<u>Environmental Literacy and Workforce Development</u>

The Environmental Literacy and Workforce Development (ELWD) focus area is new as of the 2014-2017 strategic plan. ELWD has always been a theme in the focus areas of previous strategic plans and prominently featured in SG programs and products across the network for many years. This focus area is currently organized into two goals seeking:

1. An environmentally literate public supported and informed by a continuum of lifelong formal and informal engagement opportunities.

2. A future workforce reflecting the diversity of SG programs, skilled in science, technology, engineering, mathematics, and other disciplines critical to local, regional, and national needs.

Strengths

Sea Grant (SG) contributes to the broad Science Technology Engineering and Mathematics (STEM) *ecosystem and culture*[1] in many ways by engaging in a wide variety of STEM activities related to environmental literacy and workforce development (ELWD). These activities include but are not limited to: formal and informal education, community outreach, job training, scholarships, and development of curricula and educational resources. In keyword searches of SG accomplishments and impacts, and projects from 2010-2014 for categories related to education, literacy, and job-training of both, there is clear evidence that SG actively engages in this focus area and a trend that engagement is increasing over time.[2,3]

SG has been successful in ELWD because the organization serves as trusted experts who are considered honest brokers of information.[4] This helps break down barriers between many groups (e.g. academia, industry, government, and local communities) and facilitates strong partnerships and collaborations.[5] For example in 2013, Hawaii Sea Grant promoted environmental literacy and facilitated an ongoing conservation based education program to over 770,000 visitors to Hanauma Bay Nature Preserve by partnering with local government, private, and academic stakeholders.[6] In 2014, California Sea Grant continued a collaboration with Ocean Discovery Institute, San Diego State University, and teacher communities to engage at least 166 underrepresented K-12 students in STEM education.[7]

Because SG is receptive to many different stakeholders and committed to engagement in ELWD, SG can readily adapt to educational and workforce needs at local and regional levels, over long and short time frames.[5] In 2013 at least 90 former Alaska Sea Grant students received positions in fisheries or marine

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[1] "Definition of STEM culture and ecosystem. Global STEM Paradox." New York Academy of Sciences Jan 2015. http://www.nyas.org/AboutUs/MediaRelations/Detail.aspx?cid=721e403a-e9b6-4162-bbc2-4da68a59f56f

[2] Keyword analysis in PIER database of project title and abstracts 2010-2014. 16 Keywords examined in categories related to education, literacy, and job training. Accessed Feb 2016

[3] Keyword analysis in PIER database of accomplishments and impacts 2010-2014. 16 Keywords examined in categories related to education, literacy, and job training. Accessed Feb 2016

[4] Sea Grant Outreach. Accessed March 2016. http://seagrant.noaa.gov/howwework/outreach.aspx

[5] Conversation between Julia Galkiewicz and Matt Lurie 2/12/16.

[6] PIER database Impacts and Accomplishments 2013. "Hawaii Sea Grant educated over 770,000 visitors on marine resource conservation at the Hanauma Bay Nature Preserve."

[7] PIER database Impacts and Accomplishments 2014. "Sea Grant citizen science program engages underrepresented minority groups in STEM education."

related positions and many attributed their success due to the skills and training they received from SG.[8] This example highlights the importance of Sea Grant in meeting workforce needs of communities.

Weaknesses

While Sea Grant (SG) is broadly meeting it goals for environmental literacy and workforce development (ELWD) as outlined in the 2014-2017 strategic plan, there are some weaknesses that can be addressed in the future. For example, even though SG is involved in projects related to both environmental literacy and workforce development, an analysis of keywords in the PIER data base shows more emphasis on environmental literacy than workforce development between 2010 to 2014,[2,3] reflecting a potential gap. An additional weakness in the ELWD focus area is that the definition of success is vague in the 2014-2017 strategic plan. Even though SG has products and services that represent each of the goals, outcomes, and performance measures, a deeper understanding of success will require more specific data metrics, reporting, and analysis specific to ELWD.[5] A tangential topic from a product standpoint is that it is presently unclear how SG actions or individual education and outreach events lead to environmental literacy and workforce development.[5] Is a single outreach event or training workshop contributing to individual environmental literacy or workforce development? In other words, how is the *pipeline*[9] structured and defined to move students, trainees, and communities from the start of the process to becoming environmentally literate or part of the Science Technology and Engineering workforce? A lack of definition in the ELWD prevents answers to these questions in a measurable way.

Some of the weaknesses in ELWD are broadly applicable to other focus areas but worth mentioning. For example, SG funding allocation may move slower than emerging needs as identified by programs, communities, or partnerships.[5] Additionally, a broad lack of coordination at the national level of all the products and services in ELWD may lead to overlap in programs and projects which is problematic given limited resources faced across the network.[5] As an additional consequence, programs may not be directly benefiting from each other. For example, a SG program that develops an environmental literacy product about wetland conservation on the west coast may help a project with similar goals on the east coast. This is somewhat alleviated by the PIER database[10] which is a useful resource for programs or stakeholders to search all projects within the network. However users are still limited to identifying and sifting through hundreds of projects that are relevant to their needs.

Opportunities

There are several opportunities that Sea Grant (SG) can take advantage of within the environmental literacy and workforce development (ELWD) focus area. The need for a Science Technology Engineering and Mathematics (STEM) ready workforce and STEM literate citizens has never been greater. Through coordination at the national level, SG has a very tangible opportunity to be on the forefront of the STEM field and direct conversations at a national level. This is in part because of the extensive STEM work that SG has already done and is doing across the nation. Building national level collaborations with other STEM organizations (e.g. National Science Foundation, National Science Teachers Association, National Marine Educators Association, and Department of Education) could help realize this goal.

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[8] PIER database Impacts and Accomplishments 2013. "More than 90 former Alaska Sea Grant–funded students have taken jobs as fisheries and marine professionals."

[9] The term *pipeline* is commonly used in the education field as a metaphor to describe educational programs and training modules as a series of linear steps to become a scientist or engineer. Reference: Metcalf 2010, "Stuck in the pipeline: a critical review of STEM workforce literature."

[10] NOAA Sea Grant PIER data base project search. http://seagrant.noaa.gov/WhatWeDo/SearchProjects.aspx

As SG looks to define what it means to be successful in the field of ELWD, one opportunity is to move beyond a typical linear *pipeline*[11] approach and consider a *pathways*[12] approach. A pathways approach acknowledges individuals in a STEM workforce experience many paths to reach STEM jobs and seeks to offer knowledge and skills that will guide individuals in their careers.[12] This also may be useful approach as SG tries to increase STEM service to diverse and underserved communities[13] because it focuses on skill sets in a variety of settings. SG may be particularly poised to accomplish this goal because it already has a network of educators and training programs across the country.

SG also has an opportunity to stay on the forefront of new technologies in the STEM field and use them to accomplish ELWD goals. New technologies such as data portals can be used to collaborate, share, and assess the success of ELWD products. Social media can be used to promote SG ELWD and actively participate in the STEM culture nationally. There is also a unique opportunity to look at the SG network and determine where there are avenues to engage stakeholders with new technologies that may benefit education and training on the ground.

Threats

There are several threats may pose risks to the Environmental Literacy Workforce Development (ELWD) focus area. For example, while shifts in funding are common to many areas that Sea Grant (SG) works in, they are also especially common in education. Education funding is often changing at different levels of government. This can result in SG education program partners being reorganized or consolidated in a way that may affect SG's goals.[5] In addition, political and legislative priority for STEM education and workforce fields may change at any time.[14,15] An unfortunate side product of shifting educational priorities is that SG educators or affiliates are often burdened with the reality of writing grants to fund their programs or projects.[5]

Emerging issues in the field of ELWD will always be a threat to SG. This is especially true if issues or best practices in science, technology, and pedagogy change faster than the speed that relevant programs and products are developed at SG. Educational standards also change and are variable across the network. For example, Next Generation Science Standards[16] were released for adoption in 2013 and some regions and schools have adopted them. SG needs to address whether its existing K-12 educational documents are still relevant and if new products and services need to be updated as more areas adopt these standards.

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[11] "Strengthening the STEM Pipeline: The Contributions of Small and Mid-Sized Independent Colleges." Council of Independent Colleges 2014. http://www.cic.edu/Research-and-Data/Research-Studies/Documents/STEM-Report.pdf

[12] "Revisiting the STEM Workforce: A Companion to Science and Engineering Indicators 2014." NSF. Feb 2014 http://www.nsf.gov/pubs/2015/nsb201510/nsb201510.pdf

[13] "NSF Asks for Diversity-Boosting Proposals." Feb 2016 http://newsbrief.synoptos.com/readarticleNew.cfm?a=3171391&m=281219&c=39&i=287725&u=0

[14] Pence signs $31 billion budget, with school funding shifts. Accessed March 1, 2016

[15] "Obama's Budget Shuffles STEM Education Deck." Accessed Feb 24 2016 http://www.sciencemag.org/news/2012/02/obamas-budget-shuffles-stem-education-deck

[16] Next Generation Science Standards. http://www.nextgenscience.org/

Analysis

Strengths Weakness Opportunities Threats (aka SWOT) analysis allows programs to identify strategies for overcoming weaknesses and threats while also identifying ways to maximize opportunities. Strategies for the Sea Grant (SG) Environmental Literacy and Workforce Development (ELWD) focus area include:

Strength-Opportunity Strategies
- SG can build on an already well developed network of programs, products, services to become a national leader in ELWD, providing synthesis and direction for future research and best practices.
- The extensive SG network can be used to increase service to underrepresented communities and increase diversity in STEM.

Weakness-Opportunity Strategies
- Increasing national ELWD coordination will help minimize overlap between programs and projects nationally and allow programs to more directly and tactically benefit from each other.
- SG can move from a linear *pipeline* approach to a *pathways* approach which acknowledges the many avenues to reach ELWD. SG can use the pathways approach to inform definition of goals and metrics of success and address the workforce development gap.
- SG can take advantage of new technologies including data portals, analyses, and online tools to bring SG products to a wide variety of audiences and to make tracking progress and measuring success in this focus area easier.

Strength-Threat Strategies
- SG's long history of ELWD and products provides a platform to address emerging issues in a historical context.
- The adaptive nature of the SG network and expertise in partnership building can help address changes in STEM funding, political priority, and emerging issues.

Weakness-Threat Strategies
- Increasing national ELWD coordination will make SG more adaptive to changes in STEM funding, political priority, and emerging issues.
- Having concretely defined strategic goals and increasing assessment and evaluation of ELWD products and services should help clarify and direct funding justifications.