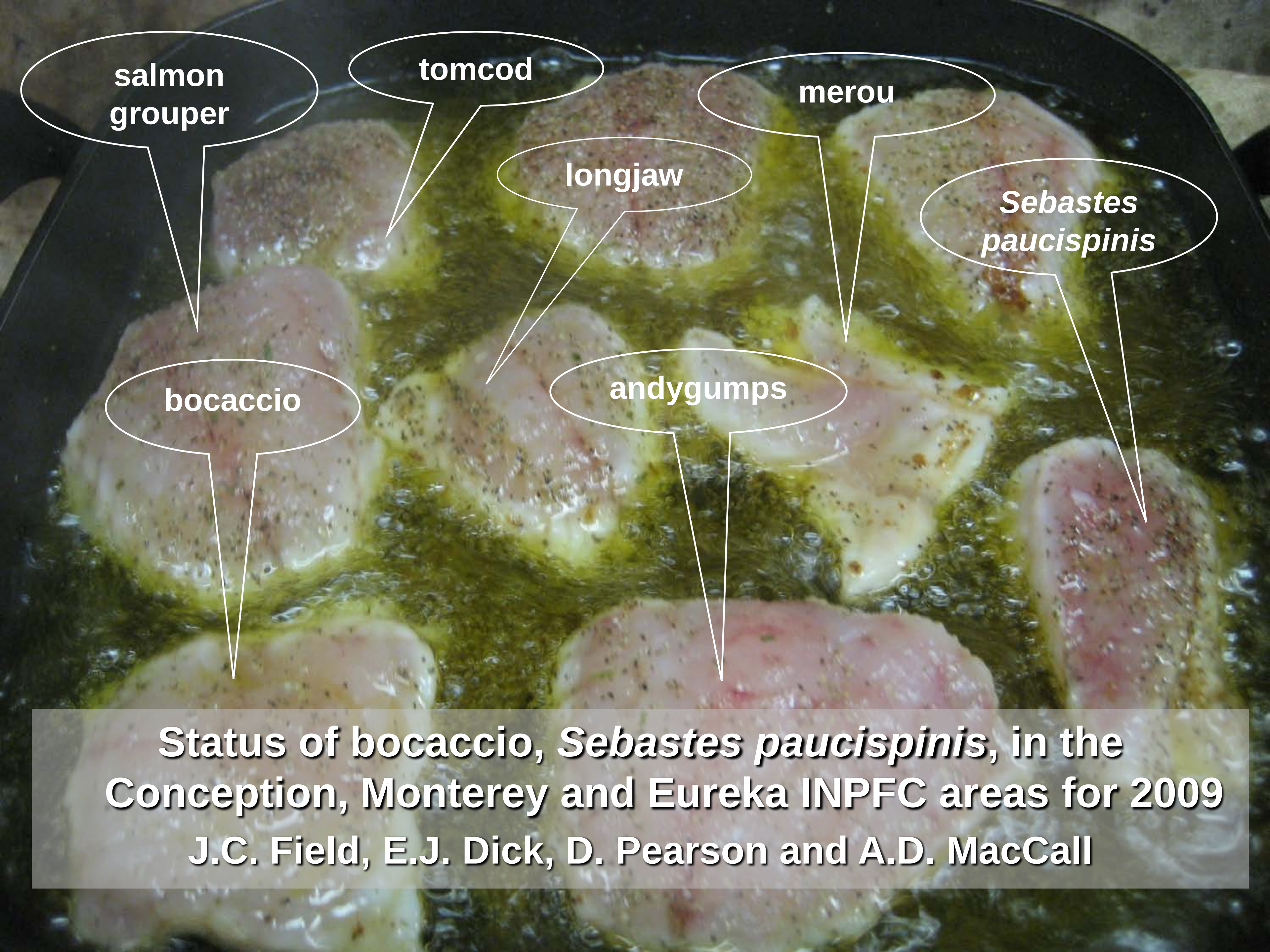
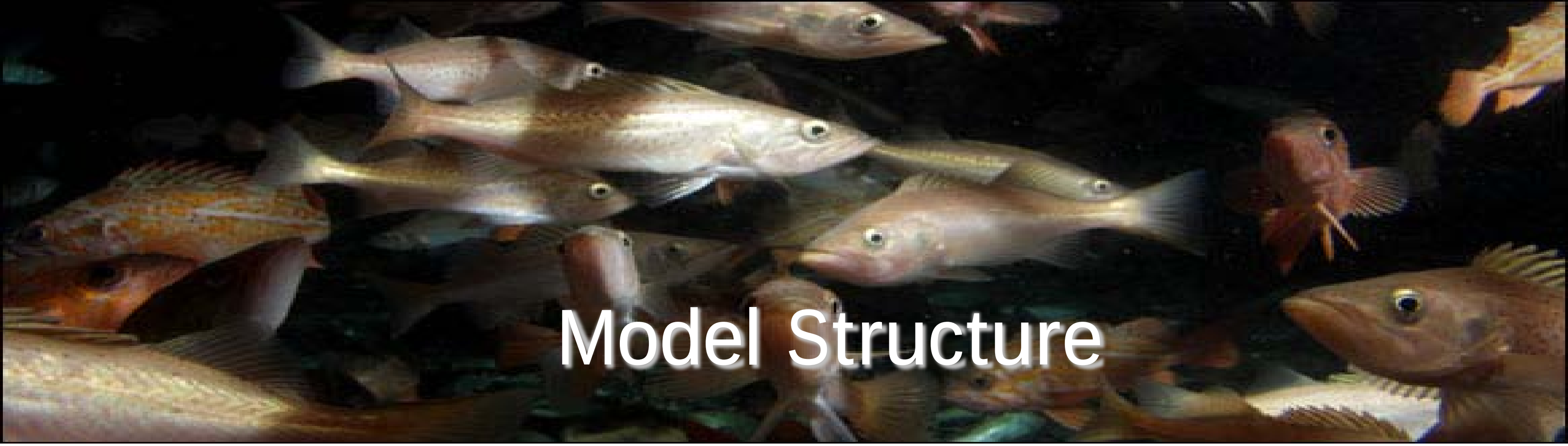



# Status of bocaccio, *Sebastes paucispinis*, in the Conception, Monterey and Eureka INPFC areas for 2009

J.C. Field, E.J. Dick, D. Pearson and A.D. MacCall

# General overview

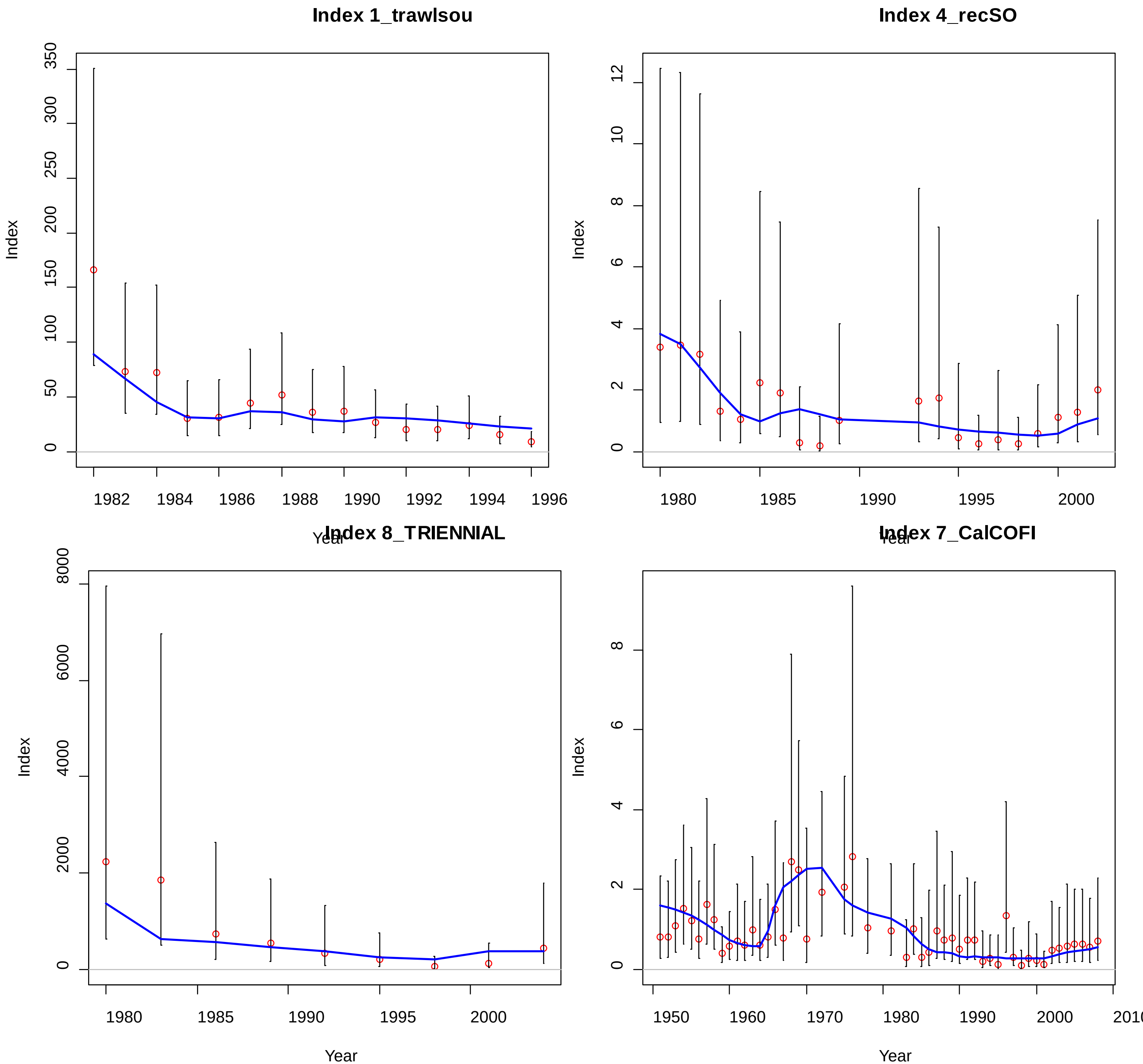
- Last full assessment was 2003, updated in 2005, 2007
- Major changes include
  - Movement to SS3 (v3.03a) from SS1 (an SS2 bypass)
  - Greatly revised catch history and extension of period modeled
  - Revise triennial survey estimate using a GLMM
  - Addition of NWFSC combined trawl survey. SCB hook and line survey, revised juvenile indices (Pier index and juvenile trawl survey index)
- Spatial structure only moderately changed from the past (from Mendocino to Blanco), fleet structure similar (difference is two trawl fisheries rather than one)
- Model seems to behave reasonably well, much faster run times than SS1 models, although likelihood surface can still be somewhat irregular.
- Base run resulting trend highly similar to 2007 model for recent (historical) period, but revised catch history scales depletion.
- Stock structure remains an unresolved problem and a major uncertainty, particularly with respect to the status of bocaccio north of Cape Blanco



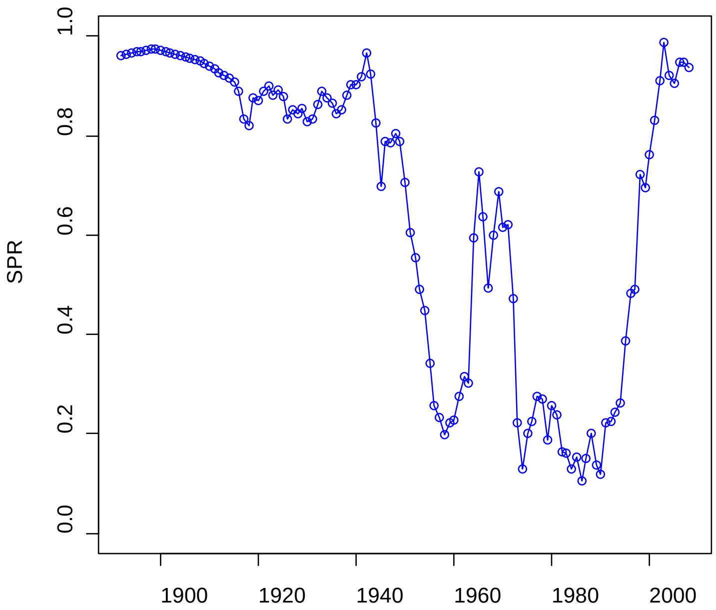
# Model Structure

- Begin model in 1892 with initial catch based on average of early catch estimates, six fishing fleets (two trawl, southern and northern, hook and line, setnet, recreational south and north). Revised catch history has ~500 tons in 1950, versus 2000 in 2003 model.
- Steepness estimated with prior (prior is 0.74, posterior 0.57)
- Two-sex, single area model, natural mortality fixed at 0.15, new maturity function, growth estimated (except $L_{min}$), new fecundity, accumulator age 21
- Recruitment deviations estimated 1954 to 2008, sigma-R fixed at 1 (effective ~1.1)
- All catchability coefficients are treated as nuisance parameters (assumed proportional)
- Selectivity curves are a mix of asymptotic and dome-shaped (double normal), based on fit to data (clear rationale for dome for some fisheries, less clear for others), some parameters had to be fixed due to convergence problems (triennial, southern trawl)
- Indices and effective sample sizes tuned (downweighting, but not upweighting), no weighting on lambdas in base model, weighting used for capturing uncertainty

Four of the key indices in this assessment, trawl CPUE, triennial trawl survey, southern recreational CPUE, and the CalCOFI larval abundance index



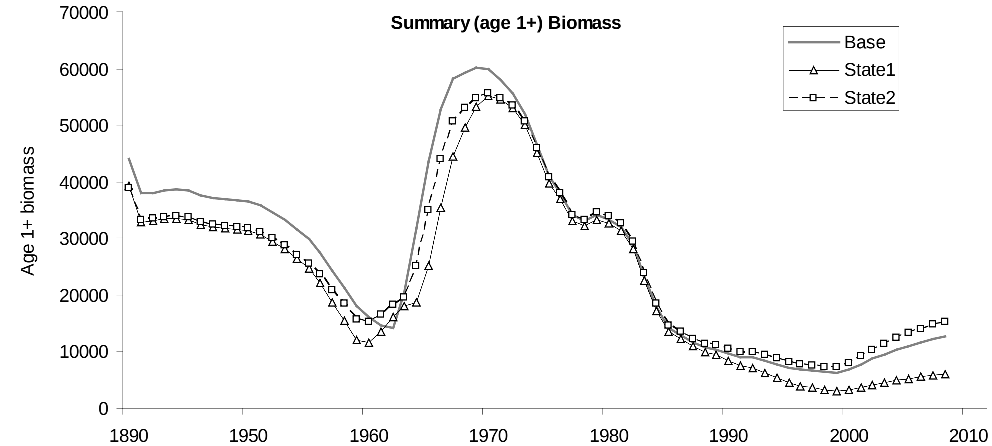
Base model estimates modest depletion from init until 1950, spike in abundance during the 1960s, followed by a very steep decline through the 1970s and 1980s.  Since the 1999 year class (and moderate 2003, 2005 year classes), biomass has slowly increased, 2009 estimated depletion is 28% of $SSB_0$

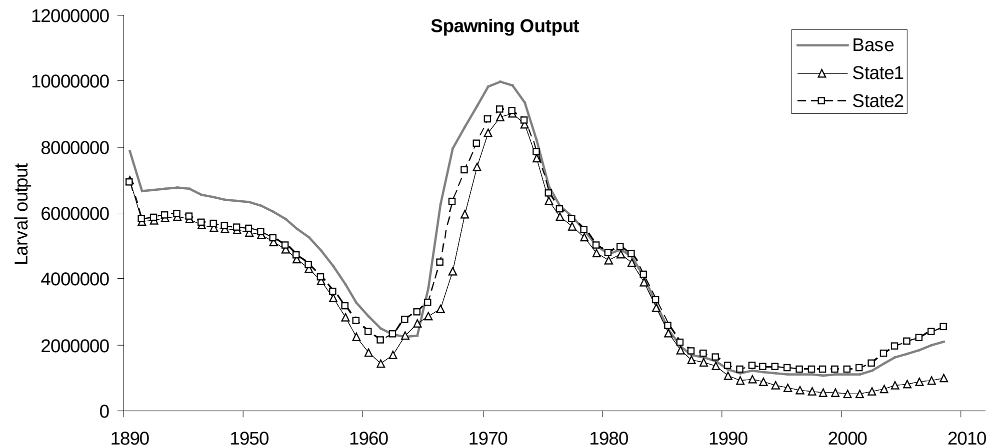


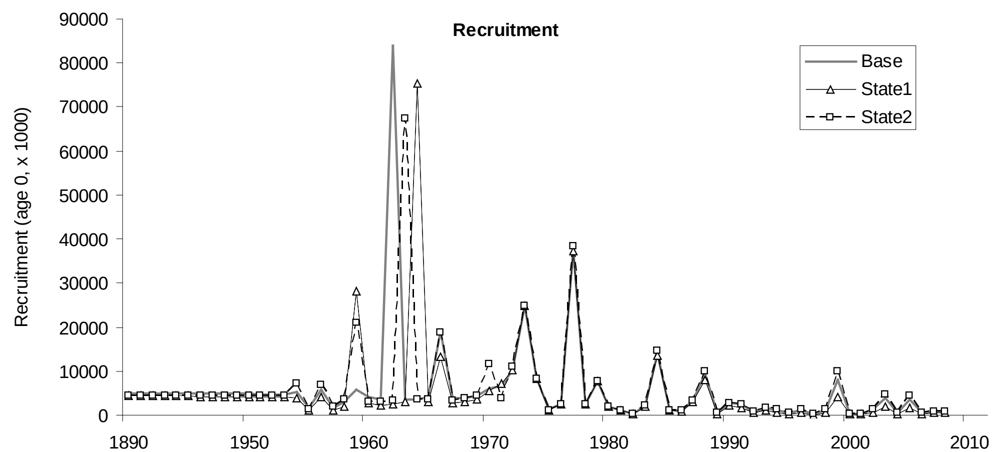
Major sources of uncertainty in the model relate to the tension between two pessimistic indices (trawl CPUE, triennial survey) and two optimistic indices (southern recreational CPUE and CalCOFI larval abundance).

The two alternative states of nature sequentially increased the emphasis on each of these groups to bracket uncertainty. These scenarios also provided useful contrast between an apparent, but poorly understood, spatial dimension - data suggest that recovery may be taking place more rapidly in the south.

Recovery in the central/northern region may be dependent on an influx of fish from the southern area, although movement/diffusion processes are poorly understood.



# Research Needs and Management Concerns

Research needs

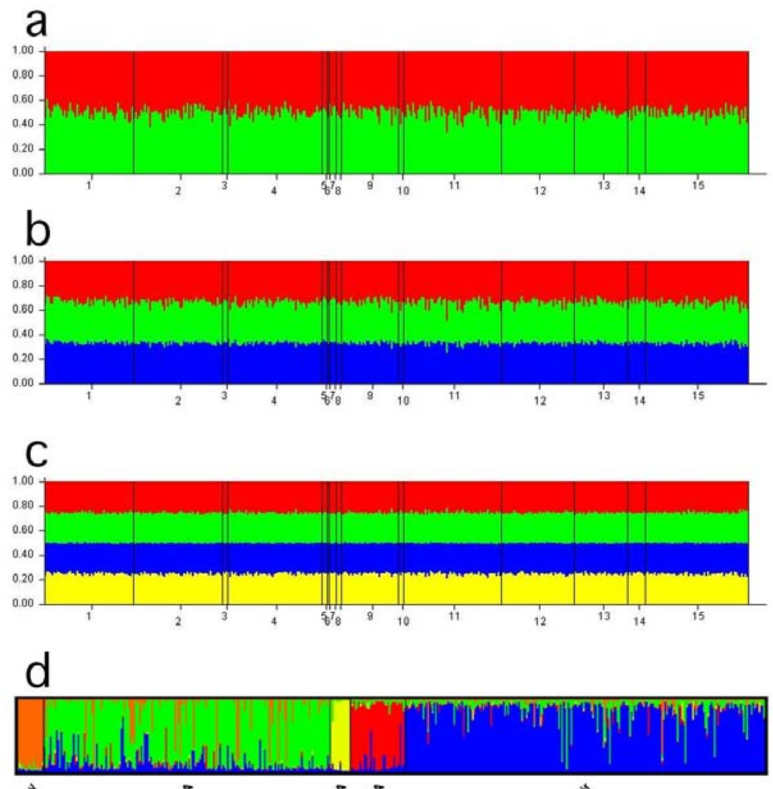
- Stock structure is a key uncertainty, particularly with respect to how best to assess abundance or trends north of Blanco
- May be some potential to explore area models, although diffusion or migration patterns and rates will not be well informed
- Ongoing efforts to retrospectively analyze CalCOFI samples from the northern stations collected in the 1950s and 1960s should help in long term
- Development of defensible ageing criteria for bocaccio in the southern area would be beneficial (but challenging)
- Trawl surveys are not well suited to this species, improved survey methodologies would be helpful
- Area closures are impacting distribution of fishing effort, leading to possible problems with some surveys

Management Concerns

- The decision to extend the boundaries of the southern subpopulation was based on the observation that catches (both fishery and survey-derived) do not end abruptly at Cape Mendocino, but rather tend to taper off to the north. As such the fish in this region were more likely to originate from the southern subpopulation than the subpopulation distributed to the north. Either boundary is imperfect.
- The vast majority of the catches and data are derived from the region south of Cape Mendocino. Thus, it would be reasonable to apply (or scale) the results of this assessment to management measures applied to bocaccio solely in this region - practical considerations could preclude the application of these results by management to the small part of the northern range

# Stock Structure

- A key uncertainty in this assessment, northern area is very data poor, not modeled.
- Stock has historically been assessed only in the southern area, based on a conceptual model of northern (BC Can, PNW) and southern (CA, BC Mex) population centers
- Past assessments suggested stock structure between CA and OR/WA/BC, but mixing between S. Cal. and Monterey Bay. Matala et al. (2004) suggested population structure related to geographic location throughout the CCS, however a reanalysis (D. Pearse/SWFSC) indicates no genetic separation
- However, there is evidence of demographic independence north/south, differences in growth, maturity, longevity (northern fish grow slower, mature at greater sizes, live longer)
- Additionally, there is a proposed rule to list a separate DPS for the Georgia Basin as endangered under the ESA

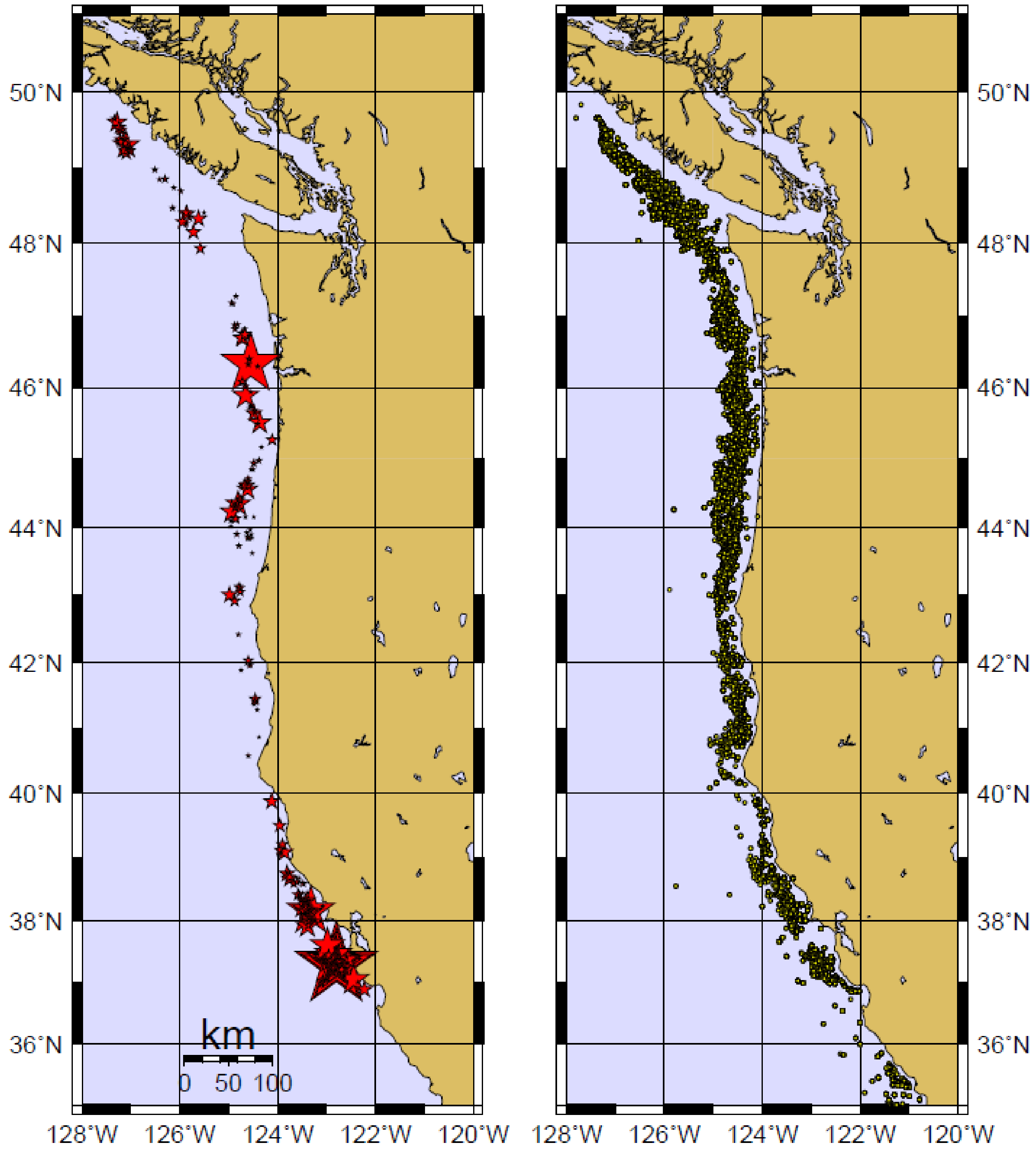


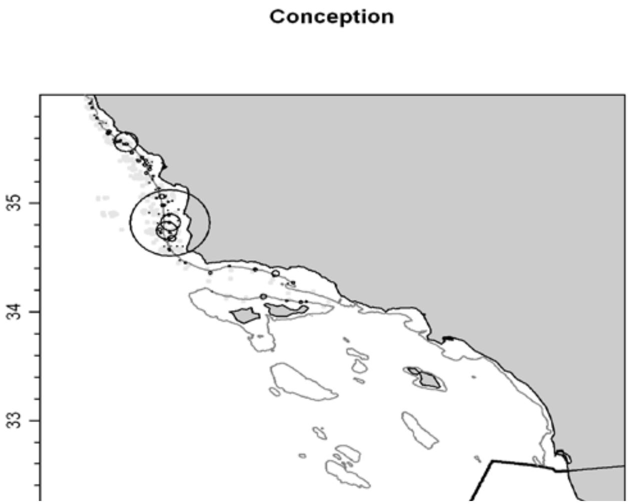

Vertical lines in the images above represent individuals, colors represent the probability of membership into distinct groups. Top three panels show bocaccio data from Matala et al., bottom panel shows analysis of genetically-distinct steelhead population (e.g., what structure would look like).

Russian fishery catches (1966-1976), bocaccio catch at left, total tows at right

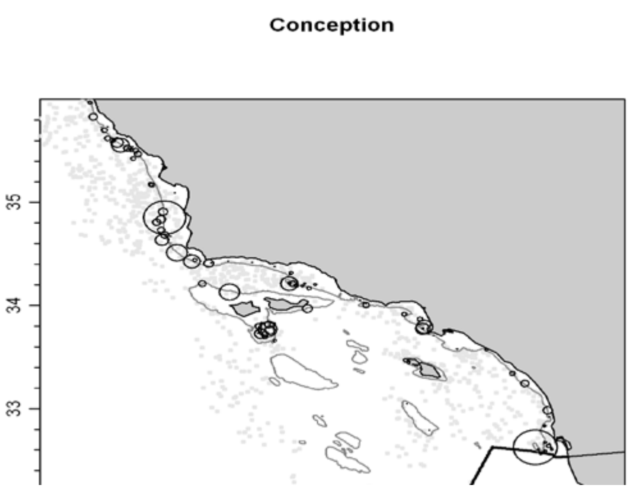
Assessment area has historically been the region of highest abundance, south of Mendocino (where bocaccio represent 20-30% of all catches)

In Oregon and Washington, bocaccio were ~1-3% of all , in Canada up to 4-7%.



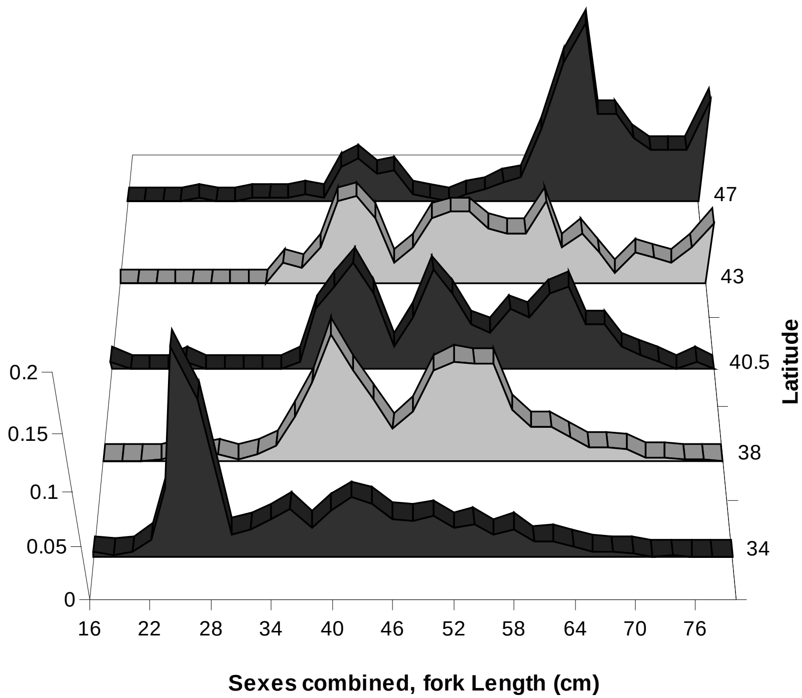


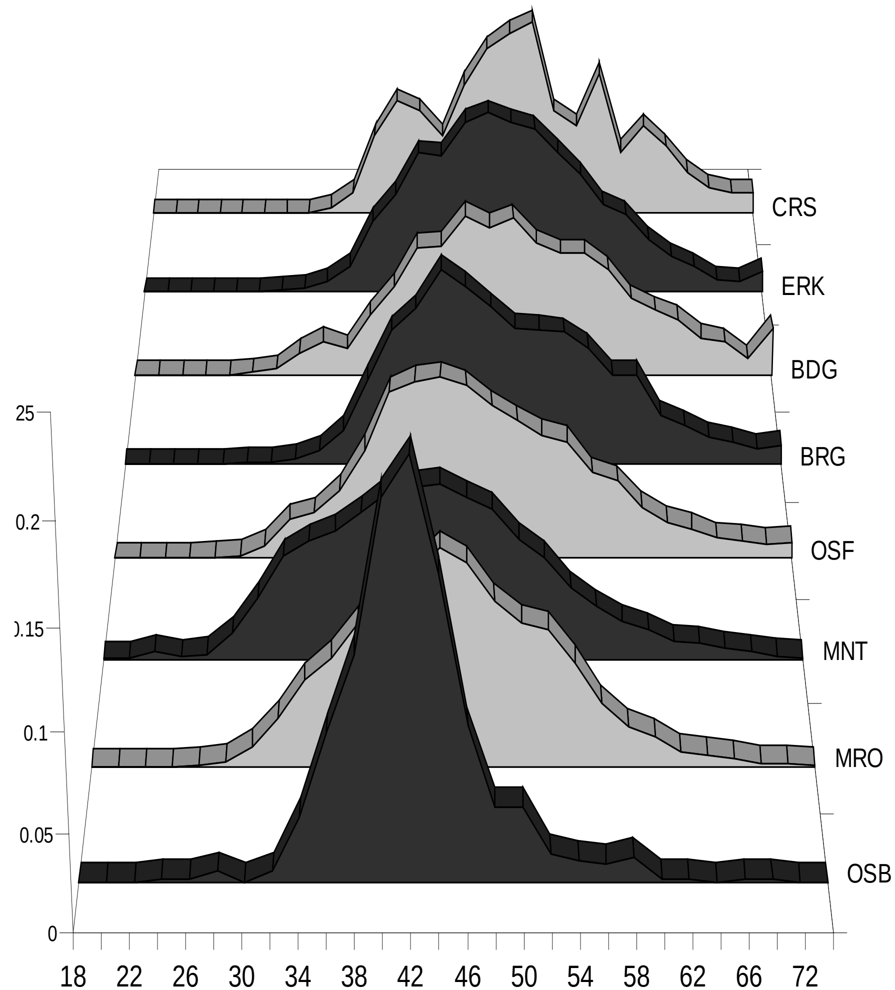

Triennial trawl survey CPUE (1980-2004)




NWFSC Combined trawl survey CPUE (2003-2008)

# Diffusion of large fish to the north?




Very small fish are typically seen only in South/central California (as far as Monterey), usually in pier fisheries – larger fish increase in FO to north.

These two scenarios formed the basis for the decision table (State 1 upweights trawl CPUE and triennial survey, State 2 upweights southern rec. CPUE and CalCOFI index).

Alternative catch streams based on observed recent catches (low scenario), catches based on the rebuilding plan SPR rate (0.77, base scenario), and catches based on SPR of 0.77 with the optimistic model (high scenario).

Even the pessimistic model with the high catch scenario predicts an increase (albeit modest) in spawning output

| | | **State1 (low biomass)** | | **Base Model** | | **State2( high biomass)** | |
|---|---|---|---|---|---|---|---|
| catch with 2008 F | | larvae | depletion | larvae | depletion | larvae | depletion |
| 2009 | 65 | 1034540 | **0.15** | 2209950 | **0.28** | 2658620 | **0.38** |
| 2010 | 62 | 1056130 | **0.15** | 2259880 | **0.29** | 2715680 | **0.39** |
| 2011 | 62 | 1059020 | **0.15** | 2267600 | **0.29** | 2720120 | **0.39** |
| 2012 | 68 | 1076100 | **0.15** | 2289230 | **0.29** | 2736480 | **0.40** |
| 2013 | 78 | 1133840 | **0.16** | 2371870 | **0.30** | 2819550 | **0.41** |
| 2014 | 90 | 1224880 | **0.18** | 2506410 | **0.32** | 2959720 | **0.43** |
| 2015 | 102 | 1337490 | **0.19** | 2675120 | **0.34** | 3137450 | **0.45** |
| 2016 | 113 | 1464190 | **0.21** | 2865660 | **0.36** | 3338590 | **0.48** |
| 2017 | 123 | 1600700 | **0.23** | 3069460 | **0.39** | 3552450 | **0.51** |
| 2018 | 129 | 1744400 | **0.25** | 3280130 | **0.42** | 3770470 | **0.55** |
| 2019 | 136 | 1893960 | **0.27** | 3493470 | **0.44** | 3986640 | **0.58** |
| 2020 | 142 | 2048240 | **0.29** | 3706040 | **0.47** | 4196180 | **0.61** |
| SPR 0.77 (base) | | larvae | depletion | larvae | depletion | larvae | depletion |
| 2009 | 267 | 1034540 | **0.15** | 2209950 | **0.28** | 2658620 | **0.38** |
| 2010 | 251 | 1025030 | **0.15** | 2228890 | **0.28** | 2684700 | **0.39** |
| 2011 | 246 | 997328 | **0.14** | 2206150 | **0.28** | 2658730 | **0.38** |
| 2012 | 265 | 986019 | **0.14** | 2199380 | **0.28** | 2646800 | **0.38** |
| 2013 | 299 | 1013570 | **0.14** | 2252490 | **0.29** | 2700770 | **0.39** |
| 2014 | 339 | 1068090 | **0.15** | 2352740 | **0.30** | 2807790 | **0.41** |
| 2015 | 377 | 1136160 | **0.16** | 2481040 | **0.32** | 2947220 | **0.43** |
| 2016 | 413 | 1210440 | **0.17** | 2625210 | **0.33** | 3105210 | **0.45** |
| 2017 | 445 | 1287560 | **0.18** | 2777630 | **0.35** | 3272010 | **0.47** |
| 2018 | 474 | 1365920 | **0.20** | 2933000 | **0.37** | 3440210 | **0.50** |
| 2019 | 500 | 1444790 | **0.21** | 3087910 | **0.39** | 3604600 | **0.52** |
| 2020 | 517 | 1523620 | **0.22** | 3239680 | **0.41** | 3761180 | **0.54** |
| SPR 0.77(State 2) | | larvae | depletion | larvae | depletion | larvae | depletion |
| 2009 | 353 | 1034540 | **0.15** | 2209950 | **0.28** | 2658620 | **0.38** |
| 2010 | 326 | 1009690 | **0.14** | 2213630 | **0.28** | 2669450 | **0.39** |
| 2011 | 314 | 967342 | **0.14** | 2176350 | **0.28** | 2628970 | **0.38** |
| 2012 | 328 | 942839 | **0.13** | 2156410 | **0.27** | 2603940 | **0.38** |
| 2013 | 360 | 956879 | **0.14** | 2196410 | **0.28** | 2645010 | **0.38** |
| 2014 | 395 | 995845 | **0.14** | 2282340 | **0.29** | 2738290 | **0.40** |
| 2015 | 429 | 1045960 | **0.15** | 2394880 | **0.30** | 2863010 | **0.41** |
| 2016 | 459 | 1100950 | **0.16** | 2522930 | **0.32** | 3006440 | **0.43** |
| 2017 | 479 | 1158410 | **0.17** | 2659810 | **0.34** | 3159810 | **0.46** |
| 2018 | 497 | 1217370 | **0.17** | 2800930 | **0.36** | 3316360 | **0.48** |
| 2019 | 512 | 1277570 | **0.18** | 2943370 | **0.37** | 3471380 | **0.50** |
| 2020 | 527 | 1338790 | **0.19** | 3084810 | **0.39** | 3621160 | **0.52** |

# Status of Cabezon (*Scorpaenichthys marmoratus*) in California and Oregon Waters as Assessed in 2009


by

Jason M. Cope[1]
Meisha Key[2]



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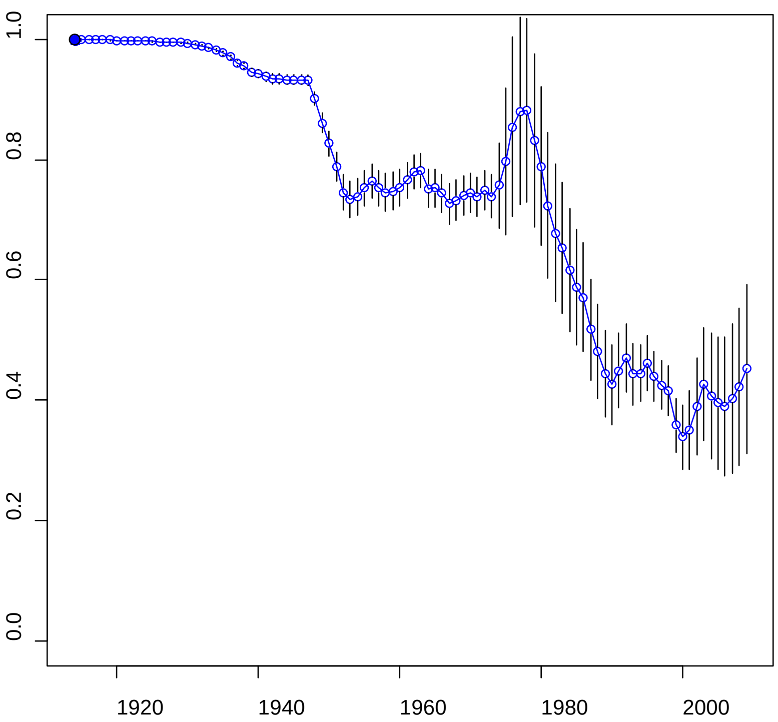
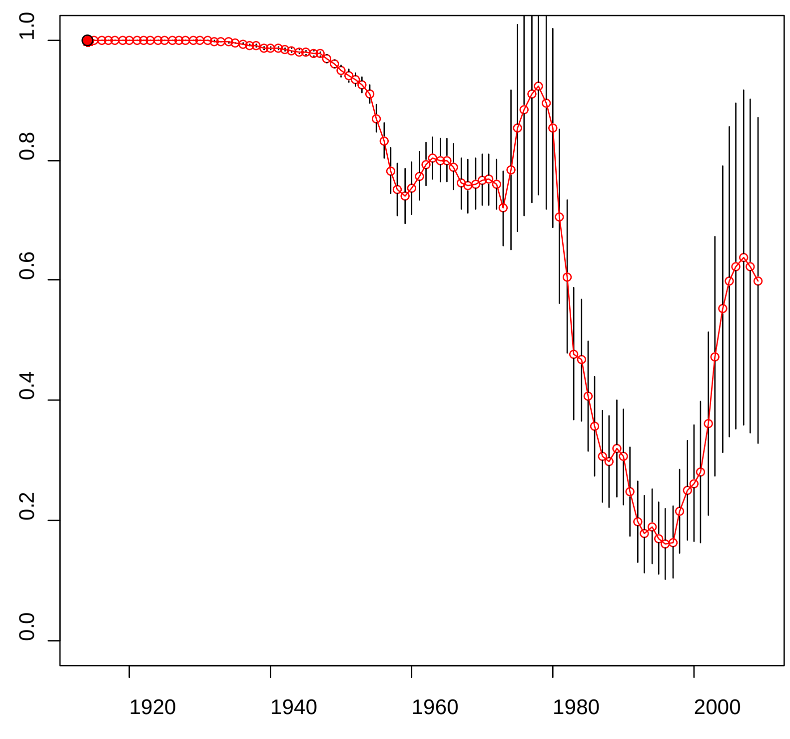
# Base Case: NCS




$SB_{1916}$: 1036 mt

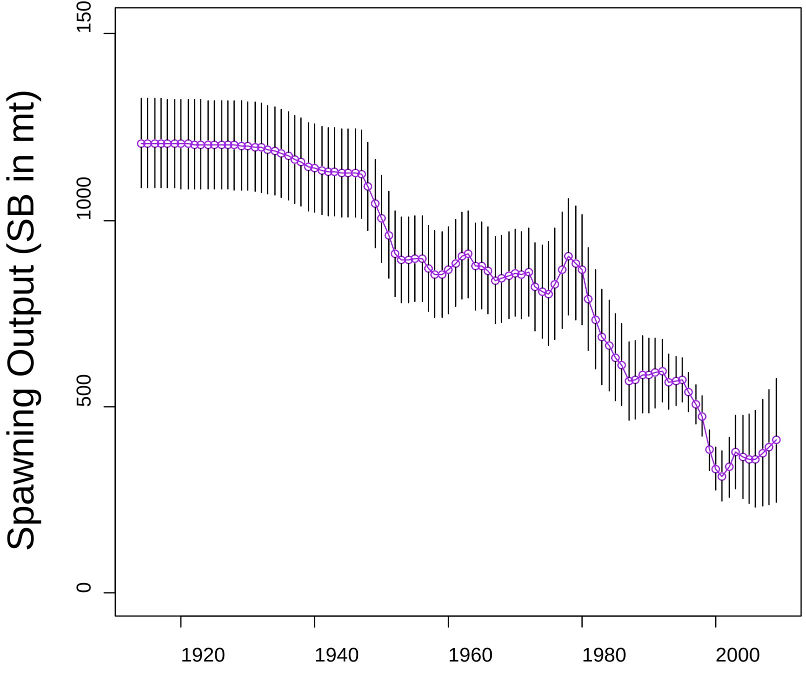
$SB_{2009}$: 469 mt

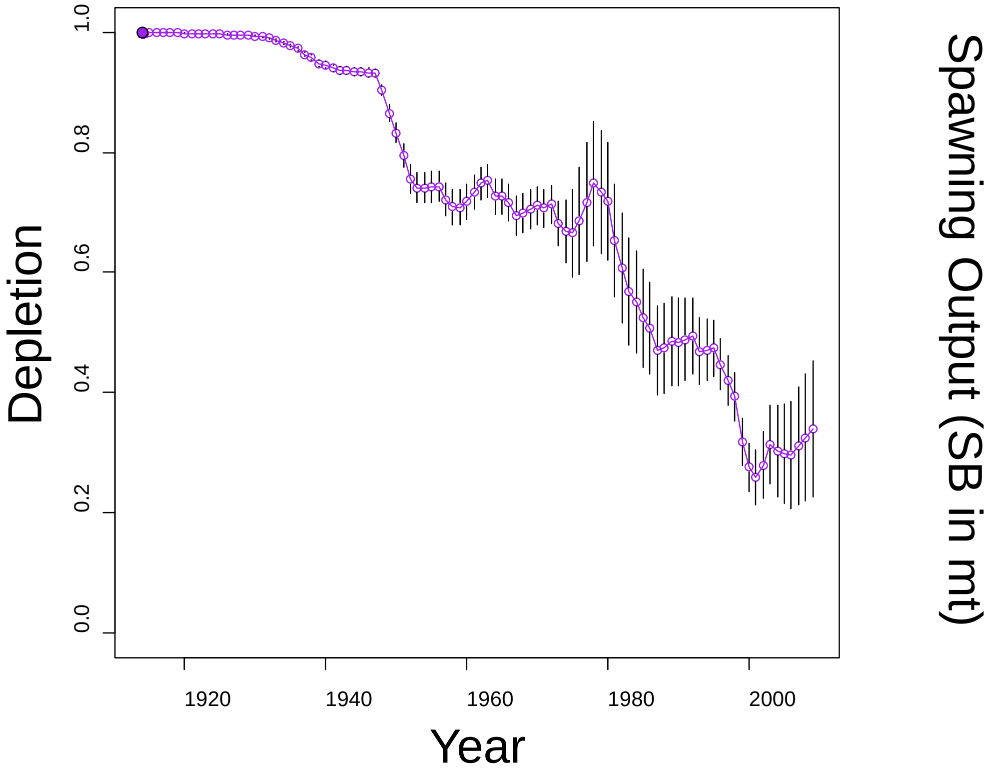
Depletion: 45%

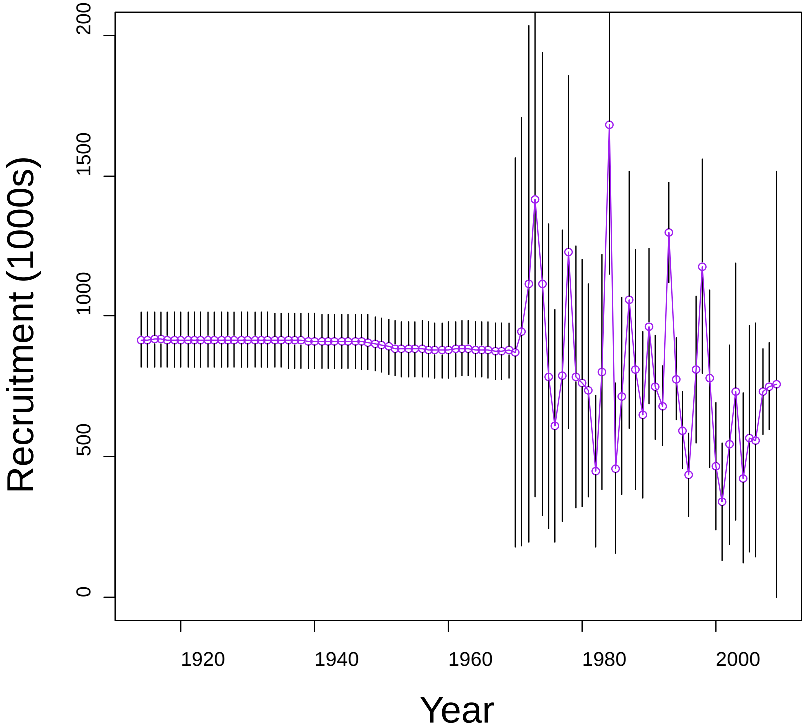


1.0
0.8
0.6
0.4
0.2
0.0
1920
1940
1960
1980
2000

# Base Case: CAS




$SB_{1916}$: 1207 mt

$SB_{2009}$: 410 mt

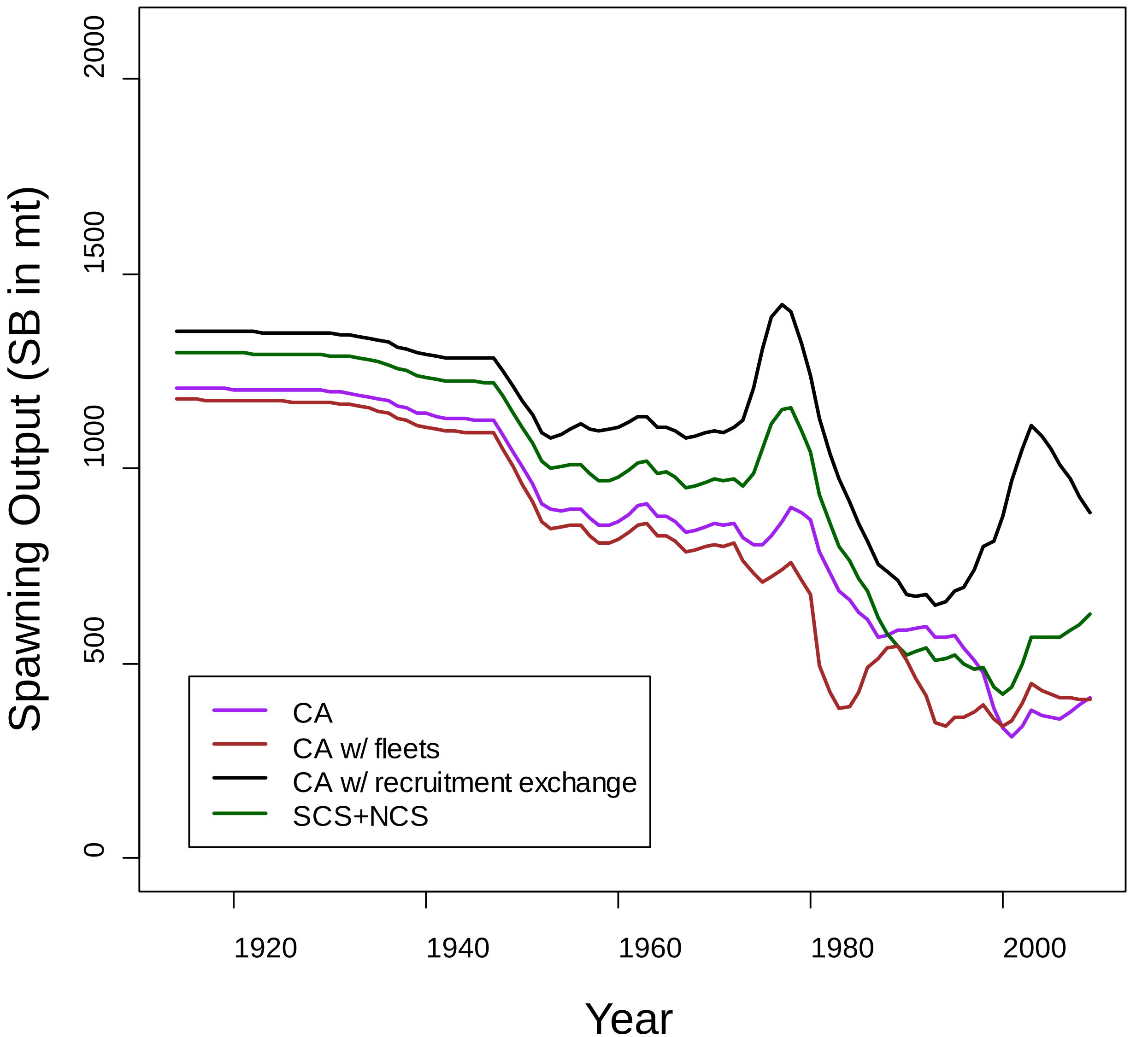
Depletion: 34%

# Stock structure & Recruitment deviations

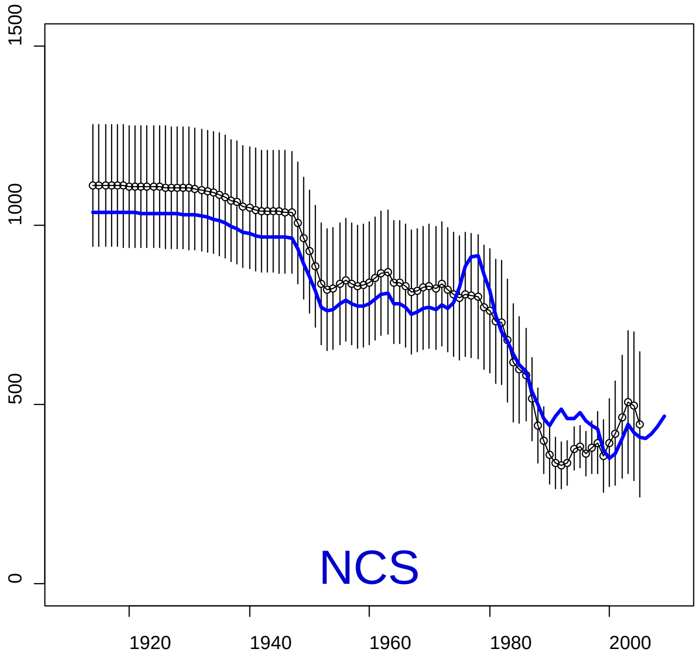
Recruitment deviations

Year

# Treating stock structure



# Assessment comparisons: 2005 vs 2009



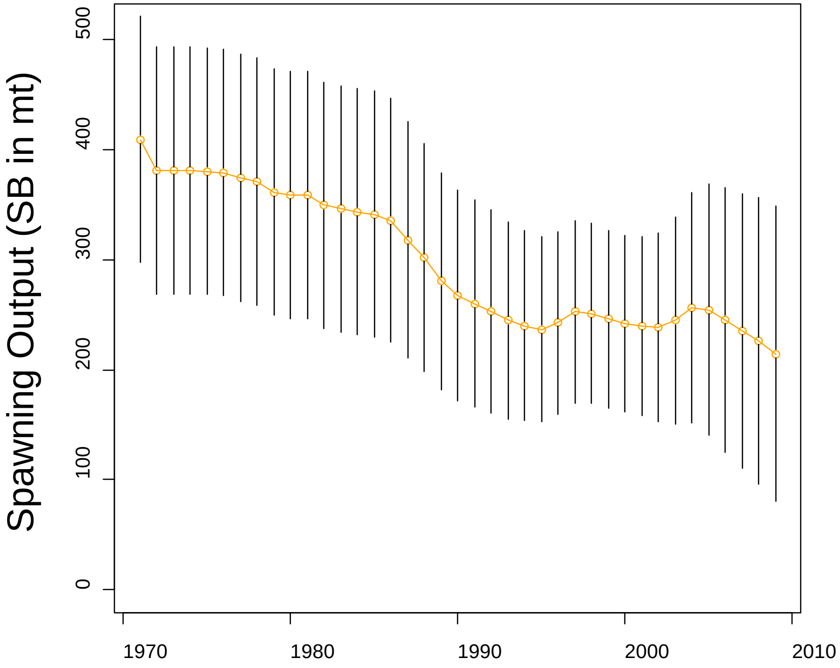

SCS

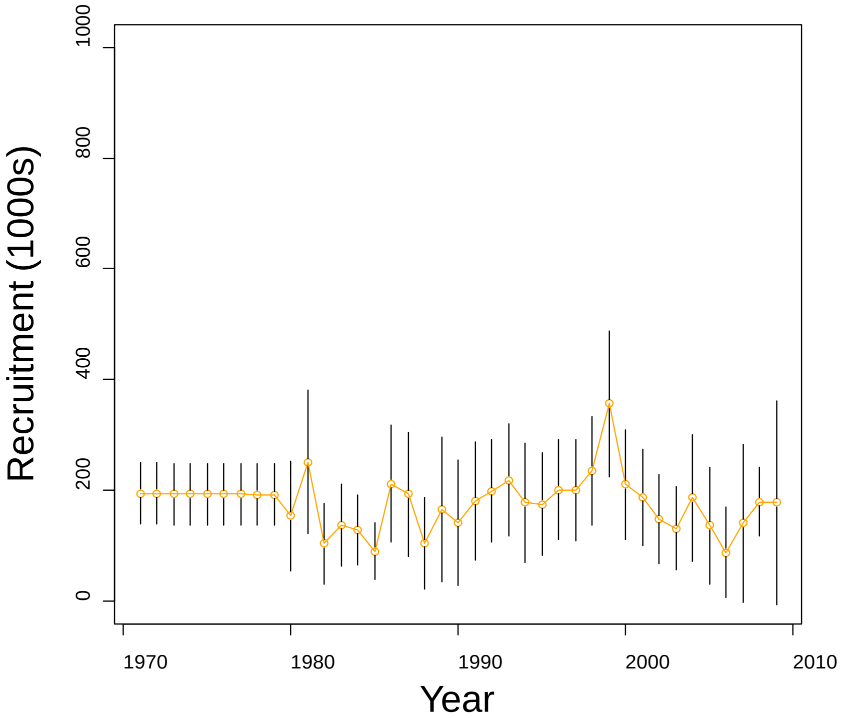
CA: NCS + SCS

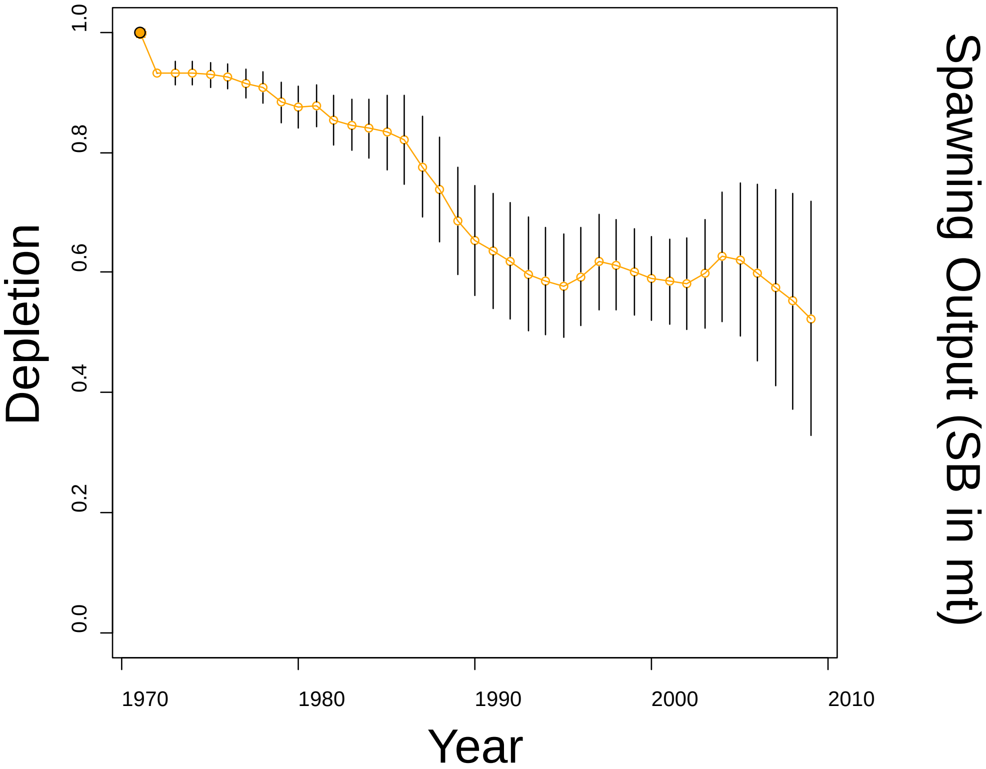
CA: 1 assessment

Year

# Base Case: ORS



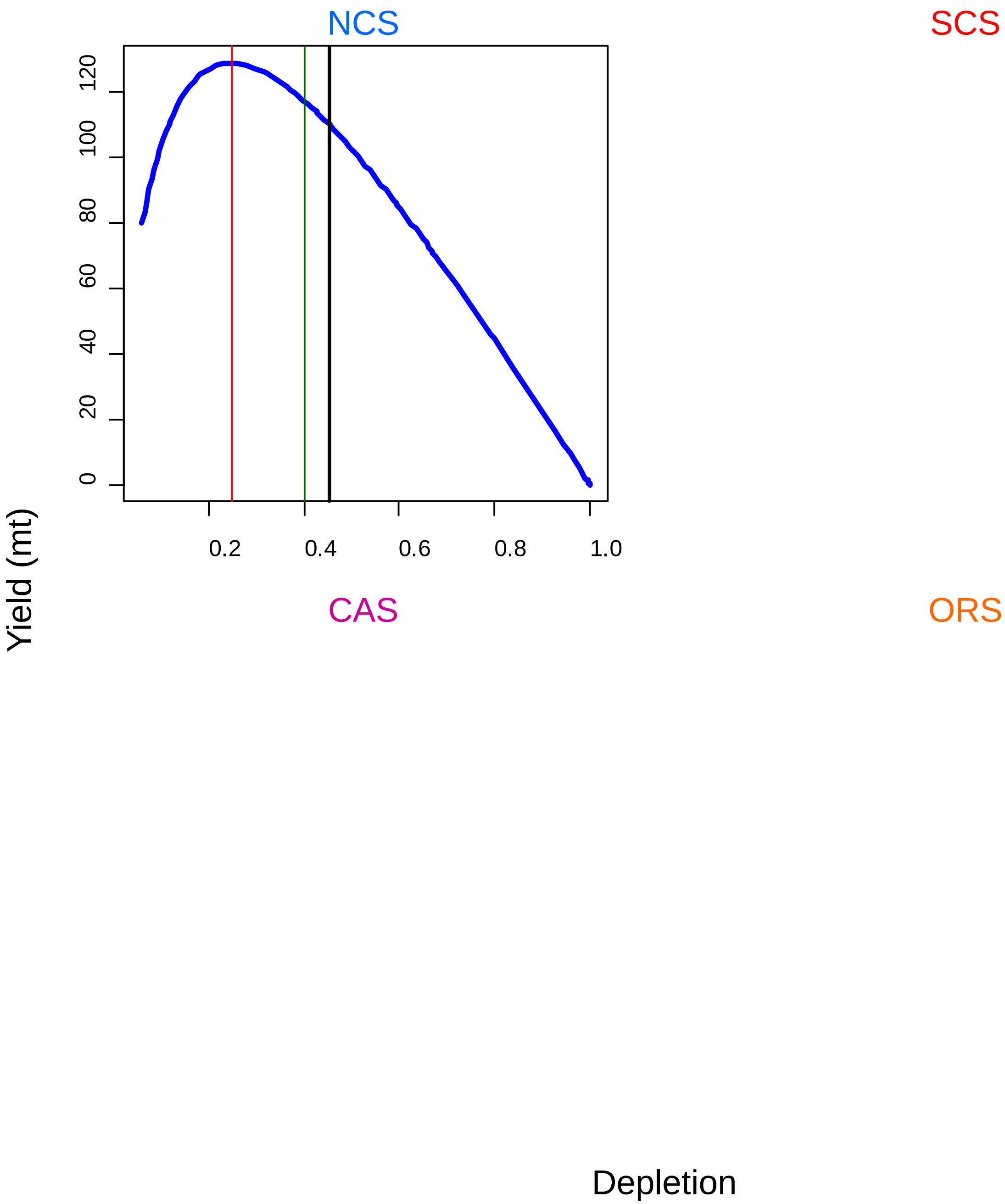




$SB_{1916}$: 409 mt

$SB_{2009}$: 214 mt

Depletion: 52%

# Equilibrium curves



# Research Recommendations

- Improve estimation
- Age and growth
- Fishery-independent surveys
- Stock structure
- Alternative assessment methods

DRAFT

# Status of greenstriped rockfish along the outer coast of CA, OR, and WA

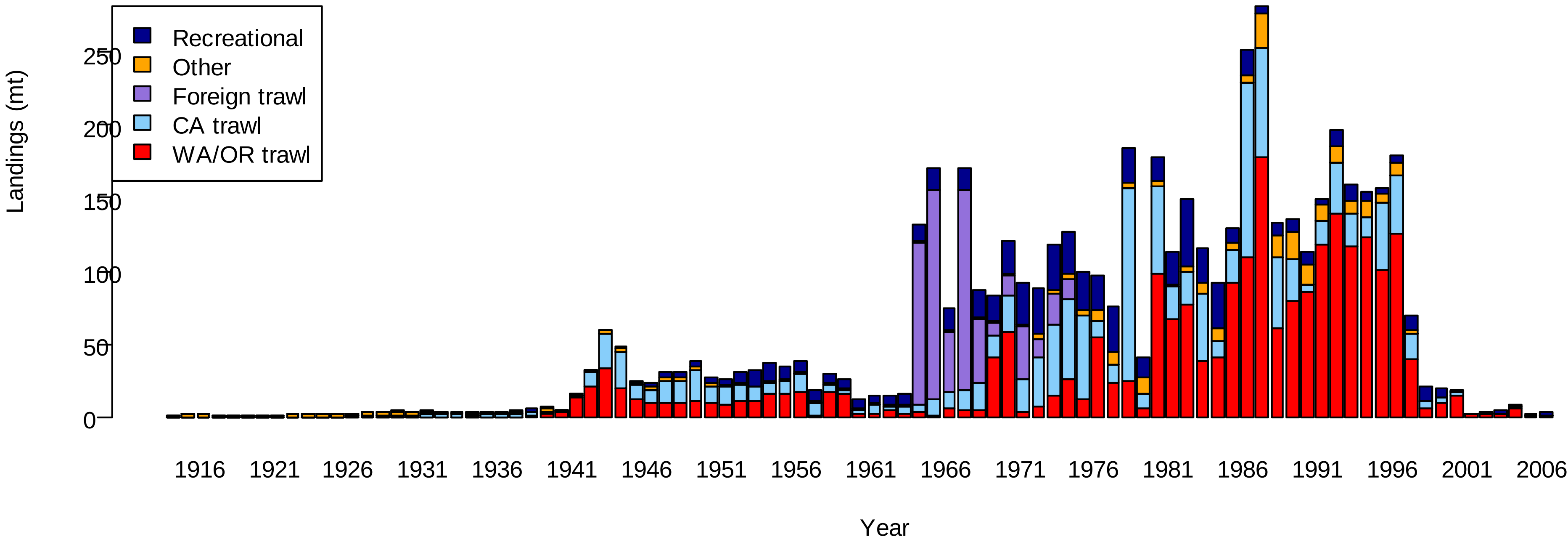
Allan Hicks
Melissa Haltuch
Chantel Wetzel

SSC Meeting
September 14, 2009

# Introduction: biology

- *Sebastes elongatus*
- Small rockfish (<45 cm)
- Found with others or alone
- Prefer mud and sand bottoms, but are found in a wide range of habitats
- Maturing fish move to deeper water

# Landings: All gears

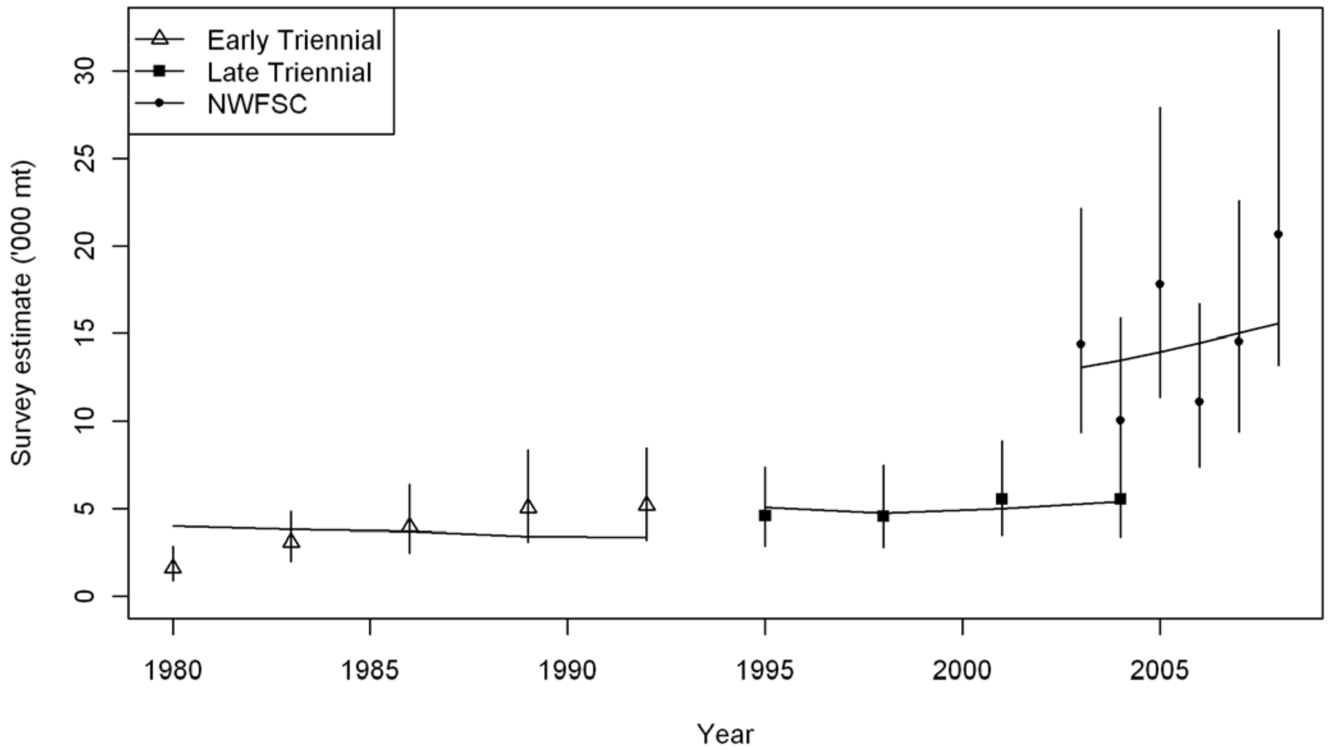


# Model description

- First assessment for greenstriped rockfish on the West Coast
- 5 commercial fleets
  1. WA/OR trawl (discards)
  2. CA trawl (discards)
  3. Foreign trawl (no discards)
  4. Other-gear (non-trawl, discards)
  5. Recreational (discards included in catches)
- 3 survey series
  1. early Triennial
  2. late Triennial
  3. NWFSC

# Fits to abundance indices

- Catchability (q)
  - early Triennial = 0.20
  - late Triennial = 0.32
  - NWFSC = 0.84

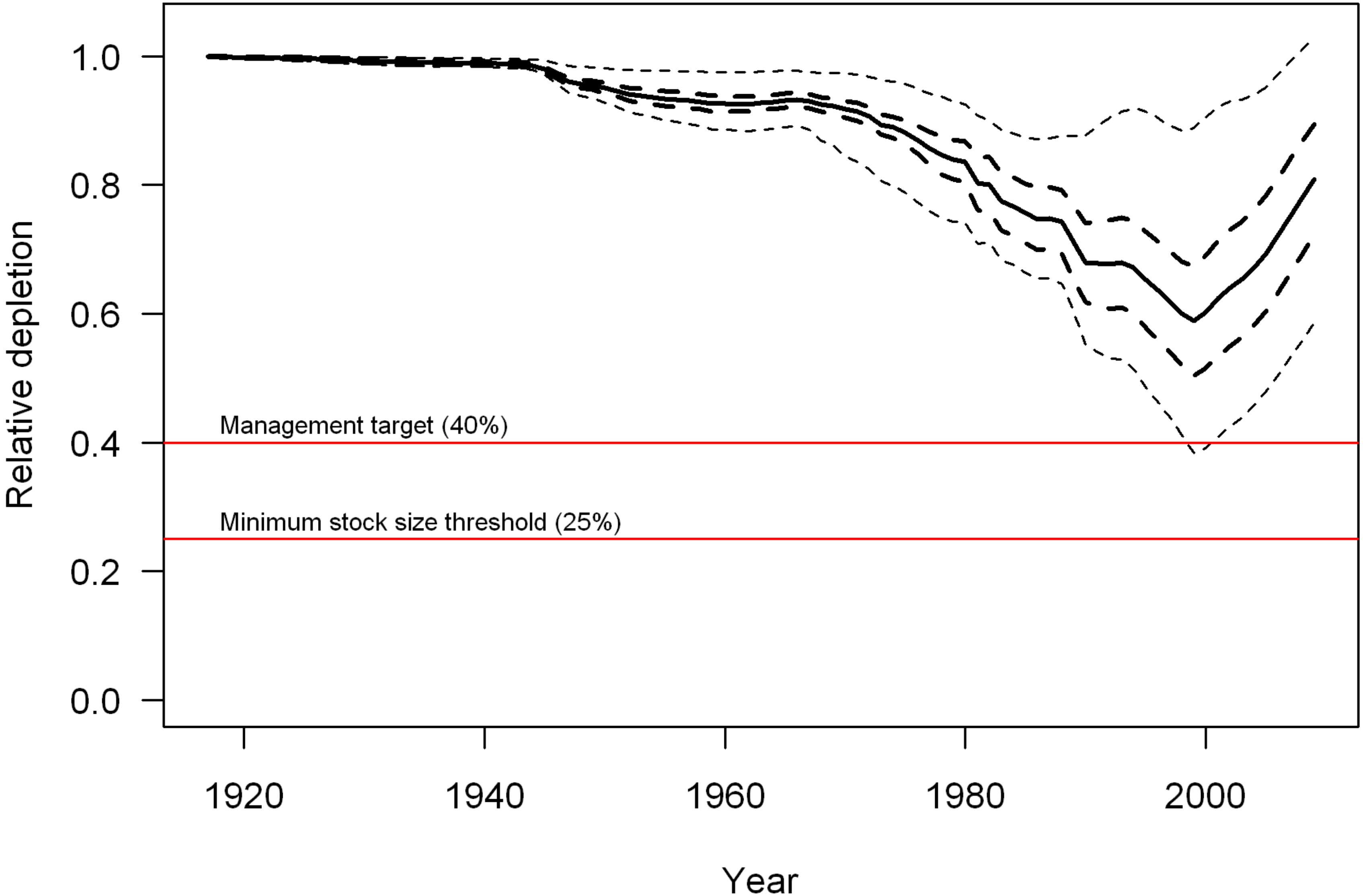


# Axes of uncertainty

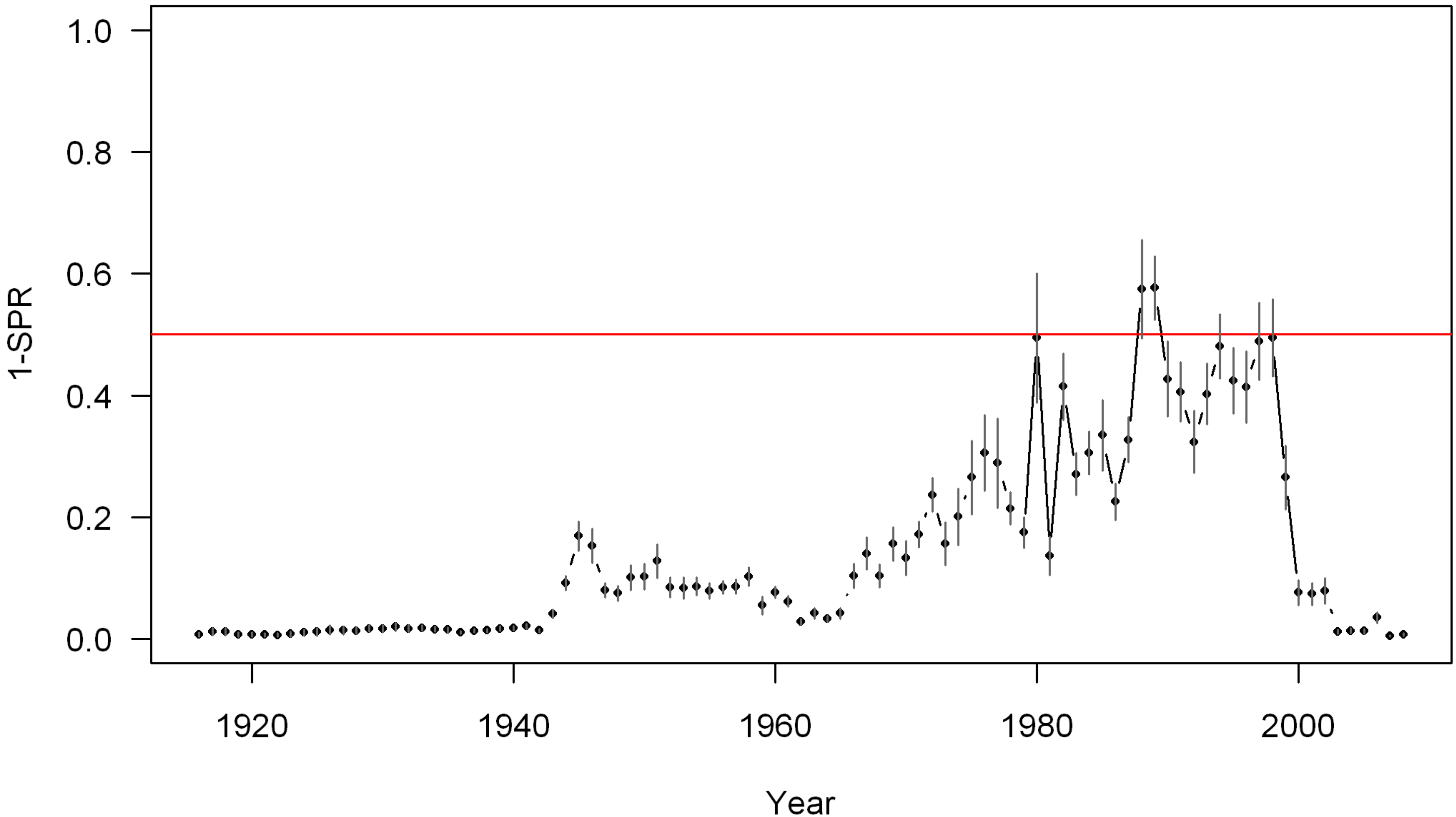
- Two axes of uncertainty
  1. Discard fraction
     - affects the absolute biomass
  2. Natural mortality
     - affects the level of depletion

| | | State of nature (natural mortality) | | |
|---|---|---|---|---|
| | | M=0.06 | M=0.08 | M=0.10 |
| State of nature (fraction discarded) | Low fraction discarded | | | |
| | Base fraction discarded | | Base Model | |
| | High fraction discarded | | | |

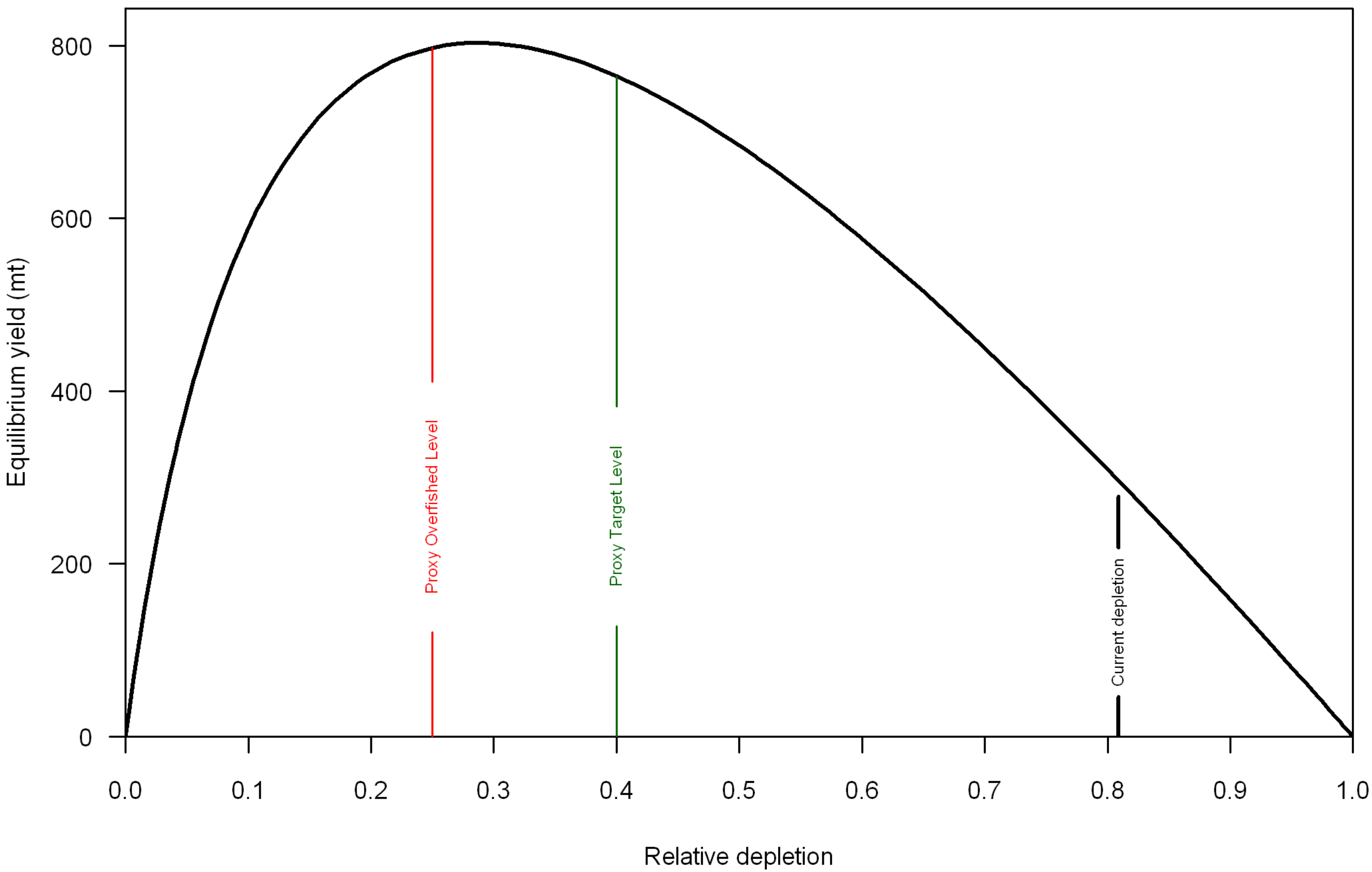
# Predicted depletion



# Spawning potential ratio



# Equilibrium yield curve



# Decision Table

| State of nature (fraction discarded) | | Year | Landed catch (mt) | State of nature (natural mortality) M=0.06 Depletion (%) | M=0.06 Spawning output (million) | M=0.08 Depletion (%) | M=0.08 Spawning output (million) | M=0.10 Depletion (%) | M=0.10 Spawning output (million) |
|---|---|---|---|---|---|---|---|---|---|
| | **Low fraction discarded** | 2011 | 20 | 66.9 | 1,340 | 88.8 | 2,904 | 106.2 | 9,316 |
| | | 2012 | 20 | 68.7 | 1,375 | 90.5 | 2,957 | 107.3 | 9,409 |
| | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| | | 2019 | 20 | 76.5 | 1,533 | 95.3 | 3,114 | 107.4 | 9,418 |
| | | 2020 | 20 | 77.3 | 1,548 | 95.5 | 3,121 | 107.0 | 9,384 |
| | **Base fraction discarded** | 2011 | 20 | 63.9 | 3,324 | 86.2 | 6,113 | 105.2 | 17,324 |
| | | 2012 | 20 | 65.9 | 3,427 | 88.1 | 6,249 | 106.5 | 17,540 |
| | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| | | 2019 | 20 | 74.7 | 3,886 | 94.1 | 6,675 | 107.3 | 17,675 |
| | | 2020 | 20 | 75.5 | 3,930 | 94.5 | 6,697 | 107.0 | 17,614 |
| | **High fraction discarded** | 2011 | 20 | 64.7 | 7,903 | 85.9 | 14,969 | 105.5 | 46,891 |
| | | 2012 | 20 | 66.6 | 8,133 | 87.9 | 15,306 | 106.8 | 47,469 |
| | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| | | 2019 | 20 | 75.0 | 9,155 | 93.9 | 16,364 | 107.6 | 47,818 |
| | | 2020 | 20 | 75.8 | 9,253 | 94.2 | 16,419 | 107.2 | 47,650 |

# Conclusions

- Large amounts of discarding
- Spawning output has been increasing
  - Low recent exploitation rates
  - High recruitment in early and late 1990's
- Very likely to currently be above 40% unfished spawning output and increasing

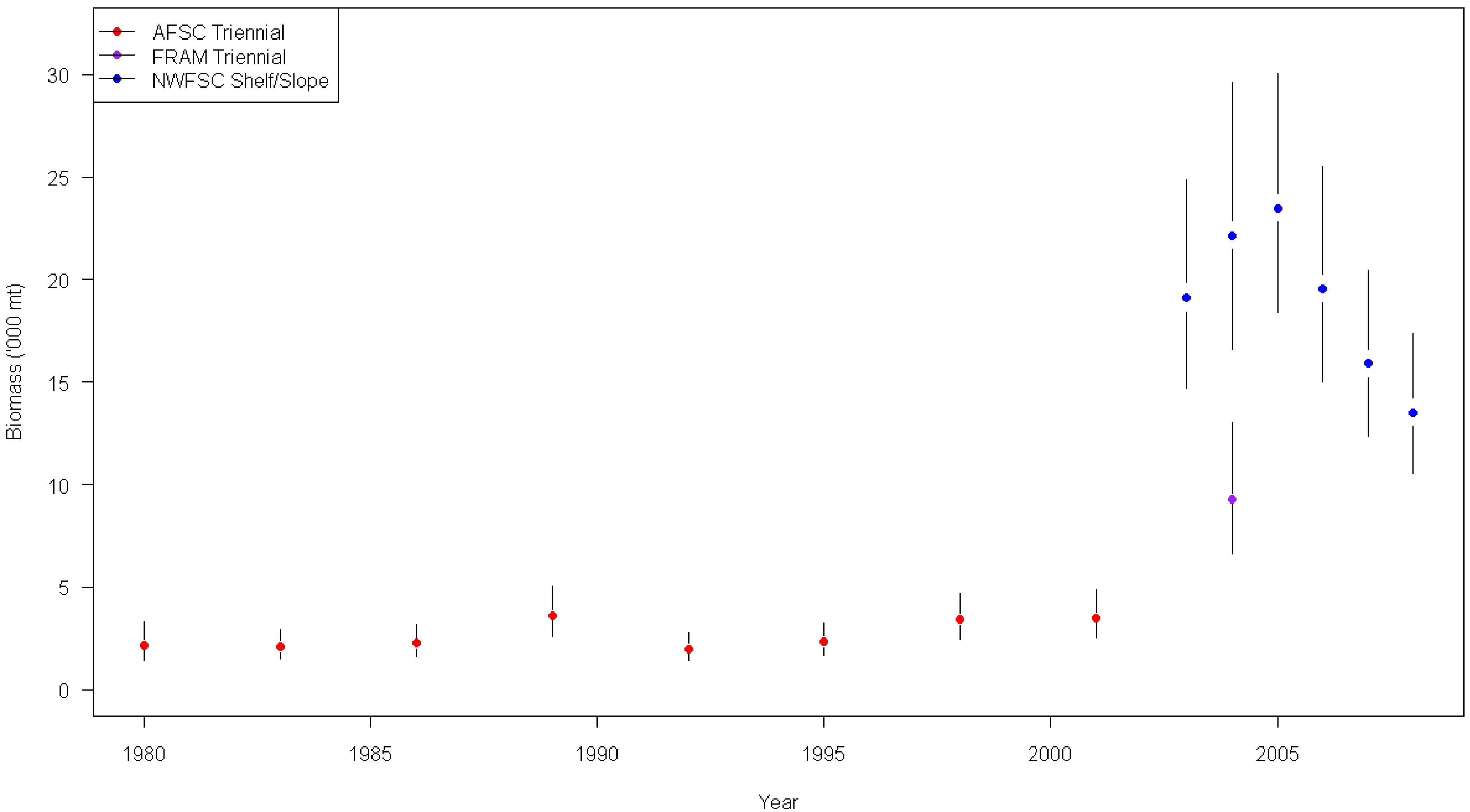
# Draft status of the U.S. petrale sole resource in 2008

Melissa Haltuch

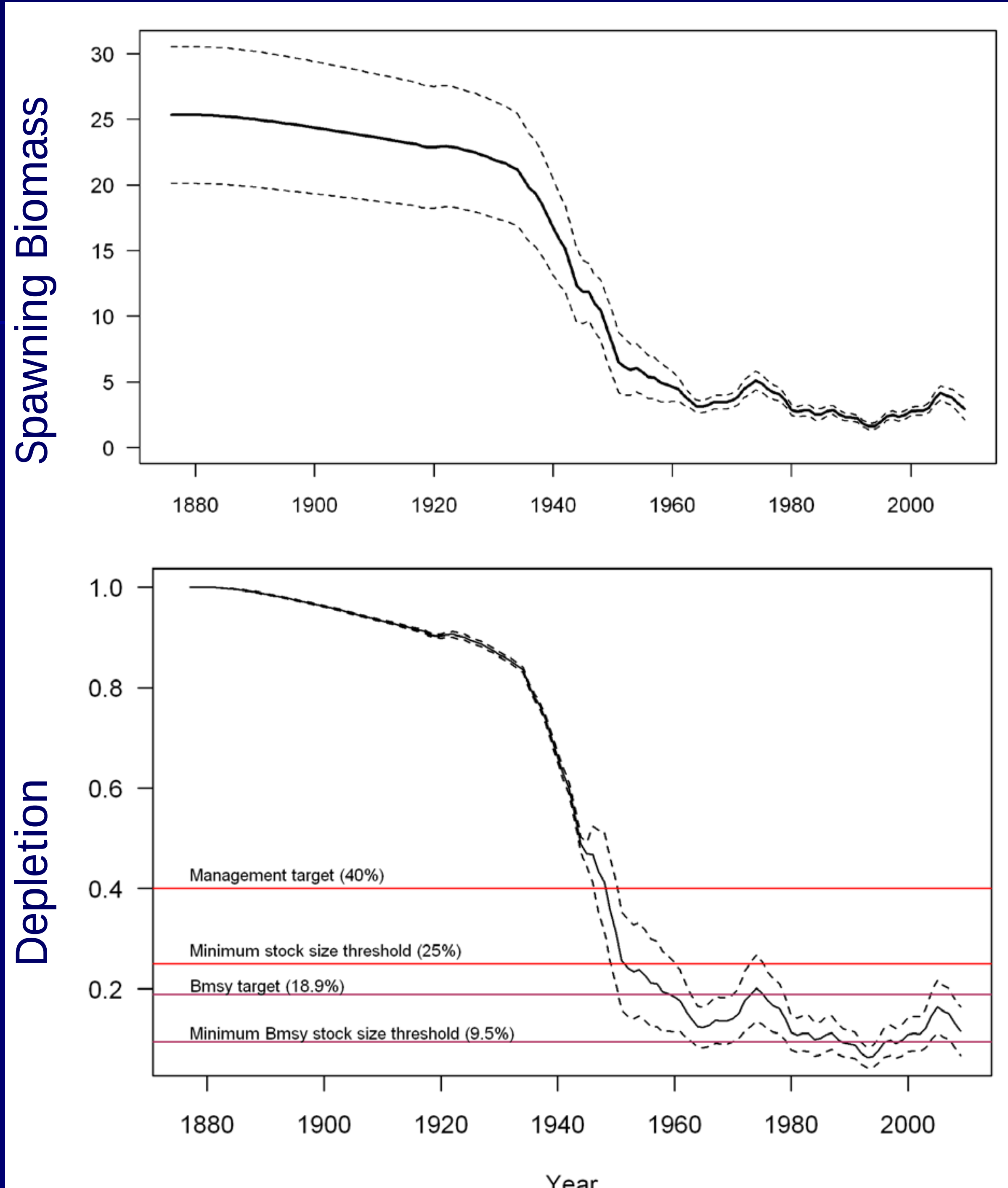
Allan Hicks

June 2009

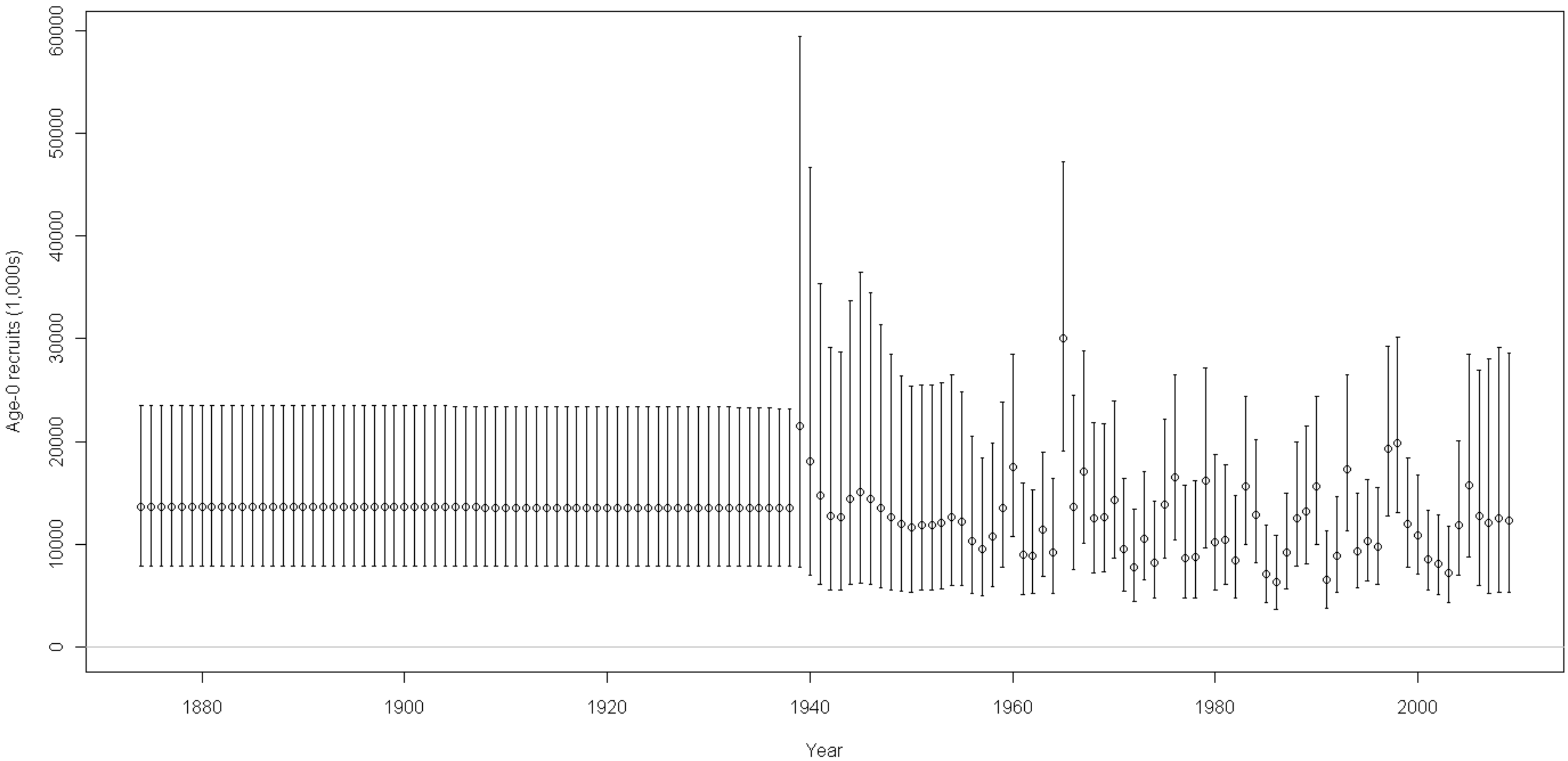
# Survey Biomass Estimates



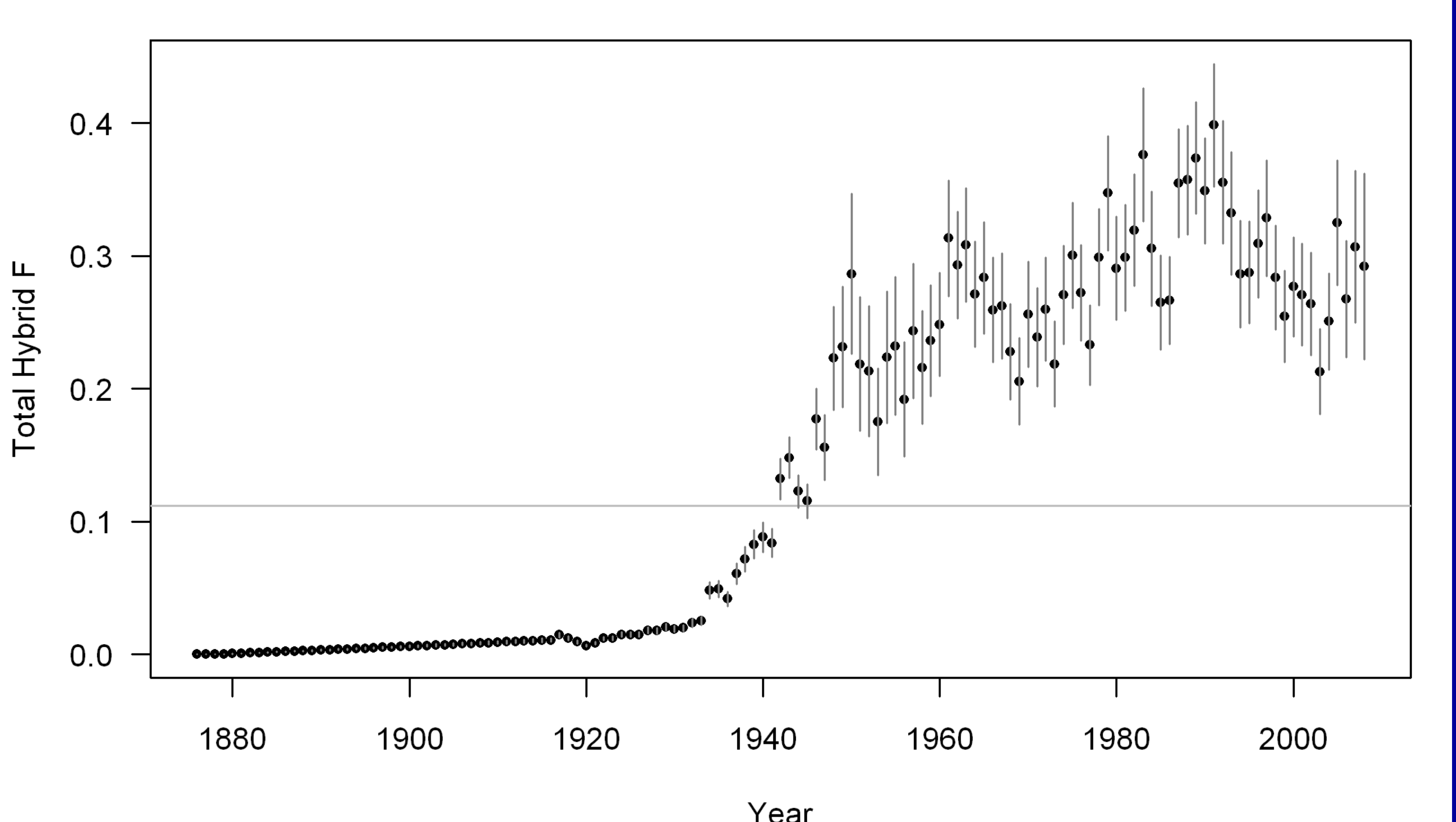
# Biomass trajectory



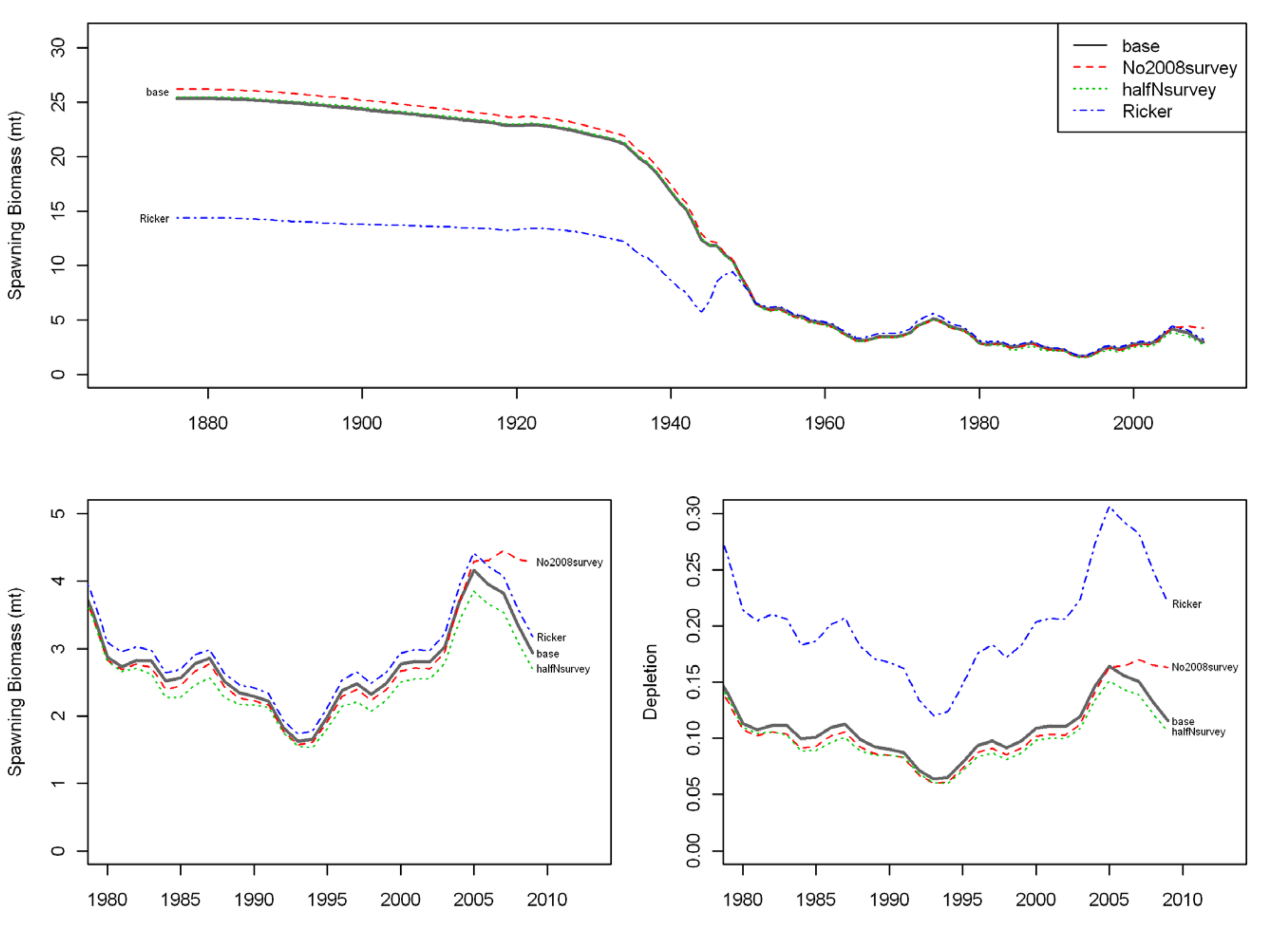
# Recruitment deviations



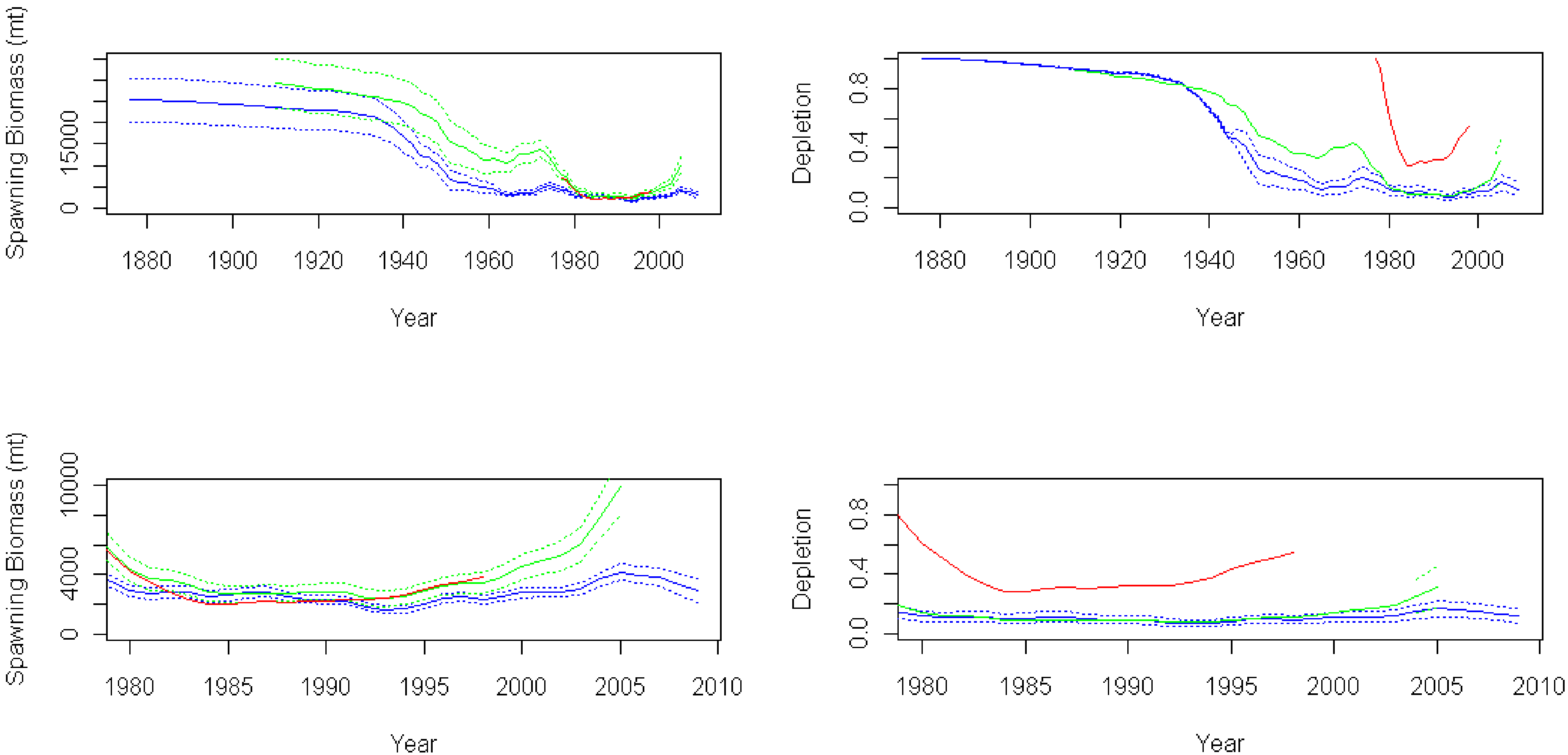
# Fishing Mortality



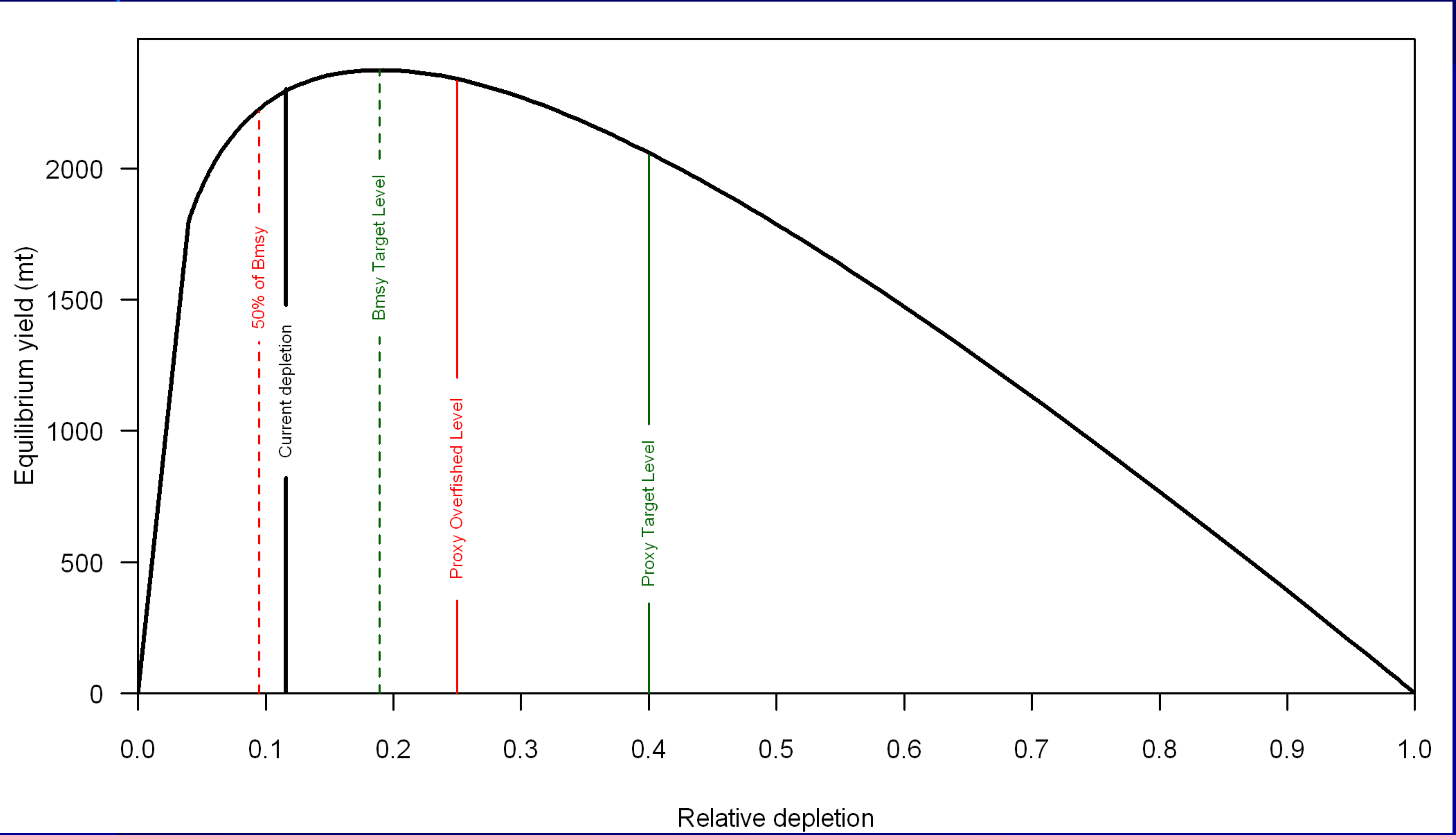
# Model Sensitivity Plots



# Comparison between 2009 (blue), 2005 (green) and 1999 (red) assessments



# Equilibrium Yield Curve



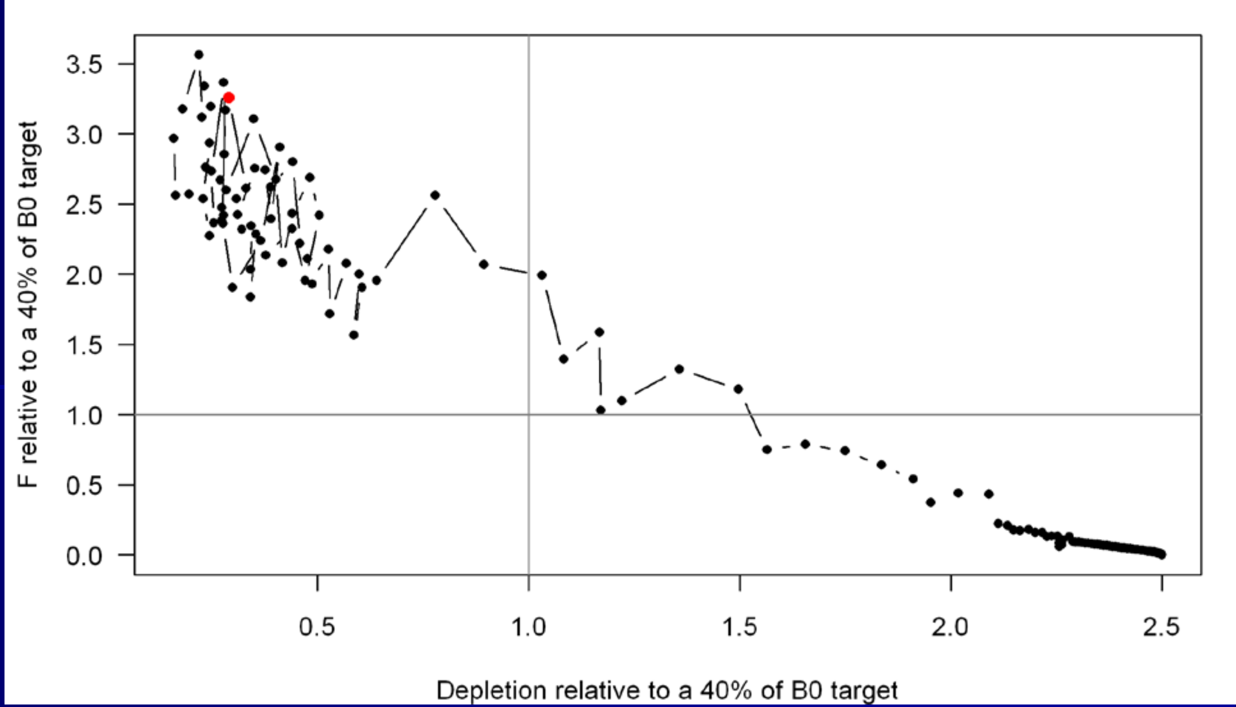
# Base model projection using 40-10 control rule

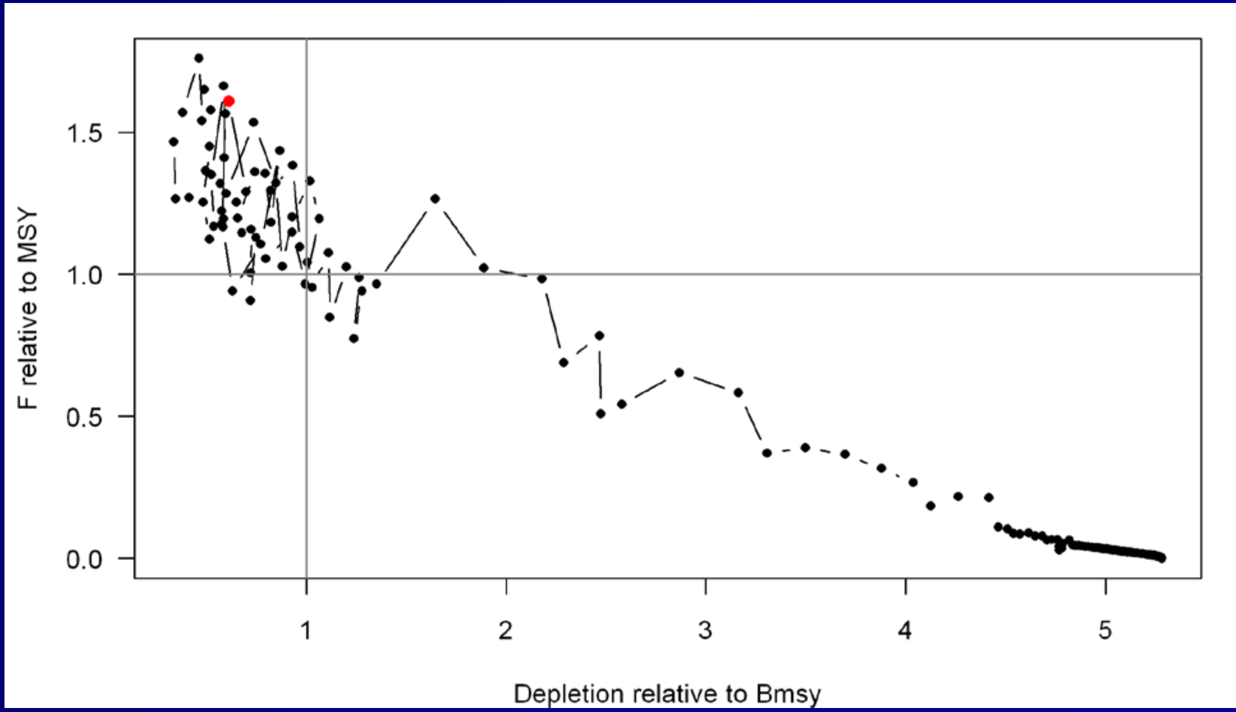
| | No current modification | | | Modify 2010 catch | | | Modify 2009 & 2010 catches | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | OY (mt) | Depl B0 | Depl Bmsy | OY (mt) | Depl B0 | Depl Bmsy | OY (mt) | Depl B0 | Depl Bmsy |
| 2009 | 2,433 | 12% | 61% | 2,433 | 12% | 61% | 2,000 | 12% | 61% |
| 2010 | 2,393 | 10% | 52% | 1,200 | 10% | 52% | 1,200 | 11% | 57% |
| 2011 | 0 | 9% | 48% | 147 | 12% | 63% | 226 | 13% | 68% |
| 2012 | 311 | 14% | 75% | 529 | 17% | 90% | 597 | 18% | 95% |
| 2013 | 680 | 19% | 101% | 870 | 22% | 115% | 926 | 23% | 119% |
| 2014 | 997 | 24% | 124% | 1,153 | 26% | 136% | 1,196 | 26% | 139% |
| 2015 | 1,211 | 27% | 143% | 1,375 | 29% | 152% | 1,453 | 29% | 155% |
| 2016 | 1,489 | 30% | 158% | 1,540 | 31% | 165% | 1,599 | 32% | 167% |
| 2017 | 1,621 | 32% | 169% | 1,661 | 33% | 174% | 1,707 | 33% | 176% |
| 2018 | 1,718 | 33% | 177% | 1,751 | 34% | 181% | 1,788 | 35% | 183% |
| 2019 | 1,794 | 35% | 183% | 1,821 | 35% | 187% | 1,851 | 36% | 188% |
| 2020 | 1,838 | 36% | 188% | 1,876 | 36% | 191% | 1,888 | 36% | 192% |

# Changes from 2005 Model

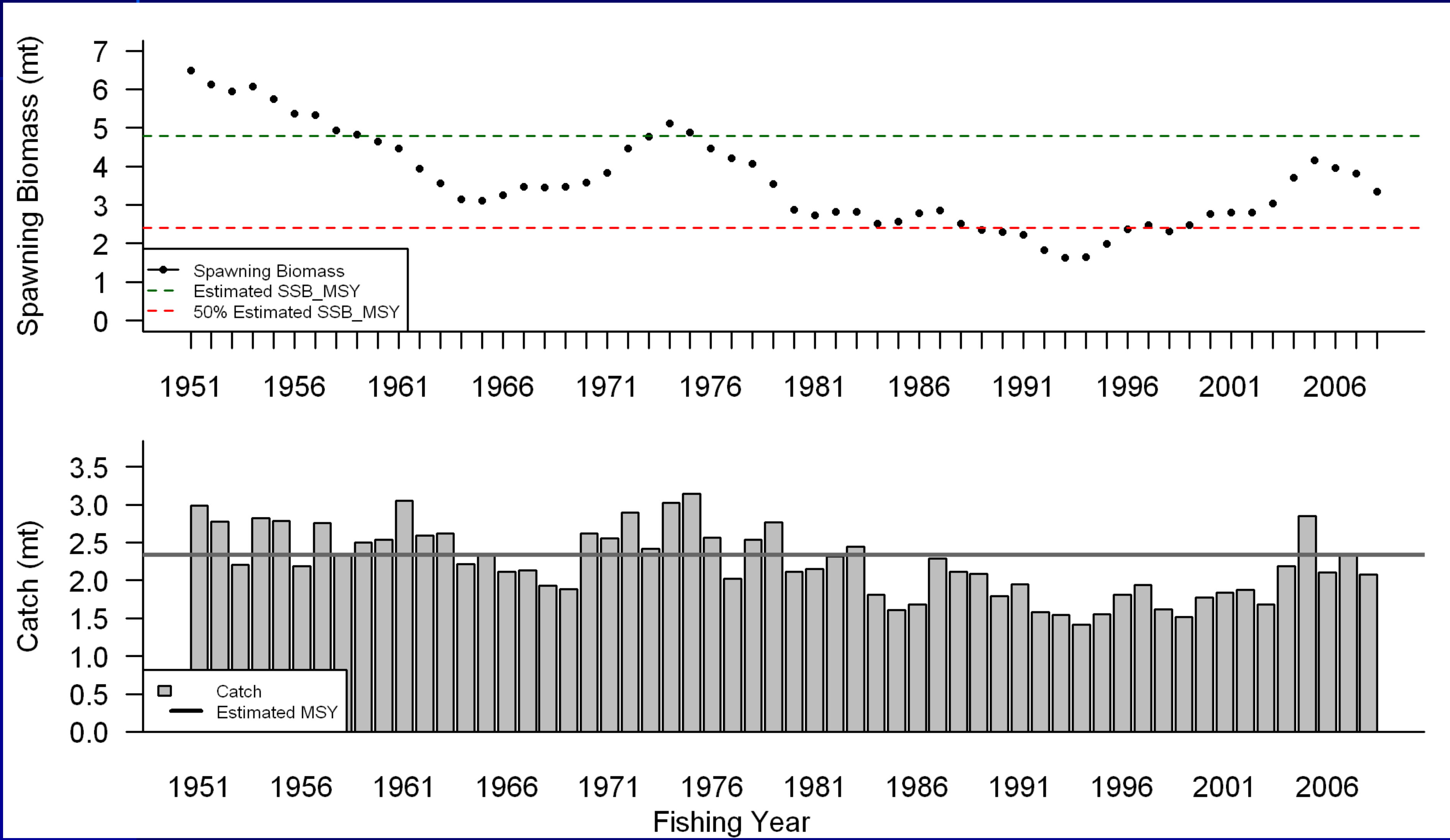
- Coast-wide model
- All age data used with new analysis of ageing bias and imprecision
- NWFSC survey index, age, and length data used
- Pikitch and WCGOP discard data used
- Updated catch history
- Recruitment and natural mortality parameters estimated

# Management performance



# Long term spawning biomass and catch in comparison to MSY based reference points



## Triennial

## NWFSC

Alaska Fisheries Science Center's
Trawl Used for the 1977-2004 West Coast Triennial Survey
89/121 PolyNor' Eastern Trawl

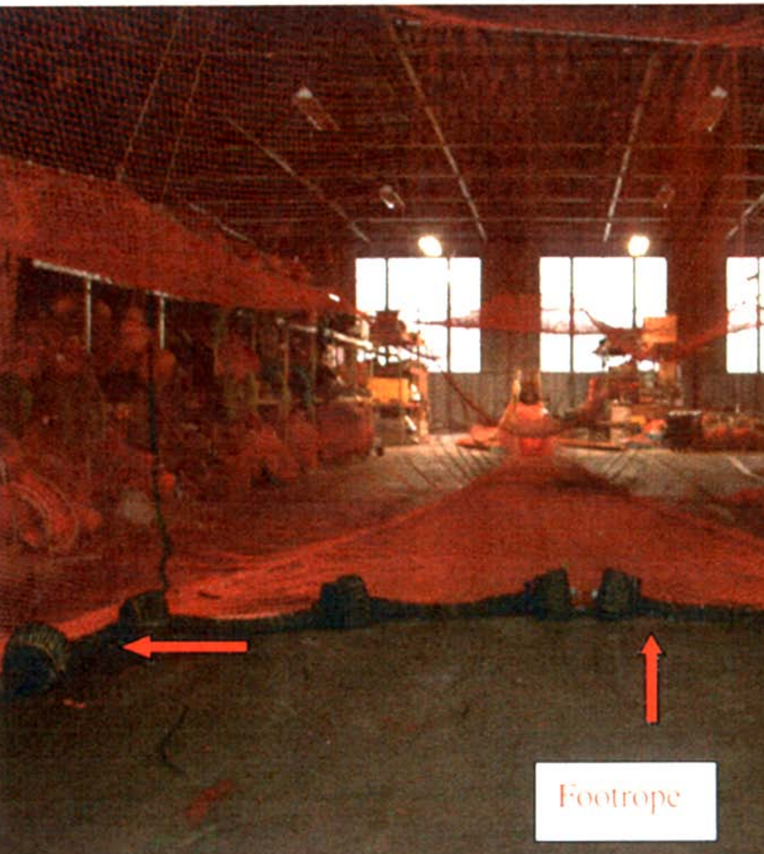
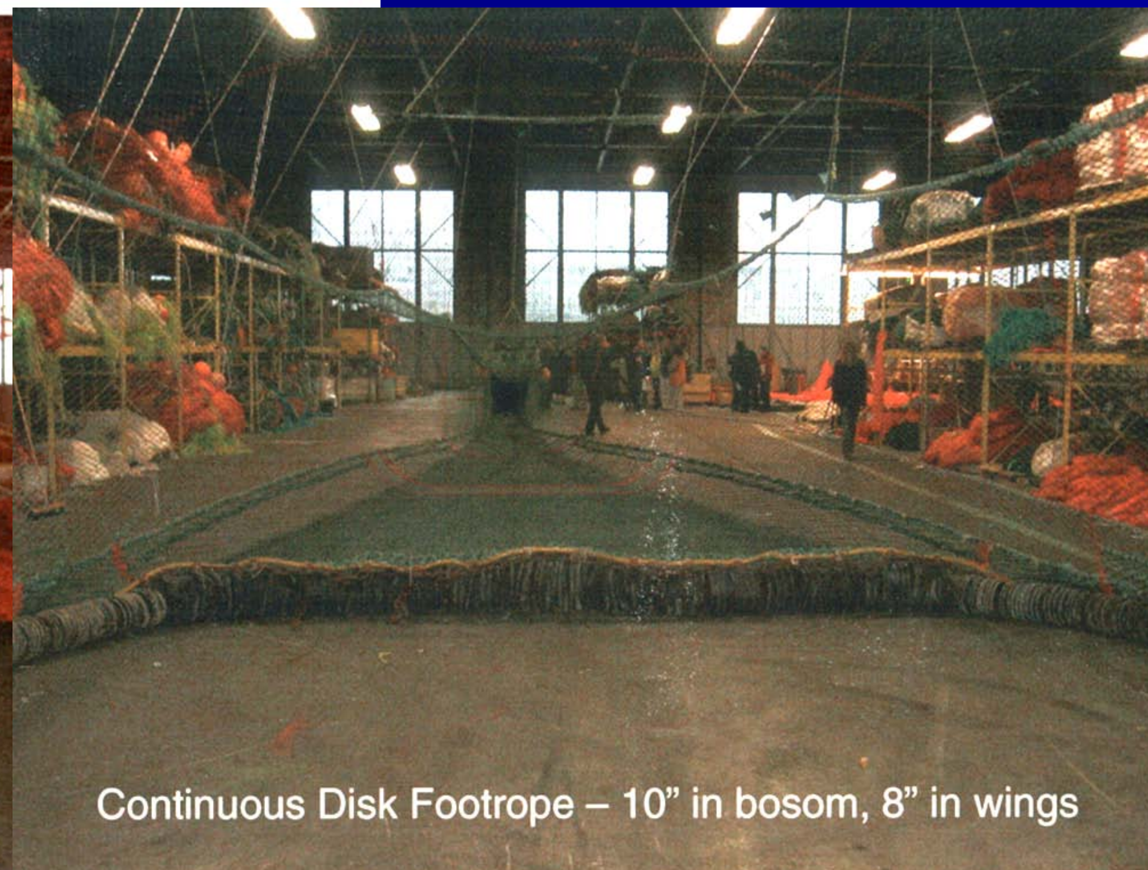



Figure 1. Front opening of the PolyNor' Eastern. Note: Footrope difference, high Rise opening, and steep taper to



Continuous Disk Footrope – 10" in bosom, 8" in wings

# Status of the widow rockfish resource in 2009

Xi He, Donald E. Pearson, E.J. Dick, John C. Field
Stephen V. Ralston, and Alec D. MacCall,

Southwest Fisheries Science Center
Fishery Ecology Division
110 Shaffer Road
Santa Cruz, CA  95060

September 2009

## Main differences from 2007 assessment:

1. Full assessment
2. Use SS3 interface – not direct ADMB coded as in previous assessments
3. Time period in model 1916 to 2008 (vs. 1958 to 2006)
4. New data:
   - 2007-08 data: catch, age, and survey
   - Catch: CA re-construction data (1916-68)
   - NWFSC combo survey (2003-08)
5. Selectivity functions and male offsets
6. Age group changed from 20+ to 30+
7. Use hybrid F (fishing mortality)

# Brief summary

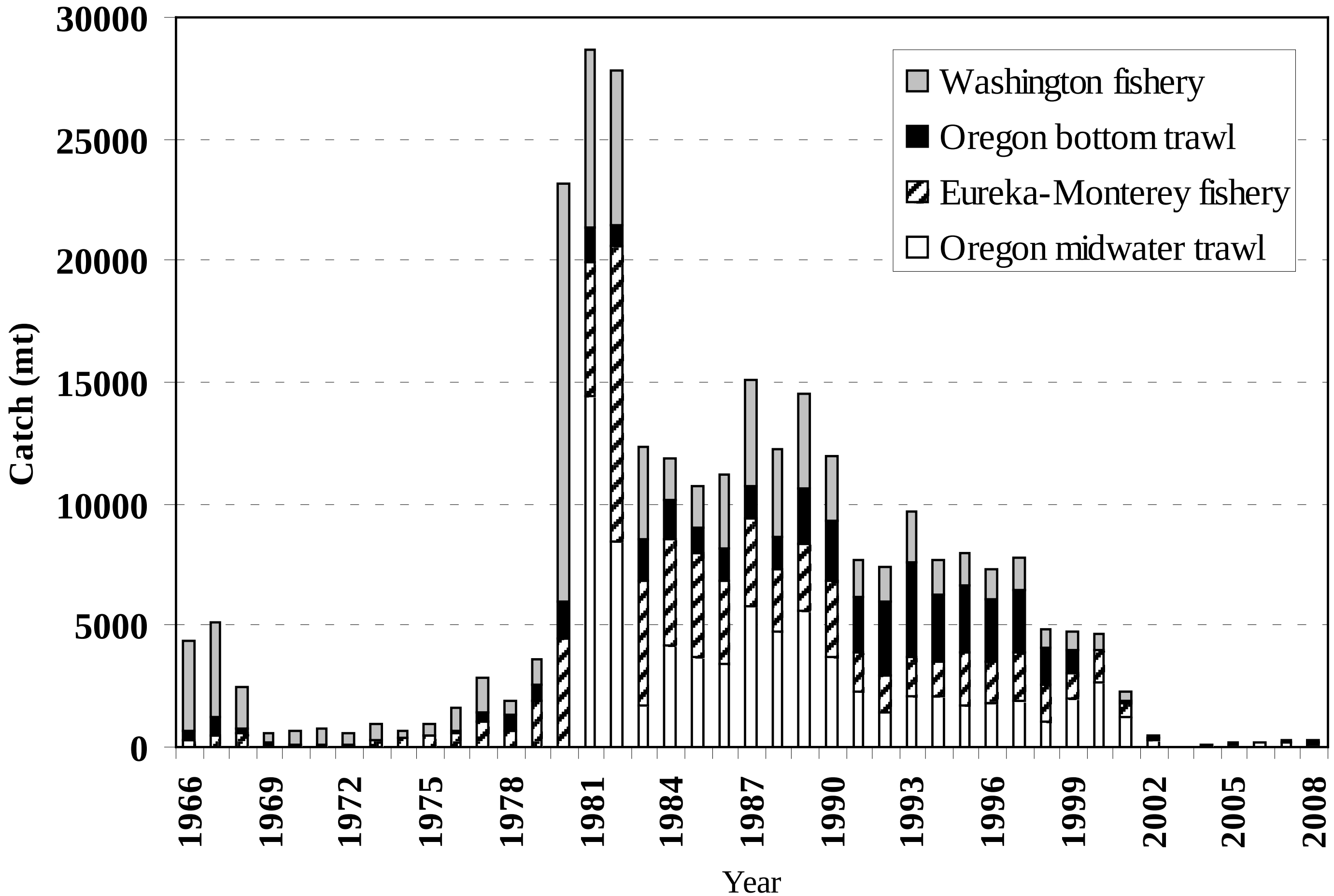
- Overall trend of the population similar to 2007 assessment;

- Estimated current depletion = 38.5% (35.5% in 2007);

- Low recruitments in recent years.

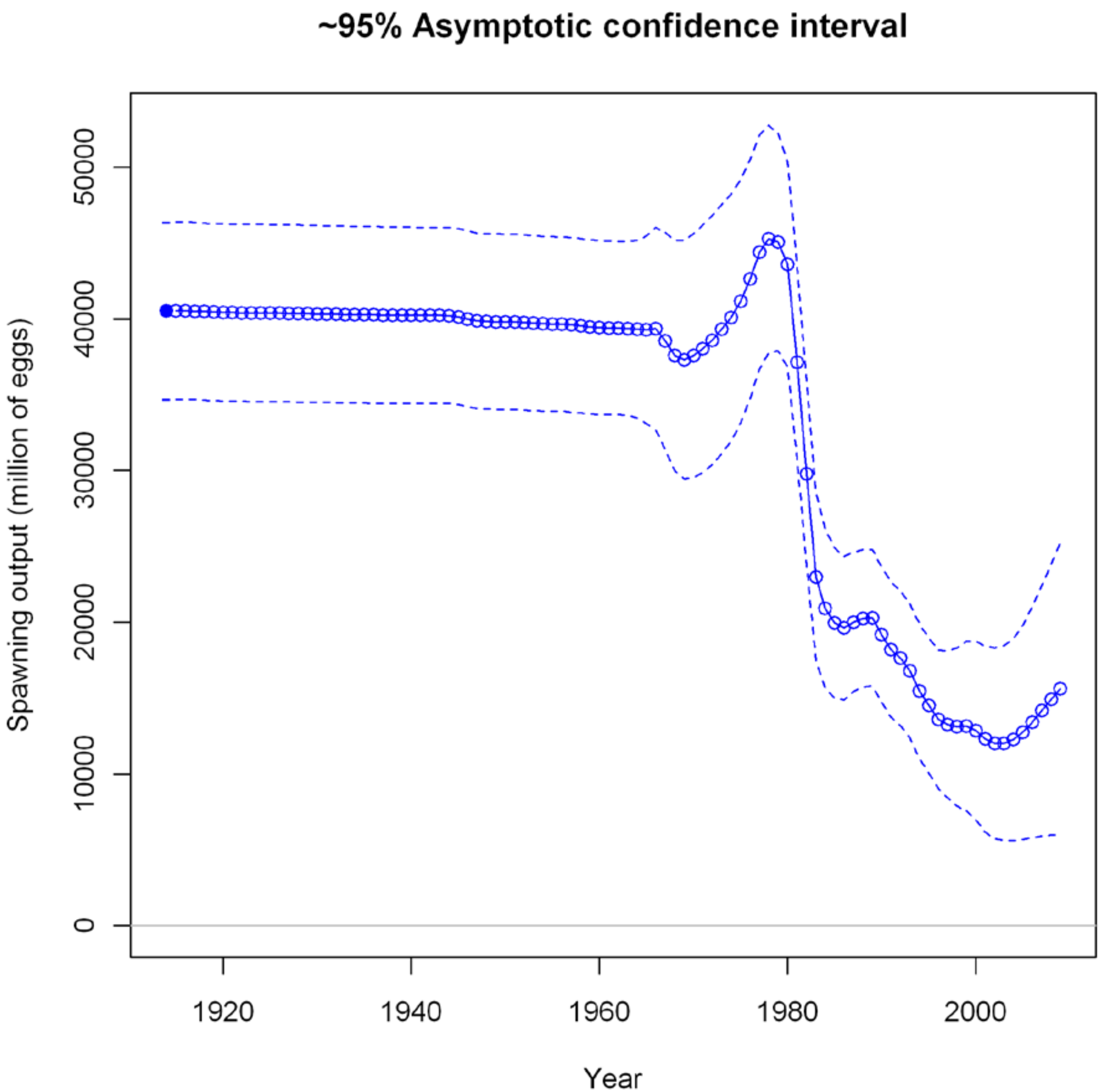
# Catches by four fisheries 1966 to 2008

(all years in next slide)

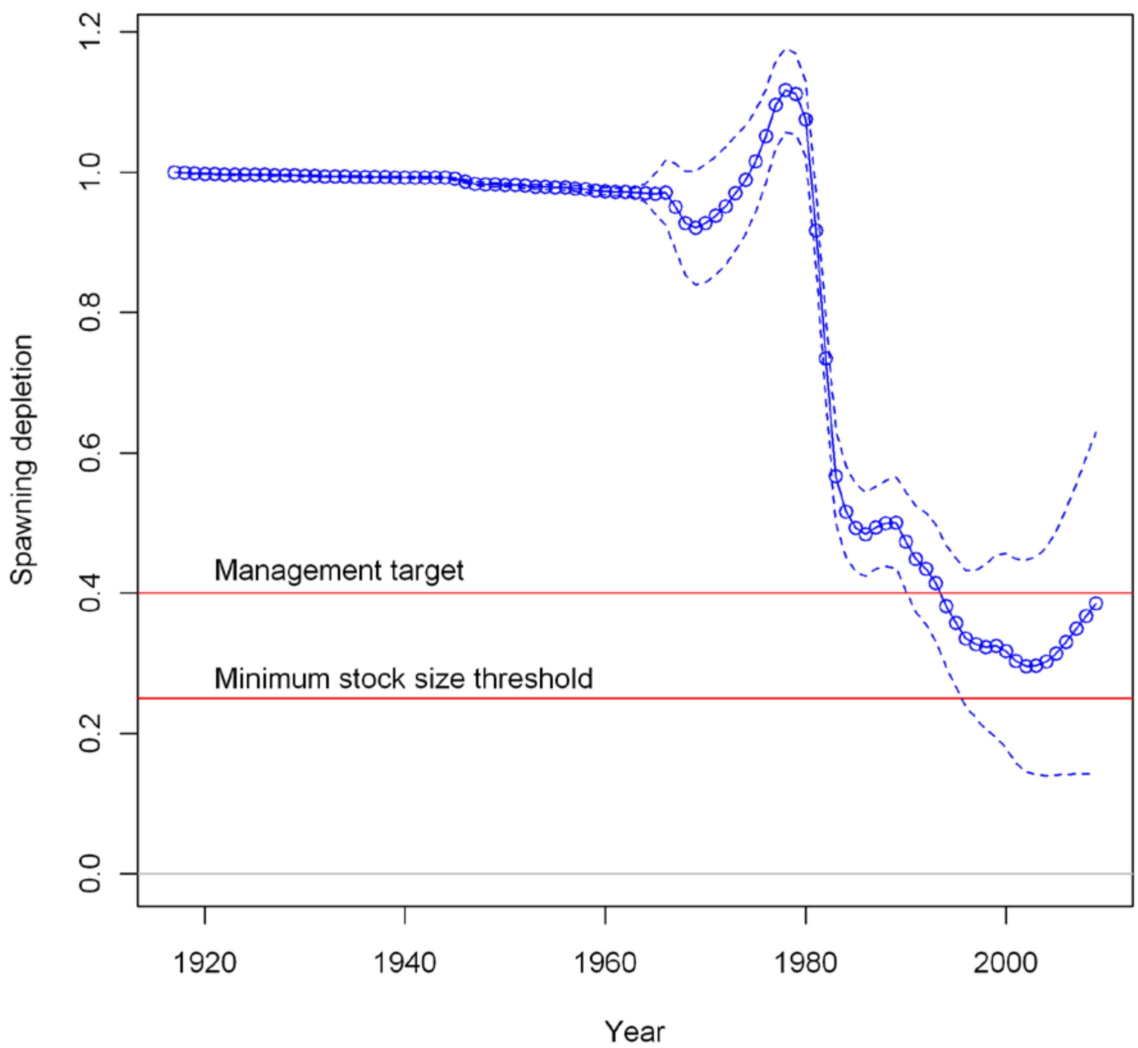



- **Peaked in early 1980s, decreasing since then**
- **Very low catches in recent years**

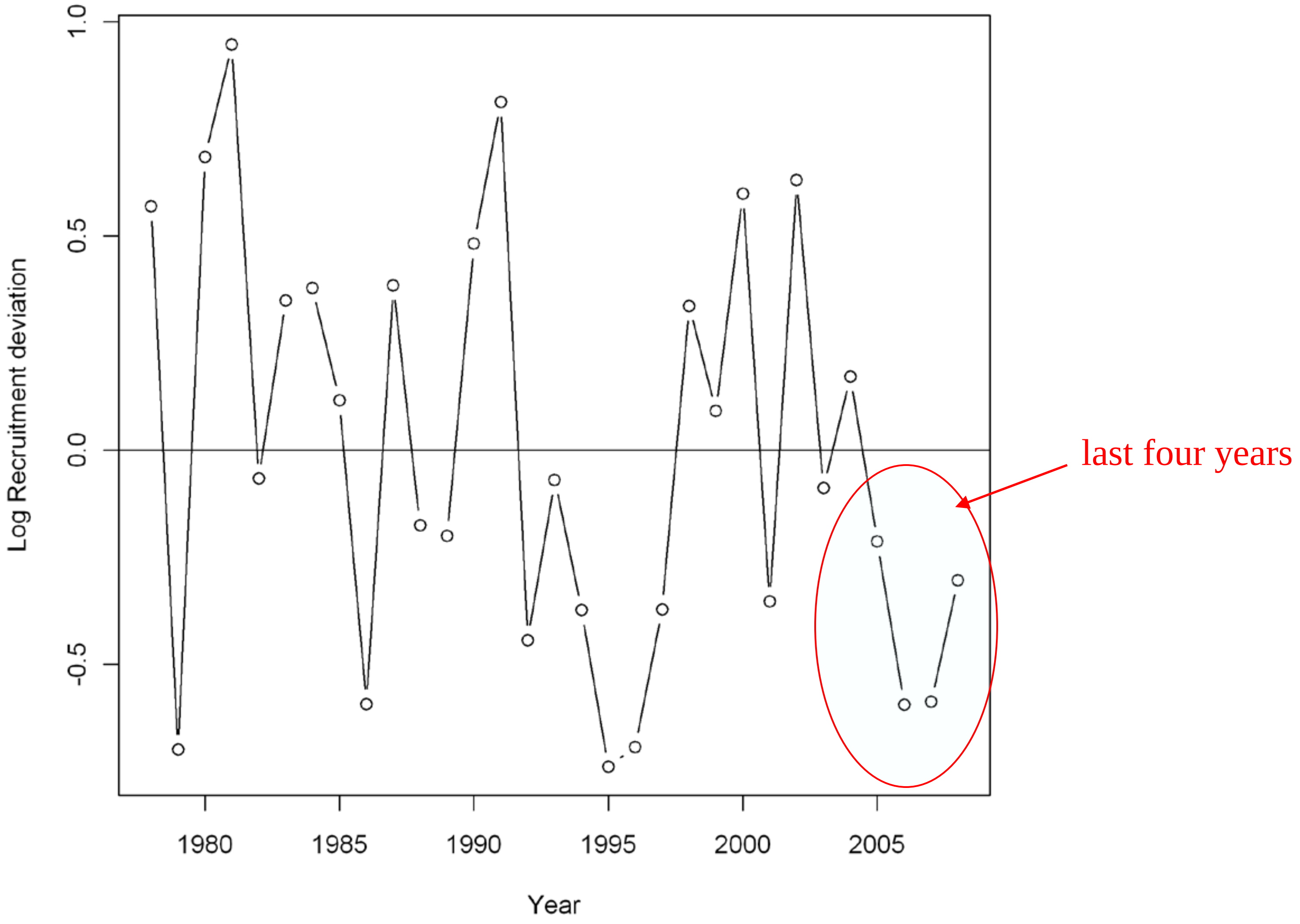
# Base model – spawning output (two areas combined)

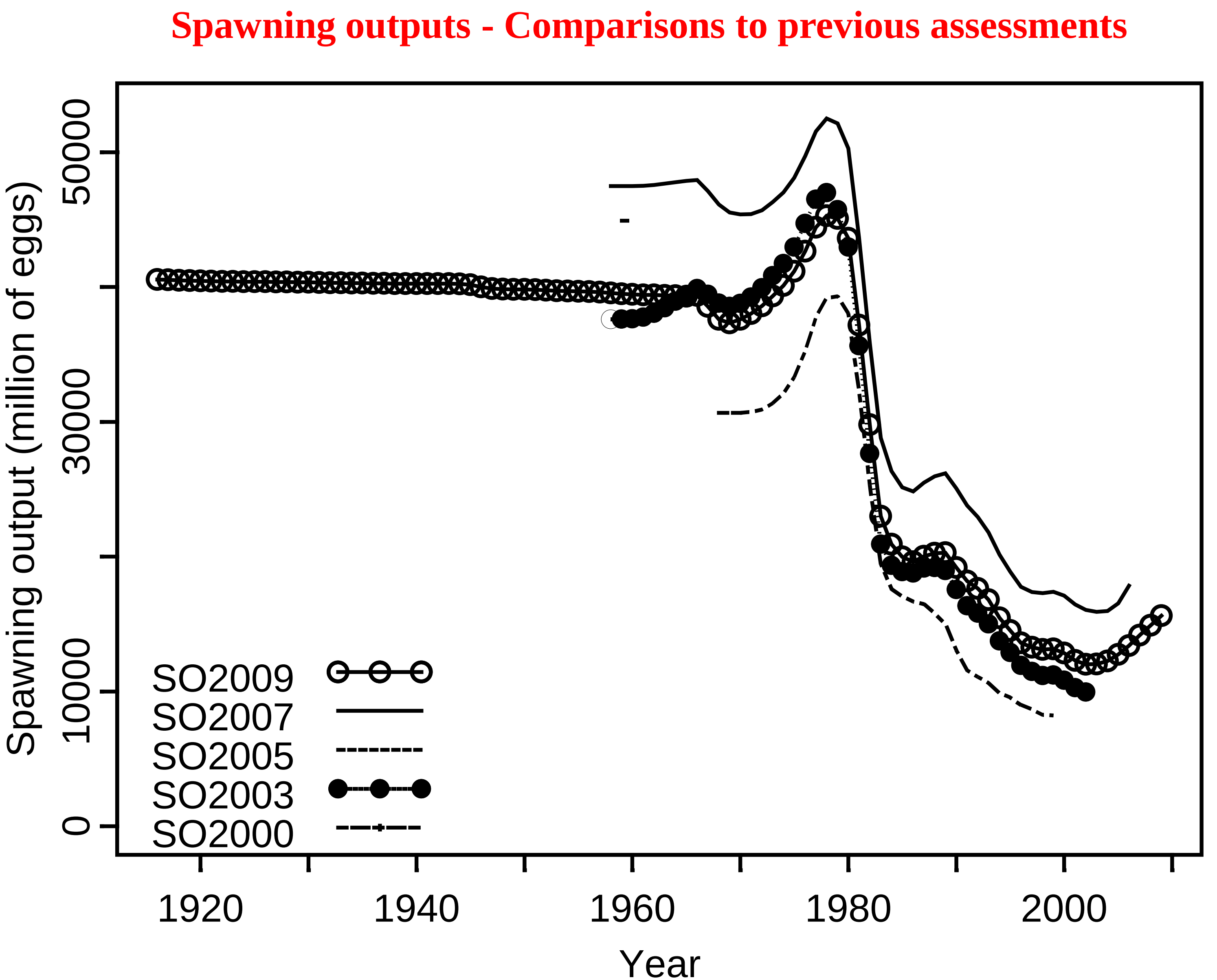


# Base model – depletion (two areas combined)



# Base model – Recruitment deviation (log)





Spawning outputs - Comparisons to previous assessments
Spawning output (million of eggs)
0
10000
30000
50000
1920
1940
1960
1980
2000
Year
SO2009
SO2007
SO2005
SO2003
SO2000

## Brief summary

- Estimated depletion in 2009 is 38.5%, better than estimated 35.5% in 2007;
- Estimated *h* is 0.40, higher than estimated values of previous assessments (lower than prior);
- Base model is sensitive to key parameters (*h*, *M*, proportion of recruitment to northern area);
- Large uncertainties in model – lack of good data in recent years – becoming 'data-poor' species?

# Overview of the 2009 yelloweye rockfish stock assessment

**Ian Stewart**
**John Wallace**
**Carey McGilliard**

PFMC Meeting
12 September, 2009

# Yelloweye biology and data sources

Biology:

Very slow-growing (95% of $L_{max}$ at >55 years)

Late-maturing (50% at 13 years)

Fecundity relationship – big fish produce disproportionally more eggs than small ones

Long-lived (Maximum observed age 147 years)

Fishery independent data:

- IPHC longline (1999-2008, OR and WA)
- NWFSC trawl survey (2003-2008, OR)
- Triennial trawl survey (1980-2004, WA)

Fishery data: Recreational and commercial

- Catch estimates: 1916-2008
  (landings and discard combined)
- Historical rec. CPUE: CA, CA charter, OR, WA (~1979-1999)
- Recent recreational CPUE (Oregon observer, 2004-2008)
- Biological data: ages and lengths
  (port samples and observer data)

# Assessment model:

Areas: Washington, Oregon, California

## Stock structure:

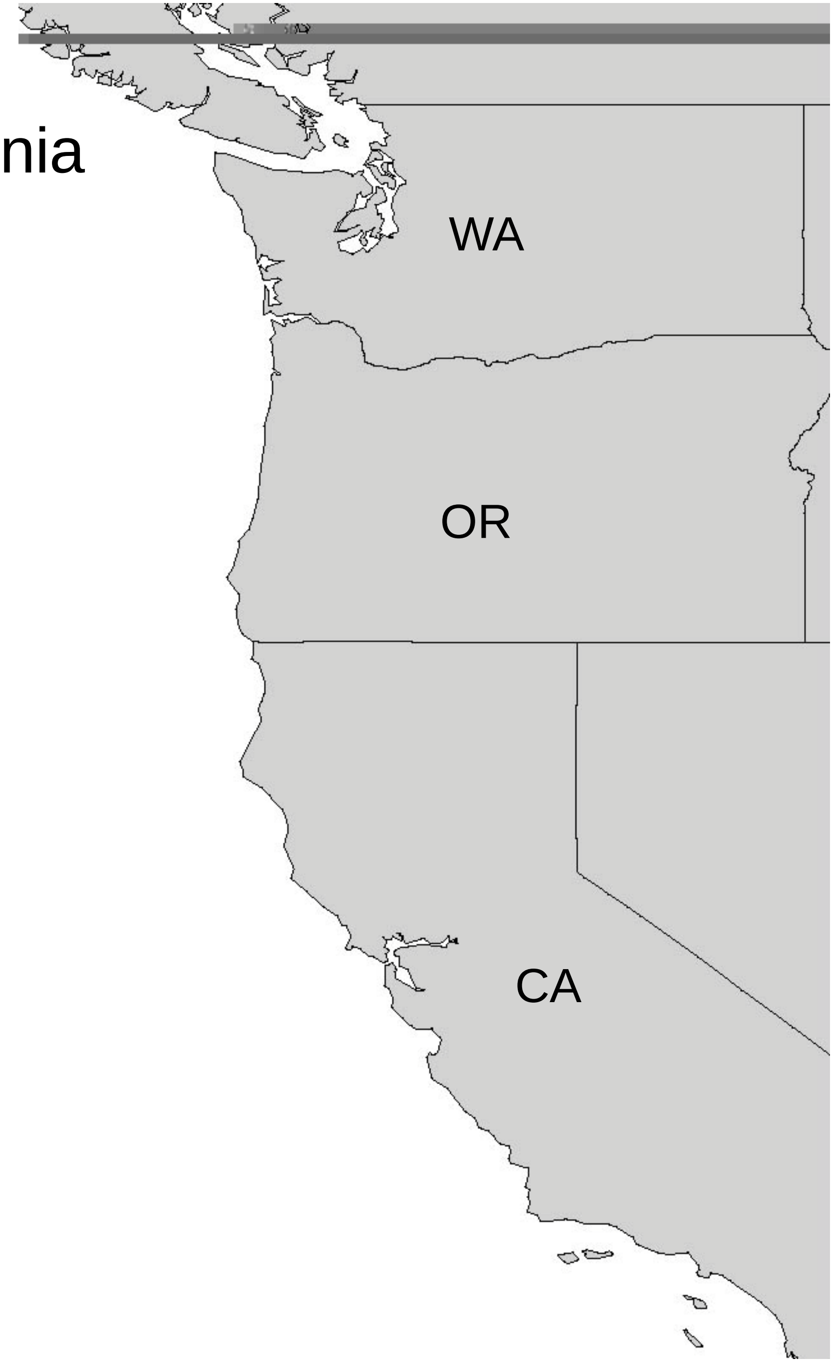
Recruitment linked, adults non-migratory

## Parameters:

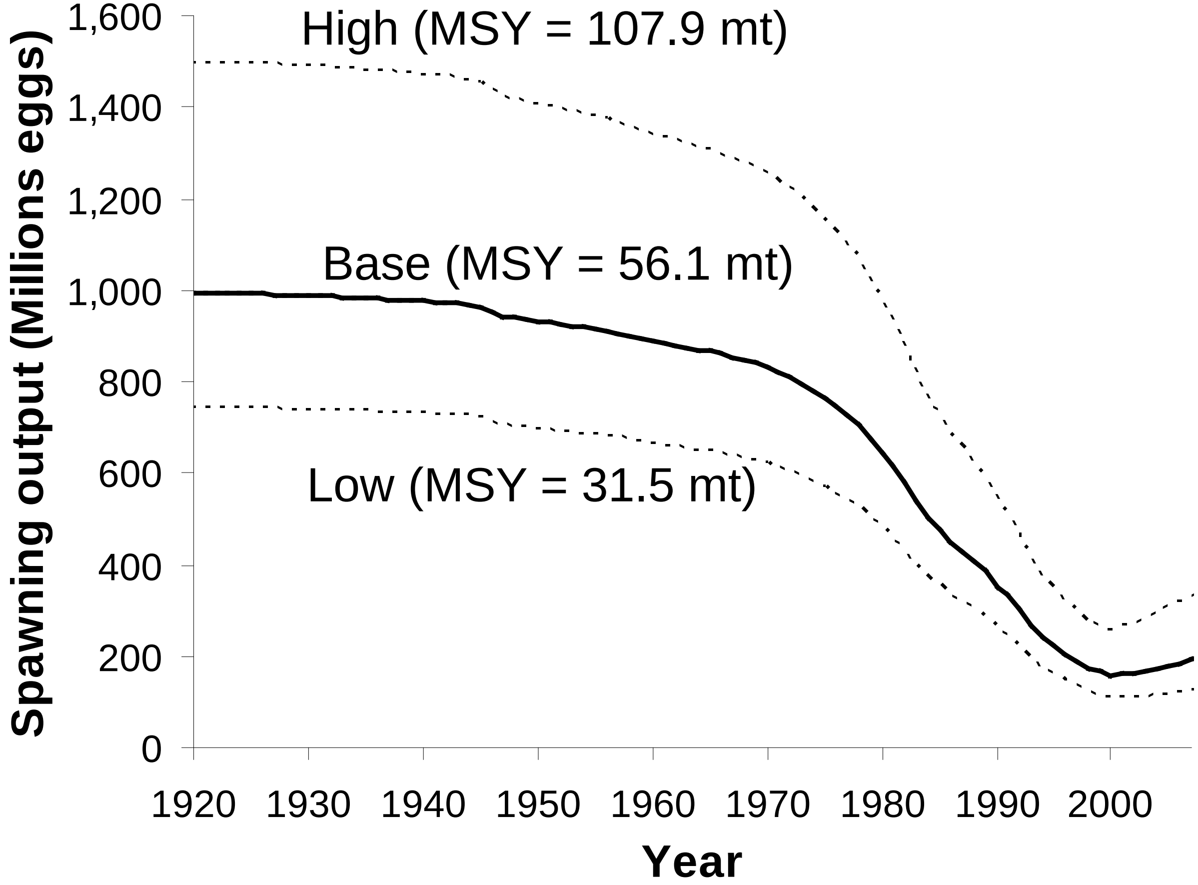
All biological input parameters recalculated
Growth, steepness (productivity),
natural mortality estimated

## Uncertainty:

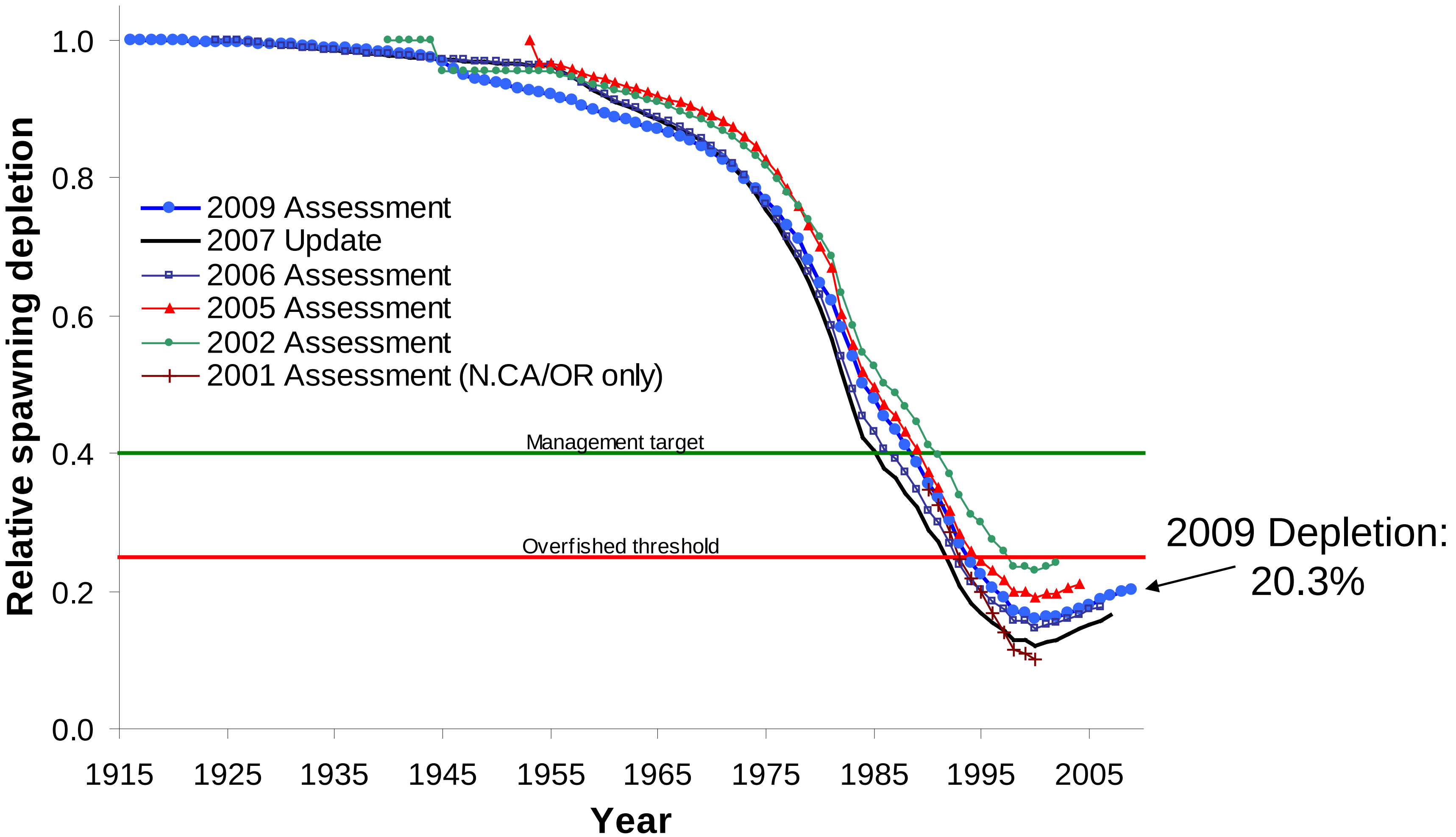
Catch series before 2000
Estimated steepness



# Results – spawning output



# Management reference points



# Short-term forecast implication: 2011-2012 OYs (mt)

Based on 17 mt OY in 2010, 2005-2007 allocation, and current SPR=71.9% target

**Note:** These values will be replaced by the rebuilding plan analysis.

| Axis | | Historical catch percentage | | |
|---|---|---|---|---|
| | level | 75% | 100% | 150% |
| Steepness | 0.3440 | 2011: 13.2<br>2012: 13.4 | 2011: 17.8<br>2012: 17.9 | 2011: 27.0<br>2012: 27.3 |
| | 0.4168 | 2011: 15.6<br>2012: 15.9 | **Base case**<br>**2011: 20.9**<br>**2012: 21.2** | 2011: 31.6<br>2012: 32.0 |
| | 0.5075 | 2011: 18.4<br>2012: 18.8 | 2011: 24.6<br>2012: 25.0 | 2011: 37.0<br>2012: 37.6 |