Post-release Survival of Blue Marlin

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Our goals were:

1. Assess the survival blue marlin released from sports fishing.

2. Develop biochemical predictors of survival.

PSATs can be used to determine mortality by examination of vertical data.

PSATs jettison from fish under three circumstances:

1. Reach programmed pop-off date.
2. Exceed depth threshold (1200 – 1500 m).
3. Remain at constant depth for 4 days.

Can differentiate “dead” from “shed”.
Mortality of a Blue Shark (*Prionace glauca*)

Fail safe mechanism jettisons PSAT after reaching 1200m
Swivel to reduce torque of tag head in tissue

Speargun barbs added to increase surface area
37 blue marlin (100-500 lbs) tagged in Hawaii
2 striped marlin (120 lb) tagged in Hawaii
1 black marlin (1000 lb) tagged in Australia
fight times: 5 - 60 min
16% on bait, 84% on lures
Results to date

30 tags reported data (79%)
8 tags failed to report (21%)
4 tags reached pop-off date (13%)

Evidence for delayed mortality in one blue marlin

<table>
<thead>
<tr>
<th>Species</th>
<th>Number Tagged</th>
<th>No. Reporting</th>
<th>Total Days at Liberty</th>
<th>Mean (Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>*No. Waiting</td>
<td>(%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Striped Marlin</td>
<td>2</td>
<td>1 (100%)</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>(Tetrapturus audax)</td>
<td>*1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black Marlin</td>
<td>1</td>
<td>1 (100%)</td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td>(Makaira indicus)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue Marlin</td>
<td>37</td>
<td>28 (78%)</td>
<td>2140</td>
<td>76 (1-245)</td>
</tr>
<tr>
<td>(Makaira nigricans)</td>
<td>*1</td>
<td></td>
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</tr>
</tbody>
</table>

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8 tags failed to report (21%)
4 tags reached pop-off date (13%)
Evidence for delayed mortality in one blue marlin
Blue marlin movement patterns
Time at depth summaries

Depth (m):
- 10.5-50
- 50.5-100
- 100.5-150
- 150.5-250
- 250.5-350

Percent of Total Time:
- Blue Marlin
- Striped Marlin
- Black Marlin
Depth distribution of blue marlin tracked near Hawaii using acoustic telemetry.
Depth distribution of blue marlin tracked near Hawaii using acoustic telemetry.
Blue marlin movement patterns
Evidence for delayed mortality in Blue marlin after 82 days

Caught on live bait

Approx. 25 minutes of fight time

130 lb monofilament test line

Hooked corner mouth

Moved almost due South 855 nmi (7.6 nmi/day)
Evidence for delayed mortality in Blue marlin after 82 days

Fail safe mechanism jettisons PSAT after reaching 1200m
Summary

• 29 of the 30 tags reporting data indicate post-release survival (i.e., only one mortality).

• Fail-safe mechanism worked as expected.

• Unlikely that mortality after 82 days was the result of the initial insult.
Previous studies investigating post-release survivability in marlin using PSATs


- 9 blue marlin tagged in Atlantic
- Estimated sizes: 150-425 lbs.
- Caught marlin on lures and bait
- Pop-off times set at 5 days
- 8 survived
- Fate of one tag unknown
- **No evidence of mortality**

9 blue marlin tagged in Atlantic

Estimated sizes: > 100 lbs.

Caught on longlines

Pop-off times set at 5-30 days

7 survived

Fate of two tags unknown

No evidence of mortality

- 7 black marlin tagged in Coral Sea
- Estimated sizes: 200-600 lbs.
- Caught on live and dead bait
- Variable pop-off dates (4 days – 5 months)
- 5 of 7 survived for 3 – 64 days
- Fate of 2 tags was unknown
- No evidence of mortality

- 80 striped marlin tagged near Baja California
- Estimated sizes: 90-188 lbs
- Caught on live bait using circle & J-hooks
- 45 fish survived
- **16 of 61 fish (26%) died within 5 days**
- Fate of 19 tags unknown
Blue marlin show a huge increase in blood lactate level.

Lowest marlin lactate is close to the highest shark lactate level.
Mahalo’s to:

• Jody Bright & Crew of Tropidilla Productions
• Roy Morioka, PORF, HIBT
• Peter Fithian, PORF, HIBT
• John Sibert, PFRP
• Pacific Islands Fisheries Science Center
• Chris Boggs, Mike Laurs, Sam Pooley, NOAA
• CABO Yachts
and the Captains and Crew who Deployed PSATs:

- Camelot
- Foxy Lady
- Happy Times
- Holly Ann
- Ho’okele
- Ihu Nui
- Jacque Apito
- Linda Sue
- Maui Jim
- Pacific Blue
- Pamela
- Start Me Up Again
- Top Shape
Blue sharks
Four parameters show clear differences between survivors & moribund

- Survivor
- Moribund
- Unknown

![Graph showing differences in parameters between survivors and moribund.](graph.png)
K$^+$ shows much greater increases in marlin

**Blue shark**  
Mg$^+$ increases ~50%

**Blue marlin**  
Mg$^+$ increases ~400%

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[Graph showing comparisons between K$^+$ and Mg$^{2+}$ increases in survivors, moribund, and unknown groups for blue shark and blue marlin.]
Blue marlin show greater Hsp70 induction

Blue shark
Hsp70 increases ~3-fold

Blue marlin
Hsp70 increases > 5-fold
Black marlin movement pattern