APPENDIX 3

to the Final Report

National Marine Educators Association Membership Profile

U.S. Commission on Ocean Policy

You may electronically download this document from:
http://www.oceancommission.gov

This document may be cited as follows:
National Marine Educators Association Membership Profile
Appendix 3 to *An Ocean Blueprint for the 21st Century*
Final Report of the U.S. Commission on Ocean Policy
Washington, D.C., 2004
ISBN#0–9759462–4–2

NMEA

SPECIAL REPORT #1

Special Edition • July 2003

SPECIAL ISSUE LOG

This *Special Issue*, "The NMEA Membership Profile Data Analyses and Interpretations," is being provided to the NMEA membership with the approval of its Board. This study was requested by the Research, Education, and Marine Operations (REMO) Working Group of the U.S. Commission on Ocean Policy. The purpose of this survey was twofold: 1) to collect baseline data regarding formal and informal efforts in marine and aquatic education based on the NMEA membership 2) to provide the interpretation of these analyses to the REMO/Commission. Further, the NMEA Board also believes these finding will be beneficial to its future strategic plans.

Funding for this *Special Issue* has been provided by the following individuals, institutions of higher learning, and/or professional societies: 1) Mr. Alan Rammer of the Northwest Aquatic and Marine Educators Chapter of NMEA; 2) The University of Southern Mississippi-Scott Aquarium through funding generated by Drs. Sharon Walker and Howard Walters; 3) The University of Florida and Florida Sea Grant College Program through funding generated by Dr. Mike Spranger; and 4) the National Marine Educators Association.

Sharon H. Walker, Issue Editor

CONTENTS

July 2003

THE NATIONAL MARINE EDUCATORS ASSOCIATION (NMEA) MEMBERSHIP PROFILE

DATA ANALYSES AND INTERPRETATIONS

EXECUTIVE SUMMARY

Sharon H. Walker[1], Howard D. Walters[2], and Wendy B. Allen[3]
The University of Southern Mississippi (USM) • College of Marine Sciences (COMS)
J.L. Scott Marine Education Center and Aquarium (MEC&A), Biloxi, MS [1 and 2]
North Inlet-Winyah Bay National Estuarine Research Reserve (NERR)
University of South Carolina (USC) • Baruch Marine Laboratory, Georgetown, SC[3]

In December 2002, the National Marine Educators Association (NMEA) surveyed its 1,182 members at the request of the Research, Education and Marine Operations (REMO) Working Group of the U.S. Commission on Ocean Policy. The purpose of the survey (see Appendix) was twofold: 1) to collect baseline data regarding formal and informal efforts in marine and aquatic education based on the NMEA membership and 2) to provide the interpretation of these analyses to the REMO/ Commission. The interpretation of these data should be helpful to the Commission members in making its education recommendations to President Bush and Congress in late fall, 2003. In endorsing this survey, the NMEA Executive Board also believes the findings will be beneficial to its future strategic plans. Of the 1,182 members surveyed, 516 individuals provided completed surveys—representing a response rate of 43.8%. It is noted a typical response rate for educational surveys is approximately 30%, indicating this current survey response rate is significantly higher than average. Possible reasons for the higher response rate is the strong communications structure of NMEA, the strong "investment" of the membership with the potentially significant outcomes of the Commission's activities, and the methodological factor of pre-paid postage being included with the survey dissemination.

DEMOGRAPHIC FINDINGS (which were optional for respondents) were as listed below:

- Gender of Respondents: 60% female and 40% male
- Age of Respondents: Over 56% were over 46 years of age indicating the majority of these formal and informal educators are nearing 25 years of service.

  These data revealed an age distinction in professional categories, i.e. the younger two age brackets (21-30 and 31-45) are far more likely to be comprised of informal educators. The older two age brackets (46-60 and over 61) are more likely to be comprised of formal educators—or informal educators who reported substantive experience in both informal and formal education.
- Ethnicity of Respondents: An overwhelming majority of the respondents are Caucasian with limited numbers of Native American, Asians, Hispanics, African Americans, and Other.
- Geographic Location of Respondents: 71% live in coastal areas and 29% live in inland areas.

TYPES OF DEGREES

The levels of the 720 degrees reported by respondents were represented by 4% Associate's degrees, 47% Bachelor's degrees, 37% Master's degrees, and 12% Ph.D./Ed.D. degrees. Of the 339 Bachelor's degrees reported, distribution was reflected by 76% in science, 17% in education, and 7% in a category designated as "Other." For the 267 Master's degrees reported, science represented 55% and education represented 45%. Distribution of Doctoral degrees was reflected by 66% in science and 34% in education. These findings for the NMEA members responding to this Membership Profile represent a significantly higher percentage of formal and informal educators with degrees in science as compared to the *National Sciences Teachers Association Report* (2000) stating that this nation's 52 million school age children between the ages of 5 and 19 are being taught by 1.9 million elementary teachers and 186,000 secondary teachers. And, of these teachers, 37% of the high school teachers, 83% of the middle school teachers, and practically all of the elementary teachers are teaching science without degrees in science.

PROFESSIONAL CAREERS

- Of the total responses provided concerning Formal and Informal Educators by profession, 47% of the responses were in the Informal Education Profession while 53% perceived themselves as Formal Educators.

  Within these two professions, the 53% of the Formal Educators placed themselves as PreK-12 Teachers (60%), Undergraduate Faculty (25%), and Graduate Faculty (15%).

  The Informal Educators, as professionals, represented employment in: Museums (5%), Aquariums (21%), Science Centers (13%), and Other (53%). The "Other" Informal Educator category representing 53% categorized their employment in Non-Governmental Organizations (43%), University-Linked Facilities (25%), or Formal Systems (14%).

  It is worth noting that 86 respondents indicated a profession in both formal and informal categories, or approximately 17% of the total. This finding may reflect a growth in informal education in university settings through extramural education grant funding, through the development of informal outreach facilities linked to universities, i.e., through cooperative and/or marine extension programs, or through the implementation of environmental science centers for K-12 audiences and the general public.

- The age distribution for formal and informal educators suggests the presence of a transition among the younger professionals in bypassing the formal education career path for a variety of reasons—perhaps a lack of availability of an informal education employment sector 20 years ago. Further, the upper age bracket of respondents most likely includes administrative leadership in informal education and at least for some part of their career, were employed in formal education. Over time and based on the current lower age bracket of informal and formal profession preferences—individuals with formal education experience migrating to informal education represent a diminishing pool of "next generation" leadership for informal education, as fewer informal educators are obtaining formal classroom experiences. This scenario is particularly true within the Sea Grant College network, i.e., the majority of the Sea Grant educators > 45 years of age have had both formal and informal professional experience. Even though the total experience would be expected to be less, those educators < 45 years of age have more limited experience in formal education. Further, this lack of formal education experience is even more pronounced in informal educators < 30 years of age.

INSTRUCTIONAL TIME INVOLVEMENT

- Of the 523 responses to the third question, 51% reported up to 20% of time each workday is spent in teaching (lecture and activities) marine and/or aquatic sciences.
- In reviewing the younger age bracket of respondents (22-45) 0-20% of their time is spent in providing instruction, while the older age bracket (>46) respondents spent 20-40% of their time involved in teaching marine and aquatic content with re-enforcement of complementary activities.

SCIENCE EDUCATION STANDARDS

- It appears curricula alignment with State and National Standards is important to both informal and formal—marine and aquatic science educators. Of the total 747 responses to the standards question, 47% of the NMEA respondents indicated they used their respective State Standards, 26% of the respondents use the *National Science Education Standards (NSES)* and 13% use *Benchmarks*; 14% of the respondents use other standards.
- In comparing the use of State and National Standards by formal and informal educators, the formal educators align their curricula in the following percentages: State Standards—45%, *NSES*—24%, *Benchmarks*—16%, and other standards—15%. The informal educators align their curricula in the following percentages: State Standards 50%, *NSES*—26%, *Benchmarks*—12%, and other standards—12%.
- In general, these findings indicate that efforts to include ocean sciences content into the *NSES* should be undertaken.
- Textbooks remain the leading source of resource materials for teaching at 44% with a close second source of resource materials being the World Wide Web at 42%. The remaining 14 percent is represented by the use of curricular kits.
- In ascertaining "why" the oceans are important to the NMEA membership, those members responding listed the categories

below as the most important:

Global Climate Change Issues — 27%
Environmental Stewardship — 25%
Economic Issues — 22%
(Economic Impact, Consumable Resources, and Fisheries Products)
Social Structures — 15% (Coastal Development, Population Growth, Distribution of Resources, Use of Coastal Zones)
Human Health — 11%

It is interesting to note the topics of National Defense and Security and Global Transportation received only minimal responses; therefore, they were not included as priorities. It will also be interesting in future profiles of the NMEA membership to include these two topics and determine increased emphasis in National Security due to both the Middle East conflict and Global Transportation issues.

CONCLUDING REMARKS

These data and their interpretations are significant findings in science education, specifically marine and aquatic education, for precollege and general public audiences. It is the opinion of the authors of this manuscript that these findings should provide continued, proactive support for the inclusion of marine and aquatic sciences within the following areas: the *NSES*; in formal and informal educators' classrooms, aquariums, science centers, museums, and governmental facilities; or professional organizations whose missions involve supporting more responsible, environmental decision-making related to marine and aquatic issues. It is also of critical importance that researchers and teachers (formal and informal) work together with mutual professional respect in "bridging the gap" which currently exists between researchers' data and the relevance of these data to the everyday lives of teachers, their students, and the general public.

Further, to have a more scientifically competitive workforce, precollege students must be involved in enhanced inquiry-based content courses—founded on sound science—with this content being reinforced through hands-on activities. To be competitive in the global workforce, this nation's students must be empowered by well-prepared preservice and inservice teachers who have been involved in high-quality professional development programs.

Lastly, the authors of this manuscript are also of the opinions, NMEA and its members are in a leadership position to make proactive, positive changes in helping advance coordinated partnerships to leverage investments in national networking, thereby delivering relevant, current research and ocean and coastal processes expertise to teachers (formal and informal) nationwide. As excerpted from an article by Walker, Brook, and Lach (2000), these increased partnerships—representing academia, government, industry, professional organizations, and the private sector are working together to administer and implement projects and resources to thousands of teachers and their students. These augmented partnerships and increased credibility for crossover activities, enhanced mutual respect, and improved communications between scientists and educators will result in a "win-win" partnership for both groups and this country's precollege teachers, students, and the general public.

THE NATIONAL MARINE EDUCATORS ASSOCIATION (NMEA) MEMBERSHIP PROFILE
DATA ANALYSES AND INTERPRETATIONS

Sharon H. Walker[1], Howard D. Walters[2], and Wendy B. Allen[3]
The University of Southern Mississippi (USM) • College of Marine Sciences (COMS)
J.L. Scott Marine Education Center and Aquarium (MEC&A), Biloxi, MS[1 and 2]
North Inlet-Winyah Bay National Estuarine Research Reserve (NERR)
University of South Carolina (USC) • Baruch Marine Laboratory, Georgetown, SC[3]

INTRODUCTION

In December 2002, the National Marine Educators Association (NMEA) surveyed its 1,182 NMEA members at the request of the Research, Education and Marine Operations (REMO) Working Group of the U.S. Commission on Ocean Policy. The purpose of the survey (see Appendix) was twofold: 1) to collect baseline data regarding formal and informal efforts in marine and aquatic education based on the NMEA membership and 2) to provide the interpretation of these analyses to the REMO/U.S. Commission on Ocean Policy. The interpretation of these data should be helpful to the Commission members in making its education recommendations to President Bush and Congress in late fall, 2003. In endorsing this survey, the NMEA Board also believes the findings will be beneficial to its future strategic plans. Of these 1,182 members surveyed, 516 individuals provided completed surveys—representing a response rate of 43.8%. It is noted a typical response rate for educational surveys is approximately 30%, indicating this current survey response rate is significantly higher than average. Possible reasons for the higher response rate are the effective communications structure of NMEA, the strong "investment" of its member

ship with the potentially significant outcomes of the Commission's activities, and the methodological factor of pre-paid postage included with the survey dissemination.

The data are both quantitative and qualitative, as reflected by the analyses and discussions below. The demographic information, which was optional for member responses— has been presented first. The qualitative analyses sections also include brief methodological descriptions. With regard to the

demographic items, some questions allowed respondents to select more than one answer, resulting in total responses being greater than the number of respondents in these cases.

Gender of Respondents

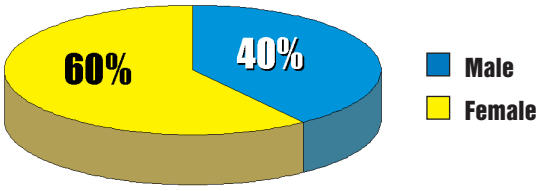

Figure 1. Respondents are comprised by 60% Females and 40% Males.

Age of Respondent

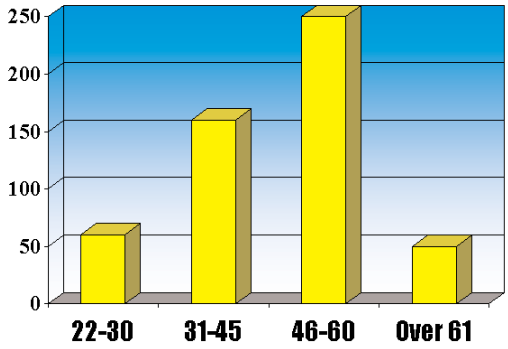

Figure 2. Over 56% of respondents indicated they are over 46 years of age. Based on typical professional development patterns, this would indicate the majority of respondents are nearing retirement age with approximately 25 years of service completed.

Teacher preparation and professional development programs are essential in ensuring enhanced content knowledge and augmented instructional strategies.

Ethnicity of Respondents

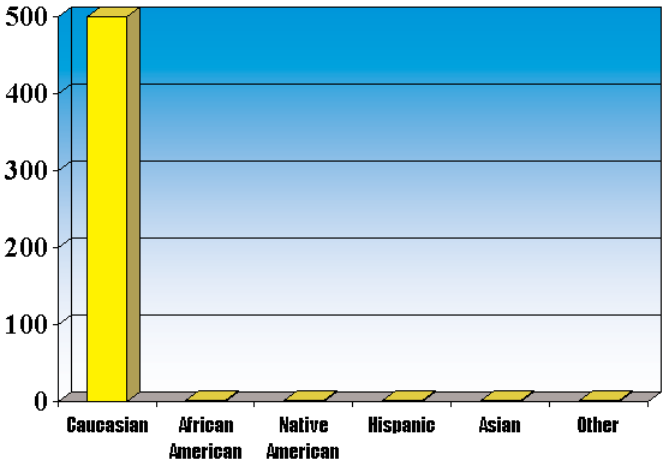

Figure 3. Data indicate an overwhelming lack of ethnic minorities among those providing responses to this survey. The marine and ocean sciences education community remains significantly underrepresented by individuals who are not Caucasian.

Geographic Location of Respondent

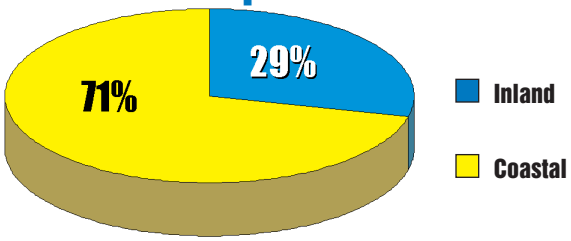

Figure 4. Respondents indicated they were predominantly geographically located coastal. However, a significant percentage of educators responding were situated geographically inland.

Percentages of Degrees Reported

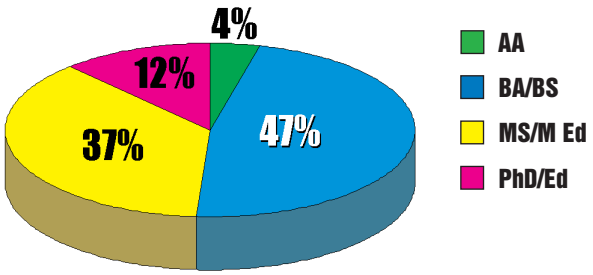

Figure 5. Percentages of degree level from the 720 degrees reported by the participants.

Teachers discussing marsh zonation and species diversity.

Distribution of Doctoral Degrees by Area

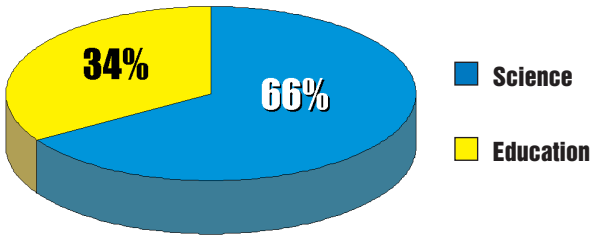

Figure 6. Doctoral degrees distributed by area of study for the 86 degrees reported.

Distribution of Master's Degrees by Area

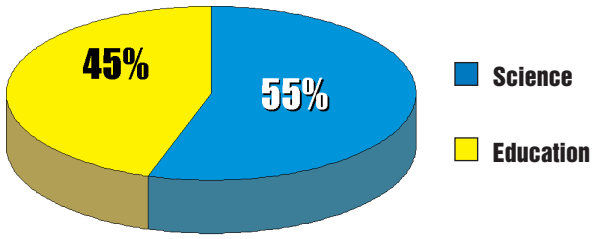

Figure 7. Master's degrees distributed by area of study for the 267 degrees reported.

Distribution of Bachelor's Degrees by Area

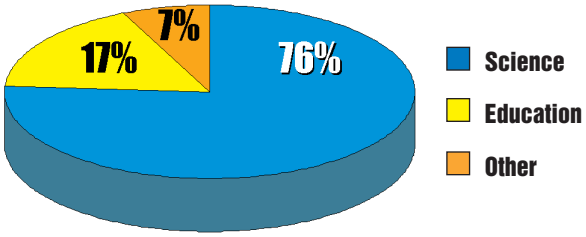

Figure 8. Distribution of Bachelor's degrees by area of study for the 339 degrees reported. The "Other" category reflects a varied assortment of academic programs too diffuse to graph.

Figures 9-11 relate to the NMEA respondents' selection of professions within formal or informal education. Of the total 769 responses to this question, 314 respondents placed themselves in the informal education while 355 respondents placed themselves in formal education. Specificity within each of these professions has been delineated graphically.



Professional development programs for precollege teachers (formal and informal) involving estuarine areas, archaeological sediment studies, and species identifications.

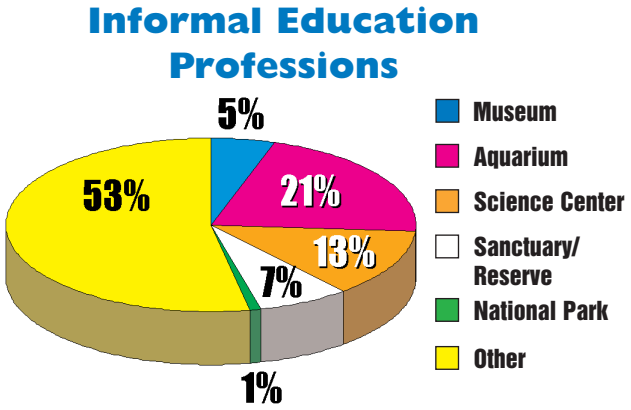

Figure 9. Percentages of 314 responses in informal education professions.

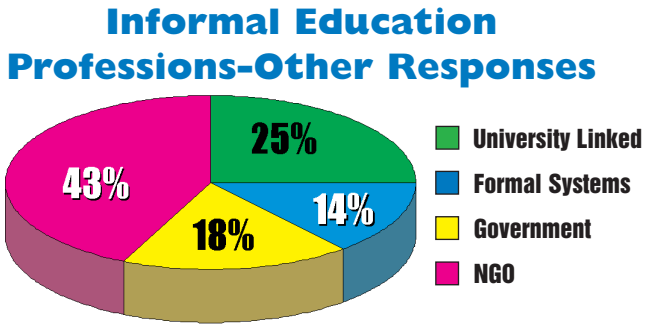

Figure 10. 165 responses in Informal Education—*Other* category of organizational types.

An analysis of the responses reflected in Figure 10 indicated this survey item was used to provide enhanced specificity of affiliation by the respondents. Consequently, a large proportion of these responses was duplicated by categories reported in Figure 9. There were a significant number of organizations which were not government agencies, nor university or K-12 school systems, which employed personnel engaged in marine and aquatic education. It should be noted, however, it appears from the data that numerous personnel were employed by universities and K-12 education systems in capacities other than formal instruction. This finding may reflect a growth in informal education in university settings through extramural educational grant funding, through the development of informal outreach facilities linked to universities, through cooperative and marine extension programs, and/or through the implementation of environmental science centers in universities for K-12 audiences and the general public. In fact, 86 respondents indicated a profession in both formal and informal categories, or approximately 17% of the total.

Formal Education Professions

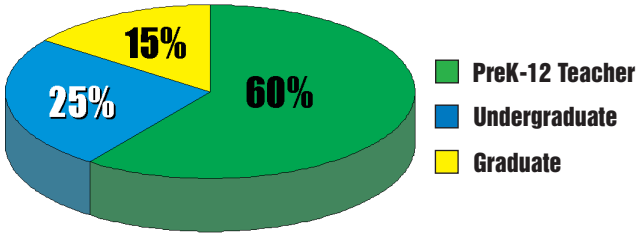

Figure 11. Percentages of 355 responses in formal education professions.

Combined Responses to Professional Affiliation

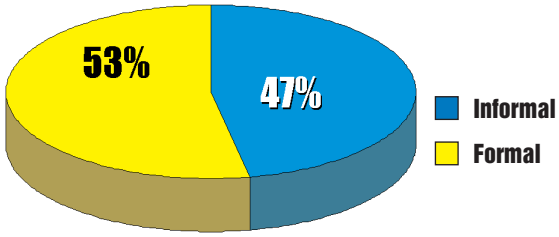

Figure 12. Combined responses to professional affiliation/career orientation.

Combining the total responses from Figure 9 (n=314) and the total responses in Figure 11 (n=355), Figure 12 graphically represents that 47% of the total responses were categorized as informal education professions and 53% of total responses were in the formal education category; i.e. classroom teachers from preK-12, undergraduate or graduate levels. Additionally, as noted above, 17% of respondents indicated overlapping professional categories between formal and informal areas.

Lower Age Professional Categories

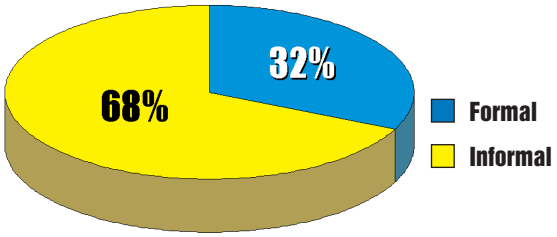

Figure 13. Sorted lower age brackets (ages 22-30 and ages 31-45) based on formal or informal professions.

Upper Age Professional Categories

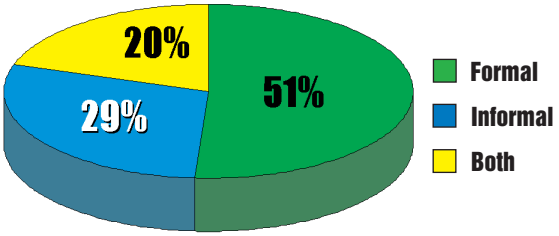

Figure 14. Sorted upper age brackets (46-60 and over 60) based on formal or informal professions.

Interdisciplinary Summer Institutes involving lectures by guest scientists and educators, followed by field activities to reinforce increased content knowledge.

Figures 13 and 14 sort the responses relative to informal or formal professions (Figures 9, 10, and 11) on the responses to the Ages of Respondents (Figure 2). This sorting of the respondent data revealed an age distinction in professional categories. The younger two age brackets, 22-30 and 31-45, are far more likely to be comprised of informal educators. The upper age brackets, 46-60 and over 61, are more likely to be comprised of formal educators—or respondents who reported substantive experience in both formal and informal education. The upper age bracket data appear to indicate a trend of migration from formal to informal throughout the professional career. However, this is contrary to the current lower age bracket data in which an individual is more than twice as likely to be an informal rather than a formal educator. These conflicting views suggest the presence of a transition in direction for the education workforce. First, younger professionals with an interest in teaching marine and aquatic sciences may be bypassing the formal education career path for a variety of reasons, to include the availability of an informal education employment sector not available twenty years ago. Second, the current upper age brackets of respondents most likely include administrative leadership in informal education who, for at least some of their professional career, were invested in formal education. Over time and based on the current lower age bracket of informal and formal profession preferences—individuals with formal education experience migrating to informal education represent a diminishing pool of "next generation" leadership for informal education, as fewer informal educators are obtaining formal classroom experiences. If this finding proves accurate, a disconnect between these two education communities could develop. Specifically, the strength of the informal education community to provide meaningful professional development to the formal education community—based on a shared understanding of the professional demands on classroom teachers—will lessen as informal educators who have no formal experiences assume positions of leadership in the informal community.

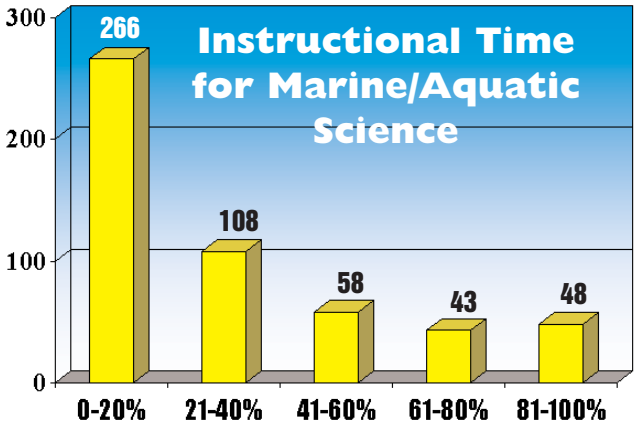

Figure 15. Percent of workday in which respondents were involved in marine and/or aquatic education through lectures and/or activities.

Of the 523 responses to this question, 51% of the responses (266 individual responses) reported up to 20% of time spent in each workday was invested in marine or aquatic education through lectures or activities.

Based on the 60% K-12 teachers completing the survey (Figure 11), these data could be reasonably interpreted that a majority of the classroom teachers who are members of NMEA regularly teach other courses than marine/aquatic sciences. Further, it seems clear that instruction of students is not the primary professional responsibility of the informal educators responding to the survey—otherwise the amount of daily time should have been significantly higher than reported.

Formal and Informal Educator Responses—Instructional Time

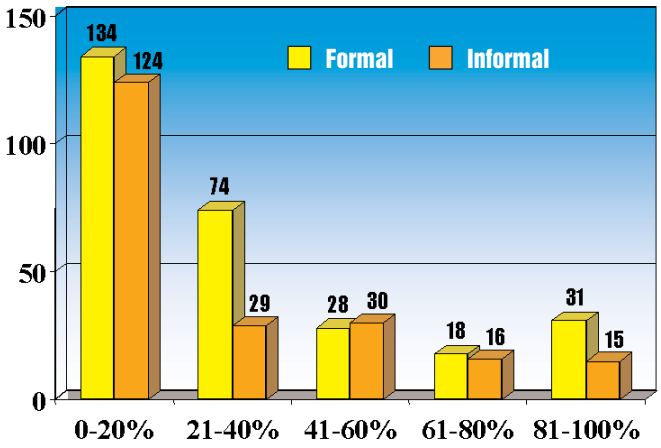

Figure 16. Percent of workday comprised with marine and/or aquatic education through lectures and/or activities disaggregated by profession.

Sorting the responses for the percentage of daily time spent in lectures or activities based on informal and formal education responses revealed that those individuals reporting they were formal educators spend more daily time in instructional activities on an average than do informal educators. The median response for formal educators was in the 21-40% time range, while the median response for informal professions was in the 0-20% time range (Formal = n142; Informal = n107).

Instructional Time for Lower Age Brackets

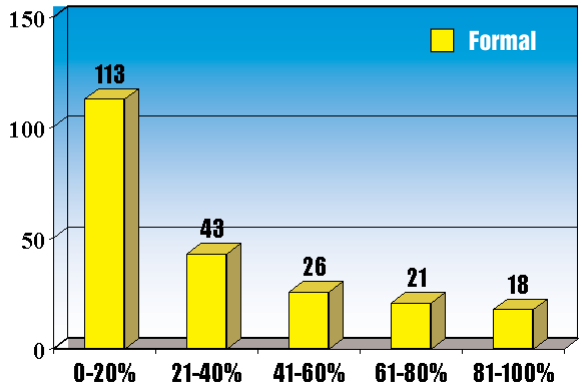

Figure 17. Instructional time spent on marine and aquatic education activities or lectures sorted by age of participant.

One additional variable, which related to interpretation of these data, was to compare the instructional time of formal and informal educators (Figure 17) with the Age of Respondent (Figure 2.) The time of service for all respondents indicated a significant number of respondents were in fact administrators with limited instructional responsibilities. Figure 17, however, limits the sample by analyzing data only for the lower two age brackets, i.e. <46 years of age. The median score for this age grouping is n=110 within the 0-20% time bracket. Consequently, administrative

Hands-on, inquiry-based invertebrate dissections of crabs and oysters to better understand biological science, to include the economic impact of these resources.

responsibilities due to age in profession does not appear to explain time on instructional responsibilities for those respondents <46 years of age. Although 80% of the instructional time is not spent on marine and aquatic-related activities, this percentage of time may be interpreted as being spent on educational activities in other areas of study—and not in administrative duties.

Alignment to Instructional Standards

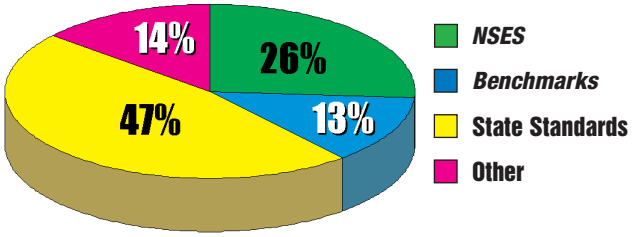

Figure 18. Adopted curricular materials are aligned with both State and National Standards.

Of the 747 total responses to *State Science Standards* and/or *National Science Education Standards [NSES]* (National Research Council, 1996) for curricular alignment, the 171 respondents who selected *State Science Standards* also selected the *NSES* and/or *Benchmarks* (the American Association for the Advancement of Science, 1993). This would suggest that a significant number of states are incorporating both State-developed and Adopted Standards, as well as National Standards documents. If this dual level of Standards was observed over time, it could be interpreted as a trend toward either a national science curriculum or toward accountability measures within individual states.

Formal Educators Alignment to Instructional Standards

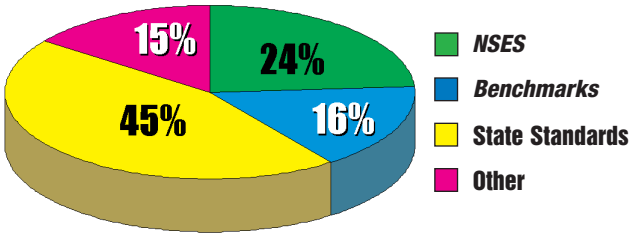

Figure 19. Formal Educator responses for alignment of curricular materials to various standards.

Trawling aboard various research vessels allows teachers opportunities to gain vertebrate and invertebrate collections for classroom use.

Informal Educators Alignment to Instructional Standards

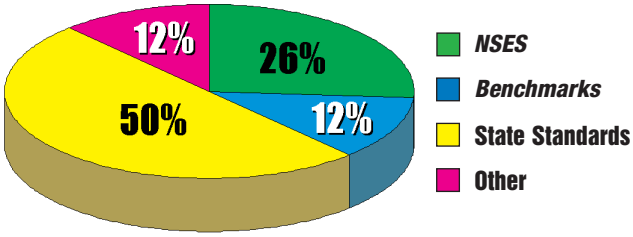

Figure 20. Informal educator responses for alignment of curricular materials to various standards.

Figures 19 and 20 depict the correlation of the curricular standards alignment based on the professional designation of the respondent, i.e. informal or formal. There was a significant overlap, due to multiple responses, in the individuals who selected State and one of the two National Standards documents indicated. With respect to the *NSES* or *Benchmarks*, there was a clear preference for the *NSES* among all respondents, with a slightly larger reliance on the *NSES* among informal educators than formal educators. It is not possible to determine rationales for this preference, but it would seem efforts to include ocean content standards within a national standards document would be more immediately received or implemented based on the *NSES* rather than on *Benchmarks*.

Source of Resource Materials

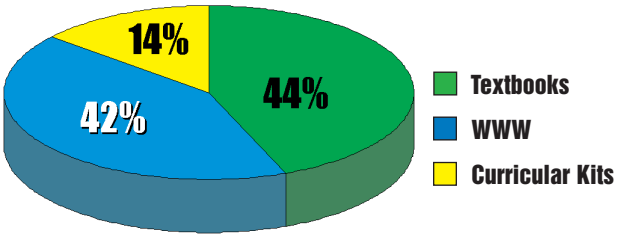

Figure 21. Respondents indicate that textbooks remain the leading source of resource materials for teaching. However, based on a number of responses, the World Wide Web (WWW) is almost equal to textbooks in terms of importance as a source of information and/or activities.

Data presented in Figure 21 suggested that agencies interested in infusing specific content or activities could incorporate the WWW as a fiscally efficient and effective mechanism, as opposed to the relatively more expensive development and publication of print materials. Nevertheless, a continued reliance on textbooks as indicated by these data reflected a need to develop relationships with traditional publishing and textbook companies to ensure that marine and aquatic sci-

ences are adequately and appropriately infused in these materials.

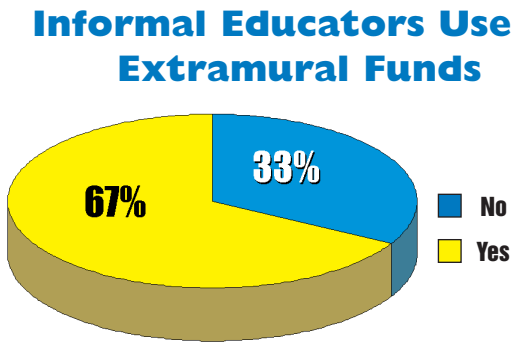

Figure 22. Informal educators report nearly two of every three professionals rely on extramural grant support to implement educational programs.

Learning how to start and maintain fresh or saltwater aquariums for students to monitor water quality parameters is a valuable lesson for precollege teachers.

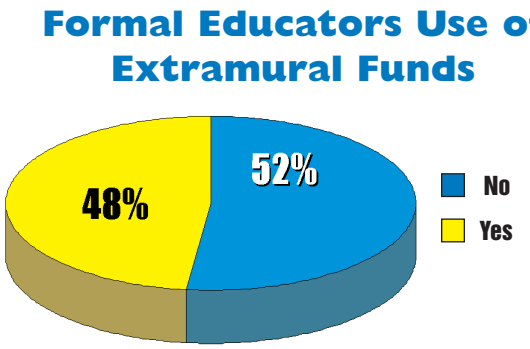

Figure 23. Formal educators continue to rely more heavily on systemic funding for programs; however, they report an increasing reliance on grants as government budgets at all levels are currently being reduced.

Percentages in Figures 22 and 23 indicate informal educators exceed formal educators in the use of extramural funds to support programs (survey question eight, see Appendix). Analyses of comments provided for this question, however, indicate significant concern among formal educators regarding decreased government funding, resulting in enhanced reliance on grant funds among this group of professionals. Informal educators' comments suggest they increasingly rely on grants not only for programming but for basic operational "survival." This is alarming given the significant role informal science education centers serve in providing continuing professional education to formal educators.

It may be that over time, a system of fund-sharing from government sources to support informal education—as it supports formal education—should be considered. Additionally, some consideration of the relationship between the type of extramural funds available for informal education and the types of professional development programs needed by the formal community would perhaps reveal pathways through which these funding arrangements could be implemented. A precedent for this

funding pathway can be seen in the now-terminated Dwight D. Eisenhower Program, through the U.S. Department of Education. Through this federal funding stream, fiscal support was made available to informal science education centers either directly or through subcontracts with state departments of education or local school districts in some states. The recently enacted No Child Left Behind Act of 2001 (2002), while still being refined, will perhaps support a continuity and expansion of professional development programs for preK-12 educators through informal centers for ocean sciences content. As the funding decisions are made at state levels, it seems critically important that the informal marine and aquatic education leadership be proactive in leveraging partnerships to stabilize its operational costs in support of programming to enhance the preK-12 systems' professional development needs.

Question nine on the NMEA Membership Profile (page 18) was an open-ended response question to elicit feedback from respondents regarding perceived importance of the oceans and watersheds for education among precollege students and the American public. The analyses of these anecdotal comments were implemented through a qualitative analysis procedure (phenomenological content analyses) described by Patton (1980) and others. The responses were scanned for content similarity and compared to an external compilation of previously described categories pertaining to the importance of the oceans in education (Walker, 2002). The use of an external set of categories for unit clustering is viewed as an important mechanism to strengthen the validity and credibility of qualitative data, and their interpretations and uses (Merriam, 1990).

From the narrative provided by the respondents, 822 discrete units of content were noted. These units of content were sorted based upon a set of seven categories provided by Walker (2002) in testimony to the U.S. Commission on Ocean Policy on March 7, 2002. These seven categories were related to perceptions that the oceans are important in education in relation to:

1. National Security;
2. Economic Impact;
3. Human Health;
4. Global Transportation;
5. Fisheries Products;
6. Social Structure; and
7. Aesthetic Qualities.

Field activities and subsequent curriculum development through simulation games are essential in reinforcing content knowledge, as well as demonstrating the relevance of marine and aquatic sciences.

Professional development programs in which precollege teachers are involved in plotting latitude and longitude coordinates, as well as discussing field-trip logistics for near-shore submerged vegetation studies.

The initial sorting of the 822 units of content into the above delineated categories proved adequate for 344 content areas but revealed the necessity of establishing additional categories. The inclusion of three additional categories, i.e. Environmental Stewardship/Decision-Making, Global Climate Change, and Consumable Resources, increased the explained content units from 344 to 779. Additionally, based on a confidence interval of +/- 5% for significance of categories, the Economic Impact, Consumable Resource, and Fisheries Products categories were combined into a larger category of Economic Issues. Additionally, the National Security and Aesthetic Qualities categories were disregarded due to minimal responses. The revised category structure for the narrative with percentage responses has been described in Figure 24.

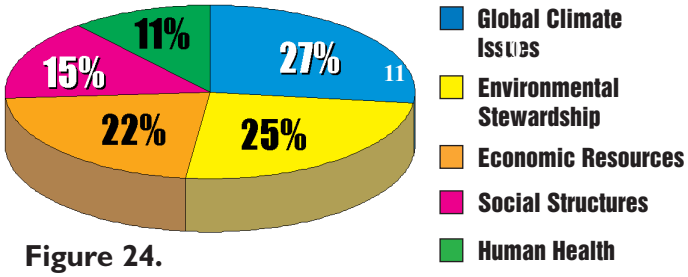

Figure 24. Participants' rationales for including the oceans in science education content.

As indicated by Figure 24, the two most important reasons—as perceived by the NMEA membership—to infuse ocean (marine and aquatic) sciences in public education were the global climate issues impacted by the world's oceans and the need to develop a sense of environmental stewardship among students and the general public. At issue in these categories appeared to be the pressing and increasingly critical threats to the global environmental systems, biological sustainability, and species survivability on this planet. Additionally, the population of educators completing the survey had primarily identified education programs as a mechanism to create social change through science-based, decision-making by an informed populace. Significant overlap did exist in

the data set among these concepts as a foundation for understanding the significance of economic impacts, social structures such as population growth and coastal development, and positive impacts to human health and survivability due to protein harvesting or biomedical research—or negative implications as a result of overharvesting of commercial fish stocks or pollution in coastal waters. In short, the formal and informal educators completing this survey perceived that ocean (marine and aquatic) sciences education is in fact an opportunity for the United States to provide international leadership based on global climate impact and environmental stewardship concerns.

Precollege teachers involved in beach profile studies....

CONCLUDING REMARKS

These data and their interpretations are significant findings in science education, specifically marine and aquatic sciences education, for precollege and general public audiences. It is the opinion of the authors of this manuscript that these findings should provide continued, proactive support for the inclusion of marine and aquatic sciences within the following areas: the *NSES*; in formal and informal educators' classrooms, aquariums, science centers, museums, and governmental facilities; or professional organizations whose missions involve supporting more responsible, environmental decision-making related to marine and aquatic issues. It is also of critical importance that researchers and teachers (formal and informal) work together with mutual professional respect in "bridging the gap" which currently exists between researchers' data and the relevance of these data to the everyday lives of teachers, their students, and the general public.

Further, to have a more scientifically competitive workforce, precollege students must be involved in enhanced inquiry-based content courses—founded on sound science—with this content being reinforced through hands-on activities. To be competitive in the global workforce, this nation's students must be empowered by well-prepared preservice and inservice teachers who have been involved in high-quality professional development programs.

Lastly, the authors of this manuscript are also of the opinions, NMEA and its members are in a leadership position to make proactive, positive changes in helping advance coordinated partnerships to leverage investments in national networking, thereby delivering relevant current research and ocean and coastal processes expertise to teachers (formal and informal)

....and investigating invertebrates during low tide.

nationwide. As excerpted from an article by Walker, Brook, and Lach (2000), these increased partnerships—representing academia, government, industry, professional organizations, and the private sector are working together to administer and implement projects and resources to thousands of teachers and their students. These augmented partnerships and increased credibility for crossover activities, enhanced mutual respect, and improved communications between scientists and educators will result in a "win-win" partnership for both groups and this country's precollege teachers, students, and the general public.

ACKNOWLEDGEMENTS

The authors of this manuscript wish to express appreciation to the following organizations and/or individuals: the NMEA Board, the NMEA members completing the Membership Profile, the U.S. Commission on Ocean Policy, the REMO Group within the U.S. Commission on Ocean Policy, staff members within the U.S. Commission on Ocean Policy with special thanks to Ms. Roxanne Nikolaus, USM, and the USM-MEC&A and Gulf Coast Research Laboratory staff members: Johnette Bosarge, Mary Anne Dykes, Bobbie Martin, Glynda Garriga, LaJoyce Davis, and Ann Moran.

About the Authors:

- **Dr. Sharon H. Walker** is the Associate Dean for Outreach, USM-COMS; Administrator, MEC&A; Professor in the COMS-Department of Coastal Sciences; and Director of Education for the MS-AL Sea Grant Consortium.
- **Dr. Howard D. Walters** is a Senior Researcher for the USM-COMS-MEC&A with extensive experience in educational evaluation and assessment and early childhood development.
- **Ms. Wendy B. Allen** is the Manager for the North Inlet-Winyah Bay NERR-USC-Baruch Marine Laboratory and the 2002-2003 NMEA President

References:

American Association for the Advancement of Science (1993). *Benchmarks for Science Literacy*, Oxford University Press: New York.

Merriam, Sharan B. (1988). *Case Study Research in Education: A Qualitative Approach*. Jossey-Bass Publishers: San Francisco. 226 pp.

National Research Council (NRC, 1996). *National Science Education Standards*. Washington D.C.: The National Academy Press.

Nation Science Teachers Association (2000). Science Education Statistics. Available: <http://www.nsta.org/press-rel/factsheet.asp>.

Patton, Michael Q. (1990). *Qualitative Evaluation and Research Methods*. Sage Publications: Newbury Park. 532 pp.

U.S. Department of Education (2002). *No Child Left Behind Act of 2001*. Washington, D.C. <http://nclb.gov/>.

Walker, Sharon H. (2002). "Invited Public Testimony to the U.S. Commission on Ocean Policy," March 7, 2002. New Orleans, LA.

Walker, Sharon H., R. Dan Brook, Mary Alyce Lach, Charles M. Calvo (1958-2000), Reid R. Riggle, Mark H. Bochenhauer, Cheryl M. Whitfield, Connie C. Templeton, Elizabeth S. Klein, and Howard D. Walters. (2001) *COAST A Final Report*. January 12, 2001. pp. 1-15.

Appendix

National Marine Educators Association

..to make known the world of water, both fresh and salt

December 16, 2002

Dear NMEA Members,

Please find enclosed a membership survey that has been developed by the Research, Education and Marine Operations (REMO) Working Group of the United States Commission on Ocean Policy (Commission). As you may know, this Commission is charged with establishing findings and making recommendations to the President and Congress for a coordinated and comprehensive ocean policy for our Nation. Four Working Groups were established to assist the Commission in this effort, including the REMO Working Group on which own Membership Secretary, Dr. Sharon Walker serves. We are very fortunate to have Sharon representing marine education interests in this Working Group. Largely through her encouragement, the REMO Working Group agreed to evelope and cover the costs of this membership survey. The information gained from this survey will be used to strengthen the Commission's recommendations pertaining to marine education and will also help NMEA better serve its membership.

Please take a few minutes to complete the enclosed survey and return it in the self-addressed, pre-stamped envelope by **January 15, 2003**. This will allow time to summarize the results before Sharon meets again with the REMO Working Group later in January.

To learn more about the Commission and its efforts, you can visit its website at: www.oceancommission.gov. Several NMEA members have presented testimony at public meetings of the Commission. In September, NMEA provided recommendations in the form of a letter to the Commission. This letter is part of the public record and can be viewed in the public comment section of the Commission's website. Individuals are also encouraged to share their recommendations with the Commission.

Thank you for your contribution to this important effort to move marine education forward in our Nation over the next several decades.

Best wishes for a safe and happy holiday season,

Wendy B. Allen
President, National Marine Educators Association

Enclosure

P.O. Box *1470* • Ocean Springs, MS *39566-1470*
www.marine-ed.org

THE NATIONAL MARINE EDUCATORS ASSOCIATION (NMEA) MEMBERSHIP PROFILE

This survey, profiling the NMEA membership, has been requested by the U.S. Commission on Ocean Policy and approved by the NMEA Executive Board. Please take five minutes and provide your responses as we need and value your input. These membership responses will collectively provide the U.S. Commission on Ocean Policy an enhanced understanding of our passion for having a more ocean literate society and increased numbers of precollege students more empowered to make environmentally-sound, ocean-related resource decisions.

Please circle your answers or provide a short response to the questions; more than one answer may apply.

1. Concerning your educational background, do you possess a(n)

a) Associate of Science Degree
Associate of Art Degree
In what subject/discipline? _____

b) Bachelor of Science Degree
Bachelor of Art Degree
In what subject/discipline? _____

c) Master of Science Degree
Master of Art Degree
In what subject/discipline? _____

d) Doctor of Philosophy Degree
Doctor of Education Degree
In what subject/discipline? _____

e) Other (please specify) _____

2. In what educational profession do you work?

a) Informal education, i.e., as a educator in a(n)
- Museum
- Aquarium
- Science center
- National Marine Sanctuary or Reserve
- National Park Service
- Other

If your response is other, please identify your informal working environment.

_____

b) Formal education, i.e. as a classroom teacher for
- PreK-12 students
- Undergraduate students
- Graduate students

3. How much time do you spend in your workday teaching marine and/or aquatic education through lectures and/or activities?

a) 0 - 20%

b) 21 - 40%

c) 41 - 60%

d) 61 - 80%

e) 81 - 100%

4. Do your education efforts rely on your curricular materials being aligned with

a) The *National Science Education Standards* (National Research Council, 1996)

b) *Benchmarks* (American Association for the Advancement of Science, 1993)

c) State Science Standards

***5.* Are most of your resource materials derived from:**

a) Textbooks

b) Online/web-based materials

c) Other (if this is your answer or one of your answers, please explain)

_____

6. Do you have access to scientists with whom you can regularly contact and/or interact for questions and/or comments?

a) Yes

b) No

***7.* Would you like to be involved in a science researcher and classroom teacher partnership?**

a) Yes
Why? _____

_____

b) No
Why? _____

_____

8. Is seeking extramural funding a component in the implementation success of your program(s) Yes _____ No _____

If your response is yes, please elaborate. . .

9. In one brief paragraph, why do you believe the oceans and their watersheds are important to precollege students and/or the general public?

10. Geographically, do you live in an inland or coastal area? (Inland may be defined as within 60 miles of a coast).

Inland _____ Coastal _____

Optional Questions:

11. What is your gender? Male or Female

12. Your age is represented by which of the following years?

a) 22 - 30
b) 31 - 45
c) 46 - 60
d) over 61

13. You ethnicity is:

a) Caucasian
b) African American
c) Native American
d) Hispanic
e) Asian
f) Other (please identify if desired)