Mortality rate of Tanner crab bycatch discarded by Alaska bottom trawlers

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Cooperative research to address fisheries management questions

- Scientists working and fishing industry working together on management issues – understand or reduce

- Trawling issues
  - Bycatch – catch of fish not wanted or allowed to be kept
    - Additional non-target mortality (escape / unobserved)
  - Effects on seafloor and habitats
Bycatch management for Alaska groundfish fisheries

- Many valuable managed stocks occupy same grounds
- Many area / time closures
- Prohibited species catch (PSC)
- PSC are fish/crabs that other fisheries rely on – trawlers must discard
  - Salmon
  - Halibut
  - Crabs
  - Other groundfish
- Concerns increase for bycatch stocks is in trouble
Bycatch management for Alaska groundfish fisheries

• Track bycatch through observer sampling and stop fishing when a set amount is exceeded
  • By fishery – all boats in a pool no individual incentive to improve
  • Allocated to vessel or cooperative – requires more data
• Estimate mortality rate from experimental studies
  • For example, halibut and crab can often survive, while salmon rarely do
Crab mortality from trawl fisheries

- **Unobserved mortality**
  - Crabs damaged from encountering trawls on seafloor, but not captured (Hammond et al. 2013, Rose et al. 2013)

- **Discard mortality**
  - Crabs captured, sorted out aboard the vessel, and released
  - Immediate mortality – easiest to assess
  - Delayed mortality – occurs after release (not directly observable)

- Our study – estimating immediate and delayed mortality rates for Tanner crabs discarded from trawl catches
Previous estimate for Tanner crab discard mortality

- Brad Stevens (Kodiak NMFS lab) 1987 – published 1990
- Held crabs from trawl catches during Bering Sea trawl experiment on avoiding crab bycatch
- Foreign (Soviet Union) processor with catches delivered from U.S. vessels
- Long times on-deck – increased mortality (up to 12.8 hours)
- Held crabs in on-deck tanks, ‘vitality’ assessments
  - Vitality assessment included one RAMP reflex (mouth)
- Overall average mortality 78%
Previous estimate for Tanner crab discard mortality – Stevens 1990

Captivity includes ½ tow time – approximate average 1 hour more than air exposure
Reflex scans of crabs discarded from Gulf of Alaska (Kodiak) trawlers

- Six vessels hosted scientists to ride aboard and assess the crabs as they were returned to the sea (1265 crab assessments from two major fisheries with Tanner bycatch)

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Species</th>
<th>Tows</th>
</tr>
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<tbody>
<tr>
<td>Mar Del Norte</td>
<td>arrowtooth flounder</td>
<td>7</td>
</tr>
<tr>
<td>Marathon</td>
<td>arrowtooth flounder</td>
<td>7</td>
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<tr>
<td>Chelissa</td>
<td>arrowtooth flounder</td>
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<tr>
<td>Excaliber II</td>
<td>shallow water flatfish</td>
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<td>New Life</td>
<td>shallow water flatfish</td>
<td>13</td>
</tr>
<tr>
<td>Caravelle</td>
<td>shallow water flatfish</td>
<td>11</td>
</tr>
</tbody>
</table>
Reflex scans of crabs discarded from Gulf of Alaska (Kodiak) trawlers

- On deck sorting, 5 with Conveyor belts
Reflex scans aboard a Bering Sea processor trawler

- Hosted AFSC scientist for a one week trip
- Generally longer times (1 - 3 hours) before release than the Kodiak trawlers
- Several tows at end with very long onboard times 7 to 24 hours
Discard mortality RAMP from previous talk (Yochum et al.) applied to reflex scans
Revised estimates

1990 estimate
Air Exposure

Increasing mortality above 1 hour

Substantial additional variability between tows and vessels
Air Exposure

Increasing mortality above 1 hour
Air Exposure
Increasing mortality above 1 hour

Tows > 7 hours essentially 100%
Air Exposure
Increasing mortality above 1 hour

Bering 53%
SWF 45%
ATF 28%
ATF 42%

> 7 hours
100%

Combined
More small crabs came from higher mortality vessels. On those vessels, higher mortality occurred with both large and small crabs.
Caveats

• Mortality rates reflect holding conditions during validation
  • Longer delays not reflected – infection, molting effects
  • Some environmental factors not reflected
    • Predation
    • Temperature change from surface to seafloor
  • Negative effects of holding conditions
• However, most crabs either lively with all reflexes or moribund
  • RAMP estimates most important for remaining 10 – 40%
Conclusions

• Crab mortality rates lower than originally estimated
  • Due to long on-deck times during earlier study
• Time on deck affects mortality
  • Short sorting time, other factors more important
  • Sorting times 1 – 3 hours, air exposure becomes a significant factor
  • Sorting times > 3 hours, few survive (>7 none)
• Most vessel and tow variability not explained by time on deck
  • May indicate improvement possible with better handling
Conclusions

• Potential for improving mortality from deck handling
  • Catch handling – conveyors, improved lifts?, speed
  • Discard handling – design chutes for easy and gentle release

• Incentives for acting to reduce mortality?
  • Document release time – EM application?
  • RAMP sampling
    • Cost / benefit of sampling, estimation, management
    • Simplified reflex set