Broad Creek Restoration Report

Friends of the Environment
In collaboration with Dr. Craig Layman (Florida International University)
Project Completed October 2010

Background: Tidal creeks and associated mangrove wetlands are among the most important habitats in The Bahamas. Of particular importance are their roles as "nurseries", that is, areas where juvenile fish and invertebrates mature before moving to deeper habitats (e.g., coral reefs) as adults. For example, juvenile Nassau grouper preferentially settle in red algae that are found in tidal creeks. Over a period of months to years, individuals grow rapidly and eventually migrate back to coral reefs. As such, maintaining the connectivity between tidal creeks and the ocean is critical for many fishery species and for overall health of the marine environment.

Unfortunately, tidal creeks and mangrove wetlands are affected by many human impacts, including direct removal, dredging and pollution. But perhaps the most common problem in The Bahamas is *fragmentation* – some obstruction, typically a road, that blocks the flow of water from the ocean into the wetland. This fragmentation prevents the movement of larval and juvenile fishes between the ocean and tidal creeks and causes drastic changes to the creek environment. For example, on East Andros, over 80% of creeks are fragmented to some degree. One example on Abaco was Broad Creek, which was blocked by the road running to Camp Abaco (See Fig. 1 below). This road had rendered the upstream portion of the creek functionally "dead". The purpose of this project was to restore tidal connectivity, and thus return the creek toward its historic functional state.

Figure 1. Aerial image of Broad Creek. The road to Camp Abaco blocks a large wetland to the northeast. Installation of culverts was intended to restore more natural tidal flow to the wetland area.

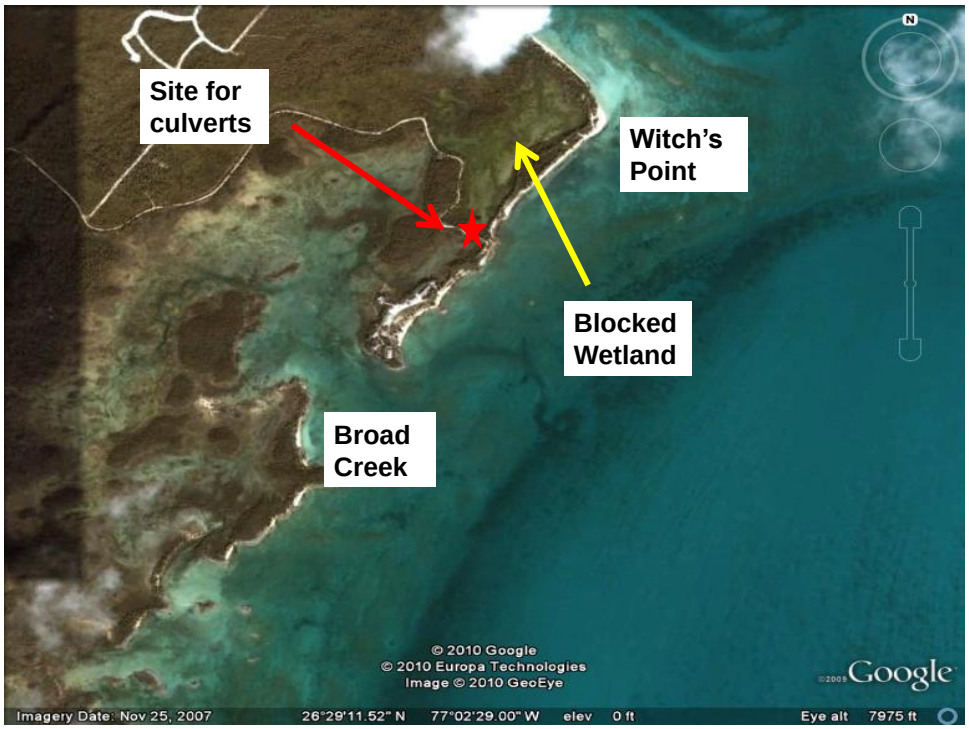

Figure 2. The road to Camp Abaco blocked 28 acres of wetland area (top left). The first step in the restoration was to remove the road, put the culverts in place, and then re-build the road. This step of the project was completed with an excavator (top right). Rocks were place around the mouth of the culverts to stabilize the road and provide habitat for small snapper (bottom left). Areas were cleared on each side of the culverts to provide for freely flowing water (bottom right).

The Restoration: The restoration project was conducted in two phases. First, four 30" diameter culverts were installed under the under the road to allow tidal waters to again flood upstream areas (October 9th, 2010, see Figure 2 above). The culverts were positioned so that the high tide line reaches just above the top of the culverts. An excavator was used to remove this portion of the road, and subsequently infill the area around and above the culverts. Large rocks were placed on either side of the rebuilt road to prevent erosion from tidal flow. The excavator also cleared areas on either side of the road so that water could freely flow through the culverts. The bedrock layer was closer to the surface than at Cross Harbour (restoration in April 2006), so the cleared areas on either side of the culverts are not as deep as in the previous project. Small snapper were observed to move through the culverts the first day following the culvert installation. The rocky areas on either side of the road are expected to support dozens of small juvenile snapper (1-4 inch fish) within weeks.

The second phase of the project provided the opportunity to extend the restoration to local students and community members (Figure 3). By hand (i.e., no heavy equipment was used), mangroves that had encroached into the historic tidal channel were removed. Mangroves are critical components of coastal tropical and sub-tropical ecosystems, and

their removal is an unwanted activity in almost all situations. However, this project was a focused effort to re-create the historic channel for water to flow freely, and ultimately we removed <0.1% of all the mangroves in the system. Approximately 510 Bahamians assisted with the channel creation, the majority of which were students. Most of the schools on Abaco had a chance to be involved in the project. Classroom lectures were coupled with the field trips to maximize the learning experience for the students. This was a true "win-win" situation: an extremely valuable project was completed for the environment of Abaco (at relatively low cost), while serving as a core educational tool.

Figure 3. More than 500 Abaconians were involved with re-creating the historic tidal channels. Most of the schools on Abaco participated.

In total, ~28 upstream acres were restored (Figure 4). These areas will once again become vital additional "nursery" areas for juvenile fishes and invertebrates. Larvae will ride high tides through the culverts and above the mangrove ridge to the upstream "pond" area. The connection with the ocean will allow them to ultimately move back to the ocean as adults and to join the breeding population. Additionally, the restoration re-created the historic tidal regime in the downstream portion of the creek system. Previously, the lack of tidal flow rendered the area too shallow to support populations of foraging fish. The restored channel substantially increases the available area for fish to feed, even in the portion of the system downstream of the road.

Figure 4. Before and after photos of the downstream portion of the creek. The cleared channel will provide for more natural tidal flow throughout the downstream wetland to the ocean, through the culverts and into the formerly blocked upstream areas.

Scientific Monitoring

Prior to the restoration, we made numerous measurements of key variables related to the health and ecology of the system. We will continue to monitor the following variables in the coming months in order to compare them to pre-restoration values and track changes as the ecology of the system changes through time. We will use this monitoring effort to continue to provide additional reports to stakeholders

-Surveys of aquatic vegetation
-Measures of water depth at fixed points across the system
-Additional measures of various physic-chemical variables (e.g, salinity, temperature, dissolved oxygen)
-Collection of aquatic invertebrates
-Quantitative measures of fish abundance
-Diets of fish trapped on the upstream side of the road
-Growth rates of fish on the upstream side of the road
-Quantitative bird surveys