NATIONAL ACADEMIES Sciences Engineering Medicine

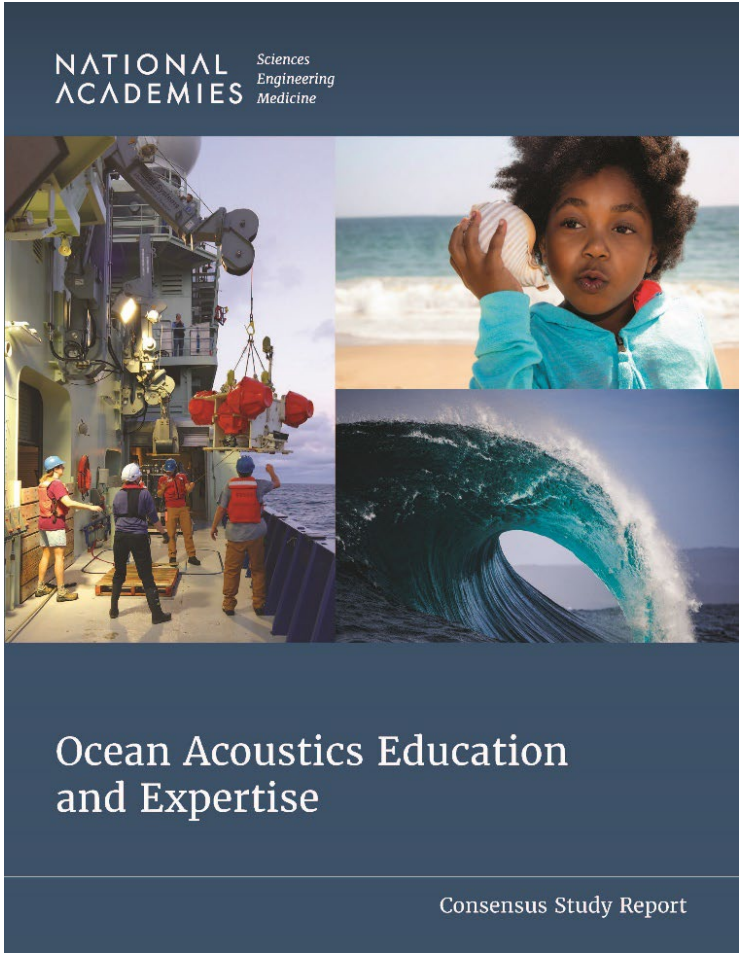
Ocean Acoustics Education and Expertise

Liesl Hotaling and Gail Scowcroft, Committee Members

AUGUST 29, 2024

Take-home Messages

- Careers within ocean acoustics are vital for the national security and defense, economic, and environmental sectors.
- Growth within these sectors is requiring increased ocean acoustic skills at all levels, **but especially technicians.**
- **Increased support for and and access to** training and education is needed to meet the demands of the growing ocean acoustics workforce.



Published Statement of Task

An ad hoc committee will assess the current and future state of ocean acoustics expertise required to realize the full value of ocean acoustics knowledge and capabilities across a diversity of fields and applications. This will be conducted through (1) an examination of ocean acoustics education in the United States, (2) assessment of the demand for acoustics expertise, as anticipated over the next decade, (3) identification of competencies required for undergraduate, graduate, and professional training programs that will be required to fulfill that demand, and (4) exploration of strategies to **raise the profile of careers in ocean acoustics**, including education, training, and workforce recruitment and retention. The report will include information on:

- Academic institutions that offer courses in ocean acoustics or include ocean acoustics as a unit within related coursework.
- Public and private sector professional-level organizations that require expertise in ocean acoustics as part of their operations.
- Ocean acoustics workforce needs in key sectors/industries.
- Training programs currently available in these key regions.
- Examples of current ocean acoustic programs.

This information will be gathered by the committee as part of their assessment of the needs for ocean acoustics expertise, anticipated demand in the next decade, and potential needs for additional training opportunities. The committee will recommend resources required to support ocean acoustics research and education, and **preparation and recruitment of a diverse workforce**.

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Committee

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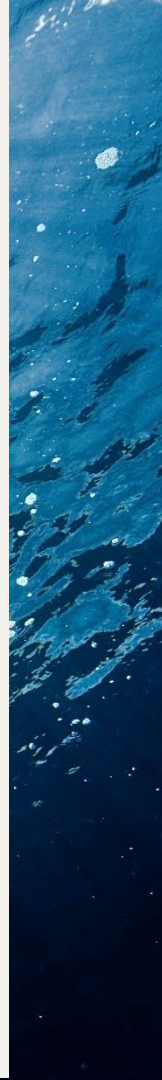


Study Overview

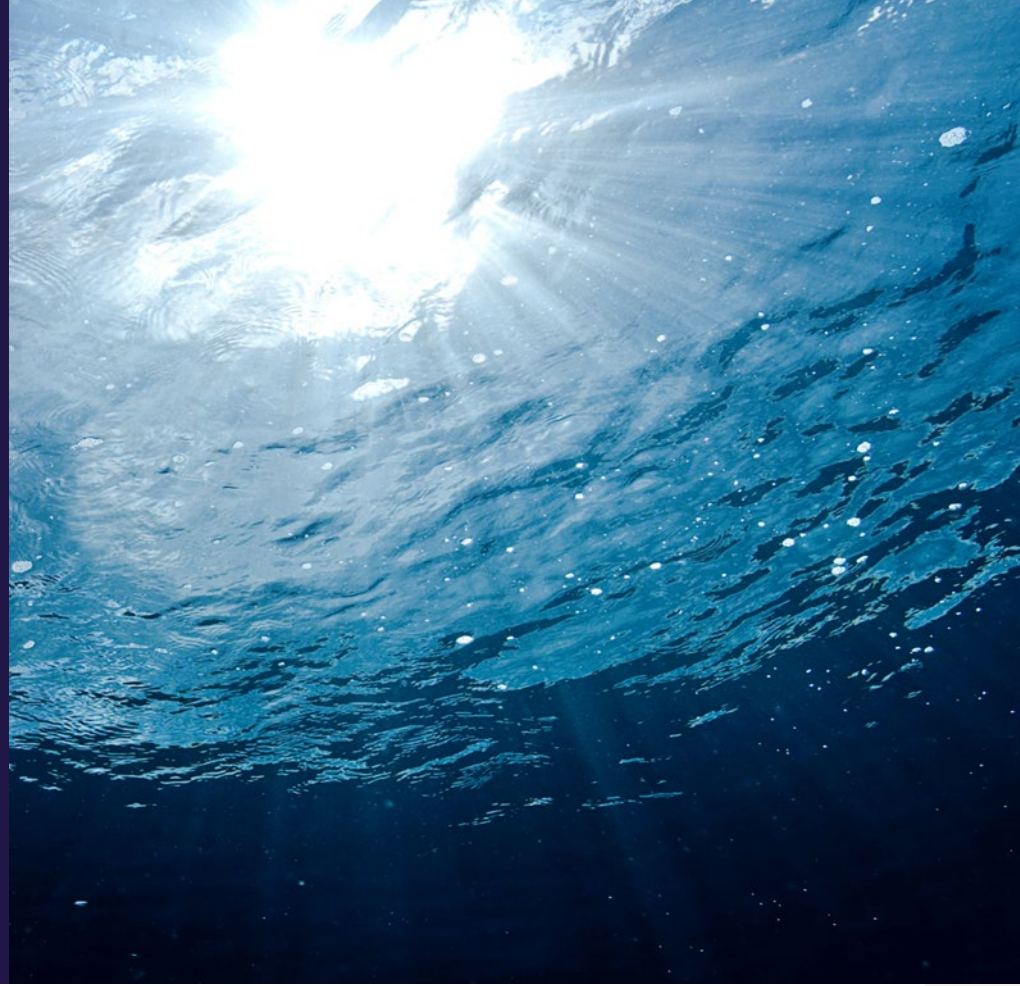
The committee collected information on topics to inform the report through:

- Review of relevant literature including reports and evaluations of various aspects of ocean acoustic research.
- Online survey on Ocean Acoustics Education and Expertise.
  - Contracted a consultant to develop, distribute and analyze results.
- Information gathering panels covering the following topics:
  - Workforce (Government, Academia, and Industry).
  - Early – Career and Recent Graduates
  - Higher Education and Training
  - Outreach
  - STEM Education
  - Naval Training Programs

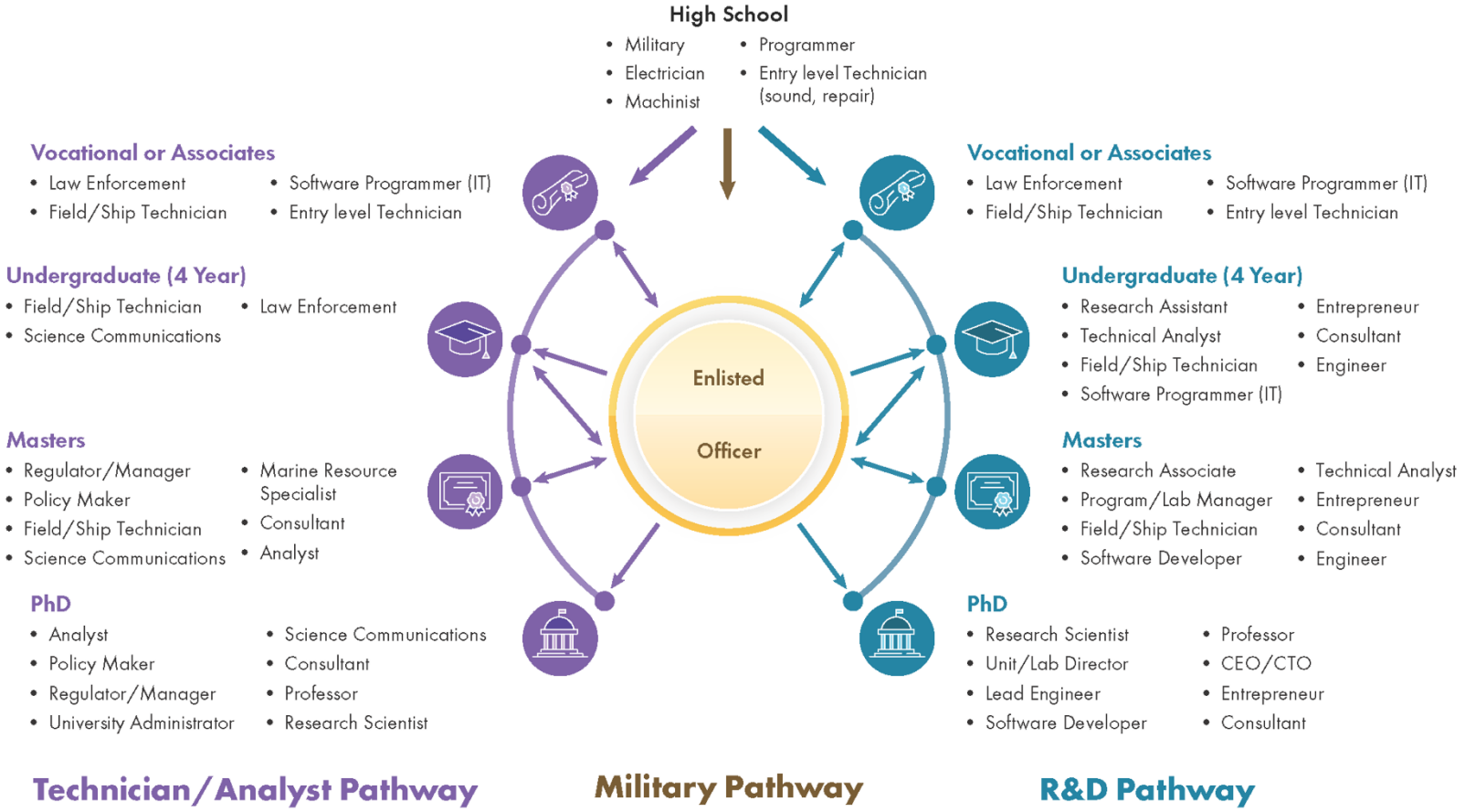
State of Ocean Acoustics Education and Training

More ocean acoustics learning opportunities are needed to prepare the volume of people and amount of knowledge required for the future marine technology workforce.

[Conclusion 3-5]



Sample Ocean Acoustics Career Paths



Current and Future Employment Landscape

Some jobs in ocean acoustics could be filled by those with technical training or on-the-job experience.

[Conclusions 4-2]

Organization Type	Applications
Academic institutions (degree-granting)	Full range of ocean acoustics activities
Aquaculture	Monitoring of behavior, fitness, enclosure conditions
Cable laying	Active and passive acoustics to support and maintain cable infrastructure; submit environmental compliance documents
Commercial fishing	Active acoustics for fish detection and bycatch deterrence
Industry organizations	Advocacy for and education about use of ocean acoustics; conduct studies on effects of ocean acoustics
Marine acoustic consulting	Desktop acoustic modeling to support various sectors; occasional sound source verification or other at-sea experiments
Marine survey, construction, and salvage firms	Active acoustics for seafloor and subseafloor characterization, mostly in support of site survey for infrastructure development (ports, energy); submit environmental compliance documents
Non-governmental advocacy organizations (environmental/conservation)	Passive acoustics to monitor marine life or ocean noise or advocate for conservation/management objectives
Nonprofit research institutions	Full range of pure and applied ocean acoustics activities
Ocean sensor instrumentation/technology firms	Design and market passive and active acoustic instrumentation
Offshore energy and carbon mitigation	Active acoustics for site and geotechnical surveys; submission of environmental compliance documents
Research foundations	Active and passive acoustics in support of applied (e.g., exploration) research; data science
Transportation (vessel owners and operators)	Active acoustics for biofouling/invasive species, navigational hazard detection

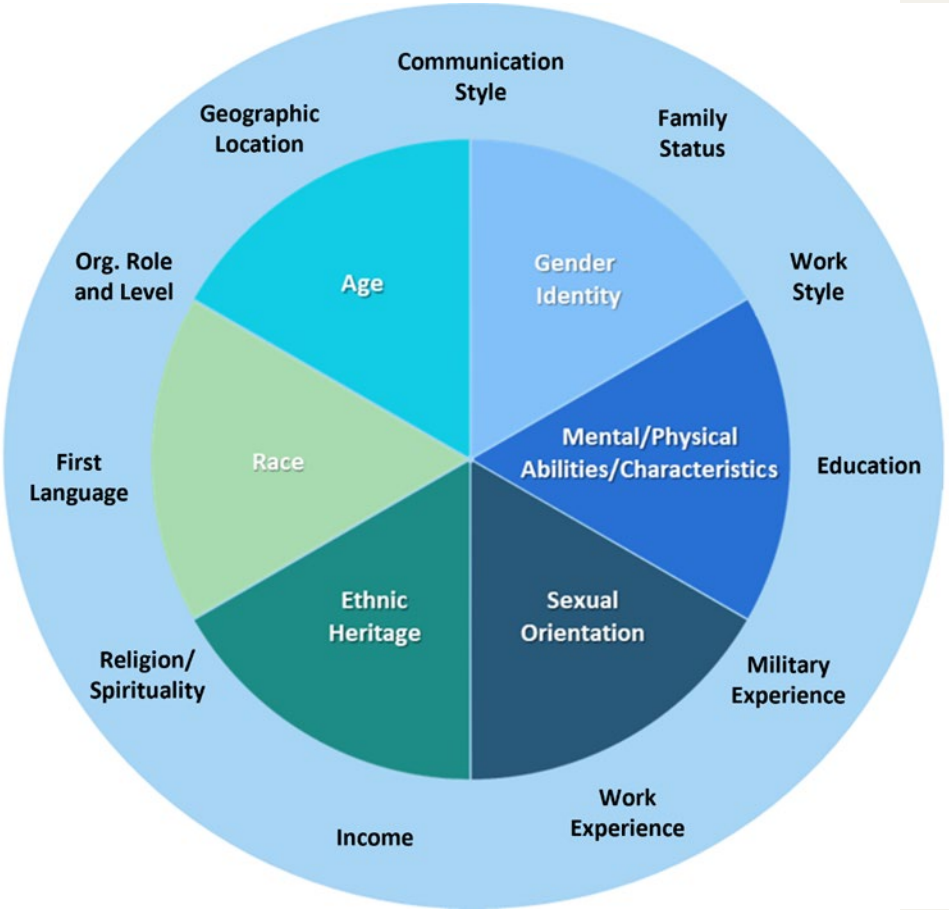
Attracting, Recruiting, Retaining, and Diversifying the Ocean Acoustics Workforce

Attracting, Recruiting, Retaining, and Diversifying the Ocean Acoustics Workforce

More granular demographic information is needed to develop support systems to encourage greater diversity in ocean acoustics.

The ocean acoustics community needs to take action to accelerate diversity and retain a diverse workforce.

[Conclusions 5-1 and 5-2]

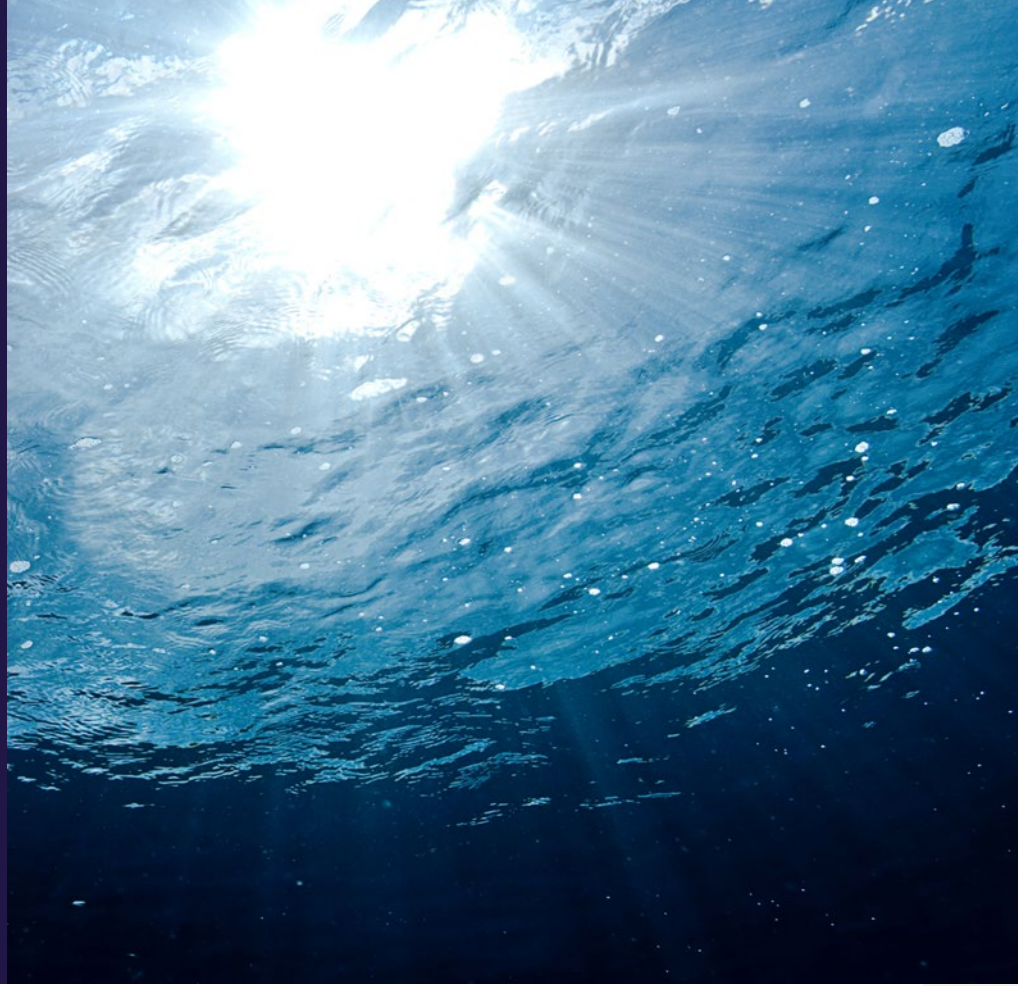


Source: Adapted from Williams (2013) and Yarber (2019)

Attracting, Recruiting, Retaining, and Diversifying the Ocean Acoustics Workforce

Issues suppressing parity include:

- A sense of belonging
- Implicit and explicit cultural and institutional constraints
- Underrepresentation in supervisory roles

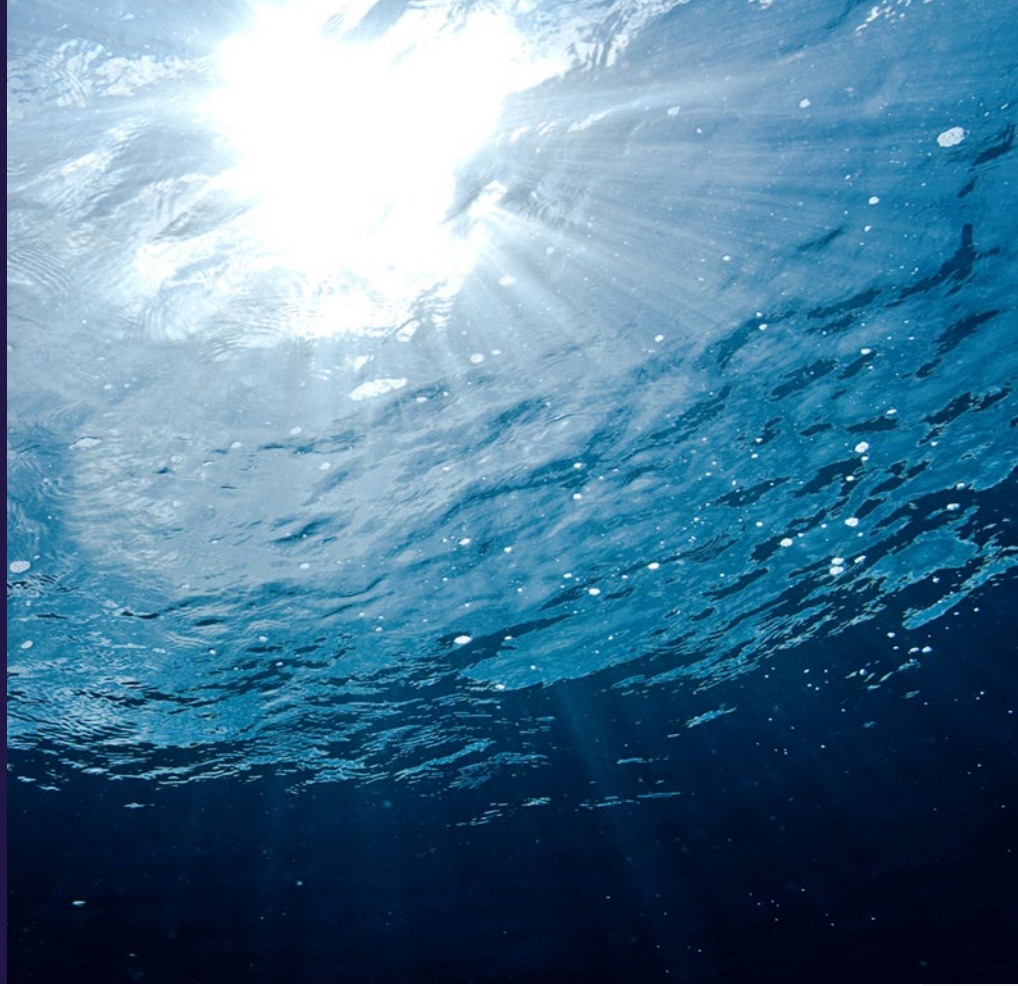


Recommendation 5-1 The ocean acoustics community should increase diversity and retention through the following:

- Institutions of higher education offering degrees in disciplines supporting ocean acoustics should increase academic retention programs to promote a sense of belonging for underrepresented students within STEM disciplines.
- Institutions of learning should provide more exposure to positive STEM role models and mentors for girls, young women, and underrepresented minorities at all education levels to integrate STEM identities, build STEM confidence, and demonstrate the possibilities for turning STEM learning into a career.
- Employers should improve the workplace climate for women and underrepresented minorities by challenging cultural biases, providing leadership training, supporting work-life balance, promoting parity and providing equal pay.

Recommendations for Addressing the Gaps Between Education and Expertise and Workforce Needs

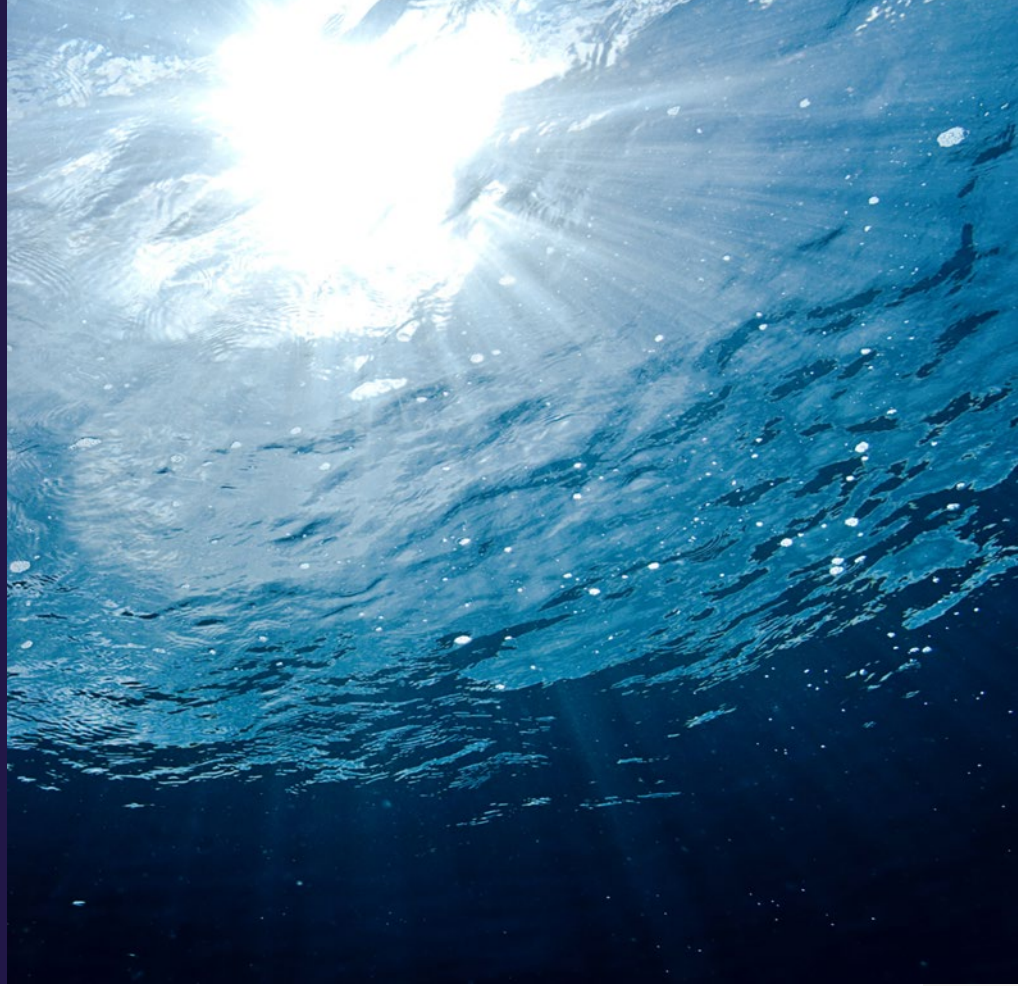
Without increased investment and ***regularly*** offered education, training, and outreach programs, the ocean acoustics community will not grow fast enough to meet workforce demands over the next decade.



Attracting, Recruiting, Retaining, and Diversifying the Ocean Acoustics Workforce

The COSEE model could be used by the ocean acoustics community to raise the profile of the discipline, train scientists and education professionals, and provide opportunities for ocean-acoustics-related activities to be integrated into existing K–12 curriculum.

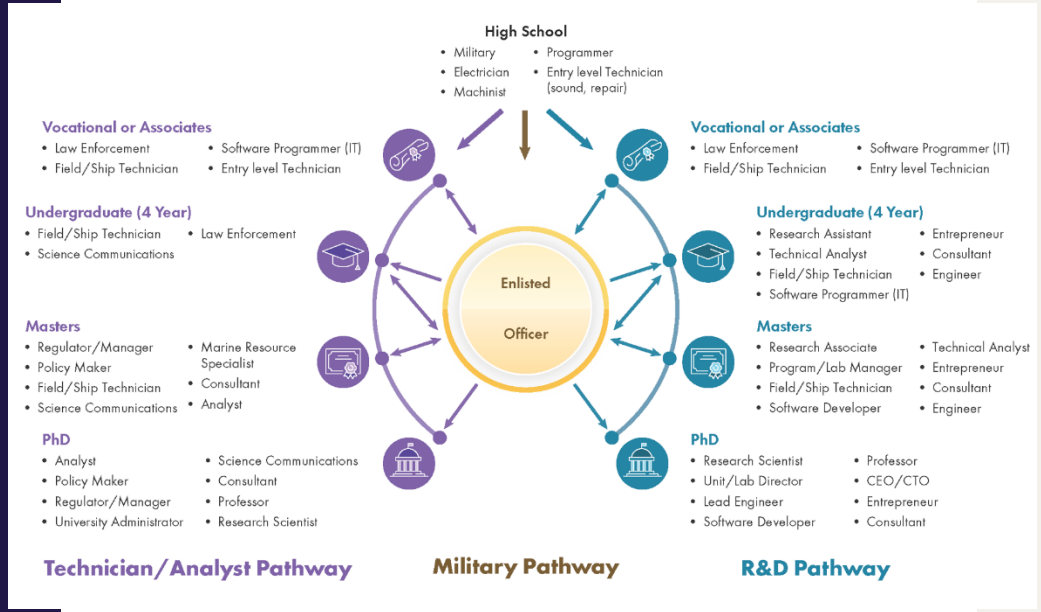
[Conclusion 5-7]



Attracting, Recruiting, Retaining, and Diversifying the Ocean Acoustics Workforce

Increasing awareness of ocean acoustics related career paths and jobs that are connected to community needs will reduce the perception that ocean acoustics is an overly specialized field.

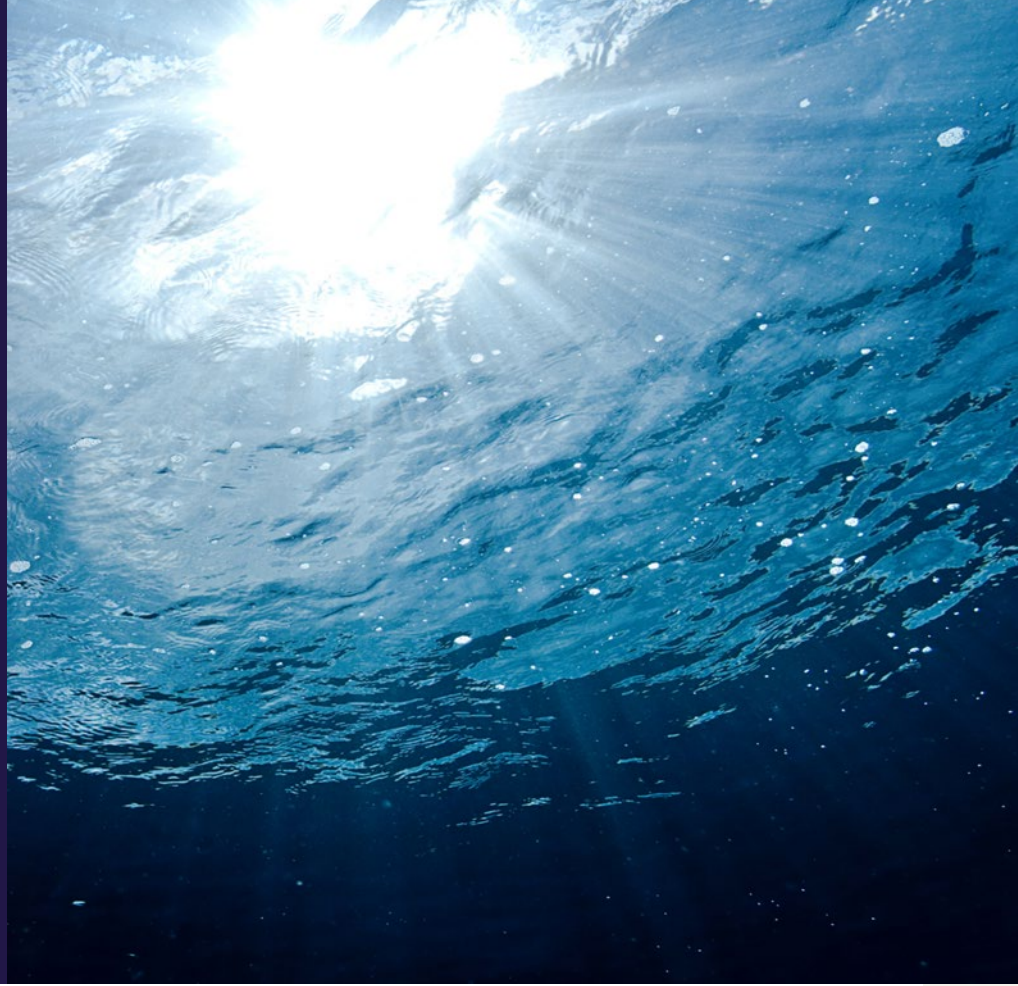
[Conclusion 5-9]



Attracting, Recruiting, Retaining, and Diversifying the Ocean Workforce

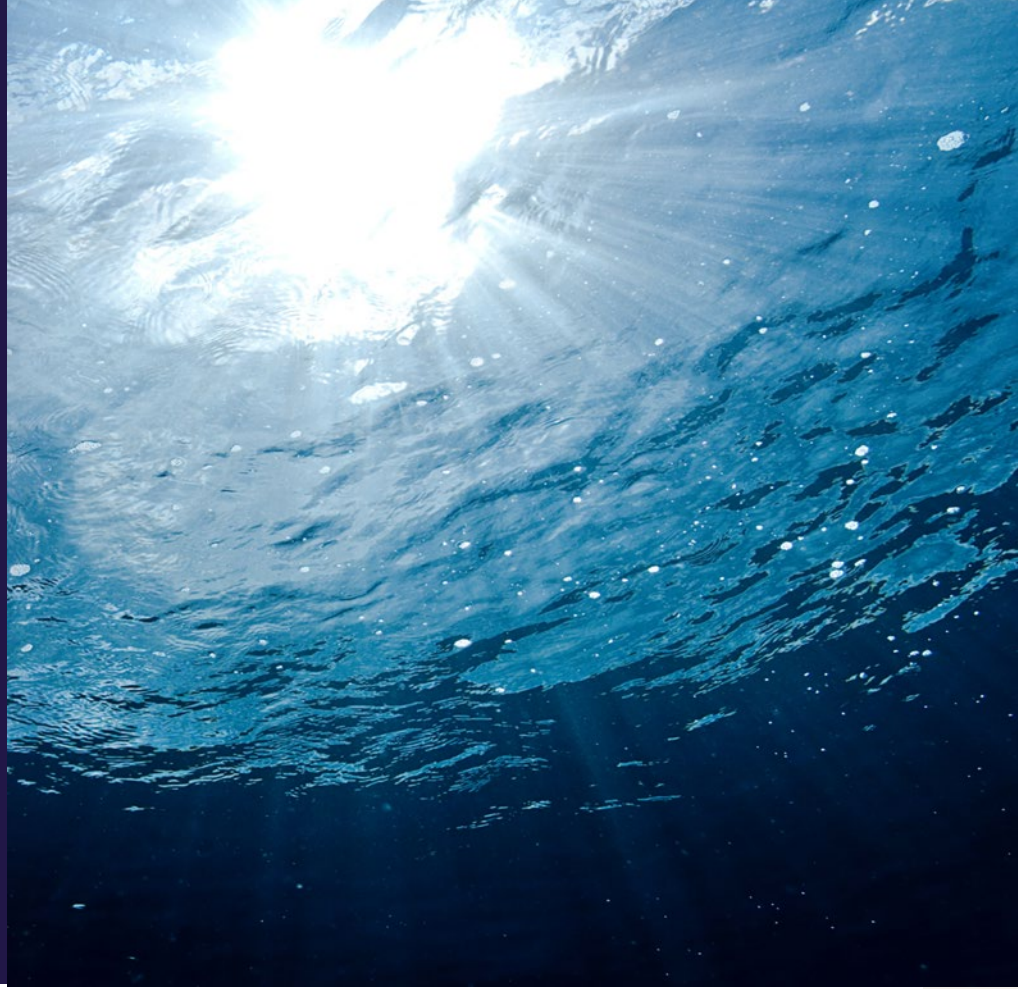
Employers' encouragement of professional development opportunities can help retain and develop acoustic talent on the job, especially related to expanding and retaining diversity.

[Conclusion 5-10]



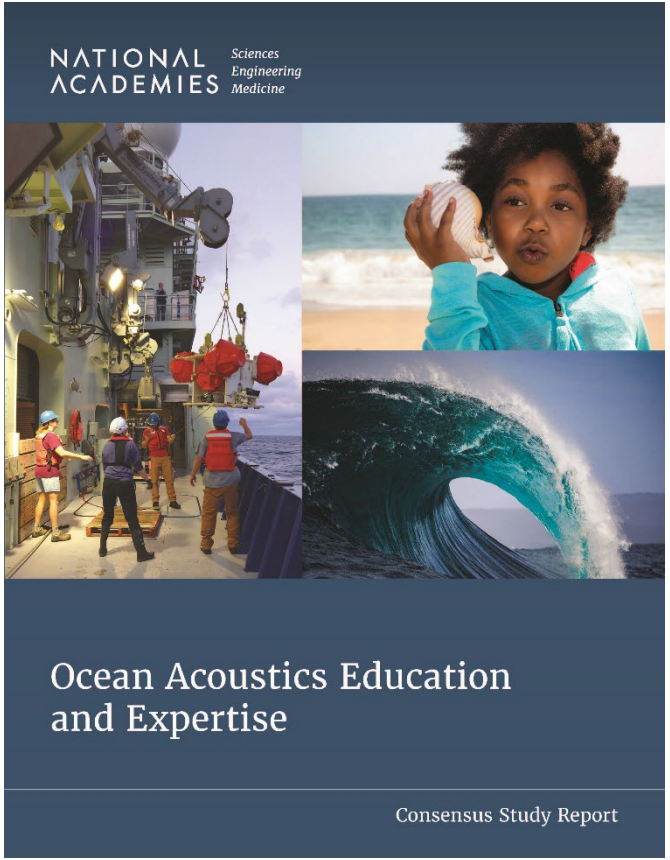
Summary

- The field of ocean sciences is growing with the expanding blue economy and technology advances.
- It remains critical to continue to support advanced degrees while developing programs at the vocational or associates' level.
- The interdisciplinary nature of the field can be used to help expand education and training programs and increase outreach to meet workforce demands.



Download the Report

https://nap.nationalacademies.org/catalog/27337/ocean-acoustics-education-and-expertise



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Questions?

CONSENSUS STUDY REPORT