

Recovery of the Hawaiian Monk Seal through Coastal Management

Jon Miguelé Zapien-Pina
Mars. 6920
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Justification

First and foremost the Hawaiian monk seal (*Monachus schauinslandi*) is the second most endangered pinniped in the world. The species has declined at approximately 11% per year since 1989 and is the most endangered U.S. marine mammal (USFWS). Second only to the Mediterranean monk seal (*Monachus monachus*) the most endangered pinniped species worldwide and is currently on the brink of extinction. (SCS) The present population is estimated at about 1,200 to 1,300 seals, a decrease of 60% since the 1950s (Antonelis et al. 2006). There has also been a severe drop in seals surviving to adulthood. Currently, a monk seal pup's chance of surviving to the reproductive age of seven to ten years is less than one in five (PIFSC 2007). Some of the serious threats facing the Hawaiian monk seal are the following: infectious disease, habitat loss, fishery interactions, male aggression, and human interactions. (NOAA 2007)

For the Hawaiian monk seal one of the greatest threats to its overall survival as a species is the loss of habitat. This loss of habitat creates a limitation in the area available for pups to be nursed by adult females and high levels of competition. This is a factor that is an indirect mechanism affecting all ages of monk seals. It is certain that the sea level is rising and the possibility for mitigating this problem is low. The main causes for current and future loss of habitat are major storm events and the

overall rise in sea level (Baker et al., 2006). The loss of Whaleskate Island reduced the available parturition sites at FFS and resulted in the movement of parturient females to Trig Island, where the density of mother/pup pairs increased dramatically in 1999 (NOAA 2007). However, high levels of shark predation on preweaned pups at Trig Island were documented in the same year (NOAA 2007).

Some prior work has been attempted to aid the survival of the Hawaiian monk seals of the NWHI. Critical habitat was designated in 1988 from beaches to a depth of 20 fathoms (120 feet) around the northwestern Hawaiian Islands (USFWS). In 2000, the waters from 3 to 50 nm around the NWHI were designated the NWHI Coral Reef Ecosystem Reserve by Presidential Executive Order 13178, which provides specific restrictions on human activities permitted within the Reserve (Antonelis et al. 2006). On June 15, 2006, President Bush announced the designation of the Papahānaumokuākea Marine National Monument in the Northwestern Hawaiian Islands (NWHI). At nearly 140,000 square miles in size, the monument is the largest marine protected area in the world (MCBI).

The anticipated research is an attempt to aid in the continued survival of the species through two different forms of coastal management. By attempting both at the same time an accounting will take place to determine which suggested form of management will best aid in the seals survival. The main populations occur at Kure Atoll, Pearl and Hermes Reef, Lisianski Islands, Laysan Island, and the French Frigate Shoals (UNEP-WCMC). Because the NWHI are the location of the majority

of the Hawaiian monk seal population it is imperative that all that can be done is in order to maintain the monk seals natural breeding grounds.

The hypothesis is that the loss of the Hawaiian monk seals habitat from rise in sea level has direct link to their decline and is it contributing to other areas of monk seal depletion. The null hypothesis states no significant change will be observed from the change in area of the habitats regardless of method used.

Objectives

- To increase monk seal survival rates and also survivorship by way of increasing land masses used for giving birth. As well as to aid in the overall increase in the North Western Hawaiian monk seal population.

- Direct observation of monk seal populations.
 - Document interactions and compare control islands with experimental islands. Establish the most efficient way of aiding survival in altered island environments.

- Increase area and height of main islands used for breeding and weaning.
 - Allow for more seals to properly reproduce and nurse pups in an uncrowned environment.

- Measuring the final and fluctuations over time of the monk seals populations of each specific island over a five year period.

Use to determine the most effective way to mitigate habitat loss.

- Determine which islands are most vital to breeding.

Apply this information to determine which islands are most important to continued survival.

- Examine the projected sea level rise

Use as a timeline guide to establish the necessary implementation of proper coastal management for future survival.

Methods

First three known monk seal breeding locations will be chosen all of similar size and elevation. The islands must also have similar influences when it comes to sea rise and loss of habitat. One island labeled Island 0 will be used as the control.

Nothing will be changed at this site; it will be used solely for observation and comparison. The other two islands will undergo two different forms of coastal management. One labeled Island 1 will undergo land reclamation. Meaning sand and sediment from the sea bed will be used to directly increase the size of the island in order to try and increase the size of the island to better accommodate the existing and future populations of Hawaiian monk seals. The remaining island labeled Island 2

will undergo a different form of coastal defense known as moving seaward. This form entails the building of a dune that will be located in the water on one side of the island and then removing the residual water in order to extend the island to a size that is similar to that of Island 1. This dune will be constructed so that it will slowly erode over time and form a small barrier around one side of the island. The proposed research will take place over a five breeding intervals in order to obtain an average of the effects overtime on the populations. The monk seal populations of all the islands will be under direct and indirect observation techniques. Critter Cams will be fitted on various females that are of reproductive age and also on various weaned pups. This will aid in the observation of the population interactions and the foraging abilities of the weaned pups on all islands. Also satellite linked telemetry similar to that used in the Captive Care Project will be used to determine geographic location and compare the whereabouts of new pups and females of all islands. In depth observation of individual mother-pup interactions and the pups that have weaned as well as their survival abilities on all islands. Every breeding interval that is undergone all new pups and returning females will be quantified. This information will be used to compare survival rates percentage increase of the populations. The locations and distribution of the seals on each island will also be noted. Other factors that will be taken into account are the social behavior as it will be affected by the change in available area. It will also be necessary to account for all storm events.

Results

All results will be based on the efficiency of the population to utilize the new land area given. That being said the survival rates of the populations will be compared to the starting number of individuals and the new pups that survive to the next breeding interval. The percentages will be compared and used to determine the most efficient way to assist the development of the monk seal populations. The expected outcome is that Island 1 will experience the most drastic improvement in population growth overall. It is also expected that Island 2 will show an increase in population but not as significant as that of Island 1. Island 0 will experience no change or even a slight drop in population size due to emigration of females to the more suitable breeding grounds. The expected outcome of Island 1 having a greater increase in population will be due to the fact that ocean access will not be limited. This was due to the use of land reclamation instead of seaward movement. Because only additional nonexistent land was added and no restriction was in place competition for breeding sites should diminish. The area of Island 2 was also increased but the method used was not as efficient in increasing the survival of the seals. The reason being that this method involved creating a dune instead of gathering additional sand extended the shoreline. Because this was only done on one side of the island the access point of the ocean was limited to the side where the dune had not been built. This is believed to affect the locations of nursing because the monk seals will tend to be more concentrated towards the side of the island that had access to the water. This

caused for some competition for space even though the island itself was bigger. These seals are also expected to experience some changes in the foraging locations over the duration of the experiment. It is expected that the prey that the monk seals depend on will begin to become less abundant on the side with accessibility to the water and aggregate closer to the seaward side of the dune where there will be less predation. Following this change the seals will be forced to go around the dune where it is expected that due to the inaccessibility to the shore the weaned pups will experience a difficulty in evading sharks and the dune prove to be an obstacle.

Contributions

If this experiment goes as projected the addition of new land to the NWHI will undoubtedly increase the survival of juveniles and birth rates of pups. One of the biggest problems that the Hawaiian monk seals is facing is loss of habitat. Because the potential for mitigation is so low and there are not many options. The frequency of this threat occurring and the certainty of impact are both high (NOAA 2007). Projected terrestrial habitat loss by 2100 has a great variability; anywhere from a median of 48 cm rise to a maximum 88 cm rise and during spring tides all land below 89 cm to 129 cm could be periodically inundated (Baker et al., 2006). This poses a great threat to the continued existence for the Hawaiian monk seal. If the islands that are used for resting, breeding, and nursing are lost these animals have little alternative. If they begin to use the main Hawaiian Islands the threat of human interaction would increase dramatically. It has been proven that sea level is rising and

if something is not done in the near future to secure the natural habitat for the monk seal it could be lost along with the Hawaiian monk seal itself. Basically what it boils down to is if the habitat is lost it does not matter what else is done to help assist in survival without an area to occupy the Hawaiian monk seal cannot survive.

References

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- (SCS) Seal Conservation Society <http://www.pinnipeds.org/species/medmonk.htm>
- (USFWS) U.S. Fish and Wildlife Service, Pacific Islands-Endangered Species
<http://www.fws.gov/pacificislands/wesa/monkhi.html>
- (UNEP-WCMC) United Nations Environment Programme World Conservation
Monitoring Centre Hawaiian Monk Seal - *Monachus schauinslandi*
http://www.unep-wcmc.org/species/data/species_sheets/hawmonk.htm