European Community Plan of Action (ECPOA) for reducing incidental catch of seabirds in fisheries

Proposal by BirdLife International

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1. Introduction

Incidental mortality of seabirds in commercial fisheries poses a serious threat and is causing declines in many populations, especially of the family Procellariiformes which includes the albatrosses, petrels and shearwaters. The interaction is global in extent and a major issue in Community waters[1]. The unwanted interaction of seabirds with fishing gear can also have an adverse effect on fishing productivity and profitability.

However, simple but significant technical advances, applied on vessels in the correct combination, have enabled seabird bycatch to be substantially reduced in some of the world's more environmentally-aware fisheries (e.g. CCAMLR), so the problem is highly solvable to the benefit both of highly threatened seabird populations and improved fishing efficiency.

This paper aims to help translate that knowledge and experience into the emerging European Community Plan of Action with the intent of assisting the Commission to complete its proposal by the end of 2009, as specified in its current work programme. It highlights the priority issues of concern, the species and measures for consideration, and recommends actions. It also outlines key elements which should be taken into account in the impact assessment (see **Annex**).

In terms of Community Waters, the main focus is on longlines (pelagic and demersal) and gill-nets. In several parts of the world, trawling has been found to inflict heavy mortality on seabirds. The extent of this threat in Community waters is unknown although research suggests that certain injuries suffered by seabirds in the Mediterranean are consistent with trawling gear[2].

2. Policy background: global

In 1999, within the framework of the Code of Conduct for Responsible Fisheries, the FAO adopted the International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA-Seabirds) in response to growing international awareness of the threat posed to seabird populations from bycatch.

IPOA-Seabirds calls upon States to assess their longline fisheries and, if a bycatch problem is identified, to develop and implement a National Plan of Action (NPOA-Seabirds). The main objective of such a plan is to reduce the incidental catch of seabirds using a set of measures to quantify and reduce bycatch – data collection, research, adoption of mitigation measures to reduce seabird bycatch, and ongoing monitoring and review.

[1] Dunn, E (2007) The case for a Community Plan of Action for reducing incidental catch of seabirds in longline fisheries. BirdLife International, Cambridge, UK.

[2] Carboneras, C. 2009. *Guidelines for reducing bycatch of seabirds in the Mediterranean region*. UNEP MAP RAC/SPA, Tunis. 52 pp.

In 2007, the FAO Committee on Fisheries (COFI) identified that 'Best Practice Technical Guidelines' (BPTG) could assist countries in implementing the IPOA-Seabirds for longline and other relevant fisheries. It was also agreed that Regional Fisheries Management Organizations (RFMOs) would benefit from the provision of information on the implementation on IPOA-Seabirds on a regional scale.

In response, in 2008 a FAO Expert Consultation (Bergen, Norway) elaborated a detailed draft of BPTG based on six fundamental principles:

1. Broadening the scope and effectiveness of IPOA-Seabirds by developing NPOA-Seabirds that reduce the incidental catch of seabirds in relevant fisheries.
2. Ensuring the effective application by RFMOs of IPOA-Seabirds within a regional framework, including the adoption of technical and institutional measures required to adopt effective mitigation measures by RFMOs to provide consistent implementation through a regional plan.
3. Adopting scientifically proven, practical and cost-effective mitigation measures, or combinations of mitigation measures.
4. Conducting collaborative research into the development and testing of mitigation measures.
5. Designing and implementing education, training and outreach programmes to reduce the incidental catch of seabirds
6. Using data collection programmes (including observer programmes) and reporting frameworks designed and implemented to provide representative data on the incidental catch of seabirds.

These principles formed the basis of a 10-point approach to achieving best practice plans of action to reduce seabird bycatch, as follows:

1) Extend the IPOA-Seabirds to other relevant fishing gear including trawls and gillnets
2) Uptake of seabird measures by RFMOs/RFMAs[3]
3) Defining an incidental catch problem
4) Mitigation measures and related standards
5) Mitigation research
6) Education, training and outreach
7) Observer programmes
8) Seabird incidental catch reduction objectives
9) Monitoring and reporting framework for NPOA-Seabirds and regional plans
10) Periodic performance review

[3] Regional Fisheries Management Arrangements

Of these ten BPTG elements, 4-7 reflect the 4 original recommended elements for NPOA-Seabirds contained in the IPOA-Seabirds. In 2009, COFI gave its support for the BPTG as the appropriate model for States and RFMOs to use in developing their actions to minimize seabird bycatch.

3. Policy background: the Community

Despite the urgency of the need to take measures to reduce seabird bycatch where EU vessels operate, both internally and externally to Community waters, seabird bycatch has not so far been subject to a coherent framework of systematic measures at Community level.

The European Commission presented a preliminary draft seabird action plan to FAO COFI in 2001 but did not develop it further until 2008 when the Commission made a request to ICES for a formal assessment, as required by IPOA-Seabirds. ICES[4] found that there were insufficient data to indicate the true extent of the bycatch problem, but concluded that '*enough information existed to recognise that there is indeed a problem, and that the EU should develop and implement a Community Plan of Action aimed at investigating the issue further and reducing this bycatch*'. The ICES advice incorporated the FAO's 2007 intent to develop BPTG, notably in respect of addressing: (a) all relevant fisheries (not just longline), (b) external (as well as Community) waters.

3.1 Objectives and actions under the ECPOA based on the FAO Best Practice Technical Guidelines

The ECPOA-Seabirds should comprehensively follow the BPTG, with key actions listed below. In addition to the information presented in the Table below, the ECPOA should set a timetable for the proposed actions and also make clear (beyond the broad 'Level of Action') the responsible party/parties (Commission, Council, Community, Member States, and/or RFMOs. The subsequent text (sections **4**-**7**) of this BirdLife proposal includes some specific measures for regional fisheries (e.g. the Mediterranean) which the Commission should take into account when proposing actions within ECPOA.

Specific objectives:

1.To minimise the incidental mortality of seabirds in fisheries, notably by implementing mitigation measures, prioritising action for threatened species such as Balearic, Cory's and Yelkouan shearwaters, and where incidental mortality is known (e.g. Mediterranean) or likely to be impacting on seabird populations[5].

[4] Report of the ICES Working Group on Seabird Ecology, 2008.

[5] Note that the option of regulating fishing effort to meet a *maximum allowable bycatch mortality of seabirds* is not acceptable, not least for Community waters because the EC Birds Directive does not allow any 'deliberate killing' of birds.

2. To require Member States to collect and report seabird bycatch data in relevant fisheries to an agreed protocol of defined minimum levels of observer coverage, and to amend the Data Collection Regulation to facilitate this.

3. To ensure a coherent and equally robust approach between internal and external EU policy on reducing seabird bycatch, incorporating new objectives for RFMOs on mitigation measures, observer programmes and data collection protocols.

4. To provide EU funds for research to develop and test mitigation measures, tailored to specific fisheries, and for enabling distribution of best practice mitigation to relevant fleets, accompanied by awareness-raising and training programmes for fishers, and training programmes for observers.

BPTG Principle	**Level of Action**	**Action**
1. Extend IPOA to other relevant fishing gears including trawls and gillnets	Community RFMOs	Ensure the scope covers all relevant fisheries in which seabird bycatch is known or likely to be occurring, including both Community and external waters.
2. Uptake of seabird measures by RFMOs/As	RFMOs	See Section **7**, below.
3. Define an incidental bycatch problem	Community Member States RFMOs	Define problem based on (a) magnitude of seabird bycatch; (b) species that are incidentally caught and their conservation status; (c) spatial and temporal overlap of fishing effort with seabirds. This assessment should: (i) review available data relevant to the incidental mortality of fisheries; (ii) validate sources of information and, where appropriate, follow up with more detailed investigations, including defining need for relevant demographic studies of impacted species; (iii) adopt a precautionary approach where information is lacking.
	Community RFMOs	Research on fishing effort data of relevant EU fleets and their overlap with seabird populations (risk assessment)
	Community	Monitor recreational fishing catch/bycatch (as appropriate to Community waters) and distinguish between fish/seabird mortality exerted by recreational and commercial fishing sector.
4. Mitigation measures and related standards	Community RFMOs	Set minimum requirements for mitigation measures in relation to known fisheries-seabird interactions
	Community Member States	Require the use of at least two mitigation measures, out of a specified list, for longline fisheries which incur seabird bycatch, the best mix to be determined in field trials and adapted in the light of experience.

		Establish night-setting and weighted lines as the two most effective measures for demersal longline fishing (notably in the Mediterranean). Where night-setting and/or line-weighting are not practicable for demersal longline vessels, they should carry at least one bird-scaring line which meets a prescribed standard and is ready for inspection and use (as a vital precaution against bycatch of Balearic shearwater particularly). Require on-board management of offal/discards for demersal longline and trawl fisheries: prohibit offal discharge from *any part* of the vessel during gear-setting; during hauling, restrict offal discharge to the side of the vessel *opposite* the hauling side. Limit or prohibit gill-net fishing in areas which overlap with key concentrations of threatened birds, through SPA designation and appropriate management of fisheries.
	Community Member State	Ensure that the Spanish regulation is strengthened to make night-setting a *requirement* rather than a *preferred option* in the Gran Sol fishery, and ensure enforcement of the requirement to minimise deck-lighting (to mitigate bycatch of Great shearwater)
	Community RFMOs	Identify legislation (Basic CFP Regulation, Data Collection Regulation, regulations for particular fisheries and fleets) which needs to be amended or established in order to implement and underpin action.
	Community Member States	Designate SPAs sufficiently large to contribute to bycatch mitigation, and manage by licensing of fishing methods/gears conditional on reducing seabird bycatch rates, and ultimately on meeting targets for bycatch reduction.
5. Mitigation research	Community RFMOs	Collect data on fishing techniques and mitigation measures currently in use and their efficacy, in order to spread and improve best practice
	Community RFMOs	Adapt and refine mitigation measures on basis of dedicated research (in EU and elsewhere), observers' and fishermen's knowledge and other empirical evidence.
	Community RFMOs	Provide/facilitate sufficient resources, notably supporting application for EFF funding and FP7 for mitigation, e.g. design and implementation of effective bird-scaring lines, gill-net design, adapting vessels for offal storage
6. Education, training and outreach	Community RFMOs	Establish awareness-raising and training programmes for fishermen, including seabird identification and handling, maintenance and use of mitigation measures,

		etc. Crews should be trained in deploying bird-scaring lines rapidly and efficiently at sea across a full range of ambient conditions.
	Community RFMOs	Promote and support training programme for observers.
7. Observer programme	Community RFMOs	Require implementation of a comprehensive observer programme at a sufficient level of coverage (both within and across fisheries).
	Community RFMOs	Select pilot fisheries with a presumption of significant bycatch for observation to determine appropriate levels of observer coverage.
	Community RFMOs	Promote 10% coverage as an absolute minimum in the short term (assessment of problem and where it occurs) and at least 20% in the medium-long term if there is evidence of significant bycatch.
	Community RFMOs	Design and implement data collection protocol.
8. Incidental catch reduction objectives	Community RFMOs	Aim to minimise incidental mortality of seabirds, as in 'Specific objective 1' (above), within specified timelines.
	Member States RFMOs	Monitor seabird populations with the aim of determining demographic responses to changes in bycatch and setting bycatch reduction objectives.
9. Monitoring and reporting framework for NPOA-S and regional plans	Community RFMOs	Facilitate collaboration between scientists, the fishing sector (local to the problem), management authorities and NGOs to review evidence, authorise new mitigation measures, agree observer programmes and protocols.
10. Performance review	Community	Evaluate ECPOA implementation and report to FAO-COFI at least every 4 years.

4. Assessment of seabird bycatch in Community and external waters

Seabird bycatch is an issue which affects vessels of EU Member States operating in both Community and external waters, the latter mostly under the jurisdiction of RFMOs. Within Community waters there are significant longline and trawl fisheries which impact adversely on seabirds in the Mediterranean, Azores, Madeira and west of Ireland. However, it is important to emphasise that there are likely to be other parts of Community waters, especially where artisanal fisheries prevail (e.g. NW Spain, JM Arcos, *pers.comm.*), where problems may also exist but remain undetected due to lack of monitoring. Gill-net fisheries are a geographically widespread threat but especially so in the Baltic Sea. Finally (Annex) potential economic benefits of mitigation are shown.

The following assessment builds on and updates the report on the interactions between fisheries and seabirds in EU waters conducted by the ICES Working Group on Seabird Ecology (2008), taking particular account of Carboneras (2009). The approach taken is to address the issue through the main geographical areas of

concern for which there is hard evidence, rather than gear type, with the exception of gill-nets which are in widespread use throughout Community waters.

4.1 Mediterranean Sea

As the WGSE (2008) assessment highlighted, the Mediterranean is a high-risk but data-poor region for seabird bycatch and therefore needs to be given high priority by the ECPOA. The high risk derives from the presence of several species which are sensitive to bycatch and other threats on the basis of their restricted geographic range and relatively small population size. The data scarcity arises because most of the fishing is done by artisanal fisheries whose activities are generally under-reported.

4.1.1 Mediterranean fisheries

Whereas trawling is more homogeneous as a fishing method, several types of demersal and pelagic longlining coexist, with great variability in vessel type, fishing technique, target species, area and season. Variation in parameters such as longline configuration, hook size (smaller in demersal longlines), size and type of bait (sardine, squid, horse mackerel), the depth at which the longline is deployed, and time of setting (in relation to daily light cycle), doubtlessly imply differential probabilities of risk to seabirds. Offshore fisheries apart, artisanal fishing is also important and may interact with seabirds, likewise recreational fishing (trolling) for tuna-like fish. Recreational fisheries in Spanish waters, for example, are conducted by ca. 70,000 vessels, none of whose activities are regulated, compared with ca. 12,000 vessels in the traditional commercial sector (JM Arcos, *pers. comm.*).

Compared to other regions, observer coverage in Mediterranean fisheries is poor, with the exception of some pelagic longline fisheries for tuna/swordfish/shark. Data on interactions with seabirds in demersal (e.g. hake) or artisanal fisheries is very sparse. Such data are usually available for only a few months of the year (spring and summer) due to the fact that artisanal vessels are typically most active at this time (they change their target species and thus their gear type on a seasonal basis). Moreover, because bycatch events are sporadic, such data are rarely reported or published.

4.1.2 Interactions between fisheries and seabirds

There are particular concerns for three species of shearwater – **Cory's shearwater** *Calonectris diomedea*, **Balearic shearwater** *Puffinus mauretanicus* (Critically Endangered, IUCN 2009; estimated to face extinction in 40 years at current rates of decline) and **Yelkouan shearwater** *P. yelkouan* – since these are the most threatened seabird species in the region. However, we have only a rudimentary knowledge of which species are caught when and where and by which fleets (not all EU-flagged) and fishing methods, and what mitigation may currently be operational.

In the case of all three species, the need for a precautionary approach is invoked by (i) lack of observer data which handicaps accurate assessment of the incidence and scale of bycatch; (ii) paucity of monitoring demographic data for Mediterranean

breeding seabirds which makes it hard to gauge the ultimate impact on seabird population status of at-sea mortality and any mitigating measures.

The available information, however, has been summarised by Carboneras (2009) from which **Tables 1 and 2** are adapted. Table 1 shows the international protection status of these 3 shearwater species and two other seabird species (**Mediterranean shag** *Phalacrocorax aristotelis desmarestii*, **Audouin's gull** *Larus audouinii*) subject to interaction with Mediterranean fisheries, along with their occurrence in EU coastal States. Table 2 shows a risk assessment for these 5 species in terms of (i) their level of attraction to different fisheries/gears and (ii) their known or predicted risk of capture (very high, high etc) according to the birds' feeding habits and fishing gear characteristics.

Table 1: International protection status for key Mediterranean Action Plan species subject to interaction with fisheries, and their occurrence in EU Member States as breeders (●) and non-breeders (□)

Species	Scientific name	IUCN	Barc'a Conv'n	Birds Dir.	CY	FR	GR	IT	MA	SL	SP
Cory's shearwater	*Calonectris diomedea*	LC	√	√	□	● □	● □	● □	●□		● □
Balearic shearwater	*Puffinus mauretanicus*	CR	√	√		□		?			●
Yelkouan shearwater	*P. yelkouan*	NT	√	√		● □	● □	● □	●□	□	● □
Mediterranean shag	*Phalacrocorax aristotelis desmarestii*	LC	√	√	●	●	●	●		□	●
Audouin's gull	*Larus audouinii*	NT	√	√	● □	● □	● □	● □	□		● □

Key:
IUCN categories from IUCN (2008) *Red List of Threatened Species*: CR = Critically Endangered; NT = Near Threatened; LC = Least Concern
Barcelona Convention: Species listed in the *Protocol concerning specially protected areas and biological diversity in the Mediterranean*. Annex II: List of Endangered or Threatened Species.
EC Birds Directive: Species listed in *Council Directive 79/409/EEC on the conservation of wild birds*. Annex 1: Species subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution.
CY = Cyprus, **FR** = France, **GR** = Greece, **IT** = Italy, **MA** = Malta, **SL** = Slovenia, **SP** = Spain

Table 2: Risk assessment for seabird-fishery interactions for key Mediterranean Action Plan species, showing (i) level of attraction to different fisheries/gears (●● = very strong, ● = strong, o = light); (ii) known or predicted risk of capture (very high, high, moderate (mod), unknown (unk)) according to the birds' feeding habits and fishing gear characteristics. For scientific names of species, see Table 1.

Species	LL dem	LL pel	Trawl	Gill-net/ Trammel	Purse-seine	FAD	Drift -net	Troll	Rec-O	Rec-I	Pot/ Trap
Cory's shearwater	●● very high	●● very high	● high	o unk	o unk	o unk	o high	o mod			
Balearic shearwater	●● very high	● high	● high	● high	o unk	o unk			o mod		
Yelkouan shearwater	●● very high	● high	● high	● high	o unk	o unk	o high		o mod		
Mediterr-anean shag	o low		o low	● high					o mod	o mod	o mod
Audouin's gull	● high	● high	● high	o unk	● unk	o unk	o high	o mod		o mod	

LL dem = Demersal longline
LL pel = Pelagic longline
FAD = fish aggregation device (for dolphinfish)
Troll = Trolling
Rec-O = Recreational fishing offshore
Rec-I = Recreational fishing inshore

Summarising Table 2, longline fishing poses a very high risk to Cory's shearwater, Yelkouan shearwater and Balearic shearwater. Trawl, drift-net and gill-net fisheries are also thought to pose a high risk to these species. Audouin's gull is also at high risk from various fisheries, as is Mediterranean shag from gill-nets.

Each of the shearwater-fisheries interactions will now be examined in more detail.

Cory's shearwater is mostly *aerial* and does not dive to great depths below the sea surface; it also ranges far offshore where pelagic longlines (for tuna and swordfish) predominate. This species has a very high risk of interaction with both demersal and pelagic longline fisheries and a high risk of interaction with trawl and drift-net fisheries. There is clear evidence for significant bycatch in pelagic and demersal longline fisheries in the Spanish sector of the western Mediterranean[6]. Interviews with Maltese fishermen indicated that the bycatch rate of this species by demersal longlines in Maltese waters could equate to 8.5-10% of the population being killed annually[7].

[6] Belda, EJ and Sanchez, A (2001) *Seabird mortality in longline fisheries in the western Mediterranean; factors affecting bycatch and proposed mitigation measures*. Biol. Conserv. 98, 357-363.
[7] Dimech, M, Darmanin, M, Caruana, R and Raine, H (2008*) Preliminary data on seabird by-catch from the Maltese longline fishery (central Mediterranean)*. ICCAT Standing Committee on Research and Statistics. SCRS/2008/027.

By contrast with Cory's shearwater, **Balearic shearwater** and **Yelkouan shearwater** are *deep-divers* (capable of foraging to considerable depths beneath the surface) and tend to be more coastal in distribution, thereby more often encountering demersal longline fishing (for hake and other whitefish, etc). Balearic shearwater is also a proficient diver and highly competitive behind trawlers. A feature of this species, to some extent applicable also to Yelkouan shearwater, is the tendency to forage in large congregations (often up to a few thousand birds), especially in coastal areas during the non-breeding period. These congregations are relatively sporadic in occurrence, but when they coincide with a nearby longline vessel setting its line, this can lead to (occasional) events of mass mortality (cases of up to 100+ birds have been reported for a single setting operation). Yelkouan shearwater has a similar risk profile but – unlike in the western Mediterranean[8] – occasionally suffers mortality in drift-nets, e.g. in Greece, up to 500 Yelkouan shearwaters were reportedly caught in a single drift net in 2008 (MOm/The Hellenic Society for the Study and Protection of the Monk Seal, 2008, unpublished data).

4.1.3 Mitigation measures for Mediterranean longline fisheries

There are a number of key mitigation measures to consider in the context of Mediterranean longline fisheries. Depending on the conditions (fishery, species at risk, etc), these should be used in the combination appropriate to best delivery of bycatch reduction. For the most up-to-date and comprehensive descriptions of mitigation measures, see BirdLife and ACAP (2009) *Seabird bycatch mitigation fact-sheets*. BirdLife International, Cambridge, UK[9].

Bird-scaring lines, also known as 'streamer' or 'tori' lines, are likely to significantly reduce by-catch of all three shearwater species by deterring them from venturing close to longline gear, whether pelagic or demersal. Bird-scaring lines have also proved effective in mitigating seabird bycatch in trawl fisheries in various parts of the world. Such lines will only be efficient deterrents if they meet a number of design criteria (e.g. see CCAMLR specification) and paired lines generally have greater mitigating effect than a single line. There is evidence from other parts of the world to show that a well-designed bird-scaring line may increase fishing efficiency by enhancing capture of fish, with the reduction in bait loss itself a further economic gain (see **Annex**).

Comparing seabird species at risk, bird-scaring lines may be most effective for mitigating bycatch of Cory's shearwater (and the equally aerial Audouin's gull), much less so for Balearic and Yelkouan shearwater which, as deep divers, can access baited hooks relatively far below the surface, beyond the deterrent effect of bird-scaring lines.

[8] Drift nets are not used in Spain, except in some pelagic areas of the Alboran sea (by Moroccan fishermen)

[9] http://www.rspb.org.uk/ourwork/policy/marine/international/publications.asp

Line-weighting is likely to mitigate bycatch of the two deep-diving shearwaters (Balearic, Yelkouan) in demersal longline fisheries since the faster the longline sinks, the lower the risk of capture. However, there are no studies to indicate the minimum sink rate required to contribute to bycatch reduction for these species.

Rudimentary line-weighting is used in the Mediterranean demersal longlines which commonly use the less-than-ideal Spanish (*piedra-bola*) method, combining stones as weights with floats (plastic balls). This method should be discouraged, and *integrated* line weighting (ILW) encouraged wherever appropriate for the size of the vessel. Because of the currently-available diameter of gear, smaller artisanal vessels may not be able to operate with ILW and may have to use external weights that achieve the necessary sink rate .

In pelagic longlining, the ECPOA should recommend the use of weighted swivels (rather than integrated line weighting which has not yet been developed for pelagic longlines) in combination with a bird-scaring line and/or night-setting. Weighted swivels have the potential to reduce the bycatch of seabirds including shearwaters. However, to be effective, such weighting needs to be capable of achieving an appropriately rapid sink rate (e.g. in South Africa, the prescribed sink rate is 0.3m/sec, or a depth of 10m no further than 150m behind the vessel: B. Sullivan, *pers. comm.*).

Another means of facilitating faster sinking of longlines in Maltese waters is **side-setting** (N. Barbara, *pers.comm.*). As the term suggests, the longline is set from the side of the vessel rather than the stern, which acts as a safeguard in two ways: (i) baited hooks are kept clear of the propeller wash which slows the sink-rate of hooks set from the stern; (ii) birds are often unable or unwilling to forage for bait close to the side of a vessel. In some parts of the world, e.g. Hawaii, side-setting has proved effective not only at reducing seabird bycatch but also in delivering a number of operational advantages (BirdLife bycatch mitigation fact-sheet 9).

Night-setting, by reducing visibility of and therefore attraction to fishing operations, has been shown to reduce seabird bycatch in Mediterranean pelagic and demersal longline fisheries. The risk to species depends partly on their activity rhythms, e.g. some surface feeders such as Audouin's gull tend to associate at night with vessels because their lights aid prey detection. Night-setting seems to be particularly effective in mitigating bycatch of Cory's shearwater in areas where the birds and pelagic longline fisheries overlap during the breeding season (March-Oct). Night-setting may be less effective for the other two shearwater species although this needs further investigation. Night-setting may best be used in combination with bird-scaring lines and line-weighting to enhance mitigation of bycatch. Implicit in effective night-setting is the **minimisation of deck lighting** (consistent with safety) on the vessel but especially at the stern where the longline (or trawl) is deployed (see, e.g., **4.2**, below). It is appreciated that night-setting is least disruptive to vessels which operate offshore and far from port. For artisanal vessels operating relatively

inshore and close to port, a requirement for night-setting may require significant adjustments to their daily rhythm of fishing and onshore activity.
Area and temporal restrictions Apart from night-setting, other temporal or spatial constraints on fishing can prevent the co-occurrence of vessels and seabirds at risk. This approach has not been widely deployed globally as a mitigation method but can be a seasonal restriction of fishing (as in the confinement of longline fishing in CCAMLR waters to the winter months in order to avoid the breeding season when the birds forage closer to the colony) or an area restriction on particular fishing gears/practices. Many Mediterranean seabird species range over extensive areas and do not easily lend themselves to such an approach but it is a measure which requires serious consideration in the vicinity of breeding colonies and in migration hotspots (e.g. bottlenecks). Moreover, despite the wide-ranging nature of seabirds, most species tend to occur repeatedly in the same areas (hotspots) for foraging, with such areas being easily predictable at least at the mid-scale (tens of kilometres).

BirdLife International has pioneered the methodology for the identification and delimitation of offshore marine Important Bird Areas (IBAs) for seabirds and their designation as SPAs under the Birds Directive, not least in the Mediterranean[10] and Portugal[11]. In 2006, a BirdLife-led consortium began a LIFE funded project to identify a Yelkouan shearwater IBA in Malta[12]. IBAs/SPAs need to be sufficiently large to facilitate both fisheries management and to mitigate damaging fishing activity on seabird populations. Such management also has to be adaptive in order to amend operating conditions in the light of experience.

Offal and discard management has been proven to make an important contribution to bycatch mitigation, especially in trawl fisheries and demersal longlining, since seabirds are attracted much more strongly to the vessel when it is discharging waste fish. Prohibition of throwing waste overboard during setting and hauling demersal longlines and trawls has been shown to contribute strongly to reducing seabird mortality in (e.g.) CCAMLR waters. BirdLife has shown that such waste management dramatically reduces seabird bycatch in South African fisheries. To this end, and subject to the vessel's storage capacity, various methodologies have been developed for retaining offal and discards onboard for later disposal at a time when seabirds are not at risk (possibly even landing waste onshore). Offal and discard

[10] Arcos, J.M., J. Bécares, B. Rodríguez y A. Ruiz. 2009. *Áreas Importantes para la Conservación de las Aves marinas en España*. LIFE04NAT/ES/000049-Sociedad Española de Ornitología (SEO/BirdLife). Madrid.

LIPU (2009) *Aree importanti per gli uccelli dalla terra al mare*. Tracce, Modena: LIPU, Ministerio dell'Ambiente, Direzione per la Protezione della Natura.

[11] Ramírez, I, P Geraldes, A Meirinho, P Amorim & V Paiva (2008) *Áreas Importantes para as Aves Marinhas em Portugal*. Sociedade Portuguesa Para o Estudo das Aves. Lisboa.

[12] http://www.birdlifemalta.org/conservation/LIFE_project/

management should not be interpreted (as in some parts of the world) as 'strategic' dumping of offal and discards to distract birds away from baited hooks.

4.1.4 ECPOA recommendations for the Mediterranean

Given the complexity of Mediterranean fisheries, and the paucity of empirical data on seabird-fisheries interactions and seabird demographics, there is a clear need for a precautionary approach and the implementation of minimum mitigation standards, informed by existing experience in the Mediterranean and from best practice elsewhere in the world.

At the same time, it is difficult in the current state of knowledge to be highly prescriptive about the suites of mitigation measures appropriate to each fishery and its operational conditions. To gain compliance from the industry, this calls for a flexible and collaborative approach with the fishing communities to determine the best practice for their respective fisheries. This approach needs to be underpinned with awareness-raising and training programmes. The development and implementation of on-board observer programmes, working to agreed data collection protocols (such as ICCAT) will be vital to monitor performance, establish baselines for seabird bycatch and help develop the most effective suite of mitigation measures for each fishery. Adaptive management, to trial and improve mitigation practice over time in the light of experience, and dedicated research, will also be intrinsic features of this regime.

Resource constraints mean that collection of data for estimating bycatch rates in the Mediterranean is necessarily going to be restricted to few vessels, with further constraints likely on spatial and temporal representativity. At least artisanal vessels, which return to port daily, could be obliged to land seabirds caught in fishing gear, as long as there was sufficient onshore arrangements to facilitate and monitor this. In the Yelkouan shearwater project (BirdLife Malta), longline fishers are contracted and paid by the Fisheries Authority to produce a log of bycatch of seabirds (and other species such as marine turtles, cetaceans and sharks) for each fishing trip. The ECPOA should encourage such initiatives, though not to the exclusion of independent observer programmes where necessary.

Bycatch rates for a given species need to be extrapolated to the total fleet activity in order to assess the likely impact of the bycatch on seabird species and to help establish the overall effect on their population status. In this regard, our knowledge of the fishing activity of Mediterranean fleets (both EU and non-EU) with the potential to impact adversely on seabirds is currently wholly inadequate. The sourcing and acquisition of effort data from Member States for analysis is a high priority.

In terms of setting minimum mitigation measures for the Mediterranean, while it is appreciated that the precise gear specifications and conditions of use under which these are used may vary (see below), the ECPOA should require the following

combinations to be used. Where there are more than 2 mitigation measures in a given cell, then the use of at least 2 should be mandatory (the best mix to be determined by field trials and adapted in the light of experience). If, in combination, two should prove ineffective at mitigating bycatch adequately, then a different pair - or alternatively a more comprehensive suite - of measures may have to be considered in revision of the ECPOA. Summarising, in respect of the Mediterranean, the ECPOA should require the following measures according to fishery type (**Table 3**):

Species at risk	Pelagic longline	Demersal longline	Trawl
Cory's shearwater	Bird-scaring line, LW, night-setting	Bird-scaring line, ILW, night-setting, offal management	Bird-scaring line, offal management
Balearic shearwater		Bird-scaring line, ILW, night-setting, offal management	Bird-scaring line, offal management
Yelkouan shearwater		Bird-scaring line, ILW, night-setting, offal management	Bird-scaring line, offal management

Notes:
1) Preferably 2 bird-scaring lines should be deployed simultaneously, and each should meet (legally) minimum design and operational criteria for effectiveness as deterrents; fishermen's knowledge should help fine-tune the most effective design for particular vessels and fisheries.
2) LW = Line weighting (weighted swivels)
3) ILW = Integrated line-weighting
4) Night-setting should always be accompanied by minimising deck-lighting, to avoid attracting seabirds to the vessel
5) All these species/fisheries mitigation measures should be supplemented, as appropriate, by designating SPAs, with fisheries management restrictions on gear use.

In considering which combination of two measures is preferable to use with demersal longlines, it should be noted that use of bird-scaring lines is harder to monitor and enforce than line weighting and night-setting. Firstly, line-weighting, especially where integrated, is built-in to the fishing method and not an 'add-on' like a bird-scaring line, which might therefore not get used at all. Secondly, night-setting can be monitored by VMS.
The ECPOA should therefore recommend introduction of night-setting and weighted lines as the two most effective measures for demersal longline fishing, given that there is a choice of 2 out of 3 mitigation measures for this fishing method.

On-board management of offal (and discards) should be *routine* required practice for both demersal longline and trawl fisheries, and this may require not only regulation but stronger regulation than is currently in place. The 2006 Spanish Regulation on mitigation measures for longline fisheries[13] specifies that *'if offal discharge is*

[13] Orden APA/2521/2006, de 27 de julio, por la que se regula la pesca con el arte de palangre de superficie para la captura de especies altamente migratorias y por la que se crea el censo unificado de palangre de superficie. BOE núm.183, de 2 agosto de 2006, págs. 28896-28901.

unavoidable during setting and hauling, it shall be done on opposite side of the vessel from where setting is done'. This is an absolute minimum and the ECPOA should go further and recommend, as in CCAMLR, prohibition of offal discharge from <u>any part</u> of the vessel during setting, as birds will be attracted to the vessel irrespective of where fish waste is discharged. During hauling, any offal discharge should be restricted to the side of the vessel opposite the hauling side.
Where night-setting and/or line-weighting are not practicable for demersal longline vessels, they should carry at least one, and preferably two, bird-scaring lines which meet a prescribed standard and ready for inspection and use, although it is appreciated that these could be challenging to deploy from small, artisanal vessels with small crews. Allowance should also be made for the fact that seabirds will not always be in the vicinity of fishing vessels or may be so at only very low density (according to season, proximity of breeding colonies etc). Vessel captains should then use discretion on when a bird-scaring line(s) should be deployed but should be obliged do so when birds are attracted in numbers to the vessel and especially if at least one has already been caught in the gear. Control will have to be sufficient to enforce this approach which relies on the willing compliance and good judgement of captains and crews.

In this regard, it has already been noted (4.1.2, above) that the pattern of Balearic shearwater bycatch is of relatively uncommon but mass mortality events in demersal longlines (especially), each incidence however representing a significant escalation of the species extinction risk. Vessels operating in regions where Balearic shearwater occur need to be particularly vigilant and alert to this possibility and ready to deploy bird-scaring lines in good time to help pre-empt any bycatch of this Critically Endangered species.

Priority has been given here to mitigating incidental catch of the 3 shearwater species. These same measures should also help mitigate the risk to Audouin's gull. In the case of Mediterranean shag, which has a relatively small foraging range in the breeding season, the SPA approach with suitable fisheries management measures to control gill-net placement and effort, are likely to be the most beneficial. The ECPOA must give explicit impetus to relevant Member States to implement this approach. For gill-net mitigation elsewhere, see **6**, below.

5. <u>North-East Atlantic: the Gran Sol fishery</u>
In 2006-07, an independent onboard survey[14] was made of the spatial and temporal interaction between the Gran Sol fishery (W Ireland, ICES VII) and seabirds. The fleet consists of about 35 Galician demersal longline vessels operating on average for about 165 days per year in the area and targeting mainly hake and black bream. On average 16 vessels were estimated to be fishing at any one time. Lines are set mostly

[14] The study (publication pending) was carried out by an observer Álvaro Barros, made possible by an agreement between the Dept of Environment of the Government of Galicia, the port authority of Celeiro (Lugo Province, Galicia) and Sociedad Española (SEO/BirdLife) to promote sustainable fisheries for seabirds in the Gran Sol fishing grounds.

at night and at dawn. Daylight setting does occur at times, however, often in an attempt to increase effort after successful hauls, and the higher resulting seabird bycatch of such setting was clear (Á Barros, *pers. comm.*).
Three surveys were undertaken, representing the entire seasonal spread of the fishery, during which the number of hooks set, the proportion monitored, and the seabird bycatch was recorded, along with any influencing conditions – notably the use or otherwise of deck lighting at the stern of the vessel. During the course of the study, a total of 238,205 hooks were set on the observed vessels using deck lighting.

From the overall results (Table 4) an annual bycatch of 56,307 seabirds of six species was extrapolated for the Galician fleet activity, representing an overall bycatch rate of 1.008 birds per 1000 hooks. This rate is *very high* by global standards. By far the most heavily impacted species was Great shearwater *Puffinus griseus* (annual estimated total bycatch 39,908).

Table 4: Seabird bycatch rates in the Gran Sol fishery, 2006-07

Species	Scientific name	Birds /1000 hooks	Estimated bycatch/year
Northern fulmar	*Fulmarus glacialis*	0.277	9493
Great shearwater	*Puffinus gravis*	0.546	39908
Sooty shearwater	*Puffinus griseus*	0.034	1303
Northern gannet	*Morus bassanus*	0.038	1331
Great black-backed gull	*Larus marinus*	0.004	158
Black-legged kittiwake	*Rissa tridactyla*	0.109	4114
TOTAL		**1.008**	**56307**

On days when the observer conducting the study asked deck lighting to be switched off as an experiment, bycatch was virtually eliminated. Use of deck lighting is thus a major cause of seabird bycatch, and switching lights off (except for position lights) would be a very efficient – and highly cost-effective - mitigation measure. Such reduction of deck lighting is specified by the Spanish Regulation of 2006 on longline mitigation measures (see footnote 13) but is clearly not complied with in the Gran Sol fishery. Art 7 of the Regulation specifies that: *Setting shall be done preferably between dusk and dawn; vessel external lights must be reduced to those strictly necessary for navigation and fishing purposes.* No other mitigation measures (such as bird-scaring lines or line-weighting) are used by the Gran Sol fishermen. They seem very reluctant to use bird-scaring lines, claiming that they often get entangled with the fishing gear, and that they are very difficult to use in bad weather conditions.

The scale of bycatch in the Gran Sol exposes lack of compliance with a key recommendation in 2006 Spanish regulation. It also points up the potential for similar bycatch in the wider area and south to Macaronesian waters.

5.1 ECPOA recommendations for Gran Sol fishery

These findings were made possible by a consortium of Galician bodies and a NGO (SEO/BirdLife) and there is a need for the ECPOA to lend formal weight to reducing this bycatch by addressing the following issues with the Spanish authorities:

- continue assessment of the interaction through observer coverage (at least 20%) working to an agreed data collection protocol
- strengthen Spanish regulation to make night-setting a requirement rather than a preferred option, and ensure enforcement of the requirement to minimise deck-lighting
- assess compliance with and amendment of the existing mitigation measures for offal management (as also required by the 2006 Spanish regulation)
- promote trials of other mitigation measures (bird-scaring line, integrated line weighting) which may, in combination, assist the reduction of deck-lighting and offal management in mitigating bycatch
- establish a programme of awareness-raising and training of skippers and crews to these ends

6. Gill-net fisheries (other than in Mediterranean)

Gill-nets are in widespread use in small-scale fisheries throughout EU coastal waters but their impact on birds is not well known (WGSE 2008, pp. 65-70). Measuring bycatch rates is especially challenging since gill-net fishing effort combines length, mesh size and other design characteristics of nets, setting depth, soak times and duration of fishing season, all of which are highly variable, seldom recorded, and interact in often unpredictable ways with the distribution and foraging behaviour of the seabirds at risk. Moreover, bycatch incidence is rarely subject to systematic monitoring by trained observers.

A recent review[15] has been undertaken of 30 studies reporting seabird bycatch in the Baltic Sea and (predominantly eastern) North Sea in order to assess the scale of the problem and the potential effects on the status of bird populations. While the cumulative annual bycatch estimate (made up mainly of divers, grebes, sea ducks, diving ducks, auks and cormorants) from this survey was 90,000 birds, this was considered to be 'a substantial underestimate' and the authors conclude it more likely that between 100,000 and 200,000 birds are killed in gill-nets in the region each year.

Several of the species at risk are rare in the region and subject to international legal protection. Steller's eider (*Polysticta stelleri*) is listed as Vulnerable by IUCN and is on

[15] Zydelis, R, Bellebaum, J, Österblom, H, Vetemaa M, Schirmeister, B, Stipniece, A, Dagys, M, Eerden, M van, and Garthe, S (2009) *Bycatch in gillnet fisheries – An overlooked threat to waterbird populations*. Biol. Conserv. 142, 1269-1281.

Annex 1 of the EU Birds Directive. Also at risk and listed in the Directive are red-throated diver (*Gavia stellata*), black-throated diver (*G. arctica*), Slavonian grebe (*Podiceps auritus*) and smew (*Margellus albellus*). The modelling approach by Zydelis et al indicated that bycatch in gill-nets was a matter of conservation concern for at least long-tailed duck (*Clangula hyemalis*) and greater scaup (*Aythya marila*). Concentrations of such species can be substantial. For example, the Baltic SPA Pomeranian Bay holds more than 1 million waterbirds, both bivalve- and fish-eating species, during the non-breeding season[16]. There is a high likelihood of this assemblage being stationary in the area in winter[17]. However, presence is not confined to winter, with common scoter (*Melanitta nigra*) and velvet scoter (*M. fusca*) using the Odra Bank in the south of the SPA for moulting in summer.

6.1 Mitigation measures for gill-net fisheries

6.1.1 Gear modification

In Puget Sound, USA, Melvin et al (1999[18]) demonstrated that modifying gill-nets so as to increase their visibility to birds, coupled with temporal regulation of fishing effort (to avoid coinciding with peak foraging activity of the birds) could decrease bycatch of auks by up to 70-75% without significantly reducing the target fish catch.

Acoustic pingers, clipped to the nets, were also effective although they have not been adopted as a seabird deterrent in this or any other gill-net fishery, including in Europe. While they have been used to deter cetaceans from bottom-set gill- and tangle nets in Community waters, and indeed are mandatory (EC Reg 812/2004) for such nets operated by vessels of 12m+, concerns remain about their practicality, long-term effectiveness, potentially negative acoustic effects, and enforcement.

6.1.2 Alternative gears

The ICES EMPAS study addressing *inter alia* seabird bycatch in gill-nets in SPA Pomeranian Bay (Baltic Sea) put forward a variety of options for management to reduce conflict, including a switch (subject to socio-economic investigation) to alternative gears such as fish traps which would reduce bird catch to 'close to zero'. (See also Mentjes & Gabriel 1999, below, for longline option).

6.1.3 Spatial and temporal measures

[16] Skov, H et al (2000) *Inventory of coastal and marine Important Bird Areas in the Baltic Sea*. BirdLife International. Cambridge.

[17] ICES (2008) Report of the Workshop on Fisheries Management in Marine Protected Areas (WKFMMPA), 2-4 June, 2008, ICES Headquarters, Copenhagen, Denmark. ICES CM 2008/MHC:11. 160 pp.

[18] Melvin, EF, Parrish, JK and Conquest, LL (1999) *Novel tools to reduce seabird bycatch in coastal gill-net fisheries*. Biol. Conserv. 13, 1386-1397.

Mentjes and Gabriel (1999[19]) concluded that for gill-net fishing in the western Baltic Sea, it was impractical to reduce local and temporal bycatch by modifying net design or by other tactical approaches. They argued that only a temporary avoidance of fishing grounds which host large concentrations of ducks, or a switch to longlines, might be effective, although the latter may also pose a significant bycatch risk. For SPA Pomeranian Bay, the ICES EMPAS study considered both year-round spatial closure (i.e. exclusion of static gear) and temporary closure of the Adler Ground in periods of high bird concentrations (November-April). Such closure would be highly beneficial, although it would not fully meet the conservation objectives of the SPA as summer bycatch would persist in the Odra Bank.

6.2 ECPOA recommendations for gill-net fisheries

The ECPOA should promote research on 'seabird-friendly' gill-net design, including by encouraging funding bids to this end. Although it is true of all fishing methods, it is especially true of gill-nets (given their highly variable configuration and setting conditions, and their widespread use across the Community waters) that designing effective measures must take account of local conditions and fishing practices, using the experience and expertise of the fishermen. As such, it is difficult for the ECPOA to be prescriptive about mitigation measures. However, given the challenges of technical modifications of gear, high priority should be given to total exclusion of gill-net fishing from key concentrations of threatened birds, through SPA designation and appropriate management of fisheries.

7. The ECPOA and external policy

The RFMOs have an increasingly critical role to play in reducing incidental bycatch of seabirds as an integral part of implementing an ecosystem-based approach to fisheries management. RFMOs in which EU-flagged vessels are operating, and in which seabird bycatch is known or likely to be occurring include:

- ICCAT – International Commission for the Conservation of Atlantic Tunas
- IOTC – Indian Ocean Tuna Commission
- IATTC – Inter-American Tropical Tuna Commission
- WCPFC – Western and Central Pacific Fisheries Commission
- SPRFMO – new RFMO in the South Pacific, currently under negotiation
- SEAFO – South-East Atlantic Fisheries Organisation
- NEAFC – North East Atlantic Fisheries Commission
- GFCM – General Fisheries Commission for the Mediterranean
- CCAMLR – Commission for the Conservation of Antarctic Marine Living Resources

[19] Mentjes, T & Gabriel, O (1999) *Fangtechnische Möglichkeitein zur Reduzierung des Beifangs von Meeresenten in der Dorschfischerei mit staionären Fanggeräten (Technical possibilities to reduce duck bycatches in winter cod fishery with static gear)*. Informationen für die Fischwirtschaft aus der Fischereiforschung 46, 36-41.

ICCAT, IOTC and SEAFO have particular importance for the EU, given that one-third of the world's albatrosses breed on the overseas territories in the South Atlantic and South Indian Ocean belonging to the UK and France, respectively. Some of the most severe declines in albatross populations are taking place in colonies in the South Atlantic, with bycatch in fisheries identified as the main driver. Conservation of these species will depend on all relevant fisheries – not just EU-flagged vessels – minimising their bycatch.
In terms of overall approach to its role in the RFMOs, the ECPOA needs to set the framework for the EU to do the following:

7.1 Apply common standards at home and abroad

In terms of mitigating bycatch, the EU should be as scrupulous and progressive in regard to setting best practice standards for its vessels fishing externally to Community waters as it does for its vessels operating internally. Requirements for applying mitigation measures externally must be as strong as those applied internally, and should not just follow the minimum requirements required by RFMOs. At least some such actions could be taken independently by the EU while others may need to be adopted and implemented through the appropriate RFMO.

In the context of the ECPOA, the European Commission should ensure that standards developed for vessels fishing in Community waters also apply to EU-flagged vessels fishing in external waters, and also, to the extent possible, to vessels flagged to non-EU States but owned or controlled by EU-based owners and operators.

7.2 Lead in bycatch reduction in RFMOs

In recent years the EU has taken the lead in proposing the need for seabird bycatch mitigation measures in a number of RFMOs. The EU has also led on establishing requirements for RFMO observer programmes, through which seabird bycatch data are collected. The EU should maintain this proactive role and continue to push for new measures where these are needed. The EU should also ensure compliance with existing and new RFMO measures, and make these data publicly accessible.

7.3 Specific areas in need of action

Apart from CCAMLR which has a long history of ecosystem-based management, five RFMOs (ICCAT, IOTC, WCPFC, SEAFO and IATTC) have now passed seabird bycatch mitigation requirements. All five have recommended their members to implement NPOA-Seabirds. However, much remains to be done to translate this rhetoric into operationally effective measures. In terms of the FAO Best Practice Technical Guidelines, the following are key areas of specific policy where the EU can and should be promoting:

7.3.1 Development of observer programmes and supporting data collection protocols

Observers need to be placed on a sufficiently representative sample of vessels, and observe sufficient hooks being set, to achieve a realistic assessment of seabird

bycatch. As reported in WGSE (2008), experience elsewhere in the world demonstrates that observing at least 10% of hooks set will enable detection of (a) whether a bycatch problem exists, (b) sea areas where more data are needed. But once a problem is detected, observers are needed on at least 20-30% of vessels in order to monitor bycatch accurately. In the recent past, the EC has called for observer coverage of at least 5% (IOTC) and 10% (IATTC).

Recommendation: The EU should promote 10% coverage as an absolute minimum in the short term (assessment period) and at least 20% in the medium-long term if there is evidence of significant bycatch.

7.3.2 Progressive improvement of seabird bycatch mitigation requirements

Mitigation measures must be subject to innovation and adaptive change as research and operational experience yield fresh insights and new data. For example, when the WCPFC mitigation measure was adopted in 2006, it was recognised that this was an interim first step and that further improvements would be needed. In particular, some of the mitigation measures offered as options for pelagic longlining were known to be relatively weak (e.g. line shooter, bait caster) or still under development (e.g. underwater setting chute).

Since the WCPFC measure was adopted, measures have been adopted in IOTC and SEAFO, with the support of the EU. In both cases, measures represent an improvement on the WCPFC measure, and a next step is to promote these same improvements in ICCAT, IATTC and WCPFC.

Recommendations: The EU should:

- press for further refinement of mitigation requirements to ensure that seabird bycatch mitigation is as effective as possible
- to this end, support research on improving seabird bycatch mitigation measures, especially for pelagic longline fisheries
- be proactive in translating best practice adopted in one RFMO to adoption in others, as appropriate

7.3.3 Development of RFMO Plans of Action

Recommendation: The EU should encourage RFMOs, both through direct request and via the FAO, to develop regional plans of action-seabirds, consistent with the FAO Best Practice Technical Guidelines. These should apply to all fisheries which incur bycatch and should incorporate all necessary elements including assessment, data collection, mitigation requirements, mechanisms to allow monitoring and compliance, education, and observer training.

Annex

Economic benefits of mitigating seabird bycatch

The development and testing of mitigation measures is only the first step towards solving the problem of seabird bycatch. Securing support for regulation or licensing conditions is part of the answer but achieving at-sea adoption and compliance is the final and most challenging step. This invariably requires an incentive for fishermen if they are to buy in to adopting measures as a routine part of their fishing operations.

In encouraging adoption, at both political and operational levels, of mitigation measures, it is therefore important to recognise that adopting them yields economic incentives to longline fishermen. This presents a powerful argument for adoption and compliance beyond the conservation objectives. Seabirds are hooked whilst stealing bait from hooks. Because birds often become adept at bait-snatching without getting hooked, many more baits are successfully taken than seabirds are caught. For example, studies conducted in Chile and by Nigel Brothers have suggested that between 20-30 baits are successfully taken for each albatross finally hooked. Moreover, unbaited hooks cannot catch fish and effectively reduce fishing effort. Any mitigation measure that can reduce the number of foraging attempts on baited hooks will therefore not only reduce seabird mortality but will increase the number of baited hooks set and therefore the catch of fish.

Quantitative evidence is emerging from various studies around the world to show that mitigating seabird bycatch in longline fisheries can yield economic gains for fishermen in terms of reduced bait loss and increased fish catch. In general, there is a smaller direct cost incurred by bait loss to seabirds and a large indirect one from the resulting loss of fish which could potentially have been caught on those baited hooks.

The economic cost of bait loss alone can be substantial. A study[20] of unmitigated demersal longlining in Norway with Northern Fulmar showed that bait loss can be as high as 70%. In a 2008 study[21] of Japanese pelagic longlining for bluefin tuna in the New Zealand EEZ off Fiordland, bait loss to seabirds in different observation periods ranged from 14.7 – 15.9%. The authors conclude that bait loss on this scale '*could have huge negative consequences for the fishing operation – a clear example of a no-win situation*'.

[20] Løkkeborg, S and Bjordal, Å (1992) *Reduced bait loss and bycatch of seabirds in longlining by using a bird scarer*. Document to Working Group FSA-92 CCAMLR, Hobart, Australia Pp 5.

[21] Melvin, EF and Walker, N (2008) *Optimising tori line designs for pelagic tuna longline fisheries*. Report of work under New Zealand Ministry of Fisheries Special Permit 355. Pp 8.

Falklands Islands demersal longline fishery
Munro[22] analysed data for 2 Falkland Islands longline vessels targeting Patagonian toothfish over ten years, 1994-2003. The cost of bait loss and foregone catches (reduced effort) was calculated for each mortality rate of seabirds, enabling an estimate of the benefit that would have been accrued through improved baiting percentage and fishing effort. This analysis showed that in a fishery of 8,000,000 hooks the annual benefit to fishermen of using mitigation measures was approximately US$200,000. Over the 10 year history of longlining in the Falklands this amounts to US$2 million in increased revenue. In order to make this analysis applicable to other toothfish fisheries, these figures were extrapolated to units of 1 million hooks with a calculation of the benefits of reducing the mortality rate by 0.1 bird/1000 hooks and 0.01 bird/1000 hooks. For each 1 million hooks a reduction in mortality rate of 0.1 bird/1000 hooks would raise an additional US$5025 of revenue.

While most studies show a positive result for seabird bycatch mitigation, however, not all show a statistically significant differences in fish catch. The following table adds to a review by Raichoudhury (2007)[23] of a number of studies comparing the impact on target fish catch in a variety of fisheries employing a range of mitigation measures:

Table: *Summary of studies showing the impact of various mitigation measures on seabird bycatch, bait loss and fish catch. ↓ = reduced, ↑ = increased, + = not recorded or reported.*

Study/fishery	Where &target fish	Mitigation measures	Impact on seabirds	Impact on fish catch
Løkkeborg 2003 DL	Norway Torsk, ling, etc	Bird-scaring line	↓98-100%	↑32% catch (in 1 of 3 cruises)
Munro 2003 (see boxed text) DL	Falkland Is Patagonian toothfish	Range of measures 1994-2003	↓ 99% (?) seabird bycatch	↓bait loss; value of increased catch almost $200,000/year
Robertson et al 2006 DL	New Zealand Ling	Unweighted longline vs IWL	↓ seabird bycatch 98.7% in 2002 and 93.5% in 2003.	Not statistically different
Robertson et al 2006	Heard Island Patagonian	Unweighted longline vs	+ (but significant	Not statistically different

[22] Munro, G (2003) *The potential economic benefit to fishermen of using mitigation measures to reduce bait loss*. Presentation to Futruno/Valdivia workshop, Chile, 2-6 Dec 2003.

[23] Raichoudhury, A (2007), *A cost-benefit analysis of the mitigation measures available to reduce the bycatch of albatrosses due to longline fishing vessels.* MSC dissertation, UCL, London.

DL	toothfish	IWL	reduction in similar study at Kerguelen I (T Micol))	
Robertson et al 2006 DL	Heard Island Patagonian toothfish	Unweighted longline + weight vs. IWL	+	↑34% target catch
Melvin and Dietrich 2005 DL	North Pacific groundfish	Unweighted longline + weight vs IWL	↓	Not statistically different
Melvin et al 2005 (unpubl) DL	Alaska IFQ sablefish	Paired bird-scaring lines vs none	↓88-100% seabird bycatch	Not statistically different
Melvin et al 2005 (unpubl) DL	Alaska Pacific Cod	Paired bird-scaring lines vs none	↓94% seabird bycatch	Not statistically different
Brothers 1991 PL	Southern Ocean Bluefin tuna	Bird-scaring line vs. none	↓ seabird bycatch	↓up to 69% loss of bait; value of annual catch foregone $A7.2 million[24] (£3.2m)
BirdLife 2008 PL	S. Brazil Swordfish/tuna	Bird-scaring line vs none	↓55%	↑18.1% catch

Acronyms:
ATF = Albatross Task Force
DL = Demersal Longline
IFQ = Individual Fishing Quota
IWL = Integrated Weight Line
NEMA = Núcleo de Educação e Monitoramente Ambiental
PL = Pelagic longline

There are possible benefits beyond increases in target catch and reduction in bait being taken. Integrated weight(IW) longlines are safer to use than an external weight line, which could result in lower costs associated with injuries. IW lines take less time to set than external weights – one estimate is that a 10-20% increase in haulage can be achieved through using IW lines.

Costs

There are some costs to fishers associated with seabird mitigation measures. IW lines may be 12.5-17% more expensive than lines with external weights; another

[24] Brothers' original estimate of $A4.9m transformed to 2007 equivalent.

calculation estimated that IW lines were 14-23% more expensive than unweighted longlines (cited in Raichoudhury 2007). Streamer lines can be made from materials found on the fishing vessels. If they are bought commercially, they cost between $50-150 a pair. Usually these can be attached to the boat without additional expense but costs will be incurred if a davit has to be fitted. However, the costs of all of these measures are relatively trivial compared to the running costs of a fishing vessel.

Implications for the ECPOA

These studies show unequivocally the efficacy of mitigation measures in reducing seabird bycatch, both in demersal and pelagic longline and fisheries. It is expected that similar gains would be made by EC vessels operating in Community and external waters. Economic benefits are demonstrated to be two-fold: reduced loss of expensive bait and increased fish catch. Gains in one or both of these are demonstrated in half the studies. Two studies (Munro, Brothers) estimate the benefits at fleet level, showing massive financial gains for the implementation of relative simple technical fixes (see also Robertson et al 2006 for similar extrapolation from a 34% increase in catch).

Where no benefit to fish catch rate is shown, there may be reasons for this. In some cases the author points to relatively small sample sizes, in others the local conditions and foraging behaviour of the target fish are likely to have played a part. Where there was no clear benefit, authors were (without exception) at pains to point out that applying mitigating measures, especially integrated weighted lines, at the very least were not *detrimental* to rates of fish catch.

While bait costs may be absorbed by large offshore operators, the loss may be a much more significant overhead for artisanal fishermen. On the other hand, such fishermen may be unable to justify implementing measures if they are costly and show little private benefit, particularly if they are already struggling for income. This has clear relevance to the Mediterranean which is characterised by a disproportionate number of small, coastal vessels operating on tight margins. This is an area where the European Fisheries Fund's priority of adaptation to more environmentally-selective gear has clear potential benefit.

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