ASSESSMENT OF THE PACIFIC SARDINE RESOURCE IN 2009 FOR U.S. MANAGEMENT IN 2010

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## Assessment Changes in 2009

<table>
<thead>
<tr>
<th>Component Changed</th>
<th>2007 full &amp; 2008 update</th>
<th>2009 full</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>SS2 version 2.00i</td>
<td>SS version 3.03a</td>
</tr>
<tr>
<td>DEPM &amp; TEP survey series</td>
<td>per Lo et al. 2008 &amp; Hill et al. 2008</td>
<td>Re-analyzed per May 2009 STAR</td>
</tr>
<tr>
<td>Fishery Definitions</td>
<td>CA as single fishery</td>
<td>SCA and CCA separated</td>
</tr>
<tr>
<td>Catch-weighted Compositions</td>
<td>CA fishery only</td>
<td>All Fisheries</td>
</tr>
<tr>
<td>Season time step</td>
<td>Quarter</td>
<td>Semester</td>
</tr>
<tr>
<td>Selectivity</td>
<td>Annual - all fisheries</td>
<td>Seasonal for SCA and CCA</td>
</tr>
<tr>
<td>Growth</td>
<td>Time invariant</td>
<td>Two periods: 1981-90, 1991-09</td>
</tr>
<tr>
<td>Fishing mortality</td>
<td>Pope's approximation</td>
<td>Continuous-F (hybrid method)</td>
</tr>
</tbody>
</table>

### New Data:

- DEPM survey - 2009
- Aerial Survey - 2009
- Catch - updated for all fisheries
- Size and age comps updated for SCA, CCA, PNW
- Canadian fishery length comps (pooled with PNW)
- WCVI survey w/ lengths (excluded from Base)
- PFFS survey w/ lengths (excluded from Base)
Low egg density
Relatively high fraction of spawning females
SSB\textsubscript{total} = 166,404 mt
SSB\textsubscript{female} = 99,162 mt
Model fit to DEPM & TEP series
West Coast Sardine Aerial Survey

- SS3 model tuned prior to inclusion of aerial survey;
- Aerial biomass = 1.35 mmt (0.55)
- Length comp fit with double-normal selectivity, domed shape;
- Selectivity assumption not explored during STAR, but is inconsistent with PNW fishery selectivity which is forced to asymptotic shape
Stock Biomass (Ages 1+)
With and Without Aerial-2009
Fishing Mortality Rate

No Aerial

- ENS
- SCA_S1
- SCA_S2
- CCA_S1
- CCA_S2
- PNW

w/ Aerial

- ENS
- SCA_S1
- SCA_S2
- CCA_S1
- CCA_S2
- PNW

Continuous F

Year


Stock Biomass (Age 1+): Previous PFMC Assessments
### U.S. ABC - Base Model

HG\textsubscript{2010} = (BIOMASS\textsubscript{2009} – CUTOFF) • FRACTION • DISTRIBUTION

<table>
<thead>
<tr>
<th>Model</th>
<th>Stock biomass (age 1+, mt)</th>
<th>Cutoff (mt)</th>
<th>Harvest Fraction</th>
<th>U.S. Distribution</th>
<th>U.S. ABC for 2010 (mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASE</td>
<td>702,024</td>
<td>150,000</td>
<td>0.15</td>
<td>0.87</td>
<td>72,039</td>
</tr>
</tbody>
</table>