

QUILLBACK ROCKFISH ROV LENGTH DATA STRATIFICATION BY LATITUDE AND DEPTH



Length Analysis Introduction

Data

- Quillback rockfish length data from California Marine Applied Research and Exploration (MARE) Remotely Operated Vehicle (ROV)
- ROV Stereo Cameras and analytical software used to measure fish length of fish in suitable orientations

Methodology

- **Goal:** Identify differences in length distributions across latitudinal and depth strata for design-based methods of estimates of abundance
- **Statistical Analysis:** Kolmogorov-Smirnov (K-S) tests used to assess statistical significance of differences between various length frequency distributions.
- **Comparison:** MARE ROV length data visually compared with California Recreational Fisheries Survey (CRFS) data for validation

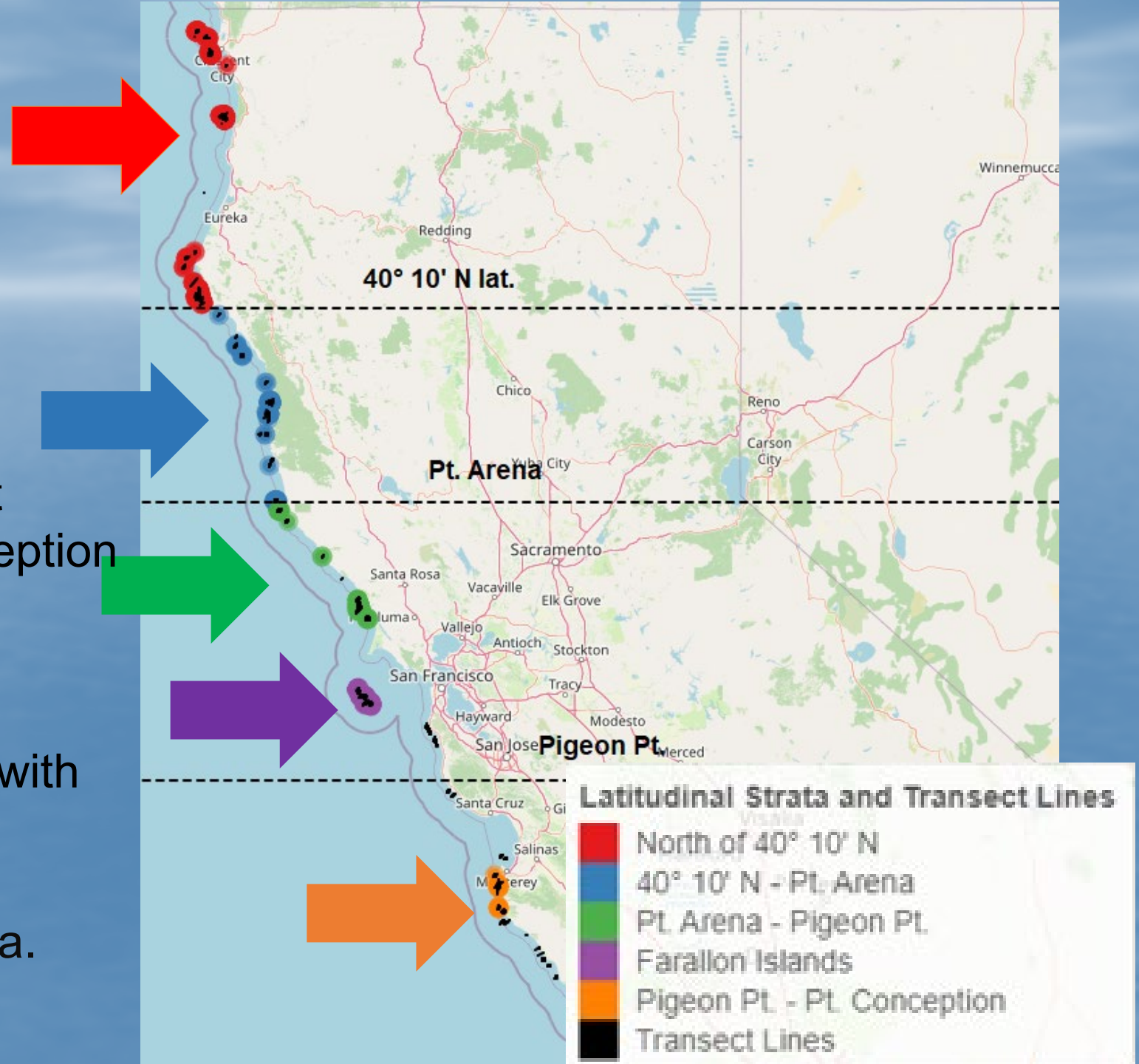
Latitudinal Strata Map

Strata

- North of 40°10' N
- 40°10' N to Point Arena
- Farallon Islands
- Point Arena to Pigeon Point
- Pigeon Point to Point Conception

Map Details

- Colored circles represent individual quillback rockfish with stereo length data
- Black dots represent ROV transects used to collect data.



Length Frequency Distributions (LFDs)

LFDs by Stratum

- Displays length frequency distributions from previously discussed strata.

Pattern

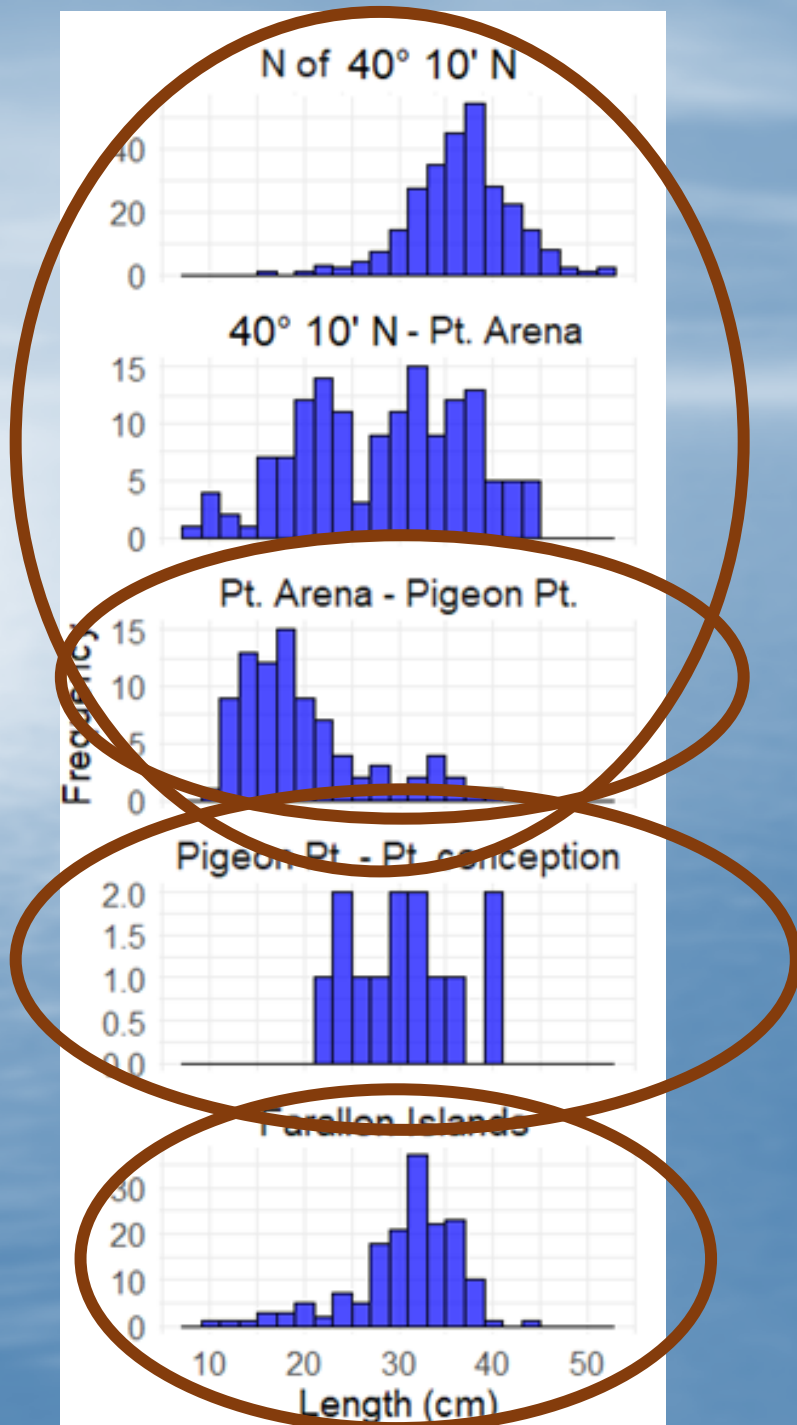
- Larger to smaller fish observed along the coast from North to South to Pigeon Point.

Pigeon Point to Point Conception

- Low sample size ($n = 13$), southern end of range.

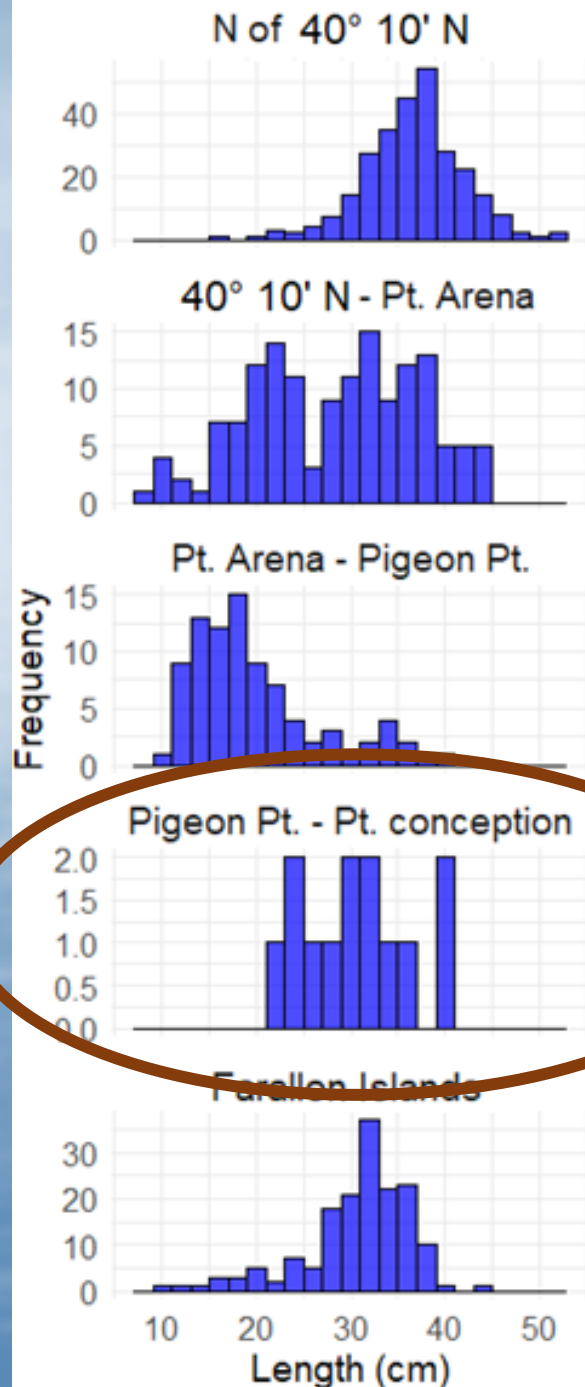
Farallon Islands

- Appear much different compared to the adjacent Point Arena – Pigeon Point stratum.

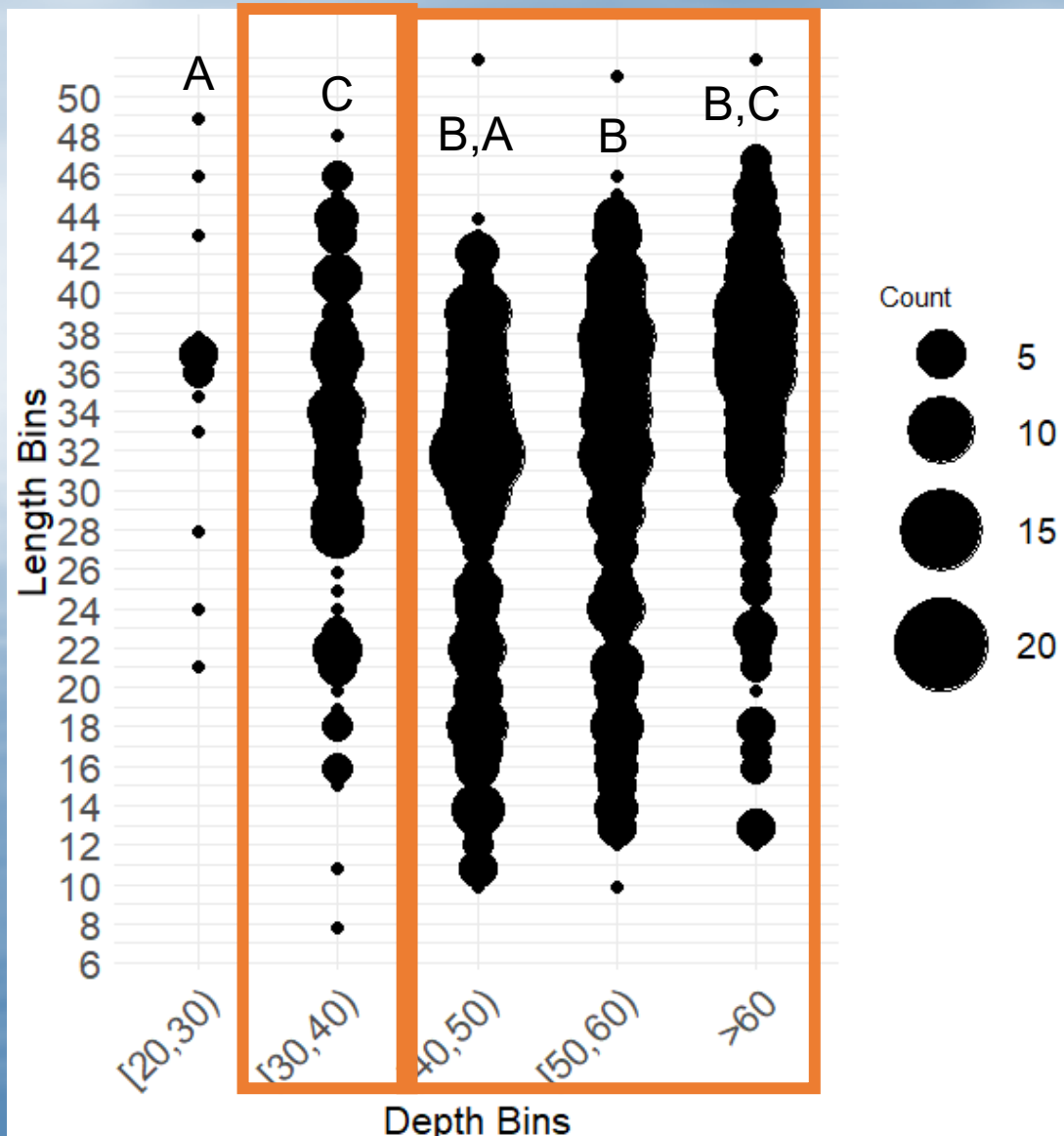


Kolmogorov-Smirnov Test Results

- Most LFDs are significantly different ($P < 0.05$) across strata
- Statistically significant differences observed in all other stratum combinations
- Exceptions: No significant difference in 2 of 4 combinations involving Pigeon Point – Point Conception stratum (low sample size, $n = 13$)



Coastwide LFDs: 10-meter Depth Strata



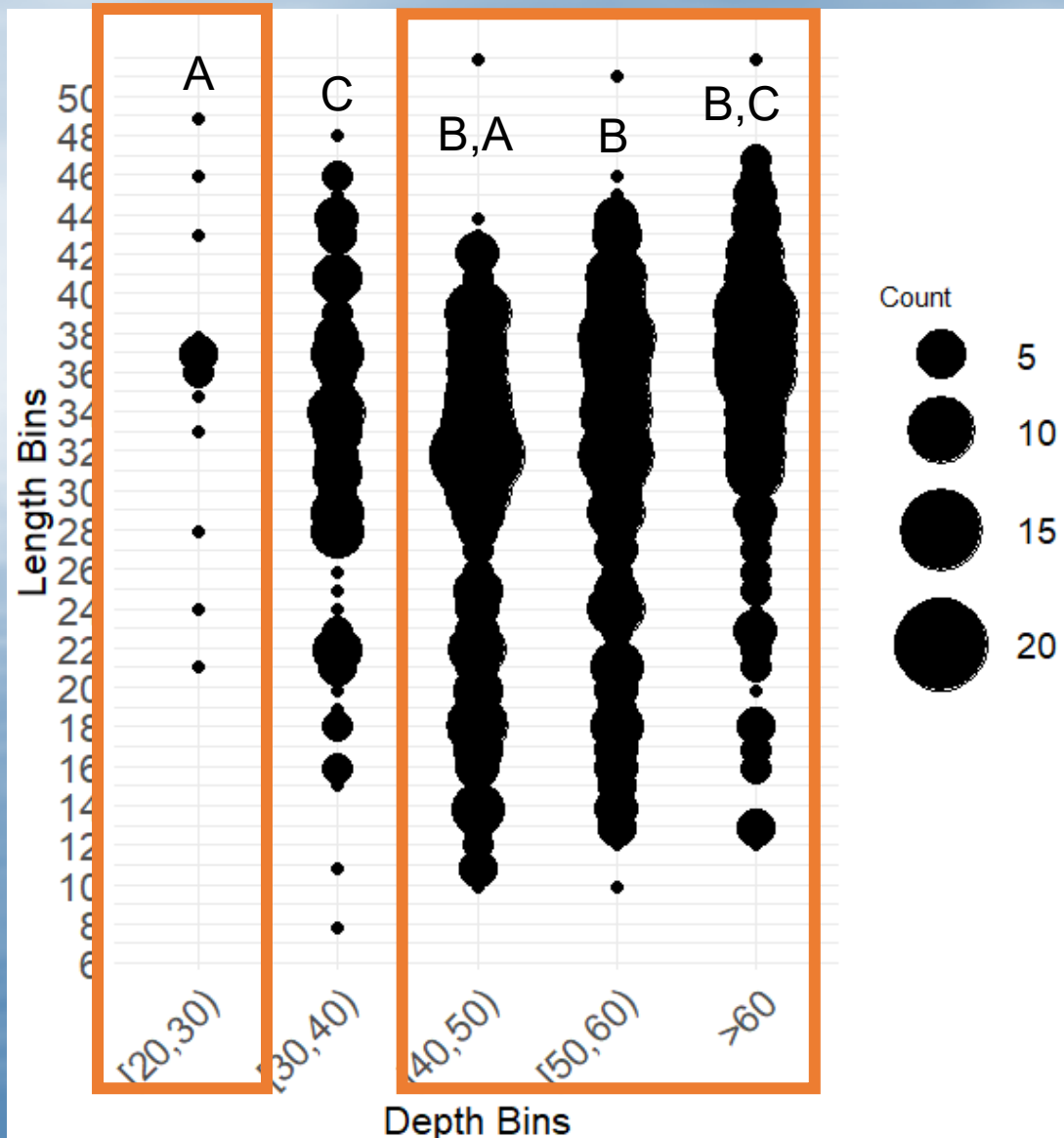
Pattern

- Deeper than 40 meters, size correlated with depth

Unexpected Result

- 30-40 meter stratum shows larger fish in shallower waters.
- Mainly from the North of 40°10' N stratum, aligning with anecdotal angler knowledge.

Coastwide LFDs: 10-meter Depth Strata



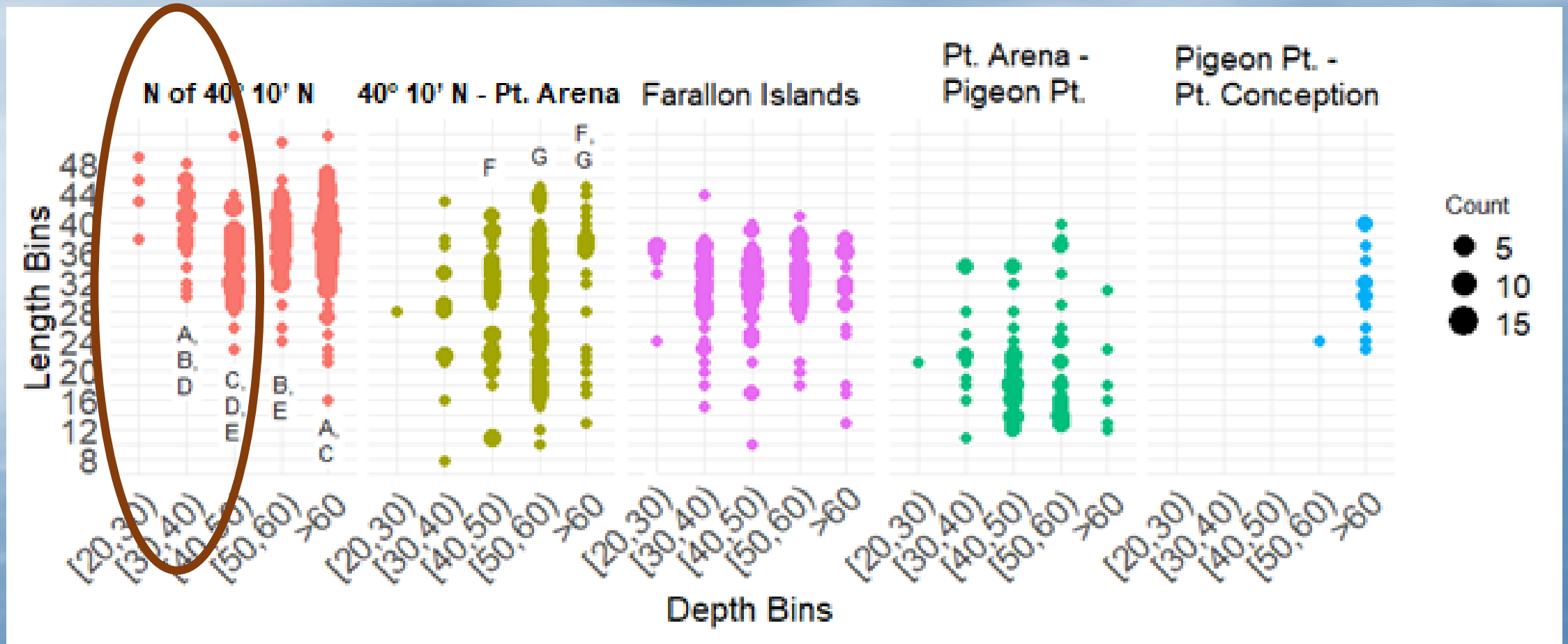
Low Sample Size: 20-30m

- The 20-30 meter stratum has a low sample size reflecting the range of this species.

Statistical Results

- Matching Letters indicate statistically significant differences ($p < 0.05$) between distributions.

LFDs: By Depth and Latitudinal Strata



- North of 4010 stratum contains most of the large fish in the 30–40 m depth range
- Matching letters indicate statistically significant differences within each latitudinal depth stratum.

ROV/CRFS COMPARISON

ROV/CRFS Comparison Introduction

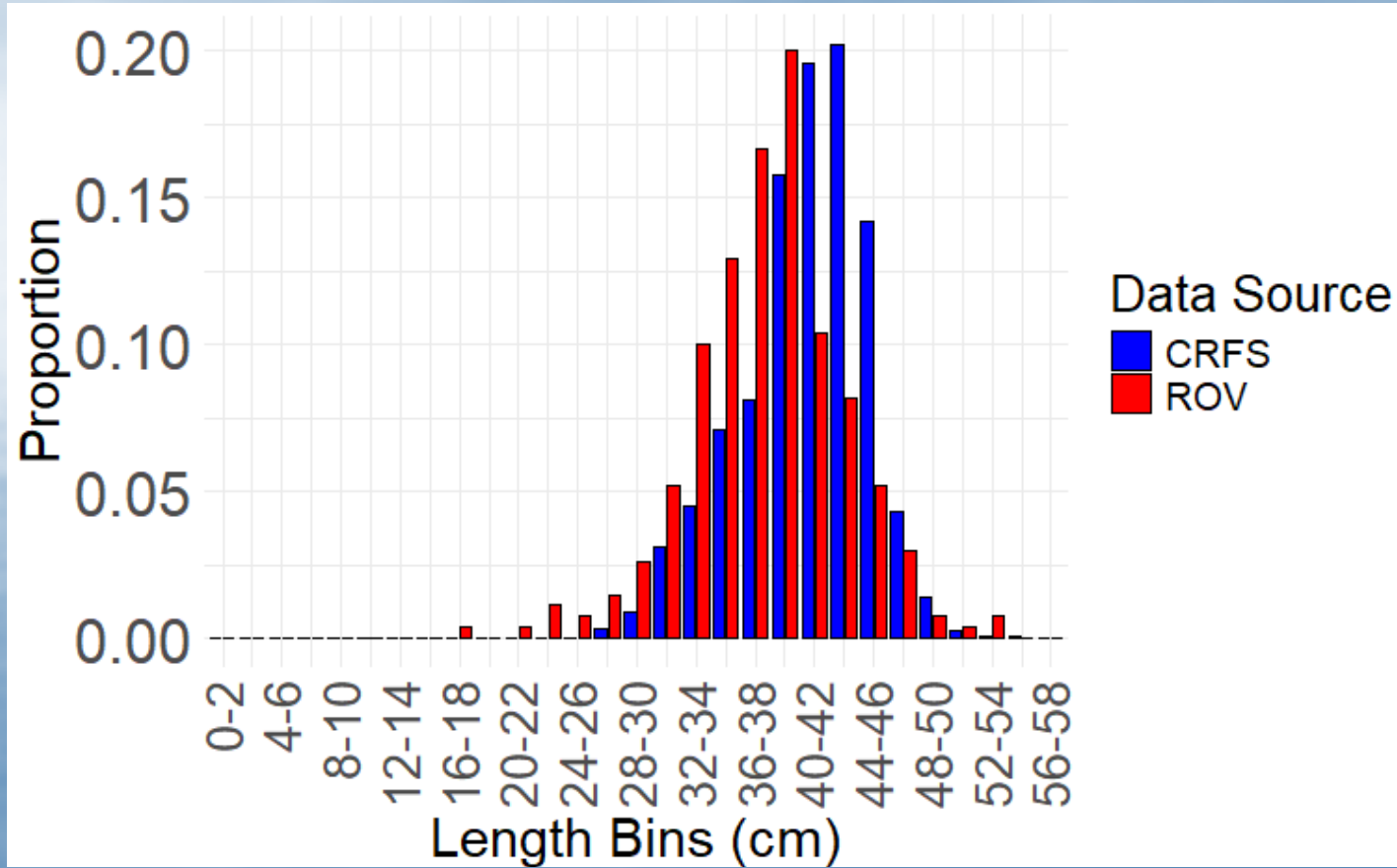
California Recreational Fisheries Survey (CRFS) Bio Data

- Quillback Rockfish
- Years 2014 – 2021

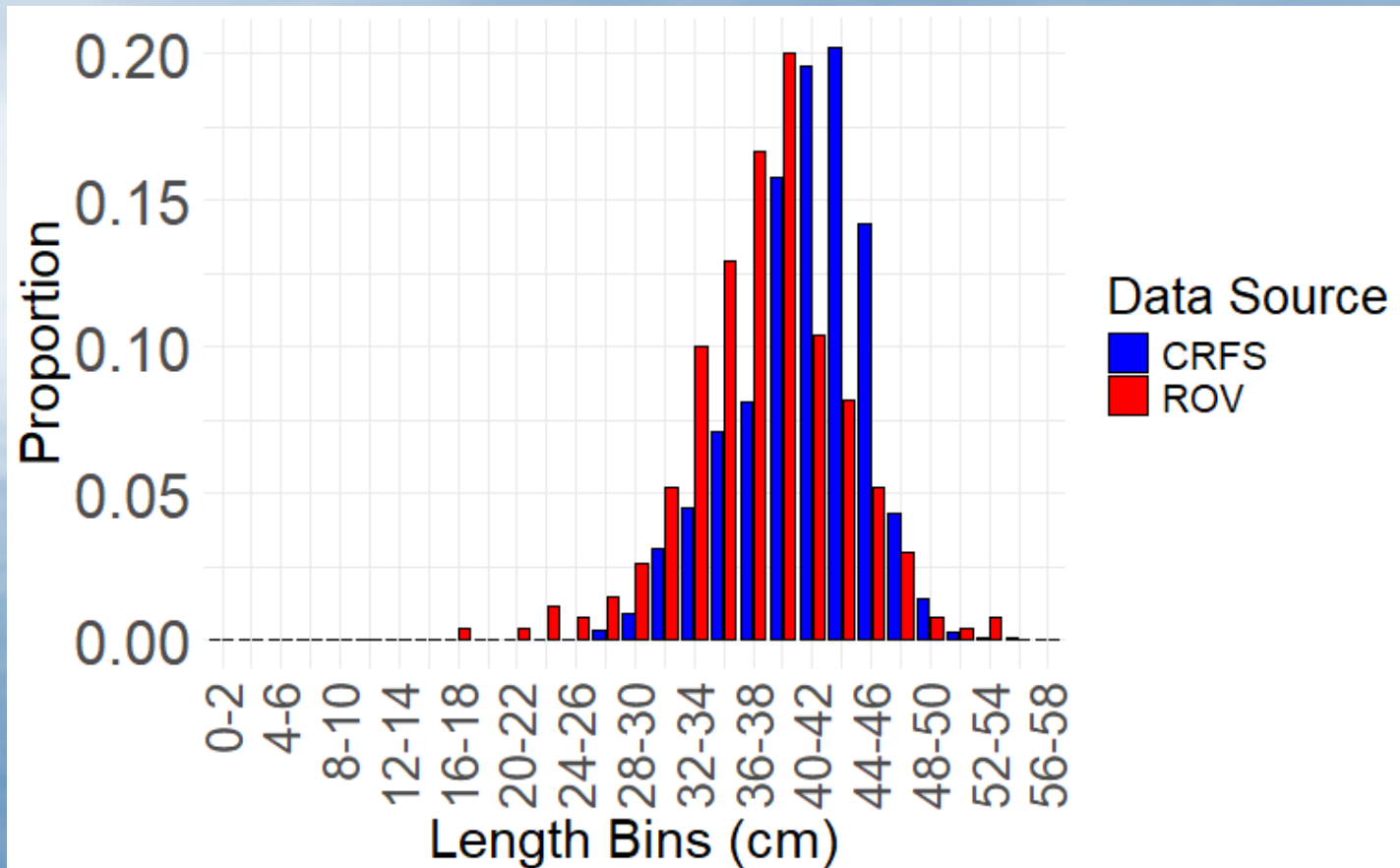
Matching Latitudinal Strata:

- RECFIN_PORT_NAMES matched to previously defined ROV strata.

Redwood (CRFS) North of 40°10' N (ROV)



Redwood (CRFS) North of 40°10' N (ROV)



CRFS

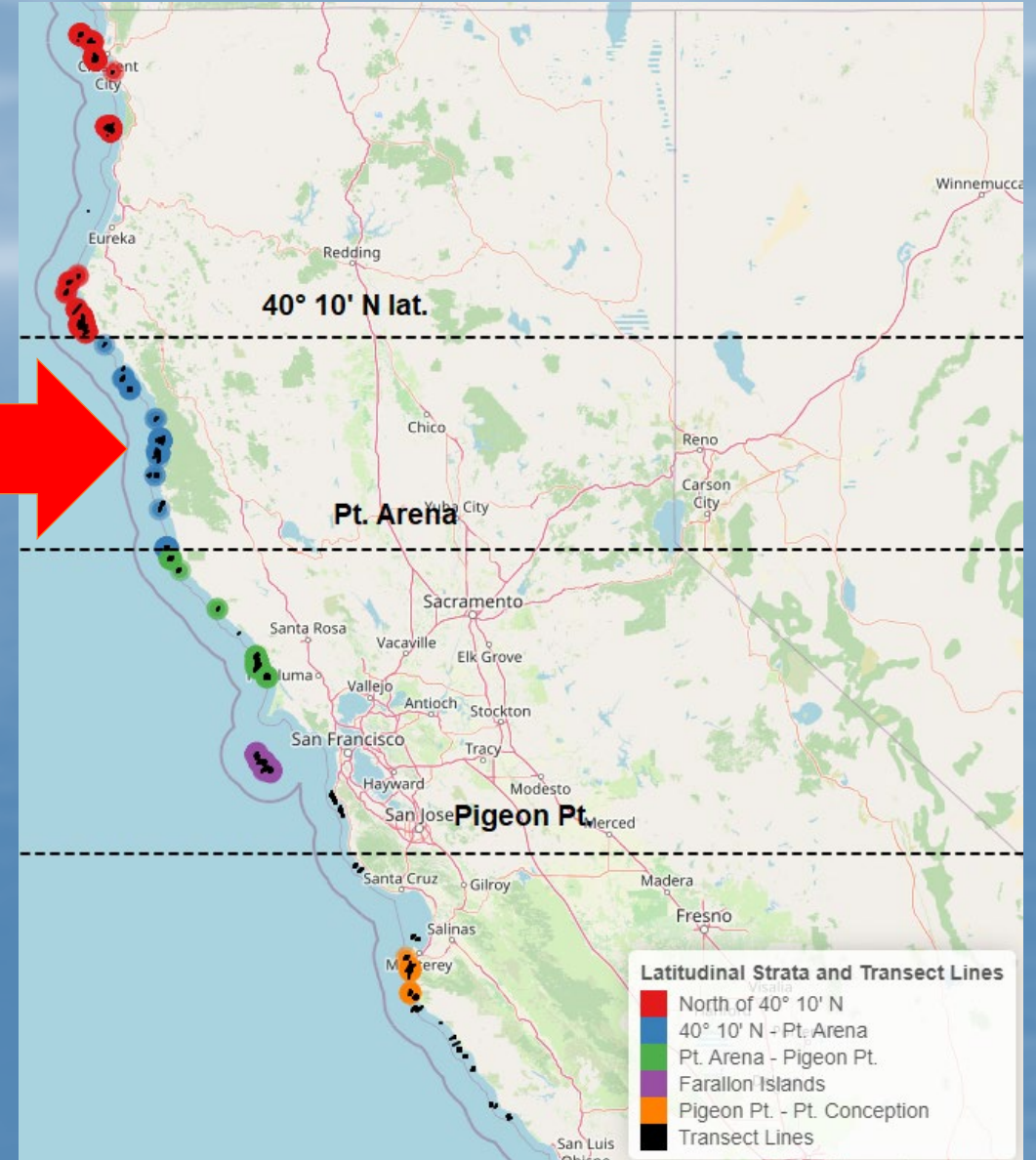
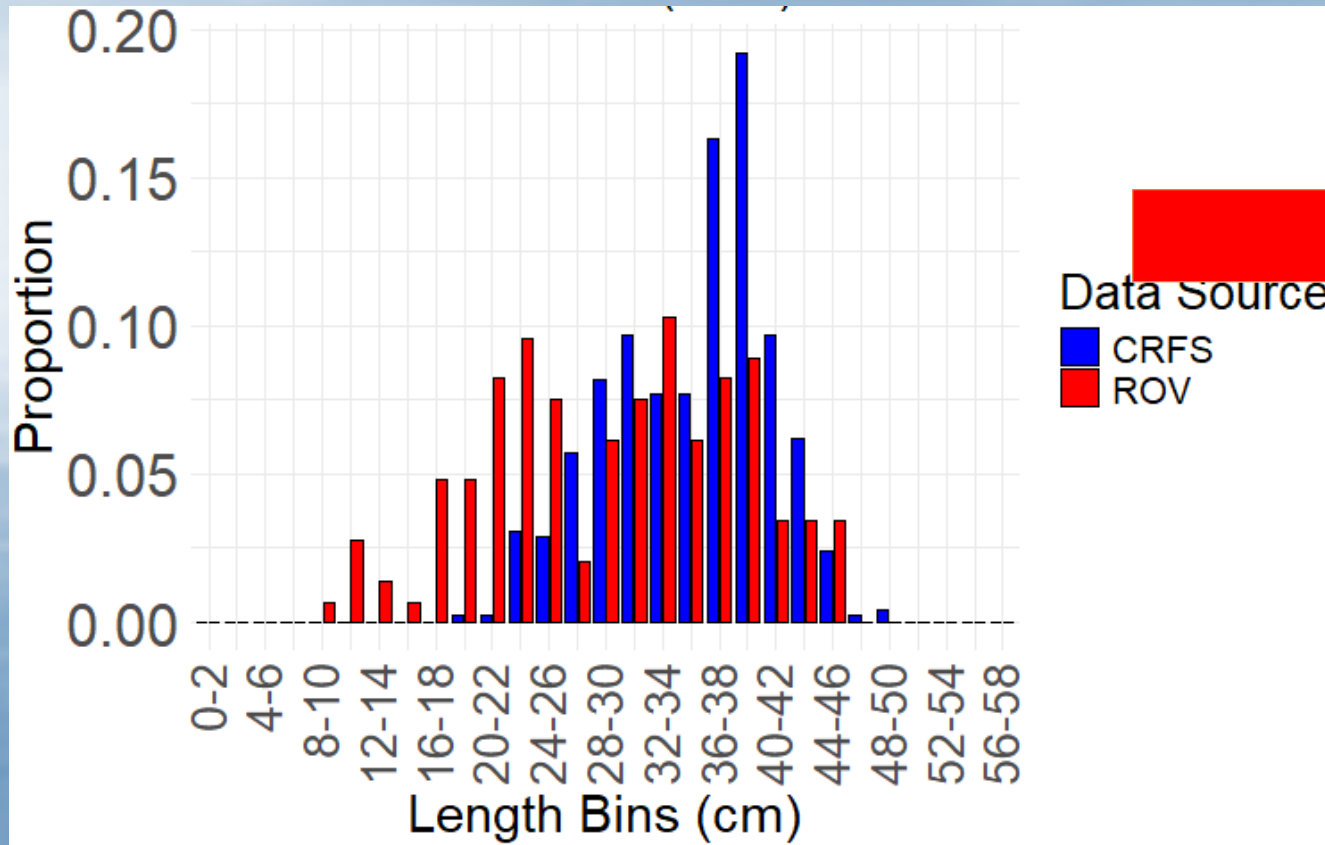
- Slight shift towards larger fish.
- Likely due to gear selectivity

Comparison:

- In general ROV and CRFS, in this stratum, have similar shapes

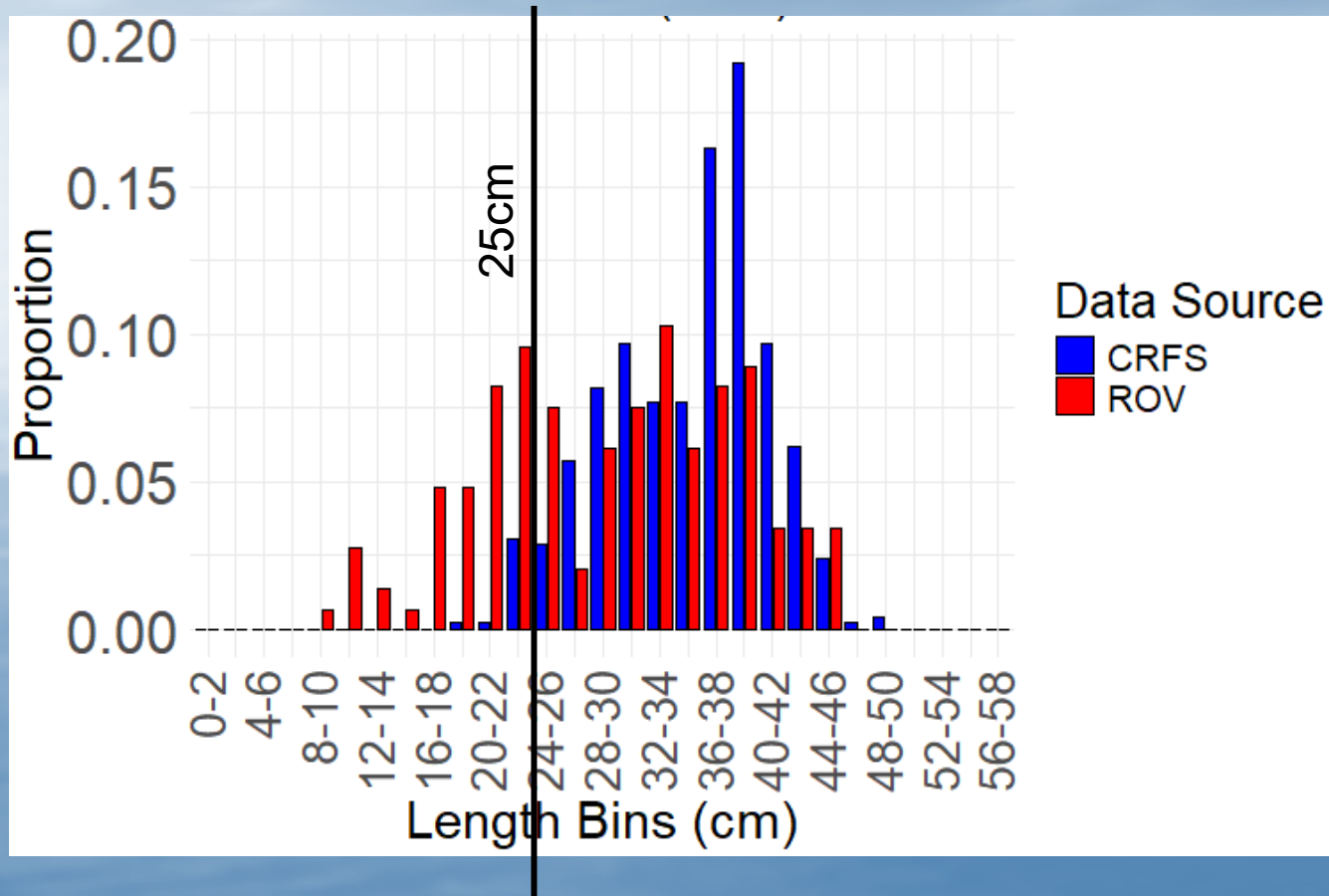
Wine (CRFS)

40°10' N – Pt. Arena (ROV)



Wine (CRFS)

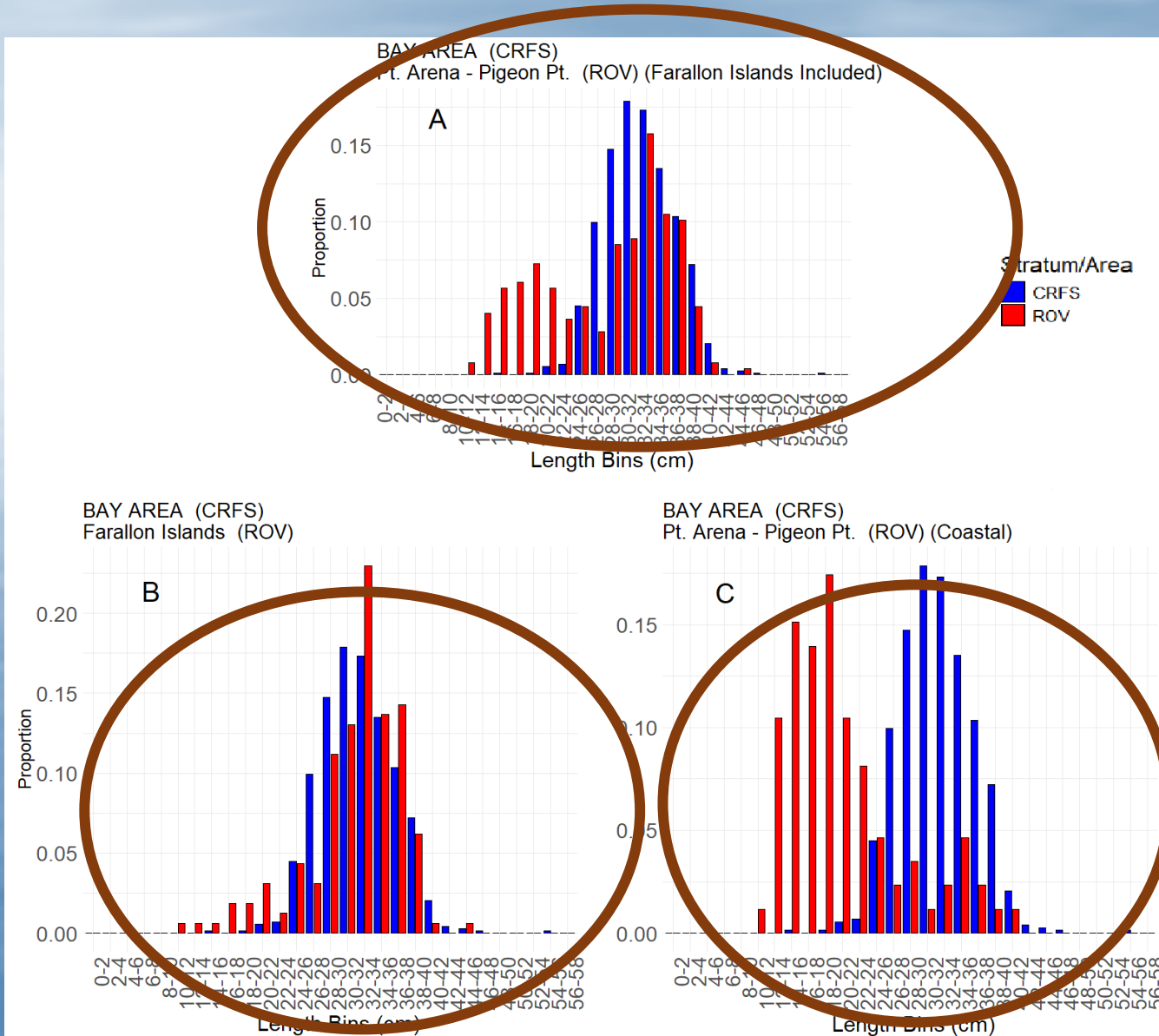
40°10' N – Pt. Arena (ROV)



Comparison

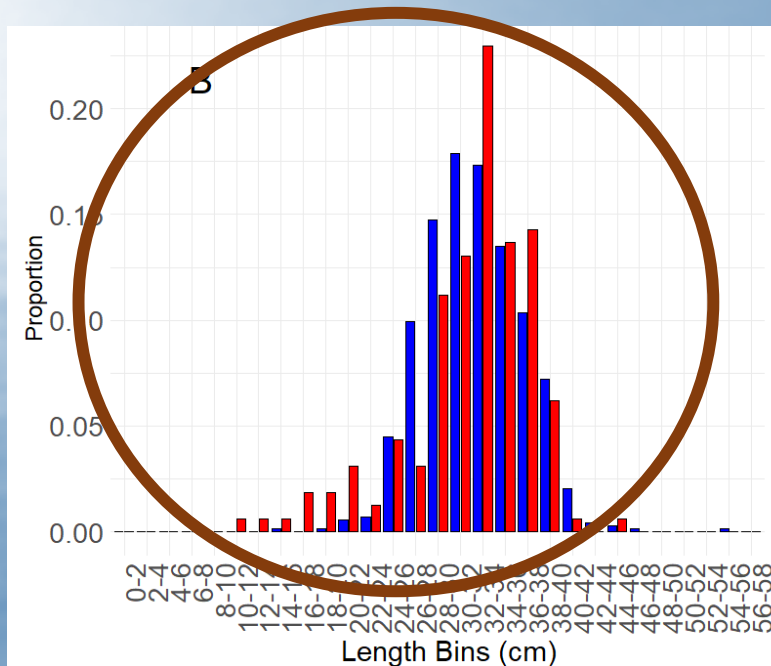
- ROV able to observe smaller fish.
- Spike in large fish seen in the CRFS data (selectivity)

Bay Area (CRFS) & Pt. Arena – Pigeon Pt (ROV)

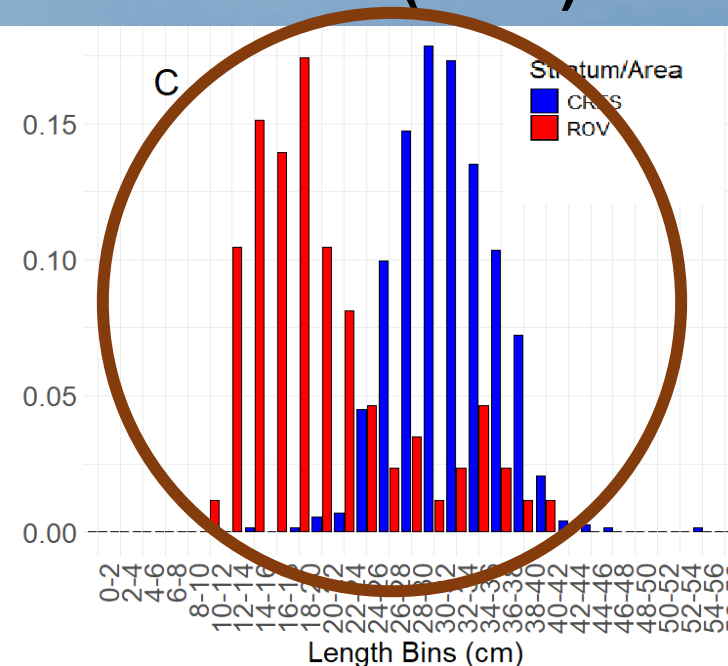


Bay Area (CRFS) & Pt. Arena – Pigeon Pt (ROV)

Bay Area (CRFS)
Farallon Islands (ROV)



Bay Area (CRFS)
Pt. Arena – Pigeon Pt.
Coastal (ROV)



Panel B (Left)

- Distributions appear relatively similar

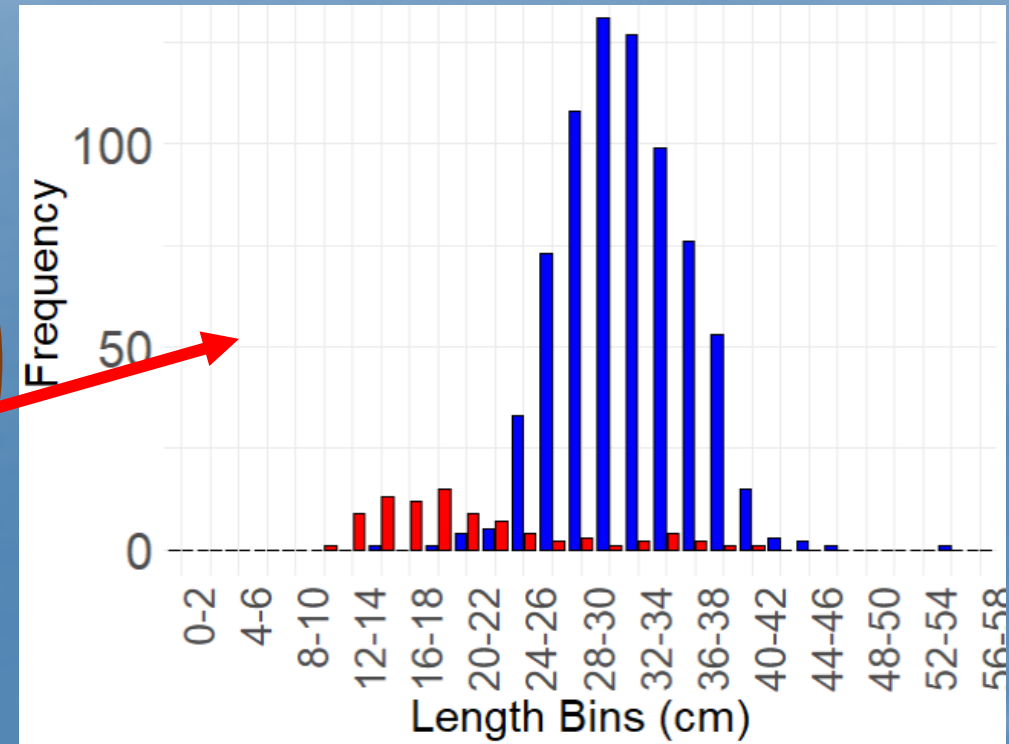
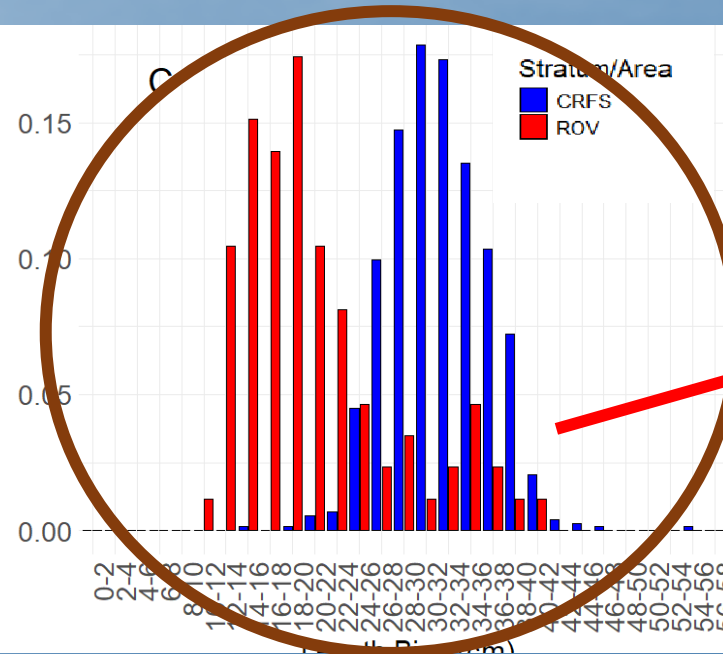
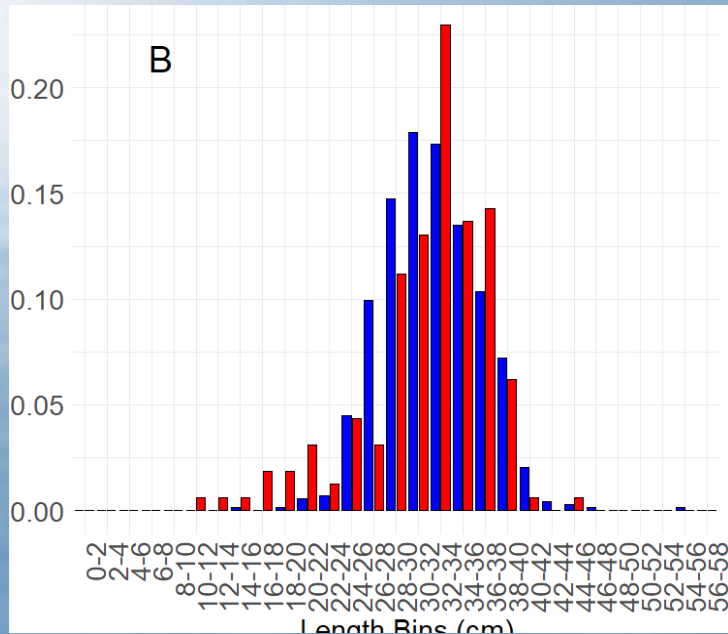
Panel C (Right)

- ROV contains mainly small fish.

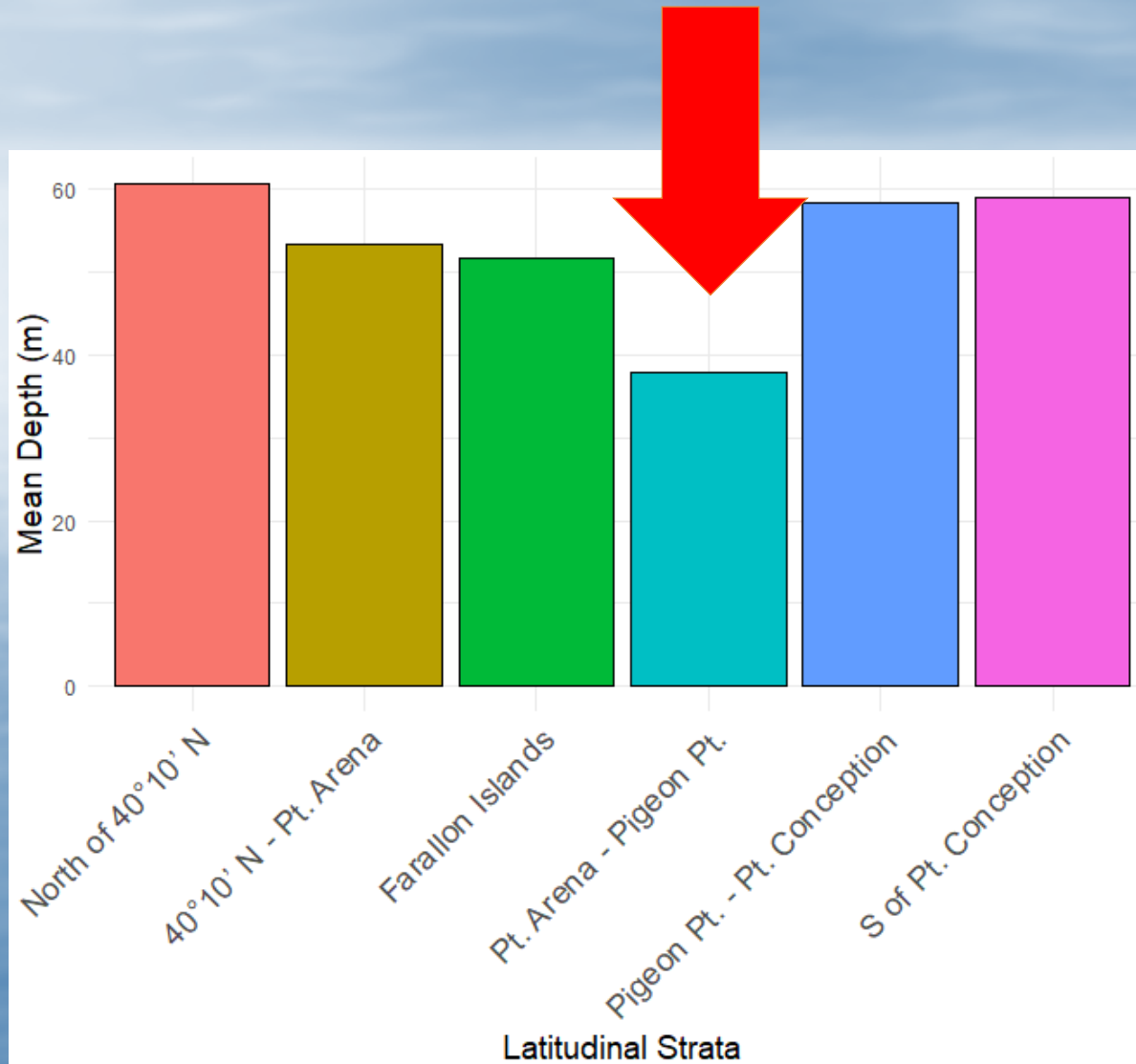
Bay Area (CRFS) & Pt. Arena – Pigeon Pt (ROV)

Bay Area (CRFS)
Farallon Islands (ROV)

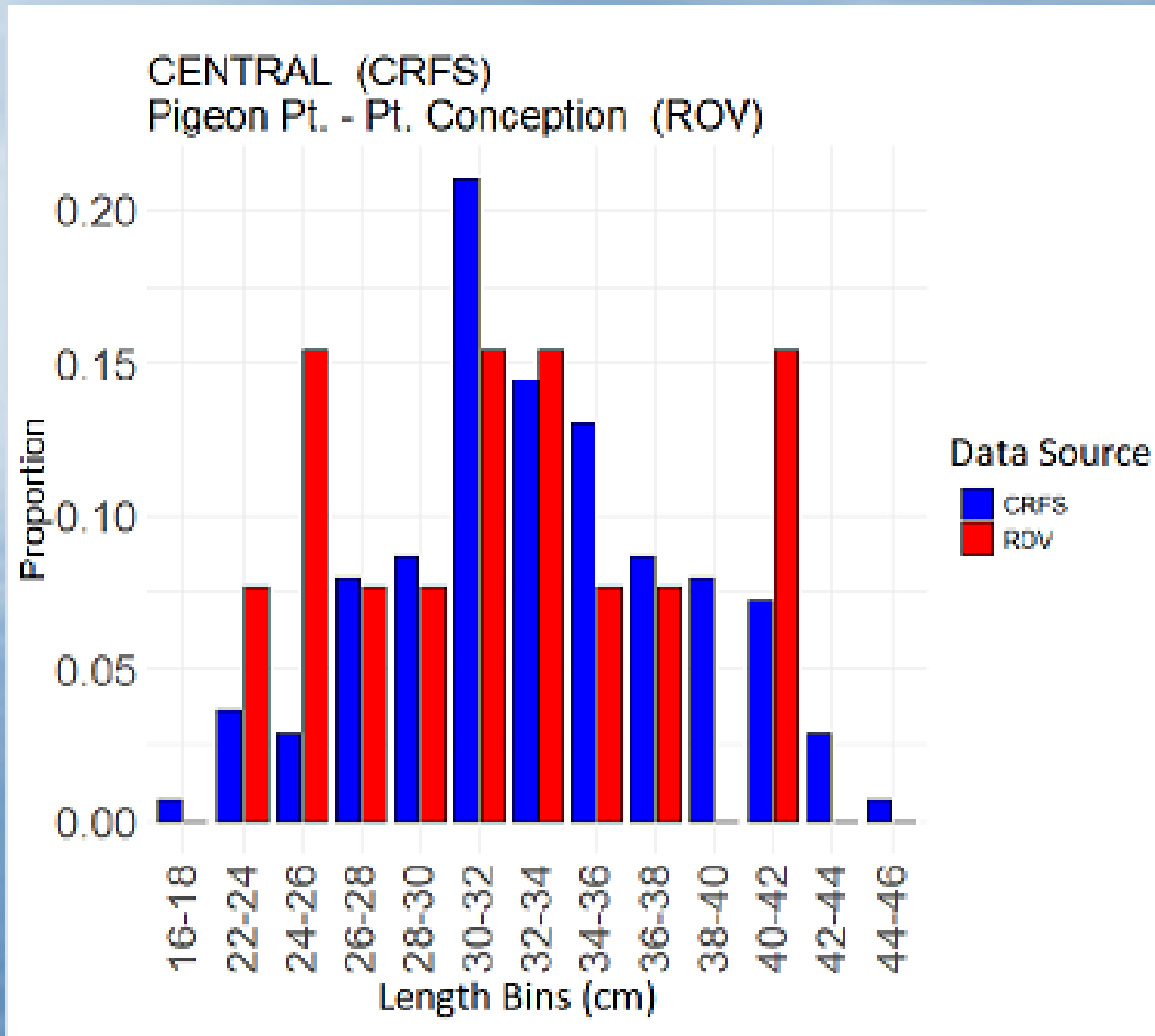
Bay Area (CRFS)
Pt. Arena – Pigeon Pt.
Coastal (ROV)



Pt. Arena – Pigeon Pt. (ROV) Small Fish



Central (CRFS) & Pigeon Pt. – Pt. Conception (ROV)



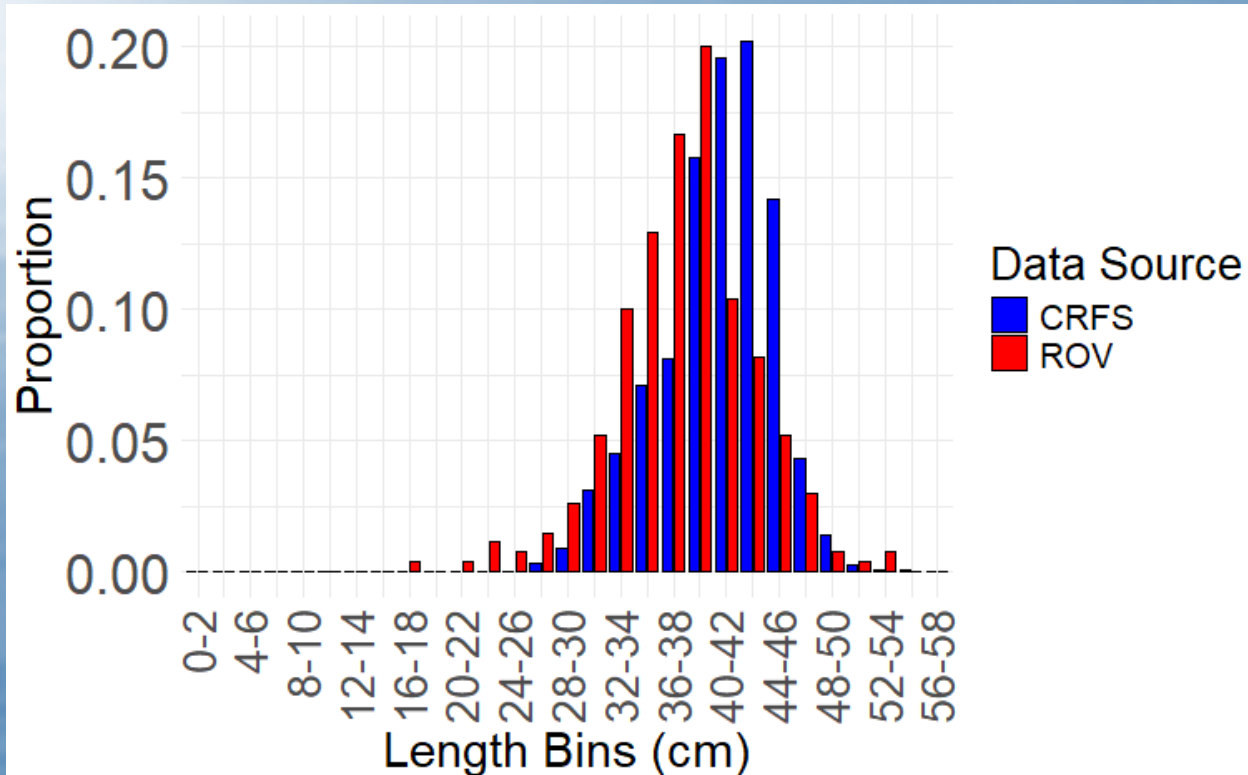
Key Takeaway

- Despite small sample sizes, the distributions appear very similar.

ROV/CRFS Comparison

Conclusions

Redwood (CRFS)
North of 40°10' N (ROV)

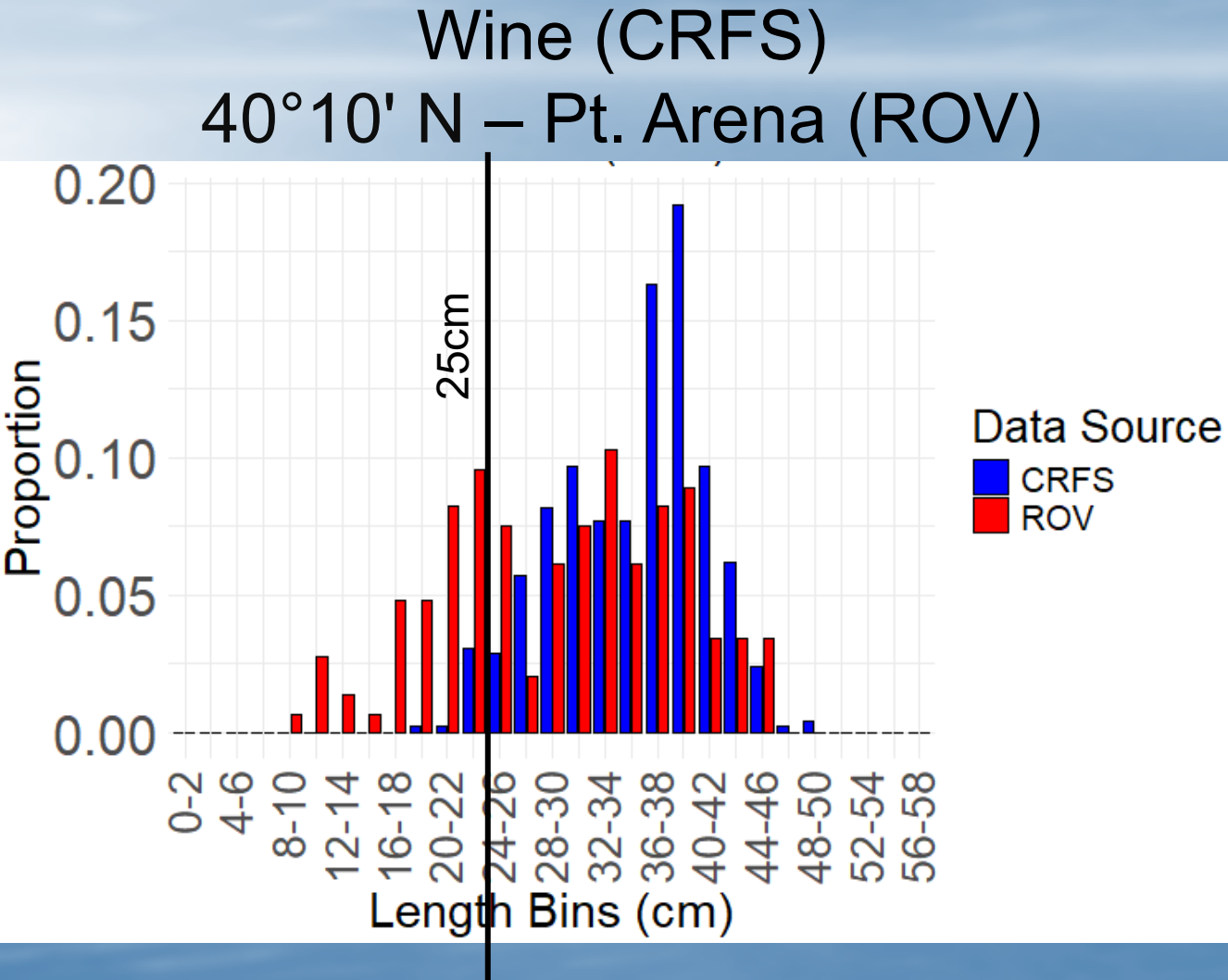


Validate the ROV data

- Issues due to uncertainty in CRFS data
- Highlights need for increased ROV sampling

ROV/CRFS Comparison

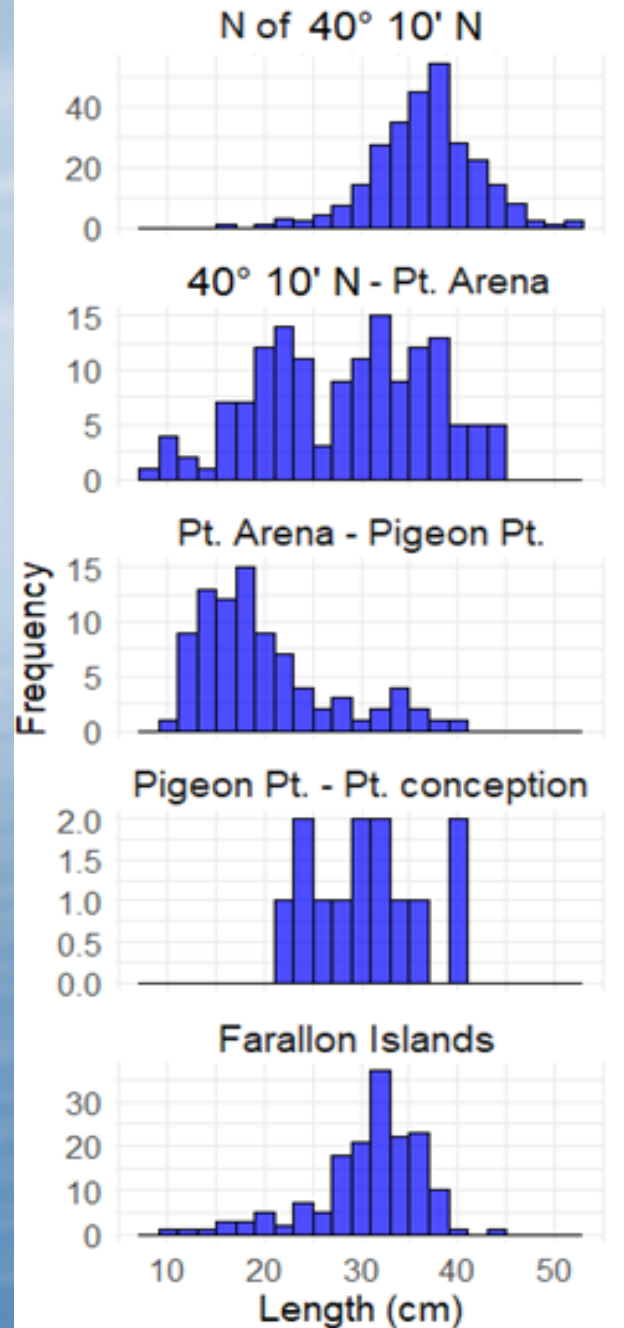
Conclusions



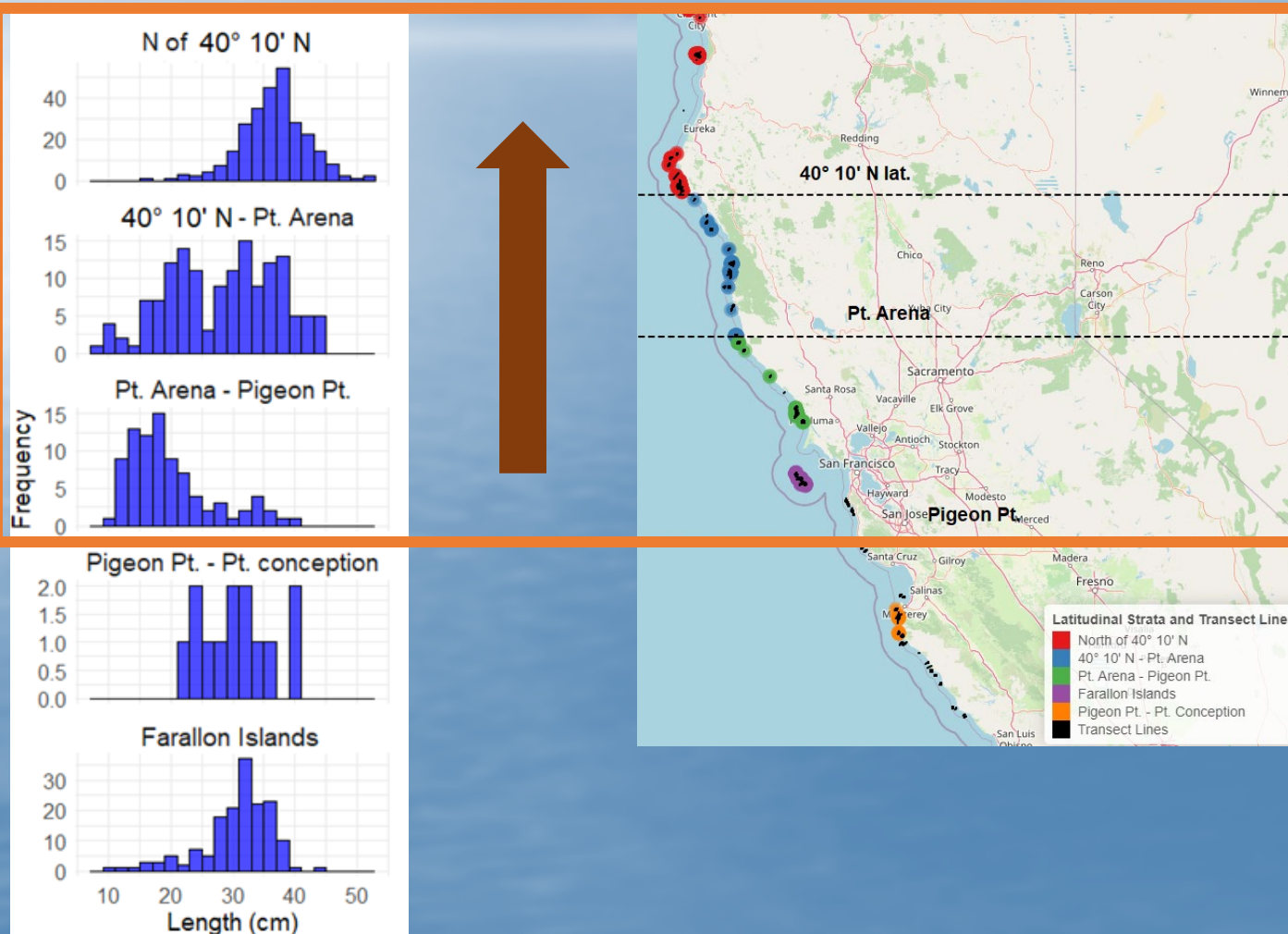
ROV detects smaller fish

- Before they are seen in CRFS data
- May be useful to detect recruitment events

Potential Hypotheses Explaining the Pattern of Large to Small Fish

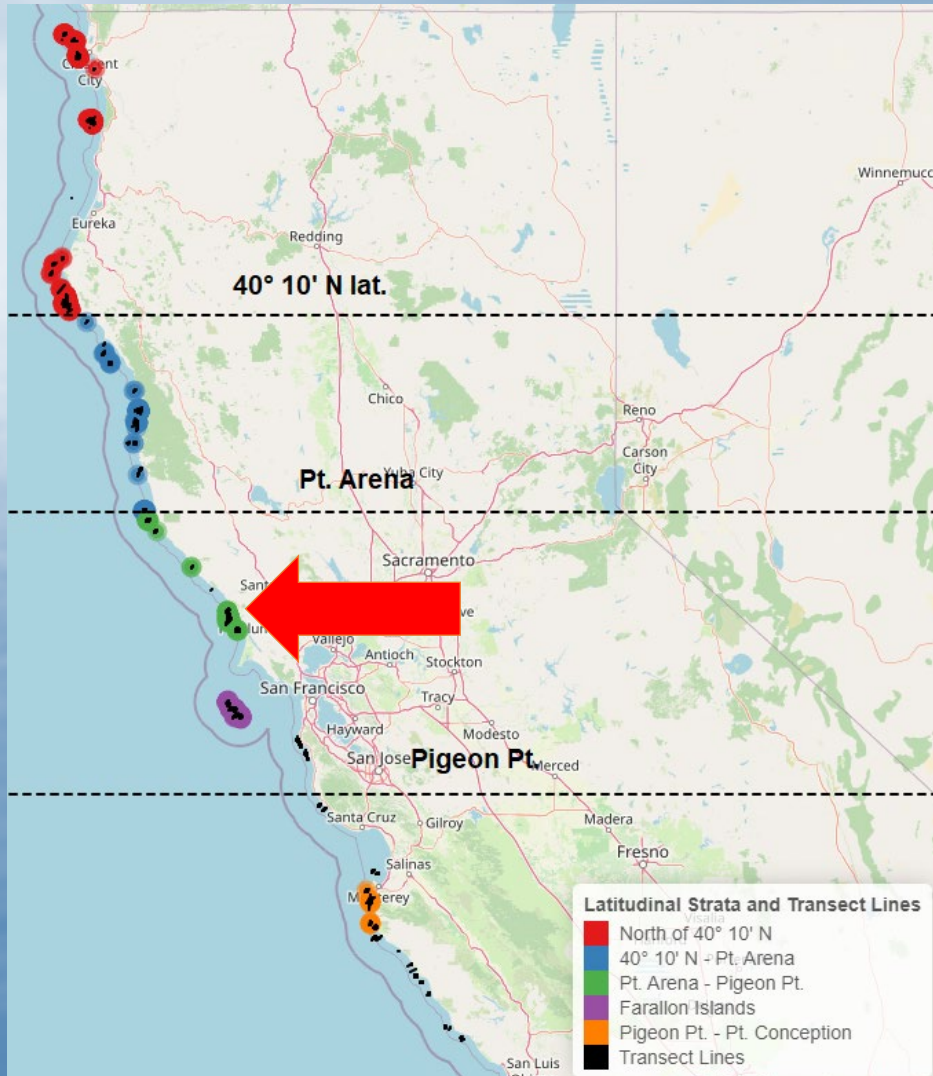


Nursery Ground Hypothesis



- Pt. Arena – Pigeon Pt. stratum acts as a nursery ground for small quillback rockfish
- 85% of small fish seen in this stratum only seen in the 2020 super year
- Minimal small fish seen north of 40°10' N

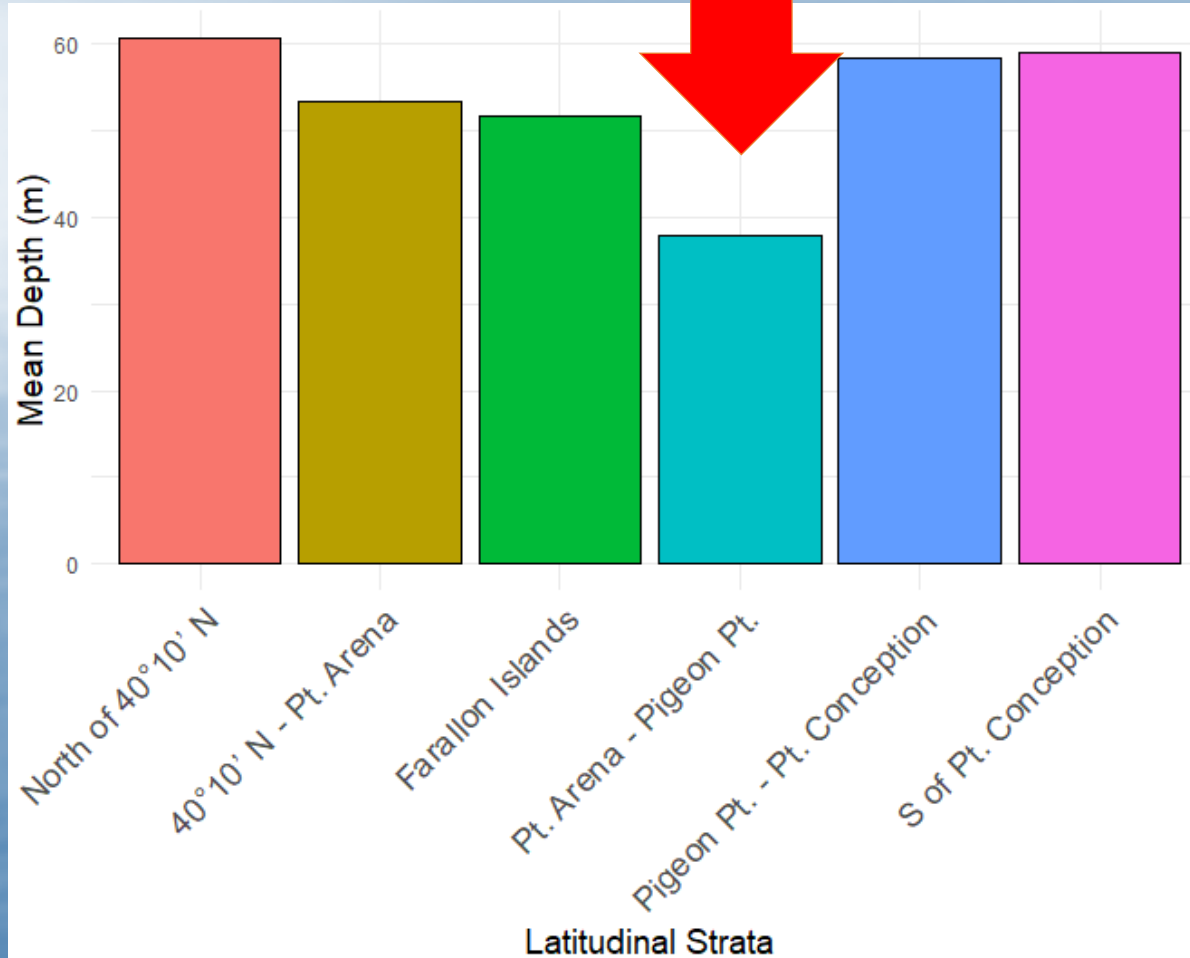
High Fishing Pressure Hypothesis



Fishing Pressure Hypothesis

- Potential high fishing pressure in the Coastal Point Arena – Pigeon Point stratum.
- Note: quillback rockfish distribution closed from 2001 – 2018 for canary and yelloweye rockfish rebuilding measures

ROV Sampling Hypothesis



Potential Bias

- ROV data may not capture larger quillback rockfish in the coastal Point arena – Pigeon Point stratum

Reason

- Sampling locations – as seen by average depth.

Length Analysis Conclusion

Questions?

QUILLBACK ROCKFISH ROV DENSITY DATA STRATIFICATION BY LATITUDE AND DEPTH



Density Analysis Introduction

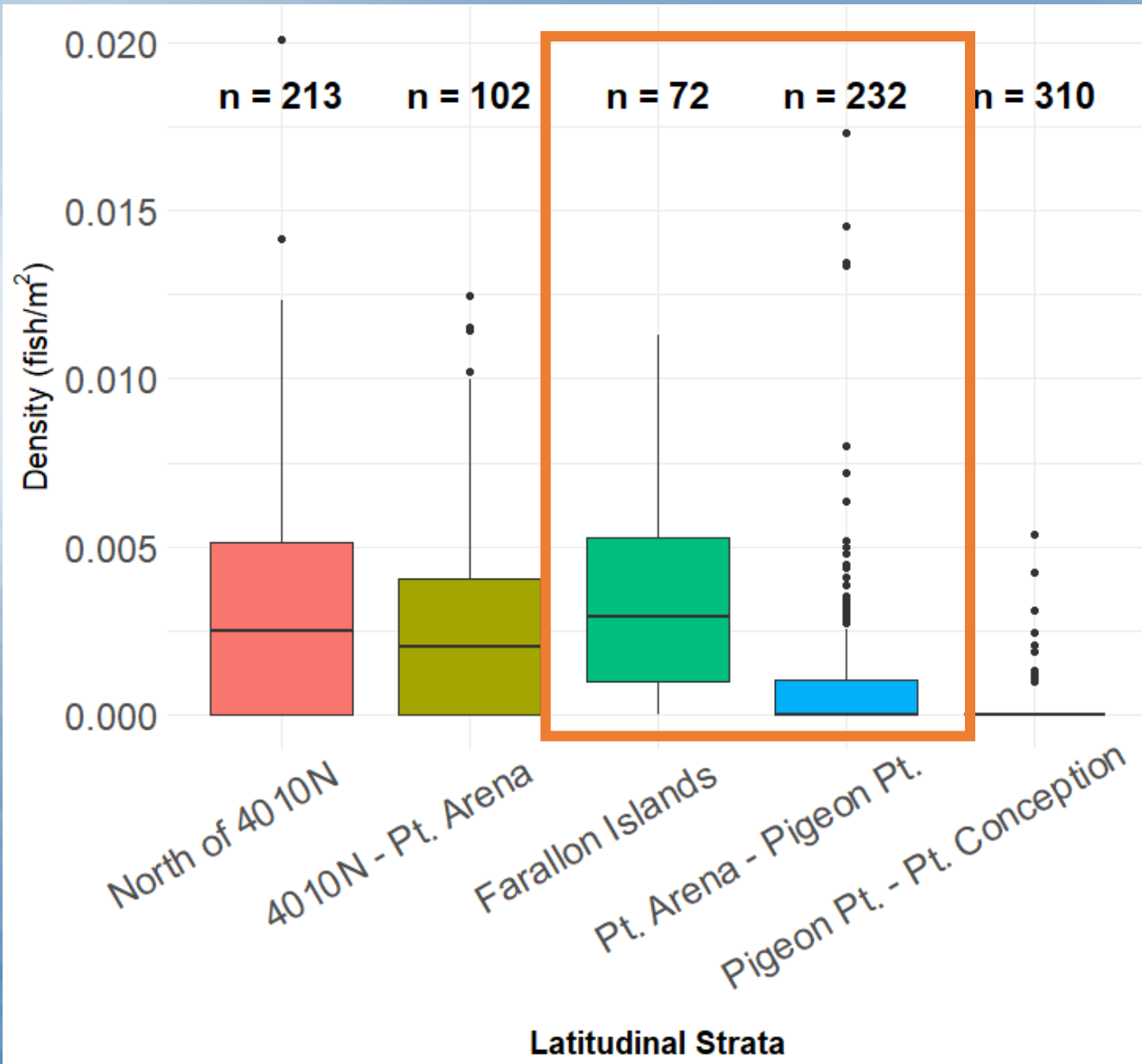
Data

- Quillback Rockfish density data from California Marine Applied Research and Exploration (MARE) Remotely Operated Vehicle (ROV)
- Transect level data

Methodology

- **Goal:** Identify differences in densities across latitudinal and depth strata
- **Comparison:** Visual comparisons are made using box and whisker plots

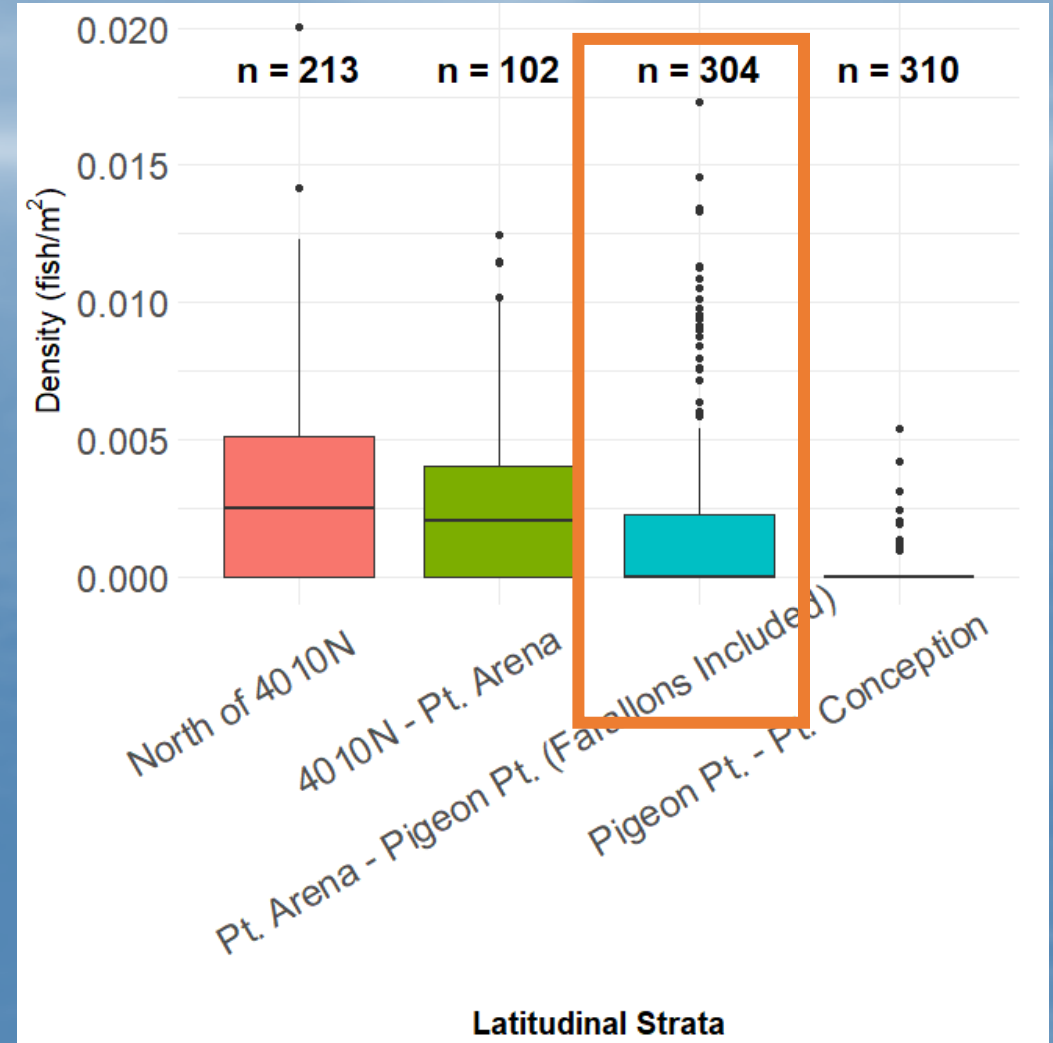
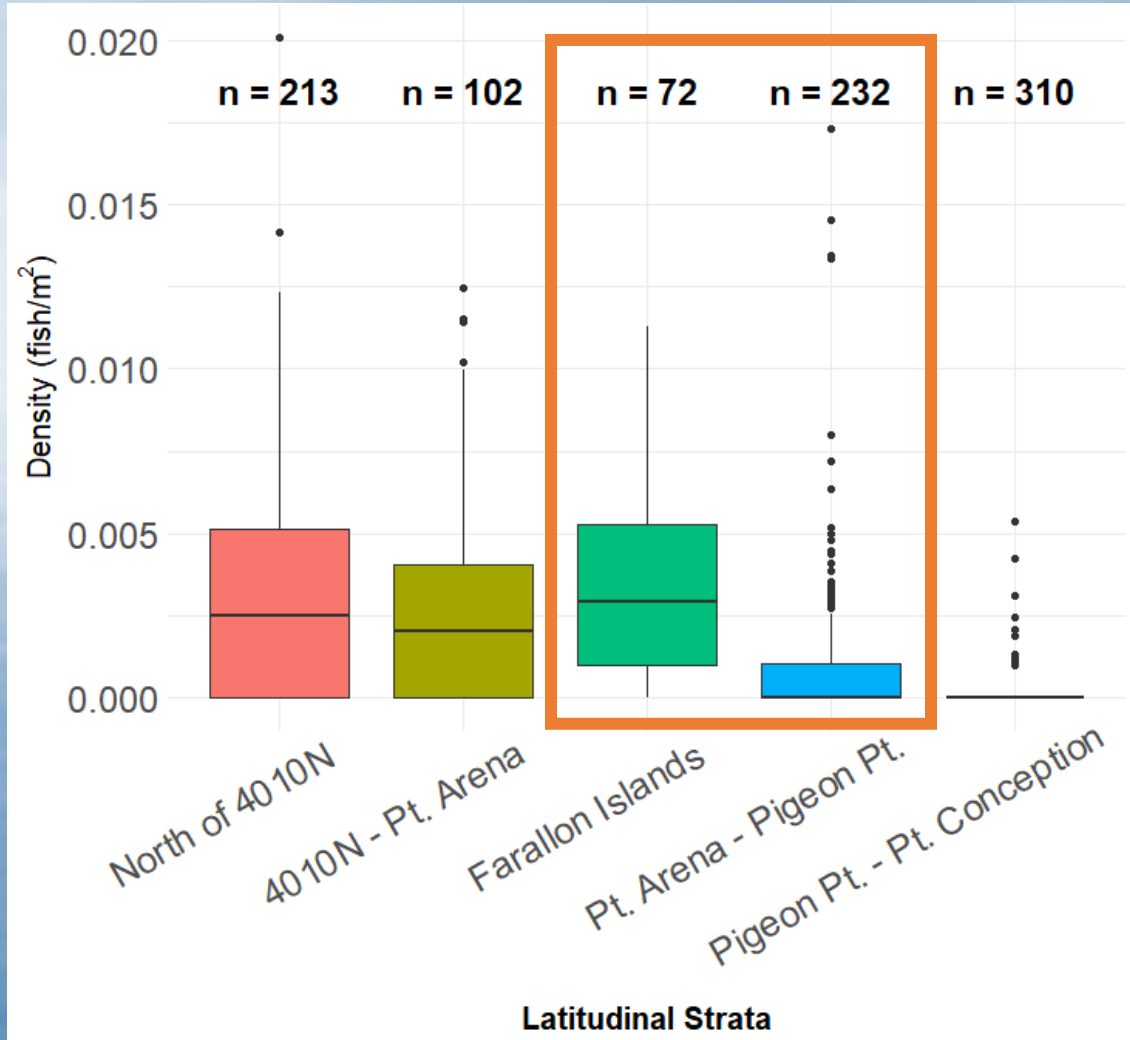
By Latitudinal Strata



Key Takeaways

- Difference in densities observed between Farallon Islands and adjacent coastal region Pt. Arena – Pigeon Pt
- Large sample size from Pt. Arena – Pigeon Pt. compared to Farallon Islands

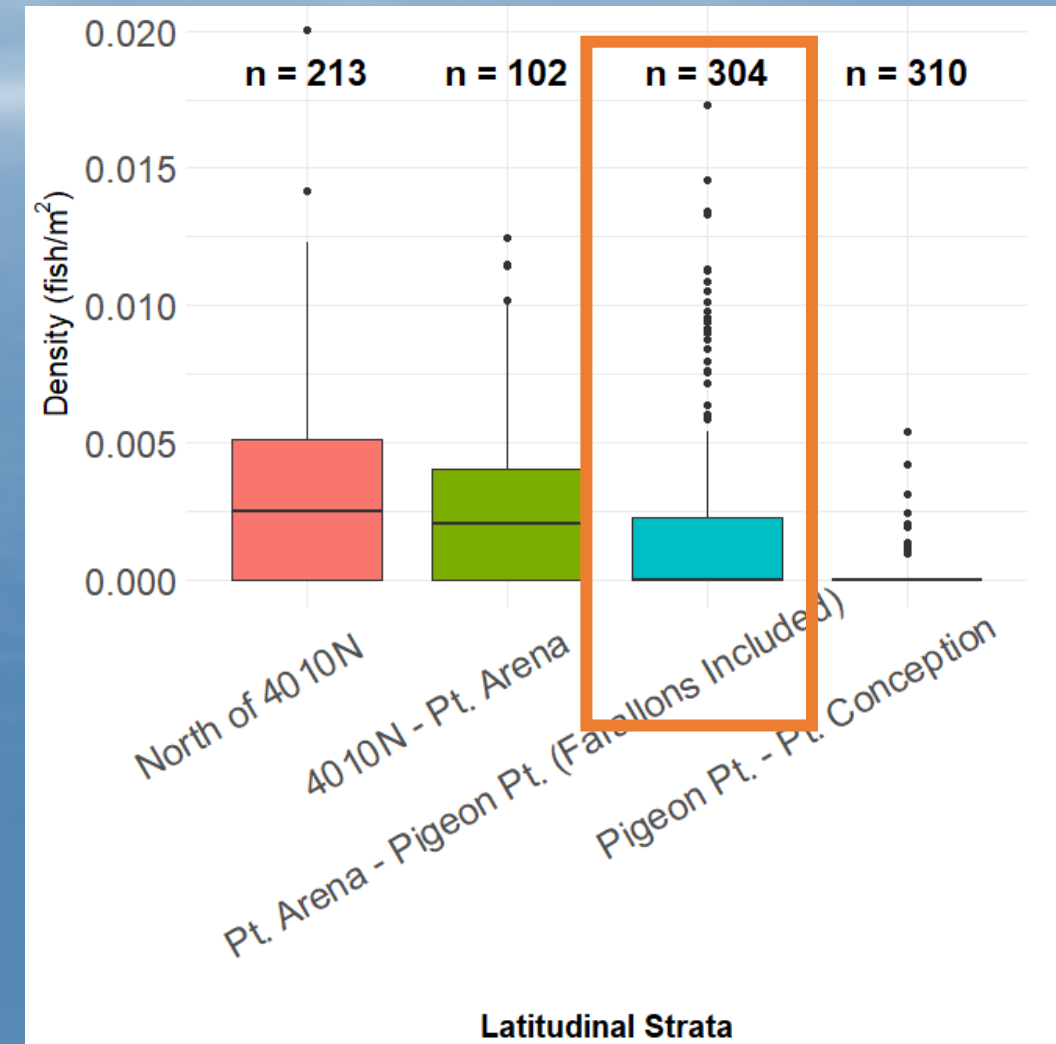
By Latitudinal Strata



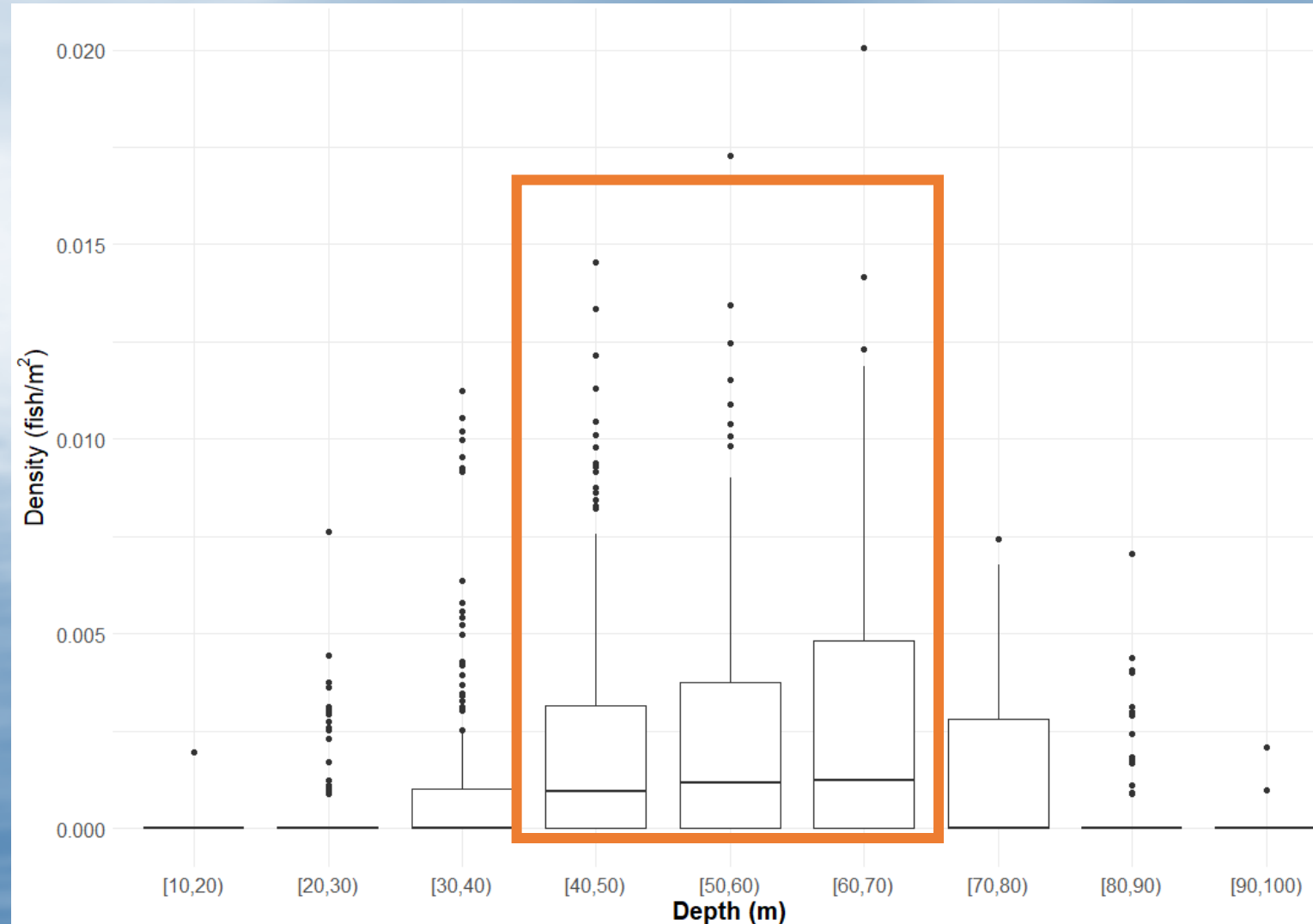
By Latitudinal Strata (Farallons and Pt. Arena – Pigeon Pt. Combined)

Key Takeaways

- Combined with the Farallon Islands, Pt. Arena – Pigeon Pt. changes minimally
- This is due to sample sizes and large number of zero transects in the Pt. Arena – Pigeon Pt. stratum



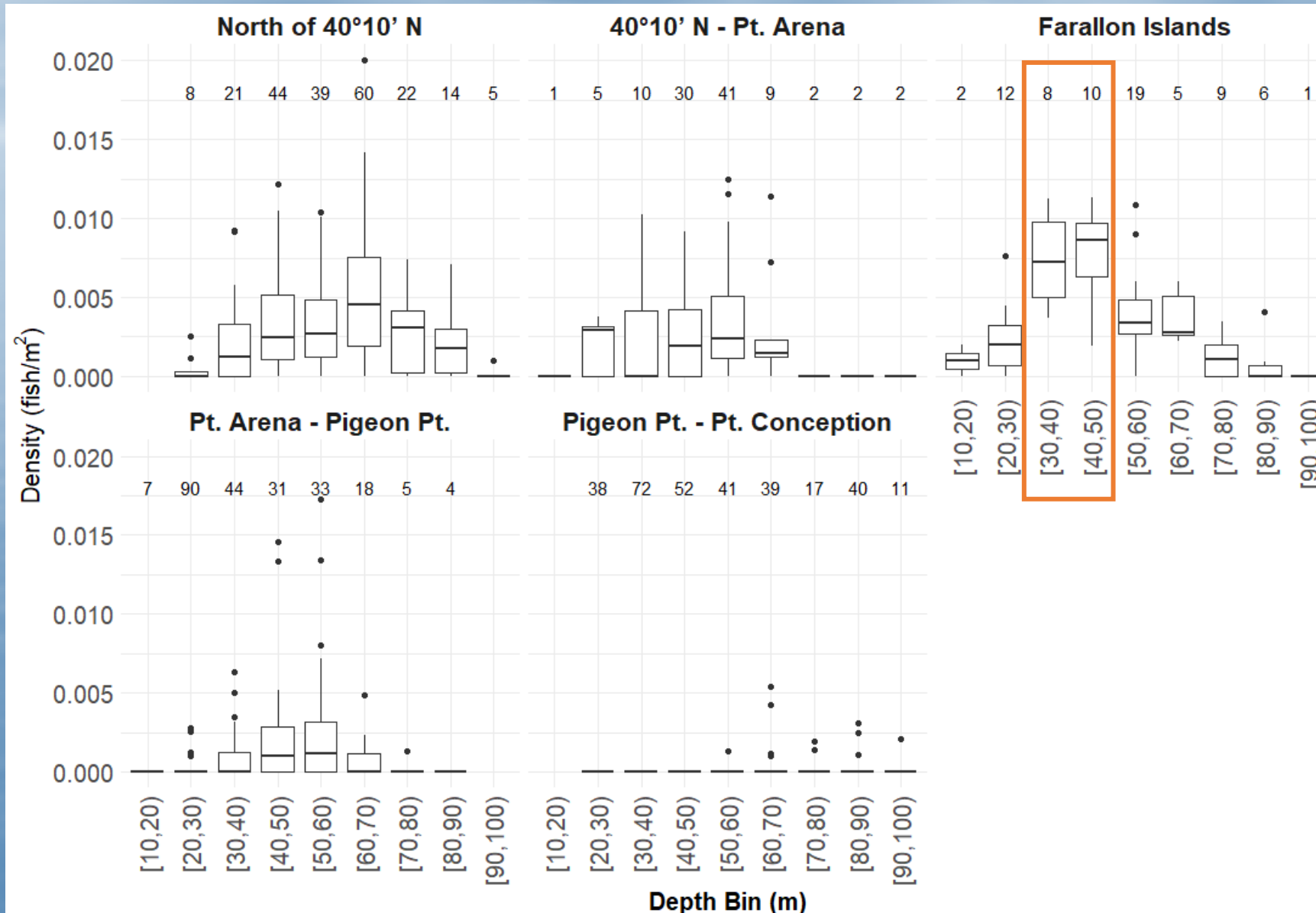
By Depth Strata



Key Takeaways

- Primary depth distribution seen between 40 and 70 meters (approximately 20 - 40 fathoms)

By Depth and Latitudinal Strata



Depth Analysis Conclusion

Questions?