

Monitoring Water Quality in Virgin Islands National Park

While over half of the island and 2,287 ha of the surrounding waters are protected within the boundaries of Virgin Islands NP, (VINP). St. John is subject to the same types of developmental pressures that are currently affecting numerous other Caribbean islands. The waters that surround the island and the numerous white sand beaches are perhaps the biggest attraction to the park for visitors from all over the world. More fundamentally, the nearshore waters provide important habitats for complex communities. The characteristically clear waters (low nutrient levels), provide ideal conditions for growth of corals, seagrasses, and a host of other marine organisms.

Sparked by tourism-based economies, development in the Caribbean is occurring at an alarming rate and may prove to be the single greatest pressure facing tropical marine ecosystems. Over the past 25 years, visitation to Virgin Islands National Park has increased drastically, with many visitors arriving on cruise ships and small boats. In 1966, an average of fewer than 10 boats per day used park waters. By 1989, this figure had jumped to averages of 70-80 boats per day in the park (Rogers et al. 1990). As with many islands in the Caribbean, there is a need for good baseline data on water quality. Such data are essential to researchers and park managers as tools for understanding and pinpointing changes affecting marine ecosystems.

In 1988, VINP began its water quality monitoring program encompassing sites both inside and outside the park. Twenty-nine sites, (16 within VINP and 13 outside of VINP), are sampled on a monthly basis. The parameters measured include salinity, dissolved oxygen (D.O.), conductivity, pH, temperature, and turbidity. Salinity, D.O., conductivity, pH and temperature are measured in situ, at the 'surface' (at a depth of 1m), using a Hydrolab Surveyor II Datasonde. Beginning in 1989, subsurface temperatures have also been measured at Lameshur Bay (on the island's south shore), using Ryan Tempmentors. The Tempmentors are secured at the site of permanent transects used to monitor coral cover at sections of the reef, and record temperature every 2 hrs. Turbidity, (water clarity), is evaluated in three ways: 1. by using a Secchi disk, to estimate the depth at which the disk is no longer visible. 2. by analyzing 150ml samples taken from 15-20cm depth, with a Turner TD 40 Nephelometer, and 3. by lowering a Martek Model XMS Transmissometer

over the side of the boat to measure percent light transmission in the water column.

Some Key Findings

• Salinity, pH, and Conductivity

Apparently, there are no inter-annual trends with salinity, pH, and conductivity. There was little fluctuation between sites and years for these parameters. Averages for all sites from January 1988 until March 1991 were 35.52ppt, 7.58 and 53.87mmhos/cm, respectively. Marine systems, primarily due to greater mixing, generally experience little variation of these parameters. This is especially true for St. John which possesses no substantial estuaries or fresh water input, and has a relatively well flushed coastline.

• Dissolved Oxygen

The average D.O. concentration for all sites for this sampling regime was 6.63mg/l. Reef Bay, Rendezvous Bay, and Chocolate Hole had markedly higher average D.O. concentrations than the mean at 8.02, 7.15, and 7.79mg/l respectively. Dense seagrass beds, (dominated by *Thalassia testudinum*), characterize these sites, elevating local dissolved oxygen concentrations as a result of photosynthesis. In contrast, the lowest average D.O. concentration of all sites was 5.94mg/l at Cruz Bay. This is not surprising, as this very shallow site has a barren, muddy bottom, with little flushing, but constant resuspension of sediments.

• Temperature

Temperature fluctuated little over the sampling period. An overall low of 24.47°C was recorded in March 1989 at the ferry dock in Cruz Bay, while the highest surface temperature was recorded in August

1991 at Coral Bay (30.82°C). A comparison of temperature data taken at Lameshur Bay for monthly surface temperatures (measured with a Hydrolab Surveyor II), and from the subsurface temperature shows slight increases at both depths. Mean surface and subsurface temperatures increased from 27.02°C to 27.90°C and from 27.10°C to 27.49°C respectively, from 1989 to 1990. Temperature data, especially from the Lameshur Bay site, is an integral part of a database established to monitor temperature changes in association with coral bleaching episodes (as increases in water temperature have been suspected of triggering bleaching).

• **Turbidity**

Over the past four years, turbidity has increased for sites outside of park boundaries as well as for sites within the park. However, for each year, turbidity values have been consistently higher for sites outside of the parks boundaries (Fig.1). Trends in transmissometry (initiated in 1989), support our findings with the nephelometer turbidity data.

Measurements of percent light transmission and nephelometry readings indicate that Cruz Bay, Great Cruz Bay, Fish Bay and Coral Bay Harbor, all outside of the park, have the highest turbidity measurements of the 29 sites sampled. All are extremely well sheltered bays with naturally poor water circulation. However, it is doubtful that the relatively high turbidity encountered in these bays is due solely to geographic location, and/or physical structure of the embayments. Because of their location outside VINP, these sites experience upland development of the watersheds draining into the bays, and virtual unregulated commercial use of their waters. The significantly poorer water clarity of sites outside of VINP boundaries indicates that restrictions on development and commercial use of embayments within the park is contributing to higher water quality of the bays protected within the park.

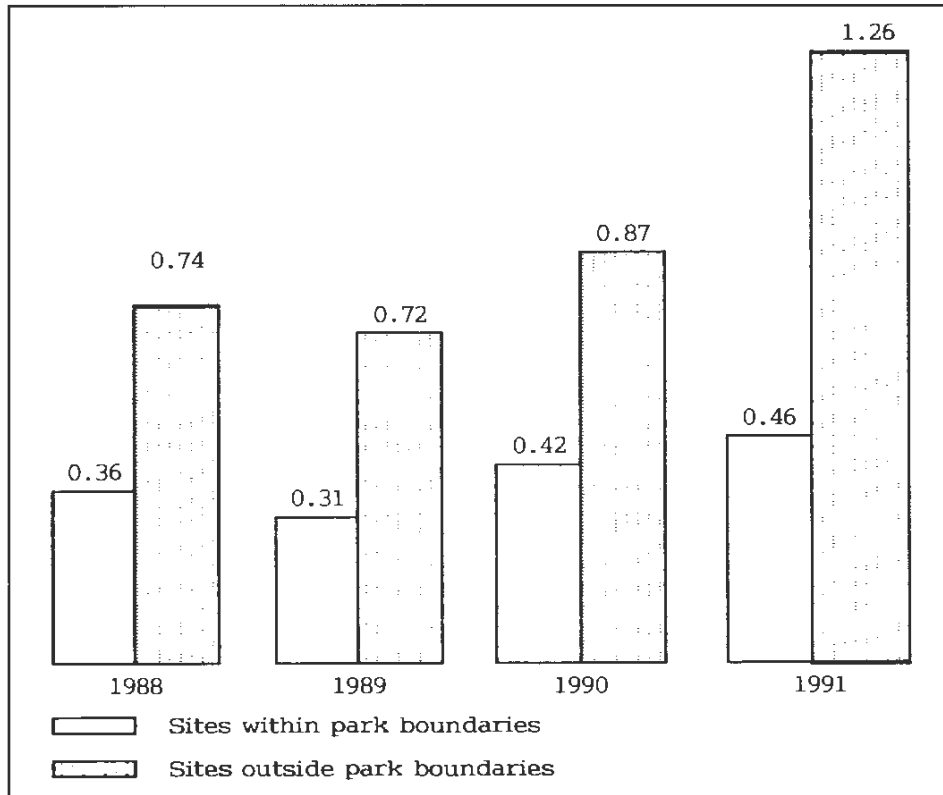


Figure 1. Mean Turbidity (NTU) for Sites Inside and Outside of Park Boundaries

Future Plans

We hope to continue the monitoring program to establish a sufficient database to assess long-term trends in water quality in the park. We also hope to start analyzing bacterial contaminants, in particular, fecal coliforms, for sites adjacent to coastal developments or heavily visited bays.

Giglia Beretta is a Biological Technician at Virgin Islands NP; Tobias formerly was a Biological Technician on the park staff.

Literature Cited

Rogers, C.S., McLain, L.N., and C.R. Tobias. 1990. Damage to Marine Resources in Virgin Islands National Park: Often out of Sight, but No Longer out of Mind. Proc. of the 1990 Congress on Coastal and Marine Tourism. Vol.1. pp. 132-137.