Article

Traditional Ecological Knowledge in Conservation Research: Problems and Prospects for their Constructive Engagement

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Abstract: *In response to growing interest in accessing traditional ecological knowledge (TEK) for conservation purposes, we discuss some of the complexities involved in doing TEK research. Specifically, we consider the issues of power and politicisation, ethics and situated knowledge. These are standard issues to be considered in any social scientific endeavour and are particularly compelling when dealing with indigenous groups or cross-cultural contexts. We argue that the human context, and the researcher's ability to adequately understand and account for it, will largely determine the success or failure of TEK research. To this end, we offer three broad recommendations for conservation researchers hoping to engage TEK. Only through an informed and conscientious approach can TEK be incorporated into mainstream conservation research in a manner beneficial to both conservation and TEK holders.*

Keywords: traditional ecological knowledge, cross-cultural research, indigenous research, power, ethics, situated knowledge, marine conservation biology

INTRODUCTION

CONSERVATION RESEARCHERS are approaching traditional ecological knowledge (TEK) with increased alacrity (Drew 2005; Drew & Henne 2006; Fraser et al. 2006), recognising its potential contributions to both understand-

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ing biological phenomena and the practice of protecting species and ecosystems. For example, fisheries biologists and ecologists have recognised the need to engage with local knowledge holders, particularly when they are indigenous and/or have long ties to ecosystems, in order to fill in the gaps in our understanding of marine ecosystems (Pauly 1995; Pitcher & Pauly 1998) and to explore alternative approaches to management (Pitcher & Pauly 1998; McGoodwin 2001; Berkes 2003). Engaging with TEK (and also with local ecological knowledge (LEK)) may indeed be a means for conservation researchers to link their efforts to the local environmental and cultural context (Berkes et al. 2003). It may also provide a much needed tool to help revamp environmental management practices (Acheson 2005; McLeod & Leslie *forthcoming*). In the marine context in which we work, the potential for TEK may be especially relevant given the current shift to ecosystems-based approaches, and the dearth of historical marine ecological data (Jackson 1997; Jackson et al. 2001; Bolster 2006), the recognised need to break down barriers between disciplines, and the decreased distinction between basic and applied research (Hughes et al. 2005).[1] In this vein, Drew (2005) notes that the typical conservation biologist may find herself becoming a jack-of-all-trades, or an 'anthropologist, political advisor, economist and sociologist' (Drew 2005: 1286).

While we agree with the value of TEK[2] to conservation, we are concerned that some of the complex issues associated with conducting TEK research are being overlooked as enthusiasm for it grows. Whether TEK is sought out to fill in gaps in knowledge about species considered important by researchers, to understand traditional management practices and how these contribute to (or detract from) resource conservation, or to directly inform the design and implementation of a conservation project or management strategy, failure to attend to the complexity in TEK research may result in substantial consequences for both the researchers and the TEK holders with whom they engage. For example, researchers who begin a TEK study with an oversimplified vision of what is required and what can be gained may be disillusioned with the process of conducting TEK research and with results. Cumulative experiences may invite a backlash against this important research field, and may even bring harm to TEK holders and their communities (Tuhiwai-Smith 1999).

Whether TEK is of interest for basic or applied research, to natural or social scientists, in this paper we use the generic terms 'researcher' and 'scientist' to refer to individuals engaged in research on TEK in a conservation context, regardless of how far distant the conservation application may be from the actual data collection. While all researchers working in indigenous communities may face challenges similar to those we describe below, there are additional complexities associated with research on TEK in a conservation context. For example, conservation goals may not coincide with the worldview, practices and perspectives on rights to resource use in the TEK-holding communities;

conservation agendas may conflict directly with TEK-holder's dependence on subsistence gathering, or other culturally evolved practices of resource use and management (Berkes 1999). Attention to this conservation context runs throughout the paper.

Three issues that contribute to the complexity of TEK research are discussed in this paper: power and politicisation, ethics and situated knowledge. These are standard issues to be considered in any social science research, and conducting research with TEK is primarily a social rather than a biophysical science. While the ultimate objective of researchers may be to collect detailed biophysical data, the collection of these data is achieved through social interactions, for example, through interviews, participant observation, oral histories, and intensive, preferably long-term engagement with the TEK holders and immersion in their culture. These social interactions constitute part of the human context for TEK research, and although this context is important in any social science research, its importance is magnified several-folds in the case of cross-cultural TEK research, where local people's worldviews and ways of knowing may differ dramatically from those of 'Western'[3] researchers.

Challenges associated with researching TEK are plentiful. A researcher will find himself/herself facing the dynamics involved when 'researcher meets the researched' (and the researched talks back); the demands of ethical requirements for conducting research with human subjects; and the challenges posed to his/her own views of nature and how it should be managed. These challenges are also part of the human context of TEK research and, we argue that this human context, and the researcher's ability to adequately understand and account for it, will largely determine the success or failure of TEK research. Success is a subjective term, open to interpretation; in this paper, we define successful conservation TEK research as that which achieves research goals in an ethically sound and methodologically rigorous manner, and where goals are meaningful to both the researcher and the 'researched'. To this end, we conclude our paper by offering recommendations for pursuing successful conservation research in indigenous communities.

POWER AND POLITICISATION

TEK has become an important intellectual topic (Berkes 1999) and an increasingly political one (Tuhiwai-Smith 1999). Politicisation, or political contentiousness, in TEK research stems in part from the inherently unequal power relations between the researchers and the researched. Many indigenous people and communities are concerned about being the subjects of research, a process that has been described by various indigenous people as a 'site of significant struggle' deeply intertwined with colonial histories (Tuhiwai-Smith 1999). Scientists engaged in TEK research are powerful in a number of ways, some of which they may not recognise.

First, the global legacy of colonialism has created a complex field of values, meanings, and practices through which Westerners are positioned as a superior and non-Westerners are placed as an inferior, but necessary, 'other' (Butz & Besio 2004). The marginalisation of alternate perspectives so deeply pervades Western science that it is engrained in the most basic assumptions made by scientists (Nader 1996). Thus, the ways in which a scientist's approach ignores local knowledge, and even stifles or harms non-Western peoples, may not be obvious to a Western researcher (Forsyth 2003). For example, the received wisdom in French colonial West Africa labelled indigenous pastoralists, whose villages were often ringed by trees in an otherwise treeless savannah, as the cause of widespread deforestation. In Guinea-Bisseau, this idea was perpetuated unquestioned for decades in both academic research and policy interventions, until anthropologists Melissa Leach and James Fairhead used ethnographic interviews and aerial and satellite images to show that this received wisdom was inaccurate. Local people had actually planted trees around villages (Leach & Mearns 1996; Leach & Fairhead 2000). Their ongoing objections to being characterised as a source of deforestation went unheard, illustrating not only that Western scientists failed to see how local people managed their environments, but also that it took Western scientists (albeit social scientists) to demonstrate this failure.

Research overturning environmental orthodoxies that vilify local people, in part, led to a more mainstream recognition of TEK. Since then, working with TEK holders has been heralded by Westerners as one way of strengthening indigenous voices and responding to critiques of the hegemony of Western science. TEK is now a required part of impact assessments in Canada (Usher 2000). In Australia's Kaduku National Park, which is co-managed by the federal government and the indigenous Jawoyn people, efforts were made to assess the various values on feral animal management. Although feral animal management is often based on the proposition that introduced species threaten ecological and conservation values, Robinson et al. (2005) found that view is not necessarily shared by all stakeholders, including those indigenous people who own and co-manage the Park (Robinson et al. 2005).

Nevertheless, the very promotion of TEK often reinforces such power divides (Agrawal 1995), because TEK is frequently defined in contrast to scientific knowledge as less universal, less empirical, etc. (Gadgil et al. 1993). For example, Ortiz (1999) celebrates indigenous knowledge, but also advocates educating local people when TEK is 'wrong', that is, when it disagrees with Western science. From this perspective, indigenous knowledge might fill in some knowledge gaps, but cannot challenge Western knowledge. Thus, Ortiz's 'celebration' ultimately reinforces the marginalisation of TEK. Fully analysing and articulating potential power divides may go far to avoid being complicit with hegemonic orthodoxies.

Second, power over the research process, from inception to final reporting, most often lies with Western scientists. As such, by default the research proc-

ess largely benefits those conducting it: academics obtain data, publish results, and perpetuate careers, while conservationists may achieve the establishment of protected areas. In contrast, research subjects' control over their participation and power therein often varies depending on how scientists approach and include them. (There are exceptions to this, where indigenous groups have taken control of the research process, as discussed in the section titled 'towards constructive engagement'.) In addressing the 'politics of TEK', Nadasdy (1999) critiques the act of 'integrating' TEK with Western science, noting that TEK is assumed to be a form of data that can conform—regardless of cultural context—to western knowledge. Either TEK holders or scientists must compartmentalise and distil TEK into 'data'. That data are incorporated into existing bureaucracies and acted upon by scientists and managers, therefore serves to concentrate power in administrative centres rather than indigenous people (Nadasdy 1999).

Scientists may envision TEK research as a partnership that more equitably distributes power among participants (see Warner 1997; Drew 2005, Drew & Henne 2006); and while this is possible, empowerment may only be realisable through a careful methodological process (Davis & Wagner 2003) from the inception of research through the life of publications and research products. Partnerships such as co-management are described as a continuous problem solving process, involving joint learning, deliberation, and negotiation – a process of which power sharing is the result, rather than the starting point (Carlsson & Berkes 2005). But notions of empowerment are underlain with problematic assumptions, for example, about parallel objectives of researchers and TEK holders for conservation research, and the interests of local people in conservation and debates about sustainability (Davis & Wagner 2003; Campbell & Vainio-Mattila 2003; Wiber et al. 2004). The abilities and interests of researchers to design true partnerships in research will largely dictate what TEK holders get out of participating in research, as it is not always clear what benefits they derive. Tuhiwai-Smith (1999), a prominent voice on indigenous rights, maintains that little benefit has come to the Maori people following decades of researchers 'collecting' Maori knowledge (Tuhiwai-Smith 1999). A lack of attention to the asymmetry of knowledge sharing and benefits from research is a serious issue, both ethically (see the section titled 'ethics') and for the people participating in research.

Ultimately, while we agree with the general sentiment that true benefits can come to all participants, we suggest that there is nothing about conducting TEK research that makes it inherently respectful and culturally sensitive. In fact, TEK research may require extra vigilance to ensure respectful and culturally sensitive methods, the most powerful of which may very well be staying out of indigenous communities entirely!

Third, knowledge itself is power. Once a researcher collects TEK data, he/she often controls that knowledge through the interpretation of results and deciding how, when, where, and to whom conclusions are presented. In some

instances researchers may claim outright ownership of data. A researcher's power is magnified further by the power of science itself, since the scientific voice informs policies, maintains access to networks of power and prestige, and travels widely as it is articulated through numbers, abstraction, and other more globally accessible languages (Raffles 2002). Within the local context, when a scientific study is published, the release of TEK into the public domain can affect directly and indirectly TEK holders and their communities. Ecological knowledge can have direct impacts when used to inform policy that might, for example, establish conservation areas or limit access to fisheries. Indirectly, the way TEK or local people are portrayed in research publications or the media can influence how these people are perceived by outsiders and themselves (Dowling 2000).

Using TEK can imply *appropriation*, and indigenous peoples in their histories of contact with Western civilisation are not strangers to *mis*appropriation. While colonialism was expressed through conquering of others' lands, peoples and cultures, its information-age analogue is perhaps the conquering of others' knowledge. Because of the potential that TEK will be appropriated for purposes contrary to TEK holders' worldview or cultural practices, or for purposes they would not support, researchers must critically evaluate their *own* intentions for collecting TEK. For example, marine protected areas (MPA) are a favourite tool in contemporary marine conservation and often incur restrictions on use (Christie et al. 2003). If a local peoples' knowledge is used to justify establishing an MPA, do the local people support the establishment of such areas? Do they support the use of their knowledge to restrict particular uses? In asking and attempting to answer such questions, researchers must engage seriously with ethical issues associated with TEK research.

In recognising that TEK research is a politicised project, the point is not to try to depoliticise it. Any attempts to do so would likely be futile and may lull researchers into a false sense of security, thus making the problems arising from politicisation less obvious. The point is rather to recognise the politics and power dynamics of conducting research with TEK holders, the myriad of ways those can play out (and evolve and change), and the consequences for research and research subjects.

ETHICS

Ethical issues are associated with all research involving human subjects, but are even more pronounced with indigenous peoples. While requirements vary from country to country, in the USA researchers are bound by strict federal and institutional requirements. They are responsible for minimising the possibility that research subjects will be harmed as a result of their participation in research, and that subjects are fully appraised of any potential for harm (US code of federal regulations, Title 45, Deptartment of Health and Human Services, Part 46, Protection of Human Subjects. Hereafter referred to as 45 CFR

46). As previously discussed, social science data collection takes place in a social context influenced by societal norms, expectations of individuals, structures of power (Dowling 2000), and histories of interactions between cultures and societies (Gibbs 2001). Thus, preventing or minimising harm is not a particularly straightforward research task. Rather, it requires substantial thought, and consideration of conduct and context.

In the USA, federal regulations mandate ethical principles that underlie acceptable conduct for research involving 'human subjects' (45 CFR 46). Bound by federal, institutional, and sometimes additional state requirements, researchers studying people (human subjects) abide by three fundamental principles: respect for persons, beneficence and justice (The Belmont Report 1979). These ethical principles underlie what is considered acceptable research practice with human subjects. The potential for harm to come to research subjects must be critically assessed at all stages of the study: in initial question development and design of research tools, fieldwork, and writing and publishing conclusions. In addition, researchers are required to anticipate potential impacts of their activities after a project is complete. When engaging potential research subjects, researchers must inform research participants about the purpose of the study, sources of funding, its duration and procedures, any potential risks or benefits that might result from participation, the voluntary nature of participation, the extent to which confidentiality can be protected (or not), and how records identifying the individual will be managed. With this information, the research subject can give her 'informed consent' to participate. 'The informed consent process is designed to honour the right of individuals to decide whether or not they wish to become research participants. It acknowledges self-determination as an essential human right' (45 CFR 46).

In any research with people, a researcher must understand the context in which he/she is working in order to fully anticipate potential for harm to human subjects. In the indigenous and often cross-cultural setting of TEK research, these tasks require additional time, preparation and consideration. Otherwise, how might we know, for example, that sharing the life cycle of a fish may result in overturn of elder control of society (McGoodwin 2001)? Or that discussing fish out of season is believed to endanger the organism and the community (Kamakau 1964) or to disrupt the natural order of the universe (Berkes 1999)? These examples highlight an important ethical issue in TEK research, namely the possession and transmission of knowledge within and among peoples. Significant reasons often underlie why certain people possess environmental knowledge while others do not (Raffles 2002), and why some might or might not share that information. For example, Ruddle (1994) recognises the commonality of gender disparity in the possession of fisheries or marine ecological knowledge. Transmission of knowledge between sexes may be taboo (Ruddle 1994), and this could have ethical implications for the researcher. If research subjects will not share information with a researcher of

the opposite sex, how can the researcher fully account for local TEK? If women are less likely or able to share their fishing knowledge (McGoodwin 2001), how can we ensure that their views, knowledge and experiences are taken into account in any management interventions resulting from research (for example, the establishment of a community-based marine protected area)? Access to knowledge, environmental or otherwise, in many societies maintains social structure and can ensure economic stability and means of sustenance (McGoodwin 2001). Thus, the issue for a TEK researcher is not simply one of determining the best person to talk to in order to gain information. Understanding *why* people will or will not share information is perhaps more critical.

The significance of a researcher understanding the cultural context in collecting fisher's ecological knowledge, and the ethical consequences arising from such understanding, are exemplified in Maurstad (2002). In her study of cod fishing in Norway, Maurstad (2002) discovered that fishers' economic use of the sea hinges upon both ecological knowledge used to choose a place to fish, as well as social rules regulating how fishers distribute themselves in the local commons. Their social structure depends on knowledge being specialised, transmitted partly based on participation and years of experience. Because it limits the numbers of participants in the fishery, this social structure enables long-term catch success. When she realised this, Maurstad (2002) faced an ethical dilemma regarding whether or not to publish detailed maps of spatio-temporal fishing distribution derived from her interviews. Since they would reveal enough information to give away the fisher's specialised knowledge, she concluded that publication would put fisher livelihoods in jeopardy, and maps showing fishing grounds would also overturn the norms ordering behaviour in their society. While her ultimate decision *not* to publish her maps left her without funding, Maurstad's ethical obligations to her research subjects were too compelling to be overlooked (Maurstad 2002). Maurstad's case is one of the few published accounts of this type of ethical dilemma. Katz (1994: 71) notes a more general problem with ethnographic work—that it can '(inadvertently) expose sensitive practices of subaltern people to those who (might) use this knowledge to oppress them. While virtually all ethnographers protect the anonymity of their participants, there may be times when this is not enough and data must be withheld or reported selectively'.

Ethical protocols seem paternalistic in assuming that research participants cannot anticipate the potential cultural, societal, familial or individual fallout from sharing their TEK. It is not our purpose to contribute to a picture of indigenous peoples as victimised or as needing Western scientists to 'look out' for them. We note here that indigenous communities and advocacy groups have published their own research protocols (e.g. the Indigenous Peoples' Council on Biocolonialism has a template to guide communities entering into research relationships, including model research agreements, see http://www.ipcb.org/publications/policy/index.html). However, given that the

balance of research benefits most often accrue to scientists themselves, it is appropriate that scientists also accept responsibility for understanding and fully disclosing any potential harm that might come to participants. Accepting responsibility may be as necessary for ensuring a fully aware researcher, as it is for ensuring fully informed participants.

SITUATED KNOWLEDGE AND THE NATURE OF TEK

Traditional ecological knowledge is a culturally developed framework (Wenzel 1999) involving people, their beliefs about the world, and their cultural means of collecting, processing and transmitting information about the environment. People enter into relationships among themselves and with nature through embodied practice, and through these relationships they come to know nature and each other (Raffles 2002). Accordingly, the management-oriented *Traditional Ecological Knowledge Handbook* describes TEK as:

> …not just a system of knowledge and practice; it is an integrated system of knowledge, practice, and beliefs. The social context of TEK includes such aspects as:
>
> 1. Symbolic meaning through oral history, place names and spiritual relationships.
> 2. A distinct world view; including a view of the environment different from that of Western science.
> 3. Relationships based on sharing and obligations toward other community members and other beings, and community resource management based on shared knowledge and meaning (Miraglia 1998).

While there are a number of similar definitions of TEK (e.g. Berkes et al. 2000 is one of the most widely referred references), we cite Miraglia (1998) because she clearly emphasises a keystone issue to this discussion, namely that knowledge is embedded in a particular context, or is *situated* (Haraway 1988). Culture is a human invention, under constant revision and reinvention as people within communities and societies adjust it to meet their various human needs. It is a means of finding answers to questions, concrete and cosmic. It is shared knowledge, language, behavioural patterns, means of subsistence, and modes of social, economic, political and religions organisation. Importantly, it is an ideational design of how to live and how to behave that is generated, learned, and transmitted in a dynamic, but ordered fashion (McGoodwin 2001).

In a classic ethnography of Puluwatan navigators and the processes, production and application of navigational knowledge, the author states: 'This book is principally concerned with the enabling techniques of sailing and navigation, and with the psychological processes which govern their applica-

tion. Yet these cannot be understood apart from the way of life in which they are embedded' (Gladwin 1970: 4). Similarly, in a cross-cultural process of marine-protected area planning, Australian researchers discovered that situated knowledge underpinned Torres Straight Islanders' observations, meanings attached to, and understandings of the ecosystem. Further, it moulded the way in which these peoples communicated with other local people and management officials, engaged in conflict resolution, and assigned representatives to participate in the MPA planning process (Palmer 2004).

Situated knowledge, or that TEK is embedded in context, should factor into how data are gathered, interpreted and portrayed. Tension exists when collecting qualitative data for more quantitative-oriented disciplines, because knowledge may be approached erroneously as something that can be 'downloaded' or 'tapped into to'. Biophysical research relying on quantification may tend to code, categorise and typologise the stories of TEK holders (Agrawal 2002), telling only parts of them (Miller & Glassner 2004). Often, the knowledge is oversimplified, or commoditised to fit into categories and disciplines for 'consumption' by people other than those who generated the knowledge. A primary issue in the representation of TEK relates to whether or not the richness of the lived experience, embodied in the stories told in TEK interviews, can be portrayed accurately and without bringing harm to people, their culture, or the environment. In the conservation context, if TEK is 'used' as a source of biological data, this is an especially important issue. There are choices in the stories that are told and the language used to tell them, and thus language used in translating TEK to an academic can 'displace the very thing it is meant to represent—the lived experience' (Miller & Glassner 2004). Moreover, when TEK is collected and shared with the outside world, that knowledge is then out of its cultural context where it makes the most sense, where it is situated, and where it has life and voice (Gibbs 2001). Divorced from its context, it may not retain its significance for conservation over time, nor maintain its vitality and vigour in responsiveness to environmental dynamics (Agrawal 2002). Despite how much we may strive to give voice to indigenous people, outsiders (some would say this includes indigenous peoples trained in the academic traditions) may never achieve this goal.

It is important to note that all knowledge, not just TEK, is situated in a cultural context (Haraway 1988). One source of power in Western science is its perceived lack of cultural context, i.e. science is portrayed as a universal means of accessing truth (Nader 1996). While Western scientists might be able to see the cultural context of TEK, they are less likely to see the cultural context of their own knowledge (Forsyth 2003). Greater attention to the knowledge context might facilitate a wider acceptance of the diverse ways of knowing.

TOWARDS CONSTRUCTIVE ENGAGEMENT

In this essay, we have outlined the ways that the issues of politicisation and power, ethics, and situated knowledge pose challenges for TEK researchers. We have also argued that these challenges are heightened in a conservation context, where the 'end use' of TEK research may negatively impact TEK holders. This conservation context makes engagements between conservation-oriented TEK researchers and indigenous peoples and communities additionally complex. Nevertheless, the potential benefits of these engagements for both conservation and TEK holders encourage us to explore productive means of dealing with this complexity. Potential benefits include many things, such as learning from TEK holders, bringing together multiple environmental and cultural perspectives, and partnering with TEK to fill in the gaps in our understanding of ecosystems. In order to assist in the realisation of such benefits, we offer suggestions towards facilitating constructive engagements. We stop short of providing a recipe, or list of 'best practices' for TEK research, as each indigenous community will be unique, and we believe many of the 'rules' for TEK research should be set by the knowledge holders themselves.

Establish Protocols for TEK Research

Protocols for TEK research, designed in advance and with active participation of TEK holders, can provide a formal mechanism for addressing some of the challenges outlined in this paper. They outline the 'rules' for conducting research in particular communities, and can clarify researcher responsibilities as well as expectations of the researched. Issues associated with data ownership, for example, can be addressed explicitly. Many indigenous communities and research institutes working with indigenous people have or are in the process of developing such protocols (e.g. Desert Knowledge Cooperative Research Centre, Protocol for research with aboriginal peoples, http://www.desertknowledge.com.au/file_store/4B7406E1-80AD-72DE-1BE435DD2FCEF5DD.pdf; Principles for the Conduct of Research in the Arctic, http://ankn.uaf.edu/IKS/conduct.html). Some protocols set standards for researcher-community communications, e.g. that 'results should be explained in non-technical terms and, where feasible, should be communicated by means of study materials that can be used by local teachers or displays that can be shown in local community centres or museums' (Social Science Task Force of the U.S. Interagency Arctic Research Policy Committee. Principles for the Conduct of Research in the Arctic). Protocols advise how a researcher should behave in terms of respect and adherence to local language, custom and values. Giving back to local communities is also a common principle addressed, e.g. by providing research training for young people in the community. Where such protocols exist, a TEK researcher's job is made easier. However, we suggest researchers treat existing protocols as a starting point from which they

then actively engage in a discussion of what additional concerns might arise in the specific context of their own project.

If protocols have not yet been developed, we encourage researchers to assist in developing them, at least in relation to their specific project. Given each indigenous community's unique context, and the specificity of research projects, there is no one-size-fits-all protocol for TEK research. However, protocol development can be informed by existing protocols in other communities, and by the general literature on cross-cultural research and research in indigenous communities. These provide valuable theoretical and practical 'how-to' lessons for contemporary TEK-based research (e.g. Mullings 1999; Tuhiwai-Smith 1999; Gibbs 2001; Miller & Glassner 2004). For example, Gibbs (2001) combines the practical and theoretical in describing how she entered into a Memorandum of Understanding with a Maori community that bound her to specific practices, including how she would interact with individuals and publish results with local collaborators as co-authors. In co-management of Kaduku National Park between the Australian federal government and indigenous peoples, Robinson et al. (2005) utilised a range of cross-cultural methods developed with the indigenous Jawoyn community to engage their people in research, such as holding separate male and female gatherings at sites identified by the community, and working with key elders identified by the community. Caine et al.'s (n.d.) bibliography on conducting research with indigenous communities offers numerous relevant sources, both practical and theoretical, for potential TEK researchers to consult.

Consider Collaborative Research

Collaborative or participatory research moves beyond the rule setting approach of research protocols, to more fundamentally challenge traditional approaches to research. Participatory research has a long history in some research fields, e.g. in feminist research, development studies, and research concerned with social justice. Participatory research is concerned with: the relationship between researchers and the researched, with research 'subjects' becoming 'partners' involved in defining the issues to be investigated; the most appropriate (ethically, culturally and contextually) methods for accessing local knowledge; data ownership and decisions about how data will be analysed and circulated, and; empowerment and emancipation of partners through the research process (McTaggart 1997; Fals Borda 1998; Holland & Blackburn 1998; Greenwood 2007). Mutually beneficial outcomes in participatory research, to both indigenous/local communities and resource management agencies, have been documented in the marine resource management literatures (St. Martin 2001; Moller et al. 2004; Wiber et al. 2004). Strategies for improving potential outcomes of cooperation are also detailed (Christie et al. 2003; Kaplan & McCay 2004; Olson 2005). Similar discussions about empowering local and indigenous people have appeared in the marine resource

management literature, relating to the development of alternative research strategies (Davis & Wagner 2003; Berkes et al. 2003).

While participatory research is evident, and we encourage TEK researchers to consider the possibilities for it, we also note that the concept itself has also been widely critiqued. As the popularity of participation has grown, in both conservation research and practice, so too have the varying interpretations of it (Pretty 1995; Barrow & Murphree 2001; Campbell 2000; Campbell & Vainio-Mattila 2003). Participation may not always be of interest to target communities, and some forms of participation can actually be coercive (Cooke & Kothari 2001; Hayward et al. 2004; Silver & Campbell 2005). In advocating that researchers consider participatory engagements, we are advocating a critical treatment of the concept with an aim for true collaboration rather than superficial forms of participation. Partnerships in which all parties gain from the research encounters are possible, given a situation in which potential power dynamics, ethical issues, and cultural context are explored, articulated and respected conscientiously throughout the research process. For example, Wiber et al. (2004) describe a project to engage fishers (aboriginal and non) in defining research priorities of interest to them and carrying out related research projects. Despite several obstacles in the process, fishers did identify with projects and saw them of direct relevance to themselves.

Interdisciplinary Engagements

In addition to partnering with local communities, interdisciplinary cooperation among scientists in conservation TEK research may assist in overcoming the challenges outlined in this paper. We believe that, rather than having individual researchers attempt to be an 'anthropologist, political advisor, economist and sociologist' (Drew 2005: 1286), building research teams of individuals trained in these disciplines is preferable. Social scientists experienced in working with human research subjects will be familiar with the social science research methods, are likely to have been exposed to the issues addressed in this paper, and at the very least, those working in institutions with ethical protocols for such work will have basic ethics training. In no way are we suggesting social scientists are immune to the challenges we identify; in contrast, anthropologists have been implicated in significant ethical controversies in work with indigenous peoples (Tierney 2000). However, we do believe that social scientists are more likely to be familiar with the issues we address in this paper and to have the appropriate research skills for working with human subjects. We believe inter-disciplinary research teams are more likely not only to navigate the challenges outlined here, but to produce better research (Campbell 2003, 2005).

Inter-disciplinary research comes with its own set of challenges and interdisciplinary projects require significant time, resources, and good will to set up and execute. Recent writings by and exchanges between social and natural

scientists highlight these challenges and provide suggestions for overcoming them (e.g. Christie et al. 2003; Mascia 2003; Kaplan & McCay 2004; Campbell 2005). Most importantly, they reaffirm the necessity of pursuing inter-disciplinary approaches to conservation-oriented research (Boulton et al. 2005; Campbell 2005; Christie et al. 2005; Lélé & Norgaard 2005; Balmford & Cowling 2006; Drew & Henne 2006; Eigenbrode et al. 2007).

CONCLUSIONS: TEK RESEARCH AS AN OPPORTUNITY TO REVISIT CONSERVATION COMMITMENTS

Our incentives to write this article arose from our concerns with the treatment of TEK in conservation-oriented research. The conservation interests, objectives, and sometimes advocacy activities of researchers pose perhaps the greatest challenge for successful TEK research. This is not to say that indigenous communities do not want, understand or practice conservation, but their approaches to it may vary greatly from those of Western researchers and even among indigenous groups (Berkes 1999; Martello 2004). Just as assumptions regarding what conservation should look like can undermine inter-disciplinary scientific collaborations (Campbell 2005), they also underlie and magnify the issues of politics and politicisation, ethics, and situated knowledge in TEK research. Our three suggestions for overcoming challenges associated with TEK research—adopting research protocols, and engaging in participatory and inter-disciplinary research—will also provide the opportunity to revisit conservation commitments and the normative assumptions embedded in these. At the very least, researchers need to make conservation commitments explicit to TEK holders to satisfy their ethical obligations to human research subjects. But at a more fundamental level, open conversations about conservation commitments, those of both researchers and TEK holders, can provide important opportunities for questioning, challenging, re-envisioning, and sometimes reinforcing such commitments. We may, in fact, end up with 'better' conservation, that is, conservation that achieves biological and socio-economic goals in a culturally appropriate manner, that recognises and respects the TEK, and that is supported by both researchers and TEK holders with whom they engage.

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Notes

1. Our own research takes place predominantly in the marine environment, and many of our examples are marine; however, we also used examples drawn from terrestrial conservation, and we believe our overall argument is relevant beyond the marine environment.
2. Herein we define TEK 'as a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment' (Berkes et al. 2000: 1252), though in section titled 'situated knowledge and the nature of TEK' we refer Miraglia (1998) for the purposes of explaining some of TEK's complexities. As in Davis and Wagner (2003: 477), LEK 'is presumed here to constitute a "body" and a "system" of understandings and know-how that arise through time from a variety of individual and shared experiences and observations, mediated by culture, with regards to environmental factors, behavioural attributes and ecological dynamics'.
3. Here we use Western to denote university trained researchers, rather than geographic location. 'Western' science is distinguished (for example from 'Northern', 'Southern' or 'Eastern') because of traditions stemming from the European Renaissance, which underpin Western science's perceived lack of cultural context, and its portrayal as a universal means of accessing truth (Nader 1996). Furthermore, this is in part because of the literature that says all research in indigenous communities is inherently cross-cultural, even if conducted by indigenous academics. Research as a process affiliates the researcher with the specific goals and contexts, typically with those in generating knowledge and products for academic or similar research contexts. Thus, indigenous academics can be seen as affiliated with at least two cultural contexts—academic and indigenous (Gibbs 2001; Agrawal 2002).

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