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EXECUTIVE SUMMARY

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This report summarises the methods used and results provided to the Ministry of Fisheries as part of Objective 2 of Project ENV2001/01: *Each year, to provide weekly within-season estimates (with confidence intervals) of total captures, deaths and releases – where possible by species – by area for seabirds taken in the southern bluefin tuna fishery beginning two weeks after the start of the 2001/02, 2002/03, 2003/04 fisheries until the end of the season.*

Four chartered Japanese vessels fished in the southern bluefin tuna (*Thunnus maccoyii*) longline fishery during April–June 2003 and completed 264 sets (870 990 hooks) in waters off the west coast of the South Island, between 40° and 47° S (Area 3). All sets were observed and 93% of hooks were observed. Weekly captures peaked in early to mid–April, when five different seabird species were observed caught. Of the 39 seabirds observed caught, 20 were landed dead and 19 were captured and released alive (15 of which were considered unlikely to survive after their release). Two vessels accounted for 72% of the observed seabirds. An estimated 42 seabirds (41–43, 95% CI) were caught. Based on the observers' reports (and with autopsy verification of species identifications), about 35 Buller's albatrosses (*Thalassarche bulleri*), 2 southern royal albatross (*Diomedea epomophora*), 1 Gibson's albatross (*D. gibsoni*), 2 white-capped albatrosses (*T. steadi*), and 2 white-chinned petrels (*Procellaria aequinoctialis*) were estimated caught. Seabirds released alive, either after being tangled or with hook injuries, were Buller's albatrosses, other than one white-capped albatross. The mean capture rate for Area 3 of 0.048 seabirds per 1000 hooks (s.e. = 0.01) was substantially lower than that observed for these vessels in the 2002 season, and slightly higher than those in recent years before 2002.

1. INTRODUCTION

The overlap of the areas fished and the foraging zones of the seabird species may result in the incidental capture of seabirds as they attempt to grab baits from the longline during setting or hauling. At present the chartered southern bluefin tuna (*Thunnus maccoyii*) fleet which generally operates in southern waters has a voluntary code of practice that places a limit on the number of captures of seabird species that are considered "at risk" by the Department of Conservation and Ministry of Fisheries (draft NPOA-Seabirds (Anon. 2000)). In the 2003 season these vessels were limited to a total catch of 75 "at-risk" seabirds (C. Hufflett, pers. comm.). Within-season estimation of the numbers caught by these vessels supports the Ministry of Fisheries' responsibilities in the management of this fishery.

Ministry of Fisheries observer data from previous years have shown that area fished is an important factor in the bycatch of different seabird species (Baird 2001, 2004), and the chartered vessels have restricted their fishing areas in recent years to off the southern east and west coasts of the South Island (Fishery Management Areas 3, 5, and 7). Few of the "at-risk" seabird species appear in bycatch records from any fishery in these areas (Baird 2001, 2004). In recent years, four chartered Japanese vessels have fished each season, with 100% observer coverage of vessels and over 80% coverage of 0.8–1 million hooks set each season (for example, Baird 2004).

These vessels set about 3000 hooks per set on a longline (usually 8-strand multifilament, though one vessel used this material in combination with 3-strand rope) about 130 km long. The setting operation usually takes 5–6 hours, after which the line is left to soak for about 5 hours (Murray et al. 1999). The haul takes about 12 hours, and observers are required to watch as much of the haul as possible, within a 12-hour shift. The observers average out the number of hooks per minute of the haul and then estimate the number of unobserved hooks for the time the haul was not observed.

Seabirds may swallow the hook, become hooked in a body part, or tangled in the line. The number of seabirds observed caught by these vessels (either landed dead or released alive) has fluctuated in recent years and, of the seabirds reported, a higher proportion are released alive from being caught on the haul than in earlier years when most were landed dead from capture during setting (Baird & Griggs 2004). The code of practice that these vessels operate under requires that every possible attempt is made to mitigate against seabird capture. The vessels set their lines at night and comply with tori line regulations. Usually more than one tori line is used in conjunction with mitigation methods such as sonic guns on the set, and various structures such as hanging pendulums are used during the haul to create no-fly zones near the hauling point.

This report summarises the method and results of the within-season estimation of the total numbers of captures of seabird species (as identified by Ministry of Fisheries observers) from the chartered southern bluefin tuna fleet in 2003 and provides updated species identification from those landed dead and returned for autopsy (unpublished data provided by C. J. R. Robertson from the autopsy contract under the Conservation Services Programme (CSP)).

2. METHODS

2.1 Data

All vessels reported daily effort data to the fishing company and these were provided to NIWA on a weekly basis. These data included:

- position data
- number of hooks per set

Ministry of Fisheries observers reported observed daily effort and seabird captures on a weekly basis. These data included:

- number of hooks per set
- estimated number of hooks observed per set
- number of each seabird species captured (as identified by the observer), including numbers landed dead and released alive. For those seabirds observed caught and released alive, observers also reported a "survival code" which is a measure based on how the seabird was caught. Thus any seabird caught alive and hooked in the following manner was assigned a code that suggested that the seabird may not survive:
  - hook swallowed or in the bill
  - hook penetrated any body parts, including flight feathers.

The data were checked for inconsistencies and entered into a single spreadsheet to amalgamate the two data sets. Set start position data were used to allocate each set to one of the four bird areas used in the analysis of tuna longline-seabird interactions (see Figure 1).

2.2 Within-season calculations

On receipt of the weekly data, the method described below was used to estimate the total number of captures of each seabird species from the observed portion of the effort (n_1) and the number captured per unobserved portion of the effort (n_2):

$$p = \frac{\sum k_i}{\sum h_{oi}} \qquad n_1 = \sum k_i \qquad n_2 = \sum h_{ui} p$$

where p is the observed catch rate (expressed as the number of observed seabird captures per 1000 observed hooks), and k_i is the number caught in set i, h_{oi} is the number of observed hooks in set i, and h_{ui} is the number of unobserved hooks in set i. The total number caught is

$$T_k = n_1 + n_2$$

To estimate $Var(T_k)$ and the 95% confidence intervals, the observed set data were reselected in a bootstrapping procedure (after Efron & Tibshrani 1993) to give a bootstrap capture rate p^*. Thus a bootstrap value for n_2 is given by

$$n_2^* = \sum h_{ui} p^*$$

Weekly within-season estimates were submitted to the Ministry of Fisheries Chief Scientist within two working days of receipt of the within-season seabird capture data from the fishing company and the Ministry of Fisheries observers. At the season end, the weekly report data

were compared with the final observer logbook data to check for any discrepancies, and those seabirds landed dead were returned to shore for autopsy and the identifications provided from this work were compared with those recorded by the Ministry of Fisheries observers during the within-season estimation period. Amendments to observer identifications were made where required.

3. RESULTS

3.1 Summary of data received

Chartered Japanese longline vessels began fishing in Area 3 (Figure 1) in early April 2003 and completed targeting southern bluefin tuna in Area 3 in late June 2002 (Table A1 in Appendix A). The four vessels completed 264 sets (870 990 hooks), with effort in the first few weeks off the southwest coast of the South Island. Seabirds were observed caught on 10% of the sets in Area 3 (Table 1). Thirty-nine seabirds were observed caught and of the 19 that were released alive, 15 were assigned codes that indicated the seabirds may not survive (Table 2).

Total weekly captures peaked in Week 2 (ending 15 April), with 33% of all seabirds reported from this week. One vessel was responsible for 10 of the 13 reported captures in this week. Reported captures decreased to 3 or less a week from Week 6 as vessels fished in deeper more northern waters. Generally vessels set each day throughout the season, with at least 87 600 hooks set each week in Weeks 5–10, before the season end in Week 12 (end of June) (Figure 2).

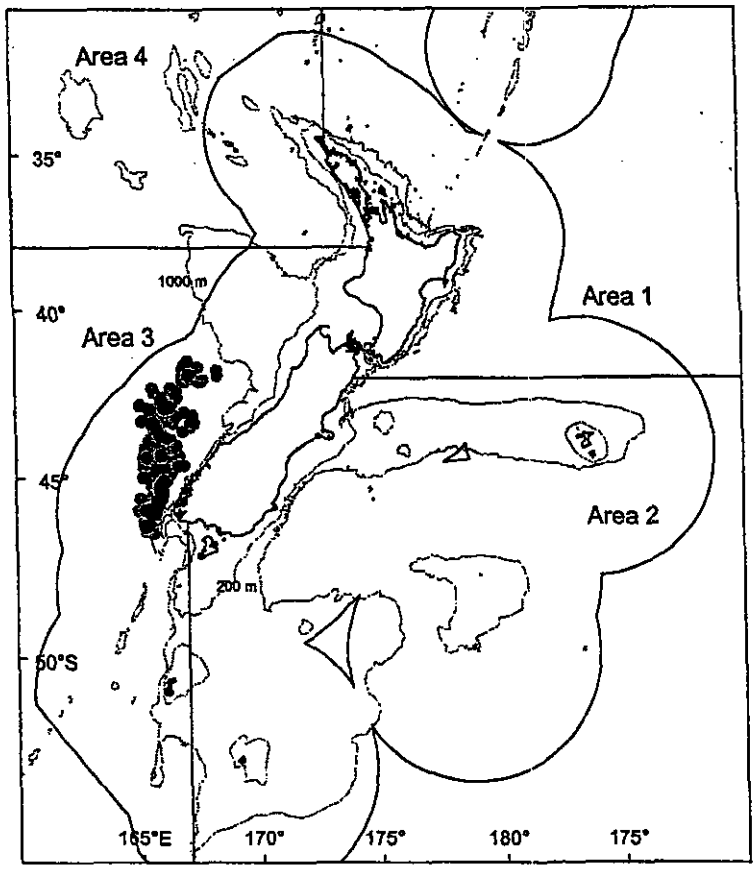

Figure 1: Set start positions of observed chartered Japanese southern bluefin tuna longline effort up to 29 June 2003 (•) (n = 264 sets), including those with observed seabird captures (•).

Table 1: Frequency of seabird capture for chartered Japanese longline vessels in the 2003 southern bluefin tuna season (Area 3).

No. seabirds per set	Vessel A	Vessel B	Vessel C	Vessel D	All vessels
0	63	61	60	53	237
1	3	4	8	4	19
2	1	2	2	1	6
3	–	1	–	–	1
4	–	–	–	–	–
5	–	1	–	–	1
% sets with birds	6	12	14	9	10
Total sets	67	69	70	58	264
Total seabirds	5	16	12	6	39

Table 2: Within-season seabird species captures by vessel for Area 3, including survival codes assigned by observers. Note that all dead bird identifications given here have been verified (see Section 3.2).

Vessel Area 3	Observed no. hooks		Total birds	No. dead	No. alive	Survival codes*
A	195 399	Buller's albatross	3	0	3	2C D
		Southern royal albatross†	1	1	0	–
		White-chinned petrel	1	1	0	–
B	229 398	Buller's albatross	12	9	3	B 2C
		Southern royal albatross	1	1	0	–
		Gibson's albatross†	1	1	0	–
		White-capped albatross	1	1	0	–
		White-chinned petrel	1	1	0	–
C	201 293	Buller's albatross	12	2	10	5B 2C 3D
D	184 410	Buller's albatross	5	3	2	B C
		White-capped albatross	1	0	1	B

* Number for each survival code, as defined by: B = hook swallowed or in bill; C = hook pierced body part, including flight feathers; D = hooked around body part or tangled. The survival of a seabird is considered unlikely if the seabird is classed as a "B" or "C".

† The observer reported this bird as a "wandering albatross".

3.2 Seabird species

Observers identified the 39 seabirds as 32 Buller's albatross (*Thalassarche bulleri*), 1 southern royal albatross (*Diomedea epomophora*), 2 wandering albatross (*Diomedea* sp.), 2 white-capped albatross (*T. steadi*), and 2 white-chinned petrels (*Procellaria aequinoctialis*). All 20 dead birds were returned for autopsy (through the CSP autopsy programme) and all were correctly identified by observers, other than the two wandering albatrosses which were later identified as one Gibson's (*D. gibsoni*) and one southern royal albatross (*D. epomophora*) (see Table 2).

Eighteen Buller's albatrosses and one white-capped albatross were released alive and of these, 4 Buller's were considered (by the observer) likely to survive. Of the Buller's albatrosses that were released alive and coded as unlikely to survive, 7 birds had their bodies pierced by a hook and another 8 were hooked in the bill or had swallowed the hook. Another 4 were hooked by a body part or tangled in the line.

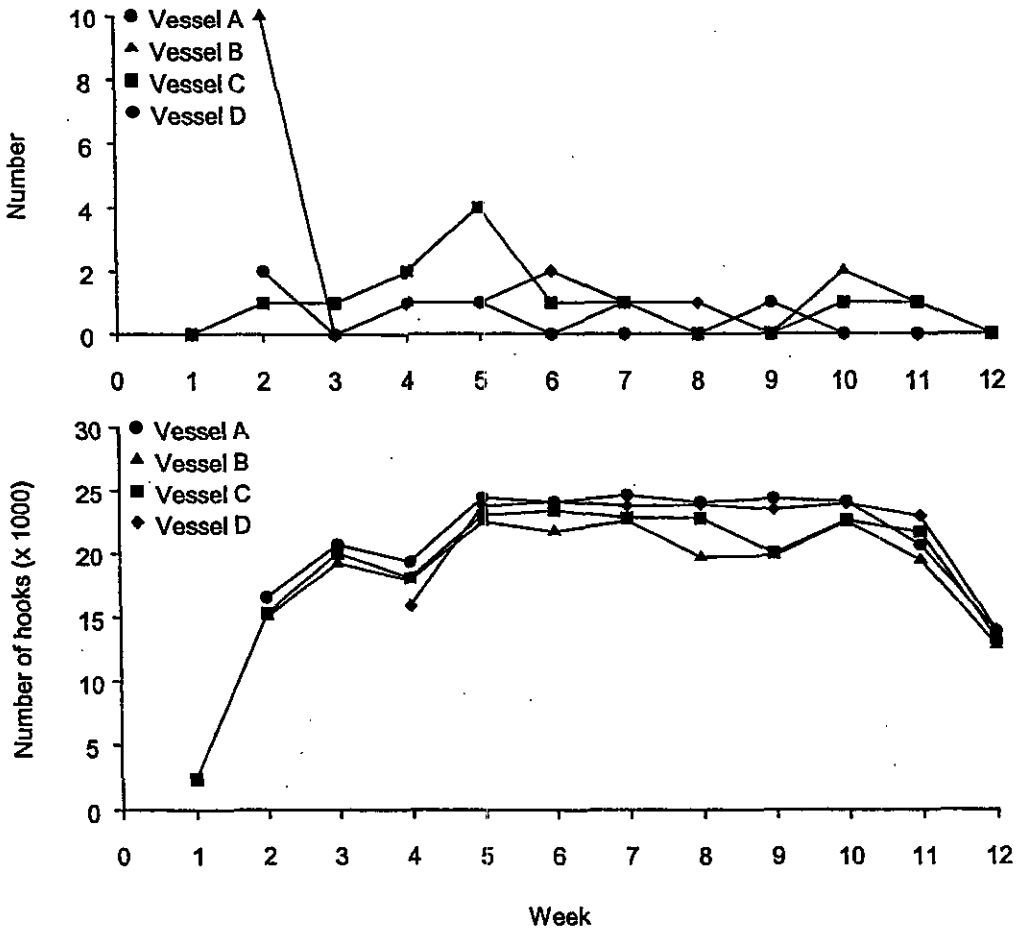

Figure 2: Observed number of seabird captures (top) and observed number of hooks (bottom) in Area 3 for each vessel, by week, where Week 1 starts on 7 April 2003 and Week 12 finishes on 29 June 2003.

3.3 Within-season estimates of total numbers caught

These results indicated that most of the seabirds observed caught (and released alive) would die as a result of injuries sustained. Therefore, total observed captures of each species (using the revised identification) were used to produce estimated total captures (Figure 3). An estimated 42 seabirds were caught (41–43 95% CI) (summary statistics are given in Table A2 in Appendix A). Based on the observers' reports (and with autopsy verification of species identifications), about 35 Buller's albatrosses (*Thalassarche bulleri*), 2 southern royal albatross (*Diomedea epomophora*), 1 Gibson's albatross (*Diomedea gibsoni*), 2 white-capped albatrosses (*T. steadi*), and 2 white-chinned petrels (*Procellaria aequinoctialis*) were estimated caught. The mean capture rate for observed hooks in Area 3 was 0.048 seabirds per 1000 hooks (s.e. = 0.01), which is substantially lower than the comparable mean reported for the previous season (Baird & Griggs 2004), and slightly higher than those in 2000 and 2001 (Baird 2001, 2004).

3.4 Within-season data from one domestic vessel in southern waters

The fishing company also sent weekly faxes during the southern bluefin tuna season summarising effort by one large domestic vessel fishing in Areas 2 & 3. This vessel was also observed and these data are summarised in Appendix B. This vessel fished alongside the Japanese chartered vessels (compare Figure 1 and Figure B1 in Appendix B) and caught only one seabird (southern royal albatross). The seabird catch rate of this domestic vessel is substantially less than that for two of the chartered vessels (Figure 4).

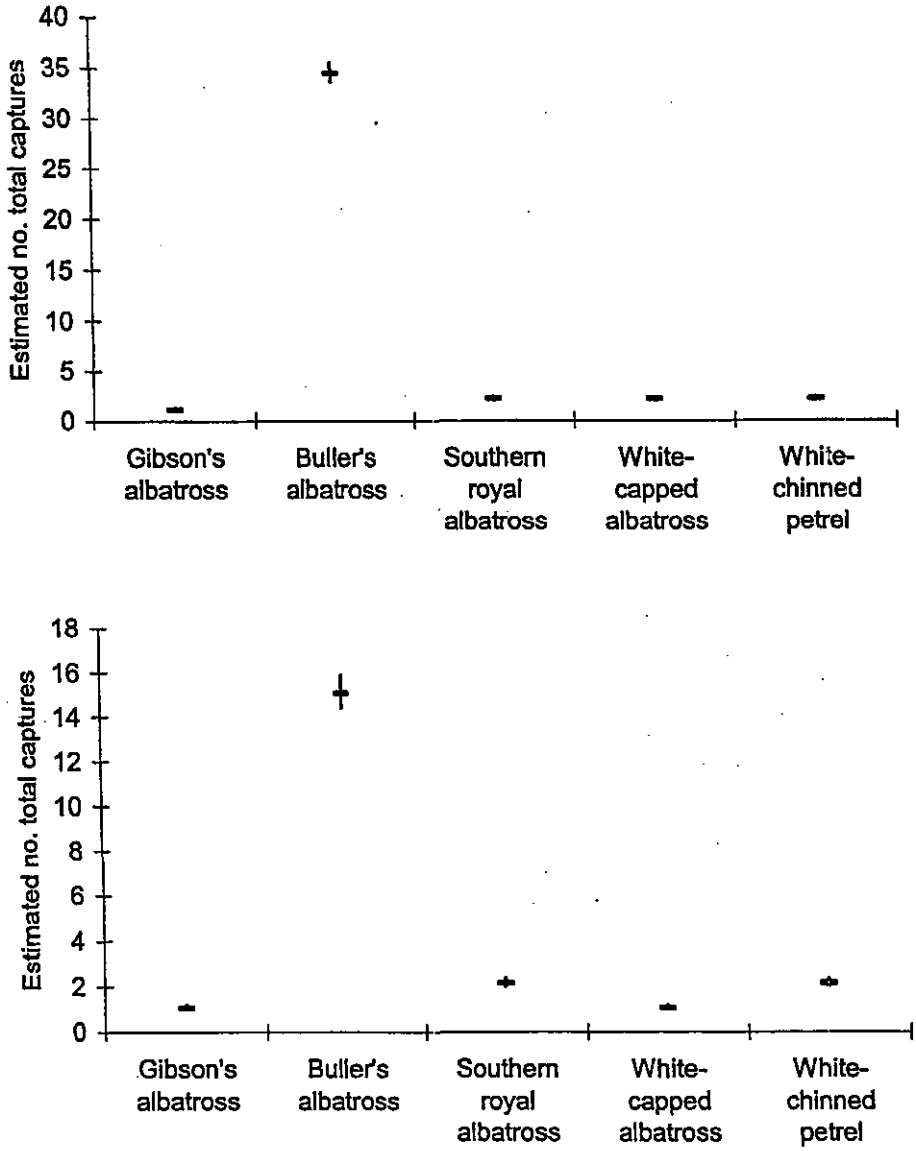

Figure 3: Estimated total captures of seabirds during the chartered southern bluefin tuna longline fishery, by species for Area 3. [Amended species identifications are used here; observers had reported the southern royal albatross and Gibson's albatross as "wandering albatrosses". The number of birds landed dead was used to estimate the total of dead birds shown in the lower plot.]

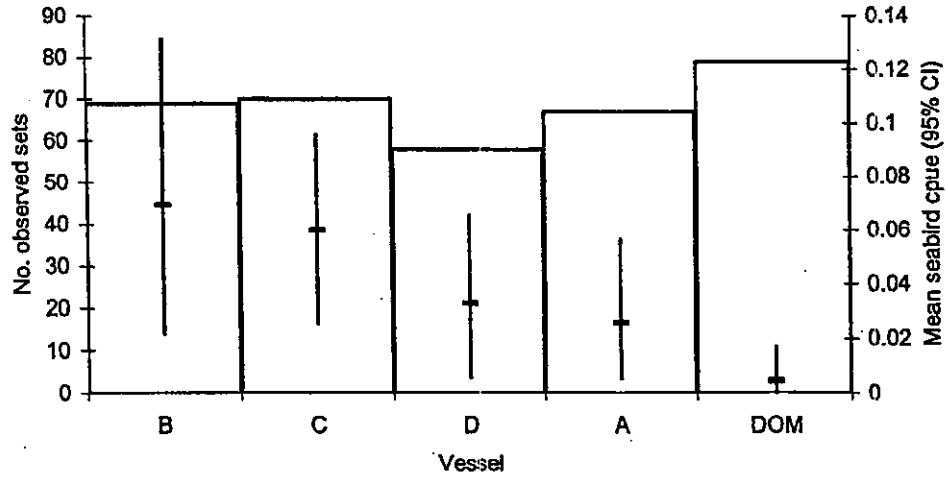

Figure 4: Observed sets (histogram) and mean seabird catch per 1000 hooks (and 95% confidence intervals) based on all observed seabird incidental captures by vessel, where chartered vessels A-D and domestic vessel DOM were targeting southern bluefin tuna in Area 3, for all data up to 29 June 2003.

4. DISCUSSION

The observed and total effort data will be verified in the next fishing year, once the data have been received, but there should be few differences in the hook numbers, given the experience of last year's within-season work. Captures dropped off towards the end of the season when vessels targeted southern bluefin tuna further up the west coast of the South Island in deeper, more northern waters where, in past years, the seabird capture rates have been lower. Observers have previously noted that fewer seabirds are seen around the vessels when the vessels move away from the lower west coast waters off Fiordland.

Given that there were differences in the numbers caught by each vessel, the method used to determine the estimated number of seabirds caught could be biased depending on the representativeness of the effort in any one week. This is not a concern for these data because all sets were observed, 93% of hooks were observed, and vessels set similar numbers of hooks each week. The sum of the total estimated captures for individual vessels is equal to that estimated for the fleet overall.

These vessels are all required to report their seabird captures to the fishing company, and if a seabird is caught when the observer is on a break, this bird may later be handed to the observer and reported as observed. Crewmembers reported two seabird captures in Week 2 during the time the observer was not on duty: one dead Buller's albatross and one unidentified seabird that was released alive. In Week 8, one albatross was found dead on the upper deck and the observer assumed that it had struck the vessel; this bird (perhaps a white-capped albatross) is not included in the analyses. None of these seabirds were included in the analyses. Other than these seabirds, the number reported to the fishing company each week was the same as the number reported by observers.

5. ACKNOWLEDGMENTS

We are grateful to the Ministry of Fisheries observers for their diligence and effort in completing the weekly reports on time and to Solander Fisheries for their timely provision of fishing effort data. We thank Chris Robertson of Wild Press for providing the species verification of the autopsied seabirds well within the timeframe for this project. This work was completed under the Ministry of Fisheries Project ENV2001/01, Objective 2.

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Appendix A: Within-season weekly data summaries, by area

Table A1: Summary of weekly* data provided by Solander Fisheries and Ministry of Fisheries observer programme, Area 3.

		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Total
Area 3														
No. vessels		1	3	3	4	4	4	4	4	4	4	4	4	4
Total sets		1	15	18	23	28	28	28	27	26	28	26	16	264
Total hooks		2 400	46 860	59 900	71 250	93 640	93 330	93 770	90 420	87 600	93 140	84 770	53 910	870 990
% hooks observed		98	93	95	94	93	93	95	94	93	93	91	88	93
Seabird captures†														
Buller's albatross	Total	0	7	1	4	7	3	3	1	1	3	2	0	32
	Dead	–	6	0	0	0	3	1	0	0	3	1	–	14
Southern royal albatross	Total	0	2	0	0	0	0	0	0	0	0	0	0	2
	Dead	–	2	–	–	–	–	–	–	–	–	–	–	2
Gibson's albatross	Total	0	1	0	0	0	0	0	0	0	0	0	0	1
	Dead	–	1	–	–	–	–	–	–	–	–	–	–	1
White-capped albatross	Total	0	1	0	1	0	0	0	0	0	0	0	0	2
	Dead	–	1	–	0	–	–	–	–	–	–	–	–	1
White-chinned albatross	Total	0	2	0	0	0	0	0	0	0	0	0	0	2
	Dead	–	2	–	–	–	–	–	–	–	–	–	–	2

Total number seabirds observed caught up to week ending 29 June 2003 = 39; mean catch rate = 0.048 per 1000 hooks (s.e. = 0.010)

* Week 1 began on 7 April 2003 and Week 12 ended 29 June 2003.

† Seabird species for dead seabirds are those verified through the autopsy programme (as provided by C. J. R. Robertson, unpublished data).

Appendix A—*continued*

Table A2: Summary statistics for chartered Japanese longline vessels in the 2003 southern bluefin tuna season.

Area fished:	Area 3
Total number of vessels in fishery:	4
Total number of sets:	264
% sets observed:	100
Total number of hooks:	870 990
% hooks observed:	93
Total number seabirds observed:	39
Total number dead seabirds:	20
Total number alive seabirds:	19 ["survival" codes indicate observer believes 4 of these birds will survive]
Mean catch rate:	0.048 per 1000 hooks (s.e. = 0.010)
Estimated total seabirds caught (95% confidence intervals):	42 (41–43) for all birds; 21 (20–22) for dead birds
Species observed caught (includes verified identification):	Buller's albatross (32), Southern royal albatross (2), Gibson's albatross (1), White-capped albatross (2), White-chinned petrel (2).

Appendix B: Total and observed effort from one domestic fishing vessel in Areas 2 & 3

Table B1: Summary of weekly* data provided by Solander Fisheries and Ministry of Fisheries observer programme, Area 3.

	Week 1*	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Total
Area 2													
No. vessels	1	0	0	0	0	0	0	0	0	0	0	0	1
Total sets	5	–	–	–	–	–	–	–	–	–	–	–	5
Total hooks	16 100	–	–	–	–	–	–	–	–	–	–	–	16 100
% hooks observed	95	–	–	–	–	–	–	–	–	–	–	–	95
Area 3													
No. vessels	1	1	1	1	1	1	1	1	1	1	1	1	1
Total sets	9	7	6	6	5	7	7	7	6	7	7	5	79
Total hooks	26 700	20 300	17 600	17 250	16 300	23 310	25 050	20 700	21 300	24 450	21 157	15 750	252 785
% hooks observed	95	94	93	95	95	81	86	93	90	88	88	84	90
Observed seabird captures (Area 3)													
Southern royal albatross Total	1	0	0	0	0	0	0	0	0	0	0	0	1
Dead	1	–	–	–	–	–	–	–	–	–	–	–	1

* Week 1 starts on 7 April 2003. Note that effort shown in Week 1 includes data from the previous week as this vessel began fishing on 31 March 2003.

Appendix B—*continued*

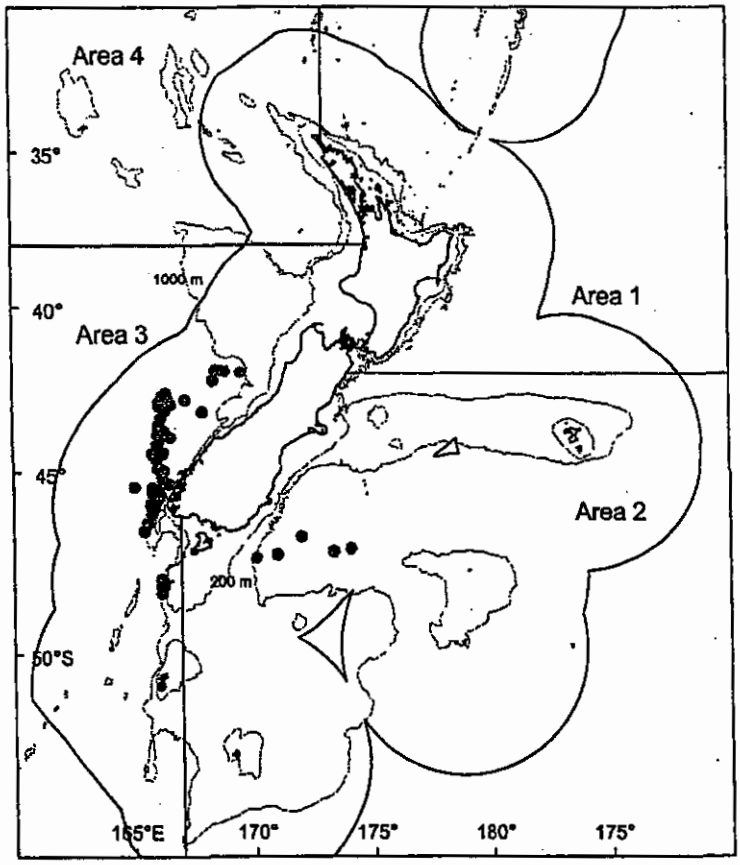

Figure B1: Set start positions of observed southern bluefin tuna longlines (•), including those with seabird captures (•), on a large domestic vessel in Areas 2 & 3 (n = 84 sets) up to 29 June 2003.