

# Bering Sea-Aleutian Islands Stock Assessment and Fishery Evaluation Report

Plan Team Report to the NPFMC, December 2009





## **BSAI Plan Team Members**

### **(15 Members from 8 Major Agencies)**

**NPFMC**

**Jane DiCosimo (Plan Coordinator)**

**NMFS (AFSC)**

**Loh-Lee Low (Chair), Mike Sigler (Vice-Chair)**

**Grant Thompson (Link to the SSC)**

**Lowell Fritz, Kerim Aydin**

**Dana Hanselman, Alan Haynie**

**NMFS (Region) Mary Furuness**

**USF&W -- Leslie Slater**

**ADF&G -- Dave Carlile, Dave Bernard**

**Univ. Alaska-- Brenda Norcross**

**WDF&W -- Henry Chen**

**Halibut Comm- Bill Clark**

# 2009 Safe Documents

1. Summary (Appendix A)
2. Status of Stocks Chapters  
(75+ Authors, 24 Reports)
3. Ecosystems Considerations Chapter  
(95+ Contributors)
4. Economics Chapter  
(8+ Authors)

# Ecosystem Considerations Chapter

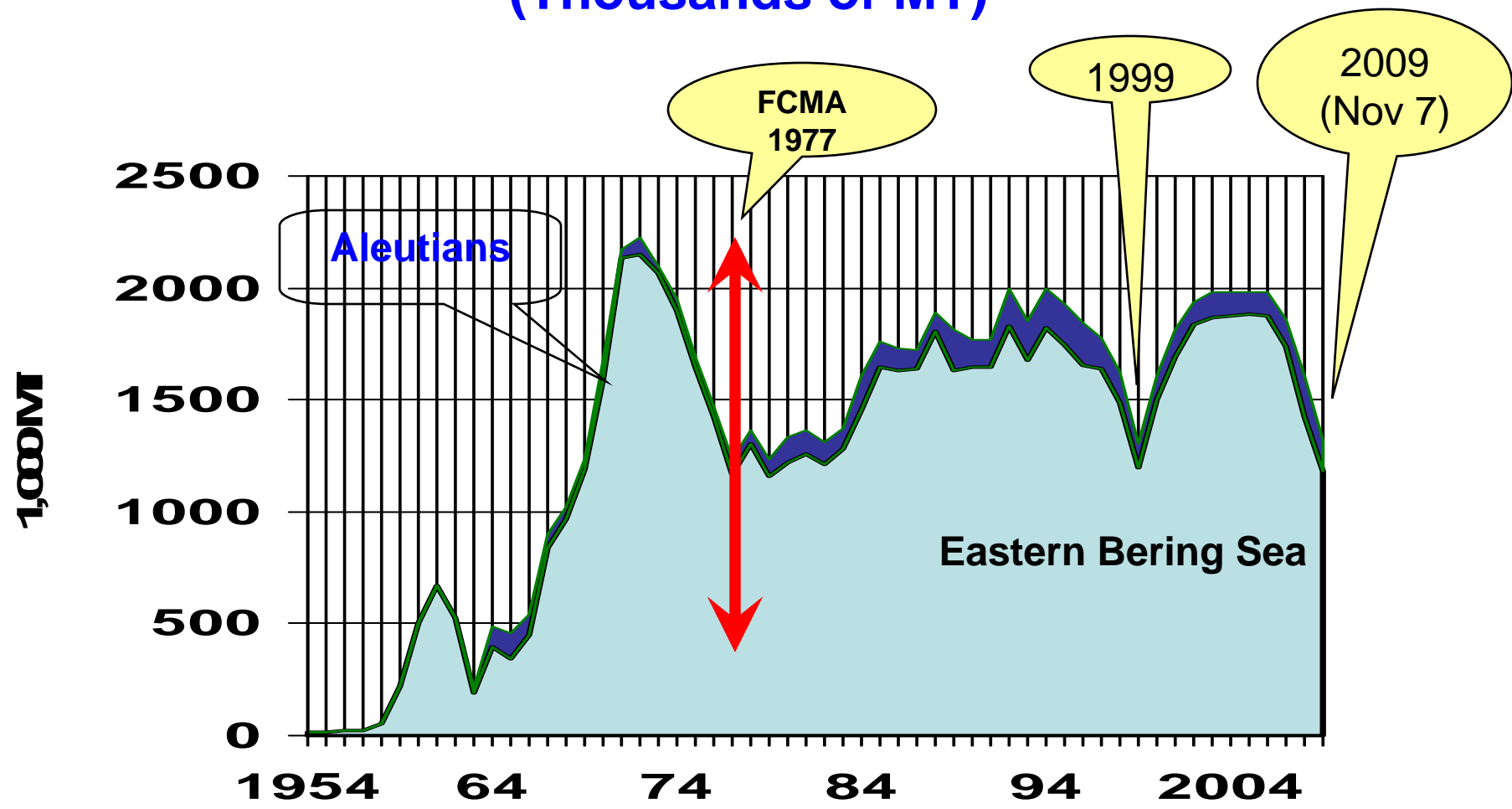
- **Collection of articles from subject experts on Ecosystem Status Indicators, like**
  - Physical environment & Habitat
  - Productivity of lower trophic levels and forage fish
  - Productivity of Herring, salmon, groundfish, benthic community, marine mammals, seabirds
  - Ecosystem community indicators
- **Climate effects & environmental trends**
- **Fishing effects on ecosystems**
- **Stock chapters now also have ecosystem discussion to add effects of regime shifts, changing climate conditions, food base characteristics, over-winter survival on recruitment, etc**

# Economics Chapter

- **Figures and Tables**
  - Catches, Discards, Bycatch Rates
  - Exvessel Prices of Species
  - Fishery Values
  - Vessel Statistics & Vessel Activities
  - Employment Statistics
  - Currency Exchange Rates
- **Reports of Alaska Groundfish Market Profiles**
  - Pollock Fillet, Surimi and Roe
  - Pacific Cod
  - Sablefish
  - Yellowfin Sole and Rock Sole
  - Arrowtooth Flounder
  - Alaska Groundfish Export Market Forecasts
- **Socio-economics, Cultural and Community Profiles**
- **Other Economics Research and Data Collection Reports**

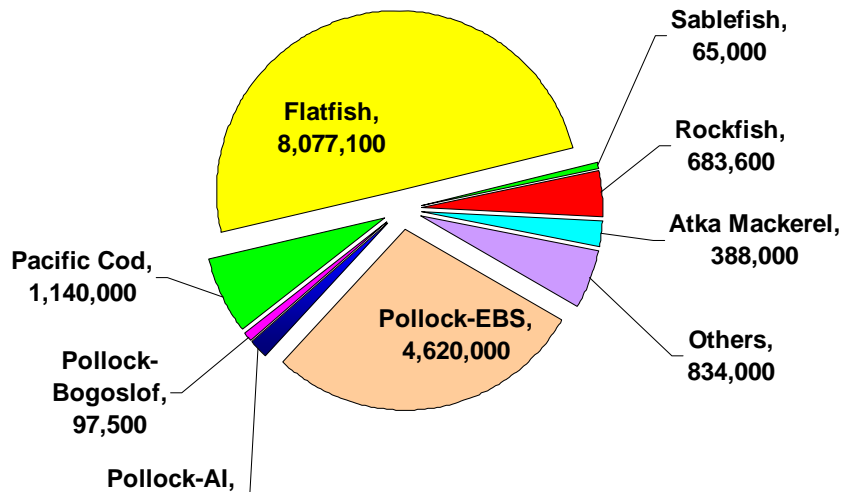
# General Overview Slides

# Catch History of Total BSAI Groundfish 1954-2009 (Thousands of MT)



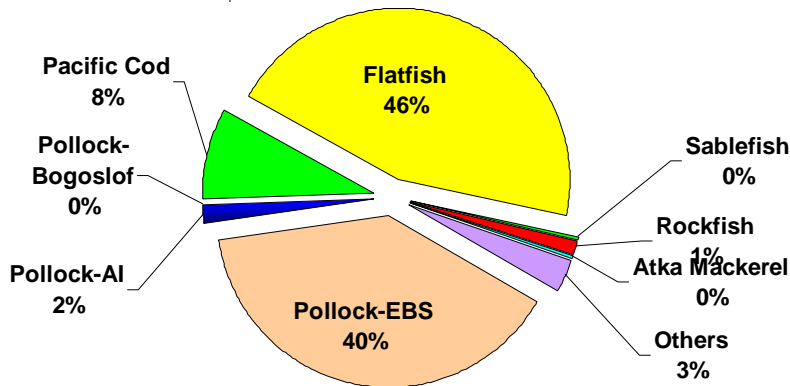
# Summary Result of Dec 2009 BSAI Assessment

## Exploitable Biomass versus ABCs (Percent Change from 2009-2010)



**Biomass = 16.2 mmt**

**Down 6%**



**ABC = 2.12 mmt**

**(Within 10% of 2 mmt OY)**

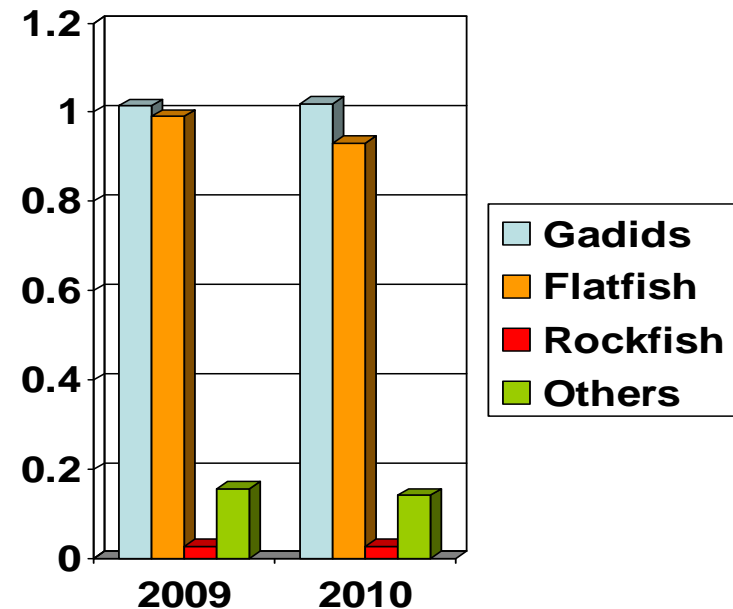
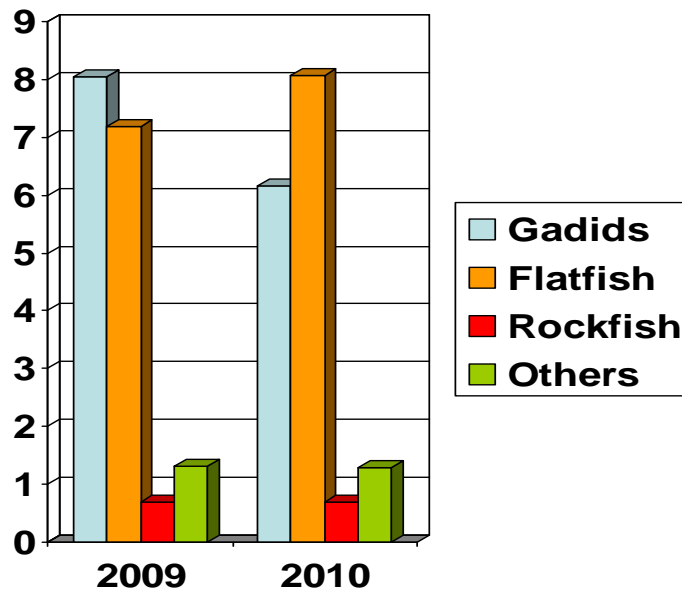
**Down 3%**



# BSAI Percent Changes by Major Groups, 2009-2010

## Changes from Last Year

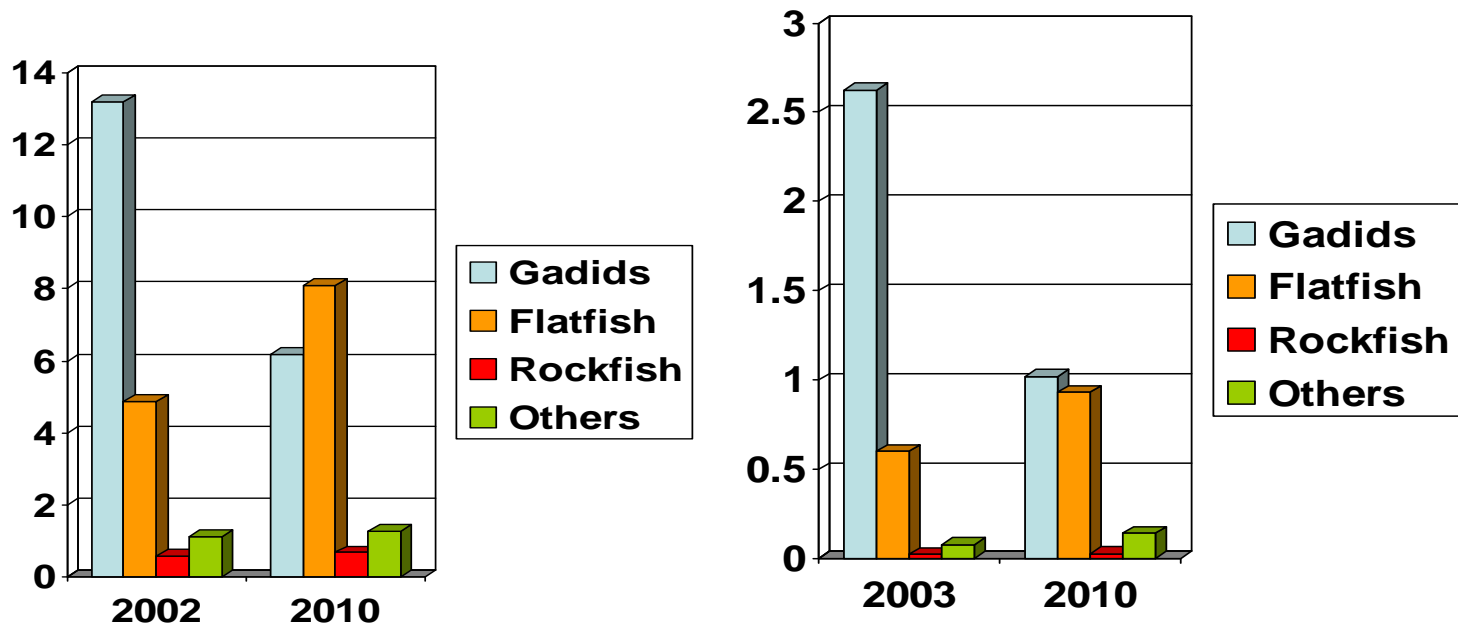
Groups	Biomass	ABC
Gadids	- 23	+ 1
Flatfish	+ 12	-6
Rockfish	+ 1	+ 1
All Others	- 1	- 10
Total	- 6	- 3



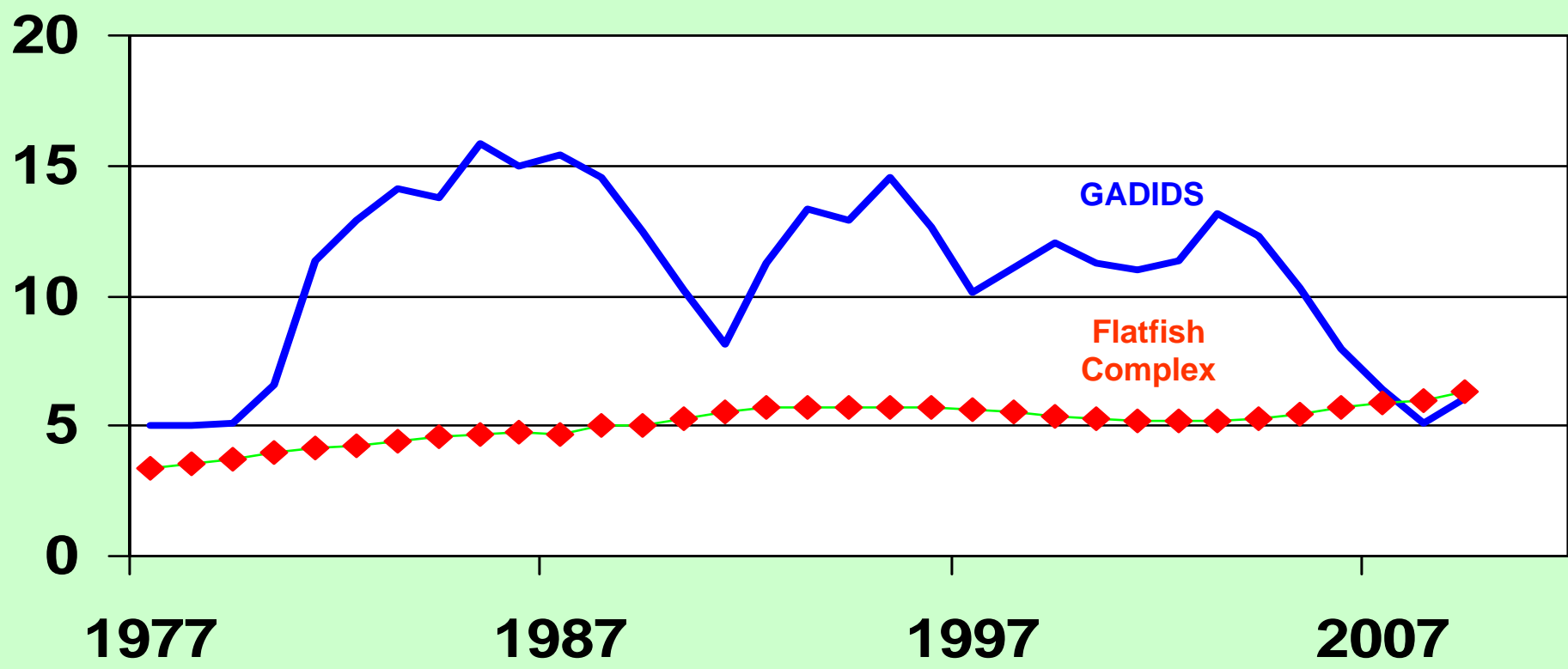
# BSAI Percent Changes by Major Groups, 2003-2010

## Changes from 7years ago

Groups	Biomass	ABC
Gadids	- 53	- 61
Flatfish	+ 66	+ 66
Rockfish	+ 15	+ 14
All Others	+ 15	+ 83
Total	- 18	- 35

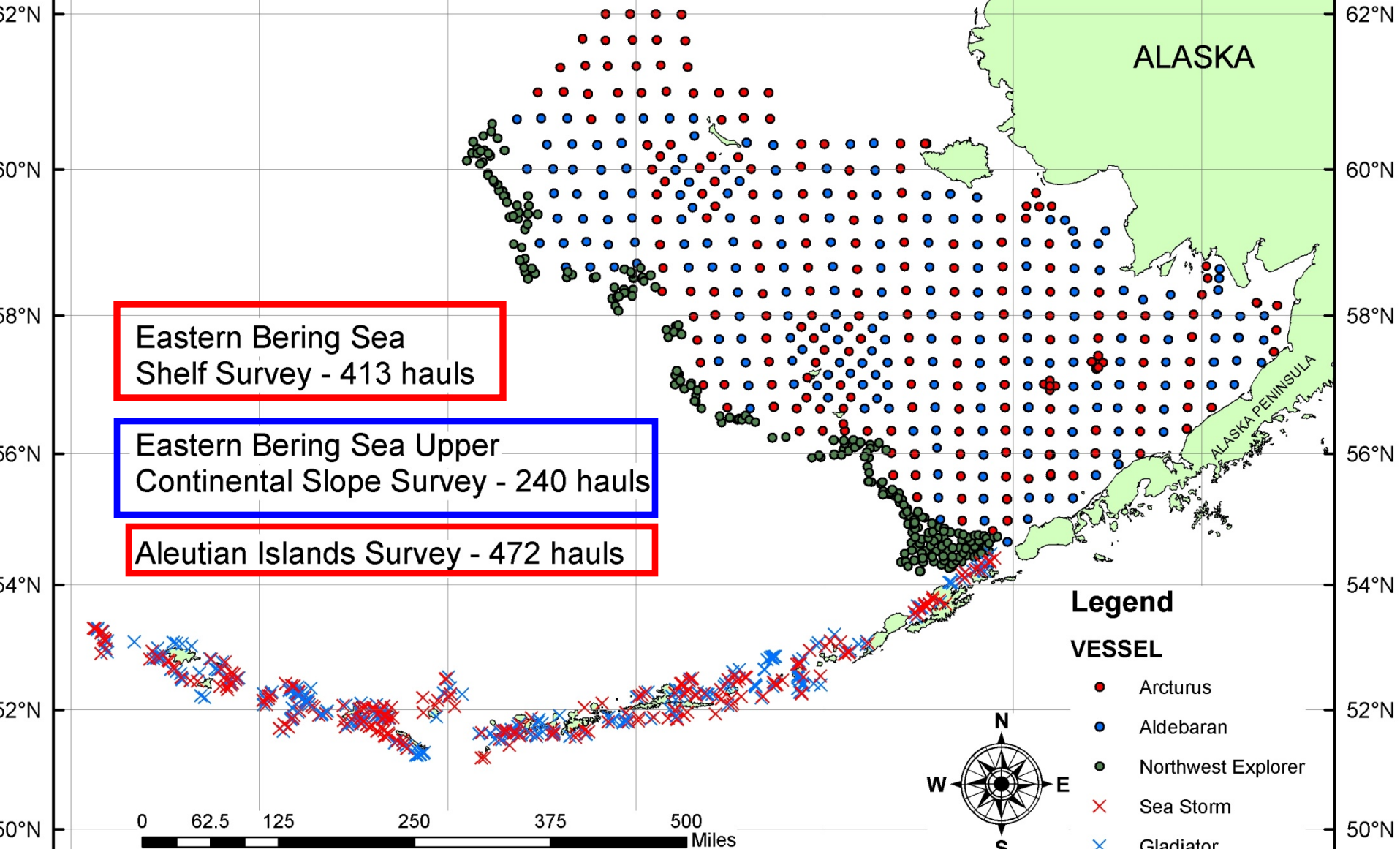


# Exploitable Biomass Gadids versus Flatfishes



170°E 175°E 180° 175°W 170°W 165°W 160°W

# AFSC 2004 Groundfish Survey Effort



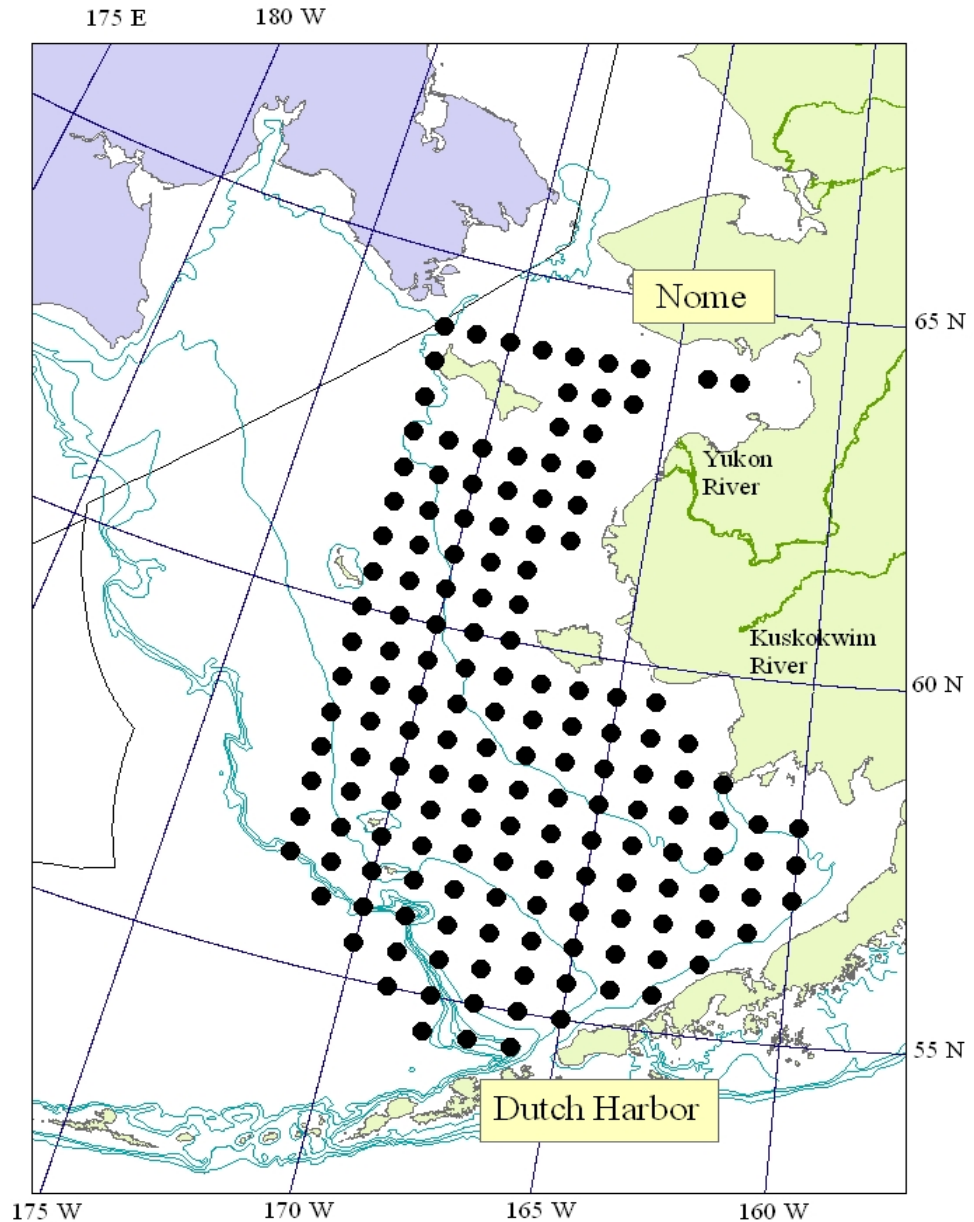
# Notes on Aleutians Surveys

- **Trawl Surveys are scheduled every 2 years**
- **The 2008 Survey was cancelled**
- **Team recommends scheduled surveys to happen in 2010**
- **As surveys directly affect assessments on**
  - **Aleutians pollock and Pacific cod**
  - **Atka mackerel**
  - **Aleutians Rockfish complex, including POP**
- **Aleutians Survey is in AFSC Plan; but depends on whether we get about \$3M in the budget**

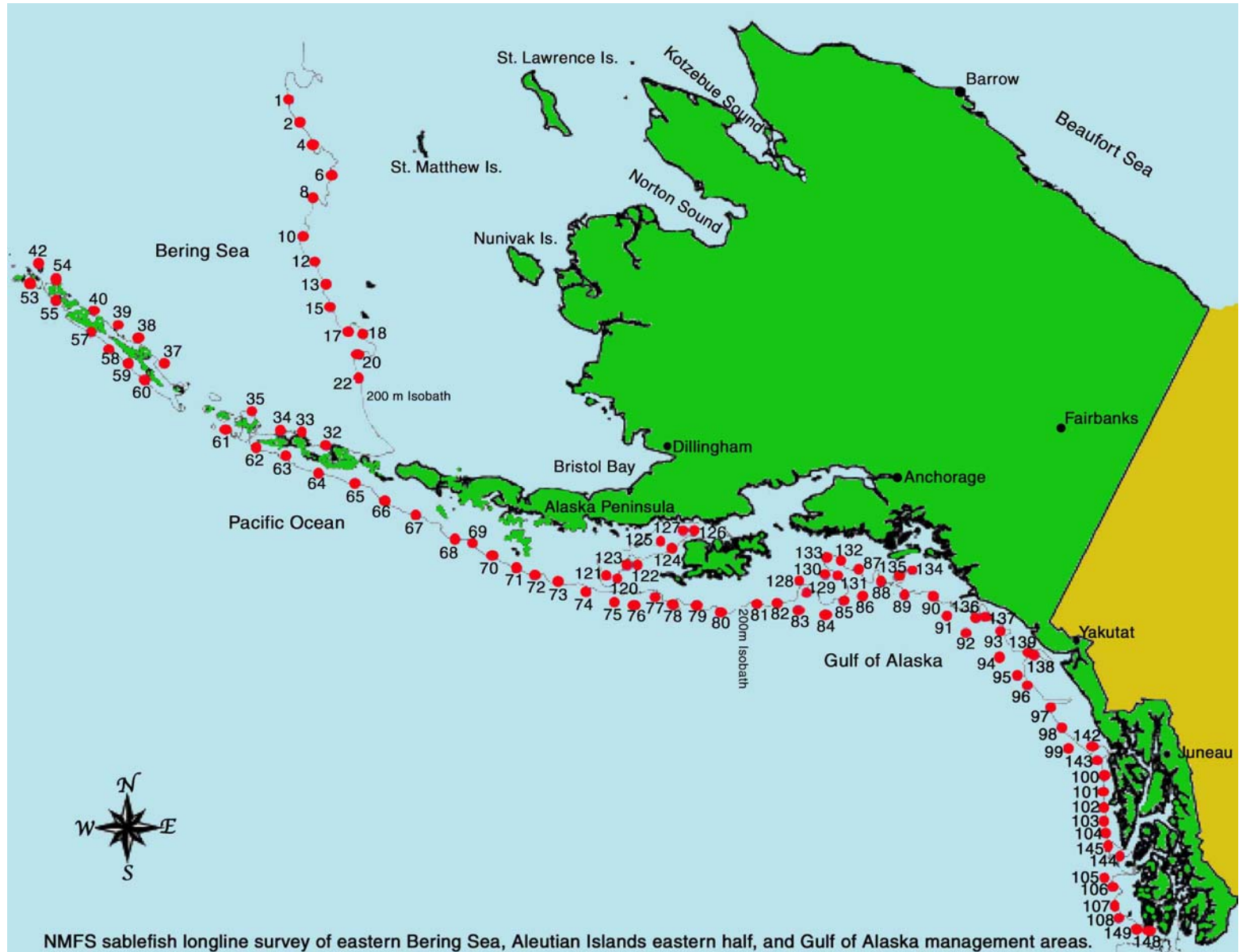
**U.S. BASIS  
Cruises, 2003-  
2009**

**Near Surface  
Surveys of  
Young Fish +  
Oceanography**

**Covered 3 warm  
& 4 cold years**



# Sablefish Longline Survey

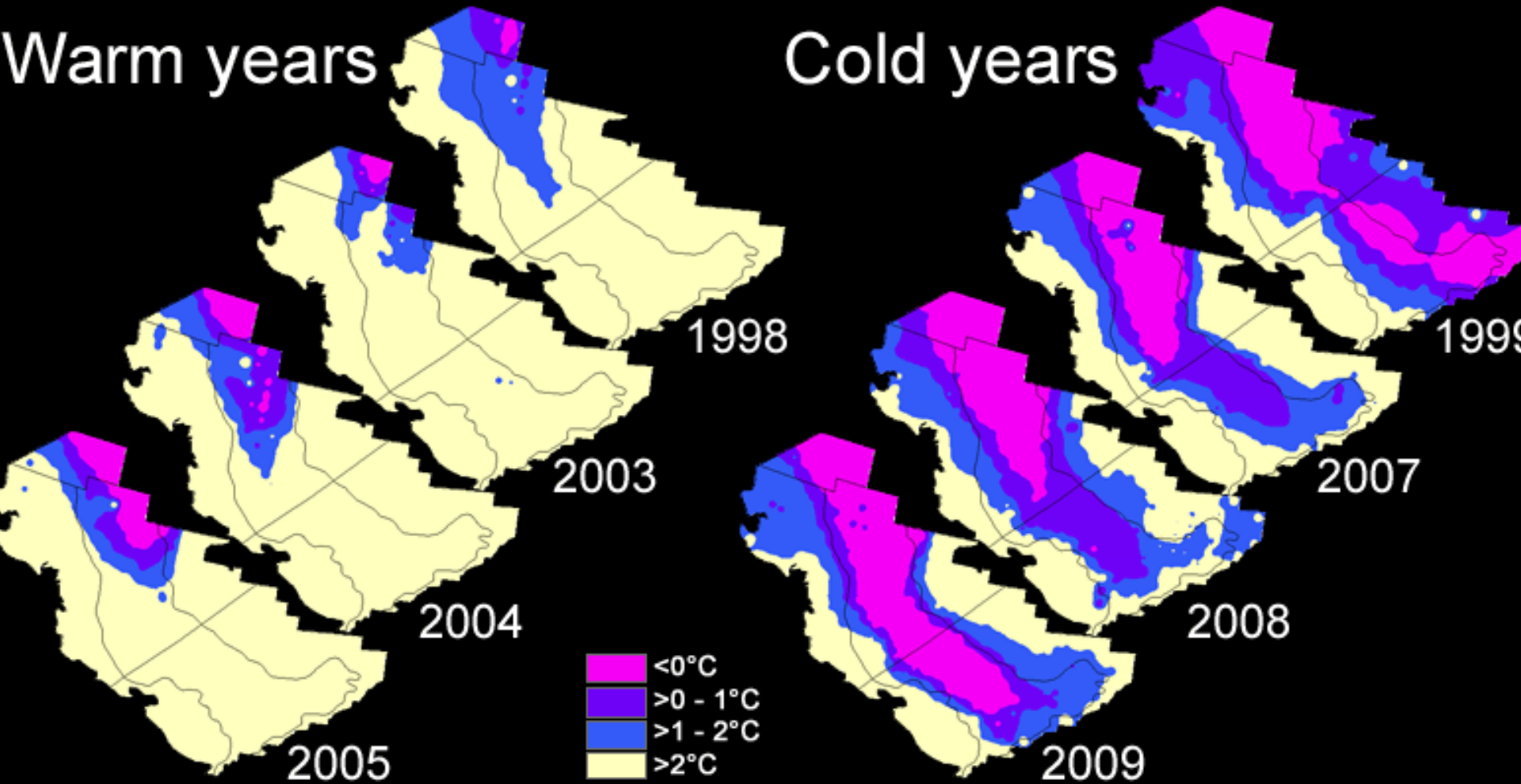


NMFS sablefish longline survey of eastern Bering Sea, Aleutian Islands eastern half, and Gulf of Alaska management areas.



# EBS shelf cold pool (<math><2^{\circ}\text{C}</math>)

Red is colder, yellow is warm





# **Stock Assessment Theme**

Appendix A Plan Team Summary, Pages 7-8

## **1. Model the Population Dynamics of the Stocks**

- 1. Need good history of accurate Catch data**
- 2. Need Survey biomass to calibrate models and provide biological characteristics of the stocks and fish-gear interaction dynamics**
- 3. Need Observer data to provide age/size composition of catch and other biological data**
- 4. Age Structured Population Dynamics Models**
- 5. Custom Population Dynamics Models**

## **2. Determine Exploitation Rates**

**(Harvest Control Rules by 6-Tier System)**

# Harvest Control Rules

**Based on Quality of Data & How well we can model the stock dynamics**

(Page 6 of SAFE Appendix A)

**Tier 1 -- Reliable B, Bmsy, pdf of Fmsy & S/R function**

**Tier 2 -- Reliable B, Bmsy, Fmsy, F35, F40**

**Tier 3 – Reliable B, B40, F35, F40**

**Tier 4 – Reliable B, F35, F40**

**Tier 5 -- Reliable B and M**

**Tier 6 – Reliable Catch History Data**

# Parameters of Special Attention

## Biomass Levels:

B<sub>msy</sub> (of the exploitable population)

FSB (Female Spawner Biomass)

B 20% (eg. probability of falling below level)

## Fishing Mortality Rates:

F *overfishing* ...

F *abc* .....

# Typical Format of Chapter Overviews with SSC by Grant Thompson

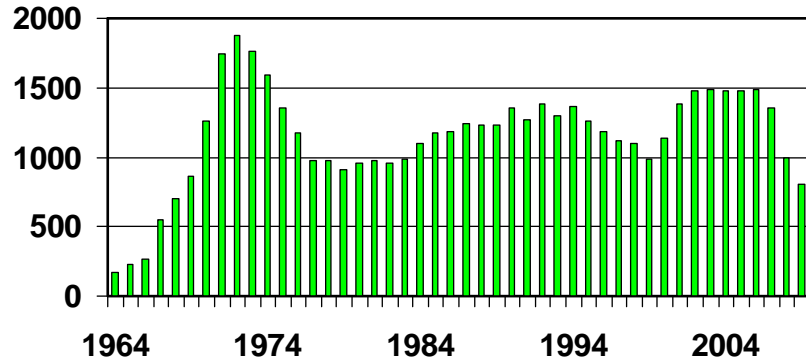
- **Author responses to SSC/Team/Public comments**
- **New data**
- **Changes in analytic approach**
- **Stock status and trend**
  - Recruitment strengths and weaknesses
  - Age+ and spawning biomass trends
  - Spawning biomass projection
- **ABC**
  - Tier determination
  - 2010, 2011 maxABC
  - Recommended ABC (if < max)
- **OFL**
- **4-Panel graphical summary**

# Overview of Species Summary Slides

- By Species Groups
- Details of Key Stock Analyses will be presented by Jim Ianelli
  - Pollock (EBS)

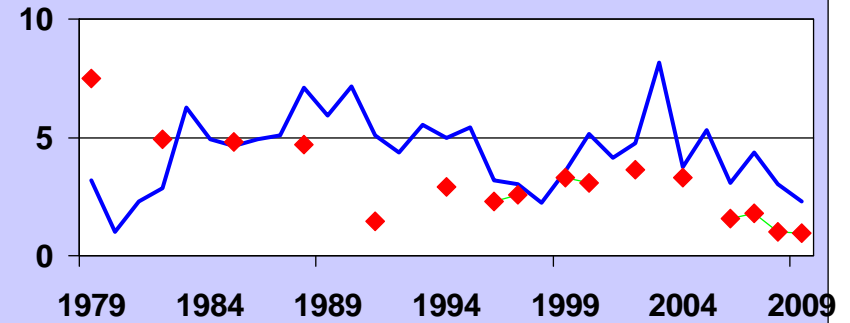
# C1 - EBS Pollock Stock Assessment, Dec 2009

**Catch (1,000 M.Tons) 1964-2009**  
 2009 Catch through Nov 7

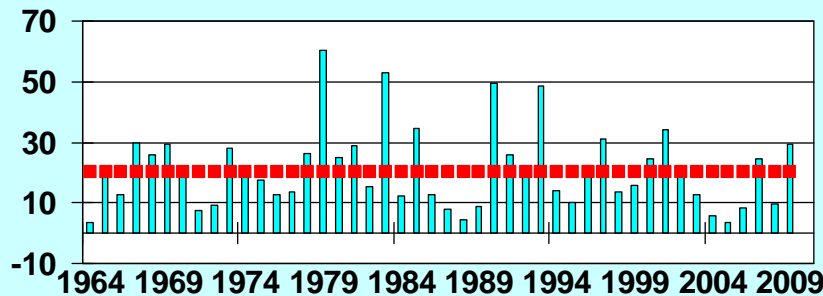


**Survey Biomass 1979-2009**

Line=On-Bottom Trawl, - 25% from 2008  
 Diamonds Dots = Off-Bottom, = 2008

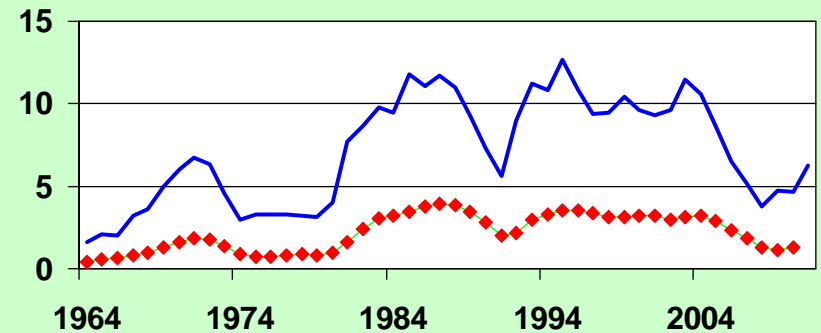


**EBS Pollock Age 1 Recruits in Billions**  
 Average Recruitment 1964-2009 = 20  
 Below Average Ycs 2002-05  
 Above = 2006 & 2008



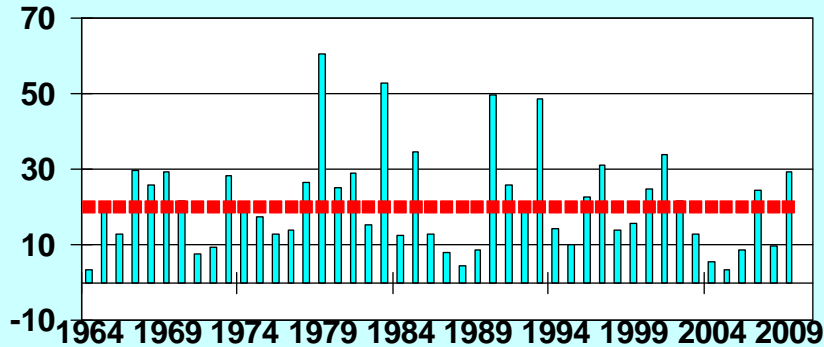
**Model Biomass 1964-2011**

Line=Age 3+ Biomass, Diamonds Dots =  
 Female Spawning Biomass



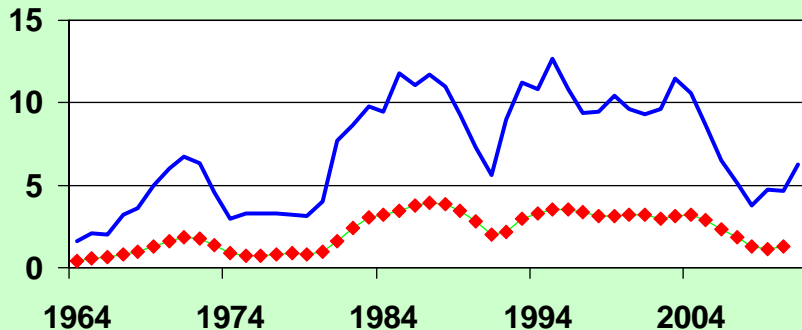
# C1 - EBS Pollock Notes, Dec 2009

**EBS Pollock Age 1 Recruits in Billions**  
Average Recruitment 1964-2009= 20



**Model Biomass 1964-2011**

Line=Age 3+ Biomass, Diamonds Dots =  
Female Spawning Biomass



- No big changes in analytic approach
- Stock status and trend
  - Similar to last year’s projections
  - 2001-2005 year classes all weak; 2006 & 2008 stronger
  - Age 3+ biomass has been declining since 2003
    - 2008 age 3+ biomass lowest since 1980 but expected to turn up after 2009
  - Spawning biomass has also been declining & to turn up
  - 2010 spawning biomass 15% below BMSY and projected to be near BMSY by 2012
- Pr(B<B20%) = 15% in 2008, < 10% in 2009

# EBS Pollock Stock-recruitment

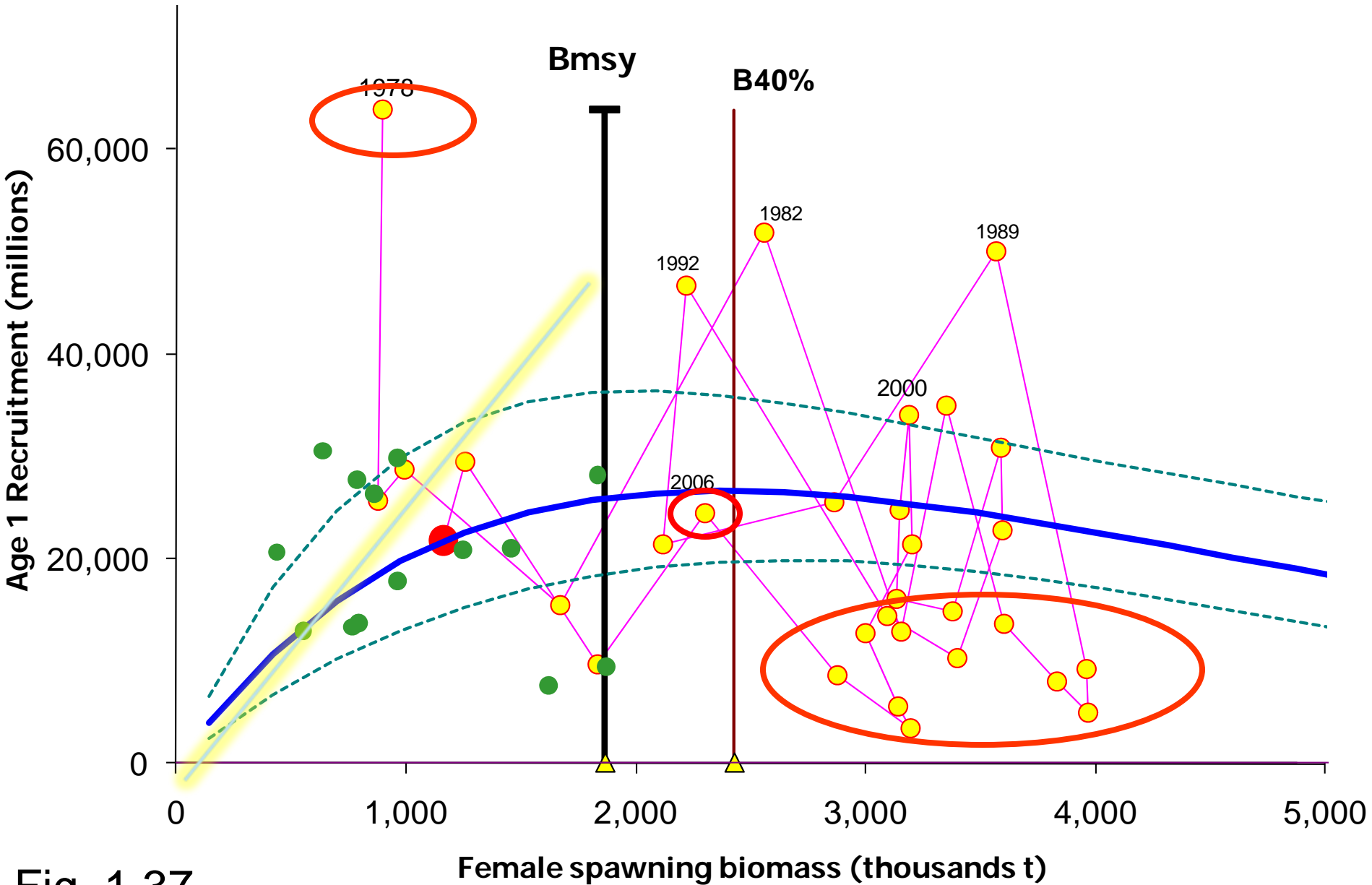


Fig. 1.37



# Discussions of ABC of recruitment under Tier 1b

(Team favored left column by 1 vote)

## Tier 1b Determination when 2006 YC was estimated from the surveys and Model

- Tier 1b ABC = 813,000 t
- 2006 YC not bias and above LT Average
- While stock is dependent on 2006 YC, it has occurred many times before
- 2008 YC above Average

## Tier 1b Determination when YC is assumed to be LT average

- Tier 1b ABC = 738,000 mt
- Projected stock to reach Bmsy in 2012 instead of 2010
- Survey biomass is low
- Even if 2006 YC is strong, previous 4 YCs were below average
- Spawner-Recruit relationship is uncertain

# Team Discussions of ABC of Tier 1b vs Tier 3

(Favor: Tier 1b)

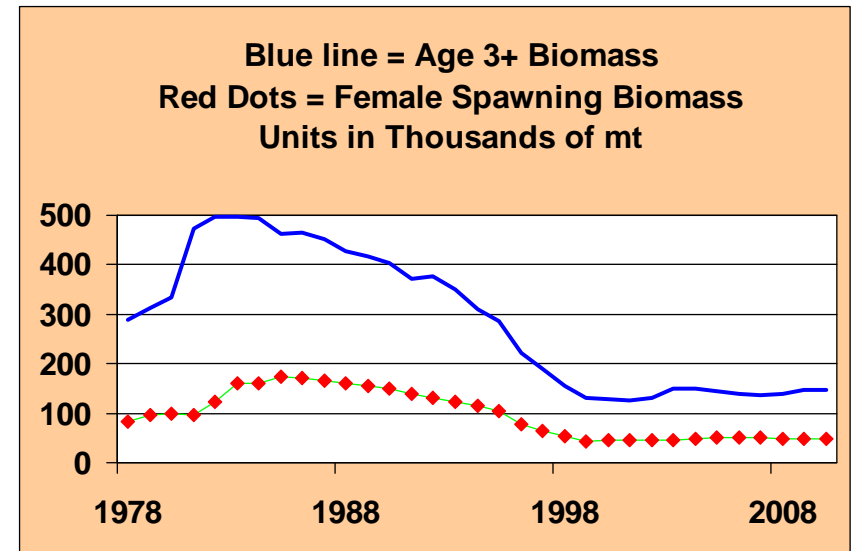
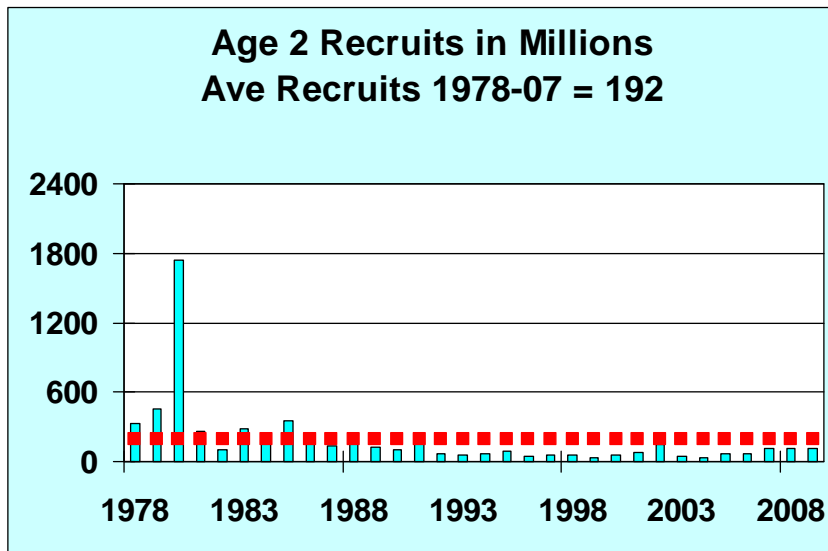
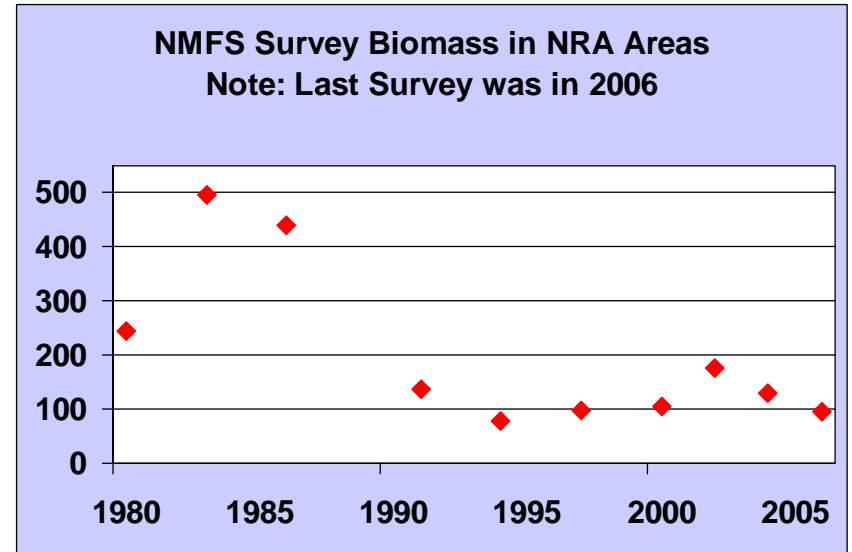
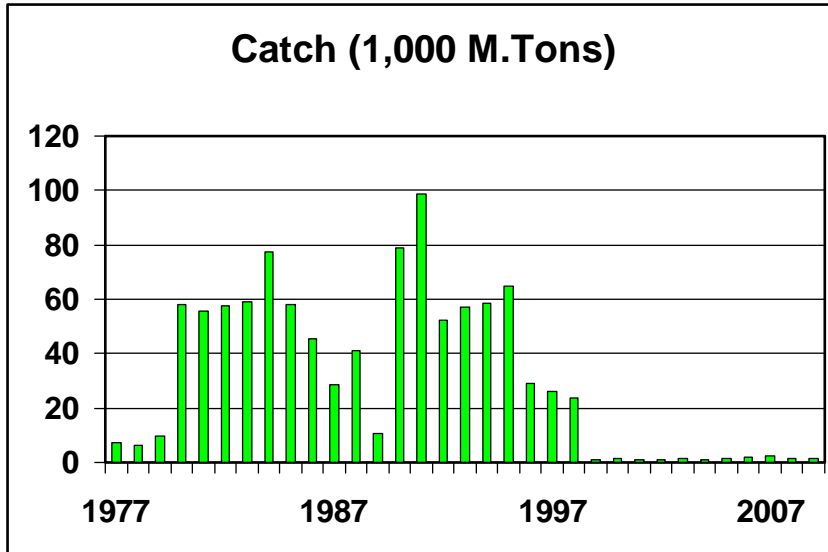
## Tier 1b Determination (ABC = 813,000 t)

- Model is appropriate
- 2006 YC not bias
- While stock is dependent on 2006 yc, it is has occurred many times before

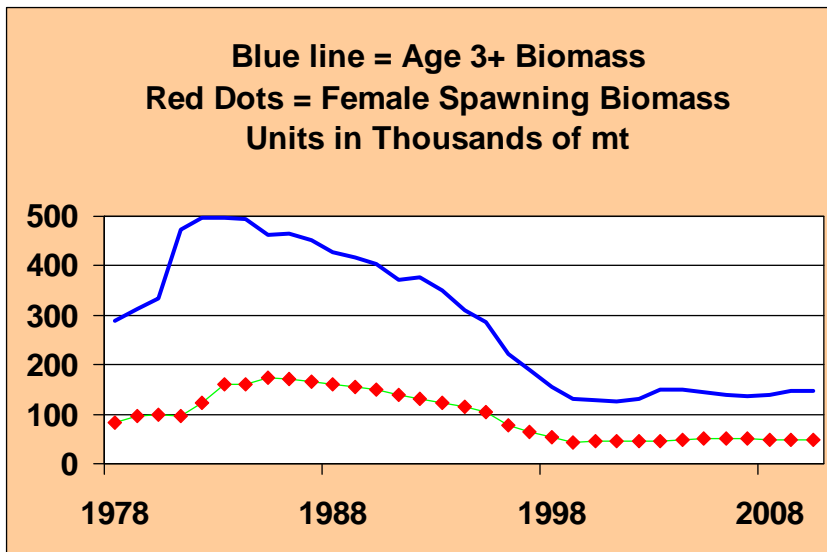
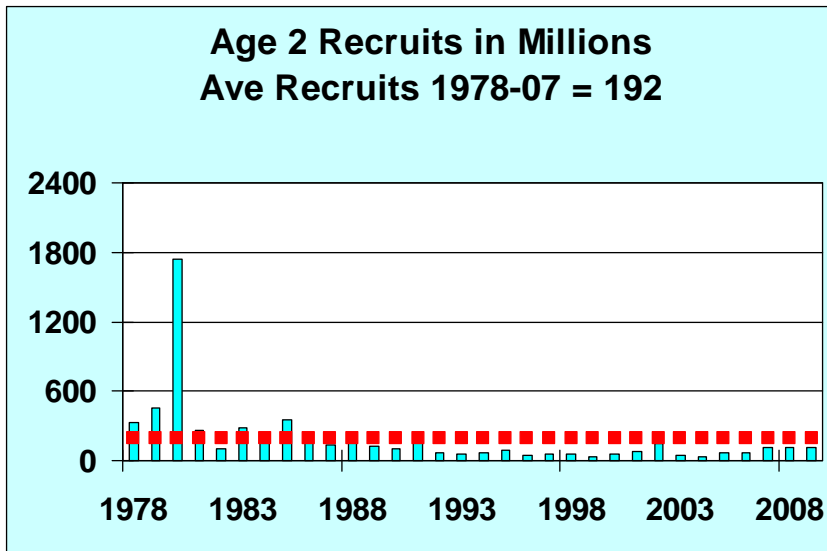
## Tier 3 Determination (ABC = 433,000 t)

- This Tier does not consider recruitment function to be reliable

# C1a - Aleutian Islands Pollock Assessment, Dec 2009

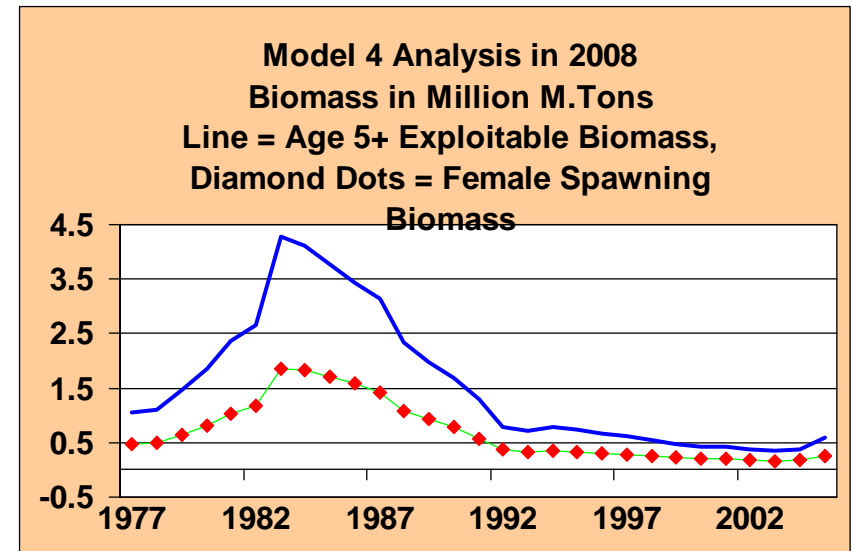
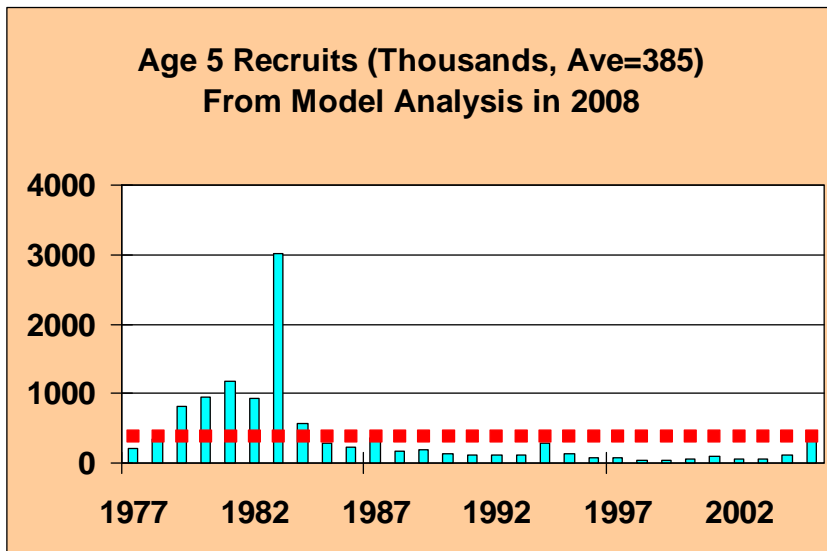
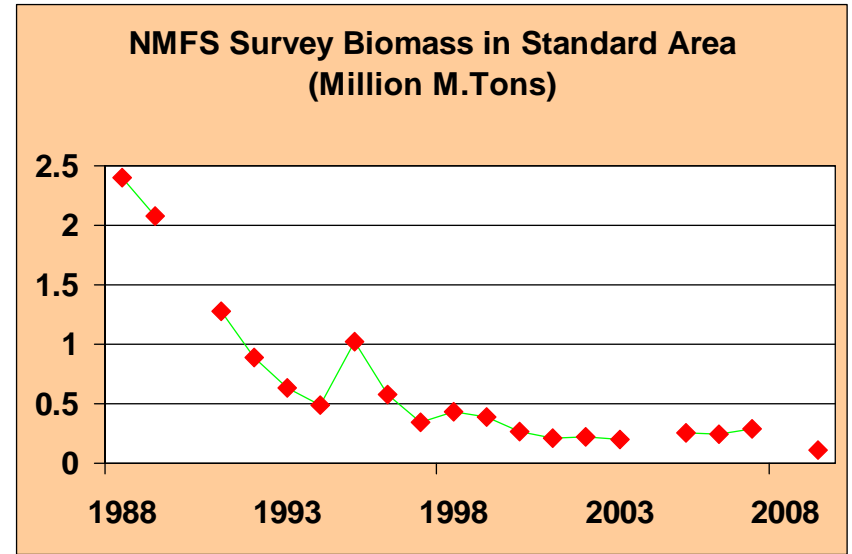
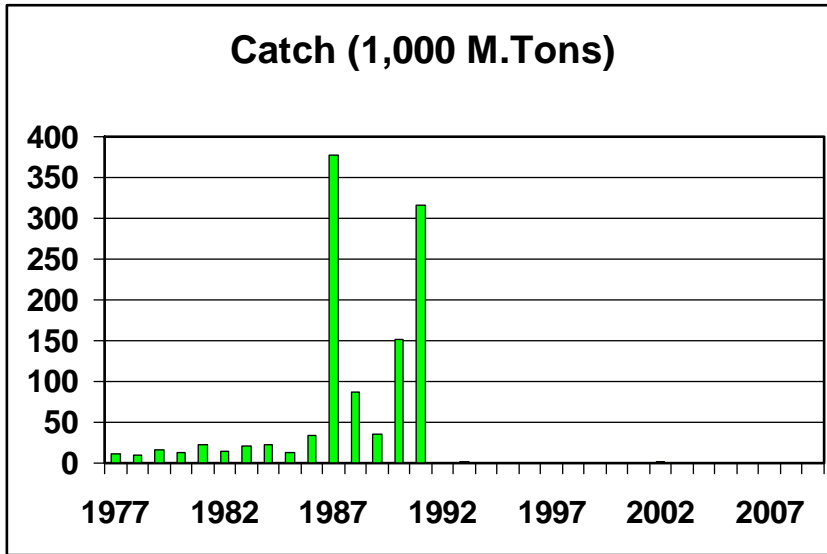


# C1a - Aleutian Islands Pollock Notes, Dec 2009

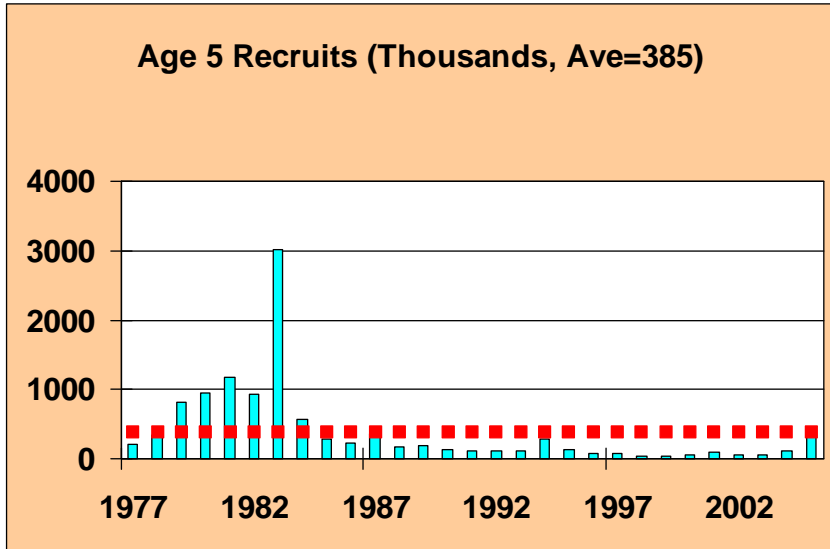


- No fishing since 1999; except for Special Aleut Corp Allocation of 19,000 t from 2005
- Age structured model was recommended after 2007 from a CIE Review
- We used Tier 5 approach for ABC up through 2008
- Now Tier 3 is accepted by SSC; thus OFLs & ABCs are calculated by Tier 3

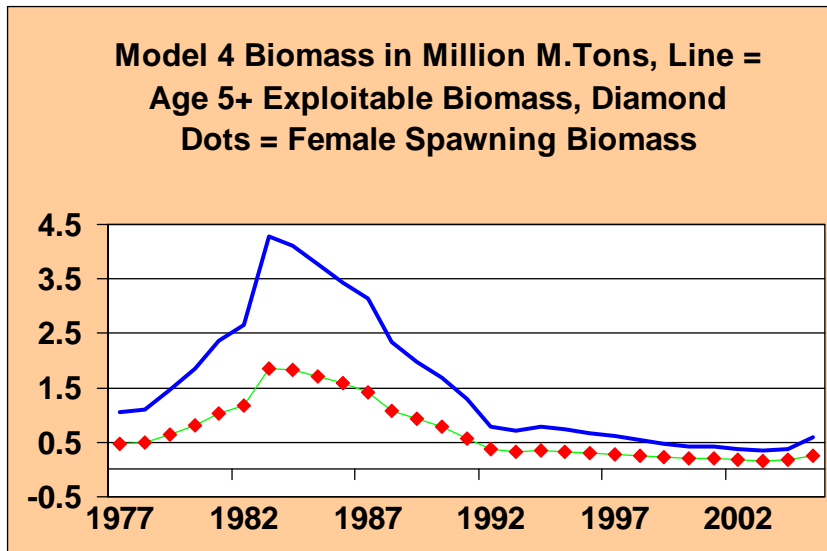
# C1b - Bogoslof Island Pollock Assessment, Dec 2009



# C1b - Bogoslof Island Pollock Notes, Dec 2009

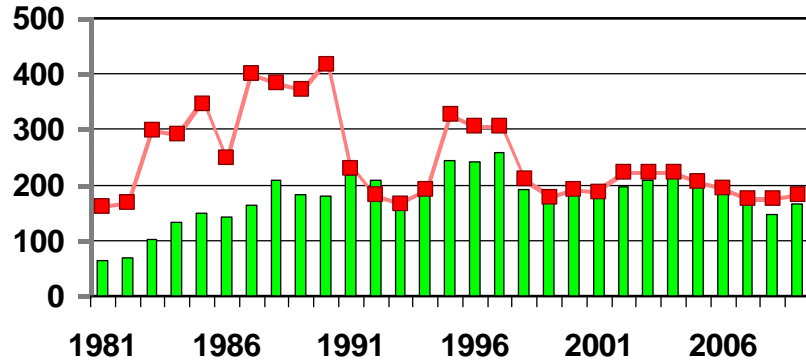


- Age structured Models are available from 2008; but not accepted by SSC to set ABCs
- ABCs are calculated from 2009 Survey Estimate based on Tier 5 procedure by SSC
- Survey Biomass in 2009 was the lowest ever; thus ABC is set very low

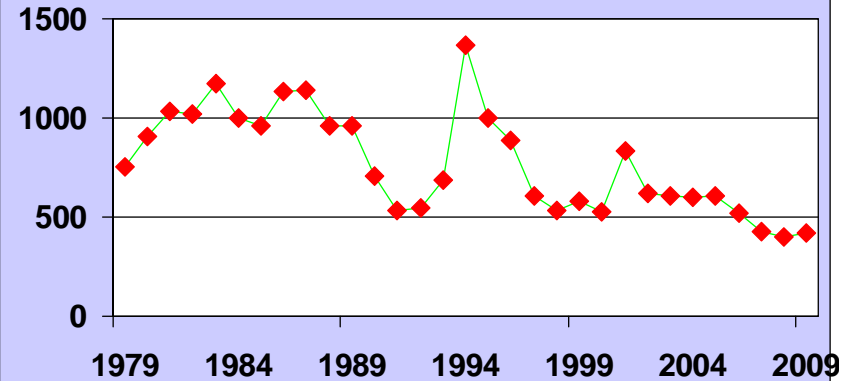


# C2- Pacific Cod Stock Assessment, Dec 2009

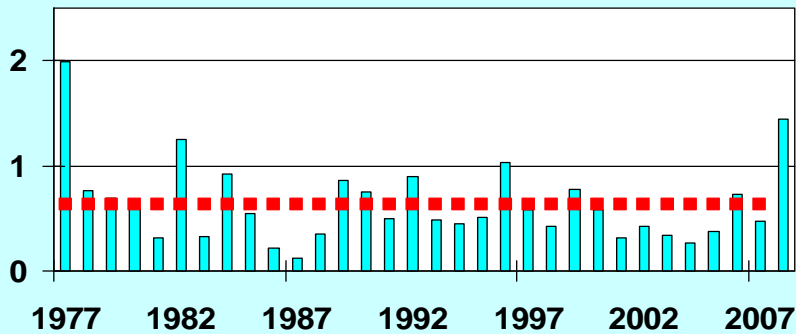
Catch (1,000 M.Tons in bars) and ABC (red line)



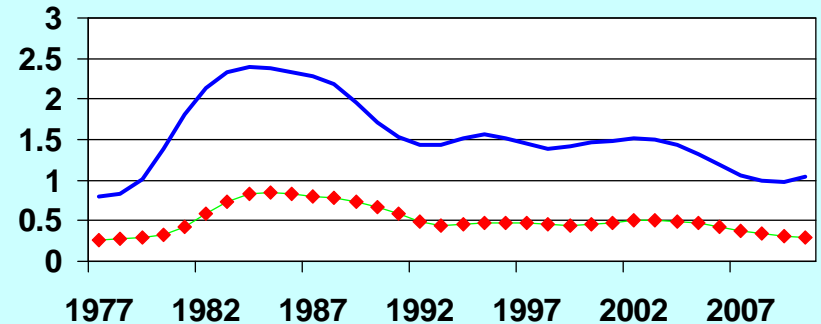
NMFS EBS Survey Biomass in Thousands of M.Tons



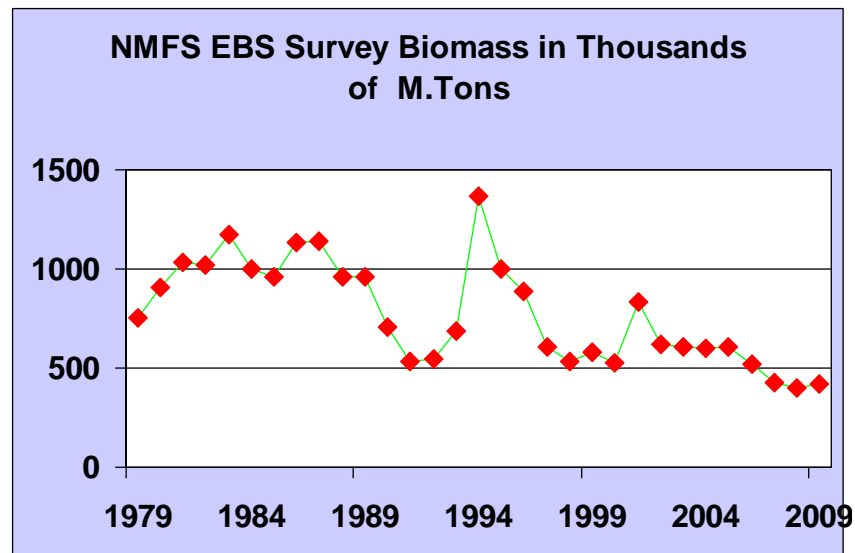
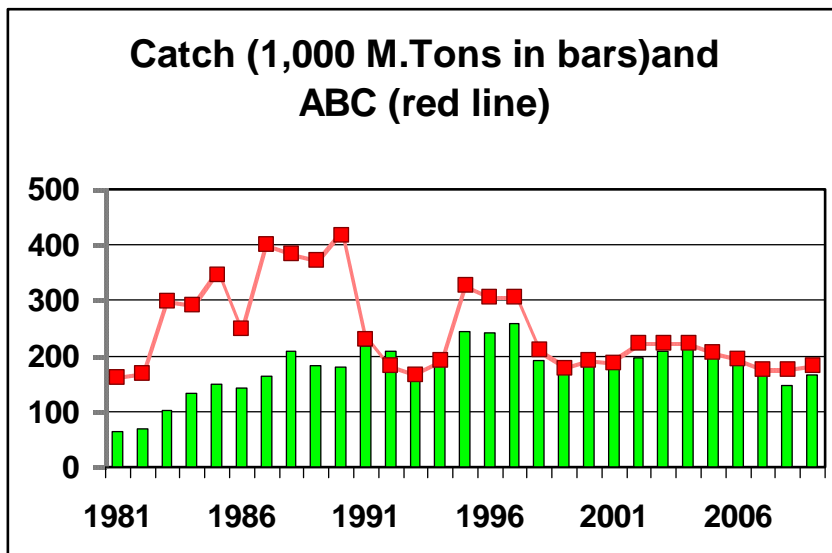
Model B1-BS Age 0 Recruits (31-Yr Ave=0.635 Billion)



EBS Model Biomass in Million M.Tons  
Line = Age 0+ Total Biomass  
Diamond Dots = Female Spawning Biomass



## C2- Pacific Cod Stock Assessment, Dec 2009



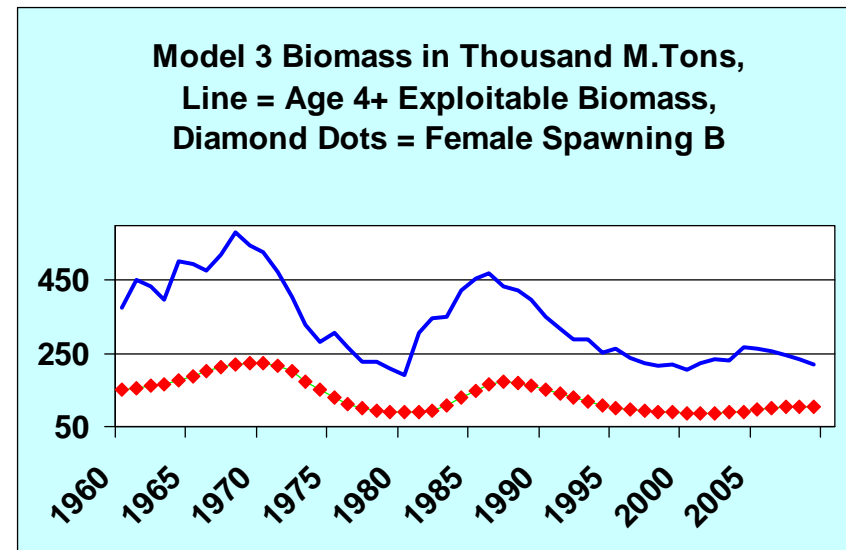
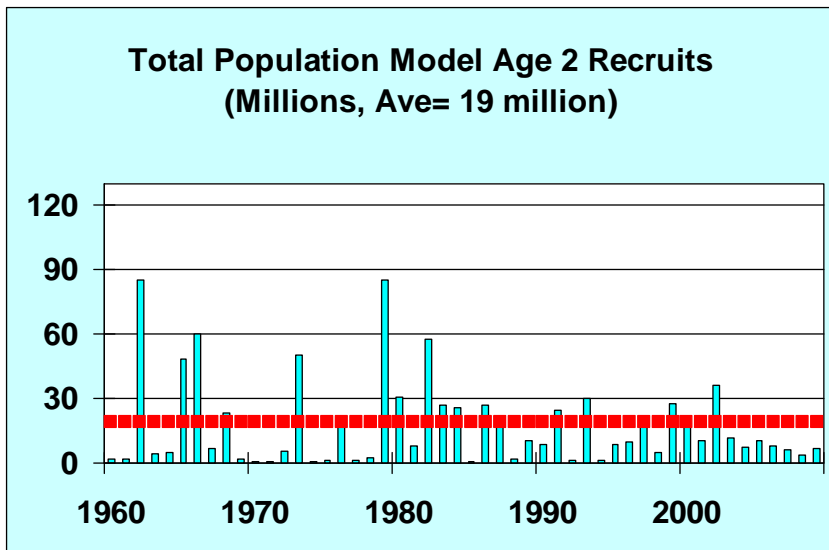
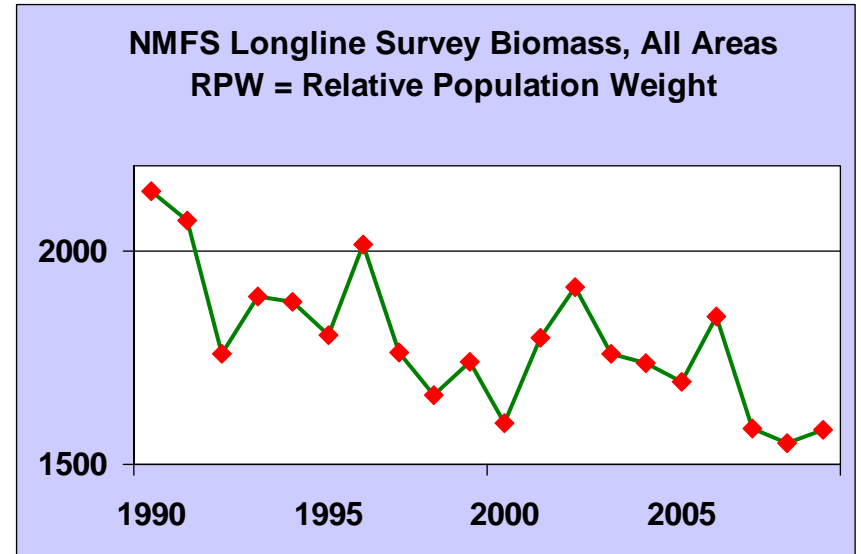
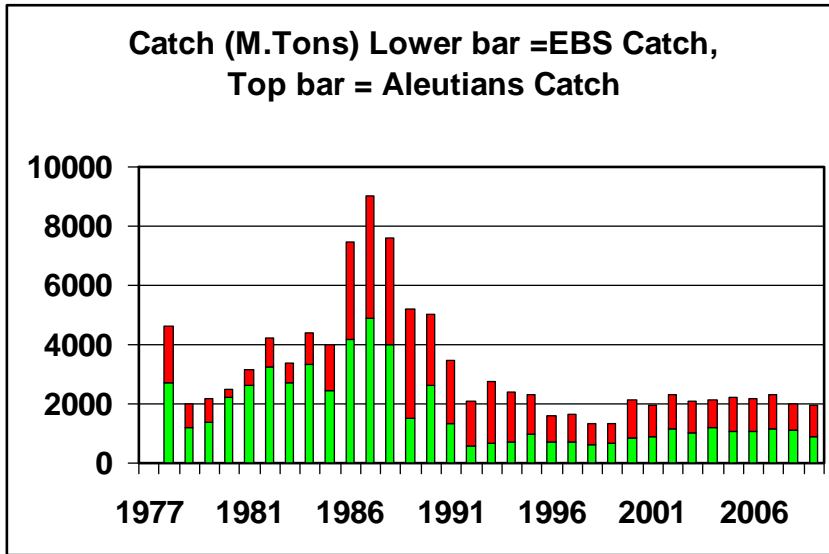
1. Main Analyst is Grant Thompson, 200-page document
2. Especially responsive to suggestions for Modeling by SSC, Plan Team, Public. He presented 14 Models based on these suggestions that may be grouped into 3 groups
3. Key aspects of modeling P Cod are:
  - Model by age groups vs size groups
  - How to treat M and Selectivity
  - Model fishing gear effects on catch
4. All the models fitted the data adequately. Author and Team selected Model B1 for its best fit, use of age data, and implementation of suggested changes
5. P Cod stock has declined from 1983 peak; but expected to improve
6. 2006 YC slightly above average and 2008 YC looks stronger
7. Tier 3 Stock, Not overfished nor approaching overfishing



## Chapter 3: sablefish (p. 405)

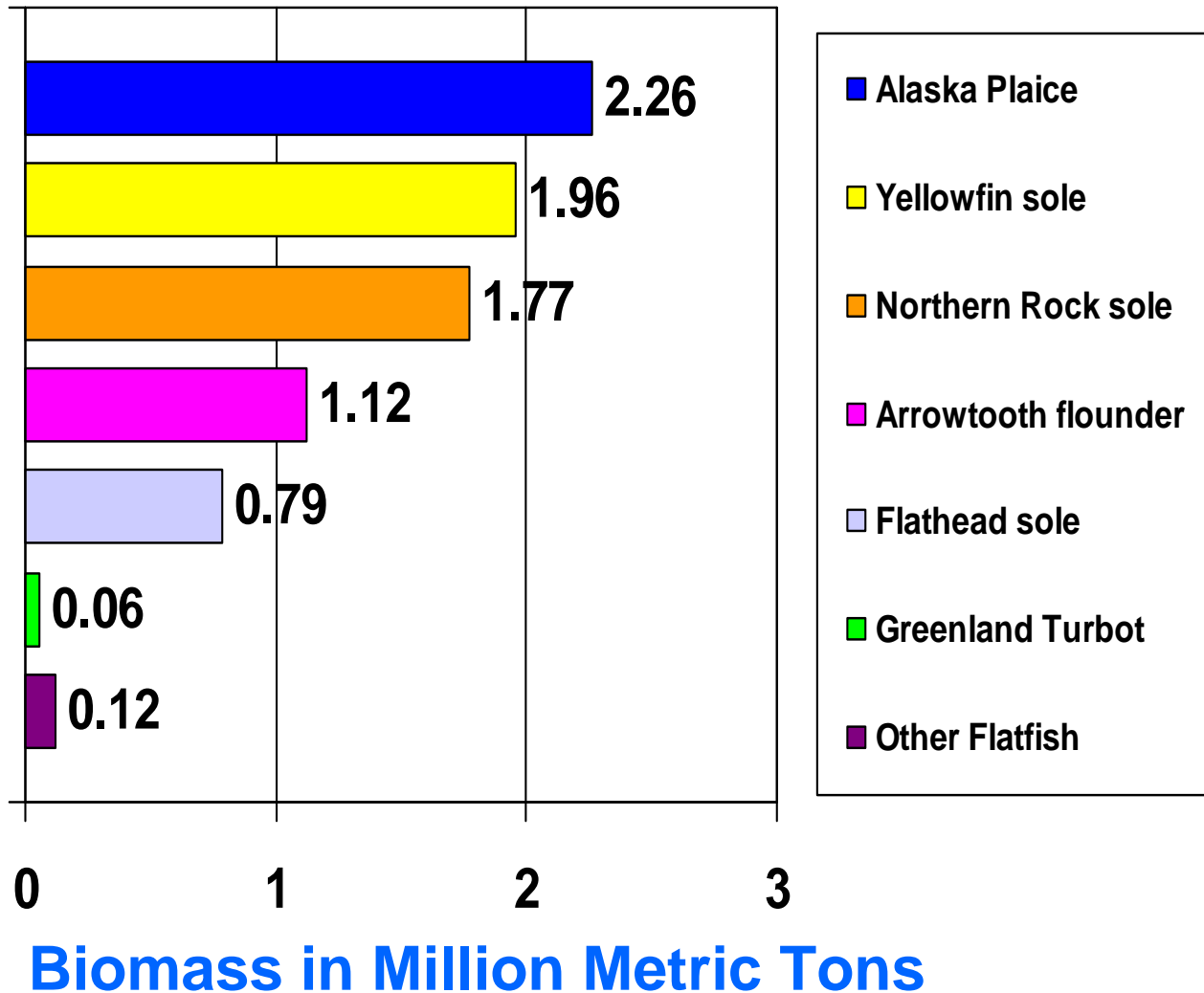
- To be covered in GOA Plan Team report
- ABC is apportioned from a Single Model
  - 2010 maxABC = 2,790 t (EBS); 2,070 t (AI)
  - 2011 maxABC = 2,500 t (EBS); 1,860 t (AI)

# C3 - Alaska-wide Sablefish Stock Assessment, Dec 2009



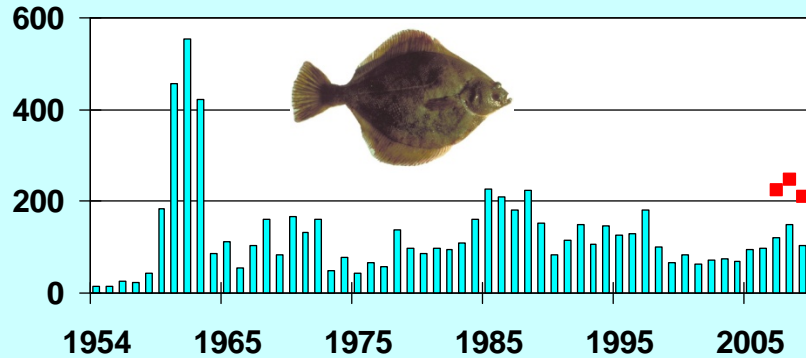
# Flatfish Complex Exploitable Biomass, 2009

50% of BSAI groundfish complex  
High in Abundance, except G. Turbot



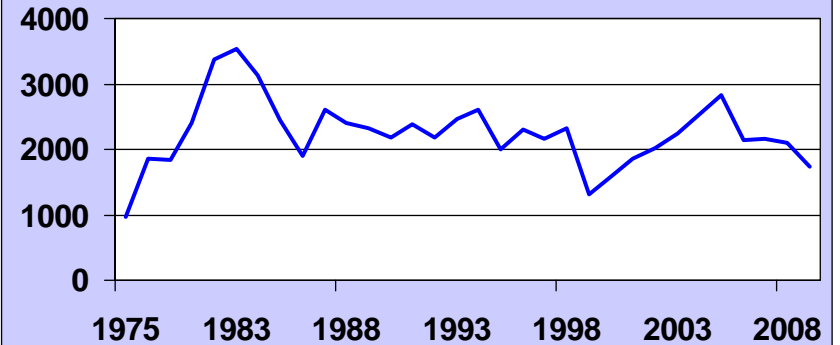
# C4 - Yellowfin Sole Stock Assessment, Dec 2009

Catch History and recent ABCs (red dots)  
Units in 1,000 mt



NMFS Bottom Trawl Survey Biomass  
(Thousand M. Tons)

Survey Biomass is down 17% from 2008-09



Age 5 Recruits in Billions, Ave= 1.5

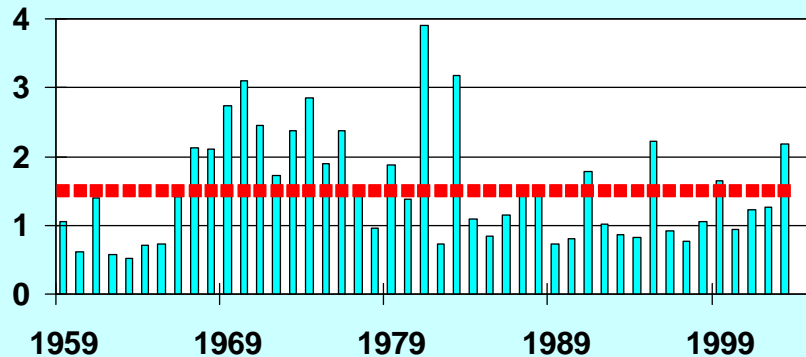
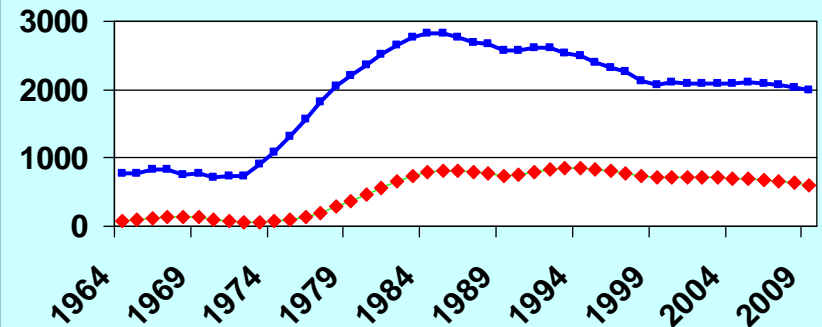


Table 4.17 Model Biomass in Thousand M.Tons, Line = Age 2+ Biomass, Red Diamond Dots = Female Spawning Biomass



## C4 - Yellowfin Sole Notes, Dec 2009

Age 5 Recruits in Billions, Ave= 1.5

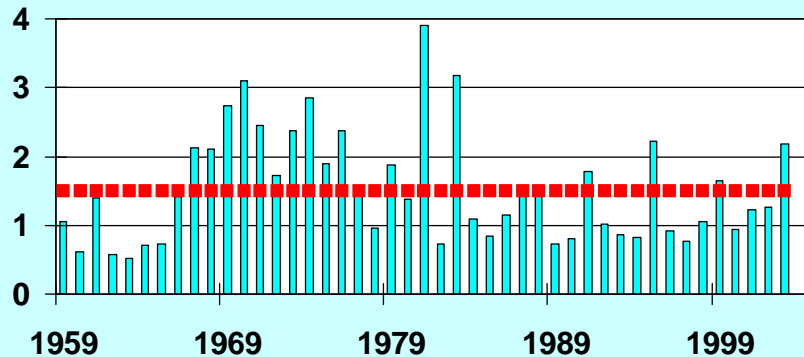
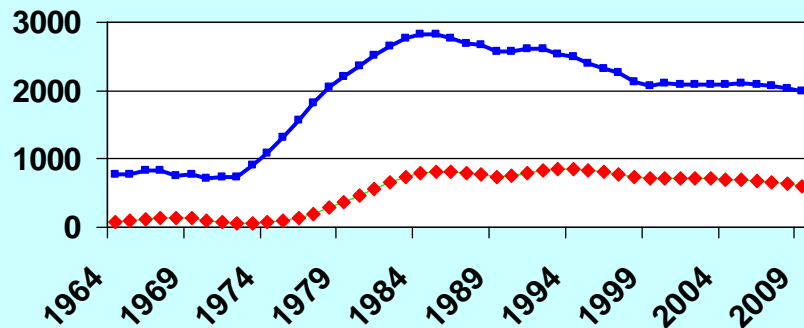
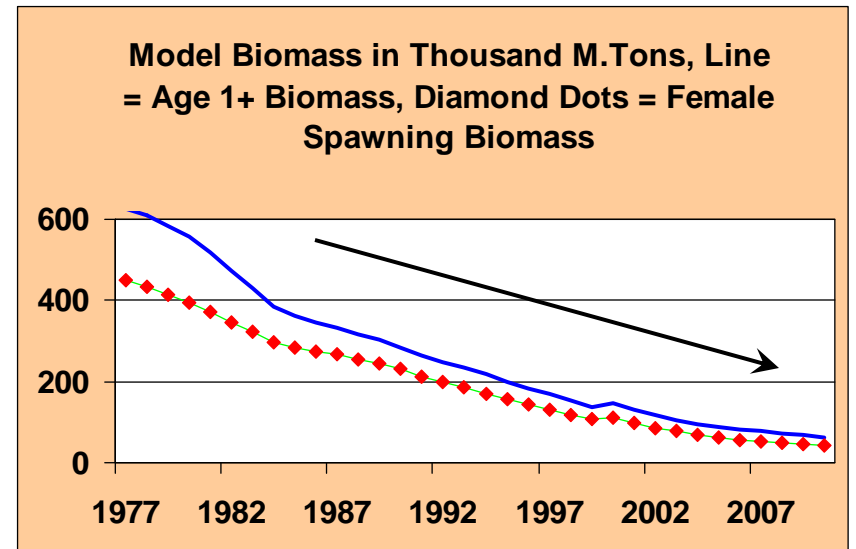
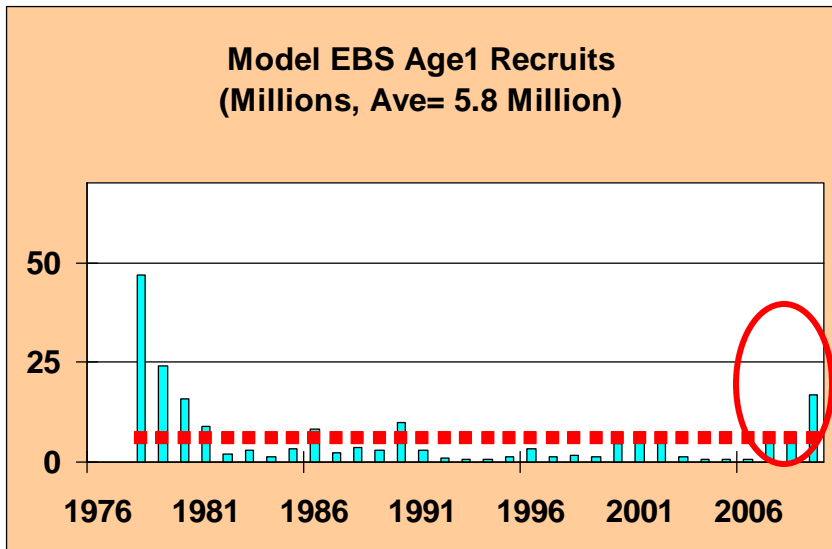
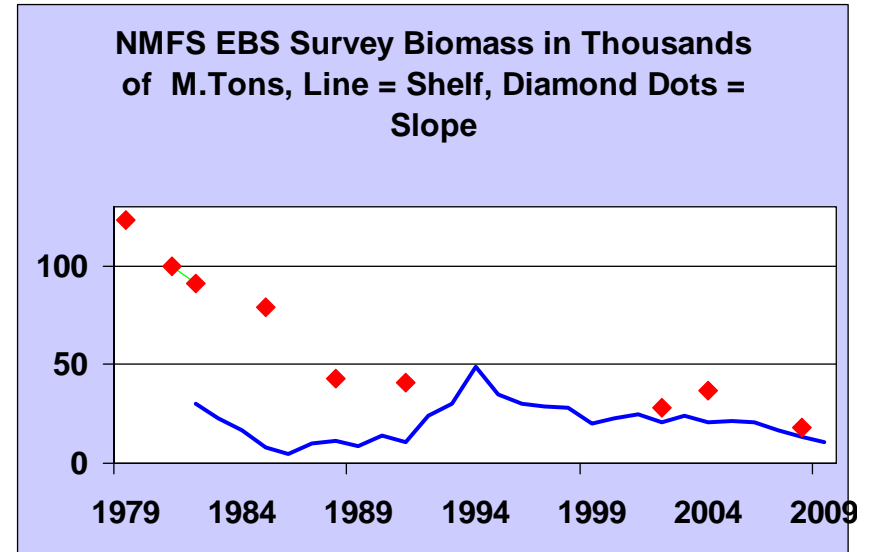
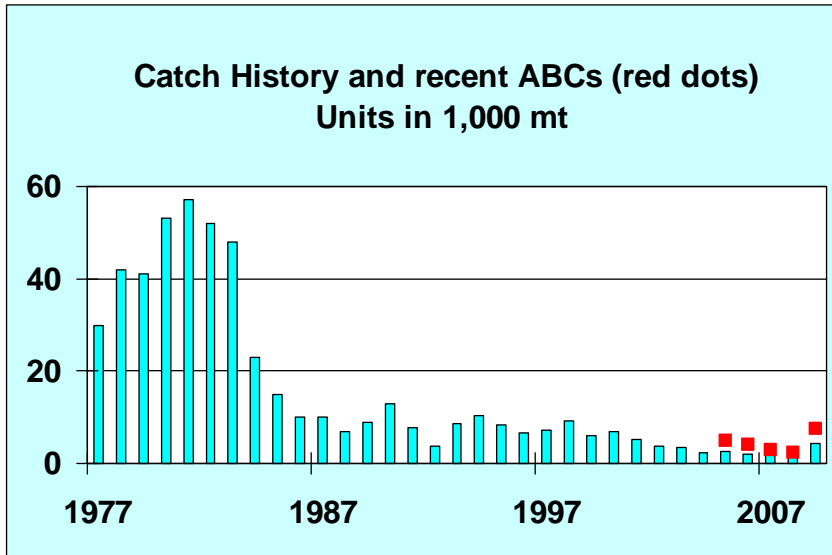


Table 4.17 Model Biomass in Thousand M.Tons, Line = Age 2+ Biomass, Red Diamond Dots = Female Spawning Biomass



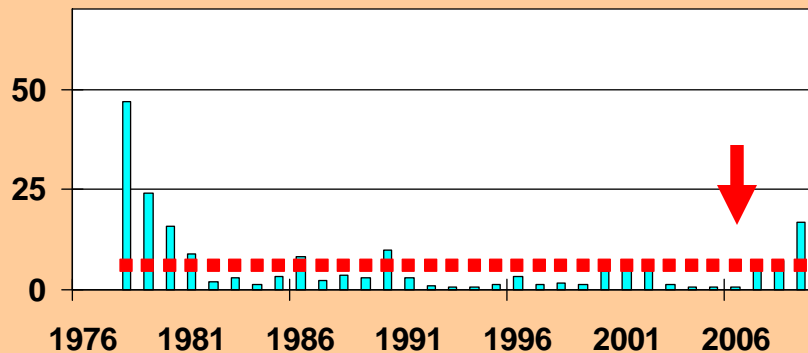
- Tier 1a, Split sex models
- Status and Trend
  - Recruitment had been above average from 1967-1976, 2 peaks in 1981 & 83 followed by almost 20 years of below average recruitment
  - Age 2+ biomass declining slowly since 2000
  - Spawning biomass declining slowly since 1994

# C5 - Greenland Turbot Stock Assessment, Dec 2009

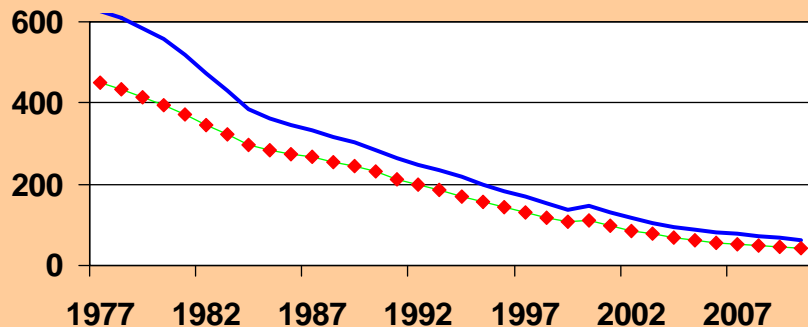


## C5 - Greenland Turbot Notes, Dec 2009

Model EBS Age1 Recruits  
(Millions, Ave= 5.8 Million)



Model Biomass in Thousand M.Tons, Line  
= Age 1+ Biomass, Diamond Dots = Female  
Spawning Biomass



- No changes in analytic approach

- Tier 3a

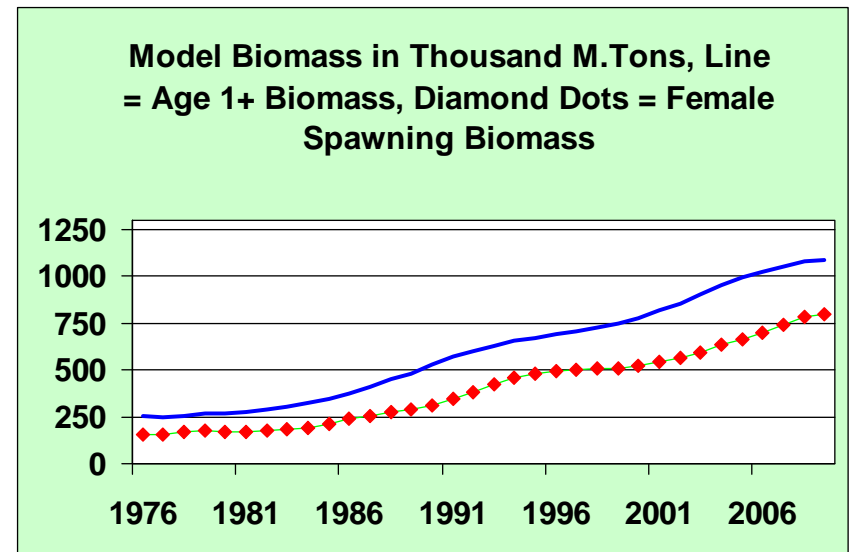
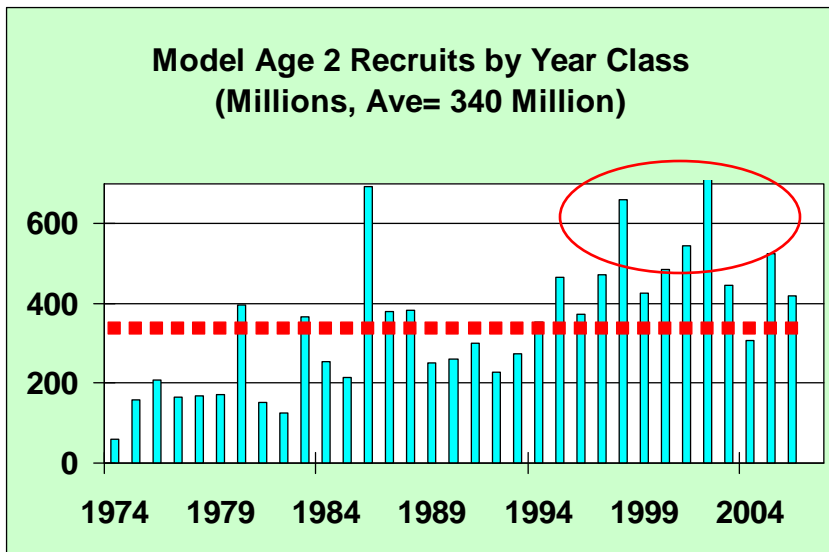
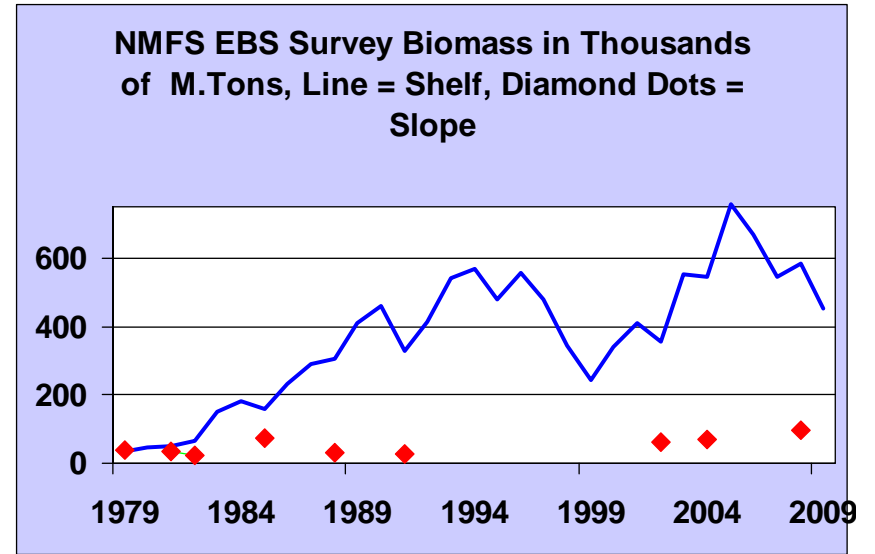
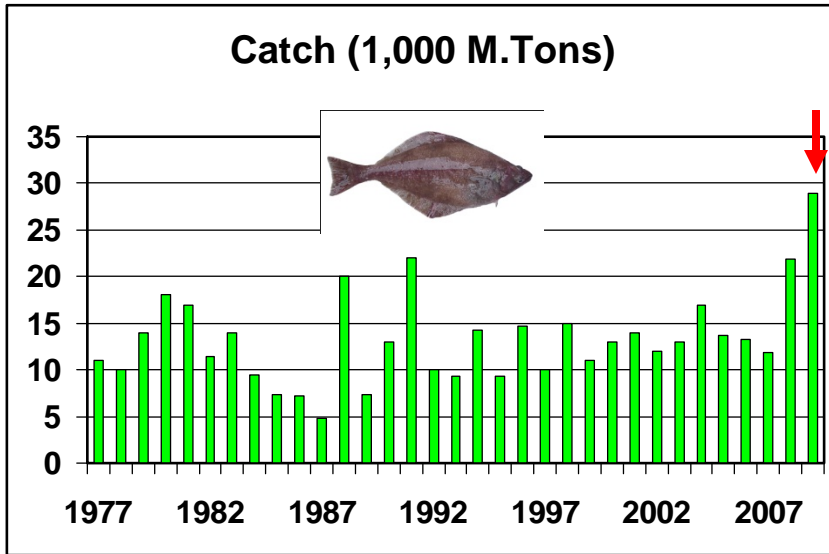
- Status and trend

- Last 3 YCs are above average

- 2008YC appears strong

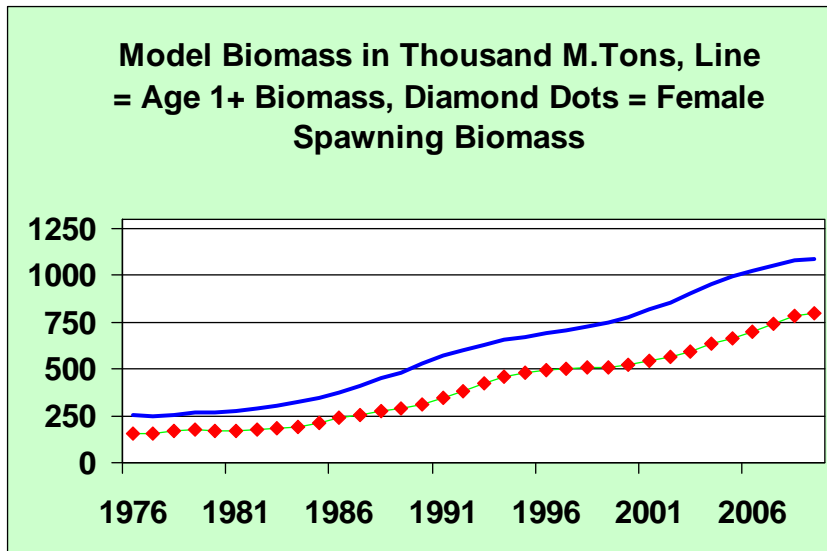
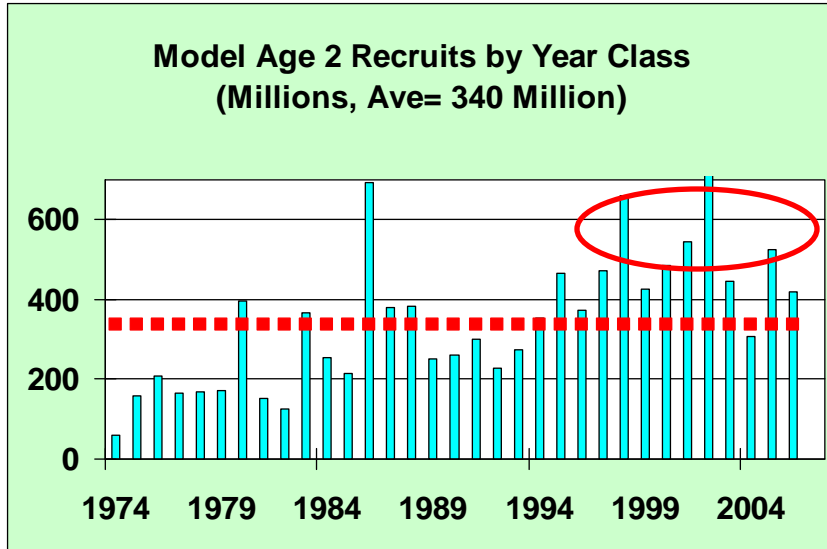
- Age 1+ biomass and spawning biomass have steady LT declines; but stabilizing

# C6 - Arrowtooth Flounder Stock Assessment, Dec 2009





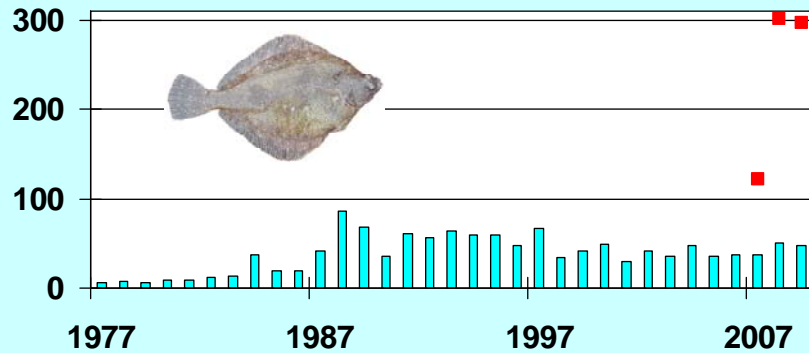
## C6 - Arrowtooth Flounder Notes, Dec 2008



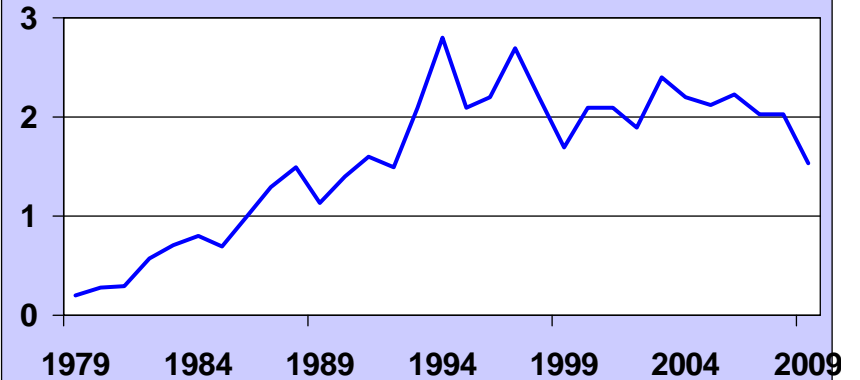
- **Straight Update from last year's assessment**
- **Tier 3a**
- **Stock status and trend**
  - **1995-2006 YCs are above ave.; 1998, 2002 YCs are large**
  - **Both Total and Spawning Biomass are still increasing; but surveys predict declines**

# C7 – N. Rock Sole Stock Assessment, Dec 2009

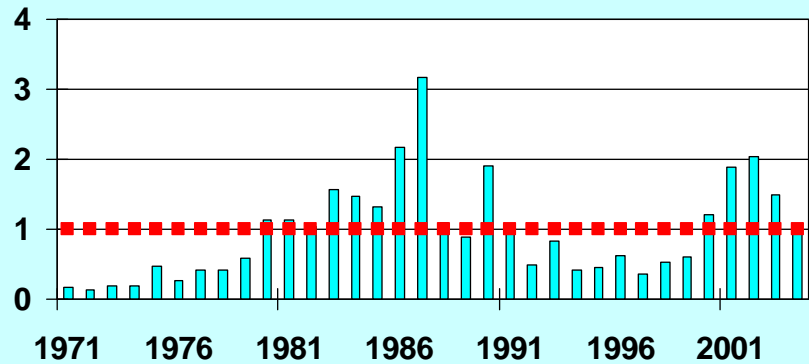
**Catch History and recent ABCs (red dots)**  
Units in 1,000 mt



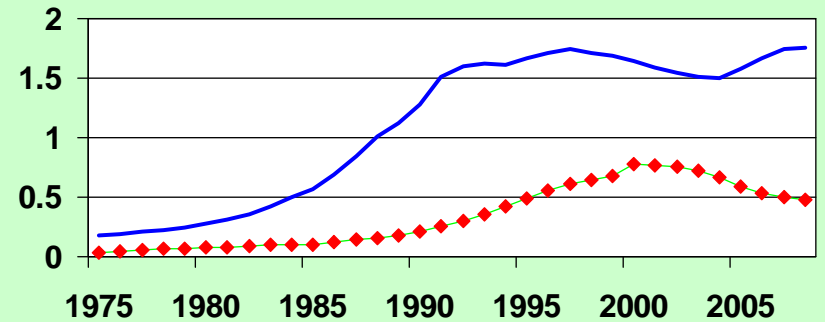
**NMFS EBS Survey Biomass**  
(Million M.Tons)



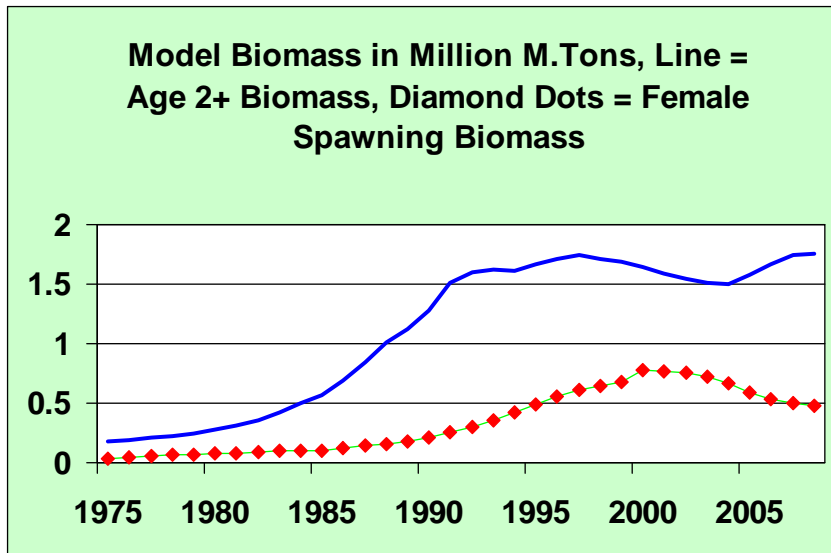
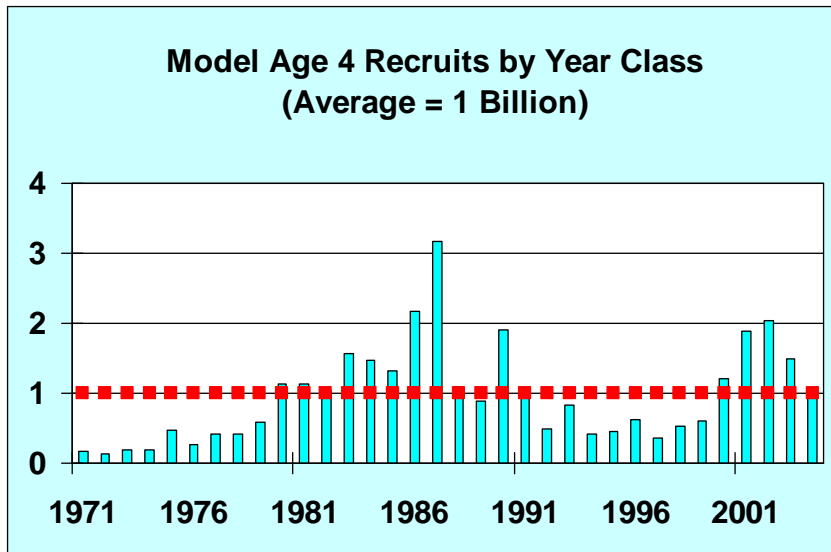
**Model Age 4 Recruits by Year Class**  
(Average = 1 Billion)



**Model Biomass in Million M.Tons, Line = Age 2+ Biomass, Diamond Dots = Female Spawning Biomass**



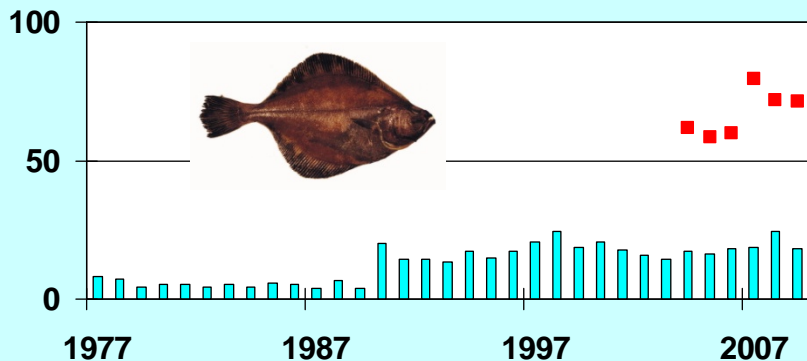
# C7 – N. Rock Sole Notes, Dec 2009



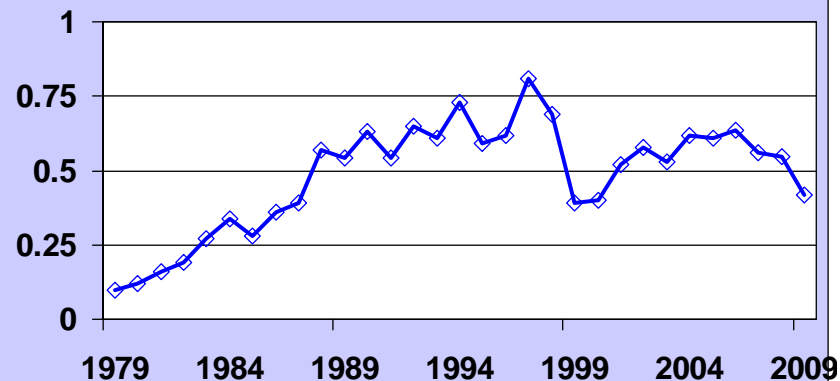
- **Tier 1a Stock**
- **Stock status and trend**
  - 2001-2003 YCs were very strong
  - Age 2+ biomass increasing since 2004
  - Spawning biomass shows slight decrease but expected to increase

# C8 - Flathead Sole Stock Assessment, Dec 2009

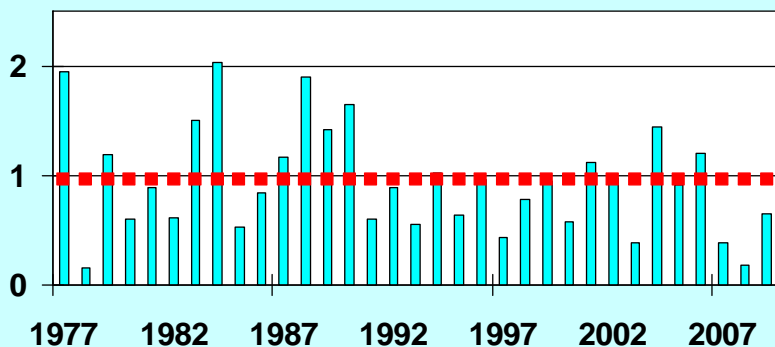
Catch History and recent ABCs (red dots)  
Units in 1,000 mt



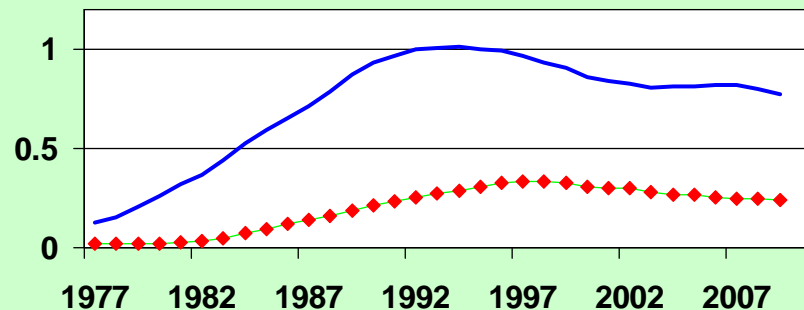
NMFS EBS Survey Biomass  
(Million M.Tons)



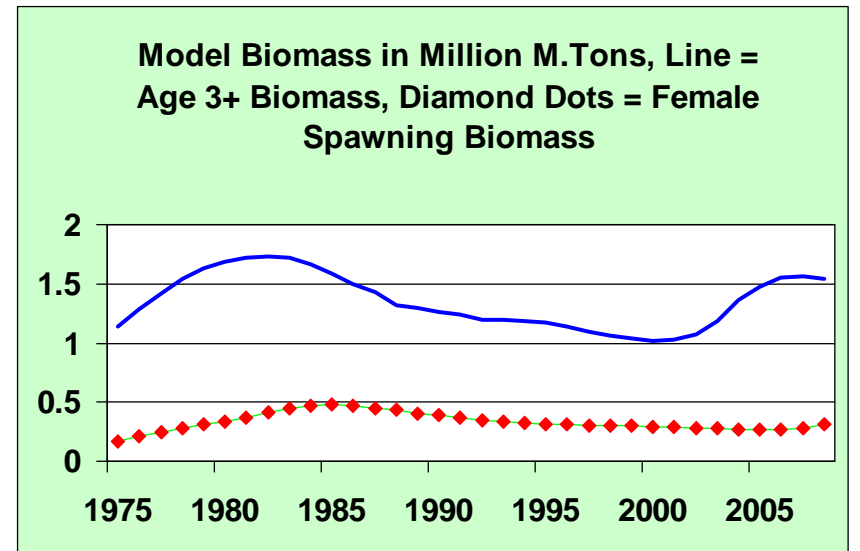
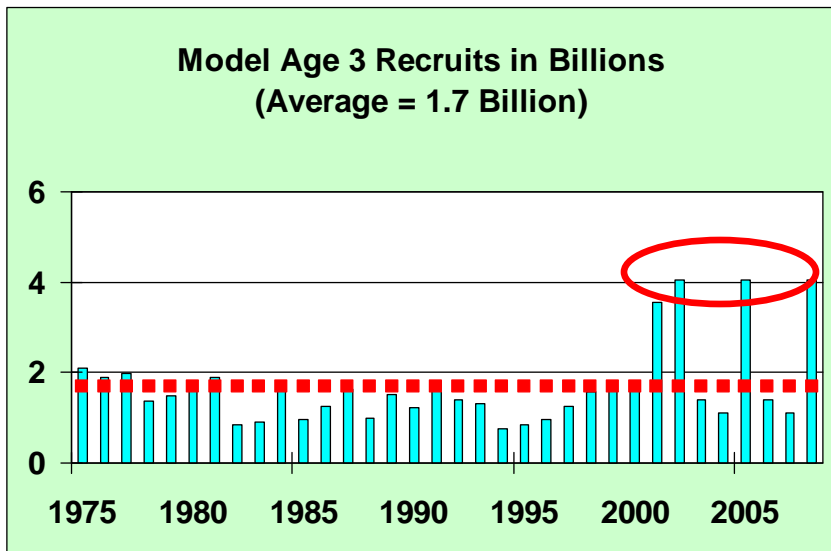
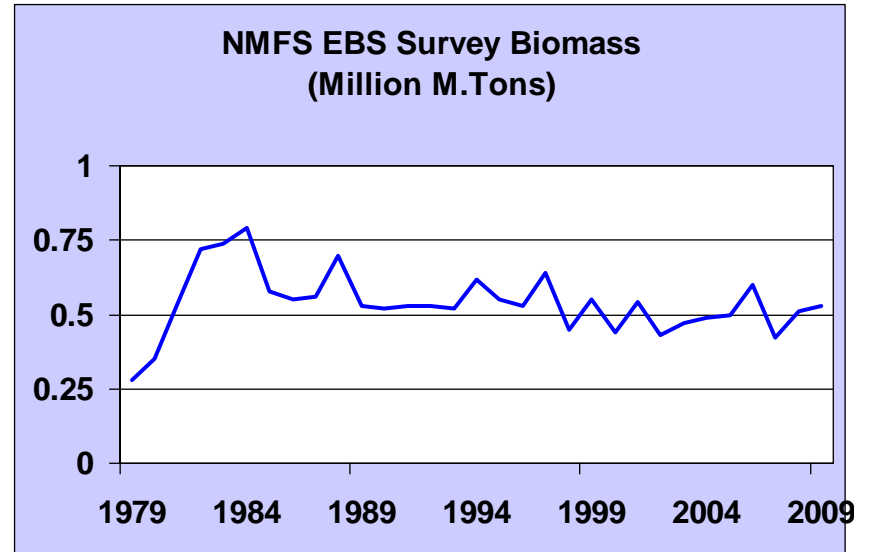
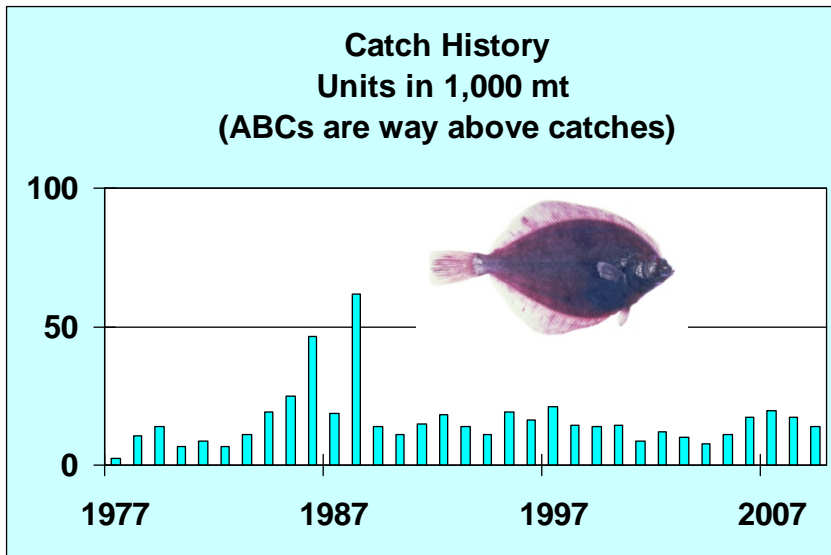
Model Age 3 Recruits in Billions  
(Average= .96 Billion)



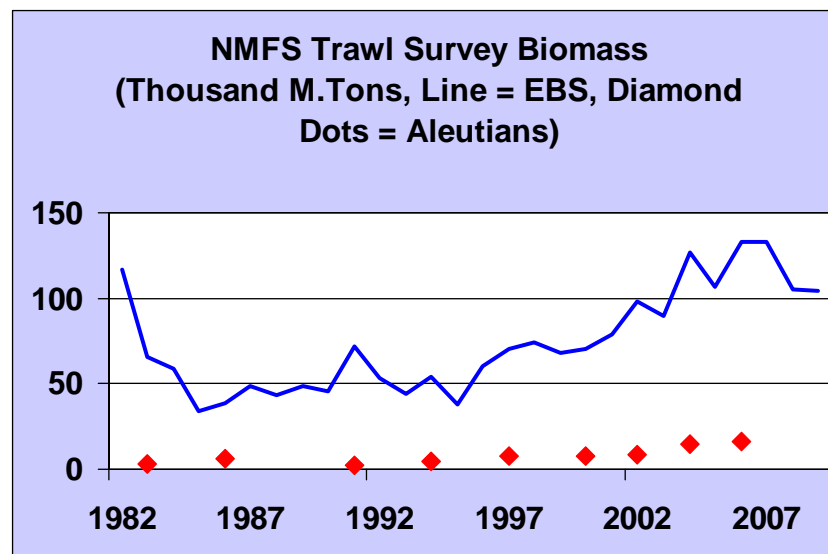
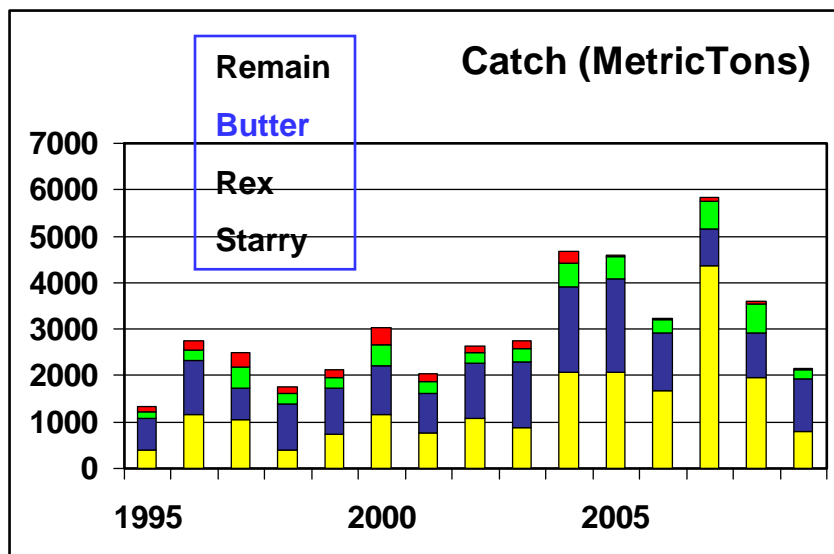
Model Biomass in Million M.Tons, Line =  
Age 3+ Biomass, Diamond Dots = Female  
Spawning Biomass



# C9 - Alaska Plaice Stock Assessment, Dec 2009



# C10 - Other Flatfish Group Assessment, Dec 2009



**Model Biomass and Recruitment Estimations are not Available**

**Assessment based on Tier 5 using NMFS Survey Biomass**

## Assessment Features

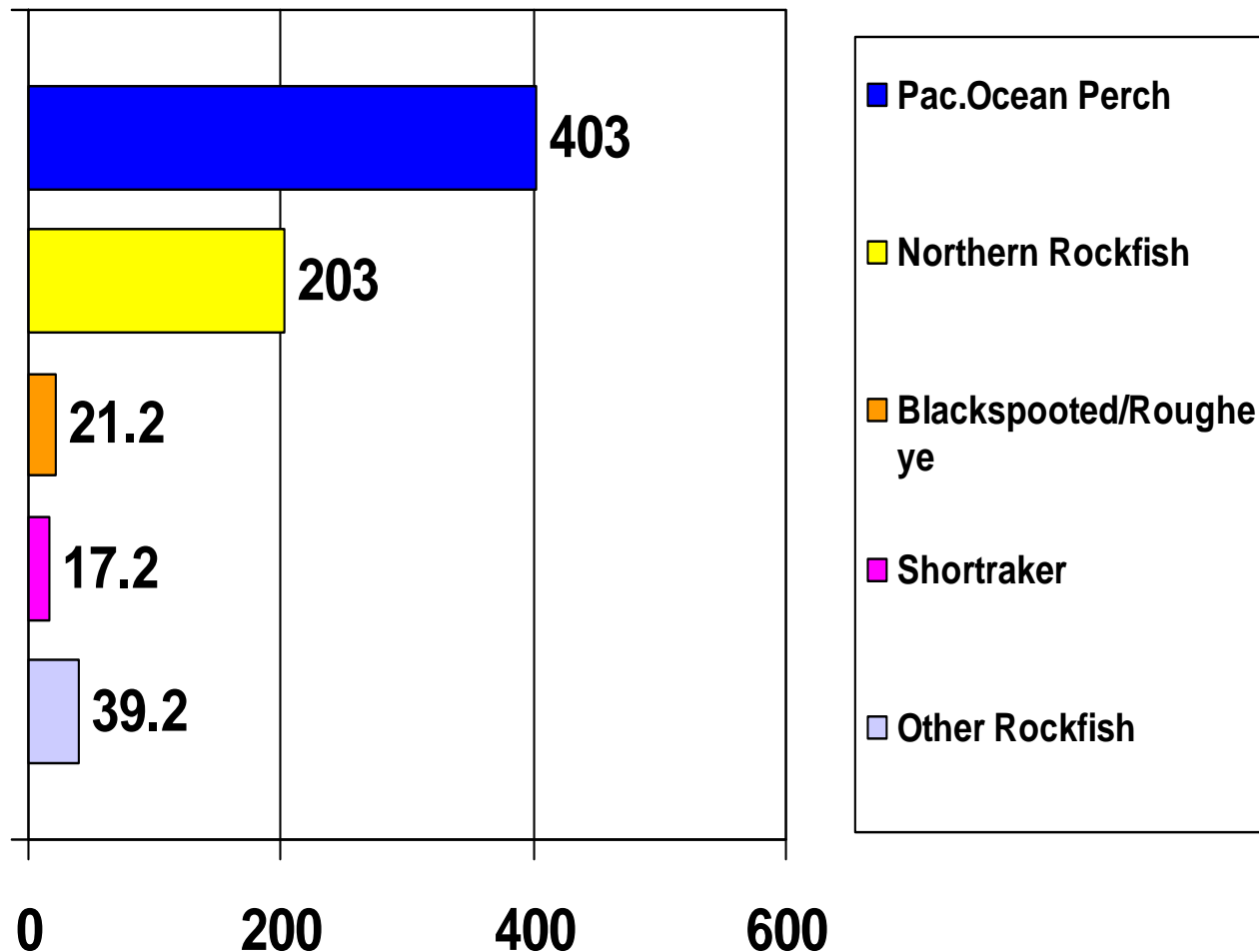
### 1. Species Composition

- 16 species from EBS, 5 species from Aleutians,
- Starry flounder = 74 % of Biomass
- Rex & Butter Sole = 25%

# Rockfish Complex Exploitable Biomass, 2009

4% of BSAI groundfish complex

Mostly in Aleutians, POP and N. Rockfish Dominate



**Biomass in Thousand Metric Tons**

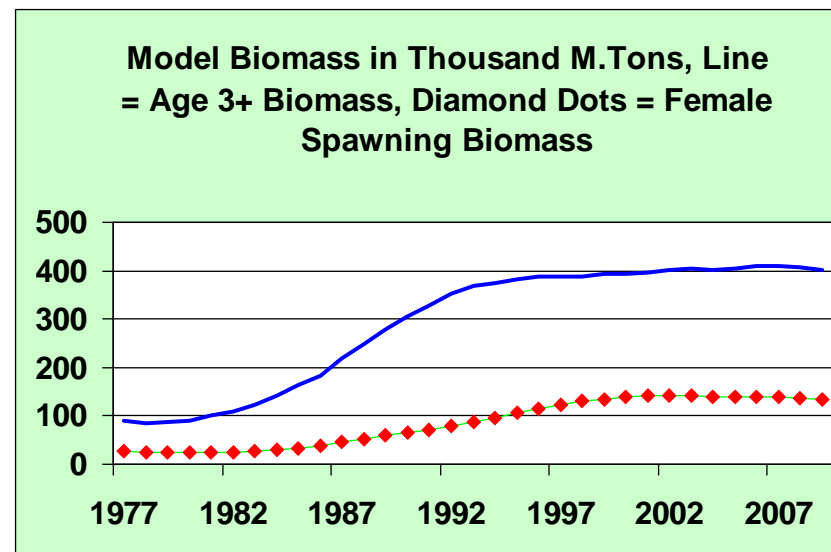
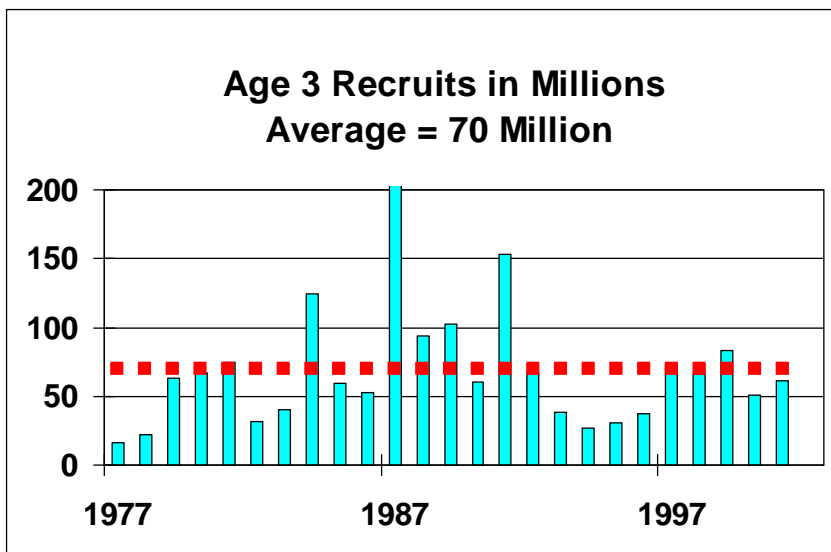
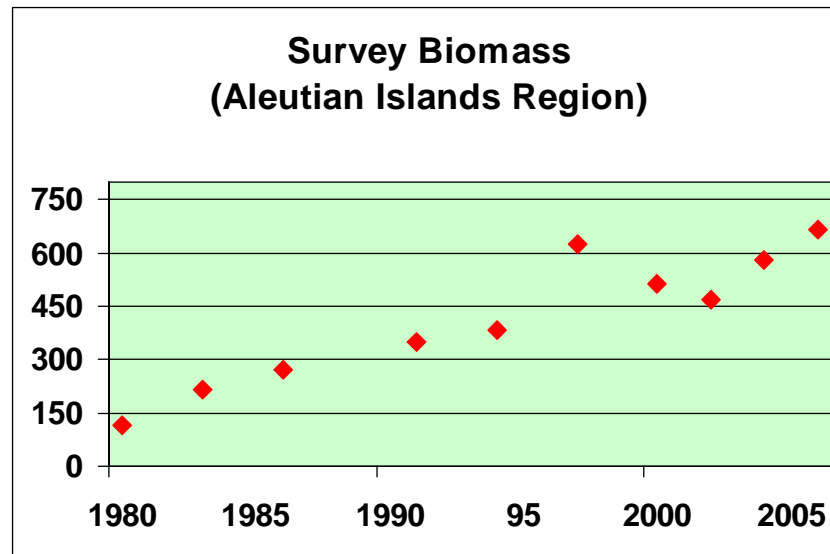
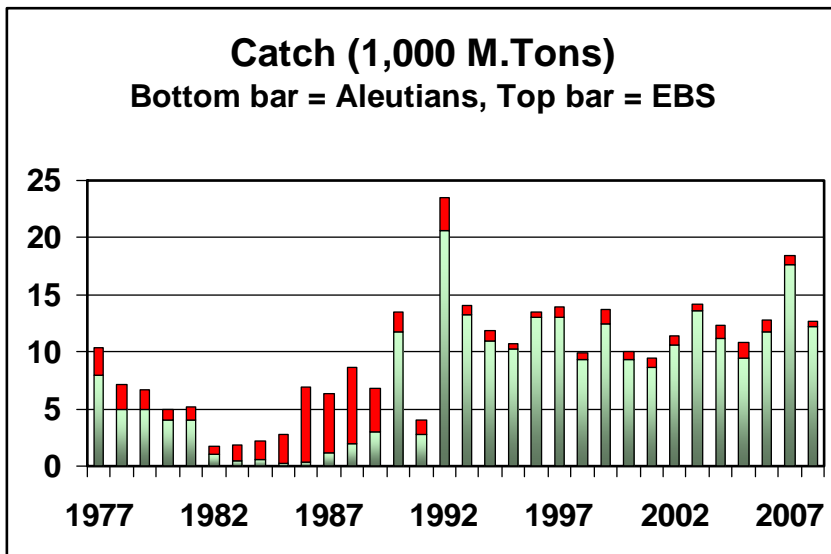
# Rockfish Assessments

Essentially no change from Last Year's Analyses

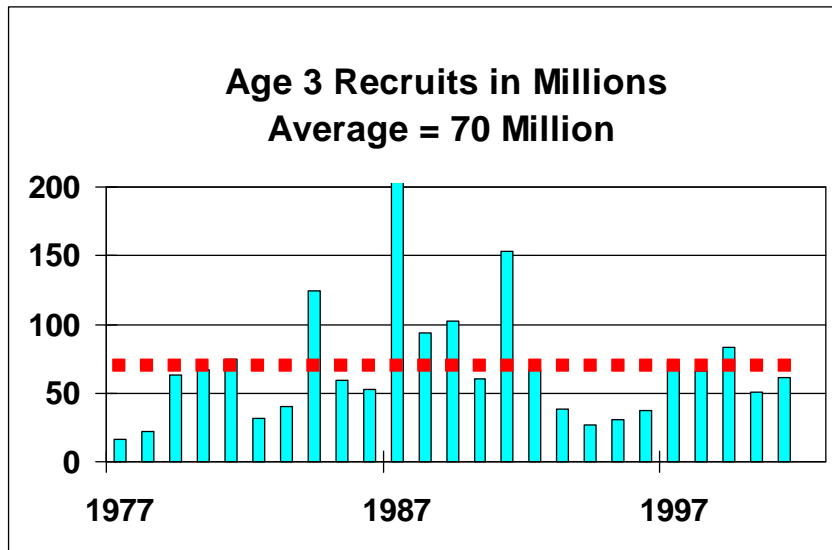
- 1. Major Updates of Assessment are on 2 year cycle to coincide with Aleutian Islands surveys. No survey in 2008. Urgent need for 2010 Survey**
- 2. Estimates for 2010 are based upon last years analysis and re-running projection models with new 2009 catch data**
- 3. Analyzes for POP and Northern Rockfish groups are based on Age Structured Models and their ABCs are calculated under Tier 3.**
- 4. ABCs for all other rockfish groups are dependent directly on survey biomass under Tier 5 calculations, where  $ABC = 0.75M \times \text{Biomass}$**



# C11 - Pacific Ocean Perch Stock Assessment, Dec 2008



# C11 - Pacific Ocean Perch Notes, Dec 2008



- No big changes in analytic approach

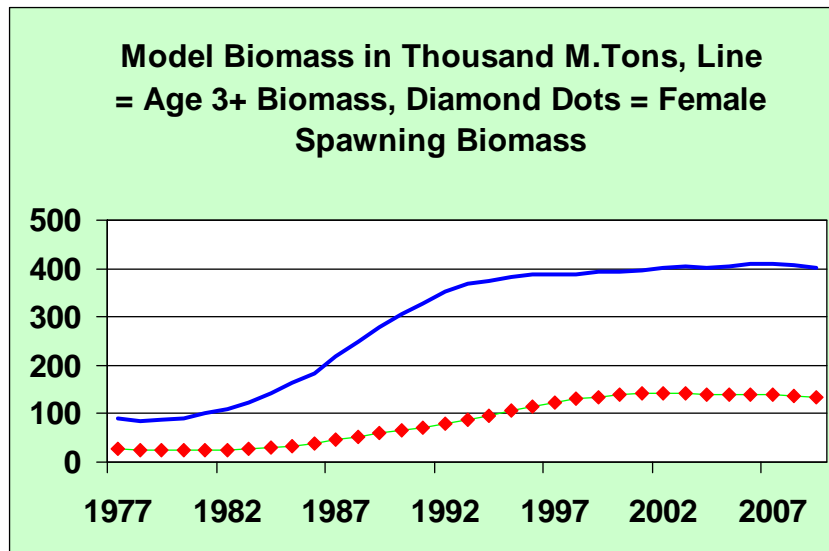
- Tier 3a

- Status and Trend

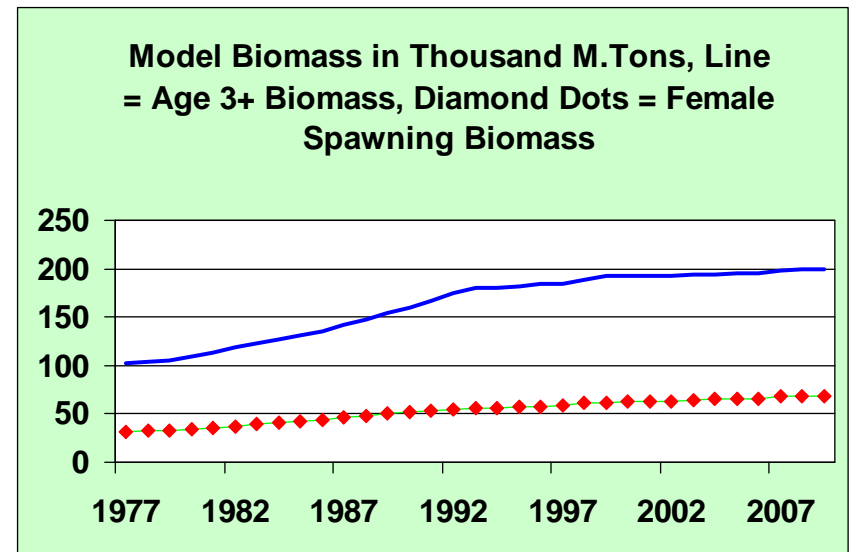
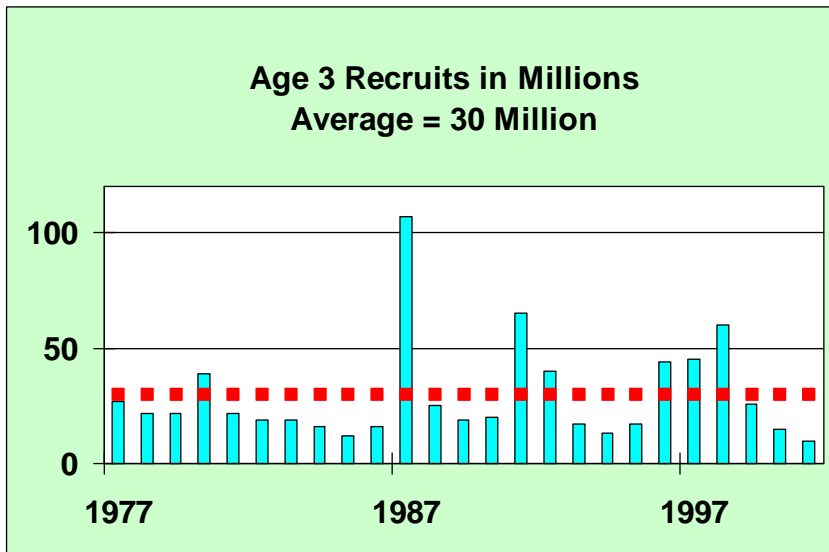
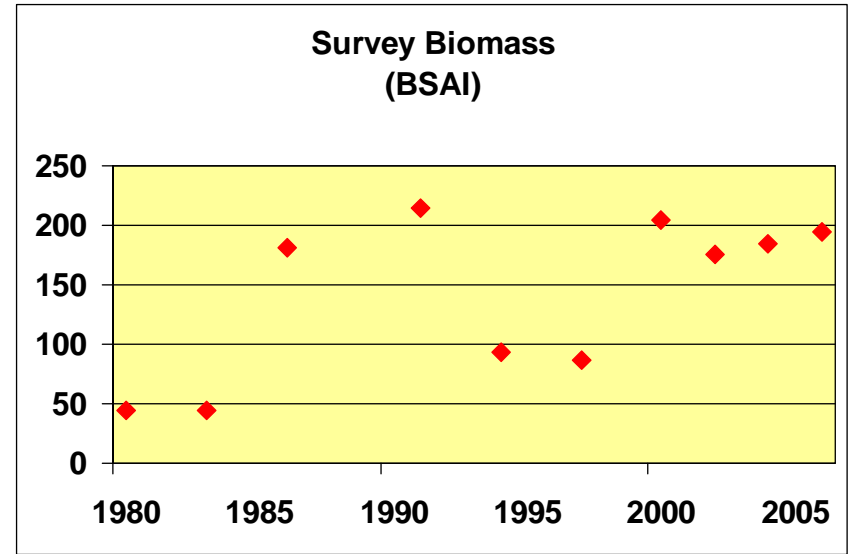
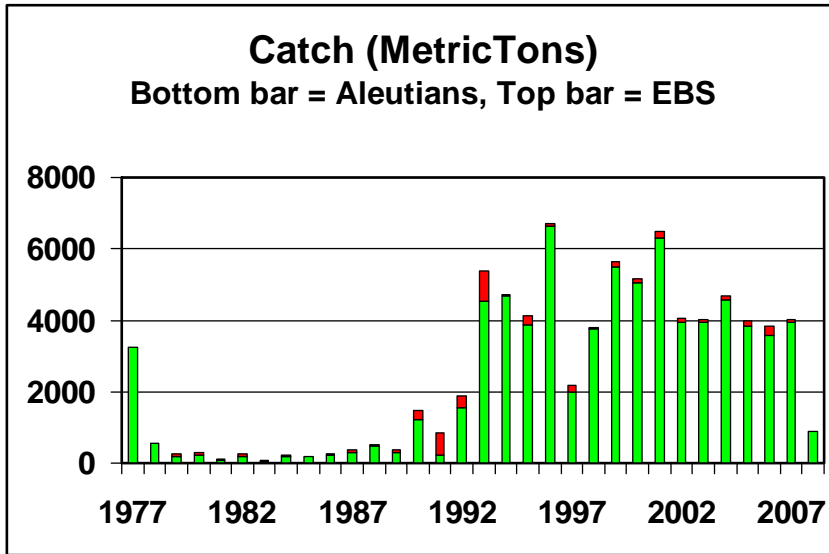
- 2004-2008 EBS biomasses all higher than 1983-2003

- All biomass is now steady

- Exploitation rate has been generally light



# C12 - Northern Rockfish Stock Assessment (Dec 2008)



## Chapter 13a: Shortraker Rockfish

- Split from Shortraker-Rougheye Group
- Changes in analytic approach
  - Two-species surplus production model now 1-species
- Tier 5
- Status and Trend
  - Biomass has declined continuously since 1980

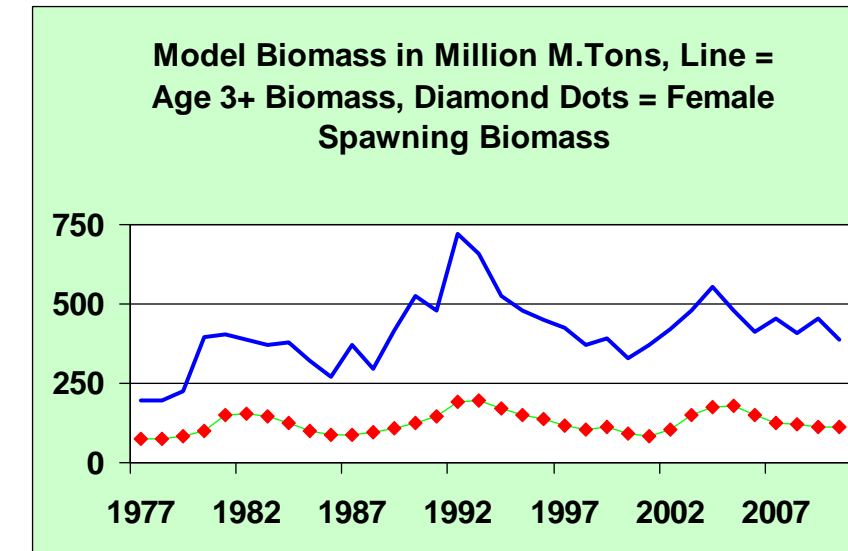
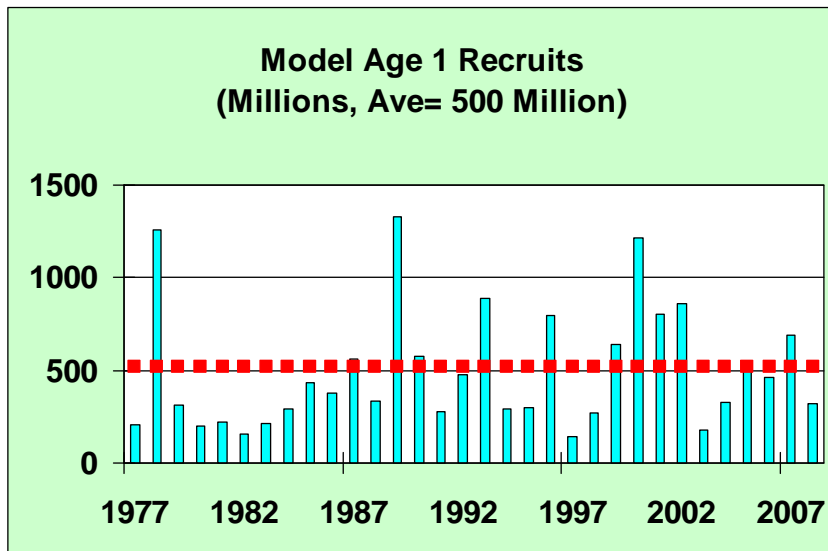
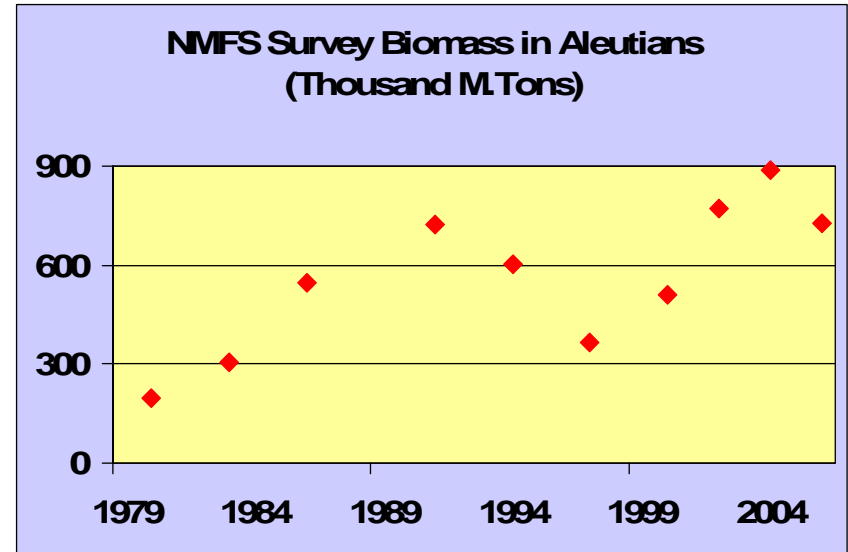
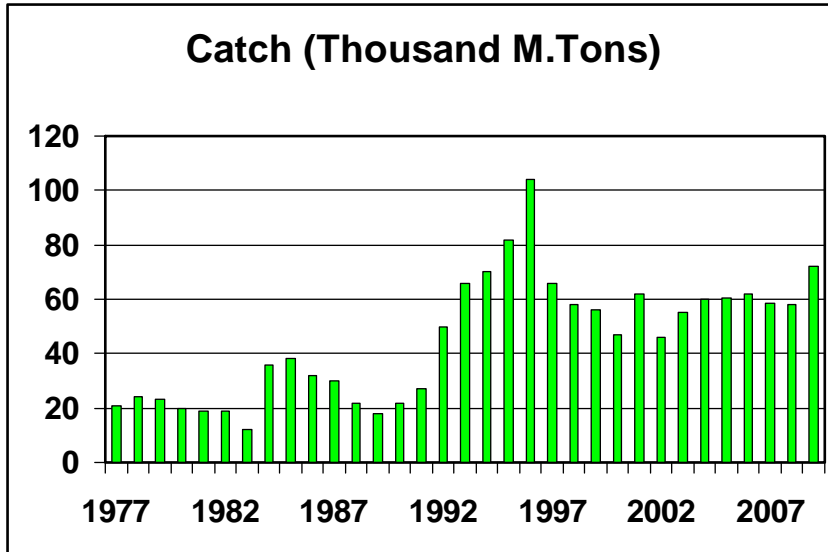
## Ch. 13b: Blackspotted / Rougheye

- Species are now separated out
  - Blackspotted far more abundant in BSAI
  - But composition differ between BS and AI
- Changes to analytic approach
  - First use of age-structured model
- Status and Trend (AI, Tier 3b)
  - 1998 YC is enormous (5× ave.); 1999, 2000 strong
  - Age 3+ biomass and Spawning Biomass are increasing since 2002
- Status and trend (BS, Tier 5)
  - Large year-to-year variability in survey biomass
  - 2006 biomass is near high end of 1991-2006 range

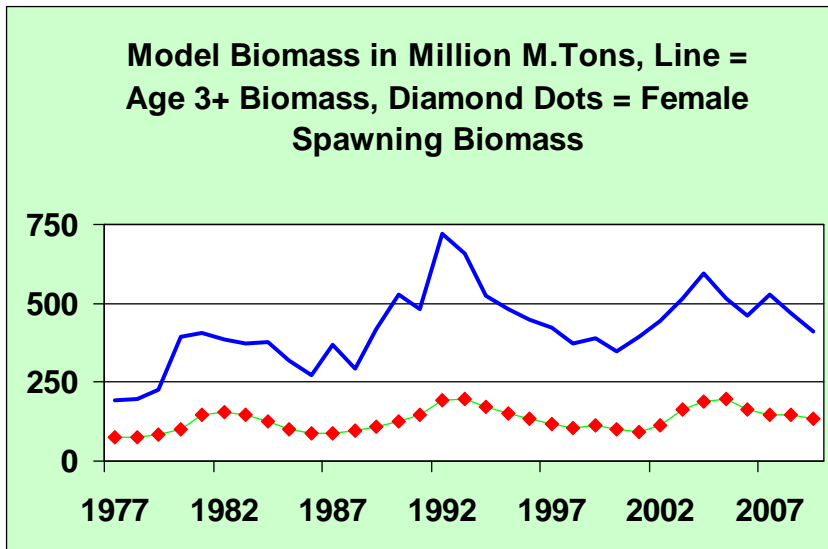
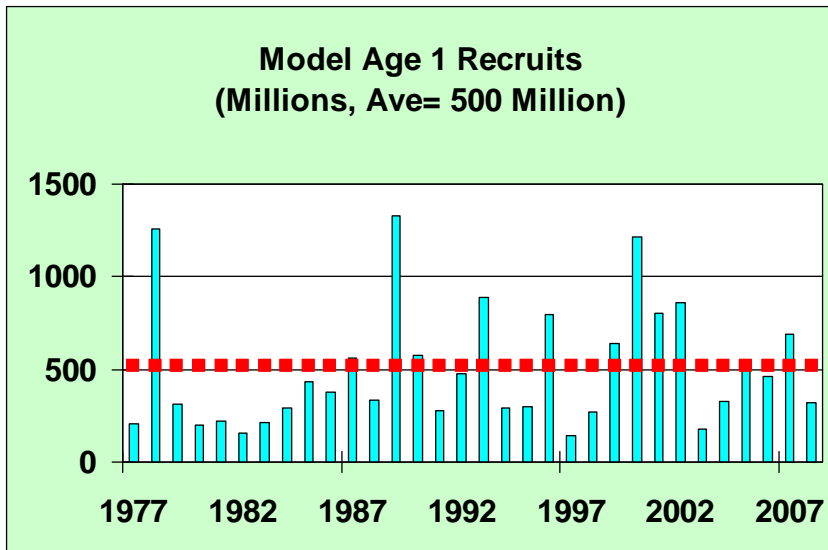
# C14: Other Rockfish Complex

- **Former complex included 8 species**
  - Shortspine thornyhead is now separated out, Dusky rockfish dominant
- **Biomass Trend**
  - Survey Biomass has general increase
  - Spawning Biomass trend is unknown
- **Straightforward update of SOS from before**
  - ABC Calculation based on Tier 5

# C15 - Atka Mackerel Stock Assessment, Dec 2009



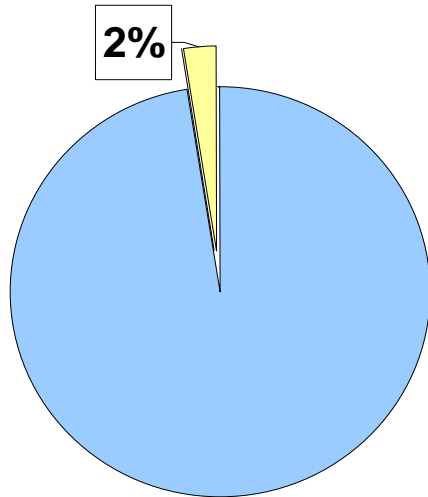
# C15 - Atka Mackerel Notes, Dec 2009



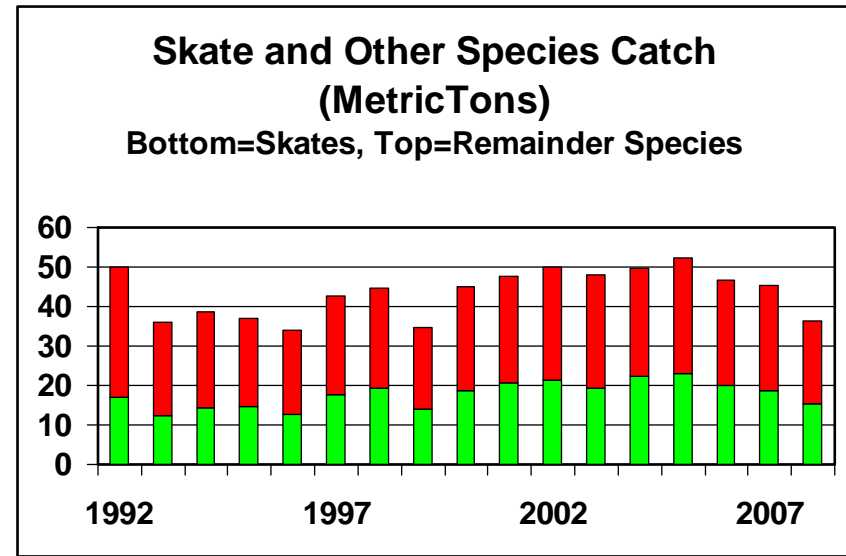
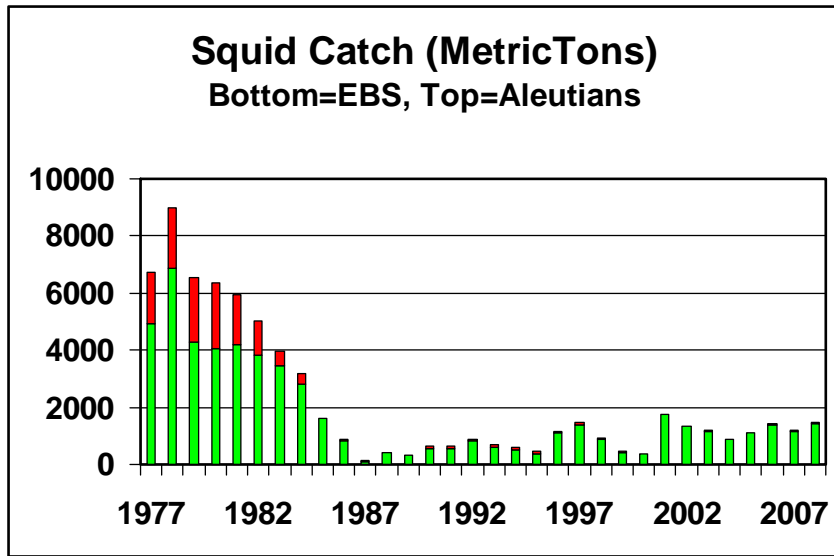
- 2% of BSAI Complex
- Major changes lasy year (in response to CIE)
- Tier 3a
- No survey since 2006, Need 2010 survey bad
- Status and Trend
  - Only 1 YC was above average in last 6 years
  - Total biomass reached all-time high in 2003; decreasing since
  - Spawning biomass reached high in 2005; decreasing slightly since



# C16-20. Squid and Other Species Resources, Dec 2009 Assessments



**Squid + Skate +  
Others Combined =  
2.0 % of BSAI  
Groundfish Complex**



# C16-20. Squid and other species Assessment

## ABC Calculations

1. **Squid ABC is calculated under Tier 6**  
average catch from 1977-1995, ABC = 1,970 mt
2. **Other species: author recommends managing by major taxonomic groups under Tier 5**

Species	Biomass (mt)	ABC (mt)
Sharks	n/a	447
Skates	634,000	35,000 (Tier 5 by SSC)
Sculpins	234,000	31,000
Octopus	n.a.	233
Total	868,000+	66,700

3. **Now managed by a group; but Plan Team and Authors recommend management by Break-out Species groups on the long run**

# Adjustments to ABCs

- due to Special Ecosystems Concerns

1. The Team did not make specific adjustments to ABCs for ecosystem concerns
2. General Concerns about ecosystem considerations have already been built into the Analyses
3. Ecosystems evaluations have been more extensive each year

# Summary (Pollock)

(From Table 5, Team Summary Appendix A)

Stock	ABC 2009 (mt)	ABC 2010 (mt)	ABC Change from 2009
Pollock, EBS	815,000	813,000	Down 0.24%
Pollock, AI	28,200	33,100	Up 17%
Pollock, Bogoslof	7,970 (156)	156	No change

# Summary (Cod and Sablefish)

(From Table 5, Team Summary Appendix A)

Stock	ABC 2009 (mt)	ABC 2010 (mt)	ABC Change From 2009
Pacific Cod, BSAI	182,000	174,000	Down 4%
Sablefish, EBS	2,720	2,790	Up 2%
Sablefish, AI	2,200	2,070	Down 6%

# Summary (Flatfishes)

(From Table 5, Team Summary Appendix A)

Stock	ABC 2009 (mt)	ABC 2010 (mt)	ABC Change from 2009
YellFn. Sole	210,000	219,000	Up 4%
Grn. Turbot	7,380	6,120	Down 17%
Arrow. Fl.	156,000	156,000	No change
N.RockSole	296,000	240,000	Down 19 %
Flathead S	71,400	69,200	Down 3%
Alaska Plaice	232,000	224,000	Down 3%
Other Flats	17,400	17,300	Down 0.5%

# Summary (Rockfishes)

(From Table 5, Team Summary Appendix A)

Stock	ABC 2008 (mt)	ABC 2009 (mt)	ABC Change From 2009
POP, BSAI	18,800	18,860	Up 0.3%
Northern R	7,160	7,240	Up 1%
ShortRaker	387	387	No change
Black- S/Rougheye	539	547	Up 1%
Other Rock	1,040	1,040	No change

# Summary (Atka Mackerel & Other Species)

(From Table 5, Team Summary Appendix A)

Stock	ABC 2009 (mt)	ABC 2010 (mt)	ABC Change From 2009
Atka Mackerel	83,800	74,000	Down 12%
Squid	1,970	1,970	No Change
Other Species	66,700	61,100	Down 8%



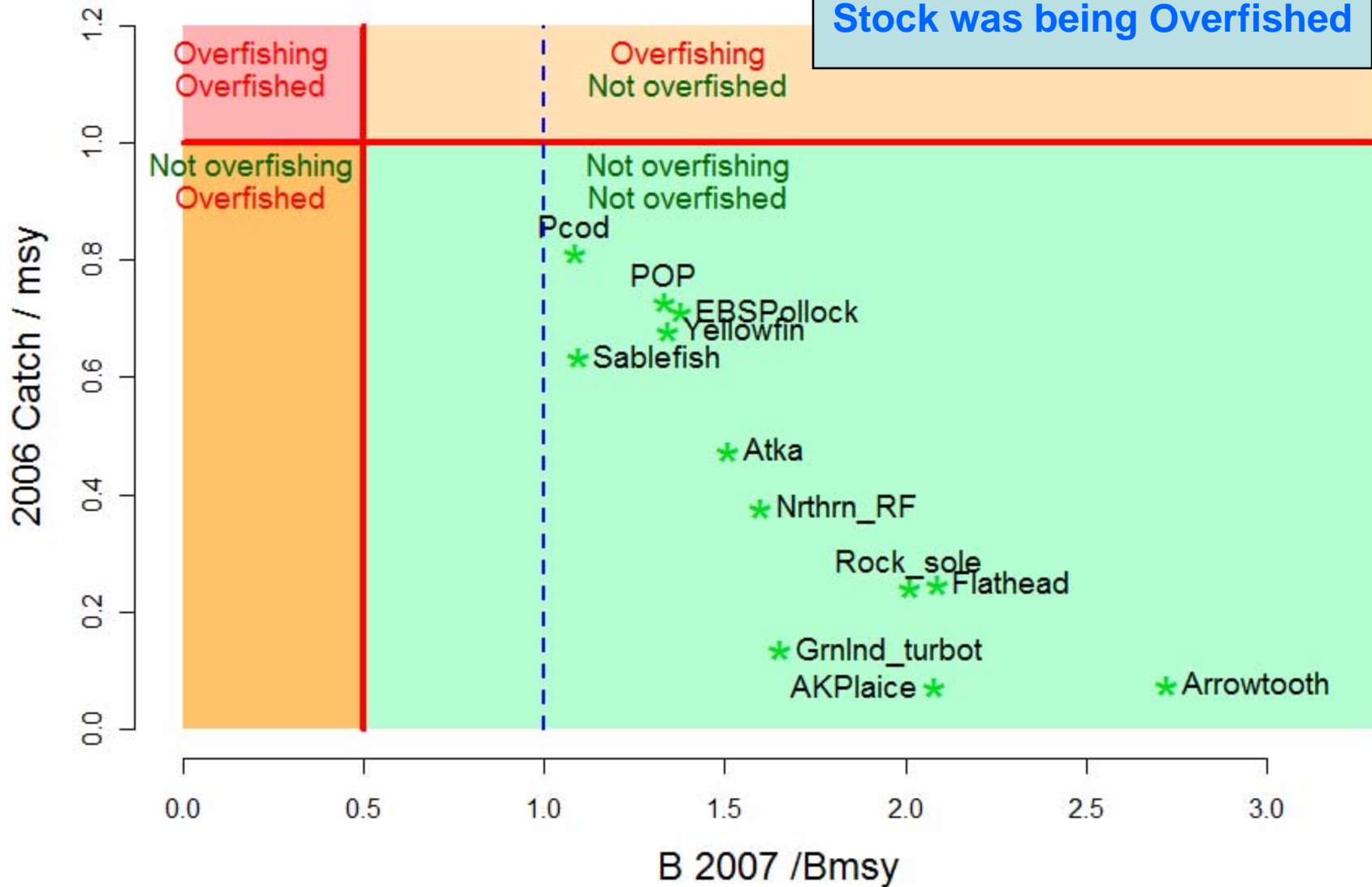
# **Report Card on Status of Stocks**

**Relative to  
Fishing Levels (Vertical Scale)  
and  
Reference Biomass Levels  
(Horizontal scale)**

# 2006

## Bering Sea and Aleutian Islands

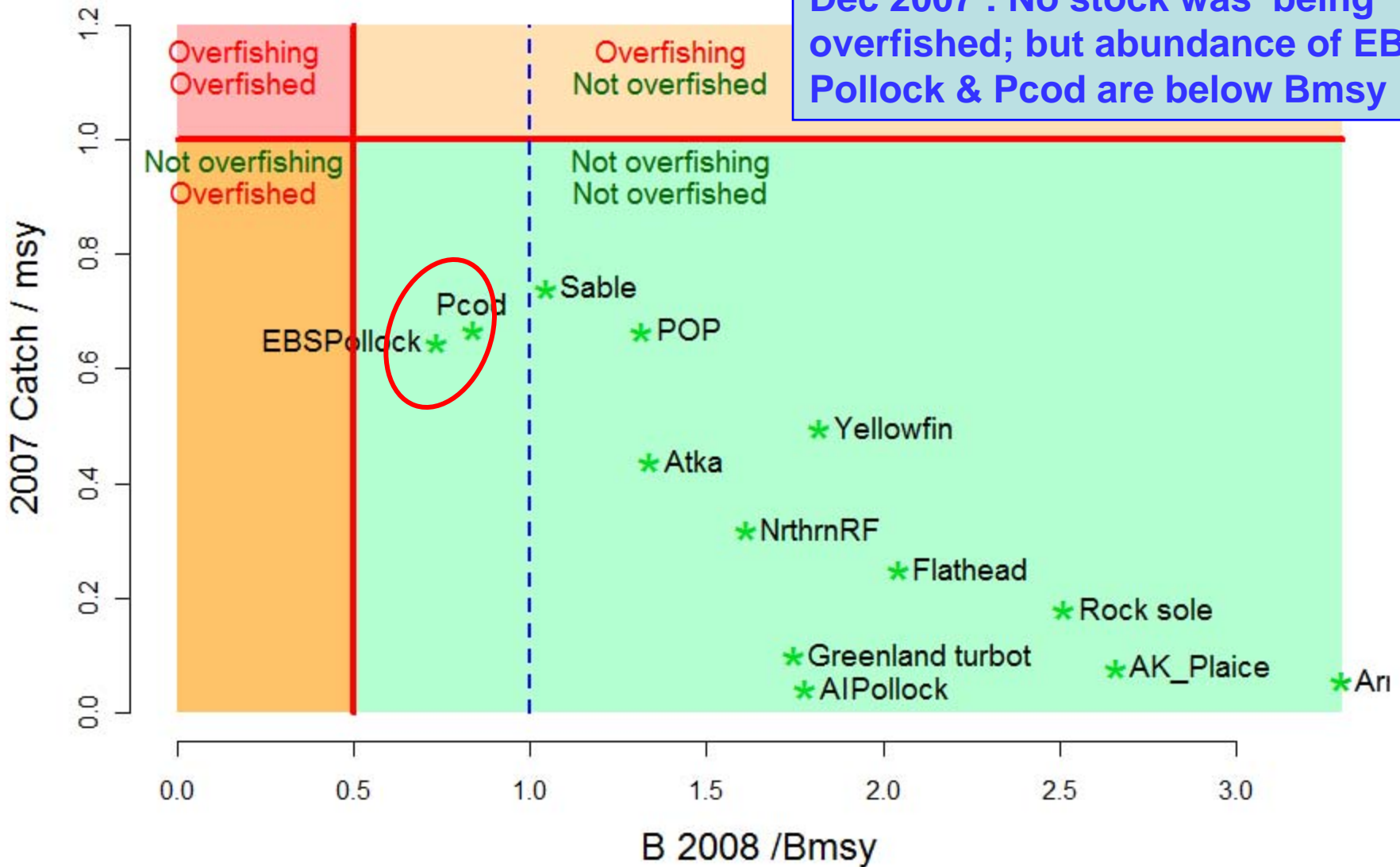
Dec 2006 Summary: No Stock was being Overfished



# 2007

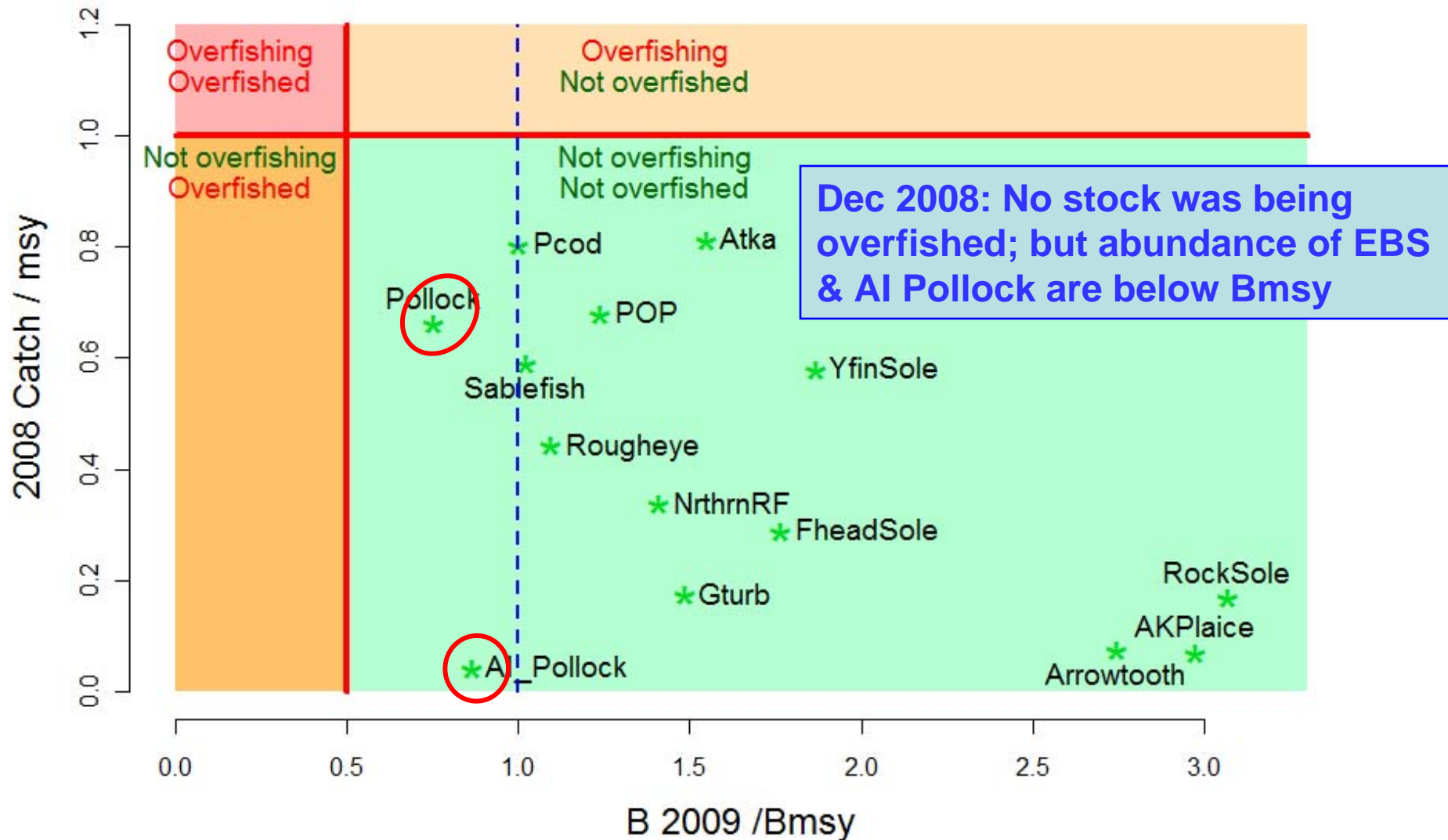
## Bering Sea and Aleutian Islands

Dec 2007 : No stock was being overfished; but abundance of EBS Pollock & Pcod are below Bmsy



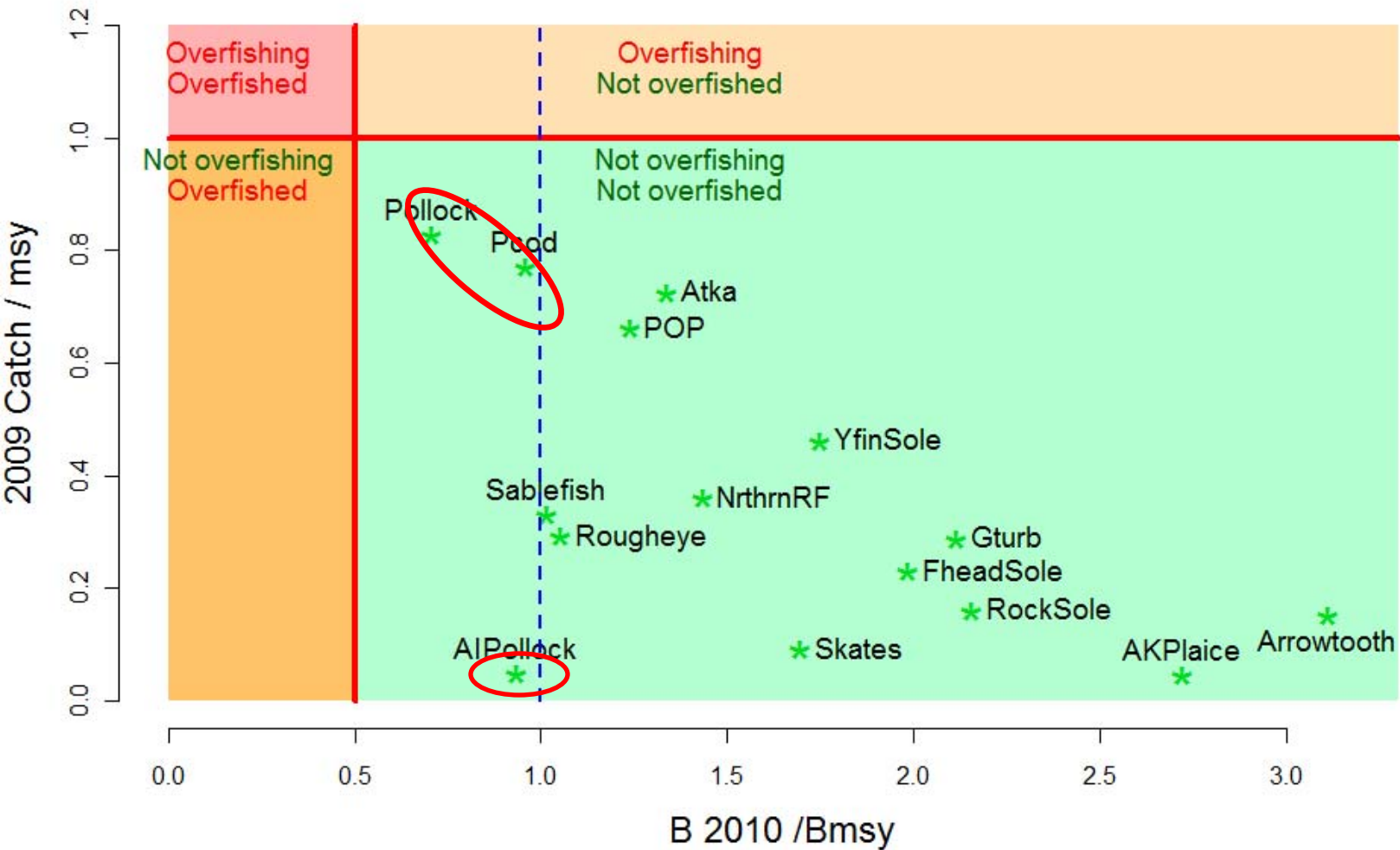
# 2008

## Bering Sea and Aleutian Islands



# 2009

## Bering Sea and Aleutian Islands



# Summary Graph, BSAI Groundfish Complex

