

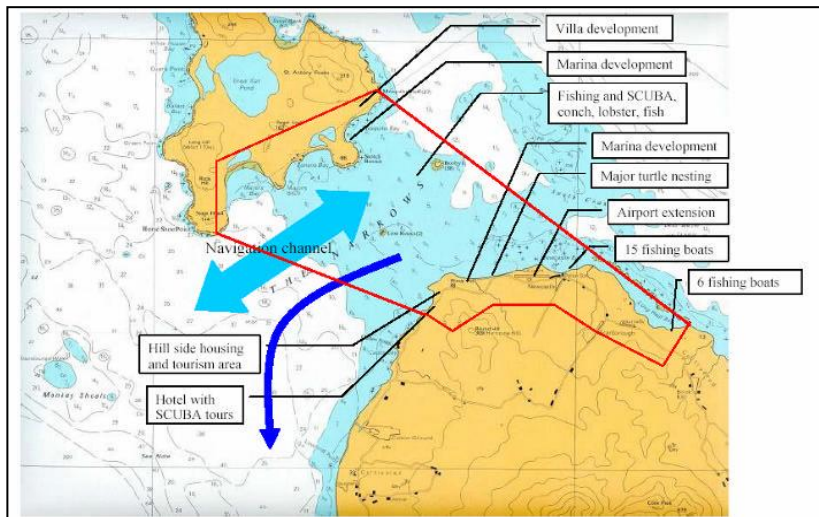
PROPOSAL

Evaluating the risk to the Newcastle Bay Lagoon (and by extension the *proposed Narrows MPA*) from anthropogenic factors, using the RIOS Habitat Risk Assessment model

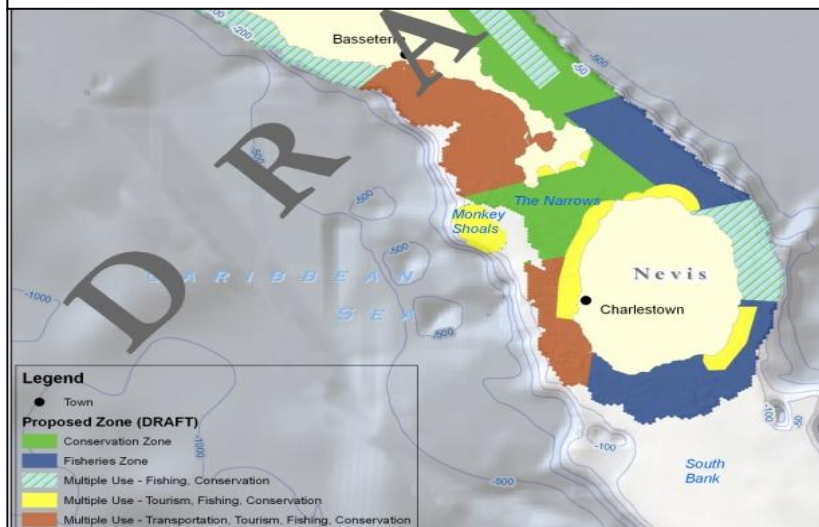
A. Background

The Narrows is a marine area located between the Southeast Peninsula of St. Kitts and the North coast of Nevis. It has been identified as an area for conservation and has been proposed as a Marine Protected Area (MPA) for St. Kitts and Nevis, primarily because of the dense seagrass habitat and biodiversity which exists there. The Narrows has been the focus of various planning and management initiatives for several years.

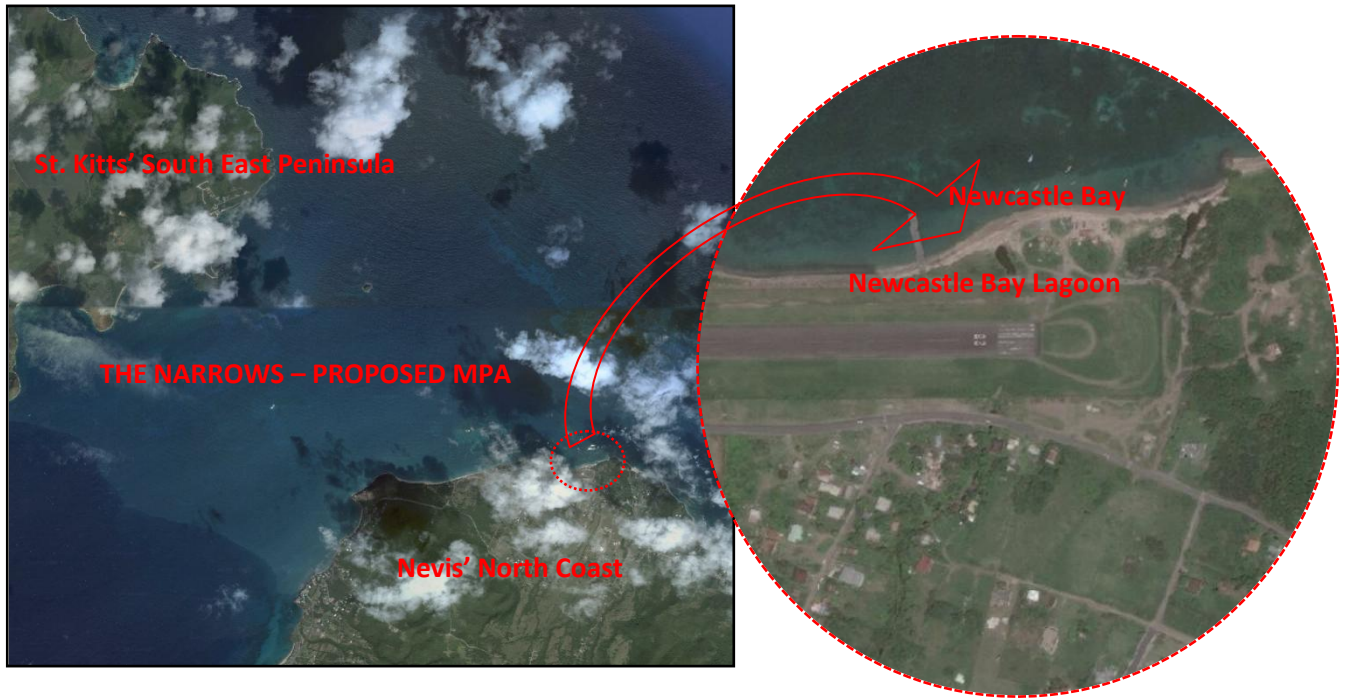
The socio-economic monitoring program (2008) to collect baseline data focused on The Narrows (Fig. 1). Analysis of the data indicates that fishing is the most important activity at the site under study. It is also a traditional area for harvesting lobster, conch, finfish and turtle nesting. Tourism is the second major social and economic activity, which is developing rapidly with the main activities including snorkeling, scuba diving, kayaking, and sport fishing. The fishing and other tourism-related activities occur throughout the year.



The Narrows is designated as a conservation area in The Nature Conservancy (TNC) draft marine zoning plan (2010) (Fig. 2). Ongoing efforts are being coordinated under the Eastern Caribbean Marine Managed Areas Network (ECMMAN) project to establish a Marine Managed Area (extending two miles out) around the two islands. The Narrows is being considered to be the first MPA established (within the MMA or independent of the MMA) to benefit from another project, the Sustainable Financing and Management of Eastern Caribbean Marine Ecosystems Project.



Nevis has a system of freshwater lagoons located throughout the island, some of which are along the coast and are therefore subject to saltwater intrusion. These lagoons may be as a result of either mountain ghaut (stream) run-off, as in the case of Pinney's Estate Lagoons, or underground springs as evidenced at Nelson's Spring in Cotton Ground. These features contribute to the richness, diversity and beautiful scenic qualities of the island's ecosystem. Newcastle Bay Lagoon is part of the coastal ecosystem on Nevis' North coast which directly impact and will contribute to the health or degradation of the resources in the proposed Narrows MPA.



Presently Newcastle Bay has many uses which include water sporting activities such as snorkeling, surfing and diving. It is also used for pot and line fishing and as a fish landing site. Man-made structures that border the bay are the disused Newcastle Jetty, several fishermen's huts, a restaurant as well as at least 3 culverts about 1m in diameter emptying into the bay.

The Newcastle Bay Mangrove system is located adjacent to the eastern end of the Newcastle Bay, North of the Vance W. Amory Airport runway. Only white mangroves are observed at this riverine system. Nonetheless, the mangrove system provides protection to the land from erosion by wave activities, and protects the marine environment, The Narrows, from over siltation by surface runoff. The Lagoon provides a habitat for local biodiversities; various invertebrates, crabs and shore birds, such as the great blue and great white herons, moor hens, kingfishers etc. inhabit these areas and the system serves as nursery for pelagics such as snook and gars. However, there are signs of extensive sedimentation in the lagoon and cutting of mangroves, probably for fence posts or the burning of charcoal.

The bay is protected by extensive offshore fringing reefs.

The condition of a habitat is a key determinant of the environmental services it can provide. For example, multiple stressors including fishing, climate change, pollution and coastal development threaten the ability of coastal ecosystems to provide the valuable goods and services that people want and need. As human activities continue to intensify, so too does the need for quick, clear and repeatable ways of assessing the risks posed by human activities under various management plans. Recent global analyses have revealed that almost no area of the world's oceans is untouched by human impacts (Halpern et al. 2008). Thus, an understanding of the location and intensity of human impacts on nearshore ecosystems is an essential component of informed and successful coastal and ocean management.

In 2013 Nevis participated in a ReefFix project to help determine the value of Nevis' ecosystem services. It was highlighted in the project report that Nevis' coastal ecosystems have been increasingly under threat from natural and anthropogenic factors. Threats are primarily associated with natural hazards, illegal development activities, indiscriminate fishing practices, nonpoint source pollution as well as climate change. The valuation of the services which these systems provide helps to raise public awareness and appreciation of the need to effectively manage and protect these systems. The socioeconomic monitoring program reported that the primary problems for marine resources identified by respondents in that study were pollution / garbage and bad fishing practices.

B. Project Objective(s)

The objective of this project is to evaluate the risks to the Newcastle Bay Lagoon (and by extension the Proposed Narrows MPA) from anthropogenic factors, using the RIOS Habitat Risk Assessment model, with a view to explore strategies that would reduce the exposure of the Lagoon to a particular stressor activity.

Based on the outcome of implementing the RIOS model at the Newcastle Bay Lagoon, it is envisioned that the model could be applied to other lagoons which discharge into the proposed Narrows MPA, both in St. Kitts and Nevis. The identification and implementation of strategies that would reduce the exposure of a particular habitat to a particular activity would contribute significantly to the overall health of the proposed Narrows MPA.

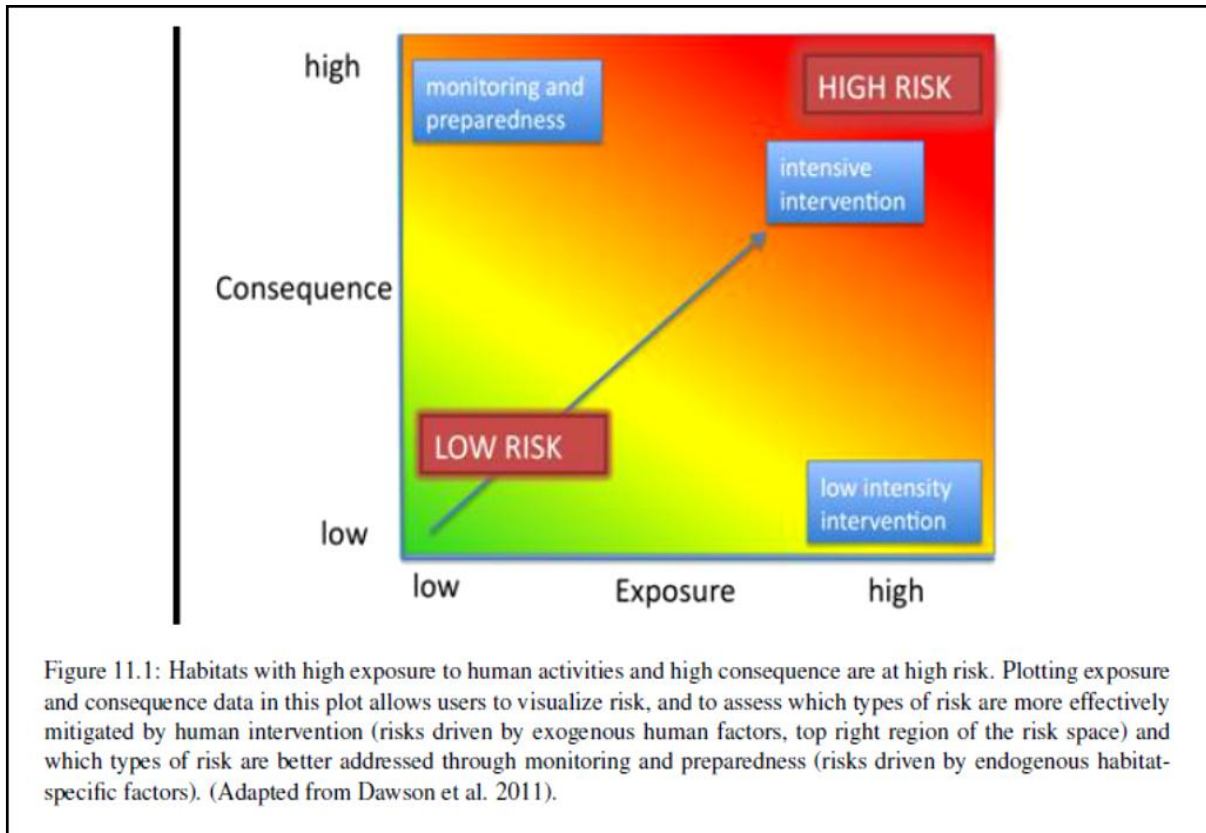
C. Methodology

In the context of marine ecosystem based management, risk assessment evaluates the probability that human activities will impede the achievement of desired marine management objectives. Researchers have made significant progress in evaluating human impacts on marine ecosystems in recent years. However, many of these approaches lack generality because they are focused on the effects of a single sector (i.e. fisheries e.g. Astles et al. 2006, Hobday et al. 2011), or have limited transparency and flexibility because they are based on expert opinion (Halpern et al. 2008, Teck et al. 2010).

RIOS (Resource Investment Optimization System) is a simple, yet powerful tool that provides a standardized, science-based approach to watershed management. It combines biophysical, social, and economic data to help users identify the best locations for protection and restoration

activities in order to maximize the ecological return on investment, within the bounds of what is socially and politically feasible.

Integrated Valuation of Environmental Services and Tradeoffs (InVEST) is a free and open-source software suite designed by RIOS to inform and improve natural resource management and investment decisions. InVEST currently includes 16 models that analyze different aspects of marine and terrestrial environments: **The Habitat Risk Assessment (HRA)** model evaluates the risk to marine or terrestrial habitats from anthropogenic factors. The HRA model in Marine InVEST allows users to evaluate the risk posed by a variety of human activities to key coastal habitats in a transparent, repeatable and flexible way. In the HRA model, risk is defined as the



likelihood that human activities will reduce the quality of nearshore habitats to the point where their ability to deliver environmental services is impaired.

The risk of human activities to coastal and nearshore habitats is a function of the habitat's exposure to the activity and the consequence of exposure. To determine exposure, users provide model inputs such as base maps of habitat distribution and human activities, the timing and intensity of the activity and the effectiveness of current management practices in safeguarding habitats. To determine consequence, users provide model inputs such as observed loss of habitat and the ability of habitats to recover. The model is flexible and can accommodate data-poor and data-rich situations. Data may come from a combination of peer-reviewed sources at the global scale and locally available fine-scale data sources. Model inputs and results can be updated as better information becomes available.

The HRA model produces information about risk at two scales and with several types of outputs. Maps display variation at a grid cell scale in the relative risk of human activities to habitats within the study area and among alternative future scenarios. Tables and risk plots (ie., Figure 1) show the contribution of different activities to the risk posed to each habitat at a subregional scale within the study area and among future scenarios. When run as part of a complete Marine InVEST analysis, the HRA model can be used to identify which human activities are likely to cause trade-offs in other environmental services. As a result, the model will help managers prioritize and evaluate management strategies with regards to their effectiveness of reducing risks to nearshore habitats and maintaining the delivery of desired environmental services.

Procedures

The risk of human activities to habitats is modeled in four steps:

- Step 1. The first step involves determining the likelihood of exposure of the habitat to the stressor and the consequence of this exposure.
- Step 2. The second step combines the exposure and response values to produce a risk value for each stressor-habitat combination.
- Step 3. In this step, the model quantifies the cumulative risk of all stressors on the habitats.
- Step 4. The model identifies areas of habitats that are risk ‘hotspots’. These are areas where the influence of human derived stressors is so great that ecosystem structure and function may be severely compromised. In these areas, there may be trade-offs between human activities and a range of ecosystem services.
- Step 5. Analyse data to determine which activities are contributing the most to habitat risk and identify strategies that would reduce the exposure of a particular habitat to a particular activity.

D. Assumptions

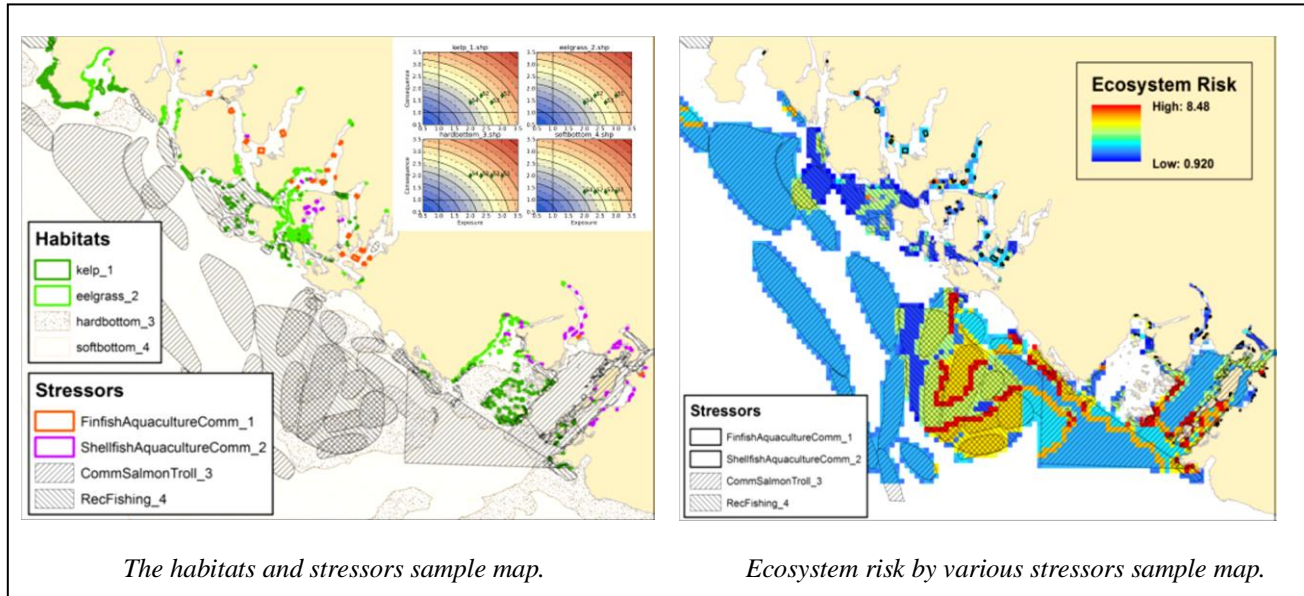
The assumptions are as follows:

1. That there will be adequate access to the RIOS software and required applications.
2. Field visits will be conducted
3. Users of the site will be interviewed
4. Government Departments of Planning and Fisheries will be consulted.
5. All products generated will be shared with Government Departments
6. The project will proceed in accordance with the terms and conditions of the funding agency.
7. The project will be concluded by December 31, 2014

E. Deliverables

The project's deliverables will be:

1. A map depicting the habitats and stressors of the Newcastle Bay Lagoon.
2. A map depicting the level of ecosystem risk by the various stressors in Newcastle Bay Lagoon.
3. A matrix of strategies that would reduce the exposure of a particular habitat to a particular activity.



F. Budget

Activity	Budget(US\$)
Acquisition and Review of Habitat Risk Assessment software	500.00
Delineate project boundaries, including tributaries to Lagoon / Bay	1,000.00
Data Collection – Literature review, Interviews, Field Surveys	1,000.00
Modeling using InVEST HRA model	2,000.00
Production of Deliverables	500.00
Total	U\$5,000.00

References

2010. A. Laurel Arthurton and Karen McDonald. Establishing a socio-economic monitoring program for the Narrows to inform marine conservation and decision-making in St. Kitts and Nevis.

Heather Tallis, Taylor Ricketts, Anne Guerry, Spencer Wood, and Richard Sharp. InVEST 2.6.0 User's Guide: Integrated valuation of Environmental Services and Tradeoff.

Hodge, J. 2013. Nevis ReefFix Report. An OAS Integrated Coastal Zone Management Ecosystem Services Valuation and Capacity Building Project For the Caribbean Project.