



# Effects of Air Exposure on Post-Release Mortality Rates of White Marlin Caught in the U.S. Offshore Recreational Fishery

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# White Marlin

## *Kajikia albida*

- Fisheries
  - Directed
    - Artisanal
    - Recreational
  - Incidental/Bycatch
    - Pelagic longline
    - Purse seine
- 2012 assessment
  - $B/B_{MSY} = 0.50$
  - $F/F_{MSY} = 0.99$
- ICCAT Management
  - 400 mt TAC
  - Country-specific quotas
  - Live release



# U.S. White Marlin Fishery

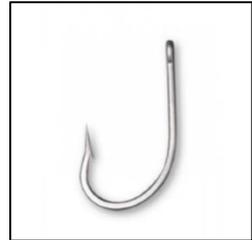
- Commercial landings prohibited
- U.S. Recreational fishery limited to 250 white marlin and blue marlin combined
- ~99% white marlin released
  - Regulatory: minimum size of 66 inches LJFL
  - Voluntary: angler conservation ethic
- >10,000 releases per year along U.S. mid-Atlantic

# Post-release Mortality

- Post-release mortality studies using pop-up satellite archival tags (PSATs)
  - 10-30 day deployments

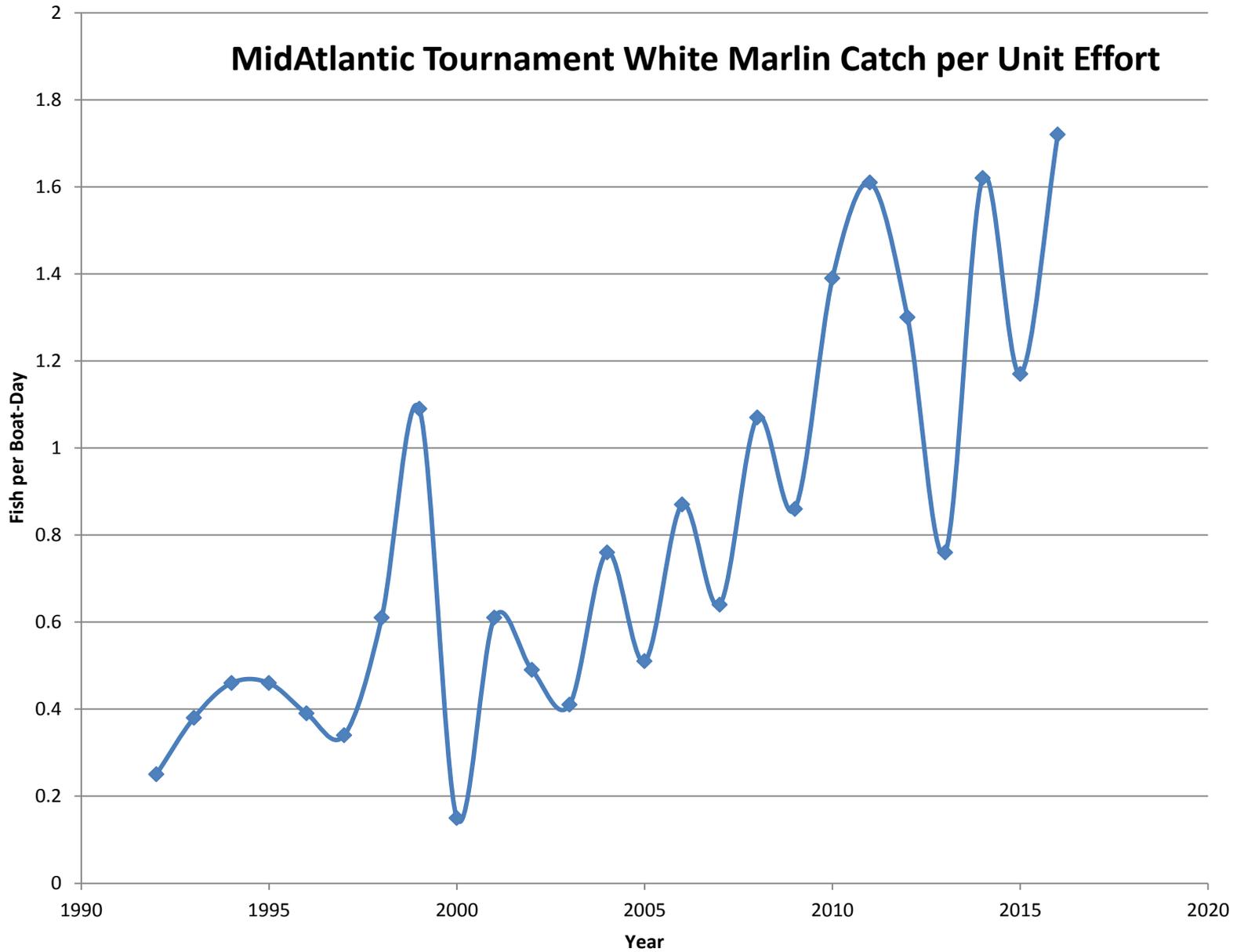


- Circle hooks versus J hooks
  - All fish left in the water for tagging
  - J-hooks: 7 of 20 fish died (35%)
  - Circle hooks: 1 of 59 fish died (1.7%)



- $10,000 \text{ fish} * 0.35 * 22 \text{ kg} = 95.2 \text{ mt}$

# MidAtlantic Tournament White Marlin Catch per Unit Effort



- Voluntary adoption of circle hooks by recreational billfish community
- NMFS requires use of circle hooks with natural baits in billfish tournaments
- Vast majority of circle hooks lodge in corner of the jaw
- Investigate impact of physiological stress w/o mechanical damage



# Lela Schlenker's Thesis

- Took blood samples and tagged 22 fish w/30 day PSATs
- No relation between fight time and post-release mortality
- Serum  $K^+$  sole predictor of mortality
- Post-release mortality (32%) much greater than fish tagged in water and not sampled (1.7%)
- Was increased mortality due to aortic puncture and/or ~ 2 min. air exposure?



# Air Exposure

- Increases PRM in other species (Cook et al. 2015)
- NMFS regulation prohibits removing billfish from water unless retained
- But...



[www.meltontackle.com](http://www.meltontackle.com)



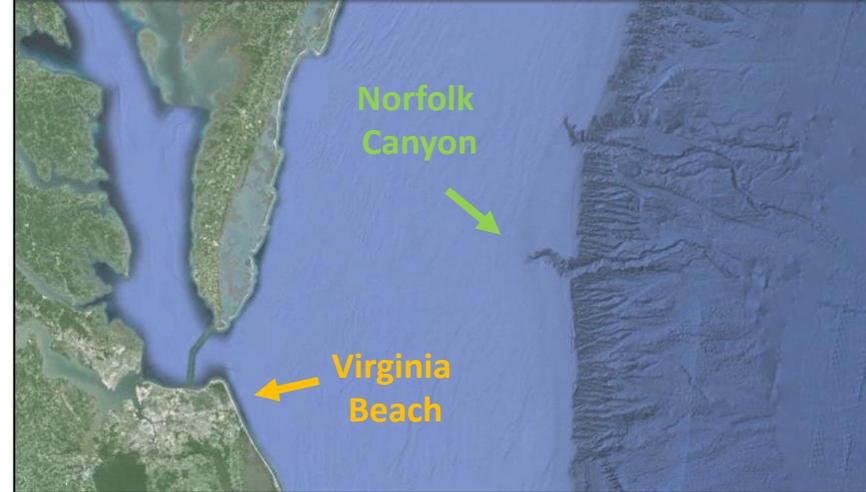
[www.tripadvisor.com](http://www.tripadvisor.com)

# Objectives

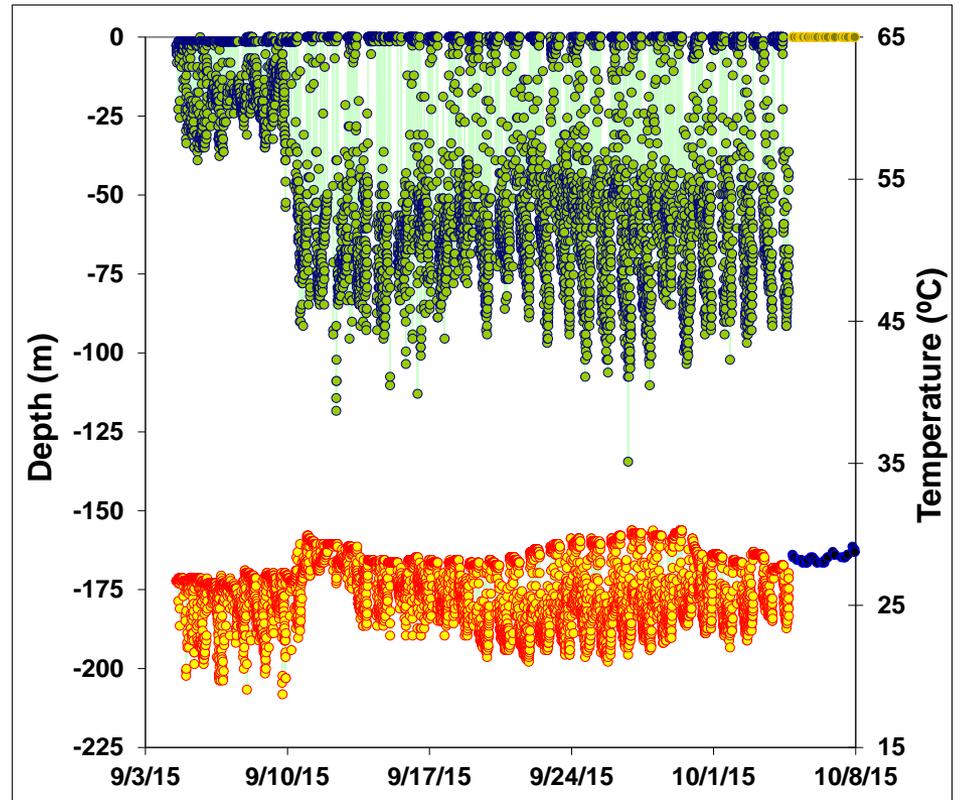
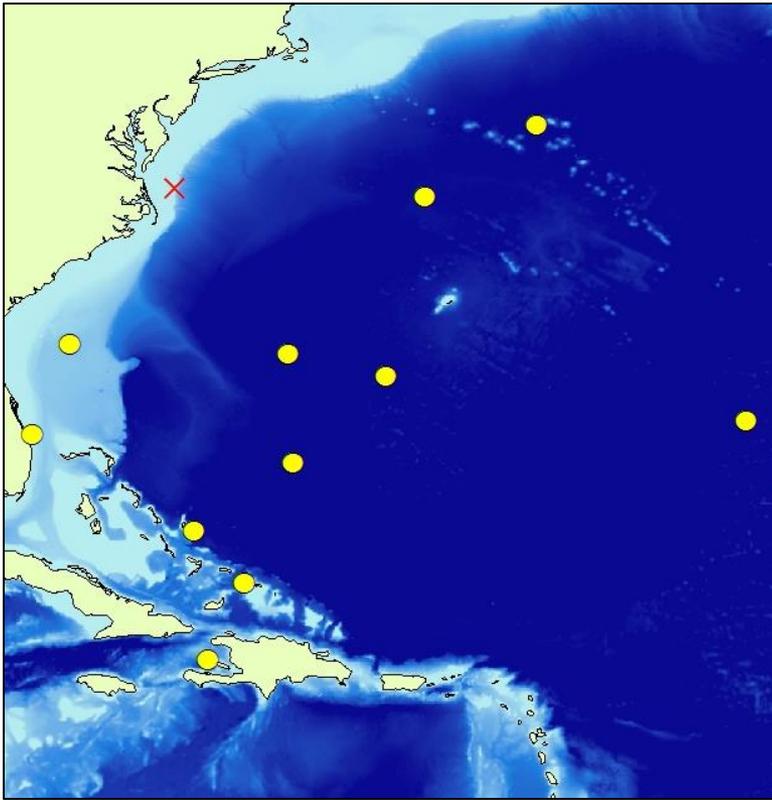
- Deploy PSATs on white marlin subjected to varying levels of air exposure
- Estimate the effect of air exposure on post-release mortality of white marlin
- Communicate findings to the recreational fishing community to encourage best practices

# Methods

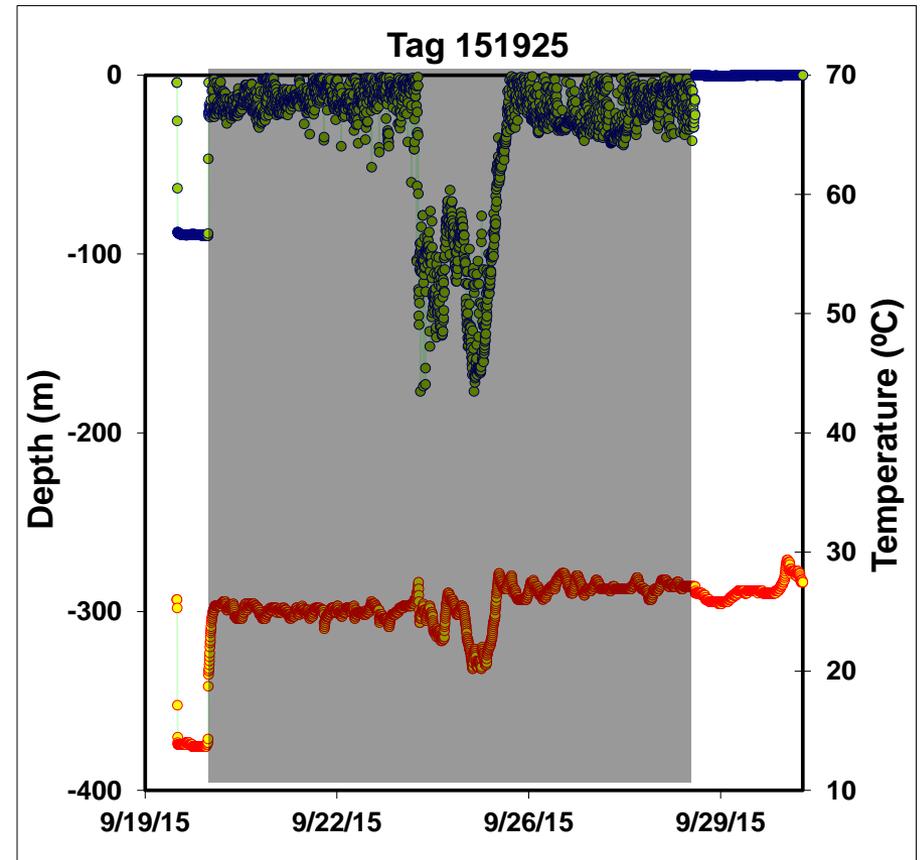
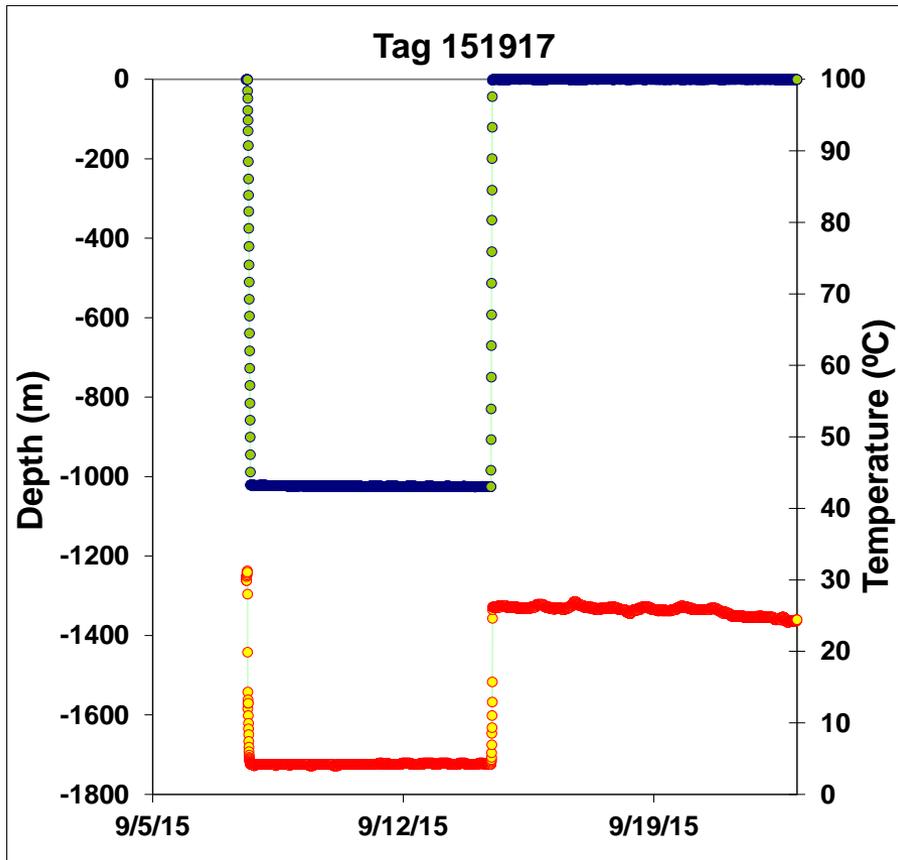
- White marlin caught using circle hooks, slow-trolling ballyhoo in September 2015
- 3 treatments (21 PSATs, 30 day pop-off, no constant depth release):
  - 1 min
  - 3 min
  - 5 min } Fish on deck, head covered with wet cloth
- Record fish length, fight time/intensity, hook location, revival time
- Compare findings with reference group (no air exposure): 59 fish, 1.7% mortality



# Inferring Survival

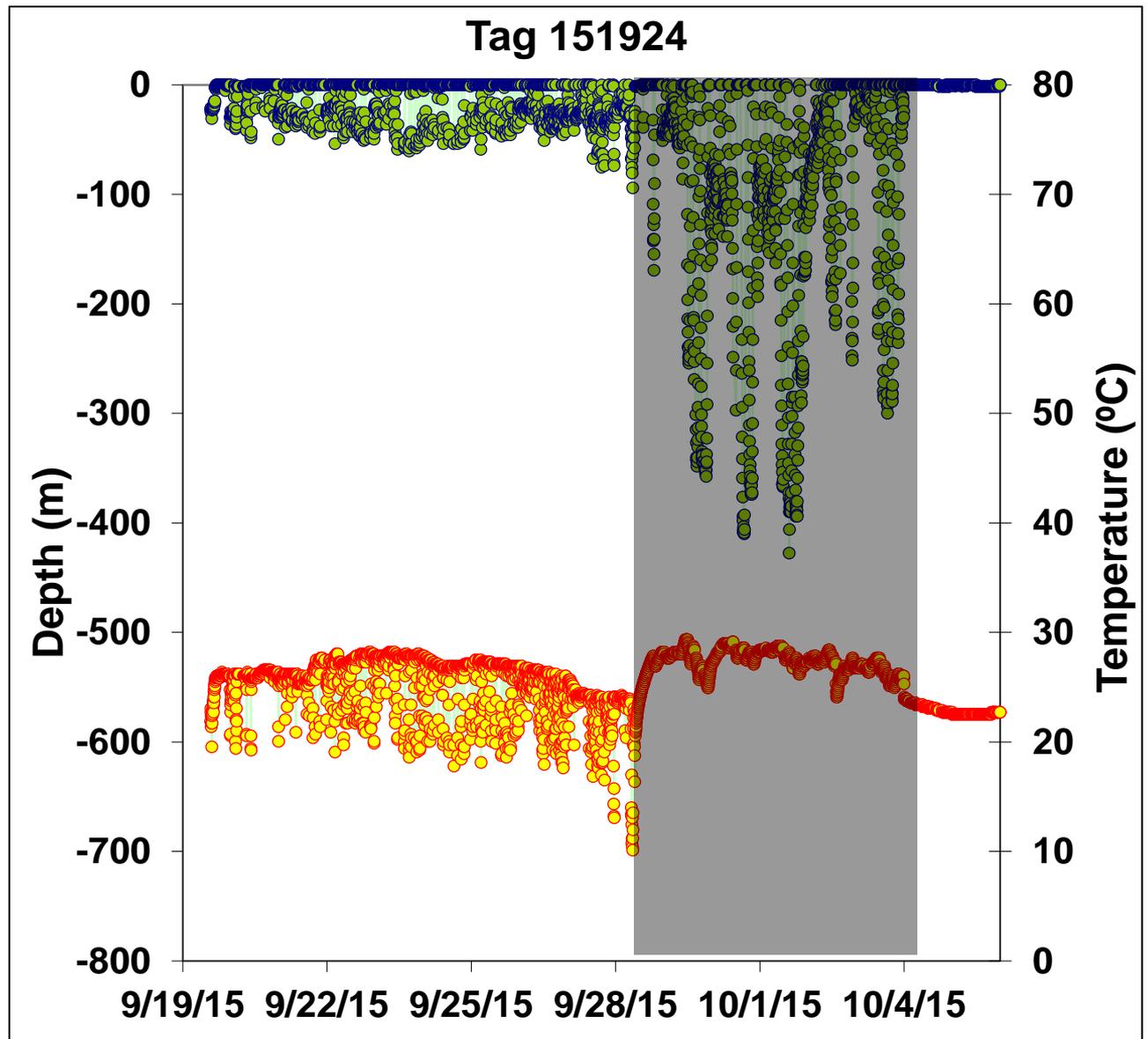


# Inferring Mortality



Mortality?

Natural mortality  
Fishing mortality



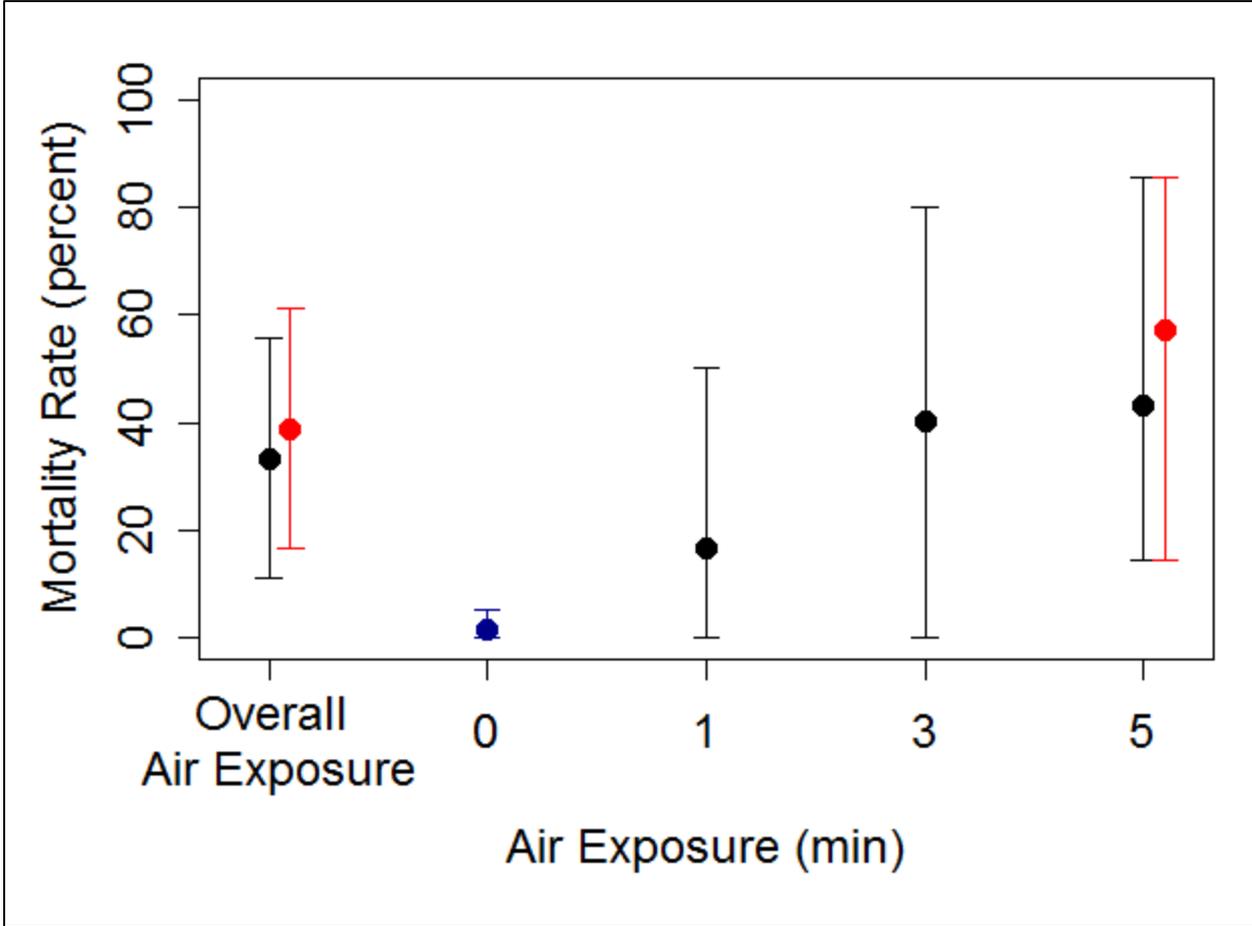
# Results

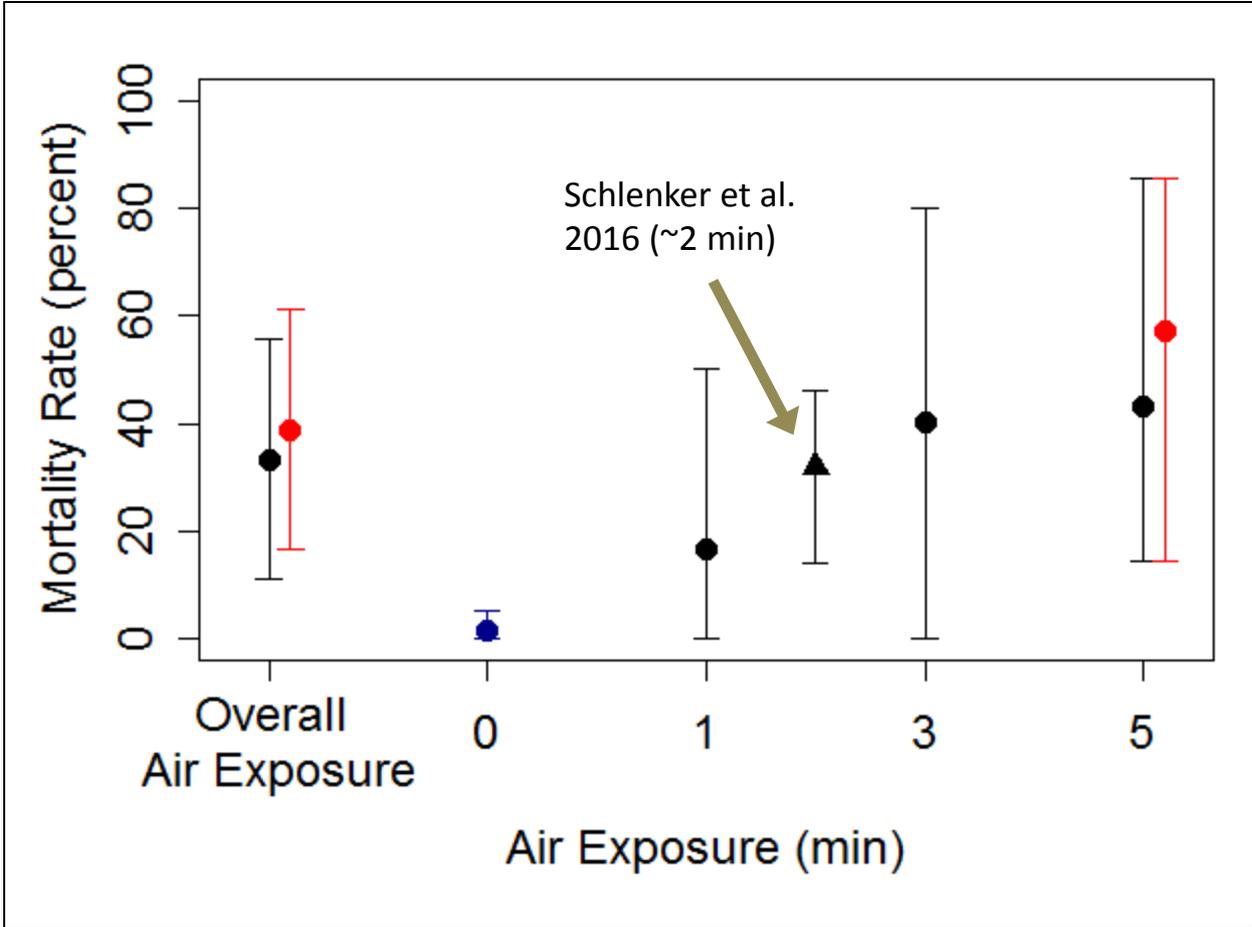
- 18/21 tags deployed
  - 1-min: 6
  - 3-min: 5
  - 5-min: 7
- All 18 tags reported
- 6 of 18 fish (33%) died within 30 hrs (2 tags subsequently scavenged)
- 1 fish was predated upon after 9 days (38.3%)
- Fight time, intensity, and fish size did not differ among fish that survived and died
- Fight times: 6 - 59 min (*4 - 40 min*)
- Estimated fish size: 18 - 27 kg (*16 - 41 kg*)

# Mortality and Air Exposure

- Post-release mortality for fish subjected to air exposure (33.3%/**38.9%**) higher than for fish left in the water ( $p = 0.002/0.0006$ )
- Post-release mortality increased with air exposure duration

Air Exp.	Tagged	Died (F)	PRM
0 (control)	59	1	1.7%
1 min	6	1	16.7%
3 min	5	2	40%
5 min	7	3( <b>4</b> )	42.9% ( <b>57.1%</b> )



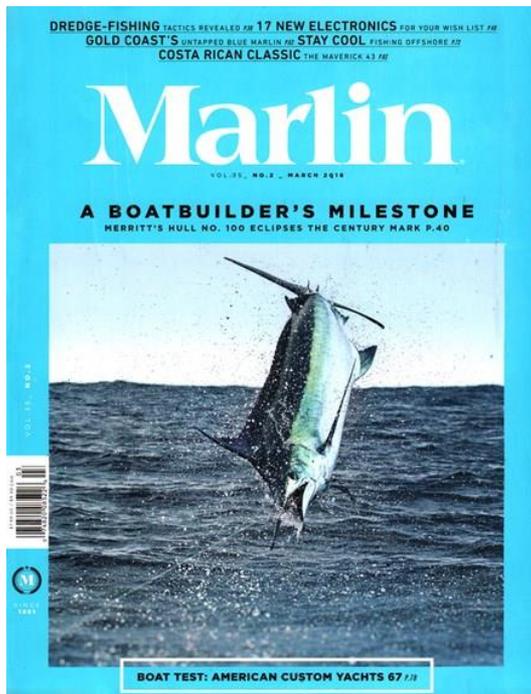


# Conclusions

- Despite small sample sizes (large CIs), negative effects of air exposure evident
- Oxygen debt (fight) exacerbated by air exposure (Cooke and Suski 2005)
- Post-release mortality rates increase with air exposure duration
- Outreach to recreational billfish community to promote conservation awareness

# ZERO AIR TIME

*Sport Fishing* January 2016



## FISH OUT OF WATER

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*New study adds scientific backing to a widely disputed argument about billfish*

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*Marlin* March 2016

# Acknowledgments

- Captains and crew (Virginia Beach, VA):
  - Capt. Ken Neill *Healthy Grin*
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