

Need for a Clear and Fair Evaluation of Biodiversity Offsets for Fisheries Bycatch

C. WILCOX* AND C. JOSH DONLAN†

*CSIRO Marine and Atmospheric Research, Castray Esplanade, Hobart, Tasmania 7000, Australia, email chris.wilcox@csiro.au

†Advanced Conservation Strategies, P.O. Box 1201, Midway, UT 84049, U.S.A. and Department of Ecology and Evolutionary Biology, Cornell University, Ithaca, 14850-2824, U.S.A.

Žydelis et al. (2009 [this issue]) is a direct critique of 2 recent papers we published on the use of biodiversity offsets in managing fisheries bycatch (Wilcox & Donlan 2007; Donlan & Wilcox 2008). The authors misrepresent the use of biodiversity offsets as we presented them, misunderstand the policy objectives of fisheries (and bycatch) management, present a flawed analysis of the appropriateness of offsets for seabirds and other marine megafauna, underestimate the cost of standard bycatch reduction measures, and overestimate the data requirements involved in implementing offsets.

Žydelis et al. set up a false dichotomy between bycatch-mitigation measures and offsets, misquoting us in the process. They state, “we address the case of bycatch offsets as proposed by D&W, where measures for avoidance and minimization of adverse impacts are not required before considering offsets,” which implies the adoption of offsets as a tool forces managers to leave direct mitigation approaches behind. We have consistently eschewed this approach, insisting that offsets should be used only after direct mitigation measures have been implemented. In the abstract of one of our papers that Žydelis et al. cite we state, “A bycatch management framework based on the hierarchy of ‘avoid, minimize, and offset’ from the Convention on Biological Diversity would result in cost-effective conservation gains” (Donlan & Wilcox 2008). In our initial paper, we presented a comparison of whether offsets or a fisheries closure would be more cost-effective in reducing the threat to a declining shearwater. This analysis was in the context of direct mitigation measures that were both legally mandated and ineffective in achieving the required degree of bycatch reduction (Wilcox & Donlan 2007). The false dichotomy set up by Žydelis et al. distracts from the real challenges and opportunities of integrating biodiversity offsets into bycatch management.

Bycatch is not a problem of species conservation; rather, it is a problem in environmental management

of an industry. Most agencies that regulate bycatch are fisheries agencies, whose objective it is to manage their industries so that their economic activity does not generate unsustainable environmental impacts. For instance, the U.S. National Marine Fisheries Service sets an annual limit on the catch of turtles in the Hawaiian pelagic long-line fishery. The regulatory agency does not require the fishery to conserve turtles; rather, it requires that turtle mortality remain below the level that would trigger a jeopardy decision under the U.S. Endangered Species Act (NOAA 2004). Žydelis et al. misunderstand this fundamental point, implying that fisheries are responsible for recovering marine megafauna populations, as opposed to ensuring their impacts are below sustainable levels. This view leads to their misconception that offsets would only work if they address population-limiting threats. The opposite is true, after implementing direct bycatch-mitigation measures, reducing any other mortality source such that the total net impact is below a predetermined sustainable level could offset residual bycatch. There is no a priori requirement in regard to the size or importance of these other mortality sources. If conservationists seek to engage effectively with industry, they must appreciate the difference between their goals (i.e., species recovery) and those of industry and their regulators (i.e., sustainable economic activities).

The analysis by Žydelis et al. of the availability of offsets is flawed. Although we discuss eradication of invasive predators as a strategy for seabirds and mention its application for turtles, we do not suggest it is applicable for all marine megafauna. Like current bycatch management, offset programs would be implemented on a species-by-species basis (e.g., Tori poles help reduce seabird bycatch, but have no effect on sharks, marine mammals, or sea turtles). Furthermore, terrestrial invasive species have no interaction with sharks, and purporting to look for a relationship merely obfuscates the discussion of offsets.

We mention a range of activities in addition to invasive predator eradication that could serve as potential offsets, including restoration of extirpated seabird colonies via social attraction techniques, reductions in human harvesting of turtles, and habitat restoration. For sharks, touted to be the most difficult taxon to offset, buyouts of low-value shark fisheries or increased interdiction of illegal fisheries may be options (Donlan & Wilcox 2008).

Žydelis et al. estimate that offsets would be applicable for only 8 of 97 seabird species; however, they include only species for which both bycatch and invasive species effects are major and current threats. A potential offset only has to be a current threat, not a major one as explained earlier. We reexamined the Birdlife International Database to evaluate the scope of this error for albatrosses, a group of seabirds that, due to a negative relationship between invasive-species impacts and seabird body size (Jones et al. 2008), should have the lowest frequency of potential offsets. The database reports 13 of the 22 albatross species are currently threatened by invasive species and fisheries bycatch. In their literature review, Žydelis et al. also missed a number of albatross species with documented invasive species impacts, including Laysan (*Phoebastria immutabilis*), Waved (*P. irrorata*), White-capped (*Thalassarche steadi*), and Wandering Albatrosses (*Diomedea exulans*) (Anderson et al. 2002; Cisneros 2005; Wanless et al. 2007; Thompson & Sagar 2008). For instance, Guadalupe Island, Mexico, is 1 of 9 breeding sites for the Laysan Albatross that have over 100 breeding pairs. Predation by feral cats has tripled the nest failure at one colony on the island (Keitt et al. 2006). Given that albatrosses are the largest seabirds and thus should be least affected by invasive predators, it is quite likely that opportunities for offsets are even more pervasive for smaller species.

Žydelis et al. suggest that offsets will be onerously expensive in comparison with other measures due to monitoring and enforcement requirements. This is incorrect on at least 2 counts. First, nearly all mitigation and avoidance measures require surveillance and enforcement to be effective. For example, 10 years after turtle excluder devices (TEDs) were required at all times on U.S. shrimp trawlers, compliance and proper use were low (Lewison et al. 2003). Estimates of turtle mortalities dropped between 39% and 46% following a 6- to 8-week temporary closure to protect shrimp stocks, and a time-series analysis identified TED violations, along with turtle population size, as the most important variables in turtle stranding (Lewison et al. 2003). Turtle excluder devices are presumably one of the easiest bycatch reduction devices to enforce because they are large, visible, and permanently attached to the nets. Furthermore, shrimp trawlers do not spend large amounts of time at sea; hence, dockside compliance checks are feasible. Nevertheless, onshore and at-sea enforcement appears inadequate and difficult, which suggests the need for substantial investment of

resources toward compliance (Cox et al. 2007). Many of the success stories for bycatch mitigation measures, such as the nearly zero seabird bycatch achieved in the CCAMLR fisheries, involve 100% observer coverage (Cox et al. 2007).

Second, compliance with bycatch mitigation measures and monitoring of bycatch rates are often done using statistical estimates made from observing a subset of vessels in a fishery. These estimation procedures could be done at a fleet level for offsets in exactly the same manner, scaling up the number of birds or turtles killed on observed vessels to produce a fleetwide estimate. Thus, the cost of monitoring fisheries to obtain the necessary information for instituting an offset program would often be no larger than the costs for other effective at-sea mitigation measures.

Žydelis et al. exaggerate the complexity and costs of evaluating an offset program. The costs and benefits of fisheries closures and other bycatch reduction methods are readily available from past closures and gear trials, and they can also be directly estimated from fisheries models (Breen et al. 2003; Huang & Leung 2007).

Practitioners have completed over 800 eradications, and with this experience can reasonably predict their biological benefits and financial costs (Donlan & Heneman 2007; Cruz et al. 2008; Donlan & Wilcox 2008). Furthermore, monitoring and evaluation of terrestrial components of an offset program will often cost less and have less uncertainty than marine components due to the ease of monitoring aggregated breeding populations.

Bycatch is a problem in regulating an industry and should be treated as such when evaluating management options. We suggest offsets be considered for residual bycatch, after feasible avoidance and minimization measures have been exhausted. Offsets need to be appropriate for the taxa at hand. Although eradication of invasive predators at breeding locations might represent a viable offset for some species, it will be necessary to search for viable alternatives for each scenario, and sometimes there will be no suitable options. Evidence from the literature suggests that opportunities for offsets exist. The cost of implementing and evaluating an offset program will likely often be similar to any other effective bycatch reduction method (and perhaps sometimes cheaper). In cases where viable options exist, offsets could allow industries to reduce their impacts to acceptable levels, potentially even reaching zero impact on a net basis (Donlan & Wilcox 2007), without undue cost to the public or the industries themselves.

Literature Cited

- Anderson, D. J., K. P. Huyvaert, V. Apanius, H. Townsend, C. L. Gillikin, L. D. Hill, F. Juola, T. Porter, and D. R. Wood. 2002. Population size and trends of the Waved Albatross (*Phoebastria irrorata*). *Marine Ornithology* 30:63–69.

- Breen, P. A., R. Hilborn, M. N. Maunder, and S. W. Kim. 2003. Effects of alternative control rules on conflict between a fishery and Hookers sea lion (*Phocarcos bookeri*). *Canadian Journal of Fisheries and Aquatic Sciences* **60**:527–541.
- Cisneros, D. F. 2005. La avifauna de la isla de La Plata, Parque Nacional Machaililla, Ecuador, con notas sobre nuevos registros. *Continga* **24**:22–27.
- Cox, T. M., R. L. Lewison, R. Zydels, L. B. Crowder, C. Safina, and A. J. Read. 2007. Comparing effectiveness of experimental and implemented bycatch reduction measures: the ideal and the real. *Conservation Biology* **21**:1155–1164.
- Cruz, F., V. Carrion, K. J. Campbell, C. Lavoie, and C. J. Donlan. 2008. Bio-economics of large-scale eradication of feral goats from Santiago Island. *Journal of Wildlife Management* **73**:191–200.
- Donlan, C. J., and B. Heneman. 2007. Maximizing return on investments for island restoration with a focus on seabird conservation. Report. Commonweal Ocean Policy Program, Advanced Conservation Strategies. Santa Cruz, California. Available from <http://advancedconservation.org> (accessed December 2008).
- Donlan, C. J., and C. Wilcox. 2007. Reaching the zero bycatch goal—integrating avoidance, mitigation, and offsets. *Bycatch Communication Network Newsletter* **7**:12–13.
- Donlan, C. J., and C. Wilcox. 2008. Integrating invasive mammal eradications and biodiversity offsets for fisheries bycatch: conservation opportunities and challenges for seabirds and sea turtle. *Biological Invasions* **10**:1053–1060.
- Huang, H., and P. Leung. 2007. Modeling protected species as an undesirable output: the case of sea turtle interactions in Hawaii's longline fishery. *Journal of Environmental Management* **84**:523–533.
- Jones, H. P., B. R. Tershy, E. S. Zavaleta, D. A. Croll, B. S. Keitt, M. E. Finklestein, and G. R. Howald. 2008. Severity of the effects of invasive rats on seabirds: a global review. *Conservation Biology* **22**:16–26.
- Keitt, B., R. W. Henry, A. Aquirre, C. Garcia, L. L. Mendoza, M. A. Hermsillo, B. Tershy, and D. Croll. 2006. Impacts of introduced cats (*Felis catus*) on the Guadalupe Island ecosystem. Pages 15–24 in G. K. S. d. Prado and E. Peters, editors. Taller sobre la restauración y conservación de Isla Guadalupe: memorias. Instituto Nacional de Ecología, Mexico, D.F.
- Lewison, R. L., L. B. Crowder, and D. J. Shaver. 2003. The impact of turtle excluder devices and fisheries closures on Loggerhead and Kemp's Ridley strandings in the western Gulf of Mexico. *Conservation Biology* **17**:1089–1097.
- NOAA (National Oceanic and Atmospheric Administration). 2004. Pelagic longline fishing restrictions. *U.S. Federal Register* **69**:17329–17354.
- Thompson, D., and P. Sagar. 2008. A population and distributional study of white-capped albatross (Auckland Islands). Contract POPO 2005/02. Department of Conservation, Wellington, New Zealand.
- Wanless, R. M., A. Angel, R. J. Cuthbert, G. M. Hilton, and P. G. Ryan. 2007. Can predation by invasive mice drive seabird extinctions? *Biology Letters* **3**:241–244.
- Wilcox, C., and C. J. Donlan. 2007. Compensatory mitigation as a solution to fisheries bycatch-biodiversity conservation conflicts. *Frontiers in Ecology and Environment* **5**:325–331.
- Zydels, R., B. P. Wallace, E. L. Gilman, and T. B. Werner. 2009. Conservation of marine megafauna through minimization of fisheries bycatch. *Conservation Biology* **23**:in press.

