Sightings of southern right whales around 'mainland' New Zealand

SCIENCE FOR CONSERVATION 225

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Published by
Department of Conservation
PO Box 10-420
Wellington, New Zealand

Science for Conservation is a scientific monograph series presenting research funded by New Zealand Department of Conservation (DOC). Manuscripts are internally and externally peer-reviewed; resulting publications are considered part of the formal international scientific literature.
Titles are listed in the DOC Science Publishing catalogue on the departmental website http://www.doc.govt.nz and printed copies can be purchased from science.publications@doc.govt.nz

ISSN 1173–2946
ISBN 0–478–22454–0

In the interest of forest conservation, DOC Science Publishing supports paperless electronic publishing. When printing, recycled paper is used wherever possible.

This report was prepared for publication by DOC Science Publishing, Science & Research Unit; editing by Jaap Jasperse and layout by Ruth Munro. Publication was approved by the Manager, Science & Research Unit, Science Technology and Information Services, Department of Conservation, Wellington.

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ABSTRACT

The status of southern right whales around 'mainland' New Zealand was assessed by reviewing 110 sightings and 23 individual photo-identifications collected between 1976 and 2002. Sightings were reported in 11 of the 12 Conservancies (Department of Conservation administrative areas) with coastal waters. Southland Conservancy was the primary area visited by non-cow/calf whales and Hawkes Bay Conservancy represented the primary area for cow/calf pairs. Whales were sighted in all seasons with the majority of sightings reported in winter (60%) and spring (22%). Between 1988 and 2001 (when whales were consistently sighted), southern right whales showed a significant increase in number of sightings and number of whales per sighting. The estimated rate of increase is imprecise and likely affected by uneven sighting effort over the years. Despite this apparent increase in overall sightings, there was little evidence of increase in the number of cow/calf pairs sighted around New Zealand's three main islands ('the mainland'). No matches were made between 26 photo-identified whales from around the mainland and the extensive catalogue of whales photo-identified in the subantarctic islands. The former population remains severely depleted, and likely contains between 4 and 11 reproductive females. The lack of evidence of movement between the mainland and the subantarctic islands and the marked difference in recovery between the two areas suggests that the two populations represent separate stock.

Keywords: southern right whale, New Zealand, population status

Patenaude, N.J. 2003: Sightings of southern right whales around 'mainland' New Zealand. *Science for Conservation 225*. 43 p.

1. Introduction

Most species of great whales have been the target of an extensive whaling industry in Europe, America and Asia and subsequently in Southern Hemisphere countries. As a result of worldwide exploitation, the numbers of many great whale species were reduced to levels below 10% of their original abundance (Walsh 1967; Schevill 1974; Allen 1980). One of these severely depleted species is the southern right whale (*Eubalaena australis*).

Right whales are large, stocky, baleen whales, reaching an estimated maximum weight of 80 to 100 tonnes, and average c. 14–15 m in length with females slightly larger than males. Newborn calves range between 4.5 m and 6 m in length (ref). They are identified by their predominantly black colouration, lack of dorsal fin or ridge, and 'callosity' patterns on their heads. These patterns are unique to each individual and change little over time—a useful feature for individual photo-identification (Payne et al. 1983; Kraus et al. 1986).

Until recently, there were two taxonomically recognised species of right whales (Eubalaena Gray, 1864): the northern right whale, *Eubalaena glacialis* (Balaena glacialis Borowski, 1781) and the southern right whale *Eubalaena australis* (Balaena australis Desmoulins, 1822). Because of differences in timing of southern and northern breeding seasons, and apparent discontinuity of distribution across the Equator, there appears to be no mixing between the northern and southern hemisphere taxa. The absence of shared mtDNA haplotypes between North Atlantic and South Atlantic right whales further suggests reproductive isolation (Schaeff et al. 1991; Malik et al. 2000). The presence of a continent also precludes mixing between North Atlantic and North Pacific right whales. Based on a recent genetic study demonstrating concordance of oceanic distribution and mtDNA control region sequences (Rosembaum et al. 2000), the International Whaling Commission (IWC 2001) now recognise three species of right whales: *Eubalaena glacialis* (North Atlantic right whale), *E. japonic*a (North Pacific right whale) and *E. australis* (southern right whale).

Based on historical whaling records and recent sightings, southern right whales generally inhabit waters between 20 and 60° latitude (Townsend 1935; Brown 1986; Ohsumi & Kasamatsu 1986; Scarff 1986; Hamner et al. 1988).

Right whales calve in coastal waters in winter months and tend to migrate offshore to feeding grounds during summer months. Their distribution in summer is likely linked to the distribution of their principal prey species (copepods and euphausids, Best & Schell 1996; Woodley & Gaskin 1996; Tormosov et al. 1998).

The IWC (2001) recognise seven winter calving grounds in the South Pacific/Indian Ocean basin. These are Chile/Peru, Crozet I., Central Indian Ocean (around St Paul I.), New Zealand mainland/Kermadec, New Zealand subantarctic, Southeast Australia, and Southwest Australia. Of these, only the Southwest Australia and the New Zealand subantarctic calving grounds are showing clear signs of recovery.

The summering (feeding) grounds for southern right whales in the South Pacific are not well known. Information from Japanese scouting vessels in 1965–88 showed summer concentrations of southern right whales between the Subtropical and Antarctic Convergence (45–55°S: Ohsumi & Kasamatsu 1986). Other whales were seen in summer months in waters south of Australia (41–44°S: Ohsumi & Kasamatsu 1986; Bannister et al. 1997). Historical whaling records also suggest summer feeding grounds, in the southeast Indian Ocean between 61 and 65°S (Tormosov et al. 1998) and off the Chatham Rise east of New Zealand (Townsend 1935).

The southern right whale species is listed as lower risk/conservation dependent (IUCN 2002). This designation implies that although southern right whales are showing signs of recovery in some areas, the continued recovery is dependent on ongoing conservation programmes, the cessation of which would result in the species qualifying for one of the threatened categories within a period of five years.

1.1 SOUTHERN RIGHT WHALES IN NEW ZEALAND WATERS

Historically, southern right whales were widely distributed in New Zealand waters, around the mainland* as well as the subantarctic islands. Shore whaling started in 1829 with a peak of up to 80 stations along both the North and South Is in 1843–45 (Dawbin 1986). Pelagic whaling started in 1791 and by the late 1830s American, British, French and Australian vessels were whaling in New Zealand waters. Following this extensive exploitation, New Zealand southern right whales were considered commercially extinct. Although protected from hunting by international agreement since 1935, right whales were hunted illegally by the Soviet whaling fleet from 1950 to 1970 (Yablokov 1994; Tormosov et al. 1998).

Based on 19th century whaling records (Townsend 1935), most of the pelagic whaling occurred offshore near the Chatham Is and east of the Kermadec Is. Some researchers have questioned Townsend's plots of southern right whale catches east of the Kermadec Is, suggesting that he incorrectly allocated and plotted sperm whale catch records onto the right whale charts (Richards 1998). A recent reanalysis of historical whaling records confirm that southern right whales were taken from the Kermadec Is grounds (Richards 2002).

Density-dependent demographic modeling based on historical catches suggested that, prior to exploitation, southern right whales in New Zealand likely numbered more than 16 000 individuals (Patenaude 2002a). At its lowest point (in 1913), the population may have numbered as few as 14–52 whales. The recovery of southern right whales in New Zealand has been slow. More than 35 years elapsed between the last recorded sighting of a right whale along the New Zealand mainland (1928) and a reported sighting in 1963 in the Tory Strait

* The 'mainland' of New Zealand is defined here as comprising the three main islands: North, South and Stewart Island; as opposed to other major offshore islands in the New Zealand Exclusive Economic Zone (particularly the subantarctic Campbell and Auckland Islands in this context).

(Gaskin 1964). Rare sightings were reported during the next two decades (Cawthorn 1981, 1990), but no large aggregation of southern right whales, as observed in the Auckland Is (see below), has been reported around the mainland.

In the subantarctic islands, the pattern of recovery has differed. In mid-1980, a private yacht visiting the Auckland Is in mid-winter reported seeing up to 100 whales in Port Ross (R. Suisted, DOC, pers. comm.). Following other such reports, the Royal New Zealand Air Force surveyed the Auckland Is in July 1992 and counted 70 whales in the Port Ross area. A similar survey the following year counted 43 whales (Donoghue 1995). A recent research project investigating the demographic and genetic status of southern right whales in the New Zealand subantarctic found that the Auckland Is was a primary wintering habitat and calving ground for right whales (Patenaude et al. 1998; Patenaude & Baker 2001). Photographic evidence of interchange between the Auckland and Campbell Is suggested that both are part of one intermingling population (Patenaude et al. 2001). Based on capture-recapture analysis, the subantarctic stock was estimated at c. 900 whales (CI 740–1140), including 330 reproductive females (Patenaude 2002a).

Despite 65 years of protection, right whales in New Zealand waters still number less than 5% of their historical abundance. The apparent paucity of sightings around mainland New Zealand is of particular concern, given the abundance of whales in the subantarctic islands. There are few published reports of sightings of right whales around mainland New Zealand (Gaskin 1964; Cawthorn 1981, 1988; Duffy & Brown 1994; Lusseau & Slooten 2002) and no other information is available on the current status of the southern right whale population around mainland New Zealand.

2. Purpose of research

This report reviews the current demographic status of New Zealand southern right whales around mainland New Zealand. Sightings and photographs of southern right whales around mainland New Zealand were gathered and reviewed in order to:

- Determine if there is any evidence of a recovery of southern right whales around mainland New Zealand;
- Identify mainland coastal sites where there have been repeated sightings of southern right whales;
- Determine residence time and behaviour of right whales in areas of repeated sightings;
- Collate a photo-identification catalogue of southern right whales from around the mainland; and
- Determine, by photo-identification matching of regional catalogues, if the right whales from around the mainland are part of the subantarctic stock, or represent a separate stock.

3. Methods

3.1 COLLATION OF SIGHTINGS AND PHOTOGRAPHS

Southern right whale sightings and photographs were obtained by contacting selected individuals, the Department of Conservation (DOC) and other organisations. These included DOC Regional Offices and Conservancies, whale- and dolphin-watching tour operators, members of the public, vessel logs from fishers, marine mammal researchers, DOC sighting sheets (forwarded by A.N. Baker), the printed press, television archives, and a sighting list collated opportunistically over the past seven years.

Southern right whale sighting information collected included, when available: date, location, group size and group composition, observed behaviour, the person that first reported the sighting, estimated length of the whales, and whether or not photographs were taken. Although southern right whales are easily identifiable (black, lack of dorsal fin, v-shaped blow), it was impossible to confirm that some sightings were of right whales. These sightings were listed as 'unconfirmed' and not included in the analysis. Locations of sightings to the nearest degree and minute were plotted on a map with DOC Conservancy boundaries. These boundaries were used to categorise sightings by Conservancy.

Determining group composition, in particular if an animal was a calf, can be difficult for an observer who is not familiar with right whales. Generally, a calf is defined as an animal whose body when visible at the surface is less than half of the length of an accompanying adult, and the accompanying adult is assumed to be the cow. From this author's experience, members of the public often call a calf an animal that is smaller in size than the companion whale (e.g. juvenile). In this study, sightings considered as definite cow/calf pairs were confirmed by at least one of the following: sighting by an experienced observer; photographs; or when the estimated length of the animal was reported to be between 4.5 and 6 m. Instances when the person reporting indicated that an animal may have been a calf, but status was not confirmed, were listed as such and excluded from analysis pertaining to cows and calves.

Instances when two or more reported sightings were on the same days or within a few days of each other, and in the same location or within a few n.m. of each other, were considered likely resightings if the group size and group composition were similar. This subjective method of grouping sightings is based on right whale behaviour and movement at other southern right whale grounds. The grouping of sightings may downward-bias the number of true unique sightings. However, some 'unique' sightings may have been duplicate sightings of the same whales seen several days apart. This will upward-bias the true number of unique sightings. Without individual photo-identification records of each sighting, the extent of these biases are impossible to resolve.

3.2 PHOTO-IDENTIFICATION AND MATCHING

The technique of photo-identification is relatively straightforward. An animal is uniquely photo-identified by natural (or artificial) markings, and later reidentified by matching the images to a catalogue of photographs. This method has been successfully applied to a wide range of cetacean studies, including right whales. Individual photo-identification of southern right whales has been the primary tool in several studies to determine demographic parameters, including reproductive rates, length of residency, interchange between grounds, and estimating population size (e.g. Payne 1986; Bannister 1990; Best 1990; Payne et al. 1990; Bannister et al. 1997; Burnell & Bryden 1997; Best et al. 2001; Burnell 2001; Patenaude et al. 2001; Rowntree et al. 2001; Patenaude 2002). Individual identification of southern right whales is based on callosity patterns found on the lower lip and rostrum, crenulations along the lower lip, and unusual skin pigmentation on the head or back following methods developed by Payne et al. (1983) and Kraus et al. (1986).

Generally, the selection of photographs to be included in a photo-identification catalogue is based on the quality of the photograph and the number of visible features used in identification. These include the rostral islands, lips, bonnet, coaming and the post-blowhole callosities (Fig. 1). Because of the paucity of photographs available for southern right whales from around the mainland (see Results), any photographs showing at least some of the features mentioned above were included in the catalogue. In order to assess the 'usability' of the images for matching, the overall quality of the photographs was graded as good, fair, or poor based on a combination of parameters judged to affect quality, including focus, grain size of image, horizontal angle, and number of identifying features visible.

In addition, the 'distinctiveness' of each photo-identified whale was evaluated. Distinctiveness refers to the quality of markings used for individual recognition, and by definition refers to markings that are incongruent with common patterns found in other southern right whale catalogues. For example, a continuous callosity pattern is extremely unusual in any southern hemisphere population and thus would be very distinctive. This same pattern would be less distinctive in the North Atlantic catalogue where the majority of whales have a continuous callosity pattern. Distinctiveness of individuals was scored from 1 to 3 with '1' representing highly distinctive individuals, and '3' representing an animal with an identification profile that lacked obvious distinguishing features. These distinctiveness categories were assigned subjectively by a researcher experienced with right whale photo-identification. A special category, '0', was

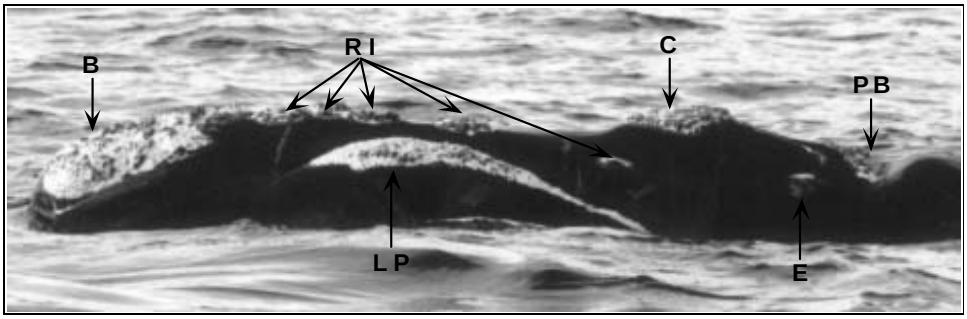

Figure 1 Southern right whale head showing the natural markings used in identification: bonnet (B), rostral islands (RI), coaming (C), lip patch (LP), post-blowhole callosity (PB), and lateral blowhole islands or 'ears' (E). (Author's photograph.)

assigned to those whales with unusual skin patterns ('mottled') that assured a positive identification regardless of the photo quality.

The collated photo-identification catalogue from around the mainland was compared with the New Zealand subantarctic catalogue (Patenaude 2002b). To date, this digital catalogue contains 849 images of southern right whales photographed at the Auckland and Campbell Is. The catalogue is divided into 3 sections: left-side profiles (n = 425); right-side profiles (n = 309); and top-side profiles (n = 115). Photographs of whales from around the mainland were compared with the relevant section in the subantarctic catalogue. In addition, a subset of the available mainland photographs (top-side profiles, n = 6) were compared with the catalogues from Eastern Australia, Western Australia and South Australia at a workshop on southern right whale photo-identification held in Adelaide, South Australia in March 2002.

4. Results

4.1 SIGHTING DATABASE

A total of 110 confirmed, unique sightings of southern right whales, totalling 179 whales, were reported between 1976 and 2002 (Appendix 1). Date, location, and group size were recorded on most occasions. Most groups of known size consisted of singletons (59%), and groups of 2–4 whales (29%). One group, reported in Port Pegasus (Southland Conservancy) in 1990, consisted of at least 10 whales. This is the single largest aggregation of right whales reported in waters around mainland New Zealand.

Groups with cow/calf pairs represented 10% of the sightings (n = 11; Table 1), the first of which was reported in 1991 in Kaikoura. Sightings of cow/calf pairs also were reported in 1992, 1995, 1996, 1997, 1998, 2000, 2001 and 2002 (two sightings). One pair was sighted in or around 1992. Allowing for an average three-year calving interval, as observed in other southern right whale populations (Best et al. 2001; Burnell 2001; Cooke et al. 2001), and assuming that the cows are always returning to waters around mainland New Zealand to calve and that they are sighted when they do, four to five different reproductive females have calved in waters around mainland New Zealand (Table 1). This increases to five or six reproductive females when assuming a four-year calving interval. If every female was different then, at most 11 reproductive females visited waters around mainland New Zealand between 1976 and September 2002.

4.2 TRENDS IN ABUNDANCE

A total of 110 sightings and 179 whales were reported in the last 25 years. Between 1976 and 1987, few right whales were observed around mainland New Zealand (Fig. 2). Single sightings of one whale were reported in 1976 and 1979, another sighting of three whales was reported in 1981. Cawthorn (1981)

reported four whales (unspecified number of sightings) sighted around the mainland between June 1979 and May 1980. No southern right whale sightings were reported from 1982 to 1987. From 1988 onwards, between 1 and 17 sightings of southern right whales were consistently sighted each year, with the highest number of whales reported in 2000 (n = 22).

Both the overall number of sightings and the number of whales sighted have increased significantly between 1988 and 2001 (linear regression; R^2 adj. = 0.67, $P < 0.001$ for sightings and R^2 adj. = 0.41, $P = 0.008$ for whales). The average annual (arithmetic) rate of increase (r) of sightings was 0.207 (95% CI: 0.116–0.303) and the exponential rate of increase (b) was 0.188 (95% CI: 0.110–0.265).

No cow/calf pairs were reported around the mainland between 1976 and 1990. Between 1991 and 2001, no more than one cow/calf pair was sighted in any year (Table 1). In 2002, three separate sightings of cow/calf pairs were made.

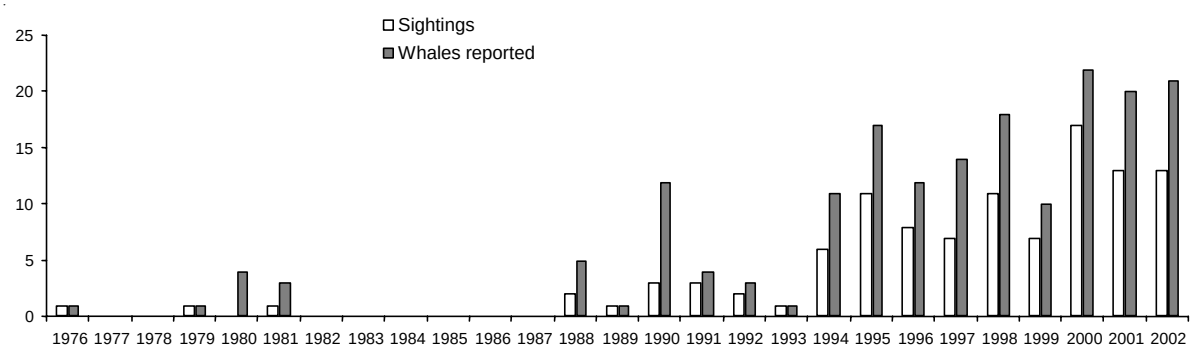

Figure 2. Number of southern right whale sightings and whales reported each year, excluding likely resightings.

TABLE 1 CONFIRMED SIGHTINGS OF COW/CALF PAIRS AROUND MAINLAND NEW ZEALAND. Length of residency, and number of females calving around mainland New Zealand were based on a three- or four-year calving interval.

CONSERVANCY	YEAR	LOCATION	LENGTH OF RESIDENCY	3-YEAR INTERVAL	4-YEAR INTERVAL
Canterbury	1991	Kaikoura	22+ days	Cow 1	Cow 1
Auckland	1992?	Lower Mahurangi Harbour	?	Cow 2	Cow 2
Southland	1992	Te Wae Wae Bay	1 day	Cow 3	Cow 3
Bay of Plenty/East Coast-Hawkes Bay	1995	Mahia Peninsula, Whakatane and back, Fig. 7	27 days	Cow 2 or Cow 3	Cow 1
East Coast/Hawkes Bay	1996	Waihua Bay	1 day	Cow 4 or Cow 3	Cow 2
Bay of Plenty/East Coast-Hawkes Bay	1997	Whakatane River, Mt Manganui, Hicks Bay, Fig. 7	27 days	Cow 1	Cow 4
Bay of Plenty	1998	3 miles reef off Taraunga	1 day	Cow 2 or Cow 3	Cow 5
East Coast/Hawkes Bay	2000	Bay View to Mohaka River, Fig. 7	5 days	Cow 1 or Cow 3	Cow 2
East Coast/Hawkes Bay	2001	Orutua River mouth, Whangawehi, Hicks Bay, Fig. 7	18 days	Cow 2 or Cow 3	Cow 4
Wanganui/Wellington	2002	Bell Block, New Plymouth to Palliser Bay, Fig. 8	21 days	Cow 4	Cow 5
Otago Peninsula	2002	Otakou, Otago Harbour to Cape Saunders	2 days	Cow 4 or Cow 5	Cow 6

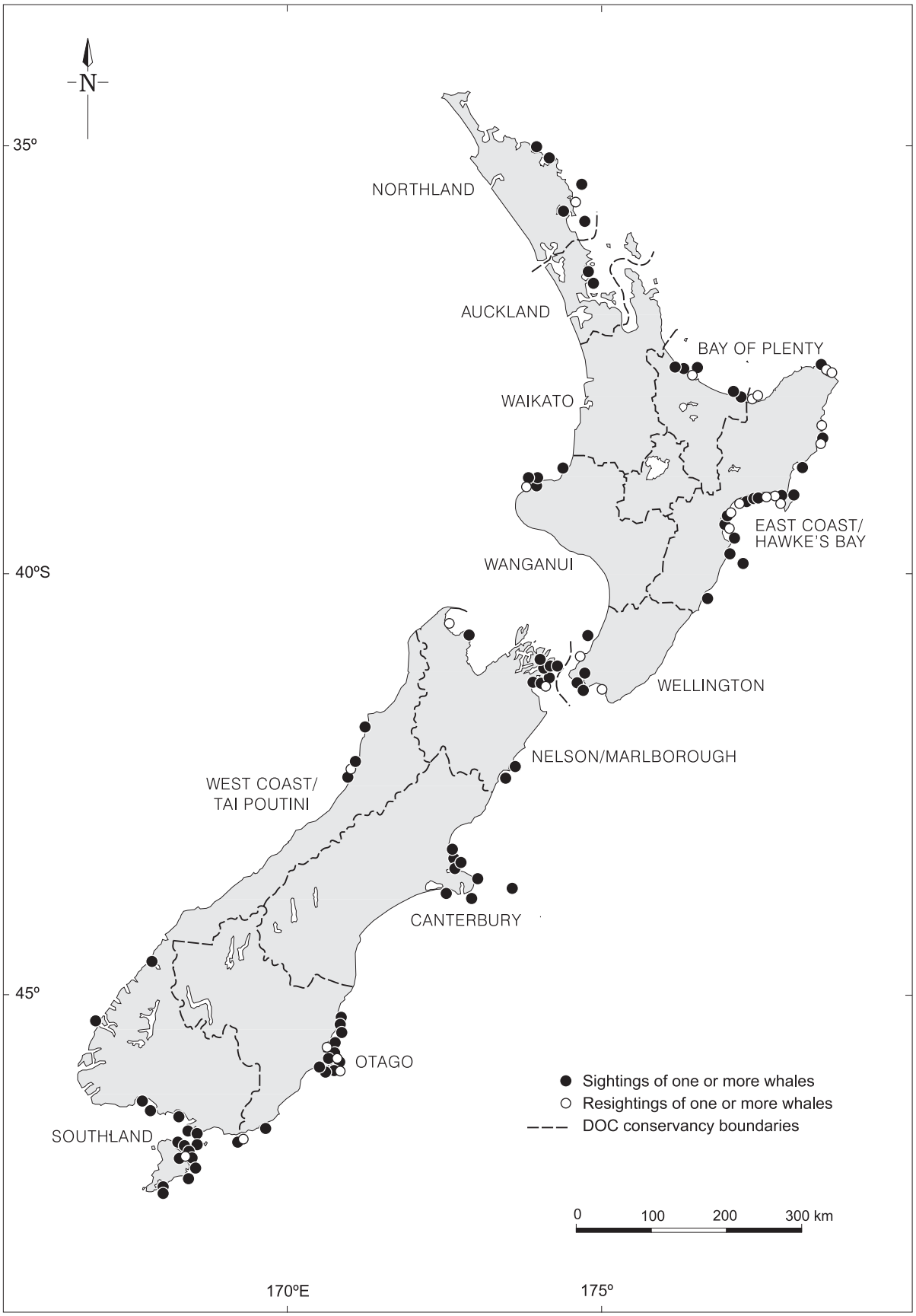

Figure 3. Locations of known sighting and resightings of southern right whales reported around mainland New Zealand between 1976 and June 2002, also showing DOC conservancy boundaries. For detailed locations by conservancy see Appendix 2.

The first two sightings likely represent the same pair traveling from New Plymouth (Wanganui Conservancy) to Palliser Bay (Southland Conservancy) over a three-week period (Table 1, Appendix 1). It was assumed that the third sighting of a cow/calf pair five weeks later in Otago Harbour was of a different pair. Without photo-identification (or genetic identification), it is impossible to determine if these, or in fact any of the sightings reported here, are of the same or different whales.

4.3 DISTRIBUTION

The majority of southern right whale sightings were distributed along the east coast of the North I., and the east and south coast of the South I., generally within 200 m of shore (Fig. 3, Appendix 2). In total, 11 of the 12 Conservancies with coastal boundaries had sightings of southern right whales along their shores (Figs 3 and 4). Waikato is the only Conservancy for which no sightings were reported along its coastline. The northernmost sighting was of a group of 3 whales sighted in 1981 in the Bay of Islands (35°07′S, 174°01′E: Appendix 2). The southernmost sightings (n = 4) were reported in Port Pegasus (47°12′S, 167°40′E: Appendix 2). The highest proportion of sightings was reported for Southland (n = 29 or 26%; Fig. 4). Most sightings in this Conservancy occurred around Stewart I. and the south coast of Southland, and few sightings (n = 2) occurred on Southland's southwest coast (Milford and Doubtful Sounds: Appendix 2). Three other Conservancies had more than 10 sightings reported along their coastlines in the last 25 years: East Coast/Hawkes Bay (n = 19 or 17%), Otago (n = 16 or 15%) and Canterbury (n = 11 or 10%). Other sightings were reported in Wellington (n = 7), Nelson/Marlborough (n = 7), Bay of Plenty (n = 6), Northland (n = 6), Wanganui (n = 5), West Coast (n = 3) and Auckland (n = 2) Conservancies.

The majority of sightings of cow/calf pairs occurred in Bay of Plenty and/or East Coast/Hawkes Bay areas (6 of 11 sightings; Table 1). The distribution of the cow/calf pairs sighted along this eastern coastline extended from Mt Manganui (37°39′S, 176°12′E) to Bay View (39°25′S, 176°52′E: Fig. 3). One cow/calf pair was sighted traveling from New Plymouth (39°05′S, 173°58′E) to Palliser Bay (41°24′S, 175°04′E). Other sightings of cow/calf pairs were reported in Kaikoura (42°24′S, 173°42′E), Mahurangi Harbour (36°30′S, 174°45′E) and Te Wae Wae Bay (46°18′S, 167°37′E). One cow/calf pair was sighted in Otago

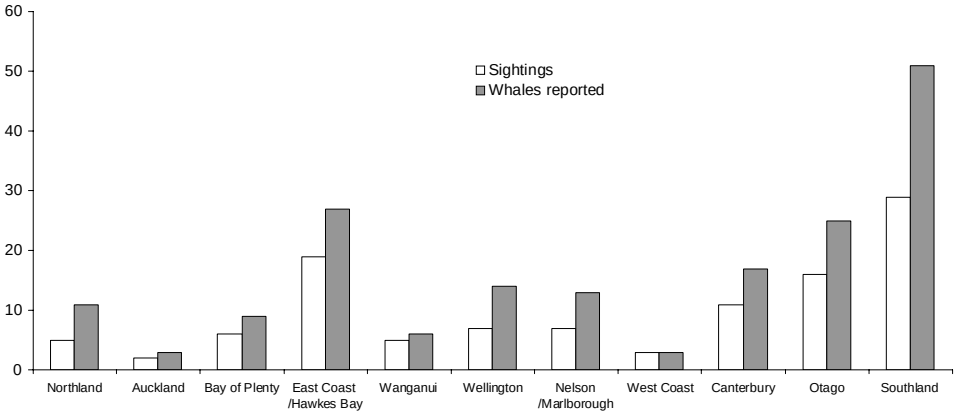

Figure 4. Numbers of southern right whale sightings and numbers of southern right whales reported by Conservancy (excluding likely resightings) between 1976 and 1 October 2002.

Harbour (45°49′S, 170°41′E) and resighted the following day near Cape Saunders (45°53′S, 170°47′E).

4.4 SEASONALITY

Sightings of southern right whales occurred in all four seasons with the majority of sightings occurring in winter (59%, 21 June–20 September: Fig. 5). Almost a quarter of sightings occurred in spring (23%, 21 September–20 December) and few sightings were reported in summer (7%) or autumn (6%). The distribution of southern right whales varied seasonally. While sightings in the south and southern coast of the South Island occurred in all seasons, the occurrence of right whales in the northeastern part of the North Island was limited to winter, spring and autumn. The sighting furthest North in summer occurred in the Hawkes Bay area.

Almost all sightings of cow/calf pairs (one exception) were reported in winter or spring, between 1 August and 5 November (Appendix 1, Table 1). One exception is that of a cow/calf pair reported in the Mahurangi Harbour in 1992. The exact date of the sighting is unknown but was reported as 'sometime in May'.

4.5 RESIDENCE TIME

It is difficult to establish the period of residency without confirmation of a whale's identity. Assumptions of likely residency periods were made based on the timing, location, group composition and behaviour (when reported) of whales sighted (see Methods). Based on these assumptions, most non-cow/calf groups were sighted on a single day, and occasionally on two or three consecutive days, and very rarely during more than a week (Fig. 6). The average residency for non cow/calf groups was 2.5 days (range 1–60 days). One exception consists of a social group sighted over a two-month period in Foveaux Strait, Southland in winter 1990 (Appendix 1). Sightings were reported from Green Islets in the west to Bluff in the east, with the majority of sightings reported from Te Wae Wae Bay. Because few whale groups were sighted during that year, and none other of that size, it was assumed that the multiple sightings were of the same group. The group size was estimated at between 8 and 12 whales. It is likely that the residency of individual whales varied within this group.

The residency of cow/calf pairs range from 1 to 27 days, with a mean residency of 11.5 days (Fig. 6). Movements of five cow/calf pairs sighted over two- to four-week periods are described below.

- In winter 1991, a cow/calf pair was sighted over several days in August. The pair was resighted on 21 September. The minimum residency was of 22 days.
- In winter 1995, a cow/calf pair travelled around Mahia Peninsula and East Cape to Whakatane and back, and was sighted over a period of 27 days (Fig. 7).
- In winter 1997, a cow/calf pair travelled from Whakatane River to Mt Manganui and back to Hicks Bay, and was sighted over a period of 27 days (Fig. 7).

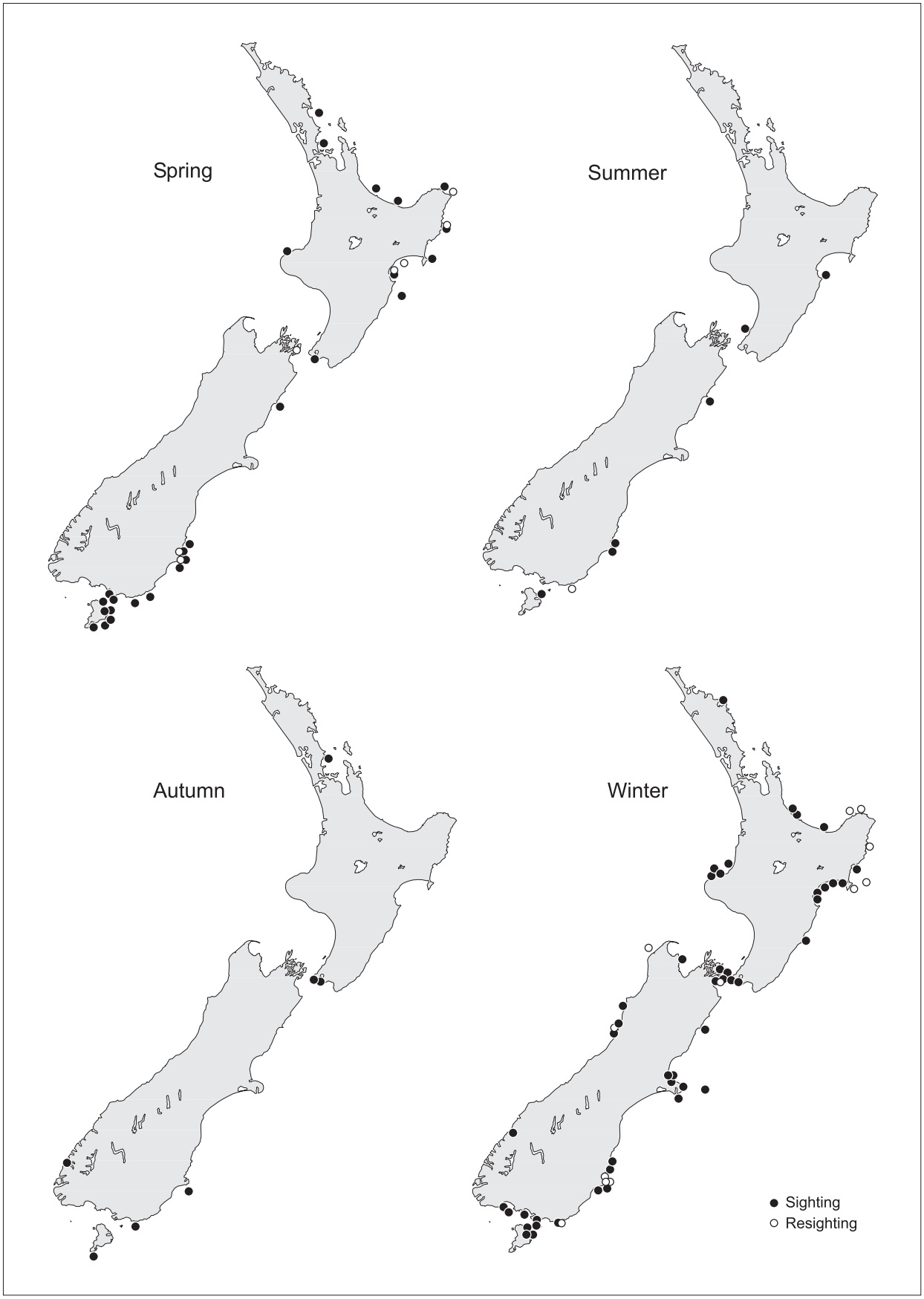

Figure 5. Location of sightings of southern right whales around mainland New Zealand from 1976–2002 during spring (21 September–20 December), summer (21 December–20 March), autumn (21 March–20 June) and winter (21 June–20 September).

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