

ENVIRONMENTAL GRANT SCHEME # 3: UPDATE

Seagrasses of Bermuda

Collaborating to Protect and Enhance a Vital Marine Resource

Seen from above the water seagrass meadows are murky, dark, patches on the sea bottom – not very inviting places to swim. Close up, they are remarkably like the grassy meadows we know on land - with sunny and shaded patches in ever-changing patterns, as the grass blades move in the currents and surface ripples overhead filter the sunlight. Fishes, squid and turtles swim over the meadows. A very close look will reveal smaller animals moving among the blades, and many more animals and plants living on the blades of the seagrasses and on the sandy bottom. The meadows provide temporary and permanent homes to hundreds of species of organisms - plants, animals, fungi and bacteria. This concentration of biological diversity makes these meadows beautiful and biologically intriguing, but the meadows are also key to the health of other habitats in the coastal environment – including reefs and rocky shores. Seagrasses are often called environmental engineers, which means they build and maintain the framework of their meadows.



Seagrasses are highly specialized flowering plants that grow on shallow, soft, sediments of oceans and seas. Like other plants, seagrasses take CO₂ out of their environment when they are photosynthesizing (storing food) and release O₂ into the environment when they are burning energy (respiring), and can maintain healthy water and sediment conditions for themselves and other organisms. The seagrass meadows hold sediments in place offshore of mangroves and other coastlines during rough weather; act as filters or traps for particles in the water flowing through the meadows, which helps to maintain the high water clarity

needed by reef-forming corals; and are a direct food source to some snails, sea turtles, and parrot fish.

Seagrasses in Bermuda are particularly interesting as, like the corals on the reefs, our tropical seagrasses are near their northern limits in the Atlantic, and they are in a tropical marine environment that is considered very healthy, compared to the rest of the greater Caribbean region. In Bermuda, seagrass meadows are found in many harbours and bays, along open shorelines in the west, north and east, in the North Lagoon among patches of coral reefs, and along the inside margins of the outer or rim reefs. Even though they are widespread and common, many details of their distribution, health, and importance to significant commercial or protected species, like spiny lobster, queen conch, grouper, and seahorses, are not known. Bermuda's seagrasses are also very important northern Atlantic feeding areas for juvenile green turtles. A turtle may stay in Bermuda, eating grass, for as long as 15 years.

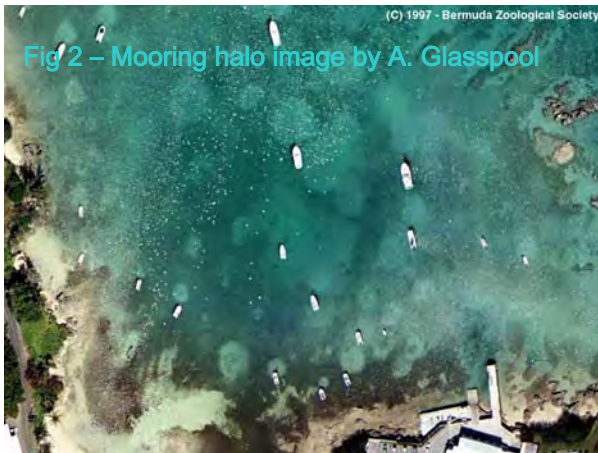
Even so, seagrass habitat has never been the focus of any long term management, monitoring, or research programs in Bermuda, and, as yet, there is no specific legislation to protect either the overall habitat or the seagrasses themselves. The shortfall in our attention and knowledge became obvious when an assessment of general observations of the meadows, made from 1993 through 2004, revealed that some of Bermuda's seagrass meadows were rapidly, and unexpectedly, disappearing. Scientists from both the Ministry of the Environment and Sport (Department of Conservation Services) and from the Bermuda Institute of Ocean Sciences (BIOS) had noticed changes, but no one had put these observations together.

In August 2004, supported by Environmental Grant Scheme #3 from the Ministry, we convened an international group of concerned experts, the "Seagrass Group", in Bermuda. The objectives for the meeting were: to assess the status and current condition of seagrasses in Bermuda, to review current knowledge of

seagrasses in Bermuda, to determine whether further work in Bermuda was needed, and, as needed, to outline a plan for an effective and collaborative program for managing and monitoring seagrasses in Bermuda.

The meeting of August 2004 included expert presentations, site visits to 26 meadows around Bermuda, site analyses, and, development of lists of priorities for management, education and research on Bermuda seagrass meadows – all in just four (long, but productive) days. High resolution aerial images of the Bermuda platform from 1997 and marine habitat maps for 1997 and 2004 created from these by the Bermuda Biodiversity Project (reported in EnviroTalk of October 2004 by A. Glasspool, Bermuda Zoological Society, Bermuda Biodiversity Project) were essential to the overall evaluation of the current status and condition of seagrass habitat in Bermuda.

First and foremost, it was confirmed that seagrass meadows in the North Lagoon and near the rim reef had lost as much as half their total area since the late 1990s, probably declining most rapidly over a period between 1993 and 1997.



Second, it was determined that we could not easily identify any probable cause for the decline of those particular meadows. Whereas, in meadows along the shore and in harbours physical disturbance from boats, for example, is easily recognized, such disturbance is not evident in meadows further from

shore. It was also decided that the decline of the seagrass meadows should be communicated as widely as possible and that there was an enormous need for additional information and for improved access to information about seagrass habitats of Bermuda. Subsequently, a scientific paper reporting this massive loss of seagrass habitat was published in 2007 by the “Seagrass Group” (*Murdoch et*

al. 2007. Large-scale decline in offshore seagrass meadows in Bermuda. Marine Ecology Progress Series Vol. 339: 123–130).

To ensure we took comprehensive action in studies and management of the seagrass meadows, the “Seagrass Group” adopted five objectives for studies of marine benthic habitats of Bermuda, with a focus on seagrass meadows.

1. To support, solicit and encourage collaborative and multidisciplinary studies on seagrass habitats in Bermuda;
2. To support and assist data collection, data management and data sharing, locally, regionally and internationally;
3. To work to integrate needs, interests and activities of resource managers, scientists and habitat users;
4. To promote public awareness of the beauty and significance of seagrasses; and
5. To develop an integrated and overarching management plan for seagrass habitat in Bermuda.

Over the past three years, the “Seagrass Group” has raised international awareness on the condition and status of seagrass meadows in Bermuda through publication in international journals, presentations at international and regional science meetings, and by enthusiastically soliciting and supporting international and local collaborations. The Seagrass Group also held meetings to engage local managers and scientists in the conservation of this resource.

A workshop and course on management and basic seagrass biology was offered in August 2005 by the Department of Conservation Services. The lead instructors were Dr Jim Fourqurean, Florida International University, and Dr Jud Kenworthy, National Oceanic and Atmospheric Administration. The introductory session of this course was designed for all stakeholders – tour operators, resort managers, government managers, scientists and other interested parties. Following this,

four intense days of lecture and practical sessions in the field and laboratory were offered to those involved in managing or studying seagrass habitat.

A management plan for seagrass habitat in Bermuda, based on the outline created at our meetings in 2004, was completed in early 2008. A number of monitoring and research programs were begun in the summer of 2006 and more are being added as we get a better understanding of the dynamics of seagrass habitat and its connectivity to other marine benthic habitats. The overall objectives of the management and monitoring projects are to:

1. acquire, archive and disseminate basic water quality data for the Bermuda platform;
2. regularly monitor and map the condition, health, and extent of seagrass and other marine benthic habitats, using time and cost effective methods;
3. understand the basic ecological requirements of seagrasses in Bermuda through environmental mapping and data analyses;
4. determine and predict effects of marine development (shoreline modifications, dredging) on seagrass meadows;
5. understand grazing patterns of sea turtles and the effects grazing has on Bermuda's seagrasses;
6. determine the influence of seagrass meadows on fish diversity and abundance, with a emphasis on fishes that are used locally for food; and
7. assemble historical data about Bermuda's seagrass habitat, in order to determine temporal patterns of change in our meadows before and during the decline of the 1990's.

We expect to give a short report on the progress of the benthic and seagrass project in a future issue of EnviroTalk, with this being an update on the project since we received funding for first meeting in 2004. Here is just a sampling of some of what we have done so far.

- Since August 2006, we have surveyed benthic habitat at 422 locations around Bermuda, by SCUBA diving, and measured water quality characteristics at all these locations. We now know where seagrass grows and which of our four species are most abundant and most healthy.
- Since March 2007, we have been surveying four times a year at 17 seagrass beds to see how the beds change over the year and to get a record of how environmental conditions change through the year.
- Since September 2007 we have been going to our 17 seagrass sites every month to collect water quality data. The “Bermuda Water Quality Program” data can be found at <http://serc.fiu.edu/wqmnetwork/>.
- In September this year (2008), we started a year long experiment, in one location where seagrass is continuously grazed by turtles and fishes, to see what happens when turtles are prevented from grazing. We already know from a preliminary experiment we started in December 2007 that in the summer the grass gets long and dense very quickly if you keep the turtles away.
- A research group led by Dr Ivan Nagelkerken has been studying which fish use our seagrass beds and is comparing this to Caribbean locations (*Huijbers et al 2008. Shallow patch reefs as alternative habitats for early juveniles of some mangrove/seagrass-associated fish species in Bermuda. Revista de Biología Tropical Vol. 56: 161-169*, and other articles in preparation).

Through the contributions and collaboration of many experts and stakeholders, individuals and groups from within and from outside Bermuda, representing institutions including the US Geological Survey, University of Puerto Rico, Radboud University Nijmegen [The Netherlands], Florida International University, and National Oceanic and Atmospheric Administration, we are moving toward vastly improved and extremely useful knowledge of this essential marine resource. Through continuing and expanded collaboration we hope to achieve

the most effective and efficient use of time, expertise and funding. This is a very exciting initiative.

The continuing activities of the “Seagrass Group” and recruitment of new collaborators have only been possible because of the strong commitment and enthusiasm of the Department of Conservation Services and because of the amazing personal and professional commitment of members of the “Seagrass Group”, in particular Dr Sarah Manuel, Mr Anson Nash, Dr Jim Fourqurean, and Dr Jud Kenworthy.



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Titles for Figures

1. French grunts in a turtle grass meadow. Photo by K. Holzer.
2. Halos of bare sand around boat moorings in Mangrove Bay. Photo by A. Glasspool.
3. “Seagrass Group” of August 2004; Dr Wolfgang Sterrer, Dr Penny Barnes, Mr. Jack Ward, Dr Sarah Manuel, Dr Jim Fourqurean, Dr Thad Murdoch, Dr Kathryn Coates, Ms Jennifer Gray, Dr Annie Glasspool, Mr. Anson Nash. Missing: Dr Joanna Pitt, Mr Donald Humphries, Dr Robbie Smith and Dr Marjo Vierros. Photo by K.A. Coates.