

# Conservation of Marine Megafauna through Minimization of Fisheries Bycatch

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**Abstract:** *Many populations of marine megafauna, including seabirds, sea turtles, marine mammals, and elasmobranchs, have declined in recent decades due largely to anthropogenic mortality. To successfully conserve these long-lived animals, efforts must be prioritized according to feasibility and the degree to which they address threats with the highest relative impacts on population dynamics. Recently, Wilcox and Donlan (2007, *Frontiers in Ecology and the Environment*) and Donlan and Wilcox (2008, *Biological Invasions*) proposed a conservation strategy of “compensatory mitigation” in which fishing industries offset bycatch of seabirds and sea turtles by funding eradication of invasive mammalian predators from the terrestrial reproductive sites of these marine animals. Although this is a creative and conceptually compelling approach, we find it flawed as a conservation tool because it has narrow applicability among marine megafauna, it does not address the most pervasive threats to marine megafauna, and it is logistically and financially infeasible. Invasive predator eradication does not adequately offset the most pressing threat to most marine megafauna populations—fisheries bycatch. For seabird populations, fisheries bycatch and invasive predators infrequently are overlapping threats. Invasive predators have limited population-level impacts on sea turtles and marine mammals and no impacts on elasmobranchs, all of which are threatened by bycatch. Implementing compensatory mitigation in marine fisheries is unrealistic due to inadequate monitoring, control, and surveillance in the majority of fleets. Therefore, offsetting fisheries bycatch with eradication of invasive predators would be less likely to reverse population declines than reducing bycatch. We recommend that efforts to mitigate bycatch in marine capture fisheries should address multiple threats to sensitive bycatch species groups, but these efforts should first institute proven bycatch avoidance and reduction methods before considering compensatory mitigation.*

**Keywords:** compensatory mitigation, elasmobranchs, fisheries bycatch, invasive predators, marine conservation, marine mammals, sea turtles, seabirds

Conservación de la Megafauna Marina Medianate la Minimización de la Captura Incidenta de Pesquerías

**Resumen:** *Muchas poblaciones de megafauna marina, incluyendo aves, mamíferos y elasmobranchios, han declinado en décadas recientes principalmente debido a mortalidad antropogénica. Para conservar exitosamente a estos animales longevos, los esfuerzos se deben priorizar de acuerdo con la factibilidad y el grado en que atienden las amenazas con los impactos relativos más altos sobre la dinámica de la población. Recientemente, Wilcox y Donlan (2007) y Donlan y Wilcox (2008) propusieron una estrategia de conservación de “mitigación compensatoria” en la que las industrias pesqueras compensan la captura incidental de aves y tortugas marinas mediante el financiamiento de la erradicación de mamíferos depredadores invasores*

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de las localidades reproductivas terrestres de estos animales marinos. Aunque este es un método creativo y conceptualmente imponente, lo consideramos deficiente como una herramienta de conservación porque su aplicación es limitada entre la megafauna marina, no aborda las amenazas más grandes a la megafauna marina y no es factible logística y financieramente. La erradicación de depredadores invasores no compensa adecuadamente la amenaza más fuerte para la mayoría de las poblaciones de megafauna marina — la captura incidental de pesquerías. Para las poblaciones de aves marinas, la captura incidental de pesquerías y los depredadores invasores son amenazas que se traslapan poco frecuentemente. Los depredadores invasores tienen impactos limitados a nivel población sobre tortugas marinas y mamíferos marinos y no tienen impactos sobre elasmobranquios, todos ellos amenazados por la captura incidental. La implementación de la mitigación compensatoria en pesquerías marinas no es realista debido a que el monitoreo, control y vigilancia son inadecuados en la mayoría de las flotas. Por lo tanto, es más probable que la compensación de la captura incidental con la erradicación de depredadores invasores revierta la declinación de poblaciones y no reduzca la captura incidental. Recomendamos que los esfuerzos para mitigar la captura incidental en las pesquerías marinas deberían atender amenazas múltiples a los grupos de especies sensibles a la captura incidental, pero estos esfuerzos primeramente deberían instituir métodos de reducción de captura incidental antes de considerar la mitigación compensatoria.

**Palabras Clave:** aves marinas, captura incidental de pesquerías, conservación marina, depredadores invasores, elasmobranquios, mamíferos marinos, mitigación compensatoria, tortugas marinas

## Introduction

To conserve long-lived marine megafauna such as seabirds, sea turtles, marine mammals, and sharks, management strategies must simultaneously take into account multiple threats to their populations that affect different life stages (Mills et al. 1999). One such threat is fisheries bycatch, which has been implicated as a major driver in declines of several marine vertebrate populations (Tuck et al. 2001; Lewison et al. 2004a, 2004b; Read et al. 2006). Nevertheless, given their tendency to have broad geographic ranges and, for some taxa, terrestrial reproductive sites, impacts of other threats to these organisms must also be addressed to halt declines and recover depleted populations (Grand & Beissinger 1997; Flint 1999; Baker et al. 2002). For example, several seabird populations have declined owing to adult and subadult mortality related to fisheries bycatch, but also to high rates of depredation by invasive mammals on eggs and chicks at island nesting rookeries or degradation of terrestrial habitats on nesting islands (Cuthbert et al. 2004; Priddel et al. 2006). Thus, management strategies should be prioritized based on relative population-level impacts of different threats across a population's range to strategically allocate limited conservation resources (Gerber & Heppell 2004; Murdoch et al. 2007). To establish priorities a broad array of parameters should be considered for each proposed action, including effects on target populations and other components of the ecosystem, implementation costs relative to conservation benefit, and logistical feasibility.

Wilcox and Donlan (2007) and Donlan and Wilcox (2008)—hereafter both publications referred to as D&W—described a market-influenced conservation strategy of “compensatory mitigation.” The authors propose

that large-scale fishing industries could offset their bycatch of seabirds and sea turtles by investing in conservation activities that reduce impacts of other threats to those populations. Donlan and Wilcox suggest that such a scheme would allow continued fishing while paying for bycatch that is difficult to avoid or very expensive to mitigate. Admitting that there could be a range of options for compensatory mitigation, D&W advocate strongly for eradication of invasive predators because they see it as a widely applicable and effective strategy to offset bycatch impacts on threatened species. Donlan and Wilcox support the strength of this proposal by stating that most seabirds and sea turtles threatened by fisheries bycatch are concurrently threatened by invasive predators; eradication is a relatively low-cost option compared with bycatch mitigation (area closure in their example) but has potentially high conservation impact according to a population model of one species (Flesh-footed Shearwater [*Puffinus carneipes*]); fisheries industries would welcome an opportunity to support conservation efforts without modifying conventional fishing operations; and eradications have been effectively carried out on islands of variable size, thus demonstrating their wide applicability. We recognize that compensatory mitigation can use a variety of models, such as those used in U.S. wetlands law (Environmental Law Institute 2006). Nevertheless, here 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 measures to offset the anticipated losses.

Despite the conceptual appeal of D&W's proposed management prescription, various authors have criticized it on several fronts. For example, Doak et al. (2007) argue that D&W's evaluation of population-level impacts of invasive predator eradication is flawed and leads to an

overestimate of conservation benefit from this strategy. Priddel (2007) challenges D&W on the grounds that their depiction of the feasibility of compensatory mitigation is inappropriate and misused. Most recently, Finkelstein et al. (2008) conclude that D&W's proposal has little potential for benefit and a substantial potential to harm marine megafauna if implemented in an attempt to address most fisheries bycatch problems.

In our view compensatory mitigation, as proposed by D&W, represents a creative but ecologically and practically problematic proposal that would shift the focus of conservation efforts from the primary threat to several marine megafauna species (i.e., fisheries bycatch) to a secondary and much less pervasive one (i.e., eradication of invasive mammals). In this paper, we challenge the D&W compensatory mitigation proposal based on 3 principal arguments: it fails to adequately address the most pressing threats to most marine megafauna populations, it is irrelevant to the many species of marine megafauna threatened by bycatch, and its implementation would involve significant financial and logistical challenges. We agree with D&W that conservation strategies for certain marine megafauna populations would benefit from terrestrial mitigation efforts, but we argue that such efforts must include mechanisms of bycatch avoidance and reduction and sound fisheries management in both industrial and artisanal fisheries.

### Importance of High Survival of Late-Stage Individuals

In general, marine megafauna such as seabirds, sea turtles, marine mammals, and elasmobranchs share similar life histories (e.g., late maturity, long life span) and life-cycle traits (e.g., distinct ontogenetic habitats, separate breeding and feeding grounds). Therefore, population trends of such organisms typically are influenced most by survival rates of late-stage individuals (subadults and adults), a factor that favors conservation efforts that enhance survivorship of late-stage classes (Heppell et al. 2005; Arnold et al. 2006).

Because fisheries bycatch mortality often eliminates late-stage individuals, it is especially important to minimize this threat to reverse population declines (Heppell et al. 2005). Increasing fecundity through elimination of invasive predators is critical for some populations (e.g., Tristan Albatross [*Diomedea dabbenena*]), but even achieving maximum reproductive output would not safeguard the survival of many of these species if bycatch mortality persists (Cuthbert et al. 2004). According to several population models for sea turtles, increased early-stage survivorship (i.e., hatchling production) without a concomitant increase in late-stage survivorship will delay population extinction but typically cannot reverse

population declines by itself (Heppell et al. 1996; Grand & Beissinger 1997; Santidrián Tomillo et al. 2008).

Conservation efforts that have addressed widespread and detrimental threats to early life stages (e.g., egg harvest by humans) have contributed significantly to documented sea turtle population increases (Dutton et al. 2005; Chaloupka et al. 2008). Nevertheless, these efforts focused on major threats, none of which have included elimination of invasive mammals that prey on sea turtle eggs and hatchlings. Furthermore, the scenarios in which sea turtle population increases were associated with nesting beach conservation tactics also included enhanced late-stage survival (high annual adult survivorship [Dutton et al. 2005]; reduction of turtle harvest [Chaloupka et al. 2008]). Therefore, in cases where threats to early life stages are not primary causes of population-level declines, conservation efforts that increase survival of late stages should be emphasized over those that increase early-stage survival because of differences in relative population-level impacts.

### Eradication of Invasive Predators versus Fisheries Bycatch

To assess the extent to which invasive predators and fisheries bycatch are considered major threats to marine megafauna species, we reviewed the International Union for Conservation of Nature's (IUCN) Red List assessments for globally threatened species of seabirds, sea turtles, marine mammals, and elasmobranchs (those listed as critically endangered, endangered, or vulnerable) to calculate the proportions of species affected by fisheries bycatch (threat code 4.1), invasive predators (threat code 2.2), or both (IUCN 2007). We omitted sea turtles from this exercise because assessments were out-of-date or insufficient information was available for 4 of the 6 species. In addition, no specific threats were listed under the general category "accidental mortality" (threat code 4) for 5 marine mammal species (northern fur seal [*Callorhinus ursinus*], Steller's sea lion [*Eumetopias jubatus*], Mediterranean monk seal [*Monachus monachus*], Hawaiian monk seal [*M. schauinslandi*], New Zealand sea lion [*Phocarctos hookeri*]), but relevant literature specified that fisheries bycatch was indeed a major threat to these species (Kiyota & Baba 1999; Manly et al. 2002; Perez 2003; CMS 2005; Antonelis et al. 2006).

Fisheries bycatch was considered a major threat to 67% of marine megafauna species, whereas 32% of species were threatened by invasive predators and only 15% were threatened by both invasive predators and fisheries bycatch (Fig. 1). There were pronounced differences among taxa. For seabirds, invasive predators was listed more frequently as a threat (77%) than bycatch (47%), and both threats overlapped for 34% of seabird species

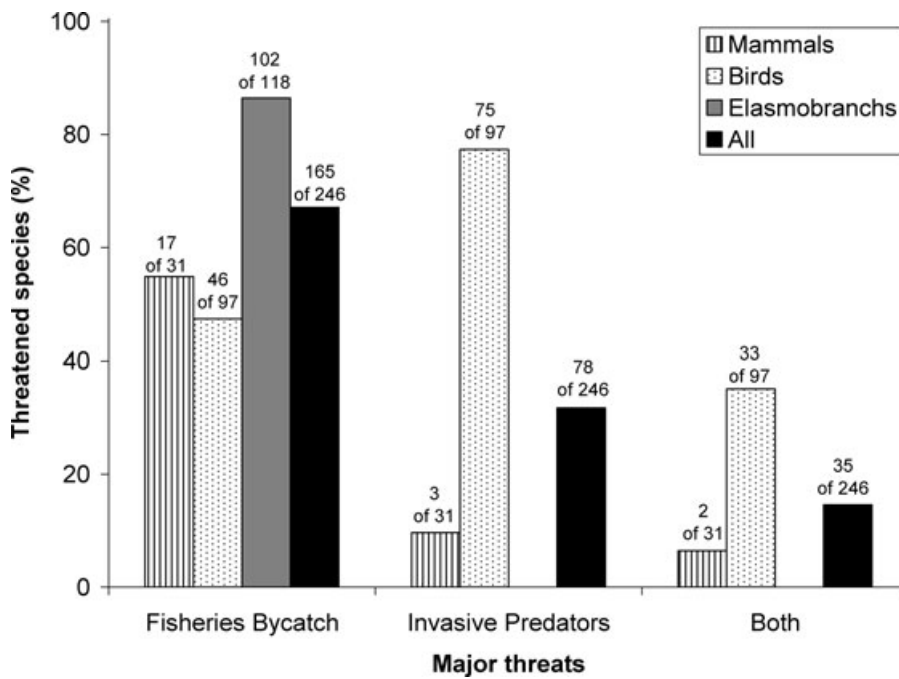


Figure 1. Proportions of marine mammal, seabird, and elasmobranch species threatened by fisheries bycatch, invasive predators, or both according to IUCN Red List of Threaten Species (2007).

(but see below). Marine mammals were mostly threatened by bycatch (55%), and 3 species were threatened by invasive predators (10%) (both threats overlapping in only 2 species [7%]). Elasmobranchs were affected only by fisheries bycatch (86%).

**Seabirds**

An important point D&W make in support of their proposal is its broad applicability to conserving a variety of marine megafauna populations. Review of threats according to the IUCN Red List identified that, for instance, all 19 globally threatened albatross species are affected by fisheries bycatch, and 10 of them are also threatened by invasive predators. Considering that threats listed in the IUCN Red List are not categorized according to their severity and that they include past, current, and future threats,

we used BirdLife International’s World Bird Database (BirdLife International 2007) and other relevant sources to extend our review for seabirds. In this literature review, we aimed to identify whether invasive predators and fisheries bycatch are principal threats, which we defined as *current* population-limiting factors.

This exercise revealed that bycatch is the principal threat currently affecting the survival of 17 threatened albatross species, whereas predation by invasive mammals is a significant current threat to only 2 species—Tristan Albatross and Amsterdam Albatross (*D. amsterdamensis*)—and is listed as an additional threat for 8 other species (Table 1, Supporting Information). Extending our review to all threatened seabird species, there was little overlap between segments of the seabird community primarily affected by fisheries bycatch and invasive predators (Table 1, Supporting Information). In

**Table 1. Globally threatened seabird species affected by fisheries bycatch, invasive predators, and both.\***

Taxonomic group	Number of species	Affected by bycatch	Bycatch is principal threat	Affected by invasive predators	Predation is principal threat	Affected by both bycatch and predators	Bycatch and predators are principal threats
Penguins	10	6	2	8	2	6	1
Albatrosses	19	19	17	10	2	10	2
Petrels and shearwaters	40	11	6	39	30	11	4
Cormorants	10	6	2	8	2	5	0
Larids	6	0	0	2	1	0	0
Auks	5	5	1	3	1	3	1
Other species	7	3	0	1	0	0	0
Sum	97	50	28	71	38	35	8

\*Threats affecting current population trends. Presence and severity of threats were assessed by reviewing BirdLife International’s World Bird Database and relevant literature sources. A full list of species and the methodology of this review are provided in Supporting Information.

contrast to the IUCN Red List, in which threats from both invasive predators and fisheries bycatch were listed for 34% (33 of 97) of threatened seabird species (Fig. 1), a more thorough literature review revealed that both threats are identified as current population-limiting factors for only 8 species (Table 1). These findings agree with well-documented knowledge that invasive predators have the greatest impact on smaller seabirds (e.g., prions, storm petrels, diving petrels, small shearwaters), whereas bycatch of industrial longline and trawl fisheries affects primarily larger species (e.g., albatrosses, large petrels, and shearwaters) (Taylor 2000; Baker et al. 2002; Towns et al. 2006; Jones et al. 2008).

The enormously detrimental effect of invasive mammal predators on several populations of seabirds is indisputable. For example, Midway Atoll in the northwestern Hawaiian Islands had approximately 500,000 pairs of Bonin Petrels (*Pterodroma hypoleuca*) in 1943 before black rats (*Rattus rattus*) were accidentally introduced. Within 35 years, the Bonin Petrel population was down to <5000, and Bulwer's Petrels (*Bulweria bulwerii*) and Laysan Rails (*Porzana palmeri*) were extirpated from the atoll (Flint 1999). At the same time, rat predation has not been considered as a population-limiting factor for Laysan and Black-footed Albatrosses (*Phoebastria immutabilis*, *P. nigripes*) nesting on Midway (Gales 1998).

Therefore, the majority of seabird populations affected by invasive predators are not concurrently threatened by industrial fisheries bycatch. These findings run counter to D&W's claim of broad applicability of eradication of invasive predators as a compensatory mitigation for fisheries bycatch.

### Sea Turtles

Impacts of invasive and feral mammal predators on sea turtle eggs and hatchlings, where predation occurs, are typically restricted to specific nesting sites and thus generally do not have population-level impacts on widespread sea turtle nesting rookeries. In most reported cases of predation by feral or invasive mammals on sea turtle clutches, predation rates typically do not exceed 60% of all clutches and usually are much lower (~10–30%) (e.g., Hamman et al. 2006; Hitipeuw et al. 2007; Ordoñez et al. 2007; Tapilatu & Tiwari 2007).

Nevertheless, there are some documented cases of much higher predation rates on sea turtle clutches. For example, pigs and dogs destroy up to 100% of flatback turtle (*Natator depressus*) egg clutches at some nesting sites in northern Australia (Limpus 2007), and they destroy leatherback (*Dermochelys coriacea*) egg clutches at a few locations in Southeast Asia (Hamman et al. 2006). Another exception, also cited by D&W, documented 2 central Florida beaches where predation of sea turtle nests by *native* mammalian predators (e.g.,

raccoons and armadillos) was historically nearly 100%, and schemes to eliminate this predation have resulted in dramatic increases in hatchling production (Engeman et al. 2005).

Sea turtle nesting that occurs at the sites mentioned earlier represents small fractions of total nesting abundance and distribution for these populations (e.g., 1–3% of U.S. Atlantic and Gulf Coast loggerheads [Ehrhart et al. 2003] in the Engeman et al. [2005] example). In fact, of all terrestrial threats to sea turtles, only widespread egg harvest by humans (Santidrián Tomillo et al. 2008), extreme storm events (Milton et al. 1994), and tidal inundations and beach erosion (Eckert & Eckert 1990) have demonstrated capacity to cause substantial mortality (Miller 1997). Nevertheless, conservation efforts focused on nesting beaches can only succeed in recovering sea turtle populations with concomitant increases in late-stage survivorship (Dutton et al. 2005; Chaloupka et al. 2008; Santidrián Tomillo et al. 2008). For these reasons, we conclude that control of invasive predators would be an effective conservation strategy at some sea turtle nesting sites, but reduction of sea turtle bycatch in fisheries worldwide (and of other threats to late-stage survivorship) should remain among the top conservation priorities.

### Marine Mammals and Elasmobranchs

Whereas bycatch offsets from mitigation of invasive mammal predation has some potential to recover a few populations of seabirds and sea turtles, such efforts would provide no discernible conservation benefit to the majority of populations of marine mammals or elasmobranchs. Obviously, the latter group and many marine mammal species would be ineligible for such an offset program because they lack a terrestrial stage. Our review of IUCN Red List assessments for threatened marine mammals (31 species of cetaceans, pinnipeds, sirenians, and otters) revealed that only 2 species (marine otter [*Lontra felina*] and New Zealand sea lion) are threatened by both invasive predators and fisheries bycatch (Fig. 1). On the other hand, bycatch was listed as a major threat for 17 of 31 globally threatened species, and estimates suggest that the global bycatch of marine mammals is in the hundreds of thousands annually (Read et al. 2006). For elasmobranchs (e.g., skates, rays, and sharks), bycatch was listed as a major threat to 102 of 118 (86%) globally threatened species.

Considering that fisheries bycatch is clearly a more prevalent primary threat than invasive mammal predation and that both threats overlap in a very few species, we conclude that compensatory mitigation, as suggested by D&W, has relatively narrow applicability and limited potential for multispecies conservation.

## Financial and Logistical Challenges of Implementing Compensatory Mitigation

### Cost of Compensatory Mitigation Schemes

Despite the limited conservation impact of D&W's proposal (see above), bycatch offsets would require monumental increases in logistic and financial investments to be successfully implemented. For a bycatch offset program to function properly, rigid caps on fishing-associated mortality of a protected species or population, maximum vessel or fleetwide bycatch rate, or another performance standard would have to be established, and any fishery that exceeded established thresholds would be required to compensate for its high bycatch. Numerical limits on bycatch have been established for a very few fisheries, most of which are under U.S. jurisdiction, because necessary demographic information for nontarget populations (see below) and resources for extensive monitoring and enforcement are usually unavailable. Thus, a bycatch offset program would be costly for the fishing industry and would require substantial additional investment of monitoring effort (e.g., on-board observers) to execute adequately. One such fishery, also mentioned by D&W, is the Hawaii swordfish longline fishery that instituted strict limits to sea turtle bycatch and has comprehensive (100%) monitoring and mandatory mitigation measures in place to reduce sea turtle and seabird bycatch (Gilman et al. 2007). To illustrate high costs of such measures, on-board observer coverage on all Hawaii longline swordfish trips and on 25% of tuna trips costs about US\$3 million annually. This scheme was achieved by years of litigation that forced a temporary, 2-year closure of the fishery.

In their example of the Flesh-footed Shearwater, D&W did not account for expenses of the necessary implementation of additional monitoring that their proposal would necessitate. Thus, it appears that the financial and logistical challenges of implementing bycatch offsets, as proposed by D&W, would be much more costly and much less feasible than they contend.

In contrast, bycatch mitigation techniques are often relatively inexpensive, but lack comprehensive implementation in most places (Gilman & Moth-Poulsen 2007). To be efficient bycatch mitigation also requires monitoring, control, and surveillance (Cox et al. 2007). Nevertheless, many bycatch avoidance measures could be implemented successfully without full observer coverage if they defined standards for fishing-gear configuration and fishing methods (e.g., turtle excluder devices on trawls; Medina panel in purse seine fisheries; integrated weighted lines, bird-scaring lines and night setting in longline fisheries for seabirds; time-area closures in quota-limited fisheries) and are required fleetwide (see Werner et al. [2006] for review of bycatch-reduction techniques).

### Lack of Data Preclude Assessment of Alternatives

To implement an offset program of the kind described by D&W, a considerable body of data would first need to be assembled. These data would simultaneously require adequate demographic information on populations and quantitative knowledge of bycatch levels, impacts from introduced predators on the same species, and the financial costs and conservation benefits of implementing such a strategy. Lack of such information is a challenge recognized by D&W and highlighted by Doak et al. (2007) as a major flaw in D&W's proposal. For many species affected by bycatch, such information is unavailable and would require large investments of resources to collect. Even when population analyses are conducted, the paucity of information on mortality rates and magnitude of interactions with distinct fisheries prevent quantitative comparisons of population-level impacts originating from different sources (Wallace et al. 2008). Moreover, adequate economic analyses that allow determination of the relative cost-benefits of bycatch offsets versus bycatch mitigation are also unavailable but crucial to prioritization of conservation efforts with respect to fisheries bycatch. Therefore, it should be recognized that even in cases where biological and conservation justifications exist for pursuing a bycatch offset program, there are likely only a few locations in the world, if any, where sound economic and ecological information required for implementing such a scheme as proposed by D&W also exists.

### Extending Bycatch Research and Mitigation Effort into Artisanal Fisheries

Although our analysis finds limited utility of the proposal made by D&W, industrial fisheries would appear to be the most likely candidates for introducing bycatch offset programs for eradication of invasive mammals due to their broad geographic operating ranges and large financial investments in maintaining operational capacity. Nevertheless, there is an urgent need to develop effective bycatch mitigation tools in artisanal fisheries. Artisanal fishers make up more than 90% of the world's fishing workforce and tend to operate in coastal, continental shelf regions featuring high productivity that can aggregate high levels of marine biodiversity, including many apex predator species (Kenney et al. 1999; James et al. 2005). Therefore, we speculate that the global impacts of artisanal fisheries on populations of seabirds, sea turtles, and marine mammals could be enormous and thus require immediate assessment. Two recent studies indicate that overall bycatch of nontarget animals in coastal and artisanal fisheries might approach or even exceed bycatch in industrial fleets (Jaramillo-Legorreta et al. 2007; Peckham, et al. 2007). Small-scale fishers are unlikely to

have the funds required to pay for compensatory mitigation schemes. Furthermore, most reside in developing countries, where there generally is limited or no information on threatened nontarget species and insufficient capacity and, often, political will to enforce and monitor such a compensatory mitigation scheme. A more sensible approach would be to draw from the extensive body of research and experience in reducing bycatch of industrial fisheries and carry out evaluations of these with artisanal fishers.

## Conclusion

Any conservation activity proposed as compensatory mitigation must offset the population-level effect of the adverse impact. We conclude that D&W's proposal to offset fisheries bycatch through invasive mammal eradication does not meet this expectation. Compensating for bycatch by mitigating impacts from invasive mammal predation would be justifiable for only a few populations and species of seabirds and sea turtles, and would be ineffective in offsetting the population-level effects from bycatch for elasmobranchs and nearly all marine mammal species. Reduction of global fisheries bycatch through changes in fishing gear and practices has the highest potential to reverse declines of marine megafauna populations. Compensatory mitigation holds promise to contribute to mitigating fisheries bycatch if used to compliment and not detract from actions to first avoid and minimize bycatch. We agree with D&W that marine conservation efforts to reduce bycatch of nontarget species should account for previously unmeasured or unaddressed threats, but we maintain that priority should be given to broader implementation of proven and more practical bycatch mitigation techniques in industrial fisheries and to quantification and reduction of artisanal fisheries bycatch.

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## Supporting Information

A list of threatened seabird species and impact of threats arising from fisheries bycatch and invasive predators as identified by literature review (Appendix S1) is available as part of the on-line article. The author is responsible for the content and functionality of these materials. Queries

(other than absence of the material) should be directed to the corresponding author.

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