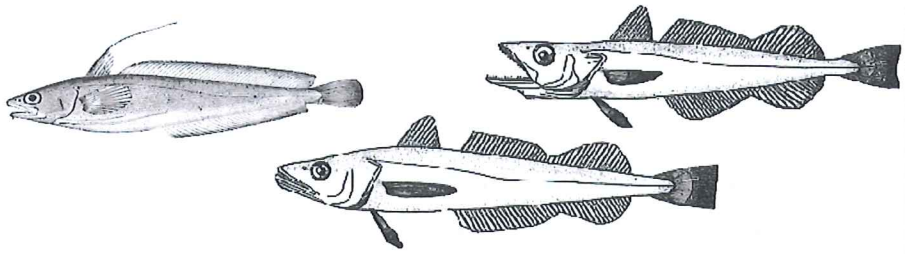


Hakes Assessment
SARC 51

Whiting NEFMC PDT Meeting

February 14, 2011

Milford, MA

Revisions and Updates to Assessment Summary Document

- Silver hake
  - Revised assessment document "Silver hake assessment summary for 2010_Revised2-10-11.docx"
  - Modified Reference Points for SMA (Page 12, Page 25
  - Other changes are mainly editorial
- Red hake
  - Revisions of discards in Summary catch Table on Page 44
  - "Revised Red Hake Catch and Status Table.docx"

State of the Stock

- Based on the accepted reference points, the northern and southern Stocks for both ***red*** and ***Silver hake*** were NOT overfished and overfishing is NOT occurring

- However, the stock status for ***offshore hake*** could not be determined because the fishery data was not sufficient and the survey trends did not reflect the stock trends

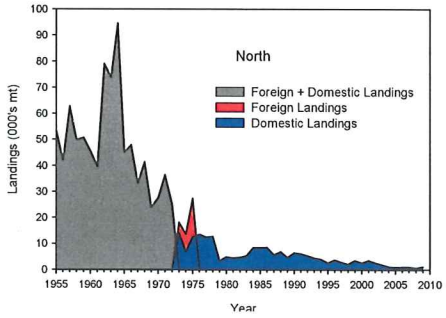
Assessment Highlights

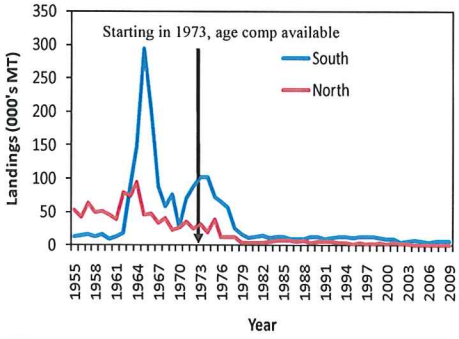
- Commercial Landings
  - Species Composition (Depth vs. Length Based Estimators)
- Survey
  - Arithmetic vs. Delta transformed Means
  - Survey Calibrations
- Stock Structure
  - Adult and larvae distributions, growth, maturity, etc.
- Model Explorations
  - Silver hake (Index method, AIM, ASAP)
  - Red hake (Index method, AIM, SCALE, SS3)
  - Offshore hake (Index method, AIM, SEINE)

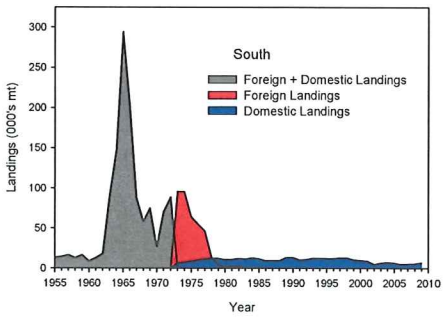
A. Silver hake

Commercial Landings

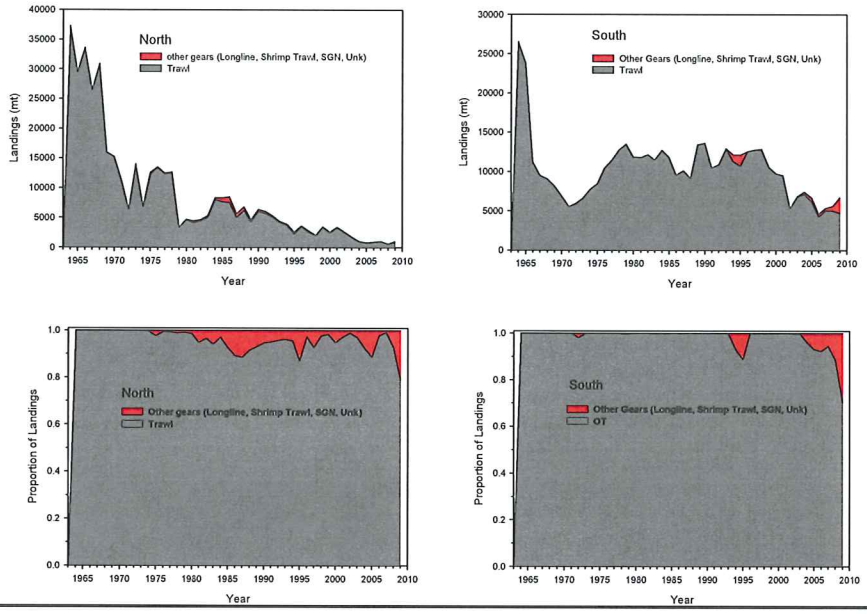
- DWF: Significant in the mid 1950's and 1960's
- Peaked over 90,000mt in North (1964) and over 250,000mt in South (1965)
- Despite departure of DWF in the late 1970's, landings continue to decline.



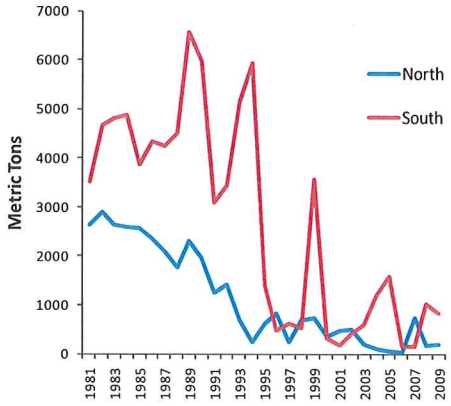




Silver hake Comm. Landings by Gear



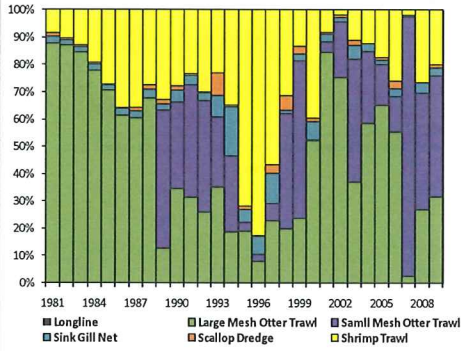
Silver hake Commercial Discards



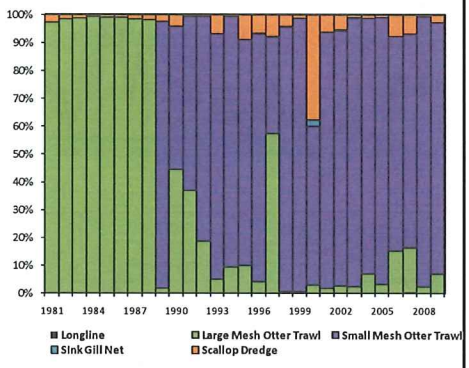
- Generally, discards have declined since the late 1980's
- Range
  - North (37-2900mt)
  - South (146-6600mt)
- Recent 10yr Avg.
  - North: ~ 240mt
  - South: ~ 650mt

Silver hake Comm. Discards by Gear

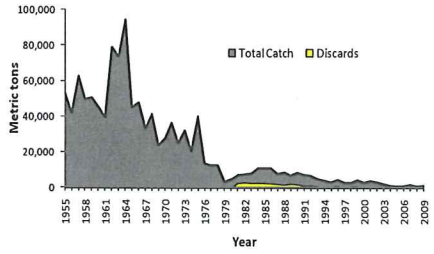
North

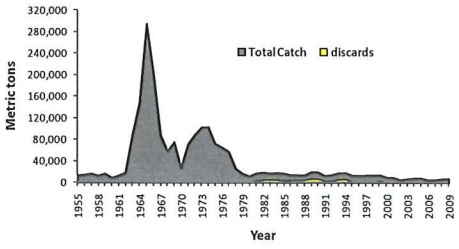


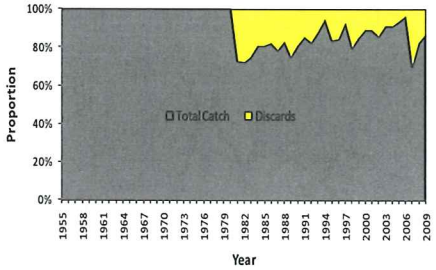
South

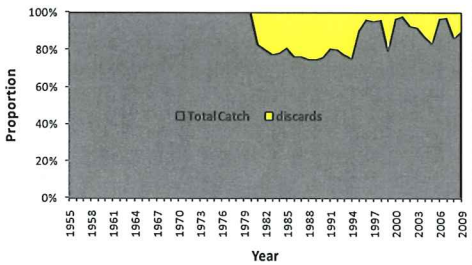


Silver hake Total Catch

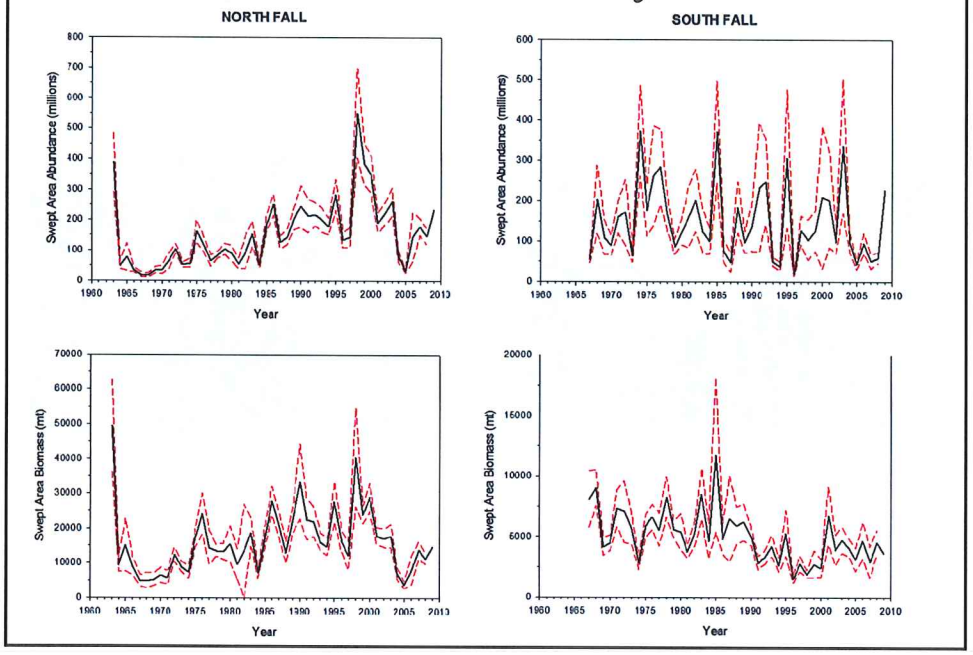




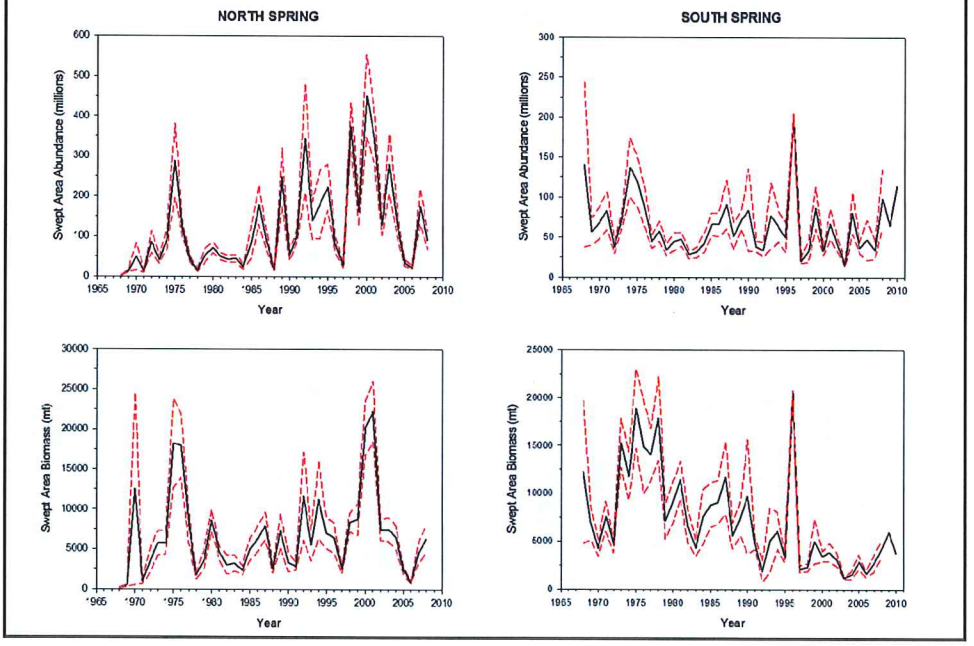




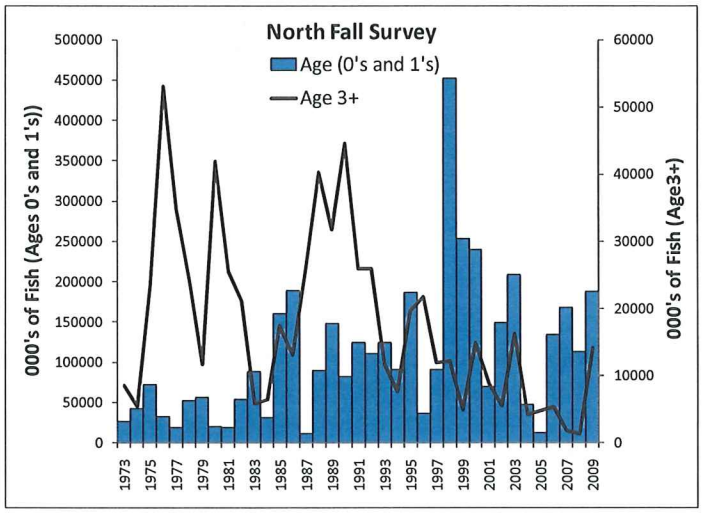
Silver hake Fall Survey Trends



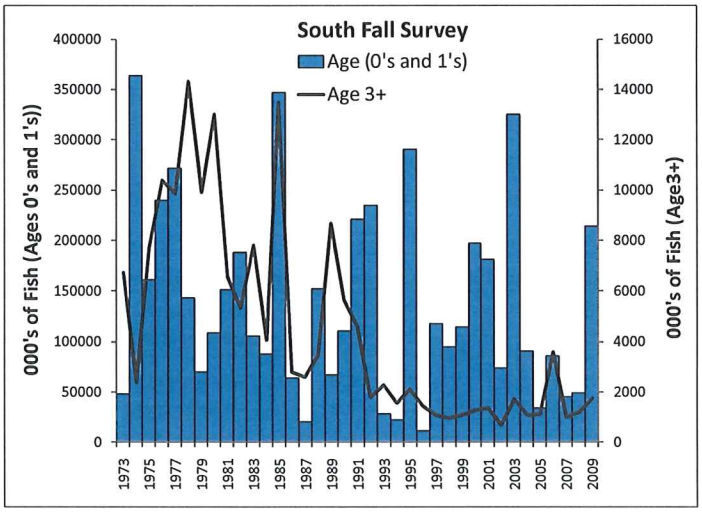
Silver hake Spring Survey Trends



North - Survey Recruits and Adults



South - Survey Recruits and Adults



Current FMP Overfishing Definition

*Silver hake is **overfished** when the three-year moving average of the fall survey weight per tow is less than 3.31 kg/tow and 0.89 kg/tow for the northern and southern stocks respectively, one half of the B_{MSY} proxy (the average observed from 1973 – 1982). If an analytical assessment (e.g. VPA) for silver hake is available, the three-year moving average will be replaced with the terminal year biomass estimate and compared with the mean biomass estimated for 1973 – 1982.*

***Overfishing** occurs when fishing mortality, derived from the latest three years of survey data, exceeds F0.1 (0.41 and 0.39 for the northern and southern stocks of silver hake respectively). If an analytical assessment is available, then the terminal year fishing mortality rate will be compared to F0.1.*

SARC 51 Biological Reference Points

- Lack of ASAP model, the panel recommended the "fall back" method (Index approach)
- Biomass reference points based on the arithmetic average of fall Survey (1973-1982)
- Exploitation Index is based on ratio b/w total catch and arithmetic fall survey index averaged from 1973-1982

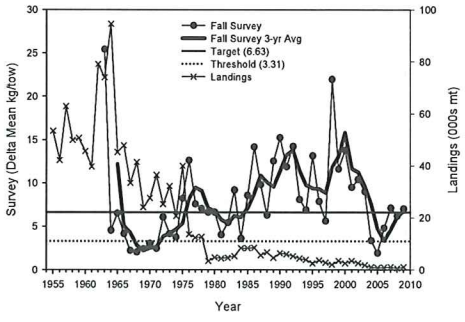
STOCK	THRESHOLDS (Current)	TARGETS (Current)	THRESHOLDS (SARC 51)	TARGETS(SARC 51)
Northern Silver Hake	1/2 B_{MSY} Proxy (3.31) F_{MSY} Proxy (2.57)	B_{MSY} Proxy (6.63) F_{MSY} Proxy (2.57)	**1/2 B_{MSY} Proxy (3.21)** **F_{MSY} Proxy (2.78)**	**B_{MSY} Proxy (6.42)** **F_{MSY} Proxy (NA)**
Southern Silver Hake	1/2 B_{MSY} Proxy (0.89) F_{MSY} Proxy (34.39)	B_{MSY} Proxy (1.78) 60% F_{MSY} Proxy (20.63)	**1/2 B_{MSY} Proxy (0.83)** **F_{MSY} Proxy (34.19)**	**B_{MSY} Proxy (1.65)** **F_{MSY} Proxy (NA)**

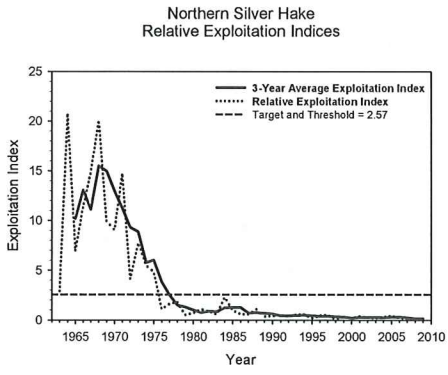
Silver hake updated Overfishing Definition SARC 51

*Silver hake is **overfished** when the three-year moving average of the fall survey weight per tow (i.e. the biomass threshold) is less than one half the B_{MSY} proxy, where the B_{MSY} proxy is defined as the average observed from 1973-1982. The most recent estimates of the biomass thresholds are **3.21 kg/tow** for the **northern stock** and **0.83 kg/tow** for the **southern stock.***

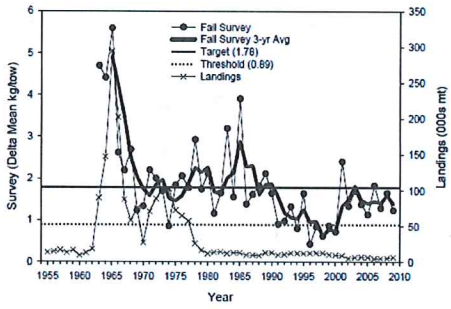
***Overfishing** occurs when the ratio between the catch and the arithmetic fall survey biomass index from the most recent three years exceeds the overfishing threshold. The most recent estimates of the overfishing threshold, are **2.78 kt/kg** for the **northern stock** and **34.19 kt/kg** for the **southern stock** of silver hake.*

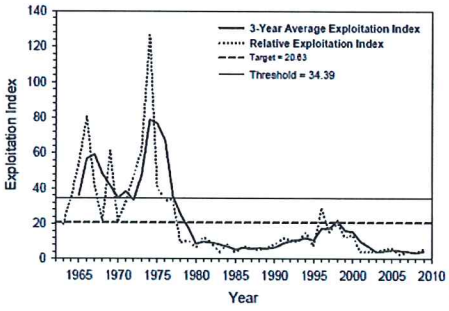
Northern Silver Hake Reference Points and Stock Status (Survey: Delta Transformed)



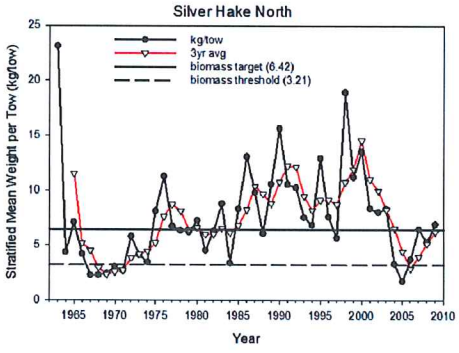


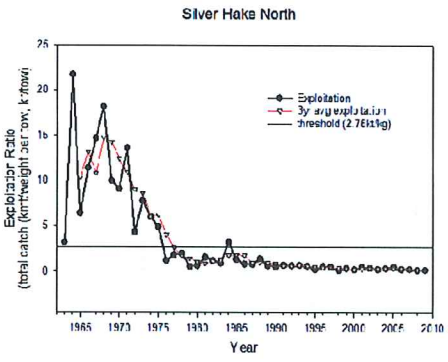
Southern Silver Hake Reference Points and Stock Status (Survey: Delta Transformed)



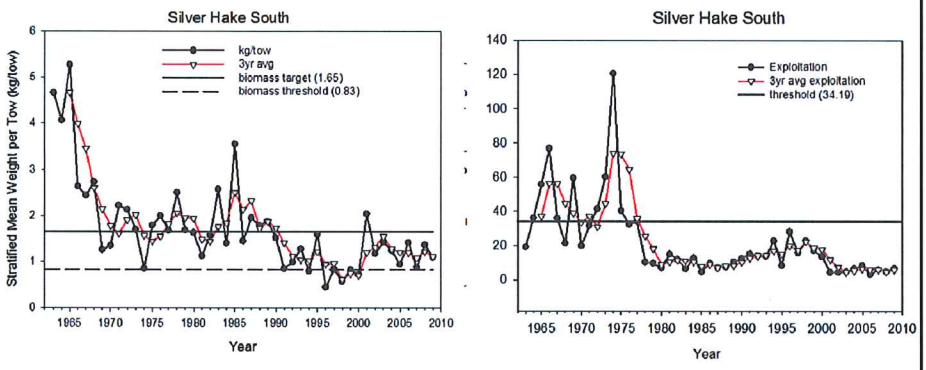


Northern Silver Hake Reference Points and Stock Status (SARC 51)





Southern Silver Hake Reference Points and Stock Status (SARC 51)

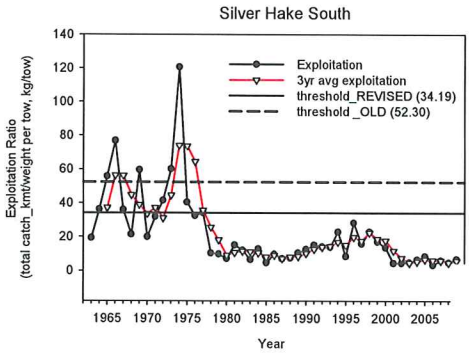


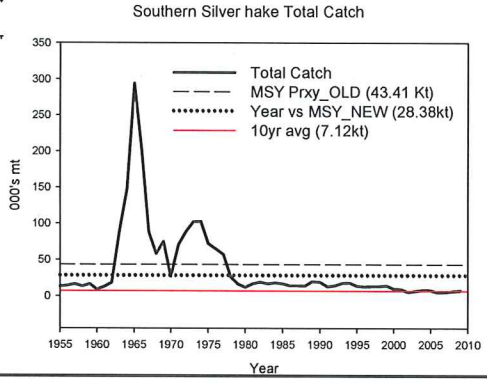
Revisions to Reference Points

STOCK	THRESHOLDS (SARC 51)	TARGETS(SARC 51)	THRESHOLD (Revised)	TARGETS (REVISED)
Northern Silver Hake	1/2 B_{MSY} Proxy (3.21) F_{MSY} Proxy (2.78)	B_{MSY} Proxy (6.42) F_{MSY} Proxy (NA)	1/2 B_{MSY} Proxy (3.21) F_{MSY} Proxy (2.78)	B_{MSY} Proxy (6.42) F_{MSY} Proxy (NA)
Southern Silver Hake	1/2 B_{MSY} Proxy (0.83) F_{MSY} Proxy (52.30)	B_{MSY} Proxy (1.65) F_{MSY} Proxy (NA)	1/2 B_{MSY} Proxy (0.83) F_{MSY} Proxy (34.19)	B_{MSY} Proxy (1.65) F_{MSY} Proxy (NA)

- The threshold exploitation reference point for the SMA was revised to reflect the correct the set of years (1973-1982) for deriving the FMSY proxy
- (52.30kt/kg to 34.19kt/kg) a 34% decrease from the original estimate
- However, status determination remains unchanged (i.e. overfishing is not occurring in the SMA of Silver hake)
- Applying the threshold exploitation index to the most recent three year average biomass index from (1.11kg/tow) and Bthreshold also resulted in a 34% decrease in both allowable catch and MSY.
- Both estimates exceed the level of landings in the recent decade suggesting that these levels of catch may not support the level of productivity in the SMA

Revised Reference Points





Silver hake updated Overfishing Definition SARC 51

*Silver hake is **overfished** when the three-year moving average of the fall survey weight per tow (i.e. the biomass threshold) is less than one half the B_{MSY} proxy, where the B_{MSY} proxy is defined as the average observed from 1973-1982. The most recent estimates of the biomass thresholds are **3.21 kg/tow** for the **northern stock** and **0.83 kg/tow** for the **southern stock.***

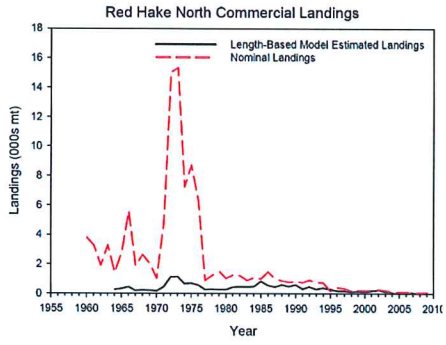
***Overfishing** occurs when the ratio between the catch and the arithmetic fall survey biomass index from the most recent three years exceeds the overfishing threshold. The most recent estimates of the overfishing threshold, are **2.78 kt/kg** for the **northern stock** and **34.19 kt/kg** for the **southern stock** of silver hake.*

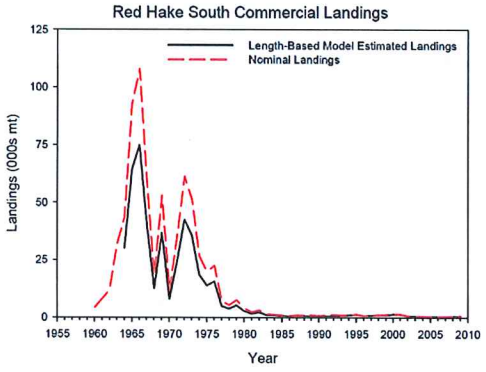
Summary

- Silver hake is not overfished and overfishing is not occurring
- Recent catches have been considerably less than historical levels
- Age 3+ silver hake in the fall NEFSC survey have been declining since the 1990's
- This suggest that the current reference points may not be appropriate
- Potential suggestion for ABC: A measure of central tendency that reflects the contemporary state of the stock and the environment conditions.

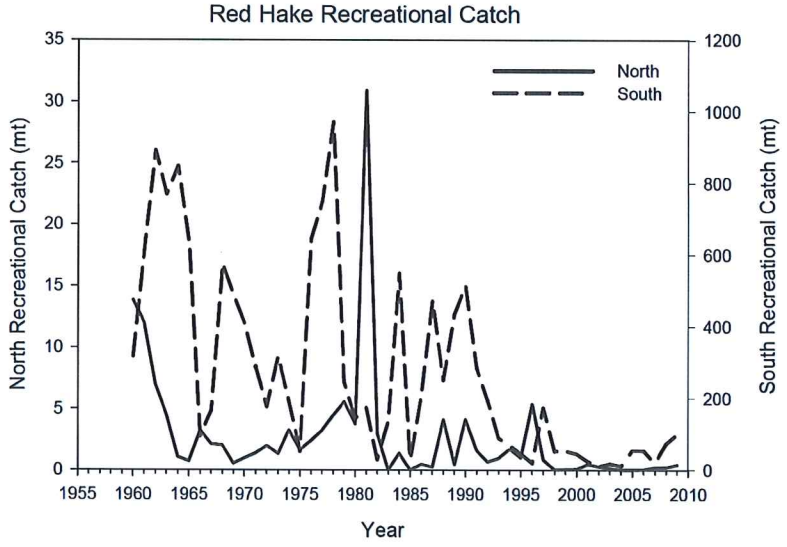
B. Red Hake

Red hake Comm. Landings



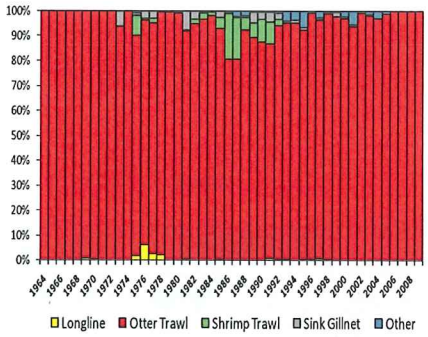


Red hake Recreational Landings

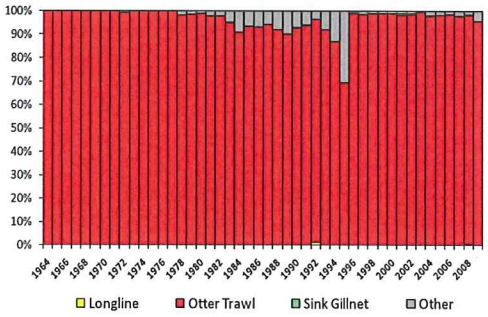


Red hake landings by gear

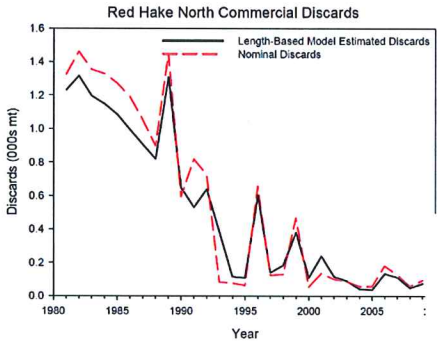
North

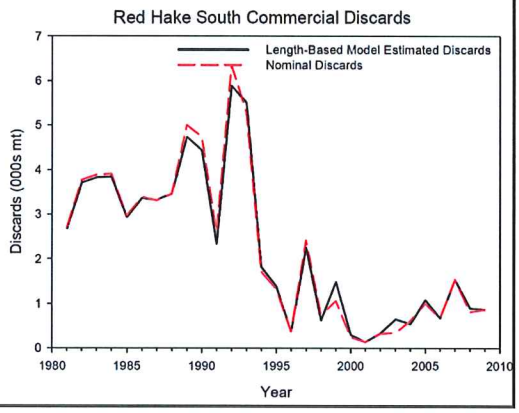


South

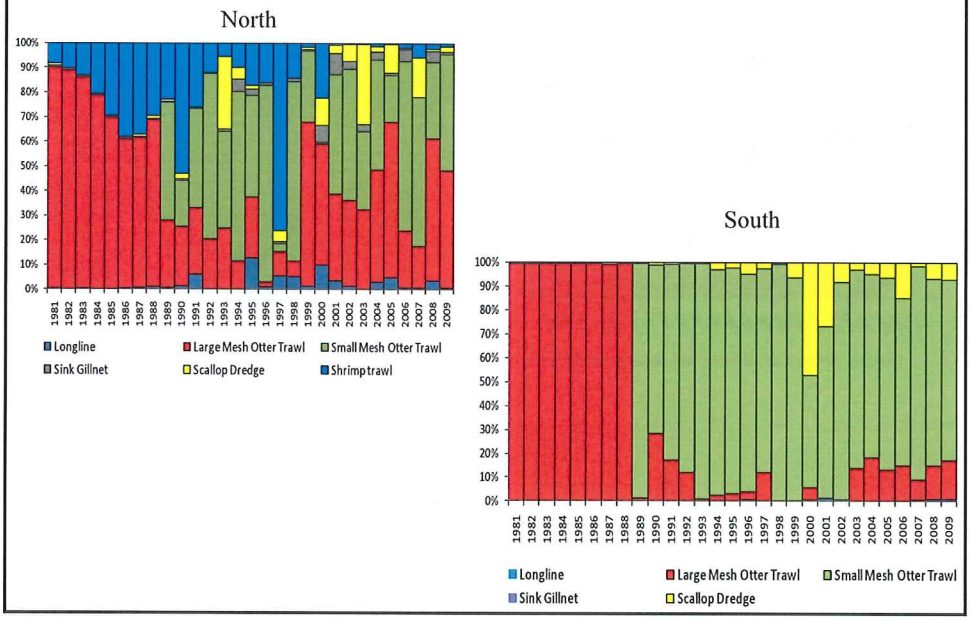


Red hake Comm. Discards

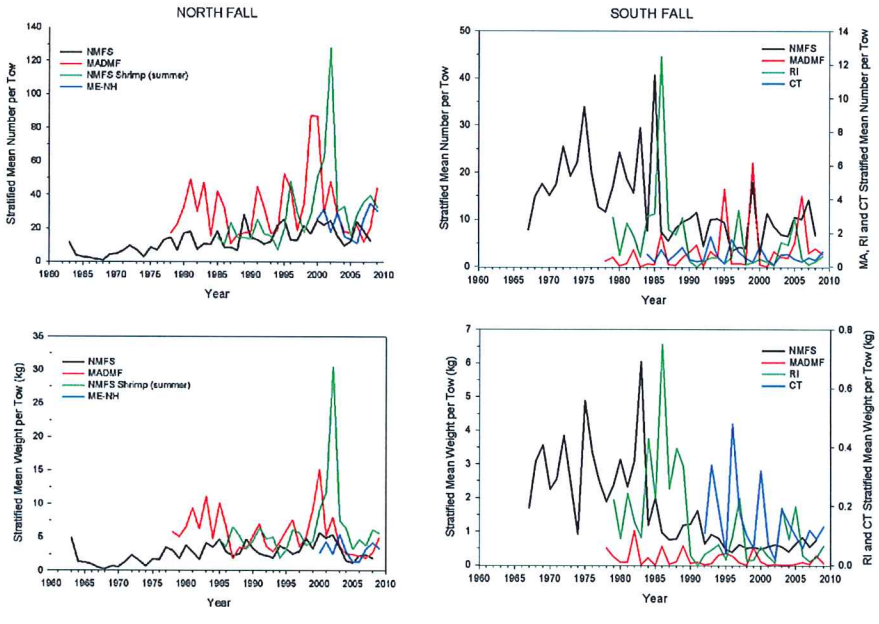




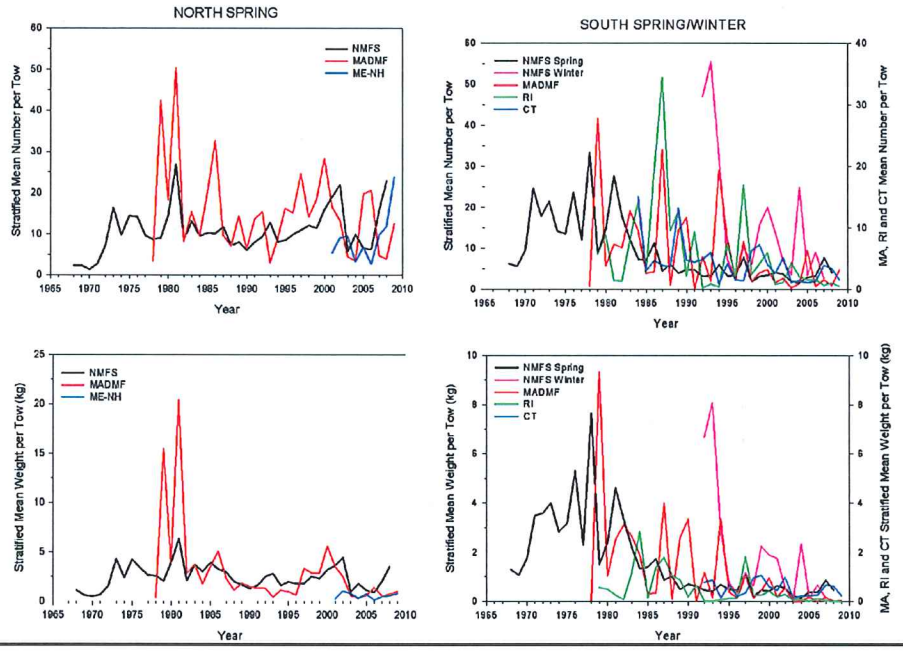
Red hake discards by gear



Red hake Fall Survey



Red hake Spring Survey



Current FMP Overfishing Definition

*The **northern stock** of red hake is overfished when the three-year moving average of stock biomass, derived from the fall survey, is below **1.6 kg/tow. If an analytical assessment is** available for northern red hake, then the three-year moving average will be replaced with the terminal year biomass estimate and compared with the biomass reference points.*

*Overfishing occurs when the ratio between catch and survey biomass exceeds **0.65, the** proxy for FMSY. When biomass is less than 3.1 kg/tow (the biomass target), the stock is overfished when fishing mortality is above a rate that declines linearly to zero when biomass equals the minimum biomass threshold (1.6 kg/tow).*

*The **southern stock** of red hake is in an overfished condition when the three-year moving average weight per individual in the fall survey falls below the 25th percentile of the average weight per individual from the fall survey time series 1963-1997 (0.12) AND when the three-year moving average of the abundance of immature fish less than 25 cm falls below the median value of the 1963-1997 fall survey abundance of fish less than 25 cm (4.72).*

SARC 51 Biological Reference Points

- Lack of adequate model formulations, the panel recommended the "fall back" Index method
- Biomass reference points based on the arithmetic average of Spring Survey (1980-2010)
- Exploitation Index is based on ratio b/w total catch and Spring survey index from 1980-2009 from AIM analyses

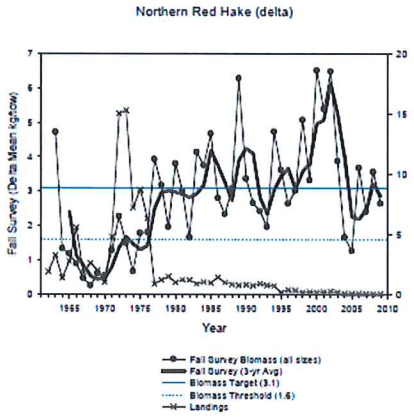
STOCK	THRESHOLDS (Current)	TARGETS (Current)	THRESHOLDS (SARC 51)	TARGETS(SARC 51)
Northern Red Hake	Biomass (1.60) F_{MSY} Proxy (0.61)	Biomass (3.30) F_{MSY} Proxy (0.37)	**B_{MSY} Proxy (1.27)** **F_{MSY} Proxy (0.16)**	B_{MSY} Proxy (NA) F_{MSY} Proxy (NA)
Southern Red Hake	Biomass: Ind. Wt <0.12 and survey abundance for immature fish < 4.07kg/tow) F_{MSY}Not Specified	Biomass (Not Specified) FMSY Proxy (Not Specified)	**B_{MSY} Proxy (0.51)** **F_{MSY} Proxy (3.04)**	B_{MSY} Proxy (NA) F_{MSY} Proxy (NA)

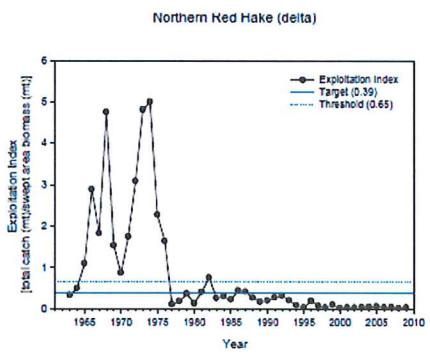
Red hake updated Overfishing Definition SARC 51

*Red hake is **overfished** when the three-year moving arithmetic average of the spring survey weight per tow (i.e., the biomass threshold) is less than one half of the BMSY proxy, where the BMSY proxy is defined as the average observed from 1980 – 2010. The current estimates of BTHRESHOLD for the northern and southern stocks are 1.27 kg/tow and 0.51 kg/tow, respectively.*

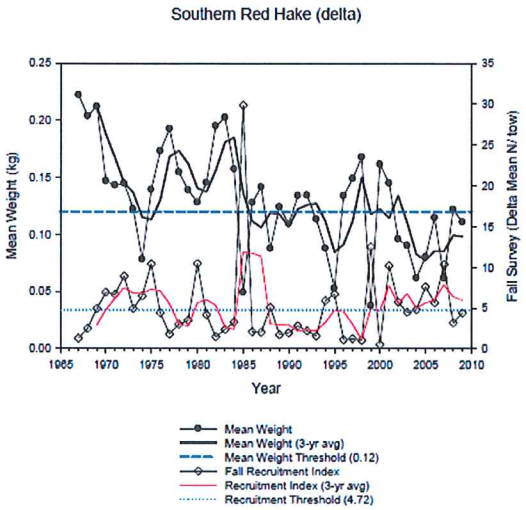
***Overfishing** occurs when the ratio between catch and spring survey biomass exceeds 0.163 kt/kg and 3.038 kt/kg, respectively, derived from AIM analyses from 1980-2009.*

Northern Red Hake Reference Points and Stock Status (Survey: Delta Transformed)

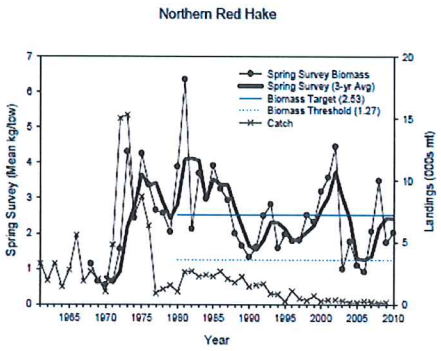


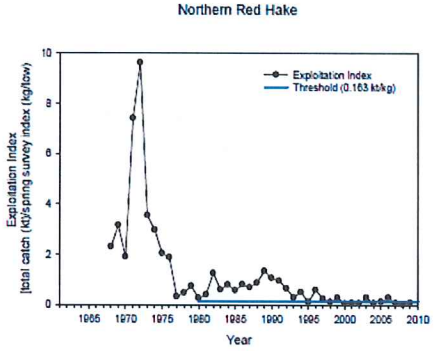


Southern Red Hake Reference Points and Stock Status (Survey: Delta Transformed)

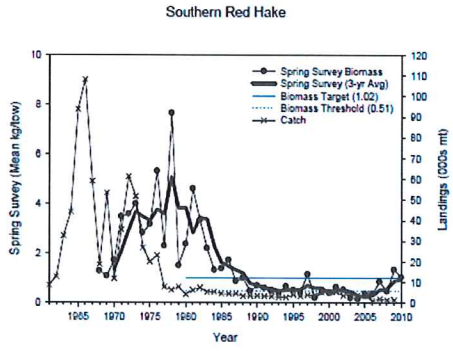


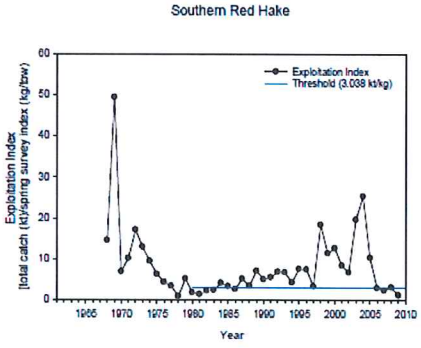
Northern Red Hake Reference Points and Stock Status (SARC 51)





Southern Red Hake Reference Points and Stock Status (SARC 51)



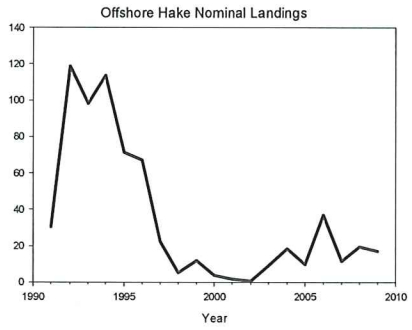


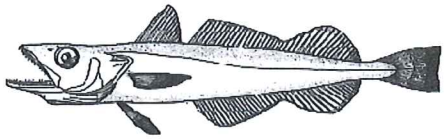
Summary

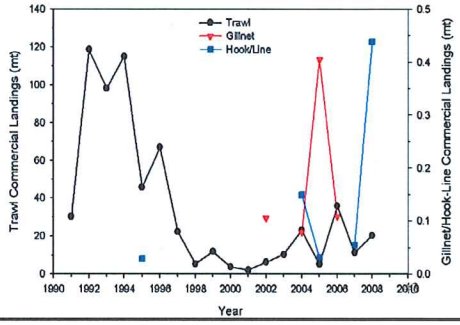
- Red hake is not overfished and overfishing is not occurring
- MSY ~ (F_{MSY},B_{MSY} proxies)
  - North : 412mt
  - South: 3,086mt
- Applying $F_{Threshold}$ to most recent 3yr average biomass allows for catches of 394mt in the North and 2,897mt in the South. (OFL, a reasonable starting point for ABC)
- 80% CI F_{MSY}
  - North (0.062-0.240kt/kg/tow
  - South (2.240-3.700kt/kg/tow)

C. Offshore Hake

Nominal Landings



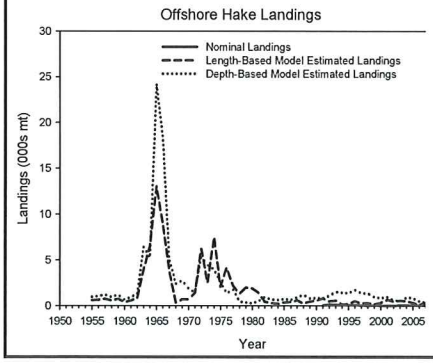


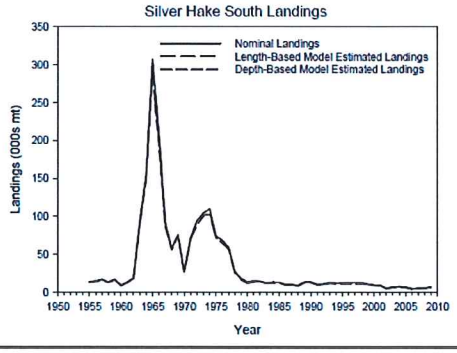


- Began in 1991, peaked in 1992 with 120mt
- Trawl based fishery
- Primarily a bycatch fishery for silver hake
- Fishing mortality rates remain unknown

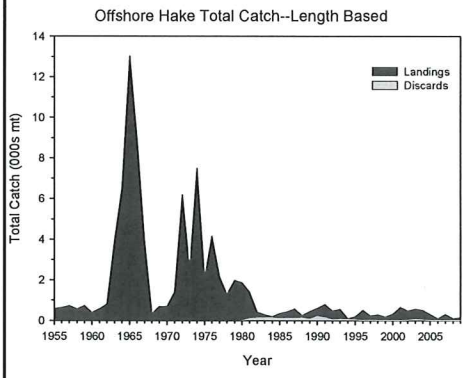
Length based vs. Depth Based Estimates

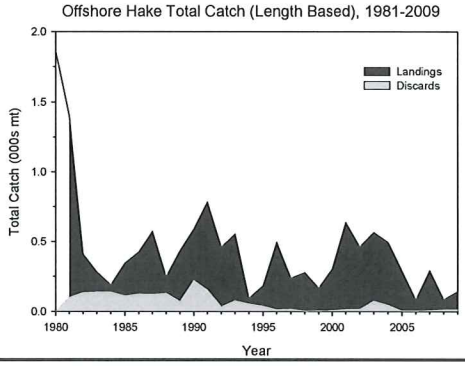
- SARC 51 decided to go with Length based estimates to reduce hindcasting
- Both methods gave slightly different results
  - Length based ~4% offshore hake
  - Depth based ~7% offshore hake



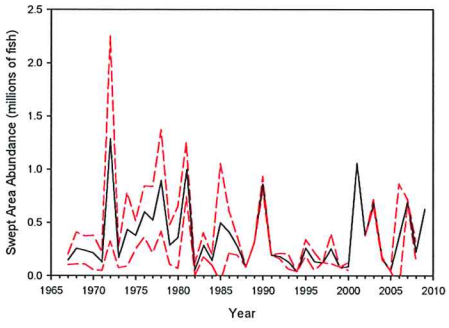


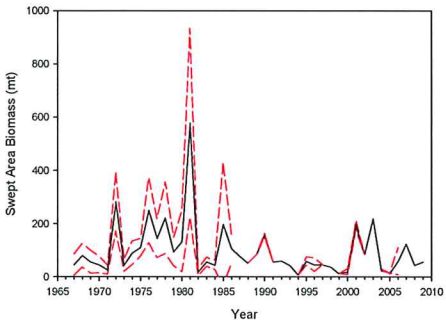
Off shore Length-based Total Catch





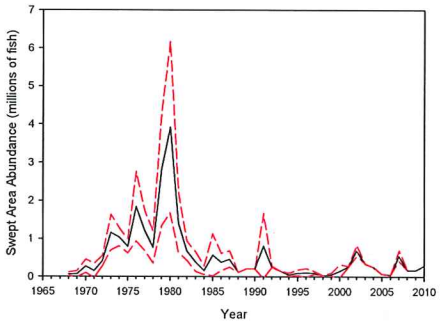
Fall Survey Swept Area

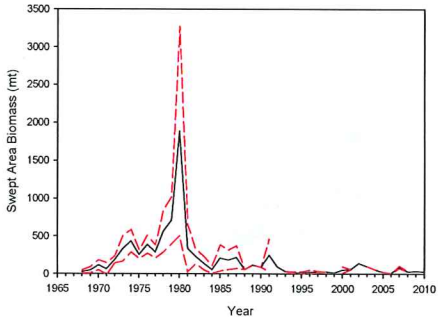




Highest point in 1981
with 577 mt

Spring Survey Swept Area

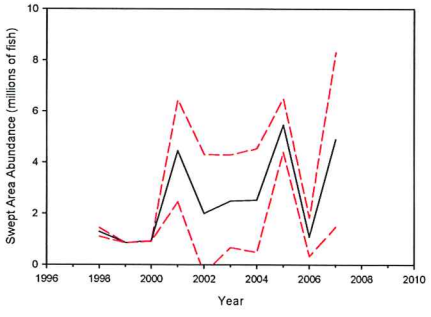


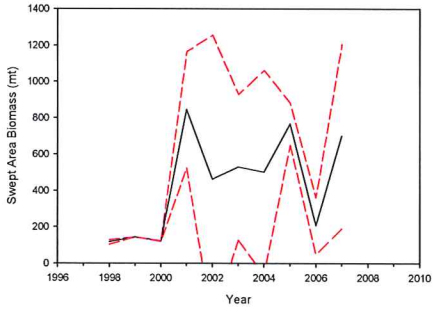


Highest point in 1980
with 1,886 mt

47

Winter Survey Swept Area

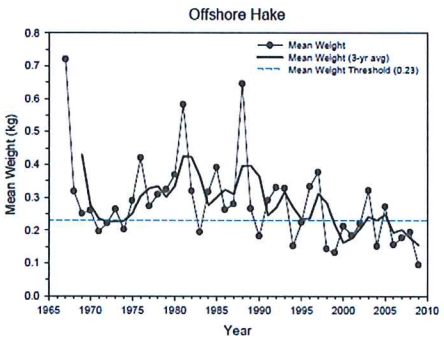


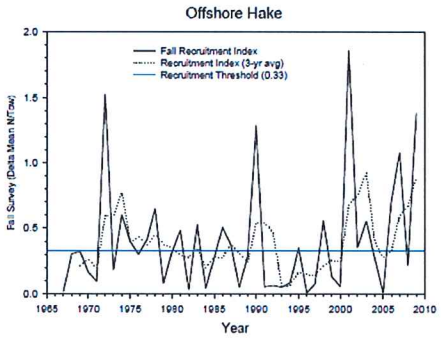


Current FMP Overfishing Definition

*"Offshore hake is in an **overfished** condition when the three year moving average weight per individual in the fall survey falls below the 25th 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)*

Offshore Hake Reference Points and Stock Status (Survey: Delta Transformed)





Summary

- 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.
- 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
- 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.