

## S37-3 Reducing longline mortality in seabirds: a South African perspective

Peter G. RYAN<sup>1</sup>, Deon C. NEL<sup>2</sup>, John COOPER<sup>3</sup>

1. Percy FitzPatrick Institute, University of Cape Town, Rondebosch 7701, South Africa; pryan@botzoo.uct.ac.za

2. BirdLife International, Seabird Conservation Programme, Box 1586, Stellenbosch 7599, South Africa; dnel@savethealbatross.org.za

3. Avian Demography Unit, Dept. of Statistical Sciences, University of Cape Town, Rondebosch 7701, South Africa; jcooper@adu.uct.ac.za

**Abstract** Longline mortality is the most significant factor causing population decline among several seabird populations. South Africa has three major longline fisheries operating in its Exclusive Economic Zone (EEZ). Over the last six years, we have quantified the impacts of these fisheries. The success of mitigation measures to reduce seabird bycatch has varied among fisheries. For the Patagonian toothfish (*Dissostichus eleginoides*) fishery, operating around the sub-Antarctic Prince Edward Islands, a well-controlled licensed operation has shown excellent reductions in bird bycatch, rates falling from 0.2 to <0.05 birds per 1 000 hooks. However, illegal, unreported and unregulated (IUU) fishing remains a significant problem due to the distant-water nature of this fishery. The longline fishery for hake (*Merluccius* spp.) in continental shelf waters around South Africa has a much lower observer coverage, and resultant poor compliance with mitigation measures. Fortunately it kills relatively few birds. The most damaging fishery is the pelagic tuna (*Thunnus* spp.) fishery, which includes South African and foreign vessels operating inside the EEZ and in international waters. Estimates of the numbers of birds killed are complicated by a paucity of observers, especially on foreign vessels, but bycatch rates are high and compliance with mitigation measures required by permit is poor. The ease with which mitigation can be implemented depends on the type of fishery, its history, location and number of operators. We find that well-trained fishery observers play a crucial role in reducing longline mortality among seabirds.

**Key words** Longline fishing, Seabirds, Mortality, Mitigation, Fishery observers, South Africa

### 1 Introduction

Longline fishing is widely acknowledged as the cause for population declines among several albatross and petrel populations (Gales, 1998). Birds are killed when they pursue baited hooks during setting, and are drowned when they are dragged underwater either after swallowing hooks or becoming entangled. Smaller numbers of birds are also killed or injured during hauling operations. Because of the conservative life-history traits of the affected seabirds (single-egg clutches, delayed maturity and sometimes biennial breeding), only relatively few birds have to be killed to precipitate population declines. As a result, longline fishing is cited as a significant threat to 24 species listed as Threatened and a further six listed as Near-threatened (BirdLife International, 2000).

Fortunately, there is a suite of relatively simple mitigation measures that can be implemented to limit bird bycatch on longlines (Brothers et al., 1999). These include setting exclusively at night to avoid diurnal foragers such as albatrosses, adequate line weighting and slow setting speeds to maximize line sink rates, underwater setting through funnels or chutes to preclude bird access to baits, use of bird-scaring or *tori* lines over the setting line, and

appropriate management of discards to reduce the risk of entanglement during hauling, the attractiveness of fishing vessels and the risk of hooks being obtained from discards. Another option is to declare closed seasons or areas in especially sensitive situations, for example at seabird breeding colonies. Together these measures can reduce seabird bycatch to acceptable levels (see Discussion).

The main challenge today is to ensure that fisheries adopt the mitigation measures promulgated. In this paper we report progress made in implementing the measures in three longline fisheries operating off South Africa. We measure the success of implementation in terms of change in bird bycatch rates. The main aims of the paper are to identify problem areas and to share lessons learned from attempts to reduce bird bycatch in South African fisheries.

### 2 Materials and methods

There are three major longline fisheries operating in waters off South Africa. One is a widespread pelagic fishery for tunas (*Thunnus* spp.) and broadbill swordfish (*Xiphias gladius*), which sets *c.* 12 million hooks a year. The other two are demersal fisheries, one in continental waters for hake (*Merluccius* spp.), which sets 15 million hooks, and

the other around the Prince Edward Islands for Patagonian toothfish (*Dissotichus eleginoides*), which sets three million hooks. Fishing is conducted by South African vessels and, in the case of the tuna fishery, by Japanese and Taiwanese license holders. The foreign licenses will not be renewed at the end of 2002. All fisheries have mitigation programs designed to limit seabird bycatch as part of their permit requirements, and Japanese and Taiwanese vessels licensed for tunas in South African waters also fall under the guidelines set out in their National Plans of Action — Seabirds (FAO, 1999).

Most of what is known about the numbers of birds killed in these fisheries comes from observer programs (Barnes et al., 1997; Ryan and Boix-Hinzen, 1998, 1999; Nel et al., 2002; Ryan et al., 2002), although some data is also available from observations of the quantities of fishing tackle brought back to breeding colonies by seabirds (Nel and Nel, 2000). We also obtained information from the Taiwanese tuna fishery in South African waters by inspecting vessels and interviewing captains (Ryan and Boix-Hinzen, 1998). Data presented in this paper include updates of bycatch estimates based on observer data subsequent to these published accounts. Additional information came from voluntary programs that ask boat captains to return any birds killed to port; such data, however, are not comprehensive.

### 3 Results

The longline fishery for toothfishes is the best documented of the South African fisheries, with almost complete observer coverage since the sanctioned fishery commenced operating in 1996 (Nel et al., 2002). Large numbers of birds were killed in the first year of operations, when compliance with prescribed mitigation measures was poor (Table 1). Since then more stringent implementation of mitigation measures and a shift in fishing effort away from the immediate vicinity of breeding islands have combined to reduce bycatch rates to a point where fewer than 0.05 birds have been killed per 1 000 hooks over the last four years (Table 1). There has thus been a more than 10-fold drop in bycatch rates, with the lowest rate in 2001/2002 when compliance

with mitigation measures was all but complete.

The hake longline fishery started in 1983, but ceased in 1990 due to excessive targeting of the more valuable kingklip (*Genypterus capensis*). The fishery recommenced in 1994, when fishery observers collected the first data on seabird bycatch. They reported substantial mortality among white-chinned petrels *Procellaria aequinoctialis* (0.44 birds per 1 000 hooks set), with small numbers of other species being caught and released during hauling (Barnes et al., 1997). Based on these findings, mitigation measures were made part of the permit requirements for the fishery. Fortunately, fish catches are highest on lines set at night, resulting in good compliance with this measure and greatly reducing the risk of killing species other than those of *Procellaria*. Compliance with other key mitigation measures is relatively poor, probably in part because of the currently low observer coverage (9%). Despite these problems, the bycatch rate is a more moderate 0.14 birds per 1 000 hooks set (Marine and Coastal Management unpubl. data for 2000/2001), which is a three-fold improvement since the start of observations in 1994.

The pelagic fishery for tunas, and more recently swordfish, is the oldest longline fishery off South Africa, dating back to the 1950s. Until the later 1990s, there was little direct evidence to assess the numbers of birds killed, because prior to 1997, most fishing within the South African Exclusive Economic Zone (EEZ) was conducted by vessels from Japan and Taiwan (Ryan and Boix-Hinzen, 1998). Since then, an increasing number of South African vessels have entered the fishery, making it easier to deploy observers. As a result, observer coverage on domestic vessels is a commendable 17%, whereas that for foreign vessels remains woefully inadequate at 1% for Japanese boats and none for Taiwanese (Ryan et al., 2002). The poor observer coverage precludes an accurate assessment of compliance with permit requirements, creating uncertainty about the impacts of this fishery.

Within the domestic pelagic fishery, seabird bycatch inside the EEZ averages 0.34 birds per 1 000 hooks ( $n=294\ 000$  hooks observed). This is substantially lower than

**Table 1** Changes in annual seabird bycatch rates compared with compliance with the ban on daytime sets in the Patagonian toothfish fishery off the Prince Edward Islands

Year	Bycatch rate (birds per 1000 hooks set)			% daylight sets*
	Procellaria	Other birds	All species	
1996/1997	0.210	0.079	0.289	55
1997/1998	0.111	0.006	0.117	15
1998/1999	0.012	0.004	0.016	18
1999/2000	0.034	0.002	0.036	19
2000/2001	0.008	0.001	0.009	16
2001/2002	0.001	0.000	0.001	1

\* Proportion of hooks set during the day (nautical dawn to dusk), excluding experimental sets through a Mustad underwater funnel (see Ryan and Watkins, 2002). "Other birds" are predominantly albatrosses (*Thalassarche* spp.) and giant petrels (*Macronectes* spp.).

the 2.64 birds per 1 000 hooks recorded by observers on two Japanese vessels fishing off South Africa (Ryan et al., 2002). Data from observers in the Japanese Real Time Monitoring Programme reported bycatch on tuna longliners off southern Africa in the 1990s at 0.360 birds per 1 000 hooks (Ryan and Boix-Hinzen, 1998), closer to the domestic fishery catch rate; but this includes fishing in oceanic waters where bycatch rates are much lower. South African vessels fishing in warm oceanic waters outside the EEZ caught only 0.02 birds per 1 000 hooks ( $n=222\ 000$  hooks observed, all north of  $30^{\circ}\text{S}$ ). Even within the EEZ, bycatch rates vary greatly, with few birds killed off the east coast (0.02 per 1 000 hooks) compared with south and west coasts (0.45 per 1 000 hooks) where bird numbers attending vessels are substantially higher (Ryan et al., 2002). Of particular concern is the high proportion of albatrosses killed by this fishery, 70%–80% of them within the EEZ. Irrespective of uncertainties surrounding the data, it is clear that current bycatch by the tuna fishery is unacceptably high.

## 4 Discussion

Despite the fact that all three longline fisheries are subject to similar mitigation measures as part of their permit requirements, levels of compliance and concomitant rates of seabird bycatch vary greatly. Both demersal longline fisheries have shown significant improvements in seabird bycatch rates since monitoring commenced in the 1990s. However, only the sanctioned fishery for Patagonian toothfishes has attained the interim target of 0.05 birds per 1 000 hooks deemed “operationally acceptable” (Environment Australia, 1998), even though the target may be demographically faulty with respect to sustainability of seabird populations. Three factors probably account for the success of mitigation in the toothfish fishery, despite its proximity to a globally-important breeding site for a large number of longline-affected seabird species. First and foremost, the fishery has had 100% observer coverage since its inception. Secondly, the fishery has had only six license holders, which simplifies outreach to the operators. Thirdly, as a newly-established fishery, its operators were more open to alter fishing practices. Together, these factors allowed rapid and effective implementation of mitigation measures laid down in the permit requirements for the fishery.

The main remaining issue concerning the toothfish fishery is illegal, unreported and unregulated (IUU) fishing, presumably with little if any mitigation measures to reduce seabird bycatch. This problem is especially serious because of the great distance of the fishery from South African ports (some 2 000 km), coupled with the virtual absence of long-range patrolling. Control of IUU fishing is problematic for remote fishing areas and for fisheries where access for large numbers of potential fishers is easy. In the case of the toothfish fishery around South Africa’s Prince Edward Islands, IUU effort is fortunately in decline because of the rapid drop in fish catch rates.

The demersal fishery for hake could potentially

achieve a target of 0.05 birds per 1 000 hooks in the near future, provided there is improved compliance with mitigation measures. At present, compliance is poor partly because fishers are ill-informed of the problem, and partly because there is no enforcement of permit conditions pertaining to seabird bycatch, even when vessels carrying observers flout the regulations. Increasing observer coverage in this fishery (planned for 2003) will probably help the situation, provided that the observers are well trained. Action also needs to be taken against license holders known to repeatedly ignore mitigation measures. Compliance in this fishery is also complicated by the large number of license holders operating from numerous harbors, so making fisher education and outreach a formidable task.

The pelagic fishery for tunas and swordfish remains the most problematic fishery, in part because of the greater difficulty in limiting bird bycatch on pelagic longlines (Brothers et al., 1999), and in part because of the history of the fishery. This foreign-based fishery has been long established, resulting in considerable resistance to change in practices (Robertson, 1998). Moreover, many of the foreign-licensed vessels only call once in South African ports, making it extremely difficult to deploy fishery observers. The announced halt to licensing of foreign vessels by the end of 2002 should go some way towards reducing the problems, but it remains to be seen whether this merely results in foreign vessels taking on local partners in joint-ventures. Foreign vessels may also transfer their fishing effort farther offshore into international waters, where the lower densities of birds are likely to reduce bycatch rates but increase pressure on threatened oceanic species.

Although the South African pelagic fishery has a much lower bycatch rate than that of the few foreign vessels which have carried observers, there is still a need to reduce its rates further. These are currently more than six times the interim target of 0.05 birds per 1 000 hooks. Compliance is moderate among vessels carrying observers, but given the low observer coverage, compliance overall could be poor. Most of the bycatch is taken in the south, where the numbers of birds attending vessels are greatest (Ryan et al., 2002). Special care is needed when fishing in that area, and the development and deployment of effective underwater setting devices is a priority if this fishery is to attain its target.

South Africa is currently developing a National Plan of Action — Seabirds to reduce seabird bycatch on longlines, as called for by the Food and Agriculture Organization of the United Nations (FAO, 1999). This includes a broad participatory program that should help to expose the problem. We hope to use the process both to educate fishers and to ensure that mitigation measures are implemented effectively.

**Acknowledgements** We thank the many observers on fishing vessels that helped to collect data on seabird bycatch. We are also grateful to Barry Watkins, Rene

Osbourne, Marcel Kroese and Craig Smith from Marine and Coastal Management, who administer the various South African longline fisheries. Funding and logistical support was received from the World Wide Fund for Nature — South Africa, the Charl van der Merwe Foundation, the South African Dept. of Environmental Affairs and Tourism, the University of Cape Town and the South African National Research Foundation.

## References

- Barnes KN, Ryan PG, Boix-Hinzen C, 1997. The impact of the hake *Merluccius* spp. longline fishery off South Africa on procellariiform seabirds. *Biol. Conserv.* 82: 227–234.
- BirdLife International, 2000. *Threatened Birds of the World*. Barcelona and Cambridge: Lynx Edicions and BirdLife International.
- Brothers NP, Cooper J, Løkkeborg S, 1999. The incidental catch of seabirds by longline fisheries: worldwide review and technical guidelines for mitigation. *FAO Fish. Circular* 937: 1–100.
- Environment Australia, 1998. *Threat Abatement Plan for the Incidental Catch (or By-catch) of Seabirds during Oceanic Longline Fishing Operations*. Canberra: Australian National Parks and Wildlife Service.
- FAO, 1999. *International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries*. Rome: Food and Agriculture Organization of the United Nations.
- Gales R, 1998. Albatross populations: status and threats. In: Robertson G, Gales R ed. *Albatross Biology and Conservation*. Chipping Norton, NSW: Surrey Beatty and Sons, 20–45.
- Nel DC, Nel JL, 2000. Marine debris and fishing gear associated with seabirds at sub-Antarctic Marion Island. *CCAMLR Sci.* 6: 85–96.
- Nel DC, Ryan PG, Watkins BP, 2002. Seabird mortality in the Patagonian toothfish longline fishery around the Prince Edward Islands, 1996–2000. *Antarct. Sci.* 14: 151–161.
- Robertson G, 1998. The culture and practice of longline tuna fishing: implications for seabird by-catch mitigation. *Bird Conserv. Int.* 8: 211–221.
- Ryan PG, Boix-Hinzen C, 1998. Tuna longline fisheries off southern Africa: the need to limit seabird bycatch. *S. Afr. J. Sci.* 94: 179–182.
- Ryan PG, Boix-Hinzen C, 1999. Consistent male-biased seabird mortality in the Patagonian toothfish long-line fishery. *Auk* 116: 851–854.
- Ryan PG, Keith DG, Kroese M, 2002. Seabird bycatch by tuna longline fisheries off southern Africa. *S. Afr. J. Mar. Sci.* 24: 103–110.
- Ryan PG, Watkins BP, 2002. Reducing incidental mortality of seabirds with an underwater longline setting funnel. *Biol. Conserv.* 104: 127–131.