Assessment of the conservation status of African Black Oystercatcher *Haematopus moquini*

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This chapter is dedicated to Phil Hockey and Doug Loewenthal, both of whom died during the preparation of this volume.

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The African Black Oystercatcher *Haematopus moquini* occurs in southern Africa, breeding exclusively in Namibia and South Africa. The non-breeding range extends into Angola and Mozambique. The population size in the early 2000s is estimated to be 6,670 birds, an increase of 46% since the early 1980s, and continues to increase. The breeding range is expanding eastwards, into KwaZulu-Natal. The increase in population size is attributed to the invasion of the southern African shoreline by the Mediterranean Mussel *Mytilus gallo-provincialis*, better conservation management of the offshore islands and a ban on off-road vehicles driving on beaches in South Africa. Females are larger than males, with the largest relative distance being in bill-length with the bills of females being 13% longer than those of males. Breeding takes place during the austral summer, mainly October to March, but stretching into May. Mean clutch size is 1.8 eggs, with most clutches having one or two eggs; there has been an increasing proportion of three-egg clutches. Human disturbance and coastal development, both impacting oystercatchers both during the breeding season and outside of it, are regarded as key threats to the species. Because the African Black Oystercatcher breeds in the open, in the narrow zone between the spring high-tide level and the edge of the coastal vegetation, two predicted consequences of climate change are likely to impact breeding success: higher temperatures may result in embryos overheating; storm surge events, especially if they coincide with spring high tide, are likely to result in losses of eggs. Nine postgraduate research projects have focused on the African Black Oystercatcher since 2000, generating a vast of amount of new knowledge and insights into the species. We recommend that the current conservation status for the African Black Oystercatcher, as 'Near-threatened' can no longer be justified, and that the species be reclassified as 'Least concern'.

TAXONOMIC STATUS

The African Black Oystercatcher was described as a species by Bonaparte, 1856. At one stage, the now extinct Canarian Black Oystercatcher was considered conspecific with the African Black Oystercatcher (Hockey 1982).

Photo A. A pair of copulating African Black Oystercatchers on the coast of Luderitz, Namibia (photo: Jan Paul Roux).

INTRODUCTION

The African Black Oystercatcher is one of the all-black oystercatcher species, occurring along the coastline of southern Africa, almost exclusively in Namibia and South Africa, with records from Angola on the west coast and Mozambique on the east coast of Africa. The breeding range is shorter, stretching from southern Namibia to southern KwaZulu-Natal in South Africa. This chapter reviews the

LIFE HISTORY

Biometrics, survival rates, age at first breeding, intrinsic population growth rates and population viability

Female African Black Oystercatchers are c. 40 g heavier than males (701 g vs 660 g), a difference of 6% (Table 1). The mean wing lengths and tarsus lengths, though statistically significantly different with the females being larger than the males, are similar (wing lengths differ by 1.5%, tarsus lengths by 2.6%). The largest relative difference is for bill-length; the mean bill-length of females is 72.6 mm, 13% longer than that of males, which is 64.1 mm (Table 1).

Average annual survival of breeding adults was estimated to be 96% (SD 2%), based on four years of colour ring-resighting data of adult birds on Dassen Island (33°26'S, 18°05'E), Western Cape (Loewenthal 2007). Average first-year survival post-fledging was estimated to be 60% (SD 15%), and average yearly survival of prebreeding birds of 1–4 years of age was estimated to be 80% (SD 8%) based on six years of colour ring-resighting data of birds reared on islands and on the mainland, on the west coast of South Africa and repeatedly resighted at 39 important roost sites (Rao 2005) on the west coast of South Africa and Namibia (Loewenthal 2007). A capture-recapture analysis using models such as MARK remains to be undertaken, so these survival estimates should be treated as provisional.

The females become sexually mature at three years and the males at four (Hockey 1996a). They do not breed until they have obtained a territory. The range of ages at first breeding has been estimated to be 4–10 years for island populations and 4–6 years for mainland populations (Loewenthal 2007). The youngest recorded age at first breeding is three years for males and four years for females (Hockey 1996). However, based on known age distributions, it is likely that the age at first breeding for island birds exceeds 10 years (Loewenthal 2007).

Based on these estimated values for survival of different age classes, and mean breeding success values at unprotected mainland sites, at protected mainland sites, and on islands, the mean intrinsic population growth rates were estimated to be 6.4%, 7.6% and 17.5%, respectively (Loewenthal 2007).

Hockey (2001) estimated that 0.33 fledglings per pair per year were needed to keep the population stable. Population viability analyses indicated little chance of population extinction, both treating the population as one global entity and as separate populations for unprotected mainland sites, protected mainland sites and islands (Loewenthal 2007). These models incorporated (a) variability in breeding success, (b) error in estimates of adult survival, (c) error in estimates of first year survival, (d) error in estimates of subadult survival (i.e. survival from 1–4 years) and (e) mass mortalities with a frequency probability of once in 10 years, which lowered adult survival to between 50% and 70% (based on data on paralytic shellfish poisoning from Hockey & Cooper (1980)). In all cases the persistence probability over 200 years and at more than 5% of current population levels was estimated to be greater than 80% (Loewenthal 2007).

BREEDING SUCCESS

Mean breeding success rates for local populations (fledglings per pair) are highly variable, both between years and between sites, but populations in protected areas have higher reproductive output than populations in unprotected areas on the mainland of South Africa, while breeding success of populations on islands is 2−3 times higher than that for mainland populations (Loewenthal 2007) (Fig. 1). The mean and SD values (fledglings per pair per year) are estimated to be 0.34 (SD 0.24), 0.42 (SD 0.19) and 0.91 (SD 0.13) for unprotected mainland populations (UMPs), protected mainland populations (PMPs) and island populations (IPs), respectively. This analysis was based on 57 site-years of data for UMPs, 25 site-years of data for PMPs and five site-years of data for IPs analysis, and used data gathered between 1984 and 2005, but not all populations were monitored in all years Loewenthal's (2007).

In a clutch of more than one egg, the chicks hatch almost simultaneously (Hockey 1983b) thus siblings are virtually the same size until about two weeks after hatching when their masses become visibly different (Tjørve *et al.* 2007). This difference in size is influenced by sibling rivalry and parental care and result in one larger, faster growing chick and one slow growing, smaller chick (Tjørve *et al.* 2007). The larger chick frequently fledges earlier than the smaller and thus improves its chances of survival compared to the smaller chick (Tjørve & Underhill 2009).

African Black Oystercatchers breed in the southern hemisphere summer (October till March) but some may carry on into May (Calf & Underhill 2005). This is the best time of year because the weather is warm and dry (Calf & Underhill 2005) and few storms occur (Tjørve & Underhill 2005). The extent of their breeding range is from Lüderitz in Namibia in the north and along the coast to the Eastern Cape Province of South Africa in the east (Hockey 1983a). The offshore islands play a major role in supporting the breeding population of oystercatchers due to the lack of predators and minimal disturbance (Summers & Cooper 1977).

The camouflaged eggs are laid in a small indentation or scrape just above the spring high tide level (Hockey 1982, 1983b, Calf & Underhill 2002). Their territories are usually a narrow strip along the shore about 5–20 m wide, depending on the width of the intertidal zone (Calf & Underhill 2005). Territory length varies, clearly dependent of food availability.

Table 1. Biometric measurements for female and male African Black Oystercatchers (data from Kohler 2011 where the measurement details are described). Birds were sexed using molecular methods. The oystercatchers were measured at nine sites between East London, Eastern Cape, and Langebaan Lagoon, Western Cape. There was no significant variation within this range (Kohler 2011).

	Females			Males		
	Mean (SD)	Range	n	Mean (SD)	Range	n
Mass (g)	701 (39)	630–775	29	660 (36)	580–730	32
Wing (mm)	269 (4)	260–277	30	265 (6)	253–282	33
Tarsus (mm)	58.2 (2.1)	54.5–62.2	30	56.7 (2.5)	52.7–66.3	33
Bill length (mm)	72.6 (3.2)	64–78	30	64.1 (2.6)	58.7–69.8	33
Bill depth (mm)	12.3 (0.7)	11.1–14.1	25	12.3 (0.9)	10.0–14.4	26
Bill-tip depth (mm)	5.6 (0.5)	4.6–6.8	25	6.0 (0.7)	4.5–7.2	26
Bill-tip depth/Bill length	0.08 (0.01)	0.06–0.09	25	0.09 (0.01)	0.07–0.11	26

Photo B. Nest with two eggs of an African Black Oystercatcher (photo: Les Underhill).

On mainland sandy beaches, territory lengths are frequently of the order of 1 km, whereas within the sheltered artificial rocky shore at the Koeberg Nuclear Power Station, shortest territory lengths were about 50 m (Parsons 2006). The birds have to compromise between lack of visibility to the approach of predators, and therefore higher predation risk when they breed high on the shore, close to the vegetation line, and a higher risk of nests washing away when they breed low on the shore (Calf and Underhill 2005).

The mean clutch size is 1.77 eggs (Parsons 2006). Mean dimensions of 947 eggs on Robben Island were 61.63 mm (SD 0.37) × 42.01 mm (SD 0.18) with a mean reconstituted fresh mass of 57.96 g (SD 0.55) (Underhill & Calf 2005, Spiby 2012). Most clutches (c. 80%) contain two eggs, but three-egg clutches have increased to c. 8% of clutches since the invasion of the Mediterranean Mussel *Mytilus galloprovincialis* (Hockey *et al.* 2005, Parsons 2006), described below. The incubation period is c. 32 days. The chicks are semi-precocial, mobile from hatching and parent-fed. The period from hatching to flight, at about two-thirds adult mass, is c. 40 days, but chicks rely on their parents for food until after fledging (Hockey 1984, 1996b, Parsons 2006). The period from fledging to departure from the territory of the adults is variable, from 50 days to 180 days (Hockey *et al.* 2005, Parsons 2006). Up to four replacement clutches have been recorded in a single breeding season (Parsons 2006).

In a review of 23 detailed studies of breeding productivity, which took repeat clutches into account, the number of eggs produced per breeding pair per season ranged from 1.9 to 4.1, with a median of 2.5 and a mean of 2.57 eggs (Parsons 2006). The number of hatchlings per breeding pair per season ranged from 0 to 1.53, with a median of 0.72 and a mean of 0.79 hatchlings per pair and the number of fledglings per breeding pair per season ranged from 0 to 0.94, with median 0.31 and mean 0.37 (Parsons 2006). The number of fledgling per egg ranged from 0 to 0.42, median 0.12 and mean 0.15 (Parsons 2006).

Hatching success, measured as the percentage of eggs which hatched ranged from 0% to 63% (median 30%, mean 32%) and fledging success, measured as the percentage of hatchlings which fledged ranged from 15% to 100% (median 45%, mean 48%) (Parsons 2006). Parsons (2006) noted that hatching success was less than fledging success in 17 of 22 studies for which this information was available.

MOVEMENTS

Hockey *et al.* (2003) calculated that 36–46% of juveniles from South Africa migrate to one of five nurseries on the coast of Namibia and southern Angola. They cover distances of up to 1,500–2,000 km in 2–3 months, the longest recorded distance being 2800km from East London along the coastline to the Walvis Bay nursery in Namibia (Hockey *et al.* 2003). The birds leave the nurseries at 2–3 years of age, where they then return to where they were hatched (Hockey *et al.* 2003). The rest of the juveniles undertake short-distance dispersal, no more than about 150 km from their natal sites (Hockey *et al.* 2003).

The main factor influencing the dispersal strategy of the birds is their body condition during development (Hockey *et al.* 2003). The heavier birds tend to undertake the long-distance migration to a nursery (Hockey *et al.* 2003). There are costs and benefits associated with each dispersal strategy (Hockey *et al.* 2003). The birds that embark on the long-distance migration use up a lot of energy during the flight but once there they have access to competition-free food, whereas the short-distance dispersers do not need to be able to meet the high energetic costs of flying long distances but they do, however, have to compete with aggressive adults for foraging grounds (Leseberg 2001).

In contrast to juveniles, adults are monogamous and once a territory is secured they remain on it, and defend it for life (Hockey *et al.* 2003).

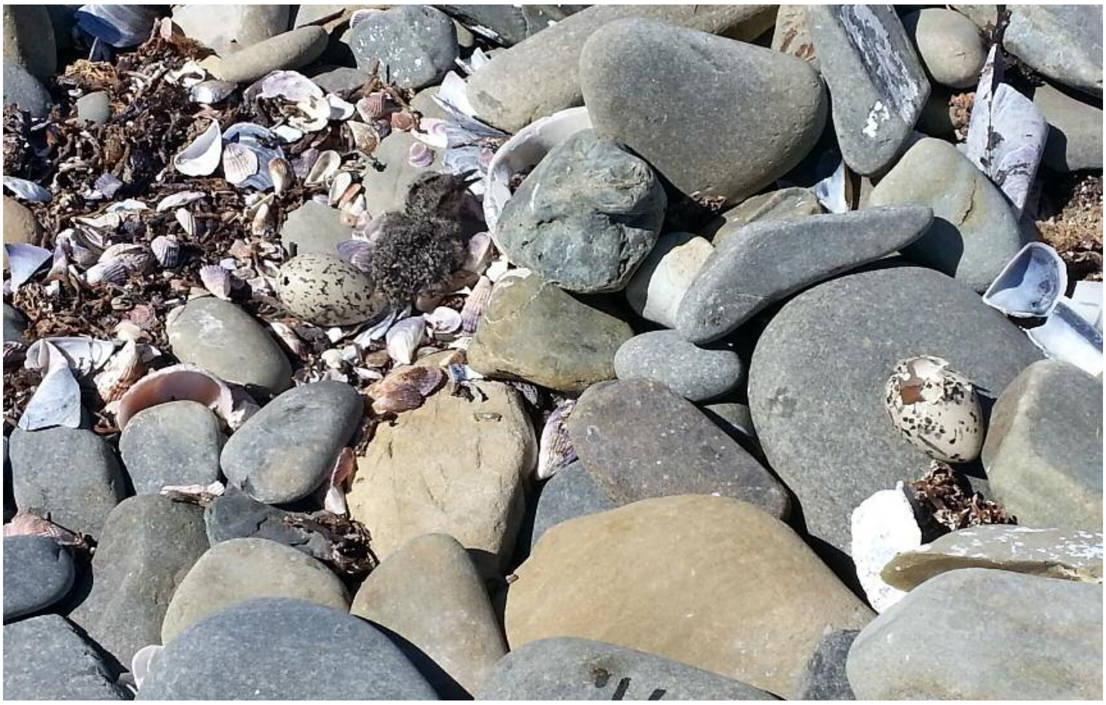

Photo C. Nest of an African Black Oystercatcher with a chick that has just hatched and an egg in the process of hatching on 27 December 2013 (photo: Les Underhill).

HABITAT

The African Black Oystercatcher is exclusively coastal; it occurs on rocky shores, sandy shores, and mixed rocky and sandy shores (Hockey *et al.* 2005). It also occurs at estuaries (in South African terminology, an estuary is a river which is open to the sea), lagoons (a sandbank blocks the river from the sea, and the site has no tidal activity) and at coastal pans (frequently saline or hyper-saline); these are primarily used as roost sites (Hockey *et al.* 2005). It avoids, or occurs at low densities, on high-energy rocky shores, most of which have a narrow intertidal zone. Many of the gaps in its distribution in South Africa are attributable to these shore-types; it also does not occur where there are cliffs (Summers *et al.* 1976, Underhill *et al.* 1980).

FOOD

The main prey items of the African Black Oystercatcher are the limpet *Scutellastra cochlear*, the invasive Mediterranean Mussel (Kohler *et al.* 2009) and a variety of other invertebrates (Hockey 1996) with slight sex-related differences. Kohler *et al.* (2009) found that while both sexes had a mix of isotope signatures, the males had one nearer to that of limpets and the females nearer to that of mussels. This difference in diet preference helps reduce intra-specific competition and allows for maximum use of the foraging grounds (Durell 2000). A major problem for these birds is that their foraging time is limited to low tide which is when they can access their foraging grounds; the intertidal zone (Tjørve and Underhill 2008). African Black Oystercatchers on sandy shores are probably less time-constrained than those on rocky shores, because feeding takes place throughout the tidal cycle (Parsons 2006).

DISTRIBUTION

The African Black Oystercatcher has a regular breeding range along the coast extending from Ichaboe Island, north of Lüderitz, in southern Namibia, to the Inhlanhlani River mouth near Port Edward in southern KwaZulu-Natal (Brown

Table 2. Trends in numbers of African Black Oystercatchers on the mainland of Namibia and South Africa.

Sub-region	Shore length (km)	1978–1980		1997–2002	
		Count	Birds.km^{-1}	Count	Birds.km^{-1}
Kunene River–Orange River	1,520	506	0.33	379	0.25
Orange River–Olifants River	175	86	0.49	79	0.45
Olifants River–Cape Point	387	949	2.45	1,264	3.26
Cape Point–Mossel Bay	284	394	1.38	677	2.38
Mossel Bay–Port Elizabeth	241	315	1.31	726	3.01
Port Elizabeth–Kei River	271	315	1.16	637	2.35
Kei River–Ramsgate	192	25	0.13	43	0.22
Total	**3,071**	**2,590**	**1.04**	**3,876**	**1.26**

& Hockey 2007). Extralimital breeding attempts on the Namibian coast north of Lüderitz have been unsuccessful (Braine 1987) or unconfirmed (Simmons & Kemper 2000).

Breeding adults are territorial, sedentary and non-migratory (Hockey 1983b). Breeding populations are known to occur on three of the 18 islands in Namibia and particularly Possession Island (27° 01'S, 15° 12'E) (102 nests, April 2001) (Simmons & Brown 2007), on eight of 11 islands in the Western Cape (Hockey 1983a, Loewenthal 2007) and on two of three islands in the Eastern Cape Province (Hockey 1983a, Loewenthal 2007). On the mainland, breeding populations occur throughout the breeding range with discontinuities due mainly to lack of suitable habitat. Coastal cliffs and areas where rocks plunge steeply into the sea do not support either breeding or non-breeding birds (Hockey 1983a, Loewenthal 2007). As with Namibia, in South Africa, the largest breeding densities occur on predator-free islands (Hockey 1983a, Simmons & Brown 2007, Loewenthal 2007). In South Africa, the largest breeding densities occur on off-shore islands and along some mainland stretches of mixed rock and sandy shore in the southwestern area of the species' range in the Western Cape, as well as on stretches of sandy beach on the mainland coast in the Eastern Cape (Hockey 1983a, Loewenthal 2007).

The west coast of South Africa and the coastline of Namibia and southern Angola support *c.* 39 important roost sites regularly used by pre-breeding birds of 1–4 years of age (Rao 2005). Of these areas, four sites on the Namibian coast and one site on the southern Angolan coast, all of which lie outside of breeding range, support *c.* 40% of the global annual production of young (Leseberg 2001, Hockey *et al.* 2003): Douglas Point (26°19'S, 14°52'E), Hottentots Bay (26°07'S, 14°55'E), the Sandwich Harbour/Walvis Bay/Swakopmund complex (birds move between these sites located between 23°19'S, 14°28'E and 22°40'S, 14°31'E), Hoanib River Mouth (19°28'S, 12°42'E) and Baie dos Tigres, southern Angola (16°43'S, 11°44'E).

Since the early 1990s, the African Black Oystercatcher has undergone an eastward range expansion into the eastern part of the Eastern Cape and KwaZulu-Natal (Brown &

Table 3. Counts of African Black Oystercatchers and population changes on the offshore islands of Namibia and South Africa.

Region	Island	Pre-1980	Post-1997	Difference
Namibia	Mercury	2	6	4
	Ichaboe	3	23	20
	Marshall Rocks	0	0	0
	Staple Rocks	0	0	0
	Dumfudgeon Rocks	2	0	-2
	Flamingo	10	142	132
	Seal	97	6	-91
	Penguin	55	34	-21
	Shark	8	10	2
	Halifax	71	77	6
	North Long	2	1	-1
	Lady's Rocks	0	0	0
	North Isle	5	–	-5
	Possession	281	386	105
	Albatross Rocks	3	2	-1
	Pomona	24	60	36
	Plumpudding	8	7	0
	Sinclair	5	1	-3
	Total	**574**	**755**	**181**
South Africa				
Western Cape Province	Unamed Islands	14	0	-14
	Malgas	66	129	63
	Marcus	123	65	-58
	Jutten	175	234	59
	Schaapen	23	25	2
	Meeuw	10	8	-2
	Vondeling	78	117	39
	Dassen	221	339	118
	Robben	40	166	126
	Seal (False Bay)	1	–	-1
	Geyser	1	–	-1
	Dyer	–	–	–
	Total	**788**	**1,143**	**355**
Eastern Cape Province	Seal (Mossel Bay)	0	9	9
	St. Croix	16	20	4
	Bird Island Group	14	14	0
	Total	**30**	**43**	**13**
	Island Total	**1,406**	**1,941**	**535**

Hockey 2007). Layard (1867) mentioned oystercatchers being present at Port Elizabeth and East London, but not plentiful at either place, and very scarce in KwaZulu-Natal. Clancey (1964) noted that an oystercatcher had been sighted near Durban in 1953. Prior to 1983, there were only four records of oystercatchers east of the former Transkei, with the most northerly being from Mtunzini, KwaZulu-Natal (Hockey 1983a). No breeding birds had been recorded in KwaZulu-Natal; the most easterly breeding record was from Mazeppa Bay, Eastern Cape (32°28'S, 28°39'E) (Hockey 1983a). Martin (1997), commenting on the four records made in KwaZulu-Natal between 1987 and 1991 stated: "It seems as rare now in KwaZulu-Natal as it was at the beginning of the 20th century." However, since then there has been a substantial increase in numbers in the Eastern Cape (Vernon 2004) and pairs have bred at two localities in southern KwaZulu-Natal (Nevill 1999, Brown & Hockey 2007).

The northern limits of vagrancy have been extended repeatedly. On the east coast, these records were within KwaZulu-Natal until 1996 (Clancey 1964, Cyrus & Robson 1980, Hockey & Douie 1995, Martin 1997). There were records from Inhaca Island (26°00'S, 32°58'E), Mozambique, in December 1996 (de Boer & Bento 1999, Parker 1999) and from the Limpopo River mouth (25°12'S, 33°31'E), in August 2012 (BirdPix Virtual Museum 2012). Oystercatchers were recorded at 31 localities in KwaZulu-Natal between 1998 and 2006; apart from a roost of up to 10 birds at Umkomaas Beach (30°12´S, 30°48´E), observations consisted of 1–3 birds (Brown & Hockey 2007). If minimum and maximum numbers over the period 1998–2006 at the 31 localities are taken into account, this represents between 71 and 148 birds in KwaZulu-Natal. On the west coast, vagrants occur north to Lobito, Angola (Hockey 1983a) and farther south a maximum of 73 birds has been recorded along the Baia dos Tigres coast in southern Angola (Dean *et al*. 2002, Simmons *et al*. 2006).

POPULATION SIZE AND POPULATION TRENDS

The global African Black Oystercatcher population, of birds more than one year old, was evaluated by Loewenthal (2007), and was based primarily on comparisons of survey data gathered between 1997 and 2002 (Oystercatcher Conservation Programme unpubl. data), and historical observations (Underhill & Cooper 1982) (Tables 2, 3 and 4). Survey data for the Northern Cape and Namibia were based on aerial surveys while data from other areas were based on surveys carried out on the shore (Loewenthal 2007). Data used to assess population trends on islands were obtained from Namibian Ministry of Fisheries and Marine Resoruces (unpubl. data), Oceans & Coasts, Department of Environmental Affairs, South Africa (unpubl. data), R. Simmons (unpubl. data), V. Ward (unpubl. data), N. Klages (unpubl. data), Calf & Underhill (2002). Data for wetlands were obtained from Taylor *et al*. (1999).

The global African Black Oystercatcher population size has increased by *c.* 46% since the early 1980s, from *c.* 5,000 individuals to 6,670 birds in the early 2000s (Table 4).

Namibia (Kunene River (17°52'S, 12°10'E) to Orange River (28°37'S, 16°28'E): Numbers of oystercatchers on the Namibian coast apparently decreased from 506 to 379 in the two decades since the early 1980s (Table 2). However, historically, 300 birds were estimated (rather than counted) along the stretch of coast between Grossebucht, Lüderitz and the Orange River (236 km) (Hockey 1983a), whereas only 103 were counted on this stretch of coast during the aerial survey. While decreases have been demonstrated for one small area within this stretch at Elizabeth Bay (26°54'S, 15°12'E), almost certainly due to mining activities, all other areas surveyed in the same study showed stable or increasing numbers (Simmons 2005). It is therefore likely that the historical figure of 300 (Hockey 1983a) was an overestimate.

Northern Cape (Orange River to Olifants River (31°40'S, 18°10'E): Recent surveys recorded 79 birds for this stretch of coast, compared with 86 birds estimated from historical surveys (Table 2). Values are close, and the size of the population on this section of coastline can be considered unchanged.

Western Cape and Eastern Cape (Olifants River to Kei River (32°38'S, 28°21'E): The estimated mainland oystercatcher population for this stretch of coast increased by more than 1,300 birds, from 1973 to 3,304, in two decades since the 1980s (Table 2). Oystercatcher densities remained highest along the west coast of South Africa, with the stretch of coast between the Olifants River and Cape Point

Table 4. Regional summary of oystercatcher numbers based on historical and recent surveys in Namibia and the provinces of South Africa.

Locality	Mainland coast		Islands		Central wetlands		Total	
	1979/1980	1997/2002	1979/1980	1997/2002	1979/1980	1997/2003	1979/1980	1997/2003
Namibia	506	379	574	755	89	163	1,169	1,297
Northern Cape	86	79	14	–	26	0	126	79
Western Cape	1,574	2,403	788	1,143	133	98	2,495	3,644
Eastern Cape (excluding former Transkei)	644	1,464	30	43	104	100	778	1,607
Former Transkei	23	43	0	0	0	0	23	43
Total	**2,833**	**4,368**	**1,406**	**1,941**	**352**	**361**	**4,591**	**6,670**

Photo D. A young chick of the African Black Oystercatcher hiding from predators among washed-up seaweed on 17 January 2014. (photo: Les Underhill).

(34°20'S, 18°30'E) supporting the highest average density (3.26 birds.km^{-1}). However, this stretch of coast also had the lowest proportional increase in population numbers compared to all other sections (Loewenthal 2007). The largest increases occurred between Mossel Bay (34°09'S, 22°07'E) and Port Elizabeth (33°40'S, 25°40'E), where populations more than doubled.

Former Transkei (Kei River to Ramsgate (31°03'S, 30°14'E): Numbers increased from 23 to 43 birds between the Kei River and Ramsgate (Table 2). During the historical survey, no birds were recorded east of the Dwesa-Cwebe Reserve (32°18'S, 28°50'E). During the survey birds were observed as far as 3 km west of Ramsgate, *c.* 220 km further east (Loewenthal 2007).

Population trends on islands, by region

Namibia

Numbers of oystercatchers on Namibian islands increased by 181 birds over the two decades since the early 1980s, primarily due to a large increase on Possession Island, where the population increased by more than 100 birds (Table 3). All other Namibian island populations appear to have remained fairly stable, except those on Flamingo Island (26°35'S, 15°10'E). However, the Flamingo Island count, especially in the light of low counts from nearby Seal (26°36'S, 15°10'E) and Penguin (26°37'S, 15°10'E) Islands, probably represents a high-tide roost. Flamingo Island is small and is connected to the mainland at low tide and could not possibly support a resident oystercatcher population of 140 birds. Oystercatchers do move regularly between Flamingo, Seal, Penguin and Shark (26°38'S, 15°09'E) Islands (P.A.R. Hockey pers. comm.). Treated as a unit, these four islands have shown a population increase of 12 birds.

Western Cape

Most island populations in this region have undergone marked increases (Table 3). At Meeuw Island (33°05'S, 18°01'E) the population is unchanged, and at Marcus Island (33°03'S, 17°58'E) there was a steady decrease in numbers from the early 1980s until the mid 1990s. This decrease and lack of recovery is due to the impacts of terrestrial predators, a result of the island being connected to the mainland by a causeway (Cooper *et al.* 1983, Hockey 1983a). The most spectacular change was on Robben Island, where there was an eight-fold increase between 1977 and 2012 (Spiby 2012).

Eastern Cape

In comparison to populations on the islands in the Western Cape, numbers on islands in this region have remained virtually unchanged over the past 20 years (Table 3).

Population numbers, by habitat type

In the early 2000s, the three main habitat types on mainland shores between the Olifants River and the Kei River, South Africa, were estimated to support 3,867 African Black Oystercatchers. This was more than double the population size in the early 1980s (*c.* 1,650 birds). The three habitat types were shores of mixed rock and sand, sandy shores and rocky shores; these three shore types supported 42%, 31% and 24% respectively of the oystercatcher population in this region (Loewenthal 2007).

DEMOGRAPHIC AND MECHANISTIC CAUSES OF POPULATION CHANGE

The Mediterranean Mussel, an invasive alien, was introduced from Europe in about 1979, almost certainly by shipping at the port of Saldanha Bay (33°02'S, 17°58'E), Western Cape, near the cluster of islands (Malgas, Markus, Jutten, Schapen, Meeu and Vondeling, Table 2) which are a regional oystercatcher hotspot (Robinson *et al.* 2005, Picker & Griffiths 2011). The mussel spread northward along the west coast to Namibia rapidly, and more slowly southward towards Cape Agulhas and the Eastern Cape (Robinson *et al.* 2005, Picker & Griffiths 2011). Population increases of oystercatchers on mixed and rocky shores, particularly on the islands and the mainland on the west coast of South Africa are attributed to *Mytilus* which has enhanced the food supply for oystercatchers. On Saldanha Bay islands, Hockey & Van Erkom Schurink (1992) linked an increase in the proportion of *Mytilus* in the diet of oystercatchers to an increase in the reproductive output of these populations and to a dramatic increase in population numbers. Loewenthal (2007) demonstrated that the presence of *Mytilus* was the key factor attributed to long term population increases of the mainland population. Ward (1990) suggested that population increases on mainland sandy shores in the Eastern Cape were due to improved protection of a key component of the diet there, the white mussel *Donax serra.* An example from this region is an increase over two decades from 70 to 296 birds on a 15 km sandy stretch of coast between the Van Stadens and Gamtoos Rivers (Underhill 1999, Loewenthal 2007). In summary, improved food supply and availability has been a key factor in population growth.

Another important factor has been improved protection of coastal areas, and particularly the islands. In all cases, levels of disturbance have been reduced. A particularly important example is Robben Island. The population of African Black Oystercatchers was 40 birds in 1977, and had increased to 126 in 2001 and thereafter to 345 in 2012 (Tjørve & Underhill 2006, Spiby 2012). The main factors behind the increase in population size of oystercatchers on the island were a decrease in human disturbance since the closure of the prison, and the near-eradication of the feral cat population. Low breeding productivity in the 2003/04 and 2004/05 breeding seasons on the island was caused by an explosion in the feral cat population, dealt with by culling, and the increase in the oystercatcher population on the island would have been even larger had it not been for this setback (Braby & Underhill 2007, Spiby 2012).

A nationwide vehicle ban on off-road vehicles driving on beaches was implemented in South Africa in 2000 (Department of Environmental Affairs and Tourism 2003, 2004). This reduced levels of disturbance, particularly on coastal areas remote to coastal resorts which provide access points to the coastline, and this action also appears to have benefitted local populations (Williams *et al*. 2004).

Population declines

Although the global oystercatcher population has unquestionably increased over the past 25 years, numbers on 41 of 239 stretches of mainland coast (16%) have decreased (Loewenthal 2007). Of these areas, approximately 80% had experienced rapid development, particularly coastal township development. Most local decreases were detected along relatively small stretches of coastline (in the order of a few kilometres), and at 72% of the 'decreaser' sites, adjacent populations increased (Loewenthal 2007).

IUCN CONSERVATION STATUS

Despite the potential threats facing the species, the global population size of oystercatchers has increased by *c.* 46% since the early 1980s and now stands at approximately 6,670 birds. The regional Red Data Book (Underhill 2000) classified the African Black Oystercatcher as 'Near-threatened' by virtue of the fact that the population size was small (<10,000) and numbers had decreased or were previously recorded as decreasing. By global standards the population is still small (<10,000 birds), but the increase in population size and improved breeding performance over the past 25 years (Loewenthal 2007) contradict the criteria that precipitated the species' inclusion in regional (Barnes 2000) and international (BirdLife International 2004) Red Data Books. The status of 'Near-threatened' can no longer be justified. Indeed, Kemper *et al.* (2007) recommended reclassification as 'Least Concern'. This also becomes our recommendation for the conservation status of this species.

THREATS

Threats to local oystercatcher populations

Human disturbance and oystercatcher breeding success

The breeding success of oystercatcher populations outside of protected areas is frequently below that required to main stable population numbers and is significantly lower than that for populations within protected areas on the mainland of South Africa (Leseberg *et al*. 2000, Loewenthal 2007). In addition, approximately 80% of the mainland African Black Oystercatcher population in South Africa exists outside of protected areas (Lombard *et al*. 2004, Loewenthal 2007). A key to understanding the impact of human disturbance on breeding African Black Oystercatcher relates to the synchronicity of the breeding season with the annual influx of holiday makers to the coastline of South Africa, especially the Western Cape and the Eastern Cape, which have towns and villages at 10–20-km intervals along most of the coastline. Based on analyses of 57 site-years of nest monitoring data for unprotected mainland sites, the most important ways in which human-related activities outside of protected areas directly lower breeding success are (a) through uncontrolled dogs depredating young chicks, and (b) due to young chicks hiding under rocks, as a result of human presence, and subsequently drowning on incoming tides (Loewenthal 2007). Human disturbance to foraging parental oystercatchers may also result in chick starvation and consequently lowered reproductive success, although this is likely to only be a widespread form of human-induced chick mortality on the mainland shores of the Western Cape and Eastern Cape (Leseberg *et al*. 2000, Loewenthal 2007).

Coastal Development and habitat loss/degradation

Breeding populations: Rapid coastal development, in many areas along the South African coast is resulting in the destruction of prime oystercatcher habitat. For example, at Noordhoek (34°08'S, 18°22'E) on the western seaboard of the Cape Peninsula, an entire breeding population, now has disjunct breeding and feeding areas, almost certainly as a result of development close to the high-water mark. The area backing the rocky intertidal at Noordhoek is ideal breeding habitat for oystercatchers, yet oystercatchers are forced (by virtue of habitat destruction and increased disturbance) to breed on a nearby sandy beach, adjacent to the rocky shore. Historically, they almost certainly did breed adjacent to the foraging area, but the level of human disturbance is high, with a housing development directly behind the beach.

Photo E. A ringed adult African Black Oystercatcher (photo: Les Underhill).

Because pairs are distributed linearly along the adjacent sandy shore, when feeding chicks, adults have to fly large distances back and forth to deliver food (DL, pers. obs.). For a species with a life-history strategy which makes chick rearing an energetically expensive process (Leseberg *et al*. 2000), this probably impacts on fledgling production and, ultimately, on population growth rates. There are a number of other recorded cases where it appears that breeding oystercatchers are being forced to nest in suboptimal habitat (Loewenthal *et al*. MS) as a result of coastal development, although the extent and manner in which this may be impacting on oystercatcher breeding success is not well understood.

Oystercatcher roost sites

Thirty-nine roost sites along the west coast of South Africa and Namibia have been identified (Rao 2005). Many of these are not just seasonal roost for wintering adult birds (Hockey 1985), but also form important foraging areas at stopover points and endpoints for dispersing juvenile birds (pre-breeding birds-particularly between 1–3 years of age) (Rao 2005). Most African Black Oystercatcher roosts on the west coasts of South Africa and Namibia are not located in protected areas. Holiday home development in the Western Cape is a potential threat to shorebird roosts in general, particularly as it has occurred without the completion of environmental impact assessments, and because further developments are occurring and planned without thorough consideration of their cumulative impacts. Habitat characteristics of locations at which developments are built or planned are often equivalent to the physical habitat characteristics that characterize west coast oystercatcher roosts. (A similar situation probably exist for the *c.* 23 identified roost sites on the south and east coasts of South Africa, however, although the location of all important roosts have been identified in these areas (P.A.R. Hockey *et al*. unpubl. data), the extent to which these roosts also play a role as important juvenile foraging areas has not yet been ascertained). Other threats to west coast roosts include continued (and illegal) use of off-road vehicles on beaches, coastal diamond mining (destruction of foraging habitat) and proposed oil and gas development (Rao 2005). The relatively few juvenile 'nurseries' in Namibia, are particularly important, as concentrated populations of juvenile birds here enjoy optimal foraging conditions (areas of high food availability, lack of tidal constraints and outside the adult breeding range-thereby avoiding competition with much more efficient adult foraging birds). Together, Walvis Bay and Swakopmund form the most important sites for juvenile birds and, at the same time, are the most threatened by human activity (other roosts in Namibia are in much more remote areas and support much lower numbers of juvenile birds) (Leseberg 2001). Threats to oystercatchers in Walvis Bay, in particular include pollution (associated with the harbour, fish processing factories and the salt works), sedimentation of the lagoon and consequent degredation of foraging habitat and uncontrolled recreational activities and further coastal development (Leseberg 2001).

Paralytic shellfish poisoning

Important, high density breeding populations, particularly on offshore islands on the west coast of South Africa are susceptible to paralytic shellfish poisoning (PSP). Only one such event has been recorded during which five high-density island populations were approximately halved during a PSP outbreak (Hockey & Cooper 1980). Whatever the reason for these mass mortalities, they certainly impact oystercatchers at the local population level, although the severity, frequency and locality are not readily predictable.

Predation

Aside from the threat of uncontrolled dogs to breeding oystercatchers (see Human disturbance and oystercatcher breeding success), 25 site-years of data from protected areas on the mainland indicate that, in these areas, mammalian predators are responsible for approximately 40% of all known egg losses and *c.* 30% of known cases of oystercatcher chick mortality on the South African mainland (Loewenthal & Hockey MS). Although important breeding populations on offshore islands are currently well protected (and most have very low levels of human disturbance), many (such as populations on Robben Island (33°49'S, 18°22'E) and Dassen Island (33°26'S, 18°05'E) in the Western Cape, South Africa) are not free of introduced mammalian predators such as Feral Cats *Felis catus* and House Rats *Rattus rattus*, which are all potential predators of oystercatcher eggs and chicks (Tjørve 2006, J. Visagie pers. comm.). Avian predation (particularly by Kelp Gulls *Larus domicanus*) of oystercatcher eggs and chicks accounts for approximately 56% of known egg losses and 44% of known chick mortalities (Loewenthal 2007) on islands and breeding populations of gulls have increased dramatically on many islands off the west coast of South Africa (Crawford *et al.* 2007). Differences in levels of mammalian predation are the single most important reason behind differences in reproductive success (fledglings.pair^{-1}.year^{-}1) of island and mainland populations (currently 2–3 times higher for island populations than for mainland populations) (Loewenthal 2007). In one instance, the construction of a causeway connecting Marcus Island (in Saldanha Bay, Western Cape, South Africa) to the mainland, provided access to terrestrial predators and consequently, breeding success of island oystercatchers fell to levels equivalent to adjacent mainland populations (Cooper *et al.* 1983).

Climatic/Environmental conditions

On the mainland of South Africa, spring high tides and consequent flooding of nests are responsible for *c.* 25% of known causes of egg losses (Calf & Underhill 2005, Loewenthal 2007). This loss is exacerbated if extreme storm events coincide with spring high tides; an increasing frequency of storms is a prediction of global climate change (Calf & Underhill 2005). Excessively high temperatures may result in eggs overheating and embryos dying. Although overheating of eggs is unlikely to be an threat, even in the face of human disturbance (Adams *et al.* 1999), excessively high temperatures (>35°C) over a number of days on the west coast of South Africa in 1999 and 2001, were probably the reason for a reduced reproductive output of high density breeding populations on some offshore islands in these years (Loewenthal 2007).

RECOMMENDATIONS

The first of these recommendations relates to conservation research needs, and the remaining three relate to management.

1. Monitoring

Nest monitoring should be continued at sites on the mainland supporting important breeding populations and where multiple years of nest monitoring data already exist. In the face of variable breeding success of local oystercatcher populations, such data sets have been/will be invaluable in assessing the efficacy of past, current and future protection measures (such as the off-road vehicle ban on South Africa's beaches, reduction in disturbance, removal of introduced predators from offshore islands). Colour ringing of oystercatcher chicks and monitoring of colour-ringed birds (particularly juveniles) at roosts should be continued, to help identify which roost sites are also important as stopover and/or endpoints for dispersing juvenile birds. Continued colour-ring resighting efforts will also help to refine survival estimates of nonbreeding birds (i.e. birds from fledging to four years of age).

2. Management of breeding populations on the mainland

Important breeding populations outside of currently protected areas on the mainland need to be systematically identified and protection measures implemented. The easiest and most effective protection measures to improve reproductive output of these breeding populations would be linked to controlling/banning domestic dogs from areas with important breeding populations, during the breeding season. Ribbon development (i.e. development along an entire stretch of coastline) should be discouraged, in favour of concentrated nodes, to ensure that undisturbed habitat remains for roosting, foraging and breeding oystercatchers.

3. Management of non-breeding populations

A large proportion of oystercatcher roost sites on the west coast of South Africa have also been identified as traditional, multi-purpose (stopover and endpoint) sites used by immature African Black Oystercatchers. Many of these occur in the Northern Cape, South Africa, which is under-represented in terms of protection (Hockey & Branch 1997, Attwood *et al.* 2000) and many of these sites are also important as multi-species sites (Rao 2005). These roost sites should be prioritized and protection implemented. Similar multi-purpose sites on the southern and eastern coasts of South Africa still need to be identified, prioritized and, where necessary, protection measures implemented. Improved protection of juvenile 'nursery' areas outside of the adult breeding range on the Namibian coast (and particularly in the Walvis Bay/Swakopmund region) should be effected; this is by far the single most important way that conservation efforts in Namibia can contribute to the protection of the species as a whole.

4. Management of island populations

Breeding populations on islands are currently well protected. Vigilance needs to be maintained over the introduction (or reintroduction) of mammalian predators; the final cats on Robben Island need to be removed. Populations of gulls (in particular Kelp Gulls *Larus dominicanus*) at many offshore islands, and particularly at Robben and Dyer Islands, have increased, and avian predation on both eggs and chicks is suspected to be increasing. The impacts of avian predation on the breeding success of island populations of oystercatchers should be assessed in more detail, as has been done for Cape Cormorants on Dyer Island (Voorbergen *et al.* 2012).

REFERENCES

Adams, N.J., Kerley, G.I.H. & Watson, J.J. 1999. Disturbance of incubating African Black Oystercatchers: is heating of exposed eggs a problem? *Ostrich* 74: 225–228.

Attwood, C.L., Moloney, C.L., Stenton-Dozey, J., Jackson, L.F., Heydorn, A.E.F. & Probyn, T.A. 2000. Conservation of marine biodiversity in South Africa. In: Durham, B.D. & J.C. Pauw (es.). *Summary of Marine Biodiversity Status Report for South Africa*. National Research Foundation, Pretoria. Pp. 68–83.

BirdLife International. 2004. *Threatened Birds of the World* – CD-ROM. BirdLife International, Cambridge.

BirdPix Virtual Museum. 2012. African Black Oystercatcher *Haematopus moquini.* http://vmus.adu.org.za/?vm=BirdPix-183.

Braby, J. & Underhill L.G. 2007. Was poor breeding productivity of African Black Oystercatchers on Robben Island in 2004/05 caused by Feral Cats, Kelp Gulls, Mole Snakes or the Sumatra tsunami? Wader Study Group Bulletin 113: 66–70.

Braine, S. 1987. Extension of the breeding range of the African Black Oystercatcher *Haematopus moquini*. *Madoqua* 15: 87–88.

Brown, M. & Hockey, P.A.R. 2007. The status and distribution of African Black Oystercatchers *Haematopus moquini* in KwaZulu-Natal, South Africa. *Ostrich 78: 93–96.*

Calf, K.M. & Underhill, L.G. 2002. Productivity of African Black Oystercatchers *Haematopus moquini* on Robben Island, South Africa, in the 2001–2002 breeding season. *Wader Study Group Bulletin* 99: 45–49.

Calf, K.M. & Underhill, L.G. 2005. Tidal impact on breeding African Black Oystercatchers on Robben Island, Western Cape, South Africa. Ostrich 76: 219–221.

Clancey, P.A. 1964. *The Birds of Natal and Zululand*. Oliver & Boyd, Edinburgh and London.

Cooper, J., Hockey, P.A.R. & Brooke, R.K. 1983. Introduced mammals on South and South West African islands: history, effects on birds and control. In L.J. Bunning (ed.). *Proceedings of the Symposium in Birds and Man.* Southern African Ornithological Society, Johannesburg. pp 179–203.

Crawford, R.J.M., Underhill, L.G., Altwegg, R., Upfold, L. & Dyer, B.M. 2007. The influence of culling, predation and food on Kelp Gulls *Larus dominicanus* off western South Africa. In S.P. Kirkman (ed.). *Final Report of BCLME (Benguela Current Large Marine Ecosystem) Project on Top Predators as Biological Indicators of Ecosystem Change in the BCLME.* Avian Demography Unit, Cape Town. pp. 181–188.

Dean, W.R.J., Dowsett, R.J., Sakko, A. & Simmons, R.E. 2002. Additions and amendments to the birds of Angola. *Bulletin of the British Ornithological Club* 122: 180–185.

De Boer, W.F. & Bento, C.M. 1999. *Birds of Inhaca Island, Mozambique*. Mondi BLSA Guide 22. Birdlife South Africa, Johannesburg.

Department of Environmental Affairs and Tourism. 2003. Draft Policy on the Implementation of the Regulations that Control Vehicle Use in the Coastal Zone. National Environmental Management Act, 1998 (Act No. 107 of 1998). No. 1003, 9 July. Republic of South Africa: Pretoria. 143 pp.

Department of Environmental Affairs and Tourism. 2004. Guidelines on the Implementation of Regulations Pertaining to the Control of Vehicles in the Coastal Zone. 23 pp.

Donnelly, B.G. 1966. An invasion of Cape Cormorants *Palacrocorax capensis* into Algoa Bay with a note on mortality. *Ostrich* 37: 228.

Hockey, P.A.R. & Cooper, J. 1980. Paralytic shellfish poisoning: a controlling factor in Black Oystercatcher populations? *Ostrich* 51: 188–190.

Hockey, P.A.R. 1982. The taxonomic status of the Canary Island Black Oystercatcher *Haematopus meadowaldoi. Bulletin of the British Ornithologists' Club* 102: 77–83.

Hockey, P.A.R. 1983a. The distribution, population size, movements and conservation of the African Black Oystercatcher *Haematopus moquini*. *Biological Conservation* 25: 233–262.

Hockey, P.A.R. 1983b. Aspects of the breeding biology of the African Black Oystercatcher. *Ostrich* 54: 26–35.

Hockey, P.A.R. 1985. Observations on the communal roosting of African Black Oystercatchers. *Ostrich* 56: 52 –57.

Hockey, P.A.R. 1996. Family Haematopidae. In: del Hoyo, J., Elliot, A. & Sargatal, J. (eds.). *Handbook of the Birds of the World, Vol. 3*. Lynx Edicions, Barcelona. pp. 308–325.

Hockey, P.A.R. & van Erkom Schurink, C. 1992. The invasive biology of the mussel *Mytilus galloprovincialis* on the southern African coast. *Transactions of the Royal Society of South Africa* 48: 123–139.

Hockey, P.A.R. & Douie, C. 1995. *Waders of Southern Africa*. Struik Winchester, Cape Town.

Hockey, P.A.R. & Branch, G.M. 1997. Criteria, objectives and methodology for evaluating marine protected areas in South Africa. *South African Journal of Marine Science* 18: 369–383.

Hockey, P.A.R., Leseberg, A. & Loewenthal, D. 2003. Dispersal and migration of juvenile African Black Oystercatchers *Haematopus moquini. Ibis* 145: E114–E123.

Kemper, J., Underhill, L.G., Crawford, R.J.M. & Roux, J.-P. 2007. Revision of the conservation status of seabirds and seals in the Benguela Ecosystem. In: S.P. Kirkman (ed.). *Final Report of BCLME (Benguela Current Large Marine Ecosystem) Project on Top Predators as Biological Indicators of Ecosystem Change in the BCLME.* Avian Demography Unit, Cape Town. pp. 325–342.

La Cock, G.D. 1986. The southern oscillation, environmental anomalies, and mortality of two southern African seabirds. *Climate Changes* 8: 173–184.

Layard, E.L. 1867. *Birds of South Africa: A Descriptive Catalogue of All Known Species Occurring South of the 28th Parallel*. Juta, Cape Town.

Leseberg, A., Hockey, P.A.R. & Loewenthal, D. 2000. Human disturbance and the chick rearing ability of African Black Oystercatchers *(Haematopus moquini):* a geographical perspective*. Biological Conservation* 96: 379–385.

Leseberg, A. 2001. *The foraging ecology, demographics and conservation of the African Black Oystercatcher* Haematopus moquini *in Namibian nursery areas*. M.Sc. Thesis, University of Cape Town, Cape Town.

Loewenthal, D. 2007. *The population dynamics and conservation of the African Black Oystercatcher* Haematopus moquini. Ph.D. Thesis, University of Cape Town, Cape Town.

Lombard, A.T., Strauss, T., Harris, J., Sink, K., Attwood, C. & Hutchings, L. 2004. Specialist Report: *National Spatial Biodiversity Assessment: Marine Component*. Prepared for the National Biodiversity Institute. 96 pp.

Nevill, M. 1999. African Black Oystercatcher breeding in KwaZulu Natal. *Albatross* 337: 11.

Parker, V. 1999. *The Atlas of the Birds of Sul de Save, Southern Mozambique*. Avian Demography Unit and Endangered Wildlife Trust, Cape Town and Johannesburg.

Picker, M. & Griffiths, C. 2011. *Alien & Invasive Animals: a South African Perspective*. Struik Nature, Cape Town.

Rao, A.S. 2005. *Dispersal of Young African Black Oystercatchers (*Haematopus moquini*): Movement Patterns, Individual Characteristics, Habitat Use and Conservation Implications*. M.Sc. Thesis, Memorial University of Newfoundland, St. Johns.

Robinson, T.A., Griffiths, C.L., McQuaid, C.D. & Ruis, M. 2005. Marine alien species of South Africa – status and impacts. *African Journal of Marine Science* 27: 297–306.

Scott, H.A. 2007. Breeding success of the African Black Oystercatcher *Haematopus moquini* in relation to habitat and human disturbance in De Hoop Nature Reserve, South Africa. Unpubl. DTech thesis, Nelson Mandela Metropolitan University, Port Elizabeth.

Simmons, R.E. & Kemper, J. 2000. Survey of breeding African Penguins at Sylvia Hill and Easter Cliffs, November–December 2000. Unpublished report, Ministry of Environment & Tourism, Windhoek.

Simmons, R.E. 2005. Declining coastal avifauna at a diamond-mining site in Namibia: comparisons and causes. *Ostrich* 76: 97–103.

Simmons, R.E., Sakko, A.L., Paterson, J. & Nzuzi, A. 2006. Birds and conservation significance of the Namib Deserts least known coastal wetland: Ilha and Baia dos Tigres, Angola. *African Journal of Marine Science* 28: 713–717.

Simmons, R.E. & Brown, C.J. 2007. *Birds to Watch in Namibia: Red, Rare and Endemic Species*. National Biodiversity Programme and Namibia Nature Foundation. Windhoek.

Spiby, J. 2012. Trends in African Black Oystercatchers *Haematopus moquini* on Robben Island, South Africa: population size and nest characteristics. Unpubl. BSc(Hons) thesis, Department of Zoology, University of Cape Town.

Taylor, P.B., Navarro, R.A., Wren-Sargent, M., Harrison, J.A. & Kieswetter, S.L. 1999. *Coordinated Waterbird Counts in South Africa, 1992–1997*. Avian Demography Unit, University of Cape Town, Cape Town.

Tjørve, K.M.C. & Underhill, L.G. 2006. Population increase of African Black Oystercatchers *Haematopus moquini* on Robben Island, South Africa. *Ostrich* 77: 229–232.

Tjørve, K.M.C., Underhill, L,G, & Visser, G.H. 2007. Energetics of growth in semi-precocial shorebird chicks in a warm environment: the African Black Oystercatcher, *Haematopus moquini*. *Zoology* 110: 176–188.

Tjørve, K.M.C. & Underhill, L.G. 2008. Breeding phenology of African Black Oystercatchers *Haematopus moquini* on Robben Island, South Africa. *Ostrich* 79: 141–146.

Tjørve, K.M.C. & Underhill, L.G. 2008. The influence of tourism and predation on the breeding success of the African Black Oystercatcher, *Haematopus moquini,* on Robben Island, South Africa. *Waterbirds* 31: 83–96.

Tjørve, K.M.C. & Underhill, L.G. 2009. Growth and its relationship to fledging success of African Black Oystercatcher *Haematopus moquini* chicks. *Zoology* 112: 27–37.

Underhill, L.G. & Calf, K.M. 2005. How far is an egg through incubation? Wader Study Group Bulletin 106: 39–41.

Underhill, L.G. & Cooper, J. 1982. Counts of waterbirds on the coastline of Southern Africa. 1987–1981. Western Cape Wader Study Group and Percy FitzPatrick Institute of African Ornithology, University of Cape Town.

Underhill, L.G. 2000. African Black Oystercatcher. In: Barnes, K.N. (ed.). *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. BirdLife South Africa, Johannesburg.

Underhill, L.G., Tree, A.J., Oschadleus, H-D. & Parker, V. 1999. *Review of Ring Recoveries of Waterbirds in Southern Africa*. Avian Demography Unit, Cape Town.

Vernon, C.J. 2004. Status and abundance of the African Black Oystercatcher *Haematopus moquini* at the eastern limit of its breeding range. *Ostrich* 75: 243–249.

Voorbergen, A., de Boer, W.F. & Underhill, L.G. 2012. Natural and human-induced predation on Cape Cormorants at Dyer Island. Bird Conservation International 22: 82–93.

Ward, D. 1990. The demography, diet and reproductive success of African Black Oystercatchers on a sandy beach. *Ostrich* 61: 125–133.

Williams, A.J., Ward, V.L. & Underhill, L.G. 2004. Waders respond quickly and positively to the banning of off-road vehicles from beaches in South Africa. *Wader Study Group Bulletin* 104: 79–81.

APPENDIX. OVERVIEW OF RECENT STUDIES AND RESEARCH

A series of MSc and PhD research projects and other student projects have been completed since 2000.

Leseberg (2001) undertook a study of African Black Oystercatchers in their Namibian nursery areas at Walvis Bay, Swakopmund and Sandwich Harbour. These nurseries had been discovered in 1998. She did the bulk of her fieldwork in 1999 and 2000. She quantified seasonal and tidal patterns of habitat use and foraging. At Walvis Bay foraging was independent of tides, and birds met energy requirements during daylight hours and fed on washed up prey. At Swakopmund, foraging took place mainly at low tide, and birds fed both by day and night.

Joubert & Wheeler (2001) focused on the Walvis Bay Lagoon nursery roost, and in a five-month study in 2001, found that numbers increased from July to October, from about 90 to 130 birds, presumably as juveniles arrived from the breeding localities. They estimated that about half the birds were in their second-year, with approximately quarters being first-years and third-years.

The key conclusion of Rao (2005) was that “immature oystercatchers disperse to a range of distances along the southern African coast, therefore it is more appropriate to consider distance travelled as a continuous variable” and that “body condition, relative hatch date, and sex did not differ significantly for immature African Black Oystercatchers dispersing different distances”. Rao’s results contrast strongly with the view of Hockey *et al.* (2003), who stated that “young from the western part of the breeding range either remain within 150 km of their natal site or migrate 1,500–2,000 km to one of five discrete nursery areas on the Namib Desert coast of central and northern Namibia, and southern Angola” and described the movements as “highly dichotomous”. It seems likely that Rao’s (2005) conclusions are correct, because she made observations of juveniles in the intermediate region.

Tjørve (2006) made two major contributions. She undertook a doubly-labelled water-based study of chick energetics, the first for any oystercatcher species. Her energy budgets from hatching to fledging decomposed the total metalizable energy into components for resting metabolism, tissue development, tissue synthesis and, by subtraction, thermoregulation and activity. She developed growth curves for body mass, culmen length, head length, tarsus length, foot length and wing length. These are based on 367 sets of measurements made on 138 checklists, larger samples than are available for any other oystercatcher species.

The Koeberg Nuclear Power Station and the adjacent Koeberg Nature Reserve was the study site of Parsons (2006) from November 2002 until June 2005. The site had low levels of human disturbance; it had two main breeding habitats, both ideal for making observations: 20 pairs on sandy beaches north and south of two breakwaters which stretched into the ocean at right angles to the shore, lined on the inside with a gently-sloping and sheltered artificial rocky shore with the high densities of breeding African Black Oystercatchers (26 pairs in the ‘harbour’ area). Behavioural data were collected throughout the year on both shore types and related to tide, weather, day-length and time of day. Feeding behaviour differed radically between the rocky and sandy shores, with feeding throughout the tidal cycle on the sandy shore.

Scott (2007) undertook a study of the species within the De Hoop Nature Reserve, near the southern tip of Africa at Cape Agulhas, Western Cape, South Africa. She made detailed studies of numbers, habitat usage, breeding success and diet of oystercatchers along an 11-km stretch of coastline over a period stretching from 1984 to 1998. The coastline contained sections of sandy, rocky and mixed sandy/rocky habitats and had a total of 33 territories. The diet study was undertaken prior to the arrival of Mediterranean Mussels in the area.

The main objective of Loewenthal (2007) was to provide a global overview of the conservation status of the African Black Oystercatcher. He reviewed population sizes on all sections of the mainland shore, and the offshore islands. He found that the population had increased substantially (he estimated 46% over three decades), although there had been some local decreases. The energetics models developed in this thesis ignored the studies of Tjørve (2006) and makes use of allometric relationships in spite of the fact that data for this species was available. He considered that the key factor driving the population increase had been the invasive Mediterranean Mussel.

The primary objective of Kohler’s (2011) study was to use the stable isotopes of carbon and nitrogen to examine the influence of oceanographic conditions and benthic species assemblages on the feeding ecology of the African Black Oystercatcher at a local scale and across its entire geographical distribution, a distance of *c.* 2000 km. She found that the oceanic isotopic signals which lie at the base of rocky shore food webs were mirrored in the prey and the tissues of African Black Oystercatchers. She also undertook a detailed study of breeding behaviour of the species at four study sites in the eastern end of its range, at the eastern end of the Western Cape and the Eastern Cape.

Spiby (2012) collated monitoring data on numbers and on components of the breeding productivity of African Black Oystercatchers on Robben Island for the breeding seasons from 2001/02 to 2011/12. The size of the overall population had increased from 135 in 2001/02 to 400 in 20011/12. In spite of this, the number of breeding pairs remained fairly constant at 80 pairs. Mean clutch size decreased from 2.0 eggs to 1.8 eggs, potentially a consequence of the disruptive behavior of the large population of non-breeding birds best described by the term ‘hooligan’.