



**Review of Existing Data
on Sengekontacket Pond and
Recommendations for Future Research**

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Introduction

Friends of Sengekontacket and others have motivated a number of studies on the pond, encompassing water quality (Gaines & Solow 1991, Huston 1994, Keller 1994, Gaines 1995, MVC 1997, Dripps & Wilcox 1998, Wilcox 1999), pond ecology (Costello 1994, Hempy & Wilcox 1998), tidal flow (Wilcox 2002), barrier beach maintenance (Shabica et al. 1988), potential and real impacts of dredging (Britz 1993, Gaines 2000), shellfish harvest trends (Waterman 1989, Taylor 1994b), recreational value (Kaoru 1991), management recommendations for Sengekontacket Pond (Davis & Bliven 1996, Horsely & Witten 1998, Gaines 1999), and overall great pond management (Taylor 1994).

Gaines (1995) provides the best review available of research completed on the pond to that date. Davis and Bliven (1996) provide a detailed summary of studies conducted up to that date and recommendations for pursuing a comprehensive management plan for the pond. This report will review and summarize reports made available since 1996 and present a further outline of recommendations for pursuing a comprehensive management plan for the pond. These recommendations are intended to be sufficiently specific to lay out a series of next steps which Friends of Sengekontacket could pursue towards completion of a comprehensive management plan.

Data Review

Previous work

Davis and Bliven (1996), in Appendix A to their report, *Recommendations Regarding a Management Plan for Sengekontacket Pond*, provide an annotated bibliography including most of the studies focusing on Sengekontacket Pond completed through 1996. The appendix is attached here for reference. Their comments on each study include important statements on the qualifications of each author and the strength of each paper's conclusions. For example, much of the water quality research completed in the pond was conducted by student summer interns at Woods Hole Oceanographic Institution. Although the authors doubtless benefited from the supervision and review of Dr. Arthur Gaines, most of the papers are based on limited data and include varying amounts of conjecture and assumption. Davis and Bliven correctly call attention to these papers with the qualification, "This paper was prepared as a student project and has not been peer-reviewed. Conclusions should be used with caution."

A few papers provided for this review were not addressed by Davis and Bliven (1996). These include Taylor (1994b) and Costello & Stone (1994). These two papers are addressed below in our review of papers since 1996.

Many of the collected reports address Sengekontacket as part of an island wide study and so offer only general information on the Pond. Many of the other reports are based on limited data and rely on assumptions that are difficult to check. The most substantial and applicable papers completed prior to 1996 are:

- Gaines, Arthur G, Jr. & Andrew R. Solow. 1991. The distribution of fecal coliform bacteria in surface waters of Sengekontacket Pond and management implications. Interim Report #1, Sengekontacket Pond Project. [Unpublished Report]. Marine Policy Center Woods Hole Oceanographic Institution, Woods Hole, MA. 29pp.
- Gaines, Arthur G., Jr. 1995. *A natural systems assessment of Sengekontacket Pond, Martha's Vineyard: managing domestic wastewater at the coast. (final report)*. Marine Policy Center Woods Hole Oceanographic Institution, Woods Hole, MA.

Gaines (1995) incorporates much of the data collected for student papers in the years previous.

The following papers were completed since the 1996 Davis & Bliven review or were not included in their review. Review of each report includes comments on quality of the report and utility to management planning for Sengekontacket Pond, and summarizes the major findings. The reports are grouped by topic.

Commercial Fishing

Taylor, Jo-Ann. 1994. *Martha's Vineyard commercial fishing survey*. Martha's Vineyard Commission, Oak Bluffs.

This high quality report summarizes the findings of a survey distributed to "Island fishermen and others who have an interest in and knowledge of the fishing industry." Thirty-five "pond fishermen" responded. Results are presented town-by-town, so it is difficult to draw specific conclusions about Sengekontacket Pond. Findings include: 53% of respondents report using Sengekontacket Pond; "Water Quality and Habitat" rated as the factor most in need of planning for the future; "Fisheries Management" and "Dredging for Navigation" ranked second and third.

Eelgrass

Costello, C. T. & J. S. Stone. 1994. *Martha's Vineyard eelgrass mapping inventory*. DEP, Boston.

This very good, detailed report presents the methods and results of an eelgrass mapping effort based on May 1994 aerial photos. The report includes a good summary of the ecology of eelgrass, but provides no maps. The mapping was incorporated into a statewide map of eelgrass beds which is available digitally from MassGIS (and which shows that in Sengekontacket Pond, eelgrass was present only in Major's Cove). MassGIS reports on its website that the data was to be updated in 1999.

The report recommends that

- the inventory be updated every 5 years;
- selected beds in Sengekontacket Pond be monitored seasonally;
- GPS is employed to create digital maps of field assessments;
- Change data is used to inform management.

Hempy, Kara & William Wilcox. 1998. *A survey of the eelgrass beds of Sengekontacket and Farm Ponds*. The Martha's Vineyard Commission, Oak Bluffs.

This paper, completed by a student under the supervision of William Wilcox, offers updated data on eelgrass in the ponds and reports on an attempt to transplant eelgrass into Sengekontacket Pond. The study employed straightforward methods and the report offers good analysis of transplanting efforts.

The survey was conducted by boat transects and did not include aerial photography. Eelgrass was relocated in Major's Cove and was found to be dense in Trapps Pond. Sign of wasting disease (a plant pathogen suspected in the regional decline of eelgrass) was identified. The transplants failed; spider crabs were suspected to contribute to the failure.

The report provides very important update to the eelgrass mapping in Major's Cove and adds baseline data on Trapps Pond; and provides recommendations for future efforts at transplanting.

Water Quality

Martha's Vineyard Commission. 1997. EDA-95 groundwater sampling program Sengekontacket Pond and Farm Pond.

This important paper presents baseline chemistry from 12 wells around the pond based on water samples collected in 1995. The report offers little analysis of the results, but does create the opportunity to resample the wells, or set up an on-going monitoring and testing program to investigate trends. The authors conclude that: nutrient input was at acceptable levels; that nitrates are associated with deeper wells (i.e. groundwater from developed areas); and that management efforts should focus on localized inputs. Recommendations include:

- Research into stormwater runoff;
- Update of the eelgrass inventory;
- Continue monitoring of nutrients in Ocean Heights area;
- Continue dredging program;
- Perform periodic updates of water testing.

Horsley & Witten 1998. *Mapping analysis of critical areas within the drainage basin to Sengekontacket Pond*. Horsley & Witten Environmental Services, Sandwich.

This compilation of GIS map data provides a very good cartographic introduction to the Sengekontacket setting and surrounding land area. All of the map data is available from MassGIS except for Sengekontacket Pond watershed and groundwater recharge area from Keller (1994). Land use data was recently updated by MassGIS. An update of the land use maps, with analysis of changes, would be informative.

Dripps, W. & W. Wilcox. 1998. (draft) Nitrogen loading study for Trapps' Pond, Edgartown. Island Ponds Consortium.

This useful report adds data for Trapps Pond to the growing library of information on the Sengekontacket Pond system. The primary author had only one summer to tackle a large analysis. Much of the analysis is based on assumptions of nitrogen budgets for a variety of land use types, but the assumptions are well thought out and well explained.

The report provides an estimate of the watershed of Lower and Upper Trapps Ponds, but doesn't estimate the groundwater recharge area; estimates nitrogen input from sewage and fertilizer, by applying a multiplier to the number of businesses, residences, etc. in the watershed; and uses original data on tidal exchange to estimate residence time and freshwater input into Trapps Pond.

The report recommends general steps to lower nitrogen in the groundwater, including upgrades to domestic wastewater systems, reductions in fertilizer use, and zoning and land use management. The authors also recommend a study to investigate the potential for increased flushing of Trapps Ponds by a larger culvert between Lower Trapps and Sengekontacket.

Gaines, Arthur G. 1999. *Nutrient loading and management strategies at Sengekontacket (working draft)*. Woods Hole Oceanographic Institute Marine Policy Center, Woods Hole.

Dr. Gaines offer additional useful thoughts on the state of the pond and on management steps. He reiterates his conclusions from previous studies that Sengekontacket Pond is neither eutrophic nor over-enriched and that the pond is "healthy," but continues to emphasize that nitrogen input is the central pond management issue. Original data from nutrient enrichment studies suggest that the Pond would not suffer immediate adverse impacts from additional nitrogen inputs.

The author recommends pursuit of an adaptive management plan and offers a broad list of possible actions for Friends of Sengekontacket, from local education to motivating a nitrogen discharge quota system, which, although complex, has been implemented on parts of Cape Cod.

Wilcox, William M. 1999. *Island coastal ponds water quality study (final report)*. The Island Ponds Consortium.

This very detailed report provides additional, much-needed data on nutrient inputs to the pond. Nine stations were sampled in 1995 for dissolved inorganic nitrogen, total dissolved nitrogen, and a range of other parameters, with special emphasis on Major's Cove and the waters off of Ocean Heights. The same nine stations plus additional points were sampled in 1996. The wealth of baseline information provides the starting point for on-going water quality analysis to inform pond management.

Recommendations for additional studies include:

- Coastal pond flushing;
- Invertebrate survey;
- Finfish survey;
- Macrophyte survey;
- Assessment of primary productivity;
- Recharge area identification and build-out analysis.

Dredging

Gaines, Arthur G., Jr. 2000. *The impacts of dredging on Sengekontacket Pond*. Marine Policy Center Woods Hole Oceanographic Institution, Woods Hole, MA.

This report offers general thoughts in the potential impacts of the 1997 dredging activity in Sengekontacket Pond. It offers an excellent history of the dredging project with bathymetric maps of the borrow site before and after dredging. The author updated tidal studies of the pond, but suggests that additional data are needed to comment on changes due to dredging. The report refers to several existing reports and monitoring efforts relative to pond bathymetry and barrier beach profile which would be good to have in the Friends of Sengekontacket library.

Tidal Exchange

Wilcox, William. 2002. *Report on tidal exchange between Sengekontacket and Trapps Ponds*. Martha's Vineyard Commission, Oak Bluffs.

In this concise report, Wilcox uses new data to investigate the potential tidal restriction into Trapps Pond. After monitoring tide height on either side of the Trapps Pond culvert, the author concludes, "It is apparent that the culvert is inadequate to pass the tidal prism that is available at the Sengekontacket Pond gauge through to the Trapps Pond side." The report further concludes that increased tidal exchange would likely result from enlarging size of culvert, and that such increased exchange would tend to increase flushing of nutrients. The presence of epiphytes on eelgrass within Trapps Pond is presented as evidence of high nutrient loading within Trapps Pond.

The author recommends that before pursuing an enlarged culvert, additional studies investigate the potential impacts of increased flow, such as: flooding on the margins of Trapps Pond; erosion of the channel by increased flow; and increasing salinity at Trapps Pond margins. Other studies need to ask whether increasing flow will contribute to flushing of Upper Trapps Pond, and assure that any culvert design meets the needs of anadromous fish.

Recommendations for Additional Research

Almost all of the many studies discussed above and in Davis & Bliven (1996) attempt to use data collected within a short amount of time to draw general conclusions about the ecology of Sengekontacket Pond. Our chief recommendation is that Friends of Sengekontacket work to create an on-going, standardized pond monitoring program which will inform future management actions. Such a program would be designed with FoS, MVC, town, state, and others' input. At a minimum we would recommend including: dissolved oxygen, temperature, pH, chlorophyll, clarity, nitrogen (DIN, TDN), total suspended solids, and salinity. In addition to water quality, we would recommend that mapping of eelgrass be continued on a regular basis, and that further research be conducted into historical extent of eelgrass beds in the pond and possible causes for eelgrass decline in the pond.

Sample collections sites and frequency would be established in the study design, but it is important that water quality data be elevated from a loosely connected collection of datasets to a long-term, consistently sampled, statistically relevant body of information covering all seasons instead of summer only. More than identifying new areas of research, it would seem that Friends of Sengekontacket could have the greatest impact by utilizing its strengths as a networking organization to connect expertise and resources in the pursuit of such a consistent monitoring program.

Conclusion

Friends of Sengekontacket and other organizations and agencies interested in the long-term maintenance of Sengekontacket Pond for its economic, recreational, natural, spiritual, and many other values have invested tremendous resources in focusing high quality research on the pond. Reports ranging in intensity from one season student papers to multi-year Ph.D.-level research efforts comprise a wealth of baseline and analytical information from which an understanding of pond dynamics is crystallizing. Our central recommendation for future study is that the broad sweep approach to research be converted to pursuit of a more focused, long-term dataset.

Many of the above described reports include recommendations for management actions or outline items to be addressed in a management plan. Additional documents by Don Cullivan lay out in some detail a path towards a comprehensive management plan. The scope of our work on this report does not include discussion of a management plan; however, our review of the existing reports has prepared us to formulate a framework for management planning. It is our hope that we will continue to work with Friends of Sengekontacket to pursue that next step.