Assessing Anthropogenic Impacts on Mangrove Ecosystems

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INTRODUCTION

- **Mangrove functions:**
  - Juvenile species use the complex structure of mangroves as **protection** against predators.
  - Larger predators utilize mangroves as a **feeding ground**
  - Mangroves act as a **carbon sink** and **filter nutrients** out of the water.
  - Mangroves' long prop roots hold sediment in place and provide **shoreline protection** by stopping erosion.
- **Global Threats**:
  - **Deforestation**: Backfilling or dredging for development
  - **Overexploitation**: Overfishing of mangrove creeks
  - **Global Warming**: Global temperatures rise from human actions
- **Local Threats**:
  - **Development**: Backfilling of mangroves for land to build upon
  - **Fragmentation**: Manmade structures (ex. roads) that interrupt natural hydrology

The current policy for mangrove protection is the Bahamas National Wetlands Policy. However, this is only a suggestion for protection and does not bear weight when brought to the government.

Purpose: Collect baseline data of the anthropogenic disturbances on mangrove ecosystems and to provide support for long term mangrove conservation

METHODS

Figure 1. In a preliminary survey, satellite imagery is used to **assess** the level of anthropogenic impact (fragmentation, overexploitation, dumping). The creeks are classified as either minimally, intermediately, or severely disturbed.

Figure 2. Benthic surveys are used to **estimate** bottom type and **identify** algae on the sea floor.

Figure 3. Snorkel surveys are used to **identify** fish assemblages and fish diversity. They are also used to **quantify** fish abundance.

Figure 4. Water sampling **tests** for nutrients, dissolved oxygen, salinity, and temperature. These are all **indicators** of the health of a system.

RESULTS

Table 1. Number of species and economically important species with its corresponding creek names, and level of disturbance.

Creek Name	Location	Level of Disturbance	# of Species	# Economically Important Species.
Broad	Shallow	Minimal	12	1
Hidden Valley	Shallow	Minimal	10	1
Poison Flats	Shallow	Minimal	13	2
Rawlins	Deep	Minimal	27	7
Kemps	Shallow	Intermediate	21	6
Page	Shallow	Intermediate	14	3
Plum	Deep	Intermediate	12	3
Half Sound	Shallow	Severe	28	4
Davis Harbour	Deep	Severe	14	5
Deep	Deep	Severe	2	0

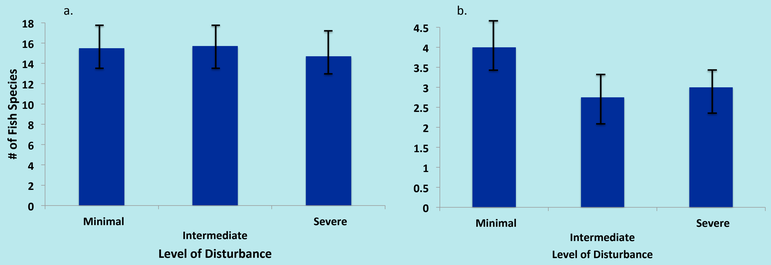

Figure 5. a; There is no statistical relation between the level of disturbance and fish diversity (*P>0.05)* . b; There is no statistical relation between the level of disturbance and number of economically important species present (*P>0.05)*

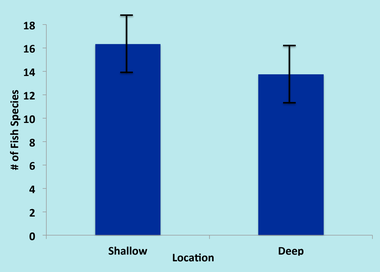

Figure 6a. There is no statistical relation between a creek's proximity to deep water and fish diversity (*P>0.05)*

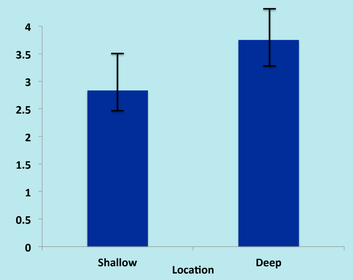

Figure 6b. There is no statistical relation between a creek's proximity to deep water and number of economically important species present (*P>0.05)*

- Davis Harbor had high levels of nutrients and reduced hydrologic flow
- Large populations of juvenile Nassau grouper were seen in Poison Flats and Hidden Valley
- Nesting egrets and white crown pigeons were seen in Kemps creek and Poison Flats
- Turtles were observed in Half Sound, Deep Creek, and Poison Flats

Figure 7. Anecdotal observations in their respective locations

DISCUSSION

After assessing Eleutheran creeks, it was determined that there was no statistical relation between the degree of anthropogenic impacts and fish diversity (Figure 5a). This finding differs greatly to a previous study done by Layman (2004), which provided evidence to support that fragmentation has a negative effect on the overall health of a creek, which was determined by assessing fish biodiversity in randomly selected areas. This difference in findings could be due to the different anthropogenic impacts examined; this study looked at overall anthropogenic impacts, such as eutrophication, dumping and development, while Layman only examined fragmentation. Further research would be needed to identify if the type of anthropogenic impact has an effect on creek health.

It was also determined that there was no statistical relation between fish diversity and its proximity to deep water (Figure 6a). No evidence was provided to support the interconnectivity of creeks and their surrounding environments. However, in a study done by Sheaves (2004), evidence was provided for an "interconnected habitat mosaic" (IHM) used by fish to connect mangrove ecosystems and surrounding habitats. While no statistical relation was observed, it does not mean there is no IHM, just that the IHM has no statistically significant effect on fish diversity.

Although fish diversity did not vary due to anthropogenic impacts, key locations for protection were also identified. Areas such as Half Sound and Poison Flats provided critical habitat for economically important species, including bonefish and Nassau grouper, as well as habitat for threatened species, such as turtles and white crown pigeons (Figure 7).

It was also concluded that the most important component of a healthy mangrove ecosystem was its hydrology. In severely impacted creeks, such as Half Sound and Davis Harbor, roads fragmented the hydrologic flow (Figure 9). It is highly recommended that legislation be put in place to protect the hydrology of mangrove ecosystems that are threatened by development. Additionally, as is seen in Lewis (2005), ecological engineering can effectively restore hydrology in disturbed mangrove creeks. This study provides further evidence that impacting the natural hydrology of a mangrove negatively impacts the ecosystem; therefore, in the development and management of mangrove wetlands, it is imperative for the natural hydrology to be maintained.

Figure 8. Poison Flats supports large populations of juvenile Nassau grouper.

Figure 9. Fragmentation in Half Sound severely altered hydrologic flow.

LITERATURE CITED

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