Cleaner Captains: The Relationship Between Recreational Boater Knowledge and their Pro-Environmental Behaviors

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Abstract Recreational boating is a major industry in California that attracts over a million users each year. However, recreational boats and associated boating activities are also major sources of water pollution. As such, state and local agencies have sought to inform boaters about their activities' environmental impacts and promote pro-environmental behaviors among the boating population. To assess the level of boaters' water pollution knowledge and their behavioral actions and to explore the relationship between boaters' water pollution knowledge and clean boating practices, a survey was conducted among recreational boaters in the spring of 2007 at boat trade shows. I hypothesized that recreational boaters with greater knowledge of water would perform clean boating practices more frequently than those without this knowledge. Recreational boaters were asked to complete a survey containing water pollution knowledge quiz questions and self-reported behavioral questions. After controlling for demographics and boating experience, results indicate that greater knowledge of water pollution, as measured in this study, is not significantly correlated with the frequent practice of pro-environmental boating.

Introduction

Recreational boating is a major industry in California that attracts over a million users each year (DBW 2002) and generates 75 billion dollars in revenue for businesses and the state (Rust and Potepan 1997). Recreational boats and associated boating activities, however, are also major sources of water pollution (EPA 2006). Boat engines often release unused gasoline into waterways and oily bilge water is often illegally, though sometimes unknowingly, discharged into marine systems (Milliken and Lee 1990, California Coastal Commission 2006). The hydrocarbons from these releases are highly toxic for marine organisms and can persist in sediments for long periods of time (Milliken and Lee 1990). Boat sewage, such as human fecal matter and untreated greywater, dumped into coastal and inland waters can cause eutrophication and introduce human pathogens (Milliken and Lee 1990). Even boat maintenance and simple cleaning procedures can release toxic chemicals into water bodies, as many cleaning agents contain phosphates and chlorines that kill marine life and make water unsafe for drinking (EPA 2006). Anti-fouling paints, designed to keep barnacles and other marine organisms off ship hulls, release copper and other biocides into waterways (Milliken and Lee 1990). Lastly, recreational boats and associated boat accessories, such as anchors, bait wells, and propellers, have also been implicated as vectors for the introduction and spread of aquatic non-native, invasive species (Johnstone et al. 1985, Johnson et al. 2001).

Because recreational boating poses such serious water pollution problems, there have been statewide attempts to inform recreational boaters about their impacts on California's waters and to promote environmentally-friendly boating practices among the boater population. The State of California has recently developed a Clean and Green initiative that includes a community-based outreach and education program designed to mitigate water pollution and introductions of invasive species (California Coastal Commission 2006). The program informs boaters and marina owners about clean boating practices through pamphlets, posters, and other educational materials (California Coastal Commission 2006). In 2000, the Clean and Green campaign distributed boater kits that included key chains, oil absorbent pads, and plastic plaques in order to educate boaters about oil spills and influence clean boating behaviors (California Coastal Commission 2006). A follow-up study (Shafer 2000) found that these boater kits were effective in increasing boater awareness of the environmental hazards associated with recreational boating

and encouraging boaters to engage in more environmentally sound boating practices. However, Shafer's study focused primarily on oil spills, though recreational boating actually results in a range of environmental hazards.

More research is warranted to understand whether knowledge of water pollution from recreational boating corresponds with clean boating behaviors across a variety of marine hazards. This project investigates the relationship between water pollution knowledge and clean boating practices within the California boater population to consider the following question: *Does greater knowledge about water pollution resulting from boat use correlate with clean boating practices?* Based on previous research, I hypothesize that *the greater a boater's knowledge about marine pollution and clean boating practices, the more the boater will practice environmentally sensitive boating.*

This project explores the relationship between environmental knowledge and environmentally responsible behavior, with specific regards to water pollution. Previous psychology and behavioral research has shown that pro-environmental behaviors, such as recycling and pro-conservation attitudes, are correlated with how much knowledge humans have about specific environmental problems (Oskamp et al. 1991, Aipanijiguly et al. 2003). Such research indicates that understanding gaps in human knowledge and educating the public are crucial for environmental management goals. However, other research has also shown that environmental knowledge may be a poor predictor of pro-environmental behaviors (Maloney et al. 1975) and, in some cases, greater environmental knowledge may actually lead to anti-environment behaviors (Alessa et al. 2003). These mixed results stem primarily from the types of environmental knowledge questions these researchers asked. Many of the knowledge questions were either too general or specific and were often unrelated to the type of pro-environmental behavior they were studying. In this research, I will be asking knowledge questions that may directly relate to and influence clean boating behaviors.

Since boaters and their boats are important sources of non-point pollution, determining what contributes to their behaviors that can help manage marine pollution. This research aims to help to assess the extent to which information campaigns from the California Department of Boating might be expected to change recreational boating behavior and mitigate water pollution. Moreover, this research will also help gauge whether recent educational efforts have been

successful in promoting clean boating practices. This information might be useful in deciding whether the State of California needs to develop more effective environmental education programs or more stringent policies to control boat recreational use.

Methods

Measuring boater knowledge and behavior In order to generate data on boaters' knowledge about marine pollution, I created a short quiz containing nine true/false and multiple-choice questions to assess boaters' knowledge and awareness about water pollution laws and boater impacts on water quality. Water pollution topics covered on this quiz include oil pollution cleanup, greywater, anti-fouling paints, invasive species, boat sewage, boat maintenance products, hazardous wastes, oil recycling, and boat trash. These knowledge questions were designed based on information about water pollution available to boaters through printed materials, such as California Department of Boating and Waterways brochures and pamphlets.

"Environmentally conscious habits and behaviors" were measured through eight questions that asked how frequently boaters performed certain clean boating practices. The "clean boating practices" that I asked for are those promoted by the Clean and Green Campaign and other state agencies. Specifically these questions asked how frequently boaters use oil absorbents, recycle used oil, clean their boats in waterways, inspect for exotic or invasive species, buy and use less toxic cleaners and green soaps, and dispose of their sewage and oily bilge water appropriately; these behavior questions covered the same water pollution topics tested on the knowledge quiz. They characterized boaters' self-reported behavioral actions, and thus did not yield observational data about boaters' actual behavior.

These knowledge and behavior questions were compiled into a single survey (see Appendix A). The survey also contained a background information section to gather basic demographic data about my respondent population. This section asked for the respondent's age, sex, income, political orientation, boating experience, type of boat owned, and boating association membership, and asked whether the respondent has ever seen or received environmental outreach materials.

Techniques of Analysis I created a composite index for knowledge and for behavior from the variables I devised for each. Each individual knowledge question was assigned a specific point value; Table 1 summarizes the variables related to knowledge. Correct answers were given

positive points, incorrect answers were given negative points, "don't know" or unanswered questions were given 0 points. I assumed that it was more detrimental for boaters to give an incorrect response than to answer "I don't know" because the boater was actually certain about his/her wrong answer. The sum of these points became the "Total Knowledge Score" for each individual boater. This knowledge score was treated as an independent variable.

Table 1: Point breakdown of knowledge score. Range of Points Possible: $-19 \leq x \leq 22$.

Knowledge Variable	**Range of Points Possible**	**Point breakdown**	**Question Number**
Oil pollution cleanup	$-3 \leq x \leq 3$	-3 for answering "True" 3 for answering "False" 0 for answering "I don't know"	1
Greywater	$-1 \leq x \leq 2$	-1 for little awareness/"don't know" 1 for moderate awareness 2 for high awareness	2
Anti-fouling paints	$-1 \leq x \leq 2$	-1 for little awareness/"don't know" 1 for moderate awareness 2 for high awareness	3
Invasive species	$-2 \leq x \leq 2$	2 for answering "Yes" -2 for answering "No" 0 for answering "I don't know"	4
Boat sewage	$-2 \leq x \leq 2$	-2 for answering "True" 2 for answering "False" 0 for answering "I don't know	5
Boat maintenance products	$-3 \leq x \leq 3$	0.5 for checking each product 0 for "I don't know" -3 for "None of the above"	6
Hazardous wastes	$-4 \leq x \leq 4$	1 for each unchecked answer -1 for each checked answer 4 for "None of the above" 0 for "Don't know"	7
Oil recycling logo	$0 \leq x \leq 1$	1 for answering "Recycle Oil" 0 for answering "No" or failing to answer	8
Boat trash	$-3 \leq x \leq 3$	0.5 for every unchecked answer -0.5 for every checked answer 3 for answering "None of the above" 0 for "Don't know"	9
Total Knowledge Score	$-19 \leq x \leq 22$		

Knowledge questions that asked about existing water pollution laws and serious water pollution problems, such as oil pollution, boat trash, and the use of toxic chemicals, were assigned more points. Questions that had multiple correct answers and thus required respondents to have greater awareness, such as the boat trash and hazardous wastes questions, were also assigned more points to attain a distribution of scores.

I assigned an "Average Behavioral Score" to each respondent by giving points for each pro-environmental behavior and then taking an average across the number of behavioral questions each boater actually answered. Each boater was given an "Average Behavioral Score," instead of a total behavioral score, because some boaters could not answer all the behavior questions due to the type of boat they own. More frequent clean boating activities were given four points and successively lower scores were given for less frequent behaviors (i.e. three points for "often," two points for "sometimes," zero points for "never"). Boaters who circled "Don't know" received zero points, assuming that a boater who circled "Don't know" do not perform such behaviors. For behavior question 3, I changed the coding of the points in order to maintain the same directionality. For question 7, any boater who checked "discharge overboard" or "use disinfectants" received 0 points; other answers received four points. For question 8, anyone answering "use a sewage pump-out" or "pump it overboard" received 0 points; other answers received four points.

In order to assess the relationship between knowledge and clean boating practices and to control for the effects that demographic variables may have on the behavioral scores, I ran a multiple regression. I used age, sex, income, political orientation, years of boating experience, boating frequency, awareness of outreach materials, and boating organization membership as possible control variables. I performed a backward stepwise regression to remove non-significant demographic variables from the multiple regression model. I used the following multiple regression model for my final analysis:

$$y = \alpha + \beta_1[knowledge] + \beta_2[sex] + \beta_3[income] + \beta_4[age] + \beta_5[outreach] + \beta_5[boatingfrequency] + \varepsilon$$

Data Collection and Survey Populations I surveyed a portion of the California boater population by attending seven boat trade shows in the spring of 2007 (see Table 1 in the Appendix for locations and dates). These trade shows were located in Northern and Southern California and attracted recreational boaters from a wide geographic range. They were selected because they allowed me to gain access to a large population of my target population in a narrow time frame. These conventions exhibited new boats and marine accessories, and provided educational seminars for boaters. During the data collection, I remained close to the Department of Boating and Waterways (DBW) outreach booth and asked passing boat show visitors to

respond to my survey. I was required by trade show organizers to remain with the DBW booth in order to conduct my survey.

A total of 140 recreational boaters responded to my survey. The typical respondent was a fairly affluent, middle-aged white male who identified as politically conservative. These boaters also reported over 25 years of boating experience (see Table 2 in Appendix for a summary of respondent characteristics). The statewide boat owner population is 85 percent male, 93 percent Caucasian, more affluent than the typical California resident, and middle-aged (DBW, 2000). I may have grossly over-sampled male boaters and ski boat owners, though the percentage of males sampled appears to be representative of the recreational boater population in California according to boater registration data (DBW, 2000).

Results

Boater knowledge scores The boater population exhibited a wide distribution of knowledge scores (Figure 1). Surveyed recreational boaters scored an average of 14.28 (standard deviation=5.40) out of 22 possible points (range: -5 to 22) on the knowledge portion of the questionnaire. Boaters, therefore, received about 65% of the total possible points attainable for the quiz, which may indicate fairly low knowledge and awareness. However, the knowledge score was also skewed toward the higher scores (those over 20 points), with roughly half of the boaters scoring an 80% or above on the quiz portion of the survey. This may suggest that most boaters are highly knowledgeable about their water pollution impacts.

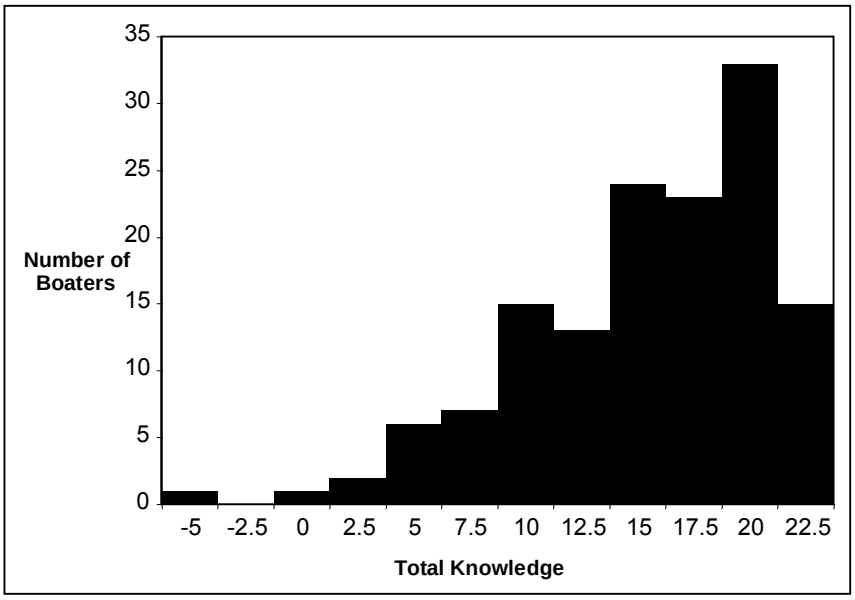

Figure 1. Distribution of knowledge scores.

Results indicate that boaters are very knowledgeable on issues regarding invasive species, hazardous boat wastes, and boat trash disposal, as most boaters were able to achieve the maximum points assigned to those questions (Table 2). However, boaters exhibited fairly poor knowledge on issues such as oil pollution cleanup, greywater, antifouling paints, boat sewage, boat maintenance products, and oil recycling. In these areas, less than 60% of the boater population was able to answer these questions correctly. In particular, recognition of the oil recycling logo and awareness of antifouling paint hazards was extremely low among surveyed boaters. Only 10 percent of respondents were able to recognize the logo and only 28 percent knew about anti-fouling paints. Though less than 60% of the boater population achieved the total points possible for the boat maintenance question, boaters were able to identify correctly at least four out of six possible toxic boat maintenance products, which suggests that boaters may be knowledgeable about boat maintenance products and their effects.

Table 2. Summary of knowledge question results. These knowledge variables are ranked in descending order, according to which questions boaters scored highest on. N=140. Refer to Appendix for survey questions.

Knowledge Variable (+Survey question number)	Mean Score (+ S.D.)	% of Maximum Points Possible	% of Boaters Achieving Maximum Points:
Boat trash (9)	2.89 (0.43)	96.3	91.4
Hazardous wastes (7)	3.64 (1.18)	91.0	90.0
Invasive species (4)*	1.33 (1.17)	66.5	72.1
Boat sewage (5)*	1.26 (1.08)	63.0	65.7
Oil pollution cleanup (1)*	1.32 (2.22)	44.0	59.3
Boat maintenance products (6)	2.15 (1.23)	71.7	57.1
Greywater (2)	1.11 (1.11)	55.5	48.6
Anti-fouling paints (3)	0.47 (1.27)	23.5	27.9
Oil recycling logo recognition (8)	0.10 (0.30)	10.0	10.0

*These have strictly true/false answers; thus, standard deviations for these particular questions do not actually reveal a "wide" or "narrow" distribution of scores.

Boater behavior scores Boaters exhibited a narrow distribution of average behavioral scores (Figure 2). As a whole, they scored an average of 2.20 on the behavioral section of the survey (standard deviation=0.84), indicating that the boater population performs pro-environmental boating behaviors infrequently, or about less than half the time. However, "often" was the most reported answer among boaters; few respondents indicated that they "never," "rarely" or "always" perform pro-environmental behaviors (Figure 2). Results suggest that boaters either actually perform pro-environmental behaviors on a frequent basis or prefer not to exaggerate the extent to which they perform such behaviors.

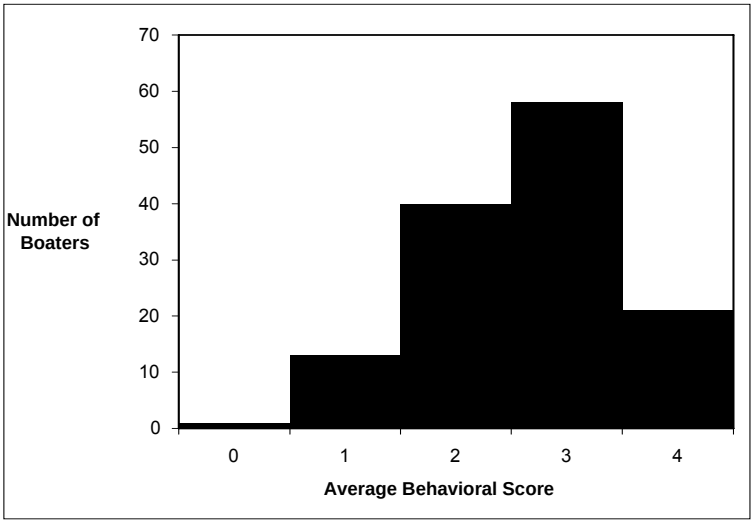

Figure 2: Average Behavioral Score distribution. 0: Never, 1: Rarely, 2: Sometimes, 3: Often, 4: Always

Results indicate that respondents often recycle their used oil, always clean their boats away from the water, and perform appropriate sewage removal and oil cleanup very frequently. Boaters rarely keep oil absorbents in the bilge to prevent possible oil leaks, rarely use less toxic cleaning substitutes, and infrequently inspect for invasive species and use green soaps (Table 3). Overall, results suggest that boaters perform more time consuming (inspections) and expensive (buying "green" products) tasks with less frequency than more mainstream, commonsense tasks (using the trash can and recycling).

Table 3. Summary of behavioral questions. 0=Never, 1=Rarely, 2=Sometimes, 3=Often, 4=Always. See appendix for complete survey questions.

Topic	Corresponding "Green" Behavior	N	Mean Score (+S.D.)	Question Number
Oil pollution	Using oil absorbents	117	1.06 (1.58)	1
Hazardous wastes	Recycling used oil	114	2.95 (1.66)	2
Boat maintenance, antifouling paints	Cleaning on the water	128	3.44 (1.15)	3
Invasive species	Inspect for exotics	131	1.58 (1.60)	4
Boat maintenance	Using less toxic methods	132	1.05 (1.31)	5
Greywater	Using "green" soaps	91	1.84 (1.68)	6
Sewage	Appropriate removal of wastes	54	3.70 (1.06)	7
Oil pollution cleanup	Appropriate cleaning	88	3.36 (1.47)	8

Behavior and knowledge relationship Multiple regression analysis revealed no significant correlation between the total knowledge score and average behavior score, after controlling for demographic data and boating experience (the model included the variables of sex, income, age, receiving outreach materials, and boating frequency) (Table 4). Regression analysis did show a significant correlation between boating frequency and average behavior score. Boaters who participate in boating activities infrequently tend to have high behavioral scores. Regression analysis also revealed that boaters who have not seen "boating clean and green" outreach materials tend to have lower behavioral scores than those who did receive these materials.

Table 4. Multiple regression parameter estimates.

Controlling Factor	Estimate (+/- standard error)	P-value
Total Knowledge	0.013 (0.014)	0.36
Sex (Female)	-0.13 (0.093)	0.18
Income	0.00 (0.00)	0.57
Age	0.00 (0.00)	0.46
Not Receiving Outreach Materials	-0.31 (0.07)	< 0.001
Boating Frequency (Sometimes to		

somewhat often*)	0.58 (0.27)	0.03

*Stepwise regression found only this answer choice to be a significant variable within the boating frequency category; the general term "boating frequency" is not itself a variable.

Discussion

Results indicate that greater knowledge of water pollution does not necessarily relate to the frequent practice of pro-environmental boating behavior. They do, however, seem to show that the surveyed recreational boater population was fairly knowledgeable about the impacts of recreational boating on water quality and do practice pro-environmental boating behavior. Even though my study addressed a specific environmental practice and geared my questions specifically toward this practice, which had not been done in previous studies, it was still unable to show a strong relationship between knowledge and behavior. My study suggests that knowledge may not be a strong influencer of pro-environmental behaviors and that other factors may work in conjunction with knowledge to influence environmentally conscious practices.

Though this study did not show a significant relationship between knowledge and behavior, it seemed to identify gaps in boater knowledge that should be addressed in environmental outreach programs. Surveyed boaters are aware that boats serve as vectors for invasive species and are aware of appropriate boat trash and hazardous waste disposal, but they are unaware of how to treat oil spills and unaware of the harmful effects of boat maintenance products, greywater, antifouling paints, and boat sewage. Boaters may have scored highly on the questions regarding trash and hazardous wastes issues because these issues have been part of older outreach campaigns and are subject to federal and state laws; they may also be commonsense knowledge. Boaters may have deficient knowledge about oil spills, boat maintenance products, greywater, antifouling paints, and boat sewage because these topics may be less publicized to boaters.

The study also shows which types of behaviors boaters are less likely to perform. Easier and more commonsense tasks such as recycling oil, hauling boats off the water to clean them, and removing sewage appropriately are performed consistently among boaters. Behaviors that required boaters to purchase eco-friendly products, such oil absorbents and "green" soaps and cleansers, and behaviors that are more time-consuming like inspecting for invasive species are performed less frequently. These are also areas in which boaters may not be entirely aware of green alternatives and solutions.

The results of this study may have been limited by the survey design itself. Because the survey offered structured questions and answers regarding "green" behaviors, I was unable to track other possible pro-environmental or detrimental behaviors that boaters may be practicing. In many cases boaters, especially those who own more expensive boats, contract their boat maintenance work to boat shops or to marinas. Thus when they read behavior questions 2 and 3, which asked about recycling motor oil and filters and maintaining boats on the water, boaters may have answered "Never" because the question asked specifically if the he/she personally performed such behaviors. Unless responding boaters specifically wrote on the survey that they took their boat to a shop, I was unable to distinguish those who contract boat shops. It is also possible, as a few survey respondents mentioned after filling out their surveys, that small fishing boat owners only need to use water to clean their boats and thus have no reason to use cleaning substitutes or green products. Unless these boaters explained their answers on the survey or circled "does not apply," I had no way of distinguishing these populations. For this reason, some responding boaters may have been assigned unfairly low scores for pro-environmental practices they have no real need to perform. At this point it is then necessary to note that non-performance of some pro-environmental behaviors does not necessarily indicate that boaters *harm* the environment.

The knowledge and behavior indexes as designed in this project may have also limited the findings or clouded the relationship between knowledge and behavior. The knowledge questions could have been "easier" or "harder" and I could have assigned different point values to each question. Moreover, nine questions may have been insufficient to assess the "true" knowledge levels of the boater population. The behavior index was also problematic, because the behavioral questions were geared primarily toward boaters who own more expensive boats. Thus many smaller boat owners were only able to answer three or four of the questions and had higher scores as a result because they could practice fewer "environmentally-friendly" behaviors. Moreover, I did not perform individual regressions for each water pollution topic; these individual regressions may have shown a relationship between specific knowledge and behavior.

Though they provided a valuable venue to reach many survey subjects, boat shows sometimes posed as an inadequate interface. Many boaters hurried through the survey because they wanted to explore other sections of the trade show. Also because many boaters attended

these shows with their spouses or children, survey respondents may have asked their spouses or children for answers to the knowledge questions, which may have distorted their individual knowledge scores. It would have been more ideal for survey respondents to answer these questions without the various distractions of the boat show itself. Lastly, these boat shows may have attracted boaters who are unrepresentative of the boater population. Boaters who did not want to pay the required entrance fee or have an interest in these shows, for example, are excluded from this study.

As noted earlier, I may have over-sampled ski-boat owners, a population rumored to be generally less knowledgeable about environmental issues than large boat owners. My over-sampling of ski-boat owners may have generated a data set that reflects more on the ski-boat owner population than on the general boater population. To reconcile the bias that my survey venue imposed on my data set, I should have collected a larger set of survey responses. However, I believe that the demographics of my respondent population closely matched the demographics of the statewide population.

Environmental knowledge, attitudes, individual altruism, the ability and desire to perform pro-environmental behaviors may form a complex and convoluted network that influences boaters to perform environmentally conscious behaviors. One boater commented after filling out his survey that most boaters would not perform these behaviors, even if they score highly on the quiz portion, because the "clean and green" boating routine is too taxing and time consuming for boaters at the end of a day of recreational boating. His comment emphasizes that simplistic explanations for pro-environmental behaviors, such as the linear knowledge-behavior model tested in this study and that most environmental outreach programs assume to be useful, are inadequate; they fail to include the myriad of other competing or mediating factors that motivate or prevent people from engaging in environmentally conscious behaviors. In the case of recreational boating—which is divided into fairly discrete categories, such as waterskiing, camping, fishing, and cruising, and attracts an extremely diverse range of participants—boaters presumably have different motivations and emotional attachments to the environment. In future studies, measures of environmental concern could be incorporated as an additional variable to explain why certain boaters perform pro-environmental behaviors.

Indeed, if knowledge may not serve as the primary predictor of environmental behaviors in boaters, then environmental education departments within state government agencies should devote more energy and money on building the necessary infrastructure in marinas and boat docks to aid boaters to practice these recommended procedures. Moreover, boat manufacturers and marine suppliers may need to offer eco-friendly products independent of consumer demand. This "top down" approach may be helpful in resolving the contradictions and complexities that motivate environmentally conscious behaviors.

My research also seems to indicate a need to understand the apparent disconnection between increased environmental knowledge and the performance of pro-environmental behaviors. Ethnographic or interview-based research designs, in which respondents can fully explain their behaviors and their gaps in knowledge, may enable researchers to find causal mechanisms. What future research needs to discover are the intermediary steps that translate cognition into actual performance.

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Appendix

Table 1: Survey dates and locations.

Date	Show Name	Show Type	Location
Saturday, January 13 Sunday, January 14	Northern California Marine Association Boat Show	Boat sales, seminars	Pleasanton
Sunday, January 21	International Sportsmen Expo	Hunting, fishing	Sacramento
Saturday, February 3 Saturday, February 10	Southern California Marine Association Boat Show	Boat sales, seminars	Los Angeles
Saturday, March 10 Saturday, March 11	Northern California Marine Association Boat Show	Boat sales, seminars	Sacramento

Table 2. Summary of respondent demographics.

Characteristic	N	Percentage	Mean
Age	135		48
Sex	137		
Male	114	83	
Female	23	17	
Income	118		
< 25,000	4	3	
25,000-50,000	12	10	
51,000-75,000	25	21	
75,000-100,000	51	43	
>100,000	26	22	
Decline to answer	22		
Political Orientation	123		
Very liberal	5	4	
Liberal	16	13	
Leaning liberal	3	2	
Moderate	32	26	
Leaning Conservative	9	7	
Conservative	51	41	
Very Conservative	7	6	
Type of boat owned	137		
Ski boat	64	47	
Fishing	28	20	
Cuddy cabin/cruiser	25	18	
Motor yacht	4	3	
Sailboat with motor	9	7	
Cigarette boat	3	2	
Other	4	3	
Size of Boat	80		
Large	42	53	
Medium	21	27	
Small	17	21	
Years of boating experience	135		25
Frequency of boating	138		
Sometimes (vacations only)	18	13	
Somewhat often (monthly)	31	22	
Often (weekly)	46	33	
Very often (year round)	43	31	
Received outreach materials	136		
Yes	69		
No	67		
Membership in boating organization	110		
Yes	38		
No	72		

Date: _____/_____/2007
(Month) (Day)

Background Information: *Please answer all questions that apply to you. All responses will remain anonymous and confidential. Thank you.*

Age: _____ **Sex:** ( ) Male ( ) Female

ZIP Code: _____

What is your income level, before taxes?
( ) Less than 25,000 ( ) 25,000 to 50,000
( ) 51,000 to 75,000 ( ) 75,000 to 100,000
( ) More than 100,000 ( ) Don't know
( ) Decline to answer

Which of the following best describes your political orientation?
( ) Very liberal ( ) Liberal ( ) Leaning liberal
( ) Moderate ( ) Leaning conservative
( ) Conservative ( ) Very conservative

What type of boat(s) do you/your family currently own? *(check all that apply)***:**
( ) Ski boat/run-about ( ) Cuddy cabin/cruiser
( ) Fishing boat ( ) Motor yacht
( ) Cigarette boat ( ) Sailboat with motor
( ) Personal watercraft/jet ski
Other *(please list)*:
_____

What is the length of your *primary* boat? _____

How many years have you participated in recreational boating? (This may include activities such as boat driving, fishing, water skiing, cruising, or weekend boating.) _____

Which of the following best describes how often you go boating? *(circle one)*
(1) Sometimes—I boat mostly during vacations
(2) Somewhat often—I may boat once-a month
(3) Often—I may boat a few times a month
(4) Very often—I may boat year-round

Have you seen or received flyers, brochures, newsletters, or ads about "clean and green" boating? ( ) Yes ( ) No
If yes, what did you do with this material?
( ) Read them closely ( ) Read them somewhat closely
( ) Skimmed them ( ) Did not read them

Do you belong to a boating association or club? ( ) Yes ( ) No

Please carefully read and answer the following questions. They are designed to understand boater knowledge, so if you are unsure about an answer please check "Don't know" rather than make a guess.

1. Soap and detergent can be used to clean oil spills in the water.
( ) True ( ) False ( ) Don't know

2. How much do you think soaps from boat sinks, showers, and dishwater impact the aquatic environment?
(1) Does not impact the environment very much
(2) Moderately impact the environment
(3) Significantly impact the environment
(4) Don't know

3. How much do you think anti-fouling paints from recreational boats impact the aquatic environment?
(1) Does not impact the environment very much
(2) Moderately impact the environment
(3) Significantly impact the environment
(4) Don't know

4. Do you think recreational boats can spread non-native aquatic species?
( ) Yes ( ) No ( ) Don't know

5. Recreational boat sewage contains less bacterial pollution than house sewage.
( ) True ( ) False ( ) Don't know

6. Which of the following boat maintenance products contain toxic chemicals? *(Check all that apply)*
( ) Mildew removers ( ) Wood polishes
( ) Drain openers ( ) Degreasers
( ) General cleaners ( ) Bleach
( ) None of the above ( ) Don't know

7. Which of the following boat products can you dispose in the garbage? *(Check all that apply)*
( ) Oil filters ( ) Transmission fluid
( ) Oil absorbents ( ) Used motor oil
( ) None of the above ( ) Don't know

8. Do you know what this logo means?
( ) Yes ( ) No
If yes, what does it mean?
_____

9. Which of the following items can be thrown safely overboard? *(Check all that apply)*
( ) Cigarette butts ( ) Plastics
( ) Glass ( ) Food
( ) Styrofoam ( ) Paper
( ) None of the above ( ) Don't know

(Just a few more questions on the backside)

Date: _____/_____/2007
(Month) (Day)

Please carefully read and answer the following questions. You may skip questions that do not apply to your boat (i.e. you may not have the equipment), but please indicate so for each question. Answer each question to the best of your abilities—your answers will be kept anonymous and confidential.

Use the corresponding key to answer these questions:
1: Never, have not done it before
2: Rarely, or approximately 10-30% of the time
3: Sometimes, or approximately 50% of the time
4: Often, or approximately 60-80% of the time
5: Always, or approximately 81-100% of the time

	Never	Rarely	Sometimes	Often	Always	Don't Know	Doesn't Apply
1. How often do you keep oil-only absorbent pillows or socks in your bilge during the boating season? *(circle one)*	[1]	[2]	[3]	[4]	[5]	[6]	[7]
2. How often do you recycle your used boat oil and filters?	[1]	[2]	[3]	[4]	[5]	[6]	[7]
3. How often do you do major boat maintenance or cleaning on the water? (This may include sanding, hull scraping, painting, etc.)	[1]	[2]	[3]	[4]	[5]	[6]	[7]
4. How often do you inspect your boat for invasive plants and exotic animals after a day of boating?	[1]	[2]	[3]	[4]	[5]	[6]	[7]
5. How often do you use cleaning substitutes--such as vinegar, baking soda, "eco-cleaners," etc.--to clean your boat?	[1]	[2]	[3]	[4]	[5]	[6]	[7]
6. How often do you buy and use phosphorus-free, biodegradable soaps for your boat sinks and showers?	[1]	[2]	[3]	[4]	[5]	[6]	[7]

7. What do you often do with your untreated boat sewage?
(Check all that apply)
( ) Discharge it overboard ( ) Use a pump-out facility
( ) Use disinfectants ( ) Use a dump station/bathroom
( ) No toilet onboard/don't use the toilet onboard
( ) Other *(please describe):* _____

8. What do you often do with your boat's oily bilge water?
(Check all that apply)
( ) Steam cleaning ( ) Use a bilge pillow
( ) Use a sewage pump-out ( ) Pump it overboard
( ) Use a bilge pump-out station ( ) Use rags or paper towels
( ) No oil collects in the bilge
( ) Other *(please describe):* _____

Note to survey respondents:

I am conducting this survey as a senior thesis project for the Environmental Sciences major at the University of California at Berkeley. It seeks to understand marine pollution knowledge and habits among recreational boaters. There are no known risks to you from taking part in this research and no foreseeable direct benefit to you either.

Thank you for participating in this questionnaire. If you have further questions about my research, you may contact me by email: ezhong@berkeley.edu or by telephone at (510) 704-8326. If you have any questions regarding your rights as a survey participant, please contact UC Berkeley's Committee for the Protection of Human Subjects at (510) 642-7461.

Your completion and return of this questionnaire signifies your consent.