

Gulf-Wide High Reward Red Snapper Tagging

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THE GREAT RED SNAPPER COUNT

Estimating the Absolute Abundance of Age-2+
Red Snapper in the U.S. Gulf of Mexico.

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Objectives

- Estimate the following parameters for the recreational Red Snapper fishery in the Northern Gulf of Mexico:
 - Regional and sector-specific (private, charter) recreational exploitation rates
 - The effect of distance from nearest port on capture rates
 - Size-based vulnerability to capture
 - Tag shedding rates
 - Discard rates
- Explore regional movement distance and direction
- Assess angler awareness of the GRSC tagging program

Methods: Tagging

- Tagging from January – June 2019
- Four spatial strata (regions): TX West, TX East, AL, FL Panhandle
- Target 300 tagged fish per region at 30 sites
- Limit of 10 fish per site
- Sites randomly drawn from lists of known waypoints (high relief structure)
- Site depth <40 m
- Legal-sized Red Snapper (>406 mm)
- Hallprint PDAT dart tag
- Double tag every third fish
- Hook and line
- Release with descender device

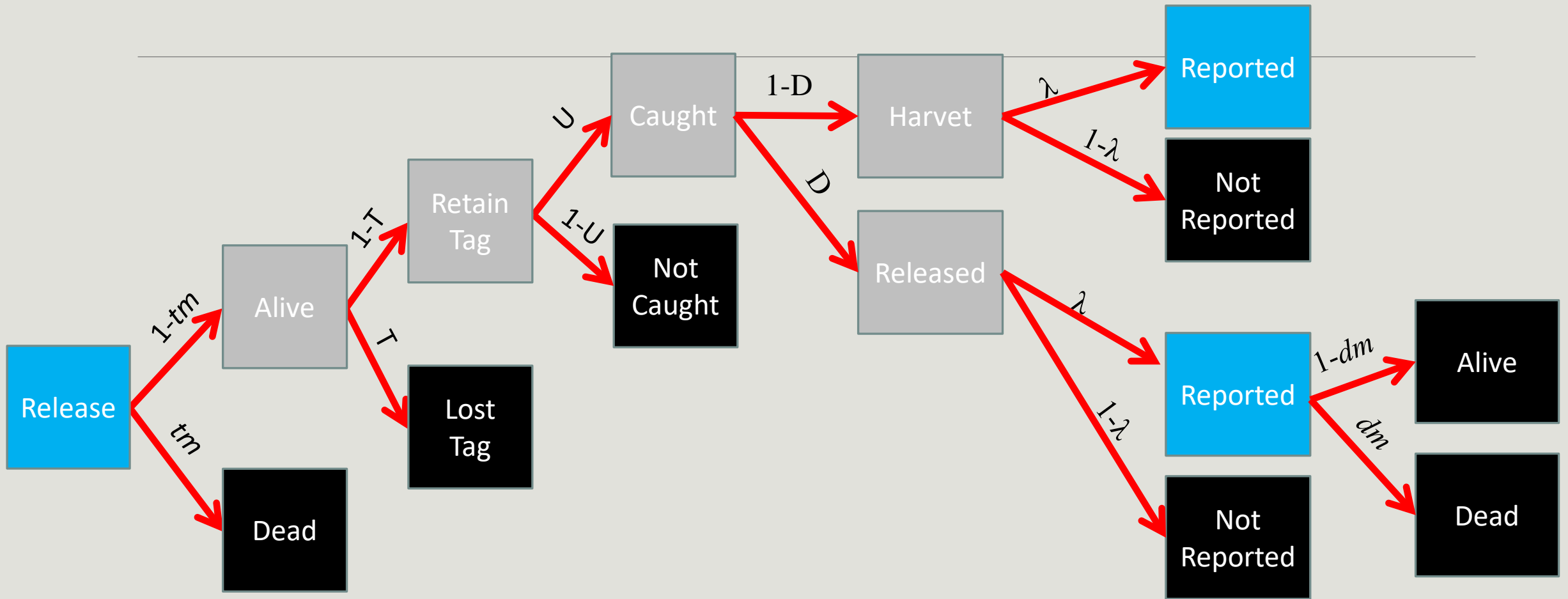
Tag Returns

- TAMUCC Phone Line
- \$250 reward per tag (reward payouts stopped on January 1, 2020)
- Information collected from anglers
 - Tag number
 - Date captured
 - Fishery sector (private, charter, commercial)
 - Discarding (harvested, released)
 - Capture location
 - How they became aware of the reward tagging program
 - Whether awareness came before or after capturing a tagged Red Snapper

Modeling

- Tag return model (Bayesian approach, JAGS software)
- Fitted to tag returns from June – October 2019
- Response variables:
 - Five individual fish capture fates (not returned, private vs charter, tag shed vs retained) – categorical distribution
 - Post-capture fate (harvest vs discard) – Bernoulli distribution
- Estimated parameters:
 - Regional and sector-specific fully vulnerable capture rates
 - Regional length-based vulnerability – exponential-logistic (Thompson 1994)
 - Log-linear distance effect on capture rates (spatially invariant)
 - Regional tag shedding rates
 - Regional discard rates
 - Random site-specific fishing mortality anomalies
 - Tagging/discard mortality rates (informative priors; no data)
- Priors:
 - Uninformative except for tagging mortality, which is literature-based
 - Tagging mortality: mean=0.19, cv=0.21 (Campbell et al. 2014, Curtis et al. unpublished, Bohaboy et al. 2019)
 - Discard mortality: mean=0.1, cv=0.25 (Campbell et al. 2014)

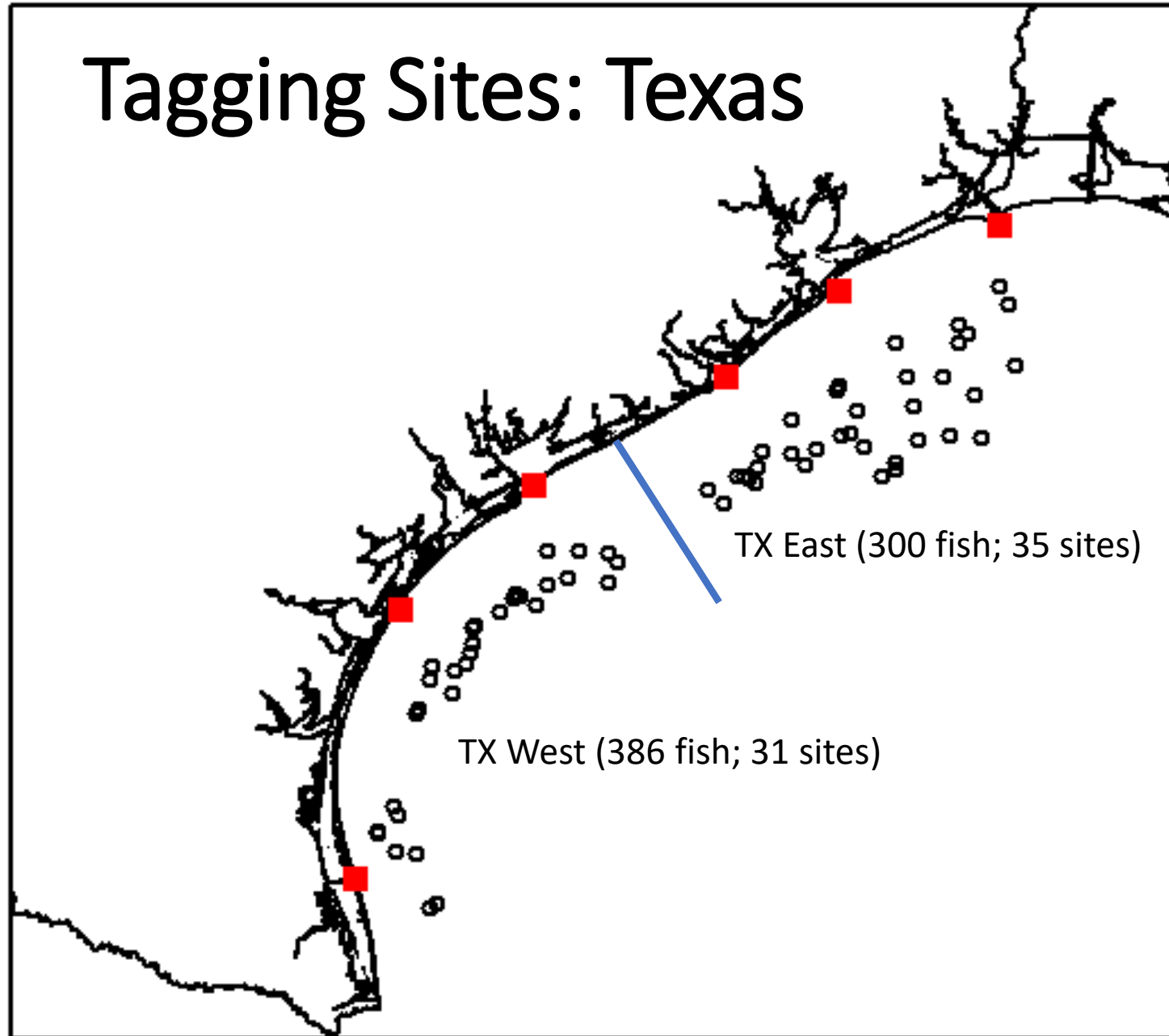
Model: How does it work?



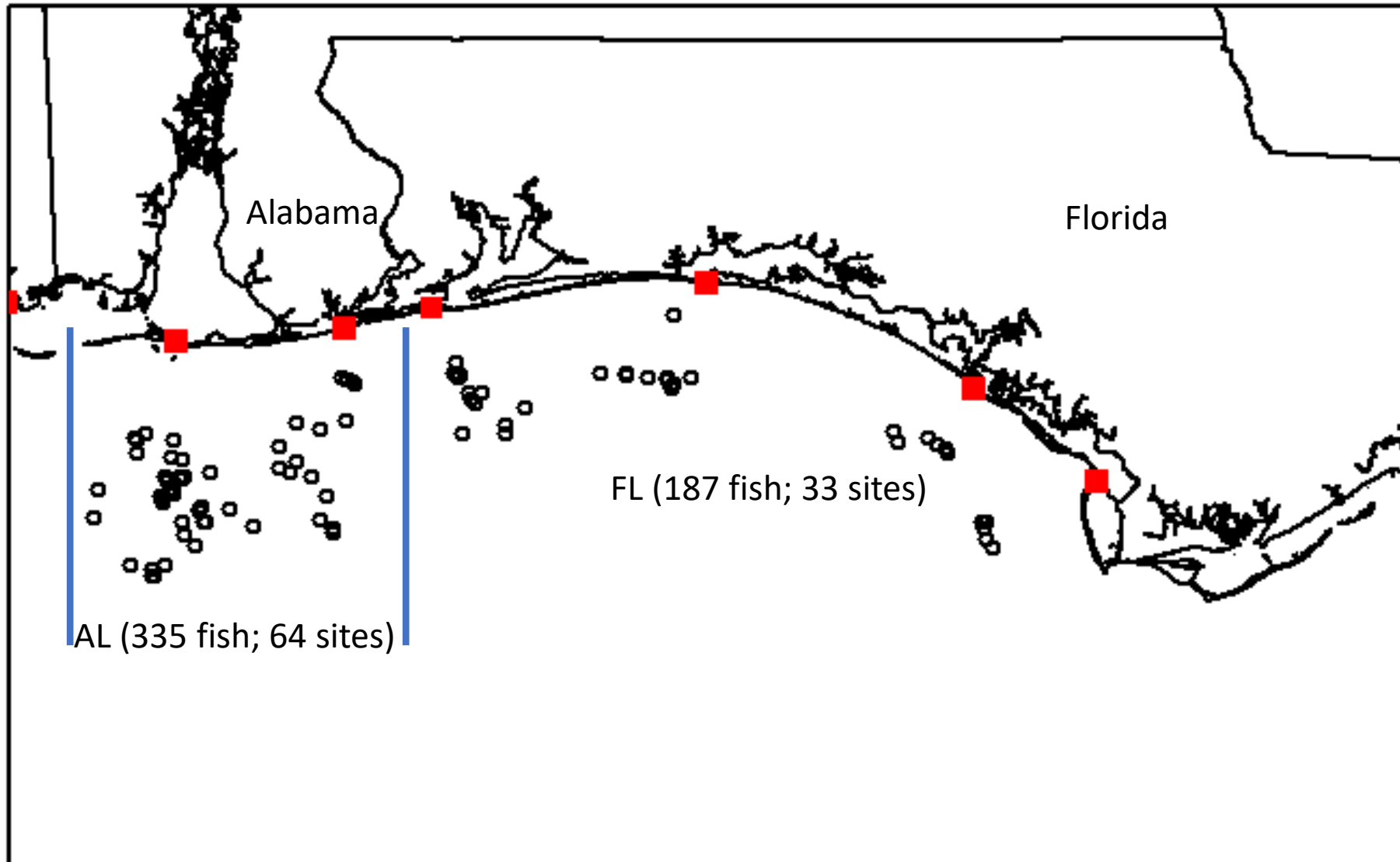
Important Assumptions

- 100% angler reporting rate
- Literature based priors on tagging and discard mortality
- Negligible movement among regions
- Vulnerability to charter and private anglers is identical
- Distance to nearest port effects are constant across regions and sectors
- Site-specific capture rate anomalies apply to both charter and private
- Immediate tag loss
- Discard rates identical for charter and private sectors
- Ignore commercial returns
- Sphere of inference: red snapper on shallow (<40 m) high relief artificial reefs

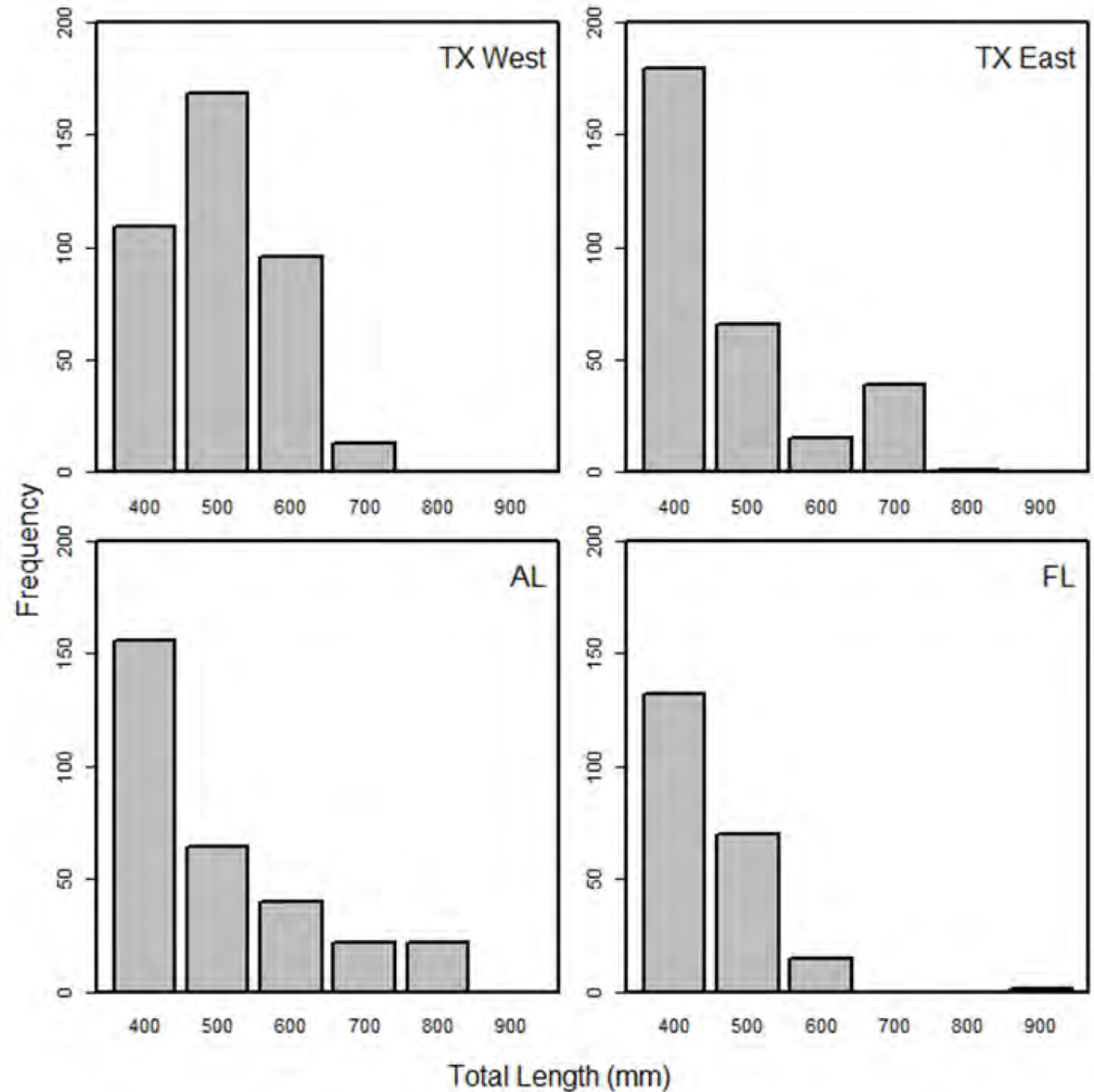
Tagging Sites: Texas



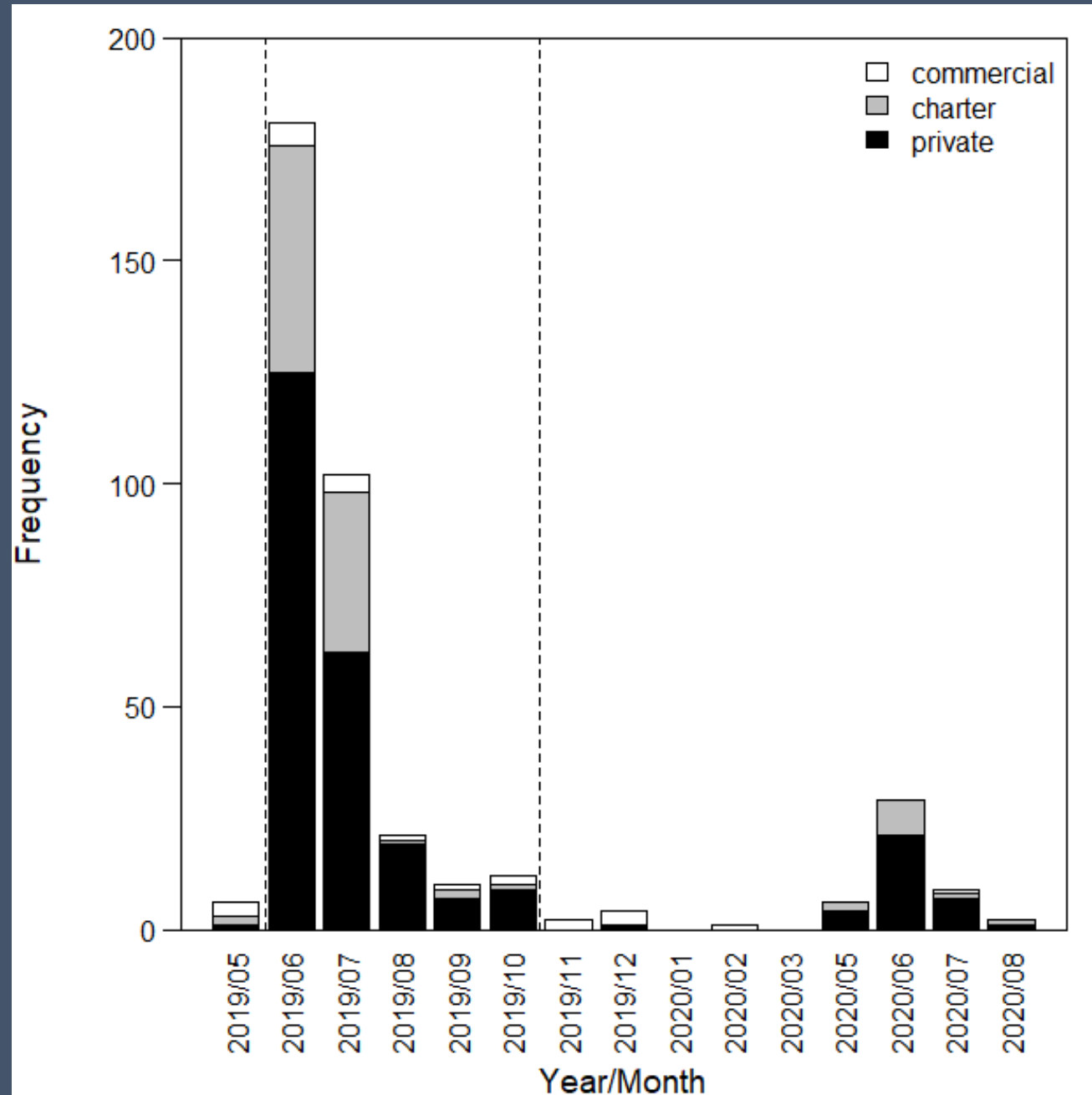
Tagging Sites: Alabama and Florida



Regional Size Distribution of Tagged Red Snapper

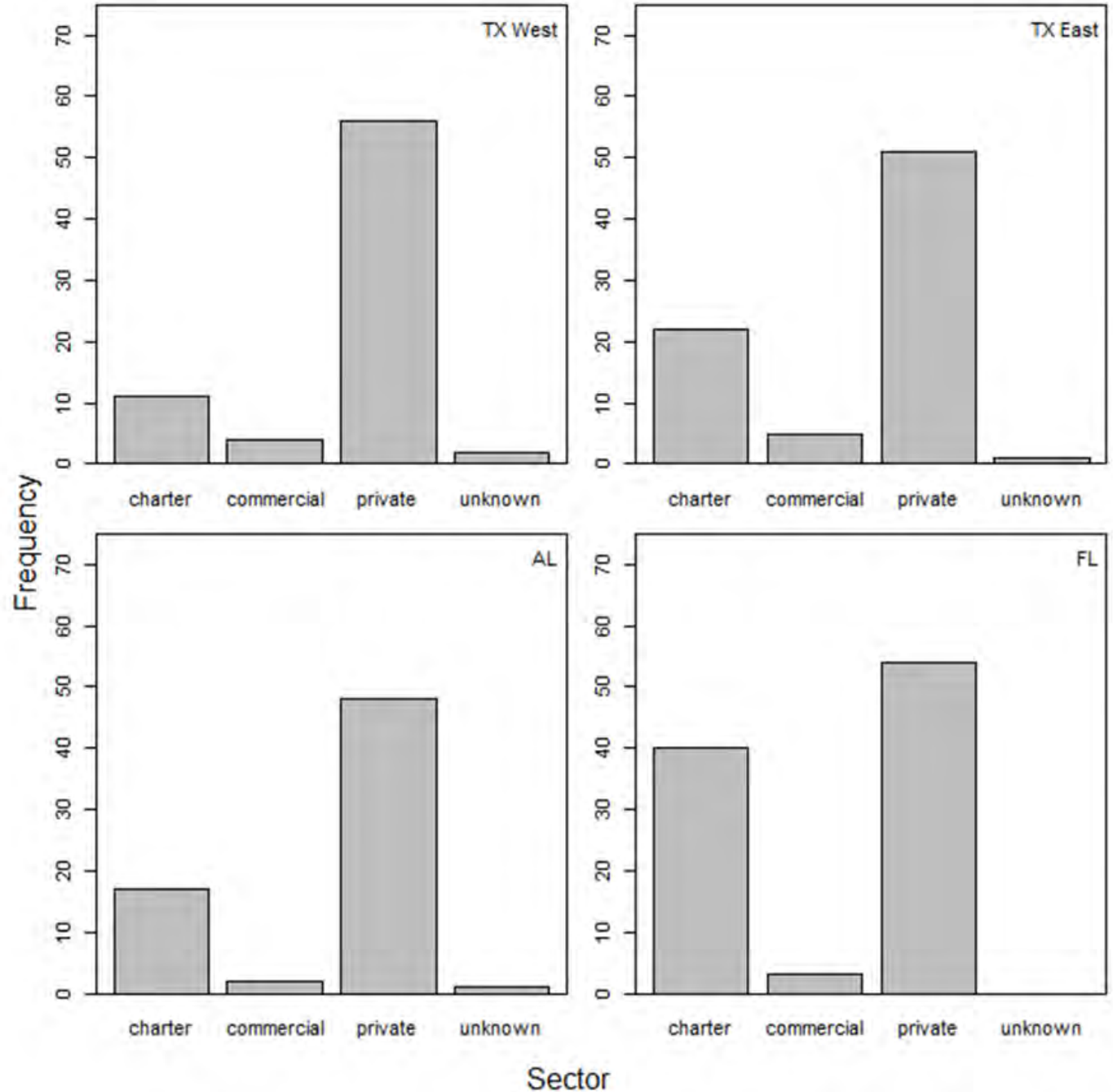


Monthly Tag Returns By Fishery Sector



Regional Tag Returns By Fishery Sector (through Aug 2020)

Region	Tagged	Returned	Percentage
FL	310	133	43%
AL	342	97	28%
TX	697	195	28%
TOTAL	1349	425	32%



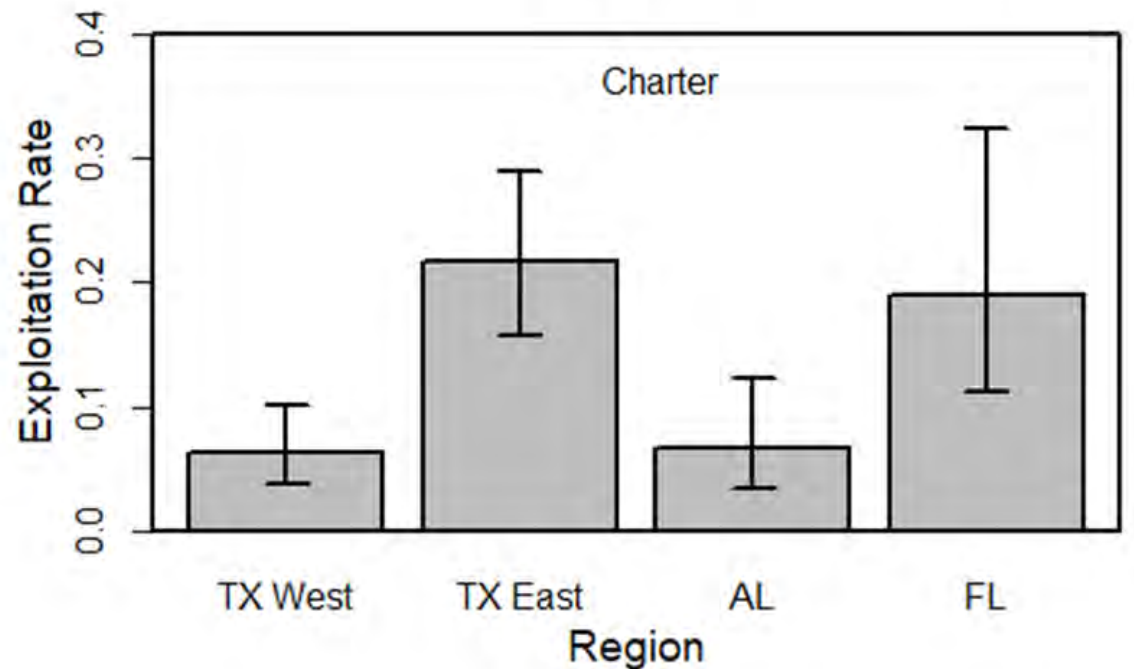
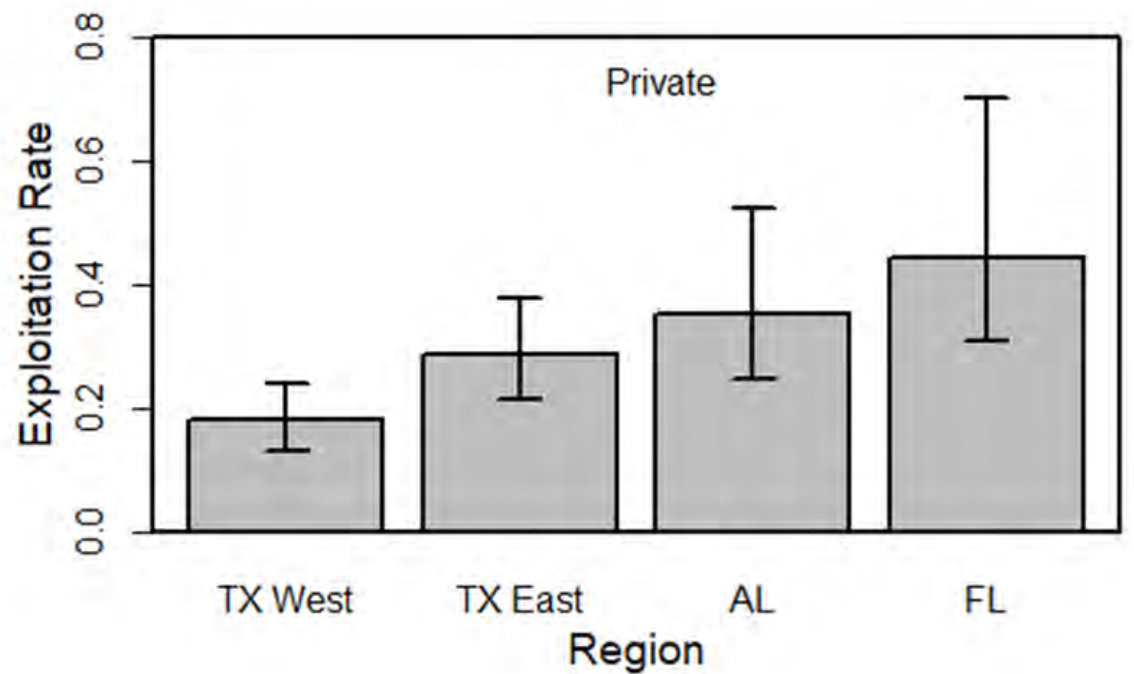
Model Selection

- Eight models
- Watanabe-Akaike Information Criterion (WAIC)
- Combinations of regional vs. spatially-invariant vulnerability, tag shedding, discard rates

Model	pD	WAIC	Weight
tag retention(\cdot), vulnerability(r), release(\cdot)	25.30	586.03	0.24
tag retention(\cdot), vulnerability(\cdot), release(\cdot)	24.09	586.80	0.16
tag retention(r), vulnerability(r), release(r)	25.87	587.09	0.14
tag retention(\cdot), vulnerability(r), release(r)	26.17	587.33	0.12
tag retention(\cdot), vulnerability(\cdot), release (r)	25.14	587.80	0.10
tag retention(r), vulnerability(r), release(\cdot)	24.85	587.70	0.10
tag retention(r), vulnerability(\cdot), release(\cdot)	24.30	588.54	0.07
tag retention(r), vulnerability(\cdot), release(r)	24.99	588.54	0.07

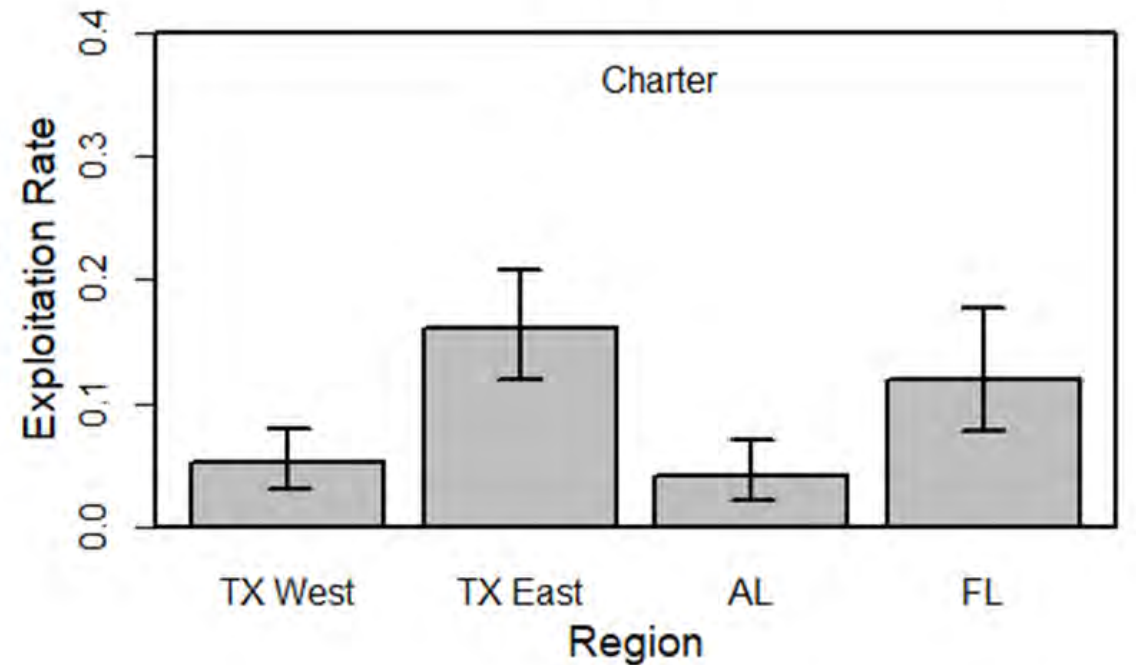
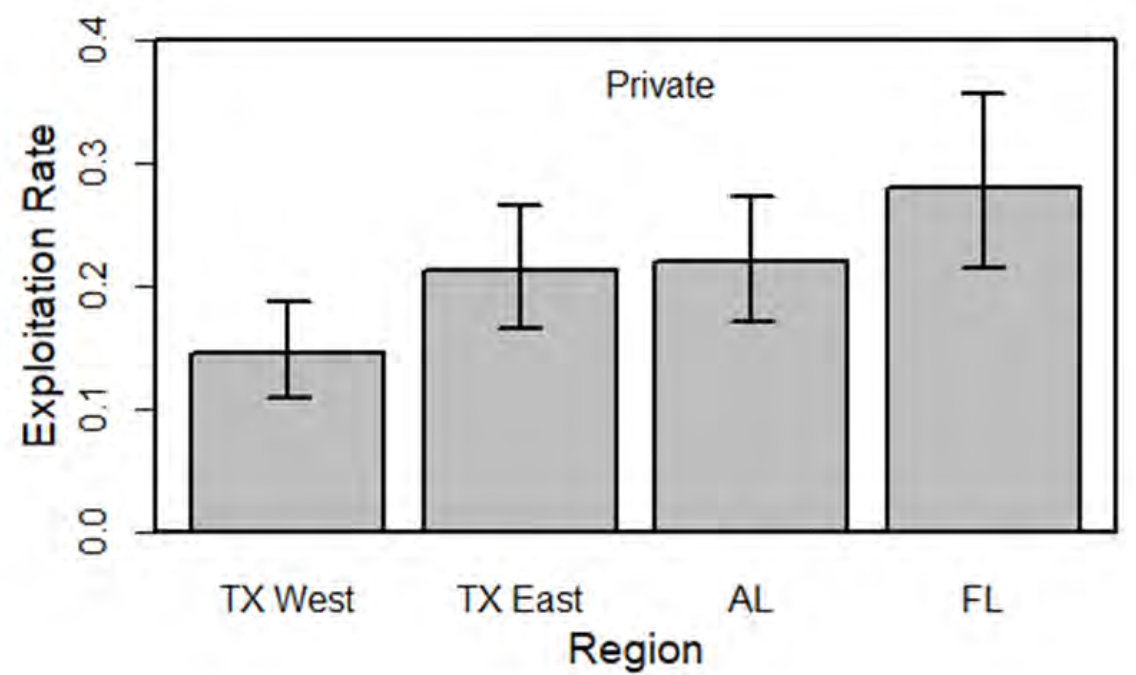
Fully-vulnerable Exploitation Rates

- Model averaged posteriors
- W to E gradient
- Variable charter effort
- Private > charter
- Up to ~60% total exploitation on fully vulnerable fish



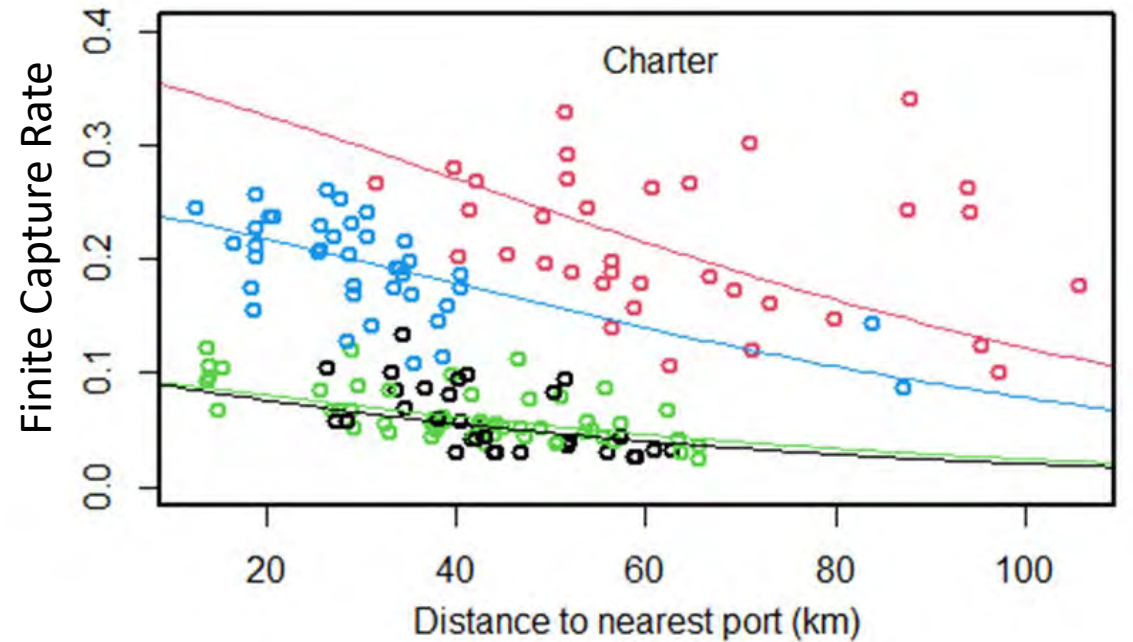
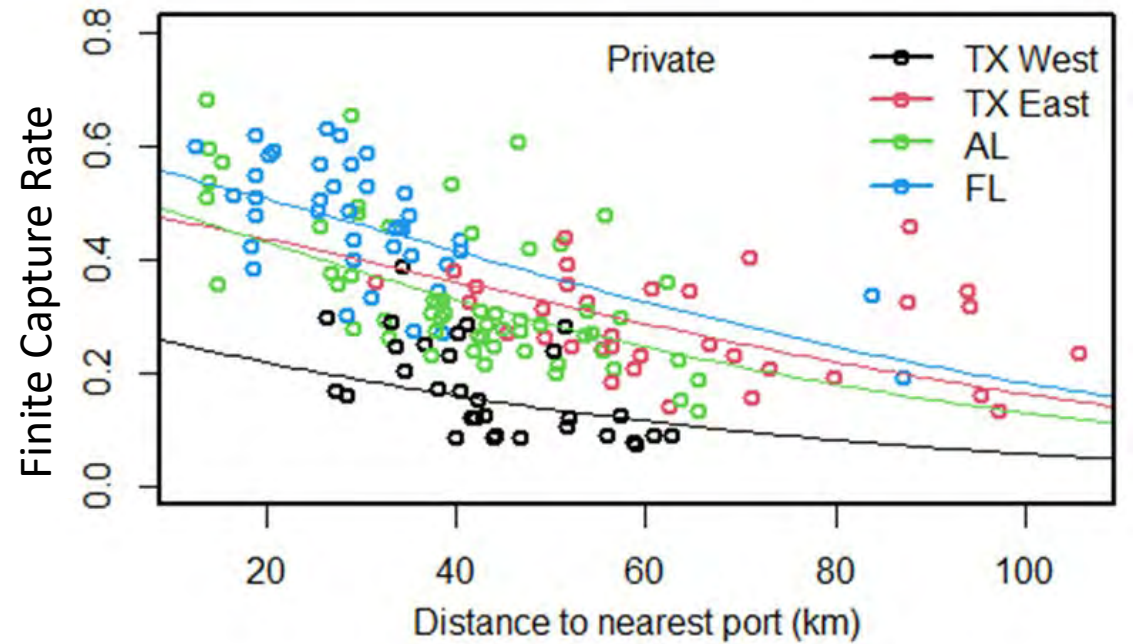
Exploitation Rates on the Tagged Population

- 20-40% exploitation



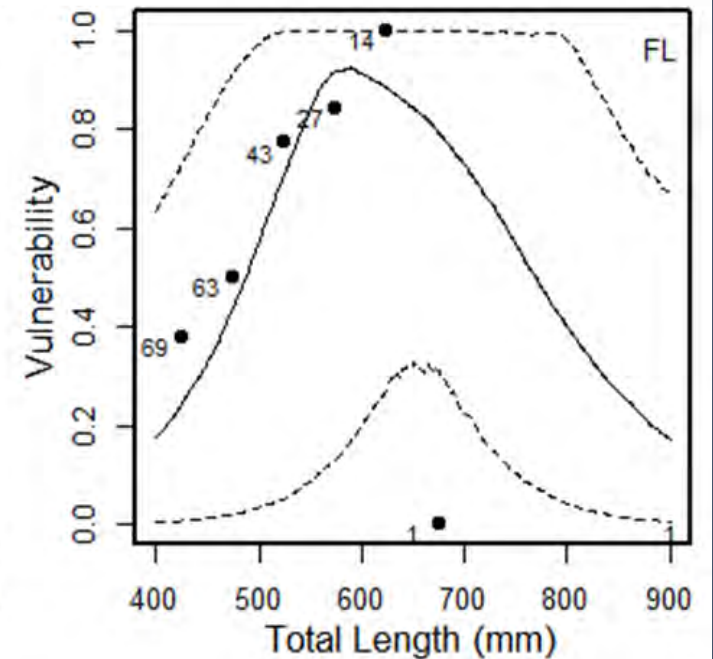
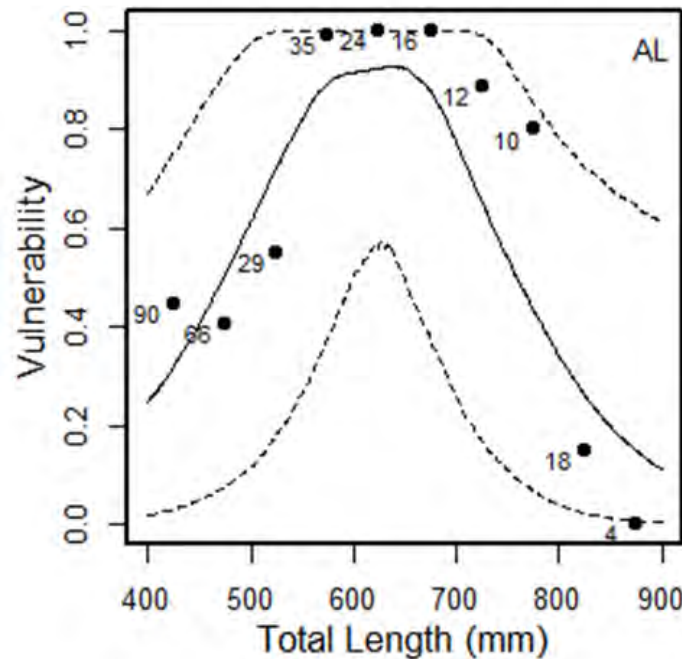
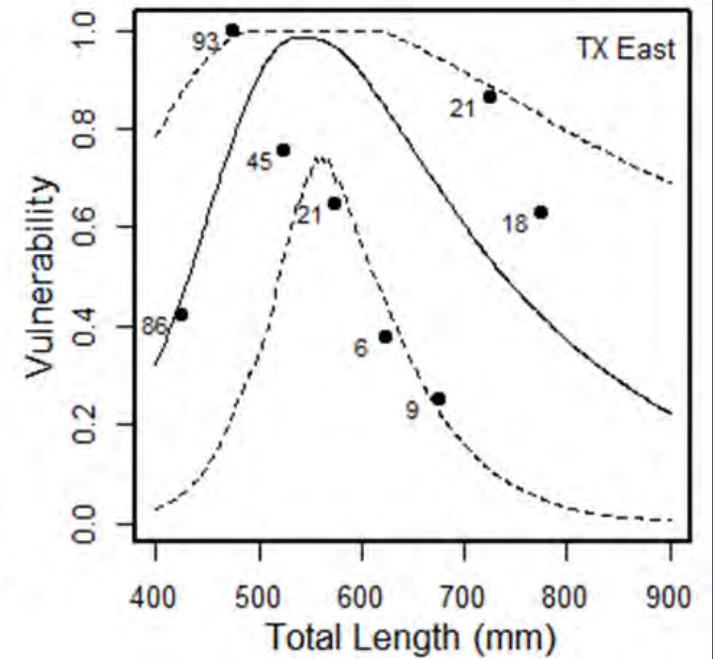
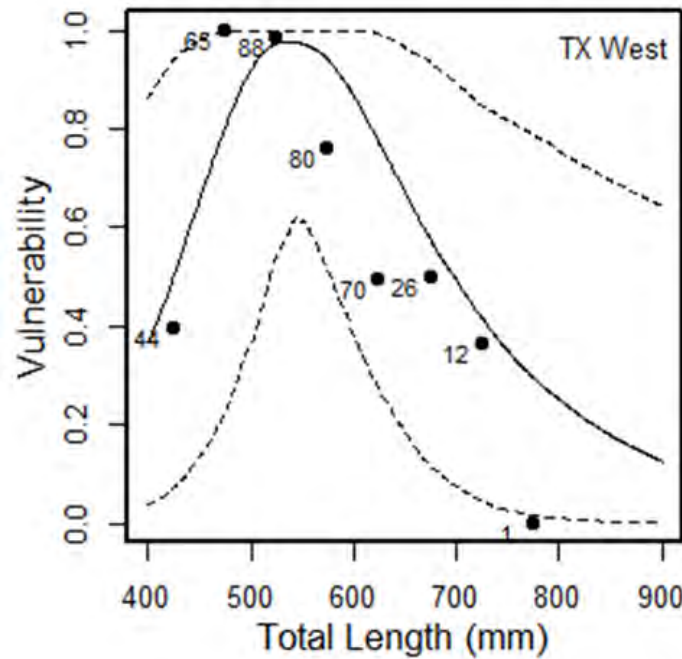
Distance From Port Effects

- Modest declines in capture rates
- Highly variable



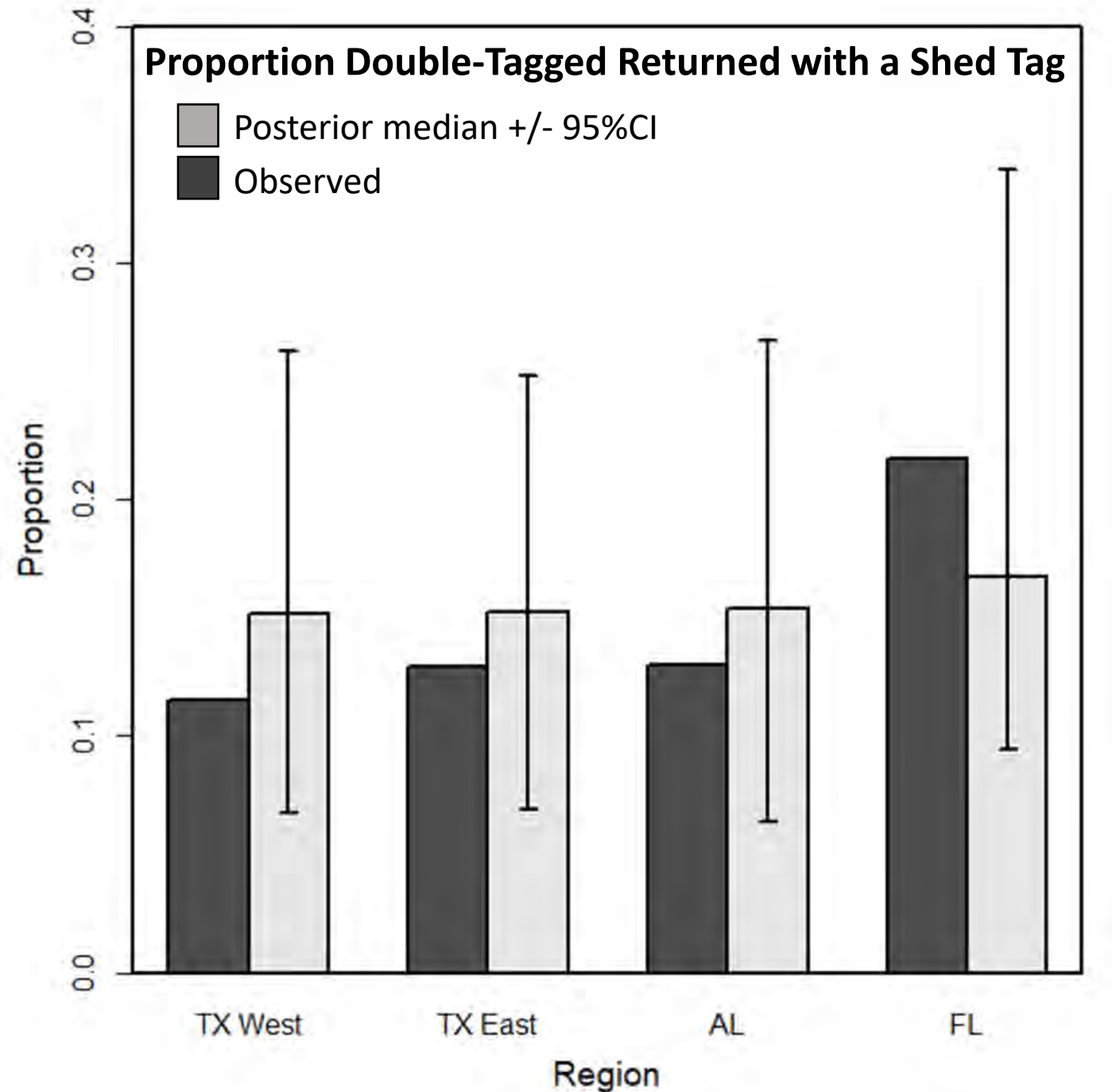
Vulnerability

- Dome shaped
- Smaller modal length in TX
- Uncertainty
- Bias
- AL/FL patterns consistent with other AL tagging study 2016-2018



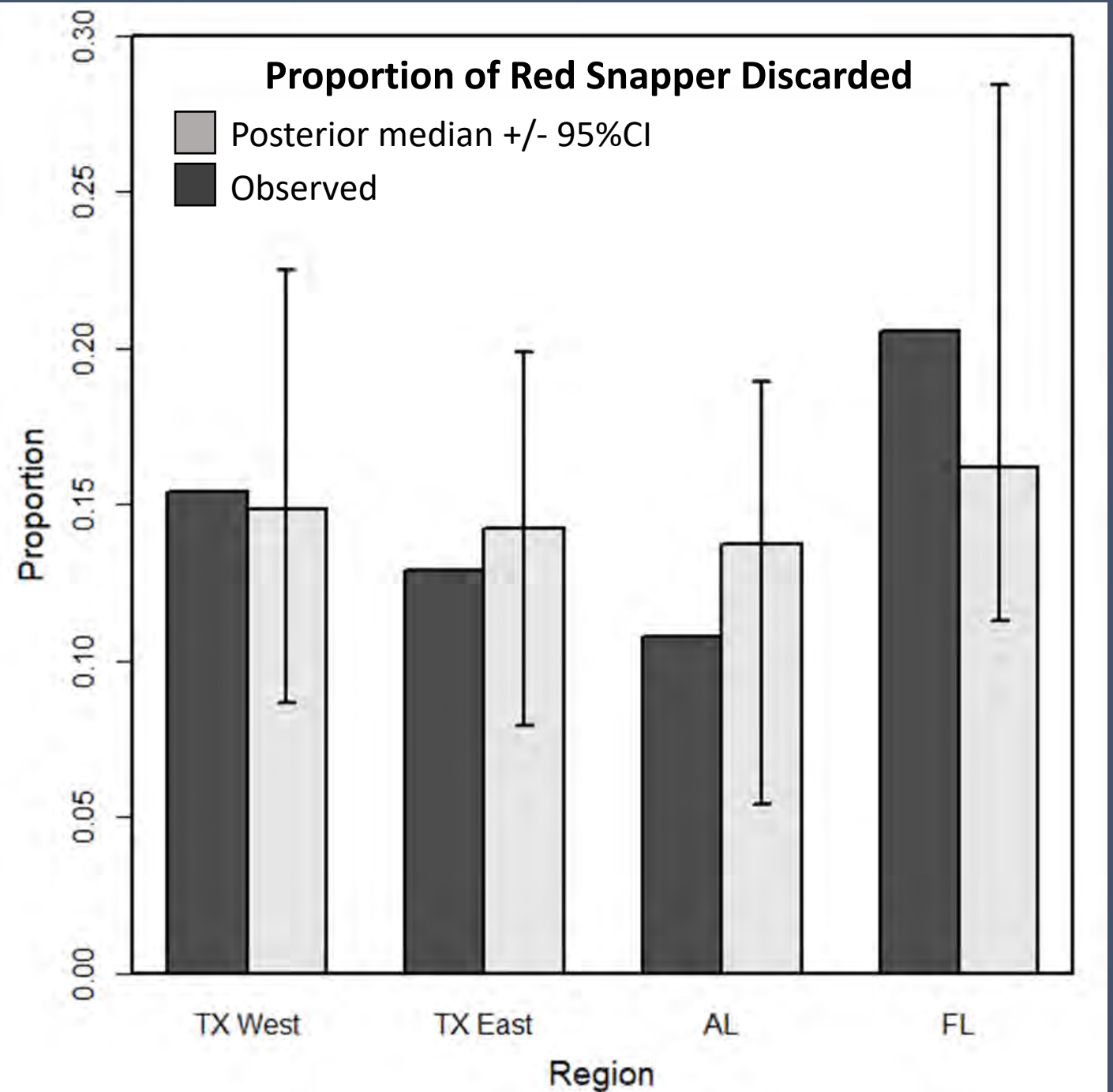
Tag Shedding

- 6 to 13% tag shedding rate
- Similar to estimates from AL tagging study 2016 – 2018



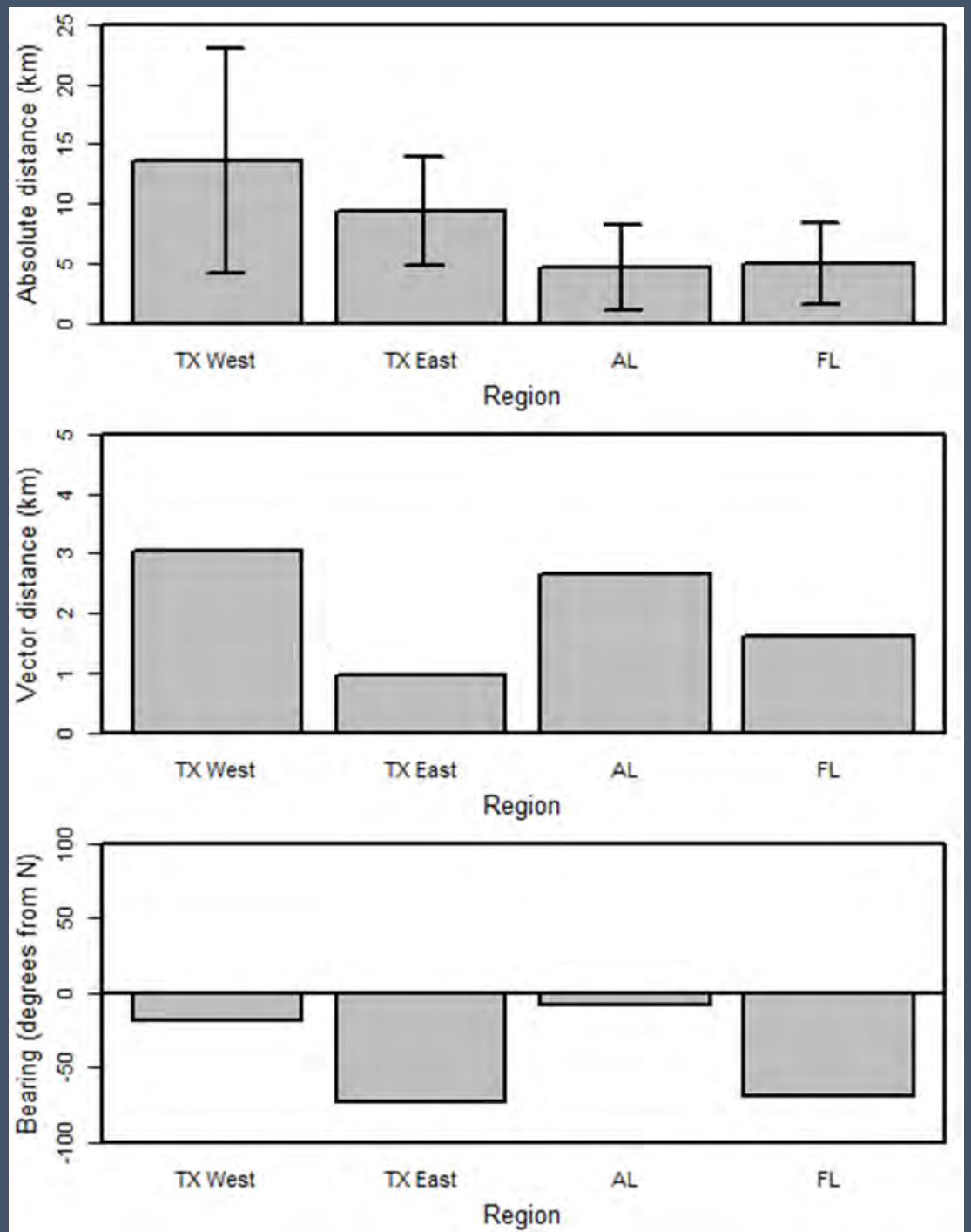
Discards

- 11 to 22% observed discard
- No relationship with length



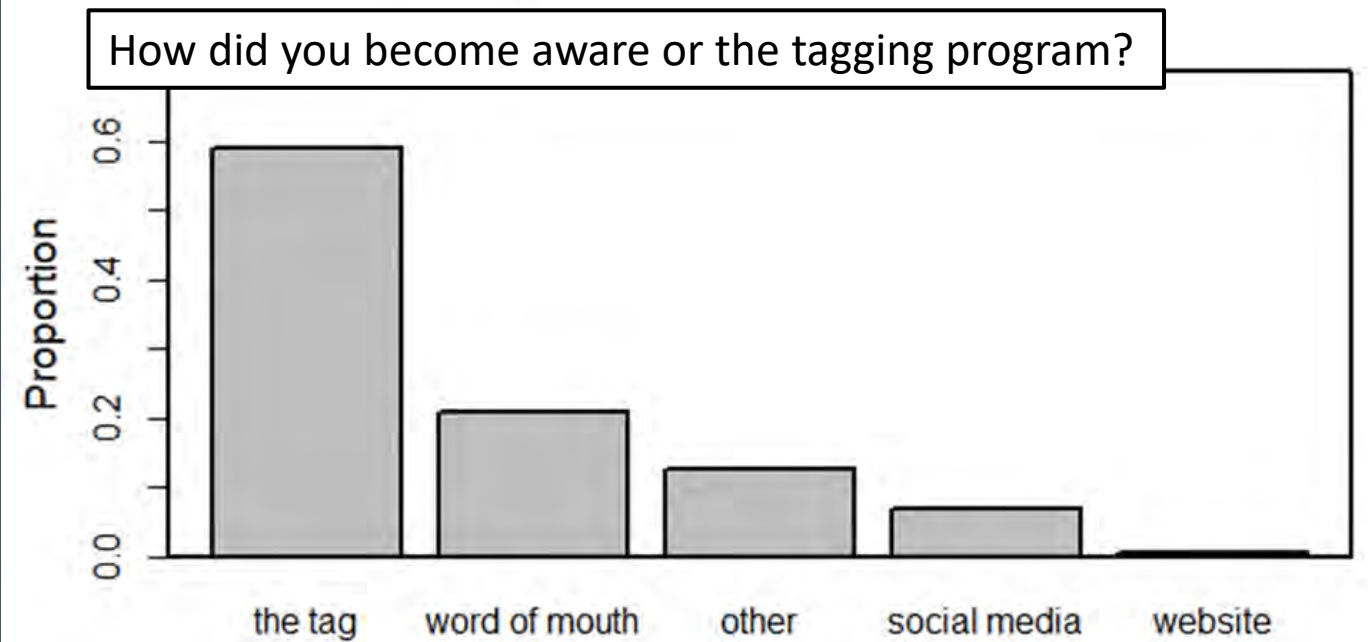
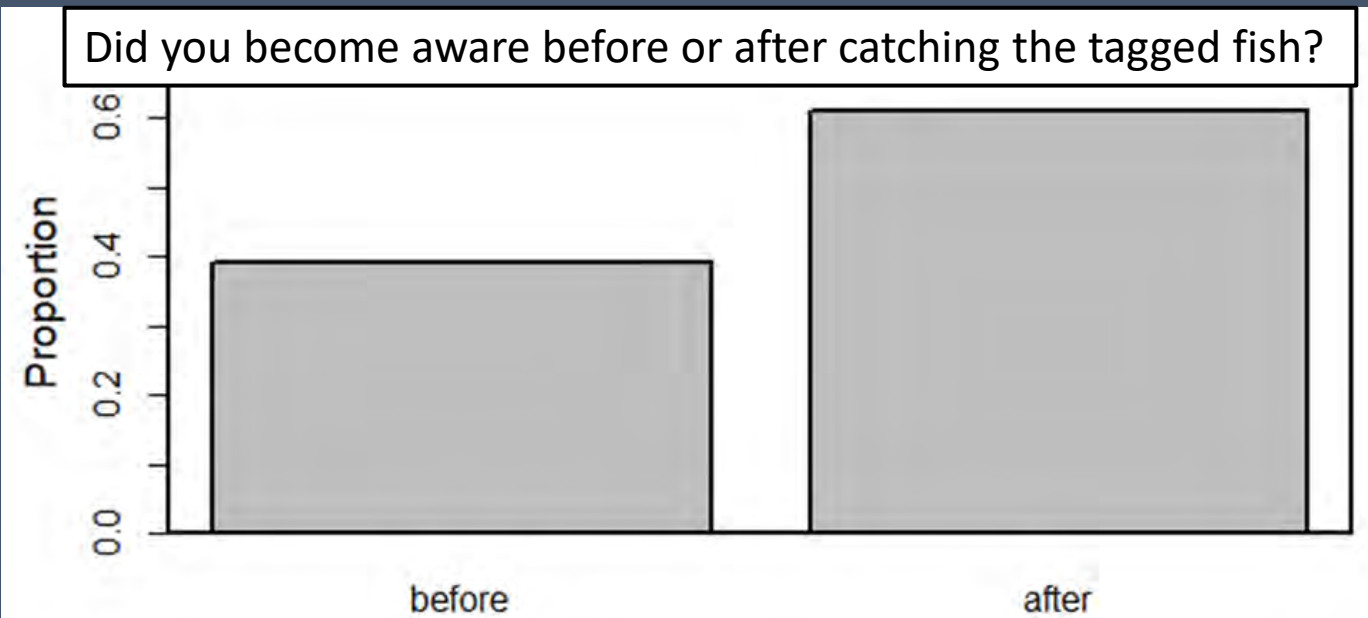
Movement

Release Region	Recapture Region			
	FL	AL	TX E	TX W
FL	95	0	0	0
AL	2	85	0	0
TX E	0	0	105	0
TX W	0	0	0	82



Angler Awareness of High-Reward Tagging

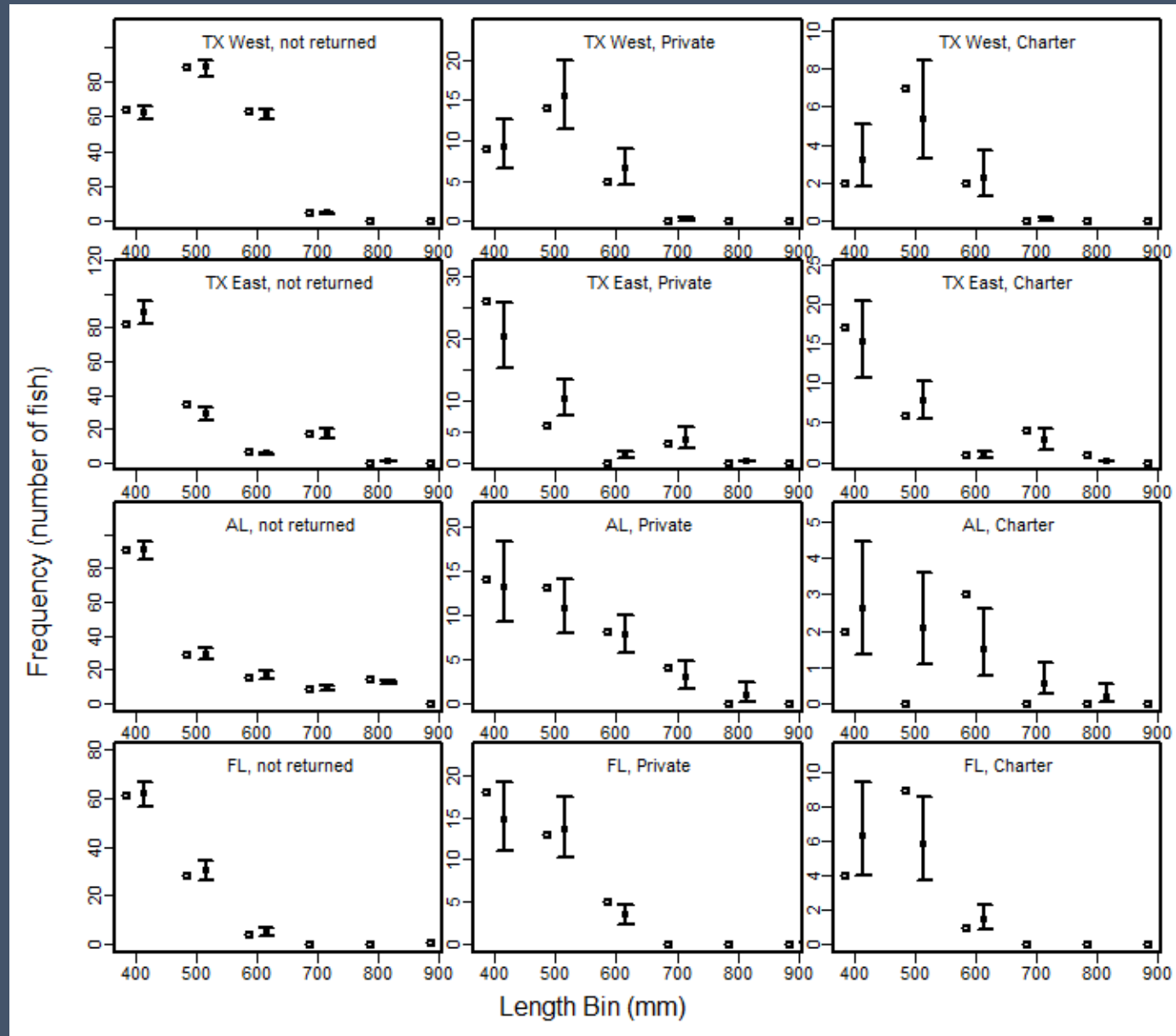
- A majority became aware by reading the tag
- Social media and website <10%
- Reporting rate?



Summary and Conclusions

- High exploitation rates at these shallow reef sites
 - Similar to 2016-18 tagging in AL
- Modest and noisy negative effect of distance to nearest port
 - Quantification of potentially protective distance effect
- Dome-shaped vulnerability – similar to 2016-18 tagging in AL
 - Real or size-based discarding/reporting?
- Minimal movement
- Anglers learned about the GRSC Tagging Program primarily by reading the tag on a captured fish

Observed vs. Predicted: Single-Tagged Fish



Observed vs. Predicted: Double-Tagged Fish

