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NAVY CONSUMERS' BELIEFS ABOUT MARINE ENVIRONMENTAL ISSUES AND BIODEGRADABLE MATERIALS

by
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13. ABSTRACT *(Maximum 200 words)*

A survey study was conducted to obtain information about Navy consumers relevant to the marketing of items made from biodegradable polymers. Three-hundred-sixty-nine sailors, mostly enlisted men, completed questionnaires assessing their beliefs about marine environmental issues and biodegradable materials. Results showed that Navy consumers are concerned about marine environmental issues and think that the Navy should be doing more about the plastics problem. Although most respondents view compliance with current plastic waste disposal regulations as "easy", they also report many problems. In addition, most sailors could correctly identify a simple definition of "biodegradability" and believe that using items made from biodegradable polymers is the best solution to the marine plastics problem. However, few respondents are clear about the specific consequences of using these materials for their workload or for the marine environment. The perceived effectiveness of various techniques for communicating information to Navy personnel about biodegradable materials was also assessed.

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PREFACE

Annex V of the Marine Pollution (MARPOL) Treaty will prohibit the dumping of plastic waste into the world's oceans beginning January 1994. To meet this requirement, the Navy, with the help of a consortium of private and public sector groups, is attempting to replace nondegradable plastics with biodegradable ones. A marketing program has been initiated to ensure the acceptance and proper use of these materials once they are available for shipboard use. This report summarizes the findings of a survey study designed to obtain information about the Navy consumer relevant to marine environmental issues and biodegradable materials.

ACKNOWLEDGEMENTS

The authors wish to thank Lt. John Rogers, formerly of Natick, for his assistance in scheduling ship visits in San Diego, CA and Pearl Harbor, HI. Thanks also go to the crews of the USS Birmingham, USS Crommelin, USS Germantown and USS Ranger, as well as members of the Navy Food Management Team who participated in the study. In addition, gratitude is extended to Ms. Ruth Roth of Natick for data entry, Ms. Debbie Shea of Natick for typing and formatting the report, and Mr. Larry Lesher of GEO-CENTERS, INC. for his assistance with the data analysis.

NAVY CONSUMERS' ATTITUDES ABOUT MARINE ENVIRONMENTAL ISSUES AND BIODEGRADABLE MATERIALS

INTRODUCTION

Effective January 1994, Annex V of the MARPOL Treaty will restrict the dumping of plastic waste into the world's oceans. The Navy has taken several steps to meet this requirement, most notably source reduction and the imposition of regulations governing plastic waste disposal for ships at sea. Interest has also been shown in replacing conventional nondegradable plastic with materials that are degradable and nontoxic in the marine environment, yet retain many of the useful properties of plastic. These materials are to be composed of starch-based polymers that degrade through consumption by living organisms (biodegradable). A consortium of public and private sector groups [U.S. Department of Agriculture (USDA), U.S. Army Natick Research, Development & Engineering Center (Natick), Massachusetts Institute of Technology (MIT), University of Hawaii, Warner-Lambert] has been organized to achieve this goal. The consortium's objectives involve not only the development of biodegradable polymer materials, but also includes plans to educate Navy personnel on proper usage and to market any products made from these materials. The Consumer Research Branch (CRB) and the Manpower Personnel Integration (MANPRINT) group, part of the Behavioral Sciences Division (BSD) at Natick, have been given responsibility for achieving the marketing and educational portions of these objectives as they relate to products developed by Natick for Navy use. These endeavors include: (1) communicating product information and benefits to Navy personnel; (2) enhancing product satisfaction and maximizing usage through the creation of "consumer-friendly" products and waste disposal systems; and (3) ensuring compliance with any changes in shipboard procedure resulting from the use of products made from biodegradable starch-based polymers.

A necessary first step in the marketing program being developed by CRB and MANPRINT is the establishment of a psychographic profile of the Navy consumer with respect to marine environmental issues. The purpose of a psychographic profile is to provide information about the eventual user of a product in terms of his/her attitudes, activities and interests. Relevant to the marketing task described above, a psychographic analysis would explore Navy consumers' views on issues related to the plastics problem in the marine environment. At present, little is

known about sailors' knowledge and opinions about the problem, their perceptions of its seriousness, or their attitudes toward possible solutions (e.g., biodegradable materials). This kind of information will aid in the development of communication strategies to educate Navy consumers and to market any products, once items have been made from starch-based polymers.

METHOD

The study was conducted during the period of 16-26 September 1991 at the Naval Stations in San Diego, CA and at Pearl Harbor, HI. Three hundred and sixty-nine sailors completed the survey. Ninety percent of the respondents were enlisted men. Surveys were administered onboard USS Ranger and USS Germantown in San Diego and onboard USS Crommelin and USS Birmingham at Pearl Harbor. Respondents on these vessels completed the questionnaires during lunch or break times. Surveys were also administered to Navy Food Management Team members at two DoD Food Program Seminars. Respondents here completed the questionnaires during a break in the seminar.

A copy of the survey is found in Appendix A. The topics covered were: (1) attitudes/beliefs about the plastics problem at sea; (2) attitudes/beliefs about the current waste disposal system; (3) the type of training received about plastic waste disposal; (4) knowledge of the "biodegradable" concept and beliefs about the impact of biodegradable materials; and (5) the perceived effectiveness of various communication strategies to convey environmental information to Navy consumers.

RESULTS

The presentation of results is divided into five sections based on the topics noted above. Questions are displayed in the same order as they appear in the actual survey (see Appendix A). To make it easy for the reader to associate questions with results, each question is presented followed by an analysis of responses. The results are displayed in the following formats:

1. For questions whose responses could range from "strongly agree" to "strongly disagree" (Q1, 2, 4, 6, 7, 9, 13, 14, 15), a bar graph is presented displaying the frequency of each response option (e.g., "strongly agree," "agree," etc.). The response options were also scaled (1 = strongly disagree; 5 = strongly agree; "don't know" responses were dropped), and a mean and standard deviation are presented;

2. For multiple-choice questions with a discrete set of options (Q3, 5, 16), bar graphs are used to display the frequency of each response option;

3. For open-ended questions or questions for which respondents were allowed to give more than one response (Q8, 10, 11), a table is provided listing the percentage of sailors who gave each response;

4. For questions measuring the perceived effectiveness of communication strategies (Q17), mean effectiveness scores and standard deviations for each individual strategy are presented in a table to allow for easy comparison.

It should also be noted that, although the questionnaire was administered to 369 sailors, the number who answered each individual question varied. Thus, in the presentation that follows, the statistics and percentages are based on the N reported for each question, and not the overall number of sailors to whom the questionnaire was administered.

1. Attitudes/Beliefs about the Plastics Problem at Sea

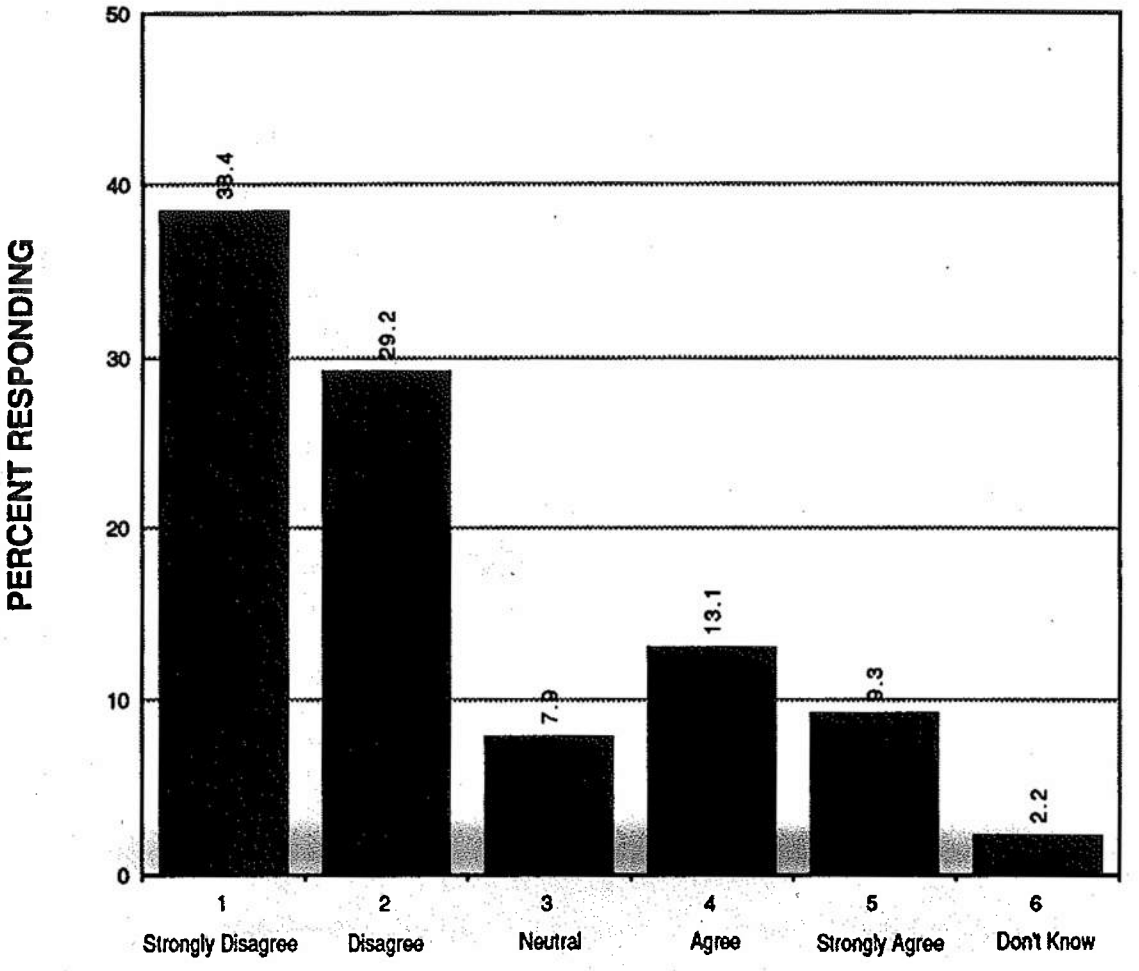


Figure 1. Question 1: Cleaning up and protecting the marine environment is not as important as some people want us to believe. (N=359; Mean 2.24; S.D. 1.34)

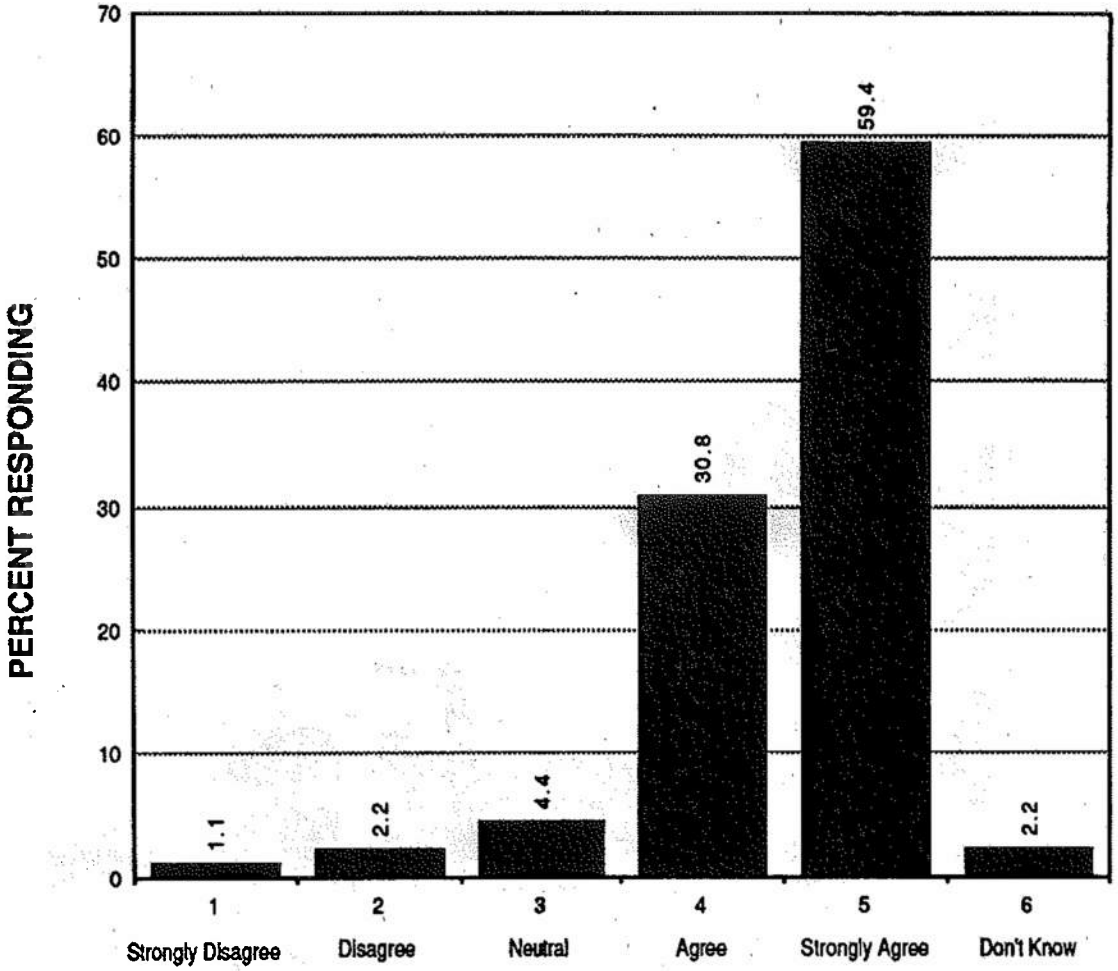


Figure 2. Question 2: Dumping plastic waste overboard is a serious threat to the marine environment. (N=359; Mean=4.48; S.D.=.78)

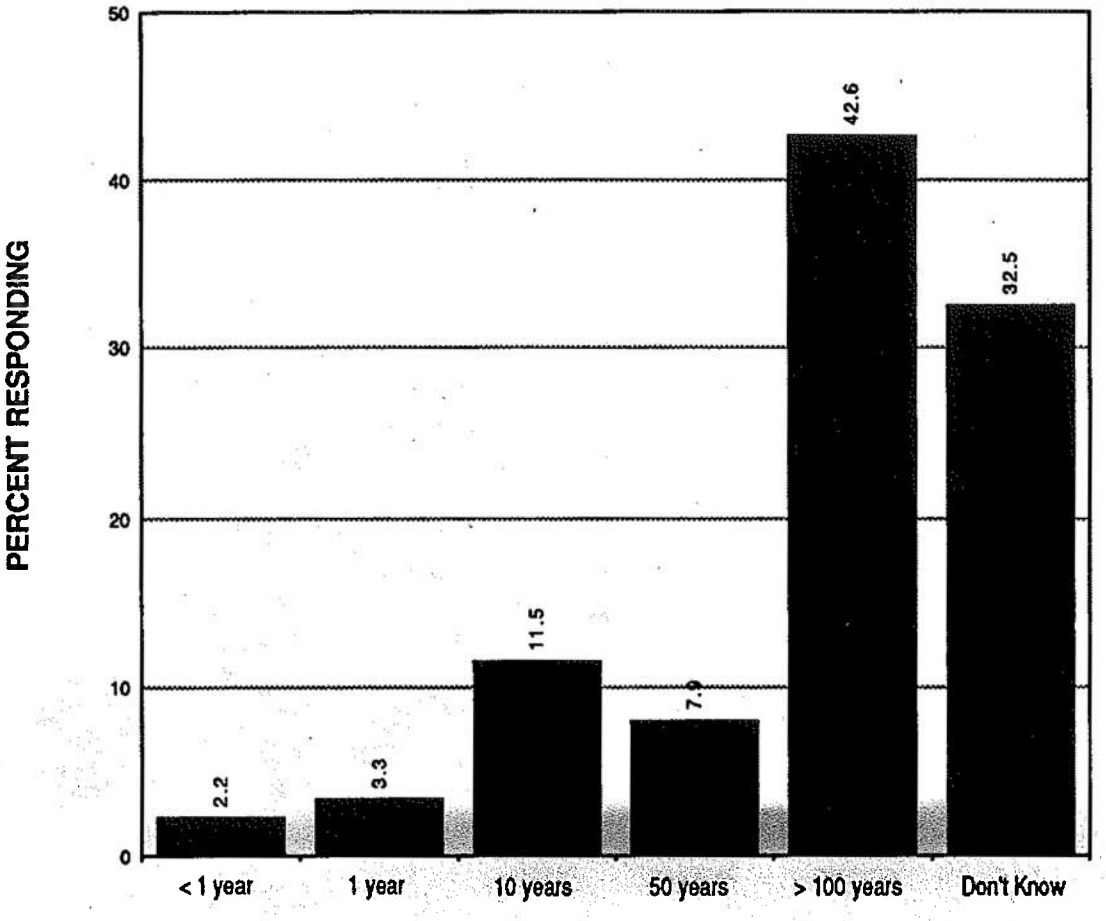


Figure 3. Question 3: How long do you think it takes plastic to disintegrate at sea? (N=364)

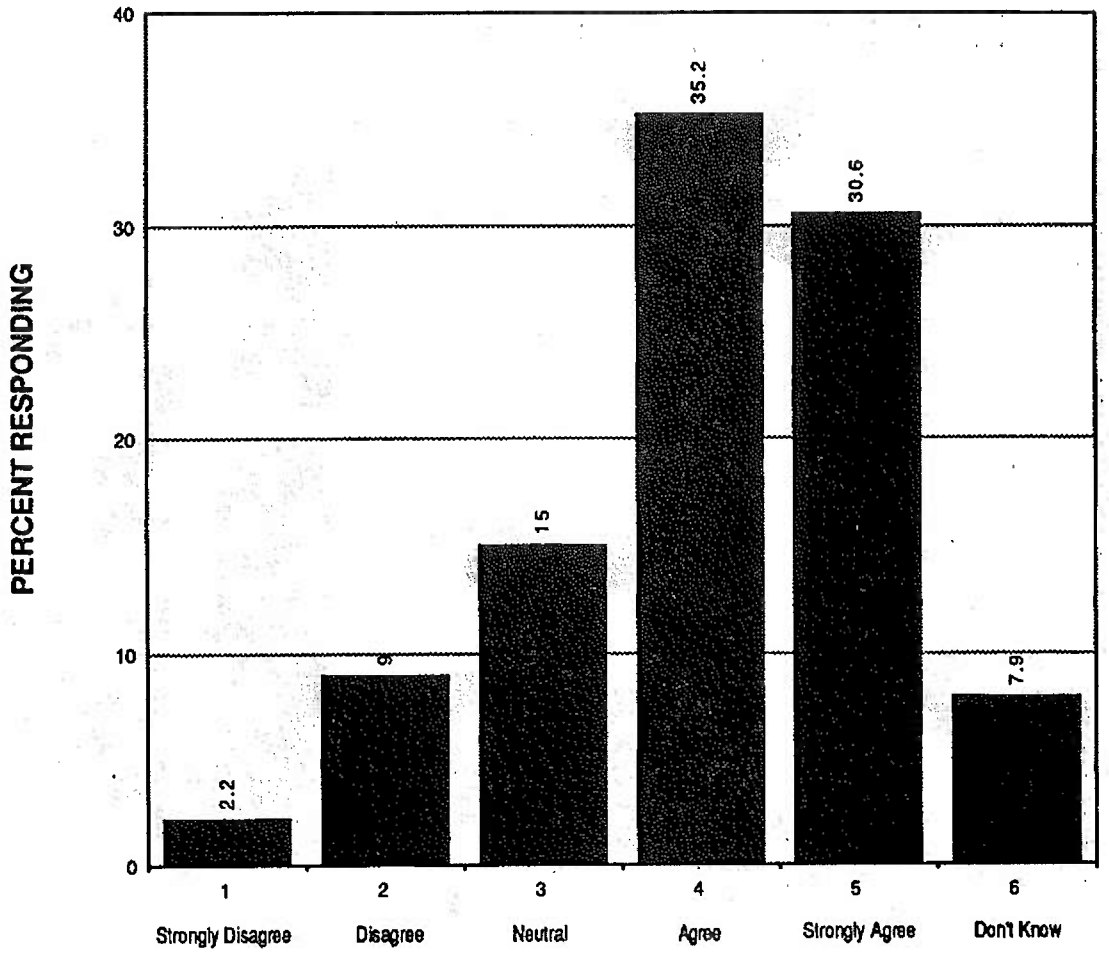
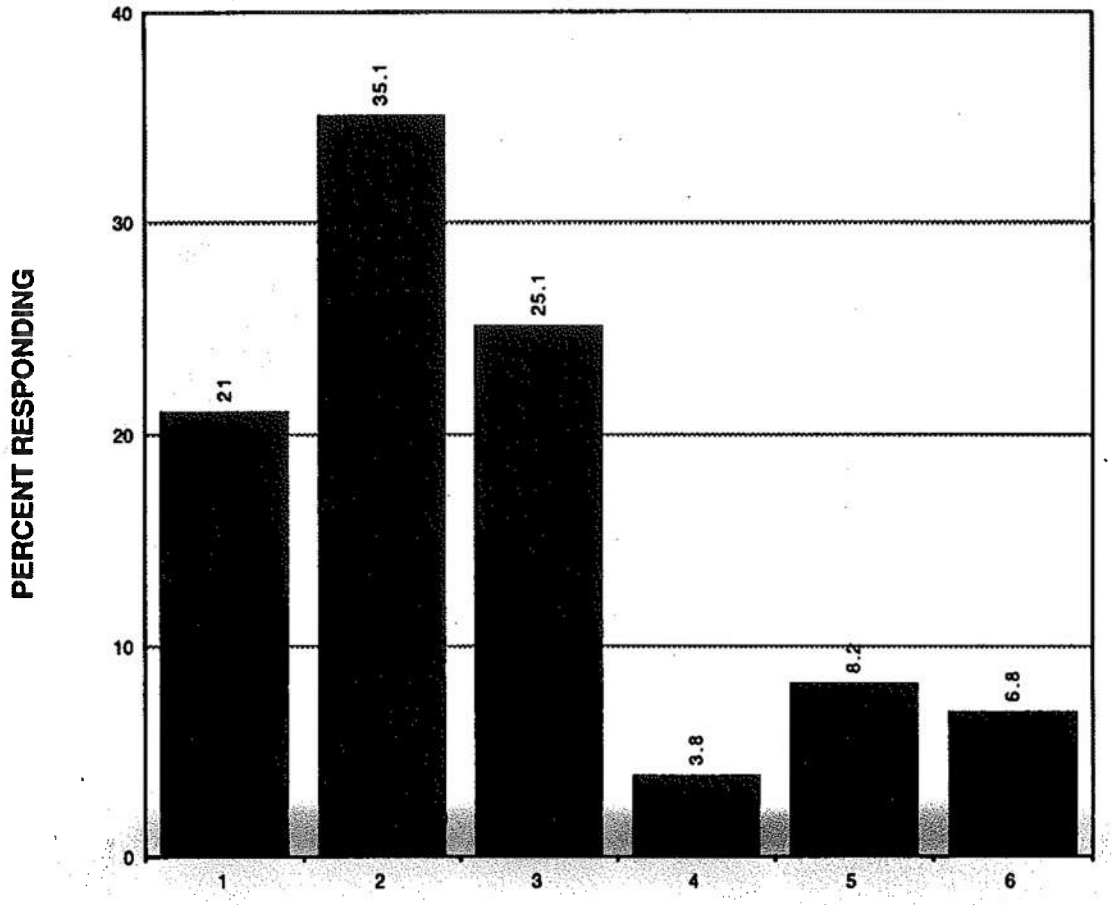


Figure 4. Question 4: The Navy could do a lot more than it is currently doing to reduce plastics pollution at sea. (N=337; Mean=3.90; S.D.=1.05)



1 = Using plastics that can be used again or processed into something else

2 = Using plastics that will decompose naturally in the environment

3 = Reducing the total amount of plastics used at sea

4 = Burning plastics

5 = Other

6 = Don't Know

Figure 5. Question 5: Which of the following do you think is the best way for the Navy to reduce plastics pollution at sea? (N=367)

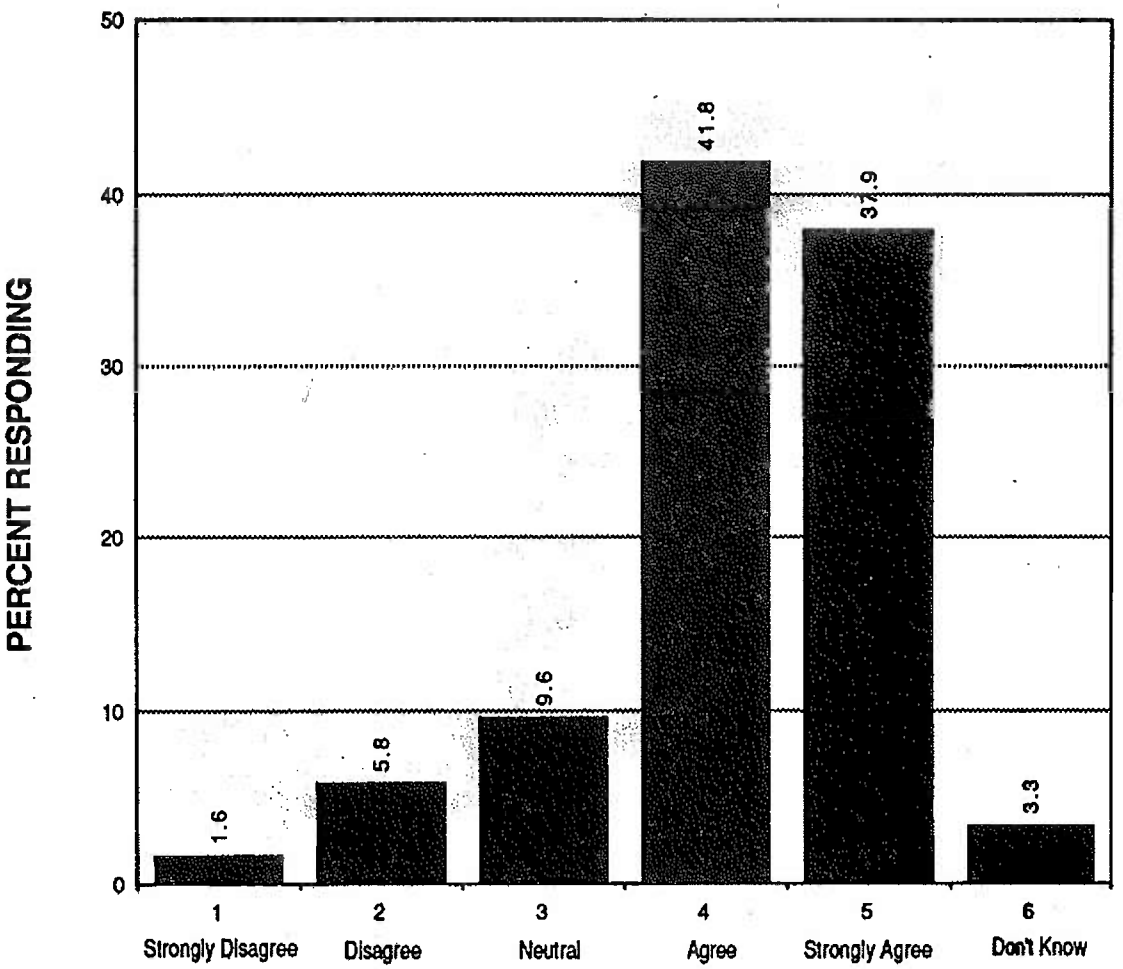


Figure 6. Question 6: Making waste disposal at sea less environmentally harmful should be a priority onboard ship. (N=352; Mean=4.12; S.D.=.93)

2. Attitudes/Beliefs about the Current Plastic Waste Disposal System

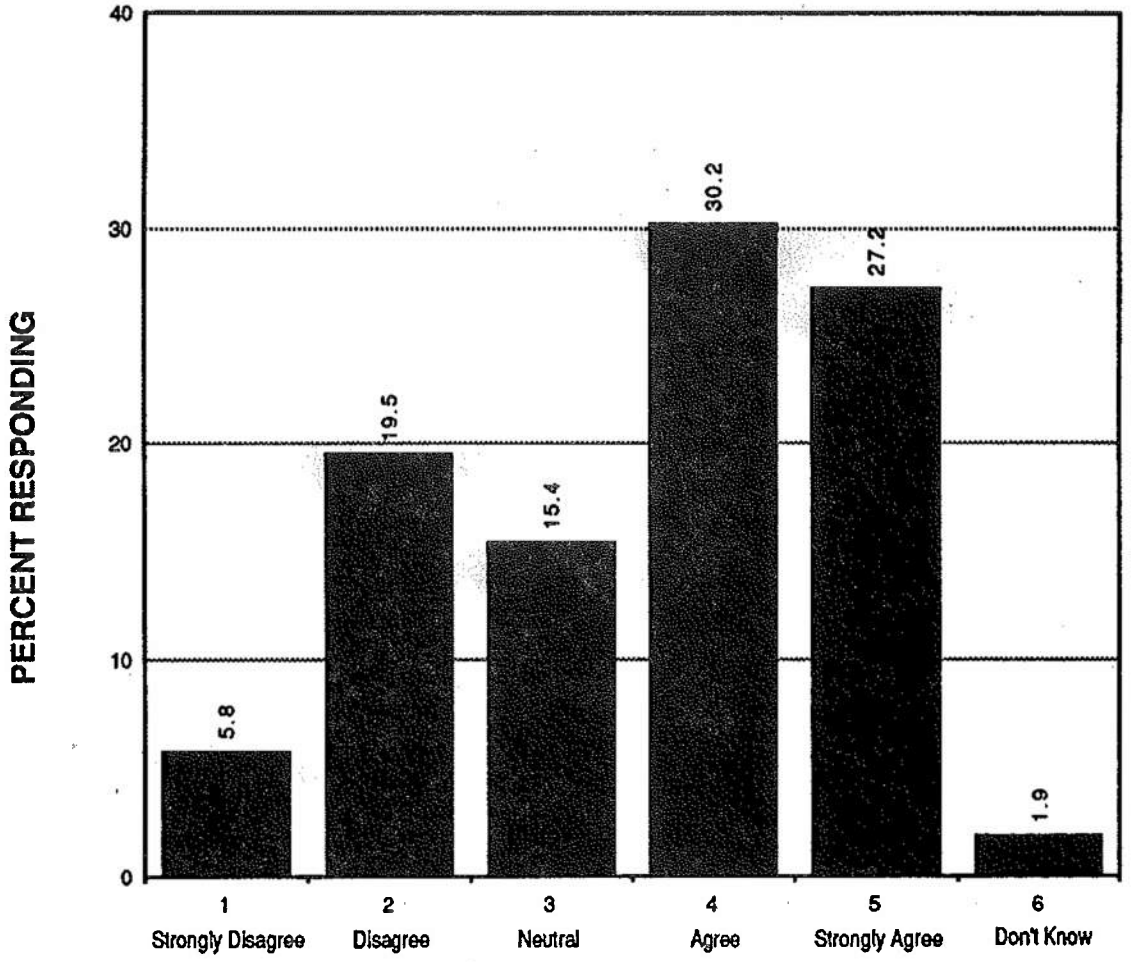


Figure 7. Question 7: When developing a new waste disposal program, one of the first considerations should be the amount of work it creates for sailors. (N=357; Mean=3.55; S.D.=1.25)

Table 1. ***Question 8*****: Current regulations state that the discharge of plastic waste from ships at sea is prohibited. Which of the following problems, if any, have you experienced in your attempts to comply with this regulation?**[1]

If you circled two or more problems, which ONE problem do you think is the most serious?[2]

PROBLEM	% Mentioning Problem[3]	% Most Serious
A. Finding space	61	25
B. Odors from waste	55	3
C. Separating plastic from other waste	55	13
D. Determining whether item is plastic	14	1
E. Lack of sailor compliance	50	19
F. Increase in workload	27	1
G. Fire hazard	30	8
H. Health hazard	42	14
I. Plastic storage bags not strong	20	0
J. Other	5	8
K. No problems	10	-

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1 n = 356

2 n = 331

3 Because sailors could specify more than one problem, percentages add to greater than 100%.

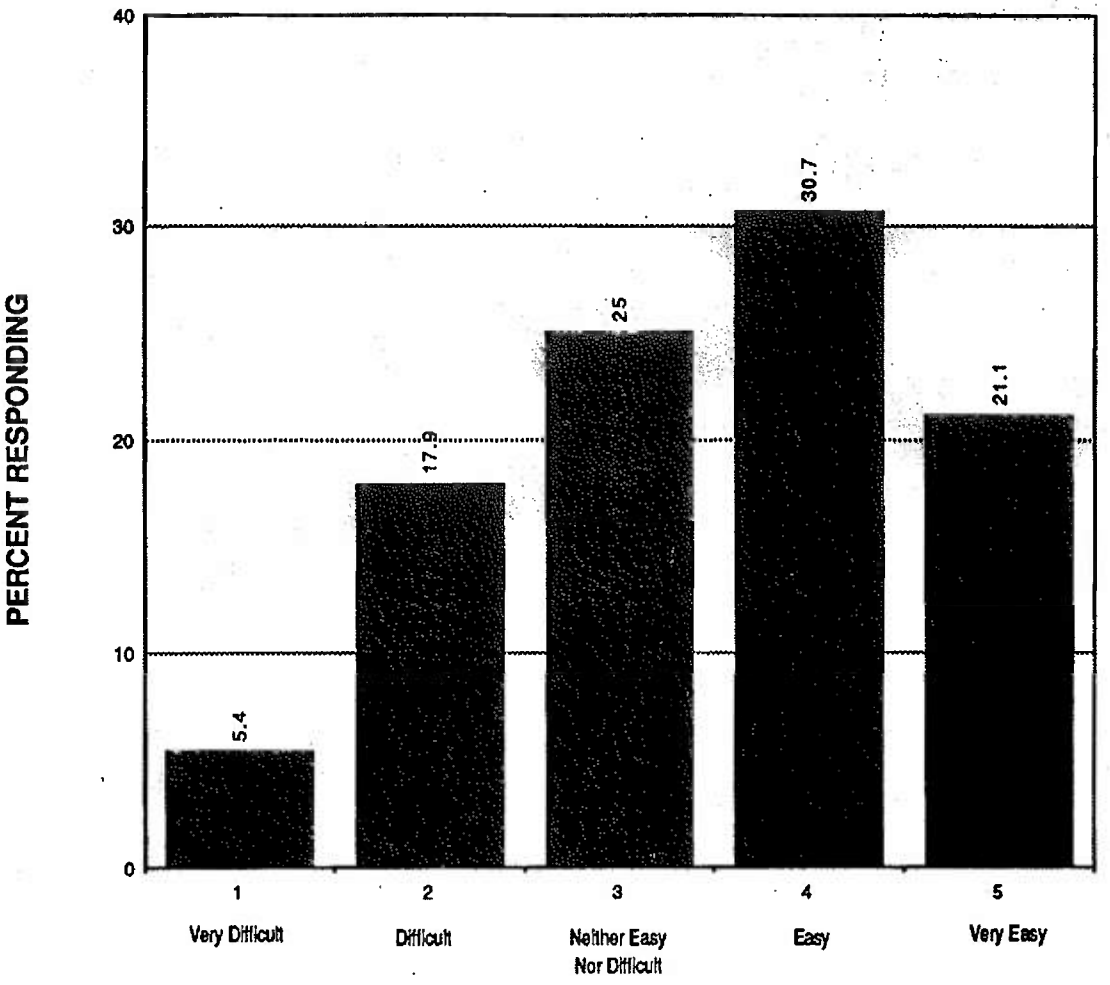

Figure 8. Question 9: How easy is it for you to comply with the Naval regulation prohibiting the dumping of plastics at sea? (N=336; Mean=3.44; S.D.=1.16)

3. Type of Plastic Waste Disposal Training Received

Table 2. ***Question 10*****: What type of training have you received about plastic waste disposal?**[1]

Type of Training	% Receiving Training[2]
Classroom	11
On the job	42
Watching others	15
Watched video	15
Recruit school	2
"A" school	3
Received no training	35

1 Because sailors could specify more than one type of training, percentages add to greater than 100%.

2 n = 340

Table 3. ***Question 11*****: Do you think additional training is needed?**

63.4 % YES 36.6 % NO

If YES, what kind of training would you like?[1]

Type of Training	% Mentioning[2]
Classroom	35
On the job	12
Videotape/Film	31
Recruit / "A" school	5
Training emphasizing information, rather than just rules	47
Uncodeable	25

1 Because sailors could specify more than one type of training, percentages add to greater than 100%.

2 n = 331

4. Attitudes/Beliefs about the Use of Biodegradable Materials

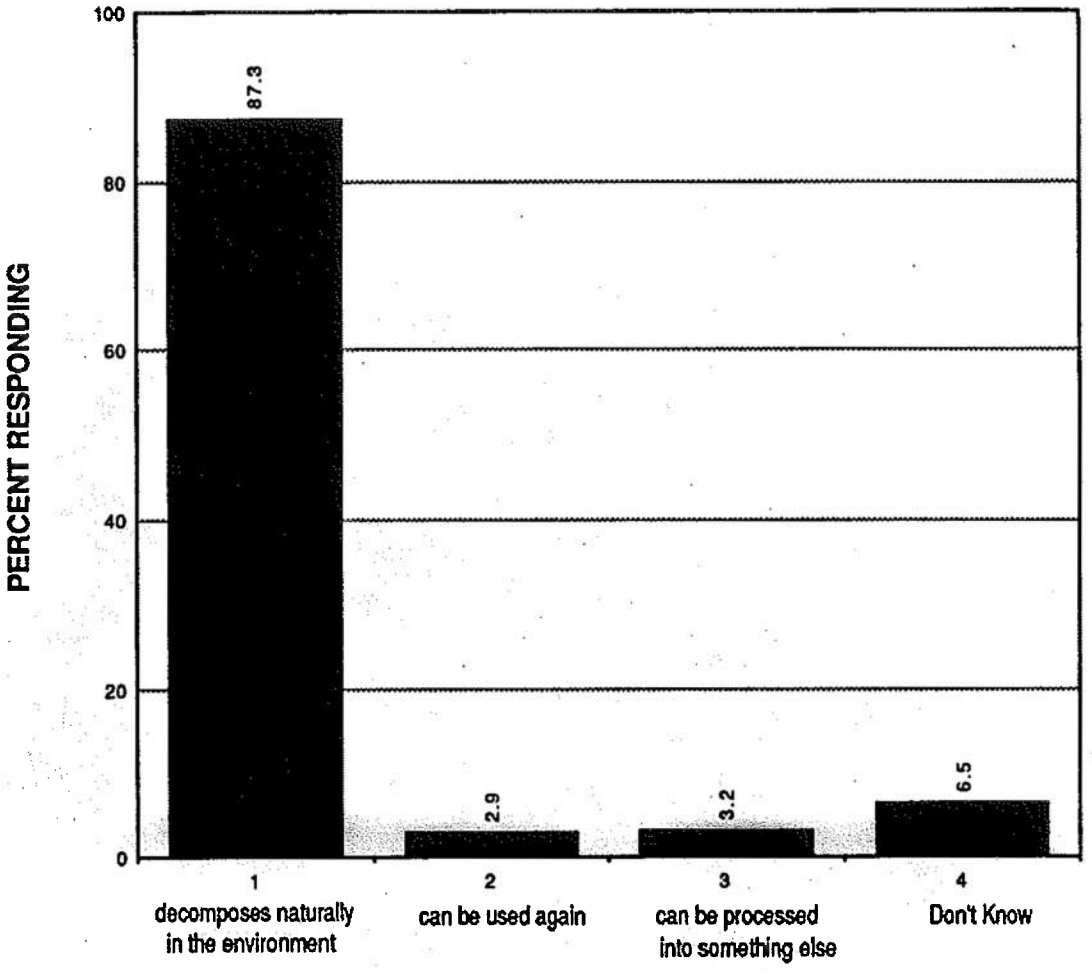

Figure 9. Question 12: A plastic that is biodegradable... (N=339)

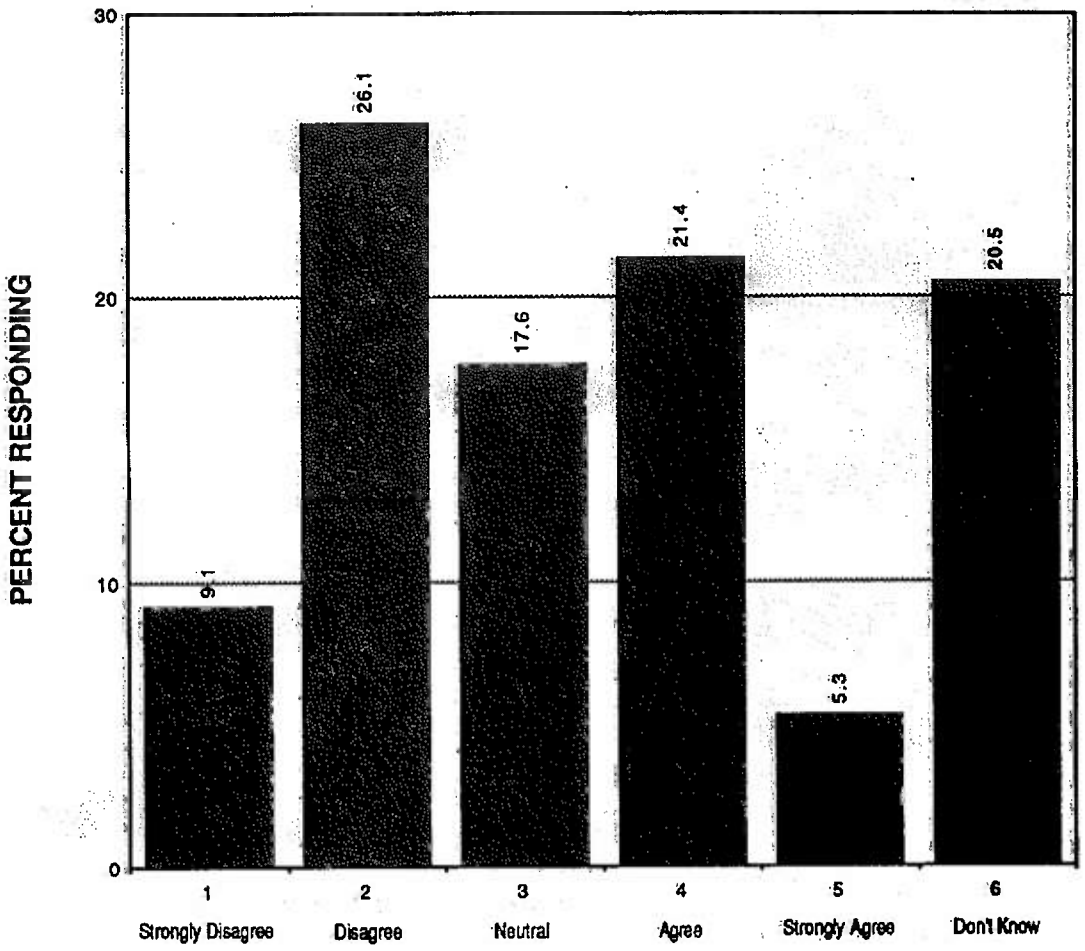

Figure 10. Question 13: Dumping biodegradable plastics into the ocean will not harm the marine environment. (N=271; Mean=2.85; S.D.=1.14)

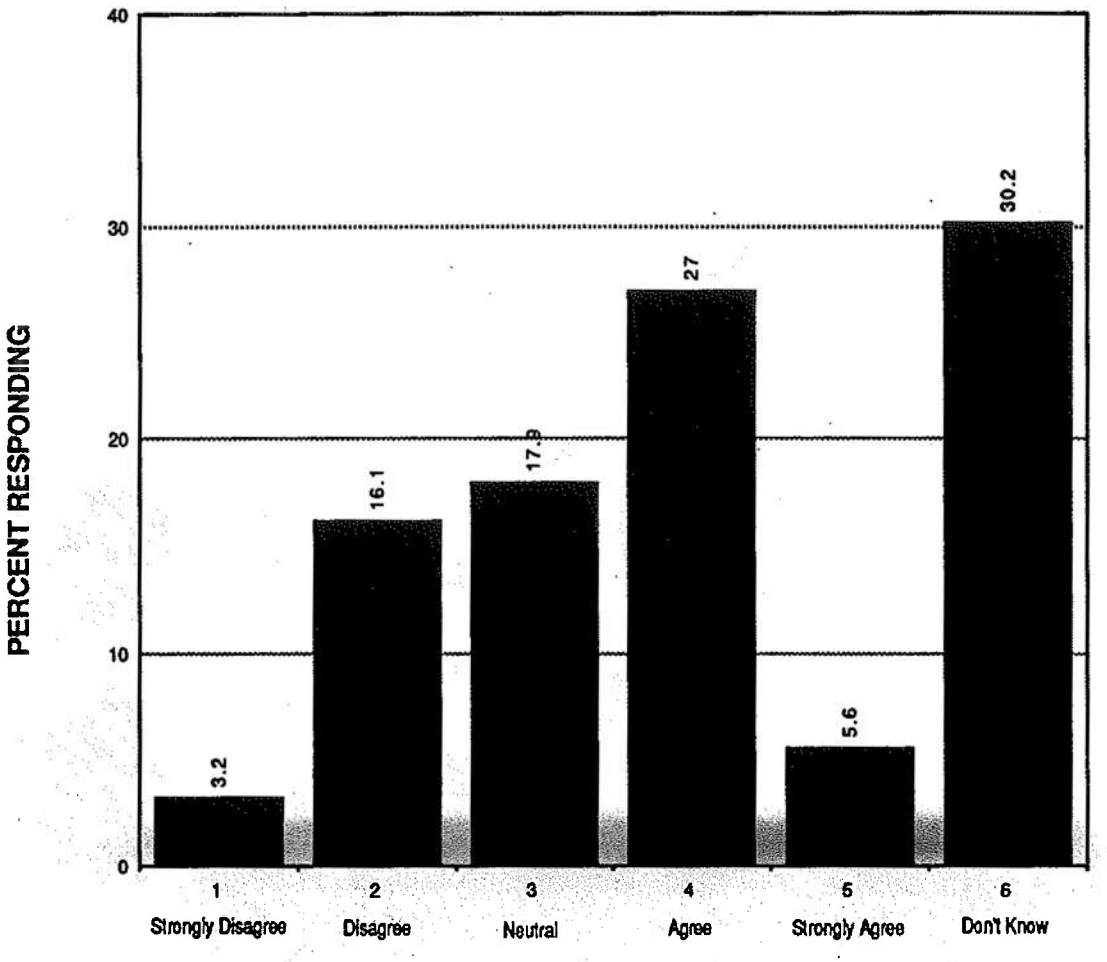

Figure 11. Question 14: When a biodegradable plastic disintegrates, it will not harm the marine environment. (N=238; Mean= 3.22; S.D.= 1.04)

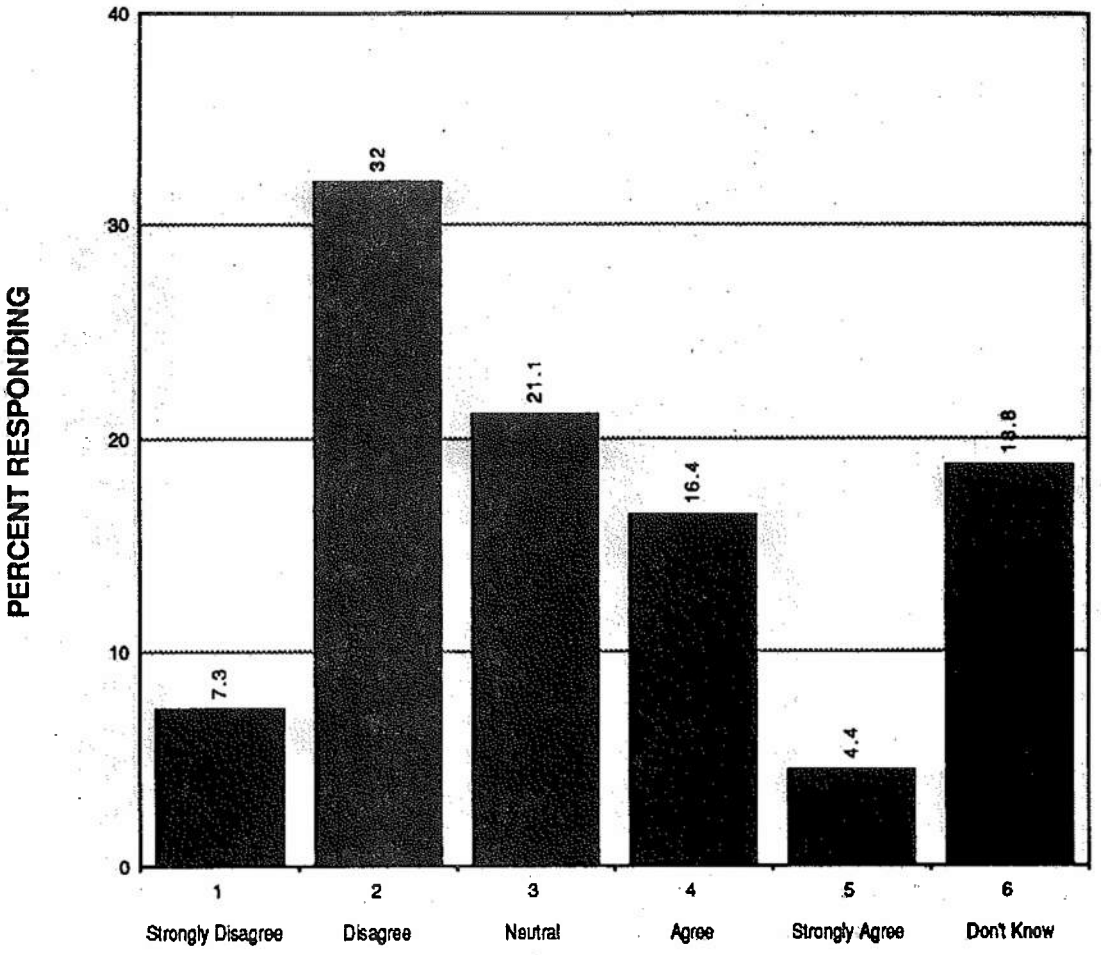

Figure 12. Question 15: Using biodegradable plastics onboard ship will make waste separation more difficult. (N=277; Mean=2.74; S.D.=1.05)

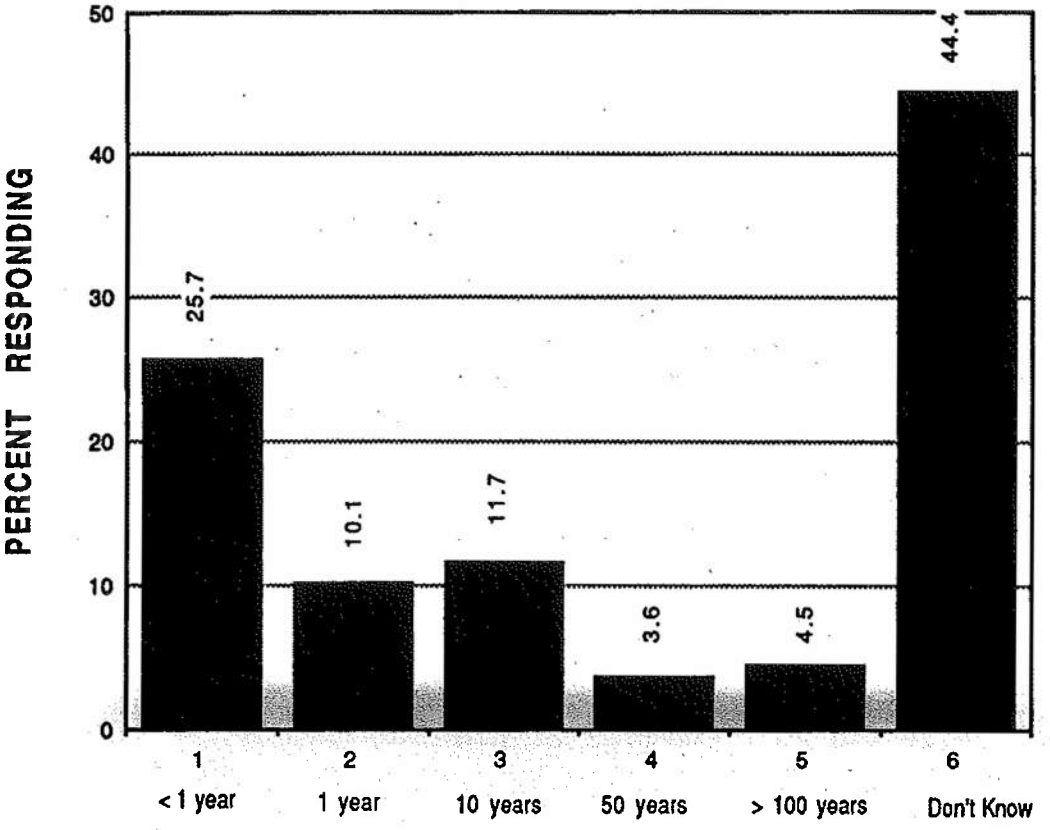

Figure 13. Question 16: How long do you think it would take a biodegradable plastic to disintegrate at sea?

5. Perceived Effectiveness of Communication Strategies

Table 4. ***Question 17.*** **If biodegradable plastics were used onboard Navy ships, how effective do you think each of the following methods would be for providing sailors with information about the materials (e.g., changes in waste disposal, impact of product on the environment, etc.):**[1]

Method	Mean Effectiveness Rating[2]	Standard Deviation
A. Direct orders by superior officer	2.12	1.06
B. Posters hung onboard ship	2.70	1.00
C. Videos shown onboard ship every few months	2.44	1.04
D. Commercials on closed-circuit television, Armed Forces Radio, and Navy Times Magazine	2.71	1.10
E. Brochures mailed directly to sailors	3.30	1.14
F. Periodic visits from government personnel	2.65	1.13
G. Presentations by other sailors who have had experience with materials	2.40	1.01
H. Information included in Plan-of-the-Day	2.37	1.01
I. Information included at quarters	2.37	1.04

1 Because all sailors did not rate the effectiveness of every method, the mean effectiveness rating for each method is based on a different number of respondents, ranging from n = 348-352.

2 1 = very effective; 5 = very ineffective

SUMMARY

The results of this survey study are useful for developing a psychographic profile of the Navy consumer regarding marine environmental issues. The major findings are as follows:

I. Attitudes/Beliefs about the Plastics Problem at Sea: Sailors are concerned about the plastics problem at sea and view dumping plastics as a serious threat to the marine environment. Many also agree that making waste disposal at sea less environmentally harmful should be a priority, and that the Navy could do more than it is currently doing to deal with the problem. Using plastics that decompose naturally in the environment when discharged (biodegradable) was mentioned by more sailors than any other method as being the best way for the Navy to solve the plastics disposal problem.

II. Attitudes/Beliefs about the Current Plastic Waste Disposal System: Over half the sailors questioned see compliance with current plastic waste disposal procedures as "easy" or "very easy." In spite of this, only 10% of them report having had no problems with the system. Most frequently mentioned difficulties with the system are finding space onboard ship (61%), odors emanating from waste (55%), separating plastic from other trash (55%), and lack of sailor compliance (50%). Of all difficulties, finding storage space (25%) and lack of sailor compliance (19%) were rated as most serious by the most sailors.

III. Type of Plastic Waste Disposal Training Received: Thirty-five percent of the sailors indicate that they have received no training about plastic waste disposal. For those who did report some training, 42% received "on the job" training. It should be noted that only 15% reported watching a video (presumably the PRIME video). Also noteworthy is the small percentage of sailors who received training in recruit school (2%) and "A" school (3%). In spite of these figures, over 60% of sailors believe additional training is needed.

IV. Attitudes/Beliefs about the Use of Biodegradable Materials: The majority of sailors (87%) could identify a simple definition of "biodegradable." Less consensus was shown about the impact of using materials made from biodegradable polymers, i.e., the effect of the dumping and disintegration of biodegradable plastic on the marine environment, or the effect of using these materials on waste separation. It should also be noted that a relatively large percentage of sailors responded to questions in this section with

"don't know." For example, when asked how long it would take a biodegradable plastic to disintegrate at sea, 44% of the sailors admit that they don't know.

V. Perceived Effectiveness of Communication Strategies: For the most part, all strategies were perceived as relatively effective means for communicating information about biodegradable materials. Direct orders by superiors were seen as most effective, followed by information at Quarters, information in the Plan-of-the-Day (POD), presentations by other sailors, and videos. By comparison, mailing brochures was seen as the least effective method.

CONCLUSIONS AND RECOMMENDATIONS

Although these data were collected in a limited geographical area, and sailors' responses may have been influenced by social desirability concerns, they do provide some profile of Naval consumers' views on marine environmental issues. These data also reveal important information about the use of communication strategies and techniques for ensuring sailor compliance once products made from biodegradable polymers are available for shipboard use. The following conclusions and recommendations are made:

1. Sailors are receptive to information: The results of this study indicate that sailors are open to information dealing with marine environmental issues and biodegradable materials. This is supported by the fact that sailors see the plastics problem as real and think it worth doing something about. Furthermore, although sailors appear to have some idea, albeit simplistic, about the concept of "biodegradability," they are less clear as a group about the consequences of using such materials. They do not, however, seem negative about relying on biodegradable materials to solve the plastics problem at sea. In fact, many believe that using products made from these materials is the best way for the Navy to deal with the problem. Therefore, rather than having to change an already-existing negative attitude, the opportunity exists to create positive beliefs about biodegradable materials. A final indicator of sailors' potential receptivity to information is their endorsement of additional training. This training could begin early in their naval careers (e.g., recruit school) and continue or be reinforced through "on the job" training.

2. Multiple communication techniques are needed: The results of this study also provide some ideas about the appropriate methods of training and communicating information to sailors. An examination of the responses to Question 17 reveals that no one method appears to stand out from the rest in terms of effectiveness. Direct orders from superiors were perceived as the most effective tools, while mailing brochures was seen as the least effective. It is likely that a variety of methods using similar themes and images to ensure consistency will prove useful. This will serve to reinforce the message and allow for individuals' preferences for certain methods of communications.

3. Investigating the context/circumstances in which communication techniques will be used: A communication technique has the potential to be effective only if it is used. Consider the case of videos. Although perceived by sailors as a relatively effective means of conveying information, only 15% of those sampled reported viewing a video that was designed in conjunction with the PRIME program. For a communication to be effective, an investigation of the factors that encourage and discourage its use should be considered. Things like unfavorable attitudes of personnel, and time and space constraints, decrease the probability that a video will be shown to all crew members. An effort should be made to examine the context or circumstances in which a communication will be used and to develop proper channels of distribution in order to increase the probability that a communication will be viewed.

4. Plastic waste disposal systems should be designed with the users in mind: Although most sailors believed that it was easy to comply with the current procedures for plastic waste disposal, they also reported many problems with the system. Difficulties mentioned by a substantial number of respondents were problems finding storage space and lack of sailor compliance. An effort should be made to address these difficulties when designing a new waste disposal system, or in modifying the existing one, when biodegradable products become available. It is probably the case that several of these problems (e.g., lack of storage space) will be alleviated by the use of biodegradables. However, other problems, like sailor compliance, may still need to be addressed since high levels of compliance are essential to the success of any waste disposal program.

5. More information is needed about sailors' attitudes toward marine environmental issues and biodegradable materials: These data provide important information about sailors' attitudes toward marine environmental problems and possible solutions. However, since the data were collected in a limited geographical region, caution

is advised in making generalizations. More research is needed to determine whether the results of this study reflect the attitudes and beliefs of sailors onboard other ships and in other geographical areas. Additional information is also needed concerning sailors' beliefs about the impact of biodegradable materials. Although this study examined the perceived effects of biodegradables on workload and on the marine environment, little is known about their perceived impact on health and safety. Since many of the biodegradable items being developed are slated for use in food service, it is important to investigate whether sailors view packaging food in biodegradable materials as safe or as a hazard to their health.

This document reports research undertaken at the US Army Natick Research, Development and Engineering Center and has been assigned No. NATICK/TR-92/037 in the series of reports approved for publication.

APPENDIX

NAVAL WASTE DISPOSAL SURVEY

NAVAL WASTE DISPOSAL SURVEY

U.S. Army Natick Research, Development and Engineering Center is conducting research on opinions about waste disposal and environmental issues of interest to the Navy. All your responses will be kept confidential, so please answer as honestly as you can. Thank you.

What is your rank? E-_____ O-_____ WO-_____ *What is your rate?* _____

How long have you been in the Navy? _____ *What is your sex?* _____ M _____ F

What is your age?

_____ under 18
_____ 18-20
_____ 21-25
_____ 26-30
_____ 31-35
_____ 36-40
_____ 41-45
_____ 46-50
_____ 51-55
_____ 56-60
_____ over 60

What is your marital status?

_____ never married
_____ married
_____ separated
_____ divorced
_____ widowed

How many children do you have?

_____ none
_____ one
_____ two or more

What is the highest level of education you have completed?

_____ some high school
_____ high school
_____ some college
_____ college
_____ graduate school
_____ other _____

For each question, circle only one answer unless otherwise indicated.

1. Cleaning up and protecting the marine environment is not as important as some people want us to believe.
   a. Strongly agree
   b. Agree
   c. Neither agree nor disagree
   d. Disagree
   e. Strongly disagree
   f. Don't know

2. Dumping plastic waste overboard is a serious threat to the marine environment.
   a. Strongly agree
   b. Agree
   c. Neither agree nor disagree
   d. Disagree
   e. Strongly disagree
   f. Don't know

3. How long do you think it takes plastic to disintegrate at sea?
   a. Less than 1 year
   b. 1 year
   c. 10 years
   d. 50 years
   e. More than 100 years
   f. Don't know

4. The Navy could do a lot more than it is currently doing to reduce plastics pollution at sea.
   a. Strongly agree
   b. Agree
   c. Neither agree nor disagree
   d. Disagree
   e. Strongly disagree
   f. Don't know

5. Which of the following do you think is the *best* way for the Navy to reduce plastics pollution at sea?
   a. Using plastics that can be used again or processed into something else;
   b. Using plastics that will decompose naturally in the environment;
   c. Reducing the total amount of plastics used at sea;
   d. Burning plastics;
   e. Other (specify: _____)
   f. Don't know

6. Making waste disposal at sea less environmentally harmful should be a priority onboard ship.
   a. Strongly agree
   b. Agree
   c. Neither agree nor disagree
   d. Disagree
   e. Strongly disagree
   f. Don't know

7. When developing a new waste disposal program, one of the first considerations should be the amount of work it creates for sailors.
   a. Strongly agree
   b. Agree
   c. Neither agree nor disagree
   d. Disagree
   e. Strongly disagree
   f. Don't know

8. Current regulations state that the discharge of plastic waste from ships at sea is prohibited. Which of the following problems, if any, have you experienced in your attempts to comply with this regulation? **Circle all that apply.**

   a. Problems finding space onboard to store the plastic waste
   b. Odors from waste
   c. Problems separating plastic waste from other waste
   d. Problems determining whether a waste item is plastic
   e. Lack of sailor compliance with regulations
   f. An increase in workload
   g. Potential fire hazard due to storing waste onboard
   h. Potential health hazard due to storing waste onboard
   i. Plastic storage bags are not strong enough.
   j. Other (specify:_____)
   i. I haven't experienced any problems.

If you circled two or more problems above, which ONE problem do you think is the most serious? Write the letter in the space provided.(e.g., if you think the potential fire hazard is the most serious problem, write "g" in the space.) _____

9. How easy is it for you to comply with the Naval regulation prohibiting the dumping of plastics at sea?
   a. Very easy
   b. Easy
   c. Neither easy nor difficult
   d. Difficult
   e. Very difficult

10. What type of training have you received about plastic waste disposal? **Circle all that apply.**
   a. Classroom training
   b. "on the job" training
   c. Learned by watching others
   d. Learned by watching a videotape on waste disposal
   e. Learned in recruit training
   f. Learned in "A" school
   g. I received no training
   h. Other (Specify:_____)

11. Do you think any additional training is needed? YES NO

If YES, what kind of training would you like?

12. A plastic that is ***biodegradable***...
   a. decomposes naturally in the environment
   b. can be used again
   c. can be processed into something else
   d. don't know

13. Dumping ***biodegradable*** plastics into the ocean will not harm the marine environment.
   a. Strongly agree
   b. Agree
   c. Neither agree nor disagree
   d. Disagree
   e. Strongly disagree
   f. Don't know

14. When a ***biodegradable*** plastic disintegrates, it will not harm the marine environment.
   a. Strongly agree
   b. Agree
   c. Neither agree nor disagree
   d. Disagree
   e. Strongly disagree
   f. Don't know

15. Using ***biodegradable*** plastics onboard ship will make waste separation more difficult.
   a. Strongly agree
   b. Agree
   c. Neither agree nor disagree
   d. Disagree
   e. Strongly disagree
   f. Don't know

16. How long do you think it would take a ***biodegradable*** plastic to disintegrate at sea?
    a. Less than 1 year
    b. 1 year
    c. 10 years
    d. 50 years
    e. More than 100 years
    f. Don't know

17. If biodegradable plastics were used onboard Navy ships, how effective do you think each of the following methods would be for providing sailors with information about the materials (e.g., changes in waste disposal, impact of product on environment, etc.):

1 = Very effective
2 = Effective
3 = Neither effective nor ineffective
4 = Ineffective
5 = Very ineffective

a. Direct orders by superior officer	**1**	**2**	**3**	**4**	**5**
b. Posters hung onboard ship	**1**	**2**	**3**	**4**	**5**
c. Videos shown onboard ship every few months.....	**1**	**2**	**3**	**4**	**5**
d. Commercials on closed-circuit television, Armed Forces Radio, and Navy Times magazine.....	**1**	**2**	**3**	**4**	**5**
e. Brochures mailed directly to sailors.....	**1**	**2**	**3**	**4**	**5**
f. Periodic visits from government personnel	**1**	**2**	**3**	**4**	**5**
g. Presentations by other sailors who have had experience with the materials.....	**1**	**2**	**3**	**4**	**5**
h. Information included in the Plan of the Day.....	**1**	**2**	**3**	**4**	**5**
i. Information included at Quarters.....	**1**	**2**	**3**	**4**	**5**