# 13 White hake

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*This assessment of the white hake (Urophycis tenuis) stock is an operational update of the 2015 operational assessment (NEFSC 2015) and the last benchmark assessment (NEFSC 2013). Based on the previous assessment the stock was not overfished and overfishing was not ocurring. This assessment updates commercial fishery catch data, research survey indices of biomass, and the ASAP assessment model and reference points through 2016. Stock projections have been updated through 2020.*

**State of Stock:** Based on this updated assessment, the white hake (*Urophycis tenuis*) stock is not overfished and overfishing is not occurring (Figures 63-64). Retrospective adjustments were made to the model results. Spawning stock biomass (SSB) in 2016 was estimated to be 21,276 (mt) which is 69% of the biomass target ($SSB_{MSY}$ *proxy* = 30,948; Figure 63). The 2016 fully selected fishing mortality was estimated to be 0.066 which is 36% of the overfishing threshold proxy ($F_{MSY}$ *proxy* = 0.1839; Figure 64).

Table 40: Catch and ASAP results table for white hake. All weights are in (mt) recruitment is in (000s) and $F_{Full}$ is the fishing mortality on fully selected ages (ages 6 - 9+). Model results are from the current ASAP assessment.

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Data* | | | | | |
| Commercial discards | 36 | 171 | 83 | 91 | 54 | 34 | 28 | 33 | 24 | 32 |
| Commercial landings | 1,530 | 1,340 | 1,712 | 1,820 | 2,899 | 2,771 | 2,235 | 1,887 | 1,632 | 1,325 |
| Canadian landings | 56 | 39 | 79 | 104 | 86 | 83 | 43 | 35 | 25 | 39 |
| Other landings | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Catch for Assessment | 1,621 | 1,543 | 1,859 | 2,002 | 3,039 | 2,887 | 2,306 | 1,980 | 1,680 | 1,396 |
| | | | | | *Model Results* | | | | | |
| Spawning Stock Biomass | 12,351 | 13,678 | 13,801 | 17,836 | 21,517 | 22,534 | 23,221 | 22,652 | 21,600 | 25,638 |
| $F_{Full}$ | 0.148 | 0.133 | 0.16 | 0.127 | 0.163 | 0.152 | 0.115 | 0.099 | 0.085 | 0.058 |
| Recruits (age 1) | 3,335 | 3,822 | 3,858 | 3,359 | 3,072 | 2,746 | 2,820 | 2,896 | 5,497 | 4,925 |

Table 41: Comparison of reference points estimated in the 2015 assessment and from the current assessment update. An $F_{40\%}$ proxy was used for the overfishing threshold and was based on long-term stochastic projections which sampled from a cumulative distribution function of recruitment estimates from ASAP from 1963-2014. The annual fishery selectivity, maturity ogive, and mean weights at age used in the projection are the most recent 5 year averages.

| | 2015 | 2017 |
|---|---|---|
| $F_{MSY}$ *proxy* | 0.188 | 0.1839 |
| $SSB_{MSY}$ (mt) | 32,550 | 30,948 (24,833 - 39,004) |
| MSY (mt) | 5,422 | 4,867 (3,907 - 6,133) |
| Median recruits (age 1) (000s) | 4,608 | 4,616 |
| *Overfishing* | No | No |
| *Overfished* | No | No |

**Projections:** Short term projections of catch and SSB were derived by sampling from a cumulative distribution function of recruitment estimates from ASAP from 1995-2014. The annual fishery selectivity, maturity ogive, and mean weights at age used in the projection are the most recent 5 year averages. The numbers-at-age used to start the projections were adjusted for retrospective bias using age-specific rho estimates.

Table 42: Short term projections of total fishery catch and spawning stock biomass for white hake based on a harvest scenario of fishing at $F_{MSY}$ *proxy* between 2018 and 2020. Catch in 2017 was assumed to be 1,634 (mt) which is 34% of the 2017 OFL.

| Year | Catch (mt) | SSB (mt) | $F_{Full}$ |
|---|---|---|---|
| 2017 | 1,634 | 23,553 (19,971 - 27,472) | 0.077 |

| Year | Catch (mt) | SSB (mt) | $F_{Full}$ |
|---|---|---|---|
| 2018 | 3,885 | 24,720 (21,017 - 28,888) | 0.1839 |
| 2019 | 3,753 | 23,936 (20,521 - 27,863) | 0.1839 |
| 2020 | 3,645 | 22,963 (19,929 - 26,483) | 0.1839 |

**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).

  *1. Catch at age information is not well characterized due to possible mis-identification of species in the commercial and observer data, particularly in early years, low sampling of commercial landings in some years, and sparse discard length data, particularly in early years.*

  *2. Since the commercial catch is aged primarily with survey age/length keys, there is considerable augmentation required, mainly for ages 5 and older. The numbers at age and*

*mean weights at age in the catch for these ages may therefore not be well specified.*

*3. White hake may move seasonally into and out of the defined stock area.*

*4. There are no commercial catch at age data prior to 1989 and the catchability of older ages in the surveys is very low. This results in a large uncertainty in starting numbers at age.*

*5. Since 2003, dealers have apparently been culling extra-large fish out of the large category. However, there was no market category for landings until June 2014. The length compositions are distinct from fish characterized as large and have been identified since 2011. This may bias the age composition of the landings, particularly in 2014 when 2000 of the 5000 large samples were these extra-large fish.*

*6. A pooled age/length key is used for 1963-1981 and fall 2003 (second half of commercial key).*

- 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 $F_{Full}$; see Table 8).

  *The 7-year Mohn's ρ, relative to SSB, was 0.18 in the 2015 assessment and was 0.22 in 2016. The 7-year Mohn's ρ, relative to F, was -0.12 in the 2015 assessment and was -0.15 in 2016. There was a major retrospective pattern for this assessment because the ρ adjusted estimate of 2016 SSB ($SSB_{\rho}$=21276) was outside the approximate 90% confidence regions around SSB (21,466 - 30,052). A retrospective adjustment was made for both the determination of stock status and for projections of catch in 2018. The retrospective adjustment changed the 2016 SSB from 25,638 to 21,276 and the 2016 $F_{Full}$ from 0.058 to 0.066.*

- 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 white hake are not well determined and projected biomass from the last assessment was outside the confidence bounds of the biomass estimated in the current assessment. The rebuilding deadline for this stock was 2014 and the stock is not yet rebuilt.*

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

  *The 2014 catches-at-age were re-estimated for landings, discards, and both surveys. The annual spring and fall age/length keys were completed and used to estimate the catches-at-age.*

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

  *While stock status of white hake has not changed, the stock has not rebuilt even with a very low fishing mortality. The change in the 2014 catch-at-age by using annual age/length keys resulted in a lower SSB in 2014 before additional years were added.*

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

  *The white hake stock shows no truncation of age structure. There may be a year class (2015 Age 1) that is above average. Estimates of commercial landings and discards have decreased over time.*

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

  *Age structures collected by the observer program are available and should be aged to augment the survey keys. They are also available from the ASMFC shrimp survey and would allow another survey to be added to the model. Otoliths are currently being collected from the market category for heads and these should also be aged.*

- Are there other important issues?

  *None.*

## 13.1 Reviewer Comments: White hake

**Assessment Recommendation:**

The panel concluded that the operational update assessment with adjustments for retrospective bias was acceptable as a scientific basis for management advice.

**Alternative Assessment Approach:**

Not applicable

**Status Recommendation:**

Based on this updated assessment, the panel agrees with the recommendation that the white hake stock is not overfished and overfishing is not occurring. The white hake stock shows no truncation of age structure. There may be a year class (2015 Age 1) that is above average. Also, estimates of commercial landings and discards have decreased over time.

**Key Sources of Uncertainty:**

The primary sources of uncertainty affecting this stock are as follows:

Catch at age information is not well characterized due to possible mis-identification of species in the commercial and observer data, particularly in early years, low sampling of commercial landings in some years, and sparse discard length data, particularly in early years.

Since the commercial catch is aged primarily with survey age/length keys, there is considerable augmentation required, mainly for ages 5 and older. The numbers at age and mean weights at age in the catch for these ages may therefore not be well specified.

White hake may move seasonally into and out of the defined stock area.

There are no commercial catch at age data prior to 1989 and the catchability of older ages in the surveys is very low. This results in a large uncertainty in starting numbers at age.

Since 2003, dealers have apparently been culling extra-large fish out of the large category. However, there was no market category for landings until June 2014. The length compositions are distinct from fish characterized as large and have been identified since 2011. This may bias the age composition of the landings, particularly in 2014 when 2000 of the 5000 large samples were these extra-large fish.

A pooled age/length key is used for 1963-1981 and fall 2003 (second half of commercial key).

**Research Needs:**

The panel recommends that the age structures collected by the observer program should be aged to augment the survey keys. Ages are also available from the Atlantic States Marine Fisheries Commission (ASMFC) shrimp survey and this would allow another survey to be added to the model. Otoliths are currently being collected from the sow market category and these should also be aged. The panel also recommends considering and evaluating the addition of recreational catch and discards in a future assessment. Another recommendation is to consider market categories and how landings are aggregated in the model. Finally, the longline survey should be considered for inclusion in a future assessment.

**References:**

NEFSC. 2013. $56^{th}$ Northeast Regional Stock Assessment Workshop ($56^{th}$ SAW) Assessment Report.US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 13-10; 868 p. http://www.nefsc.noaa.gov/publications/crd/crd1310/

NEFSC. 2015. Operational Assessment of 20 Northeast Groundfish Stocks Updated Through 2014.US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 15-24; 251 p. http://www.nefsc.noaa.gov/publications/crd/crd1524/

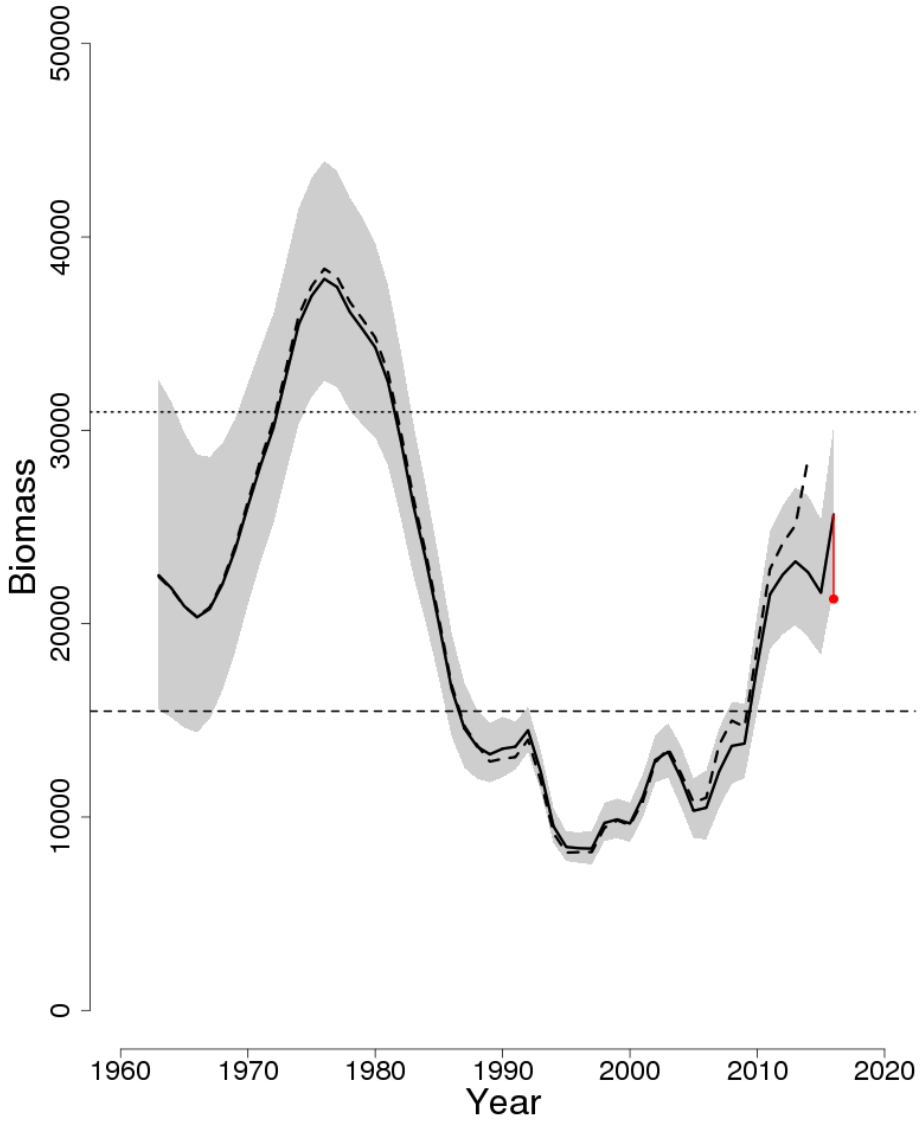


Figure 63: Trends in spawning stock biomass of white hake between 1963 and 2016 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{Threshold}$ ($\frac{1}{2}$ $SSB_{MSY}$ *proxy*; horizontal dashed line) as well as $SSB_{Target}$ ($SSB_{MSY}$ *proxy*; horizontal dotted line) based on the 2017 assessment. Biomass was adjusted for a retrospective pattern and the adjustment is shown in red. The approximate 90% lognormal confidence intervals are shown.

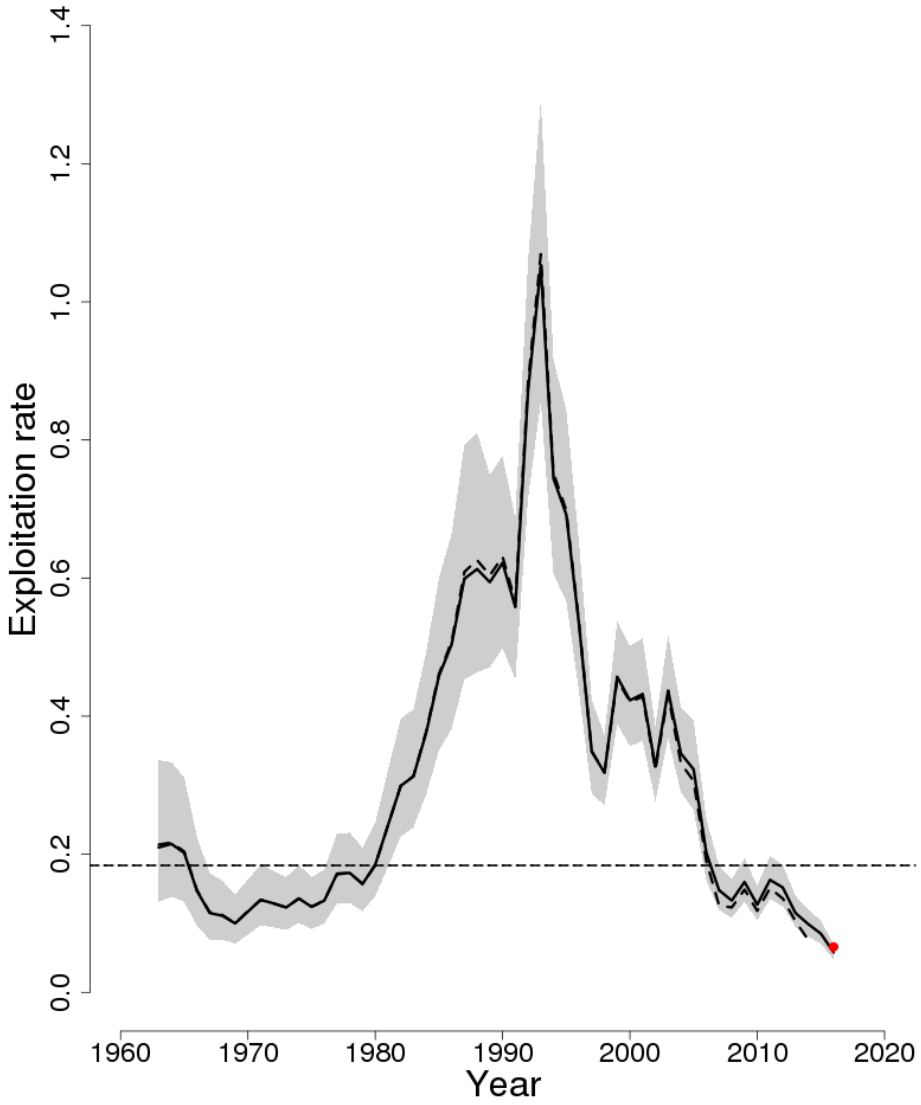


Figure 64: Trends in the fully selected fishing mortality ($F_{Full}$) of white hake between 1963 and 2016 from the current (solid line) and previous (dashed line) assessment and the corresponding $F_{Threshold}$ ($F_{MSY}$ *proxy*=0.1839; horizontal dashed line). based on the 2017 assessment.The $F_{Full}$ was adjusted for a retrospective pattern and the adjustment is shown in red. The approximate 90% lognormal confidence intervals are shown.

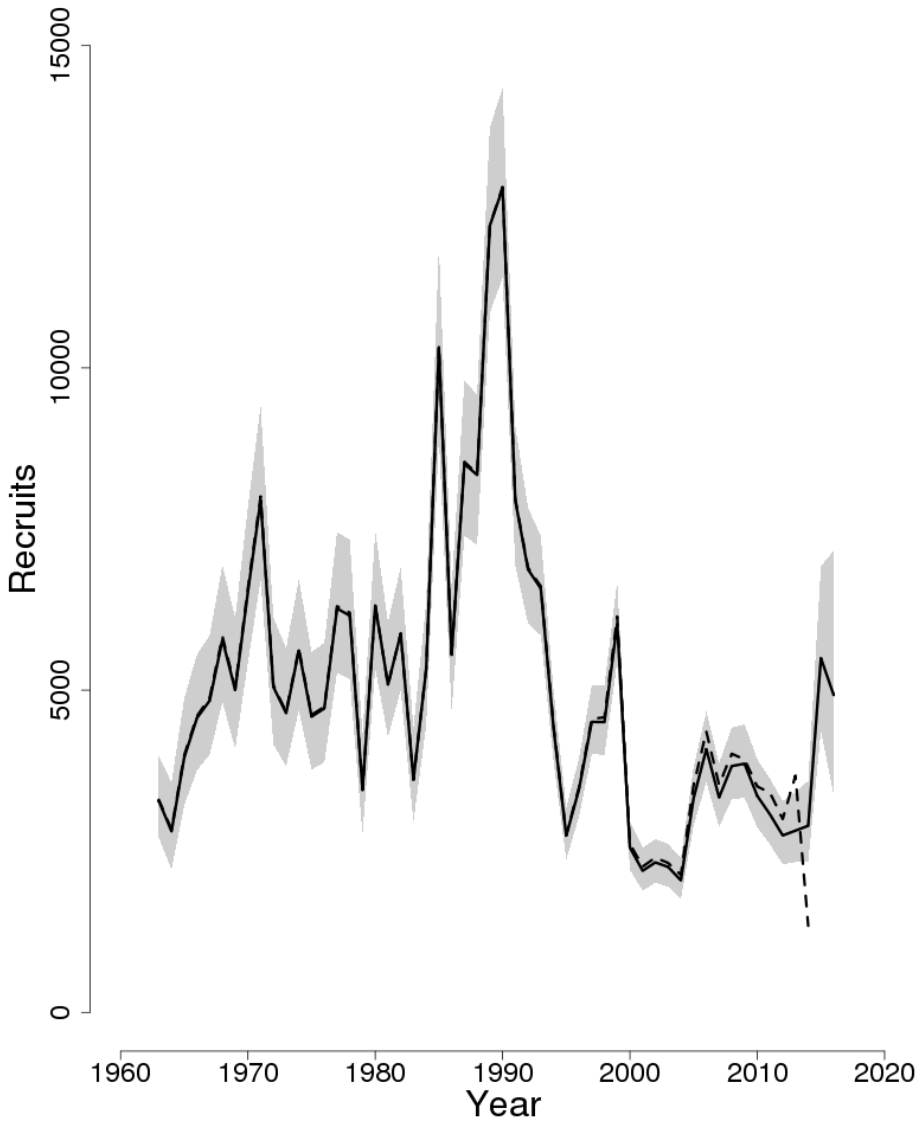


Figure 65: Trends in Recruits (age 1) (000s) of white hake between 1963 and 2016 from the current (solid line) and previous (dashed line) assessment. The approximate 90% lognormal confidence intervals are shown.

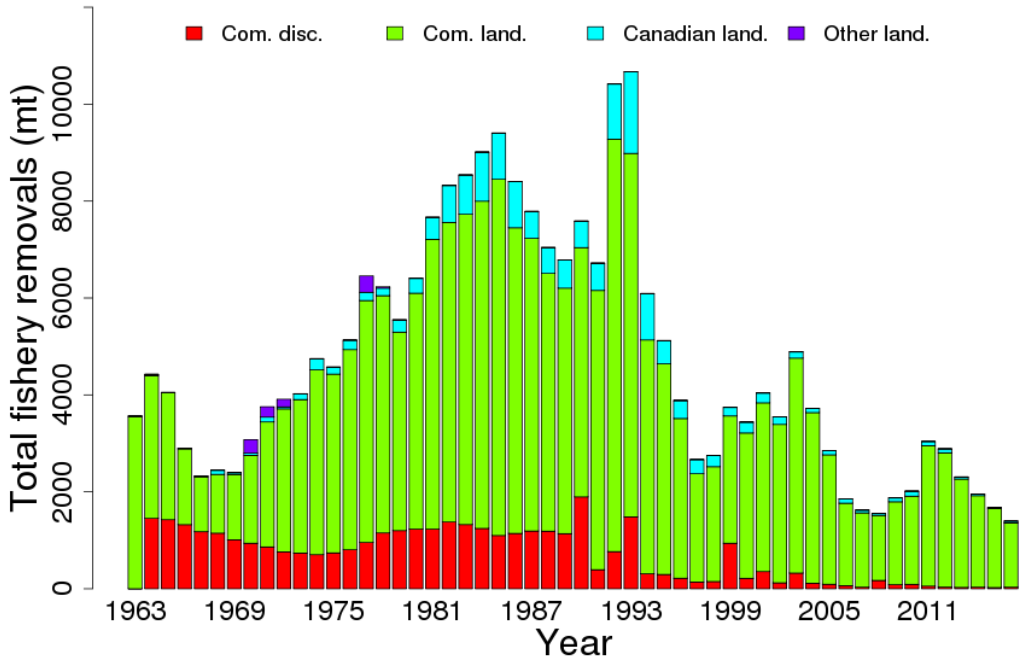


Figure 66: Total catch of white hake between 1963 and 2016 by fleet (commercial, recreational, or Canadian) and disposition (landings and discards).

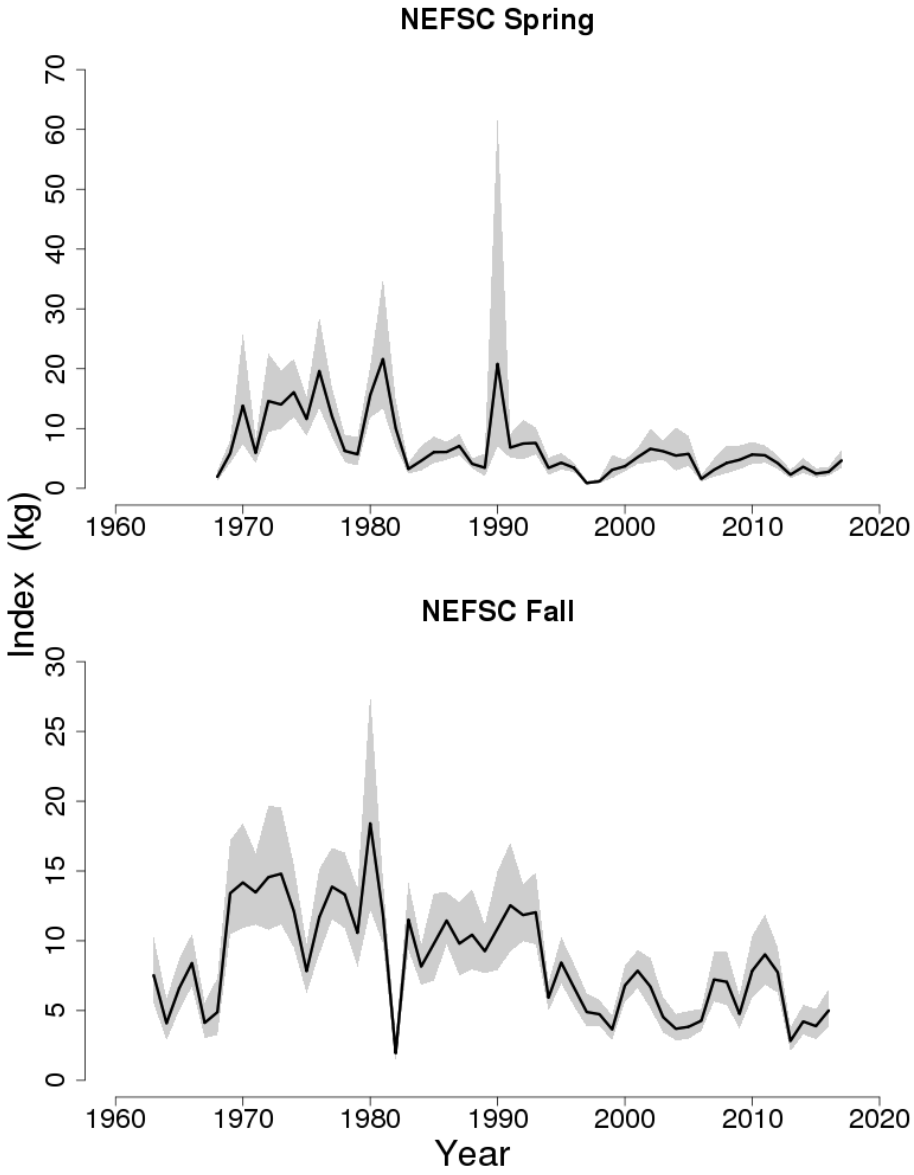


Figure 67: Indices of biomass for the white hake between 1963 and 2017 for the Northeast Fisheries Science Center (NEFSC) spring and fall bottom trawl surveys. The approximate 90% lognormal confidence intervals are shown.