This document includes the Cover Page, Table of Contents, Executive Summary, Background Information, Design, Implementation and Analysis, Results, References, List of Tables, and List of Figures for the EPA report Final No-Discharge Zone Evaluation. The reference number is: EPA-842-R-04-001

Final No Discharge Zone Evaluation

Front Material, Report, Results and References, Tables, and Figures

August 2004

FINAL

NO-DISCHARGE ZONE EVALUATION

EPA/OCPD Contract No. 68-C-03-041
Work Assignment No. 1-03, Amendment 1

Prepared for
U.S. Environmental Protection Agency
Office of Wetlands, Oceans and Watersheds
Oceans and Coastal Protection Division
Washington, D.C.

Prepared by
Battelle
410 Severn Avenue
Suite 305A
Annapolis, Maryland 21401

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EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) is evaluating the effectiveness of vessel sewage No-Discharge Zones (NDZs) established by States under Section 312(f)(3) of the Clean Water Act (CWA). The discharge of any vessel sewage is prohibited in NDZs. In order for a State to establish a NDZ under CWA Section 312(f)(3), EPA must find that adequate facilities are reasonably available for the safe and sanitary removal and treatment of sewage from all vessels.

EPA surveyed 958 boaters and 69 marinas from 15 coastal and Great Lakes NDZs around the country to obtain information about pumpout availability, pumpout use, and NDZ awareness. According to the surveys, 93% of boaters reported that they had no occasions in 2003 when they looked for but could not find a working pumpout or toilet dump facility in the NDZ. Only 9% experienced trouble at a pumpout facility in the 2003 boating season; 3% experienced trouble with a pumpout facility on their most recent trip. Most boaters, 94%, knew that the area in which they were boating was a NDZ and 97% knew that the discharge of treated or untreated sewage is prohibited in a NDZ. Many boaters believe that multiple parties are responsible for enforcing the requirements of NDZs. Over 60% of the boaters surveyed believe that the U.S. Coast Guard enforces NDZ requirements.

When marinas were asked what percent of the time their pumpout facilities were functional during the 2003 boating season, 63% reported that their facilities were functional 100% of the time, and 33% reported that their facilities were functional 75 to 99% of the time. Only 23% of marinas surveyed indicated that a boater needed to wait more than 15 minutes to use the pumpout facilities at the marina during the 2003 season; such waits were reported to occur rarely, occasionally, or only at certain times (e.g., weekends at sunset). This is consistent with boaters' reported experience; only 5% of boaters found the waiting time too long at pumpout or dump facilities during the 2003 season. Finally, 93% of the marina representatives indicted that they knew about the existence of the NDZ, and 91% said that they inform their boaters of the NDZ by signs, brochures, word of mouth, or some combination of these. Like boaters, many marinas representatives believe that multiple parties are responsible for enforcing the requirements of NDZ, and over 60% believe that the U.S. Coast Guard enforces NDZ requirements.

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1.0 BACKGROUND AND PROJECT DESCRIPTION

1.1 Background

Vessel sewage is regulated under Section 312 of the Clean Water Act (CWA). Section 312 mandates the use of a marine sanitation device (MSD) (on-board equipment for treating and discharging or storing sewage) on all vessels that are equipped with installed toilets (see Appendix G for MSD Standards). Section 312 also allows for States and EPA to establish "No-Discharge Zones" (NDZs), where the discharge of sewage from vessels, whether treated or not, is prohibited.

Three types of NDZs may be established under CWA Section 312.

- Under Section 312(f)(3), if any State determines that the protection and enhancement of the quality of some or all of the waters within such State require greater environmental protection, such State may completely prohibit the discharge from all vessels of any sewage, whether treated or not, into such waters, except that no such prohibition shall apply until EPA determines that adequate facilities for the safe and sanitary removal and treatment of sewage from all vessels are reasonably available for such water to which such prohibition would apply.

- Under Section 312(f)(4)(A), if EPA determines upon application by a State that the protection and enhancement of the quality of specified waters within such State require such a prohibition, then EPA shall by regulation completely prohibit the discharge from a vessel of any sewage (whether treated or not) into such waters. These NDZs, which are established to protect special aquatic habitats, do not require the availability of adequate facilities for the removal and treatment of the sewage.

- Under Section 312(f)(4)(B), upon application by a State, EPA shall, by regulation, establish a drinking water intake zone in any waters within such State and prohibit the discharge of sewage from vessels within that zone. These NDZs do not require the availability of adequate facilities for the removal and treatment of the sewage.

To date, 52 NDZs have been established. Forty-seven of these were designated by States under Section 312(f)(3). There has been some concern in recent years over the availability of adequate pumpout facilities at State-established NDZs, and thus over the effectiveness of the NDZs.

1.2 Project Description

EPA surveyed boaters and marinas in 15 coastal and Great Lakes NDZs around the country in order to evaluate the effectiveness of NDZs established by States under CWA Section 312(f)(3). In particular, EPA was interested in the availability of adequate pumpout facilities and awareness of the discharge prohibition in these areas. Sections 2.1 and 2.2 describe how NDZs, marinas, and boaters were chosen for the survey.

- *Boater Survey:* Boaters were asked about their experiences using pumpout or dump facilities in NDZs. In particular, the survey requested information about the respondent's boating activity and whether the boater had trouble finding or using pumpout or dump facilities in the NDZ. The survey also sought information on the boater's knowledge about the NDZ. A copy of the boater survey can be found in Appendix A-1.

- *Marina Survey:* Marinas were asked about pumpout and dump facility operations, downtime of these facilities, and their use by boaters. The survey also sought information regarding the marina representative's knowledge about the NDZ. A copy of the marina survey can be found in Appendix A-2.

EPA also requested information from State government officials to determine (1) if the designation of NDZs has been effective in addressing water quality issues, (2) if boaters were in compliance with NDZ requirements, and (3) the roles and responsibilities associated with the NDZ. In particular, EPA requested data on shellfish bed health, beach closures, and other water quality data with measurements from before and after NDZ designation. Two States responded to this request. This information was not sufficient for analysis but will be reviewed by EPA. A copy of this survey can be found in Appendix A-3 and information on its implementation and results can be found in Appendix F.

To evaluate the effectiveness of MSDs in removing harmful pollutants from the waste stream of the device, EPA also requested information from MSD manufacturers and U.S. Coast Guard-accepted independent laboratories that test MSDs. These surveys requested information on effluent constituents and their concentrations, bacteria eradication processes, suspended solids removal, cost, and installation. Five MSD manufacturers and one laboratory responded. This information was not sufficient for analysis but will be reviewed by EPA. A copy of these surveys can be found in Appendix A-4 and information on their implementation and results can be found in Appendix F.

2.0 DESIGN, IMPLEMENTATION, AND ANALYSIS

2.1 Definition of the Sampling Frame

The sampling frame is the larger group of entities (e.g., NDZs, marinas, boaters) from which a smaller number was selected for evaluation or survey.

2.1.1 No-Discharge Zone Sampling Frame

The NDZ sampling frame was defined as all coastal NDZs, as well as Great Lakes NDZs located on Lake Michigan established by States under CWA Section 312(f)(3). For sampling purposes, the NDZs in the sampling frame were divided into six geographic regions to ensure that sampling occurred in all areas of the country (see Section 2.2.1 for details on sampling). Table 1 lists all NDZs in the sampling frame and shows which NDZs were grouped together.

2.1.2 Marina Sampling Frame

The marina sampling frame was defined as those marinas in the selected NDZs having at least one stationary pumpout facility and being used primarily by boats over 22 feet in length. Table 1 includes the initial estimate of the number of marinas meeting these criteria in each NDZ. Boats smaller than 22 feet are much less likely to have an MSD on board; therefore, marinas primarily servicing such boats were not included in the sampling frame. Marinas with only a mobile pumpout facility (usually a boat or barge) were not included in the sampling frame because it was not feasible to interview boaters using a mobile pumpout. The following sources were used to identify marinas in the sampling frame: NDZ Federal Register notices, Regional EPA employees, State agencies, the Marina Operators Association of America, and the Internet.

2.1.3 Boater Sampling Frame

At most marinas, in-person survey interviews were conducted; thus, the boater sampling frame was defined as boaters appearing at the marina on the date selected for boater interviews. At marinas in Michigan, Wisconsin, and Richardson Bay, California, in-person survey interviews were not possible, so surveys were mailed to the marina for distribution to boaters. Therefore, the boater sampling frame was defined as all boaters appearing at the selected marina at the end of the 2003 boating season (see Section 2.2.3 for more information on boater sampling).

Table 1. Distribution of NDZs by Region

Region	NDZ	Date of NDZ Designation	Number of Vessels Berthed	Number of Marinas with Stationary Pumpouts
Massachusetts/ Rhode Island	Three Bay/Centerville Harbor, MA	7/6/2001	1,667	1
	Waquoit Bay, MA	3/10/1994	2,610	1
	Westport Harbor, MA	9/2/1994	1,240	1
	Wellfleet, MA	6/9/1995	640	1
	Nantucket Harbor, MA	9/25/1992	1,725	3
	Buzzards Bay, MA	7/31/2000	12,257	19
	Wareham Harbor, MA	1/22/1992	1,300	7
	Stage Harbor Complex, MA	3/24/1997	1,161	2
	Harwich, MA	8/18/1998	735	1
	Rhode Island	8/10/1998	41,314	37
	Subtotal		***64,649***	***73***
New York/ New Jersey	Peconic Estuary, NY	6/10/2002	11,247	20
	Greater Huntington/North Port, NY	6/14/2000	3,900	11
	Port Jefferson Harbor Complex, NY	10/11/2001	900	2
	Mamaroneck Harbor, NY	11/19/1997	1,160	3
	Barnegat Bay, NJ	6/12/2003	28,487	61
	Navesink River, NJ	5/12/1999	1,122	5
	Shark River/Manasquan River, NJ	3/12/1998	3,807	9
	Shrewsbury River, NJ	5/22/2000	2,115	5
	Subtotal		***52,738***	***116***
Maryland	Northern Coastal Bays	1/10/2002	12,913	12
	Subtotal		***12,913***	***12***
Florida	City of Key West waters	8/25/1999	628	5
	Destin Harbor	1/21/1998	336	5
	Subtotal		***964***	***10***
Michigan/ Wisconsin	Michigan	1/15/1976	N/A	75
	Wisconsin	3/22/1976	N/A	40
	Subtotal		***N/A***	***115***
California	Newport Bay, Sunset Bay, Huntington Harbor	1/15/1976	N/A	12
	Richardson Bay	9/2/1987	N/A	6
	Channel Islands Harbor, Avalon Bay Harbor	5/8/1979	N/A	6
	San Diego Bay, Mission Bay, Oceanside Harbor, Dana Point Harbor	8/13/1976	N/A	15
	Subtotal		***N/A***	***39***
	TOTAL		***131,264***	***365***

N/A = Not available

2.2 Sample Allocation and Selection

2.2.1 No-Discharge Zone Selection

Due to resource constraints, EPA decided to evaluate 15 of the NDZs in the sampling frame. To ensure that marinas and boaters from around the country were surveyed, EPA divided all the coastal NDZs, as well as Great Lakes NDZs located on Lake Michigan into the following six geographic regions (see Figure 1), and then chose NDZs from each region for evaluation:

1) Massachusetts and Rhode Island
2) New York and New Jersey
3) Maryland
4) Florida
5) Michigan and Wisconsin
6) California

All NDZs in the last 4 categories were included in the study.

Three NDZs were selected in each of the remaining two regions.

- For the Massachusetts/Rhode Island region, Buzzards Bay and Rhode Island were selected because of the large number of vessels berthed in these NDZs (see Table 1). The number of vessels berthed in each NDZ was taken from Federal Register notices establishing the NDZ or was estimated based on contacts with marinas in the NDZ. The third NDZ selected in the Massachusetts/Rhode Island region, Nantucket Harbor, was picked randomly from the remaining NDZs in this group.

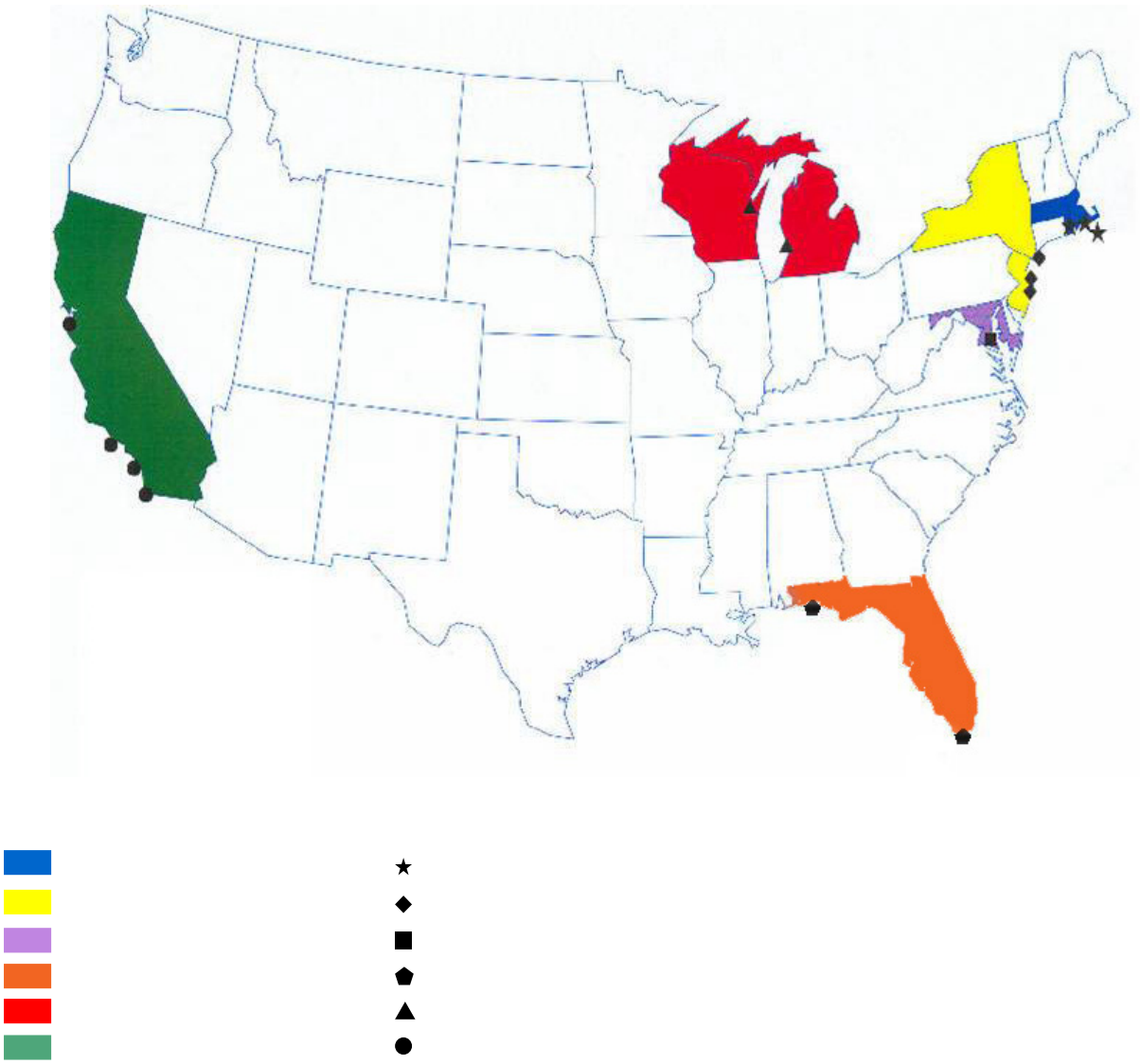
- For the New York/New Jersey group, Barnegat Bay was selected because of the large number of boats berthed there (see Table 1). Two additional NDZs, Peconic Estuary and Shark River/Manasquan River, were picked randomly from the remaining NDZs in this group.

2.2.2 Marina Allocation and Selection

Due to resource constraints, 75 marinas in total were targeted for the survey. Rather than assigning an equal number of marinas to each of the 15 selected NDZs, EPA divided these 75 marinas among the NDZs proportional to the number of marinas in each NDZ. For example, the Buzzards Bay NDZ, which has 19 marinas meeting EPA's criteria (see Section 2.1.2), was allocated four marinas for survey. This was calculated by multiplying 75 (the total number of marinas to be surveyed) by 19/365 (the number of marinas in the Buzzards Bay NDZ divided by the total number of marinas in sampling frame).

The only exception to this was the allocation of marinas to the three randomly chosen NDZs (Nantucket Harbor, Peconic Estuary, and Shark River/Manasquan River). For these three NDZs, the number of marinas assigned was proportional to the number of marinas in those NDZs *plus* the number of marinas in all the other NDZs in the same region that were not selected for surveying. For example, Nantucket Harbor represented 17 marinas, three located in the Nantucket Harbor NDZ plus 14 located in the seven other NDZs in Massachusetts/Rhode Island not selected for surveying. Consequently, Nantucket Harbor was allocated three marinas for survey (75 multiplied by 17/365). The marinas in the NY/NJ NDZs not selected for evaluation were apportioned between Peconic Estuary and Shark/River/Manasquan River.

Figure 2. NDZ by Region



After all 75 marinas were allocated, an adjustment was made for the NDZs that received only one or two marinas by adding one extra marina to their allocation and reducing the number of marinas at the NDZs with the largest allocations. Table 2 shows the final allocation of the 75 marinas to the 15 NDZs. Note that this allocation simply determined the number of marinas that would be surveyed in each NDZ. The actual marinas to be surveyed within each NDZ were selected randomly. For instance, the four marinas selected for Buzzards Bay were randomly chosen from the 19 marinas in that NDZ.

Table 2. Allocation of Marinas to NDZs

Region	Selected NDZ	Number of Marinas in (or represented by*) the NDZ	Number of Marinas Allocated to the NDZ for the Survey
Massachusetts/ Rhode Island	Nantucket Harbor, MA	17*	3
	Buzzards Bay, MA	19	4
	Rhode Island	37	8
	Subtotal	***73***	***15***
New York/ New Jersey	Peconic Estuary, NY	30*	6
	Barnegat Bay, NJ	61	11
	Shark River/Manasquan River, NJ	25*	5
	Subtotal	***116***	***22***
Maryland	Northern Coastal Bays	12	3
	Subtotal	***12***	***3***
Florida	City of Key West waters	5	2
	Destin Harbor	5	2
	Subtotal	***10***	***4***
Great Lakes	Michigan	75	14
	Wisconsin	40	7
	Subtotal	***115***	***21***
California	Newport Bay, Sunset Bay, Huntington Harbor	12	3
	Richardson Bay	6	2
	Channel Islands Harbor, Avalon Bay Harbor	6	2
	San Diego Bay, Mission Bay, Oceanside Harbor, Dana Point Harbor	15	3
	Subtotal	***39***	***10***
	TOTAL	**365**	**75**

* The randomly selected NDZs represent the marinas in the NDZ plus the marinas in all the other NDZs in the region that were not selected for further evaluation; see Section 2.2.2 for details.

2.2.3 Boater Allocation and Selection

There were two important factors for determining how many boaters to survey. The first factor was the desired precision of the sample estimates, that is; how closely the responses from boaters taking the survey should reflect the responses from all boaters. For this study, EPA requested that responses from boaters taking the survey be within approximately ±5 percentage points of the true responses from all boaters. The second factor was the degree to which boaters within selected marinas would tend to respond similarly to survey questions because they utilize the same marina. If boaters within a marina tend to respond similarly, fewer boaters need to be surveyed to obtain a good estimate of the response of all boaters in the marina. Conversely, if boaters within a marina tend to respond differently, more boaters need to be sampled.

Prior to the study, there was no evidence to suggest that boaters would tend to respond similarly because of their association with a particular marina. Therefore, for this study, EPA made the most conservative assumption—that there is no clustering of responses by boaters due to their association with a particular marina. Based on the required sample size, the conservative assumption used to estimate the desired precision was a distribution of roughly 50/50 for the responses (e.g., 50% yes, 50% no on a yes-no question). Statistical formulas for estimating precision indicated that an overall sample of approximately 1,000 boaters would yield precision estimates that ranged from ±3.4% to ±5.6% with 95% confidence. Again, statistical formulas used to estimate precision for the number of boaters per marina indicate that 15 boaters per marina should be surveyed. Therefore, 1,125 boaters across the 75 selected marinas were targeted (15 boaters per marina).

At most marinas, boater surveys were administered through in-person interviews. Interviewers intercepted boaters as they passed a booth set up on the marina grounds and requested that boaters complete the survey. Each marina had one interviewer present for one Saturday or one Sunday beginning in late August and during September and October 2003. Due to early cold weather in Michigan and Wisconsin, boater traffic was very light during the late summer and fall of 2003. Therefore, marinas in these States were asked to distribute the survey to any boaters appearing at the marina for the remainder of the boating season. Also, marinas in Richardson Bay, California, denied permission to conduct boater surveys at their marinas because privacy was an issue. However, these marinas agreed to distribute the survey to their boaters. In these cases where personal survey interviews were not performed, boaters were provided with a postage-paid envelope in which to return their survey. EPA also sent boater surveys to two commercial boat trade associations (the Passenger Vessel Association and the American Waterways Operators) with a request that they encourage their members to respond to the survey; none of these surveys were returned.

2.3 Survey Implementation

2.3.1 Interviewer Training

Prior to conducting marina and boater surveys, field interviewers were given a half-day training session. Training focused on the goals and background of the survey so that the interviewers would be able to respond to questions from boaters and marina representatives. The marina and boater surveys were reviewed and the data collection protocol was summarized. Prior to conducting the survey interviews, all field interviewers were provided with an annotated Boater Survey (including EPA definitions to assist the interviewer in explaining specific terms to a boater if necessary), 40 copies of the Boater Survey, a Marina Survey (if one was not completed via telephone), the appropriate NDZ map, copies of EPA's "*Using Your Head to Help Protect Our Aquatic Resources"* brochure to distribute to boaters, a "*Keep Our Waters Clean - Use Pumpouts"* poster, and a name tag (see Appendix B for copies of these materials).

2.3.2 Boater Survey

In most NDZs, boater surveys were administered as in-person interviews at the marina. To encourage boater participation, EPA literature on NDZs and floating key chains with an EPA logo were distributed to anyone interested. At marinas in Michigan, Wisconsin, and Richardson Bay, California, surveys were distributed by the marina representative (see Section 2.2.3 for details).

In total, 958 of the 1,125 targeted boater surveys were completed at 68 marinas (see Table 3).

- At some marinas, no boater surveys were completed. Some of these marinas were in Michigan and Wisconsin, where the survey was distributed by the marina representative rather than conducted in person due to cold weather. Two of these marinas were in Barnegat Bay, where there was an impending hurricane on the day of the interviews.

- At some marinas, fewer surveys were completed than targeted. The lowest response rates were in Wisconsin, Michigan, and Richardson Bay, where surveys were distributed by the marina representative rather than conducted in person. For a complete list of the number of boaters surveyed at each marina (see Table 5 in Appendix C).

While not all of the targeted surveys were completed, the large number of completed surveys from NDZs around the country makes it possible to estimate national-level boater and marina characteristics.

2.3.3 Marina Survey

After marinas were selected for the survey, they were screened to confirm that they met EPA's criteria (having at least one stationary pumpout facility and being used primarily by boats over 22 feet in length; see Section 2.1.2). Any marinas that did not meet the criteria or declined to participate in the survey were replaced by another randomly chosen marina. In order to identify 75 that met the criteria and were willing to participate, 120 marinas were screened; eight marinas declined to participate and 37 were either no longer in business, closed for the season, or did not meet the criteria.

The majority of marina interviews were conducted by telephone. Typically, once a marina was determined to meet EPA's criteria during the initial screening call, the marina representative was asked to complete the survey. If the interview was not completed at that time, three options were provided to complete the survey: (1) complete an in-person survey with the field interviewer on the day of the boater surveys; (2) complete the survey independently and submit it via fax or mail; or (3) complete the survey during a return telephone call. In total, 69 marinas responded to the survey (see Table 4).

Table 3. Summary of Boaters Surveyed

Region	Selected NDZ	Number of Marinas Allocated to the NDZ	Number of Marinas Where Boater Surveys Were Completed	Number of Boater Surveys Targeted	Number of Boater Surveys Completed
Massachusetts/ Rhode Island	Nantucket Harbor, MA	3	2	45	22
	Buzzards Bay, MA	4	5	60	94
	Rhode Island	8	8	120	150
	Subtotal	***15***	***15***	***225***	***266***
New York/ New Jersey	Peconic Estuary, NY	6	6	90	104
	Barnegat Bay, NJ	11	10	165	133
	Shark River/Manasquan River, NJ	5	5	75	71
	Subtotal	***22***	***21***	***330***	***308***
Maryland	Northern Coastal Bays	3	3	45	87
	Subtotal	***3***	***3***	***45***	***87***
Florida	City of Key West waters	2	2	30	28
	Destin Harbor	2	2	30	16
	Subtotal	***4***	***4***	***60***	***44***
Michigan/ Wisconsin	Michigan	14	9	210	65
	Wisconsin	7	5	105	15
	Subtotal	***21***	***14***	***315***	***80***
California	Newport Bay, Sunset Bay, Huntington Harbor	3	4	45	55
	Richardson Bay	2	2	30	10
	Channel Islands Harbor, Avalon Bay Harbor	2	2	30	39
	San Diego Bay, Mission Bay, Oceanside Harbor, Dana Point Harbor	3	3	45	69
	Subtotal	***10***	***11***	***150***	***173***
	TOTAL	***75***	***68***	***1,125***	***958***

Table 4. Summary of Marinas Surveyed

Region	Selected NDZ	Number of Marinas Allocated to the NDZ	Number of Marina Surveys Completed
Massachusetts/ Rhode Island State	Nantucket, MA	3	2
	Buzzards Bay, MA	4	5
	Rhode Island	8	8
	Subtotal	**15**	**15**
New York/ New Jersey	Peconic Estuary, NY	6	6
	Barnegat Bay, NJ	11	11
	Shark River/Manasquan River, NJ	5	4
	Subtotal	**22**	**21**
Maryland	Northern Coastal Bays	3	3
	Subtotal	**3**	**3**
Florida	City of Key West waters	2	2
	Destin Harbor	2	2
	Subtotal	**4**	**4**
Michigan/ Wisconsin	Michigan	14	13
	Wisconsin	7	6
	Subtotal	**21**	**19**
California	Newport Bay, Sunset Bay, Huntington Harbor	3	2
	Richardson Bay	2	1
	Channel Islands Harbor, Avalon Bay Harbor	2	2
	San Diego, Mission Bay, Oceanside Harbor, Dana Point Harbor	3	2
	Subtotal	**10**	**7**
	TOTAL	**75**	**69**

2.4 Analysis

2.4.1 Weighting

Survey responses were weighted based on two factors. The first factor accounts for the fact that different boaters and marinas had different chances of being selected. The second factor accounts for variation in the boater participation rates across the marinas. This process prevented biased results towards those boaters or marinas with a greater chance of being selected or those from an area with a higher participation rate. In general, the weighted value for a particular boater or marina was calculated as the reciprocal of the chance that the boater or marina had of being selected for the survey multiplied by the reciprocal of the survey participation rate.

2.4.2 Estimation of Survey Proportions and Means

The survey weights were used in the estimation of survey response proportions and means. For estimates of proportions (e.g., proportion of boaters who used a pumpout facility during the 2003 boating season), the denominator of the proportion was the sum of the weights for boaters with a valid response to the question. The numerator of the proportion was the sum of the weights for those boaters falling in the response category of interest (e.g., boaters who had used a pumpout facility in the 2003 boating season). Estimates of means were similarly calculated. To compute the denominator of the mean, the weights for those boaters having a valid response to the questionnaire item were summed. The numerator of the mean was calculated by multiplying each boater's valid response by his or her weight and summing these products across all boaters having a valid response. Similar procedures were used in the estimation of marina owner/operator characteristics.

2.4.3 Standard Error Calculations

The standard error measures how closely the sample results come to results that would be obtained from an inclusive census of all 27 NDZs, all 365 marinas, and all individuals boating within the NDZs in 2003. The computation of the standard errors accounted for the stratification, clustering, and unequal selection probabilities. Similar standard error computations were used for marinas and boaters.

The computation of standard errors was complicated somewhat because one NDZ in the Massachusetts/Rhode Island geographic group and two in the New York/New Jersey geographic group were randomly selected, while in all remaining geographic groups, all NDZs were purposively selected. Focusing first on the calculation of the marina standard errors, the variability of the responses of the marina representative of the sampled marinas within each of the purposively selected NDZs was computed. These estimates of variability were summed over all the purposively selected NDZs. The variability in the marina representatives' responses for the three randomly selected NDZs then was computed and added to the estimated variability for purposively selected NDZs, resulting in the final within-NDZ variance component (although located in the randomly selected groups, Rhode Island, Buzzards Bay, and Barnegat Bay NDZs were treated like those NDZs in the purposively selected NDZs). Because NDZs in the Massachusetts/Rhode Island (Nantucket NDZ) and New York/New Jersey groups (Peconic Estuary and Shark River/Manasquan NDZs) were sampled, the variability between NDZs had to be computed. The between-NDZ variance component was added to the within-NDZ variance component. For the Nantucket NDZ, all marinas were selected for the survey thus there is no within-NDZ variance component for Nantucket.

For the calculation of the standard errors for the boater estimates, the steps were similar to those described above. Because there was no boater sampling within a marina, the total number of boaters having the characteristic of interest (e.g., boaters using pumpout facilities in 2003) was computed for each marina. The variability of these marina totals was measured within each NDZ. For the Nantucket, Peconic

Estuary, and Shark River/Manasquan NDZs, the total number of boaters having the characteristic of interest was tabulated and a between-NDZ variance component was computed using these NDZ totals.

2.4.4 Quality Assurance/Quality Control

2.4.4.1 Keying Survey Data

Data from the boater and marina surveys were entered into separate Access databases by two different people. The two databases were compared to identify any differences. A data entry supervisor reviewed all discrepancies and made any appropriate corrections. As a further quality control check, a random sample of 20% of the surveys was compared against the keyed data. Some minor data entry errors were found in some categories of data, therefore the information in these categories was rechecked. A data dictionary, provided in Appendix C, presents the variables and data for each survey question.

2.4.4.2 Confidentiality and Sensitive Questions

The boater and marina surveys conformed to Federal regulations, specifically the Privacy Act of 1974 (5 U.S.C. 552a) and the Hawkins-Stafford Amendments of 1988 (P.L. 100-297). The respondents were informed that their participation in each survey was voluntary and that their identities would be kept confidential and not associated with their responses. Neither EPA nor any other agency will have access to the names of the marinas or boaters, and no identifying information will be included in the final report provided to EPA for these surveys. The surveys included no questions on sexual behavior and attitudes, religious beliefs, or other matters that are commonly considered private or sensitive.

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3.0 RESULTS

3.1 Boater Survey Analysis

The purpose of the boater survey was to determine whether boaters in NDZs (1) have trouble finding pumpout facilities, (2) have trouble using pumpout facilities, and (3) know that the discharge of sewage is prohibited in NDZs. Major conclusions from this survey are discussed below. Note that all statistics were calculated using the weighting described in Section 2.4.1. Frequency tables and histograms for all responses from the boaters are provided in Appendix D. Results for some questions were combined to allow for comparisons across certain categories.

General Profile of Boaters Answering the Survey

A total of 958 boaters completed the survey. Some basic characteristics about these participating boaters are provided below. Note that most of the general profile questions allowed boaters to check more than one answer. Therefore, for each bullet below, the percentages may not add to 100, and the total number of boater responses may exceed 958. Note also that percentages were weighted; see Section 2.4.1 for a description of the weighting procedure.

- Boats operated by survey respondents averaged 32 feet in length and had an average draft of 3 feet.
- 764 boaters (86%) indicated that their boat was a power boat; 198 (27%) had a sail boat.
- 866 boaters (94%) used their boats for recreational purposes, 51 (8%) had commercial boats, and 124 (17%) indicated that they live aboard their boats.
- 746 boaters (78%) had an installed toilet on their boat and 136 (15%) had a portable toilet; 84 boaters (9%) did not have a toilet on their boat.
- Of the 746 installed toilets, 134 (19%) were flow-through toilets and 736 (99%) had a holding tank. The main sources of training for the boaters on how to operate the installed toilet were the instruction manual for 299 (39%) boaters and the boat dealer for 176 boaters (24%); 261 boaters (35%) indicated that they did not receive any training. 656 boaters (90% of 730 respondents to Question 8) regularly service their installed toilets.
- In 2003, survey respondents averaged 46 days of boating (median of 30 days). Within the NDZ where they were interviewed, the boaters averaged 33 days (median of 20 days) of boating during 2003.
- During the 2003 season, 430 boaters (52%) out of 874 with toilets (either installed or portable or both) had used a stationary pumpout, 244 (31%) had used a mobile pumpout, 159 (21%) had used a shore-based portable pumpout, and 47 (7%) had used a portable toilet dump station. 524 boaters (60%) had used one of the pumpout facilities within the specific NDZ where they were interviewed.

Did Boaters with an MSD have Trouble Finding a Working Pumpout Facility in the NDZ?

Question 19 of the survey asked boaters whether they had occasions during the 2003 season when they looked for but could not find a working pumpout or toilet dump facility in the NDZ. Of the 851 boaters

who answered this question, 794 (93%) said 'no' (in other words, during 2003, 93% of boaters who looked for a working pumpout or toilet dump facility in the NDZ were able to find one).

Did Boaters Experience Trouble Using Pumpout Facilities?

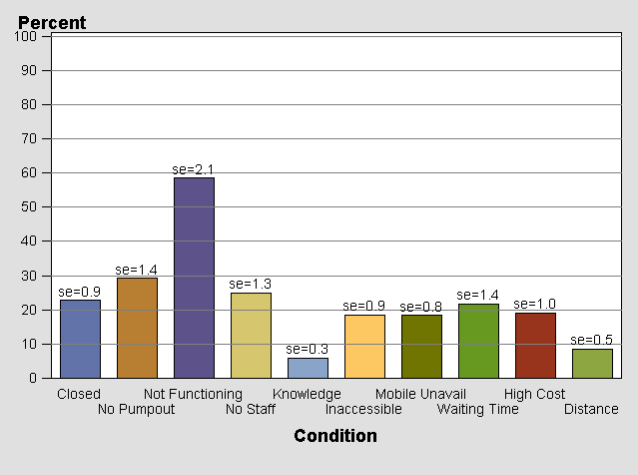
Question 17 asked boaters whether they had trouble using a pumpout or toilet dump facility during the 2003 season in the NDZ. Of the 852 boaters who answered this question, 79 (9%) said 'yes' (they had trouble); 632 (74%) said 'no' (they did not have trouble); and 141 (17%) said they had not attempted to use a pumpout in this NDZ during 2003.

Question 18 asked boaters whether they had trouble using a pumpout or toilet dump facility on their last trip in the NDZ. Of the 842 boaters who answered this question, 24 (3%) said 'yes' (they had trouble); 589 (70%) said 'no' (they did not have trouble); and 229 (27%) said they had not attempted to use a pumpout on their last trip in the NDZ.

Question 21 asked whether the boater found any conditions at any pumpout or toilet dump facilities in the NDZ during the 2003 season that could have impacted use of the facilities. Of the 766 boaters who answered this question, 186 (24%) encountered one or more potential problems. The most frequently reported problem was a non-functioning pumpout facility (see Figure 2).

Figure 3. Problems at Pumpout or Toilet Dump Facilities During the 2003 Boating Season as Reported by Boaters

(Question 21 of Boater Survey)



Question 22 asked whether any of the conditions or problems listed in Question 21 deterred the boater from using the pumpout facilities. Of the 745 boaters who answered this question, 667 (90%) said 'no'; in other words, none of these conditions deterred them from using a pumpout facility in the NDZ during 2003. Of the 186 boaters who reported encountering one or more conditions at any pumpout or toilet dump facilities in the NDZ in the 2003 season, 75 (42%) reported that the problem(s) deterred them from using the facility.

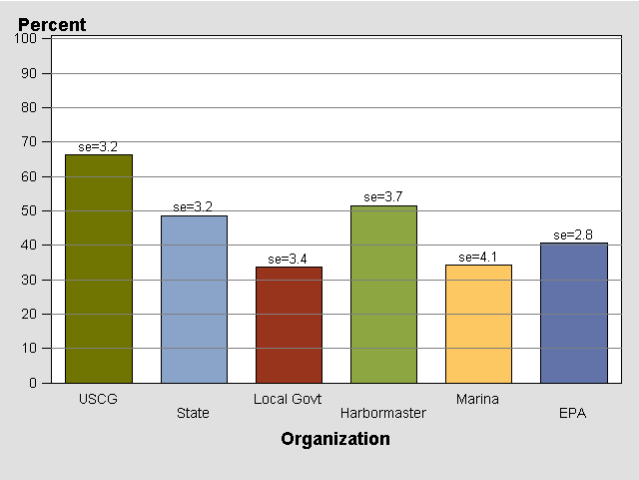
Did Boaters in NDZs Know that the Discharge of Sewage is Prohibited in the Area?

In Question 23, boaters were shown a map with the NDZ borders designated on it and asked if they knew the designated area was a NDZ. Of the 946 people answering this question, 892 (94%) said 'yes' (that is, they knew it was a NDZ). Question 24 asked boaters whether they knew the discharge of treated and untreated vessel sewage is prohibited in a NDZ. Of the 942 boaters answering, 914 (97%) said 'yes' (that is, they knew that such discharges were prohibited). Of the 134 boaters who reported in Question 7 having a flow-through MSD, 125 (74%) reported closing the Y-valve (i.e., preventing discharge), sending the waste to a holding tank, or not using the device while in the NDZ; in Question 11, 42 (26%) reported operating the device normally in the NDZ. There may have been some confusion by respondents over the meaning of operating the device normally in the NDZ; some boaters may have interpreted this as operating the device as they normally would outside the NDZ, while others may have interpreted it as operating the device as they normally would inside the NDZ.

Did Boaters Know who is Responsible for Enforcing NDZ Requirements?

Many boaters believe that multiple parties are responsible for enforcing the requirements of NDZs (Question 26). 592 of 901 boaters (60%) believe that the U.S. Coast Guard enforces NDZ requirements. Other responses to this question are shown in Figure 3.

Figure 4. Entities that Enforce NDZ Requirements as Reported by Boaters (Question 26 of Boater Survey)



3.2 Marina Survey Analysis

The purpose of the marina survey was to ask marina representatives about the operability of their pumpout facilities and their knowledge about the NDZ. Major conclusions from this survey are discussed below. Note that all statistics were calculated using the weighting described in Section 2.4.1. Frequency tables and histograms for all responses from the marina representatives are provided in Appendix E. Results for some questions were combined to allow comparisons across certain categories.

General Profile of Marina Representatives Answering the Survey

Representatives from 69 marinas agreed to complete the survey. Some basic characteristics about these marinas are provided below. Note that most of the general profile questions allowed marina representatives to check more than one answer. Therefore, for each bullet below, the percentages may not add to 100, and the total number of marina representative responses may exceed 69.

- The marinas had an average of 212 slips (median of 165) and an average of 175 boats (median of 126) in the marina at the time of the survey.

- 62 marinas (90%) had onshore pumpout facilities, 14 (21%) had mobile pumpout boats, 16 (23%) had toilet dump stations, and 21 (33%) had portable pumpout facilities.

- 24 marinas (35%) do not charge boaters for pumpouts. The average charge per pumpout or toilet dump at the marinas that charge was $8 (median of $5).

- At 19 marinas (27%), both marina staff and boaters perform the pumpouts. Marina staff alone are responsible for the pumpouts at 28 marinas (44%), and boaters perform the pumpouts without marina staff oversight at 20 marinas (30%).

- 48 marinas (83% of the 58 responses to Question 11) require staff to be trained on the operation and/or maintenance of the pumpout facilities; 49 marinas (86%) provide hands-on training for staff.

- 47 marinas (70% of the 66 responses to Question 23) inform boaters on how to properly operate MSDs by signs, brochures, word of mouth, or some combination of these.

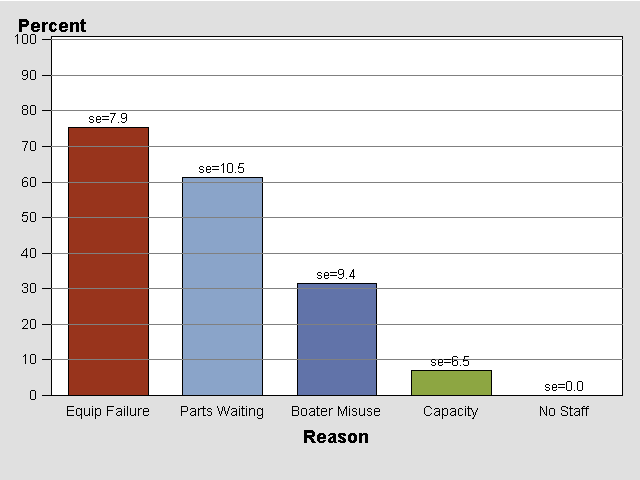
Operability of Pumpout Facilities

Question 16 asked representatives from marinas with pumpout or toilet dump facilities what percentage of time these facilities were functional during the 2003 season. Of the 67 marinas answering this question, 42 (63%) answered 100% of the time and 22 (33%) answered 75 to 99% of the time. The remaining three respondents (4%) said their facilities were functional only 0 to 25% of the time during the 2003 season.

The most common reasons for the 25 facilities being nonfunctional for some of the time were ‘equipment failure’ (18 responses) and ‘waiting for equipment parts/repair’ (12 responses). Other reasons are shown in Figure 4.

Figure 5. Reasons for Pumpout or Toilet Dump Facilities being Nonfunctional During the 2003 Boating Season as Reported by Marinas

(Question 17 of Marina Survey)



Only 15 of 63 marinas (23%) indicated that a boater needed to wait more than 15 minutes to use the pumpout facilities at the marina during the 2003 season; such waits were reported to occur rarely, occasionally, or at certain times (e.g., weekends at sunset). This is consistent with the boaters' reported experiences – only 33 of 693 boaters (5%) indicated that they found the waiting time too long at a pumpout or toilet dump facility in the NDZ during the 2003 season (Question 21 of boater survey).

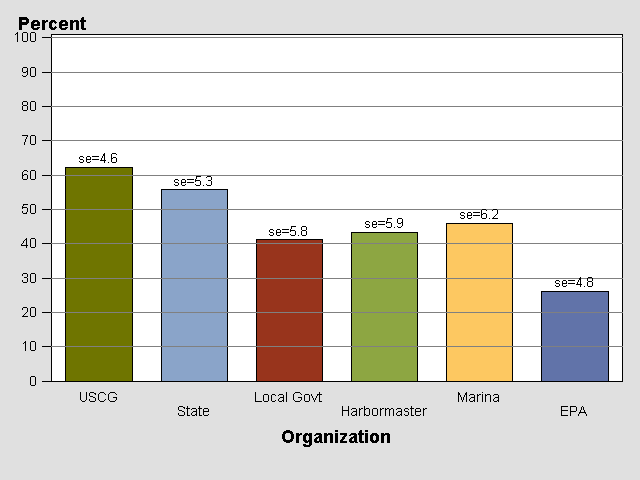
Do Marinas Inform Boaters about NDZs?

Most marina representatives, 61 out of 66 (93%) knew about the existence of the NDZ. Of the 69 marina respondents, 63 (91%) they said that the boaters are informed they are in a NDZ by signs, brochures, word of mouth, or some combination of these (Question 22).

Did Marina Representatives Know who is Responsible for Enforcing NDZ Requirements?

Many marinas believe that multiple parties are responsible for enforcing the requirements of NDZs (Question 24). Marina representatives, 41 out of 67 responding (60%) believe that the U.S. Coast Guard enforces NDZ requirements. Other responses to this question are shown in Figure 5.

Figure 6. Entities that Enforce NDZ Requirements as Reported by Marinas (Question 24 of Marina Survey)



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