Sea Turtle Bycatch Reduction Research: Update on Field Trials

Yonat Swimmer, Randall Arauz, Chris Boggs, Marti McCracken, Richard Brill, Lianne M'Naughton, Mike Musyl, etc.
DIRECT TESTS OF THE EFFICACY OF BAIT AND GEAR MODIFICATIONS FOR REDUCING INTERACTIONS OF SEA TURTLES WITH LONGLINE FISHING GEAR IN COSTA RICA

CR Sea turtle CPUE ~ 8
Cooperative fishers
Test of Bait Modifications to Reduce Sea Turtle Bycatch in LL Fisheries in CR

Experiments:

- Bait Modification: Blue vs. Untreated

- Green turtle
- Kemp’s Ridley turtle

![Loggerhead Turtles (n=49)](chart.png)
Experiment:
Mahi mahi fishery, December 2003
Compare turtle catch rates blue vs untreated bait
2 boats, paired trips,
11 sets each, treatment days randomly alternated
Experimental Design

* Bait types not mixed on a set.

Circle hook 13/0
Dying Bait
Target species
Olive ridley turtle
Deeply ingested hook
Hooked in jaw
Turtle tangled in buoy
“String Method”
“De-hooker”
### Total Catch Results from Both Boats after 11 Sets per Boat

<table>
<thead>
<tr>
<th>Boat</th>
<th>Don Miguel</th>
<th></th>
<th>Don Roberto</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>total</td>
<td>%</td>
<td>total</td>
<td>%</td>
</tr>
<tr>
<td><strong>Hooks/trip</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SHARKS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black tip</td>
<td>5</td>
<td>2.1%</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Silky</td>
<td>18</td>
<td>7.6%</td>
<td>38</td>
<td>14.96%</td>
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<tr>
<td>Oceanic whitetip</td>
<td>2</td>
<td>0.8%</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Bigeye thresher</td>
<td>4</td>
<td>1.7%</td>
<td>1</td>
<td>0.39%</td>
</tr>
<tr>
<td><strong>OTHER FISH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mahi mahi</td>
<td>75</td>
<td>31.5%</td>
<td>35</td>
<td>13.78%</td>
</tr>
<tr>
<td>Yellowfin tuna</td>
<td>19</td>
<td>8.0%</td>
<td>15</td>
<td>5.91%</td>
</tr>
<tr>
<td>Sail Fish</td>
<td>16</td>
<td>6.7%</td>
<td>19</td>
<td>7.48%</td>
</tr>
<tr>
<td>Skipjack tuna</td>
<td>1</td>
<td>0.4%</td>
<td>11</td>
<td>4.33%</td>
</tr>
<tr>
<td>Black Marlin</td>
<td>5</td>
<td>2.5%</td>
<td>4</td>
<td>1.57%</td>
</tr>
<tr>
<td>Blue Marlin</td>
<td>3</td>
<td>1.3%</td>
<td>5</td>
<td>1.97%</td>
</tr>
<tr>
<td>Striped Marlin</td>
<td>1</td>
<td>0.4%</td>
<td>7</td>
<td>2.76%</td>
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<tr>
<td>Dragon fish</td>
<td>2</td>
<td>0.8%</td>
<td>1</td>
<td>0.00%</td>
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<tr>
<td>Flying fish</td>
<td>0</td>
<td>0.0%</td>
<td>2</td>
<td>0.39%</td>
</tr>
<tr>
<td>Manta Ray</td>
<td>0</td>
<td>0.0%</td>
<td>2</td>
<td>0.30%</td>
</tr>
<tr>
<td>Sting Rays</td>
<td>34</td>
<td>14.3%</td>
<td>53</td>
<td>20.87%</td>
</tr>
<tr>
<td><strong>SEA TURTLES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olive ridley</td>
<td>47</td>
<td>19.7%</td>
<td>61</td>
<td>24.02%</td>
</tr>
<tr>
<td>Pacific green</td>
<td>5</td>
<td>2.1%</td>
<td>2</td>
<td>0.79%</td>
</tr>
</tbody>
</table>

Total catch results from both boats after 11 sets per boat.
Blue bait not effective to reduce sea turtle capture rate

- Watson et al. 2002
- Nakano, Kiyota, Minami et al. 2004
Tests of Gear Modifications to Reduce Sea Turtle Bycatch in LL Fisheries in CR

- Gear Modification (on-going)
  - Hook with offset vs. hook without non-offset
    - 14/0, no offset vs. 14/0 10° offset

*Design: To evaluate treatment hooks using randomized block design alternating control (C) and experimental (T) hooks along entire set.
Related & Relevant Sea Turtle Bycatch Research in the NED/Atlantic

- John Watson, NOAA/SEFSC
- Bluewater Fishermen’s Association
- NED, 2002-2004, Tests of hooks, baits, float distance

- Compare rates of turtle and target fish CPUE
NED experiments partial results

Hooks and Bait:

Compare to 9/0 J:

- Non-offset 18/0 circle + squid bait =
  Decreased loggerhead & leatherback takes ~75%

- 10 degree offset 18/0 circle + mackerel =
  Decrease loggerhead take ~ 88%
  Decrease leatherback take ~ 63%

Bait effect only works with J hooks—
No diff. when compare rates between 18/0 Circle hooks

Watson et al. 2004
Impact on Target species:

18/0 Circle Hooks -
   Squid Bait = decrease in swordfish, increase in tuna
   Mackerel = increase in swordfish, decrease in tuna

J Hooks + Mackerel
   Increase in swordfish, decrease in tuna

...the costs to stay in business???
Research on mitigation measures for sea turtle bycatch in Japan

- Mackerel bait found to reduce sea turtle catch
- Same size circle and J hooks ineffective at reducing bycatch
- Effectiveness of large circle hooks and offset not yet clear
- Future tests planned, including participation with Hawaii fishery

- 30 paired sets (2 research vessels)
- Test 5 hook types/sizes (against conventional J hook)
Field Trials in Ecuador

- NOAA, IATTC, Ecuadorian Government, etc.
- Experiments of hook type and size
J Hooks vs. 16/0 vs. 18/0 Circle Hooks
Hook exchange program—2/3 original hooks

Billfish and sharks: 16/0 and 18/0 Circle
Mahi mahi: 14/0 Circle

Observers on vessels to record data
Final goal - to produce a massive replacement of the current hooks with circle hooks
Working with the Ecuadorian fishing community to reduce sea turtle mortality in longlines
Ecuador Preliminary Results
(after 5,000 hooks of each type constituted sample)

Tuna Fishery (Circle 16/0 and 18/0):

✓ Turtle bycatch greatly reduced (vs. J hooks)
✓ Decrease in deep hooking
✓ Assumed decrease in mortality

✓ 18/0 hooks caught fewer turtles, but also significantly fewer fish

Must standardize effort!!
Must use statistical models to deal with heterogeneity
Itajai
Ubatuba/Paraty
Praia do Forte
Captive turtle experiments
Semi-wild turtles/net tanks
Fishing experiments
Brazil
Semi-wild turtles, net tanks

Turtles brought into net tanks after their capture from longline fishing gear

- allow for long-term monitoring post-hooking
- test potential repellents
Modified baits prepared and presented to unconditioned loggerhead turtles:

- Ammonia
- Citrus
- Tutti-frutti
Test 1: Blue Bait

- Feb. 2004
- 300 hooks/set
- 4 sets
- Bad weather
- 1 leatherback

Federal vessel used for experiments
Trip 2: J hook vs. 18/0 Circle + 10°

- Fall 2004
- 1,050 hooks/set
- 17 sets
- 9 loggerheads, 1 leatherback
- 100% turtle capture on J hooks

CPUE:

\[
\text{J hooks} = 1.7143 \text{ loggerhead} \\
0.1905 \text{ leatherback}
\]

Impact on target species:
Circle hooks caught fewer fish, except tuna
100% survivorship for ~ 60 days post release
Acknowledgements

Questions? Comments:

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