draft working paper for peer review only

Butterfish

2020 Assessment Update Report

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

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This assessment of the butterfish (Peprilus triacanthus) stock is a a Level-2 management track assessment of the existing benchmark assessment (NEFSC 2014). Based on the previous assessment update (Adams 2018), the stock was not overfished, and overfishing was not occurring. This assessment updates commercial fishery catch data, research survey indices of abundance, the analytical ASAP4 assessment model, and reference points through 2019. Additionally, stock projections have been updated through 2022

Not ASAP3

State of Stock: Based on this updated assessment, the butterfish (*Peprilus triacanthus*) stock is not overfished and overfishing is not occurring (Figures 1-2). Retrospective adjustments were not made to the model results. Spawning stock biomass (SSB) in 2019 was estimated to be 29,308 (mt) which is 69% of the biomass target (SSB_{MSY} *proxy* = 42,427; Figure 1). The 2019 fully selected fishing mortality was estimated to be 0.21 which is 24% of the overfishing threshold proxy (F_{MSY} *proxy* = 0.86; Figure 2).

Table 1: Catch and status table for butterfish. All weights are in (mt) recruitment is in (millions) and F_{Full} is the fishing mortality on fully selected ages (ages 2-4). Model results are from the current updated ASAP4 assessment.

	2013	2014	2015	2016	2017	2018	2019
Data							
Commercial landings	1,091	3,135	2,104	1,194	3,681	1,673	3,431
Commercial discards	434	1,047	826	1,520	940	1,380	1,651
Catch for Assessment	1,525	4,182	2,930	2,714	4,621	3,053	5,082
Model Results							
Spawning Stock Biomass	36,325	53,665	67,674	51,243	35,347	27,508	29,308
F_{Full}	0.04	0.09	0.05	0.05	0.14	0.11	0.21
Recruits (age 0)	6,439	9,586	4,540	3,295	2,768	3,782	2,932

Table 2: Comparison of reference points estimated in the 2017 assessment and from the current assessment update. An F_{MSY} proxy was used for the overfishing threshold and was based on $2M/3$ (Patterson 1992).

	2017	2020
F_{MSY} *proxy*	0.82	0.86
SSB_{MSY} (mt)	48,681	42,427
MSY (mt)	38,694	31,136
Median recruits (age 0) (millions)	8,368	8,693
Overfishing	No	No
Overfished	No	No

Projections: Short term projections of catch and SSB were derived by sampling from a cumulative distribution function of ASAP4 recruitment estimates for 1989-2019. The annual fishery selectivity, maturity ogive, and mean weights at age used in the projections are the time series averages. Retrospective adjustments were not applied in the projections.

Table 3: Short term projections of total fishery catch and spawning stock biomass for butterfish based on a harvest scenario of fishing at F_{MSY} *proxy* between 2021 and 2022. Catch in 2020 was assumed equal to the Domestic Annual Harvest quota 23,752 (mt).

Year	Catch (mt)	SSB (mt)	F_{Full}
2020	23,752	17,324	1.305

Year	Catch (mt)	SSB (mt)	F_{Full}
2021	19,588	29,784	0.860
2022	28,239	39,956	0.860

Special Comments:

- What are the most important sources of uncertainty in this stock assessment? Explain, and describe qualitatively how they affect the assessment results (such as estimates of biomass, F, recruitment, and population projections).

  Discard estimates are highly variable and imprecise with CVs prior to 2010 ranging from 0.23 to 1.44.

  The commercial catch is aged with NEFSC survey age-length keys so the catch at age and mean weights at age are uncertain.

  The application of an assumed q to estimate M is a source of uncertainty. Additionally, this estimated q assumes that the FSV Henry B. Bigelow is 100% efficient at sampling butterfish during the daytime.

- Does this assessment model have a retrospective pattern? If so, is the pattern minor, or major? (A major retrospective pattern occurs when the adjusted SSB or F_{Full} lies outside of the approximate joint confidence region for SSB and F_{Full}).

  No retrospective adjustment of spawning stock biomass or fishing mortality in 2019 was required.

- Based on this stock assessment, are population projections well determined or uncertain? If this stock is in a rebuilding plan, how do the projections compare to the rebuilding schedule?

  Population projections for butterfish are reasonably well determined. The stock is not in a rebuilding plan.

- Describe any changes that were made to the current stock assessment, beyond incorporating additional years of data and the effect these changes had on the assessment and stock status.

  The time series of discards was re-estimated to incorporate changes made to the underlying data. The NEAMAP indices at age were re-estimated using the NEAMAP age-length key. These changes had no impact on stock status.

- If the stock status has changed a lot since the previous assessment, explain why this occurred.

  Stock status has not changed since the previous assessment.

- Provide qualitative statements describing the condition of the stock that relate to stock status.

Fishing mortality during 2017-2019 has been the highest in the time series, but in 2019 it still remains 76% below the F_{MSY} proxy = 0.86. While SSB has been below the SSB_{MSY} proxy during the same time period, it is 38% above the $SSB_{Threshold}$ (21,214 mt) in the terminal year.

- Indicate what data or studies are currently lacking and which would be needed most to improve this stock assessment in the future.

  There is stakeholder interest in evaluating approaches to include the various state surveys in the assessment model. This will be addressed in the upcoming research track assessment scheduled for fall 2021. Additional research recommendations can be found in the most recent benchmark assessment (NEFSC 2014).

- Are there other important issues?

  As in the previous assessment update (Adams 2018) biological references points were recalculated based on advice from the Mid-Atlantic Fishery Management Council Science and Statistical Committee to enable internal consistency with the ASAP4 estimate of M.

  The natural mortality estimate from the previous assessment update (M = 1.25) changed to M = 1.29 in the current assessment update.

  Updates to the thermal habitat index are no longer available. Thus, the time series mean (A = 0.62) for 1989-2015 from the previous assessment update (Adams 2018) was used for the current assessment update.

  The NEFSC fall offshore index for 2017 was set to -999 in the ASAP4 model due to only 11 of 59 strata being sampled that year.

References:

Adams CF. 2018. Butterfish 2017 Stock Assessment Update. US Dep Commer, Northeast Fish Sci Cent Ref Doc. 18-05. 31 p. CRD18-05

Northeast Fisheries Science Center (NEFSC). 2014. 58^{th} Northeast Regional Stock Assessment Workshop (58^{th} SAW) Assessment Report. US Dep Commer, Northeast Fish Sci Cent Ref Doc. 14-04. 784 p. CRD14-03

Patterson K. 1992. Fisheries for small pelagic species: an empirical approach to management targets. Rev Fish Biol Fisher 2(4):321-338

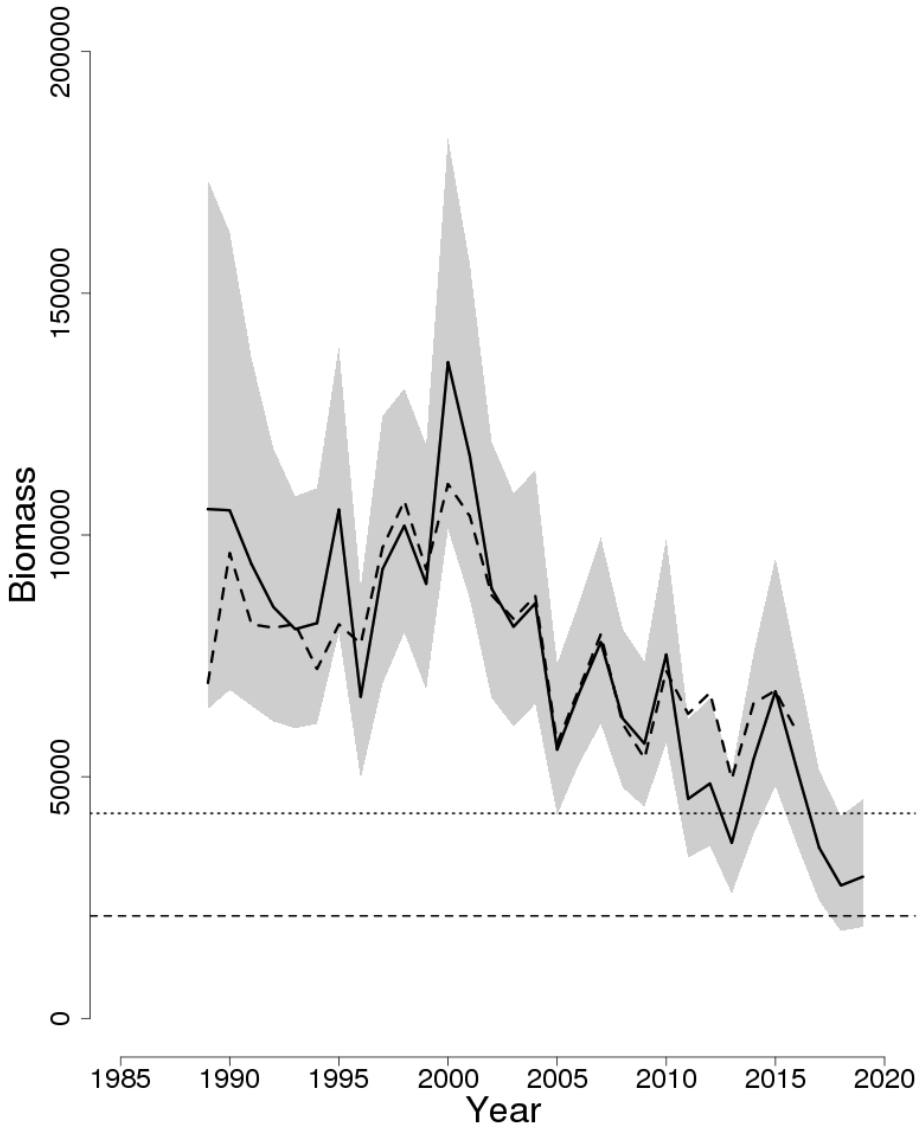

Figure 1: Trends in spawning stock biomass of butterfish between 1989 and 2019 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ SSB_{MSY} *proxy*; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} *proxy*; horizontal dotted line) based on the 2020 assessment. Biomass was not adjusted for a retrospective pattern. The approximate 90% lognormal confidence intervals are shown.

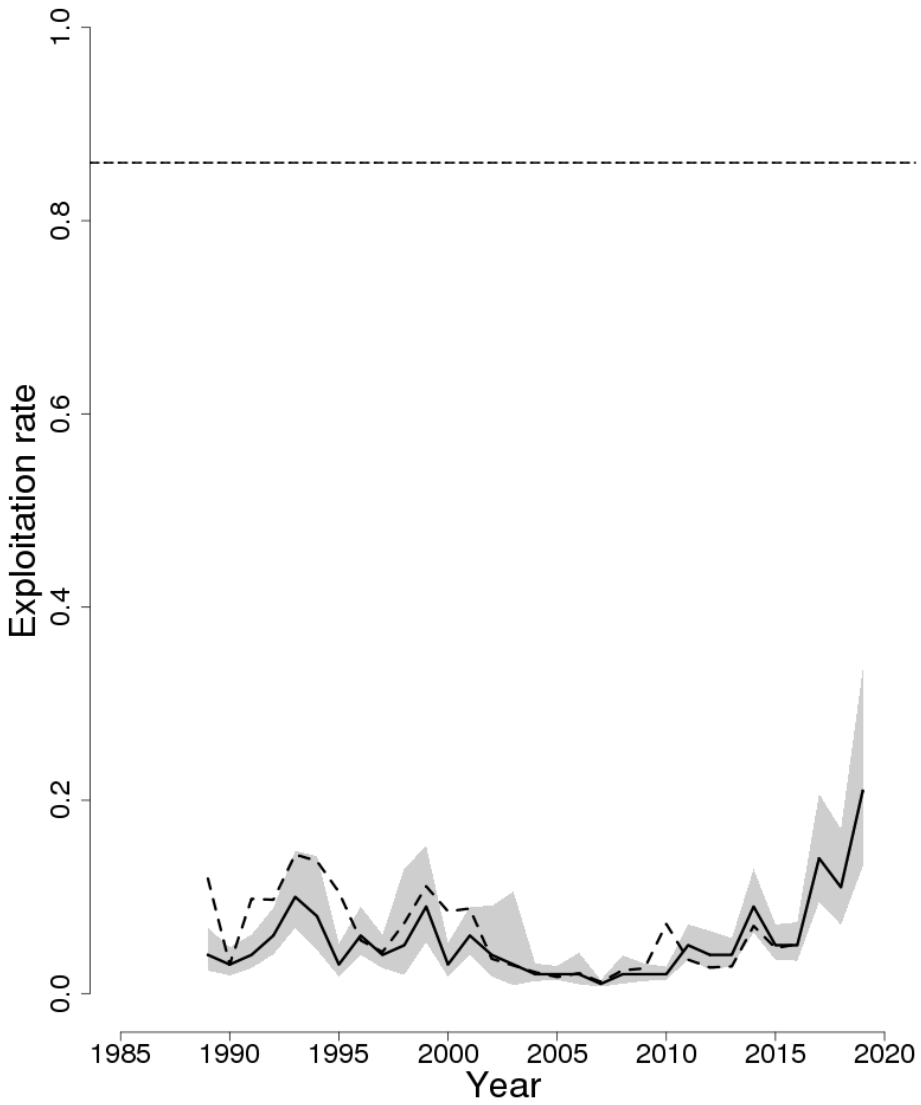

Figure 2: Trends in the fully selected fishing mortality (F_{Full}) of butterfish between 1989 and 2019 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{Threshold}$ (F_{MSY} *proxy*=0.86; horizontal dashed line). F_{Full} was not adjusted for a retrospective pattern. The approximate 90% lognormal confidence intervals are shown.

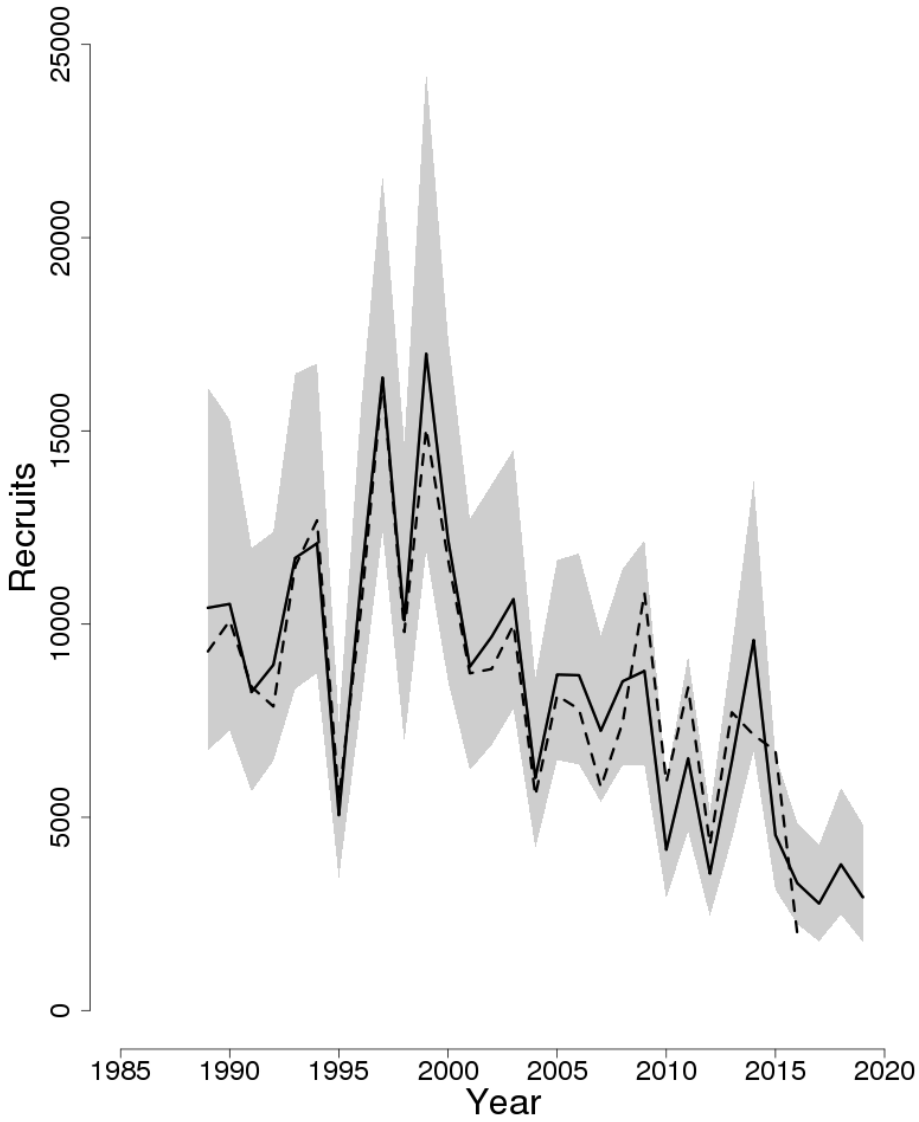

Figure 3: Trends in age 0 recruits (millions) of butterfish between 1989 and 2019 from the current (solid line) and previous (dashed line) assessment. The approximate 90% lognormal confidence intervals are shown.

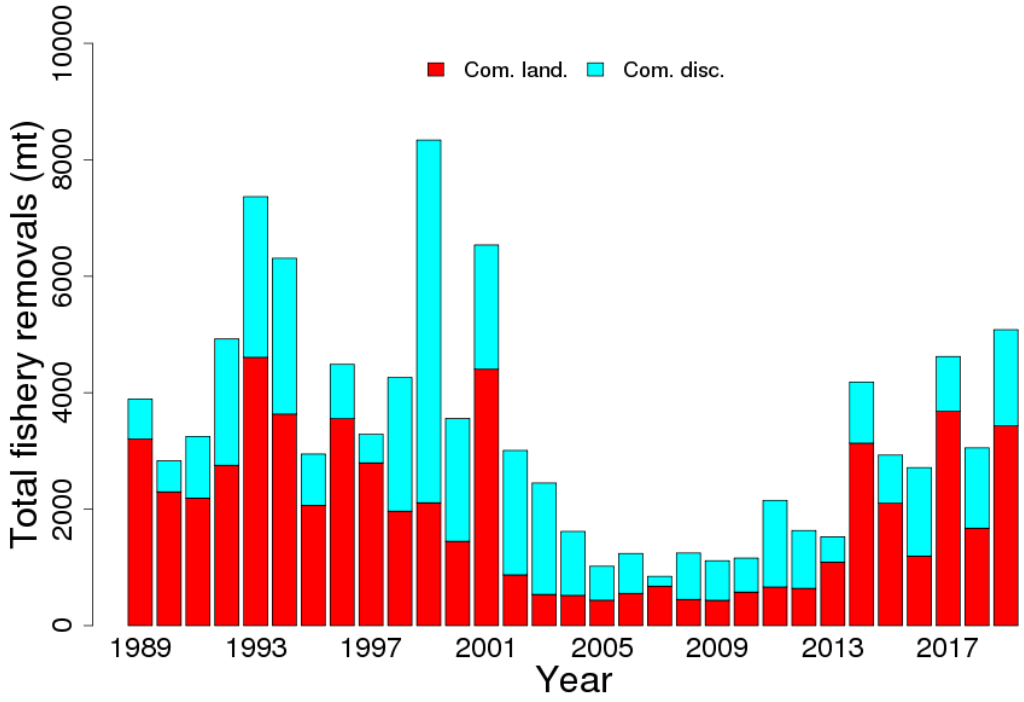

Figure 4: Total commercial catch of butterfish between 1989 and 2019 by disposition (landings and discards).

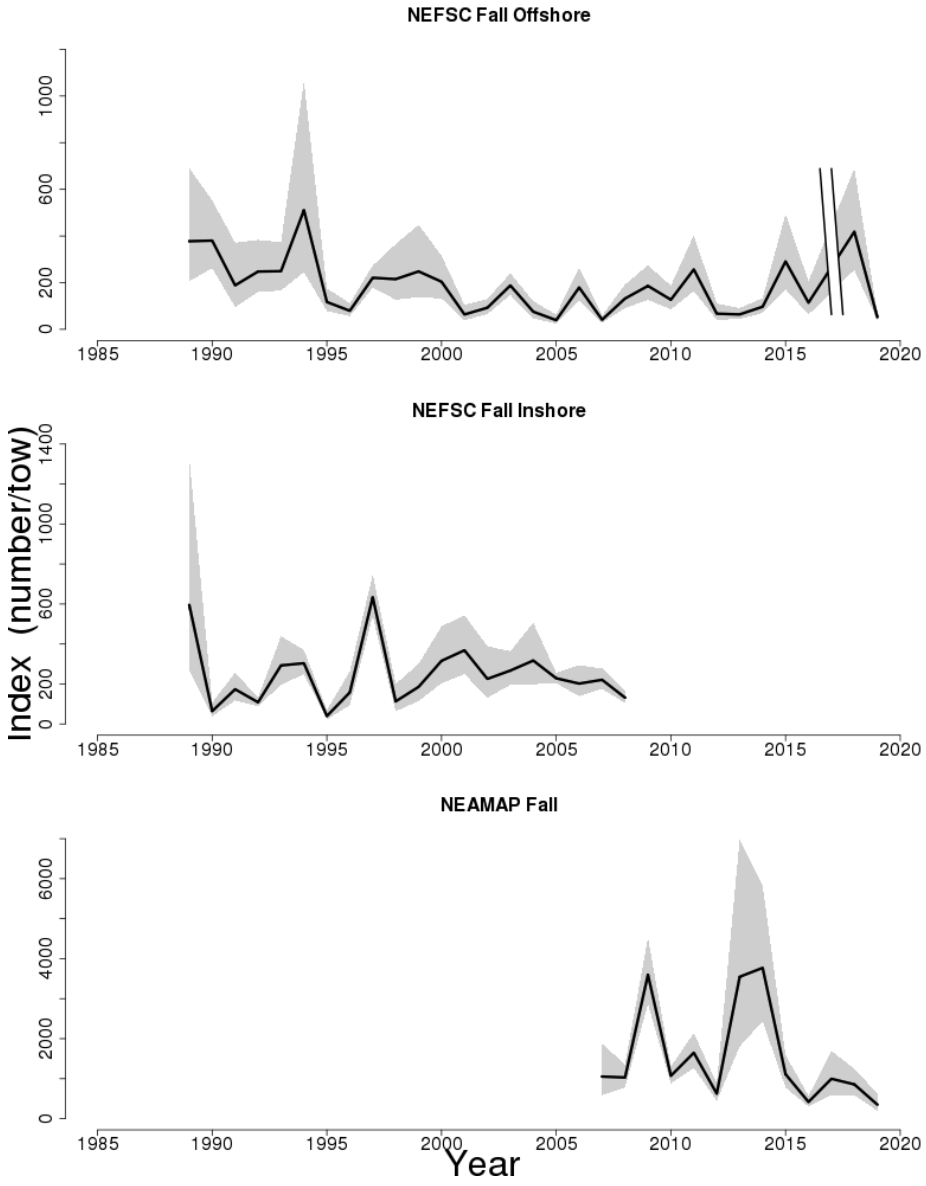

Figure 5: Indices of abundance for butterfish between 1989 and 2019 for the Northeast Fisheries Science Center (NEFSC) fall offshore and inshore bottom trawl surveys, and the Northeast Area Monitoring and Assessment Program (NEAMAP) fall survey. The approximate 90% lognormal confidence intervals are shown.The NEFSC fall offshore index for 2017 is NA due to only 11 of 59 strata being sampled that year.