NOAA Technical Memorandum NMFS-SEFSC-618

AN EVALUATION OF THE EFFECTIVENESS OF THE POPULATION DYNAMICS RECRUITING PROGRAM FROM 2004 TO 2010

By:

Jim Berkson
National Marine Fisheries Service
Southeast Fisheries Science Center
RTR Unit at Virginia Tech

and

Amy Tillman
Department of Statistics
Virginia Tech

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Science Center
75 Virginia Beach Drive
Miami, Florida 33149

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Gary Locke, Secretary

NATIONAL OCEANANIC AND ATMOSPHERIC ADMINISTRATION
Jane Lubchenco, Under Secretary for Oceans and Atmosphere

NATIONAL MARINE FISHERIES SERVICE
Eric Schwaab, Assistant Administrator for Fisheries

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Miami, FL 33149

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Springfield, VA 22161
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EXECUTIVE SUMMARY

The Population Dynamics Recruiting Program (PDRP) was established by the Southeast Fisheries Science Center in 2003 to recruit outstanding undergraduate students into the field of marine resources population dynamics (MRPD) and careers with NMFS. Working through a Cooperative Agreement with Virginia Tech, the PDRP has held weeklong winter workshops annually since 2004 and summer programs lasting four to six weeks since 2005. Summer program students are selected from previous winter workshop attendees.

A questionnaire was developed and sent to past PDRP participants in the fall of 2010 to evaluate the program's effectiveness. The 2010 study encompassed winter workshop students from 2004-2010 (also including all summer program participants during the same time period). The evaluation took place under the auspices of Virginia Tech's Institutional Review Board policies pertaining to research on human subjects (approval #06-229). A total of 106 students participated in the seven PDRP workshops. In total, 88% (91) of the past winter workshop participants contacted responded to at least some of the questions.

Over half of the respondents studied, are studying, or want to study MRPD in graduate school. Of those students interested in MRPD, more than two-thirds stated that they knew little about the discipline before attending the winter workshop and that the winter workshop helped them learn this was a discipline they wanted to pursue. Similarly the PDRP increased the respondents' knowledge of NMFS and their interest in working for the agency. Nearly half of the respondents have worked or are working with NOAA/NMFS in some way after their winter workshop.

Changes were made each year to the PDRP in an effort to increase its effectiveness. The changes appeared to be successful, as the proportion of respondents who have studied, are studying, or want to study MRPD has increased annually over the seven years of the workshop program.

Results indicate the summer program was also a powerful recruiting tool. Of the respondents who attended a summer program, 75% agreed with the statement, "I learned this was a field I wanted to pursue because of the summer program."

A total of 27 respondents either had completed or were currently enrolled in graduate school to study MRPD at the time of the questionnaire. Three-quarters entered graduate school initially in a Masters degree program while the remaining one-quarter initially entered a Doctoral degree program. None of the respondents had completed their doctoral degrees at the time of questionnaire. Virginia Tech, the home of the PDRP during this time period, has been a graduate institution for 41% of the graduate students studying MRPD.

Based on this study's results, we estimate that approximately 27% of future winter workshop students will enter a doctoral program in MRPD, given similar conditions (e.g. average PDRP effectiveness, graduate funding opportunities).

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INTRODUCTION

Population dynamics scientists are critical to the management of marine fish stocks, fisheries, and marine protected resources including marine mammals and sea turtles. Population dynamics scientists develop the tools used to evaluate the status of fish stocks, fisheries, and protected resources; estimate the likely effects of alternative management policies; and contribute in the design of monitoring and research programs that provide the input necessary for assessments.

A recent study concluded that a shortage of population dynamics scientists existed due to three primary reasons: (1) insufficient numbers of faculty in the discipline, (2) insufficient numbers of graduate students in the discipline, and (3) and insufficient numbers of highly qualified undergraduate students applying for graduate school in the discipline (DOC and DOE 2008). An essay summarizing the conclusions of the report appeared in the journal *Fisheries* (Berkson et al. 2009b).

For the National Marine Fisheries Service's (NMFS') Southeast Fisheries Science Center (SEFSC), the shortage in population dynamics scientists was a reality with important consequences. Because of this, in 2003, the SEFSC hired Dr. Jim Berkson to create a Recruiting, Training, and Research (RTR) Unit, with the goal of increasing the quality and quantity of students entering the pipeline into the discipline of population dynamics and ultimately into careers with NMFS. The RTR Unit was the first of its kind in the country, and the only agency unit solely focused on increasing the pipeline into this discipline beginning at the undergraduate level.

The RTR Unit created the Population Dynamics Recruiting Program (PDRP). The PDRP was designed to identify and recruit outstanding undergraduate students from around the nation likely to excel in this discipline of population dynamics. It was composed of three stages: (1) a weeklong undergraduate workshop, (2) an undergraduate summer program lasting 4-6 weeks, and (3) graduate research assistantships. It is designed to be a sequential process, where the most-promising students from the undergraduate workshop are invited to attend the summer program and the most-promising students from the summer program are then offered graduate school support. This study evaluates the effectiveness of the first two stages of the PDRP, the winter workshop and the summer program. Details on the winter workshop methods were published, as was an initial evaluation of the first four years of the workshop (Berkson et al. 2009a). An outline of the summer program methods and products of the program are available online (http://nmfs.vt.edu/sumprograms.htm).

Given the importance of the program's goal and the amount of resources invested in the program, it is essential that a thorough evaluation of the program's effectiveness be conducted on a regular basis. This report is a follow-up to the previous evaluation (Berkson et al. 2009a), and provides a comprehensive look at the current interests and activities of the participants from the first seven years of the program, as well as their impressions of the impact of the PDRP on their current interests and activities.

METHODS

The 2010 questionnaire encompassed winter workshop students from 2004-2010. The evaluation took place under the auspices of Virginia Tech's Institutional Review Board policies pertaining to research on human subjects (approval #06-229). A total of 106 students participated in the seven PDRP winter workshops.

A branching questionnaire was designed that allowed questionnaire recipients to identify whether they were currently employed, currently a graduate student, currently an undergraduate student, or currently unemployed. Next, each was directed to unique questions depending on their current status to acquire more-detailed information about their current activities and activities since the winter workshop. All recipients were then asked specific questions about their winter workshop experience and how it impacted them. Finally, students who identified themselves as participants in a summer program were asked specific questions about their summer program experience and how it impacted them. Students also had the opportunity to add comments at the end of the questionnaire.

Ultimately, PDRP effectiveness will be evaluated based on the number of participants entering the discipline and also entering careers with NMFS. Because the program works initially with undergraduate students and the majority of careers in the discipline require doctoral degrees, a time lag is involved. Given the age of the program, we are still not able to base our assessment on these ultimate criteria. Instead, we can look at indicators that PDRP participants are heading towards careers in the discipline and with NMFS.

To evaluate whether winter workshop effectiveness changed over time, we plotted a regression of the percentage of respondents who studied, are studying, or want to study MRPD in graduate school by the year of the workshop attended.

Looking only at the winter workshop participants who went to graduate school, we compiled background information on each student. This information included: gender, major during workshop, year class during workshop, workshop year, and whether or not the college they attended was in the southeast region. A few assumptions were made in order to classify the students. To increase sample size for several of the more-complicated analyses, students who attended the workshop after completing their undergraduate degree were grouped with the senior year class. Therefore, the population of interest consisted of sophomores, juniors, and seniors/graduates. Undergraduate majors were grouped into four categories: math, biology, marine, and other. The southeast region consisted of Alabama, Arkansas, the District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

Graduate students were grouped into two categories, those who are studying or have studied MRPD (MRPD graduate students) and those who aren't or haven't (Non-MRPD graduate

students). Percentages of MRPD graduate students and Non-MRPD graduate students were calculated given each respective variable level. This allowed for a graphical interpretation and comparison between the two groups of graduate students.

To evaluate whether the percentage of MRPD graduate students for any particular factor was significantly different than the overall percentage of MRPD graduate students, we used an exact binomial test. To evaluate whether differences existed in the percentage of MRPD graduate students between related factors (e.g., males vs. females), we applied a chi-square test.

One goal of the current evaluation was to see if we could use our existing data to identify factors (e.g., gender, college region, college year class, major) that are more likely to lead to a student entering graduate school to study MRPD. If this was possible, we could modify our participant selection criteria to increase the likely percentage of participants who would enter the discipline based on these analyses. Examining students from the past with respect to their graduate studies has the potential to help us develop an ideal recruiting tool for the future selection of workshop students. In addition, this type of information helps us understand what type of student is likely to attend graduate school to study MRPD. To accomplish this, further analyses were completed in R using multivariate methods, including principal component analysis, cluster analysis, and stepwise logistic regression. Attempts were made to predict whether or not a student would enter the discipline based on the following independent variables: gender, college region, year class during workshop, major category, student's undergraduate school enrollment size, and the percentage of SAT math scores above 600 at the student's undergraduate school. Note that data on undergraduate enrollment size and percentage of SAT math scores above 600 by undergraduate school were found at the Peterson's College Guide website (www.petersons.com).

RESULTS

"Live" email addresses were identified for 97% of the 106 winter workshop participants. It is not known how many of these are actively used, but target servers returned none of the emails. A total of 85% (88) of the participants contacted completed at least a portion of the full questionnaire. Three additional students responded to a shorter follow-up questionnaire. In total, 88% (91) of the past winter workshop participants contacted responded to at least some of the questions.

Winter Workshop Effectiveness

Of the respondents (n=91), 74% are in or have completed graduate school; 15% have completed their bachelor's degree, but have not entered graduate school; and 11% have not yet completed their bachelor's degree (Table 1).

Respondents' Interest in Studying MRPD in Graduate School

Combining all of the winter workshop participants who answered the related questions, 99% (85) have attended, are enrolled in, or want to attend graduate school. Out of those 85 students, 51% (43) have studied, are studying, or are interested in studying marine resources population dynamics (MRPD) in graduate school. Of the 43 students interested in MRPD, 77% stated they knew little about the discipline before attending the workshop, and 67% stated that the winter workshop helped them learn that this was a field they wanted to pursue (Table 1).

Program Effectiveness Over Time

Every year changes are made to the winter workshop in an effort to improve its effectiveness. To evaluate how the winter workshop's effectiveness changed over time, respondents were grouped based on their workshop year. The proportion of respondents who have studied, are studying, or want to study MRPD by workshop year has increased over the seven years of the winter workshop program (Figure 1).

The first year of the winter workshop, 2004, appears to be an outlier with a relatively high proportion of respondents (67%) interested in entering the discipline. It's not clear why the 2004 produced so many interested in studying MRPD when compared to subsequent years. The 2004 winter workshop was held in March at the Harbor Branch Oceanographic Institute (HBOI) in Fort Pierce, Florida. Later that year Fort Pierce and HBOI were severely damaged by Hurricanes Jeanne and Frances, forcing the workshop program to relocate. As a result, there were major changes in many aspects of the winter workshop including the time of year of the workshop, housing and classroom space, dining arrangements, and field trip options. In 2005, the winter workshop moved to its new home at the Mote Tropical Research Lab in Summerland Key, Florida, where it has been held in January every year since.

Excluding the outlier year of 2004, Figure 2 shows a steady increase in the proportion of respondents who have either studied, are studying, or want to study MRPD in graduate school. A linear regression of the data indicates that the proportion of respondents interested in MRPD increased by 13.6% per year over the time period from 17% in 2005 to 91% in 2010 (Figure 2, R^2=0.91).

Respondents' Interest in Focus Areas

PDRP activities are designed to increase participants' interest in population dynamics, marine resources, and working for a marine resources agency such as NMFS. For each of the three focus areas, more than two-thirds of the respondents indicated that their interest increased as a direct result of the winter workshop (Table 2).

Respondents' Interest in Working with NOAA/NMFS

A total of 63% of the respondents rated their interest in working for a marine resources agency such as NMFS as either moderately high or very high. Of those interested, 46% stated they were not familiar with NMFS before the winter workshop. Since attending the workshop, 40% of the respondents have worked or are working with NOAA/NMFS in some capacity.

Past participants have received a number of NOAA/NMFS's most prestigious scholarships and fellowships since attending the workshop. These awards include six NOAA Hollings Scholarships, one NOAA Graduate Sciences Program Fellowship, four Sea Grant/NMFS Graduate Population Dynamics Fellowships, and four NOAA Knauss Fellowships.

Summer Program Effectiveness

A subset of the winter workshop participants also participated in a summer program, offered each year from 2005 to 2010. The respondents comprised 34 of the 36 summer program participants.

Of the respondents (n=34), 74% are in or have completed graduate school; 15% have completed their bachelor's degree, but have not entered graduate school; and 11% have not yet completed their bachelor's degree (Table 3).

Respondents' Interest in Studying MRPD in Graduate School

Combining all of the summer program participants who responded, 97% (33) have attended, are enrolled in, or want to attend graduate school. Out of those 33 students, 58% (19) have studied, are studying, or are interested in studying marine resources population dynamics (MRPD) in graduate school. Of the 19 students interested in MRPD, 89% stated that the summer program helped them learn that this was a field they wanted to pursue (Table 3).

Learning Objectives

The goal of the summer program is to serve as an effective recruiting tool by showing students the complexity of real world marine resource management issues and the important role that population dynamics scientists play with regard to them. Nearly every summer program respondent either agreed or strongly agreed that the summer program helped them learn more about the complexity of marine resources

management (100%), learn more about the role of stakeholders in marine resources management (97%), learn more about possible career opportunities (100%), and gain communication skills (91%) (Table 4). All of these are important objectives of the summer program.

Additional Winter Workshop and Summer Program Results

More than 75% of winter workshop respondents agreed that the winter workshop helped to influence their career paths, influence their educational paths, and define and narrow their career interests (Table 5). More than 90% of the summer program respondents agreed with the same statements with regard to the summer program (Table 5). Nearly all winter workshop and summer program respondents agreed that they learned more about marine resources, population dynamics, and NOAA/NMFS as a result of their participation (Table 5).

In one of the most relevant results, 45% of winter workshop respondents agreed with the following statement: "I learned that this was a field I wanted to pursue because of the winter workshop" (Table 5). An even greater percentage of summer program respondents, 75%, agreed with the following statement: "I learned this was a field I wanted to pursue because of the summer program" (Table 5).

Of the 67 respondents who have entered graduate school, 42 attended a winter workshop only, while 25 attended both a winter workshop and a summer program (Table 6). Out of the 42 winter workshop only respondents in graduate school, one third are studying MRPD. Out of the 25 respondents in graduate school who attended both a winter workshop and a summer program, just over one-half are studying MRPD in graduate school (Table 6).

Tracking the Graduate Students Studying MRPD

All Respondents

Table 7 lists the path taken by and the current status of the 26 MRPD graduate student respondents who provided sufficient information. Roughly three-quarters entered a master's program following their undergraduate work, while one-quarter went directly to a doctoral program.

None of the respondents had completed their doctoral degrees at the time of questionnaire.

Of those who pursued their master's, at the time of the questionnaire, half were enrolled and half had completed their degrees.

Of the ten who had completed their master's degree at the time of the questionnaire, six have entered a doctoral program, with four of those continuing their MRPD studies. Two who did not continue towards a doctorate are now working for NOAA in non-MRPD positions.

At the present time, twenty respondents are currently enrolled in an MRPD graduate program, half in a master's program and half in a doctoral program.

PDRP-Supported Graduate Students

While the 27 respondents who have enrolled or completed graduate school at the time of the questionnaire to study MRPD have received funding through a variety of sources, nine (33%) have received funding through the PDRP. All nine were given support to obtain their master's degrees at Virginia Tech (VT), NMFS' partner in the PDRP.

Of those nine, six have completed their degrees (Table 7). Currently three are working on doctoral degrees in MRPD, one is working on a doctoral degree in terrestrial population dynamics, and NOAA employs two in non-MRPD jobs. The remaining three PDRP graduate students are currently enrolled in the master's program at VT.

One additional MRPD graduate student is currently studying at Virginia Tech with a non-PDRP funding source, as has one past MRPD graduate student. This brings the total number of MRPD graduate students to have participated in graduate studies at VT to 11, or 41% of all MRPD graduate student respondents.

While nothing precludes the PDRP from supporting doctoral work, as currently implemented, graduate support is designed to serve as a bridge, introducing students to graduate school with strong mentoring to increase their chance of success in the future. While additional funding sources are available for doctoral studies, such as the Sea Grant / NMFS Population Dynamics Graduate Fellowships, there is little dedicated funding for master's students. The PDRP is working to fill that niche.

Searching for Patterns in the Data

Factors Influencing Effectiveness

Respondents who had entered graduate school at the time of the questionnaire were split across a number of factors into those that entered to study MRPD versus those that hadn't. Factors included gender (male vs. female: Table 8), undergraduate school region (Southeast vs. non-Southeast: Table 9), undergraduate major (majors grouped into the following categories: biology, marine, math, other: Table 10), college year at the time of

the workshop (Freshman, Sophomore, Junior, Senior, Graduated: Table 11), and the workshop year attended (2004 through 2010: Table 12).

Results from applying the exact binomial tests to each factor individually indicated that the percentage of students who entered graduate school to study MRPD did not differ significantly from the overall average across all graduate students (40%).

Chi-square tests were used to test if there was a significant difference in the number of students who entered graduate school to study MRPD within factors (e.g., male vs. female). Because the chi-square test requires that the expected cell count for all cells to be greater than or equal to five, the test could only be conducted comparing the following: males vs. females, southeast vs. non-southeast, biology vs. marine, and juniors vs. seniors. In all cases, differences in frequencies were not significant.

Predicting the Factors Leading to Future MRPD Graduate Students

Statistical tests were conducted to assess whether it is possible to predict the types of students most likely to go into discipline, based on our past experience. If the tests provided useful results, application evaluation criteria could be adjusted to target these students in the future. Analyses were completed in R using multivariate methods, but the results suggested that the explanatory variables listed above were unreliable in predicting a student's entrance in graduate school in the field. Although the explanatory variables were not significant, we cannot be sure whether this is due to the small number of MRPD graduate students or to the fact that the variables were not adequate predictors to begin with

DISCUSSION

The overall goal of the PDRP is to increase the number of highly qualified applicants for stock assessment and population dynamics jobs at NMFS, particularly in the Southeastern U.S. It is too early to evaluate the program's ultimate effectiveness. The majority of the applicable jobs with the agency require doctoral degrees and none of the respondents have completed doctorates as of yet.

Fortunately, more proximate measures of program effectiveness can be evaluated until such time when more students can get through the required educational pipeline. Over half of the respondents studied, are studying, or want to study MRPD in graduate school. Out of those students interested in MRPD, more than two-thirds stated that they knew little about the discipline before attending the winter workshop and that the winter workshop helped them learn this was a discipline they wanted to pursue. Similarly the PDRP increased the respondents' knowledge of NMFS and their interest in working for the agency. Nearly half of the respondents have worked or are working with NOAA/NMFS in some way after their winter

workshop. A number of the comments written by respondents have been selected to appear in Appendix A.

Each year, modifications are made to the PDRP based on insights gained by our instructors and by reviewing evaluations completed by the students. Over time we have changed our advertising and selection methods for students, the instructors selected to participate, the content and delivery method of our curriculum, our field trips, and more. These changes and the others we've been making over time appear to be paying off, as shown by the steady improvement seen in the proportion of winter workshop students interested in the discipline.

We previously evaluated the effectiveness of the PDRP by sending out a questionnaire in the spring of 2008 (Berkson et al. 2009a). In that study we contacted participants of the 2004-2007 winter workshops. In the current evaluation, we contacted 2004-2010 participants, representing three additional winter workshops. We asked many of the same questions again, this time for comparison purposes. The answers proved to be remarkably similar. Of the respondents who had either completed graduate school or were currently enrolled, 37% (13) were studying MRPD in 2008, where 40% (27) are now in that category. The addition of three more workshop years more than doubled the number of students studying MRPD in graduate school. Many other answers were virtually unchanged. For example, in response to the statement "The winter workshop helped influence my career path," 80% of the 2008 respondents agreed and 81% of the 2010 respondents agreed.

In the current evaluation, we specifically asked questions about the summer program to evaluate its effectiveness. It's important to note that all summer program participants are selected from students who had previously participated in a winter workshop. We expected a greater proportion of summer program participants to be interested in the discipline than workshop-only participants, by design. We specifically choose winter workshop participants for the summer program who we believe have the greatest probability of going into and succeeding in the discipline. There is a significant investment in terms of time and resources put into the summer program and we need to maximize the probability that these students will move forward in our pipeline. As expected, our results showed that over half of the summer program participants currently enrolled or having completed graduate school are in the MRPD discipline compared as compared to only one-third of the workshop-only graduate students.

Interestingly enough, there also appears to be strong evidence that the summer program itself had a major impact on sending participants into the discipline. In response to the statement, "I learned this was a field I wanted to pursue because of the summer program", 71% of summer program respondents agreed, as compared to only 45% of winter workshop-only respondents referring to the same statement with regard to the winter workshop. In addition, responses show that the summer program was highly effective at meeting its learning objectives. The utility of the summer program is very evident, based on the results of this evaluation. While it can and should be modified to improve its effectiveness, the results of this study suggest it should not be eliminated.

Unfortunately, the analyses conducted did not provide any answers that would help us select students in the future with a greater probability of going into the discipline. We have learned a great deal over time from experience regarding the characteristics of students likely to go into the discipline. We'll need to rely on that knowledge and continue to refine it to improve our selections. Ultimately, our selection criteria go beyond a mere data vector to include intangibles such as a student's personality and references.

Our effort to track students provided a number of interesting results. A majority of the graduate students entering the MRPD discipline began by pursuing a master's degree rather than a doctorate. Of those, less than half have continued on to their doctorate, at this point. It will be interesting to see in future evaluations how many of those students were merely taking a break in their studies or had completed their studies. Next, almost half (41%) of the students that went on to study MRPD in graduate school did so at Virginia Tech, the home of the PDRP. This suggests that there is a strong advantage of being the home of the PDRP in attracting graduate students, both in terms of having funding available as well as being able to build relationships with the PDRP participants over the course of the winter workshop and the summer program. Given how strong these students are, this can be considered a substantial benefit of being home to the PDRP.

Based on the results of this evaluation, we can construct a rough estimation of the percentage of winter workshop participants that will go on to enter a doctoral program in MRPD. We'll need to assume conditions stay the same in the future (e.g., average PDRP effectiveness, availability of graduate funding). Assuming we start with 1,000 winter workshop participants and based on the results in Table 1, approximately 50% (500) of all winter workshop participants would be interested in entering graduate school to study MRPD. Then we can use Table 7 to see that three-quarters of those students would enter a master's program (375) and the remaining one-quarter would enter a doctoral program (125). Of the students that complete the master's, 40% would continue to enter a doctoral program in MRPD (150). So, if we start with 1000 winter workshop students, based on our current evaluation, we would estimate that approximately 275 (27.5%) would get a doctorate in the discipline.

The current evaluation also allows us to better estimate the cost effectiveness of the program, as compared to the 2008 study. In 2008 we looked at the cost to the PDRP for each winter workshop participant who enters a graduate program (masters or doctoral) to study MRPD based on winter workshop costs alone. Now, with our current information, we can estimate the cost for each winter workshop participant who enters a doctoral program to study MRPD, based on the combined costs of the first two stages of the PDRP, i.e., the winter workshop and the summer program. Each winter workshop has cost approximately $40,000 per year. The cost of summer programs varies greatly depending on the number of participants and the travel locations in any given year. Costs have ranged from $30,000 to $70,000. If we take the mid-point of the summer program and add it to the annual cost of the winter workshop, the annual cost equals approximately $90,000. Given that 27.5% of the 15 winter workshop students are estimated to enter a doctoral program, this implies that it costs, on average, $21,800 for each winter workshop participant who enters a doctoral program from the PDRP. It is also important

to note, as was done in Berkson et al. (2009a), the costs in terms of NMFS personnel time, not already included in the estimates, would likely increase these figures by approximately 80%. These costs also do not include the cost of graduate school.

When the PDRP was created, one of our most important objectives was to help our participants identify what it is they wanted to do with their futures, so they could make informed decisions when it came to graduate school and careers. We hoped the program would benefit all participants, even those who decided not to go into the discipline. Our philosophy was that the PDRP could claim additional success if even one participant learned that they didn't want to go into the MRPD discipline as a direct result of the program. As shown in Table 5, over 75% of PDRP participants learned more about their graduate school and career interests as a result of the winter workshop and summer program, including many participants that decided not to go into MRPD. We know from staying in touch with past participants that many have entered related disciplines including oceanography, marine acoustics, marine policy, and fisheries law, thus providing additional benefits to NOAA partially as a result of their experience with the PDRP.

In the fall of 2011, the PDRP will be moving from Virginia Tech, its home since its creation, to the University of Florida. While several important components of the program won't change (e.g. its program leader will move with the program), many other components will change (e.g. the faculty associated with the program, components of the PDRP and the design and implementation of its methods). The University of Florida can learn a lot and benefit from the experience and knowledge gained by Virginia Tech over the years. It will be very important to maintain the program's successful trajectory as it shifts location.

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Table 1. Summary of the impact of the winter workshop on participants' interest in pursuing marine resources population dynamics, broken down by student status at the time of the questionnaire. Results are presented both as percentages and as (numbers).

	Bachelors degree incomplete	**Bachelors degree complete, but not yet enrolled in graduate school**	**Currently enrolled in or completed graduate school**	**Total**
	(10)	(9)	(67)	(86)
(1) Finished, enrolled in, or interested in attending graduate school	90% (9)	100% (9)	100% (67)	**99%** (85)
(2) Of those in (1) above: Interested in studying Marine Resources Population Dynamics	100% (9)	78% (7)	40% (27)	**51%** (43)
(3) Of those in (2) above: The workshop introduced them to a subject they knew little about.	89% (8)	72% (5)	74% (20)	**77%** (33)
(4) Of those in (2) above: The workshop helped them learn that this was a field they wanted to pursue.	56% (5)	29% (2)	81% (22)	**67%** (29)

Table 2. Perceived increase in focus area interest levels for all respondents. Results are presented both as percentages and as (numbers).

	Population Dynamics	**Marine Resources**	**Working for a Marine Resources Agency**
Yes, my interest increased	**69%** (60)	**65%** (57)	**72%** (63)
I was already very interested.	**17%** (15)	**26%** (23)	**16%** (14)
No, my interest did not increase.	**14%** (12)	**9%** (8)	**11%** (10)

Table 3. Summary of the impact of the summer program on participants' interest in pursuing marine resources population dynamics, broken down by student status at the time of the questionnaire. Results are presented both as percentages and as (numbers).

	Bachelors degree incomplete (4)	**Bachelors degree complete, but not yet enrolled in graduate school** (5)	**Currently enrolled in or completed graduate school** (25)	**Total** (34)
(1) Interested in attending graduate school	75% (3)	100% (5)	100% (25)	**97%** (33)
(2) Of those in (1) above: Interested in studying Marine Resources Population Dynamics	100% (3)	60% (3)	52% (13)	**58%** (19)
(3) Of those in (2) above: The summer program helped me learn that this was a field I wanted to pursue.	67% (2)	100% (3)	92% (12)	**89%** (17)

Table 4. Students' responses to questions about how the summer program helped them. Percentages indicated those students who either strongly agreed or agreed with each statement.

How much do you agree with the following statements regarding how the workshop helped you?	**Summer Program Respondents** (n=34)
I learned more about the complexity of marine resources management.	100%
I learned more about the role of stakeholders in marine resource management.	97%
I learned about possible career opportunities.	100%
I gained communication skills.	91%

Table 5. Students' responses to questions about how the winter workshop and summer program helped them. Percentages indicated those students who either strongly agreed or agreed with each statement.

How much do you agree with the following statements regarding how the winter workshop or summer program helped you?	**Winter Workshop Respondents (n=88)**	**Summer Program Respondents (n=34)**
The winter workshop / summer program helped influence my career path.	81%	91%
The winter workshop / summer program helped influence my educational path.	77%	91%
I learned this was a field I wanted to pursue because of the winter workshop/summer program.	45%	71%
The winter workshop/summer program helped define/narrow my professional interests.	80%	91%
I learned more about marine resources during the winter workshop/summer program.	99%	100%
I learned more about population dynamics during the winter workshop/summer program.	99%	80%
I learned more about NOAA/NMFS during the winter workshop/summer program.	98%	100%

Table 6. Comparison of participants' disciplinary area in graduate school between participants who attended only the winter workshop vs. those who attended both the winter workshop and the summer program. Results are presented both as percentages and as (numbers).

	Winter Workshop Only Participants	**Winter Workshop and Summer Program Participants**
MRPD Graduate Students	33% (14)	52% (13)
Non-MRPD Graduate Students	67% (28)	48% (12)

Table 7. Current status of MRPD graduate students including one column for all MRPD graduate students and another for a subset of those students who received PDRP support for their master's degree.

				All MRPD Graduate Students (n=26)	PDRP Supported for Master's (n=9)
Initially enrolled in an MRPD master's program	Currently enrolled			10	3
	Completed	Enrolled in an MRPD doctoral program	Currently enrolled	4	3
			Completed	0	0
		Enrolled in a non-MRPD doctoral program	Currently enrolled	2	1
			Completed	0	0
		Working an MRPD job		0	0
		Working a non-MRPD job	Working for NMFS	2	2
			Other employer	1	0
		Not employed		1	0
Initially enrolled into an MRPD doctoral program	Currently enrolled			6	0
	Completed			0	0

Table 8. Comparison of participants' disciplinary area in graduate school by gender. Results are presented both as percentages and as (numbers).

	Gender	
	Female	**Male**
MRPD Graduate Students	38% (20)	50% (7)
Non-MRPD Graduate Students	62% (33)	50% (7)

Table 9. Comparison of participants' disciplinary area in graduate school by geographic region (Southeastern versus Other) of participants' undergraduate schools. Results are presented both as percentages and as (numbers).

	College Region	
	Southeast	**Other**
MRPD Graduate Students	44% (21)	32% (6)
Non-MRPD Graduate Students	56% (27)	68% (13)

Table 10. Comparison of participants' disciplinary area in graduate school by undergraduate major categories. Results are presented both as percentages and as (numbers).

	Undergraduate Major Category			
	Biology	**Marine**	**Math**	**Other**
MRPD Graduate Students	38% (17)	38% (5)	60% (3)	50% (2)
Non-MRPD Graduate Students	62% (28)	62% (8)	40% (2)	50% (2)

Table 11. Comparison of participants' disciplinary area in graduate school by participants' college year at the time of the workshop. Results are presented both as percentages and as (numbers).

	College year at time of workshop			
	Graduated	**Senior**	**Junior**	**Sophomore**
MRPD Graduate Students	67% (2)	47% (17)	27% (6)	67% (4)
Non-MRPD Graduate Students	33% (1)	53% (19)	73% (16)	33% (2)

Table 12. Comparison of participants' disciplinary area in graduate school by participants' workshop year. Results are presented both as percentages and as (numbers).

	Workshop Year						
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
MRPD Graduate Students	64% (7)	18% (2)	36% (4)	20% (2)	45% (5)	44% (4)	75% (3)
Non-MRPD Graduate Students	36% (4)	82% (9)	64% (7)	80% (8)	55% (6)	56% (5)	25% (1)

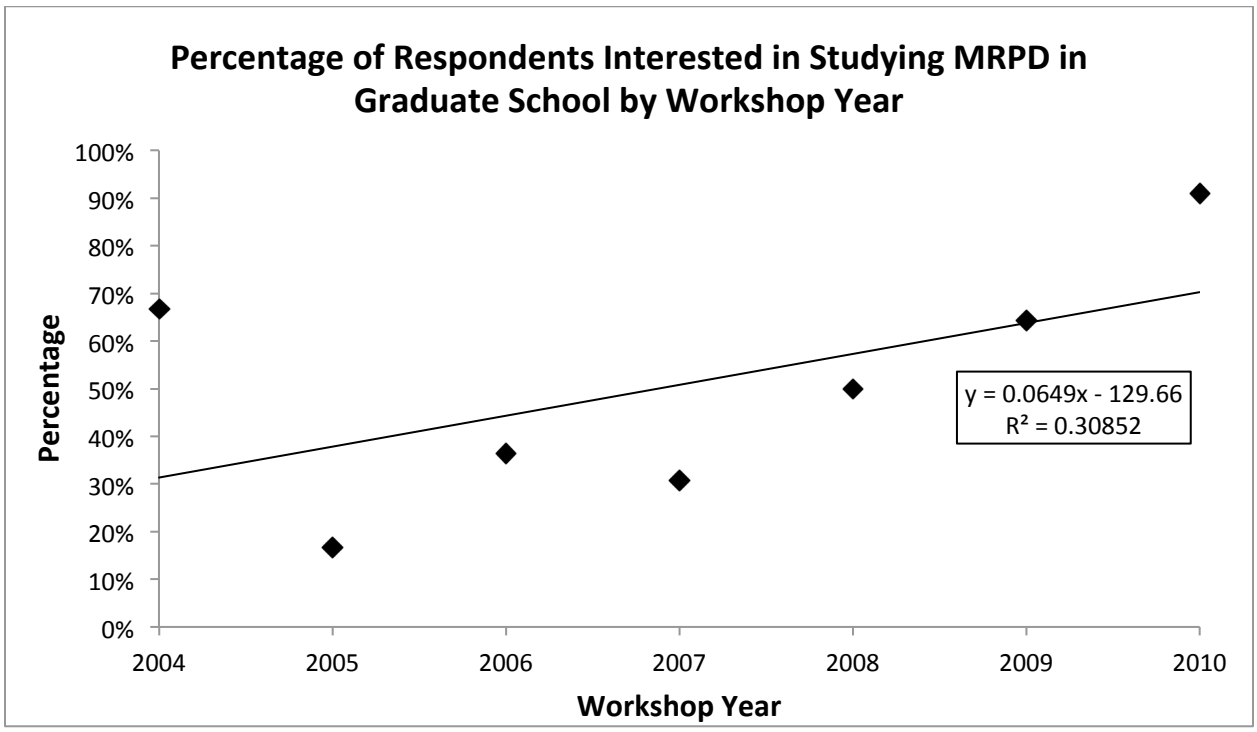

Figure 1. Percentage of respondents having studied, currently studying, or interested in studying MRPD in graduate school by workshop year for all workshop years.

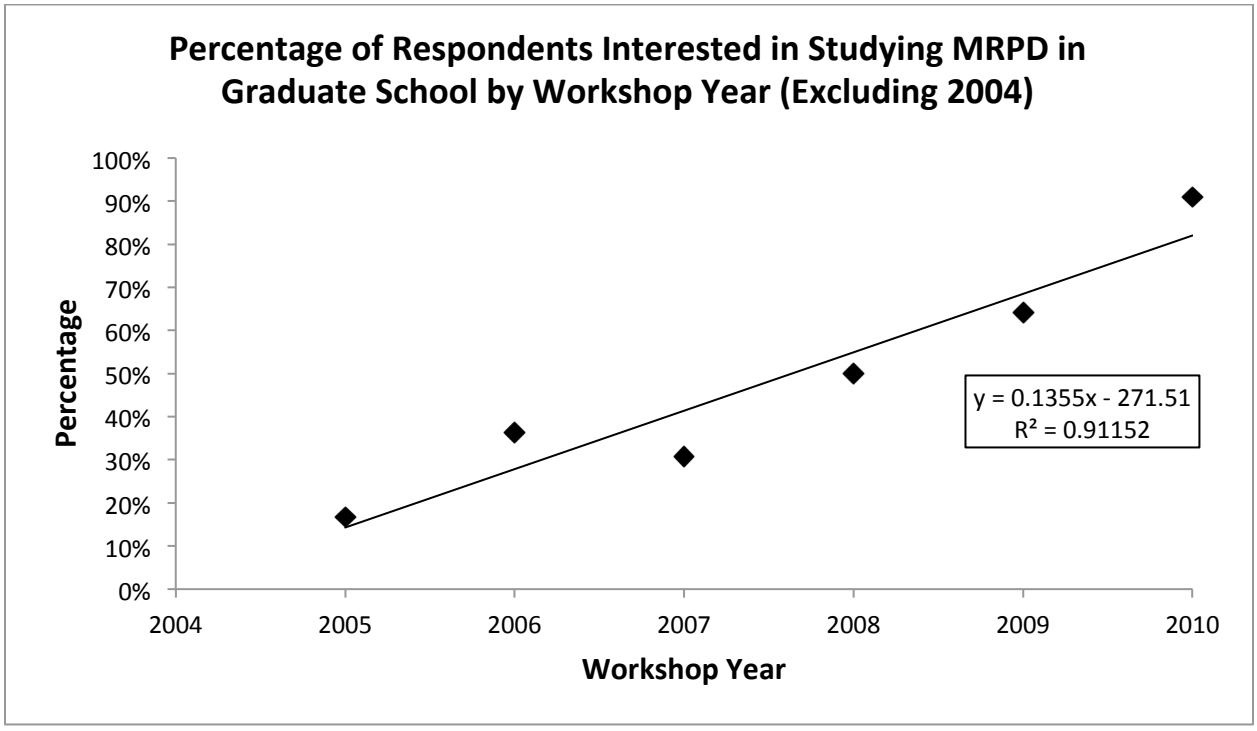

Figure 2. Percentage of respondents having studied, currently studying, or interested in studying MRPD in graduate school by workshop year for workshop years 2005-2010.

APPENDIX A. SELECTED QUOTES FROM PDRP PARTICIPANTS

Respondents were given the option of adding comments at the end of the questionnaire.

- Respondents who have entered graduate school in the MRPD discipline wrote the following comments:

    - "It is hard to overstate how strongly the Winter and Summer workshops effected my career path. Previous to it, I didn't know anything about fisheries or marine management; since it, I've spent four years studying fisheries modeling and management."

    - "Both experiences gave me the opportunity to establish contacts and interact with professionals in the field. Additionally, by keeping in touch with Jim Berkson following my experience in the summer program I learned of the NOAA Graduate Science Program. Through this program my current position is both as a Virginia Tech graduate student and NOAA employee."

    - "The winter workshop and summer program are the top two highlights of my education thus far. I have gained more knowledge and experience than I could have ever imagined. The experiences have led to exciting opportunities and (hopefully) a great career."

    - "I thought it was overall a wonderful experience that really shaped me as a student and provided great advice concerning my education and future career. It was one of the most enjoyable and beneficial experiences in my undergraduate career. I made lasting connections with fellow students, professors, and scientists in the field. I would highly recommend the program."

    - "These have both been extraordinary, life-changing experiences. I am amazed at how much we covered in relatively short time periods!"

- Respondents who have not yet completed their Bachelor's degree but are interested in attending graduate school to study MRPD wrote the following comments:

    - "The combination of the two experiences has really shaped my academic direction, graduate plans, and future career plans. It introduced me to a field that I knew little about beforehand, but which I believe I will most likely end up working in at some point in the future."

    - "Honestly I think the January 2010 MRPD workshop is the reason I became so passionate about fisheries and have become so interested in fisheries biology. It was an extremely valuable experience, one that I feel very lucky to have been

chosen for. I wish I could have participated in the summer internship but due to studying abroad but I hope to participate this upcoming summer."

- "I find that I am often describing my experiences at the workshop to people I meet in statistics and applied math. The workshop provided a lot of great experiences and posed interesting statistical problems. A lot of people on the math/stat side of things don't even know that marine resource management exists, let alone that it is a field rich in interesting modeling/ sampling problems."

- "I regard both the winter and the summer program as some of the most valuable educational pursuits I have participated in."

- "I very much enjoyed the workshop, felt the participants (both students and scientists) were enjoyable company and great educators, and now feel that I have many resources to draw upon in planning for the future. I can't say that I'm certain about what path I'd like to pursue, but I'm infinitely appreciative of the experience that I've had and continue to have with the program and its organizers."