

Chapter 5

Report on the availability and quality of seabird information in Namibia and South Africa

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1. NAMIBIA

1.1 Historical seabird information in Namibia before 1994

Early, anecdotal, accounts of seabird numbers in Namibia stem from whalers, sealers and guano collectors traveling along the coast of western Africa. Notable among those are descriptive accounts from Morrell (1844; in Shelton *et al.* 1984), Ex-member of the Committee (1845), Eden (1846), Anonymous (1885) as well as those listed in Kinahan (1990, 1992).

The first comprehensive surveys of the Namibian islands as well as the artificial breeding platforms were done using aerial photography in 1956 (Rand 1963). Since then, aspects of seabird population trends, biology and diet have been investigated in Namibia, mainly by the then Sea Fisheries Institute (e.g. Rand 1960, Matthews 1961, Crawford *et al.* 1985, 1991) as well as Cape Nature Conservation (e.g. Berry 1974, Williams 1985, Williams and Dyer 1990) and the University of Cape Town (e.g. Cooper 1985). Largely anecdotal information was also collected, mainly in diaries, by island headmen, tasked with guarding guano stocks and overseeing guano and seal harvesting operations. In addition to subsequent aerial surveys in 1967 and 1969 (Shelton *et al.* 1984), ground surveys of most islands were conducted in 1970 (Frost *et al.* 1976), and roughly annually between 1977 and 1979 and during the 1980s (e.g. Shelton *et al.* 1984, Crawford *et al.* 1995). Counting methods differed between surveys, including aerial surveys and ground counts during which individuals, nests or potential nest sites were counted (see Appendix 1 for an example of different techniques used by various institutions to count African Penguins at Ichaboe Island between 1956 and 1990). Monitoring effort of seabird populations intensified when Ichaboe Island became permanently staffed for that purpose in 1989, followed by Mercury Island in 1992.

1.2 Seabird information in Namibia since 1994

Namibia achieved independence in 1990 and all offshore islands were transferred from South Africa to Namibia by the Transfer of Walvis Bay to Namibia Act, 1993. Since 1994, the Ministry of Fisheries and Marine Resources (MFMR) has been responsible for the management of the islands; while mainland sites fall under the authority of the Ministry of Environment and Tourism (MET), Namdeb or local authorities.

The artificial platforms near Swakopmund and Cape Cross are privately owned.

In 1996, Possession Island became permanently staffed (it had also been briefly staffed during the early 1990s) for the purpose of seabird monitoring. Halifax Island, easily accessible from the town of Lüderitz, has been regularly visited by staff of MFMR and J. Kemper since 1996. Most Namibian seabird information stems from the four staffed / regularly visited islands. In addition, photographs were taken of the guano platforms and gannet colonies during aerial seal censuses, undertaken in mid December in most years since the early 1980s. This is a cooperative effort between MFMR and Marine and Coastal Management (MCM). The aerial photographs are developed, counted and housed by MCM. Occasional surveys of other seabird breeding localities in Namibia, particularly of the non-staffed islands are undertaken. *Ad hoc* sightings of seabirds at sea have been recorded by D. Boyer (formerly of MFMR) during pilchard research cruises in the 1990s. More recently, staff of the seabird section of MFMR have been involved in occasionally monitoring seabirds at sea during trawling and long-lining activities (this includes collecting data for a BCLME project on the effects of long-lining on seabirds).

A large number of seabirds, particularly African Penguins and Cape Gannets, have been and are being ringed in Namibia. A comprehensive data base containing all Namibian seabird ringing records, as well as records of ringed birds recaptured or recovered in Namibia are kept at MFMR.

1.3 Seabird information collected by MFMR

1.3.1 African Penguins *Spheniscus demersus*

1.3.1.1 Population estimates

Monthly count data of active nests (containing eggs or chicks) are available from Mercury Island since 1994, Ichaboe Island since 1992 and from Halifax and Possession Islands since 1996. These four islands support approximately 96% of the African Penguin population in Namibia. Counts are done every two weeks at Possession Island. Separate counts of nests containing eggs and those containing chicks have been done at Halifax Island since 2000 and at Possession Island since 1996. Additional nest counts from other penguin breeding localities are collected during annual seabird surveys and during *ad hoc* visits. Counts done at all localities prior to 1992 are mostly single annual counts of nest sites (nests containing nesting material, eggs or chicks

or those defended by an adult).

Two-weekly counts of moulting individuals (with juvenile individuals undergoing moult counted separately from those in adult plumage) have been done at Mercury Island since 1991 (with a gap between April 1993 and March 1994), Ichaboe Island since 1992, Halifax Island since 1996, with some gaps during the late 1990s and between November 2005 and February 2007, and Possession Island since 1996. All penguin nest and moult counts have been collated, computerised and vetted and are regularly updated.

A comprehensive review of all count data for African Penguins in Namibia was done in 2006 (Kemper 2006).

1.3.1.2 Banding

Large numbers of African Penguins have been banded and subsequently monitored in Namibia. A total of 8 623 penguins were banded between 1991 and 2005; of these, 7 346 were banded as chicks (Table 1). Monitoring intensity of banded penguins in Namibia was poor during the 1980s and early 1990s. As islands became staffed or were visited regularly, monitoring effort increased. At all four islands, banded penguins are currently recorded during fortnightly moult counts as well as during monthly active nest counts, and during daily island rounds at the three staffed islands. Since 2000, additional, dedicated band searches have been carried out at all four islands. Re-sighting effort at these four localities is relatively uniform throughout the year. Since 2002 only rehabilitated penguins and fledglings from monitored study nests are banded, pending the design and supply of better quality penguin bands. Banding, re-sighting and recovery records are regularly updated on MFMR's seabird ringing database (in Excel format), which contained nearly 38 000 records in December 2006. Copies of records are sent electronically to SAFRING and MET at the end of each ringing year. In addition to the information required by SAFRING, the database provides details of the bird's activities, such as breeding or moult status.

1.3.1.3 Breeding success

Individual penguin nests have been monitored throughout the year at Mercury and Ichaboe Islands since December 1996, and at Possession and Halifax Islands since December 1999 and April 2000 respectively. Since January 2000, a number of nest site characteristics have been recorded for each monitored nest. Nest contents of monitored nests were

checked every 5–7 days. A total of 2 780 nests have been monitored until April 2004 at the four islands. Nest monitoring data (including information on the date at which the nest was first monitored, estimated hatching and fledging dates of individual eggs or chicks, and estimated egg / chick mortality dates), associated nest site characteristics, chick weights taken shortly before fledging and banding details of study nest fledglings banded during this period have been collated, computerised and vetted. Study nest data collected after April 2004 still need to be collated and computerised.

Since nests rather than individual pairs are followed, these data do not allow for a calculation of annual breeding success per pair.

1.3.1.4 Diet sampling

Diet sampling of African Penguins is regularly done at Mercury Island (since 2000), and more sporadically at Ichaboe and Possession Islands. Between 2001 and 2005, an average of eight stomach samples were collected each week at Mercury Island. Diet samples have been processed by island staff. Records of diet samples are largely still written in island log books and need to be computerised. Records include information on date and time of collection, weight of the bird, mass of the diet sample and identity and mass of the individual prey species.

1.3.1.5 Transmitter studies

Satellite PTTs (Platform Terminal Transmitters) were fitted to one breeding penguin each at Mercury and Ichaboe Islands in January 2003. Rough summary maps of the recorded tracks were forwarded to MFMR. During a seabird survey in 2005 one breeding penguin each at Halifax and Possession Islands were equipped with PTTs. Electronic data for all four deployments are available at MFMR (Janine Basson) and MCM (A.B. Makhado).

GPS loggers (recording the individual's position at regular interval in addition to other information such as diving depth and water temperature) have been deployed on a number of penguins at Mercury, Halifax and Possession Islands in 2004 and 2005 to obtain information on foraging strategies at different localities. This information forms part of a PhD project by Ms. Katta Ludynia, who is based at the University of Kiel, Germany. Data are currently collated, analysed and interpreted. A copy of all data will be given to MFMR to be incorporated into the seabird data base.

1.3.2. Cape Gannets *Morus capensis*

1.3.2.1 Population estimates

Owing to the size of the gannetries, particularly at Ichaboe Island, and the associated difficulties of doing accurate ground counts of nests, estimates of breeding population size are derived from aerial photos. In most years, aerial photos are taken of all gannetries in Namibia (i.e. at Mercury, Ichaboe and Possession Islands) during the aerial seal census in mid-December, which, in some years might be prior to the breeding peak. The photos are developed and analysed by staff at MCM. The area (in ha) occupied by breeding gannets is estimated using an Ibas interactive image-analysis system; numbers of breeding pairs at a particular breeding locality are extrapolated from the estimated area occupied and ground-based density estimates. Population estimates based on this method have been forwarded to MFMR, but copies of the aerial photos still need to be made available to MFMR for further analysis.

1.3.2.2 Ringing

Between 1998 and 2006, 5 513 Cape Gannet chicks and 834 adults have been ringed at Mercury, Ichaboe and Possession Islands. These records, in addition to 985 re-sighting or re-

Table 1: Number of African Penguin chicks banded in Namibia between 1991 and 2003. Year refers to 1 July of that year to 30 June the following year

Year	Banding locality			
	Mercury	Ichaboe	Possession	Other
1991	305	366	83	33
1992	886	598	190	37
1993	240	309	2	5
1994	76	192	0	0
1995	43	181	0	0
1996	35	84	15	6
1997	118	123	240	12
1998	78	122	172	14
1999	275	228	220	3
2000	118	180	223	49
2001	60	20	165	47
2002	93	307	47	19
2003	34	228	125	18
2004	9	76	131	11
2005	0	78	2	15

covery records between 2002 and 2006 have been computerised and vetted. Additional gannet ringing records from Namibia prior to 1998 have not been computerised yet; in some cases, paper copies of ringing records are missing. These records could be obtained from SAFRING.

1.3.2.3 *Breeding success*

Individual gannet nests have been monitored annually between since the mid 1990s at Mercury and Ichaboe Islands. No study nests have been monitored at Possession Island, as the single, small gannetry there is particularly vulnerable to disturbance. Nest contents of study nests are recorded weekly. Study nest information is recorded in island log-books. None of these data have been collated, computerised or analysed.

1.3.2.4 *Diet sampling*

Diet samples have been regularly collected from Cape Gannets at Mercury Island (between 2000 and 2005). Diet sampling has been sporadic at Ichaboe Island. At Possession Island, virtually no diet sampling has been done in recent years owing to the vulnerability to disturbance of that colony. Some of the samples have been processed; few data have been collated and computerised.

1.3.2.5 *Transmitter studies*

In January 2003, one breeding Cape Gannet each was fitted with a PPT at Mercury, Ichaboe and Possession Island. The transmitter of the gannet at Possession Island failed and another gannet was fitted with a transmitter there in January 2005. Rough summary maps of the recorded tracks of the individuals equipped in 2003 were sent to MFMR. Electronic data for all four deployments are available at MFMR (Janine Basson) and MCM (A.B. Makhado).

GPS data loggers have been deployed on a number of breeding Cape Gannets at Ichaboe Island during the 2004/05, 2005/06 and 2006/07 breeding seasons by Ralf Mullers, PhD student at the Avian Demography Unit, University of Cape Town. This data yields detailed information on foraging flight paths. Data are currently collated and analysed; copies of the data will be given to MFMR upon completion of the project. Similar loggers were used on a smaller sample of Cape Gannets at Mercury Island by K. Ludynia from Kiel University, Germany in 2004.

GPS loggers have also been deployed as part of a collaborative, international study. The data, collected by Drs Sue Lewis in December 2003 at Ichaboe and Mercury Islands, were partially analysed by B. Dundee as part of his MSc project during 2004 and 2005.

1.3.3 *Bank Cormorants **Phalacrocorax neglectus***

1.3.3.1 *Population estimates*

Monthly counts of Bank Cormorant active nests (containing eggs or chicks), active nest sites (nests under construction, but not yet containing eggs or chicks), as well as head counts have been collected at Mercury Island (since October 1990), Ichaboe Island (since January 1990) and Possession Island (since June 1996). Nests at other breeding localities are counted during (annual) seabird surveys or on an *ad hoc* basis. Nest counts have been collated, computerised and vetted.

1.3.3.2 *Ringing*

A total of 586 Bank Cormorants, including 489 chicks, have been ringed at Mercury and Ichaboe Islands as well as Neglectus Islet between 1998 and 2005. Altogether 87 resighting records and nine recovery records (all but one from chick which never fledged) have been reported since 1996. These records are all incorporated into MFMR's seabird ringing database. Computerised records have been vetted; more

ringing records prior to 1998 may exist. These need to be traced, possibly through SAFRING.

1.3.3.3 *Breeding success*

A number of Bank Cormorant nests have been monitored weekly at Mercury Island since 2001. None of these data have been computerised or analysed yet.

1.3.3.4 *Diet sampling*

Samples of Bank Cormorant pellets are collected at irregular intervals, with data gaps between for some years at Mercury and Ichaboe Islands since 2001. Few pellets have been processed and otoliths extracted, sorted by species and counted. Processed and unprocessed pellets are stored at MFMR. No Bank Cormorant diet sampling data have been collated, computerised or analysed.

1.3.4 *Crowned Cormorants **Phalacrocorax coronatus***

1.3.4.1 *Population estimates*

Monthly counts of Crowned Cormorant active nests (containing eggs or chicks), active nest sites (nests under construction but not yet containing eggs or chicks) as well as head counts have been collected at Mercury Island (since August 1996), Ichaboe Island (since January 1990) and Possession Island (since June 1996). Nests at other breeding localities are counted during (annual) seabird surveys or on an *ad hoc* basis. Nest counts from these localities have been only partially collated, computerised and vetted.

1.3.4.2 *Ringing*

Only one Crowned Cormorant has been ringed by MFMR staff since 1996; Potential ringing records prior to 1998 need to be traced, possibly through SAFRING.

1.3.4.3 *Breeding success*

No Crowned Cormorant nests have been monitored in southern Namibia. During 2002, some nests were monitored at Bird Rock platform as part of a final year project of a student studying at the Polytechnic of Namibia. These data have not been made available to the MFMR seabird database.

1.3.4.4 *Diet sampling*

No diet samples have been collected from Crowned Cormorants in Namibia.

1.3.5 *Cape Cormorants **Phalacrocorax capensis***

1.3.5.1 *Population estimates*

Monthly counts of Cape Cormorant active nests (containing eggs or chicks), active nest sites (nests under construction but not yet containing eggs or chicks) as well as head counts have been recorded at Mercury Island (since March 1996), Ichaboe Island (since January 1990) and Possession Island (since June 1996). Peak nest counts, as well as estimates of numbers of nests at other breeding localities are obtained from aerial photographs taken during the seal census in mid-December, during seabird surveys or on an *ad hoc* basis. Counts made during mid-December may not necessarily represent peak breeding activities. Monthly counts have been partially collated, computerised and vetted. Estimates of numbers of breeding pairs from aerial surveys, as well as from correlations with guano production of the platforms in central Namibia have been provided by MCM.

1.3.5.2 *Ringing*

Of the 54 Cape Cormorants ringed in southern Namibia since 1998, 50 were ringed during the January 2003 seabird cruise with rings issued to MCM. These ringing records have been incorporated into the MFMR seabird ringing database. Potential ringing records prior to 1998 need to be traced and

incorporated, possibly with the assistance of SAFRING.

1.3.5.3 Breeding success

No Cape Cormorant nests have been monitored in southern Namibia.

1.3.5.4 Diet sampling

Some pellets have been collected from Cape Cormorants in Namibia, particularly at Mercury and Ichaboe Islands; few have been processed or analysed.

1.3.6 Kelp Gulls *Larus dominicanus*

1.3.6.1 Population estimates

Monthly counts of Kelp Gull active nests (containing eggs or chicks) and active nest sites (nests under construction but not yet containing eggs or chicks) have been recorded at Ichaboe, Halifax and Possession Islands. Monthly head counts are made at these three islands as well as at Mercury Island. Much of these counts are still in island logbooks. So far, data for Ichaboe have been computerised for the period July 1998 to October 2004, Halifax (January 2000 to November 2005) and Possession Island (parts of 1998 and 1999, 2004). Nests at other breeding localities are counted during (annual) seabird surveys or on an *ad hoc* basis; some of these data have been computerised.

1.3.6.2 Ringing

A total of 784 Kelp Gulls, including three juvenile and three adult individuals were ringed in southern Namibia between 2000 and 2005. These data, as well as 153 re-sighting and recovery records have been incorporated into MFMR's seabird ringing database. Ringing records from before 2000 need to still be entered on the database.

1.3.6.3 Breeding success

A few nests have been monitored at Ichaboe Island as well as at Possession Island. These data have not been computerised, vetted or analysed yet.

1.3.6.4 Diet sampling

No diet samples have been collected from Kelp Gulls in Namibia.

1.3.7 Other species

Other seabird species for which monthly counts exist from Mercury, Ichaboe, Halifax and Possession Islands include Whitebreasted Cormorant (*Phalacrocorax lucidus*), Hartlaub's Gull (*Larus hartlaubii*), Swift Tern (*Sterna bergii*), Damara Tern (*Sterna balaenarum*) and African Black Oystercatcher (*Haematopus moquini*). Information collected may include counts of individuals, active nests and active nest sites.

The presence of other species of sea- and shorebirds encountered at the staffed islands are recorded during monthly counts or during daily island rounds.

1.4 Recommendations

It is suggested that basic but regular monitoring of seabird populations in Namibia, particularly those which are threatened locally or globally, is continued at least at Mercury, Ichaboe, Halifax and Possession Islands. Where possible, monthly counts are advantageous, although single annual counts at remote localities are also valuable.

It is imperative that good quality photocopies of ALL island logbooks are made. This task should be a priority, to be effected by the seabird section at MFMR. Copies need to be carefully checked for quality, collated and stored properly. On several occasions logbooks have been lost or became illeg-

ible, and valuable information has been lost. Similarly, poor-quality photocopies of logbooks have caused data to become illegible.

All data need to be computerised in a way which maximises the detail of data collected, yet allows easy summarising, filtering and sorting of data. Data headings must be explicit to avoid confusion and to ensure a standardised monitoring approach. An original database should always be kept separately, in case of a diskette becoming corrupt or infected with a virus, or through accidental "mis-sorting" (a classic example involved a large Excel spreadsheet containing detailed ringing and re-sighting information from Mercury Island. During a sorting operation, only one column was sorted instead of the whole sheet, causing the information on the spreadsheet to become jumbled. The problem was only noticed until after the jumbled version had been saved. The file had not been backed up anywhere else and had to be re-typed). Computerised data need to be backed up regularly in more than one location.

A number of monitoring techniques have been used to estimate seabird populations since comprehensive counts of seabirds were first made in the 1950s. Although monitoring protocol has been standardised in Namibia, there are still inter-regional differences, particularly with regard to the definition of what constitutes a nest. Differences must be considered and acknowledged when interpreting long-term population trends at a particular locality or between localities and regions.

1.5 Contacts and queries regarding Namibian data

All data collected at seabird breeding localities in Namibia by staff of the Ministry of Fisheries and Marine Resources are collated and curated by the Seabird Section, Lüderitz Marine Research, Ministry of Fisheries and Marine Resources, PO Box 394, Lüderitz, Namibia. Ownership of these data rests with MFMR.

Queries regarding all MFMR seabird data should be directed to:

Head of Section, Seabird Section
National Marine Information and Research Center
Ministry of Fisheries and Marine Resources
P.O. Box 912, Swakopmund, Namibia
Tel: +264 64 4101000, Fax: +264 64 404385

Queries regarding data collected in Namibia prior to 1994 by the South African Sea Fisheries Research Institute (SFRI), now named Marine and Coastal Management (MCM), and not yet made available to Namibia, should be directed to:

The Deputy Director
Sub-directorate Ecosystem Utilization and Conservation
Department of Environmental Affairs and Tourism
Branch: Marine and Coastal Management
Private Bag X2, Roggebaai 8012, South Africa
Tel: +27 21 4023114, Fax: +27 21 4023639

Additional information regarding seabird abundance at coastal localities not monitored by MFMR is collected by staff of the Ministry of Environment and Tourism, as part of their bi-annual Wetland Bird Count. For further details, contact:

Holger Kolberg
Principal Conservation Scientist, Survey Unit
Directorate Scientific Services
Ministry of Environment and Tourism
Private Bag 13306, Windhoek, Namibia
Tel. +264 61 2842554, Fax +264 61 259101

2. SOUTH AFRICA

Similarly to Namibia, information on seabirds breeding in South Africa was largely anecdotal until surveys were undertaken by Rand (1963a) in the 1950s. Little information was collected in the 1960s and early 1970s (for sources of these sporadic studies refer to Hockey *et al.* 2005).

2.1 Population estimates

Commencing in 1977, the numbers of active nest sites of all seabird species have been counted at many South African colonies in many years. The raw data are stored on maps of islands and island visit cards at MCM (contact person B.M. Dyer).

Results for African Penguins up until 1994 have been published in Crawford *et al.* (1995) and for the Western Cape for 1987 to 2005 in Underhill *et al.* (2006).

For African Penguins, two-weekly counts of moulting individuals (with juvenile individuals undergoing moult counted separately from those in adult plumage) have been done at Robben Island since 1989 (Underhill and Crawford 1999). Shorter time series exist for some other islands. Information for Robben Island is computerised at MCM (R.J.M. Crawford) and for Dassen (contact person A.C. Wolfaardt) and Dyer (contact person L. Waller) islands at CapeNature.

As in Namibia, owing to the size of the gannetries, estimates numbers of Cape Gannets breeding are derived from aerial photos and measures of nest density (Crawford *et al.* 2007). Large colonies of Cape Cormorants have also been counted from aerial photographs (methods described in Shelton *et al.* 1982). The photographs are developed and housed at MCM (contact person B.M. Dyer).

2.2 Banding

Large numbers of seabirds have been banded and subsequently monitored in South Africa. Information on banding, as well as recoveries and re-sightings, is stored at SAFRING. Recent analyses for African Penguins include Whittington *et al.* (2005a, 2005b). Other species that have been intensively banded include Great White Pelican, Cape Gannet, Cape and Crowned Cormorants, Kelp and Hartlaub's Gulls and Swift Tern. Some results are reported in Hockey *et al.* (2005).

2.3 Breeding information

Breeding success of African Penguins has been monitored over several years by MCM and Earthwatch (L.G. Underhill, University of Cape Town) at Robben Island (Crawford *et al.* 2006) and by CapeNature at Dassen Island (contact person A.C. Wolfaardt). For Cape Gannets, it has been monitored by MCM at Lambert's Bay and Malgas Island. The data collected by MCM and Earthwatch are stored at MCM (contact person L. Upfold).

Colony census cards have recorded information on the nest contents of most seabirds over several years. These cards are stored at MCM (contact person B.M. Dyer). They provide information on the numbers of eggs and chicks present at nests that were investigated.

2.4 Diet sampling

MCM maintains a computer database that records information pertaining to the diet of seabirds. A manual for use of the database is available (contact person L. Upfold). Sampling of the diet of Cape Gannets has been undertaken in most months at Lambert's Bay and Malgas Island since 1978 (about 50 regurgitations being collected each month). More

sporadic information is collected from Bird Island, Eastern Cape. Sampling of the diet of African Penguins has been conducted at Robben Island since 1989 and at Dassen Islands since 1991. More sporadic information is collected from Dyer Island and the Eastern Cape. For other seabirds, diet samples are collected opportunistically, e.g. regurgitations by chicks when they are being banded.

2.5 Transmitter studies

PTTs have been fitted to African Penguins and Cape Gannets by MCM. Electronic data are stored on a database at MCM (contact person A.B. Makhado).

GPS loggers (recording the individual's position at regular interval in addition to other information such as diving depth and water temperature) have been deployed on a number of penguins and gannets by the University of Cape Town (contact person P.G. Ryan, Percy FitzPatrick Institute, also R. Navarro, Avian Demography Unit).

2.6 Queries

Queries regarding MCM data should be directed to:

The Deputy Director
Sub-directorate Ecosystem Utilization and Conservation
Department of Environmental Affairs and Tourism
Branch: Marine and Coastal Management
Private Bag X2, Roggebaai 8012, South Africa
Tel: +27 21 4023114, Fax: +27 21 4023639

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APPENDIX

Example of different counting methods used for African Penguins at Ichaboe Island, Namibia, between 1956 and 1990

Date	Method	What counted	Count	Source
Oct. 1828	anecdotal		literally covered	Morrell 1844; in Shelton <i>et al.</i> 1984
28 May 1845	anecdotal		about 100 000	Eden 1846 ¹
Dec. 1851	anecdotal		innumerable	Keane 1851, in Kinahan 1992
1853	anecdotal		numbers much reduced	Anonymous 1885
1860	anecdotal		numbers recovering	Anonymous 1885
1885	anecdotal		present	Anonymous 1885
20 Nov. 1956	aerial	individuals	4179	Rand 1963 ²
20 Nov. 1956	aerial	individuals	8400	Rand 1963 ³
15 Nov. 1967	aerial	individuals	2882	Shelton <i>et al.</i> 1984
25 /26 Nov. 1969	aerial	individuals	3226	Shelton <i>et al.</i> 1984
1970	rough estimate	total population	2000	Frost <i>et al.</i> 1976
12–13 March 1977	visit	adults	several thousand	Shaughnessy 1977
24–28 Nov. 1978	transects	nest sites	3598	Shelton <i>et al.</i> 1984
24–28 Nov. 1978		breeding population	7196	Shelton <i>et al.</i> 1984 ⁴
28 Nov. 1978	aerial	individuals	10 437	Shelton <i>et al.</i> 1984
28 Nov. 1978	aerial	individuals	12 207	Shelton <i>et al.</i> 1984 ⁵
9 July 1979	aerial	individuals	2120	Shelton <i>et al.</i> 1984
3–7 Feb. 1980	head count	nest sites	4200	Shelton <i>et al.</i> 1984
24 Nov. 1985	visit	nest sites	2070	Crawford <i>et al.</i> 1990
25 Nov. 1986	visit	nest sites	739	Crawford <i>et al.</i> 1995
27 Nov. 1986	visit	nest sites	739	SFRI unpubl. report 1986
29 Aug. 1987	visit	nest sites	1372	Crawford <i>et al.</i> 1995
2 Dec. 1987	visit	nest sites	827	Crawford <i>et al.</i> 1995
June 1990	visit	nest sites	2427	Crawford <i>et al.</i> 1995

¹ “more numerous than at any other part of the coast which I have seen” p. 34

² actual count from photos

³ estimated population

⁴ extrapolated from nest sites

⁵ aerial count adjusted for absenteeism