

Guidelines for cross-cultural Participatory Action Research partnerships: a case study of a customary seabird harvest in New Zealand

HENRIK MOLLER¹

PHILIP O'B LYVER²

COREY BRAGG¹

JAMIE NEWMAN¹

ROSEMARY CLUCAS^{1,3}

DAVID FLETCHER³

JANE KITSON⁴

SAM McKECHNIE¹

DARREN SCOTT¹

RAKIURA TITI ISLANDS ADMINISTERING
BODY⁵

¹Centre for Study of Agriculture,
Food & Environment
Department of Zoology
University of Otago
PO Box 56
Dunedin 9054, New Zealand

²Landcare Research
PO Box 40
Lincoln 7640
New Zealand

³Department of Mathematics & Statistics
University of Otago
PO Box 56
Dunedin 9054, New Zealand

⁴21 Thurso St
Invercargill 9810, New Zealand

⁵PO Box 743
Invercargill 9840, New Zealand

Abstract Adaptive co-management and Participatory Action Research (PAR) promotes social ecological resilience by simultaneously protecting wildlife and its habitat and promoting capacity and motivation for sustainable harvest management by communities. We report here on a case study of

learning through a partnership (1994–2009) between science and Traditional Ecological Knowledge (TEK) to determine the sustainability of titi (sooty shearwater, *Puffinus griseus*) harvests by Rakiura Maori in southern New Zealand. Testimony of Maori elders and titi harvesters (birders), members of the Rakiura Titi Islands Administering Body, researchers and participants in workshops and meetings were recorded throughout the 14-year research project to identify critical determinants of success of the partnership. A large majority of participants supported the research, mainly because it expanded their knowledge by investigating the reasons for declining bird numbers and the means of ensuring the continuation of their muttonbirding heritage. Initial concerns about the research included fear that prohibition or quota would be imposed through political pressure from external groups; the intrusion of strangers on the islands; the misconception that the research was being promulgated by government regulatory agencies; and scepticism about research findings. Research also precipitated conflict and division within the Rakiura community, and some birders feared that science might displace matauranga Maori (TEK) of the Rakiura people for guiding harvest management. Core conditions for community engagement included trust between parties, effective communication of the science, equitable decision-making responsibility, and building scientific capability and monetary support to enable meaningful participation. The most fundamental requirement is mutual respect for each party's knowledge. Attention to this inclusive, equitable, slow and prolonged process makes it more likely that the community will uptake results to improve sustainability of harvesting. The research has heightened awareness within the harvesting community of conservation issues facing the titi and of potential options to mitigate them. Eradication or control of weka (*Gallirallus australis*), and reducing titi harvest levels from around a quarter of the manu (family birding territories), are the main practical ways of increasing sustainability, but the magnitude and direction of climate change impacts on the shearwater population remains uncertain.

Keywords Traditional ecological knowledge; mātauranga; science; Rakiura Maori; muttonbirding; sooty shearwaters; *Puffinus griseus*

INTRODUCTION

Indigenous communities throughout the world need to develop new ways of maintaining and enhancing their cultures, knowledge and traditional resource uses in the face of impacts from technology, markets, population increases, climate change, pollution, invasive species and declining biodiversity (IUCN 1997; Berkes et al. 2003, 2005). Cultural diversity, just like biodiversity, is threatened by ecological and social changes wrought by globalisation that has reached far into local communities and traditional lifeways. Indigenous peoples' communities combat these threats by applying Traditional Ecological Knowledge (TEK), "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 the environment" (Berkes 2008).

Recently, the adaptive nature of TEK and its coupling to environmental governance of local resource use is being recognised as "Adaptive Co-management" (Berkes & Turner 2006; Turner & Berkes 2006). It is in many ways akin to the "passive adaptive management" (Walters & Holling 1990) approaches used by many western environmental management agencies and scientists to learn how social-ecological systems work and how best to manage them sustainably. Incorporation of science, or at least dialogue with science, potentially strengthens and complements TEK to assist adaptive co-management (Moller 1996; Newman & Moller 2005; Kitson & Moller 2008; Lyver et al. 2009). Equally, science has much to learn from TEK.

The need for partnership between TEK and science is especially urgent in the neo-colonial "New World" nations like USA, Canada, Australia, New Zealand and Pacific island states where massive habitat change and introduction of new organisms threatens natural resource abundance, local economies and biodiversity. Accommodations between the indigenous knowledge systems and the science brought by colonists become all the more important in these neo-colonial societies, where different cultures now share places and contest how best to sustain them. It is therefore a concern that partnerships between TEK and science are still relatively infrequent. In this

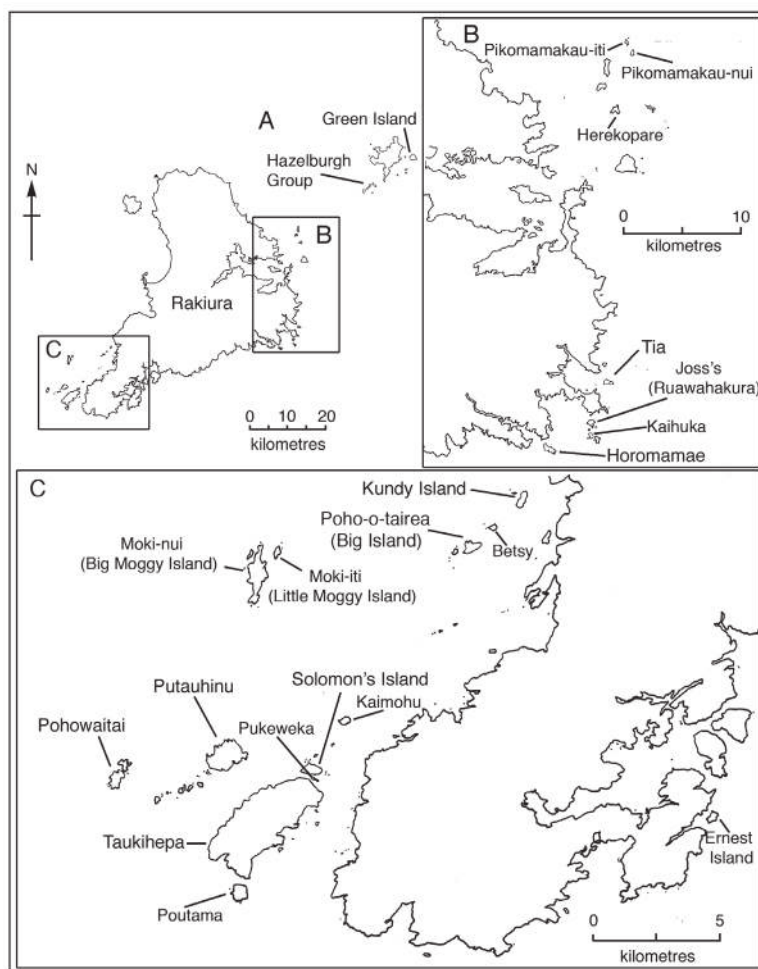
paper we use our case study of a seabird harvest by Rakiura Māori in southern New Zealand to consider why partnerships between science and *mātauranga* (Māori knowledge, part of which embodies TEK) have not developed more often. What barriers and enablers for establishing effective partnerships did we encounter? More importantly, how did we try to overcome these barriers? We tentatively identify some general "rules of thumb" that might guide other communities and science research teams that seek to establish cross-cultural research partnerships. We proffer our experience as an early example of one cross-cultural partnership in New Zealand ecological research, not because we consider it ideal or perfect, but because we hope that our stumbles and successes can empower others to more quickly realise mutual goals of improved understanding of ecosystems and culturally important *taonga* (treasured) species.

Our narrative is unusual for a scientific paper in its liberal use of direct quotes of participants. This difference partly reflects our Participatory Action Research (PAR) approach in which the experience and testimony of the community members and scientists is a huge part of discovery itself (Burns 2007). However, personal commentary is also especially salient for Māori and indigenous people, for whom knowledge is shared and refined verbally. Just as few of the *kaitiaki* (Māori environmental guardians) would read zoological journal articles to guide their environmental management, few zoologists and ecologists will regularly go to the *marae* (traditional Māori community meeting places) to listen to *kōrero* (discussion, debate) about Māori environmental management. We therefore record here the direct voices of the participants as a way to join two worlds.

Our voices first illustrate the way our experiences highlight more general challenges and opportunities for improved mātauranga-science partnerships in New Zealand. We then describe what we believe the *kaitiaki* and scientists require for an honourable research partnership, and what both seek in an ideal scientist, before describing ways that we adapted conventional science processes to be acceptable to both the Rakiura Māori community and university science institutions. In the light of our experience, what then are realistic expectations of what might be achieved? We end by considering what New Zealand's government and educational institutions do to foster better partnerships between mātauranga and science to promote social-ecological resilience.

Our case study of community co-management through research partnerships concerns

Fig. 1 Rakiura (Stewart Island) and adjacent Tītī Islands, with interviewee’s birding islands named. **A**, Ruapuke island group; **B**, northeastern and southeastern island groups; **C**, southern and southwestern island group.



muttonbirding, the traditional harvest of tītī (sooty shearwater, *Puffinus griseus*) by Rakiura Māori (southernmost tribe of Māori in New Zealand). Management of birding is an important example of environmental stewardship, which Māori term *kaitiakitanga*. The tītī harvest represents an iconic and last example of customary use of native birds which remains almost entirely within the control of Māori (Wilson 1979; Moller 1996; Stevens 2006; Kitson & Moller 2008). Rakiura Māori initiated the *Kia Mau Te Tītī Mo Ake Tōnu Atu* (“Keep the Tītī Forever”) research project (hereafter referred to as the “Tītī Project”) in 1994. Its overall goal was to “ensure that the birds remain plentiful for Rakiura Māori *mokopuna* [grandchildren]”. Seabirds were extensively harvested throughout the world until around 100 years ago, and important harvests remain in Scandinavia, Africa, Australia and New Zealand

(Moller 2006). Amongst these, only the “muttonbird” harvests in Australia and New Zealand are supported by scientific research for sustainability (Skira 1990; Moller et al. 1999; Lyver et al. 2008; present study).

THE TĪTĪ HARVEST CASE STUDY

Annual tītī harvesting

The annual harvest of tītī in April and May from about 30 “Tītī Islands” around Rakiura (Stewart Island) in southern New Zealand (Fig. 1) is very important both culturally and economically for the Rakiura Māori community (Newman et al. 2008a,b; Moller et al. 2009c). Extended family groups visit the islands from 15 March until around 20 May each

year to harvest late-stage chicks, which are then either sold, bartered or used for home consumption or important communal events like weddings, funerals or cultural commemorations and *hui* (gatherings) at marae. The tītī harvest features strongly in *karakia* (prayers), *whaikōrero* (oratory), *waiata* (song), *whakairo* (carving), *taha toi* (art) and storytelling. Tītī are a sought-after traditional food of Māori throughout New Zealand (Kitson & Moller 2008; Moller et al. 2009c). Ownership of the Tītī Islands, their sale to the Crown, and disputes about the ongoing authority of Rakiura Māori to manage different islands, are all strands of a complex and in parts painful and contested history (Wilson 1979; Waitangi Tribunal 1991; Stevens 2006).

Harvest and research governance

Two community-elected committees have managed the annual tītī harvests in collaboration with the New Zealand Department of Conservation since 1987 (and formerly with the Department of Lands & Survey).

- (1) The Rakiura Tītī Islands Committee is a group of 10 elected representatives of the wider birding community under the auspices of the Tītī (Muttonbird) Islands Regulations (1978). They manage the day-to-day affairs of the tītī harvesting community, especially those birding on the “Beneficial Tītī Islands”. Beneficial Islands were set aside for the use of Rakiura Māori descended from chiefs who signed the Deed of Cession 1864 (Wilson 1979).
- (2) The Rakiura Tītī Islands Administering Body (RTIAB) is a similar committee of 10 members elected by the community to give effect to the Ngāi Tahu Settlement Act (1998) provisions. The RTIAB has special responsibilities for developing bylaws and management plans for what were formerly known as the “Crown Tītī Islands”. Crown Islands were mistakenly retained by the Crown for the use of other Rakiura Māori who wrongly missed out on allocations on the Beneficial Islands. Ownership of the Crown Tītī Islands was then returned to Ngāi Tahu *iwi* (tribe) in 1998 as part of redress for broken Treaty of Waitangi promises to provide ongoing access to *mahinga kai* (food gathering places) for Māori (Moller et al. 2000b).

This history brings added national scrutiny on adaptive co-management of the tītī harvests, but more importantly, it has embedded fierce protection of bird harvesting rights by Rakiura Māori.

This strong and continually asserted kaitiakitanga made our test of the cultural safety and utility of a science–mātauranga partnership all the more stringent.

Initially the Tītī Project was directed by a joint RTIC and RTIAB committee (the same members administered both RTIAB and RTIC regulations), but from 2003 the two committees split and the research was then directed only by RTIAB. The tītī harvesters are predominantly members of the Kāi Tahu, the southern people of the Ngāi Tahu, but others affiliate to Waitaha and Kāti Māmoe *iwi*.

Gathering testimony of research participants

Responses and observations about the Tītī Project’s processes, failures and successes were recorded throughout the 14-year partnership from the following:

- (1) Interviews with 20 *kaumātua* (respected male elders) and *kuia* (respected female elders) between 1997 and 1999 (Kitson & Moller 2008; Moller et al. 2009a,b). Quotes from these qualitative interviews are notated as Elder 1, Elder 2, etc. in this paper, and their testimony is distinguished from that of the other community participants in Table 1.
- (2) Two surveys of randomly selected informants, first in 2001 ($n = 23$) and then again in 2007 ($n = 36$), also involved recorded face-to-face interviews. However discussion was focused on a questionnaire seeking specific answers to closed questions that were designed from information given in the previous interviews with elders (Moller 2003; Bragg et al. 2008). Quotes from the 2001 interviews are notated as Birder 1, Birder 2, etc. in this paper.
- (3) Interviews with community research directors (RTIC and RTIAB) and University of Otago researchers in February and March 2002 (Lyver 2002a, 2005). The testimony of these leaders and researchers is referred to as Interviewee 1, 2, ... and Researcher 1, 2 ... etc. in this paper.
- (4) Several *hui* called specifically to discuss tītī matters and the research project itself, became important means of establishing links between the community and researchers. We recorded discussions about the research project at these *hui*, which included: (a) *He Minenga Whakatū Hua a Te Ao* (“an intense discussion on maintaining the fruits of the land”) over 2 days and involving kaitiaki and researchers from all over New Zealand at Murihiku Marae in 2000 (Howard

& Moller 2001); (b) 1-day hui involving only the tītī research team and birding community in 2004, 2006, 2007 and 2008 to present research findings; and (c) annual “Permit Day” hui, an annual gathering of harvesters to choose supervisors for the islands, issue permits and discuss the general affairs of the tītī harvesting community in each of the 14 years of the project. There were no recordings of *kōrero* (discussion) at the Permit Day hui, but researchers kept notes of the issues arising and used the discussion as vital indicators of the wider community’s response to the research project. *Kōrero* at the other hui was recorded and transcribed for research team analysis to inform a PAR context. Quotes from these *kaikōrero* (speakers) in these hui are referred to as *Kaikōrero 1*, *Kaikōrero 2* etc. in this paper.

- (5) Retrospective self-reflection by the community’s research directors and researchers was recorded in a group discussion at the very end of the project (November 2008). The discussion was recorded, transcribed and returned to the participants for checking. A preliminary outline of this paper was drafted by the research team and circulated to the RTIAB for comment and amendment. All 50+ reports arising from the project were considered by the kaitiaki as part of the original “cultural safety contract” guiding the research process (Moller 1996; Moller et al. in press). Direct quotes from community directors and researchers from this focus group discussion are cited as RTIAB 1, RTIAB 2 ... and Researcher 1, 2 ... etc.

All direct quotes are italicised, and where additional information is added to provide context and meaning, the words are inserted in square brackets.

PARTICIPANTS’ PERSPECTIVES AND EXPERIENCES

Levels of support for the research

Vigorous discussion and community debate, as is normal and expected by all members of the community on the marae, emphasised that some of the community opposed the science project in the first 8 years of the research (Moller 2001a, 2003). The decision at the Permit Day hui in 1994 to further investigate the possibility of research was passed by the narrowest of margins in a vote. A hui of the

kaitiaki a month later authorised commencement of the research only once a legally binding “cultural safety” contract was signed by RTIC and the University of Otago. Nevertheless, by two-thirds of the way through the project in 2002, 91% of 22 randomly selected active birders responded to a direct question (“Should the research be happening or not?”) as being in favour of the research. By the end of the field work (2006), 100% of a different sample of 35 randomly selected active birders said “yes” to the same question. We are confident that the shift from 91 to 100% agreement between the 2002 and 2006 surveys represents a real shift in attitude within the community, because several birders told researchers that they had become less sceptical of science in recent years. The community gave the research team a standing ovation at the conclusion of their last research presentation at Permit Day (2007).

What then were the reasons for the initial opposition to the research and why did it wane?

Concerns about the research

Initially, birders regarded the presence of newcomers, scientists and external influences resulting from the research as an important threat (Table 1). Even some who personally supported the research feared that it could lead to prevention of birding, imposition of quota, or external interference by the Department of Conservation (DoC), Ngāi Tahu and preservationists. Many opponents of the Tītī Project believed the research was being promulgated by DoC rather than by the Rakiura Māori community itself (which sub-contracted the University of Otago research team), even though the reality was explained repeatedly each year for a decade. The recurring lesson was clear—some of the birders thought that researchers from university worked for government departments (DoC etc), and they were unwilling to distinguish universities or the various government departments from each other. In view of this fear of external interference, a tension emerged between whether the researchers should recommend management responses from their results or not (Table 1). By the end of the project there were several requests from the community for firm recommendations to be set out by the researchers when the final sustainability predictions were in place, but these invitations were declined by the researchers to honour the original agreement with the wider community.

For some birders the power issues around management and research of tītī were identified as a cross-cultural conflict related to colonisation of Māori by *Pākehā* (non-Māori). A birder who stated

Table 1 External societal pressures perceived by Rakiura Māori kaumātua and kuia and experienced birders to be confronting the muttonbirding community.

| External pressures | Rakiura Māori feedback |
|---|---|
| Interference in rights and governance | <i>"I do think some people are afraid. They're afraid of having something taken away from them that they see as a fundamental right. Yes, the word sustainability scares some people. The other word that scares people and has never been promoted by the Tītī Committee is that word quota"</i> (Elder 2). |
| Imposition of harvest prohibition or quota | <i>"I personally don't think there's going to be a lot of good come out of it [the research]. Now my reason for saying that is somewhere along the line some of these groups are going to try and impose quotas and this science that's happening now is ammunition [that will be used] against us"</i> (Elder 1). <i>"I'm very dubious of research because of what I've done in my life. We've had research into crayfish, we had research into oysters, research into cod and all of a sudden they come up with new laws and took them away. I think less said, best said sometimes. So I'm not sure [about whether the research should be happening]"</i> (Birder 5). |
| Public expectation that Rakiura must conduct research and scientifically monitor tītī | <i>"But the overall result I think of the research will be of benefit to Rakiura. Certainly it was helpful during the claim period for the return of the Crown Tītī Islands. This is purely political when you think about it because we were seen to be doing something that would protect the tītī rather than just being a user group. I think that was helpful as far as, having the islands returned to Ngāi Tahu"</i> (Elder 2). |
| Expectation that modern technology should not be used in the harvest of tītī | <i>"Oh well some of these ones cry you know, mostly the ones that don't go to the islands say that you shouldn't be doing this and you shouldn't be having this and that and you should go back to the old way, but then if you got to go back to the old way you got to go back to waka and who is going to go to the island in a waka? It's ridiculous, I mean, let's face it everything is modernised today, and that is making it easier on you. Why not do it?"</i> (Elder 3). |
| Expectation to provide island refuge habitat for endangered species and be subjected to DoC policies | <i>"You know they [DoC] used to come ashore on our island and study the saddlebacks. And they'd put out lines of rat traps, ... there's no rats on our island [but] they'd put out a line of rat traps and you'd go back there they'd would have left them there and there would be tui and things in them, and you'd keep going back and in the end I said "well look you will fix it", but he said well I'm sorry but you know we have this policy that we follow and it's not the guys fault that are in the field because they have that policy [to follow]"</i> (Elder 4). |
| Expectation that Rakiura harvests should be reduced or stop to compensate for other population impacts that can not be managed easily (e.g., bycatch, climate change) | <i>"There will always be some [tītī] to come back but if they are going to keep going, doing what they're doing, well it will be like the pāua and slowly disappear. Besides we don't know what's happening overseas ... but see we don't know what's happening in the Northern Hemisphere's with this nuclear fallout and that sort of thing. Could kill all the birds and we wouldn't know, would we? See about two or three years ago they had this El Niño or whatever it's called and many thousands of birds were killed up around the Arctic Ocean. Thousands and thousands of muttonbirds were in amongst that lot. So you know some people would like to blame [Māori]. It's oh, Māori catching too many of them"</i> (Elder 5). |
| Written testimony takes on authority and brings external pressure for control | <i>"Once it's written down and if there's no protest and removed it becomes accepted. You've accepted it, why are you complaining now. In 10, or 15, 20 years time, they'll always dredge up the exact date that it was published but I see it as a weapon to be beat us with in the future"</i> (Elder 1). |
| DoC and Te Rūnanga o Ngāi Tahu retains an interest and a measure of control over the ex-Crown Tītī Islands | <i>"If the conservation groups within New Zealand had their way, those so called Crown Islands would never have been returned. As it is they should have been returned free and without any encumbrance whatsoever but because of these conservation groups throughout New Zealand, DoC retains a, an interest in them, a control in them, a management in them, so they will always retain some measure of control over them"</i> (Elder 1). |
| Research has international participation increasing the risk of losing control over knowledge | <i>"They can say what they like, but with that Yankee woman involved, it's become an international project. [This is wrong because] tītī are our taonga, not the world's taonga. Not even New Zealand's taonga. The tītī are the taonga of the Rakiura, Ngāi Tahu Māmoë, Waitaha Rapuwai—not for anyone else. The pressure may not come from inside New Zealand to make tītī a quota species, it may come from outside"</i> (Elder 1). |

Table 1 (continued)

| External pressures | Rakiura Māori feedback |
|--|---|
| Intrusion and influence of NGOs and other interested groups in the Treaty of Waitangi claim process. | <i>“It annoys me that, the negotiations were carried, are, were between Ngāi Tahu and the Crown, where these conservation groups got their right to in be involved, I don’t know. I don’t believe they should have ever been allowed to be involved. The Treaty of Waitangi was signed between the Chiefs of New Zealand and the Crown, not anyone else and why has anyone else has got the right to put their nose in to any of that business is, is got me beat. Yes it annoys me no end the fact that they can stick their oar in but I can’t stick my oar into their business”</i> (Elder 1). |
| Political opposition from Animal Rights Groups to killing of birds | <i>“Now they can get they can get the birds out much easier now with the ..., getting them out with the ..., well I shouldn’t say what they get it out with. Greenpeace could get the wrong idea and be worried about cruelty and not killing the tītī chicks straight away. But Rakiura have nothing to hide in birding”</i> (Elder 6). |
| Intrusion on family space—having new researchers on your manu or island each season | <i>It’s [the island] pretty spiritual place. Perhaps cause it’s quite untouched by a lot of people although there’s the five houses on it. It’s still fairly remote you know you are not you don’t actually meet and see the other families on the island a great deal. It’s changed for us with the research, and that’s something that I have found difficult to cope with. It’s the fact that the faces you meet are not just the faces of your own family</i> (Elder 2). |
| Science casting doubt on mātauranga | <i>“I would go along with the conservation group to a certain extent but they have got to remember they can’t keep saying to us as Māori that we don’t know anything about conservation. The reason why I am saying that is for a thousand years or more, there’s been muttonbirds taken from down there and they been still being taken today and it’s only because our tūpūna had conservation in mind”</i> (Elder 7). |
| Research may displace mātauranga and traditional management | <i>“It’s not about what they [researchers] can do for us. It’s about us. It’s about us knowing what’s happening on the island ourselves and it’s about the birders themselves being observant and taking note of what’s happening the way we used to in the old days. They [the tūpūna] monitored the birds and the seasons. We should be doing the same thing. That’s part of our, that should be part of, our tikanga [custom/lore]”</i> (Birder 12). |
| Science may remove the symbolism from mātauranga | <i>“One thing that we do not talk about in research is the way it reduces what we know. Often when it [science] comes in contact with kaupapa Māori or things Māori, it takes the symbolism out of what it is that we are actually talking about”</i> (Kaikōrero 1). |

uncertainty about whether the research should be proceeding was concerned about “*power and control of Pākehā*”, as well as cynicism about “*what the researchers themselves were receiving*” for doing the research (presumably financial remuneration). Some birders stated firmly that there should not be Pākehā on the islands, and saw the research as yet another form of racist interference and control. A hui participant expressed mistrust of the motives of the researchers in this way:

“I teach people good manners. Often that gets lost in the midst of a science project because we are looking after someone else’s agenda. And when we look at truth in science, whose truth are we looking at? Where does the science go and who at the end of the day is going to benefit? I think Pākehā people need to continuously reflect on racism and what happens in that intimate interaction where good manners leave and the agenda of power takes over. Māori have got a lot of knowledge. We have

got so much knowledge that in this day and age I wonder why we give it out to anyone. For example, those that practice muttonbirding are the only ones that know exactly what’s happening. You can investigate, you can research, you can turn it inside out, you can meet agendas, and you can get millions of dollars worth of funding for something that really only the people that practice it know about” (Kaikōrero 1).

On the other hand, the community research directors reported that “*They [the birders] were frightened of you [researchers], frightened of the science*” and that “*by nature we put up a barrier of suspicion because of colonisation*”. A third interpreted this response as “*an inbuilt defence mechanism*” because of the history of colonisation.

One community research director was willing to support the research in general, but she was unwilling to support research undertaken on her own manu (family birding ground) in case the science or

scientists reduced the *mana* (value, honour, prestige, respect) of her place:

"I couldn't go there myself. I wasn't going to risk that awful feeling, even the chance of somehow or other that the mana of our place would be trampled [by having the researchers visit her manu]. It's a trust thing" (RTIAB 5).

Although the most common concern expressed was related to fear of external control and limitation of birding, some interviewees mentioned other reasons for being sceptical of the value of research. Some had a low opinion of the value of the scientific information in general, or little confidence in the scientific results. Others thought that the research was not revealing anything new and were wary of the research being done by outsiders who appear to discount the knowledge of the birders themselves. For example:

"They are trying to tell us what we know. All they have come up with so far is somebody found some bones 20 foot under the ground as far as I am concerned. They put a camera down [the tītī burrows] and said some chick got fed down the burrows. Who the hell didn't know that? Beware of strangers bearing gifts" (Birder 5).

Birder 5 is referring to a carbon dating study confirming early occupation of the Tītī Islands (Hawke et al. 2003) and to "burrowscoping" to measure population density and breeding success (Lyver et al. 1998; Newman et al. 2009a this issue, b; McKechnie et al. in press a,b).

Many opponents held misconceptions about the way the research was done, its goals and who was directing the work. For example Birder 12 believed that the research team had broken a centuries old *rāhui* (restriction or ban) prohibiting visits to the manu before mid March each year, although there was no such violation of the *rāhui* (Kitson & Moller 2008):

"I don't like them being there out of season. And there was a reason that the tūpuna [ancestors] put that law down there and if the birders can't go, then neither should they" (Birder 12).

Some community members believed their *whānau* (family, family members) were deflecting concerns about sustainability onto the researchers and unfairly blaming them. For example:

"A lot of people that are putting down the likes of the tītī research people don't really know or don't understand what they are about. The land has been devastated and the manu has been desecrated by those who go down there and do not look after the place. Not by the birds, not by the research people

and nor by anybody else. That land has been desecrated because the people that already go there have not maintained and not looked after the manu itself. Until they do that, nothing's going to change. Full stop. End of story there. Those people who are saying that these research people are stuffing the place up are totally out of order" (Birder 17).

Part of the concern about the research stemmed from a perception of a fundamental divide between science and Māori culture and *mātauranga*. A leader expressed the size of the gulf between science and Māori that needs to be bridged here in the following way:

"A Māori is a Māori, and a scientist is a scientist – and never the twain shall meet. [Laughter]. I mean down where it counts, you know. I don't mean it that harshly, but I do really sort of mean it like that" (RTIAB 5).

This belief that there is some fundamental difference about truly Māori or truly a scientist sometimes made it especially difficult for Māori students training within the Tītī Project, e.g.:

"What is a Māori scientist? It is hard to feel valued as a Māori scientist when these opinions are put out. At times the tension between my two worlds made me feel like an outcast in both worlds rather than a connecting point between them" (Researcher 4).

In view of the widely divergent opinions at the outset, and the supreme importance of the tītī and their islands for Rakiura Māori, the research precipitated strongly opposing views amongst the community. After receiving unanimous support for the research from the birders on Poutama Island at the end of the first season, an invitation to return the following season was extended to the researchers. However, during the off-season attitudes towards the research by some individuals changed, and the researchers experienced aggressive and offensive responses from some *whānau* birding in the second season. The community leaders called a meeting between the *whānau* and the researchers to see if the issues might be resolved, but in the end, without unanimous support from the birders on the island the decision had to be made to cease work on the island. This episode illustrates two important features of conflict resolution and governance issues in the community: (i) communication is to be open, face-to-face and honest, and (ii) community-level sanctions for work is never enough on its own—the *whānau* retain control of what happens (or doesn't happen) on their own manu. For research to proceed at a given place it must be supported both by the collective *iwi* and by the *whānau*. After discontinuing

the work on Poutama Island, the researchers were required to take another year out to build relations with the birders on Putauhinu Island and transfer the benchmark studies there in 1997 (Bragg et al. 2009). Therefore, for some field research agendas the research had to start again in year four, a somewhat frightening prospect for the researchers that were bound by contracting schedules to produce results by fixed dates.

Misunderstanding and lack of knowledge of what the researchers do were identified as part of the source of conflict:

“It’s trial and error. It’s like ... they [the researchers] started off green and they ran into trouble ... they are asking questions and the muttonbirders weren’t used to them having people there underfoot asking these questions and they [the birders] just didn’t make allowances for it” (Birder 6).

Given the broad scale and deeply held opposition to the research at the outset, why then did the community leaders choose to initiate the partnership, and why did the majority of the birding community eventually gain confidence in it?

Guiding values behind successful partnership

The partnership prevailed partly because guiding values and fair processes were established right from the very start of the project. Both the RTIAB members and University of Otago scientists identified a range of attributes they considered crucial for successful co-management partnership (Table 2). Core concepts included: (i) trust between parties, (ii) effective communication of scientific concepts and results, (iii) equitable decision-making responsibility, (iv) building scientific capability, (v) monetary support to participate fully in the partnership, and (vi) respect for each other and each party’s knowledge.

Of these, trust and respect for each other were the most fundamental and time consuming to establish and demonstrate.

I’d say there is trust between the Rakiura Tīti Committee and the Zoology Department. There’s probably not so much trust coming from the Rakiura people themselves and so that probably indicates to us that, yes we do need more communication with them [our own people] to let them understand exactly what’s going on” (Interviewee 8).

Respect for local participants and their knowledge, coupled with transfer of power to the community to control the research, was clearly an essential component of the project acceptance and ownership by the community:

“I find [the researchers] very respectful and [they have] good ears. I think they [the researchers] all do very well, and DoC and other organisations could learn a lot from the way they operate actually” (Birder 7).

Seven of the eight RTIAB members interviewed in 2002 felt that co-management should be represented by a 50:50 partnership, defined by equal input and joint decision-making, and with a willingness of parties to work together and respect each other’s authority and ideologies. Two members expressed the view that partnerships should be conducted according to the principles laid down in the Treaty of Waitangi in 1840 (Lyver 2005).

“I expect co-management to be all parties working together in good faith basically and accepting each other’s wants and needs and making them work as good as possible. A good co-management arrangement is for everyone to understand and accept each other’s needs and wants and if they are not acceptable or in the original arrangements, then you just don’t go there. But you need to define what it is you want and need and how acceptable is it” (Interviewee 6).

“I have done quite a bit of work with co-management by the Crown and Māori. Really all you want is a fair say and just meeting within the agreement of the Treaty. It is part of our responsibility to practice our Māoridom on how we feel about species, the whenua [land], or whatever. It’s just about being fair” (Interviewee 5).

University of Otago scientists recognised that the term “co-management” was an ambiguous word, which could mean many things to different people. One researcher expressed that a 50:50 split in power-sharing was a minimum requirement for a collaborative partnership. Anything less would denigrate the mana of Māori as equal partners. However, lodging nearly all the power to the community was in his view more likely to lead to sounder science, increased community participation and ownership of the science so that eventually it will be applied (Lyver 2005):

“Well I think co-management is a much abused term and it means many different things to different people. The word has a seductive sort of quality to it that leads some people to think that it means a bit of power sharing—nothing too threatening from the outset. But actually the international literature uses the term in a much more general sense of a complete continuum from very little power sharing through to complete devolution of power to local stakeholders. The whole principle of subsidiary is

Table 2 Conditions identified by eight Rakiura Tītī Islands Administering Body (RTIAB) members and two University of Otago scientists as fundamental to a strong co-management partnership. TEK, Traditional ecological knowledge.

| Condition | Examples from within the Tītī Project |
|--|--|
| Respect for Treaty of Waitangi 1840 principles | Research supported the return of ownership and management of the Crown Tītī Islands to Ngāi Tahu. Research was conducted under the spirit of the Treaty of Waitangi. |
| Establishing appropriate decision-making procedures | Establishment of a Cultural Safety Agreement to protect both Rakiura Māori and researchers, and to guide scientific process, and ownership and release of knowledge. |
| Equitable power-sharing | RTIAB were required to review and approve all research methodologies and scientific findings prior to their implementation or public release. Ownership and responsibility for project by Rakiura Māori. |
| Equitable transfer of problem definition and project initiation | Rakiura Māori identified signs of declining harvest and tītī population. Rakiura Māori invited research to investigate status of the tītī population. |
| Equitable decision-making responsibility and solution identification | RTIAB held final decision-making responsibility for research. University of Otago scientists advised on most appropriate scientific activities and interpretation of results. |
| Developing trust and respect | Concession to wider New Zealand society made by Rakiura Māori to open up the harvest of tītī to scientific scrutiny. Continuity of participants from RTIAB and university in partnerships avoided any destabilising effect of new members on relationship. Participants maintained regular face-to-face contact throughout entirety of research. |
| Initiation of dialogue | Research project opened lines of communication between Rakiura Māori and research provider to address tītī declines. |
| Distillation and communication of scientific concepts and results | Quarterly meetings held between RTIAB and university scientists, and annual meetings held with Rakiura birding community. Series of final meetings held with Rakiura community to deliver final results and recommendations. Participation of RTIAB at national and international conferences, workshops and hui. |
| Building scientific confidence and capability | Approximately 8–9% of annual project budget assigned to RTIAB to participate in project. Four Māori students supported through post-graduate studies over course of research. |
| Facilitating access to TEK | Access to TEK and harvest diaries provided by muttonbirders and elders throughout the project. Provision of detailed historical data by muttonbirders. |
| Respect for both knowledge systems | All TEK remains the intellectual property of Rakiura Māori, while science is jointly owned. Approximately 20–30% of research addressed TEK constructs and understandings. Both TEK and science used in study of relationship between tītī population declines and El Niño Southern Oscillation. |
| Facilitating use of TEK and opportunity to practice tikanga (custom and culture) | Both knowledge systems have been used jointly to inform final harvest sustainability recommendations to Rakiura community. |
| Sharing of benefits | Employment and training opportunities provided to both Rakiura Māori and University of Otago participants. RTIAB members developed sense of scientific understanding, control and confidence. University of Otago researchers developed greater cultural competency through interaction with the Rakiura community. |
| Adaptation to unfamiliar cultural structures and ideologies | These adjustments are outlined in detail in Table 3. Further research will have to be done in a very different way to conventional approaches predominating until now, even though the fundamental parts of scientific method and inference are not changed. |

involved here. Normally the power is a transferal down from some central agency or assumed authority for a country to shift responsibility and decision-making, problem definition, solution identification and day-to-day active management to a local group. Without this transfer of real power, co-management could result in tokenism and still be called co-management. At worst the local people are just being informed, so called ‘consulted,’ when the government or researcher has already made up their mind what the priorities are and what the actions will be and what the solutions are” (Researcher 1).

Research must be focused and relevant for the community

Many birders saw long-term value from the research “to ensure that the birds are coming back”, to ensure that the birders “have a sense of belonging”, to ensure that “all the birders are looking after the islands” and to ensure that their “children can maintain and continue their heritage”. Amongst those that supported research, birders mainly emphasised the need for the research to be focused on the birds and their wellbeing. This was often coupled with acknowledgement that the birds were declining and a wish to measure baselines from which future changes could be benchmarked and understood, and to protect tītī and their habitat. For example:

“.. we have got to find out what the story is, why these seasons are bloody, you know, dropping off, then coming back again” (Birder 6).

Although there was immediate focus on supporting the birds, there was repeated recognition that the science was “not just for the bird, it was also for the people”. Another community research leader expressed the wide concern as follows:

“When you look at things holistically like we do, it’s about cultural wellbeing. There is a lot to that—it’s the spiritual side, the mental side and the physical side. “Taha wairua, taha hinengaro, taha tinana”. That’s saying all parts have to be in balance for you to have wellbeing. Yes we do things holistically, which will be very difficult for the science perspective that looks at the one nut and bolt. We do look at the whole thing” (RTIAB 1).

It is testimony to how much the birders revere their bird and birding’s spiritual side that they were willing to take on the risk of the research (Table 1) in order to help safeguard the ecological resilience of the tītī population.

A need for leadership and community mandate

A research partnership will not succeed unless there is a strong mandate from the community at large. Gaining that mandate requires strong leadership and institutional processes for joint decision making from within the community. Three members of the committee that directed the research discussed it this way:

“We gained the confidence of Rakiura Māori. They gave us the mandate to go ahead to do this project, to facilitate in partnership with Otago University’s Department of Zoology. That’s a huge thing. That stacks up big time. For all our people to give us the mandate to go ahead, to me that was a big thing” (RTIAB 4). *“We couldn’t have done it otherwise. Leaders must discuss it openly with your own people first.”* (RTIAB 2). *“That’s a must. Absolutely, before it passes go, even gets to go”* (RTIAB 5).

Respect for the rights of individual whānau was paramount. Field trips to different islands and manu was by invitation of their owners only, even though the community directors actively managed the research process on a collective basis for the whole community. Any research procedure or work plan therefore needed to gain approval at both the whānau and Rakiura Māori level. Similarly, initial approaches to establish the research had to be signalled, discussed and approved at both the Rakiura and tribal (Ngāi Tahu) level, even though thereafter all the decisions and processes were vested entirely with Rakiura. Visits and field procedures on DoC-administered islands needed annual permits and demanded annual reporting. The Foundation for Research, Science and Technology conducted its own audits and investigations of the progress of the project (e.g., Morris 2002).

Strong and active leadership from within the participating community was critical to our partnership prevailing. Leadership has been identified as an emerging, important and somewhat understudied contributor to social-ecological resilience where local communities throughout the world respond to resource management challenges (Agrawal 2005). The interplay between individual leaders, whānau, hapū (sub-tribe) and iwi based authority is fundamentally and intimately based in culture, so of course the processes and needs for research planning, execution and response are going to be very different for Māori. Research teams need to find guides, strong leaders and learn for themselves how to meld with and negotiate these local power structures for successful science.

Once accepted by a local community, the research team must then avoid capture by any particular factions or leaders within the community—otherwise disaffected sections of the community will oppose, disrupt or disregard the research results simply because they see research to be supported by another faction of the community.

There is also a need for strong leadership of the research team:

“I don’t feel that our team leader is power hungry or dictating or anything. It’s just that if he wasn’t there directing, it wouldn’t be happening because of the fact that it seems to require somebody with amazing energy and also the knowledge of the science system and to be in the science world to getting a project like this going and to keep it going” (Researcher 3).

The importance of sharing knowledge and diversity of approaches:

Both scientists and kaitiaki were united in respect for knowledge.

“The Māori were well aware of the importance [of] that since time immemorial really because there’s this whole whakatauki that was handed down “kia tupato ki ou whakaaro, koia nei te matua o te kaha” and that’s just saying “be careful of all your thoughts because thoughts are the most powerful thing of all”. Or another way of expressing it is that “knowledge is the most powerful thing of all” (RTIAB 1).

Arrogance about ones’ own knowledge potentially precluded partnership at the beginning:

“Before you [scientists] came aboard, we thought we knew everything, which we do! [Laughter]. But you learn as you go when you are working together. That’s what I’m meaning, because we thought, and I’m not the only sitting here that thought this, that you [the researchers] couldn’t tell us anything. We knew it all. And you got that from the people, from the birders themselves. But as the time went on and you explained more and you got your Tītī Times, I think people have come now to know and to work with science. Especially the elder ones. Hopefully the younger ones will come on to the party too” (RTIAB 3).

The *Tītī Times* referred to by RTIAB 3 is a biennial community newsletter initiated by the researchers.

There were repeated references throughout the 14-year research project to the arrogance of science and the way it discounted mātauranga.

“Our knowledge wasn’t accepted and I think we found that out with the mahinga kai or through

the Ngāi Tahu Claim. It was a struggle for others to accept that Māori actually knew something” (RTIAB 2).

There was widespread recognition that the decision to engage in science-mātauranga partnership was both politically dangerous and expedient (Table 1). One way of protecting the birding was to use science as a way of giving confidence to external agencies that the harvesting was sustainable and that the Tītī Islands were being managed responsibly:

“The first kaupapa [agenda] was about validating our tikanga, which is ‘procedural integrity’. Tikanga is about how we do things and that’s what the kaupapa of the whole research was largely based around. We wanted the research to validate the way we have managed on the islands sustainably over the years. And I think it largely showed that. Of course it showed that there were outside influences, things from outside that are threats, big threats [to birding]” (RTIAB 1).

“We entered into the partnership because we were wanting to prove that mātauranga Māori and the way that we had managed the islands was just as relevant as using a western science approach. I wanted to reinforce in my mind that the management of the island was being well done from a Māori perspective” (Interviewee 2).

Some birders were cynical about opposition to the science from within their own community which they saw as politically motivated:

“So coming back to the political side of it, I do believe in my heritage to a certain extent but there are a lot of people out there who just get on to the political Māori side and the financial side [of birding and oppose the science]” (Birder 8).

Many birders emphasised a need for research because of inevitable global changes and the need for Rakiura Māori to change with them. Others stressed that a two-way learning process was necessary:

“We need to do [research] as much as we [need to] teach you [the researchers]. But we have also got to be taught ourselves” (Birder 3).

Some birders supported the research on wider fronts because the birders’ own knowledge was constrained by only observing them during the late breeding season, a theme emphasised by Moller et al. (2004), Newman & Moller (2005) and Moller et al. (2009a):

“Anything that’s off the island, that’s the information I’m interested in. Because what’s happening on the island, I can watch for myself” (Birder 12).

Science capacity building

There was also a fundamental choice of the community directors to use the Tītī Project as a way of encouraging their children to take up careers in science:

“We sent a signal to our young, our next generation, that this is important. Get an education. Go to university, study zoology—you know. We sent the signal to the [whole] tribe actually, because they know we have to have competent people who are also educated in western science. They might learn off their old people as well, but they have got to learn both ways of it for today’s world” (RTIAB 2).

The Tītī Project was seen as a particularly ideal one to trigger involvement of their young people in science:

“For these young people that have come through, it was a golden opportunity for them to become scientists by being involved with something that is part of their life, their tikanga. How closer can you get than that to learn something, to learn science, about a precious taonga? Though we harvest the birds, at the same time we practice ways to keep them there. When you asked what came into our minds when you said the words “Tītī Project” I put the word “future”. Because that was the whole essence of the project. It was looking to the future” (RTIAB 4).

Māori students training in the Tītī Project had particular opportunities as well as added pressures and expectations because of their ethnicity:

“It is not just the Pākehā in the team that needs to be kept safe. Māori can cop flack on social and spiritual levels—especially young and naïve ones. There is a need for mentors for both Pākehā and Māori researchers” (Researcher 4).

This difference in expectations makes it very important that the relationships and diversity amongst the researchers themselves are respectful and inclusive across ethnicities:

“It can be very lonely for a Māori member of the research team when members of their own community oppose science and members of his/her own research team distrust him/her for it” (Researcher 4).

The Tītī Project was able to train three Māori PhD students (two of whom were Rakiura), one Māori Masters student and one Rakiura Māori Honours student throughout its 14 years. Three additional PhDs, five Masters and four Postgraduate Diploma theses were completed in the programme by Pākehā students. There were a further two Rakiura Māori hired as long-term research assistants and managers and six members of the community were hired

for short-term field work duties as part of a capacity building initiative. The main postdoctoral and overall research leadership rested with four Pākehā. Altogether, despite strenuous efforts to recruit them to the programme, only around five (29%) of 17 students, and none of the long-term research leaders were Māori. A main reason for this minority of Māori in the science team is a simple lack of Māori graduates so far. Science is a specialised skill that requires years of training and many emerging Māori scholars have targeted medicine and law as career options.

It was mutual respect for and sharing of each other’s knowledge that cemented the trust between the partners:

“It’s a sharing of knowledge that’s been a huge part of this project, to get to where we are now” (RTIAB 4).

Confidence and understanding of the science grew once it was applied and framed in terms of mātauranga. For instance, one of the community leaders stated:

“I thought science was just Bunsen burners and things that you learnt when you were at school in those dim old days. But then as time went on it turned around for us because the research partnership brought in the mātauranga Māori, the customs and the uses of what we have done over the centuries” (RTIAB 2).

However, even at the end of the study, some of the community research directors considered that the sharing of knowledge was not fully reciprocal: *“We imparted knowledge, the scientists didn’t arrive with knowledge. They were gathering it off us. Through all the trial it is put together and then it’s shared. So it didn’t come with the scientists”* (RTIAB 1).

This point of view is generally not shared by the researchers. They believed that their own knowledge system, which has also been handed down through the generations, had been shared as fully as practicably possible with the birders. It is not surprising that specific and complex science methods or results cannot be immediately and fully understood and then challenged on scientific terms by community members who had not been trained in science. The kaitiaki were vigorous and forthright in challenging the science from a mātauranga perspective, often effectively identifying weaknesses in scientific conclusions, but this peer review was generally not based on conventional evaluation of the science methods or results.

The ideal scientist for cross-cultural research

The community research directors were adamant and unanimous that Pākehā scientists could work in a respectful and successfully cross-cultural way. Nevertheless, many of them thought that the ideal scientist for this type of work would “ultimately be one of our own” i.e., a Rakiura Māori from their own community. One explained it this way:

“It’s partly about seeing our faces in our places—taking our rightful place. Because of colonisation, we are not seen like we should be. Which is nothing to do with capability. It’s just that we have got to develop that capability, so it’s about taking opportunities when they come. Some of them will have to be pushed. It’s going to take a generation or two to see us going into science. It’s a bit of a catch-up” (RTIAB 1).

Qualities sought in an ideal scientist by the kaitiaki were “respect” and “a sense of awareness”. They must “have an open mind” and “have an understanding of indigenous people and their sensitivities, to know how to work with them and accept them”. A fundamental requirement was for the scientist to “work with” mātauranga. There was a clear wish that the same person needed to be strong in their tikanga and mātauranga as well as in science:

“I think it’s really useful when they [scientists] have it from both sides: western science and being brought up with their mātauranga. If we are talking about that sort of process I think that is invaluable” (RTIAB 1).

The kaitiaki see the ideal researcher as having “a bit of humility”. A research leader emphasised that there was an important difference between arrogance and confidence of the researchers that their way of knowing really could make a difference, and that these are often confused by opponents of cross-cultural research partnerships.

“I don’t think one culture can raise its own pou [pole] higher, to bring its own mana up, by pulling down the other culture’s pou. I’m proud of science and I wouldn’t be seeking a collaboration with Māori if I did not think it might be useful for them, but I don’t need to takedown mātauranga to express my love of science” (Researcher 1).

True and valued partnership was never about submerging differences, or seeking some blend or mix of knowledge systems that pretends these are not very different ways of knowing. These issues came into sharpest focus when science and mātauranga challenge each other in robust peer review and dialogue, e.g.,

“We [scientists] are trained to be sceptics. But I hope we were not cynics. I think there is a big difference. A cynic is someone who would write off mātauranga or any other point of view, right? And they might be arrogant enough to say science is the only way of knowing. I’m afraid that happens a lot. The ideal cross-cultural scientist must never be cynical but remain sceptical. Until we have some evidence for this we are not going to accept this is true. We felt really uncomfortable about having to stand and say well actually we don’t necessarily believe that birding is sustainable until we have got some evidence. That could come across as though we are being culturally arrogant, but it is actually the way science goes” (Researcher 1).

Others acknowledged that they have to be good scientists, first and foremost, while having these additional qualities to work effectively with Māori, e.g.,

“They have to be scientific for a start. It’s no good having them on the islands if they are not scientific. Got to have someone like you [a science leader], I am saying, at the kick-off, to get it rolling” (RTIAB 6).

Retaining confidence and courage

Scientists working in cross-cultural arenas need courage, self-confidence and surety in their own role and culture to enable them to withstand conflict and the mistrust from some individuals in the community:

“We [scientists] found it difficult to be mistrusted. That was quite hard because we were sometimes under attack from our own peers [from within science]. So we felt kind of in no man’s land between the two cultures. It really was excruciating to have people shout at us for six years on the marae about the same thing that we tried to explain, and when the community as a whole had sanctioned and invited the research. We were really surprised by the kōrero at the marae was almost one-way traffic against us at the beginning, until one of you [kaitiaki] jumped on your feet one hui after four years and shouted back in our defence. That was a big milestone for us. We found that we were continually going into aggression towards us. That’s quite wearing for a team that is desperately wanting to be ethical and honourable” (Researcher 1).

The challenging reception on the marae was viewed by the RTIAB as “a character test”, “a form of baptism”, and “cultural thing”. One leader explained it thus:

“Well from my experience it is about—“Harden up. I’ve got things to say to you, if you’ve got things to say to me I expect you to say them”. That’s how I see it from a Māori perspective. From my Māori perspective anyway, I’m not speaking for all Māori. But in my experience, that’s what it’s about—it’s the challenge and the thrust and the parry of your kōrero and my kōrero. And heh, eyeball to eyeball stuff. That goes with the territory” (RTIAB 5).

The community research directors advised the scientists to “give it back”, not to “harbour it within yourself”, and “just let it go with a grain of salt” because it is “absolutely not personal, it’s not about you”. It might even be a sign of respect—“if they don’t give it to you, you’re not worth it”. Their advice to young scientists, or even the older ones starting along the path of cross-cultural research, is to “not lose their confidence from it”, to “be aware that it might happen and find a way to work around those people”, that oppose your presence or role. One of the researchers put it this way:

“Our new researchers needed to be aware they are going to be held responsible for the past and current wrongs to Māori and not to be affronted by it. It’s part of the iwi checking how we respond, and whether we’re aware and responsive to those wrongs. It’s not a personal attack” (Researcher 2).

Changing how science is done to better meet Māori community needs

Part of the agenda of the kaitiaki in forming the partnership was to influence and change the way science was done, to make it better meet their needs:

“We needed to learn how to involve people like yourself [researchers], changing the thinking of western science to acknowledge what is mātauranga Māori. I think you became more of an ear. I’m not saying you have changed completely! [Laughter] But some of your views have changed. I think that the wider NZ scientific groups, some are more aware of involving Māori in the many different facets of science now” (RTIAB 2).

The research team quickly realised that science would have to be done in very different ways than they had been taught if it was to be accepted by the Māori community. The fundamental processes of scientific inference and testing, full public disclosure of results remained unchanged, but the way the work was done and communicated must be different in cross-cultural, community co-managed research (Table 3). Individual scientists had to learn a whole new range of skills, to give over a huge measure of control of the research process, to deal with conflict, and to make themselves personally accountable for their science.

Table 3 Some of the lessons from the *Kia Mau Te Tītī Mo Ake Tōnu Atu* research partnership between Rakiura Māori and Te Whare Wānanga o Otago (University of Otago). The summaries here are compiled from Davis (2001), Howard & Moller (2001), Moller (2001 a,b, 2003), Newman & Moller (2005), Kitson & Moller (2008) and Moller et al. (2009c) and from the final focus group discussion between the RTIAB and researchers that informed this paper. Elements are arranged in order from start-up, to relationship building, execution and reporting and interpretation of results.

| Issue | Summary of lesson |
|------------------------|---|
| Learn by doing | Learning about Māori perspectives on the environment needs to be hands-on rather than abstract and isolated from the community. Learning how to establish and maintain a respectful bicultural research relationship cannot come from a book. You’ll need confidence and trust to work it out together. |
| Audits and assessments | Audits and review of teaching, research priorities and process, or management structures by an external assessor can be informative and offer guidance to improving biculturalism. An external audit rather than an internal audit is likely to deliver the greater truth. |
| Cultural mentoring | Pākehā should take a guide from the local Māori community to help introductions and understand Te Ao Māori, iwi structure and tikanga, e.g., a DoC Kaupapa Atawhai manager was crucial in our case to guide the researchers in the establishment of the research partnership. |
| Conflict management | Māori have a refreshingly honest, open approach to conflict resolution which can be very unsettling and sometimes daunting for Pākehā scientists when approaching iwi for the first time. Initially establishing agreement about how conflict is to be managed can be beneficial to partnerships. A moderate level of well-managed conflict can bring diversity and creativity to the identification of problems and solutions. |

(continued over page)

Table 3 (continued)

| Issue | Summary of lesson |
|---|---|
| Personal accountability of scientists | <p>It is important for iwi to know the researcher, and what drives them. Contact must be <i>kanohi ki te kanohi</i> (face-to-face) as much as possible.</p> <p>Iwi demand personal accountability from researchers.</p> <p>Keep the research and community directorial teams as stable as possible—personal trust is needed, so having a flux of researchers or committee members undermines trust (and institutional memory).</p> <p>Relevance of research nurtures pride and commitment in scientists. Working amongst <i>tangata whenua</i> (local people) and resource users is enormously satisfying for scientists who are able to work with the challenges and constraints.</p> |
| Written agreements | <p>Cultural safety agreements can be important in the beginning to set out expectations.</p> <p>Some communities may want a formal contract to help initiate partnerships and provide a feeling of safety before trust can grow from actions.</p> <p>Other communities may feel a formal written agreement makes the whole process all the more “Pākehā”.</p> |
| Cultural intellectual property | <p>Science information and findings should be jointly owned by iwi and researchers.</p> <p>Tangata whenua retain complete discretion on whether mātauranga is disclosed.</p> <p>Individuals within the community will ultimately make the choice of what, if anything, will be disclosed; yet community agreement and safeguards are also needed.</p> |
| Persistence | <p>Agree to a minimum time period (10 years in the tīfī case) to work together through thick and thin.</p> <p>Keep on going when the going gets tough.</p> <p>Researchers and external agencies often exit the partnership after initial commitment when the cross-cultural difficulties become evident; researchers need security of a medium-length period to invest in baseline measurements and establish methods.</p> |
| Scientific freedom, values and ethics | <p>The community must respect the fundamental scientific ethic around freedom of information release; reliability of science depends on publication of results, no matter what answer was obtained from the research—otherwise the publically available evidence becomes biased.</p> <p>Tangata whenua have no right to stop public release of scientific findings, regardless of outcome, otherwise scientific integrity and ethics are violated.</p> <p>Researchers and kaitiaki in most instances cannot accept public funds for research unless the results are to be fully disclosed.</p> <p>The choice of goals, methods and communication modes of science can readily be changed to reflect tikanga and facilitate participation by Māori, but fundamentals of objectivity, measurement, test and logic are not negotiable if science is to remain science.</p> |
| Tikanga (lore/Māori ethics) | <p>Researchers need to be prepared to adapt their scientific procedures to accommodate tikanga—this is no different from obeying ethical norms of wider society (e.g., do not cause unnecessary pain to experimental animals), it is just that Māori have a different set of ethical bounds.</p> <p>In the eyes of kaitiaki, how the science is done may be more important than what is done.</p> |
| Communication | <p>Invest a large amount of time and resources in appropriate communication with all members of the community.</p> <p>Oral communication and discussion of research is the favoured mode of reporting.</p> <p>Popular newsletters are useful for delivering science and assisting the community in understanding the research.</p> <p>Science publications are needed to safeguard scientific rigour.</p> |
| Science can be invasive | <p>Science brings strangers into local communities.</p> <p>Science-mātauranga partnerships can generate community conflict, and sometimes also help reduce it.</p> |
| Standing between two cultures can be lonely | <p>It can be unsettling for a research team when opposition seems to be come from both sides of the cultural divide.</p> <p>It can be unsettling for leaders within Māori communities to stand by a science partnership when some members of the community oppose science.</p> <p>Research teams must overcome opposition from both sides, i.e., from within their own scientific culture and from within the participating community’s culture.</p> |

Table 3 (continued)

| Issue | Summary of lesson |
|---|--|
| Research pace | <p>Appropriate pacing of the research is critical and difficult. Going too fast before trust is established will break the partnership, but going too slow will also frustrate the partnership.</p> <p>Begin with less invasive and concrete research subtopics to build trust; deepen the research and venture into culturally sensitive issues later.</p> <p>Science progress may be much slower than usual when establishing co-management across a cultural divide, especially if there is opposition to the research.</p> <p>Kaitiaki and scientists must be willing to invest time to build partnerships, which takes away energy and capacity to work on the science or other issues.</p> <p>Scientists and kaitiaki often need to be trained in a whole new set of social and personal skills to work on bicultural co-management project.</p> |
| Individuals and leaders within the participating community and within the research team are important | <p>Support for research given by locals has a lot to do with friendships between individuals. Key individuals within local community and research team can have a huge impact in grounding (or disrupting) partnerships.</p> <p>Strong leadership within the participating community and the research team is essential for the partnership to be effective and safe.</p> |
| Resourcing for participation | <p>Unpaid iwi authorities can carry an immense work burden, and fitting in the management of a research project may jeopardise the sustainability and quality of other mahi.</p> <p>Science is expensive.</p> <p>It is unrealistic to expect iwi to participate fully in environmental management without mechanisms and resources to pay for their time and input.</p> |
| Researchers need to go to the marae to listen and learn | <p>Understanding the links tangata whenua have to the land can be useful motivation for persevering with bicultural co-management.</p> <p>Listening to the mātauranga being shared in the marae kōrero is an important way of learning its context and meaning.</p> |
| Kaitiaki need to go to scientific forums to listen and learn | <p>Provide funds for kaitiaki to attend science conferences so that they can learn how their researchers' peers receive the joint work.</p> |
| Accessing research funds | <p>Money for research belongs with the mana of what is being researched.</p> <p>Secure funding in the name of the community research directors, not in the name of the research providers. This strategy affirms the authority of the local community and builds safety and control for locals.</p> <p>Capacity to write research grants normally resides with the researchers. It is a technical and very time consuming task, and competition for funds is extreme for Māori-oriented research. Research providers need to ensure that they do not misuse this opportunity to become gatekeepers. Grants must reflect the kaitiakis' needs, not just the researchers' priorities.</p> |
| Hold fast to your beliefs | <p>Mātauranga and science both have a lot to offer, but they are very different.</p> <p>Respect for mātauranga does not diminish respect (and pride) in science, nor vice versa.</p> <p>Scientific scepticism (a friend of scholarship) is quite different from cynicism (an enemy of objective analysis), however it can be perceived as cultural arrogance.</p> <p>Partnership is not about surrendering one's own values or identity, but about recognising the validity of a partner's reality in return for their respecting yours.</p> |
| Pick the best of both worlds | <p>Cross-cultural emic (insider) and etic (outsider) perspectives are both valuable for understanding mātauranga and science and the problem they are being directed towards.</p> <p>Synchronic (science) and diachronic (traditional ecological knowledge) can complement each other.</p> <p>If the partnership and processes have been set up right, mātauranga and science help test each other.</p> <p>Trying to meld or blend the knowledge systems, or pretend they are the same, diminishes the mana of each, and risks not capturing the best of both worlds.</p> |

Transferring control of research processes to the community

Control of the research process, its goals, ethics, methods, interpretation and the way results were communicated was fundamentally important for the community to feel safe. One community research director put it this way: “*We needed to have control of it [the science project]. We wanted to be steering the boat rather than being part of the crew in the way we usually are*”. Clear definitions of roles, conflict management procedures, intellectual property ownership and power around decision making were therefore essential from the very start (for details see Moller 2001a).

Although the intent and hope of both sides of the partnership was to have Rakiura Māori direct the research as closely as possible, this was not always practical, especially in details of scientific design: “*We try to have them run the show, but it still very much feels like we set the agenda and ask the questions and then get ‘yes’ and ‘no’ answers for things. Of course, there are a whole host of reasons for that. One of them being the workload they’re [RTIAB] under and also that they are not scientists. We have to generate the science questions we are wanting to ask, and then go to them with the questions for their confirmation and approval. If they had the expertise to do that, to design the detailed science steps, that would be the ideal situation*” (Researcher 3).

In view of mistrust that the science would bring external control of birding (Table 1), the community research directors were anxious about all media attention. For the first decade the researchers were given no direct say in what was said to the media. After individual members of the birding community misrepresented the science in the media and potentially undermined the credibility of the science team, this was changed to an agreement that joint statements of the community and scientists would be made for the remainder of the project. The University of Otago trained two of the Rakiura community leaders to work with the media.

Pacing the research: go slower than usual!

Developing the research at a pace appropriate to the iwi can be difficult. Going too fast can precipitate fear and mistrust within the iwi, and the feeling that the researchers rather than the community are leading the project. However, kaitiaki can become frustrated if progress is too slow because there are many other demands on their time and resources—as one community leader put it: “*This [directing*

science] is only one thing that iwi do. This is one little piece. The iwi is swamped with many, many kaupapa”. It is inevitable that some members of a large community oppose what is happening, so the delicate balance for the community research directors and researchers themselves is to go just slow enough to take the majority of participants with them, but not to be captured by the minority that may wish to block. Having several discussions at the outset is important, but in the end it is getting on with the work that forms the trust and understanding that underpins and reinforces the relationship. As one RTIAB member put it—“*you learn as you go when you are working together*”. In general, the process is more uncertain and much slower than science done largely in isolation from society or an involved community of interest. We were able to keep up with and exceed science milestones in the Tītī Project, but nevertheless would have done much more science itself with our available funds and energy had the added requirements of community interaction and communication not have been necessary.

Personal accountability of scientists

The fundamental requirement of individual scientists is that they make themselves personally accountable for the research process and are willing to build a relationship with the community research directors: “*The key to success for any project, for anybody I guess, but particularly for us as a people, is having open and good relationships with those people kano ki kano, face-to-face. Hearing what you have got to say, sussing you, you being able to do the same with us. That for me is a bottom line—face-to-face interaction as a foundation for a good relationship*” (RTIAB 6).

This flows on to a requirement to build personal relationships between the researchers and community members—the individual participants become the face and heart of the institutes they represent in the minds of the community participants. Those bonds became strong when the researchers and birders had spent time together, worked on field work together, travelled to co-present papers at conferences, laughed and sometimes cried together, and prayed together.

At first we had too many short-term and temporary researchers involved. Having lots of new people, and especially some students on the manu, was not always a comfortable experience for the birders because they then had no time to gauge their ethics and personality and therefore did not necessarily trust them:

“People come down [to the manu] and they have a PhD to do. So they are focused in what they have gotta do. They have to do the mahi [work] to get the marks. At times the perspective of the mātauranga is cast aside and their focus is science and their way to gain it—to get where they want to be at the end of the day. I suppose that is a human thing, to gain the ground. They only know of that way and some went to great lengths to get what they wanted. So it’s been learning for both parties. I must say though the main percentage of the [research] people have been very good. Those that are there for the duration and those that we got to know and those that got to know us, they were good. But it is the ones that have come and gone, flown in on that helicopter, stayed for a week or whatever, come from overseas and were gone. You know, you felt a bit empty after a while, because the knowledge and that information was taken away. You had a sense of some people who were very respectful and still some of those people come down. Whether it be for the Tūi Project, or whether it be from the Department [of Conservation], only some understand the sensitivities—they respect our knowledge and the tikanga” (RTIAB 4).

In the last half of the study the researchers managed much more closely who went to the islands and worked closely with the birders. We only allowed PhD students (doing 3 years of thesis work) to go to the islands, and avoided having Masters students (1 year of thesis work) in close contact with the kaitiaki. Rakiura Māori were hired as field assistants in the initial years as part of a science capacity building and sharing benefits strategy, but this was abandoned after 4 years when their lack of training or commitment to the science itself led to problems. Long-term funding is essential to secure long-term employed positions for researchers working with Māori communities so that stable and trusted relationships can be established and maintained.

Sharing resources and benefits between the community and research institute

Equitable sharing of resources (Table 2) to facilitate active participation in the research process (Table 3) by the community is essential. Funding Māori communities for sharing their knowledge and fully participating in the science research process is extremely difficult because of the way funding is allocated and evaluated in government funding contests. Both the researchers and the RTIAB would have preferred there to be more money for supporting the community’s participation, e.g.,

“We had to look people in the eye on the marae and say we are actually getting a job out of this. We have to. We don’t have a choice. And it’s expensive and it is excruciatingly embarrassing to be working with a community that is not being paid for sharing their knowledge” (Researcher 1).

“We [the kaitiaki] are probably used to not being paid for it too much. So maybe that’s something that should be looked at in the future so that everybody could be funded as well for what they do. There needs to be give and take. Usually it’s all give of time and effort from our folk” (RTIAB 2).

Around 9% of the research funds were retained by Rakiura Māori to direct the project. Amongst other things, the kaitiaki used the funds to attend international science conferences, to represent their own project and to learn how science worked. The RTIAB are unanimous that this travel was “*extremely valuable*” and “*broadened their outlook on life*”. We strongly recommend that other partnerships fund participation of their community participants to attend conferences so they can represent their own views, learn about the world in which the scientists have to operate. This also enables their own people to report back to their community about how their research project is being received by international or national science community.

For two kuia, one such trip to Canada was a lonely experience, even though the chosen conference featured co-management of the environment by indigenous people. The Rakiura delegates were the only community-level indigenous people participating amongst over 100 scientists and other process or policy professionals from around the world, even though the topic under discussion purported to support local indigenous communities:

“It felt lonely and we were overpowered by western science. We were the only people who talked about anything that was indigenous to a country. That was my feeling. I thought it was going to be with indigenous people and actually able to discuss their science and how they could address their issues. But it was being addressed by high powered science people who were there to write good papers and be better known around the world. That was exactly what it was about” (RTIAB 2).

“The North American native peoples weren’t there [at the conference]—it was only when we went outside the arena of the conference that we able to meet up and talk and go to their villages. I found a lot of the indigenous people would ask us about our relationship with you people, the scientists, and how

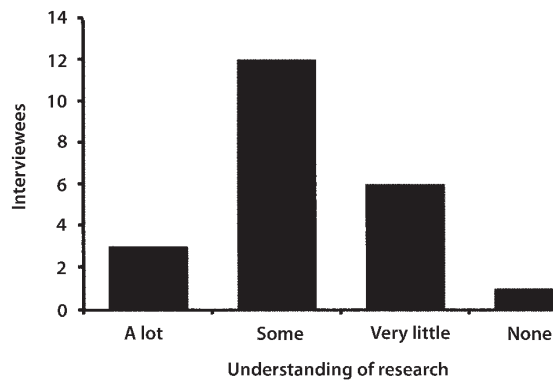


Fig. 2 Interviewees' self-assessment of their level of understanding of the *Kia Mau Te Tūi Mo Ake Tōnu Atu* research in 2001.

we managed to work with you and you with us—it was very educational really" (RTIAB 3).

Obviously other indigenous communities are contemplating partnerships with scientists but not knowing how best to go about establishing them. Throughout the 14-year project, travel by the RTIAB members to meet indigenous groups from Canada, Australia, and South America underscored that "*their worries were similar to ours*" and strengthened the resolve of the Rakiura Māori partners in the science project:

"They were losing some of their mātauranga. They were being directed by the NGOs. That's what I felt in Canada. That a lot of their indigenous groups were being overpowered by these world [conservation] groups. Groups that thought they knew what was best for the indigenous communities. I think that has been something that has happened to indigenous people throughout history when the stronger culture takes over or goes in there with the best intentions to help and then they become the driving force of what they think indigenous people should do. It's the wrong way round" (RTIAB 2).

The RTIAB urged scientists and conservation activists and policy makers to go direct to meet and learn from the indigenous people:

"Listen to them. Listen to what they have got to say. Don't read it out of someone else's writing" (RTIAB 2).

Communication to build understanding—a key to community ownership of the project

Most (68%) of the interviewees in 2001 considered that they had some level of understanding of the research, but 18% considered they had very little

or no understanding of it (Fig. 2). This level of understanding was considered disappointing by the research directors and scientists alike, so they collectively doubled and then redoubled their investment in hui and communication in the latter quarters of the study.

Informal and popular styled science writing

The research team created *Tūi Times*, a community newsletter to communicate research results to the community. It was written in popular style, mixing science results with history of birding, featuring key birders and whānau, providing a vehicle for community dialogue about all aspects of birding. The newsletter was expensive and extremely time consuming to write, but it was greatly appreciated (Bassett 2006) and is now credited with helping rebuild community links:

"Tūi Times is filling the gap from when we all travelled together [to the islands] as one big family on the Wairua. We were all together then, and since then it has fragmented. Tūi Times I feel is bringing us back together" (Kaikōrero 4).

Now that the research has ended, Te Rūnanga o Ngāi Tahu has provided funding to keep *Tūi Times* going.

Formal science reporting: a barrier to understanding and relationship building

The challenge of community communication is immense, especially when the community face a huge number of demands on their time, and similar hui on all manner of other issues in everyday life, and especially because many of the community are not strong or habitual readers:

"If some of us are not trusting that's only because maybe we haven't taken enough opportunity to, you know, read the materials and understand what's going on" (Interviewee 8).

Community participants complained repeatedly about the "*mounds of paper*" they were expected to read, especially when highly technical language was needed. Even some of the RTIAB research directors, after 14 years of interaction with the researchers, struggled with "*scientific gobbledegook*" and jargon and referred to being "*baffled by science*" and thought it "*somewhat tedious*".

Scientists are taught to be sceptical of all information, but especially of information that is not written down. They are inclined to accept its veracity even if they cannot meet or discuss it with the author. Students are taught to find a written citation as evidence for their argument and avoid as much as possible

the use of “personal communications” or informal written sources like the internet or popular articles. In contrast, some Rakiura Māori were extremely sceptical of information that scientists gleaned from books, particularly as the written word has been dislocated from direct communication with a knowledgeable community member who otherwise could check that you have understood it correctly. This is a part of a wider cultural difference in the way the veracity of knowledge is assessed by science and TEK. In TEK the circumstances that you learned the knowledge, especially who you learned it from (the messenger), is judged as a key predictor of whether it is correct. The knowledge is also tested against personal experience of the practitioners. The science ideal is for the knowledge itself (the message) to be tested completely independently of who asserts it (Newman & Moller 2005).

Science reports to individual whānau and the community

Confidential whānau-oriented individual reports were prepared by the researchers before the information could be aggregated into formal scientific papers in the usual scientific manner (a stipulation of the cultural safety contract was that information linked to a particular manu stayed with the whānau birding there and that the participating *whānui* (wider family groups) would always be the first to hear the results). To date the *Kia Mau te Tūi Mo Ake Tōnu Atu* project has produced 56 reports to the community (about two-thirds of which were confidential to particular whānau), 21 publications of *Tūi Times* (each with around 15–20 articles), and have reported the results in approximately 40 hui as well as a similar number of formal science conferences. There have been around 15 media exchanges (TV, newspapers and radio), and the researchers have contributed to four natural history films.

This “additional” form of communication can be weighed against production of 49 formally peer reviewed science papers and book chapters so far, with a further six at the planning stage. Therefore, approximately two-thirds of the research reporting was of the informal and “non-peer reviewed” type, at least as defined by scientific institutions, but all of it was needed to allow the Rakiura Māori community to scrutinise and analyse results. Communication within the community was the only way that mātauranga could formally peer review science findings. If the partnership is genuine, the community and mātauranga experts are peer reviewers just as much as the anonymous referees and journal

editors are peer reviewers of publications in science journals. Unfortunately this dimension is totally unrecognised by science institutions that have created indicators for excellence of science (like the Performance Based Research Funding model; Adams 2008) that values only the opinions of experts, preferably international ones, and written outputs in their own discipline judged only by science. The partnership could not have survived without commitment to reporting to all levels: whānau, Rakiura community, New Zealand society and the normal science institutional frameworks.

Practical demonstrations and participation in field work

At first the Rakiura community was concerned that they could not evaluate whether the researchers were good scientists or not. They “*watched us [scientists] very carefully, your every moove!*” and it was not until some of them saw the researchers in action on the manu that confidence grew:

“It was excellent when they were on our manu. It made us respect you more because I didn’t think you were doing a hell of a good job for a start. It was excellent for me, working with you, having my daughter working with you” (RTIAB 5).

This gathering confidence in the researchers was not simply about learning scientific techniques from practical involvement in field work—it was also about testing the ethics of the researchers from seeing first hand whether they treated the ground with respect, looked after the manu carefully by rebuilding collapsed burrows, and the way the researchers handled the adults and chicks.

Verbal reporting “kanohi ki te kanohi”

Several birders wanted the researchers to “*explain things first hand*”. Others referred to hui as the best way of learning about the research. Accordingly, the researchers increased the frequency of research hui in the last half of the project. However, one interviewee referred to living over 500 km away and therefore being unable to attend most hui to gain better understanding of the research that way. Verbal communication allowed dialogue, questioning to secure understanding and allowed the community participants to assess the personal ethics, commitment and competency of the researchers.

In our case, nearly all the research was conducted in English rather than in *Te Reo* (the Māori language). This reflected the way Rakiura Māori participants currently conduct nearly all of their business and marae discourse, though many of the community are

rapidly rekindling Te Reo and associated *kawa* (ceremony and protocols). Use of Te Reo is clearly more widespread amongst Māori communities further north in New Zealand and much of their mātauranga will be described most accurately in Te Reo. Therefore, our case study probably is not representative of the challenge presented by language and translation that could be encountered elsewhere. Nevertheless, the researchers were challenged and had to learn a modicum of Reo to operate effectively and respectfully on the marae and at hui and to understand key words that often were inserted in the kōrero which otherwise was predominantly in English. Just as the kaitiaki had to become familiar with important scientific terms, the scientists had to learn key Māori words.

DISCUSSION

Research, knowledge and power

Some antagonism to the Tītī Project probably lingers amongst some Rakiura community members because they mistakenly believe that it is associated in some way with DoC, and therefore must be motivated by a preservationist philosophy that will lead to external control of birding. This tension between local and central governance is probably all the more intense because the history of colonisation and cross-cultural struggles for agency and sovereignty leads to guarded decision-making on both sides of the cultural divide. The management of the tītī harvests is a remarkable and unusual case where much of the *rangatiratanga* (chieftainship, authority) has been retained by the kaitiaki (Stevens 2006).

The need for fierce protection of those rights was expressed by many of the birders we interviewed. Application of science, especially if coupled with assumed supremacy of that knowledge over mātauranga Māori, was viewed by some as just another form of control that will alienate the kaitiaki from their rightful place as ecological managers. The rise of urban-based preservation-oriented pressure groups in New Zealand over the last 4 decades has been paralleled by a rising animal rights lobby that often aligns with preservationist approach to conservation (Moller 1996; NZCA 1997). These groups claim a role as society's moral gatekeepers, with the right to assert their own perceptions of what is and what is not legitimate resource use or acceptable environmental management. Harvesting a native bird, and visiting offshore islands to do so,

are particularly opposed by some preservationists. Also, these groups often claim to "speak for the animal", thereby justifying their stance and actions to the exclusion of humans. The same antagonism and prescription of harvest prohibition by agencies outside the culture engaged in the customary use of wildlife is widespread overseas (Posey 1996; IUCN 1997). The fears of many birders, even those supporting the research initiative, that external groups will use the research results to seek to control or limit the harvests is therefore understandable. On the other hand, and equally understandably, devolution of power and authority on a local community that was not wanting or resourced to take on that responsibility would be inappropriate and potentially damage social-ecological resilience. The justice and equity issues boil down to giving the local kaitiaki every possible opportunity to contribute, and resourcing them adequately for exercising those warrants (Moller 1996; Taiepa et al. 1997).

Getting beyond scientism to embrace mātauranga

Scientism is the belief that the only real way of knowing is through science—that what is true is scientifically verifiable, and what is not verifiable is therefore not true (see Box 2 in Moller 1996). This is naturally interpreted as arrogance by most of the Rakiura kaitiaki, and they expected that this would be the stance of the individual scientists in our project. This preconception created a large barrier to the formation of trust between the two. There were 118 submitters to a public consultation process about return of the Crown Tītī Islands to Rakiura Māori in 1994, about the time of the start of the *Kia Mau Te Tūtū Mo Ake Tōnu Atu* project. All but 12 of the submitters opposed the return of the islands, and only one of those supporting their return was identifiably Pākehā. The official stance of the Royal Forest & Bird Protection Society was that they opposed Rakiura Māori ownership of islands that they considered to be nature reserves, but they did not oppose birding provided that scientific methods were used to monitor and manage the harvest (Southland Conservation Board 1994).

Insistence on science to define, monitor and judge sustainability cuts over the top of and discounts the local knowledge or mātauranga used by local resource users to guide their harvesting (Moller 1996; Kitson & Moller 2008; Moller et al. 2009c). Imposition of science against the will or choice of the local community steps in the opposite direction of the meaningful involvement of local communi-

ties in environmental management urged by the co-management advocates (Taiepa et al. 1997; Moller et al. 2000b). Research on how to enhance “environmentality”, a long-term change within people towards environmental care (Agrawal 2005), emphasises that appropriate local governance using local knowledge and community bonds triggers improved environmental sustainability and social wellbeing. Environmental co-management will not bring its expected benefits for culture and the environment unless the grass-roots resource users are all involved in the decision-making and monitoring of the resource (Borrini-Feyerabend 1996; Moller 1996; Agrawal 2005).

It is important that partnership goes well beyond simply “cherry picking” a few of the concepts of TEK-mātauranga that sit comfortably within a science framework (Ellis 2005; Stevenson 2006). An equal dialogue about all aspects of each knowledge system is more likely to identify the strongest solutions for improved management (Moller et al. 2004; Newman & Moller 2005).

“Māori Sustainable Development” is a term often used to describe a pathway to Māori autonomy, self-determination and the building of human and social capital (Harmsworth et al. 2002). If local “agency” (self-determination, individual authority and importance) is not recognised and empowered with meaningful roles in environmental management, individual and community resistance will inevitably emerge, and collective and long-term decision making for resource protection is less likely (Scott 1985; Agrawal 2005). Once a local community of interest has been offended or discounted, recognition of *who* has the right to decide becomes more important than *what* might be decided. For example, a survey of public attitudes to customary harvests of native wildlife showed that Māori and non-Māori probably would make similar decisions about whether or not to harvest wildlife, but Māori attached paramount importance to ensuring that they themselves should be allowed to make such decisions (Moller 2001b). More importantly, sustainable management depends in part on what individual birders do on their own ground and away from scrutiny (Kitson & Moller 2008; Moller et al. 2009c), and community-level surveillance is crucial and usually more successful than enforcement from outside the community (Moller 1996; Moller et al. 2009c). The same principles of equity and access that guide Māori sustainable development must guide the research process that is used to identify the goals and the means of attaining them.

Meeting the community’s information needs

Apart from the acceptance and negotiation of fundamental power issues in directing research process, we single out active management of communication as the next most critical criterion for success of cross-cultural research partnerships. The power issues surrounding arguments about which culture or community has the right to direct the research has a parallel within the community itself. Success of subsidiarity, the bottom-up approach to environmental management, depends on vesting power in the wider community and its subjects, not just in community leaders and executives (Taiepa et al. 1997; Borrini-Feyerabend 2006). Empowering these “flaxroots” members of Māori communities to enable full peer review by the resource users, and fully informed decision-making based on *whakawhānaungatanga* (extended family linkages), requires setting up mechanisms enabling their full involvement and review of the science.

The tītī research team was initially unaware of the extent and cost of the communication required to make the partnership work. At first it seemed to them to be mainly lost opportunity to do what scientists are trained to do best—the science itself. This diversion of time and energy to community consultation seemed to be a particular penalty for ecological studies seeking to understand population dynamics of a long-lived vertebrate living in a spatially and temporally variable environment (Moller et al. 2000a; Knight et al. 2008). Several scientists had warned us beforehand that 10 years (the period of the initial cultural safety contract) was too short for reliable scientific inference about seabird dynamics (Moller 2000), so the pressure to obtain quick results was acute.

Some clues emerged from interviewees’ responses at the half way stage of our project that their understanding of the research methodology was incomplete, and that this was one of the reasons that a minority of birders remained sceptical of the value of research. Eventually the researchers understood that communication and contact with the wider community strengthened the research, underscored the relevance of the team’s effort and ultimately made it more pleasurable to do the science. In the end the close involvement with the community nourished the researchers rather than handicapped their commitment to the research process.

In view of the size of the gulf between science and mātauranga, the recent colonisation history and the fierce kaitiakitanga associated with managing the environment and whenua (like the tītī harvest and

breeding islands), increased understanding is very unlikely to be sufficient in itself to remove all concerns about research amongst the Māori community. A community-led project to eradicate rats from four islands is an early tangible example of intervention stimulated by the research. A surprise scientific finding was that a native rail, the weka (*Gallirallus australis*) is killing a high proportion of tītī (Harper 2006, 2007) and impacting heavily on the population (Dillingham et al. 2007). This has led to weka eradication from three islands and an ongoing search for funds to eradicate them from Taukihepa, the largest of the remaining islands with weka present (Newman et al. 2008b). The community has elected to take a “watching brief” on global research efforts to predict climate change effects on the El Niño Southern Oscillation, the key correlate with knockdowns in adult survival (Bragg et al. 2007; Newman et al. 2008a; Fletcher et al. in press). If climate change is confirmed to increase the frequency or intensity of El Niños, prospects for sustainability of birding is much reduced and the community will then re-evaluate management options. In the meantime the community has asked the researchers to customise “down-scaled” harvest models for each manu, and to interact with the whānau who are taking too many chicks for numbers to remain stable irrespective of climate change.

Emergence of Kaupapa Māori research frameworks

Māori interest in research has led to formation of “Kaupapa Māori” research methodologies where Māori remain in charge of research initiation, benefits, representation, legitimation and accountability (Bishop 1996; Smith 1999). Their frameworks corroborate, complement and greatly extend our own early experiences in the Tītī Project (Davis 2001; Moller 2001a). Smith (1999) summarises some of its key elements as: *Aroha ki te tangata* (respect for the people); *Kanohi kitea* (the face seen, i.e., you present yourself to the people face-to-face); *manaaki i te tangata* (share and host people, be generous); *titiro, whakarongo, kōrero* (look, listen, [then] speak); *kaua e māhaki* (don't flaunt your knowledge); *kia tūpato* (be cautious); *kaua e takahi i te mana o te tangata* (do not trample over the mana of the people).

Participatory Action Research is particularly suited to Te Ao Māori?

Many of the challenges of communication and power sharing between researchers and community

members that we encountered in this study will apply equally to PAR projects that are not cross-cultural or focused on an activity that is not peculiarly Māori. Indeed, many local communities struggle with “external interference” in managing local resources, and science is often seen as trumping local knowledge to inform decision making about what should and should not happen in local neighbourhoods. However, whakawhānauanga demands participation of all members of a community, so there is a natural synergy between PAR and Kaupapa Māori approaches. There is also natural resonance between the approaches because the *tangata whenua* (original people of a place) are intensely rooted in a locale, they are more committed to sustainable use of that place because there is no prospect that they will go elsewhere, and their knowledge is often “place dependent” (whereas science often portrays itself as place independent). Both kaupapa Māori and PAR principles were essential to the Tītī Project at all its stages—the research simply could not have happened had we not used them. However, there may be many instances where Māori communities or stakeholders wish to take a non-participatory approach to a scientific investigation in their area, and times when other priorities force them to participate less in scientific research that they still wish to be performed for their wellbeing and in their area. Therefore, we caution against assuming that the guidelines from our partnership will necessarily apply to all other research with Māori. We do, however, predict that our experience will be particularly germane when researching topics requiring a dialogue between mātauranga and science, and when mahinga kai and customary use are involved. Pākehā scientists were welcome in our partnership, and nationally have a role to play in supporting emergence of more research for Māori (Walker in press), but not all communities will invite non-Māori scientists in to share culturally sensitive places or knowledge.

In many cases genuine participation of local communities in research and resource management has much to offer by grounding research, making it more relevant, accurate and tuned to local ecology. Community participation to define “the problem”, design an inquiry, gather and interpret results means that “uptake” of the research is much more likely to become a seamless part of the overall project. PAR and the additional aspects of Kaupapa Māori research have therefore much to offer non-Māori research process.

Institutional responses to foster better partnerships between mātauranga and science

Long-term multidisciplinary research is needed for all sustainability problems (e.g., Gow 1997). However, it is especially needed for genuinely cross-cultural PAR of sustainable resource use. Longitudinal studies are particularly difficult to maintain in the face of limited science funding and a highly competitive business model of research investment that emphasise novelty and quick results (Knight et al. 2008). FRST's support for the Tītī Project has been exceptional and generous, but more prolonged than most. Funding is especially limited for *Vision Mātauranga* research “to unlock the innovation potential of Māori knowledge, resources and people”. FRST's Māori knowledge and development research constituted only 0.7% of its 2007/08 investments (FRST 2007) and projects are nearly always in “short-term” funding cycles that therefore limit the size of the overall research contract and force rebidding after 4 years at the most. The full trust and experience needed for harmonious research process were not fully established until 8–10 years into this project. This is much longer than most normal research projects in the natural sciences funded by FRST or mounted by universities that encourage a synchronic rather than diachronic research to guide environmental management. If it takes nearly a decade to establish the trust and the experience needed to work fully effectively in this cross-cultural arena, there is little prospect that many of New Zealand's 50+ iwi will have an opportunity to participate in long-term science projects directed at issues of substantive interest to their *whānui* (wider families).

Effective research partnership with Māori requires personal adjustments, self reflection and unimagined challenges not yet encountered by most scientists. Formal mentorship and systems to support Pākehā science teams engaging in cross-cultural research are not in place at the University of Otago, and probably not at other New Zealand universities. If Māori communities choose to engage research teams made up predominantly of Pākehā, it is a matter of professional best practice that educational institutes establish support systems for those Pākehā as they negotiate a cross-cultural minefield. Stronger institutional support for the research leaders is required to keep them safe, especially if they are Pākehā or inexperienced in the issues.

Maximising the best from both worlds for sustainable management

Many birders feared falling birding numbers more than they feared the risks from research and outside scrutiny. Respondents expressed this sentiment in different ways and, with few exceptions, did not use the word “sustainable”. However, nearly all the interviewees had embraced the basic sustainability goals of the Tītī Project—to ensure that the birds remain plentiful enough to allow their mokopuna to harvest.

There were many ways that both mātauranga and science strengthened and complemented each other to strengthen investigations into sustainability. Many people in the community have confronted the ecological reality that continued birding, at least as currently practiced, will be threatened if the birds continue to decline in abundance at the rate observed over the past 4 decades (Veit et al. 1996, 1997; Lyver et al. 1999; Lyver 2002b; Scott et al. 2008; Moller et al. 2009b). Our joint research was initiated, focused and rapidly accelerated because of the mātauranga and science dialogue. The knowledge of the birders highlighted the prolonged decline in tītī abundance (Lyver et al. 1999; Lyver 2002b; Moller et al. 2009b) and spurred the initiation of the research project itself. Similar examples abound overseas where indigenous communities have detected long-term changes long before they were noticed by scientists, e.g., climate change in the Arctic (Berkes et al. 2005).

Birders' hunting diaries were designed by the birders themselves and have been maintained for decades, providing a strong diachronic database (Lyver et al. 1999; Clucas 2009) but can now be complemented and strengthened by formal science monitoring methods (Moller et al. 2004; McKechnie et al. in press a). Statistical analysis linked these hunting records to international climate data and identified a probable link between adult survival and fecundity to the El Niño/La Niña Southern Oscillation. Long-term sustainability was predicted from computer modelling of climate change by international science teams (Bragg et al. 2007; Newman et al. 2008a; Fletcher et al. in press). The international dimension of science is also illustrated by tracking studies undertaken by joint USA/Canadian/French/Australian and New Zealand research teams (Shaffer et al. 2006, in press; Söhle et al. 2007) and international databases on fisheries bycatch (Uhlmann 2003; Uhlmann et al. 2005) that have helped the kaitiaki pinpoint where the main threats to locally breeding sooty shearwaters have been operating.

The birders emphasised the importance of interannual variations in food supply from their detailed tracking of chick condition over several decades, and therefore insisted that diet studies were included in the research brief (Kitson et al. 2000; Cruz et al. 2001). The birders' detailed knowledge of the spatial and temporal variation in chick abundance and condition greatly helped the ecologists define field sampling protocols (Newman et al. 2008a; Moller et al. 2009a; Scott et al. 2009; Charleton et al. in press) and emphasised the need for extraordinary levels of replication in population studies (Moller et al. 1999).

The tikanga and traditional teachings of the birders served as a warning to the researchers of the risks associated with research methods. For example, telemetry attachments to adult birds affected their behaviour despite the equipment being well within international guidelines of weight and bulk (Söhle et al. 2000; Adams et al. 2009). The insistence of the kaitiaki that researchers monitor this potential interference strengthened these scientific interpretations, because confirmation of the birders' fears signalled a warning that the resulting telemetric information (Shaffer et al. 2006, in press; Söhle et al. 2007) was biased (Adams et al. 2009). The important tikanga of not violating the mana or *mauri* (life force) of the bird and affecting adult survival (Kitson & Moller 2008; Moller et al. 2009c; Moller & Lyver in press) is corroborated by the mathematical modelling by the scientists, showing that variation in adult survival has the biggest impact of all on population resilience (Hamilton & Moller 1995; Hunter et al. 2000a; Hunter & Casswell 2005). Rakiura Māori select above-average sized chicks for harvest (Hunter et al. 2000b), but this has relatively little impact on sustainability predictions at current harvest levels (Hunter & Casswell 2005; Newman et al. 2008a,b; McKechnie et al. in press b). Strong teaching to not disturb the ground forced restricted and non-random sampling and more time consuming methods to check science methods, plus follow-up monitoring where the ground was disturbed by the scientists (McKechnie et al. 2007, 2008). These and many more scientific-mātauranga cross references and challenges assisted a search for ecological patterns, and then for biophysical mechanisms to explain those patterns. A whole different realm of spiritual and metaphysical understandings of the birds, the islands and their relationships with humans (Kitson & Moller 2008; Moller et al. 2009c; Lyver & Moller in press) simply could not be met by science, and therefore remained largely unexplored within our

science partnership. However, the scientists can readily appreciate how these beliefs by the birders did aid and reinforce sound ecological management, built commitment to sustainable management, and even spurred the risky business of forming a partnership with science brought into their midst by strangers.

Conclusions: bridging two solitudes

Berkes (1994) poignantly refers to co-management as "bridging two solitudes". Partnership of science and mātauranga bridges a much more fundamental divide than simply the right to manage. Mātauranga is an all embracing concept combining knowledge, identity, place and in the case of its application to mahinga kai in the past, the key to bioeconomic security of Māori. Partnership of mātauranga and science could underpin shared or devolved power to manage New Zealand's environment, but when set against a recent history of colonisation and assimilation, this requires acceptance of risk and development of innovation and trust rather than integration of knowledge systems. Upcoming resolution of WAI262, a Waitangi Tribunal claim by several iwi to re-assert environmental management rights for all native fauna and flora (Murray et al. 2001; Solomon in press) will bring these issues of partnership into renewed focus and debate.

The discussions at many community meetings over the past 14 years have often considered the wisdom or otherwise of initiating the tītī research project. Several speakers have referred to teachings of the tūpuna to minimise publicity and external scrutiny of their birding—this is the "*less said, best said*" strategy expressed by one of the birders we interviewed (Table 1). It is a remarkable testimony to how much the birders value their birds, the islands and their cultural heritage of birding that they have opened up to scientific scrutiny. In so doing they placed trust in a group of researchers that they did not know. Those researchers were mainly Pākehā, and they sought to apply methods that most birders did not understand in detail and which sometimes contradicted tikanga and kaitiakitanga teachings.

The tītī example is one of a growing number of research projects that have tried to break down the traditional monocultural model of ecological scientists working on things Māori from outside Māori communities (Moller 2009). These projects, together with the findings of Bishop (1996), Smith (1999) and Harmsworth (2001) provide a meta-analysis of challenges and opportunities to building meaningful collaborative research models within Māori communities. These concrete examples can

now guide future research collaborations with the kaitiaki to capture improved ecological and cultural wellbeing by using both mātauranga and science. Our hope is that this record of our partnership, and the papers following in this special issue of the *New Zealand Journal of Zoology*, will encourage more and better partnerships of science researchers and Māori to understand and conserve biota throughout New Zealand.

ACKNOWLEDGMENTS

We would especially like to thank the interviewees and wider Rakiura Māori community who so generously gave their time and knowledge to help and engage in this research effort in so many different ways (e.g., sharing mātauranga, peer review, hosting researchers, providing historical data, contributing to *Tiiti Times*). There were also many other researchers and especially students that forged and furthered the *Kia Mau Te Tiiti Mau Ake Tōnu Atu* research project and who thereby contributed to learning the lessons we have summarised here, including: Josh Adams, Kristin Charleton, Tina De Cruz, Alex Gilks, Sheryl Hamilton, Grant Harper, Christine Hunter, Chris Jones, Hannah Nevins, Detta Russell, Paul Scofield, Ilka Söhle, Sebastian Uhlmann, Malcolm Rutherford, Grant Blackwell and Suzanne Bassett. The families of the principal researchers in the Tiiti Project have supported the project enormously throughout by putting up with the prolonged absences, travel to hui and exhaustion of their partners. Scores of volunteers in the science team and hours of practical field assistance by the birders themselves got the field work done. Throughout we have been guided and inspired by science mentorship provided by Christopher Robertson and cultural mentorship by Rau Kirikiri (Te Whānau o Apanui) and by Graham Metzger and Jane Davis (both of Kāi Tahu). Mere Roberts also made a special and unique contribution by guiding us both on science and cultural matters. The current members of the RTIC and RTIAB that have co-directed this research and now co-authored this overview include: Margaret Bragg, Ron Bull, Stuart Bull, Jane Davis, Tane Davis, Arnold Kelland, Paul Lee, Lesley Rewi, Michael Skerrett, and Morrison Trow. Past members of RTIC and RTIAB that assisted in research direction were Mhari Batty, Gypsy Fyfe, Paddy Gilroy, Julian McKay and Shane McManus. Apart from the current and past members of the RTIAB, there were particular individuals within the Rakiura Community who played a crucial role in establishing and guiding the research project, including Jim Bull, Graham Metzger, George Te Au and Johnny Wixon. Initial guidance and facilitation of the research teams' process in establishing the project by Matapura Ellison (Kaupapa Atawhai Manager with the Department of Conservation) was crucial. The surveys and interviews were authorised by the University of Otago Ethics Committee. Jeremy Carrol, Greg Lind, Pete McClelland and Andy Norris from the Department of Conservation's "Southern

Islands" team offered considerable ecological advice and administrative and permitting support throughout. Aparna Lal made several useful criticisms of an earlier draft of this manuscript and helped format it and the references. The manuscript benefited greatly from refereeing by Hemi Whaanga and Priscilla Wehi. The *Kia Mau Te Tiiti Mo Ake Tōnu Atu* project was funded mainly by a Public Good Science Fund grant from the New Zealand Foundation for Research, Science & Technology to Rakiura Māori for 12 of its 14 years. FRST's trust, long-term support, and flexible administrative arrangements to reflect the mana of the participating community have been pivotal to allow the completion of a research project that was inherently difficult because of the long-lived nature of seabirds, their inter-annual variation and the expense and logistical challenges of study on remote offshore islands. Generous additional financial and logistic support for the overall project has been given by the University of Otago—this partnership was a learning curve for the university just as for Rakiura Māori. Many officials and managers within the university coped well and were flexible when the requirements of this study stretched their systems and previous ways of managing science. New Zealand Aluminium Smelters Ltd, Te Rūnanga o Ngāi Tahu and South West Helicopters provided additional financial and practical help. The Rakiura Tiiti Islands Administering Body and contributing scientists are especially grateful to the *New Zealand Journal of Zoology* and its editor, Carolyn (Kim) King for featuring our project, and for superb editorial support and patience.

REFERENCES

- Adams J 2008. Strategic review of the performance-based research fund: the assessment process. Report prepared independently for the Tertiary Education Commission. Tertiary Education Commission, Wellington, New Zealand. 112 p.
- Adams J, Scott D, McKechnie S, Blackwell G, Shaffer SA, Moller H 2009. Effects of geolocation archival tags on reproduction and adult body-mass of sooty shearwaters (*Puffinus griseus*). *New Zealand Journal of Zoology* 36: 355–366, this issue.
- Agrawal A 2005. Environmentality. technologies of government and the making of subjects. Durham and London, Duke University Press. 344 p.
- Bassett S 2006. What you guys think of Tiiti Times. A survey of readers. *Tiiti Times* 18: 17.
- Berkes F 1994. Co-management: bridging the two solitudes. *Northern Perspectives* 22 (2–3): 18–20.
- Berkes F 2008. Sacred ecology. New York, Routledge. 336 p.
- Berkes F, Colding J, Folke C 2003. Navigating social-ecological systems. Building resilience for complexity and change. Cambridge, Cambridge University Press. 393 p.

- Berkes F, Huebert R, Fast H, Manseau M, Diduck A 2005. Breaking ice: renewable resource and ocean management in the Canadian North. Calgary, University of Calgary Press. 396 p.
- Berkes F, Turner NJ 2006. Knowledge, learning and the evolution of conservation practice for social-ecological system resilience. *Human Ecology* 34: 479–494.
- Bishop R 1996. Collaborative research stories Whakawhanaungatanga. Palmerston North, New Zealand, The Dunmore Press. 273 p.
- Borrini-Feyerabend G 1996. Collaborative management of protected areas: tailoring the approach to the context. Issues in social policy report, September 1996. International Union for the Conservation of Nature and Natural Resources. Gland, Switzerland.
- Bragg C, Clucas R, Fletcher D, McKechnie S, Moller H, Newman J, Scott D 2007. Sustainability of tītī harvesting by Rakiura Māori. A report to Rakiura Māori for community peer review. University of Otago. 118 p. + x.
- Bragg C, Downs T, Moller H 2008. Kaitiakitanga o kā Tītī II. A survey of muttonbirding in the 2006 season. University of Otago Wildlife Management Report No. 218.
- Bragg C, McKechnie S, Newman J, Fletcher D, Moller H, Scott D 2009. Variation in abundance and harvest of sooty shearwaters (*Puffinus griseus*) by Rakiura Māori on Putauhinu Island, New Zealand. *New Zealand Journal of Zoology* 36: 275–289, this issue.
- Burns D 2007. Systemic action research: a strategy for whole system change. Bristol, The Policy Press 208 p.
- Charleton K, Bragg C, Knight B, Fletcher D, Moller H, Newman J, Scott D in press. Spatial variation in burrow entrance density of sooty shearwater *Puffinus griseus*. *Notornis*.
- Clucas R 2009. Kia Whakamāramatia Mahi Tītī: predictive measures for understanding harvest impacts on sooty shearwaters (*Puffinus griseus*). Unpublished PhD thesis, University of Otago, Dunedin, New Zealand. 301 p.
- Cruz JB, Lalas C, Jillett JB, Kitson JC, Lyver PO'B, Imber M, Newman J, Moller H 2001. Prey spectrum of breeding sooty shearwaters in New Zealand. *New Zealand Journal of Marine & Freshwater Research* 35: 817–829.
- Davis J 2001. Te Kaha te hikoi o Te Tangata. In Howard M, Moller H ed. He Minenga Whakatū Hua o Te Ao “sustaining the fruits of the land”. Proceedings of a hui, Murihiku Marae, 25–27 August 2000. Available online from <http://www.otago.ac.nz/Zoology/hui>.
- Dillingham P, McKechnie S, Harper G, Fletcher D, Moller H 2007. A model-based assessment of the impact of predator control on populations of tītī (sooty shearwaters; *Puffinus griseus*). Report prepared for Ka Mate Ngā Kiore (Kill the Rats) Incorporated Society. University of Otago Wildlife Management Report No. 206. 30 p.
- Ellis SC 2005. Meaningful consideration? A review of traditional knowledge in environmental decision making. *Arctic* 58: 66–77.
- Fletcher D, Clucas R, Moller H, Newman J, Bragg C, McKechnie S, Scott D, Lyver PO'B, Downs T in press. Will the tītī remain plentiful enough for the mokopuna? A sustainability assessment of the Rakiura Māori tītī harvests. Proceedings of Ngā Kete a Rēhua, Christchurch, 4 and 5 September 2008.
- Foundation for Research, Science & Technology (FRST) 1999. Strategic portfolio outline Māori development & advancement. Foundation for Research, Science & Technology, Wellington, New Zealand.
- Gow L 1997. National science strategy for sustainable land management: first priorities statement (September 1997). Wellington, The Royal Society of New Zealand. Available online from <http://www.rsnz.govt.nz/archives/advisory/nsslandman/priors.html>
- Hamilton SA, Moller H 1995. Can PVA models using computer packages offer useful conservation advice? Sooty shearwaters in New Zealand as a case study. *Biological Conservation* 73: 107–117.
- Harmsworth G 2001. A collaborative research model for working with iwi: discussion paper. Landcare Research Report: LC 2001/119. 29 p.
- Harmsworth G, Barclay-Kerr K, Reedy T 2002. Māori sustainable development in the 21st century: the importance of Māori values, strategic planning and information systems. He Puna Kōrero: *Journal of Māori & Pacific Development* 3: 40–68.
- Harper GA 2006. Weka (*Gallirallus australis*) depredation of sooty shearwater/titi (*Puffinus griseus*) chicks. *Notornis* 53: 318–320.
- Harper GA 2007. Detecting predation of a burrow-nesting seabird by two introduced predators, using stable isotopes, dietary analysis and experimental removals. *Wildlife Research* 34: 443–453.
- Hawke D, Newman J, Moller H, Wixon J 2003. A possible early muttonbirders' fire on Poutama, a Rakiura tītī island, New Zealand. *Journal of the Royal Society of New Zealand* 33: 497–508.
- Howard M, Moller H 2001. Proceedings of a hui, Murihiku Marae, 25–27 August 2000. In: Howard M, Moller H ed. He Minenga Whakatū Hua o Te Ao “sustaining the fruits of the land”. Available online from <http://www.otago.ac.nz/Zoology/hui>.

- Hunter CM, Casswell H 2005. Selective harvest of sooty shearwater chicks: effects on population dynamics and selectivity. *Journal of Animal Ecology* 74: 589–600.
- Hunter CM, Moller H, Fletcher D 2000a. Parameter uncertainty and elasticity analyses of a population model: setting research priorities for shearwaters. *Ecological Modelling* 134: 299–323.
- Hunter CM, Moller H, Kitson J 2000b. Muttonbird selectivity of sooty shearwater (titi) chicks harvested in New Zealand. *New Zealand Journal of Zoology* 27: 395–414.
- IUCN 1997. Intercommission task force on indigenous people. Indigenous people and sustainability—cases and actions. Gland, Switzerland. 364 p.
- Kitson JC, Cruz JB, Lalas C, Jillett JB, Newman J, Lyver PO'B 2000. Interannual variations in the diet of breeding sooty shearwaters (*Puffinus griseus*). *New Zealand Journal of Zoology* 27: 347–355.
- Kitson JK, Moller H 2008. Looking after your ground: resource management practice by Rakiura Māori tītī harvesters. *Papers and Proceedings of the Royal Society of Tasmania* 142: 161–176.
- Knight B, Moller H, Bradley S, Davies M 2008. Austral seabirds: opportunities and challenges for future research and conservation. *Papers and Proceedings of the Royal Society of Tasmania* 142: 1–8.
- Lyver PO'B 2002a. Foundation for Research, Science and Technology case study evaluation: the Kai Mau Te Tītī Mo Ake Tōnu Atū research project. Unpublished report to the Foundation for Research, Science and Technology. 5 p.
- Lyver PO'B 2002b. The use of traditional environmental knowledge by Rakiura Māori to guide sooty shearwater harvests. *Wildlife Society Bulletin* 30: 29–40.
- Lyver PO'B 2005. Co-managing environmental research: lessons from two cross-cultural research partnerships in New Zealand. *Environmental Conservation* 32: 365–370.
- Lyver PO'B, Moller H in press. An alternative reality: Māori spiritual guardianship of New Zealand's native birds. In: Tidemann S, Gosler A, Gosford R ed. *Ethno-ornithology: global studies in indigenous ornithology: culture, society and conservation*. Earthscan.
- Lyver PO'B, Hamilton S, McKenzie M, Dickson I, Doohor T, Broad T, Moller H 1998. A burrowscope for examining petrel nests in burrows. *Conservation Advisory Science Notes* No. 209. 21 p.
- Lyver PO'B, Moller H, Thompson C 1999. Changes in sooty shearwater *Puffinus griseus* chick production and harvest precede ENSO events. *Marine Ecology Progress Series* 188: 237–248.
- Lyver PO'B, Davis J, Ngamane L, Anderson A, Clarkin P 2008. Hauraki Māori mātauranga for the conservation and harvest of tītī, grey-faced petrel, *Pterodroma macroptera gouldi*. *Papers and Proceedings of the Royal Society of Tasmania* 142: 149–159.
- Lyver P'OB, Jones C, Doherty J 2009. Flavor or forethought: Tūhoe traditional management strategies for the conservation of kererū (*Hemiphaga novaeseelandiae*) in New Zealand. *Ecology and Society* 14(1): 40.
- McKechnie S, Fletcher D, Moller H, Scott D, Newman J, Bragg C 2007. Estimating and correcting for bias in population assessments of sooty shearwaters. *Journal of Wildlife Management* 71: 1325–1335.
- McKechnie S, Moller H, Bragg C, Newman J, Scott DS, Cruz JB 2008. Recovery of a sooty shearwater (*Puffinus griseus*) breeding area after artificial disturbance. *New Zealand Journal of Ecology* 32: 34–40.
- McKechnie S, Bragg C, Newman J, Scott D, Fletcher D, Moller H in press a. Assessing and monitoring of sooty shearwater (*Puffinus griseus*) abundance in southern New Zealand. *Wildlife Research*.
- McKechnie S, Fletcher DJ, Newman J, Scott D, Bragg C, Moller H in press b. Modelling the intensity of harvesting of sooty shearwater chicks by Rakiura Māori in New Zealand. *Journal of Wildlife Management*.
- Ministry of Research, Science & Technology 2005. Vision Mātauranga. Unlocking the innovation potential of Māori knowledge, resources and people. MoRST, Wellington. 28 p.
- Moller H 1996. Customary use of indigenous wildlife—towards a bicultural approach to conserving New Zealand's biodiversity. In: McFagen B, Simpson P ed. *Biodiversity: papers from a seminar series on biodiversity*, hosted by Science & Research Division, Department of Conservation, Wellington 14 June–26 July 1994. Pp. 89–125.
- Moller H 2000. Peer review of the goals, design and methods of the tītī research project. Unpublished report to Rakiura Tītī Islands Committee and the Southern Islands Area Team, Department of Conservation, Southland. 43 p.
- Moller H 2001a. Co-management of a bicultural research project: a research provider's perspective. In: Howard M, Moller H ed. *He Minenga Whakatū Hua o Te Ao* “sustaining the fruits of the land”. *Proceedings of a hui, Murihiku Marae*, 25–27 August 2000. Available online from <http://www.otago.ac.nz/Zoology/hui>.

- Moller H 2001b. A survey of public attitudes about harvests of New Zealand animals and plants. In: Howard M, Moller H ed. He Minenga Whakatū Hua o Te Ao "sustaining the fruits of the land". Proceedings of a hui, Murihiku Marae, 25–27 August 2000. Available online from <http://www.otago.ac.nz/Zoology/hui>.
- Moller H 2003. Kaitiakitanga o kā Tītī I. A Māori community's view of a science project to protect a customary wildlife harvest. University of Otago Wildlife Management Report No. 801–2. 105 p.
- Moller H 2006. Are current harvests of seabirds sustainable? *Acta Zoologica Sinica* 52 (Supplement): 649–652.
- Moller H 2009. Mātauranga Māori, science and seabirds in New Zealand. Foreword to a special edition of the *New Zealand Journal of Zoology* 36: 203–210, this issue.
- Moller H, Lyver PO'B in press. Using traditional ecological knowledge for improved sustainability: case studies from four customary wildlife harvests by Māori in New Zealand. In: Hughes C ed. Indigenous people and biodiversity conservation. Conservation International, Arlington, USA.
- Moller H, Cruz J, Fletcher D, Garrett K, Hunter C, Jones CJ, Kitson J, Lyver P, Newman J, Russell B, Scofield P, Scott D 1999. Kia Mau Te Tītī Mo Ake Tōnu Atu: goals, design and methods. University of Otago Wildlife Management Report 117. 76 p.
- Moller H, Frampton C, Hocken AG, McLean IG, Saffer V, Sheridan L 2000a. The importance of seabird research for New Zealand. *New Zealand Journal of Zoology* 27: 255–260.
- Moller H, Horsley P, Lyver PO'B, Taiepa T, Davis J, Bragg M 2000b. Co-management by Māori and Pākehā for improved conservation in the 21st century. In: Perkins H, Memon A ed. Environmental planning and management in New Zealand. Palmerston North, Dunmore Press. Pp. 156–167.
- Moller H, Berkes F, Lyver PO'B, Kislalioglu M 2004. Combining science and traditional ecological knowledge: monitoring populations for co-management. *Ecology and Society* 9(3): 2. Available online from <http://www.ecologyandsociety.org/vol9/iss3/art2>.
- Moller H, Charleton K, Knight B, Lyver O'B 2009a. Traditional ecological knowledge and scientific inference of prey availability: harvests of sooty shearwater (*Puffinus griseus*) chicks by Rakiura Maori. *New Zealand Journal of Zoology* 36: 259–274, this issue.
- Moller H, Fletcher D, Johnson PN, Bell BD, Flack D, Bragg C, Scott D, Newman J, McKechnie S, Lyver PO'B 2009b. Changes in sooty shearwater (*Puffinus griseus*) abundance and harvesting on the Rakiura Tītī Islands. *New Zealand Journal of Zoology* 36: 325–341, this issue.
- Moller H, Kitson JC, Downs TM 2009c. Knowing by doing: learning for sustainable muttonbird harvesting. *New Zealand Journal of Zoology* 36: 243–258, this issue.
- Moller H, Newman J, Lyver PO'B, Rakiura Tītī Islands Administering Body in press. Fourteen years on: lessons for community-led science partnerships from the Kia Mau te Tītī Mo Ake Tōnu Atu project. Proceedings of Ngā Kete a Rēhua, Christchurch, 4 and 5 September 2008.
- Morris M 2002. Evaluation case study: harvest of tītī by Rakiura Māori (RTI1801). Foundation for Research, Science & Technology. Available online at: <http://www.frst.govt.nz/evaluation/CaseStudies/harvestingOfTiti-03.cfm>.
- Murray S, Solomon M, Wihongi D, Parata H 2001. WAI262: Safeguarding intellectual and cultural rights. In: Howard M, Moller H ed. He Minenga Whakatū Hua o Te Ao "sustaining the fruits of the land". Proceedings of a hui, Murihiku Marae, 25–27 August 2000. Available online from <http://www.otago.ac.nz/Zoology/hui>.
- Newman J, Moller H 2005. Use of mātauranga (Māori traditional knowledge) and science to guide a seabird harvest: getting the best of both worlds? *Senri Ethnological Studies* 67: 303–321.
- Newman J, Clucas R, Moller H, Fletcher D, Bragg C, McKechnie S, Scott D 2008a. Sustainability of tītī harvesting by Rakiura Māori: a synthesis report. University of Otago Wildlife Report No. 210.
- Newman J, Scott D, Fletcher D, Moller H, McKechnie S 2008b. A population and harvest intensity estimate for sooty shearwater (*Puffinus griseus*) on Taukihepa (Big South Cape), New Zealand. *Papers and Proceedings of the Royal Society of Tasmania* 142: 177–184.
- Newman J, Scott D, Bragg C, McKechnie S, Moller H, Fletcher D 2009a. Estimating regional population size and annual harvest intensity of the sooty shearwater in New Zealand. *New Zealand Journal of Zoology* 36: 307–323, this issue.
- Newman J, Fletcher D, Moller H, Bragg C, Scott D, McKechnie S 2009b. Estimates of productivity and detection probabilities of breeding attempts in the sooty shearwater (*Puffinus griseus*), a burrow-nesting petrel. *Wildlife Research* 36: 159–168.

- New Zealand Conservation Authority (NZCA) 1997. Māori customary use of native birds, plants and other traditional materials. Interim report and discussion paper. NZCA, Wellington, New Zealand. 177 p.
- Posey DA 1996. Traditional resource rights. International instruments for the protection and compensation for indigenous peoples and local communities. IUCN, Gland, Switzerland. 221 p.
- Scott D, Scofield P, Hunter C, Fletcher D 2008. Decline of sooty shearwaters, *Puffinus griseus*, on The Snares, New Zealand. Papers and Proceedings of the Royal Society of Tasmania 142: 185–196.
- Scott D, Moller H, Fletcher D, Newman J, Aryal J, Bragg C, Charleton K 2009. Predictive habitat modelling to estimate petrel breeding colony sizes: sooty shearwaters (*Puffinus griseus*) and mottled petrels (*Pterodroma inexpectata*) on Whenua Hou Island. New Zealand Journal of Zoology 36: 291–306, this issue.
- Scott JC 1985. Weapons of the weak: everyday forms of peasant resistance. Yale University Press. 389 p.
- Shaffer SA, Tremblay Y, Weimerskirch H, Scott D, Thompson D, Sagar P, Moller H, Taylor GA, Block BA, Costa DP 2006. Migratory shearwaters integrate oceanic resources across the Pacific Ocean in an endless summer. Proceedings of the National Academy of Sciences USA 103: 12799–12802.
- Shaffer SA, Weimerskirch H, Scott D, Pinaud D, Thompson DR, Sagar PM, Moller H, Taylor GA, Foley DG, Tremblay Y, Costa DP in press. Spatio-temporal habitat use of breeding sooty shearwaters (*Puffinus griseus*). Marine Ecology Progress Series.
- Skira IJ 1990. Human exploitation of the shorttailed shearwater (*Puffinus tenuirostris*). Papers and Proceedings of the Royal Society of Tasmania 124: 77–90.
- Söhle I, Moller H, Fletcher D, Robertson CJR 2000. Telemetry reduces colony attendance by sooty shearwaters (*Puffinus griseus*). New Zealand Journal of Zoology 27: 357–365.
- Söhle IS, Robertson CJR, Nicholls DG, Mouritson H, Frost B, Moller H 2007. Satellite tracking of sooty shearwaters (*Puffinus griseus*) during their pre-laying “exodus” and incubation. Notornis 54: 180–188.
- Solomon M in press. The Wai 262 flora and fauna claim—17 years on and still waiting. Titi Times 22.
- Southland Conservation Board 1994. Submission report. Department of Conservation, Invercargill, New Zealand. 99 p.
- Smith LK 1999. Decolonizing methodologies: research and indigenous peoples. Dunedin, New Zealand.
- Stevens MJ 2006. Kāi Tahu me te hopu tītī ki Rakiura: an exception to the ‘colonial rule’? Journal of Pacific History 41: 273–291.
- Stevenson MG 2006. The possibility of difference: re-thinking co-management. Human Organisation 65: 167–180.
- Taiepa T, Lyver P, Horsley P, Davis J, Bragg M, Moller H 1997. Co-management of New Zealand’s conservation estate by Māori and Pākehā: a review. Environmental Conservation 24: 236–250.
- Turner NJ, Berkes F 2006. Coming to understanding: developing conservation through incremental learning in the Pacific Northwest. Human Ecology 34: 495–513.
- Uhlmann S 2003. Fisheries bycatch mortalities of sooty shearwaters (*Puffinus griseus*) and short-tailed shearwaters (*P. tenuirostris*). DoC Science Internal Series 92, Department of Conservation, Wellington, New Zealand. 52 p.
- Uhlmann SS, Fletcher D, Moller H 2005. Estimating incidental takes of shearwaters in driftnet fisheries: lessons for the conservation of seabirds. Biological Conservation 123: 151–163.
- Veit RR, McGowan JA, Ainley DG, Wahls TR, Pyle P 1997. Apex marine predator declines ninety percent in association with changing oceanic climate. Global Change Biology 3: 23–28.
- Veit RR, Pyle P, McGowan JA 1996. Oceanic warming and long-term change in pelagic bird abundance within the California current system. Marine Ecology Progress Series 139: 11–18. Wellington, New Zealand.
- Waitangi Tribunal 1991. Ngāi Tahu report. Brooker and Friend.
- Walker M in press. Māori research—the national picture. Proceedings of Ngā Kete a Rēhua, Christchurch, 4 and 5 September 2008.
- Walters CJ, Holling CS 1990. Large-scale management experiments and learning by doing. Ecology 71: 2060–2068.
- Wilson E 1979. Titi heritage. The story of the muttonbird islands. Invercargill, New Zealand, Craig Printing Co Ltd. 181 p.