PROJECT SUMMARIES
AUGUST 2009 MARINE SCIENCE MONTH
LIGHT-TEMPERATURE MONITORING, SEAGRASSES, MACROALGAE, AND BENTHIC MACROFAUNA

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Mr. Rick Ware, Senior Marine Biologist/President of Coastal Resources Management, Inc., Corona del Mar, CA and Mr. Stephen Whitaker, Marine Biologist with the Channel Island National Park, Ventura, California conducted oceanographic and marine biological research during the August 2009 Marine Science Month on Guana Island.

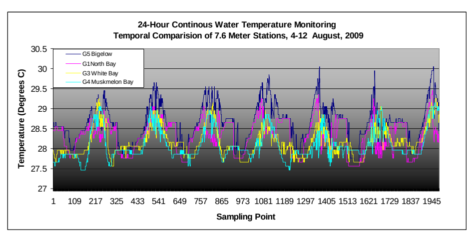
Our research included: (1) Determining bottom water temperatures and light levels within seagrass beds and coral reefs using data loggers deployed around the island; (2) mapping seagrass beds in North Bay and in the Guana Channel and following up on earlier collected (1998-2001) seagrass biological and community structure information in North Bay, Muskmelon Bay, and in the Guana Channel; (3) assembling a list of marine macrophytes from the intertidal zone to depths of 24 meters around Guana Island; and (4) identifying the epibenthic community structure in the Guana Channel between Guana Island and Tortola.

LIGHT-TEMPERATURE STUDIES

- For our underwater temperature and light studies, we deployed a series of six in-water and two in-air (reference) Onset Hobo Pendent data loggers that continuously collected information over ten, 24-hour periods. In-water data loggers were deployed at depths of 1 meter (North Bay), 7.6 meters (North Bay, Muskmelon Bay, White Bay, and Guana Channel), and 22 meters (Muskmelon Bay). Loggers were placed in seagrass beds in North Bay, Muskmelon Bay, and in the Guana Channel and in coral reef habitat in North Bay, Muskmelon Bay, White Bay, and in the Guana Channel.

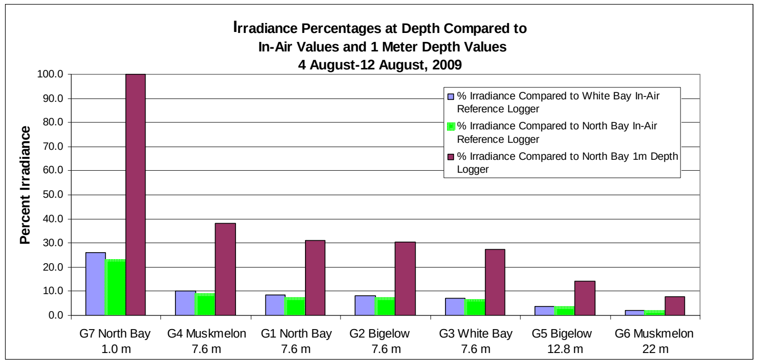
- Water temperatures were highest on the northeast and south sides of the island (North Bay and Guana Channel) and coolest on west and northwest (White Bay and Muskmelon Bay). Mean bottom water temperatures over eight, 24-hour periods in August 2009 ranged between 27.77 +/ -0.24, degrees C, (n=1,699 measurements) at a 22 meter depth in Muskmelon Bay and 29.30 +/- 1.16 degrees C, (n=1,666 measurements) at a one meter depth in North Bay. The mean bottom water temperature based on 24-hour continuous monitoring at the four 7.6 meter stations was 28.35 +/0.25 degrees (n=4 stations).

- Daily solar heating cycles had a pronounced affect on bottom water temperatures whereas we did not detect any substantial effects on bottom water temperatures as a consequence of tidal exchange. However, North Bay and Guana Channel bottom waters had distinctly different thermal regimes than White and Muskmelon Bay and the shape of daily temperature curves for these sites suggest that North Bay and Guana Channel bottom water temperatures reached a noticeably higher temperature plateau between dusk and dawn (ΔT= 0.5 degrees C).



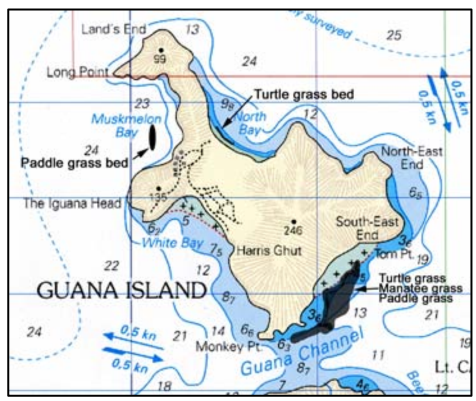
- Between 23% and 26% of the available light was absorbed within the upper one meter of the water column. Ninety-two percent of the available light was absorbed at a depth of 22 m.

- The $\%SI_w$ (percentage of light at depth compared to the light levels 1 meter below the surface) ranged from 7.8% at a depth of 22 meters in Muskmelon Bay (within a *Halophila decipiens* bed) to 38.1% at a depth of 7.6 meters also in Muskmelon Bay. Light levels in Muskmelon Bay were 7 to 9 % greater than the three other sites at a 7.6 m (25 ft) depth. In rank order of decreasing light levels, light levels were highest in Muskmelon Bay, followed by North Bay, Bigelow (Guana Channel) and White Bay. Lastly, as expected, light levels were highly correlated with depth.

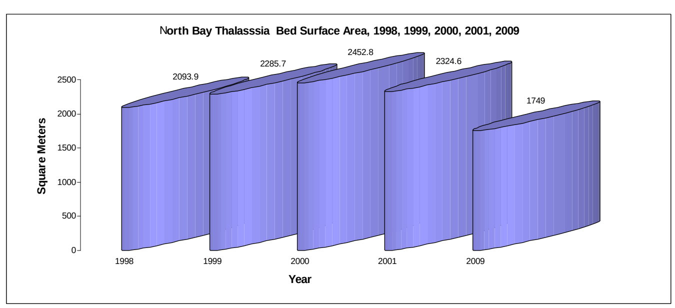


SEAGRASS, MACROALGAE, AND MACROFAUNA RESEARCH

- Our studies documented the distribution of turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and paddle grass (*Halophila decipiens*) around Guana Island at depths between 0.3 and 22 meters. A small, but dense turtle grass bed is located in North Bay 0.3 to 1 meter deep. It is more prevalent in the Guana Channel at depths between 5 and 13 meters. Manatee grass grows in the Guana Channel between Tom and Monkey Point at depths from 7 to 14 meters, and paddle grass occurs in the deeper portions of both Guana Channel (13 meters) and in Muskmelon Bay offshore of Crab Cove (15 to 24 meters).

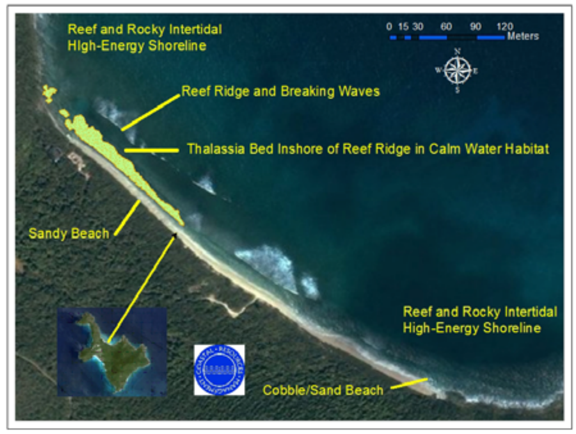


- In North Bay, turtle grass forms a narrow, elongated meadow that extends 210 meters along the 510 meter-long North Bay shoreline and is between one and 23 meters wide. Its size gradually increased from 2,094 to 2,453 square meters between 1998 and 2001 but between 2001 and 2009, the size of the bed decreased by 24.8% (1,749 square meters total area). Seagrass percent cover also declined from a survey high of 68.8% in 2000 to a survey low



of 41.7% in 2009. The decrease in areal extent was accompanied by declines in percent cover of both seagrass and macroalgae and concurrent increases of unvegetated shallow water habitat.

- The turtle grass bed is protected by a shallow reef ridge that dissipates wave energy and makes the North Beach a generally calm water environment. The bed terminates at the southeast end of the ridge. Turtle grass in North Bay is able to anchor itself deeply within the crevices and interstices of the shallow reef platform and withstand the stresses of wave energy in the very shallow subtidal environment, making it less susceptible to damage from waves and energy generated during tropical depressions and hurricanes.



- Sand cover in the turtle grass bed averaged 48% between 1998 and 2009 (n=5 surveys) and ranged between a high of 67% in 2000 to a low of 28.1% in 2009. In 2009, there was a proportional increase in rubble/rock habitat.

- Our temperature data suggests that the shallow water North Bay turtle grass bed may be surviving near its upper thermal limit due to the shallowness of the habitat and likely sustains short-term leaf losses because of exposure and desiccation during extreme low tides. In the long-term, climate changes are likely to alter this species' distribution in North Bay, because it is already near its thermal maxima (29.3 degrees C) in the very shallow subtidal zone.

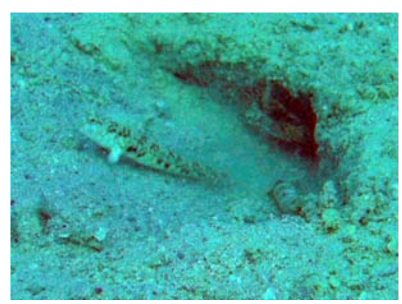
- Changes in seagrass and algal abundances were influenced by shifts in the relative amounts of sand, coral rubble, and exposed reef based on data we collected between 1998 and 2009. These shifts were likely the result of high wave and storm activity from periodic tropical depressions and hurricane activity. Despite recent reductions in turtle grass habitat, it appears to be a stable habitat in North Bay.

- Seagrass meadows encompassed about 0.11 square kilometers of seafloor in the Guana Channel around the south side of Guana Island based on the results of surveys conducted in 2000, 2001, and 2009. The seagrass beds of Guana Island and Tortola are connected via a shallow, mid-channel ridge. The Guana Channel benthos was a biologically active and diverse zone due to the protection and shelter seagrass and calcareous green algae afforded invertebrates and fishes and the high level of organics that drive the detrital-based food web.

- We compiled a listing of 58 macroalgae taxa (13 genera, 44 species, and 1 subspecies) from five locations around Guana Island and one location on Tortola (a single species found on a dock). The highest number of taxa was collected in North Bay (30) followed by Muskmelon Bay (18), Bigelow Beach/Guana Channel (15), White Bay (9) and Monkey Point (9). Based on the total time spent collecting (14 hours), the number of species collected per hour varied from 4.1 (Bigelow Beach and the Guana Channel) to 9.0 (Muskmelon Bay). Dominant algae in North Bay included several species of the genus Ca*ulerpa*, calcareous green algae (*Penicillus capitatus*, *Halimeda* spp., and *Padina jamaicensis*) brown seaweeds (*Sargassum polyceratium var ovatum* and *Dictyota spp*.) and red algae (*Amphiroa*, *Gaulaxura*, and *Liagora*). Dominant algae in the Guana Channel included the calcareous green algae *Halimeda monile, Udotea* sp., and *Penicillus capitatus.*

- Twenty types of macroinvertebrates and five types of fish were recorded from North Bay at depths between 0 and 2 meters between in 2009. Dominant macroinvertebrates in North Bay shallow water habitats included burrowing urchins and ophiuroid brittle stars.

- In 2001, turtle grass and manatee grass percent cover recorded along a single transect offshore of Bigelow Beach was 43.6% and 26.4%, respectively. In a wider-ranging survey between Tom Point and Monkey Point at depths to 15 meters in 2009 (six transects), turtle grass cover varied between 0.2 and 5.4% while manatee grass cover varied 0.6 and 17.2%.



- Besides the 15 algal taxa we found in the Guana Channel, our Guana Channel soft-bottom benthic macrobiota surveys in 2009 documented 15 types of types of macroinvertebrates and five types of fish. Alpheid burrows and ghost shrimp mounds were the principal bottom features within and outside the seagrass beds. The orange-spotted goby *Nes longus* (associated with the alpheid burrows), the giant hermit crab *Petrochirus diogenes* (living in conch shells) and rose coral (*Manicina areolata)* were three of the most common organisms encountered during dive transect surveys in 2001 and 2009.