

## **D. OFFSHORE HAKE ASSESSMENT SUMMARY FOR 2010**

### **State of Stock**

Based on current biological reference points, offshore hake (*Merluccius albidus*) is not overfished and overfishing is unknown. Based on NEFSC fall bottom trawl survey data for 2007-2009, the three year delta individual mean weight index (0.16 kg/individual) is below the management threshold (0.24 kg/individual) (Figure D1), but the three year average recruitment index (0.89 num/tow) is above its threshold (0.33 num/tow) (Figure D2). (See section: Biological Reference Points).

The new 2010 assessment concluded that information is not available to determine stock status because fishery data are insufficient and survey data are not considered to reflect stock trends. Therefore, the current BRPs should be rejected. It was not possible to recommend alternative reference points. Status is therefore unknown.

### **Projections**

Stock projections were not conducted as no model formulation was accepted.

### **Catches**

Nominal offshore hake commercial landings, which have only been reported since 1991, have varied from 120 mt in the early 1990s to less than 5 mt in 2001-2002, the lowest in the time series (Figure D3). Landings and catches data are uncertain because landings of hakes (silver, offshore and red hake) were not reported by species until 1991. Those that are reported may not be identified correctly (Garcia-Vazquez et al., 2009). Two models (length-based and a depth-based) were developed to estimate the proportion of offshore hake landed from the total mixed hake landings based on species composition in the NEFSC trawl surveys. The two model estimates were similar, both were much higher than the nominal landings (Figure D4), and the higher estimates were used in this assessment. Landings may have been as high as 25,000 mt in the 1960s and have averaged 300-600 mt over the last decade, which is much greater than the 13 mt indicated from nominal landings.

Discards from the longline and sink gill net fishery were minimal for silver and offshore hake. Discards from the otter trawl fisheries have been significant and variable for silver hake. The same problem with species identification that exists with landings also exists with discards. There are discards of offshore hake estimated for the north but because the geographical distribution of offshore hake is limited to the southern stock of silver hake, any discards from the northern stock are assumed to be silver hake. The length-based estimator was used to separate hake discards by species for the southern region.

### Catch and Status Table (weights in mt): Offshore Hake

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Max <sup>1</sup>	Min <sup>1</sup>	Mean <sup>1</sup>
Nominal Landings	4	2	1	9	18	10	37	12	20	17	119	1	35
Length-Based Split Landings													
US	302	635	463	565	494	288	82	289	84	142	1629	53	474
DWF											12007	6	2376
Total	302	635	463	565	494	288	82	289	84	142	13014	82	1554
Depth-Based Split Landings													
US	856	934	578	482	894	819	459	350	290	331	1872	110	759
DWF											22318	19	3059
Total	856	934	578	482	894	819	459	350	290	331	24189	251	2205
Nominal Discards	8	10	147	3	7	7	5	21	1	31	174	0	14
Length-Based Split Discards													
US	5	14	16	75	46	5	4	7	13	14	221	2	65
Catch Used in Assessment <sup>3</sup>	308	649	479	639	540	293	85	296	97	156	13014	85	1589
Recruitment index <sup>4</sup>	0.06	1.86	0.36	0.55	0.27	0.01	0.71	1.08	0.22	1.38	1.86	0.01	0.40
Recruitment (3-yr moving average)	0.25	0.68	0.76	0.92	0.39	0.28	0.33	0.60	0.67	0.89	0.92	0.06	0.39
Ind Mean Wt <sup>5</sup>	0.21	0.18	0.22	0.32	0.15	0.27	0.16	0.18	0.19	0.10	0.72	0.10	0.28
Ind Mean Wt (3-yr moving average)	0.16	0.18	0.21	0.24	0.23	0.25	0.19	0.20	0.18	0.16	0.43	0.16	0.28

<sup>1</sup>Nominal Landings data based on 1991-2009 (mt). Length and Depth-based Split and catch used in assessment based on 1955-2009. Commercial fishery discard means from 1981-2009. Recruitment and Individual Mean Weight are from 1967-2009.

<sup>2</sup> Foreign landings are for NAFO Areas 5 and 6.

<sup>3</sup>Catch Used in Assessment is the Length-Based Model Estimated Catch.

<sup>4</sup>Number of fish < 30 cm from the NEFSC fall survey.

<sup>5</sup> Mean weight of an individual fish from the NEFSC fall survey.

### Stock Distribution and Identification

Offshore hake are distributed off the continental slope of the northwest Atlantic and southward to the Caribbean and the Gulf of Mexico (Chang et al 1999) (Figure D5). They are found from southern Georges Bank through the Mid-Atlantic Bight at depths ranging from 160-550 meters (Bigelow and Schroeder 1953, Klein-MacPhee 2002). Offshore hake and silver hake (*M. bilinearis*) are sympatric over a considerable range of the continental slope, but are often separated by depth (Helser 1996). Due to their similar morphology and spatial overlap, they have been misidentified for years. The fishing industry did not separate the commercial landings of the two species until 1991, and the extent to which they are still landed as a single species is uncertain (Helser 1996).

### Data and Assessment

Data used in the assessment include survey indices from the NEFSC fall survey, landings and discards. Models were utilized to apportion the landings and discards into hake species. A length-based landings model used the catch-at-length for silver hake and the proportion of offshore hake at length from the survey to apportion catch. A depth-based landings model used VMS data and depth-based logistic functions from the survey to apportion landings.

The NEFSC bottom trawl survey switched from the FRV *Albatross IV* to the FSV *Bigelow* in spring 2009. Survey data given here are in “*Albatross IV*” units.

Two assessment models were attempted, An Index Method (AIM) and Survival Estimation in Non-Equilibrium Situations Model (SEINE). Neither model was considered adequate for management.

### **Biological Reference Points**

The current definition for an overfished stock is:

“Offshore hake is in an overfished condition when the three year moving average weight per individual in the fall survey falls below the 25<sup>th</sup> percentile of the average weight per individual from the fall survey time series 1963-1997 (0.236) **AND** when the three year moving average of the abundance of immature fish less than 30 cm falls below the median value of the 1963-1997 fall survey abundance of fish less than 30 cm (0.33)”.

In previous SAFE Reports, the Whiting Monitoring Committee (WMC) noted problems associated with the overfishing definition for offshore hake. Although the current definition is intended to identify an overfished (i.e. low biomass) stock, it is a better indication of overfishing (high exploitation rate). The WMC recommended that the overfishing definition for offshore hake be revisited.

Survey data may not be a good index of abundance (or of mean weight) and may be driven more by changes in distribution of offshore hake rather than changes in abundance. Therefore, no alternative reference points are recommended and the existing BRPs should also be rejected.

Estimates of catches are highly uncertain and a reliable index of stock size is absent. It is not possible to construct biological reference points with such data. If a reliable index of stock size were available and if the uncertainty in catches could be reduced, the ratio of catch to an index of stock size might be a better overfishing index than using the mean weight.

### **Fishing Mortality**

No estimates of fishing mortality are available.

### **Recruitment**

Estimates of recruitment from the fall NEFSC trawl survey are generally noisy (Figure D2).

### **Stock Biomass**

No estimates of stock biomass are available.

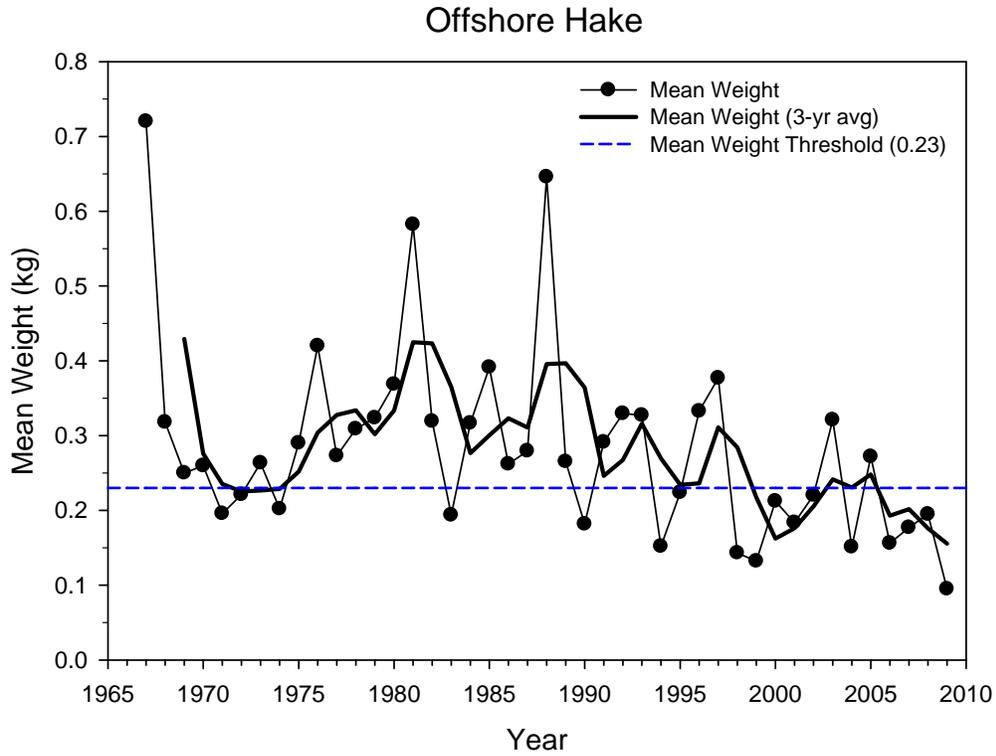
### **Special Comments**

The survey does not cover the entire area of the offshore hake stock. Survey indices could represent changes in fish availability in the survey area rather than changes in abundance (Figure D5).

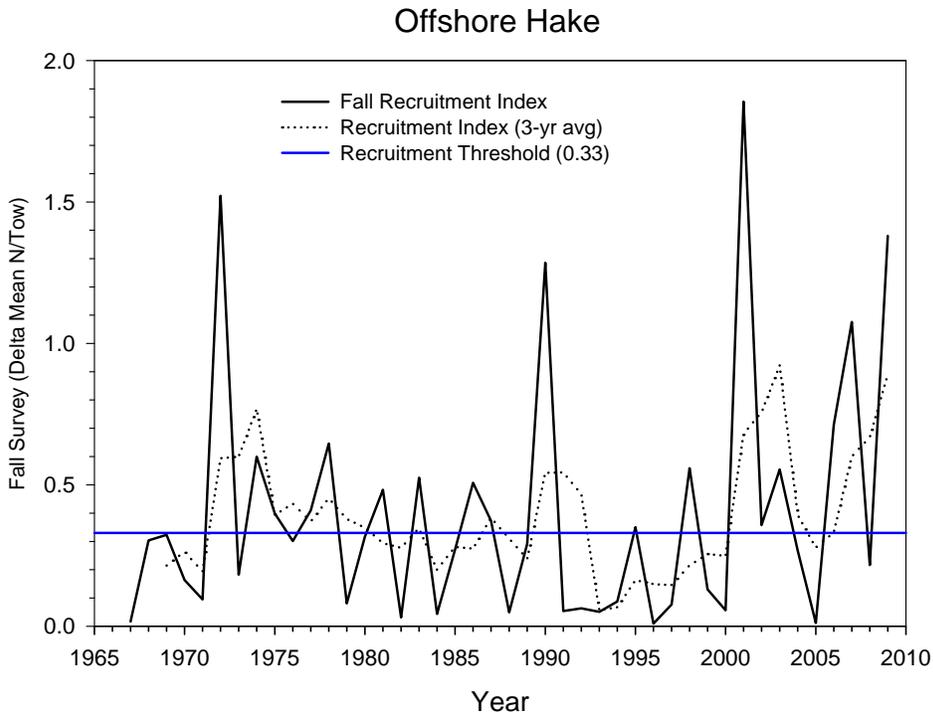
Developing an ACL for offshore hake will be difficult given that the landings cannot be reliably separated. The mixed reporting of silver and offshore hake landings is a major source of uncertainty. It may be reasonable to develop a combined “whiting” ABC and ACL scheme with suitable protection for offshore hake.

## References

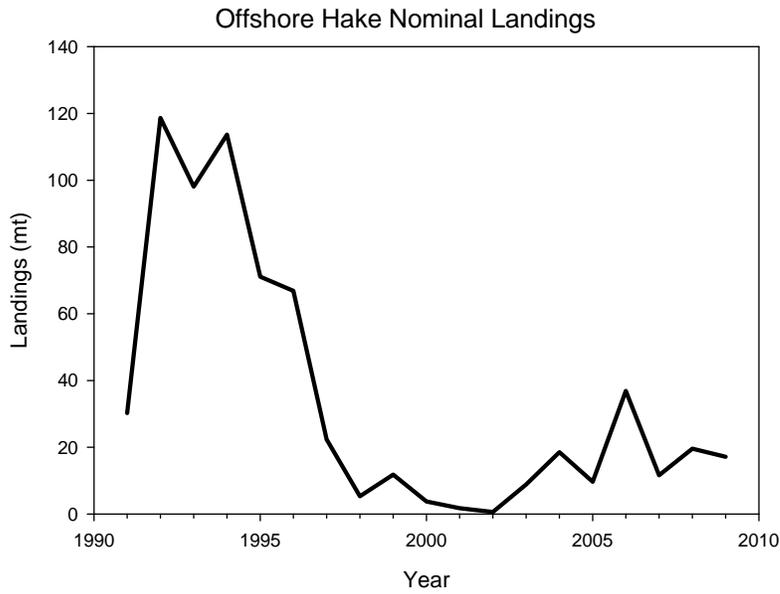
- Bigelow, H. B., Schroeder, W.C. 1953. Fishes of the Gulf of Maine. Fishery Bulletin US, 53:1-577.
- Chang, S., Berrien, P. L., Johnson, D.L., Zetlin, C. A. 1999. Offshore Hake, *Merluccius albidus*, Life History and Habitat Characteristics. US Dep Commer, Northeast Fish Sci Cent Tech Memo. NMFS NE 130. <http://www.nefsc.noaa.gov/nefsc/publications/tm/tm130/>
- Garcia-Vazquez, E., Horreo, J.L., Campo, D., Machado-Schiaffino, G., Bista, I. Triantafyllidis, A. and Juanes, F. 2009. Mislabeled of Two Commercial North American Hake Species Suggests Underreported Exploitation of Offshore Hake. Trans. Am. Fish. Soc. 138: 790-796.
- Helser, T.E. 1996. Comparative Biology of Two Sympatric Species of the Genus, *Merluccius*, off the Northeastern Continental Shelf of the United States: Offshore Hake (*M. albidus*) and Silver Hake (*M. bilinearis*). Report submitted to the New England Fishery Management Council.
- Klein-MacPhee, G. 2002. Silver Hake. Family Merlucciidae. *In*: Bigelow and Schroeder's fishes of the Gulf of Maine. 3rd Edition. B. B. Collette and G. Klein-MacPhee (eds.). Smithsonian Institution Press, Washington D.C., 748 p.
- NEFMC (Northeast Fisheries Management Council). 2003. Stock Assessment and Fish Evaluation Report (SAFE). <http://www.nefmc.org/mesh/>
- NEFSC. 2011. Report of the 51<sup>st</sup> Stock Assessment Workshop.
- Traver, Michele L., Larry Alade, and Katherine A. Sosebee. Biology and Life History of Offshore Hake (*Merluccius albidus*). Fisheries Research, in review.



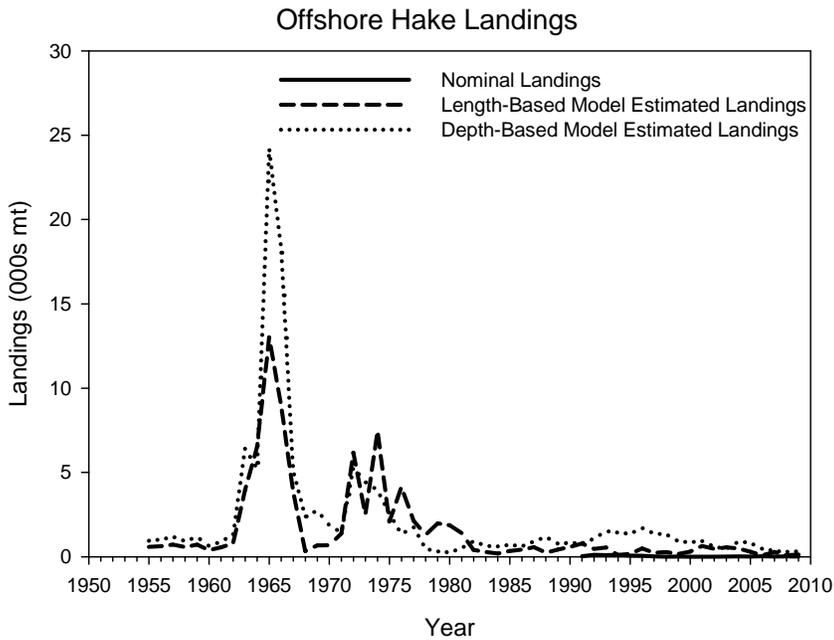
**D1.** Mean individual weight (kg/tow) of offshore hake from the NEFSC fall survey.



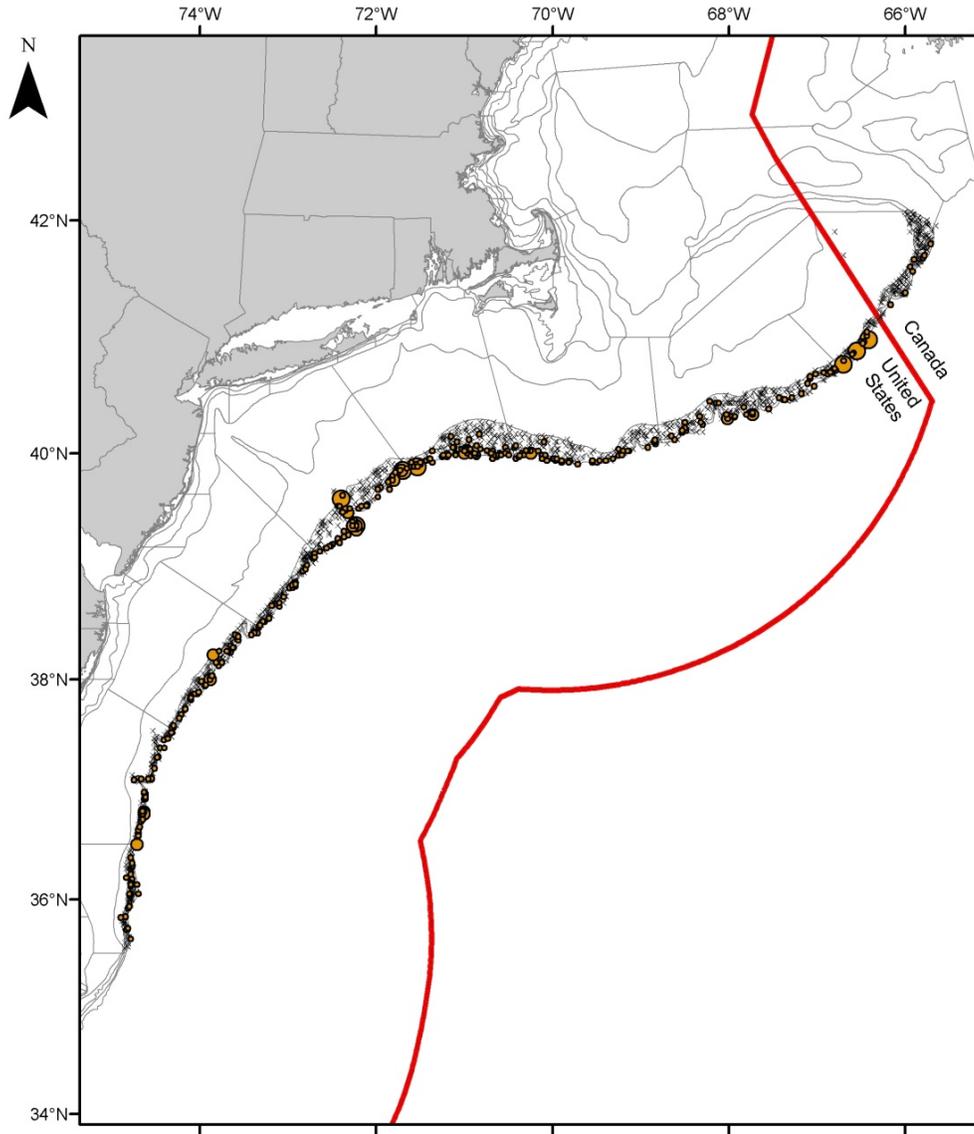
**D2.** Recruitment index (# of offshore hake  $\leq$  30 cm) from the NEFSC fall survey.



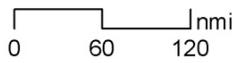
**D3.** Nominal landings of offshore hake (mt).



**D4.** Landings of offshore hake (000s mt). Comparison of nominal landings to length-based and depth-based estimates.



**Offshore Hake Maps  
Fall 1967-2009**



Mar 09, 2010

**Fall Survey Stations**

- Catch Wt (kg)
- × 0.00
  - 0.01 - 5.00
  - 5.01 - 10.00
  - 10.01 - 20.20



**D5.** Distribution of offshore hake in the NEFSC fall bottom trawl survey, 1967-2009.