



Practical Recommendations to Help Students Bridge the Research–Implementation Gap and Promote Conservation

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Abstract: *Seasoned conservation researchers often struggle to bridge the research–implementation gap and promote the translation of their work into meaningful conservation actions. Graduate students face the same problems and must contend with obstacles such as limited opportunities for relevant interdisciplinary training and a lack of institutional support for application of research results. However, students also have a crucial set of opportunities (e.g., access to academic resources outside their degree programs and opportunities to design research projects promoting collaboration with stakeholders) at their disposal to address these problems. On the basis of results of breakout discussions at a symposium on the human dimensions of the ocean, a review of the literature, and our own experiences, we devised recommendations on how graduate students can create resources within their academic institutions, institutionalize resources, and engage with stakeholders to promote real-world conservation outcomes. Within their academic institutions, graduate students should foster links to practitioners and promote knowledge and skill sharing among students. To institutionalize resources, students should cultivate student leaders and faculty sponsors, systematically document their program activities, and engage in strategic planning to promote the sustainability of their efforts. While conducting research, students should create connections to and engage actively with stakeholders in their relevant study areas and disseminate research results both to stakeholders and the broader public. Our recommendations can serve as a template for graduate students wishing to bridge the research–implementation gap, both during their current studies and in their future careers as conservation researchers and practitioners.*

Keywords: conservation education, graduate education, interdisciplinary research, research–implementation gap

Recomendaciones Prácticas para Ayudar a Estudiantes a Vencer la Brecha entre Investigación e Implementación y Promover la Conservación

Resumen: *Investigadores de la conservación con experiencia a menudo batallan para vencer la brecha de investigación–implementación y promover la traducción de su trabajo a acciones de conservación significativas. Los estudiantes de licenciatura enfrentan el mismo problema y deben luchar con obstáculos como las oportunidades limitadas para entrenamiento interdisciplinario relevante y la falta de apoyo institucional para la aplicación de los resultados de la investigación. Sin embargo los estudiantes también tienen un conjunto crucial de oportunidades (e. g., acceso a recursos académicos fuera de sus planes de estudio y oportunidades para diseñar proyectos que promuevan la colaboración con las partes interesadas) a su disposición para resolver estos problemas. Con base en los resultados de discusiones novedosas en un*

simposio sobre las dimensiones humanas del océano, en una revisión de la literatura y en nuestras propias experiencias, diseñamos recomendaciones sobre como los estudiantes de licenciatura pueden crear recursos dentro de sus instituciones académicas, institucionalizar los recursos y vincularse con las partes interesadas para promover resultados de conservación reales. Dentro de sus instituciones académicas los estudiantes de licenciatura deben fomentar enlaces con profesionales y promover el conocimiento y la compartición de habilidades entre estudiantes. Para institucionalizar los recursos los estudiantes deben cultivar líderes estudiantiles y docentes patrocinadores, documentar sistemáticamente sus actividades del programa y participar en planeación estratégica para promover la sustentabilidad de sus esfuerzos. Mientras llevan a cabo investigaciones los estudiantes deberían crear vínculos y participar activamente con las partes interesadas en las áreas relevantes de estudio y diseminar los resultados de la investigación tanto a las partes interesadas como al público en general. Nuestras recomendaciones pueden servir como plantilla para estudiantes de licenciatura que deseen vencer la brecha investigación-implementación, tanto durante sus estudios actuales como en sus futuras carreras como profesionales e investigadores de la conservación.

Palabras Clave: brecha investigación – implementación, educación para la conservación, educación de licenciatura, investigación interdisciplinaria

Introduction

Research–Implementation Gap in Conservation

Many conservation researchers aim to advance knowledge and obtain meaningful conservation actions. However, scientists often pay insufficient attention to understanding mechanisms through which conservation research can be translated into action, resulting in a “research–implementation gap” (Balmford & Cowling 2006; Knight et al. 2008; Boreux et al. 2009). A variety of factors contribute to the conservation research implementation crisis, such as the disconnect between scientists and policy makers and resulting difficulties in integrating scientific knowledge into policy (e.g., Pietri et al. 2011; Laurance et al. 2012). The science–policy disconnect has multiple roots: the divergent time scales of policy processes and conservation research (Cash & Buizer 2005); institutional differences between academia and the management and policy realms (Holmes & Clark 2008; Laurance et al. 2012); and mitigating factors such as societal needs and political realities (Heazle 2004).

In addition to the disconnect between science, policy, and management, conservation researchers often fail to invest sufficient effort in collaborating with stakeholders (e.g., community members, local organizations, and managers); target research toward questions relevant to local communities; and incorporate diverse perspectives and expert local knowledge (Knight et al. 2008; Shackleton et al. 2009). Even when researchers are aware of the importance of collaboration such efforts are rarely implemented effectively; thus, the effectiveness of conservation actions is undermined (Boreux et al. 2009). Researchers must make further effort to implement management recommendations and reduce threats—actions that can eventually lead to improved conservation (Kapos et al. 2008).

Combined, the suite of factors highlighted above greatly limits conservation science’s ability to achieve long-term effects. Scientists may be able to produce tangi-

ble research outputs, such as management recommendations or informational materials for stakeholders (Koontz & Thomas 2006). However, outcomes (i.e., the effects of research on environmental and social conditions) and lasting effects (i.e., long-term changes in the status of habitats or ecosystems) are more difficult to achieve and document (Koontz & Thomas 2006; Kapos et al. 2008).

Engaging Graduate Students in Bridging the Gap

Graduate students in conservation face similar challenges in bridging the research–implementation gap as seasoned researchers, if not more so, given they are still working to establish themselves. Students cope with problems that established researchers also face, such as limited interdisciplinary training (e.g., social sciences, practical skills used by conservation practitioners) and lack of institutional support for the application of findings (Duchelle et al. 2009; Christie 2011). When limited research funding is available, students may be forced to limit their research scope and exclude activities promoting application of results. Narrowing research scope due to limited funds can be a particular problem for master’s students because programs are shorter and less funding is available. However, students have a unique set of opportunities at their disposal to address research-application problems (Duchelle et al. 2009; Courter 2012). Students may be able to capitalize on opportunities within their institutions and take courses, such as program evaluation and science communication, that strengthen their interdisciplinary knowledge (Pérez 2005; Muir & Schwartz 2009). Additionally, students may design their research projects to promote collaboration with stakeholders and may have the flexibility to spend longer periods in the field than seasoned researchers.

Despite recent literature on the role of graduate students in overcoming the research–implementation gap (e.g., Kroll 2007; Duchelle et al. 2009; Courter 2012), there is still a critical need to understand mechanisms

by which students can increase the likelihood that their research yields conservation actions. The existing literature focuses on how students can collaborate and share knowledge with stakeholders. However, it provides few concrete examples of pathways for realizing productive collaboration without significant institutional support or existing stakeholder connections. Furthermore, discussion of methods that students can use to engender institutional support is missing in the literature, as is consideration of tactics for bolstering practical skills that are useful for stakeholder collaboration. Therefore, we offer suggestions on how students can bridge the research-implementation gap by exercising self-agency and creating grassroots changes in ways that require minimal resources and institutional support.

Our recommendations are the result of a 3-day workshop in 2012 on the human dimensions of the ocean. The event fostered breakout discussion groups to solicit expert and participants' opinions on strategies for graduate students to promote conservation effects. On the basis of the workshop's results, a review of the literature, and our own practical experiences, we devised recommendations related to 3 key topics: creating resources for graduate students within their academic institutions; institutionalizing resources; and engaging with stakeholders to promote the potential achievement of real-world conservation outcomes. The practical experiences represent successful strategies students in conservation-oriented programs at Duke University, James Cook University, New Mexico State University, University of California Santa Cruz, and University of Washington found helpful in advancing the application of their research toward conservation actions. Each of the programs referenced throughout this paper provides basic support and institutional guidance for graduate research (e.g., preliminary research funding, introductions to nonacademic partners). However, students found that research funds were often limited and securing institutional support to engage in application activities was difficult. The examples outlined below document common roadblocks and successful strategies to overcome them, which students encountered at various stages of their training and research. Although there are many factors that influence whether a student's research has conservation effects, our recommendations (Table 1) provide a way for students to conduct research that can promote tangible conservation effects.

Creating Resources within Institutions

Graduate students entering master's or PhD programs in conservation fields expect to gain knowledge and skills necessary to apply their future research toward conservation action. However, study programs generally focus on academic theory and research techniques. Students are

often not taught skills they can use to apply theoretical knowledge, whether they remain in academia or move into the nonprofit or government sector (Duchelle et al. 2009; Courter 2012). However, if students are not gaining the expertise they need for future employment from their educational institution, they have opportunities to exercise self-agency and create their own resources. By going beyond skills that a study program directly provides, students expand their professional network, practical skills and experience, and access to additional resources and funding (Table 1).

Foster Links to Practitioners

Although conservation researchers and practitioners share many goals, difficulties in communication between them limits the effects of conservation activities (Laurance et al. 2012). Graduate students often have opportunities to interact with practitioners directly. However, students must put effort into engaging effectively with practitioners. One technique students can use to further practitioner connections and create opportunities for nonacademic professional development is informational interviews (Peréz 2005) (i.e., interviews students can hold with professionals to gather information about career realities, research relevant to practitioners, and advice on getting started in the field). Informational interviews and engagement with practitioners will help students increase their research relevance; align with agencies that could bolster research effects; and expand their professional network and future employment opportunities.

Self-advocacy is imperative in expanding a professional network and creating skill-development opportunities, particularly given the challenges students may face in identifying and forming meaningful connections with nonacademic partners. Students should seek experiences that align with their career goals and help them develop opportunities to build skills needed for a conservation career (Muir & Schwartz 2009). One way to build skills is through volunteering with conservation organizations or participating in embedded experiences where a student spends an intensive period of time enmeshed in nonacademic communities, such as nongovernmental organizations (NGOs) or government agencies (Jenkins et al. 2012). For example, because of a desire to develop practitioner connections, a student volunteered with Sea Grant—a federally funded research, outreach, and education organization—throughout her master's program. Volunteering allowed her develop a professional network and led to a position with Sea Grant upon graduation. Although students are often overtaxed with existing academic requirements, for some, the benefits of expanding their professional network and forming connections outside of academia may outweigh the costs.

Table 1. Summary of key strategies, tasks, benefits, and challenges for students working to bridge the research–implementation gap.

<i>Phase</i>	<i>Strategy</i>	<i>Tasks</i>	<i>Benefits</i>	<i>Challenges</i>
Creating resources within institutions	foster links to practitioners	conduct informational interviews with practitioners	educates students in conservation career realities provides employment leads and expands professional network	difficult to form connections with nonacademic partners limited time for extracurricular activities
		volunteer with and participate in internships with NGOs, government agencies, and conservation organizations	creates new links to nonacademic partners	
	promote knowledge and skill sharing among graduate students	join peer discussion groups for improving nonacademic skills	allows students to improve nonacademic skills provides forum to share nonacademic experiences	
Institutionalizing resources within academic programs	cultivate leaders and sponsors	engage diverse student leadership	fosters shared ownership, diverse membership, and smooth leadership transfer	difficult to find sponsors because of limited perceived value in academic system transferring products to and engaging new leaders effort required to conduct program evaluation
		obtain faculty champions and sponsors	demonstrates legitimacy of student-led efforts helps activities achieve formal university status	
	document activities and plan strategically	record, evaluate, and archive outputs, outcomes, potential impacts, and lessons learned	helps students sustain their programs builds support for programs w/in organizations and communities	
Engaging with stakeholders to promote real-world conservation outcomes	create stakeholder connections	target research toward stakeholder needs (e.g., agencies, NGOs, communities)	increases relevance and applicability of research	temporal and financial constraints of academic programs
		budget for stakeholder engagement	expands students' field research and engagement opportunities	
	engage actively with stakeholders	encourage local participation in research activities	provides opportunities for ongoing engagement	political realities may limit ability to connect with relevant stakeholders cultural differences may push students outside of comfort zone
		disseminate research results through reports and workshops	increases stakeholder knowledge, skills and capacity to continue future research, monitoring, and management efforts	
	share research with stakeholders	engage with stakeholders in interpretation and implementation of recommendations	creates potential for local stakeholders to continue conservation efforts	students must develop effective science communication skills
disseminate research to the broader public	discuss research results in social media outlets (e.g., blogs, Twitter) write general media research articles	increases likelihood research results will influence policy/management decisions		
			creates broader audience for research results	
			increases potential for public support of research and related policy decisions	

Promote Knowledge and Skill Sharing among Graduate Students

In many instances, it is not necessary for students to look beyond their university to expand their skill set. Students can form peer discussion groups aimed at improving nonacademic skills, such as science communication and mechanisms for stakeholder collaboration (Peréz 2005; Duchelle et al. 2009). Students at one university used this strategy and formed a Science and Culture Club to encourage science communication and the union of science, art, and culture in the broader community. The group holds monthly exhibitions at an art gallery, which features art works produced through collaborations between local scientists and artists. The first exhibition featured a video installation of coral reef images. In addition to facilitating engagement between the public and scientists, this club has enabled the students involved to develop their skills in communicating their work to the general public—a skill that is underdeveloped in academia. Spurred by a similar desire to increase their ability to communicate science and promote peer learning, students from 2 universities formed a group called Women in Marine Science and Conservation. This group provides a forum through which they share their experiences and knowledge of applying science to management and conservation, lending a personal perspective to a largely theoretical field. Initiating and engaging in peer-learning efforts may be challenging because of the increased time and effort on the part of the already busy student; however, students interested in expanding their skills may see the trade-offs as worthwhile.

Institutionalizing Resources in Academic Programs

Initiatives to create effect-oriented student groups or networks with nonacademic partners often have initial momentum and garner excitement from colleagues. However, such enterprises require long-term collaboration among students and multiple partners. Beyond the initial start-up phase (Sharfman et al. 1991) of effect-oriented collaborations, it is important to consider their long-term sustainability. If students build and institutionalize their efforts (Table 1), they can provide continued resources for other students and seasoned researchers in their institutions who wish to engage in effect-oriented conservation work.

Cultivate Leaders and Sponsors

Creating conservation-oriented research and outreach requires collaboration among students, professors, and outside organizations (e.g., NGOs, communities, professional societies). One way to enhance the sustainability of such activities is to engage diverse student leadership.

Although one student may spearhead an initiative, if this student is the sole leader and supporter of the program it is unlikely to last beyond the leader's academic tenure (Bryson et al. 2006). Engaging multiple participants can create shared program ownership, facilitate continued engagement of new students, and aid smooth leadership transfer. A student chapter of The Coastal Society provides a useful example of a diverse and sustained conservation-oriented student group. The student chapter endeavors to provide links among students with an interest in marine and coastal issues, professionals in the field, and local communities through networking events, community service, and student conferences. Because many of The Coastal Society student members are enrolled in 2-year master's programs, in all of their efforts one chapter aims to involve many students and encourages them to hold leadership roles. Additionally, this chapter has coordinated with similar student organizations, such as a university chapter of the American Fisheries Society, to coproduce events. Although the student chapter of The Coastal Society at one university has encountered roadblocks (e.g., years with waning student membership, difficulties raising sufficient funds for conferences), their wide engagement of student partners and collaboration with like-minded students groups demonstrates one of the ways the student chapter has been able to sustain and build upon their successes.

Obtaining faculty champions and sponsors who are interested in effect-oriented conservation work can also promote the longevity of student-run programs. Faculty support helps demonstrate the legitimacy of student efforts to the wider academic community. Legitimacy is a crucial factor in the sustainability of any collaboration (Bryson et al. 2006) and thus imperative to student-initiated programs. Faculty support may help institutionalize programs by connecting students to resources not at their disposal, such as listing groups on departmental websites or helping a group transition from a skill-building club to an actual course. For instance, at UW students decided to create a Coupled Human and Natural Systems (e.g., Liu et al. 2007) journal club. The club was designed to expose students to useful examples of interdisciplinary conservation research and its policy and management applications, areas that many students believed were lacking from existing curricular options. By obtaining a faculty sponsor for the journal club, students were able to obtain an official seminar listing on the university's time schedule. The club's formalization led to diverse membership in the course with students from over 4 departments. The journal club allowed the students to become familiar with a wide array of interdisciplinary conservation literature and has been sustained over multiple quarters.

Creating sustained leaders and obtaining faculty support are not without their difficulties. Students are unlikely to be able to ensure the sustainability of their efforts

once they complete their program, particularly because some cohorts may be more enthusiastic about extracurricular activities than others. For finding faculty sponsors, one difficult reality is the lack of incentives for faculty to engage beyond their existing and substantial academic responsibilities. Courter (2012) suggests rewarding faculty for their applied conservation work, but graduate students rarely have the tenure or political clout to alter faculty-level reward structures. Rather, an approach that is practical for more graduate students and institutions is to seek out faculty who are supportive of the types of student initiatives outlined above and who are willing to engage because they find the work personally fulfilling. Although personal values and fulfillment might be the primary driver for faculty participation, graduate students should still seek opportunities (e.g., nominating faculty for distinguished service awards, inviting them to give seminars) to recognize supportive faculty in ways that are valued within academia.

Document Activities and Plan Strategically

Documentation is critical for perpetuation of research and outreach activities and understanding their possible contribution to conservation. It is imperative for students to document their efforts, lessons learned, and successes. There are 2 main audiences for this documentation: future project participants and stakeholder groups interested in the students' work, for whom the documentation can serve as an important communication tool (Duchelle et al. 2009; Courter 2012). For example, a student at Duke University spearheaded the development of a graduate student handbook for her department. The handbook documented lessons learned and best practices for all aspects of graduate student life, including the graduate-student-initiated community and conservation outreach activities. The handbook summarized the various outreach events, jobs that needed to be filled to orchestrate them, and a timeline of tasks—all of which were important factors in helping students sustain conservation-oriented programs.

Critically evaluating the outputs, outcomes, and effects of conservation programs is recognized as crucial for their success (e.g., Saterson et al. 2004; Ferraro & Pattanayak 2006). Thus, students should strive to record, evaluate, and archive all products created. Recording and highlighting the outputs, outcomes, and any potential long-term effects of student collaborations not only helps students sustain their programs, but also builds support for programs within partner organizations and communities. Evaluating a program's success requires additional time and effort on the part of the students; however, an archive of the group's work can publicize the story of the work and build legitimacy both within the program and from external partners. When publicizing the results of their efforts students should be sure to emphasize the

collaborative partnerships they have formed with those outside of their academic institution. For instance, a post-doctoral fellow highlighted research team members from the local community in her research blog (Jenkins 2011). Other students were able to include research assistants from local conservation organizations who had served as critical partners in data collection and interpretation as coauthors on papers published as a result of their research (Pietri et al. 2009; Maxwell et al. 2011).

Once students have established that their activities provide a productive pathway for engaging with nonacademic partners and offer the potential to promote positive conservation outcomes, they have the ability to leverage their initiative's reputation and get funding. Students can present the program to departmental or university administration and market it as a proven program that already has informal university affiliation but no financial support. If students can demonstrate that the department or university would be sponsoring a legitimate program, the university has the potential to reap immediate benefits by extending the program's reach and formalizing its relation with the university. Additionally, formalization may encourage the university to commit additional multiyear funds to the program. By following a similar process, a graduate of Duke University was able to convince the National Oceanic and Atmospheric Administration (NOAA) to sponsor an American Association for the Advancement of Science and Technology Policy Fellow. The director's office of NOAA has since committed funds for new fellows for 5 years and is dedicated to extending this funding in the future. Although securing institutional funding may be challenging given the current financial cutbacks in many universities, attempting to gain official support for student-initiated efforts still represents an important avenue for graduate students to pursue.

Although students should plan for the future through-out building of student-led conservation programs, such long-term vision is especially important when trying to institutionalize a program. Actions such as conducting end-of-year evaluations, drafting action plans and budgets, and creating an online platform to share resources will help assure a program's longevity. If students are able to institutionalize and sustain conservation-related endeavors they can increase the likelihood that future cohorts of students will have access to these resources.

Phases of Stakeholder Engagement to Promote Real-World Conservation

Many students' chief motivation for undertaking graduate degrees in conservation science is achieving real-world improvements (Lowman 2009). Although partnering with local stakeholders will not guarantee that research has an effect, it has many potential benefits. These include enhancing the relevance of research, fostering the

exchange of knowledge between students and stakeholders, and increasing the likelihood of success (Kainer et al. 2009). Students can engage with stakeholders directly associated with their study area (e.g., resource users, local government organizations, NGOs) throughout the different phases of their research (Table 1).

Design

Engaging with stakeholders when initially developing research questions greatly increases the probability research will have on-the-ground effects (Jenkins & Maxwell 2011). Resource users, local agencies, and NGOs involved in the management of resources or species often have a wealth of knowledge regarding conservation issues, local context, and management information needs (Kainer et al. 2009; Laurance et al. 2012). Local parties may not always be interested in student collaborations. However, when possible, early discussions can prove invaluable for identifying key issues and designing research that is likely to be valid, relevant, and fill information gaps (Morgan & Curtis 2008; Kainer et al. 2009). For example, some university students undertook their master's research in the Philippines and worked closely with a local NGO, Coastal Conservation and Education Foundation (CCEF). To conduct research in line with local needs, they collaborated with CCEF when designing their research. Consequently their research addressed information needs integral to CCEF's conservation activities, such as helping communities design a network of marine protected areas (MPAs) (e.g., Pietri et al. 2009; Varney et al. 2010). Additionally, some of their research findings were later incorporated into educational material developed by CCEF and a student regarding the establishment of community-based MPA networks (Varney et al. 2010). This guide has been distributed broadly as a handbook for small communities wishing to establish MPA networks. Although collaborating with CCEF often meant students had to wait until arrival in the field to fully develop their research approach (as opposed to having a concrete plan ahead of time), it allowed them the flexibility to adapt their interests to align with those of the local organization.

If students can communicate with local groups prior to beginning research (which may be difficult due to time and location constraints), they may also develop and submit grant applications in conjunction with relevant local management institutions. Collaborative grant applications may increase the chances the management institution will have an immediate and vested interest in the work and thus bolsters the likelihood the institution will implement recommendations generated by research.

Implementation

During the implementation phase of research, graduate students can engage local stakeholders by encouraging

their participation in research activities. Although in certain contexts students may be hindered by cultural differences that take them outside their comfort zone (Kainer et al. 2009), involving stakeholders in research provides potential mutual advantages. Students gain local skills and knowledge of the biological and cultural system, and stakeholders may gain knowledge and research skills from students, which may increase awareness and capacity to manage resources and undertake future conservation activities (Cabanban & White 1981; Stepath 2000). Conservation students can further contribute to knowledge and skill building by involving stakeholders in data analyses and manuscript preparation (e.g., Maxwell et al. 2011). For example, to foster strong community connections that could lead to long-term conservation effects, a PhD student conducting research in Indonesia engaged closely with a local NGO at each stage of her research. She developed her research questions to align with the NGO's management information needs (as well as the theoretical demands of her PhD research) and worked directly with the NGO to conduct research, including data collection and analyses and interpretation of information used to inform their adaptive-management process. Although students should avoid biasing their research by catering to any specific NGO agenda, this student found many advantages to the collaboration. She was able to draw on the NGO's previously established relationship with villagers and wealth of local knowledge, and the NGO gained skills and knowledge in experimental design of conservation-related research.

Dissemination

Upon completion of research projects, it is helpful for conservation scientists to disseminate findings to relevant stakeholders in order to contribute to real-world conservation outcomes (Morgan & Curtis 2008). Students can disseminate research results to local communities through presentations, reports, and posters that are customized to a community's educational and cultural context and interests. For example, while working in Gabon, Africa, a researcher disseminated the outcomes of her turtle research in a short report aimed at stakeholders that was translated into the local language and included local-language translations of scientific publications as supplementary material (Maxwell et al. 2011). As a result, stakeholders have been able to continue the study after her departure. Additionally, due to involvement from a local NGO that interfaces directly with management agencies, her results have been applied to the expansion of existing MPAs to create the region's first international MPA.

The more active a stakeholder's role in interpreting information presented to them, the more likely the information is to be incorporated into their beliefs and attitudes, potentially leading to concomitant behavioral change

(Freire 1970). Therefore, active learning approaches, such as workshops and community forums can be useful for building stakeholder knowledge and disseminating research findings. However, more passive learning approaches, such as posters, brochures, and reports can serve as important and long-lasting complements to more active tools. Unfortunately, political realities may limit the ability of students to engage actively with individuals or institutions able to make policy or management changes. However, graduate students should attempt to involve relevant management institutions and local groups in translating data into management recommendations (as opposed to just providing them with management suggestions). In addition to improving stakeholders' understanding of issues, local groups will be better positioned to translate data into management recommendations in the future.

An active approach is more likely to be possible if the relevant management institutions were involved in the research design phase. A student had local fishers help attach satellite-tracking tags to sea turtles as a tool to inform fishers about the effects of bycatch in Mexico. Fishers gained knowledge about turtle behavior and were involved in interpreting the effects of bycatch. Their experiences prompted them to undertake a number of voluntary conservation actions, including a community-wide gear-switching project, voluntary retirement of high-bycatch gear, and implementation of self-enforced closure of areas to fishing to protect turtles (Peckham et al. 2007).

Conservation students can extend the effects of their work on local communities beyond the duration of their research in a number of ways, which require different levels of temporal and financial commitment. For instance, if students aid in the development of decision-support tools for management during their project, these can be made available to local stakeholders. The regional-scale coral reef simulation model developed by Melbourne-Thomas et al. (2011a, 2011b) is accessible to the public on a dedicated website (www.reefscenarios.org), where practitioners can use the model (with a user-friendly interface) to explore potential conditions of coral reefs under alternative climatic and management scenarios. Researchers may also engage in the implementation of recommendations from their research findings directly, through methods such as working with communities to determine the appropriate design of an MPA network. Enacting recommendations, particularly in partnership with local organizations and stakeholders, will enhance a researcher's potential to promote conservation at a local level.

Engaging with communities beyond the scope of a research project enables students and scientists to have positive effects on the ground and to solidify relationships with stakeholders. To help increase the capacity of the local community, a student organized the distribution of

discarded computers from his university to a local ecological management group in a rural Ecuadorian community that had expressed a need for them. The group, formed by community residents, used the computers to organize local cultural and ecological information and set up an Internet station that residents could use to research conservation, land-rights issues, tourism development, and other conservation-related issues. Although these types of rewards and continued engagement may not always be feasible or appropriate, they provide an example of ways students can think about the best mechanisms for providing additional capacity to the communities in which they are working.

Although stakeholders associated with a student's study area are generally the main audience for research results, students may also contribute to conservation through engaging with other sectors of the nonacademic community. This community may include local resource users, practitioners, and policy makers in the area near the student's academic institution or field site. An increasingly effective means of reaching the general public is through modern communication technology, including creating or contributing to blogs and websites and posting pertinent information, videos, and images on social media outlets. Another method for influencing the general public is for students to write articles targeted at general media outlets to explain the activities, short- and long-term outcomes, and potential effects of their research. One student, for instance, wrote an article for the informed public explaining the science behind complicated pending regulatory changes for sea turtle conservation, and the article continues to be accessed online regularly, indicating the utility of translating this research (Jenkins 2002).

Graduate Students as Future Conservation Pioneers

The disconnect between conservation research and real-world conservation action is an important factor in the widespread failure of management to stem environmental degradation and biodiversity loss. We have provided suggestions on how students can engage with stakeholders throughout each stage of their research in order to increase the practical applicability of their work. Given that graduate students undertake a substantial portion of conservation research, training in practical skills and finding the synergy between research and action is critical to bridging the research–implementation gap. Graduate students are the senior scientists and conservation pioneers of the future. Ensuring that they are equipped with the skills and knowledge necessary to conduct applied research that can be implemented on the ground has the potential to catalyze conservation now and in the future.

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