THINKING BIG—TAKING A LARGE-SCALE APPROACH TO SEABIRD BYCATCH

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Seabird bycatch in industrial fisheries has been the focus of research and conservation concern since the late 1980s (e.g. Weimerskirch & Jouventin 1987, Bartle 1991, Brothers 1991). Recent research has explored the impacts of seabird bycatch in longline (Tuck *et al.* 2001, Lewison & Crowder 2003) and in trawl fisheries (Weimerskirch *et al.* 2000, Sullivan & Reid 2003). Understanding the impact of fisheries bycatch on seabird species involves both quantifying the number of individuals affected (including lethal and sub-lethal effects) and determining the effect, if any, that bycatch could have at the population or community level.

Fisheries bycatch is only one of several human-mediated disturbances that may threaten seabird populations. Introduced predators, toxin contamination, disease and other disturbances are also likely to impact negatively upon populations (Arcos *et al.* 2002, Finkelstein *et al.* 2003, Weimerskirch 2004). Ideally, the goal is to understand the relative effects of each of these putative threats on population growth. However, data limitations (quantity and quality), uncertainty with analytical methods and assumptions, and the difficulties associated with understanding dynamic, natural systems present formidable obstacles to quantifying the effects of fisheries bycatch and other disturbances.

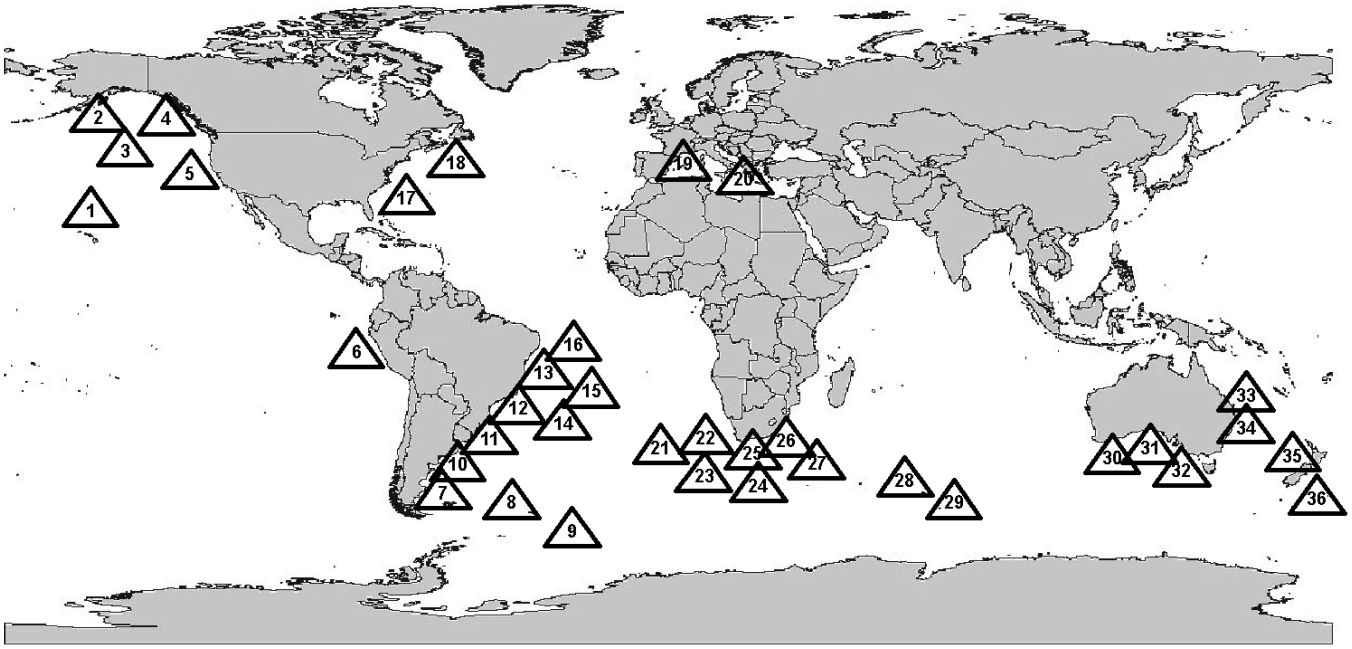

Fig. 1. Published or released seabird bycatch data from longline fisheries through 2005. Triangles represent an approximated region of data collection: 1. US National Marine Fisheries Service, Observer program; 2. US National Marine Fisheries Service, Observer program; 3. US National Marine Fisheries Service, Observer program; 4. Smith 2002; 5. US National Marine Fisheries Service, Observer program; 6. Jahncke et al. 2001; 7. Sullivan & Reid 2003; 8. Moreno et al. 1996; 9. Commission on the Conservation of Antarctic Marine Living Resources (CCAMLR) 2004; 10. Favero et al. 2003; 11. Marin 2003; 12. Stagi et al. 1998; 13. Neves & Olmos 1998; 14. Vaske 1991; 15. Olmos et al. 2001; 16. Olmos & Neves 2003; 17. US National Marine Fisheries Service, Observer Program; 18. Fisheries and Oceans Canada, Observer program; 19. Belda & Sanchez 2001; 20. Valeiras & Caminas 2003; 21. Glass et al. 2000; 22. Barnes et al. 1997; 23. Ryan et al. 2002; 24. Ryan & Boix-Hinzen 1998; 25. Osbourne & Mullins 2001; 26. Peterson 2005; 27. Nel et al. 2002; 28. Cherel & Weimerskirch 1996; 29. Weimerskirch et al. 2000; 30. Gales et al. 1998; 31. Brothers et al. 1999; 32. Brothers 1991; 33. Klaer & Polacheck 1997; 34. Australian Fisheries Management Authority, Observer program; 35. Murray et al. 1993; 36. Baird 2005

Despite these challenges, the body of bycatch data and research is growing. Fig. 1 illustrates published or released seabird bycatch data from longline fisheries up to 2005. These data come from observer programs and experimental fisheries. Although bycatch coverage is still small relative to fishing effort, the existing body of data continues to grow in size and detail. For some fisheries, bycatch data extend over more than a decade.

Carcass recovery programs point to sex-biased mortality in some regions. Bycatch studies around the Prince Edward Islands found a strong adult male bias in bycatch mortality (Nel *et al.* 2002, Ryan & Boix-Hinzen (1999) for three species (White-chinned Petrel *Procellaria aequinoctialis,* Grey-headed Albatross *Thalassarche chrysostoma* and Indian Yellow-nosed Albatross *T. carteri*), whereas studies around New Zealand, South Georgia and the Crozet Islands have found adult female–biased bycatch mortality for Grey Petrels *Procellaria cinerea* and Wandering Albatrosses *Diomedea exulans* (Weimerskirch & Joventin 1987, Croxall & Prince 1990, Murray *et al.* 1993). Knowing how bycatch patterns have changed over time and which age and sex classes interact with fishing gear is essential to understanding how current bycatch levels may affect future seabird populations (*sensu* Mills & Ryan 2005).

Beyond data limitations and uncertainty, another less obvious challenge to bycatch research is the issue of scale. Fishing effort is globally distributed. Some areas are subject to fishing pressure from multiple fisheries, but few (if any) ocean regions remain entirely unfished. A map of pelagic longline fishing effort in 2000 provides one example of the global nature of industrial fisheries (Fig. 2). Telemetry studies indicate that some seabirds also can have ocean-wide distributions, travelling hundreds of kilometres in days (Weimerskirch *et al.* 1999, Weimerskirch & Wilson 2000, Croxall *et al.* 2005). Although efforts are underway to publish more detailed distribution data (BirdLife International 2004), estimated distributions for albatross and petrel species of conservation concern suggest that seabirds can encounter as many as 12 sovereign nations and Exclusive Economic Zones (EEZs), which likely represent just as many fishing fleets (Table 1). Because seabirds encounter many fishing fleets, bycatch assessments at the national, or fleet-specific, level can represent only a small fraction of the bycatch from a much larger total. Although national bycatch assessments can address important local conservation concerns, for many seabird species, these small-scale analyses will not be indicative of the conservation status of the population or species as a whole.

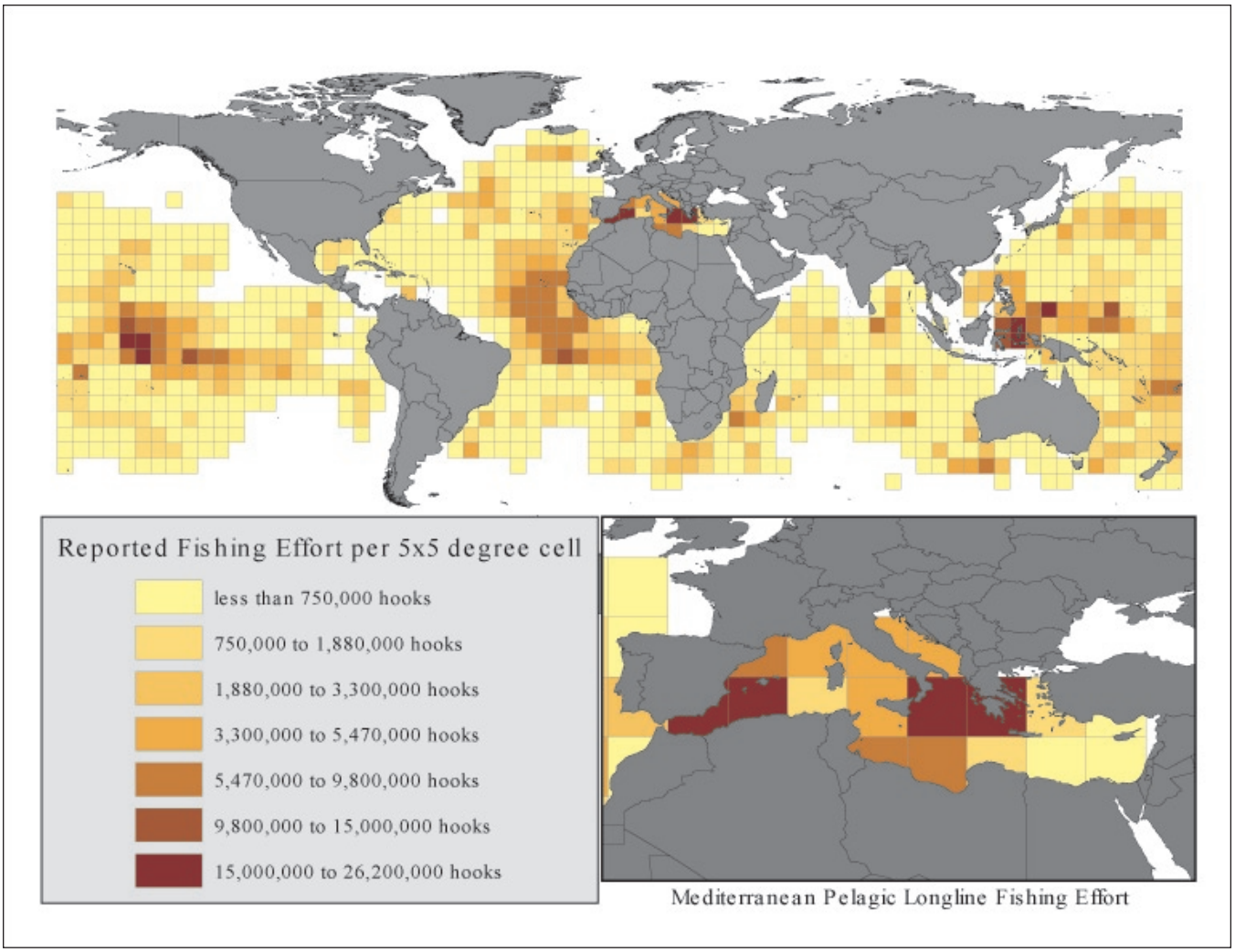

Fig. 2. An example of the global nature of industrial fisheries, showing pelagic longline fishing effort in 2000. (Reproduced with permission from Lewison et al. 2004.)

TABLE 1

The minimum number of nations likely to be encountered by seabirds of conservation concern [a] as they travel across breeding and foraging areas. The actual number of nations (and fishing fleets) encountered will be even higher when distant-water fishing fleets are included.

Species		Amsterdam Alb. *Diomedea amsterdamensis*	Antipodean Alb. *Diomedea antipodensis*	Black-browed Alb. *Thalassarche melanophrys*	Black-footed Alb. *Phoebastria nigripes*	Buller's Alb. *Thalassarche bulleri*	Campbell Alb. *Thalassarche impavida*	Chatham Alb. *Thalassarche eremita*	Grey-headed Alb. *Thalassarche chrysostoma*	Indian Yellow-nosed Alb. *Thalassarche carteri*	Northern Royal Alb. *Diomedea sanfordi*	Southern Royal Alb. *Diomedea epomophora*	Salvin's Alb. *Thalassarche salvini*	Short-tailed Alb. *Phoebastria albatrus*	Sooty Alb. *Phoebetria fusca*	Tristan Alb. *Diomedea dabbenena*	Wandering Alb. *Diomedea exulans*	Waved Alb. *Phoebastria irrorata*	Southern Giant Petrel *Macronectes giganteus*	Black Petrel *Procellaria parkinsoni*	Spectacled Petrel *Procellaria conspicillata*	Westland Petrel *Procellaria westlandica*	White-chinned Petrel *Procellaria aequinoctialis*
Conservation status		CR	V	V	E	V	V	CR	V	E	E	V	V	V	E	E	V	V	V	V	CR	V	V
Breeding areas	Argentina																		X				
	Australia			X					X								X		X				X
	Chile			X					X										X				
	Ecuador																	X					
	France [b]	X		X					X	X					X		X		X				X
	Japan				X									X									
	New Zealand		X	X		X	X	X	X		X	X	X							X		X	X
	South Africa								X	X					X		X		X				X
	United Kingdom [c]			X					X						X	X	X		X		X		X
	United States				X																		
Foraging range (EEZs)	Angola			X																			
	Argentina			X					X		X	X			X		X		X				X
	Australia		X	X		X	X	X	X	X	X	X	X		X		X		X				X
	Brazil			X							X	X			X	X					X		X
	Canada				X									X									
	Chile		X	X		X		X	X		X	X	X				X		X			X	X
	China				X									X									
	Columbia																			X			
	Ecuador					X												X		X			
	Japan				X					X				X									
	Mozambique									X													
	Madagascar									X													
	Mexico																			X			
	Namibia			X									X			X	X		X				X
	New Zealand		X	X		X	X	X	X	X	X	X	X				X		X	X	X	X	X
	Panama																			X			
	Peru			X		X		X					X					X		X		X	X
	Russia				X									X									
	South Africa			X					X	X	X	X	X		X	X	X		X		X		X
	South Korea				X									X									
	Taiwan				X									X									
	Uruguay			X					X		X	X			X	X			X		X		X
	United States				X									X									
NATIONS (n)		1	3	12	7	5	2	4	8	7	8	7	6	7	7	5	8	3	9	6	5	3	11

[a] Conservation status is based on the 2004 Red List of the IUCN, the World Conservation Union. Birds and nations are listed in alphabetic order. [b] French Southern Territories.
[c] United Kingdom Overseas Territories. CR = Critically Endangered; E = Endangered; V = Vulnerable.

Given the wide distributions of many seabird species and the highly mobile, multinational fishing fleets with which they interact, a large-scale perspective is required to characterize accurately the magnitude and extent of bycatch effects. This "big picture" perspective will also be critical to tracking the efficacy of bycatch mitigation measures implemented across fleets. Recognizing the international nature of seabird bycatch also highlights the critical roles that regional fisheries management organizations (RFMOs) must play in implementing and enforcing effective international bycatch mitigation management. RFMOs, as the entities charged with the management of international ("high seas") fisheries, can provide a much-needed forum for the coordination of mitigation efforts and proactive conservation of bycatch species (Small 2005).

To understand better the impacts of seabird bycatch and to promote effective conservation, it is essential that researchers begin to consider the effects of bycatch from multinational fleets across large ocean regions. A large-scale approach will facilitate a more integrated path to understanding and managing the impact of fisheries bycatch. Across regions, research combining fishing effort, bycatch, oceanographic conditions and seabird distribution data can provide an ecologic understanding of what generates bycatch hotspots. Although further data collection is warranted, for some regions, existing bycatch data can be used for these large-scale analyses.

A large-scale approach will be possible only with international coordination and collaboration. Such a synthesis will require attention to issues of data sharing and propriety. However, given the conservation concern for many species and the potential for bycatch research to move beyond a single-species focus to a more ecologic one, the sometimes daunting logistics of international collaboration are worth tackling. Regional and ocean-wide analyses that synthesize smaller data sets into a larger, ecologically relevant context are needed for innovation and progress in seabird bycatch research.

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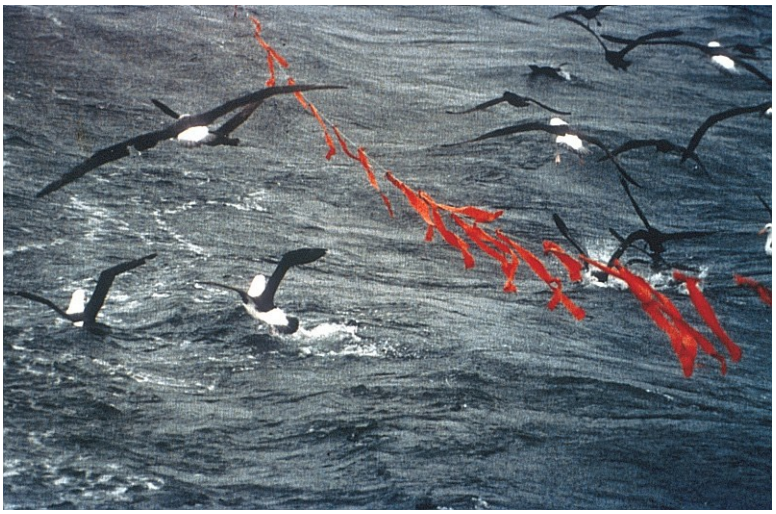

Streamer lines deter birds from taking bait from longline hooks

Black-browed Albatross *Thalassarche melanophris*, photo Jim Enticott

BirdLife International's 'Save the Albatross Campaign' is working globally to reduce the bycatch of seabirds in fisheries, including working with the regional fishery management organisations who manage many of the critical fisheries, coordinating collaboration between scientists to pool satellite tracking data on global seabird distribution, and working with fishers to encourage the use of mitigation methods to deter albatross from baited hooks, such as setting lines at night and using bird scaring tori lines (as shown above). To learn more visit www.savethealbatross.net