

Permit *Trachinotus falcatus* spawning aggregation length distributions in response to the Western Dry Rocks seasonal fishing closure

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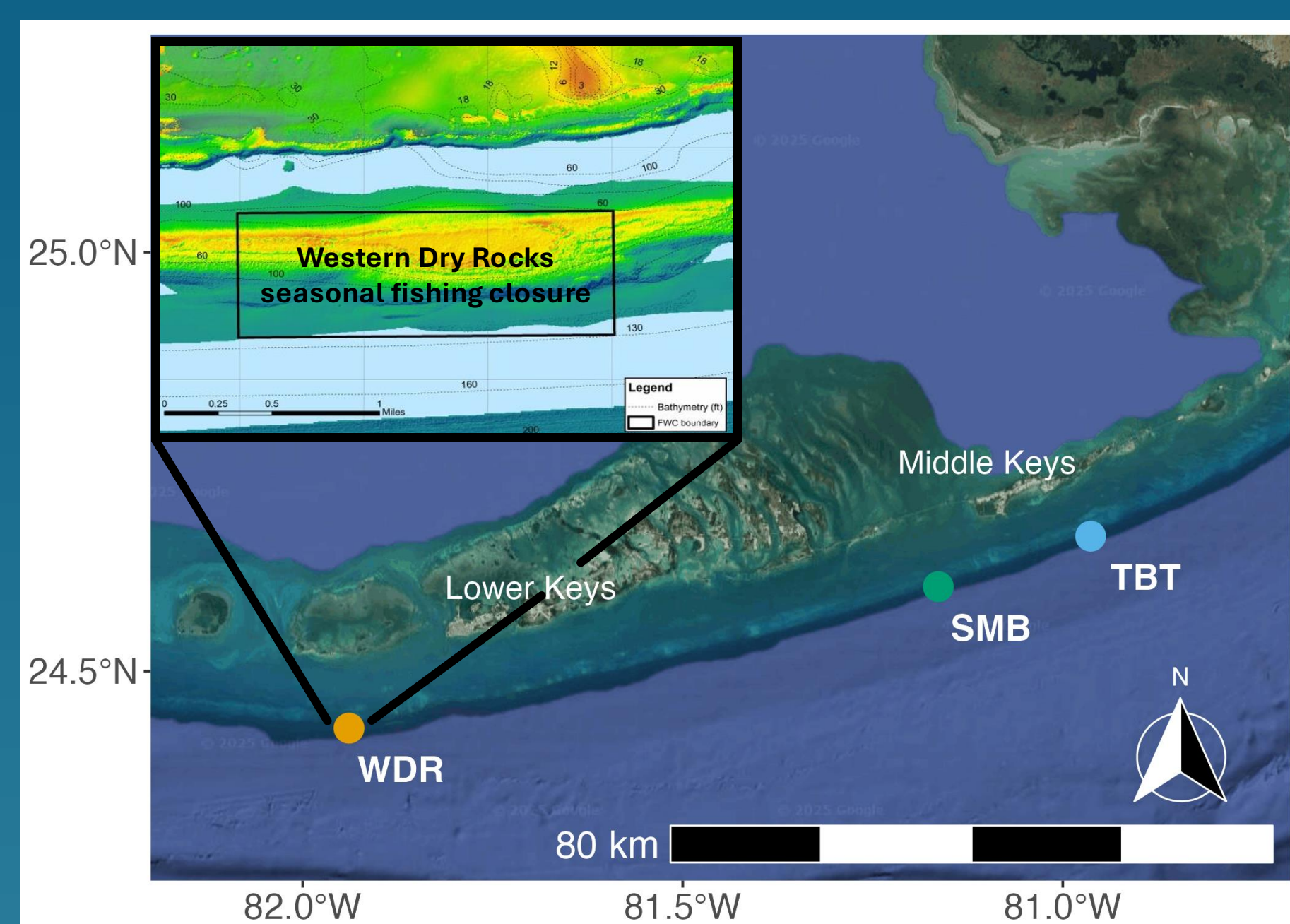
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1. Background

- Permit aggregate on natural and artificial reefs to spawn during the spring full moons (Mar-Jun) in the Florida Keys¹
- High depredation mortality at Western Dry Rocks (WDR) may undermine Permit spawning season harvest prohibition
- WDR multi-species spawning aggregation
 - Seasonal fishing closure (SFC) Apr 1-Jul 31 established in 2021
 - Will be dissolved after 2028 if deemed ineffective
- Monitor length frequency distributions and abundance to evaluate response to SFC (4 years since est.)
 - Permit reach maturity after ~3 years²



2. Fishery-independent surveys

- Rod-and-reel surveys
- Multibeam imaging sonar
- Video surveys



References

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- Crabtree, R.E., et al. 2002. Age, growth, and reproduction of Permit (*Trachinotus falcatus*) in Florida waters. *Fish. Bull.* 100, 26–34.
- Langlois, T.J., et al. 2012. Similarities between Line Fishing and Baited Stereo-Video Estimations of Length-Frequency: Novel Application of Kernel Density Estimates. *PLoS One* 7, 1–9.
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Support

- Florida Fish and Wildlife Conservation Commission
- Bonefish & Tarpon Trust
- International SeaKeepers Society

3. Questions

- How does Permit fork length and abundance change interannually:
 - at the WDR spawning aggregation (pre- and post-SFC)?
 - at Middle Keys spawning aggregations (openly fished)?
- Are interannual changes in Permit fork length due to differences in the number of:
 - large individuals (>70 cm)?
 - small individuals (<62 cm)?

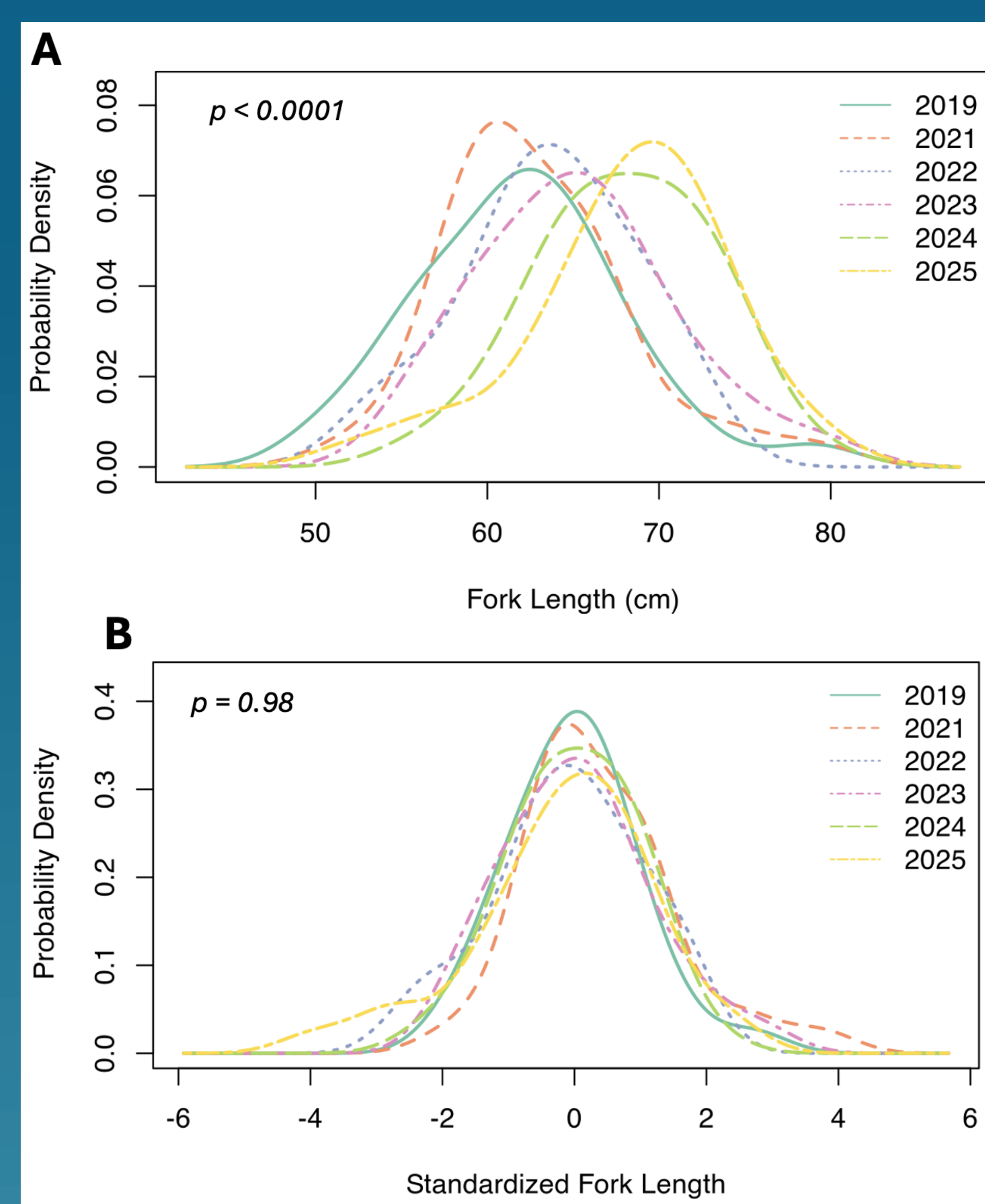


Figure 1. Comparison of kernel density estimate (KDE) probability density function for A) raw fork length and B) standardized fork length of WDR Permit. Significance tests (p-value) were based on permutation tests of the area between the probability density functions.³

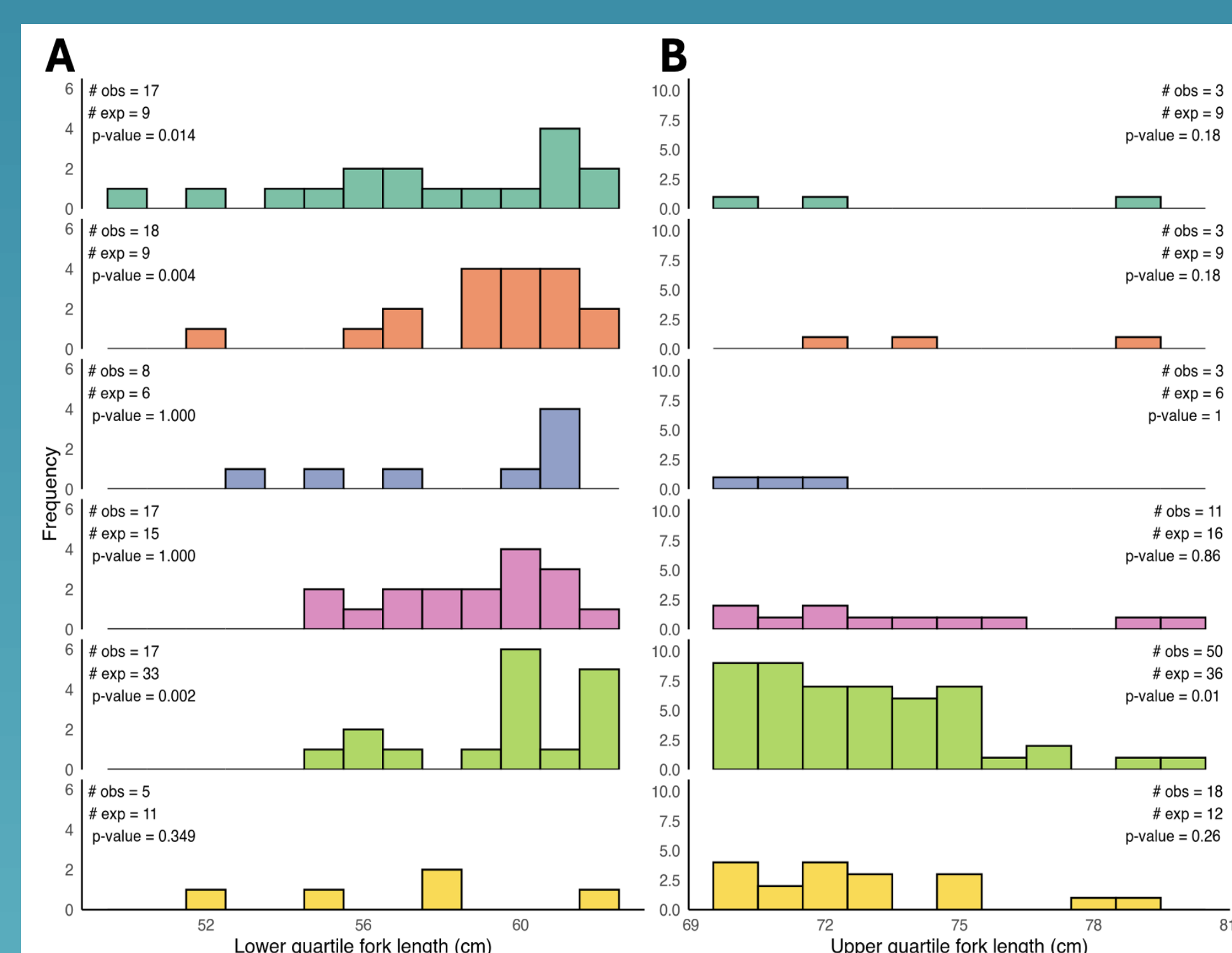


Figure 2. WDR Permit fork length frequency of A) lower quartile (<62 cm) and B) upper quartile (>70 cm) fish across surveys years. Chi-square goodness of fit test results are denoted on each plot, and p-value indicates post hoc pairwise comparison with Bonferroni correction ($\alpha = 0.05$).⁴

4. Results

Fork length

- 296 Permit measured
- Permit fork length increased since the WDR SFC was established (ANOVA : $p < 0.0001$)
- Size structure shifted right (K-S, KDE: $p < 0.0001$) but shape remains the same (KDE: $p = 0.98$)
 - More large fish and fewer small fish over recent years
- Middle Keys size structure does not differ interannually (ANOVA: $p = 0.08$)

Abundance

- No interannual differences (ANOVA: $p = 0.25$)
 - Abundance has remained stable since SFC
- Peak abundance in March & April (ANOVA: $p = 0.007$)
 - Seasonal > annual variation

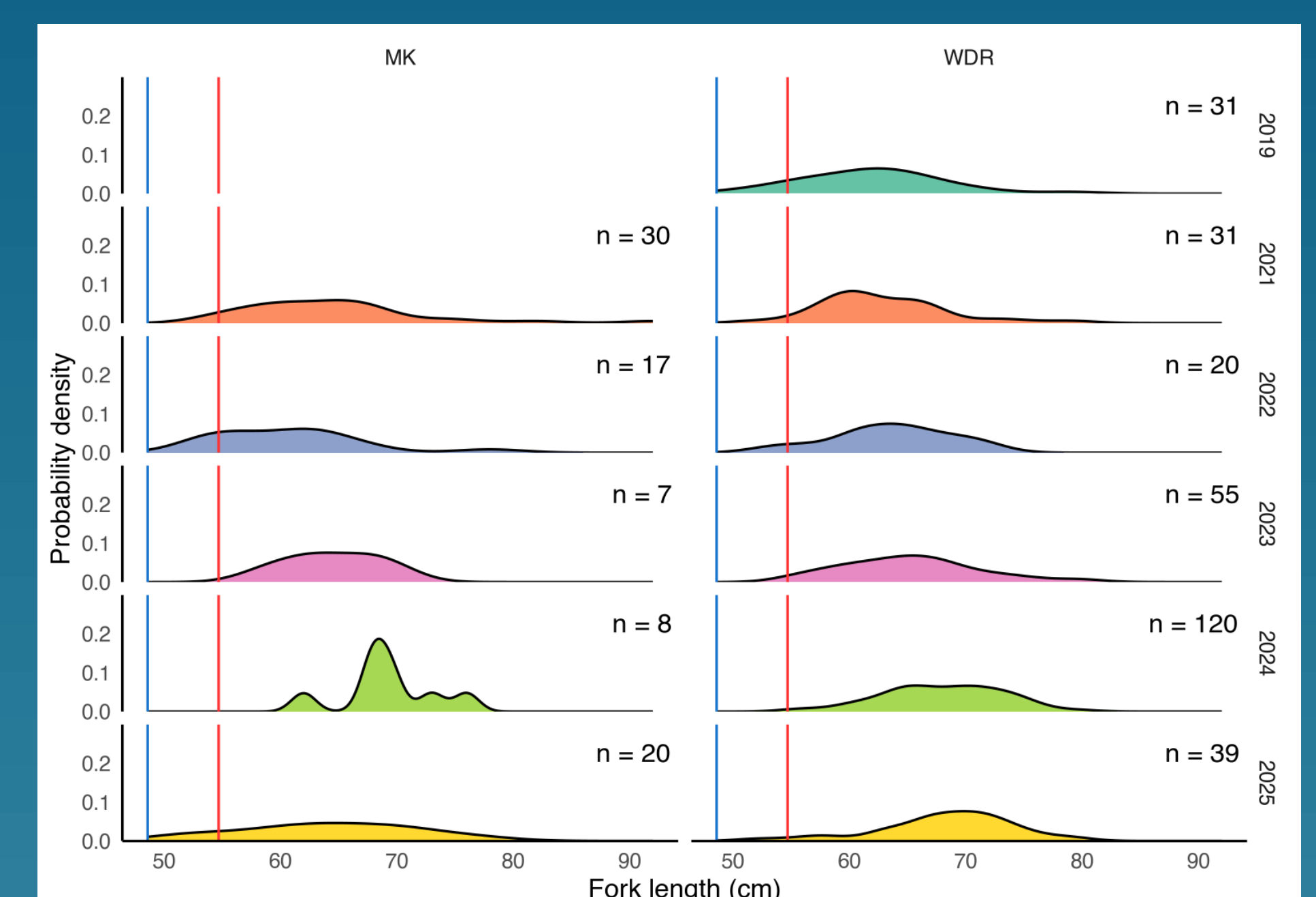


Figure 3. Probability density function for Permit fork length across years in the Middle Keys (MK; openly fished) and WDR. Blue and red lines denote size at 50% maturity for males and females, respectively (Crabtree et al., 2002).

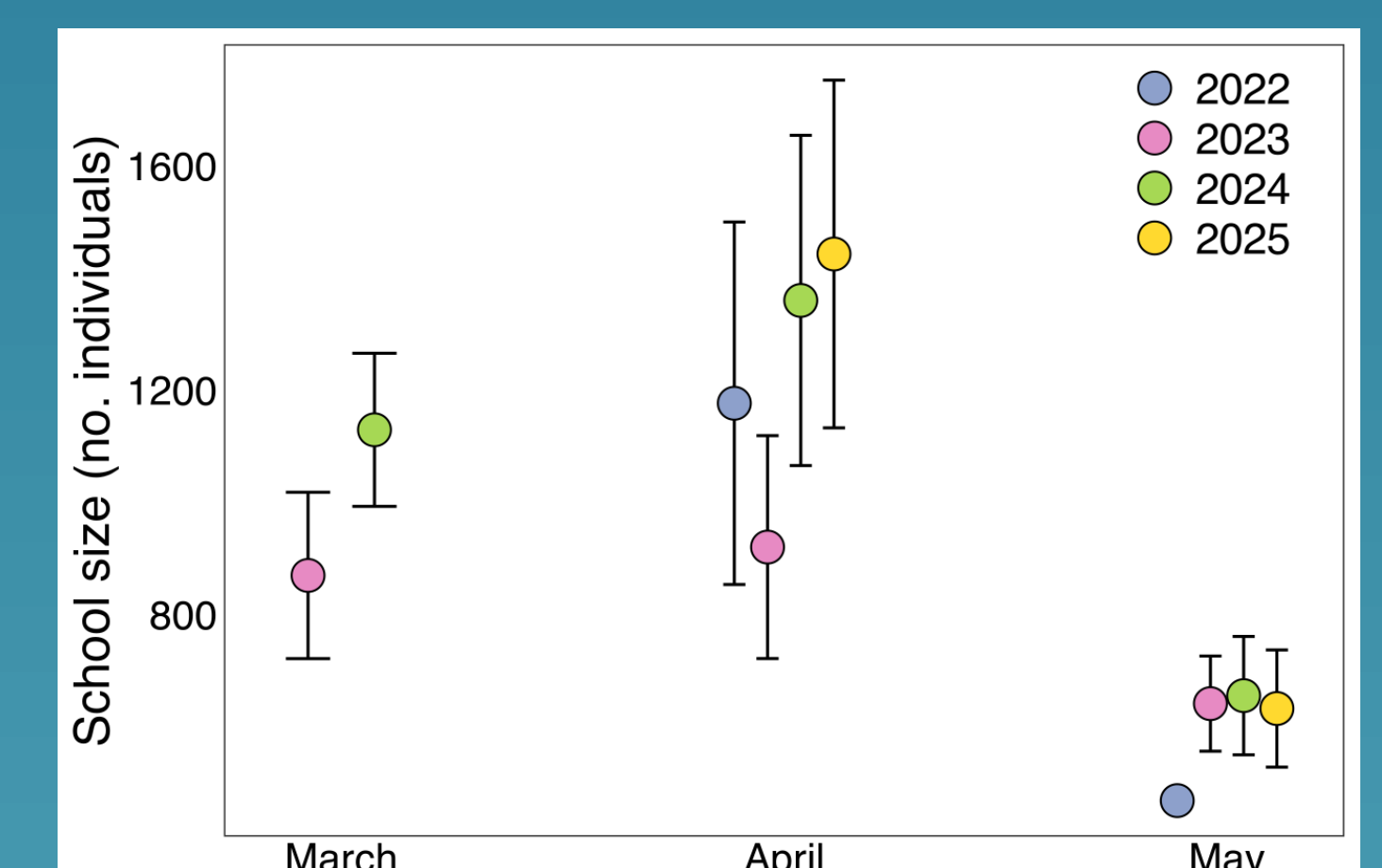


Figure 4. WDR Permit abundance (mean $\pm$ std. error) after the establishment of the SFC (1 Apr 2021). Interannual p-value = 0.25; seasonal p-value = 0.007.

5. Conclusions

- WDR SFC resulted in larger, more fecund Permit
- Positive implications for reproductive potential
- No signs of increased recruitment or abundance
- Need continued monitoring to document new size classes at the WDR aggregation

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