

Assessment of Natural Resource Conditions In and Adjacent to Biscayne National Park

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Executive Summary

This report is an assessment of the conditions of natural resources in Biscayne National Park (BNP) based on the compilation, review and evaluation of existing information on the Park's natural resources. This review evaluates threats and stressors, and is intended to improve understanding of BNP resources to help guide Park management to address the identified threats, which are supported by enhanced data collection, research and assessment efforts.

The report is focused on broad resource components, namely terrestrial resources and aquatic systems including: wetlands, canals, bay waters, marine/reef areas and ground waters. Biotic and abiotic resource components are considered in the review.

The objectives of the assessment are to:

- Provide a review/compilation of existing information on BNP natural resources.
- Provide a list and description of threats/stressors to these resources.
- Develop a semi-quantitative ranking of the threats to resource components and the extent of existing information.
- Identify research needs based on information gaps and degree of threat to the resources.

There are many threats to the resources of BNP and many gaps in our knowledge of the functioning of the Biscayne Bay ecosystem. In this report, we identified and evaluated various threats to specific natural resources and color-coded their strength using a stop-light format. To enhance the assessment further, the state of the knowledge for individual threats was complemented with a four-letter code to indicate whether the knowledge base is good, fair, poor

or only inferred. Existing problems with a good knowledge base are candidates for management actions, while problems with less certain understanding are candidates for monitoring and research. Given our understanding of the state of the natural resources of BNP, we highlight the problems that deserve research priority.

The U.S. Congress designated Biscayne National Monument on October 18, 1968 to protect the central and southern portions of Biscayne Bay. In 1982, the monument was expanded and dedicated as Biscayne National Park. The Park is located south of the city of Miami (25°39'N, 80°50'E) in South Florida. The Park covers approximately 172,000 acres, most of which are covered by water, either in Biscayne Bay proper or offshore of the northern extension of the Florida Keys. It includes estuarine ecosystems with extensive seagrass meadows in the bay proper and extensive coral reef areas offshore of the Keys. BNP also includes terrestrial ecosystems on the Keys (mainly hardwood hammocks) and mangrove forest along the mainland shoreline. Except for its developed western boundary, BNP is surrounded by protected areas: to the east by the Florida Keys National Marine Sanctuary (FKNMS), to the south by the FKNMS and Pennekamp State Park, and to the north by the extension of the Biscayne Bay Aquatic Preserve. BNP waters, Biscayne Bay Aquatic Preserve and Barnes and Card Sounds (part of FKNMS) are designated Outstanding Florida Waters. The Park is within the National Oceanographic and Atmospheric Administration (NOAA) designated Essential Fish Habitat

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(EFH) for spiny lobster, snapper, grouper, and the seaward waters are in the EFH for corals. All of BNP is within the NOAA-designated Habitat Areas of Particular Concern (HAPC) for the same groups and within the penaeid shrimp HAPC for the Biscayne Bay portion of the Park. The major threats (not in order of importance) to natural resources in BNP are:

- Overfishing generally and for specific indicator species.
- Acidification as a result of increasing atmospheric CO₂ and its potential impacts on aquatic organisms, particularly corals.
- Atmospheric deposition of anthropogenic particulates with associated pollutants and possibly pathogens.
- Nutrient enrichment resulting in modifications in community structures and potentially negative impacts through harmful algal blooms.
- Microbial contamination due to increased anthropogenic inputs caused by urban development.
- General pollutant loadings to the Park, with particular emphasis on potential ecotoxicological effects of present day pesticides and herbicides, pharmaceuticals and personal care products, marine-derived pollution (e.g., antifouling agents) and canal-derived, sediment-bound pollutants.
- Current water management practices including hydrological modifications, with emphasis on plans for enhanced freshwater delivery (discharge), timing and the associated salinity gradients and pollutant loadings.
- Deposition of marine debris.
- Habitat loss and fragmentation due to urban development, particularly for the urban environments near the Park.

- Concerns about the resilience and buffer capacity of Park natural resources with the ever-increasing visitor use, especially boating and fishing.
- Increases in diversity and abundance of exotic/invasive species for terrestrial and aquatic environments.
- Climate change and associated sea-level rise.
- Potential effects of existing and expanded power plants adjacent to the Park (e.g., thermal, water and radiological pollution).

Anthropogenic threats and stressors are significant for BNP, and their effects can be implied but not accurately predicted. With the ever-increasing urbanization of the Miami metropolitan area, the threats are imminent. Water quality (WQ) is likely to change in response to these growing

xxv human populations in South Florida and the changing policies for managing freshwater resources in the watershed of BNP. It is well established that changes in water quality will lead to changes in the benthic communities in Biscayne Bay and potentially in the marine/reef environments seaward of the barrier islands. Steps should be taken to test hypotheses about water quality. Benthic community relationships and a synthesis of existing and new information needs to be developed to predict outcomes for planned changes in the quality or quantity of water entering the Park. The relationships between altered water quality, including the ecotoxicological effects of associated emerging pollutants of concern, such as pharmaceuticals and personal care products, and the diseases of marine organisms, also need examination.

The terrestrial environments of BNP, which is better known for its marine resources, include hardwood hammocks (broadleaf forest comprised of tropical upland trees) and coastal wetlands. The latter comprise the entirety of mainland BNP, while the former characterize a diverse mixture of communities on the barrier islands that form the eastern rim of Biscayne Bay. These contrasting terrestrial ecosystems are underappreciated and critical components of the broader BNP landscape. The coastal wetlands should be considered critical primarily for their interactions with surrounding marine ecosystems, though their role in buffering nearby urbanized areas from storms is probably considerable. The significance of BNP hardwood forests lies in their contribution to biodiversity in light of the diminished regional extent of tropical hammock vegetation and, consequently, these ecosystems deserve more research focus and support than they presently receive.

Currently, local human impacts are the primary concern; however, the accelerating rate of climate change may soon overtake local impacts in importance. Research should be directed toward understanding how climate change will impact the populations of marine organisms in the benthic communities and the wetlands, in Biscayne Bay and the marine/reef zones of BNP, and also how climate change could alter the relative dominance of species in all communities. Park management practices and strategies need to be continuously enhanced to understand and mitigate visitor use of Park resources. Of particular concern are threats from boating, as well as fishing and diving. The resilience and buffering capacity of Park resources to visitor use, and the potential increase in visitor numbers, must be assessed and management plans adjusted accordingly.

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