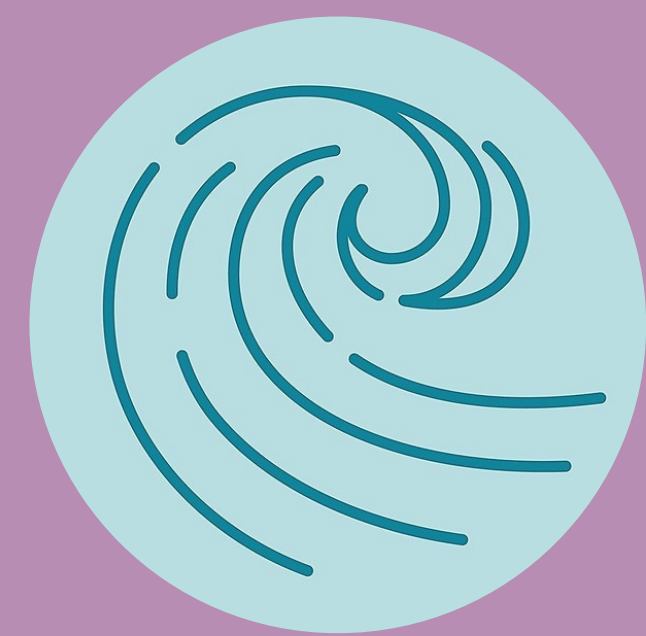


# State of the Urchins: Reproductive Analysis Through Gonadal Index and Color



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## Introduction

The pacific purple urchin, *Strongylocentrotus purpuratus*, is highly pervasive off the coasts of Oregon. Urchins can be very opportunistic feeders, but their main source of food off the Oregon coast is bull kelp. As urchin populations rise, bull kelp forests decline. There are currently very few urchin predators (sea otters and sunflower sea stars) on our coasts to keep the urchin populations stable. This means that we are seeing rapid declines in kelp forests and continued increases in urchin populations. The gonads of urchins are an indicator of the health and quality of urchins. If scientists know the health of urchins, they can determine future population trends. My goal with this project was to determine the overall health and reproductive state of purple urchins off the Southern Coast of Oregon by studying the quality of the gonads.

## Methods

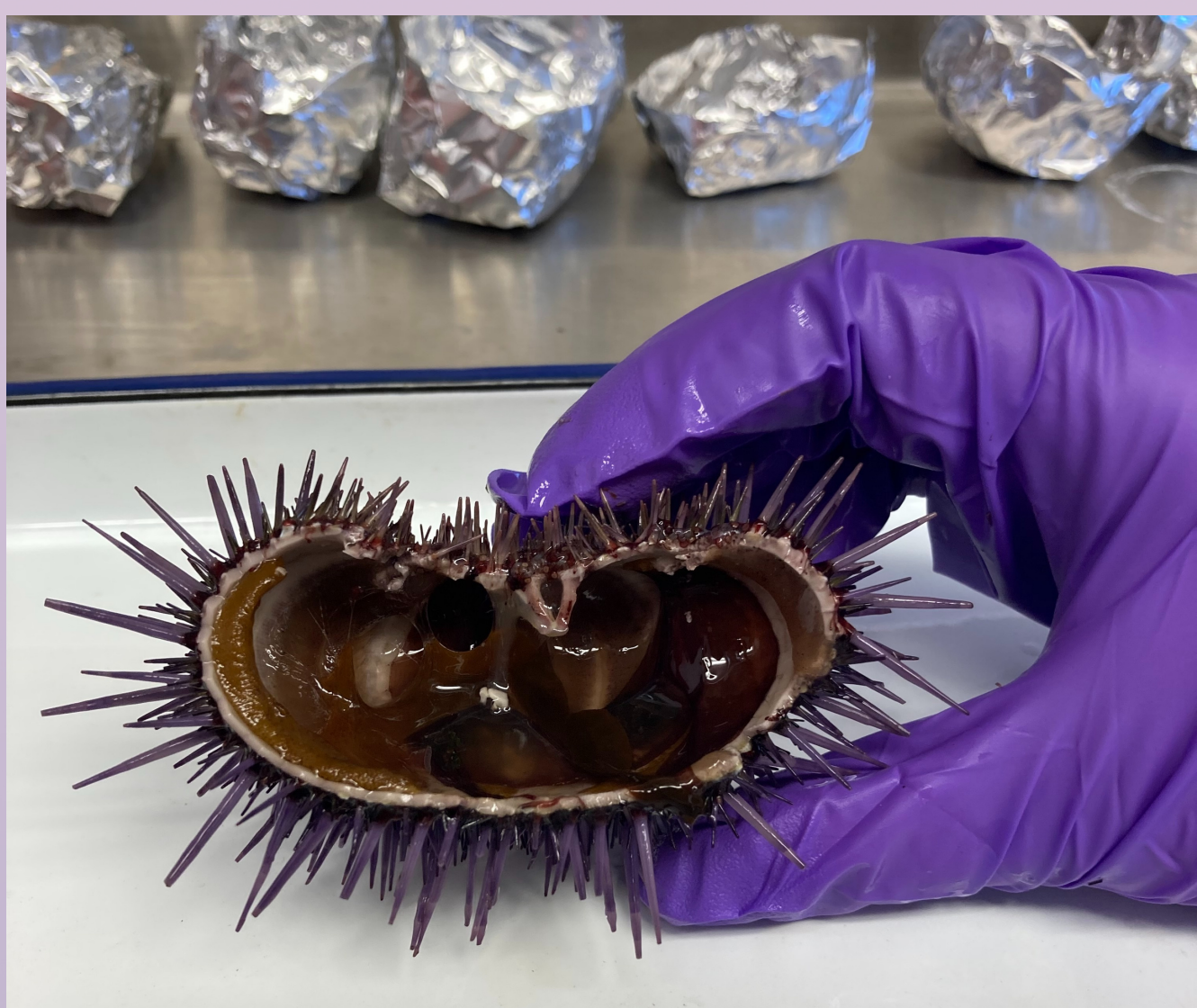
Step 1:  
Choose sample sites



Step 2:  
Collect samples



Step 3:  
Dissect urchins and collect data



Step 4:  
Perform measurements and analyze data

### GONADAL INDEX

$$GSI = \frac{GWW \text{ (gonad wet weight)}}{IWW \text{ (individual's wet weight)}} \times 100$$

## Results

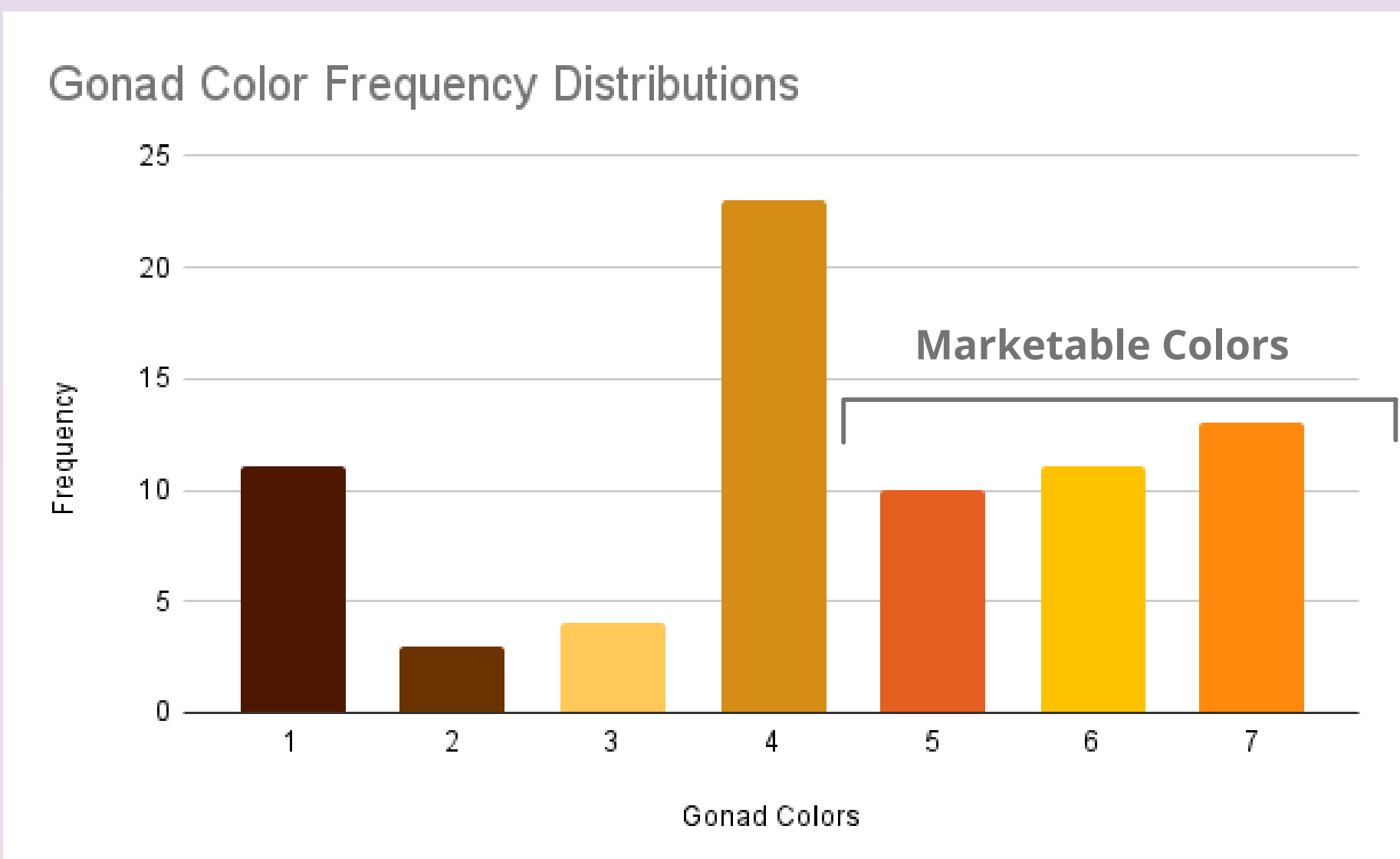


Figure 1. Distribution of gonad colors seen in all samples. Colors were chosen by sorting all colors seen in the samples into bins that would represent the full spread. Colors were then compared to current literature on urchin marketability.

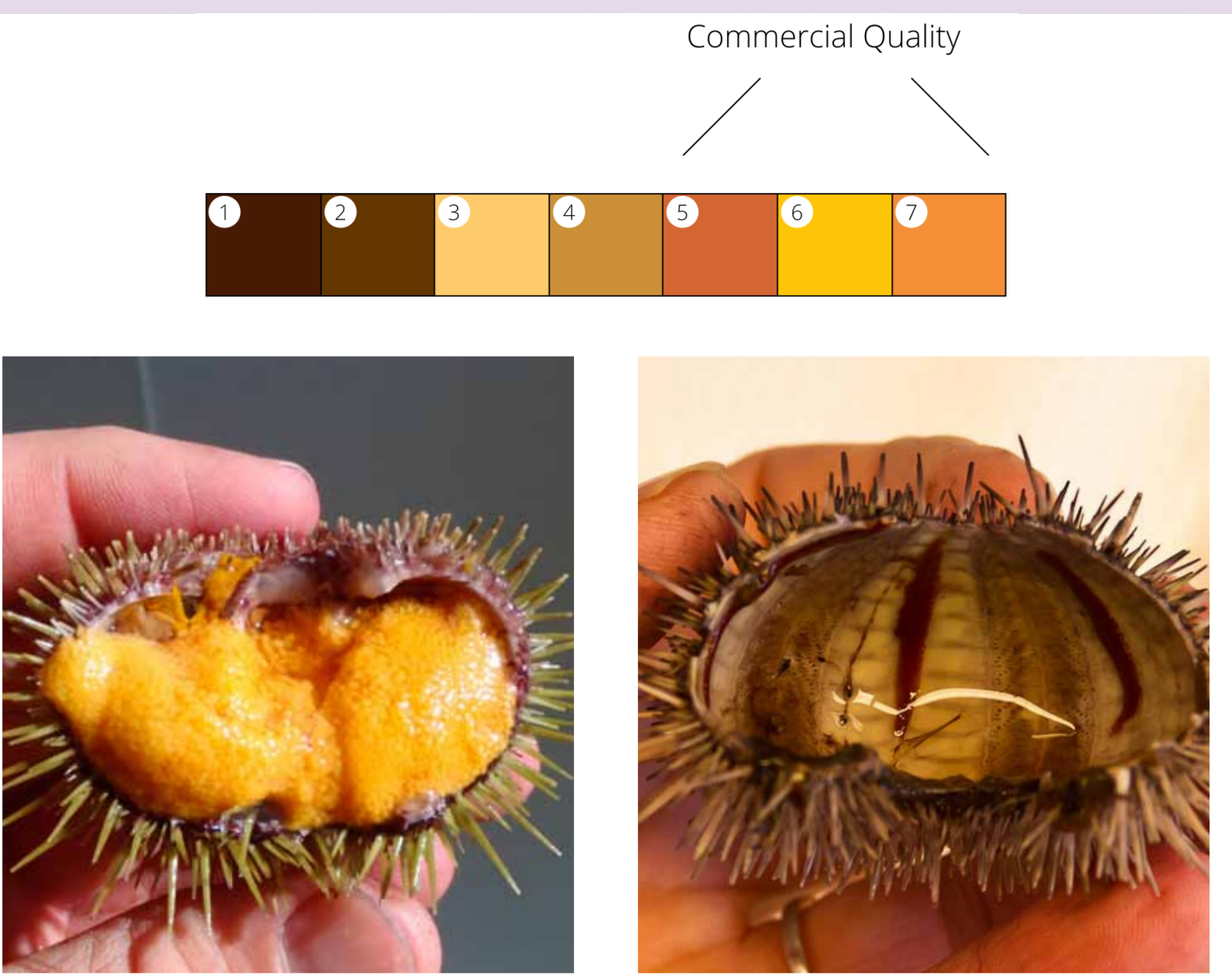


Figure 2. Color chart created by separating all colors in the samples into 7 bins and an example of a healthy versus unhealthy urchin gonad.

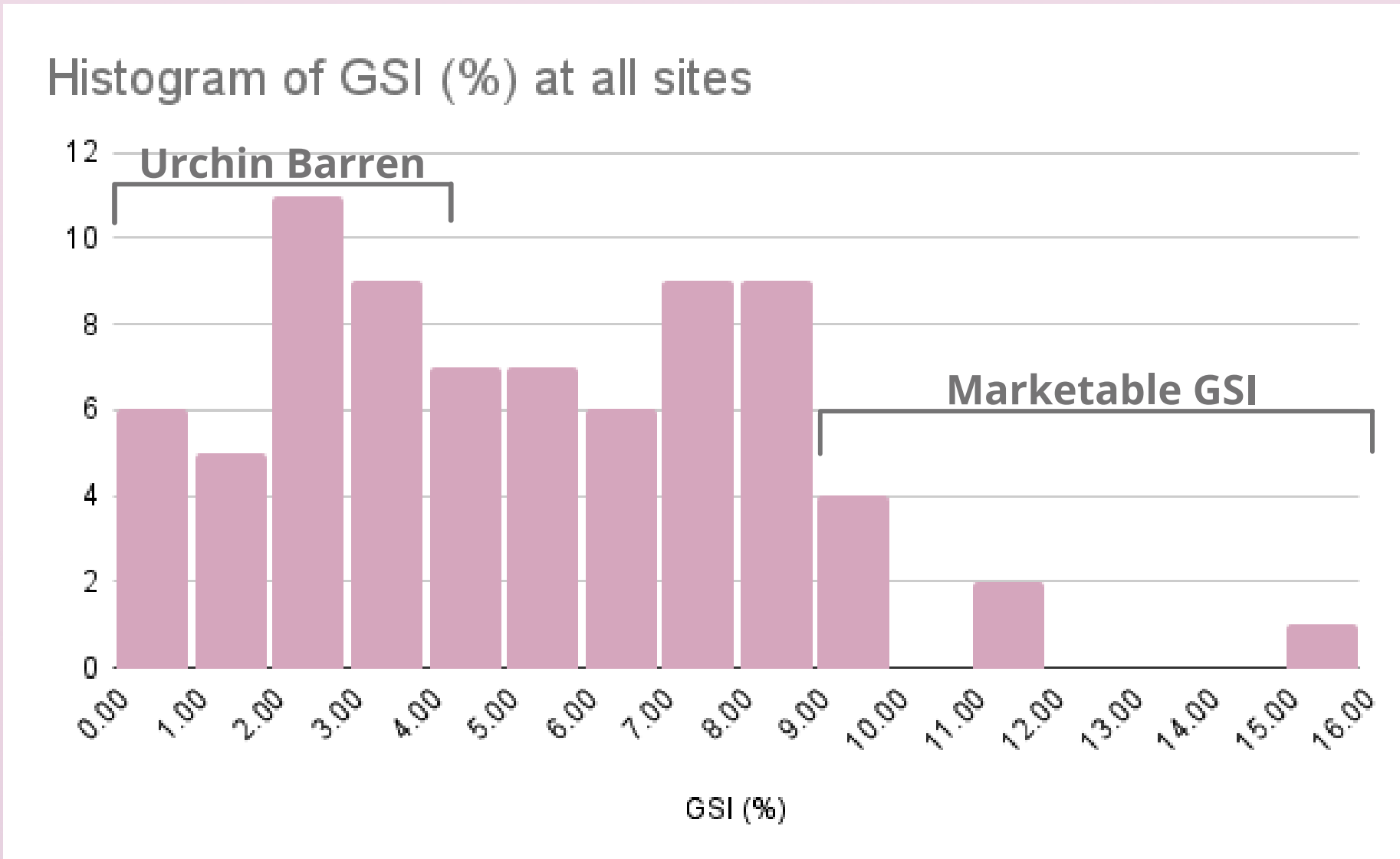


Figure 3. Distribution of gonadal indices seen in all samples. Gonadal indices were then compared to current literature on urchin marketability.

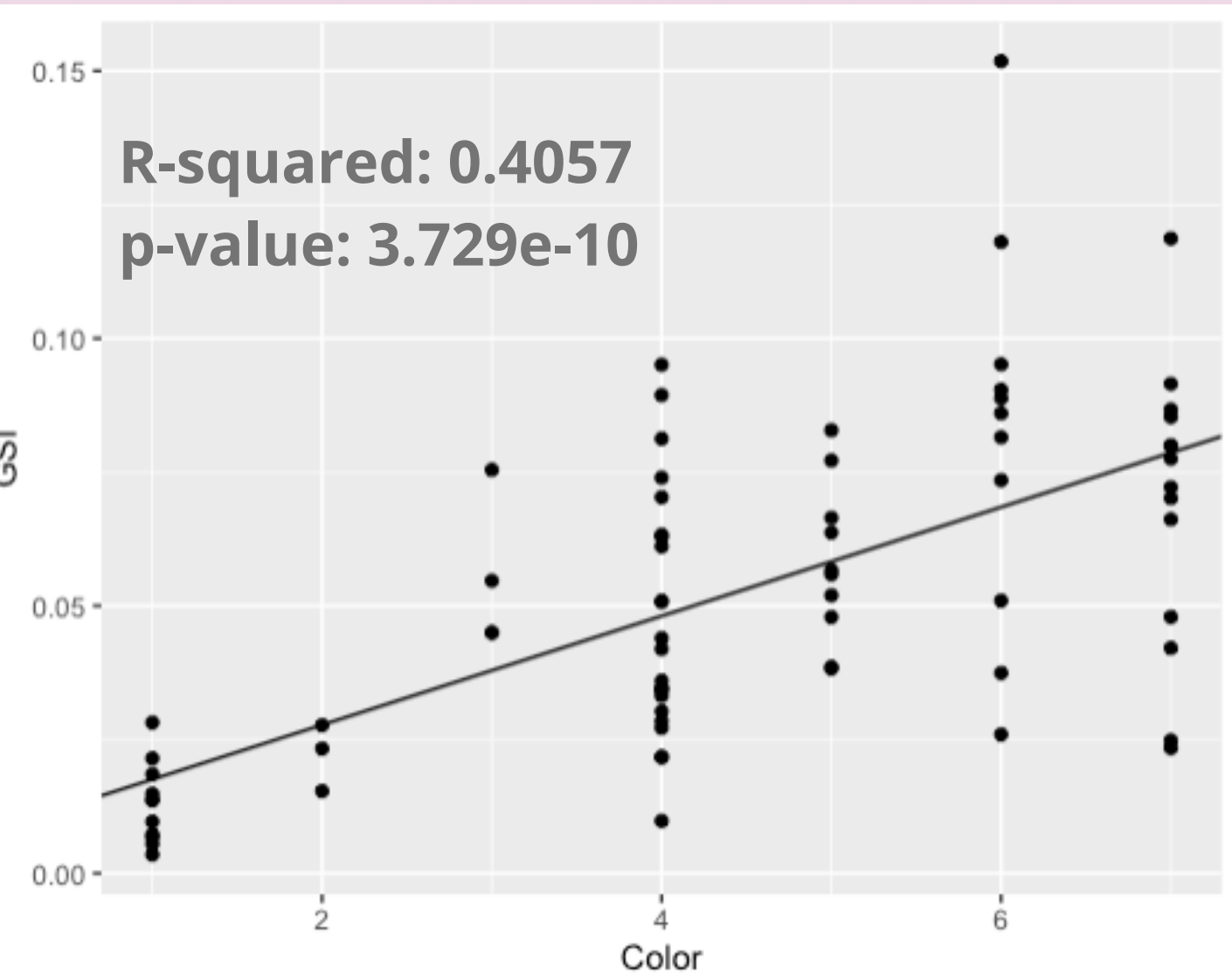
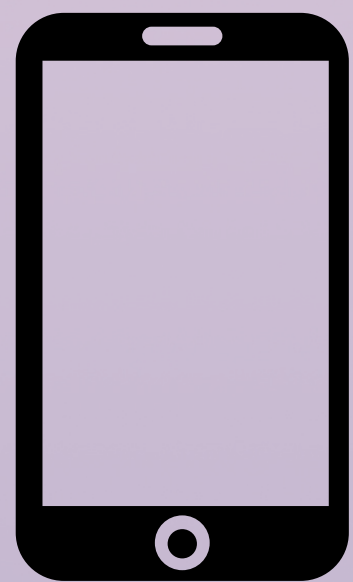


Figure 4. Linear regression of gonadal index versus gonad color.

I found that the majority of urchins sampled were not of marketable quality in both the color and size categories (as seen in Figures 1 and 3). The color of gonads was analyzed and compared to the gonadal index to determine whether there was a correlation. The R-squared value was found to be 0.4057 and the p-value was found to be 3.729e-10. Based on these results there is a significant positive correlation between the color of the gonads and the size. I also found only 8 of 91 urchins had sperm present in their gonads.

Use the link or QR code to view the color frequency distributions and GSI% distributions at each of the sample sites:



[https://www.google.com/maps/d/u/1/viewer?mid=1Q7pT\\_ot6ljBFnvH9GMTLVh1wc0hq7LzW&ll=42.72773474457428%2C-124.48724739999999&z=13](https://www.google.com/maps/d/u/1/viewer?mid=1Q7pT_ot6ljBFnvH9GMTLVh1wc0hq7LzW&ll=42.72773474457428%2C-124.48724739999999&z=13)

## Discussion

A GI below 4% is indicative of an urchin barren while urchins with 10% or higher GI are considered marketable by the commercial urchin fishery. Most urchins sampled were not especially healthy or came from urchin barrens. This pattern could be seen in the color frequencies as well, which makes sense as there was found to be a correlation between color and size. In the future, this information could be applied to management plans to allow for the removal of purple urchins for the sake of preserving the bull kelp and fostering continued biodiversity.

## Conclusion

So why should purple urchin health and reproduction matter to you? Even after a kelp forest has been diminished, urchins will live on, resulting in a positive feedback loop and a permanent lack of kelp. This loss of kelp will impact all other organisms that depend on it for habitat and we will lose biomass and biodiversity in our oceans. It's important to know how healthy urchins are and whether they are reproducing, as it can help us to predict population patterns and inform management techniques in the future.

## References

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