CURRENT BREEDING POPULATION OF THE YELLOW-LEGGED GULL *LARUS MICHAHELLIS* IN GIBRALTAR

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SUMMARY

Nesting Yellow-legged Gulls Larus michahellis in Gibraltar were surveyed and numbers compared to a previous census in 2002. A decrease in census nesting pairs was found (1505 compared to 1846, a decrease of approx 18%). Numbers had decreased in most areas but had increased on the east side of the Rock and in built-up areas. Results suggest that past culling efforts have been effective and that methodology has to be reviewed to attempt an increased, regular culling effort concentrating on the east side and urban sites.

INTRODUCTION

The Yellow-legged Gull *Larus michahellis* (formerly *L. cachinnans*) has been a common breeding species in Gibraltar since the late 1950s. Although there was no mention of definite breeding until 1934 (Rait-Kerr, 1934), the species had been recorded in Gibraltar in the 19th and early 20th century by several writers (Saunders, 1871; Irby, 1895; Verner, 1909). The population boomed in the early 1970s when there was a great expansion of nesting sites. By then, most of the cliffs in Gibraltar had been populated, both on the east and west side of the Rock, and the species began nesting within the matorral vegetation of the Upper Rock. At the time, Cortes *et al.* (1980) estimated the nesting population at 600 pairs. While the species used rooftops in the town area regularly for resting and roosting for some years since the late 1960s, the first documented record of successful nesting on buildings was in Rosia Bay in 1981 (J.E. Cortes, pers. obs.). Rooftop nesting is now very common in the urban areas of Gibraltar and is on the increase, especially as the many new, large developments provide gulls with more nesting sites. Nesting on similar sites has now spread to neighbouring towns, including La Linea and Algeciras and has recently been confirmed in Estepona. Since the removal of the water catchments and re-vegetation of the sand slopes on the east side of the Rock between 1998 and 2003, hundreds of potential new nesting sites have been created for the Yellow-legged Gull. This site now holds the largest colony of breeding gulls on the Rock.

The increase in numbers during the second half of the 20th century led the Royal Air Force (RAF) in Gibraltar to initiate seasonal culling in 1979. The Rock Gun area and adjacent cliffs on the North Face were of immediate concern as the large numbers of gulls in the area were a threat to aircraft and several strikes had occurred, so the culling effort was concentrated there. However, other areas of the Rock were not covered by the cull and so the population continued to rise throughout the 1980s and 1990s. The RAF, with the assistance of the Gibraltar Regiment, extended its operations in 1982 to include other areas of the Upper Rock and the South District. This culling continued on a yearly basis. In the early 1990s, the population of breeding gulls on the Rock was estimated at 2500 pairs (Finlayson, 1992). At around that time, the RAF presence in Gibraltar was greatly reduced, the Gibraltar Regiment was no longer able to provide manpower, and culling effort decreased.

Since 1997, the Gibraltar Ornithological and Natural History Society (GONHS) has undertaken regular culling (GONHS, 1998, 2001, 2002, 2003). In addition to GONHS' culls, a team from the UK's Department for Environment, Food and Rural Affairs (DEFRA) conducted a cull in May 2009 concurrent with this census. Their efforts were concentrated on the east side, so that area was surveyed before their operation.

The last Breeding Gull Census was conducted in the spring of 2002 by the Royal Air Force Ornithological Society (RAFOS) on behalf of GONHS (Cortes *et al*., 2005). The survey took place from 22nd April to 9th May 2002. A total of 1846 breeding pairs was counted. However a compensation factor was assigned (see Cortes *et al*., 2005) giving an estimated 3653 breeding pairs. An extra 10% was added to this value to compensate for methodology and areas not surveyed, resulting in 4018 breeding pairs or 8036 adult birds. The survey also accounted for non-breeders and fledged young, which brought the estimated total number of birds to 20,090. Less comprehensive studies by GONHS in 1998, 2001 and 2002 estimated the total

population at 30,000 birds. Birdlife International (2004) gives the population as 5,000-7,000 breeding pairs, based on information supplied by GONHS.

This census followed the field methodology of the 2002 survey (Cortes *et al.*, 2005) in order to be able to compare results directly. It also extended the methods to other areas previously omitted in order to refine the census. Recommendations are given for the next census.

METHODS

This census was conducted from 17th April to 11th May 2009. The survey focussed on breeding birds and not the total number of gulls in Gibraltar. Surveying numbers of breeding gulls provides a more meaningful and consistent comparison than including non-breeders, because estimates of non-breeding birds are difficult and potentially inaccurate due to their transient nature. Surveys were conducted by a single person. Counts included only birds that were not in flight. Birds flying were excluded due to the difficulty in making accurate counts of these, and determining whether or not these are breeding birds, or where they breed. Gulls seen sitting were recorded as 'sitting' and were assumed to be making a breeding attempt. Relatively few sitting birds have their mate close by so they were therefore recorded as one half of a breeding pair (BP). This assumption followed the 2002 survey. Such an assumption is necessary because it is not always easy to see the actual nest when a gull is incubating, especially if the nesting site is within vegetation, on cliff faces, or far away. However, in order to refine this assumption, a sitting gull was not recorded as one half of a breeding pair if the habitat was unsuitable for nesting or the bird was obviously not making a nesting attempt. For example, a bird sitting on a lamppost or unsuitable roof was recorded only as a 'standing' gull. Additionally, the number of gulls seen sitting on actual nests was recorded. Gulls seen standing were recorded as 'standing', but not considered to be breeding. Standing gulls help give an estimate of the number of gulls 'using' an area, be it for resting, roosting or feeding. In addition, gulls were also recorded as a breeding pair if a pair was seen either obviously together, mating, or defending a territory. Final estimates of breeding pairs are derived from the number of sitting gulls plus the number of breeding pairs actually seen. Compensation factors used in Cortes *et al.* (2005) were discarded due to their being based on unjustified assumptions. A direct comparison of pairs actually counted provides a more realistic assessment of change since 2002 (see Discussion).

Gulls are sensitive to disturbance and all individuals may leave their nests at once if disturbed, for example when a large bird of prey flies by. During these periods, they leave the nest unattended, making detection of breeding pairs more difficult. All counts were therefore conducted on undisturbed gulls.

Counts were made within marked areas from set viewpoints (Appendix 1, Table 1) based on Cortes *et al.* (2005). A minority of areas were surveyed as a transect (details given in Table 1). Gulls were counted using binoculars, as well as a spotting scope when necessary. In order to quickly and accurately count gull numbers, a tally counter was used. Some of the viewpoints used in the 2002 study were found to be

inadequate either due to the encroachment of vegetation, or because the viewpoint did not give the best available view for the area. As a result, some of the viewpoints were relocated in this survey in order to get the best view of the area in question. For example, the Signal Station firebreak (area O) and the Bruce's Farm firebreaks (area P) are now overgrown. Rock Gun (area M) was omitted from this survey as the dense maquis surrounding the buildings makes it difficult to survey and contains a negligible number of breeding gulls. Four extra areas were assigned as 'Y', 'Z', 'JJ' and 'AC' and included in the survey (Table 1).

In order to standardise the data for comparison between years, number of breeding pairs at each site was calculated as a proportion for each year, using the equation:

$px = x / x + y$

where: px = proportion of nesting gulls in year x, y = number of breeding pairs recorded in year y, and x = number of breeding pairs recorded in year x.

A paired *t*-test was used to compare the number of breeding pairs of gulls at all sites between 2002 and 2009. Proportions calculated as above were used in this analysis.

RESULTS

Counts obtained throughout this study are given (Table 2). A total of 1505 breeding pairs were recorded, or 3010 breeding individuals. An arbitrary 10% was added to this total to compensate for areas not included in the survey. Although gulls undoubtedly breed within these areas, they do so mainly in low densities as most is high maquis and not easily penetrable. This gives a calculated 1655 breeding pairs or 3310 individuals.

The highest number of breeding gulls was recorded on the Eastside Sand Slopes (703 pairs). This area also contains the highest density of gulls on the Rock per unit area.

A total of 2325 standing gulls were counted throughout the study area. These individuals do not represent breeding gulls but give the number of gulls using an area for resting or feeding. The data for standing gulls in Cortes *et al*. (2005) was not provided so a comparison cannot be made. However, adding these standing gulls to the enhanced estimate of nesting pairs, a total emerges of 5635 gulls.

The number of estimated breeding pairs recorded in 2002 is compared with the present survey (Table 3 & Fig. 1). When taking just the areas used in the 2002 survey into account (areas B-X), 1395 breeding pairs were recorded in 2009 (area A was omitted from the 2009 survey as gulls do not nest on Eastern Beach). This value represents a decrease from the 1846 pairs recorded in 2002, with a difference of 451 breeding pairs. The proportion of pairs nesting in 2009 was significantly lower than in 2002 (paired *t*-test: $t_{20} = 3.18$, $p = 0.005$), with the proportion of pairs recorded at each site being twice as high on average in 2002 (mean =

0.66 ± 0.23 SD) as in 2009 (mean = 0.34 ± 0.22 SD). The number of breeding gulls recorded in this study is lower for most areas except some of the urban areas (T & X, highlighted in Table 3), where there seems to have been an increase. New building developments have occurred in these two areas since the last census was conducted, providing more nesting sites.

A higher number of breeding gulls was recorded on the East Side Sand Slopes (703 pairs compared to 180 in 2002). This is no-doubt primarily a product of colonisation of new nesting sites following the rehabilitation of this habitat since the water catchments were re-vegetated in the early 2000s.

Area	Location	Habitat	Viewpoint	Viewpoint Location
A	Eastern Beach	Coastal and beach		Transverse along Eastern Beach
B	Cliffs opposite Aerial Farm	Cliffs	V_B	Eastern Beach (south end)
C	Talus	Cliffs, sandy slopes with open garigue	V_C	Oil Depot
			V_C	Catalan Bay reclamation
			V_{CD}	Sir Herbert Miles Rd - Catalan Bay
D	Catalan Bay area	Cliffs, maquis with open areas	V_{CD}	Sir Herbert Miles Rd - Catalan Bay
E_1	Eastside Sand Slopes (old Water catchments)	Sandy slopes with open garigue	$V_{E1(1\text{-}3)}$	Cable Car Top Station viewing point and Old Signal Station
E_2	Eastside Sand Slopes (lower reaches and cliffs above)	Cliffs, sandy slopes with open garigue	V_{E2}	Sir Herbert Miles Rd – Caleta Palace Hotel
			V_{E2}	Sir Herbert Miles Rd – Car park above Shirley Cove
			V_{E2F}	Sir Herbert Miles Rd – south of Both Worlds
F	Sandy Bay area	Cliffs, maquis with open areas	V_{E2F}	Sir Herbert Miles Rd – south of Both Worlds
G	Oil Tanks	Cliffs, maquis with open areas	V_G	End of Sir Herbert Miles Rd, just past the oil tanks
H	Mediterranean Steps and O'Hara's water catchment	Maquis, urban & garigue		Transect along the course of Med Steps
			V_H	O'Hara's Battery
I	Lathbury up to Spur Battery	Cliffs, maquis with open areas	V_{IJ}	Hole in the Wall Battery

Table 1.- Areas and Viewpoints covered in Gibraltar.

J	Europe Advance Rd	Cliffs, maquis with open areas	V_{IJ}	Hole in the Wall Battery
JJ*	Governor's Beach area	Sea cliffs, coastal	V_{JJ}	Clay Pigeon Shooting Club
K	Europa cliffs below Windmill Hill	Cliffs	V_K	Europa Point – Nun's Well
L	Cliffs above Devil's Tower Rd	Cliffs	V_L	North Front Cemetery
N	Rock Gun	Cliffs, maquio-garigue	V_{NOPQ}	ICC Car park (top floor)
O	Signal Station Fire Break	Maquis with open areas	V_{NOPQ}	ICC Car park (top floor)
P	Bruce's Farm Fire Break	Low maquis with some open areas	V_{NOPQ} V_P	ICC Car park (top floor) Signal Station Rd
Q	Cliff above entrance to Rock Gun	Cliffs, high maquis	V_{NOPQ}	ICC Car park (top floor)
R	Northern Defences & Laguna Estate	Cliffs, high maquis, urban	V_R	Winston Churchill Ave Pedestrian Bridge
S_1	Town and Upper Town area, maquis above Water Works	Urban, high maquis	V_{S1}	Gibraltar Under Siege Exhibition
S_2	Moorish Castle down to Europort area, including Glacis Estate, Waterport Terraces & Europort area	Urban	V_{S2}	Princess Caroline's Battery

Table 1. Areas and Viewpoints covered in Gibraltar (continued).

T	Town area from King's Bastion to Grand Parade & maquis above Flat Bastion Rd	Urban, high maquis	V_T	Devil's Gap Battery
U	Cliffs above Rock Hotel & Old Casino	Cliffs	V_{UW} V_U	Casino Bridge steps, Europa Rd Grand Parade
V	Rock Hotel area and surrounding maquis	High maquis	V_V	Apes Den Viewpoint
W	Casino area and surrounding maquis & South District area up to Bayview building	High maquis Urban	V_W V_{UW}	Queen's Gate, Old Queen's Rd Casino Bridge steps, Europa Rd
WW**	Alameda Gardens	Botanical Garden		Walking through garden
X	South District area up to Old Naval Hospital & maquis around Maida Vale	High maquis, urban	V_X V_X	Queen's Rd Viewpoint Top of Francis Building
Y*	South District area and Buena Vista	Urban, vegetated cliff areas	V_Y V_Y	Raptor Rehabilitation Unit, Windmill Hill Buena Vista
Z*	Rosia, Camp & Little Bay	Cliffs		Transect along Rosia Rd
AC*	Engineer Rd water catchment	Pseudosteppe/garigue	V_{AC}	Engineer Rd

Table 1.- Areas and Viewpoints covered in Gibraltar (continued).

* extra areas used in this survey not covered by Cortes *et al.* (2005).
** this area was previously broken into two areas V and W in Cortes *et al.* (2005). In this study it is defined as a separate area.

	A	B	C	D	E	F	G	H	I	J	JJ	K	L	N	O	P	Q	R	S	T	U	V	W	WW	X	Y	Z	AC	TOTAL
Sitting	0	6	102	15	693	46	9	8	21	11	22	10	72	45	0	17	6	16	25	27	21	14	71	0	29	23	16	9	**1334**
Standing	6	14	303	27	701	32	28	107	92	84	146	24	94	37	2	7	3	49	171	50	32	19	119	2	99	40	29	8	**2325**
BP's	0	1	33	4	10	2	0	8	5	5	8	4	7	5	2	2	1	3	5	7	1	1	19	6	16	11	3	2	**171**
Nests	0	1	34	2	476	0	2	6	7	4	12	2	33	5	0	2	0	11	14	10	0	1	31	3	24	8	16	6	**710**
Total BP's	**0**	**7**	**135**	**19**	**703**	**48**	**9**	**16**	**26**	**16**	**30**	**14**	**79**	**50**	**2**	**19**	**7**	**19**	**30**	**34**	**22**	**15**	**90**	**6**	**45**	**34**	**19**	**11**	**1505**

Table 2. Counts of gulls obtained for areas within Gibraltar 2009. BP = Breeding Pairs. The total number of Breeding Pairs = sitting gulls + BP's.

	A	B	C	D	E	F	G	H	I	J	K	L	N	M	O	P	Q	R	S	T	U	V	W	X	Total
BP's 2002	100	18	254	140	180	107	40	77	120	60	33	40	50	105	75	20	40	48	55	20	132	110	112	10	**1846**
BP's 2009	0	7	135	19	703*	48	9	16	26	16	14	79*	50	/	2	19	7	19	30	34*	22	15	90	35*	**1395**

Table 3.- Number of Breeding Pairs (BP's) recorded in the 2002 census (Cortes *et al.*, 2005) and the present census. All numbers used are actual counts. Area A was omitted from the BP estimates of the 2002 study and is not included in the total. Values highlighted with an * indicate a rise in breeding gull population from 2002 to 2009.

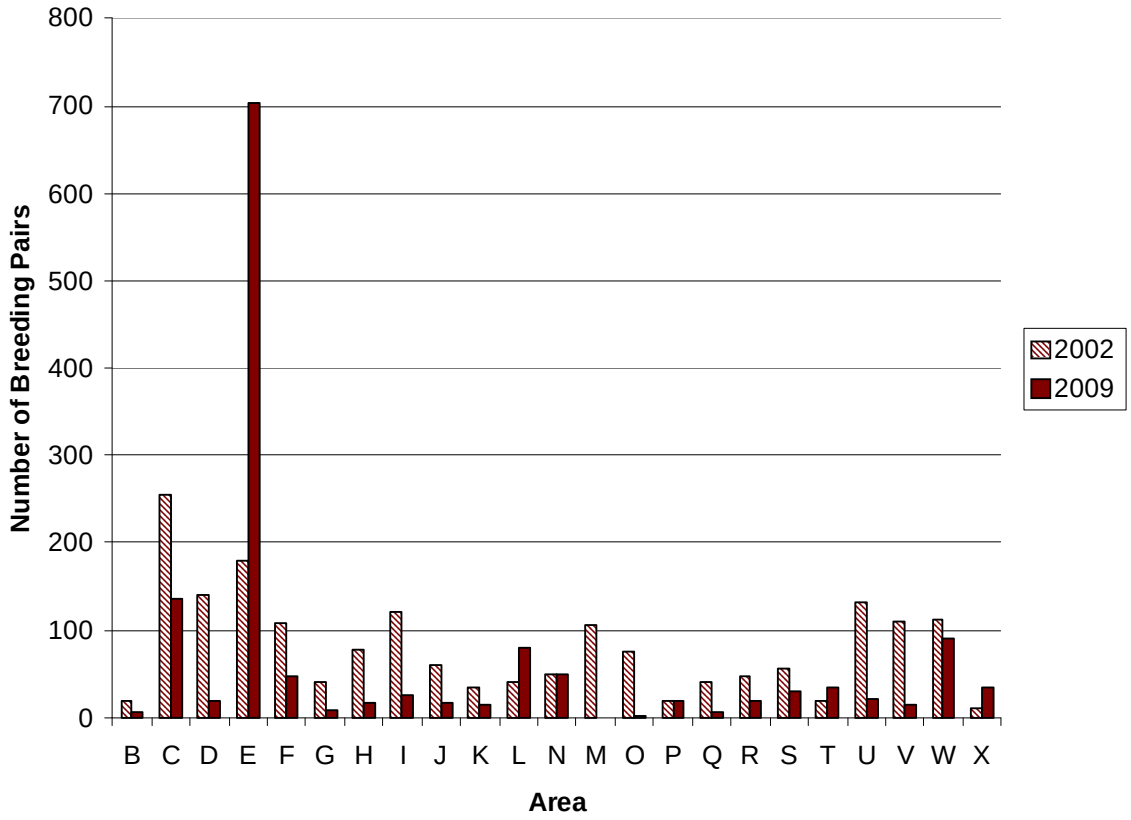

Figure 1.- Comparison in the number of Breeding Pairs between 2002 and 2009.

DISCUSSION & RECOMMENDATIONS

The 2002 survey recorded 1846 breeding pairs, compared to 1505 breeding pairs recorded in this survey. This represents a significant decrease in numbers. Although some nesting gulls could easily have been missed, this is equally true of the 2002 census. Many areas of the Upper Rock have now become overgrown, especially firebreaks, which makes gulls less conspicuous and more difficult to count. However, this also makes habitat less suitable for nesting gulls. Although the number of gulls recorded is obviously considerably lower than the true number present in the area and which can occur on the Rock at any time, previous estimates of 30,000 gulls seem excessive.

There were some inconsistencies in the 2002 survey. 'Compensation Factors' were used which were purely subjective, based upon speculative assumptions of the detectability of gulls in different types of habitat, without prior testing of these assumptions. A different compensation factor number was assigned to each area (ranging from 1-5) depending on the density of the vegetation in that area, the topography and the

likelihood of nesting occurring there. The actual numbers of breeding gulls (BP) obtained for any area was then multiplied by the specified compensation factor (see Cortes *et al.*, 2005 pg 213-214). The authors themselves say that these factors are slightly erroneous stating that "being subjectively obtained from on the spot examination of the areas, the compensation factors need to be tested and where necessary adjusted". Although these compensation factors are an attempt to provide an estimate of the total population of gulls on the Rock, their assumptions are unjustified. Providing an accurate estimate of the number of nesting pairs would require well-tested methods, such as distance sampling (Krebs, 1999). This method has two disadvantages associated with it: (i) it is very time consuming, and (ii) a large sample size (at least 70-90 objects) is required to generate robust and accurate models of density estimates (Buckland *et al.*, 2001). This renders most of our observation points unsuitable for such a method. Therefore, it was decided that using raw figures collected during 2002 and 2009 would provide the most appropriate and meaningful comparison between the two surveys, and the most simple and robust method for future surveys. Also in the 2002 study, area T was not surveyed properly by them due to observer error (see Cortes *et al.*, 2005) and an arbitrary value was used instead.

Given the time restraints and lack of manpower, other methods for counting could not be explored. Although other methods (such as the application of mathematical models to estimate density) were considered for sites in which visibility was low such as the maquis of the Upper Rock, it was decided that such sites hold such a negligible number of breeding pairs that such time-consuming measures were not justified, nor would they be uniform with methods employed elsewhere.

This survey covered more areas of Gibraltar than the 2002 survey, effectively increasing the sample area, and still recorded fewer breeding pairs. The large number of gulls present on the sand slopes suggests that a culling effort should be concentrated here. Urban gulls also need to be tackled as they are the cause of conflict with humans, especially during the breeding season. However, at present these cannot be culled with shotguns/rifles and so other more subtle methods need to be employed such as the use of birds of prey that have been trained for such an operation. Arrangements should be made with the Royal Gibraltar Police to allow culling in built up areas at certain times and with certain safety arrangements in place. All developments in Gibraltar, old and new, would benefit from measures to discourage gulls to sit or nest on their roofs. This should also apply to street lamps, which are often used as perches by gulls.

It is advised that future counts are ideally conducted before the beginning of May. Around this time the chicks start hatching and counting sitting gulls becomes a lot more difficult. Parents will stand next to the nest and so the number of sitting gulls recorded automatically becomes lower, and the count is biased towards standing gulls. Discretion must be used when faced with this situation. If a gull was observed standing next to a chick or feeding it then it was either classed as a 'sitting gull' or a 'breeding pair', depending on whether both parents were present. It is advised that a spotting scope is used when conducting surveys on cliff faces, especially along the east side, and within some of the urban areas. Binoculars alone can be used in most other areas. Eastern Beach (area A) should be excluded from the next survey. This area is not used by nesting gulls. Areas C and D should be combined in the next survey, as these areas can not be easily defined as given in Cortes *et al*. (2005).

The decrease in breeding gulls recorded over the past seven years indicates that culling by GONHS is reducing the gull population. There is a marked decrease in numbers from most areas covered compared to 2002. Interestingly, increases in breeding gulls have only occurred in areas where the GONHS gull control team is prohibited from shooting (urban areas) or where new nesting habitat has been created and culling is more difficult (the Sand Slopes). Additional nesting sites have also been provided in urban areas with the construction of large, new developments. This will cause the public perception of the numbers of gulls present to be one of an increase, since this has in fact happened in residential areas and on the east side, where beach goers will notice the impact. In order to continue to reduce the gull population, a more consistent effort is required year-round on the east side. This can be achieved by increasing the gull cull unit complement to allow the area to be covered more consistently. Urgent discussions should commence with the RGP to try to find a way to introduce shooting of gulls in urban areas. An increase in complement would also allow rooftops to be targeted more systematically, and not merely in response to call-outs, and to increase the use of birds of prey, at present the only effective culling method in such areas.

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Appendix 1: Viewpoints from which gulls were surveyed.