduced recreational discard mortality rates and allocation of catch quotas between recreational and commercial sectors based on total dead biomass versus landed catch alone can influence the efficacy of regulatory actions. We suggest increased use of simulation analyses is warranted to aid fisheries management decision making and can spur development of performance measures that better communicate trade-offs among the diverse objectives of stakeholders in multi-sector marine fisheries.

NOAA FISHERIES

Review of Bohaboy et al (2022)

The paper examines management and population outcomes relative to various input controls through simulation analysis, including:

- Slot regulations
- Changes to discard mortality rates and total discards
- Changes to recreational limits and seasons
- Focus on Red Snapper in the Gulf of Mexico

Results:

Analysis demonstrates the trade-offs among competing management objectives and illustrates how:

(i) reduced recreational discard mortality rates and
(ii) allocation of catch quotas between recreational and commercial sectors based on total dead biomass versus landed catch alone

can influence the efficacy of regulatory actions.

NOAA FISHERIES

Review of Bohaboy et al (2022)

Results (cont'd):

Reductions in recreational discard mortality rate, alone or combined with harvest slot regulations, may result in:

- longer recreational fishing seasons
- increased recreational catch rates
- reduced dead discarded biomass
- increase in the population of reproductively valuable older fish.

Authors suggest increased use of simulation analyses is warranted to aid fisheries management decision making and spur development of performance measures that better communicate trade-offs among the diverse objectives of stakeholders in multi-sector marine fisheries.

NOAA FISHERIES

Review of Bohaboy et al (2022)

<u>How can this apply to the South Atlantic?</u>

Authors suggest increased use of simulation analyses to aid fisheries management decision making.

Similar to the analysis presented to you by Shertzer et al. at your October, 2022 meeting.

- single species example of this using Red Snapper to be published soon

Authors recommend managing ABC_L and ABC_D explicitly

NOAA FISHERIES

Summary

(1) Managing by ABC_L is current practice and recommended by SEFSC

(2) Bohaboy et al recommends managing by explicit ABC_L and ABC_D

Effective difference between (1) or (2) depends on degree to which discards are accounted for in calculations and controlled so that deviations from assumptions are minimized

(3) Need better communications during assessment projection development stage on types of management actions being considered. Better TORs for assessment projections.

(4) Need to improve assessment projection accuracy

- better predictions of management effects
- continue significant time series trends?

NOAA FISHERIES

Ideally

Projection analyses would:

- include more accurate predictions of recruitment, management effects, and make use of significant time series trends
- be a part of pre-review SEDAR process and ultimately included in the final report

SSC could set the final ABC at the same time stock assessment is reviewed

Management establishes effective input controls for landings and discards

Routinely review projection analysis and management performance

Questions?

NOAA FISHERIES