Conclusions & Discussion

Objectives & Hypothesis

Hoping that the species will eventually re-substantiate effort into sea otter rehabilitation and breeding programs, along the coastline. Biologists and governmental agencies have put substantial effort into sea otter rehabilitation and breeding programs, hoping that the species will eventually re-substantiate their original range.

The 1850’s marked the beginning of the California fur trade, in which sea otters were hunted extensively for their thick, silky pelts. After nearly a change in distribution between 13 August 1994 and 26 September 2010. In 1987, San Nicolas Island, CA was chosen as the site of a sea otter translocation and recovery program through US Fish and Wildlife Service in which 140 otters were translocated to the island as an outbreeding population. San Nicolas Island was deemed suitable for this project due to its isolation and shallow reef, which helped support the recovery of critical sea otter populations. My aim was to investigate any changes that occurred in the kelp forest ecosystem surrounding San Nicolas Island during the length of the sea otter translocation program. As healthy kelp forest ecosystems are critical for sea otter survival, significant change in distribution may have contributed to the unsuccessful recovery efforts of the translocated population. I utilized Landsat 5 high-resolution multispectral imagery in order to examine kelp forest canopy surrounding San Nicolas Island and assess changes that occurred between August of 1994 and September of 2010. Based on current literature describing kelp forest decline in California, I hypothesized that San Nicolas Island experienced a decline in kelp forest density and a change in distribution between 13 August 1994 and 26 September 2010.

Kelp forest density and distribution surrounding San Nicolas Island. This addresses my research question and hypothesis, confirming that kelp forest loss did occur in the study area between the years of 1994 and 2010 in which the sea otter translocation program was in progress. This method could be used as an accurate analysis for tracking kelp forest density and distribution over time.

Overall, this project allowed me to apply remote sensing techniques to a topic that I am very familiar with in my field. I was able to acknowledge the usefulness of satellite technology in addressing various environmental issues such as declining habitat, deforestation, sea surface temperature change, and urban sprawl. Through preliminary research of my topic, I was able to discover how satellite technology is currently being utilized in the marine science field and the importance of satellite images in understanding environmental issues on global scale.

Remote sensing tools will be useful in monitoring density and distribution of kelp forests worldwide over time as ocean temperatures continue to rise and marine environments continue to face anthropogenic alteration. Kelp forest ecosystems support high biodiversity and sustain recovering sea otter populations. With invaluable ecological importance to coastal areas, kelp forests require close monitoring over time in order to ensure their prolonged survival.

Acknowledgments

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Otter Zone | San Nicolas Island, CA

A Remote Sensing Analysis of Kelp Forest Density & Distribution

During the California Sea Otter Translocation Program

Background

Kelp forest serves as the primary habitat of sea otters. Spanning the coast of California, Giant kelp (Macrocystis pyrifera) is the largest species of macroalgae. Kelp forests thrive in nutrient-dense, cold waters, in which they support flourishing underwater coastal ecosystems. The blades of the kelp are broadened and serrated, which provide shelter to their consumers, kelp gulls, sea otters, and other predators. The kelp blades also provide a resting place for kelp gulls and sea otters, which can be seen engaging in activities such as feeding, sheltering, or hiding from predators. The kelp blades provide a resting place for kelp gulls and sea otters, which can be seen engaging in activities such as feeding, sheltering, or hiding from predators. In addition to providing a resting place for kelp gulls and sea otters, the kelp blades also provide a resting place for kelp gulls and sea otters, which can be seen engaging in activities such as feeding, sheltering, or hiding from predators. The kelp blades also provide a resting place for kelp gulls and sea otters, which can be seen engaging in activities such as feeding, sheltering, or hiding from predators.

Methodology

The spectral angle mapper tool was chosen to run the classifications on the two images. Spectral angle mapper is a supervised classification tool that directly compares the image spectra to a spectral library created from the previously determined classes as the input for the overall classification of each image. The resulting images were classified based on the various predetermined kelp density: high, medium, medium-low, low, and submerged.

Spectral Angle Mapper

Kelp Forest Change 1994-2010

15 August 1994

26 September 2010

Total Kelp growth: 11.5 km² (58%)

Net kelp loss: 2.6 km² (12%)

Kelp Forest Change 1994-2010

Kelp Growth

Kelp Loss

Spectral Angle Mapper

Preprocessing (rescale using ROIs)

Landsat 5 TM Images (RGB=5-4-3 False Color Composite)

Spectral Angle Mapper

Post Classification (combining classes)

Thematic Change Workflow

Select Classes from End Members

Visual Analysis

Kelp Forest Density

High density kelp

Low density kelp

Low density kelp

Submerged kelp

Total Kelp loss: 14.1 km² (70%)

Kelp Growth: 11.5 km² (58%)

Net kelp loss: 2.6 km² (12%)

Kelp Forest Change 1994-2010

Image Sources: Blue Ocean Art, Marine Mammal Commission, Ocean Safari Scuba

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Data Sources: USGS Earth Explorer, Landsat 5 TM

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Presented on 9 May 2018

Image Sources: Blue Ocean Art, Marine Mammal Commission, Ocean Safari Scuba