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Studies of distribution, population dynamics and bycatch rates of seabirds in the Atlantic

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In order to inform discussion on potential methodology and data availability for an assessment of the impacts of ICCAT fisheries on seabirds, we provide an inventory of relevant published studies of seabirds. These include (i) the results of tracking of at-sea distribution of seabirds in the Atlantic using satellite-transmitters and geolocators, (ii) studies of population size, status and demography (estimates of vital rates) of Atlantic seabirds, (iii) studies of seabird bycatch rates in ICCAT and adjacent fisheries and (iv) various approaches to estimating total seabird bycatch and the modeling of impacts of incidental mortality on seabird populations. Summary tables are provided for (i)-(iii) above, and original publications for (i)-(iv), where available.

In accordance with the resolution by the International Commission for the Conservation of Atlantic Tunas (ICCAT) on Incidental Mortality of Seabirds (Res. 02-14), the ICCAT Sub-committee on Ecosystems is holding an inter-sessional meeting with a number of objectives, including (4.3) "Assessment of the mortality of sea birds in the ICCAT fisheries (in accordance with the *Resolution on Incidental Mortality of Seabirds [Res. 02-14]*. In preparation for this meeting, a draft assessment framework and a description of available sea bird information could be prepared by a sea bird expert. Similarly, a description of available fisheries information (from ICCAT) would be helpful." (Circular # 2370/06). This document provides background information on published, unpublished and ongoing studies of at-sea distribution, population dynamics and bycatch rates of seabirds likely to be caught in ICCAT fisheries. In addition, it includes a list of published studies estimating total bycatch and modeling the effects of bycatch on seabird populations to illustrate the range of methodologies used.

An inventory of studies of at-sea distribution and population size, status and demography is provided in Table 1. Several points are worth mentioning here:

- Only those studies that are the most recent and of highest relevance for the ACAP species are shown in the table. However, other data may be available, including further published studies for non-ACAP species, and other information in book chapters, minor journals or grey literature for all species.
- Most of the unpublished or ongoing tracking studies have deployed geolocators (GLS loggers) to enable the mapping of nonbreeding distributions of albatrosses and large petrels. Although the devices may have been recovered, such data typically require considerable post-processing.
- As far as we are aware, the only detailed information on the at-sea distribution of juveniles/immatures likely to overlap with ICCAT fisheries is unpublished data from fledgling

wandering, black-browed and grey-headed albatrosses from South Georgia (British Antarctic Survey, UK) and fledgling shy albatrosses from Tasmania (Department of Primary Industries and Water, Australia).

- Coarser scale information on bird distribution is often available from general range maps, at-sea sightings and ringing recoveries.
- The cited studies of population size and status are mainly those that involved regular monitoring of the same colonies. Other estimates of total population size exist but these may be unreliable and/or decades out of date.
- Data on population status may relate to a relatively small proportion of the total breeding population. Some estimates of trends are thus based on small samples and potentially unrepresentative.
- Some of the cited demographic studies may not have measured rates of juvenile survival or immigration/emigration.

An inventory of published and unpublished studies of seabird bycatch rates in Atlantic fisheries is provided in Table 2.

- Only those studies that are the most recent and of highest relevance are shown in the table.
- The information presented aims to be as comprehensive as possible, though it is possible that further (primarily unpublished) studies exist.
- Countries which have been identified to undertake long-line fisheries in the Mediterranean Sea but for which no seabird bycatch data are available include: Algeria, Cyprus, France, Greece, Italy, Japan, Korea, Libya, Malta, Morocco, Taiwan, Tunisia and Turkey (Cooper et al., 2003)

An inventory of published studies that have estimated the impacts of bycatch on seabird populations is provided in Table 3. PDFs of published studies that have used different approaches to estimate total seabird bycatch and to model the impacts of incidental mortality on seabird populations will also be made available at the meeting.

Table 1. Published and unpublished studies of at-sea distribution, population size, status and demography of seabirds likely to be caught in ICCAT fisheries.

N/A - Not applicable; U – Unpublished data (devices retrieved but data not yet analysed/data exist but unpublished); O – ongoing study (devices not yet recovered); En – Endangered; Vu – Vulnerable; NT – Near Threatened; LC – Least Concern; BAS – British Antarctic Survey (UK); UCT – University of Cape Town, (South Africa); RSPB – Royal Society for the Protection of Birds (UK); DPIW - Department of Primary Industries and Water (Australia); FC – Falklands Conservation (Falklands); UAdeC – Universidad Austral de Chile (Chile); PO - Polar Oceans Research Group (USA); CONICET – Centro Nacional Patagonico; CEFE - Centre d'Ecologie Fonctionnelle et Evolutive (France); CEBC – Centre d'Etudes Biologiques de Chizé; UB – University of Barcelona; UO – University of Oxford; UA – University of Aberdeen.

Species	**Breeds in Atlantic /Migrant**	**IUCN status**	**ACAP Sp.**	**Breeding island group**	**Overlap with ICCAT**	**Distribution: - adults (breeding)**	**Distribution - adults (nonbreeding)**	**Population size and status**	**Demography**
Wandering albatross *Diomedea exulans*	B	Vu	Y	South Georgia	High	Prince et al. 1998, Xavier et al. 2004	U,O (BAS)	Croxall et al. 1998, Poncet et al. 2006, U (BAS)	Croxall et al. 1998
	M	Vu	Y	Prince Edward	Low	N/A	U,O (UCT)	Nel et al. 2002, Crawford et al. 2003, U (UCT)	Nel et al. 2003, U (UCT)
Tristan albatross *Diomedea dabbenena*	B	En	Y	Tristan da Cunha	High	Cuthbert et al. 2005	U (RSPB/UCT)	Cuthbert et al. 2004, U (RSPB/UCT)	Cuthbert et al. 2004, U (RSPB/UCT)
Northern royal albatross *Diomedea sanfordi*	M	En	Y	Chatham	Low	N/A	Nicholls et al. 2002		
Southern royal albatross *Diomedea epomophora*	M	Vu	Y	Campbell	Low	N/A			
Shy albatross *Thalassarche cauta*	M	NT	Y	Tasmania	Low	N/A	U,O (DPIWE)	U (DPIW)	U (DPIW)
White-capped albatross *Thalassarche steadi*	M	NT	Y	Auckland	Low	N/A	O (NIWA) O (UCT)		
Black-browed albatross *Thalassarche melanophrys*	B	En	Y	Falklands	High	Grémillet et al. 2000, Huin 2002	Grémillet et al. 2000, U (FC)	U (FC)	
	B	En	Y	South Georgia	High	Prince et al. 1998, Phillips et al. 2004	Phillips et al. 2005b O (UCT)	Prince et al. 1994, Croxall et al. 1998, Arnold et al. 2006	Prince et al. 1994, Croxall et al. 1998
	M	En	Y	Chile	Low	N/A?	U (BAS, UAdeC)	Arata et al. 2003, Lawton et al. 2003	
	M	En	Y	Kerguelen	Low	N/A		Pinaud & Weimerskirch 2002, Nevoux et al. 2007	Pinaud & Weimerskirch 2002, Nevoux et al. 2007
Grey-headed albatross *Thalassarche chrysostoma*	B	Vu	Y	South Georgia	High	Prince et al. 1998, Xavier et al. 2003, Phillips et al. 2004	Croxall et al. 2005	Prince et al. 1994, Croxall et al. 1998	Prince et al. 1994, Croxall et al. 1998
	M	Vu	Y	Chile	Low	U (UadeC, AAD)	U (UadeC, AAD)		
	M	Vu	Y	Prince Edward	Low	N/A	U (UCT)	Nel et al. 2002, Crawford et al. 2003, U (UCT)	Ryan et al. 2007, U (UCT)
Atlantic yellow-nosed albatross *Thalassarche chlororhynchos*	B	En	Y	Tristan da Cunha	High	U,O (RSPB/UCT)	U,O (RSPB/UCT)	Cuthbert et al. 2003, Cuthbert & Sommer 2004, U (RSPB/UCT)	Cuthbert et al. 2003, U (RSPB/UCT)

Species	Breeds in Atlantic /Migrant	IUCN status	ACAP Sp.	Breeding island group	Overlap with ICCAT	Distribution: - adults (breeding)	Distribution - adults (nonbreeding)	Population size and status	Demography
Sooty albatross *Phoebetria fusca*	B	En	Y	Tristan da Cunha	High	U,O (RSPB/UCT)	U,O (RSPB/UCT)	Cuthbert & Sommer 2004	
Light-mantled albatross *Phoebetria palpebrata*	B	NT	Y	South Georgia	Low	Phillips et al. 2005a	U (BAS)		
Southern giant petrel *Macronectes giganteus*	B	NT	Y	Falklands	High?			U (FC)	
	B	NT	Y	South Georgia	Low	González-Solís et al. 2000, U (BAS)	González-Solís & Croxall 2005	U (BAS)	U (BAS)
	B	NT	Y	South Sandwich	Low?				
	B	NT	Y	Argentina	High?	Quintana & Dell'Arciprete 2002, U (CONICET)	U (CONICET)	Quintana et al. 2006, U (CONICET)	
	B	NT	Y	Chile	High?				
	B	NT	Y	South Orkneys	Low?			U (BAS)	
	B	NT	Y	South Shetlands /Antarctic Peninsula	Low?	U (PO)	U (PO)	U (PO)	U (PO)
	B	NT	Y	Tristan da Cunha	High			Cuthbert & Sommer 2004	
Northern giant petrel *Macronectes halli*	B	NT	Y	South Georgia	Low	González-Solís et al. 2000, U (BAS)	González-Solís & Croxall 2005		
White-chinned petrel *Procellaria aequinoctialis*	B	Vu	Y	South Georgia	High	Phillips et al. 2006	Phillips et al. 2006	Berrow et al. 2000	
	M	Vu	Y	Prince Edward	Low	N/A		Nel et al. 2002, U (UCT)	U (UCT)
	M	Vu	Y	Crozet	Low	N/A		Jouventin et al. 2004, U (CEBC/CEFE?)	U (CEBC/CEFE?)
	M	Vu	Y	Kerguelen	Low	N/A	O (CNRS)	U (CNRS)	U (CNRS)
Spectacled petrel *Procellaria conspicillata*	B	Vu	Y	Tristan da Cunha	High	O (RSPB)	O (RSPB)	Ryan et al. 2006	
Grey petrel *Procellaria cinerea*	B	NT	Y	Tristan da Cunha	High				
	M?	NT	Y	Prince Edward	?	N/A			
	M?	NT	Y	Crozet	?	N/A			
	M?	NT	Y	Kerguelen	?	N/A			
Cape petrel *Daption capense*	B	LC	N	Many colonies	?	N/A			
Northern fulmar *Fulmarus glacialis*	B	LC	N	Many colonies	?	Yes (details to be added)	O (UA)	Yes (details to be added)	Yes (details to be added)

Species	Breeds in Atlantic /Migrant	IUCN status	ACAP Sp.	Breeding island group	Overlap with ICCAT	Distribution: - adults (breeding)	Distribution - adults (nonbreeding)	Population size and status	Demography
Cory's shearwater *Calonectris diomedea*	B	LC	N	Many colonies	High	Yes (details to be added)	U (UB)	Granadeiro et al.. 2006 plus others	Yes (details to be added)
Cape Verde Shearwater *Calonectris edwardsii*	B	NT	N	Cape Verdes	High				
Manx shearwater *Puffinus puffinus*	B	LC	N	Many colonies	High	U,O (UO)	O (UO)	Yes (details to be added)	Yes (details to be added)
Balearic shearwater *Puffinus mauritanicus*	B	Cr	N	Balearics	High				Oro et al. 2004
Yelkouan shearwater *Puffinus yelkoan*	B	LC	N	Mediterranean	High				
Great shearwater *Puffinus gravis*	B	LC	N	Tristan da Cunha	High				
Sooty shearwater *Puffinus griseus*	B	NT	N	Falklands	High				
Little shearwater *Puffinus assimilis*	B	LC	N	North Atlantic	High		O (UO)?		
Audubon's shearwater *Puffinus lherminieri*	B	LC	N	Caribbean	High				
Black-capped petrel *Pterodroma hasitata*	B	Vu	N	Caribbean	High				
Bermuda petrel *Pterodroma cahow*	B	En	N	Bermuda	High				
Atlantic petrel *Pterodroma incerta*	B	Vu	N	Tristan da Cunha	High				
Great-winged petrel *Pterodroma macroptera*	B	LC	N	Tristan da Cunha	High				

Table 2. Studies of seabird bycatch rates in Atlantic fisheries.

Fishery type: P = Pelagic, D = Demersal.Fishery target species: T = Tuna species, SF = Swordfish, BF = Billfish species, S = Shark species
Mitigation measures: TL = Tori Lines, NS = Night Setting, BDB = Blue-dyed bait, WL = weighted lines, Au = Autosetting, UF = unfrozen bait
Data collection method: OBO = On-board observers, SF = Surveys of Fisherfolk, ME = Mitigation Experiment, LB = Log Books, RS = Research Study

Country of fishery	**EEZ or High Seas** (HS)	**Flag State of fishing vessels**	**Location of fishery**	**Fishery type**	**Fishery target species**	**Fishery active** (months)	**Fishing Effort** (hooks/year)	**Estimated average seabird annual bycatch rate** (birds/1000 hooks)	**Range of estimated annual seabird bycatch rate (S.D.)** (birds/1000 hooks)	**Estimated annual seabird bycatch** (individuals)	**Range of estimated annual seabird bycatch (S.D.)** (individuals)	**Estimated annual albatross bycatch** (individuals)	**Estimated annual petrel bycatch** (individuals)	**Estimated annual shearwater bycatch** (individuals)	**Species-specific data available?**	**Mitigation measures**	**Est' seabird bycatch rate with mitigation measures** (birds/1000 hooks)	**Est' seabird bycatch rate without mitigation measures** (birds/1000 hooks)	**Data collection period**	**Data collection method**	**Observed data sample size**	**Sources**	**Comments**
Brazil	EEZ			P	T SF BF				0.09-1.35	6656	4502-8325	3287	3652	122	Y	Testing various			1991, 1994–1995, 1997, 1998	OBO SF		Neves 2001; Olmos et al. 2000	Mitigations being tested - BDB, NS, TL, artificial squid; Plans for observer programme, in compliance with ICCAT
Brazil	EEZ HS	Brazil		P	T SF S	year-round		0.12							Y	NS			1994-1995	LB SF	38% of fleet	Neves & Olmos, 1997	Bycatch rate likely an underestimate - some dead birds unreported in log books & does not account for unmonitored foreign vessels
Brazil				P	T			0.27	0.00-6						Y	Some inc. BDB NS	0.27		2002-2003	RS	5 cruises, 64150 hooks	Soto et al., 2003 data in Projeto Albatroz, 2006;	Very small sample size, containing some inaccuracies - bycatch rate likely too high
Brazil				P	T SF S			0.09	0-2.7						N				2000-2005	OBO		Neves et al. data in Projeto Albatroz, 2006	
Brazil	EEZ HS	Brazil & various foreign		P	T SF S			0.09							Y	Some inc. BDB TL			2000-2005	OBO	371368 hooks	Neves et al., 2005	
Brazil				P	T SF S			0							N	None			2005	OBO		Projeto Albatroz, 2006	

Country of fishery	EEZ or High Seas (HS)	Flag State of fishing vessels	Location of fishery	Fishery type	Fishery target species	Fishery active (months)	Fishing Effort (hooks/year)	Estimated average seabird annual bycatch rate (birds/1000 hooks)	Range of estimated annual seabird bycatch rate (S.D.) (birds/1000 hooks)	Estimated annual seabird bycatch (individuals)	Range of estimated annual seabird bycatch (S.D.) (individuals)	Estimated annual albatross bycatch (individuals)	Estimated annual petrel bycatch (individuals)	Estimated annual shearwater bycatch (individuals)	Species-specific data available?	Mitigation measures	Est' seabird bycatch rate with mitigation measures (birds/1000 hooks)	Est' seabird bycatch rate without mitigation measures (birds/1000 hooks)	Data collection period	Data collection method	Observed data sample size	Sources	Comments
Brazil				P	T			1.35	0-97.9										1987-1990		52,593	Vaske 1991	Winter months. CPUE of 97.9 based on set of 1205 hooks.
Brazil	EEZ HS	Brazil	S Atlantic	P				0.07							Y				2000-2005	OBO	499978 hooks	Neves et al., 2006	
Brazil	EEZ			P	T SF S										N	BDB; TL; BDB & TL	0.00; 0.00; 0.00	3.3	2003	ME		Olmos & Neves, 2003	Small sample size
Brazil	EEZ	Various foreign (inc. China, Spain)		P	T	Oct-Apr; May-Sep				68				27	N				2005	OBO		Neves et al., 2006	
Canada	EEZ	Canada	Gulf of St. Lawrence						0.0036 - 0.0108						N				2001	OBO	976 sets (976000-3025600 hooks)	Canadian NPOA, 2007	Further data available but no annual figures
Japan		Japan	S Atlantic					0.19							N	TL	0.19		2001			Real Time Monitoring data in BirdLife, 2005	
Japan		Japan	S Atlantic					0.31							N	TL	0.31		2001-2			Kiyota & Takeuchi, 2004 data in BirdLife, 2005	
Japan	HS	Japan	S Africa, S Atlantic												N	BDB TL	0.0-0.5; 0.75-1.5	3.3-4.0	2001-2002	OBO		Minami & Kiyota, 2004	

Country of fishery	EEZ or High Seas (HS)	Flag State of fishing vessels	Location of fishery	Fishery type	Fishery target species	Fishery active (months)	Fishing Effort (hooks/year)	Estimated average seabird annual bycatch rate (birds/1000 hooks)	Range of estimated annual seabird bycatch rate (S.D.) (birds/1000 hooks)	Estimated annual seabird bycatch (individuals)	Range of estimated annual seabird bycatch (S.D.) (individuals)	Estimated annual albatross bycatch (individuals)	Estimated annual petrel bycatch (individuals)	Estimated annual shearwater bycatch (individuals)	Species-specific data available?	Mitigation measures	Est' seabird bycatch rate with mitigation measures (birds/1000 hooks)	Est' seabird bycatch rate without mitigation measures (birds/1000 hooks)	Data collection period	Data collection method	Observed data sample size	Sources	Comments
South Africa	EEZ	South Africa			T		460000	0.77 (0.48 off W. coast, 0.97 off S. coast)	0.0-4.3	354					Y	94% NS			1998-2000	OBO	80,039 (31,325 W. coast, 48,714 S. coast)	Ryan et al. 2002	
South Africa	EEZ	Japan			T		6601000	4.46	0.1-5.4	17427					Y	100% NS			1998-2000	OBO	37,001	Ryan et al. 2002	
South Africa	EEZ	South Africa		P	T SF S		2100000	0.18	0.0-1.16	388		271.6	100.88		Y	limited			2000-2003	OBO	11% hooks	Peterson 2005	No data on bycatch from foreign vessels
Spain	EEZ		Columbretes Islands, Mediterranean	P (small boats)	SF		2300000	0.25	(0.5)						Y	no offal discards			1998	OBO	40088	Belda & Sanchez, 2001	Estimated annual bycatch of 656-2829 is for pelagic & demersal combined, 437-1867 Cory's shearwaters (66%); 7 bycatch species
Spain		Spain	Western Mediterranean	P & Semi-P	T SF			0.0133	0-0.0234						Y	none			1999-2000	OBO	1573400 hooks, 557 sets	Valeiras & Caminas, 2003	Data covers the 'Spanish drifting longline fleet'
Taiwan	HS	Taiwan	Southern Ocean, Pacific, Atlantic & Indian oceans		Ts		3410000000 ; 45000000	0.032		1440					Y				1999			Huang & Day 2001; Hsia. 2002	various mitigations - compliance unknown, inc. tori lines, weighted baits, bait casting machine, nightsetting, thawed bait, offal management
Taiwan	HS	Taiwan	Atlantic													TL	0.0353	0.1467	2000			T.F. Hsia, pers.comm.	

Country of fishery	EEZ or High Seas (HS)	Flag State of fishing vessels	Location of fishery	Fishery type	Fishery target species	Fishery active (months)	Fishing Effort (hooks/year)	Estimated average seabird annual bycatch rate (birds/1000 hooks)	Range of estimated annual seabird bycatch rate (S.D.) (birds/1000 hooks)	Estimated annual seabird bycatch (individuals)	Range of estimated annual seabird bycatch (S.D.) (individuals)	Estimated annual albatross bycatch (individuals)	Estimated annual petrel bycatch (individuals)	Estimated annual shearwater bycatch (individuals)	Species-specific data available?	Mitigation measures	Est' seabird bycatch rate with mitigation measures (birds/1000 hooks)	Est' seabird bycatch rate without mitigation measures (birds/1000 hooks)	Data collection period	Data collection method	Observed data sample size	Sources	Comments
UK		Various	Tristan da Cunha	P	T				0.017-0.020		471-554	471-554							1990-1998			Cuthbert et al., 2005	Study of satellite tracked breeding Tristan Albatross' (2001) related to fisheries bycatch data rates from BRAZIL & S AFRICA (NOT Tristan da Cunha)
UK			Tristan da Cunha					>1							N							Glass et al., 2000 data presented in BirdLife, 2005	
Uruguay				P	T	Mar-May, July-Augu, Sept-Oct		4.7								80g swivel			1993-4	OBO	23,364	Stagi et al. 1998	
Uruguay	EEZ			P	T SF	Mar-May Jul-Oct	20000000	<0.3		6000					Y	TL NS			1998	OBO		Stagi 2001; Tuck et al. in press	Mainly in EEZ, some effort just outside
Uruguay	EEZ HS			P	T SF			0.42	0.04-1.65						Y				1998-2004	OBO	647722 hooks	Jimenez, 2005	
Uruguay	EEZ HS			P	T SF			0.26							Y				1998-2006	OBO	2242026 hooks	Jimenez & Domingo, 2006	12 bird species caught as bycatch, mainly albatrosses & petrels
USA		USA	NW Atlantic, Gulf of Mexico, Carrib.	P	T SF S		9793 sets			128					N				2004	OBO LB		Hata, 2006	Bycatch affects black-capped petrel, Bermuda petrel, Audubon's shearwater (Hunter, 2004, USFWS - reference unavailable)

Table 3. Studies of the effects of bycatch on seabird populations.

Species	**Breeding population**	**Reference**
Black-footed albatross *Phoebastria nigripes*	All (north Pacific)	Lewison & Crowder 2003
Flesh-footed shearwater *Puffinus carneipes*	Lord Howe Island (Australia)	Baker & Wise 2005
Tristan albatross *Diomedea dabbenena*	Gough Island (Tristan da Cunha)	Cuthbert et al. 2005
Wandering albatross *Diomedea exulans*	Marion Island (Prince Edward Islands)	Nel et al. 2003
Wandering albatross *Diomedea exulans*	South Georgia Crozet	Tuck et al. 2001
Amsterdam albatross *Diomedea amsterdamensis*	Amsterdam Island	Inchausti & Weimerskirch 2001
Waved albatross *Phoebetria irrorata*	Isla Española (Galápagos Islands)	Awkerman et al. 2006

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SEABIRD ASSESSMENT METHODOLOGY: EXTRACT FROM THE REPORT OF THE 2007 MEETING OF THE SUB-COMMITTEE ON ECOSYSTEMS
Madrid, Spain - February 19 to 23, 2007

3.2 Assessment of the impact of ICCAT fisheries on seabird populations

The meeting considered the proposed framework for the seabird assessment (SCRS/2007/030). The framework proposes six objectives, which would form six stages of the assessment, as follows, (1) Identify seabird species most at risk from fishing in the ICCAT Convention Area, (2) Collate available data on at-sea distribution of these species, (3) Analyze the spatial and temporal overlap between species distribution and ICCAT longline fishing effort, (4) Review existing bycatch rate estimates for ICCAT longline fisheries, (5) Estimate total annual seabird bycatch (number of birds) in the ICCAT Convention Area, and (6) Assess the likely impact of this bycatch on seabird populations.

Reference was made to the Ecological Risk Assessment (ERA) methodology developed in Australia that is also being applied in the Western and Central Pacific Fisheries Commission (WCPFC-SC2-2006/EB WP-14). The six objectives proposed are consistent with an ERA approach: the material prepared for this meeting (SCRS/2007/029 & SCRS/2007/030) relate to a pre-ERA scoping stage, Objectives 2-4 in the proposed framework relate to ERA Level 2, and Objectives 5-6 relate to ERA Level 3 (Figure 1 from WCPFC-SC2-2006/EB WP-14). It was noted that each step of the ERA may lead to a management response which may affect the results of the subsequent levels.

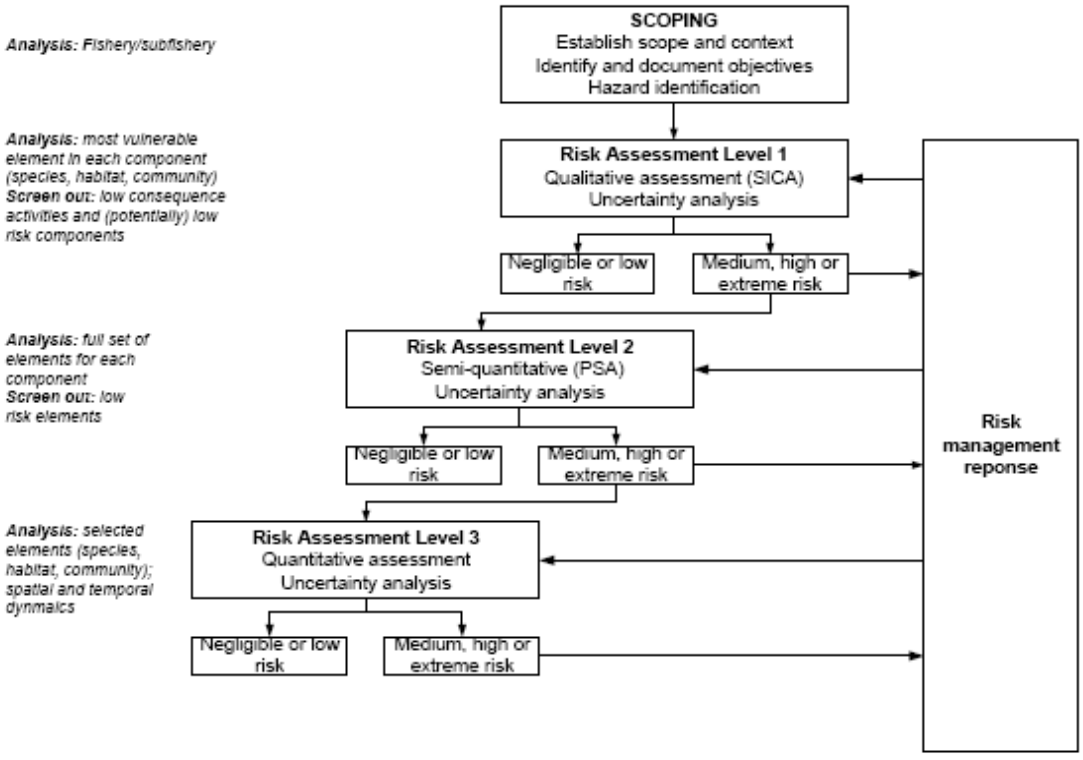

Fig. 3.1. Overview of Ecological Risk Assessment Effects of Fishing (ERAEF) showing focus of analysis for each level at the left in italics (Fig. 1 in WCPFC-SC2-2006/EW WP-14)

The meeting agreed to work to advance the stages of the seabird assessment as follows:

Objective 1: Identify seabird species most at risk from fishing in the ICCAT Convention Area

A preliminary risk prioritization exercise was carried out during the meeting. The prioritization was based on the characteristics of seabird species known or likely to be caught in ICCAT fisheries (Table 1 in SCRS/2007/029/REV). Attributes of each breeding population were converted to a numerical score, as follows: (a) global IUCN status - Critically endangered/Endangered = 3, Vulnerable = 2, Near Threatened = 1 and Least

Concern = 0; (b) breeding population status – rapid decline/unknown = 3, decline = 2, stable = 1, increase =0; (c) degree of overlap with ICCAT fisheries – high/unknown = 3, medium = 2, low = 1; (d) behavioural susceptibility to capture - high =3, low = 1, and; (e) life-history strategy - biennial breeder, single egg clutch = 3, annual breeder, single egg clutch = 2, annual breeder, multiple egg clutch = 1 (**Table 3.1**). For this application, the highest risk score was allocated where data were unknown or uncertain and thus for those cases, the risk scoring is precautionary. Level of land-based threat was not used in this exercise.

Three algorithms were used to calculate relative risk: (1) the sum of the five attributes (a)-(e) outlined above; (2) the sum of attributes (b)-(e), i.e. excluding global IUCN status, which duplicates population status to some extent; (3) the Euclidean distance to the origin of an integrated index of potential susceptibility to ICCAT fisheries (the mean of overlap with ICCAT and behavioural susceptibility to fisheries) plotted against life-history strategy. This third method is comparable to a Productivity-Susceptibility Assessment within a Level 2 ERA (Ecological Risk Assessment).

Results of this exercise are shown in **Table 3.1.** Populations were considered High Priority at arbitrary cut-offs of >=10, >=9 and >=3.16 for algorithms (1), (2) and (3), respectively (shaded in **Table 3.1**). Rankings using these different approaches were very similar, with 22 populations (16 spp.) considered High Priority according to all three algorithms, eight populations (8 spp.) according to two, and a further 11 populations (9 spp.) according to one algorithm. Overall, 41 populations (63% of populations under consideration) of 28 spp. (68% of species under consideration) were considered High Priority.

For eight of the High Priority populations, overlap with ICCAT fisheries (particularly of potential migrants from the Indian Ocean), and susceptibility to capture in fisheries were unknown, and further information may result in future relative risk scores lower than in **Table 3.1**. Similarly, a small number of species currently considered as lower priority may require additional review as further information becomes available. Of the 41 High Priority populations, currently 11 (27%) are in rapid decline, 10 (24%) are known to be, or probably, in decline, seven (17%) are stable or possibly increasing, one (2%) is increasing and 12 (29%) are unknown. By comparison, of the 24 populations considered of lower priority, only two (8%) are in decline, nine (38%) are stable or possibly increasing, 11 (46%) are increasing and two (8%) are unknown. There are published, unpublished or ongoing studies of year-round distribution, population status and demography (see Table 2 in SCRS/2007/029/REV) for only six populations identified as High Priority and of year-round distribution and population status, but not demography, for a further five of these species (**Table 3.3).**

It was agreed that **Tables 3.1-3.3** would be circulated to additional experts inter-sessionally for review and comment.

Table 3.1 Preliminary risk assessment scoring for Objective 1 of the seabird assessment. For definition of score see the text.

Species	Breeding island group	Breeds in Atlantic /Migrant	IUCN status	Population Status	Overlap with ICCAT	Behavioural susceptibility to capture	Life-history strategy	Risk score 1	Risk score 2	Risk score 3
Sooty albatross *Phoebetria fusca*	Tristan da Cunha	B	3	3	3	3	3	15	12	4.24
Tristan albatross *Diomedea dabbenena*	Tristan da Cunha	B	3	3	3	3	3	15	12	4.24
Wandering albatross *Diomedea exulans*	South Georgia	B	2	3	3	3	3	14	12	4.24
Grey-headed albatross *Thalassarche chrysostoma*	South Georgia	B	2	3	3	3	3	14	12	4.24
Balearic shearwater *Puffinus mauritanicus*	Balearics	B	3	3	3	3	2	14	11	3.61
Black-browed albatross *Thalassarche melanophrys*	South Georgia	B	3	3	3	3	2	14	11	3.61
Atlantic yellow-nosed albatross *Thalassarche chlororhynchos*	Tristan da Cunha	B	3	3	3	3	2	14	11	3.61
Atlantic petrel1 *Pterodroma incerta*	Tristan da Cunha	B	2	3	3	3	2	13	11	3.61
White-chinned petrel *Procellaria aequinoctialis*	South Georgia	B	2	3	3	3	2	13	11	3.61
Grey petrel[1] *Procellaria cinerea*	Prince Edward	M?	1	3	3	3	2	12	11	3.61
Grey petrel[1] *Procellaria cinerea*	Crozet	M?	1	3	3	3	2	12	11	3.61
Grey petrel[1] *Procellaria cinerea*	Kerguelen	M?	1	3	3	3	2	12	11	3.61
Grey petrel[1] *Procellaria cinerea*	Tristan da Cunha	B	1	3	3	3	2	12	11	3.61
Cory's shearwater *Calonectris diomedea*	Mediterranean	B	0	3	3	3	**2**	11	11	3.61
Cape Verde Shearwater[1] *Calonectris edwardsii*	Cape Verdes	B	1	3	3	3	2	12	11	3.61
Great-winged petrel[1] *Pterodroma macroptera*	Tristan da Cunha	B	0	3	3	3	2	11	11	3.61
Great shearwater[1] *Puffinus gravis*	Tristan da Cunha	B	0	3	3	3	2	11	11	3.61
Black-browed albatross *Thalassarche melanophrys*	Falklands (Islas Malvinas)	B	3	2	3	3	2	13	10	3.61
Sooty albatross *Phoebetria fusca*	Indian Ocean	M	3	3	1	3	3	13	10	3.61
Grey-headed albatross *Thalassarche chrysostoma*	Chile	M	2	3	1	3	3	12	10	3.61
Sooty shearwater *Puffinus griseus*	Falklands (Islas Malvinas)	B	1	2	3	3	2	11	10	3.61

Species	Breeding island group	Breeds in Atlantic /Migrant	IUCN status	Population Status	Overlap with ICCAT	Behavioural susceptibility to capture	Life-history strategy	Risk score 1	Risk score 2	Risk score 3
Yelkouan shearwater ***Puffinus yelkoan***	**Mediterranean**	B	0	2	3	3	2	10	10	3.61
Spectacled petrel *Procellaria conspicillata*	Tristan da Cunha	B	2	0	3	3	2	10	8	3.61
Wandering albatross *Diomedea exulans*	Prince Edward	M	2	1	1	3	3	10	8	3.61
Southern royal albatross *Macronectes giganteus*	Campbell	M	2	1	1	3	3	10	8	3.61
Grey-headed albatross *Thalassarche chrystostoma*	Prince Edward	M	2	1	1	3	3	10	8	3.61
Northern royal albatross *Diomedea sanfordi*	Chatham	M	3	0	1	3	3	10	7	3.61
White-capped albatross *Thalassarche steadi*	Auckland	M	2	3	1	3	2	11	9	2.83
Cape gannet *Morus capensis*	Namibia/South Africa	B	2	3	3	1	2	11	9	2.83
Southern giant petrel *Macronectes giganteus*	Chile	B	1	3	3	1	2	10	9	2.83
Black-browed albatross *Thalassarche melanophrys*	Kerguelen	M	3	3	1	3	2	12	9	2.83
Northern fulmar ***Fulmarus glacialis***	**Many colonies**	B	0	1	2	3	2	8	8	3.20
Cape petrel ***Daption capense***	**Many colonies**	B	0	3	3	1	2	9	9	2.83
Audubon's shearwater ***Puffinus lherminieri***	**Caribbean**	B	0	3	3	1	2	9	9	2.83
Indian yellow-nosed albatross ***Thalassarche carteri***	**Indian Ocean**	M	3	2	1	3	2	11	8	2.83
White-chinned petrel ***Procellaria aequinoctialis***	**Prince Edward**	M	2	2	1	3	2	10	8	2.83
White-chinned petrel ***Procellaria aequinoctialis***	**Crozet**	M	2	2	1	3	2	10	8	2.83
White-chinned petrel ***Procellaria aequinoctialis***	**Kerguelen**	M	2	2	1	3	2	10	8	2.83
Black-capped petrel ***Pterodroma hasitata***	**Caribbean**	B	2	2	3	1	2	10	8	2.83
Cory's shearwater *Calonectris diomedea*	Macaronesia	B	0	0	3	1	2	6	6	2.83
Light-mantled albatross *Phoebetria palpebrata*	South Georgia	B	1	3	1	1	3	9	8	3.16
Manx shearwater *Puffinus puffinus*	Many colonies	B	0	2	3	1	2	8	8	2.83
Little shearwater *Puffinus assimilis*	North Atlantic	B	0	1	3	1	2	7	7	2.83

Species	Breeding island group	Breeds in Atlantic /Migrant	IUCN status	Population Status	Overlap with ICCAT	Behavioural susceptibility to capture	Life-history strategy	Risk score 1	Risk score 2	Risk score 3
Black-browed albatross *Thalassarche melanophrys*	Chile	M	3	0	1	3	2	9	6	2.83
Bermuda petrel *Pterodroma cahow*	Bermuda	B	3	0	3	1	2	9	6	2.83
Shy albatross *Thalassarche cauta*	Tasmania	M	1	0	1	3	2	7	6	2.83
Southern giant petrel *Macronectes giganteus*	Tristan da Cunha	B	1	0	3	1	2	7	6	2.83
Southern giant petrel *Macronectes giganteus*	Falklands (Islas Malvinas)	B	1	0	3	1	2	7	6	2.83
Southern giant petrel *Macronectes giganteus*	Argentina	B	1	0	3	1	2	7	6	2.83
Northern gannet *Morus bassanus*	N Atlantic	B	0	0	3	1	2	6	6	2.83
Southern fulmar *Fulmarus glacialoides*	Many colonies	B	0	3	2	1	2	8	8	2.50
Northern giant petrel *Macronectes halli*	Indian Ocean	M	1	1	2	1	2	7	6	2.50
Southern giant petrel *Macronectes giganteus*	South Sandwich	B	1	3	1	1	2	8	7	2.24
Southern giant petrel *Macronectes giganteus*	Indian Ocean	M	1	2	1	1	2	7	6	2.24
Audouin's gull *Larus audouinni*	Mediterranean	B	1	0	3	1	1	6	5	2.24
Yellow-legged gull *Larus cachinnans*	Mediterranean	B	0	0	3	1	1	5	5	2.24
Great skua *Catharacta skua*	North Atlantic	B	0	0	3	1	1	5	5	2.24
Northern giant petrel *Macronectes halli*	South Georgia	B	1	0	1	1	2	5	4	2.24
Southern giant petrel *Macronectes giganteus*	South Georgia	B	1	0	1	1	2	5	4	2.24
Southern giant petrel *Macronectes giganteus*	South Orkneys	B	1	0	1	1	2	5	4	2.24
Southern giant petrel *Macronectes giganteus*	South Shetlands	B	1	0	1	1	2	5	4	2.24
Laughing gull *Larus atricilla*	Caribbean	B	0	3	2	1	1	7	7	1.80
Herring gull *Larus argentatus*	Widespread	B	0	0	2	1	1	4	4	1.80
Great black-backed gull *Larus marinus*l	North Atlantic	B	0	0	2	1	1	4	4	1.80