GOA ROCKFISH ASSESSMENT UPDATES

• Length-stratified rather than random growth estimation
• Extension of ageing error matrix
  • Update of ageing error matrix for POP
• Plus age group analysis redo
Length-stratified rather than random growth estimation: mean length

- **POP**
- **NR**
- **DR**
- **RE/BS**

**Graphs**

- **Mean length (cm)** vs. **Age**
- **Length-stratified mean length** vs. **Random/naïve mean length**
Length-stratified rather than random growth estimation: mean length

- Length-stratified mean length
- Random/naive mean length

% difference with random:
- POP: -0.06% -0.13%
- NR: 0.58% 0.61%
- DR: -10.00% -8.00% -6.00% -4.00% -2.00% 0.00% 2.00% 4.00% 6.00% 8.00% 10.00%
- RE/BS: -8.00% -6.00% -4.00% -2.00% 0.00% 2.00% 4.00% 6.00% 8.00% 10.00%
Length-stratified rather than random growth estimation: SD in mean length

- **POP**
  - Length-stratified SD in mean length
  - Random/naïve SD in mean length

- **NR**
  - Length-stratified SD in mean length
  - Random/naïve SD in mean length

- **DR**
  - Length-stratified SD in mean length
  - Random/naïve SD in mean length

- **RE/BS**
  - Length-stratified SD in mean length
  - Random/naïve SD in mean length
Length-stratified rather than random growth estimation: SD in mean length

- POP
  - Length-stratified SD in mean length
  - Random/naïve SD in mean length
- NR
  - Length-stratified SD in mean length
  - Random/naïve SD in mean length
- DR
  - Length-stratified SD in mean length
  - Random/naïve SD in mean length
- RE/BS
  - Length-stratified SD in mean length
  - Random/naïve SD in mean length

% difference with random:
- POP: -2.6%
- NR: -7.1%
- DR: -5.0%
- RE/BS: -5.0%
Length-stratified rather than random growth estimation: mean weight

- **POP**
  - Length-stratified mean weight
  - Random/naïve mean weight

- **NR**
  - Length-stratified mean weight
  - Random/naïve mean weight

- **DR**
  - Length-stratified mean weight
  - Random/naïve mean weight

- **RE/BS**
  - Length-stratified mean weight
  - Random/naïve mean weight
Length-stratified rather than random growth estimation: mean weight

% difference with random

POP

NR

DR

RE/BS

4.3%  5.8%  1.6%  2.6%

-10.0% -8.0% -6.0% -4.0% -2.0% 0.0% 2.0% 4.0% 6.0% 8.0% 10.0%

POP NR DR RE/BS

Length-stratified mean weight • Random/naive mean weight

Mean weight (g)

Mean weight (g)

Mean weight (g)

Age

Age

Age
GOA ROCKFISH ASSESSMENT UPDATES: AGEING ERROR MATRIX

• Reminder: 2 years ago presented alternative to current construction of ageing error matrix, gist was:
  • We were/are having an issue with overestimating the proportion of fish in the age class adjacent to the plus age group
  • One solution was to extend modeled ages out until >99.9% were in plus age group of data ages (compared a couple other alternatives as well)
  • Had pretty big influence on improving fit to adjacent age to plus age and plus age group itself
  • This year implement into GOA rockfish models
# GOA Rockfish Assessment Updates: Likelihood Results

## POP

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>2014 model</th>
<th>Updated 2014 model</th>
<th>% difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catch</td>
<td>0.12</td>
<td>0.12</td>
<td>6.62%</td>
</tr>
<tr>
<td>BTS biomass</td>
<td>10.26</td>
<td>11.18</td>
<td>8.96%</td>
</tr>
<tr>
<td>Fishery age</td>
<td>27.06</td>
<td>18.20</td>
<td>-32.74%</td>
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<tr>
<td>BTS age</td>
<td>47.67</td>
<td>30.33</td>
<td>-36.38%</td>
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<tr>
<td>Fishery size</td>
<td>54.28</td>
<td>54.52</td>
<td>0.44%</td>
</tr>
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## NR

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>2013 model</th>
<th>Updated 2013 model</th>
<th>% difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catch</td>
<td>0.04</td>
<td>0.06</td>
<td>45.40%</td>
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<tr>
<td>BTS biomass</td>
<td>11.10</td>
<td>10.42</td>
<td>-6.11%</td>
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<tr>
<td>Fishery age</td>
<td>25.54</td>
<td>21.25</td>
<td>-16.77%</td>
</tr>
<tr>
<td>BTS age</td>
<td>45.71</td>
<td>42.38</td>
<td>-7.29%</td>
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<tr>
<td>Fishery size</td>
<td>41.59</td>
<td>44.47</td>
<td>6.93%</td>
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</table>

## DR

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>2013 model</th>
<th>Updated 2013 model</th>
<th>% difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catch</td>
<td>27.14</td>
<td>28.09</td>
<td>3.50%</td>
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<tr>
<td>BTS biomass</td>
<td>38.84</td>
<td>39.94</td>
<td>2.84%</td>
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<tr>
<td>Fishery age</td>
<td>30.23</td>
<td>18.68</td>
<td>-38.19%</td>
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<tr>
<td>BTS age</td>
<td>85.83</td>
<td>79.03</td>
<td>-7.93%</td>
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<tr>
<td>Fishery size</td>
<td>49.93</td>
<td>49.69</td>
<td>-0.49%</td>
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</table>

## RE/BS

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>2014 model</th>
<th>Updated 2014 model</th>
<th>% difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catch</td>
<td>0.04</td>
<td>0.04</td>
<td>-1.44%</td>
</tr>
<tr>
<td>BTS biomass</td>
<td>8.93</td>
<td>8.92</td>
<td>-0.18%</td>
</tr>
<tr>
<td>LL RPN</td>
<td>11.92</td>
<td>11.90</td>
<td>-0.20%</td>
</tr>
<tr>
<td>Fishery age</td>
<td>37.27</td>
<td>13.52</td>
<td>-63.74%</td>
</tr>
<tr>
<td>BTS age</td>
<td>39.30</td>
<td>37.44</td>
<td>-4.73%</td>
</tr>
<tr>
<td>Fishery size</td>
<td>51.36</td>
<td>49.00</td>
<td>-4.61%</td>
</tr>
<tr>
<td>LL size</td>
<td>97.71</td>
<td>85.62</td>
<td>-12.37%</td>
</tr>
</tbody>
</table>
GOA ROCKFISH ASSESSMENT 
UPDATES: AGEING ERROR

POP

NR

2012 Fishery age comps

2010 fishery age comps

2011 BTS age comps

2011 BTS age comps
GOA ROCKFISH ASSESSMENT
UPDATES: AGEING ERROR

2010 fishery age comps

2011 BTS age comps

2012 fishery age comps

2011 BTS age comps

DR

RE/BS

Observed  
2013 predicted  
2013 updated

Observed  
2014 predicted  
2014 updated
GOA ROCKFISH ASSESSMENT UPDATEs: AGEING ERROR

POP

NR

DR

RE/BS

Spawning biomass (mt)

2014 model
Updated growth & ageing error

2013 model
Updated growth & ageing error

Updated growth & ageing error
GOA ROCKFISH ASSESSMENT UPDATES: PLUS AGE ANALYSIS

• With new ageing error matrix, was curious to see how that influenced where we set the data plus age
  • Needed to investigate for RE/BS anyway, ran for others as well
  • Extended data plus age from age 20 to 77
  • Stored SDNR of age comps, likelihoods, etc.
GOA ROCKFISH ASSESSMENT UPDATE: PLUS AGE ANALYSIS

Scaled likelihoods: POP

Scaled likelihoods: NR

Scaled likelihoods: DR

Scaled likelihoods: RE/BS
• Total likelihood plateaus/minimizes around:
  • 35-40 for POP, 50-55 for NR, 35-40 for DR, and 45-50 for RE/BS
GOA ROCKFISH ASSESSMENT UPDATES: PLUS AGE ANALYSIS

Scaled ABC

- POP
- NR
- DR
- RE/BS

Graph showing the Scaled ABC over time from 2020 to 2027.
GOA ROCKFISH ASSESSMENT UPDATES: PLUS AGE ANALYSIS

• Overall, hard to pinpoint general recommendations for setting plus age group
• Plateauing of total seemed the only consistent statistic, but could be others
• Plan: rerun with updated 2015 data, see consistency as well as possible recommendations for extending plus age group
GOA Rougheye & Blackspotted Rockfish

Shotwell, Hanselman, Hulson, Heifetz
“The assessment authors note that the choice of the plus group age, and the computation of the age error for the plus group, will be addressed in the 2015 assessment. The Plan Team supports the planned work to address these issues.”

“The SSC requests that the authors further examine trawl selectivity, as it seems unusual for age 9-11 rockfish to be selected 20% more than other ages. The SSC supports the authors’ intent to reevaluate that age of the plus group...”
1) RE/BS Selectivity
2) Nonplussed (Trawl)


Graph showing data points for different years.
2) Nonplussed (Fishery)
Selectivity Background

- All GOA rockfish models used non-parametric selectivities in the past
- A vector of selectivity coefficients were estimated up to a maximum age and the rest held at that value up to the plus group
- The coefficients are “regularized” by second differences (the differences between the differences)
- A penalty is applied that minimizes these differences
## Differences

<table>
<thead>
<tr>
<th>Differences</th>
<th>Parameters</th>
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</thead>
<tbody>
<tr>
<td>1st</td>
<td>1  4  6  10  12  15  20</td>
</tr>
<tr>
<td>2nd</td>
<td>3  2  4  2  3  5</td>
</tr>
<tr>
<td>3rd</td>
<td>1  2  2  1  2</td>
</tr>
<tr>
<td>4th</td>
<td>1  1  1</td>
</tr>
</tbody>
</table>

1st Differences:
- 9 + 4 + 16 + 4 = 44
- 9 + 25 = 34

2nd Differences:
- 1 + 4 + 4 + 1 = 10
  + 4 = 14

3rd Differences:
- 1 + 1 + 1 = 3

4th Differences:
- 0 + 0 = 0
Selectivity Options

- RE/BS is only GOA rockfish still using non-parametric, most are logistic now, with one gamma
- The current trawl survey selectivity is very lightly penalized
- Implies a dome-shape
- Impose smoother form?
Selectivity options

- BASE (very low 2\textsuperscript{nd} difference penalty) implies linear \textit{a priori}
- 3\textsuperscript{rd} Diff\_10 (penalty of 100 on 3\textsuperscript{rd} differences), fixed selectivity after age 12 implies dome \textit{a priori}
- 3\textsuperscript{rd} Diff\_Hi (penalty of 100 on 3\textsuperscript{rd} differences), fixed selectivity after age 20 implies dome \textit{a priori}
- 3\textsuperscript{rd} Diff\_Lo (penalty of 20 on 3\textsuperscript{rd} differences), fixed selectivity after age 20 implies dome \textit{a priori}
- 3\textsuperscript{rd} Diff\_max\_5 (penalty of 100 on 3\textsuperscript{rd} differences), selectivity is fixed at least 5 ages before maximum age
- Gamma (imposes a dome, though can be slight)
- Logistic (forces asymptotic)
Plus group

- Pete already talked about modeling ages out to aging error matrix $p > 0.99$
- Growth, maturity, etc extended (work on this)
- Simultaneously look at trawl selectivity and plus age group
- Look at likelihood fits to key data components
Plus age: scaled (value divided by max)

• Scaled likelihood for indices shows tradeoff between BTS and LL. At age 37 is where the scaled values meet...

• For total/data likelihoods, total flattens out around age 45, data likelihood keeps on increasing but seems to bend at 42

• Suggests maybe setting plus age >37 as a starting point
Other diagnostics

- Number of zeros in age comps
- Graphs of plus group size by fish/survey
- Graphs of average age fit to predicted
- Looked at SDNR, not shown here
Proportion in Plus Group

Survey

<table>
<thead>
<tr>
<th>42</th>
<th>54</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.05</td>
</tr>
<tr>
<td>Median</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Fishery

<table>
<thead>
<tr>
<th>42</th>
<th>54</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.25</td>
</tr>
<tr>
<td>Median</td>
<td>0.15</td>
</tr>
</tbody>
</table>
Number of Zeros in Trawl Age comp after age 25

Plus Age Group

42

54
Average observed and predicted (3rd_diff_Hi)
Average observed and predicted (3rd_diff_Hi)
Proportion at age

Average observed and predicted (gamma)

- Observed
- Predicted
- Residuals
Average observed and predicted (gamma)
RE/BS Recommendation

- Fishery selects fish way older than the survey
- Trawl survey selectivity needs to be dome-shaped to some extent
- Gamma or more flexible 3rd differences
- Plus group at about 42 or greater