TOWARDS SEABIRD-SAFE FISHERIES

GLOBAL EFFORTS & SOLUTIONS

Fransisco Berned/ProDelphinus

TOWARDS SEABIRD-SAFE FISHERIES

Seabirds are one of the world's most threatened groups of animals, with many populations in decline due to incidental capture in fishing gears. Birds are caught and drowned on baited longline hooks and in nets, or are killed by collisions with trawl cables.

Simple and inexpensive measures can be highly effective in preventing these unintentional deaths. In fact, some fisheries have already reduced seabird bycatch by 80% or more, demonstrating the scale of potential success.

Here we present some of the remarkable efforts of fisheries large and small from almost every ocean, where fishers are finding solutions to prevent unnecessary seabird deaths. These stories demonstrate that collaboration – between fishers, scientists and decision makers – can lead to practical solutions that will ultimately turn the tide for many seabird species and improve the sustainability of global fisheries.

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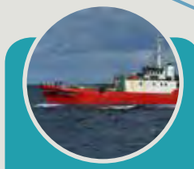

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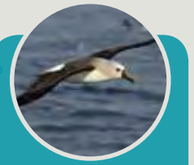

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Images by: Steph Winnard, Leo Tamini, John Paterson, Bokamoso Lebepe, Luis Cabezas, Lisa Mansfield, Rory Crawford, Brocken Inaglory

SEABIRDS IN DECLINE

Almost half of all seabird species are in decline and under threat – the albatross family is especially imperilled, with 15 of 22 species threatened with extinction. Albatrosses are long lived and slow breeding birds, so their numbers are particularly hard hit by deaths in fisheries. Most lay only one egg every two years, and some species do not breed until they are ten years old. It therefore takes many years to replace a breeding bird that is accidentally killed. Albatross naturally forage for squid and fish on the surface of the water, so to them foraging for bait from a fishing vessel mirrors their natural behaviour. For many it is their last meal. Since the 1990's some albatross populations have halved, mainly due to the impact of bycatch in fisheries.

The perilous decline of the majestic albatrosses has provided an important catalyst for action on seabird bycatch, but the scale of the threat to seabirds is broad. Three penguin species are thought to be threatened by fisheries, for example, and bycatch impacts seabirds small and large from coastal waters to the High Seas. Bycatch is of course not just limited to birds, and is an issue for a broad group of non-target species, from sea turtles to seahorses. Tailored solutions to bycatch are needed – the gear type and characteristics of fishing fleets, as well as affected species, need to be taken in to account.

The fishing gears largely responsible for seabird bycatch are:

Trawls

For many years, mortality in trawl fisheries went largely unobserved as most of the birds struck or dragged under by trawl cables are lost at sea. It was not until dedicated observers assessed the frequency of birds having serious interactions with the cables that the true death toll, particularly of albatrosses, came to light.

Longlines

It is estimated that between 160,000 and 320,000 seabirds are accidentally hooked and killed in longline fisheries globally each year. Concerted efforts have been made to tackle this major global threat to declining seabird populations, particularly albatrosses and petrels.

Purse Seines

Purse seine fishers encircle shoaling fish with a net and evidence is amassing of birds becoming entangled in this gear – research undertaken in Chile has shown that pursuit diving species like shearwaters are particularly at risk. Further investigation needs to be conducted to assess bycatch rates in fleets around the world.

Gillnets

Gillnet fisheries are globally widespread and have been implicated in high bycatch rates for sea turtles, marine mammals and seabirds. The first global review of seabird gillnet bycatch conservatively estimates that 400,000 birds are killed in this gear every year, with 148 seabird species considered susceptible to gillnet bycatch. Unlike longline and trawl fisheries, effective technical means of altering the gear to reduce and eliminate bycatch from gillnets are still under development. In addition, many gillnet fisheries are low capital and small-scale, operating across broad areas – meaning there is often poor monitoring and regulation.

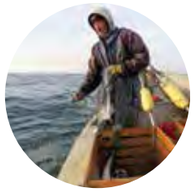
Tackling bycatch

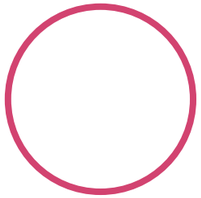
The threat from pelagic longliners to seabirds is well established, as are the techniques to prevent unnecessary seabird bycatch in High Seas tuna fisheries. Recognised best practice solutions in tuna longline fisheries include the combined use of weighted branch lines, night setting and bird-scaring lines. All five tuna commissions have adopted Conservation and Management Measures that require tuna longline vessels to use mitigation in most areas overlapping with albatrosses.

Bycatch mitigation measures are usually either species or fishery specific, and their success varies greatly. Reliable mitigation measures for gillnets or purse seines do not yet exist and work is underway to design and test measures to halt bycatch in these fisheries. Progress is being made, and fishermen, NGOs and governments are working together to come up with effective solutions.

Although seabird bycatch is a complex problem that has varying causes and solutions for different gear types, experience from around the world shows that it is a surmountable issue – healthy seabird populations and fisheries can co-exist. This booklet explores some of the finest examples of this – and with the widest possible adoption of some of the measures showcased here, this vision can become a reality.

Anderson *et al.*, 2011





ATF-Brazil. Steph Wimard. Dimas Gianuca. Bronwyn Maree. Julius Morkunas.

SOURCES OF INSPIRATION

A few stand-out cases have helped pave the way to finding solutions that work for both fishers and seabirds. These cases raised the profile of the issue, demonstrated early successes, and showed what is possible in terms of bycatch reductions when both the practical solutions and political will are available. Many of the successes you'll read about in this booklet have been inspired by the early pioneers of seabird bycatch mitigation.

Early efforts

The incidental mortality of seabirds on longlines was first reported from bird band recoveries in the early 1980s. By the end of the decade work to assess the scale of the problem and to develop solutions had begun. Japanese tuna longline vessels were estimated to be killing at least 44,000 albatross per year across the Southern Ocean. In Australian waters some of these vessels already used bird-scaring lines to avoid bait loss to seabirds. Observations showed a 69% decrease in bait loss when using a bird-scaring line, and with some design modifications the potential was expected to be even greater. Suggestions were also made for line weighting and night setting as ways of reducing bycatch. This study raised awareness amongst the fishing community of methods to reduce bycatch whilst potentially improving catch, due to lower bait loss.

In Alaska bycatch regulations were adopted in the Gulf of Alaska and Bering Sea demersal longline fisheries in 1997. One vessel, the F/V Masonic, achieved zero bycatch just one year later by trialling various bycatch reduction methods, and eventually adopting a bird-scaring line coupled with line weighting. This showed how simple the solutions to bycatch can be if industry are willing to test the methods, and configure them for their vessels.

CCAMLR

One of the prominent examples of successful seabird bycatch reductions is from the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), an international commission designed to protect the Antarctic marine ecosystem. The Government of South Georgia and the South Sandwich Islands issues licenses for a demersal longline fishery within the CCAMLR convention area. To protect the nesting seabirds of the islands, the government enacted a seasonal closure during the seabird breeding season, and outside the breeding season required vessels to use a combination of measures including discard management, bird-scaring lines, line weighting and night setting. The result was a rapid drop in bycatch from over 6,000 albatross per year to practically zero.

Through CCAMLR, these measures were adopted across the Southern Ocean, reducing the estimated annual bycatch by around 67,000 birds per year. CCAMLR's decisive action on the issue catalysed efforts to address the issue on a global scale. Seabird tracking data was used to show that the non-breeding ranges of many albatross species overlap with tuna Regional Fisheries Management Organisations (RFMOs), which has lead to requirements for longline vessels to use mitigation measures in most areas overlapping with albatrosses on the High Seas.

Hawaii

Inspiration also comes from the North Pacific where the Hawaiian swordfish and tuna pelagic fleet have reduced deaths by around 15,000 birds per year through the adoption of a National Plan of Action for Seabirds, which requires the use of seabird bycatch mitigation measures backed up by a robust observer programme. Important lessons have been derived from the work in the North Pacific, including that no single seabird avoidance measure is likely to be effective and practical for all longline fisheries, so testing of methods in individual fleets is needed to determine viability. Longline fishers must directly participate in trials as their in-depth knowledge is crucial to develop mitigation techniques. Efforts in Hawaii underscored how critical it is to identify solutions that are not only very effective, but are also economically viable and commercially practical.

Solving bycatch today

Efforts to reduce seabird bycatch continue today across the world, and in many fisheries the reductions have been significant. For some gear types including longline and trawl the solutions are well established, whereas for others mitigation methods are still being trialled. In this booklet we detail both proven methods and those still at experimental stage (which are clearly marked in the next section) that have shown promising results.

Brothers *et al*., 1991; Croxall., 2008; Gilman *et al*., 2005; Lundsten., 2001

Oli Prince, Steph Winnard, Ruth Brown, Martin Abreu, Leo Tamini

BYCATCH SUCCESS STORIES

Nahuel Chavez

Target species:
Hake (*Merluccius paradoxus* & *M. capensis)*

Bycaught species:
Albatrosses & petrel species, mainly; black-browed albatross (*Thalassarche melanophris*) & Cape petrel (*Daption capense*)

Fleet:
46 vessels

Oceans:
Atlantic & Indian

BIRD-SCARING LINES HALTING ALBATROSS DEATHS

Albatross deaths reduced by 99% in the South African hake trawl fishery.

Situation

Hake is a key species for the South African fishing industry, accounting for half of the country's annual catch. Forty six vessels land up to 160,000 tonnes every year. In 2004 the fishery was certified by the Marine Stewardship Council (MSC) and part of the criteria of the certification was that the fishery must assess impact on bycatch species and work to quantify and reduce seabird bycatch.

In 2004/2005 the South African Deep Sea Trawl Industry Association (SADSTIA) investigated the scale of bycatch and found that black-browed albatross, which was classified as Endangered at the time, and shy-type albatross, which are Near Threatened, were the species' most impacted.

Through onboard observations and the use of video cameras they estimated that 15,000 seabirds were killed by cable strikes every year. Later re-analysis with more accurate fishing effort data estimated a more conservative 9,300 killed, but 7,200 of these were albatrosses. These were still vastly higher losses than the populations could sustain.

The majority of fatalities occur when the vessels are discarding offal, as albatross can detect the smell of fish from over 20 kilometres away, so are drawn to vessels in large numbers. It is therefore imperative to use mitigation methods if discarding while trawling.

Solutions

The South African government introduced bycatch regulations in 2006, and in the same year BirdLife's Albatross Task Force (ATF) was launched and the trawl vessels began working with the ATF to mitigate seabird bycatch. Bird-scaring lines (BSL's) were tested in the fishery to see the effect they had on the numbers of birds killed. By 2010 seabird mortality had been reduced by 73-95% due to the use of BSL's compared with 2004-2005 mortality (pre-mitigation) on the observed vessels. Combined with the halving in fishing effort over the period, albatross deaths were reduced by >95%.

Seabirds are at highest risk of collisions with cables when the net is being set, so in 2011 SADSTIA decided voluntarily to deploy BSL's during setting to mitigate this risk, and a year later this was made a condition of the fishing permits. In 2013 the results of a multi-year study by the ATF was published, and it showed that albatross deaths had been reduced by an astounding 99% across the demersal trawl fishery. This amazing improvement was all down to a simple mitigation method being adopted by all vessels in the fleet.

A BSL following best practice specification costs less than US$200 to build in South Africa. This is a trivial amount compared to the huge impact it can have on reducing bycatch of threatened seabird.

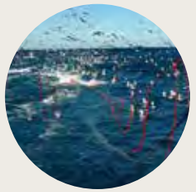
Each vessel in the fleet has now developed its own Bird Mitigation Plan, which fine tunes the mitigation method design to suit its unique needs. Tailoring the methods to meet the requirements of each vessel was key in the success of the measures.

"The use of bird-scaring lines is very important, and it's something that all trawl fishing vessels should do. Before using them, we used to catch a lot of birds in the nets and cables. Seeing that was very unpleasant, we fishermen don't like hurting animals. At the beginning, using the bird-scaring lines was difficult, and time consuming but now the guys are used to it, and we don't mind. It's more important that we don't hurt the birds"
Achmat Sadie, 2nd Mate I&J trawl fleet

Future

The fleet has had great success in reducing albatross deaths. It is a shining example of what is possible. The focus for the future is to maintain these massive bycatch reductions through ongoing monitoring of mitigation use and updating of Bird Mitigation Plans.

Maree *et al*., 2014



Bronwyn Maree. Bokamoso Lembepe.

Target species:
Hake (*Merluccius paradoxus* & *M. capensis*)

Bycaught species:
Albatross (*Thalassarche* spp.), petrels (*various* spp.) & Cape gannet (*Morus capensis*)

Fleet:
46 vessels

Oceans:
Atlantic & Indian

The Rory Line offers a neat solution to prevent smaller seabirds drifting towards the 'danger zone' around trawl cables. Trials found that they are a useful compliment to bird-scaring lines, and can dramatically reduce cable collision with white white-chinned petrels.

Situation

In trawl fisheries, high seabird mortalities have been recorded as a result of seabirds being struck by the trawl cables (which tow the trawl net) or becoming entangled on the cable and dragged under by the force of the water moving past the cable. Bird-scaring lines (BSL's) have been used to decrease seabird mortality significantly in South Africa, particularly for albatrosses (see p12), but on some vessels the trawl cables are attached outboard of the vessel side, which creates a narrow channel between the vessel and the BSL's down which smaller seabirds can drift while they feed on offal discards.

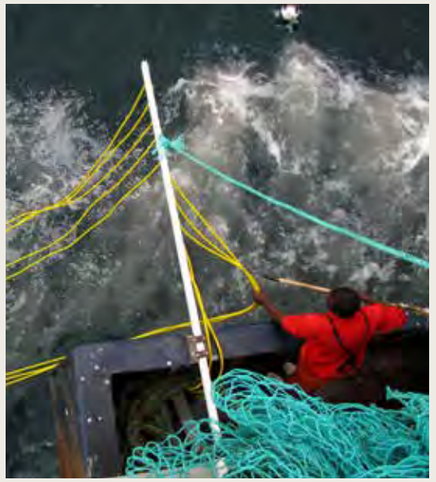
This was found to be an issue for trawlers in the substantial demersal trawl fleet for hake in South African waters, and was impacting globally Vulnerable species such as white-chinned petrel and Cape gannet.

Solutions

Fishermen are best placed to design viable solutions for their fleets, and to deal with this particular problem of birds drifting aft to the trawl cable area the Rory Line – a horizontal side boom with vertical streamers that block small birds from entering the channel between the vessel and the bird-scaring lines – was thought up by a skipper in the demersal trawl fleet. The Rory Line is designed to be used in conjunction with BSL's, and reduces cable strikes by placing a physical barrier between the scupper (where factory discards are released) and the danger zone (where the trawl cables enter the water) at the stern of the vessel.

At-sea trials of the Rory Line conducted in 2011-2012 found that cable collision rates were dramatically diminished for white-chinned petrels and great shearwaters, by 68% and 84% respectively. Use of the lines also significantly reduced the numbers of albatrosses, white-chinned petrels and Cape gannets that drifted alongside the vessel and into the danger zone around the trawl cables.

"Safeguarding our heritage for future generations is my foremost motivation for innovations. I introduced Rory Lines to deter seabirds from drifting toward the trawl cable from the side of the vessel, and it's working remarkably well" said Roy Diedricks, Skipper of the African Queen, who came up with the idea for the Rory Line and further developed it with BirdLife International's Albatross Task Force.

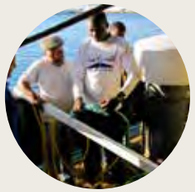


Future

Rory Lines have been found to have good potential to further reduce seabird bycatch in the hake trawl fishery, particularly when used in combination with BSL's. The efficacy of Rory Lines at reducing trawl cable strikes appears to be linked to the feeding behaviour of each seabird species. Whilst the Rory Lines halved the numbers of Cape gannets that drifted into the danger zone, cable strike rates for this plunge-diving species were not reduced as they tend to enter the water behind the Rory Line. Further tests would be useful with adjusted positions to maximise the benefit of the mitigation measure to the broadest group of seabird species possible.

In the absence of offal discharge, birds do not approach the danger area where the trawl cables enter the water. While there may be practical constraints for older vessels (e.g. to retrofit a fishmeal plant), ultimately the best solution to limit cable strikes is to manage the release of discards and a number of studies have shown that halting discharge eliminates seabird mortality.

Rice., 2012; Watkins *et al*., 2008; WWF., 2012



Steph Winnard, Dimas Gianuca, Lisa Mansfield

LONGLINE

SEABIRD SAVING SOLUTIONS FOR NAMIBIAN LONGLINERS

Target species:
Hake (*Merluccius paradoxus* & *M. capensis*)

Bycaught species:
White-chinned petrel (*Procellaria aequinoctialis*), Atlantic yellow-nosed albatross (*Thalassarche chlororhynchos*) & black-browed albatross (*T. melnaophris*)

Fleet:
14 vessels (19-55m)

Oceans:
Atlantic

Once dubbed 'the world's worst fishery for bycatch', Namibia is turning seabird safe through new regulations and industry uptake of a suite of mitigation measures.

Situation

The hake fishery is Namibia's most important. The majority of hake is caught by trawl, but in 1991 demersal longlining began, reaching a peak of 25 vessels by 2007, subsequently reducing with 14 vessels currently fishing in Namibian waters.

Namibia has historically topped the global list of longline fisheries in terms of numbers of seabirds killed as bycatch. The Benguela Current is a nutrient rich upwelling that supports large numbers of seabirds as well as fish, and is therefore a hotspot for both fishing activity and seabird foraging. In 2010 it was estimated that around 20,567 (6,328-37,935) birds were killed in the hake demersal longline fishery alone. The species most affected by this fishery is the white-chinned petrel (~85% of all birds killed), which is classified as Vulnerable to extinction. The Endangered Atlantic yellow-nosed albatross also patrol Namibia's Exclusive Economic Zone and are caught in smaller numbers in the fishery.

Solutions

Over four years BirdLife International's Albatross Task Force (ATF) worked alongside the Namibian Nature Foundation to monitor numbers of birds being killed and to test mitigation methods. Between 2009 and 2012, 126 sets were observed during 14 trips (1,800,800 hooks). During 11 of these trips the effectiveness of bird-scaring lines (BSL's, both single and paired) were tested against a control of no mitigation, and three trips compared modified main line weighting (5kg steel) with standard line weighting (3.7. ± 1.1 kg concrete).

The use of BSL's reduced bycatch from 0.57 birds/1000 hooks to 0.04. No albatrosses were caught when BSL's were used. The use of steel weights also showed significantly lower bycatch rates than when no mitigation methods were used, and sank faster than when using concrete weights. Crucially there was no significant difference in hake catch rate when using the heavier steel weights. A combination of mitigation measures is the most effective way of reducing bycatch, especially in fisheries that impact on species that are proficient nocturnal foragers and divers, such as the white-chinned petrel.

In November 2015, the Ministry of Fisheries and Marine Resources took further steps and introduced regulations requiring the use of BSL's, line weighting and night setting. Many of the vessels had already adopted the mitigation measures thanks to the Namibian Hake Association pledging that the fleet would take up the measures voluntarily.

An inclusive approach to research in collaboration with industry and government was important to achieving wide understanding and acceptance of the proposed mitigation measures in the lead up to the introduction of the fishery regulations.

"I hope Namibia will become a leader in seabird-safe fisheries and have sustainable fisheries for the future. Namibia is a range state for six albatross and four petrel species and therefore has an obligation to protect these populations." said Dr Hannes Holtzhausen, Namibian Ministry of Fisheries and Marine Resources.

Since the introduction of the regulations the ATF has been working to support the uptake of measures, and is in the process of documenting negligible seabird bycatch in the demersal longline fishery.

Future

Uptake of mitigation measures has been high with 100% of vessels adopting BSL's after regulations were passed. Namibia has almost 100% fisheries observer coverage on its vessels, which provides an important opportunity to monitor implementation. Observers who have been suitably trained can collect valuable information on the effectiveness of mitigation measures, and compliance with regulations. The next steps therefore involve training observer agencies and, focusing on working with vessels that don't yet have much experience of using seabird bycatch mitigation measures.

Paterson et al., 2017

Fabiano Peppes, Ricardo Hoinkis, Lisa Mansfield

Target species:
Argentine hake (*Merluccius hubbsi*), hoki (*Macruronus magellanicus*), grenadier (*M. fasciatus*), kingklip (*Genypterus blacodes*), red cod (Salilota australis) & rock cod (*Patagonotothen ramsayi*)

Bycaught species:
Black-browed albatross (*Thalassarche melanophris*), southern giant petrel (*Macronectes giganteus*), northern giant petrel (*M. halli*), Cape petrel (*Daption capense*) & white-chinned petrel (*Procellaria aequinoctialis*)

Fleet:
33 stern factory trawlers

Oceans:
Atlantic

SAVING LIVES WITH SCARING LINES

Bird-scaring lines (BSL's) on Argentine factory trawlers have drastically reduced seabird collisions with trawl cables. Some vessels have already voluntarily implemented bycatch reduction techniques and new binding regulations will come in to force in 2018.

Situation

The Patagonian shelf Large Marine Ecosystem extends over 2.7 million square kilometres, and is an area of high productivity. Seabirds and seals thrive there, and the area supports numerous fishing fleets. The trawl fishery operates between 41°S and 54°S, and Argentine hake accounts for a quarter of landings, with an average catch of 66,347,000 t/year. Catch is dependent on quotas and market demand, with species like whip-tail hake (hoki) dominating catch in some years.

Thousands of seabirds are attracted to vessels to feed on discards during trawl operations. The attractiveness of a obtaining a free meal puts them at risk of being struck by cables, or becoming entangled in the net.

Between 2008 and 2010, in response to this threat, BirdLife's Albatross Task Force (ATF) instructors spent 141 days onboard trawlers observing seabird interactions with the fishing gear. The results of these observations, combined with analysis of fishery effort data, suggest that approximately 13,548 black-browed albatross, 2,463 southern giant petrels, 1,847 northern giant petrels and 1,232 Cape petrels are injured or killed in this fishery every year. These numbers are unsustainable, particularly for black-browed albatross, which in some parts of its range is undergoing rapid population declines.

Solutions

ATF instructors conducted trials using paired BSL's to assess if they can significantly reduce seabird bycatch when compared to observations of seabird collisions in the absence of mitigation measures. This area of the world is known for its adverse weather conditions, and so to combat the potential for entanglement of BSL's with trawl gear a specially designed towed device (the Tamini Tabla) was invented to create directional drag to maintain the BSL's parallel with the trawl cables.

The use of BSL's dramatically reduced the number of collisions with the trawl cables for all species affected. The number of black-browed albatross collisions reduced from 16.97/hour to 2.63/hour, southern giant petrel collisions from 5.07 hour to 0.17/hour and Cape petrel collisions from 18.63/hour to 1.49/hour.

The fishermen involved in the trial were very positive about the experience, and once aware of the issue of seabird bycatch, were keen to work to solve the problem.

"I think it is important to use bird-scaring lines so that there are fewer dead albatrosses. In fishing there are very few people who are aware of the harm that can be done to birds and other species, but I believe that if we keep educating fishermen about this issue, the use of bird-scaring lines will become a habit." said Roberto Galarza, F/V Centurión del Atlántico.

Future

Trawl fisheries in Argentina have a voluntary measure to use BSL's, which will become mandatory in May 2018. It is hoped that voluntary adoption occurs across the fleet before mitigation becomes mandatory. Indeed, four vessels have already implemented BSL's.

Claudio García, is one such fisherman who has taken up measures voluntarily. He said ***"Many years ago there were many more albatrosses than there are today. I use bird-scaring lines to reduce mortality of these birds because they also have the right to live"***.

Tamini et al., 2015

Nahuel Chavez, Leo Tamini

300,000
seabirds are killed every year by longline and trawl vessels

400,000
seabirds die in gillnets every year

15/22
albatross species are threatened with extinction, many due to bycatch

20,500
seabirds were killed in Namibia every year

3
penguin species are thought to be threatened by fisheries, including the endangered yellow-eyed penguin

99% reduction in albatross killed in South African hake trawl fishery

5/5 tuna commissions now requiring seabird bycatch mitigation measures

8 out of 10 hotspot fisheries for seabird bycatch introduced new regulations to protect seabirds in the last decade

100% of Namibian longliners now using bird scaring lines after regulations came in

64% reduction in turtle bycatch from net lighting trials in Peru

LONGLINE

Target species:
Yellowfin tuna (*Thunnus albacares*), bigeye tuna (*T. obesus*), Pacific & Southern bluefin tuna (*T.orientalis & T. maccoyii*) & swordfish (*Xiphias gladius*)

Bycaught species:
Albatross & petrel species including; Buller's albatross (*Thalassarche bulleri*), white-capped albatross (*T. steadi*), Antipodean albatross (*Diomedea antipodensis*), Campbell's albatross (*D. impavida*), grey petrel (*Procellaria cinerea*), & black petrel (*P. parkinsoni*)

Fleet:
~170 vessels

Oceans:
Pacific

HIGH TECH FOR LOW BYCATCH

One stop solutions to seabird bycatch are being developed. In New Zealand - the seabird capital of the world - initial trials of Hookpods* found that they can cut out bycatch without reducing fish catch. Research is ongoing.

Situation

The New Zealand surface longline fishery comprises of around 170 domestic vessels fishing primarily off the east coast of the North Island and west coast of the South Island. New Zealand is an extremely important place for breeding seabirds and has more seabird species than any other country. In 2010-11 it was estimated there were 740 seabirds accidentally caught in the surface longline fishery. Antipodean albatross, which is currently classified as Vulnerable to extinction, are particularly susceptible to being caught on longlines, with one vessel capturing 58 birds on a single trip in 2006.

A combination of line weighting, night setting and bird-scaring lines is the best practice solution to seabird bycatch in longline fisheries, but there can be challenges with the implementation of these three measures. The nature of surface longline fishing gear, means bird-scaring lines can become entangled with the buoys and slow sinking hook lines during setting operations, for example, which can make fishing masters reluctant to use this mitigation measure. Line weighting has also raised safety concerns for crew.

Solutions

As an alternative to the traditional combination of mitigation methods, considerable effort has been put into finding a single mitigation measure designed to be a one stop solution to seabird bycatch; the Hookpod* is one such potential measures. Trials of a 45g Hookpod took place on a New Zealand surface longliner in 2016 with promising results. No seabirds were caught as bycatch when Hookpods were used, in comparison to two birds being caught on branchlines without Hookpods. Importantly no significant differences were found in catch rates of target species. The Hookpods were well received by the crew.

During setting the baited hook is loaded into the Hookpod to encase the point and barb of the hook. A pressure release system opens the Hookpod and releases the baited hook at a predetermined depth.

"These Hookpods are a great invention and they are working well for us. It has taken away the dangers of using lead weights on our gear" said –Mike Te Pou

"Not one single bird has been caught on the pods so far from the tests we have run, and yes, we have caught the odd bird on our regular gear!

"At first I was a bit suspect about using them but I have noticed that our fishing has not been affected in any way. On a few occasions the Hookpods actually out-fished our regular gear and caught more fish!" Mike Te Pou, New Zealand Skipper

Results from more extensive trials conducted in Australia, Brazil and South Africa have demonstrated that the larger 68g Hookpod is also highly effective at reducing seabird bycatch. During 19 at-sea trips (over 62,000 experimental hooks) only one seabird mortality was recorded on the Hookpods compared to 24 on the branchlines of standard gear (without Hookpods), a bycatch rate of 0.034 birds/1000 hooks and 0.77 birds/1000 hooks, respectively.

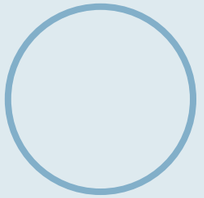
The use of Hookpods could enable fishing operations to be conducted using a single mitigation method, or could be used in combination.

Future

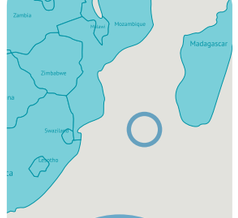
The Hookpod is recognised as a stand-alone mitigation measure by the Agreement on the Conservation of Albatrosses and Petrels. 'Hook-shielding devices' such as this, may be added to the seabird regulations of Regional Fisheries Management Organisations and would provide a further option for fishers to reduce bycatch on the High Seas. Further testing of the 45g Hookpod is required in the New Zealand fleet on a larger scale to ensure effectiveness. Fleets have differing mitigation requirements depending on their fishing operations and the species at risk of being bycaught, and trials are ongoing in New Zealand.

Sullivan & Potts., 2016; Brouwer & Griggs., 2009; MPI National Plan of Action-2013.

*Hookpod is patented in the EU and New Zealand



Dimas Gianuca: Hookpod. Oli Yates



LONGLINE

SLIDING WEIGHTS FOR SAFER TUNA FISHERIES

Collaborative trials with Korean pelagic longliners found that sliding weights did not compromise fish catch, fishing operations or safety when targeting high value tunas.

Target species:
Albacore tuna (*Thunnus alalunga*), bigeye tuna (*T. obesus*), southern bluefin tuna (*T. maccoyii*) & yellowfin tuna (*T. albacares*)

Bycaught species:
Albatrosses & petrels including; grey-headed albatross (*Thalassarche chrysostoma*), black-browed albatross (*T. melanophris*) & Indian yellow-nosed albatross (*T. carteri*)

Fleet:
IOTC 14 vessels

Oceans:
Indian

Situation

The Korean tuna longline fishery in the Indian Ocean commenced in 1957, targeting yellowfin tuna, bigeye tuna and albacore tuna, with the addition of southern bluefin tuna in the early 1990s due to its high market value. The fleet fishes in the south eastern Indian Ocean, particularly for southern bluefin tuna, and the south western Indian Ocean for various tuna species. In these areas fishing effort overlaps with several vulnerable seabird species.

In the last 10 years, the increasing recognition of the risk posed to albatrosses and petrels by pelagic longliners has lead to Regional Fisheries Management Organisations (RFMOs) adopting measures to reduce bycatch in High Seas fleets. At the point when the regulations were coming in to force in the Indian and Atlantic Oceans (2011, 2012), BirdLife International and the National Fisheries Research and Development Institute, now the National Institute for Fisheries Science (NIF'S) embarked on a research and training programme to assist Korean longline fishermen to apply the incoming regulations.

Solutions

Recognised best practice solutions in pelagic longline fisheries include the combined use of weighted branch lines, night setting and bird-scaring lines. Use of two of these three mitigation measures is required by the Indian Ocean Tuna Commission when fishing south of 25° South.

While adding weight to branchlines has been demonstrated as an effective method of reducing bycatch, concerns over crew safety are often raised. Fishing masters have suggested weights might have negative effects on fishing operations by causing bait loss, increasing branch line entanglements, or that weights placed at, or close to, the hook could reduce tuna catches. BirdLife and NIFS adopted a scientific approach to addressing these questions, undertaking collaborative, tests of various line-weighting configurations during production fishing.

Safety at sea

If a shark bite-off occurs during hauling, the weight can fire back towards crew on the hauling deck when the monofilament line recoils. Sliding weight technology has been developed as a safer alternative. Lumo Leads, are a type of sliding weight attached to branchlines via a mechanism which grips the monofilament, permitting the weights to move up and down the line when the line is under tension, unlike traditional leaded swivels. If the line snaps during a bite-off, the line passes through the Lumo Lead, often resulting in the lead falling off the end of the line, rather than shooting back dangerously towards the vessel.

Trials in 2013 (8,430 paired experimental hooks) and 2014/15 (217,000 hooks) were conducted onboard pelagic longline vessels off western Australia and southern Africa. Dominic Rollinson, who conducted the 2014/15 trials with NIFS, summarised the results: ***"We found that at specific distances from the hook Lumo Leads had no measurable effect on fish catch or fisherman safety."***

The results demonstrate that Korean-style branch lines can be optimised for a fast sink rate with a weighting regime that appears to have a very low risk of negatively impacting catch rates of target species. Neither 45g nor 60g Lumo Leads had a significant impact on catch rates of southern bluefin tuna when placed at 5cm from the hook, and catches were very similar for yellowfin tuna and bigeye tuna when Lumo leads were placed at 1m from the hook compared with unweighted branchlines. Incidences of flybacks and entanglements were few. ***"Our collaborative research shows that it is possible to develop line-weighting techniques for seabirds that do not compromise fish catch, fishing operations efficiency or crew safety"***, report NIFS.

Future

The effect of Lumo Lead colour on fish catch requires investigation, and further trials are needed in areas of high seabird bycatch.

NIFS report that Lumo Leads have now been rolled out in the Korean fleet. ***"All of our tuna longline vessels operating in the Southern Indian and Southern Atlantic oceans have been supplied with Lumo Leads, helping Korea comply with RFMO regulations that are in place to protect seabirds."***

Rollinson *et al*., 2016 (a); Sullivan *et al*., 2012; Tamini *et al*., 2013

Leo Tamini, Fabiano Peppes

LONGLINE

Target species:
Yellowfin tuna (*Thunnus albacores*), bigeye tuna (*T. obesus*), albacore tuna (*T. alalunga*) & swordfish (*Xiphias gladius*)

Bycaught species:
Shy albatross (*Thalassarche cauta*), black-browed albatross (*T. melanophris*) white-chinned petrel (*Procellaria aequinoctialis*) & cape petrel (*Daption capense*)

Fleet:
3 vessels
(1 million hooks/year)

Oceans:
Atlantic & Indian

JOINT VENTURES FOR SEABIRDS

Japanese joint venture tuna fleet reduces bycatch in South African waters using best practice mitigation measures and 100% observer coverage.

Situation

Japanese vessels have been fishing for tuna in South African waters since the 1960's. In 1995 a joint venture agreement was reached between a South African and Japanese vessel, which showed that tuna and swordfish could be profitably exploited in South African waters. The resulting fleet is known as the Japanese joint venture tuna fleet. It currently consists of three vessels, but has historically been a high as 29 vessels, and targets swordfish and tuna species.

Bycatch observations were conducted between 2002 and 2006 and found the fleet to have a bycatch rate of 0.45 birds/1000 hooks. This is almost an order of magnitude greater than the recommended acceptable maximum of 0.05 birds /1000 hooks. At this time Japanese vessels were not using any mitigation methods, and their fishing style did not utilise any line weighting, which was likely a critical factor, as hooks would be accessible to birds for a long period.

Solutions

In 2007 the South African Department of Agriculture, Forestry and Fisheries (DAFF) began to introduce a number of measures to reduce seabird bycatch. These measures are approved as best practice by the Agreement on the Conservation of Albatrosses and Petrels (ACAP).

Whilst fishing in South African waters vessels must set at night, add weights to their lines (this has typically been 60g within 2.8m of the hook) and fly bird-scaring lines (BSL's) at all times. Vessels in the fleet have 100% observer coverage to ensure compliance. Further to these measures, vessels report bycatch every five days, and if this exceeds 50 birds, and there has been non-compliance with the prescribed measures, it can lead to the revocation of the fishing permit for the season. Extra assistance is given to vessels catching more than 25 birds to try to reduce their bycatch rates. No vessels have reached this limit since 2013.

Following the introduction of these measures bycatch rates have dramatically reduced. In 2016 the bycatch rate was 0.047 birds/1000 hooks, showing that the measures do work very well when used correctly and consistently. Compliance rates have been high in this fleet with 100% of observed sets (n=8498) using BSL's by 2013.

Future

This fishery has been hugely successful in reducing its seabird bycatch, and improvements are continuously being made. Recently regulations on line weighting in South Africa were changed to align them with revised ACAP recommendations of at least 40g within 0.5m of the hook; at least 60g within 1m of the hook; or at least 80g within 2m of the hook. These changes should reduce bycatch even further.

Rollinson *et al.*, 2016 (b); Ryan *et al.*, 2002

John Paterson, Andres Silva-Costa

THE CHILEAN SYSTEM: AVOIDING PREDATORS & BYCATCH

Adapting an artisanal fishing technique to industrial longline vessels reduced bycatch, halved depredation by whales and eliminated entanglements, all while maintaining toothfish catch.

Target species:
Patagonian toothfish (*Dissostichus eleginoides*)

Bycaught species:
White-chinned petrel (*Procellaria aequinoctialis*), black-browed albatross (*Thalassarche melanophris*), grey-headed albatross (*T. chrysostoma*)

Fleet:
19.5 million hooks per year (artisanal fleet) & 14.5 million hooks per year (industrial fleet)

Oceans:
Pacific

Situation

Some longline fisheries, such as for Patagonian toothfish, have recorded issues with depredation of target catch by killer and sperm whales, sometimes taking up to 50% of the catch. In the Chilean fishery there have also been instances of sperm whales becoming entangled in longline gear. Whales are not the only issue – these fisheries often suffer from seabird bycatch.

In Chile there are two toothfish fisheries, one artisanal and one industrial. The later operates south of 47° South, in the vicinity of Cape Horn, an area that holds up to 20% of the world's black-browed albatross and 23% of grey-headed albatross.

The artisanal fishery has historically had a relatively low bycatch rate of ~0.047 birds/1000 hooks, even with the absence of mitigation measures. This is likely due to the gear configuration, which is considerably different with vertical secondary lines attached to the mother line. Each secondary line has snoods (thin monofilament line from the secondary line to the hook) attached, and a small weight at the end (200-600g), which causes the secondary line to sink comparatively quickly. The industrial longline fleet had a considerably higher bycatch rate, and in 2002 1,588 seabirds were killed, including a staggering 1,555 black-browed albatross.

Solutions

In 2006 the industrial Patagonian toothfish fishery adopted an adapted version of the gear configuration used by the artisanal fishery, including a buoyant net sleeve placed on secondary vertical lines. During fishing the sleeve remains at the top of the line, but once hauling begins the sleeve slides down the line, due to the movement of the water, and covers the catch and hooks. They used secondary lines of 15-20m in length, placed every 30-40m with a weight (4-10kg) on the end. They called this the Chilean system or 'cachalotera'.

The sink rate of this gear configuration was rapid at 0.80 m/sec until the secondary line was fully extended (over twice as fast as in the artisanal fishery). The rapid sinking rate doesn't allow foraging seabirds time to reach the baited hooks, and no seabirds were killed in 2006, despite a huge fishing effort of ~4 million hooks.

The new system also yielded substantial benefits for fishermen including a two-fold decrease in the depredation of their catch by whales, no impact on catch per unit effort, and it also eliminated entanglements of gear on the seabed.

Future

The Chilean system has proven to be a very successful solution to both seabird bycatch and whale depredation in the Chilean Patagonian toothfish fishery. This system has great potential for use in other fisheries with similar depredation issues and seabird bycatch, and is already being adopted in other longline fisheries in the South Atlantic.

Moreno *et al.*, 2006; Moreno *et al.*, 2007

Jared Tower, Katie Brigden, Steph Winnard

TIGHTENING THE NET ON SEABIRD BYCATCH

Slimming down nets is a possible solution to bycatch in Chilean purse seine fisheries. In trials modified nets resulted in zero seabird mortality, easier net handling and more fish catch for less effort.

Target species:
Anchovy *(Engraulis ringens)* and sardine *(Strangomera bentincki)*

Bycaught species:
Pink-footed shearwater (*Ardenna creatopus*), sooty shearwater (*A. grisea*), Peruvian booby (*Sula variegata*) & Peruvian pelican (*Pelecanus thagus*)

Fleet:
~Around 300 small-scale vessels (length 18m)

Oceans:
Pacific

Situation

Purse seine fisheries are very common across the world, in Chile alone there are estimated to be >3,400 registered vessels, yet little attention has been given to their impact on seabirds.

Productive areas such as the Humboldt Current System concentrate large amounts of forage fish such as anchovy and sardine. This productivity attracts breeding seabirds, bringing them into conflict with the fishing industry. In 2013 BirdLife's Albatross Task Force began working with two fleets which number around 300 vessels, in north and south-central Chile, to assess if these fisheries were involved in significant seabird bycatch.

After observing fishing effort over two years (72 complete sets) it was found that birds were being killed during fishing operations, due to excessive floating net that forms a mesh ceiling in which diving birds become entangled and drown. An early analysis of bycatch rates indicated that 3.58 birds/set were killed in the fishery, mainly pink-footed and sooty shearwaters, but included a total of 12 seabird species. With the large number of purse seine vessels fishing, these results imply that the industry as a whole are capturing large numbers of seabirds, including endangered species.

Solutions

In 2014 BirdLife began a collaborative initiative with local fishermen and local net manufacturers to come up with solutions to reduce bycatch. The key was to modify net designs to reduce the excessive net without impacting fishing efficiency. Experimental trials of a modified net design (removing ~800kg of net) were conducted. When the modified nets were tested and compared with simultaneous sets with unmodified nets, the modified net resulted in zero mortality versus 0.55 birds/set in unmodified nets.

Differences in fishing performance were recorded between the two net types. In the 11 sets monitored, the modified net caught on average 2.4x more fish biomass than the unmodified net. In practical terms this means the vessel with the modified net had to do one less trip to complete their quota catch, than the vessel with the unmodified net.

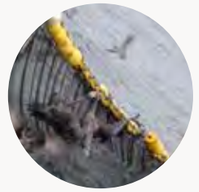
With this kind of project, today we can see how the new net is working better than the former. We feel that the modified gear is faster to set, catches more fish in less time, and is easier to handle during hauling" said David Valdebenito, Purse seine boatswain.

Future

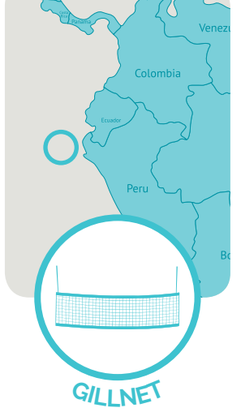
The modified net design has so far proven to be a win-win solution for both fishermen and seabirds, with more fish caught for less fishing effort, and massive reductions in seabird bycatch. Further trials are currently underway in Chile to test the modified nets on more vessels, and future work is required to assess the effectiveness of the modified net design in other fleets.

"The world of fishing is changing and everyone in the sector must learn to adapt to those changes ...I'm part of this project as a new way of fishing, towards saving seabirds" said Patricio Krause, former Purse Seine Captain and director of net company Kranet Ltd.

Suazo *et al.*, 2014; Suazo *et al.*, 2016; Debski *et al.*, 2016



Cristian Suazo, JC Gonzalez, Luis Cabezas



SHINING LIGHTS TO SAVE SEA TURTLES

Net lights in Peruvian gillnet fisheries achieve 64% green turtle bycatch reductions in trials, and show promise for seabirds.

Target species:
Flounder (*Paralichtys* spp.), guitarfish (*Rhinobatos planiceps*), rays

Bycaught species:
Green turtles (*Chelonia mydas*), hawksbill turtles (*Eretmochelys imbricata*), seabirds (various, including penguins, cormorants and boobies), seahorses (*Hippocampus ingens*), Burmeister's porpoises (*Phocoena spinipinnis*)

Fleet:
200 small vessels (6-10m)

Oceans:
Pacific

Situation

Suspended in the water column by a floatline, gillnets act as a wall to larger marine organisms, creating a risk of entanglement for non-target species including seabirds, turtles, sharks and marine mammals. Monofilament is the primary material used in gillnets now. This is far less visible to non-target species compared with traditionally-used materials (e.g. cotton, hemp), resulting in higher target catch, but unfortunately, higher bycatch as well.

The scale of gillnet fishing goes largely unreported in the Eastern Pacific due to the extensive involvement of small artisanal vessels, but bycatch is potentially significant. The very large Peruvian gillnet fleet, for example, is thought to catch more than 10,000 birds per year, including species such as the Vulnerable Humboldt penguin (*Spheniscus humboldti*), white-chinned petrel (*Procellaria aequinoctialis*), and even low numbers of Critically Endangered waved albatross (*Phoebastria irrorata*). Peruvian gillnets also have high interaction rates with sea turtles, including in bottom set gillnets used in the Constante small-scale fishery, where it's estimated that over 300 green turtles are caught annually.

''Gillnet fisheries are massive in scale in Peru but also worldwide. Our research has been directed at trying to find effective, low cost solutions to gillnet bycatch – solutions that can allow for fisheries that are sustainable for marine life and for fishers.'' said Dr Jeffrey Mangel of University of Exeter and Peruvian NGO ProDelphinus, which has been working on bycatch reduction in the Constante fishery, north west Peru, for over a decade.

Solutions

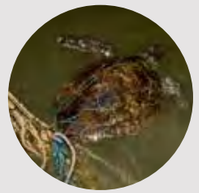
Gillnets become hard to see at low light levels beneath the waves, so proposed solutions to gillnet bycatch are centred on increasing net visibility to non-target species, including the use of high-contrast net panels and net lighting. To investigate the effectiveness of net lighting in the Constante small-scale fishery, ProDelphinus researchers used 114 pairs of nets on 11 vessels undertaking typical fishing activity targeting demersal species such as guitarfish. In each pair, one net was illuminated with green light-emitting diodes (LEDs) placed every ten metres along the gillnet floatline. The other net in the pair was the control and not illuminated. The control nets caught 125 green turtles while illuminated nets caught 62, a statistically significant reduction in bycatch, but with no reduction in the intended catch of fish.

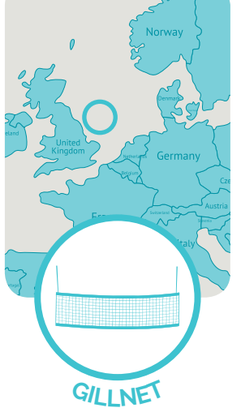
''This was the first time that lighting technology has been trialled in a working fishery, and net illumination reduced green turtle deaths by 64 per cent. The results are exciting because it is an example of a relatively cost effective measure that can work in a small-scale fishery, which, for a number of reasons, are fisheries that can be very difficult to find practical, real-world solutions in.'' said Dr Mangel.

Future

Finding practical techniques for tackling bycatch across species groups can be a real challenge, but net illumination provides hope for saving turtles, and possibly other marine life, including seabirds. ***''Based on the impressive results with sea turtles, further tests are now ongoing to see if net illumination is also effective at reducing bycatch of seabirds and marine mammals'',*** said Dr Mangel, with initial results appearing positive***. ''Given that Peru's gillnet fleet comprises the largest component of the nation's small-scale fleet and is conservatively estimated to set 100,000 km of net per year, we now need to work beyond the Constante fleet to see if the results can be repeated with other threatened and endangered species.''***

Alfaro-Shigueto *et al*., 2011; Mangel *et al*., 2011; Ortiz *et al*., 2016; Žydelis *et al*., 2013





FISHING FOR SOLUTIONS TO GILLNET BYCATCH

Collaboration between netsmen, fishery managers and conservationists has overcome mistrust and innovated to reduce bycatch in a small-scale salmon fishery.

Target species:
Atlantic salmon (*Salmo salar*)
& sea trout (*Salmo trutta*)

Bycaught species:
Razorbill (*Alca torda*)
& guillemot (*Uria aalge*)

Fleet:
Small boats (cobles),
6-8 licence holders

Oceans:
Atlantic (North Sea)

Situation

On the east coast of Yorkshire, UK, Filey Bay has been home to a sea trout and salmon fishery for over 100 years. The fishery operates using small boats and J-shaped gillnets extending from the water's surface down to the seabed, placed at right angles to the shore to trap fish passing along the bay. Filey Bay is also used by feeding seabirds, particularly razorbills and guillemots, which breed in their thousands along Flamborough and Filey's cliffs, either side of the bay. When foraging, the birds are vulnerable to being caught in the static nets, and in 2008 very high levels of bycatch were reported. Rex Harrison, a Filey Bay netsman who has fished the area for decades, describes the situation:

"In the early days, bird bycatch led to a lot of hostility and suspicion between the fishermen and conservationists. But the fact that we've come through that difficult time and work together shows how committed and open-minded everyone has been."

Solutions

Modifications to the fishing gear and net deployment were developed by the netsmen to reduce seabird bycatch, including switching parts of the net from monofilament to a thicker black nylon 'corline' net, which in some cases has been found to increase fish catch. In 2010 the Environment Agency (EA), the fishery managers, introduced a byelaw which requires netsmen to take reasonable steps to ensure the net does not kill seabirds, including the quick release of live birds, recording all bycatch and – during the peak of bycatch in June – fishing only in daylight hours using the high visibility corline in the leader of the net. It also restricts the monofilament section to 70m and requires net attendance at all times. A voluntary code of conduct also operates for the rest of the fishing season.

Since the introduction of these mitigation measures, seabird bycatch has fallen dramatically; the corline is thought to have greater visibility underwater, alerting birds to the presence of the net, whilst net attendance ensures that any caught birds can be removed swiftly, reducing mortality. All netsmen have received training in bird handling and in recent years the number of birds released alive exceeds the number of fatalities.

The success followed a concerted effort by the EA, Natural England (NE), the Royal Society for the Protection of Birds and the Filey Bay netsmen. The reduction in bycatch can be put down to a number of factors in addition to the net modifications, including regular monitoring (funded by the EA and NE) and the positive uptake and involvement of the netsmen.

"Filey shows us the art of the possible in gillnet fisheries. For sure, not everything done there will work elsewhere, but the mixture of measures has helped to bring bird bycatch down. There is much to be learnt from the collaboration and ingenuity found in this beautiful corner of England" said Rory Crawford, Gillnet Programme Manager at BirdLife International.

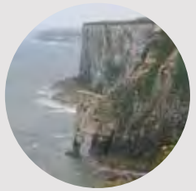
Future

Gillnet fisheries are widespread and particularly prevalent in coastal areas worldwide, affecting a whole host of birds including threatened species such as the marbled murrelet, velvet scoter and yellow-eyed penguin. While we are still some way from finding a definitive answer to the gillnet bycatch problem, building blocks are being established and Filey Bay provides a concrete example where action by fishermen, working with government and wildlife organisations, can tackle this issue in small-scale fisheries.

"I've been fishing salmon all my life', says Rex ***'these amazing cliffs and bays have been my office for decades. When you see the wildlife here, it makes you look after it as best you can, so future generations can benefit and see what I'm seeing today."***

"Rex's insight, and that of the other netsmen, has been invaluable in transforming this fishery into a flagship for bycatch mitigation" said Helen Quayle, RSPB Marine Conservation Officer. ***"The positive experience from Filey required time and trust but demonstrates what can be achieved when all parties work openly and innovatively."***

Žydelis *et al*., 2013; Quayle, 2015



Rory Crawford, Helen Quayle

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“In Namibia we have come a long way since it was found that our seabird bycatch mortalities were amongst the highest in the world. The Namibian Government put in place regulations making it mandatory for the hake trawl and demersal longline fleets to use bird scaring devices. We hope to gazette similar regulations for the surface longline fleet, which will no doubt further reduce Namibia’s seabird bycatch.”

Dr Hannes Holtzhausen, Namibian Ministry of Fisheries and Marine Resources.

“The fishing industry has played a crucial role In developing techniques to reduce bycatch. We should celebrate these positive steps, while recognising that there is still a long road ahead to tackle the accidental capture of non-target species. The long-term viability and sustainability of fishing depends on us rising to the challenge and rolling out practical bycatch solutions across fleets and entire ocean basins, and industry needs to continue collaborating to achieve this.”

Javier Garat Pérez, Secretary General, Spanish Fishing Confederation (CEPESCA).

“Collaboration with fishermen has taught me that their knowledge must be considered and applied for seabird conservation to succeed…experiences working with fishermen continue to teach me new dimensions about the sea…”

Cristián G. Suazo, Albatross Task Force Instructor, Chile.

Victor Libuku. Fernando Villar. Cristian Suazo. Dimas Gianuca

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