

MARINE DEBRIS DEMONSTRATION AND EDUCATION PROJECT
AT SQUALICUM HARBOR, BELLINGHAM, WASHINGTON, U.S.A.

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ABSTRACT

Washington Sea Grant's North Puget Sound Office in Bellingham, Washington, began a demonstration and education project about marine debris in January 1988. The objectives of this project were:

1. to develop a demonstration project to collect and recycle vessel-generated wastes from commercial and recreational vessels at Squalicum Harbor, Bellingham, Washington; and
2. to develop an educational program to teach commercial fishermen and boaters about marine debris through a variety of extension education techniques.

Squalicum Harbor provides moorage for about 1,750 boats, of which 1,050 are recreational and 700 are commercial. The commercial fishing fleet is composed mostly of gillnetters (7.6-10.8 m long) and purse seiners (15.3-18.4 m long) that fish in Puget Sound and Alaska. The recreational fleet has about equal numbers of sail and powerboats, and 75-100 boats are used as live-aboard homes.

The demonstration project was coordinated with the Port of Bellingham, which owns and manages Squalicum Harbor. The function of Washington Sea Grant staff in this project was to act as technical advisors to the port staff. They surveyed the boaters, analyzed waste collection facilities and alternatives, and offered suggestions on improvements that could be accomplished in a cost-effective and realistic manner. The educational program focused on using traditional extension education techniques. A poster and three publications on marine debris were developed. These materials were important components of the extension education portion of this project. Because of the time it has taken to implement the changes proposed in the demonstration project, no measurements of their effects have yet been made.

INTRODUCTION

For years, people aboard boats and in coastal areas threw their garbage into the water. Items such as tin cans, food waste, cardboard, and cotton fishing gear and lines quickly sank. These materials generally degraded and caused relatively few problems in the marine environment. Also, as a rule marinas had dumpsters or litter barrels near the docks for garbage disposal, but no specialized waste collection systems.

Today, however, much of the material that is thrown overboard or lost in Puget Sound and in the oceans is made of plastic. Plastics are very useful aboard vessels because they are lightweight, strong, and do not degrade when wet. However, these same qualities can cause problems when plastics are disposed of in the marine environment. Studies from many parts of the world have shown that serious problems result when wildlife encounters plastic marine debris (Shomura and Yoshida 1985; Center for Environmental Education 1987; Alaska Sea Grant 1988; Alverson and June 1988).

As more U.S. and worldwide attention focused on plastic marine debris, Annex V of the MARPOL Convention was ratified internationally in 1987, and to implement that convention in the United States, Congress passed the Marine Plastic Pollution Research and Control Act (MPPRCA) in 1987. The MPPRCA, which became effective on 31 December 1988, prohibits the dumping of plastics at sea and regulates the dumping of other wastes at sea (U.S. Department of Transportation 1988). With the implementation of MPPRCA, boaters and fishermen now must return boat wastes to port, and ports and marinas must have facilities to accept those wastes.

Within Puget Sound, the volume and sources of marine plastic debris and the problems it causes are not well known. Because of Washington's extensive recreational and commercial fishing fleets, one would expect to find debris common to those vessels and activities. Some negative impacts of derelict fishing gear within Puget Sound have been observed (High 1985), but the extent of the problem is unknown.

Despite a lack of specific data about the extent of the marine debris problem within the Puget Sound region, it was felt that marine plastic debris was causing problems in the area. Also, as a result of MPPRCA, boaters were prohibited from disposing of their wastes into Puget Sound, and marinas were mandated to have facilities to accept boat garbage. In general, however, few boaters, fishermen, or marina operators were familiar with the MPPRCA and its provisions. The Squalicum Harbor project was developed with two primary goals:

1. to develop a pilot project to collect and recycle vessel-generated wastes from commercial and recreational vessels at Squalicum Harbor, and
2. to develop an educational program to teach commercial fishermen and boaters in the Puget Sound region about marine plastic debris and its proper disposal.

The Port of Newport (PON), Oregon, had developed a pilot marine debris collection and education project that was fairly successful. With grant funding from the U.S. National Marine Fisheries Service, the Newport project was able to develop a successful waste collection system that was used by the commercial fishing fleet for nets, rope, wood, metal, and other materials (Recht 1988).

The Squalicum Harbor project hoped to build on the experiences of the Newport project. However, four major differences between the projects were evident. First, the PON project was organized as a staff project of the PON. The Squalicum Harbor project was being developed by people outside the Port of Bellingham staff. Second, the PON project provided funding for facilities and maintenance staff, whereas the Squalicum Harbor project did not. (For the project to be successful in the long run, it had to work within the operational budget of Squalicum Harbor.) Third, the types of debris at the harbors were different. In each harbor, the debris reflected the boats that use the marinas: Newport has more trawlers, and Squalicum has more purse seiners, gillnetters, and recreational boats. Fourth, the physical layouts of the harbors are different: Newport has separate marinas for the commercial and recreational fleets, whereas Squalicum Harbor has these fleets within the same marina.

METHODS

Squalicum Harbor is located some 144.8 km (90 mi) north of Seattle on Bellingham Bay. It provides moorage for about 1,750 boats, of which 1,050 are recreational and 700 are commercial. The commercial fishing fleet is composed mostly of gillnetters (7.6-10.8 m long) and purse seiners (15.3-18.4 m long) that fish in Puget Sound and Alaska. The recreational fleet has about equal numbers of sail and powerboats, and 75-100 boats are used as live-aboard homes. Squalicum Harbor has three water entrances and nine ramps to the docks.

Existing waste-handling and collection facilities and procedures were analyzed using: 1) a personal informal interview survey of boaters and fishermen who use the harbor; 2) discussions with Squalicum Harbor staff; 3) a visual survey of the waste-handling facilities; and 4) contacts with waste collection companies, recycling companies, and community agencies.

Educational materials were developed and written by Washington Sea Grant (WSG) staff working on the marine debris project. Original plans called for writing one extension education publication for each of four different audiences: Squalicum Harbor boaters and fishermen, commercial fishermen, recreational boaters, and marina operators. Additionally a poster, a slide show, and a display area were to be developed.

DISCUSSION

Squalicum Harbor Analysis and Proposal

Twenty-seven fishermen and boaters from Squalicum Harbor were interviewed during spring 1987. Tabulation of the respondents' answers

showed that 78% thought Bellingham had a marine debris problem, 52% had experienced problems such as fouled propellers or clogged water intakes caused by plastic debris, 74% indicated that the existing waste facilities at Squalicum Harbor were adequate, and 67% expressed a willingness to sort some of their wastes for a recycling program. Respondents also indicated that management of an oil recycling facility maintained for boaters' use needed improvement.

Squalicum Harbor provided one 4.58 m³ (6 yd³) dumpster at the top of each float ramp, additional dumpsters in the area where commercial fishermen work on their gear, and a 15.29 m³ (20 yd³) dumpster near the dock used for provisioning vessels.

The visual survey of dumpster contents and interviews with Squalicum Harbor staff showed that the composition of the garbage varied with the season and the type of harbor use near that dumpster. For example, the percentage, by volume, of cardboard boxes ranged from 5 to 100%, with a mean of 52%.

Squalicum Harbor had a contract with the local garbage disposal company to empty the dumpster at the harbor. Seasonal fluctuations in quantity and composition of garbage were reflected in different pickup schedules for different dumpsters (Table 1). Rates varied with the frequency of pickup, the size of the dumpster, and whether the garbage went to landfill or to incineration (Table 2). The cost of garbage service at Squalicum Harbor rose dramatically from 1983 to 1987 (Table 3). This increase was caused by marina growth, boater population growth, and increases in garbage pickup rates over the time period.

On analysis, Squalicum Harbor's waste-handling facilities were judged to be adequate. Increased volumes of waste materials generated because of heightened awareness of the facilities could be easily accommodated by increasing the frequency of dumpster pickup. Any attendant cost increases could be minimized by developing a collection and recycling system for cardboard and aluminum. As in the PON project, a significant volume of the wastes in dumpsters at Squalicum Harbor was cardboard.

With this analysis completed, a proposal was written and presented to the Squalicum Harbor staff in August 1988. This proposal provided a detailed plan to improve the waste-handling system at Squalicum Harbor. The major elements of the plan were to maintain all existing dumpsters in the harbor; provide collection boxes or cleared space for netting, cardboard, scrap metal, wood, and aluminum; organize free pickup of materials by local recycling companies; and advertise the program through signs, pamphlets, news articles, presentations, displays, and word of mouth.

Figure 1 locates the proposed waste collection facilities at Squalicum Harbor. These facilities would:

- Provide a central location at the harbor for recycling scrap metal, wood, and netting. This would be a cleared space with signs indicating where to stack different materials.

Table 1.--Frequency of dumpster pickup at Squalicum Harbor.

Season	Size of container	Frequency of pickup
Winter (Oct.-May)	4.58 m ³ (6 yd ³)	1 per week
Winter	15.29 m ³ (20 yd ³)	1 per month
Winter	15.29 m ³ (20 yd ³) (trash compactor)	1 per month
Summer	4.58 m ³ (6 yd ³)	3 per week
Summer	15.29 m ³ (20 yd ³)	On-call basis
Summer	15.29 m ³ (20 yd ³) (trash compactor)	On-call basis

Table 2.--Monthly rates for hauling and disposal of trash from Squalicum Harbor.

Dumpster size	Frequency of pickup		
	1 per week	2 per week	3 per week
4.58 m ³ (6 yd ³)	149.27	276.15	403.03
15.29 m ³ (20 yd ³)	^a 130.75	^a 205.11	^a 279.47
15.29 m ³ (20 yd ³) (trash compactor)	^a 107.20	^a 214.40	^a 321.60

^aAdditional charges for hauling and disposal fee.

Table 3.--Total costs of garbage service in Squalicum Harbor.

Year	Cost
1983	\$18,794
1984	\$22,394
1985	\$30,456
1986	\$34,492
1987	\$41,758
1988	\$50,000 (estimated)

- Provide collection boxes for sorting and recycling of cardboard at five of the nine dumpsters at the harbor, dumpsters used primarily by the commercial fishing fleet. Used wooden fish totes were donated by local seafood companies for collection boxes. Removing the cardboard was expected to reduce the rate at which the dumpsters filled up and thus reduce garbage costs.

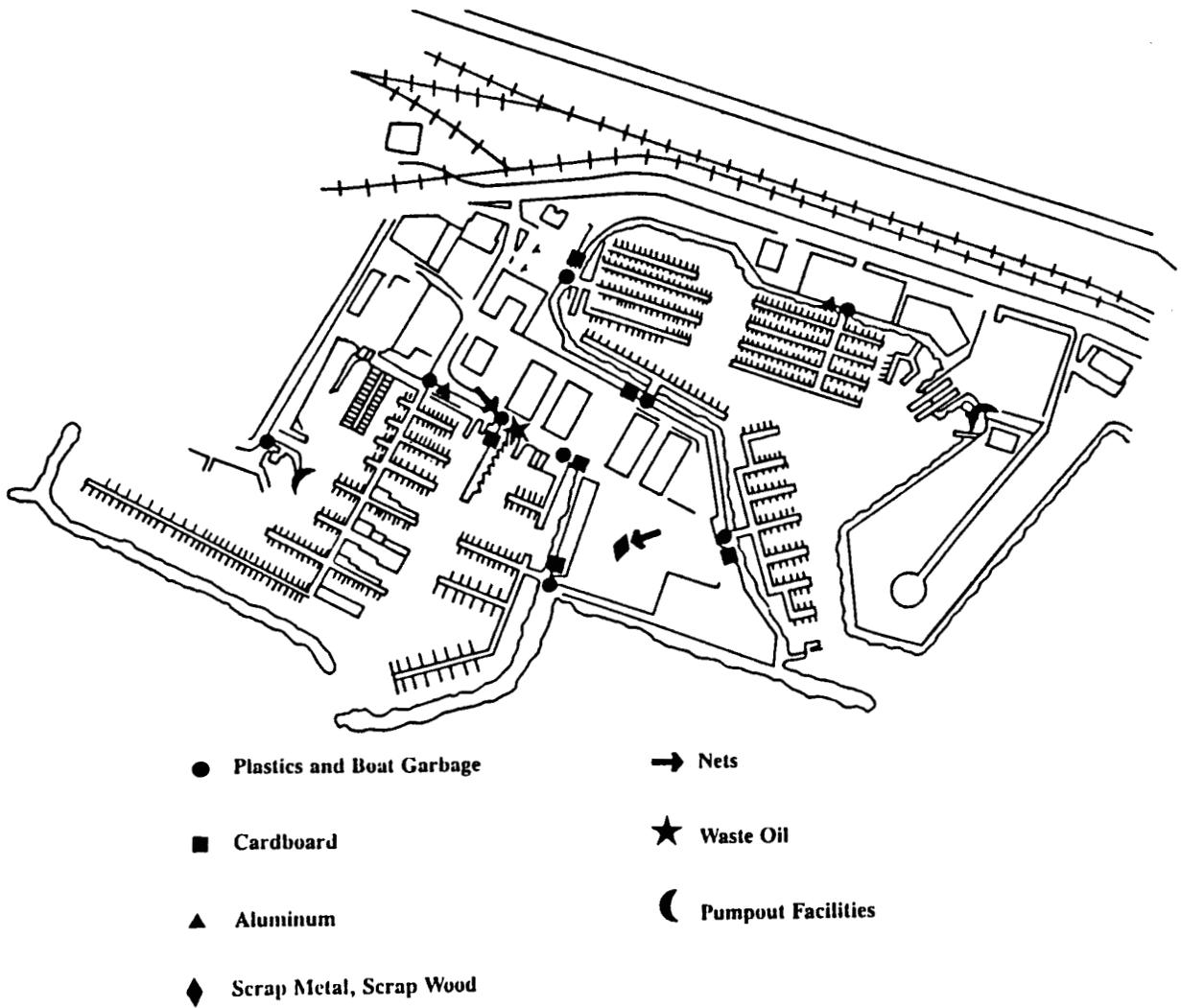


Figure 1.--Proposed waste collection facilities at Squalicum Harbor.

- Provide three aluminum recycling facilities at the harbor adjacent to the dumpsters used by the recreational boating fleet. Aluminum is a high value recyclable item, and these recycling revenues could help offset the cost of waste disposal.

The proposed facilities could be used by boaters and fishermen with a minimum of sorting. As a result, use of the facilities was expected to be heavy.

In addition, only materials that had ready markets were included in the recycling program. At no charge to the port, companies in the Bellingham area would pick up one or more of the materials being collected. This was expected to help reduce maintenance needs.

Glass was excluded from the recycling program for two reasons: 1) glass has a low market value and local companies would not pick it up at Squalicum Harbor, and 2) because of the weight of glass, specialized equipment would have been needed to handle it.

The Newport project found that blue color-coding of their recycling facilities was very useful, and the Squalicum Harbor project also color-coded the recycling facilities blue. Many fishermen and boaters travel frequently from port to port on the U.S. west coast and Alaska, and WSG suggests that for ease of recognition blue be adopted as the color for recycling facilities in all ports.

Educational Program

The educational portion of the program was multifaceted and involved working with the Washington State Task Force on Marine Plastic Debris. This task force had representatives from some 40 different governmental, environmental, industrial, educational, and community groups who worked together to develop a Washington State Marine Plastic Debris Action Plan (Washington State Department of Natural Resources 1988). As task force participants, WSG staff developed a logo for statewide marine debris cleanup (Fig. 2). This logo and the slogan "Get a Grip on Marine Debris" are being used throughout Washington State.

The educational portion of the Squalicum Harbor project also included developing and printing a marine debris poster; writing pamphlets directed at Squalicum Harbor boaters, commercial fishermen, and recreational boaters; providing presentations to various community and school (K-12) groups on marine debris; developing a liaison with Western Washington University's plastics technology program; and being available to the media on marine debris-related matters. Using these educational materials, WSG reached a total of 585 people at workshops and other meetings, and distributed more than 2,500 posters and pamphlets.

RESULTS AND CONCLUSIONS

The analysis and proposal conducted by WSG staff were provided to the Squalicum Harbor staff much the way a consultant would provide information.

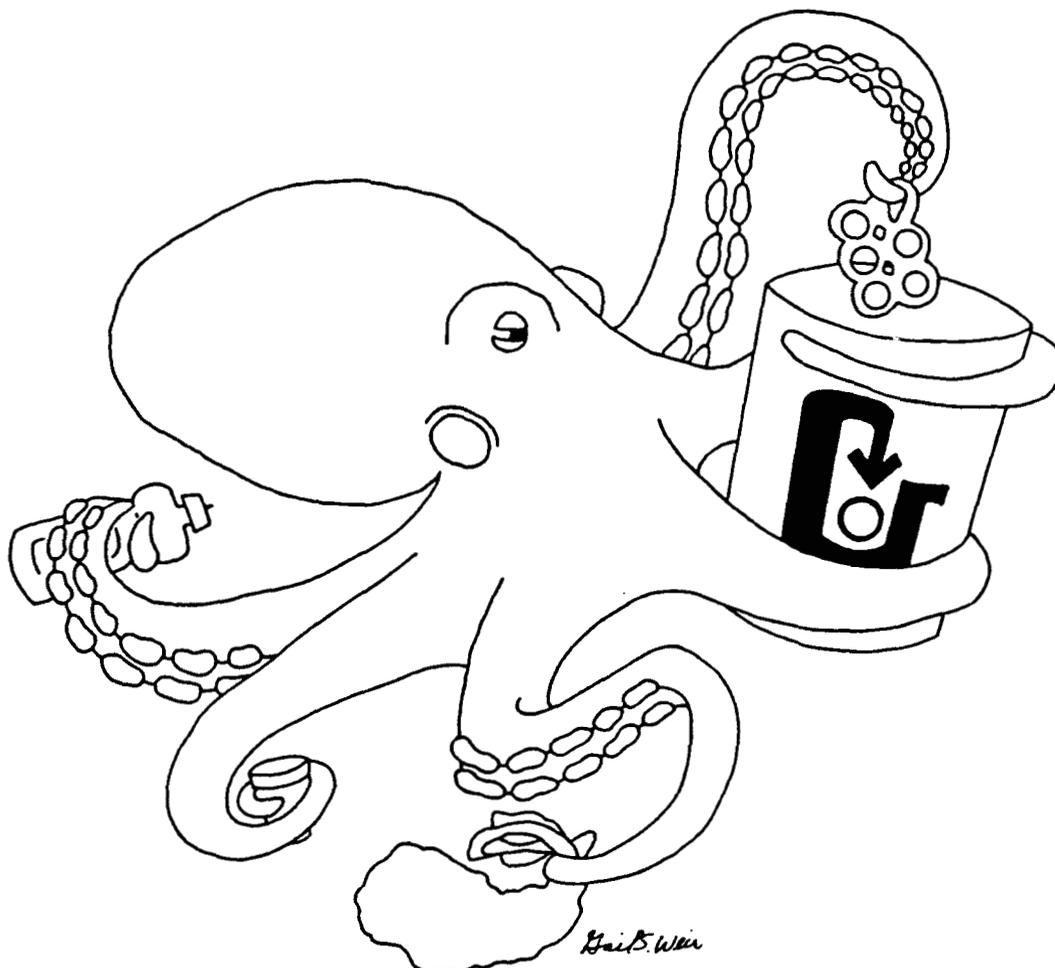


Figure 2.--Washington State marine debris logo.

However, the Squalicum Harbor staff had to make the actual changes. Six months after receiving the recommendations, they were just beginning to implement the physical changes. The first cardboard collection boxes were installed in early March 1989, and they were immediately used by the boaters and fishermen. The installation of the other facilities were expected to occur shortly thereafter.

We can only theorize about why implementing the proposal took so long. First, the Squalicum Harbor staff appeared to be already working at their maximum level. When a staff is already working at or near capacity, a new project is difficult to start. Second, in spite of the analysis and proposal, the staff appeared reluctant to implement the project for fear of generating more maintenance work for themselves. Third, this project may

have been viewed with some resentment because it was promoted by people outside of the Squalicum Harbor staff.

Because of the time it took to have physical changes made at Squalicum Harbor, no measurements have yet been made on the effects of the changes. This project points out the difficulty of setting up a demonstration project as an "outsider," and should caution others to expect to go slowly in similar projects.

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