Marine Biodiversity Hub

National Environmental Science Programme

Project A7

Monitoring Population Dynamics of 'Western' Right Whales off Southern Australia 2015-2018

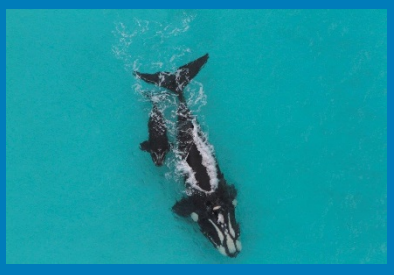
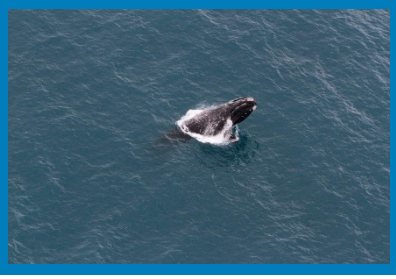
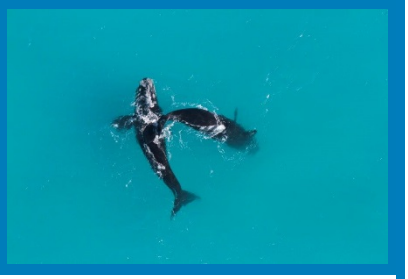
Project Leader

J L Bannister, Hon Associate, Western Australian Museum

Research Plan 2 – 2016 (RPv2)

Final report on activities –

30 March 2017

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Important Disclaimer

Cover page Images (L-R)
Southern Right whale, Cow/calf pair, 24/08/16, Trigalow Beach, south coast of WA.
Photo by Adam Halsall, © WA Museum
Southern right whale 'breaching', 24/08/16), Point Charles, southern coast of WA.
Photo by Adam Halsall, © WA Museum
Two 'unaccompanied ' adults interacting, 24/08/16, Pilpuppie Well, coast of South Australia, 26/08/16.
Photo by Adam Halsall, © WA Museum

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EXECUTIVE SUMMARY

To continue an annual series of aerial surveys off the southern Australian coast between Cape Leeuwin WA and Ceduna SA since 1993, an aerial survey was undertaken over three days, 24-29 August 2016. Because of bad weather, and for the first time in the annual series since 1993, only 'outward' flying legs were possible. For comparison with previous results, counts were obtained of 628 individuals including 228 calves of the year. The 2016 counts were higher than the very low count in 2015 but still below the recent trend line.

From 4305 photographic images obtained, 323 have been selected for computer-assisted 'matching' with those (some 7000 images of over 2000 individuals) already available in the catalogue, and 197 data sightings sheets have been added to the sightings database, currently totalling 3741 sightings sheets.

Regression analysis of log number against year for the period 1993-2016 gives increase rates for all animals of 0.0541 (95% CI 0.0371, 0.0710) equivalent to an increase of 5.55% (95% CI 3.78, 7.36) per annum, and for cow/calf pairs 0.0584 (0.0343, 0.0824) or 6.01% (3.49, 8.59) per annum, respectively.

Current population size, for this the 'western' Australian subpopulation, is estimated at 2195.

A Progress Report on the 2016 survey was provided as required under the Funding Agreement, on 31 December 2016.

This is the Final Report on the 2016 survey and associated activities as required under the Funding Agreement.

INTRODUCTION

Southern right whales were reduced almost to extinction by 19th Century whaling, throughout the southern hemisphere, including off Australia. There have been signs of recovery off the southern Australian coast, particularly off WA and western SA (the 'western subpopulation'), especially since the mid-1970s, given cessation of whaling on the species. While the greatest reduction arose from 19th Century 'open boat whaling' some whaling continued at a low level, particular by the Soviet Union, in the 1960s, but has ceased since then. Off Australia, since1976 aerial surveys have been undertaken annually to determine numbers and population trend and obtain individual identifying photographs, at first along the WA south coast from Cape Leeuwin east as far as Twilight Cove, but from 1993 extending into SA waters to as far as Ceduna, given evidence of intra- and inter-season coastal movement. Further east around the Australian coast there has been little sign of recovery in number; a working hypothesis assumes separation between two subpopulations – 'western' and 'eastern'. This report details the results of a planned aerial survey and associated activities between Cape Leeuwin and Ceduna in August/September 2016.

1. PROJECT SUMMARY

Aerial Survey, Cape Leeuwin-Ceduna, with an additional leg Perth- Augusta down the west coast, was undertaken between 24 and 29 August.

Extraction of count data was undertaken, as planned, by 30 October. Trend analysis has been undertaken for the period 1993-2016. Numbers and localities of animals seen, and for which identifying photographs have been obtained, have been databased. An estimate of population numbers is provided. Current distribution, by class, i.e. cows accompanied by calves of the year and 'unaccompanied' animals, is recorded.

2. AIMS

a) continue collection of the dataset, i.e. counts and photographs, of southern right whales, assumed to be from the 'western' Australian subpopulation, from the southern coast between C Leeuwin WA and Ceduna SA, as in each year since 1993. Obtain estimates of population trend since 1993, and current population size.

b) continue 'matching' photographs of head callosities obtained on the flights using a computer-assisted system against those (2000+ individuals) in the existing identification catalogue. Obtain information on current and past distribution and, in due course, biological parameters such as age at first parturition and calving rate.

c) continue databasing existing information on sightings, linked to animals already identified.

3. APPROACH

As in previous years survey was to be undertaken from a high wing, single engine aircraft based on Albany WA, over ca 39 hours, for four-five flying days. When whales are sighted, a count is made and individuals are circled for photography, and the GPS sighting position is recorded, as latitude and longitude. For individual identification, clear photographic images of the head callosity pattern and/or other identifying characteristics are required.

As in previous years, direct counts were to be obtained of animals observed within the search area. Photographs were to be obtained of as many animals as possible but with emphasis on cows with calves. The search area includes virtually all the area to which 'western' right whales resort in winter/spring, close to the coast, in particular for females to give birth, generally at three-year intervals.

As in previous years, the maximum count on the flight was to be compared with results since 1993 to obtain estimates of a) population trend and b) current population size.

Population size is currently obtained using a simple model based on the numbers of cow/calf pairs sighted. Given the relative paucity of animals that visit the remainder of the southern Australian coast, the 'western' population recorded between C Leeuwin and Ceduna is considered to represent the majority of the 'Australian' population.

Photographs from the flights are added to the 'WA' catalogue for computer-assisted 'matching' with those already available from WA and elsewhere, including the Antarctic. Sightings information is added to the existing sightings database which relates detailed sightings information to individuals already identified photographically.

4. RESULTS

Aerial Survey

Over 3 ‘searching’ days, 24-26 August 2016, and over 5 ‘searching’ legs, during 37.7 flying hours, there were sightings of 628 whales including 228 calves of the year between Perth WA and Ceduna SA (Table 1).

For the first year in the current series, i.e. since 1993, only ‘outward’ flights were possible between Albany and Ceduna. In previous years ‘inward’ flights i.e. return between Ceduna and Albany have been possible, and the maximum\u counts for each individual leg, ‘outwards ‘ or ’inwards’, have been taken for comparison year by year. Legs between Perth and Albany via Augusta were however flown successfully on 29 August.

This year, given the prevailing very poor weather conditions, with a series of low pressure systems sweeping across southern Australia and forecast to continue for some weeks, the decision was made to attempt at least one complete ‘outward’ set of flights – Albany to Ceduna – taking advantage of a relatively short ‘high’ pressure system forecast for around 24-26 August. Two further considerations affected that decision:

1. The availability of the pilot who had other commitments from around 5 September. An experienced substitute was available, but preference was given to the current pilot, Jenny Schmidt, who has more than 10 years’ experience of the flights.

2. Some concerns expressed by those observing right whales at Head of Bight, SA (HOB) (the major ‘western’ animal breeding area) who observed a reduction in numbers of cow/calf pairs following a record high count (of 81 c/c pairs) on August 16th. Following a large swell and bad weather from August 18-19 the HOB count dropped to 59 c/c pairs on the 20th and remained at around 60 pairs for some days thereafter (pers commn Claire Charlton, 24/08/16). In those circumstances it seemed advisable to undertake the flights as soon as possible after the beginning of the allocated window (August 15).

In the circumstances, with the ‘outward’ legs successfully completed in relatively good conditions (4-15 knots) on 24-26 August, but with very poor weather forecast for the foreseeable future, the decision was made to fly overland to Perth, via Nullarbor, Forrest and Kalgoorlie on 27/28 August. That allowed the legs Perth/Augusta/Albany to be undertaken successfully (in winds of 10-20 knots) on 29 August, but negated any possibility of completing the planned ‘inward’ legs Ceduna/Albany.

In four days, 24-29 August 2016, over 5 ‘flying’ legs, during 37.70 flying hrs, there were sightings of 628 whales including 228 calves of the year (Table 1). As described above, survey was only possible on ‘outward’ legs. For comparison with previous years, the comparable count was as above, i.e. 628 including 228 calves (Table 2). The counts were higher than in 2015, for which the lowest count was recorded since 2007.

Trend analysis

Regression analysis of the annual data 1993-2016 gives an estimated annual exponential rate of increase for all animals of 0.0541 (95% CI 0.0371, 0.0710) equivalent to an increase of 5.55% (95% CI 3.78, 7.36) per annum, and for cow/calf pairs 0.0584 (0.0343, 0.0824) or 6.01% (3.49, 8.59) per annum, respectively (Table 3, Figure 3).

Last year, (see e.g. Bannister et al 2015) inspection of the residuals of the fitted exponential regressions revealed, for the first time, weak evidence that the growth rate might be starting to indicate a slowing of the rate of increase

The 1993-2016 regression results are almost the same as for 1993-2015. Even though the 2016 counts are higher than in 2015, the estimated rates of increase are very slightly down because the new counts are still somewhat below the best fit line driven by all the counts from previous years. The weak evidence for a slowdown in growth rate therefore remains the same. However, the pattern is strongly influenced by the lower than expected counts in 2015 and an exponential increase is still the best description of the data. If the low 2015 counts are anomalous, future counts might be expected to continue to show an exponential increase. However, if this is not the case, it might be useful in future to explore models of population growth other than simple exponential growth to investigate more robustly whether the growth rate is starting to slow down. Results from 2017 (and, if possible, beyond) will inform the decision on what analytical approach to employ in future.

Population size

Current population size is estimated using a simple model adopted at the International Right Whale Workshop held in Buenos Aires, Argentina, in September 2011 (IWC, 2013), based largely on evidence from increasing populations off Argentina and South Africa, whereby the cow/calf count over three years (to allow for the 3-year periodicity in calving) is multiplied by a factor of 3.94. For the 'western' Australian subpopulation this results in current population size, i.e. for the middle year (2015) of the three-year period (2014-16), of 2195. While lower than in previous years (for 2013-2015 it was 2226) this reflects the low numbers of cow calf pairs observed recently off the coast.

Photography

From 4305 images obtained on the 2016 flight, 323 have been selected for 'matching' with those (some 7000 images) already available in the catalogue.

Current distribution

As in past years the 2016 flights recorded concentrations of particular classes of animals at various locations along the coast. As usual, cow/calf pairs, i.e. adult females with calves of the year, were found particularly in and near Doubtful Island Bay (including near Point Ann and Point Charles), west of Cape Arid, and along the coast to the north east of Israelite Bay (all in WA), and at Head of Bight (SA) (Fig 2a). 'Unaccompanied' animals, mostly adults but with no associated calves, were as usual found in much the same places, but rather more widely along the coast (Fig 2b), and with relatively very few at Head of Bight. A noticeable

feature in 2016 was a concentration of unaccompanied adults near Eucla, in contrast to 2015 where they were spread further along the coast to the west.

Databasing

For 2016, 197 data sightings sheets have been added to the sightings database, currently totalling 3741 sheets.

Data archiving

Previous count data, sightings and individual whale sheets have been submitted to the Australasian Right Whale Photo-identification Catalogue (ARWPIC) hosted by the Australian Marine Mammal Centre and Australian Antarctic Data Centre at the Australian Antarctic Division, archived at the Australian Antarctic Division Archives, Hobart. Those from 2016 are being forwarded to that archive.

The data will facilitate a planned, but not yet funded mark-recapture analysis of life-history parameters, population connectivity and individual movements as well as population abundance and trend. They will inform an assessment of the current conservation status of Australian right whales and their recovery relative to their pre-whaling abundance

ACKNOWLEDGEMENTS

Jenny Schmidt (flying for Great Southern Aviation, Albany, WA) piloted the flight, with Adam Halsall[1] (Andrew Halsall Photography) as observer/photographer: their hard work and dedication are acknowledged. Dr Josh Smith (Murdoch University) produced Figures 1 and 2. Prof Philip Hammond (St Andrews University, Scotland) undertook the trend analysis and advised on the results. Dr Mike Double (Australian Marine Mammal Centre, Hobart) advised on databasing and allied matters.

Facilities and administrative and other assistance continue to be provided to Bannister at the Western Australian Museum through the courtesy of the Trustees, the Chief Executive Officer and the Executive Director, Collections and Research.

[1] Son of Andrew Halsall, long-term observer/photographer on the flights. Adam has accompanied a previous flight as trainee observer/photographer.

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Tables and Figures

Table 1. Right whale aerial survey C. Leeuwin WA-Ceduna SA, 2016. Summary of results.

Flight	Date	Leg	Whale sightings								Weat-her[2]	Flying hrs-mins
			Right whales				Other large whales[3]					
			A[4]	C	Y	T	A	C	Y	T		
Outward legs, from Albany	24/08	1. Albany-Esperance	100	62	0	162	4	3	0	7	04/15	4.8
"	25/08	2a. Esperance-Caiguna	164	82	0	246	0	0	0	0	6/15	7.5
"	25/08	2b. Caiguna-Caiguna incl Twilight Cove	15	5	0	20	0	0	0	0		
"	26/08	3. Caiguna-Nullarbor incl Head of Bight	111	72	0	183	0[5]	0	0	0	05/10/ 10/05	7.4
	26/08	4. Nullarbor-Ceduna	6	4	0	10	*0*	*0*	*0*	*0*		
Total Outward		*1-4. Albany-Ceduna*	*396*	*225*	*0*	*621*	*0*	*0*	*0*	*0*		*17.7*
Overland[6]	27/08	Ceduna-Nullarbor-Forrest-Kalgoorlie									05/25/ 30/25	8.7
	28/08	Kalgoorlie-Jandakot (Perth)										
Additional legs	29/08	5a. Perth-Augusta -	0	0	0	0	0	0	0	0	10/20	4.8
		5b. Augusta-Albany	4	3	0	7	0	0	0	0		
Total additional		*9, 10. Perth-Augusta-Albany*	*4*	*3*	*0*	*7*	*0*	*0*	*0*	*0*	*10/20*	*4.8*
Total 2016	**3 days[7]**	**5 legs**	**400**	**228**	**0**	**628 incl 228 calves**	**4**	**3**	**0**	**7**		**37.7**
Total 2015 (outward + Perth-Augusta-Albany)	**4 days**	**5 legs**	**403**	**84**	**0**	**487 incl 84 calves**	**6**	**1**		**7 incl 1 calf**		**33.7**

[2] as indicated by wind speed, knots
[3] all humpbacks; no other large whales recorded
[4] A=adult, C=calf, Y='yearling', T=total
[5] One dead whale reported
[6] No 'inward' legs were possible, see text.
[7] For the 3 days on which searching was possible. The total period of the survey was 6 days

Table 2. Right whale aerial survey, C Leeuwin WA-Ceduna SA, 1993-2016. Comparable numbers seen.

Year	a. All animals	b. 'Unaccompanied' animals	c. Cow/calf pairs
1993	167	47	60
1994	191	95	48
1995	267	139	64
1996[8]	233	123	55
1997[1]	254	148	53
1998	342	120	111
1999	325	157	84
2000	259	113	73
2001	447	163	142
2002	377	163	107
2003	273	85	94
2004	356	142	107
2005	591	237	177
2006	427	127	150
2007	286	172	57
2008	702	230	236
2009	782	294	244
2010	519	251	134
2011	657	185	236
2012	715	275	220
2013	706	214	246
2014	623	159	232
2015	462	268	97
2016	628	172	228

[8] Probable undercounts (see Bannister 1998, 2002)

Table 3. Best fit regressions to the data of Table 2, C. Leeuwin WA-Ceduna SA, excluding 1996, 1997

Period	1993-2016		1993-2015	
Class	**All animals**	**Cow/calf pairs**	**All animals**	**Cow/calf pairs**
Exponential increase	0.0541	0.0584	0.0563	0.0588
SE	0.0081	0.0116	0.0088	0.0126
95% CI	0.0371-0.0710	0.0343-0.0824	0.0380-0.0747	0.0324-0.0852
p	0.000002	.00006	0.000004	0.00017
R^2	0.689	0.562	0.685	0.534
Percentage annual increase	5.55	6.01	5.79	6.06
SE	0.816	1.16	0.880	1.27
95% CI	3.78-7.36	3.49-8.59	3.87-7.75	3.29-8.89

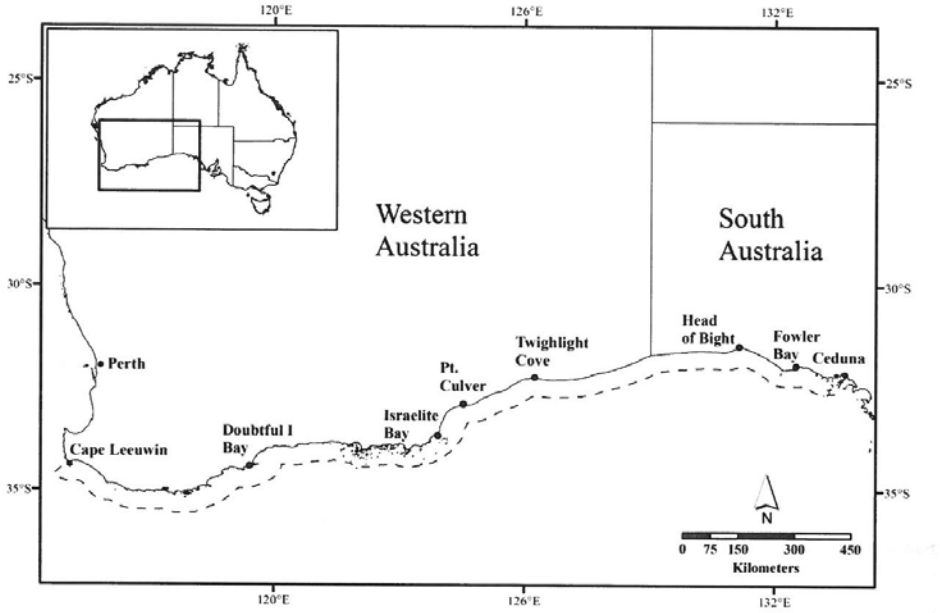


Figure 1. Right whale aerial survey off southern Australia from 1993. Dashed line represents approximate survey route.

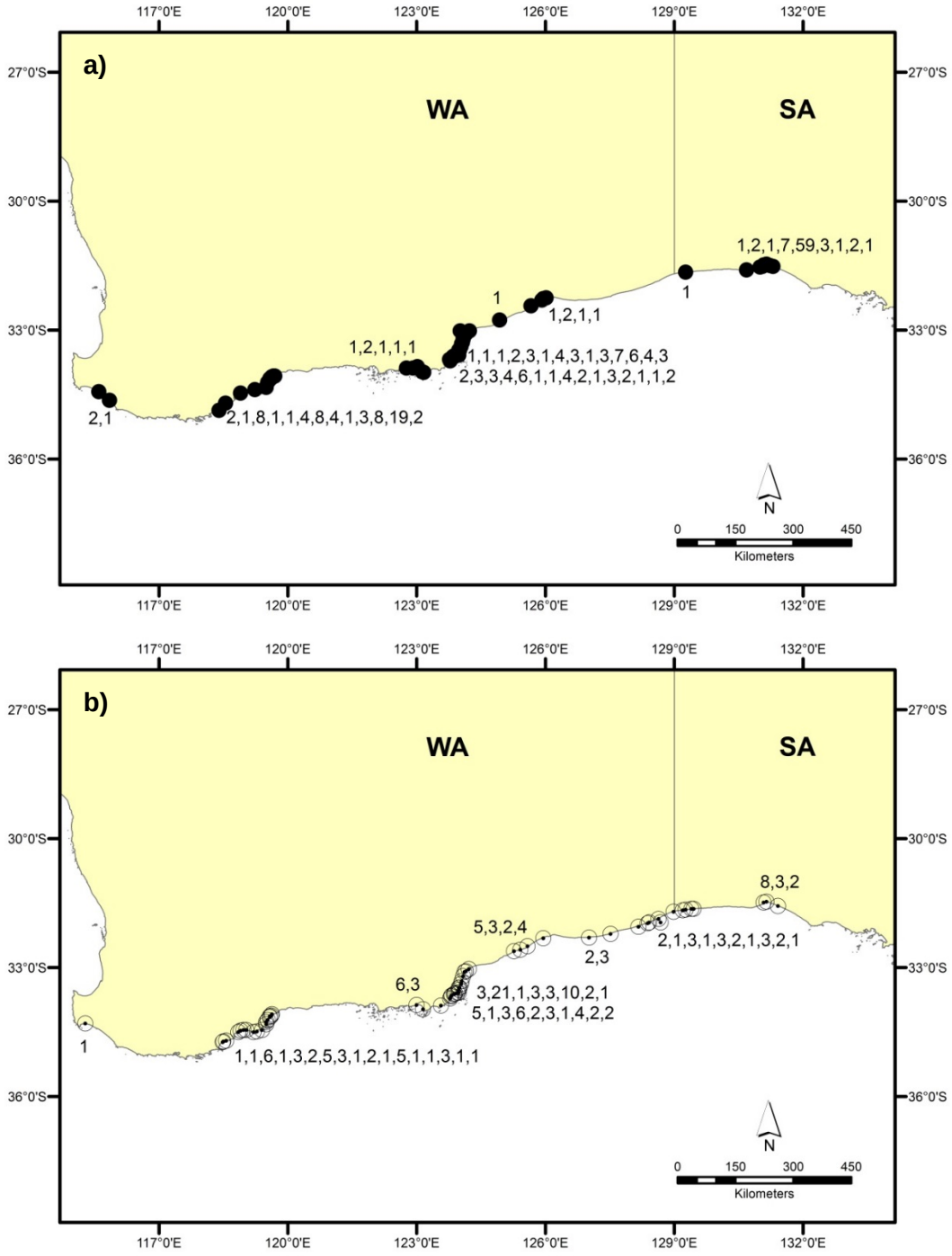


Figure 2. Aerial Survey, WA-SA, 2016. Approximate positions of right whale sightings on the flight and their associated group sizes.

a) Cow-calf pairs (●)
b) Unaccompanied animals (ʘ)

(a) All animals

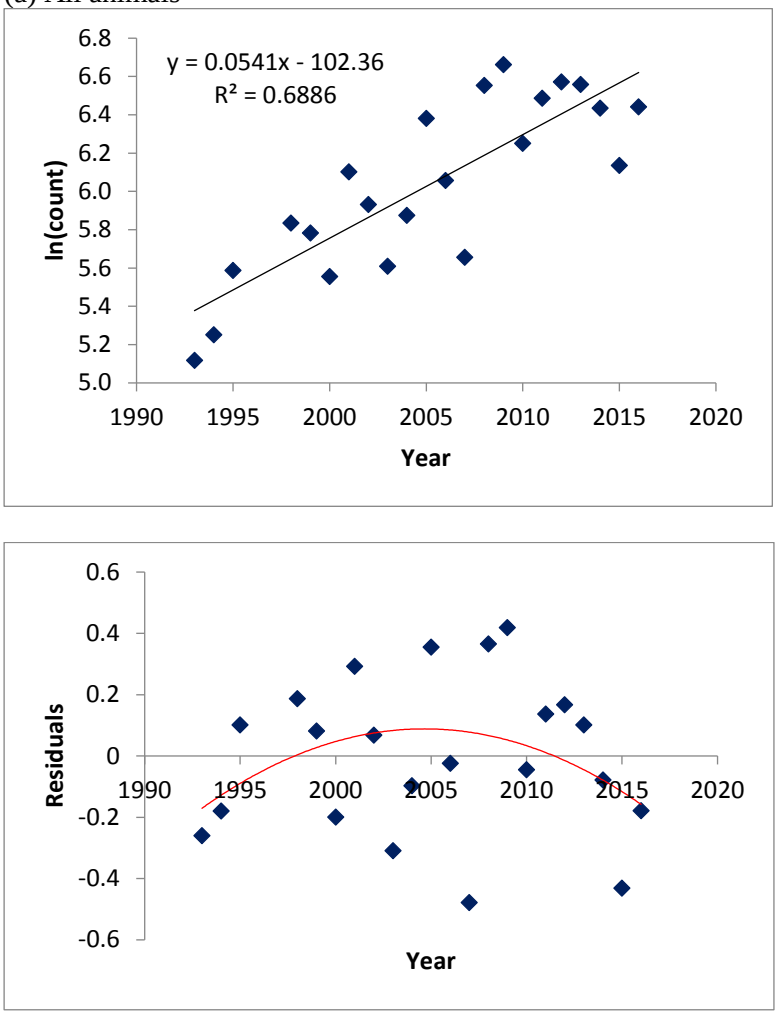
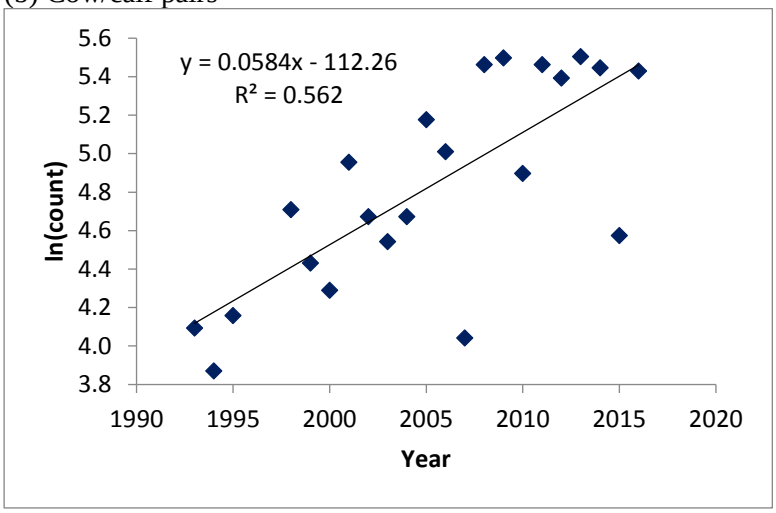
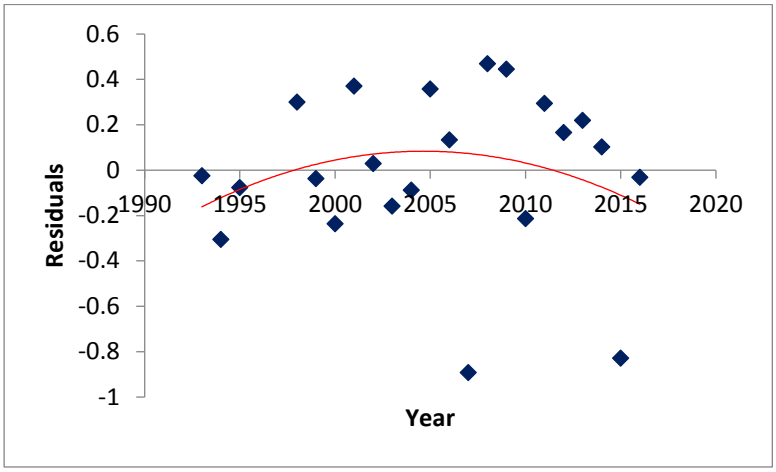


Figure 3. Plots of the fitted linear regression and residuals for the data in Table 2 for 1993-2016, excluding 1996 and 1997. The smooth lines fitted through the residuals show weak evidence that the exponential growth rate may be slowing.

(a) All animals (above)
(b) Cow/calf pairs (below)

(b) Cow/calf pairs





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