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Aquaculture Reports & Issue Papers

Maine Aquaculture Review - this is a pdf file and is about 1.5 MB

Green Slime - pdf (507.13KB)

Environmental Monitoring of Salmon Aquaculture - pdf (442.79KB)

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### Environmental Research & Monitoring

The Department, in conjunction with the Department of Environmental Protection, administers the Finfish Aquaculture Monitoring Program, or what is called the FAMP. The FAMP is a comprehensive monitoring program for all finfish farms in the State. The FAMP collects data routinely from farms in order to ensure they are operating within acceptable environmental limits.

The FAMP includes a twice-yearly video survey of all active farms collected in the spring and fall that provides clear and timely information on benthic (bottom) conditions. As well, dissolved oxygen readings are collected at farms in late summer when water temperatures are highest to ensure there are not violations of water quality standards. Finally every other year, a benthic survey of organisms is conducted under farms to determine the abundance and diversity of animals is within acceptable limits.

In addition to the FAMP, the Department conducts and participates in research on the impacts of aquaculture. Past research has included assessments of fallowing, organic enrichment, nutrient modeling of embayments, antibiotic residues, and nutrient enrichment.

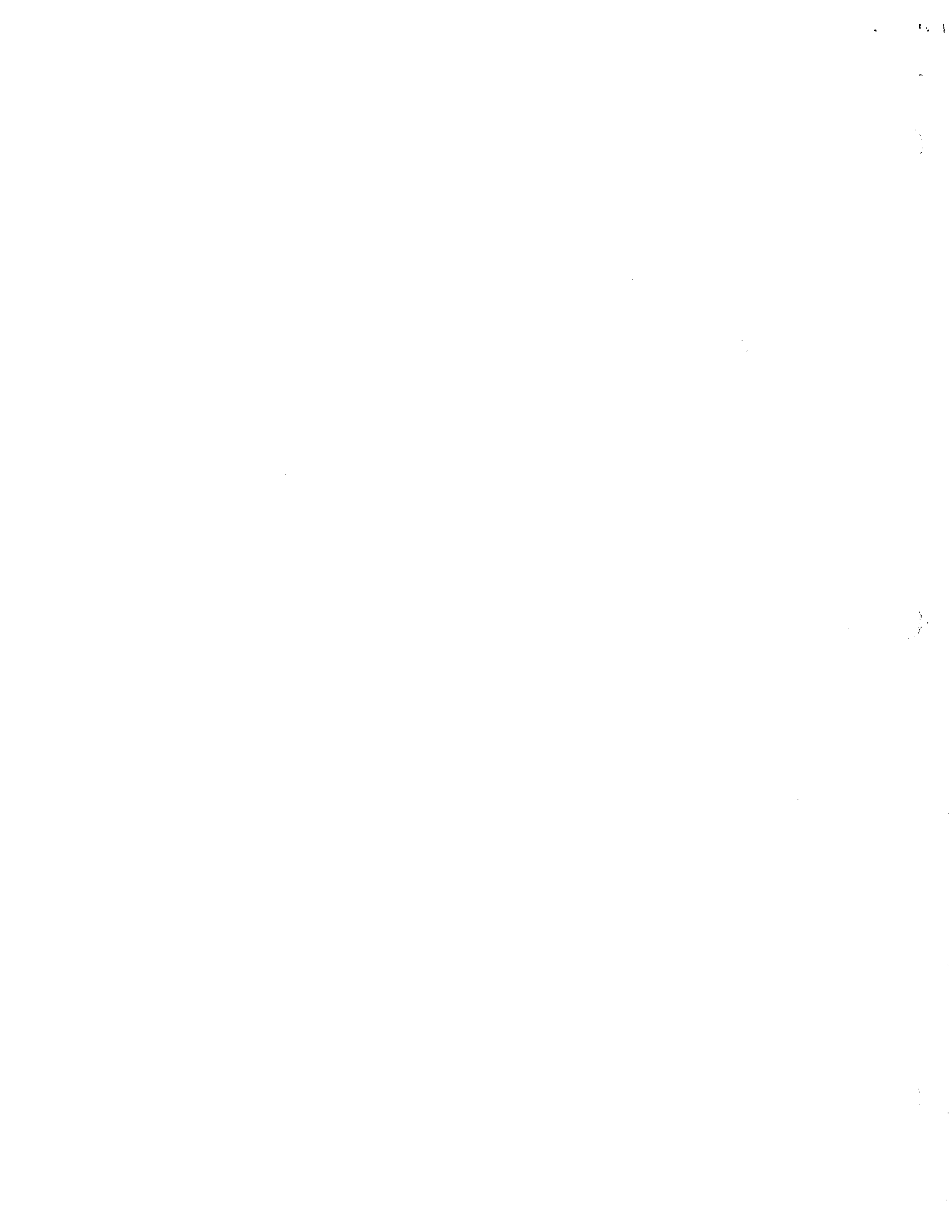
Some of the Department's work is available at this site as .pdf files.

PDF Files available on-line:

Sowles, J., L. Churchill, and W. Silvert. 1994. The effect of benthic carbon loading on the degradation of bottom conditions under farm sites, p. 31-46. In B.T. Hargrave [ed.]. Modelling Benthic Impacts of Organic Enrichment from Marine Aquaculture. Can. Tech. Rep. Fish. Aquat. Sci. 1949: xi + 125p. [Click here to see .pdf file](#) - Very big file - be patient downloading

Silvert, W. and J.Sowles. 1996. Modelling environmental impacts of marine aquaculture. J. Appl. Ichthyol. (12) 75-81. [Click here to see .pdf file](#) - Very big file - be patient downloading

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# **MAINE AQUACULTURE REVIEW**

**FEBRUARY 2003**

**MAINE AQUACULTURE REVIEW**

**Prepared for  
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## **1.0 INTRODUCTION**

### **1.1 BACKGROUND**

Aquaculture began in Maine in the 1970s, with limited culture of mollusc and finfish. Atlantic salmon aquaculture grew and was well established in the 1980s. Over the past 12 years, the salmon farming industry has grown in Maine from 19 farms in 1990, producing 1.9m pounds (Parametrix 1990) to a production estimated at 12.54m pounds in 1992, with an estimated value of \$37.5m. Maine's salmon industry in 1999 produced a estimated value of \$64.1m (Goldburg et al. 2001). Currently, Atlantic salmon produce 96% of the revenue. In 2002, there were 1,203 acres of subtidal land leased for aquaculture: 44 lease sites for finfish (26 active, 750 acres); 80 lease sites for shellfish (445 acres) and one lease site for seaweed (7 acres, Fisk 2002). The latter is no longer in production (John Sowles, MDMR, personal communication).

Aquaculture monitoring in Maine initially occurred on a case-by-case basis with a focus on finfish. Site-specific monitoring plans were developed for each site by the Maine Department of Marine Resources (MDMR) and Department of Environmental Protection (MDEP) but responsibility for monitoring was that of the individual site operators. As monitoring reports were submitted, it soon became obvious that data collection quality and methodology were extremely variable. The result was that comparisons between sites and over time were not possible. To address the problem of inconsistent monitoring in 1991, a unified monitoring program was developed. The Maine Legislature created the Finfish Aquaculture Monitoring Program (FAMP), where the state became responsible for monitoring all the finfish sites. The program was funded by a 1-cent tax for each pound of salmon. The fee supported contracting with a single entity to conduct monitoring according to MDMR and MDEP protocols. Through this, the FAMP was able to provide consistency in review for all farms and instituted a quality assurance program.

The industry and husbandry practices have changed dramatically since the early 1990s and new issues have emerged. For example, wild Atlantic salmon were declared a federally listed endangered species in 2000 in rivers and streams from the lower Kennebec River north to the U.S.–Canada border. The rivers and streams include the Denny's, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers and Cove Brook. Concern has escalated over maintaining genetic integrity and health of wild salmon given possible contact with escaped farm-raised individuals, which could interbreed and transmit disease (Goldburg et al.2001). The increased density of farms and populations within farms increase the likelihood of disease such as the epidemic of infectious salmon anemia (ISA) in 2001 in Cobscook Bay (Bangor Daily News 2002). This latest epidemic forced the removal of all farmed salmon from Cobscook Bay in February 2002. The growth of the industry has resulted in increased numbers of facilities, creating conflicts with stakeholders that include the fishing community, coastal landowners, and recreational users. The increased number of facilities has also increased the number of interactions with seals (whose population has been steadily increasing) and other wildlife. A change in feeding technology, specifically the use of continuous feeding combined with a dry feed, has reduced the amount of excess feed and nutrient input.

## 1.2 SCOPE

Given the changing landscape and as has been done in the past, an interagency committee [U.S. Army Corps of Engineers (USCOE), U.S. Environmental Protection Agency (US EPA), U.S. Fish and Wildlife Service (USFWS), U.S. National Marine Fisheries Service (NMFS), Maine Department of Marine Resources (MDMR), Maine Department of Environmental Protection (MDEP), Maine Department of Inland Fisheries and Wildlife (MDIFW)] convened to review the existing monitoring program. The objective was *“to evaluate Maine’s ability to assess severity and extent of effects of marine aquaculture on the natural environment, test the applicability of existing FAMP methods and to provide recommendations to the State on measures to improve environmental assessments.”*

In subsequent meetings of the Interagency Technical Committee, it became clear the scope of work that included finfish, shellfish and algae culture was too large. Accordingly, the committee agreed to narrow the scope of this review to the Finfish Aquaculture Monitoring Program. Furthermore, it was agreed that Endangered Species Issues would not be dealt with in this review.

The scope of our investigation had three components: literature review, existing monitoring data evaluation, and proposed monitoring program.

The literature review focused on three main themes — impacts, monitoring, and emerging issues. Current literature on the potential environmental impacts posed by finfish aquaculture was reviewed, along with management strategies utilized in other regions. Monitoring protocols and regulations developed elsewhere were evaluated in terms of Maine’s unique marine environment and regulatory framework.

The monitoring program evaluation was subdivided into water quality issues and biological issues, primarily benthos. The main objectives were to evaluate Maine’s ability to assess severity and extent of effects of marine aquaculture on the natural environment and to test the applicability of existing Finfish Aquaculture Monitoring Program (FAMP) methods. For water quality, the following questions were addressed:

- Does FAMP in its current form meet the requirements established by regulatory framework?
- As such, has FAMP provided data with which MDMR can adequately assess effects from aquaculture on the marine environment?
- Can FAMP provide data necessitated by current and future permit requirements?
- If not, but deemed necessary by MDMR, how can FAMP be modified to adequately address the current requirements and emerging water quality concerns?

Benthic monitoring evaluation asked the following questions:

- Do measured parameters allow an assessment of regulatory compliance (i.e., “no unreasonable impact”(based on best professional judgement) to the balanced indigenous benthic community)?
- Do video observations confirm conclusions based on measured parameters (both water quality and benthic) in terms of degree of impairment?

The proposed monitoring program incorporates results from the existing data evaluation to include variables that are best able to meet existing and future regulatory requirements. Lessons learned from monitoring programs from other states and provinces were used to shape suggestions for FAMP.

## 2.0 LITERATURE REVIEW

### 2.1 REGULATORY REVIEW

Aquaculture is regulated by a number of federal and state regulations as listed in Table 2-1.

**TABLE 2-1. FEDERAL AND STATE REGULATIONS GOVERNING MARINE AND ESTUARINE AQUACULTURE FACILITIES**

<b>Regulation</b>	<b>Jurisdiction</b>	<b>Description</b>
Section 402, Federal Water Pollution Control Act (33 U.S.C. 402)	US EPA , delegation to MDEP	NPDES permits
Section 403, Federal Water Pollution Control Act (33 U.S.C. 403)	US EPA	Ocean Disposal Criteria
Section 103, Marine Protection Research and Sanctuaries Act (16 U.S.C. 1431).	USCOE	Disposal of dredged material in ocean waters
Section 404, Clean Water Act (33 U.S.C. 404)	USCOE	Fill in waters in the United States
Rivers and Harbors Act of 1899 (33 U.S.C. 403)	US ACOE	Governs structures in navigable waters
The Migratory Bird Treaty Act (16 U.S.C. 703 <i>et seq.</i> )	USFWS	Depredation permit required to kill protected species
Endangered Species Act 16 U.S.C. 1531 <i>et seq.</i>	USFWS/NMFS	Protects federally listed species and their habitats
Marine Mammal Protection Act (16 U.S.C. 1361 <i>et seq.</i> )	NMFS	Protects marine mammals
Magnuson Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 <i>et seq.</i> )	NOAA	Governs Essential Fish Habitat
Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 <i>et seq.</i> )	US EPA	Pesticide control
The Food, Drug, and Cosmetic Act (21 U.S.C. 301 <i>et seq.</i> )	Food and Drug Administration	Drug approval program
Water Classification Program 38 M.R.S.A., Article 4-A	MDEP	Establishes water quality standards for receiving waters
Subtidal Lands Lease for Aquaculture	MDMR	Includes both siting and monitoring

Discharges from “point sources” are regulated by the EPA under its National Pollution Discharge Elimination System permitting process. This process has been the cause of some debate, as virtually all facilities applied to US EPA Region I for NPDES permits but their applications were not processed. In January 2001, the Maine Department of Environmental Protection was delegated authority to issue NPDES permits. MDEP is in the process of developing an aquaculture general permit that could cover many of the State’s existing and new aquaculture facilities to bring them into compliance with federal statutes. Adjudicatory hearings will be held by the Maine Board of Environmental Protection early in 2003.

In February 2001 US EPA granted a water quality permit to the Acadia Aquaculture net pen fish farm to operate in Blue Hill Bay (EPA 2001). Because some of the conditions were economically

unfeasible, the applicant refused the permit and the lease voluntarily terminated. It was, however, the first and only federal net pen permit issued to an aquaculture facility in Maine (although Washington State has issued permits for years and Maine DEP issued permits prior to 1989) and provided permit writers with a constructive exercise to address the difficult issues permitting a non-pipe discharge such as net pen aquaculture.

EPA's permit included numerous conditions and standards that would have:

- limited the total annual amount of fish feed that may be used at the site unless studies are completed to show that higher levels of nutrient addition can safely be allowed;
- required bottom monitoring with enforceable limits on conditions under and around the pens;
- required frequent water column monitoring with specific dissolved oxygen limits at the pen site;
- limited the use of fish medications;
- incorporated U.S. Fisheries and Wildlife Service recommendations for wild Atlantic salmon protection.

Since 1992, US EPA has been developing national effluent limitation guidelines and new source performance standards for concentrated aquatic animal production point source categories. Draft guidelines were recently proposed (FR, 9/12/2002, pages 57871-57928). The focus of the proposed rules emphasized use of Best Management Practices, primarily feed monitoring systems. The review also acknowledges the difficulties in permitting net pen aquaculture as opposed to conventional pipe discharges, especially regarding the site-specific and regional nature. One option, in fact the option preferred by the Joint Subcommittee on Aquaculture (JSA) is the "no rule" option in recognition of the strong regional differences and scientific uncertainty associated with net pen aquaculture discharges.

Section 404 of the Clean Water Act governs fill in waters of the United States, regulated by The US Army Corps of Engineers. The Corps is also responsible for regulating the placement of structures in navigable waters through the Section 10 permitting process of The Rivers and Harbors Act. Other statutes include the Migratory Bird Treaty, authorizing U.S. Fish and Wildlife Service (USFWS) to regulate the killing of protected birds. USFWS is also responsible for the protection of non-aquatic endangered species listed under the Endangered Species Act. USFWS shares this responsibility with National Marine Fisheries (NMFS), who has responsibility for aquatic species. NMFS also is responsible for the protection of marine mammals under the Marine Mammal Protection Act. Drugs administered to aquaculture species are regulated by the Food and Drug Administration. Pesticides are regulated by the EPA under the Federal Insecticide, Fungicide, and Rodenticide Act.

The Magnuson-Stevens Fishery Conservation and Management ("Magnuson") Act established fishery management plans for conservation and management of fishery resources and mandated that habitat identified as "essential fish habitat" ("EFH") for managed fish species for spawning, breeding, feeding, or growth be protected.

At the state level, aquaculture facilities require a lease from the Department of Marine Resources, which is responsible for processing the lease application and evaluating potential environmental effects. The lease application must characterize potential environmental impacts of the project, meeting the following standards:

