

Using Coral-Reef Physical Properties and Biotic Factors to Benchmark Jordanian Coral-Reef Fish Biodiversity

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SEE-U Jordan
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As Habitat



As Attraction



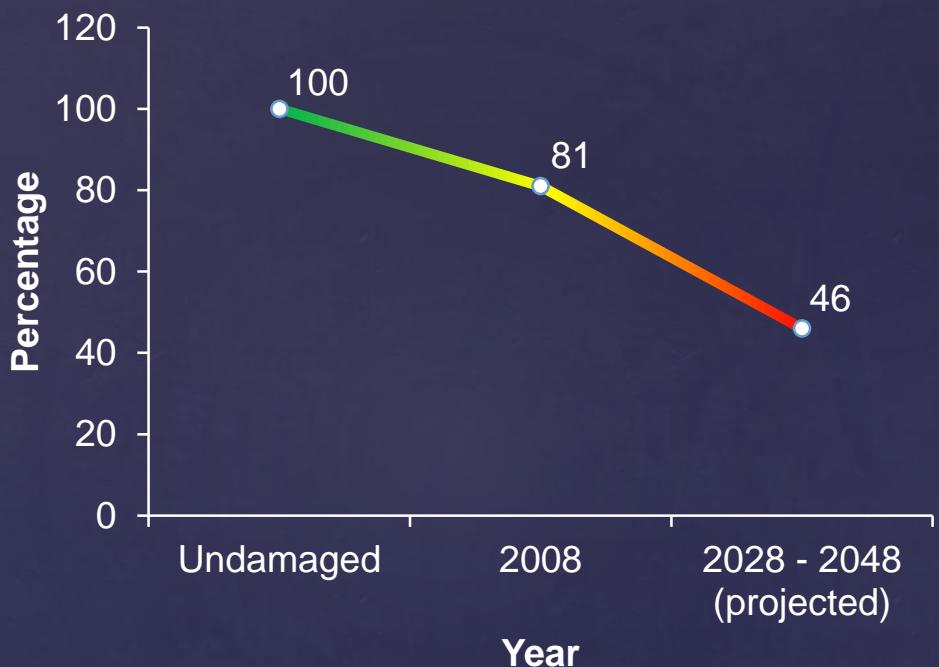
upload.wikimedia.org/wikipedia/commons/e/ef/Reef_habitats_at_Palmyra_Atoll_-_Peerj-81-fig-3C.png

Photo Credits: Julian Tung

Coral reefs provide key services

(Barbier *et al.*, 2011)

Global Coral Cover (Data from Wilkinson, 2008)

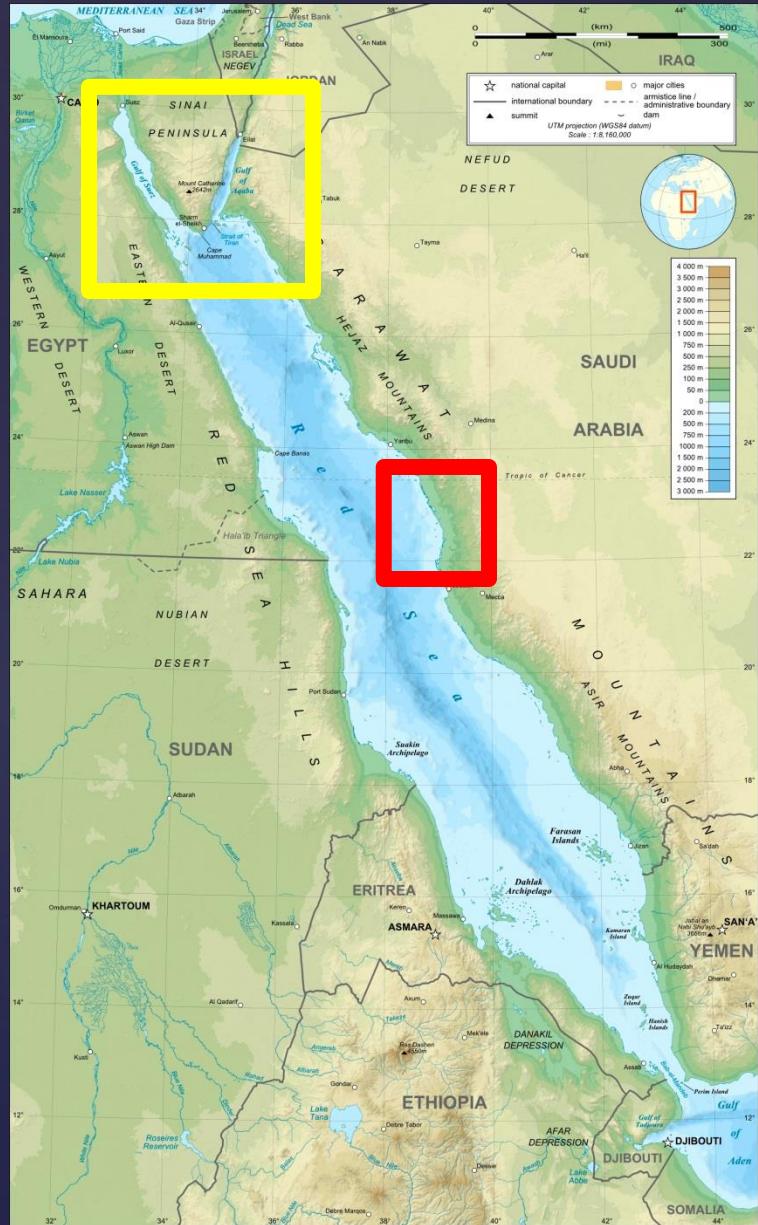


- ¶ Overfishing suggested to be a major reason
- ¶ Many fishes eat algae
- ¶ Overfishing -> fewer fish -> more algae -> weaker coral (Hughes *et al.*, 2003)
- ¶ Decline damages coral ability to provide services (Barbier *et al.*, 2011)

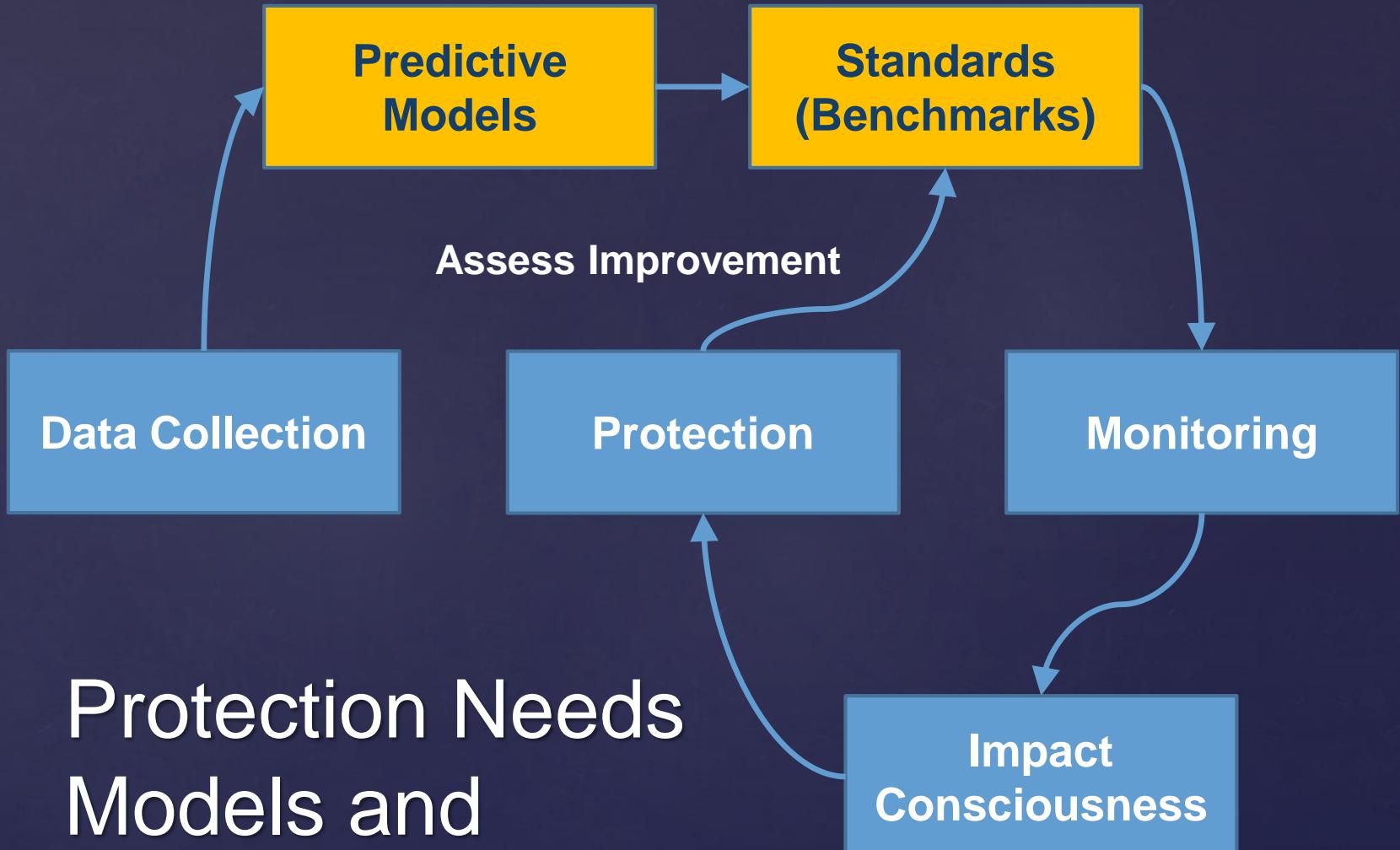
Global Coral Decline

- & 2010: major bleaching event in central Red Sea; Northern Red Sea not affected (Furby et al., 2013)
- & Gulf of Aqaba corals have unique gene: high bleaching threshold (Fine et al., 2013)
- & Threatened by various human factors (Manasrah et al., 2010)

Gulf of Aqaba Coral Needs Protection



upload.wikimedia.org/wikipedia/commons/1/19/Red_Sea_topographic_map-en.jpg



Protection Needs
Models and
Benchmarks

✉ Fish Abundance

- ☒ **Live coral cover**
- ☒ Cave area percentage (omitted)
- ☒ Patch-coral-reef volume (omitted)

✉ Fish Species Richness

- ☒ **Live coral cover**
- ☒ **Cleaner wrasse abundance**
- ☒ Cave area percentage (omitted)
- ☒ Patch-coral-reef volume (omitted)
- ☒ Year (omitted)

Factors Related to Fish Biodiversity

(Wagner *et al.*, 2015)

Can the factors proposed by Wagner
et al. (2015) accurately predict the
fish abundance and species richness
of relatively undisturbed areas of the
Gulf of Aqaba?

(Is prediction error
within 25%?)

$$\left\{ \begin{array}{ll} H_0: \text{No} & H_a: \text{Yes} \end{array} \right.$$



Site and Method

- Marine Science Station is in marine protected area
- Relatively undisturbed by human activities
(Manasrah *et al.*, 2010)



& Sample Method:
15-m Transects
5-m Intervals
& Markers on land

Site and Method (Contd.)

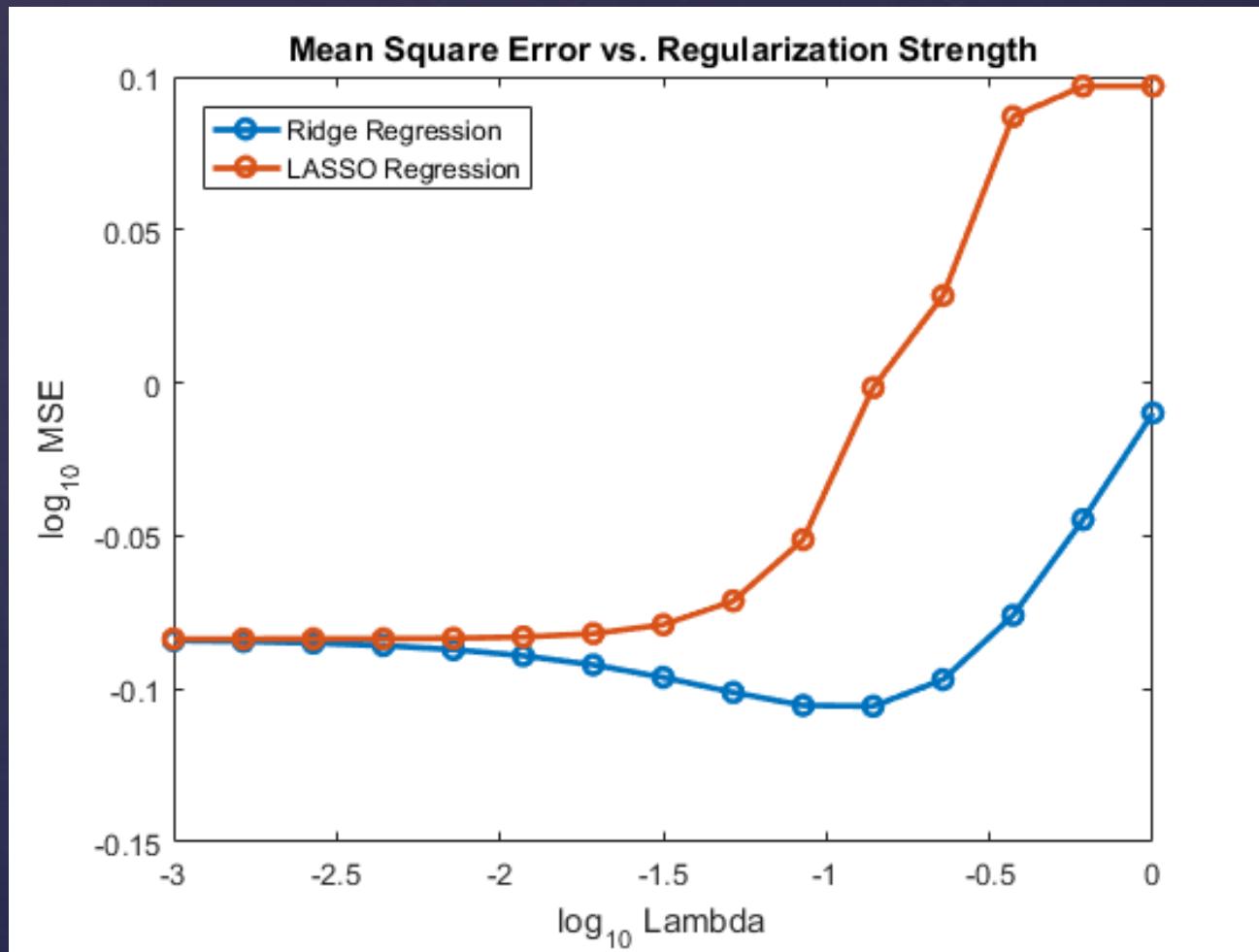


- Surveyed by snorkeling
- Found transects by coastal flags and benthic features
- Fish Survey
- Habitat Survey

Photo Credits: Cristina Mihailescu

Site and Method (Contd.)

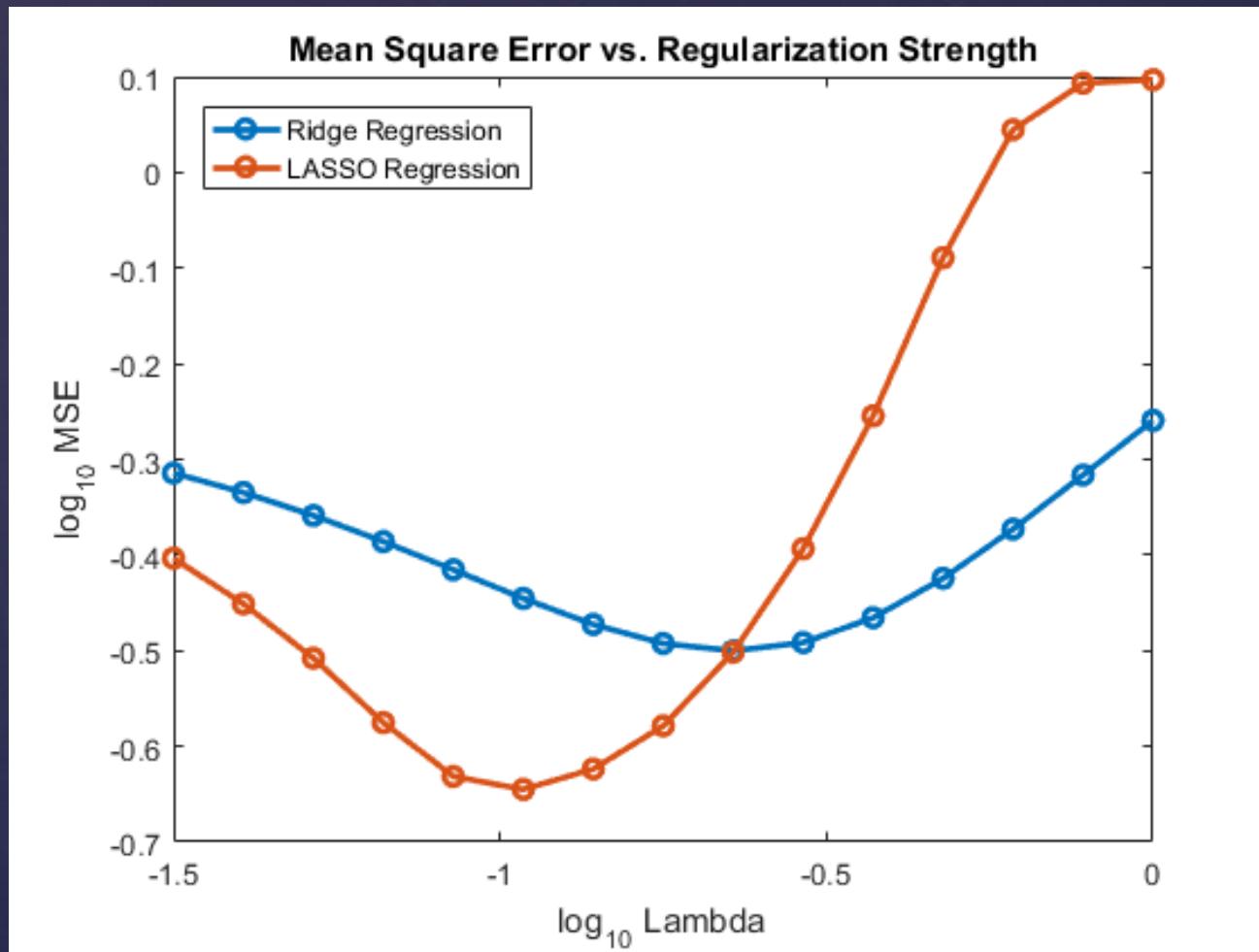
Model Prediction – Fish Abundance



Root-Mean-Square-Error (RMSE) = 0.885

Median Absolute Percentage Error (MAPE) = 93.06%

Model Prediction – Species Richness

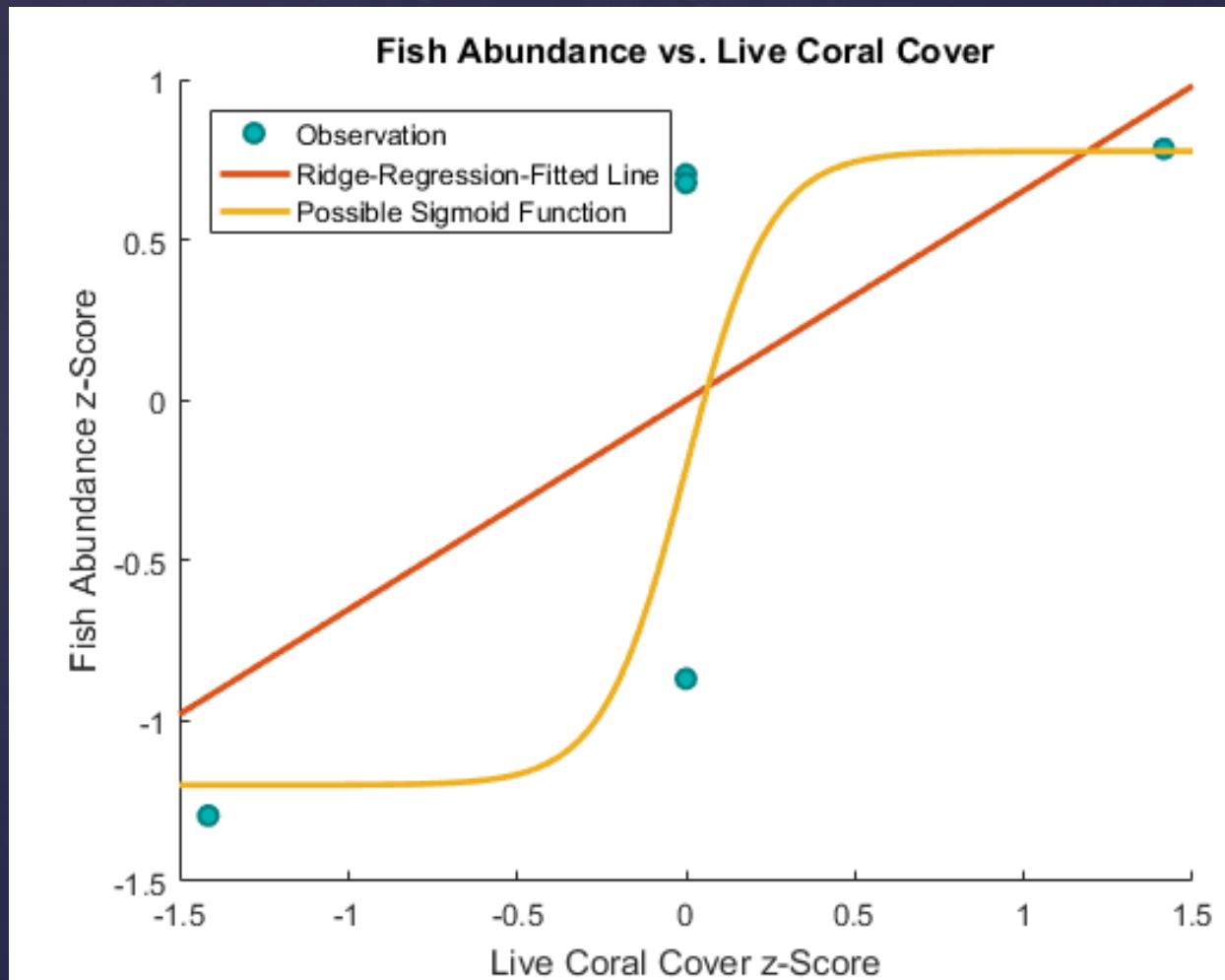


Root-Mean-Square-Error (RMSE) = 0.476

Median Absolute Percentage Error (MAPE) = 89.13%

Possible Reasons for High Error

1. Sample Size
2. Model Complexity
3. Survey Method
4. Unaccounted Circumstance
5. Different Model



- Collect more samples
- Incorporate relevant factors
- Introduce more accurate survey methods
- Consider other algorithms or models
(if enough evidence)

Next Steps

- Model currently unable to accurately predict (Error > 25%)
- Prediction has potential for improvements
- We need to continue exploring the potential of predictive models for better protection
- Aqaba -> the more conscientious Eilat?

Conclusions

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References

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- ¶ To everyone else in the group for making this trip so much fun and for letting me learn something everyday

Acknowledgements

The background image shows an underwater landscape. In the foreground, there is a large, rocky coral reef covered in various types of coral and marine life. Sunlight filters down from the surface in bright rays, creating a dappled light effect on the sandy ocean floor. Several small, dark-colored fish are scattered across the sand. The water is a clear, vibrant greenish-blue.

Any Questions?