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Breeding biology and conservation of the Black-vented Shearwater *Puffinus opisthomelas*

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The Black-vented Shearwater *Puffinus opisthomelas* is endemic to the Pacific coast of Baja California, Mexico. We studied the breeding biology of this species at Natividad Island in 1997 and 1998. The colony at Natividad Island covers approximately 2.5 km^2 and we estimated there to be 114 455 (± 27 520 95% CI) burrows in the colony. In 1997 burrow occupancy was 66.9%, providing a population estimate of 76 570 (± 18 411 95% CI) breeding pairs, representing about 95% of the world's population of this species. In 1997 the peak in egg laying occurred in early March and hatching began on 7 May. The incubation period averaged 51 days (± 6 sd) and chick rearing averaged 69 days (± 3 sd). In 1998 burrow occupancy was lower (19.6%) and nest initiation was later (peak egg laying in mid-April), perhaps a result of El Niño conditions that prevailed in the Eastern Pacific at that time. We calculated that the development of the town and roads on Natividad Island have destroyed over 15% (26 532 burrows) of the breeding habitat on the island.

The Black-vented Shearwater *Puffinus opisthomelas* is endemic to islands off the Pacific coast of Mexico and is the only shearwater that breeds on islands in the California Current. Anecdotal observations of this species at its breeding sites began in the late 1800s (Anthony 1896). However, there have been no in-depth investigations of the breeding biology of this species. Everett (1988) summarized the existing literature on the Black-vented Shearwater and provided insight from his own visits to the nesting islands. Current knowledge is limited to some egg and chick dates and cursory population estimates. Here we provide new data on the breeding biology of the Black-vented Shearwater, including population size, breeding phenology and breeding success. We also discuss impacts of the human settlement on the Shearwater population on Natividad Island, the world's largest breeding colony.

STUDY AREA AND SPECIES

Black-vented Shearwaters are reported to breed on seven islands and islets off the Pacific coast of Baja California, Mexico: Guadalupe and two offshore islets (Afuera and Negro), the three San Benito Islands, and Natividad Island (27°52′N 115°10′W, Everett 1988, Fig. 1). In general, population estimates for this species have been based on cursory burrow counts or best guesses based on numbers of birds observed at sea around known colonies. On Guadalupe Island shearwaters were reported to be 'rather common' by Anthony (1900). Surveys on the Guadalupe islet of Negro in the late 1960s and early 1970s indicated that 100–150 pairs bred there (Jehl & Everett 1985). Burrow counts on the Guadalupe islets of Negro and Afuera in the mid-1960s indicated a total of 150 breeding pairs for both islets (Delong & Crossin 1968). Jehl and Everett (1985) reported counts of flocks on the water around Guadalupe Island that indicated approximately 500–2500 pairs in the region, and suggested that other undocumented colonies may exist or that the Negro and Afuera colonies are larger than previous estimates. Actual breeding locations on Guadalupe Island have never been documented and it has been suggested that feral cats may have eliminated most, if not all, breeders from the island (Everett & Pitman 1993). Population estimates for San Benito Islands include

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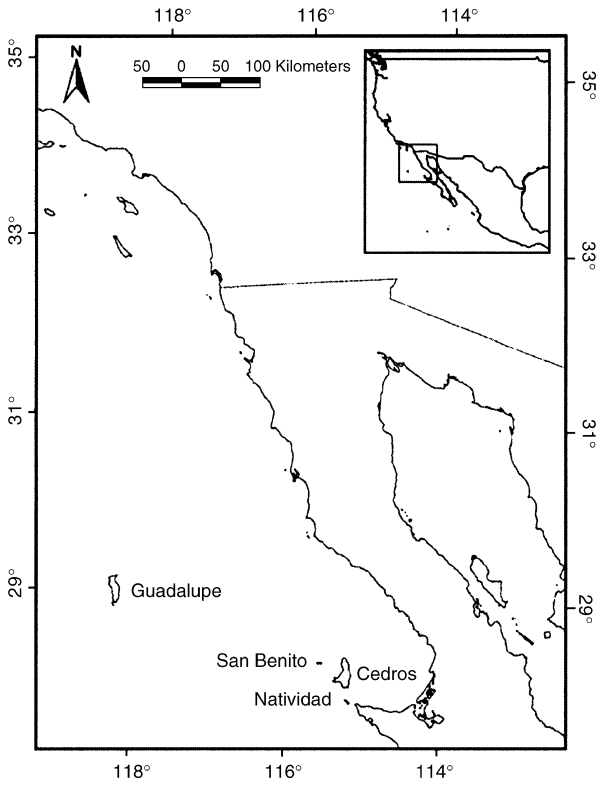

Figure 1. Breeding locations of the Black-vented Shearwater.

150 pairs (Delong & Crossin 1968) and 250–500 pairs (Everett & Pitman 1993). Anthony (1896) was the first to report that Natividad Island supported the vast majority of the world's breeding Black-vented Shearwaters. Published population estimates for Natividad Island are unavailable, but Delong and Crossin (1968) estimated 5000 burrows on the island and Everett (1988) estimated between 5000 and 10 000 burrows.

Natividad is a desert island located 3 miles north of Punta Eugenia, Baja California Sur, Mexico. The island is 6 km long and 2.5 km wide at its maximum, with an area of 10 km^2 and a maximum elevation of 300 m. Natividad Island is the north-western most corner of the Reserva de la Biosferá 'El Vizcaíno'. A permanent town was established on the island in the 1960s, and the current population is about 400 residents. The Black-vented Shearwater colony covers the entire south-eastern part of the island and is adjacent to the town.

Winds are favourable for upwelling year round in this region, with a peak in annual longshore (NW) wind stress in April and May (Chelton *et al.* 1982). Rainfall normally occurs in December to February from storms that sweep out of the Gulf of Alaska. Rainfall at Bahia Tortugas on the adjacent mainland averages 100 mm/yr (Hastings & Humphrey 1969).

There is a long history of human presence on Natividad Island. Lamb (1927) encountered approximately 40 seasonal fishermen on the island and reported that they regularly used Shearwaters as bait for lobster traps. Domestic Cats *Felis catus* were reported as feral on the island as early as 1922 by Anthony (1925) and subsequently by Bancroft (1927), Banks (1964), Delong and Crossin (1968), Jehl (1973, 1984) and Everett (1988). In 1997, a band of about 40 goats and 15 sheep roamed the north-west end of the island. We observed feral cats to be abundant during our research in 1997 and 1998 (Keitt 1998).

METHODS

Population size

Population size of Black-vented Shearwaters on Natividad Island was estimated using the methods outlined by Walsh *et al.* (1995). The entire colony was divided into two areas, one of high burrow density (HBD) and one of low burrow density (LBD). These were mapped using a Garmin 45 Global Positioning System (GPS). Burrow densities were estimated using 181 (88 in the LBD and 93 in the HBD) randomly placed circular plots (radius = 4.37 m, area = 60 m^2). Only burrows in which more than half of the entrance fell within the plot were counted. Burrow occupancy was determined using a small camera with an infrared source mounted on a flexible probe. A burrow was considered occupied if we saw a bird in incubating posture or an egg in the burrow. Partially buried eggs or eggs seen in burrows with no signs of recent activity were not considered indicative of an occupied burrow. Burrows were probed in mid-April 1997, concurrent with the mid incubation period. In 1998 burrows were probed in mid-June, after chicks had hatched. Nesting success data in 1998 indicated that by mid-June, 40% of the breeders had failed (Keitt 1998). Thus, we adjusted our 1998 estimate accordingly for comparison with our 1997 estimates.

Colony mapping

The Shearwater colony, town, garbage dump and roads were mapped with a Garmin 45 GPS. Road lengths were measured using the GPS and road area was calculated by multiplying the length by average

road width. These data were used to estimate the effects of development and other human activities on the Shearwater population.

Reproductive success/breeding phenology

Sixty-three burrows in four sites were monitored from 7 April to 27 July 1997. During this time 58 of these burrows were occupied by Shearwaters. Monitoring of burrows in 1997 began after the Shearwaters' reproductive effort was already underway. Therefore, our estimates may have missed birds that failed early in the season and thus represent maximum reproductive success for that year. In 1998, we monitored 78 burrows, of which 39 had eggs, in five sites from 17 April to 17 July. Burrow content was checked weekly with an infrared camera. In 1998, fieldwork ended before most birds had fledged. All chicks alive at this time were assumed to have fledged successfully because many of these birds were close to their maximum weight and in 1997 most mortality occurred in the early chick stage. This assumption provides an estimate of maximum fledging success for 1998. In 1997, egg-laying date was estimated by backtracking from hatching date using the mean incubation period from the 1998 data.

To supplement the literature on colony attendance in the non-breeding season, we interviewed island residents about the presence of Shearwaters. In addition, in a preliminary trip to the island in December 1996 (a month when breeding does not occur), we checked for colony attendance by placing upright toothpicks in the entrance of 55 burrows. Burrows where the toothpicks were knocked over during the night were assumed to have been entered by a Shearwater, thus providing an estimate of burrow use during this period.

Chick growth

Prior to the breeding season we created 41 artificial burrows for monitoring chick growth. All artificial burrows were placed near active natural burrows and locations were selected haphazardly. Twenty-seven of the artificial burrows were made by modifying existing burrows. The remaining 14 artificial burrows were created in sites with no existing burrow. For each of the 41 artificial burrows, we buried a 30-cm-long section of 30.5-cm-diameter PVC pipe for a nest chamber. The pipe was laid on end so that it formed the walls of the nest chamber; soil formed the floor of the nest chamber. The nest chambers were covered with 0.6 cm plywood held in place with sandbags. Access tunnels were constructed of 80–160-cm lengths of 20.3-cm-diameter PVC cut in half lengthwise. These were buried alongside the nest chamber to form the roof and walls of an access tunnel.

Chicks in artificial burrows were monitored weekly. Data are reported for birds in 1-week age classes such that week 1 reports average weight and lengths for birds aged 5–10 days old and week 2 reports averages for birds 11–17 days old, etc. We measured weight (± 1 g on 300- and 500-g spring Pesola scales), culmen, tarsus (± 0.1 mm with dial calipers) and flattened wing chord (± 1 mm using a stopped wing rule). Monitoring began as soon as the chicks were no longer brooded by a parent, about 4 days after hatching. Fledging weights and morphological measurements were obtained from chicks in artificial burrows and from those caught on the colony surface. Shearwaters often sit outside their burrows and exercise their wings just prior to fledging (Brooke 1990). We caught and measured only birds that still had tufts of down, indicating they were fledglings.

Morphological measurements

We caught adult Shearwaters at the colony throughout the breeding season. We banded the birds with USFWS bands, recorded weight (± 1 g on 600-g spring scales), culmen, tarsus (± 0.1 mm with calipers), wing (± 1 mm using a stopped wing rule) and moult score. Dead birds found in the colony were collected and sexed by dissection. We measured culmen, tarsus, wing and head length (tip of bill to back of skull).

Egg length, width (± 0.1 mm with calipers) and weight (± 0.5 g on 100-g spring scales) were measured for eight eggs varying in age from 2 to 11 days after laying. Ages of the eggs were estimated by backtracking from hatch date. Because eggs lose between 0.3 and 0.5% of their weight per day due to respiration (Rahn & Ar 1974), we added 0.4% of measured egg weight for each day after the estimated lay date that the egg was weighed. This provided a calculated fresh egg weight.

RESULTS

Population size

The Black-vented Shearwater is the only burrow-nesting species that breeds on Natividad Island

(Keitt 1998). The total area of the colony on Natividad Island was approximately 2.5 km^2. The density estimate for Black-vented Shearwater burrows in the low burrow density site was 0.0316 burrows/m^2 (± 0.04 sd, n = 88 circular plots). The area of this site was 1 908 330 m^2 yielding an estimate of 60 303 (± 17 557 95% CI) burrows.

Estimated burrow density in the high burrow density site was 0.0830 burrows/m^2 (± 0.07 sd, n = 93). The area of the HBD site was 652 433 m^2, yielding an estimated 54 152 (± 9963 95% CI) burrows in this site. The total number of burrows in the entire colony was 114 455 (± 27 520 95% CI).

In 1997 burrow occupancy by breeding birds was 66.9% (n = 171 burrows). Thus the total number of Black-vented Shearwater breeding pairs on Natividad Island in 1997 was approximately 76 570 (± 18 411 95% CI). In 1998 burrow occupancy was 19.6% with a total of 22 433 (± 1950 95% CI) pairs breeding.

Breeding phenology

Based on field observations from 1996 to 1998, discussions with island residents and reports in the literature, we estimated that Black-vented Shearwaters attended the colony in relatively large numbers for at least 10 months of the year. In December 1996 Black-vented Shearwaters were common on the island. At this time more than 90% of the burrows were active (based on data from toothpicks placed in burrow entrances). In 1997 egg laying commenced in mid-March and peaked in late March. Hatching began on 7 May and peaked in mid-May 1997 with a median lay date of 21 May. In 1998, egg laying commenced in early April and peaked in mid-April. Hatching began on 25 May 1998 and peaked in early June 1998 with a median lay date of 6 June.

In 1997 and 1998 combined, the duration of the incubation period was 51 days (± 6 sd, n = 9 nests) and the duration of the chick rearing period was 69 days (± 3 sd, n = 14 nests).

Reproductive success

In 1997, 31 of 58 eggs hatched, a hatching success of 53%. Fledging success of hatched eggs was 68% (n = 31). Survival from laying to fledging (reproductive success) was 36% (n = 58). In 1998, 17 of 36 eggs hatched, giving a hatching success of 47%. Fledging success of hatched eggs was 75% (n = 17) and reproductive success was 35% (n = 36). Sample size was smaller in 1998 than in 1997 because fewer birds bred in 1998. Total reproductive success for 1997 and 1998 combined was 36%.

Growth rate and fledging

Only three of the 14 newly created artificial burrows were occupied in 1997 or 1998 and none of these nests was successful. All data used for growth calculations came from birds in the artificial burrows that were constructed over existing burrows using the original entrance. The fact that these burrows were used in previous years prior to modification suggests that all birds were experienced breeders.

Adults stopped brooding chicks about 5 days after hatching. In 1997 in the artificial burrows, chick weight peaked about 50 days after hatching at 403 g ± 94 sd (n = 15 chicks), which is equivalent to approximately 99% of adult weight. Chicks then lost 6.5% of their maximum body weight in the last 3 weeks before the last weight was taken, 377 g ± 74 sd (n = 15) (Table 1). Culmen and tarsus growth reached an asymptote at about 30 days post hatching (Table 1). Fledge weight of birds caught on the surface of the colony just prior to fledging was 354 g ± 38 sd (n = 51), slightly lower than the last weight obtained for chicks in the artificial burrows. Culmen and tarsus measurements did not differ significantly between chicks from artificial burrows and those caught outside of their burrows prior to fledging. However, wing length was significantly longer in the birds caught outside their burrows (Table 1), probably because they were older.

Morphological measurements

Adult weight averaged 408 g ± 44 sd (range 332–545 g, n = 258, Table 2). Males tended to be slightly larger than females (Table 2). Only tarsus length ($F_{10,14} = 1.88$, $P < 0.05$) and head length ($F_{8,10} = 1.65$, $P < 0.05$) were significantly greater in males.

Egg length averaged 59.5 mm ± 3.0 sd and width 40.4 mm ± 1.1 sd (n = 10). Measured egg weight for eight eggs between 2 and 11 days post laying was 51.8 g ± 4 sd. Correcting for daily weight loss, the calculated fresh egg weight averaged 55 g ± 4 sd (n = 8).

Habitat

We measured 11 km of roads in the colony, including the airstrip. This equals 63 234 m^2 of potential

Table 1. Measurements at weekly intervals for weight, wing chord, culmen and tarsus for Black-vented Shearwater chicks in artificial burrows on Natividad Island, 1997. The bottom row, fledging birds, presents data from birds caught at night in front of their burrows just prior to fledging. Statistics are reported for comparisons between the fledging bird values and the last value reported for chicks in the artificial burrows. Values are given as mean ± sd (*n*).

Age (weeks)	Weight (g)	Wing chord (mm)	Culmen (mm)	Tarsus (mm)
1	99 ± 26 (8)	293 ± 9.4 (3)	19.6 ± 8.4 (3)	20.9 ± 6.6 (6)
2	189 ± 43 (13)	39.2 ± 5.6 (10)	25.0 ± 5.4 (11)	28.6 ± 4.9 (14)
3	245 ± 49 (14)	52.5 ± 8.5 (13)	27.1 ± 3.0 (16)	34.1 ± 5.3 (17)
4	298 ± 64 (15)	79.2 ± 12.1 (14)	30.1 ± 3.6 (17)	38.9 ± 6.1 (17)
5	329 ± 59 (15)	108.8 ± 12.6 (14)	32.2 ± 4.7 (5)	41.8 ± 7.3 (15)
6	368 ± 93 (15)	137.2 ± 13.1 (14)	33.9 ± 5.2 (15)	42.6 ± 7.5 (15)
7	403 ± 94 (15)	162.1 ± 13.3 (14)	34.5 ± 5.3 (15)	43.2 ± 7.6 (15)
8	402 ± 79 (15)	183.4 ± 15.4 (14)	35.1 ± 6.0 (14)	43.3 ± 7.6 (15)
9	399 ± 105 (15)	206.1 ± 13.1 (14)	34.8 ± 7.0 (12)	43.3 ± 8.1 (14)
10	377 ± 74 (15)	214.3 ± 10.8 (14)	No data	No data
Fledging birds	354 ± 38 (51)[a]	230.1 ± 5.9 (52)[b]	35.4 ± 1.5 (52)[a]	45.1 ± 2.0 (52)[a]

[a]ns; [b]Mann–Whitney $U = 74.0$, $P < 0.001$.

Table 2. Morphological measurements for adult Black-vented Shearwaters on Natividad Island in 1997 and 1998. Unknown sex birds were measured live. Measurements of known sex birds are from dead birds found in the colony. Measurements are given in mm ± sd (range, *n*).

	Sex unknown	Male	Female	Statistics
Culmen	36.5 ± 1.8 (32.1–41.3, 253)	37.3 ± 1.3 (34.9–39.4, 13)	36.6 ± 1.1 (34.4–37.9, 8)	ns
Wing	233 ± 5.8 (215–248, 260)	236.2 ± 6.0 (222–246, 14)	235.6 ± 6.5 (231–250, 10)	ns
Tail	74.2 ± 3.2 (62–81, 251)	75.8 ± 3.4 (71–80, 11)	77.1 ± 1.7 (75–82, 8)	ns
Tarsus	46.2 ± 1.3 (42.3–50.5, 258)	46.7 ± 0.9 (45.1–48.3, 14)	45.6 ± 1.2 (44.2–47.3, 10)	$F_{10,14} = 1.88$, $P < 0.05$
Head[a]	–	86.7 ± 4.6 (82.9–88.8, 10)	83.0 ± 2.0 (78.8–87.4, 8)	$F_{8,10} = 1.65$, $P < 0.05$

[a]From tip of bill to back of skull.

habitat within the colony that was occupied by roads. Assuming a minimum burrow density of 0.03 m^{-2}, we estimate that road construction has destroyed 1897 burrows. Including the area of the town (285 785 m^2) and the garbage dump (30 500 m^2) in the calculation of lost nesting habitat yields an estimate of 11 386 burrows destroyed through habitat loss. Discussions with island residents present when the town was built indicate the developed area had very high burrow densities prior to construction. Using the higher burrow density of 0.083 per m^2 for the town, we estimate a total of 26 532 burrows (15% of the burrows on the island) were destroyed during the construction of town and roads.

Other seabird species

In 1997 the only other breeding seabirds on Natividad Island were Double-crested Cormorant *Phalacrocorax auritus* (about 60 pairs), Brandt's Cormorant *P. penicillatus* (about 750 pairs on the main island and up to a thousand pairs on the north islet, Islote Plana), Brown Pelican *Pelecanus occidentalis* (about 75 pairs) and Western Gull *Larus occidentalis* (several thousand pairs) (B.S.K. unpubl. data). Except for the Western Gull, the nesting locations of these species did not overlap with those of the Shearwater.

DISCUSSION

Population status

Our population estimate for Black-vented Shearwaters on their primary breeding ground, Natividad Island, was the first comprehensive survey and revealed a population much larger than previous estimates. Owing to the problems associated with estimating numbers of nocturnal, burrow-nesting seabirds during the typically short visits by earlier visitors to Natividad Island, we believe the population has been underestimated in the past. Therefore, we feel the higher population estimate is not indicative of a

Table 3. Measured and predicted values for life history characteristics of the Black-vented Shearwater based on regressions for non-fulmarine petrels from Warham (1990).

Character	Regression	Measured	Predicted
Egg weight	$y^a = 0.745\ x^{0.732}$ ($r^2 = 0.991$, $n = 34$)	54.5	60.7
Egg dimensions	$y^b = 1.275\ x^{0.743}$ ($r^2 = 0.991$, $n = 52$)	98.0	110.9
Incubation period	$y^c = 26.33\ x^{0.116}$ ($r^2 = 0.935$, $n = 32$)	51	52.9
Nestling period	$y^d = 22.72\ x^{0.229 \pm 0.14}$ ($r^2 = 0.732$, $n = 37$)	69	90.0

[a]Egg weight in g; [b]Egg length × width^2 in cm; [c]incubation period in days; [d]nestling period in days.

population increase. On the contrary, our observations indicate a population decline for this species due to habitat destruction and predation from introduced animals (Keitt 1998, Keitt *et al.* 2002).

Several lines of evidence suggest that Black-vented Shearwater populations have been declining. Everett and Pitman (1993) point out that the huge flocks of Black-vented Shearwaters reported by Anthony (1896, 'not less than 50 000 birds') and Grinnell (1897, 'immense flocks') off southern California and Baja California are no longer seen. Because Black-vented Shearwaters are a coastal species rarely seen more than 25 km offshore (Keitt *et al.* 2000a, 2000b) it is unlikely that the disappearance of these flocks can be explained by changes in distribution at sea, as has been suggested for observed declines in Sooty Shearwaters *P. griseus* off California (Oedekoven *et al.* 2001). In 1968, Delong and Crossin (1968) reported widespread Shearwater mortality due to feral cats, and estimated 100 cats on Natividad Island. During this study the cat population was about 25 individuals and it was estimated that they took more than 1000 Shearwaters per month during the breeding season (Keitt *et al.* 2002). Development of the island as a fishing village has also had dramatic effects on the population of Shearwaters. Our estimate of 26 532 burrows destroyed by human activities is conservative because we did not take into account the edge effects of the town, which appear to have greatly decreased burrow density within 300 m of town.

It is likely that, at one time, Black-vented Shearwaters bred on more islands off the Pacific coast of Baja California than at present. Feral cats occur, or occurred in the recent past, on Asuncion, San Roqué, San Martín and San Jeronimo islands (McChesney & Tershy 1998). All of these islands have suitable, though limited, habitat for the Black-vented Shearwater (B.S.K. pers. obs.) and it is likely that some of these islands once supported relatively small breeding populations. The small extant populations on Guadalupe and San Benito Islands are also at risk, threatened by habitat destruction and introduced species (McChesney & Tershy 1998, Donlan *et al.* 2000). We estimate that over 95% of the world population of Black-vented Shearwaters occurs on Natividad Island. Thus, this species' future is clearly linked to the protection of this island.

Life history characteristics

The life history characteristics of the Black-vented Shearwaters measured in this study are similar to those of other petrel species. Warham (1990) provides regressions for adult weight vs. egg weight, incubation period and chick period for a range of petrel species. Our values for Black-vented Shearwaters are close (± 10%) to values estimated from Warham's (1990) regression, except for nestling period, which is more than 20% less than predicted (Table 3). However, nestling period is typically highly variable and our measure is not unexpectedly low.

As in all other *Puffinus* shearwaters, Black-vented Shearwater chicks reach a peak weight that is greater than the fledging weight (Hamer & Hill 1994). Although this peak weight is reached at approximately the same age in Manx Shearwaters *Puffinus puffinus* (50 days), the peak weight in Black-vented Shearwaters of 6–12% above fledging weight is less than the 30% above fledging weight reported in Manx Shearwaters (Lee & Haney 1996) and 15–25% for Wedge-tailed Shearwaters *P. pacificus* (Pettit *et al.* 1984, Whittow 1997). In addition, Black-vented Shearwaters appear to fledge at a lower percentage of adult mass, only 86%, than other *Puffinus* shearwaters, such as Manx (98%) (Lee & Haney 1996), Wedge-tailed (108%) (Whittow 1997) and Newell's *P. auricularis newelli* (98%) (Brooke 1990, Ainley *et al.* 1997). However, our data were collected during an El Niño event that may have affected these results. In addition, it is possible that the artificial burrows and/or handling of chicks

and adults affected chick growth negatively. Nonetheless, if these ontogenetic weight patterns are accurate, further study of the growth patterns of this nearshore, non-migratory Shearwater may prove rewarding.

Our estimates of reproductive success for the Black-vented Shearwater (36%) are lower than reported for Manx Shearwaters (range: 43–75%) and Newell's Shearwaters (66%) (Ainley *et al.* 1997, Brooke 1990). Several factors could account for this discrepancy. Cat predation occurred frequently during this study and may have contributed to the lower reproductive success in Black-vented Shearwaters (Keitt 1998). In addition, El Niño conditions and the effects of researcher disturbance may have lowered reproductive success estimates. However, shearwaters similar in size to the Black-vented Shearwater, such as the Manx Shearwater and Little Shearwater *P. assimilis* are generally much more tolerant of handling than are larger species such as Sooty, Short-tailed *P. tenuirostris* and Flesh-footed *P. carneipes* shearwaters (Warham 1990).

Conservation

Natividad Island is within the core zone of the Vizcaino Biosphere Reserve and is thus legally protected. However, many of the human activities on the island impact Black-vented Shearwaters significantly. Introduced species, such as feral cats, pose the greatest threat to the Shearwater population (Keitt *et al.* 2002). Nocturnal seabirds are often attracted to light sources, which can lead to mortality (Reed *et al.* 1985), and on Natividad Island collisions with windows, buildings and power lines are a problem (B.S.K. pers. obs.). Activities such as the building and maintenance of roads, off-road driving through the colony, dumping of garbage and humans walking through the colony all pose additional threats. Fortunately, cats, goats and sheep have been eradicated from Natividad Island (Tershy *et al.* 2002). However, the accidental introduction of rats *Rattus* spp. is a constant threat that could rapidly devastate the colony.

Although the population of Black-vented Shearwaters is larger than previous estimates suggested, and introduced predators and ungulates have been eradicated from Natividad Island, there remains much to be done to help protect this species. Management actions on Natividad and other Black-vented Shearwater breeding islands that: (1) decrease the likelihood of future mammal introductions, (2) stop habitat losses due to land conversion by island users and (3) reduce light attraction impacts will protect existing populations. Introduced mammal removal and restoration of Guadalupe Island and the closing of roads and garbage dumps on Natividad Island could greatly increase available nesting habitat.

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