

humidity, temperature, and wind could account for variation in the spectral characteristics of Dupont's lark song (as larks are aerial singers). However, no prior hypothesis has suggested that these could cause shifts in *song-call-type abundance*, the focus of our paper, and such abiotic factors are even less likely to covary with habitat fragmentation. We are aware of the studies on natural vocal variation within bird species and we cited those that treated birdsong repertoires from a *qualitative* point of view (occurrence of song/syllable types rather than *quantitative* switches in acoustics), as these better matched the scope of our paper. We also cited studies on bird communication systems in fragmented landscapes (Laiolo and Tella 2005).

Watson and Tack also addressed the possibility of *founder effect*, one of the hypotheses we considered. This hypothesis was discarded because there is published evidence of historically large population sizes and steppeland cover in the study area (Aragües 1992), in addition to the personal observations of one of us (JLT), who born there. For readers interested in the fate of Iberian steppe-lands, information on past and present changes can be found in Tella *et al.* (2005), which notes recent Dupont's lark range restriction and local extinctions, and in Laiolo and Tella (2006a), which documents the loss of the species' habitat throughout the Iberian peninsula. We stress that two populations went extinct during our study, and one uttered song types that were not recorded at any other Spanish site; these unique tunes were lost with the last male in the area.

We did not consider the hypothesis of *pre-existing historic variation* because we found no evidence of dialect boundaries in a large and less fragmented geographic zone comparable in size to our study area (see Laiolo and Tella 2006b for a comparison of the Iberian Mountains and Ebro Valley). Notably, Westcott and Kroon's (2002) study cannot be cited as an example of song dialects pre-dating isolation, as the authors themselves hypothesize a link be-

tween *Prionodura newtonia* song variation and recent forest clearance.

Finally, Watson and Tack question the relationship between call diversity and isolation due to the influence of a supposedly outlying point (see figure). However, the relationship remains significant after this point is removed ($r = -0.17$, $F_{1,21} = 4.33$; $P = 0.049$; which, in the interest of clarity, is not a statistical outlier. We also stress that the key role of isolation was previously addressed in detail in Laiolo and Tella (2006b), where we analyzed call diversification with respect to the composition of the habitat matrix and alternative isolation indices. Finally, the relationship between repertoire and fitness was not within the scope of this paper.

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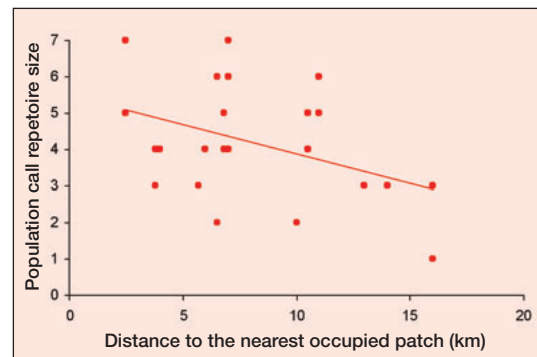


Figure 5b, (Front Ecol Environ 2007; **5**[2]: 68–72) excluding data from the most isolated patch.



Compensatory mitigation

In the August issue of *Frontiers*, Wilcox and Donlan (*Front Ecol Environ* 2007; **5**[6]: 325–31) proposed economically based compensatory mitigation for marine bycatch. The example they used to demonstrate their case was the flesh-footed shearwater, *Puffinus carneipes*, on Lord Howe Island, Australia. The compensatory action proposed was the eradication of ship rats, *Rattus rattus*, to be funded by the local long-line fishing industry.

As I have studied flesh-footed shearwaters on Lord Howe Island and am currently overseeing the planning phase for eradicating introduced rodents from this island, the article immediately grabbed my attention. Upon reading it, I saw the model as flawed and dismissed it outright. The model is based on the assumption that the current loss of 50% of eggs and chicks (50% of eggs produce flying young; Priddel *et al.* 2006) can be eliminated entirely by removing rats. This, of course, is biological nonsense. I presumed the article, and the issue of compensatory mitigation on Lord Howe Island, would die a quick death. Not so – I have received numerous communications about it. To inform the debate as to whether this type of compensatory approach is a panacea for island conservation or harmful (as suggested by Doak *et al.* [*Front Ecol Environ* 2007; **5**(7): 350–51]), I summarize the comments I received.

First, because data that I published

was used in the model (albeit incorrectly), and because I am a strong advocate for rat eradication on Lord Howe Island, there was a presumption that I would support this particular example of compensatory mitigation. This is not the case. I have major concerns with both the concept and the model, and was disappointed that the authors had apparently used our data without having actually read the manuscript (Priddel *et al.* 2006), as nowhere in it do we claim rats to be an issue for flesh-footed shearwaters. In fact, we dismiss them as a threat. We demonstrate that clearing and urbanization are the prime threats on land, while plastics and long-lining are the potential threats at sea.

Second, readers who recognized the flaws in the Wilcox and Donlan model, but who are unfamiliar with Lord Howe Island, are now skeptical of the need to eradicate rats from the island. I point out that the impact of rats on flesh-footed shearwaters has never been cited as justification for the eradication of rodents from this island. Lord Howe

Island is a World Heritage Area of immense ecological importance, with a high degree of endemism. Rats have been implicated in the extinction of at least five land birds and an unknown number of invertebrates and plants. They continue to threaten the survival of numerous species (DEC 2006), and rat predation on Lord Howe Island has been listed as a key threatening process under the *New South Wales Threatened Species Conservation Act 1995*.

Third, now that the lucrative long-line fishing industry has been fingered as a potential cash cow, the various agencies with statutory responsibilities for biodiversity conservation on Lord Howe Island will have to reassess the need to commit funds to any future rodent eradication program. Other potential funding bodies are also likely to question whether they would be better served by diverting their hard-earned cash to projects where no alternative funding source has been identified.

The eradication of introduced rodents from Lord Howe Island is

arguably one of the most noteworthy conservation actions that could be undertaken in the South Pacific. Introduction into the public arena of the concept of compensatory mitigation of bycatch has so far done little to promote our cause. Indeed, it has given us another hurdle to overcome in securing the necessary funding from conventional sources. It would be terrific if the fishing industry were to provide the US\$2 million or so needed to complete the eradication, but I, for one, will not be waiting.

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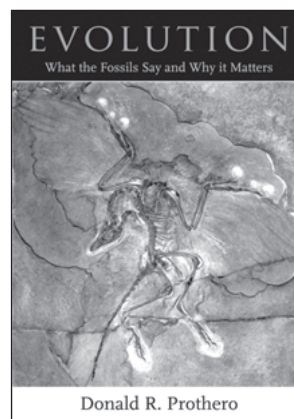
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Compensatory mitigation: the authors reply

We recently suggested that offsets might be a useful tool for reducing impacts of seabird bycatch in fisheries where direct measures are ineffective (*Front Ecol Environ* 2007; **5**[6]: 325–31). Priddel (*Front Ecol Environ* 2007; **5**[8]: 407–08) voiced the opinion that offsets may cause more harm than good and contested the information and assumptions in the cost-effectiveness analysis we used to illustrate the approach. Here, we address some points raised by Priddel.

Priddel (1) dismissed our model outright because he rejects our assumption that removing rats could eliminate the current loss of 50% of eggs and chicks (ie breeding success). He goes on (2) to dismiss rats as a threat to flesh-footed shearwaters on Lord Howe Island (LHI). He also (3) claims that we did not read his manuscript (Priddel *et al.* 2006), the source of some data in our model.

(1) Based on available evidence, it is reasonable to expect large increases in breeding success with the eradication of rats from seabird colonies. For example, following eradication on two islands, the breeding success of little shearwater populations (a congener of flesh-footed shearwaters) increased from 43% and 5% to 68% and 56%, respectively (Pierce 2002). Likewise, the breeding success of another congener, Audubon's shearwater, increased from 0% to >85% on Hardy Island (Lorvelec and Pascal 2005). While rat eradication will obviously not eliminate all burrowing seabird egg and chick mortality, drastic increases in breeding success are common following eradication. Our estimates of productivity are close to the upper bound of what has been reported in the literature (see our previous

letter in *Front Ecol Environ* 2007; **5**[7]: 351–52).

(2) While Priddel dismisses rat predation as a threat, we are not aware of any rat impact studies on flesh-footed shearwaters breeding on LHI or on any other population. Priddel *et al.* (2006) recognize this: “The degree to which mice or rats prey on flesh-footed shearwater eggs and chicks is unknown”. The authors go on to state that “there was no direct evidence of rats preying...[on] eggs or chicks”; however, they do not present any information to support their claim.

The causes of mortality for eggs and chicks would be hard to determine using the study design of Priddel *et al.* (2006). Their mortality estimates are based on the inspection of 113 burrows with eggs over 4 days in January and April. Of those, 57 nests failed to produce fledglings. Based on their data, parent mortality could account for 26 failures. The remaining failures are due to unidentified sources, potentially including plastic ingestion and rat predation. Assuming that mortalities are evenly spread over Priddel *et al.*'s observation period, 2.25 deaths would be expected per week. Even with intensive nest inspections and carcass autopsies, it is unlikely that one would document rat predation using Priddel *et al.*'s sampling design and effort. Priddel and colleagues do an excellent job at estimating the past impacts of clearing and urbanization on flesh-footed shearwater population size, but they do not address ongoing mortality sources, such as rat or plastic impacts, and their current impact on demography.

Globally, however, there is ample evidence to suggest that rats may be impacting flesh-footed shearwaters on LHI (see



our previous letter in *Front Ecol Environ* 2007; **5**[7]: 351–52; Jones *et al.* in press). Even Priddel *et al.* (2006) cite anecdotal evidence that rats could affect flesh-footed shearwaters, since invasive predators have extirpated other colonies.

(3) Claiming that we did not read Priddel *et al.* (2006) is disingenuous. We received an advance copy of the manuscript prior to publication, and conversed with the authors by phone and e-mail on specifics of their paper multiple times prior to our publication in *Frontiers*.

Priddel makes an important point about justifications for island restoration and who should pay for those actions. We agree that there are many justifications for the eradication of rodents from LHI. We did not claim, however, that the potential threat of rats to flesh-footed shearwaters is a justification for eradication; rather, we asserted that the seabird population might benefit from the eradication. We disagree that allowing fisheries to offset their residual impact by paying for other conservation interventions lets other stakeholders “off the hook”. With respect to LHI, the government is the default institution responsible for abating the impact of rats on the Commonwealth's natural heritage. Priddel points to legislation that supports that claim. Australian governments have demonstrated their responsibility and willingness to commit the funds necessary for the conservation of their natural heritage, including a recent commitment of AU\$24.6 million for invasive mammal eradications on Macquarie Island.

Despite fears or hopes, compensatory mitigation is no panacea (Donlan and Wilcox in press). We

agree with Priddel that rodent eradication from LHI is a critical conservation target in the Pacific, and the Australian Government should not hesitate to pay for it. But there are hundreds of additional islands in the Pacific where invasive mammal eradication would also result in biodiversity gains, and for the majority there is no funding, governmental or otherwise, in sight. With the many challenges compensatory mitigation brings, perhaps it could also generate the necessary capital to bring those conservation opportunities within grasp.

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