

# Distribution of seabirds from New Zealand that overlap with fisheries worldwide

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# CONTENTS

Abstract	5
1. Introduction	6
2. Seabird life cycles and ranges	7
3. Selected species	24
Antipodean (wandering) albatross	24
Black petrel	26
Black-browed albatross	28
Buller's albatross	30
Buller's shearwater	32
Campbell albatross (New Zealand black-browed albatross)	34
Chatham albatross	36
Flesh-footed shearwater	38
Fluttering shearwater	40
Gibson's (wandering) albatross	42
Grey petrel	44
Grey-faced petrel	46
Grey-headed albatross	48
Hutton's shearwater	50
Light-mantled sooty albatross	52
Mottled petrel	54
Northern giant petrel	56
Northern royal albatross	58
Pacific albatross (Northern Buller's albatross)	60
Salvin's albatross	62
Sooty shearwater	64
Southern royal albatross	66
Westland petrel	68
White-capped albatross	70
White-chinned petrel	72
4. Overlapping fisheries	74
5. Conclusions	80
6. Recommendations	81
7. Acknowledgements	82
8. References	83
8.1 Additional references	102

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## ABSTRACT

New Zealand is the breeding ground for the greatest variety of albatross and petrel species anywhere. However, large parts of the lives of these New Zealand breeding species can be spent in other national and international waters far from their breeding locations. During their foraging and migrations away from the colonies these New Zealand breeding populations can interact with a wide variety of fishing activities (demersal and pelagic longline, trawl, set net, etc.). Using the FAO fishery regions of the world as a distribution base, we identified 50 seabird species that breed wholly or partly in New Zealand waters as having been recorded in fisheries' incidental bycatch throughout the world (with 37 of these caught in New Zealand fisheries). These species are tabulated (according to fishing method and area) within a listing of 175 species of bird currently recorded as having interacted with the world's fisheries. There are few fisheries and locations with reliable data about which species interact with fishing. Therefore to enable a comparative assessment of areas and fisheries where there is potential risk for fishery/bird interaction worldwide, comparative tabulations of fish catch by nation and fishery target species are provided for the FAO regions. Seabirds which have been subject to capture in New Zealand fisheries have a probability of capture in similar fishery types during the parts of their life-cycles beyond New Zealand waters. Individual summary assessments and mapped distributions are given for 25 of the principal New Zealand breeding (mainly endemic) seabirds deemed most at risk in waters outside New Zealand jurisdiction. These selected species ranged widely, with four found using the South Atlantic and four the Indian Ocean, 22 within Australian waters and the Tasman Sea, 15 crossing the South Pacific Ocean to Chile and Peru, and six crossing the equator and using the North Pacific Ocean as far north as the Bering Sea. These birds are using the national waters of at least 18 countries. For most seabirds vulnerable to incidental capture in fisheries there is little reliable information on the global distribution of pre-breeding and non-breeding birds within species populations.

Keywords: seabirds, albatross, petrel, shearwater, New Zealand, FAO, fishing practice, satellite tracking, bycatch.

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# 1. Introduction

New Zealand and its surrounding islands are the breeding grounds for the greatest number of seabird species, especially albatrosses and petrels (Procellariiformes), of any country. Seabirds of this tube-nosed family breed, range and forage over most of the oceans of the world, especially in areas of enriched waters. Many species undertake long foraging flights during the breeding season, with especially long migrations in the non-breeding and adolescent parts of their life cycle. The most spectacular of these migrations are circumpolar in the southern hemisphere or trans-equatorial between hemispheres. Most spend more than 70 percent of their life on or over the oceans.

When seabirds originating from New Zealand migrate and forage over international waters or the economic zones of other nations, they can encounter fishing fleets. The extent of this contact or interaction outside of New Zealand is difficult to determine, because information about the incidental capture of seabirds is not routinely collected in most fisheries worldwide.

Currently the only option for determining which seabird species may be vulnerable to incidental capture, according to fishing type (pelagic, demersal longline, trawl, set net, etc.) is to identify those fisheries which occur in ocean areas frequented by New Zealand seabirds. With this approach, it is assumed that, if a seabird species has been subject to capture in New Zealand fisheries, there is a probability of its being caught by similar fishing practices during its life overseas.

For most albatrosses and petrels, knowledge of their distribution at sea is limited to a few museum specimens, the recoveries of banded birds, sightings from vessels and a limited range of satellite tracking studies, principally undertaken with adult birds during the breeding season. An even smaller number of experimental studies using satellite tracking and geolocation loggers have attempted to explore the ranges of non-breeding adults and pre-breeding adolescents. These few studies have filled out an often imperfect knowledge of their total distribution for a few species.

The available foraging data have complemented the differences in breeding cycles seen ashore in studied seabird species. These data have also demonstrated that, during their time at sea, these seabirds spend substantial portions of their life-spans feeding within the economic zones of other nations. Thus, the nutritious waters of South American countries sustain the 'resting' (non-breeding) populations of about 40 percent of albatross populations from other parts of the southern hemisphere. Equally, the waters of Australasia host foraging and 'resting' birds from the Atlantic and Indian Oceans. Individual albatrosses from those oceans have been recorded returning to the same spot off Sydney at the same time of year for as long as 30 years.

This emphasises the importance of understanding the natural food resources for many of these seabirds. Non-breeding and pre-breeding birds form at least half of the populations of the Procellariiformes. Increasingly, data suggest that

knowledge of good feeding locations is learned during the long period of adolescence. Recorded incidental captures in fisheries show that different age classes of species, and sometimes sexes, are often caught in widely separated locations. The most significant population declines have occurred in those species where a wide range of age classes and/or single sexes have been impacted by incidental capture in fisheries.

This report summarises the deduced foraging and migration ranges for some principal New Zealand breeding seabirds (concentrating on albatrosses, petrels and shearwaters) vulnerable to incidental capture in fishing operations. Also identified are those countries outside New Zealand waters visited by these seabirds, and the main deficiencies in current knowledge of their life-cycles by species. All New Zealand species recorded as having been caught are listed within a comprehensive list of world seabird species which have been the subject of incidental capture by, or interaction with, fisheries worldwide.

At the outset of this project, it was intended that information about the fisheries in the areas visited by these birds would be compiled. However, the type of information that would be useful (e.g. location, fishing method, effort, seasonality, mitigation measures used) was not generally available. Instead, we have indicated the size of fisheries in countries where current evidence suggests that New Zealand breeding seabird species are most likely to be at risk of incidental capture. Though this report demonstrates that the literature concentrates principally on the impact of longline fisheries, there is a need to be aware of practices within all types of fishery, however poorly observed or reported, where New Zealand seabirds occur.

## 2. Seabird life cycles and ranges

Thirty seven species of seabirds have been recorded caught in fisheries within the New Zealand Exclusive Economic Zone (EEZ) over the past 10 years. Twenty-eight of these have been from longline fisheries, and 24 from trawl fisheries. While some species have been caught over a wide range of fishing practices, there is a tendency for specific types of fishing to catch certain species and not others. Initially the albatrosses gained the most attention, but as better mitigation practices have been introduced to avoid albatrosses, so the smaller Procellariiformes increasingly form the majority of the total reported catch.

The species caught include some of those considered most endangered by various international bodies such as the IUCN. Regrettably, for many of the seabirds considered in this report, basic information about population size and breeding biological parameters may often be minimal. The 25 species presented here in detail do not provide a comprehensive list of New Zealand seabirds at risk from fisheries interaction, but give examples of the multinational complexity of their respective lifestyles. The species names used for albatrosses follow those suggested in Robertson & Nunn (1998) and used by Croxall & Gales (1998).

Table 1 summarises the threat status, based on the recorded incidental catch in New Zealand fisheries, biological parameters, and the number of countries where incidental capture in fisheries for the species has been reported.

A fuller summary of the general features for each species, and the state of knowledge about them, is presented in the individual species accounts and distribution maps (Figs 2-26). The shaded areas on the maps that accompany each species account give an assessment of their general distribution range. Each text indicates the source of the mapping data. Dots represent band recoveries or museum specimens outside of New Zealand's EEZ. The boundaries for the foraging ranges should not be considered exclusive and are designed to indicate the possible distribution range for the bulk of the population. For those species with minimal data, areas of speculation are indicated by a question mark (?), but are based on published sighting material, especially that shown in Marchant & Higgins (1990), del Hoyo (1992), Tickell (2000), and Birdlife (2000). Principal reference sources are given for each species.

Table 2 summarises the satellite tracking studies which have been undertaken on the species used in this report. This is a complex and expensive method of obtaining information in a reasonable timeframe. The methods for retaining a transmitter on birds for very long periods while on some migrations is not yet fully resolved. It should be noted that funding for these experimental studies has come from a wide variety of sources and demonstrates an international commitment from private individuals and trusts, NGOs and national science funders. As the results of these and future studies become increasingly available to fill some of the gaps illustrated below, the task of predicting areas of fisheries interaction will be easier.

While ongoing research is required for all species, to provide baseline information from which population changes may be assessed, it is essential that there be a better understanding of the bird behaviours and distribution at sea, and especially their interaction with fisheries and fishing vessels in other national jurisdictions. Table 3 summarises what is known about the distribution of the selected species covered in this report, according to their age classes and the national waters visited.

Table 4 results from an extensive search of the literature for evidence of birds interacting with, or caught by, any form of fishing practice. The list is unlikely to be totally comprehensive, and many published reports are very generalised in nature. In some instances the reports were not clear whether there had been an actual interaction or recorded a probable risk of interaction. Compared with the 37 species recorded from observed fisheries incidental captures within the New Zealand EEZ, a total of 50 species which have breeding populations in New Zealand or its Antarctic Territory are recorded on this world list.

Table 5 provides a numerical summary of the number of identified bird species worldwide from Table 4. This summary and Table 4 use the FAO maritime fishing zones (Fig. 1) as an area basis for the tabulation. Certain zones and fishing types demonstrate significant areas of concern as indicated by the number of species recorded. The lack of reported interaction in some parts of the world can indicate a lack of interaction, or areas where there are few observations or a lack of positive identifications of species. Zone 77 is a good

example of the latter, with a range of bird examples shown only at the generic level in Table 4. The historic interaction of drift net fishing on a wide range of identifiable species is well demonstrated in the North Pacific zones.

The summary of 175 world bird species that are recorded as interacting with fisheries shown in Tables 4 and 5 not only puts New Zealand species in context, but illustrates the types of fishing practices which are impacting species with similar behaviour in other parts of the world. Though the FAO maritime recording zones are a coarse measure of location, they have been used to enable relationships to be shown with fishing effort (Tables 6 and 7).

It is evident from Table 4 and the general texts for our selected species that many New Zealand birds use other parts of the world during their annual cycle. Equally, the New Zealand region provides foraging grounds for species from elsewhere. Members of certain species such as black-browed albatross (rare breeders in New Zealand) are caught in the New Zealand fisheries in such numbers as to indicate the arrival of birds from elsewhere.

For the majority of the seabirds presented here, the greatest advances in information will come from increased observation and recording of species interaction with fisheries overseas. This needs to combine a knowledge of what species associate with individual fisheries, with information on the seabird behaviours associated with the overseas fishing practices and any preventative measures employed. Where appropriate (for species with limited distribution data) opportunities need to be created for banding programmes and targeted satellite tracking of pre-breeding and resting breeders, to expand the knowledge of seabird distribution.

TABLE 1. SUMMARY OF THE THREAT STATUS, BREEDING INFORMATION, EXISTENCE OF SATELLITE TRACKING INFORMATION, AND INTERACTION WITH FISHERIES FOR SELECTED NZ BREEDING ALBATROSSES, PETRELS AND SHEARWATERS.

Species	Endemic or native <sup>a</sup>	IUCN rating	Breeding season	Non-breeding season	Breeding annual or biennial	Years to first breeding	NZ popln satellite tracked? <sup>b</sup>	Known-interact with NZ fisheries <sup>c</sup>	Areas where incidental fishery capture reported
Antipodean albatross	Endemic	Vulnerable	Jan-Dec	Jan-Dec	B	NA	Yes - B, N	P, S	NZ, Aus, Chile
Black petrel	Endemic	Vulnerable	Oct-Jul	Jul-Oct	A	5	No	P	NZ, Peru
Black-browed albatross	Native	Endangered	Sep-Apr	Apr-Sep	A	6-12	No	P, S, F, K	NZ, Aus, Chile, Arg, Brazil, Urug, SAfr, Namibia, CCAMLR
Buller's albatross	Endemic	Vulnerable	Jan-Sept	Oct-Dec	A	NA	Yes - P, B, N	P, D, S, F	NZ, Aus
Buller's shearwater	Endemic	Vulnerable	Oct-May	May-Oct	A	NA	No	D	North Pacific
Campbell albatross	Endemic	Vulnerable	Sep-May	Jun-Aug	A	6-13	Yes - B	P, D, S, F	NZ, Aus
Chatham albatross	Endemic	Critical	Sep-Apr	May-Aug	A	7+	Yes - P, B, N (GPS proposed)	P, D, F	NZ, Chile, Peru
Flesh-footed shearwater	Native	Near Threatened	Sep-May	May-Sep	A	NA	No	P, D, K	NZ, Aus
Fluttering shearwater	Endemic	Lower Risk	Aug-Feb	Feb-Aug	A	4	No	D	NZ
Gibson's albatross	Endemic	Vulnerable	Dec-Dec	Jan-Dec	B	NA	Yes - B, N	P	NZ, Aus
Grey petrel	Native	Near albatross	Feb-Nov	Nov-Feb	A	NA	No	P, D, S, F	NZ, Aus, SAfr, Namibia(?)
Grey-faced petrel	Endemic subspecies	Lower Risk	Jun-Jan	Jan-Jun	A	7	No	D, P, F	NZ, Aus
Grey-headed albatross	Native	Vulnerable	Sep-June	Jun-Aug	B	10	Yes - B	P	NZ, Aus, Chile, Arg, CCAMLR
Hutton's shearwater	Endemic	Endangered	Aug-Apr	Apr-Aug	A	6	No	N	NZ
Light-mantled sooty albatross	Native	Near Threatened	Oct-Jun	Jun-Oct	B	8-15	No	P	NZ, Aus
Mottled petrel	Endemic	Near Threatened	Oct-Jun	Jun-Oct	A	NA	No	-	North Pacific
Northern giant petrel	Native	Near Threatened	Aug-Feb	Feb-Aug	A	4-11	No	P, D, F	NZ, Aus, Chile, SAfr
Northern royal albatross	Endemic	Endangered	Nov-Sept	Sept-Sept	B	8	Yes - P, B, N (+loggers, GPS)	P, F	NZ, Aus
Pacific albatross	Endemic	Vulnerable	Nov-May	June-Oct	A	NA	No	P, D, K	NZ
Salvin's albatross	Native	Vulnerable	Sep-Apr	May-Aug	A	NA	No	P, D, S, F, K	NZ
Sooty shearwater	Native	Lower Risk	Sep-May	May-Sep	A	6	Yes - P, B, N	D, S, F, K,	NZ, Aus, North Pacific
Southern royal albatross	Endemic	Vulnerable	Dec-Oct	Oct-Nov	B	6-7	Yes - B	D, S, F	NZ, Aus, Arg, CCAMLR
Westland petrel	Endemic	Vulnerable	May-Dec	Dec-May	A	12	yes - B	P	NZ, Aus
White-capped albatross	Endemic	Vulnerable	Nov-July	Aug-Oct	A	NA	No	P, D, S, F, K	NZ, Aus, SAfr, Namibia
White-chinned petrel	Native	Vulnerable	Nov-May	May-Nov	A	NA	No	P, D, S, F	NZ, Aus, Brazil, Arg, SAfr, CCAMLR

<sup>a</sup> Endemic = breeds only in NZ, Native = part of a world population.

<sup>b</sup> NZ populations satellite tracked (Yes/No, P = pre-breeding, B = breeding, N = non-breeding)

<sup>c</sup> Known interaction with NZ fisheries (P = pelagic longline, D = demersal longline, S = squid trawl, F = fish trawl, K = scampi trawl)

TABLE 2. SUMMARY OF SATELLITE TRACKING STUDIES UNDERTAKEN ON NEW ZEALAND SEABIRDS.

SPECIES	AGE	NO. OF BIRDS	YEAR(S)	LOCATION	UNDERTAKEN BY	FUNDING	REFERENCE
Antipodean albatross	Breeding	c. 10	1995	Antipodes I.	Nicholls, Walker, Elliott	Aus Res Council, DOC, NGOs (Aus), private funds	Unpubl., see Nicholls et al. 2002 <i>Mar Ecol Prog Ser</i> , Murray et al. in press <i>Emu</i>
	Non-breeding	3	1996	Antipodes I.	Nicholls, Murray, Elliott, Walker	Aus Res Council, DOC, NGOs (Aus), private funds	<i>Corella 20(1)</i> : 28, <i>Emu 100</i> : 318-323, <i>Mar Ecol Prog Ser</i> 231: 269-277
	Breeding and non-breeding	c. 30	1996-2002	Antipodes I.	Walker, Elliott	DOC (CSL), FRST	<i>DSIS 79, 78, 77, 76, 75</i>
Buller's albatross	Breeding	10	1997	Solander I.	Sagar, Stahl	FRST	<div style="display: flex; align-items: center;"> <span style="font-size: 3em; margin-right: 10px;">{</span> <div> <p>in press <i>J Appl Ecol</i>, <i>Condor 98</i>: 649-652, <i>NZJ Zool 25</i>: 109-137, <i>J Roy Soc NZ 30</i>: 299-318, <i>J Roy Soc NZ 30</i>: 319-334</p> </div> </div>
	Non-breeding	8	2002	Solander I.	Sagar, Stahl	FRST	
	Breeding	35	1995-2002	The Snares	Sagar, Stahl	FRST	
	Non-breeding	8	2000-2001	The Snares	Sagar, Stahl	FRST	
Campbell albatross	Breeding	7	1997	Campbell I.	Waugh, Weimerskirch, Cherel, Shankar, Prince, Sagar	NIWA, DOC, NZ Lottery (Sci Comm), Fr/NZ Cult Agrmnt, CNRS, BAS	<i>Mar Ecol Prog Ser 177</i> : 243-254, <i>NZJ Mar Freshw Res 33</i> : 437-441
Chatham albatross	Breeding and non-breeding	3	1997-1998	The Pyramid	Nicholls, Robertson	NGOs (Aus), private funds	<i>Marine Ornithology 28</i>
	Breeding, non- and pre-breeding	10	1999-2000	The Pyramid	Robertson, Robertson	DOC (CSL)	<i>Marine Ornithology 28</i>
Gibson's albatross	Breeding	3	1994	Adams I.	Walker, Elliott, Nicholls, Murray, Dilks	Aus Res Council, Aus Nat Cons Agency, DOC, WWF (Aus), Ian Potter Foundn, WV Scott Foundn	<i>Notornis 42</i> : 127-137
	Non-breeding	1	1994	NSW waters	Nicholls, Battam, SOSSA	Aus Res Council, Environ Aus, private funds	<i>Aus J Zool 46</i> : 171-181, <i>Emu 100</i> : 318-323
	Breeding	c. 10	1995	Adams I.	Nicholls, Walker, Elliott	Aus Res Council, WWF, DOC, Ian Potter Foundn, private funds	Unpubl.
	Non-breeding	3	1994/95	Adams I.	Nicholls, Walker, Elliott	Aus Res Council, NGOs, DOC, private funds	<i>Emu 100</i> : 318-323
	Breeding and non-breeding	c. 23	1996-2001	Adams I.	Walker, Elliott	DOC (CSL), FRST	<i>DSIS 70, 71, 72, 73</i>
Grey-headed albatross	Breeding	4	1997	Campbell I.	Waugh, Weimerskirch, Cherel, Shankar, Prince, Sagar	NIWA, DOC, NZ Lottery (Sci Comm), Fr/NZ Cult Agrmnt, CNRS, BAS	<i>Mar Ecol Prog Ser 177</i> : 243-254,

TABLE 2 (CONTINUED). SUMMARY OF SATELLITE TRACKING STUDIES UNDERTAKEN ON NEW ZEALAND SEABIRDS.

SPECIES	AGE	NO. OF BIRDS	YEAR(S)	LOCATION	UNDERTAKEN BY	FUNDING	REFERENCE
Northern royal albatross	Breeding, failed and pre-breeding	20	1994-2000	Taiaroa Head and Sisters I.	Nicholls, Robertson	NGOs (Aus), DOC, private funds	<i>Corella</i> 18: 50-52, <i>Mar Ornithol</i> 28, <i>Mar Ecol Prog Ser</i> 231: 269-277
Southern royal albatross	Breeding	14	1997-1999	Campbell I.	Waugh, Troup, Fillipe, Weimerskirch	DOC, Fr/NZ Cult Agrmnt, CNRS	<i>Condor</i> in press
Westland petrel	Breeding	c. 12	1995-1996	Westland (Sth I., NZ)	Freeman, Nicholls, Wilson	NZ Lottery Bd, Nicholls, NIWA, DOC, Lincoln Univ	<i>CAS Notes</i> 160, <i>Mar Ornithol</i> 25: 31-36, <i>Emu</i> 101: 47-56

TABLE 3. NATIONAL WATERS USED BY SELECTED NEW ZEALAND BREEDING ALBATROSSES, PETRELS AND SHEARWATERS.

P = known from banding recoveries, satellite tracks, or museum specimen. ? = suspected from general reference sources. Bold **P** indicates species known (from band recoveries) to have birds from elsewhere using the New Zealand EEZ.

SPECIES	AGE CLASS	SA	Nam	Aus	NZ	Chl	Per	Ecu	Arg	Flk	Bra	Uru	Col	Pan	Mex	Jap	Kor	Rus	Can	US
Antipodean albatross	Breeder			?	P	?														
	Non-breeder			P	P	P														
	Juv/Adolesc			P	P	P														
Black petrel	Breeder			?	P															
	Non-breeder			P	P		P	P					?	?	?					
	Juv/Adolesc				P		P	P					?	?	?					
Black-browed albatross	Breeder				P															
	Non-breeder				<b>P</b>	P														
	Juv/Adolesc				<b>P</b>	?														
Buller's albatross	Breeder			P	P															
	Non-breeder			P	P	P	P													
	Juv/Adolesc				P	P	?													
Buller's shearwater	Breeder			P	P															
	Non-breeder			?	P	?	?	?							?	?	?	?	?	?
	Juv/Adolesc				P	?	?	?							?	?	?	?	?	?
Campbell albatross	Breeder			P	P															
	Non-breeder			P	P															
	Juv/Adolesc			P	P															
Chatham albatross	Breeder				P															
	Non-breeder			P	P	P	P													
	Juv/Adolesc				P	P	?													
Flesh-footed shearwater	Breeder			?	P															
	Non-breeder			?	P										?	?	?	?	?	?
	Juv/Adolesc				P										?	?	?	?	?	?
Fluttering shearwater	Breeder				P															
	Non-breeder			P	P															
	Juv/Adolesc			?	P															
Gibson's albatross	Breeder			P	P															
	Non-breeder			P	P															
	Juv/Adolesc			?	P															
Grey petrel	Breeder				P															
	Non-breeder			P	P															
	Juv/Adolesc			?	P															
Grey-faced petrel	Breeder				P															
	Non-breeder			P	P															
	Juv/Adolesc			P	P															
Grey-headed albatross	Breeder				P															
	Non-breeder			P	<b>P</b>															
	Juv/Adolesc			P	<b>P</b>															

SA, South Africa; Nam, Namibia; Aus, Australia; NZ, New Zealand; Chl, Chile; Per, Peru; Ecu, Ecuador; Arg, Argentina; Flk, Falklands; Bra, Brazil; Uru, Uruguay; Col, Colombia; Pan, Panama; Mex, Mexico; Jap, Japan; Kor, Korea; Rus, Russia; Can, Canada; US, United States.

TABLE 3 (CONTINUED). NATIONAL WATERS USED BY SELECTED NEW ZEALAND BREEDING ALBATROSSES, PETRELS AND SHEARWATERS.

P = known from banding recoveries, satellite tracks, or museum specimen. ? = suspected from general reference sources. Bold **P** indicates species known (from band recoveries) to have birds from elsewhere using the New Zealand EEZ.

SPECIES	AGE CLASS	SA	Nam	Aus	NZ	Chl	Per	Ecu	Arg	Flk	Bra	Uru	Col	Pan	Mex	Jap	Kor	Rus	Can	US	
Hutton's shearwater	Breeder				P																
	Non-breeder			P	P																
	Juv/Adolesc			?	P																
Light-mantled sooty albatross	Breeder				P																
	Non-breeder				<b>P</b>	?															
	Juv/Adolesc				<b>P</b>	?															
Mottled petrel	Breeder				P																
	Non-breeder			P	P	?	?	?								?	?	?	?	?	<b>P</b>
	Juv/Adolesc				P	?	?	?								?	?	?	?	?	?
Northern giant petrel	Breeder				P																
	Non-breeder			?	<b>P</b>				?			?									
	Juv/Adolesc			P	<b>P</b>				P			P									
Northern royal albatross	Breeder				P																
	Non-breeder	P		P	P	P			P	P	P	P									
	Juv/Adolesc	?		P	P	P			P	P	P	P									
Pacific albatross	Breeder				P																
	Non-breeder				P	?	?														
	Juv/Adolesc				P	?	?														
Salvin's albatross	Breeder				P																
	Non-breeder				P	P	P														
	Juv/Adolesc				P	P	?														
Sooty shearwater	Breeder			P	P																
	Non-breeder			P	P	P	?									P	P	P	P	P	P
	Juv/Adolesc				P	?	?									P	P	P	P	P	P
Southern royal albatross	Breeder				P																
	Non-breeder	?		P	P	P			P	P	P	P									
	Juv/Adolesc	?		P	P	P			P	P	P	P									
Westland petrel	Breeder				P																
	Non-breeder				P	?	?														
	Juv/Adolesc				P	P	P														
White-capped albatross	Breeder				P																
	Non-breeder	P	P	P	P																
	Juv/Adolesc	P	P	P	P																
White-chinned petrel	Breeder				P																
	Non-breeder			?	P	?															
	Juv/Adolesc			?	P	?															

SA, South Africa; Nam, Namibia; Aus, Australia; NZ, New Zealand; Chl, Chile; Per, Peru; Ecu, Ecuador; Arg, Argentina; Flk, Falklands; Bra, Brazil; Uru, Uruguay; Col, Colombia; Pan, Panama; Mex, Mexico; Jap, Japan; Kor, Korea; Rus, Russia; Can, Canada; US, United States.

TABLE 4. SUMMARY OF INDIVIDUAL BIRD SPECIES INTERACTING WITH OR CAUGHT BY DIFFERENT FISHERIES IN FAO MARITIME FISHING ZONES 18-88 (SEE FIG. 1). NEW ZEALAND BREEDING SPECIES SHOWN IN BOLD TYPE.

Capture methods: 1 seine; 2 trawl; 3 longline (pelagic or demersal); 4 set, drift, or gill net; 5 jig; 6 other/unknown.

SPECIES	18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Albatross sp.			3		3		3,4	3	3	3	2,3, 6	3	3,4	3,4		3,4	2,3, 4,6	3,4	3
Alcid sp.		4	4										4	3,4		4			
Amsterdam albatross <i>Diomedea amsterdamensis</i>										3	3	3							
Ancient murrelet <i>Synthliboramphus antiquus</i>													4	2,3, 4					
<b>Antarctic fulmar</b> <i>Fulmarus glacialisoides</i>							3	2											
<b>Antarctic petrel</b> <i>Tbalassoica antarctica</i>																			3
<b>Antarctic prion</b> <i>Pachyptila desolata</i>																	2		
<b>Antarctic tern</b> <i>Sterna vittata</i>								2											
<b>Antipodean (wandering) albatross</b> <i>Diomedea antipodensis</i>											2,3						2,3	3	
Arctic skua <i>Stercorarius parasiticus</i>							3	2											
Arctic tern <i>Sterna paradisea</i>								2											
Ascension frigatebird <i>Fregata aquila</i>									3										
Atlantic petrel <i>Pterodroma incerta</i>							3	2											
Atlantic puffin <i>Fratercula arctica</i>		2,3, 4,6	2,3, 4																
Atlantic yellow-nosed albatross <i>Thalassarche chlororhynchus</i>							3	2,3, 4	3		3								
Audouin's gull <i>Larus audouini</i>			3			2,3					3						3		
Audubon's shearwater <i>Puffinus lberminieri</i>							3												
Auklet sp.			2,3, 4								3			2,3, 4		4	4		
<b>Australasian gannet</b> <i>Morus serrator</i>											3,6						3,4		
Australian pelican <i>Pelecanus conspicillatus</i>											6								
Balearic shearwater <i>Puffinus mauretanicus</i>			3			3													
Black and white cormorant sp.											4								
Black guillemot <i>Cepphus grylle</i>	4	2,3, 4,6	2,3, 4											4					
<b>Black petrel</b> <i>Procellaria parkinsoni</i>																		2,3	
<b>Black shag</b> <i>Phalacrocorax carbo</i>											6								
<b>Black-bellied storm petrel</b> <i>Fregatta tropica</i>																		2	

TABLE 4. (CONTINUED) FOR FAO MARITIME FISHING ZONES 18-88, SEE FIG. 1.

Capture methods: 1 seine; 2 trawl; 3 longline (pelagic or demersal); 4 set, drift, or gill net; 5 jig; 6 other/unknown.

SPECIES	18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
<b>Black-browed albatross</b>							2,3,	2,3	2,3,	3	2,3,	2,3,					2,3,	3	2,3,
<i>Tbalassarche melanophrys</i>							5		5		6	6					6		5
Black-faced cormorant											6								
<i>Pbalacrocorax fuscescens</i>																			
Black-footed albatross	3												3,4	2,3,	3	3,4,			
<i>Phoebastria nigripes</i>														4,6		6			
Black-legged kittiwake	3	4,6	3										4	2,3,					
<i>Rissa tridactyla</i>														4					
Black-throated diver			4																
<i>Gavia arctica</i>																			
Blue petrel								2											
<i>Halobaena caerulea</i>																			
Bonin petrel													4	4					
<i>Pterodroma hypoleuca</i>																			
Booby sp.									3										3
Brandt's cormorant																4			
<i>Pbalacrocorax penicillatus</i>																			
British storm petrel								2											
<i>Hydrobates pelagicus</i>																			
British storm petrel [sic.]													4						
<i>Hydrobates pelagicus</i>																			
<b>Broad-billed prion</b>								6											
<i>Pachyptila vittata</i>																			
Brown booby					3		3												
<i>Sula leucogaster</i>																			
Brunnich's guillemot		2,3,	2,3,										4	3,4					
<i>Uria lomvia</i>		4	4																
<b>Buller's albatross</b>							3				2,3						2,3	3	
<i>Tbalassarche bulleri</i>																			
<b>Buller's shearwater</b>													4	4			3		
<i>Puffinus bulleri</i>																			
<b>Campbell albatross</b>											2,3				3		2,3		
<i>Tbalassarche impavida</i>																			
Cape cormorant								2											
<i>Pbalacrocorax capensis</i>																			
Cape gannet							3	2,3											
<i>Morus capensis</i>																			
<b>Cape petrel sp.</b>							3	2,3	3	3	2,3	3					2,3	3	3
Cassin's auklet													4	4					
<i>Ptychoramphus aleutica</i>																			
<b>Chatham albatross</b>											3						2,3	3	
<i>Tbalassarche eremita</i>																			
<b>Common diving petrel</b>								6									2		
<i>Pelecanoides urinatrix</i>																			
Common eider	4	2,4	3,4											4					
<i>Somateria mollissima</i>																			
Common guillemot		4,6	2,3,										4	3,4		4			
<i>Uria aalge</i>			4																
Common loon		4														4			
<i>Gavia immer</i>																			
Common scoter			4																
<i>Melanitta nigra</i>																			
Common tern						2		2											
<i>Sterna birundo</i>																			

TABLE 4. (CONTINUED) FOR FAO MARITIME FISHING ZONES 18-88, SEE FIG. 1.

Capture methods: 1 seine; 2 trawl; 3 longline (pelagic or demersal); 4 set, drift, or gill net; 5 jig; 6 other/unknown.

SPECIES	18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Cormorant sp.		4	2,3				3				1		4	3,4		4			
Cory's shearwater			3		3	3	3												
<i>Calonectris diomedea</i>																			
Crested auklet													4	4					
<i>Aethia cristatella</i>																			
Crested murrelet														4					
<i>Synthliboramphus wumizusume</i>																			
Crested tern											6								
<i>Sterna bergii</i>																			
Dark shearwater sp.													4	3					
Dark-rumped petrel													4						
<i>Pterodroma phaeopygia</i>																			
Diver sp.			3		3														
<i>Gavia</i> sp.																			
Diving shag sp.											6								
Double-crested cormorant																			4
<i>Hypoleucos auritus</i>																			
Eared grebe																			4
<i>Podiceps nigricollis</i>																			
Eider sp.			2,3											6					
<b>Fairy prion</b>																			2
<i>Pachyptila turtur</i>																			
<b>Fairy tern</b>											6								
<i>Sterna nereis</i>																			
<b>Flesh-footed shearwater</b>											3		4	3,4					2,3
<i>Puffinus carneipes</i>																			
Flightless cormorant																			4
<i>Compsobalieu bairdi</i>																			
<b>Fluttering shearwater</b>																			3,4
<i>Puffinus gavia</i>																			
Fork-tailed storm petrel													4	4					
<i>Oceanodroma furcata</i>																			
Frigatebird sp.																			6
Fulmar sp.		3,4	3		3									3,4	3,4				3
Galapagos penguin																			4
<i>Spheniscus mendiculus</i>																			
Gannet sp.					3	3	3	3	3	3	3	3							3
Gaviidae sp.														4					
Gentoo penguin									3										
<i>Pygoscelis papua</i>																			
<b>Giant petrel sp.</b>						3	2,3	3	3	2,3	3						2,3	3	3
<i>Macronectes</i> sp.																			
<b>Gibson's (wandering) albatross</b>												2,3							2,3
<i>Diomedea gibsoni</i>																			
Glaucous gull																			3
<i>Larus hyperboreus</i>																			
Glaucous-winged gull																			3,4
<i>Larus glaucescens</i>																			
Great albatross sp.								3			3								
Great black-backed gull		3,4	2,3	3															4
<i>Larus marinus</i>																			
Great shearwater		4	3	3			3	2,3,		3									4
<i>Puffinus gravis</i>								6											

TABLE 4. (CONTINUED) FOR FAO MARITIME FISHING ZONES 18-88, SEE FIG. 1.

Capture methods: 1 seine; 2 trawl; 3 longline (pelagic or demersal); 4 set, drift, or gill net; 5 jig; 6 other/unknown.

SPECIES	18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Great skua			2,3			3													
<i>Catharacta skua</i>																			
Grebe sp.			4													4			
<b>Grey petrel</b>								2,3			3	3					2,3,		
<i>Procellaria cinerea</i>																	6		
<b>Grey-faced petrel</b>								2,3			3						2,3		
<i>Pterodroma macroptera</i>																			
<b>Grey-headed albatross</b>							2,3	2,3	2,3,	3	2,3	3					2,3	3	3
<i>Tbalassarche cbrysostoma</i>									5										
Guillemot sp.	4	3,4	3,4										4	2,3		4			
Gull sp.	3		3	3				2,3					3,4	2,3,		3		3	
														4					
Hartlaub's gull	3		2,3					2											
<i>Larus bartlaubii</i>																			
Hawaiian petrel														4					
<i>Pterodroma phaeopygia</i>																			
Herring gull		3,4	3	3										3,4					
<i>Larus argentatus</i>																			
Horned puffin													4	4					
<i>Fratercula corniculata</i>																			
Humboldt penguin																		4	
<i>Spheniscus humboldti</i>																			
<b>Hutton's shearwater</b>																		4	
<i>Puffinus buttoni</i>																			
Indian yellow-nosed albatross							3				3	3					3		
<i>Tbalassarche carteri</i>																			
Jackass penguin								2											
<i>Spheniscus demersus</i>																			
Japanese murrelet													2,3,						
<i>Sybliboramphus antiquus</i>													4						
Juan-Fernandez petrel													4						
<i>Pterodroma externa</i>																			
<b>Kelp gull</b>								2			6							2	
<i>Larus dominicanus</i>																			
Kerguelen petrel								6											
<i>Pterodroma brevirostris</i>																			
Kittiwake			3																
<i>Larus tridactyla</i>																			
Kittlitz's murrelet														3,4					
<i>Brachyramphus brevirostris</i>																			
Large pied cormorant											4								
Laysan albatross	3										3		3,4	2,3,	3,4	3,4,			
<i>Phoebastria immutabilis</i>														4,6		6			
Leach's storm petrel		4						2					4	4					
<i>Oceanodroma leucorhoa</i>																			
Least auklet													4	4					
<i>Aetbia pusilla</i>																			
Lesser black-backed gull			3			2													
<i>Larus fuscus</i>																			
Lesser sheathbill												3							
<i>Chionis minor</i>																			
<b>Light-mantled (sooty) albatross</b>								3			3	3					3		
<i>Phoebastria palpebrata</i>																			

TABLE 4. (CONTINUED) FOR FAO MARITIME FISHING ZONES 18-88, SEE FIG. 1.

Capture methods: 1 seine; 2 trawl; 3 longline (pelagic or demersal); 4 set, drift, or gill net; 5 jig; 6 other/unknown.

SPECIES	18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Little auk <i>Alle alle</i>		2,3	2,3, 4																
<b>Little blue penguin</b> <i>Eudyptula minor</i>											1,4, 6								4
<b>Little shag</b> <i>Pbalacrocorax melanoleucos</i>																			4
<b>Little shearwater</b> <i>Puffinus assimilis</i>								2,6											
Long-billed murrelet <i>Brachyramphus perdix</i>													4						
Long-tailed duck <i>Clangula hyemalis</i>			4																
Long-tailed skua <i>Stercorarius longicaudus</i>							3	2					4	4					
Loon sp.			3,4																
Macaroni penguin <i>Eudyptes chrysolophus</i>									3										
Magnificent frigatebird <i>Fregata magnificens</i>							3												
Manx shearwater <i>Puffinus puffinus</i>			3,4		3		3												
Marbled murrelet <i>Brachyramphus marmoratus</i>														3,4					
Mollymawk sp.								3			3,6	3							
<b>Mottled petrel</b> <i>Pterodroma inexpectata</i>													4	4					
Murrelet sp.														4		4			
Muttonbird sp.											3,6								
Newell's shearwater <i>Puffinus newelli</i>													4						
Northern fulmar <i>Fulmarus glacialis</i>	3	3	2,3, 4	3	3								3,4	2,3, 4					
Northern gannet <i>Morus bassana</i>		3,4	2,3																
<b>Northern giant petrel</b> <i>Macronectes balli</i>								2			3,6	3							2,3
<b>Northern royal albatross</b> <i>Diomedea sanfordi</i>											2,3								2,3
<b>Pacific albatross</b> <i>Thalassarche (platei) nov. sp.</i>											2,3								2,3
Pacific loon <i>Gavia pacifica</i>																4			
Parakeet auklet <i>Cyclorhynchus psittacula</i>													4	4					
Pelagic cormorant <i>Pbalacrocorax pelagicus</i>																4			
Pelican sp.																			1,4
Peruvian pelican <i>Pelicanus thagus</i>																			3
Petrel sp.			3		3		3	3	3	3	2,3, 6	3	3,4	2,3		3	2,3, 4,6	3	3
<b>Pied cormorant</b> <i>Pbalacrocorax varius</i>											6								

TABLE 4. (CONTINUED) FOR FAO MARITIME FISHING ZONES 18-88, SEE FIG. 1.

Capture methods: 1 seine; 2 trawl; 3 longline (pelagic or demersal); 4 set, drift, or gill net; 5 jig; 6 other/unknown.

SPECIES	18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Pigeon guillemot													4	4		4			
<i>Cepphus columba</i>																			
Pink-footed shearwater														3,4					
<i>Puffinus creatopus</i>																			
Pomarine skua							3	2					4	4					
<i>Stercorarius pomarinus</i>																			
Prion sp.							3	2				3						2,3	
Providence petrel														4					
<i>Pterodroma solandri</i>																			
Puffin sp.		3,4	2,3										4	4					
Razorbill	4	4,6	2,3,																
<i>Alca torda</i>			4																
Red phalarope													4						
<i>Pbalaropus fulicarius</i>																			
Red-legged cormorant																			4
<i>Pbalacrocorax gaimardi</i>																			
Red-legged kittiwake														3,4					
<i>Rissa brevirostris</i>																			
<b>Red-tailed tropicbird</b>														4					
<i>Phaethon rubricauda</i>																			
Red-throated diver			4																
<i>Gavia stellata</i>																			
Red-throated loon		4	2,3																
<i>Gavia stellata</i>																			
Rhinoceros auklet													4	4					
<i>Cerorhinca monocerata</i>																			
<b>Rockhopper penguin</b>							3												
<i>Eudyptes chrysocome</i>																			
<b>Royal albatross sp.</b>							3	2			3								2,3
Ruddy duck																4			
<i>Oxyura jamaicensis</i>																			
Sabine's gull								2											
<i>Xema sabini</i>																			
<b>Salvin's albatross</b>																			2,3 3
<i>Tbalassarche salvini</i>																			
Sandwich tern						2													
<i>Sterna sandwicensis</i>																			
Scoter sp.		4																	
Seagull sp.											2								
Shag sp.			2,3			3					6								4
Shearwater sp.	3	3,4		3				3			3		4	2,3,		3	3	3	
														4					
Short-tailed albatross	3		3										3,4	3,4		3,4			
<i>Phoebastria albatrus</i>																			
Short-tailed shearwater											3,4,		4	3,4					2,3
<i>Puffinus tenuirostris</i>											6								
Shy albatross								2,3		3	3,6	3							2,3
<i>Tbalassarche cauta</i>																			
<b>Silver gull</b>											6								
<i>Larus novaehollandiae</i>																			
Skua sp.							3	3			3								6
Slaty-backed gull													4						
<i>Larus schistisagus</i>																			
Slender-billed gull						2													
<i>Larus genei</i>																			

TABLE 4. (CONTINUED) FOR FAO MARITIME FISHING ZONES 18-88, SEE FIG. 1.

Capture methods: 1 seine; 2 trawl; 3 longline (pelagic or demersal); 4 set, drift, or gill net; 5 jig; 6 other/unknown.

SPECIES	18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
<b>Snare's cape petrel</b>																	3		
<i>Daption australe</i>																			
Snow petrel sp.																			3
Snowy (wandering) albatross																	3		3
<i>Diomedea chionopectera</i>																			
<b>Soft-plumaged petrel</b>							3	2,6											
<i>Pterodroma mollis</i>																			
Solander's petrel													4	4					
<i>Pterodroma solandri</i>																			
Sooty albatross								2,3		3	3	3					3		
<i>Phoebastria fusca</i>																			
<b>Sooty shearwater</b>	4	3					3	2	3		3		4	3,4		2,4	2,3,		
<i>Puffinus griseus</i>																	4		
South polar skua								2						4					
<i>Catbaracta maccormicki</i>																			
<b>Southern cape petrel</b>																			2,3
<i>Daption capense</i>																			
<b>Southern crested grebe</b>																			4
<i>Podiceps cristatus australis</i>																			
Southern giant petrel							3	2	3		3,6	3,6					3		
<i>Macronectes giganteus</i>																			
<b>Southern royal albatross</b>							3		3	3	2,3						2,3	3	3
<i>Diomedea epomophora</i>																			
<b>Southern skua</b>							3				3						3		
<i>Catbaracta lonnbergi</i>																			
Spectacled petrel							3	3	3										
<i>Procellaria conspicillata</i>																			
<b>Spotted shag</b>																			4
<i>Stictocarbo punctatus</i>																			
Stejneger's petrel													4	4					
<i>Pterodroma longirostris</i>																			
Stercorariidae sp.													4						
<b>Stewart Island shag</b>																			4
<i>Leucocarbo onslowi</i>																			
Storm petrel sp.								2,3					4	4					
Streaked shearwater													4	4					
<i>Calonectris leucomelas</i>																			
Stellar's eider			4																
<i>Polysticta stelleri</i>																			
Subantarctic skua								2,3			3	3							
<i>Catbaracta antarctica</i>																			
Sulid sp.																			1,4
Swift tern								2											
<i>Sterna bergii</i>																			
Tern sp								2,3			1,6								
Tristan albatross							3	3	3		3						3	3	
<i>Diomedea dabbenena</i>																			
Tristram's storm petrel													4	4					
<i>Oceanodroma tristrami</i>																			
Tropicbird sp.																			
Tufted puffin													4	4					
<i>Lunda cirrbata</i>																			
Velvet scoter			4																
<i>Melanitta fusca</i>																			

TABLE 4. (CONTINUED) FOR FAO MARITIME FISHING ZONES 18-88, SEE FIG. 1.

Capture methods: 1 seine; 2 trawl; 3 longline (pelagic or demersal); 4 set, drift, or gill net; 5 jig; 6 other/unknown.

SPECIES	18	21	27	31	34	37	41	47	48	51	57	58	61	67	71	77	81	87	88
Wandering albatross <i>Diomedea exulans</i>							2,3	2,3	3	3	3	2,3, 6					3,6	3	3
Waterfowl sp.														3					
Waved albatross <i>Phoebastria irrorata</i>																3		3	
Wedge-tailed shearwater <i>Puffinus pacificus</i>											3,6						3		
<b>Welcome swallow</b> <i>Hirundo tabitica</i>																		2	
Western grebe <i>Aechmophorus occidentalis</i>														4		4			
<b>Westland petrel</b> <i>Procellaria westlandica</i>											3							2,3	
White-bellied storm petrel <i>Fregetta grallaria</i>								6											
<b>White-capped albatross</b> <i>Tbalassarche steadi</i>								3		3	2,3							2,3	
<b>White-chinned petrel</b> <i>Procellaria aequinoctialis</i>							3	2,3	3	3	2,3	2,3					2,3	3	3
<b>White-faced storm petrel</b> <i>Pelagodroma marina</i>								6											
White-winged scoter <i>Melanitta deglandi</i>		4																	
Wilson's storm petrel <i>Oceanites oceanicus</i>				3			3	2					4						3
<b>Yellow-eyed penguin</b> <i>Megadyptes antipodes</i>																	4		
Yellow-legged gull <i>Larus cachinnans</i>			3			2,3													
Yellow-nosed albatross sp.										3,4	3,4	3,4					3	3	3
											6								
Seabirds - no given sp.			2,3, 4	3			2,3, 4	3	3	3	2,3, 4	3	4	1,2, 3,4, 6	3	4	2,3	3,4	3

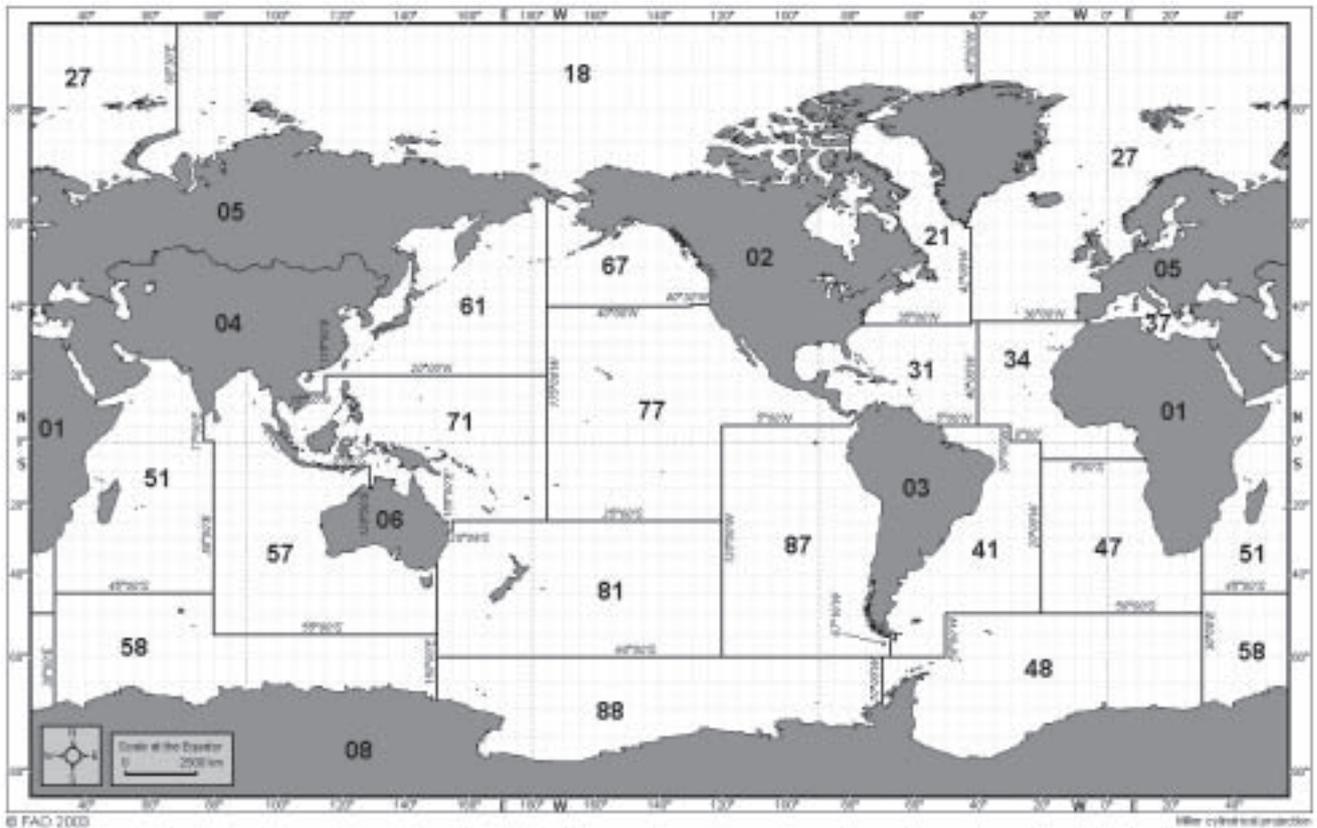


Figure 1. Map of the FAO fishing zones of the world used as the basis for the statistical reporting of fish catch. In this report the maritime zones are also used as areas to summarise the interaction of seabirds and fishing.

TABLE 5. TOTAL SPECIES INTERACTING WITH FISHERIES ACCORDING TO FAO MARITIME FISHING ZONE (SEE FIG. 1) AND FISHING METHOD.

FAO FISHING ZONES	NUMBER OF SPECIES INTERACTING WITH			TOTAL SPECIES
	LONGLINES	TRAWLERS	OTHER FISHERIES	
18	6		3	9
21	8	5	16	18
27	26	13	14	32
31	5			5
34	4			4
37	5	6		9
41	28	3	1	28
47	15	36	9	44
48	13	2	2	14
51	10			10
57	34	11	16	43
58	14	3	3	14
61	5	1	39	39
67	18	5	47	47
71	3		1	3
77	3	1	13	15
81	37	29	13	50
87	12		4	16
88	8	1	1	8
Species totals	94	77	110	175