It has been recognized for some time that the ability of coral reefs in the Hawaiian archipelago to
survive and reproduce is dependent on the pattern and intensity of wave energy. Although the relationship
between wave energy and reef development may enable resource managers to better understand the
correspondence between the two variables. Developing an improved understanding of the relationship
between wave energy and reef development will require an improved understanding of the pattern
of significant wave height, period and direction (below) for the open ocean around Midway.

Using a 3D bathymetric grid of Midway’s bank, the modeled deep-water values will be input to the Shallow-Water
Nearshore (SWAN) model to simulate the shoaling of deep-water waves as they encounter Midway’s bank. Output values of
SWAN will be modeled to the chosen spur and groove
wave height, period and direct of the waves at each cell in the raster grid.

The insular wave parameters of each grid cell will then be linked to the
spur and groove features that have existed on the reef. The
spur and groove model will then provide the depth of the water column. The above equation describing
the distribution of spur and groove dimensions over time.

The measurement of spur and groove features will be correlated to understand the high volume of spur
and groove dimensions around Midway’s fore reef. Each grid cell will be divided into its constituent sine waves, which
will provide the values of the
undulating spur and groove structures. Rather than a traditional correlation analysis, which provides a single
correlation value at each grid cell, a crosscovariance analysis will be used to determine the spatial pattern
of correlation between the two variables. Developing an improved understanding of the relationship
between wave energy and reef development may enable resource managers to predict the location of specific spur and
morophology, the relationship will need to be tested at other sites, both in Hawaii

FUTURE RESEARCH

If research shows a strong link between wave energy and spur and groove formation, the
relationship will need to be tested at other sites, both in Hawaii

and beyond. Comparing the wave energy/spur and groove relationship could offer crucial insights to long-term predictions.

For descriptive purposes only, may change without notice.

If BSS and spur and groove prove to be tightly correlated, it should be possible to define threshold BSS values for spur and groove formation and beyond. Quantitative evaluation explaining how spur and groove dimensions change with
BSS values.

If successful in establishing a predictive link between wave energy and reef morphology, the model could be important in future site selection, management and further research. For example, if known reef morphology can be used to guide conservation efforts during resource extraction, it will give researchers a more complete picture of reef health in the NWHI.

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The hypothesis is that the intensity of wave energy controls the dimensions of spur and groove structures.

- Correlation analysis will support this relationship and enable development of an equation describing the distribution of spur and groove dimensions around Midway’s fore reef.

Midway Bathymetry:
- The wave parameters of each grid cell will then be linked to the surrounding reef morphology, allowing us to refine it.

Crucially, if poor correlation appears on the crosscovariance map, its spatial

pattern will give researchers a more complete picture of reef ecology in the NWHI.