Agreement on the Conservation of Albatrosses and Petrels

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Title: Developing ACAP trend analysis and indicators: a provisional report to the Status and Trends Working Group

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Developing ACAP trend analysis and indicators: a provisional report to the Status and Trends Working Group

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Summary

- In this short paper, we report on provisional analysis carried out to inform the *ACAP Status and Trends Working Group* on trend analysis and the potential development of multi-species indicators for albatross and petrel populations.
- Our provisional analysis of albatross data shows how in principle trend data for albatrosses and petrels can be usefully analysed and how the resulting species indices can be combined into multi-species composite trend indicators.
- There are a number of ways in which species' trend data from different island groups might be combined into a single species trend. We discuss issues related to this question.
- There are also a number of ways in which species trend data can be combined into a single multi-species trend (=indicator). Again, we discuss issues related to this question.
- Our initial analysis suggests strong variation in albatross trends across bio-geographical regions (ocean sectors). This suggests any analysis needs to account for the fact that species trends vary systematically by ocean sector.
- We examined trends in 28 island populations for 13 species of albatross. The mean species trend taken across all species and periods available was slightly positive. Mean trends for the Indian Ocean and South Atlantic colonies were negative, and those for North and South Pacific positive.
- Provisional multi-species indicators constructed from 1954 paint a relatively similar picture of albatross trends, but the magnitude of changes is quite different. The indicators provide a better description of the albatross trends than the mean figures above because they incorporate temporal information in their calculation, as well as the magnitude of changes. An overall indicator constructed from the 1950s suggests a very large rise in average population levels of 569%, an average annual rate of 3.52%. Indicator trends for the Indian Ocean and South Atlantic were negative, and those for North and South Pacific were positive. An alternative indicator that combines trends for the ocean sectors again suggests a very large rise in average population levels of 577%, an average annual rate of 3.54%.
- Provisional multi-species indicators from 1980, a period when multiple species trends were available for all the sectors, suggests a modest rise in average population levels of 23%, an average annual rate of 0.72%. Trends for the Indian Ocean and South Atlantic colonies were negative whereas those for North and South Pacific were positive. A combined sectors indicator suggests a modest rise in average population levels of 31%, an average annual rate of 0.93%. On average, population trends have increased roughly linearly from 1980 to 2009.

- The current data set on albatross trends however while very impressive also appears relatively incomplete, and has obvious gaps for species and island groups. We suspect the trend data may not be representative of general trend patterns and is incomplete at present. We recommend ACAP works with relevant data holders to mobilise additional species trend data where possible, even where such data contains many missing values.
- In principle, it would be possible to produce statistically robust multi-species indicators grouping species trends by island and island groups, by ocean sectors, by feeding guild, feeding strategy, for albatrosses and petrels, both combined and separately, by conservation status, by degree of endemism; in fact, by any sensible geographical, political, policy or ecological grouping of sites and species.
- A question for the ACAP Status and Trends Working Group is whether they see purpose in developing the very provisional trend analyses here further to extend data collection and extend the analyses. It would be helpful for ACAP to spell out their potential use of both individual species trend information and potential use, or uses, of any multi-species indicators for albatrosses and petrels.

Introduction

In this short paper, we report on provisional analysis carried out to inform the *ACAP Status and Trends Working Group* on species trend analysis and the potential development of multi-species indicators for albatross and petrel populations. Our provisional analysis of albatross data shows how in principle species trend data for albatrosses and petrels can be usefully analysed and how the resulting species indices might be combined into multi-species composite trend indicators. Composite indicators of this kind for birds are widely used in Europe (Buckland *et al*. 2005; Gregory *et al*. 2003, 2005, 2007, 2008, 2009; Gregory & van Strien 2010: http://www.ebcc.info/pecbm.html) and North America (US NABCI Committee 2009: http://www.stateofthebirds.org/). Such synthetic indices might be useful to ACAP as a means of summarizing and presenting complex species trend information in a number of situations and to a number of different audiences (from scientists, policy and decision makers, general public and the media). Such indicators, if developed, could also be used to formulate and express population targets for ACAP at the relevant scale and to measure progress towards such targets.

Biodiversity indicators of this kind are not a short cut or substitute for the detailed knowledge necessary to understand the underlying patterns and causes of change in individual species populations or ecosystems, and then to guide any appropriate management or policy responses. In the best case, indicators might help to inform each step in this process to a certain degree, but they cannot replace sound autecological research, experimental and other key species or process-oriented research.

The perennial question of an indicator, and an ACAP albatross or petrel indicator would be no exception, would be about what it really indicates, and what you want it to indicate. For ACAP, a composite species trend indicator could for example be used to describe the underlying trends of bird covered by the agreement, to measure the effectiveness of the agreement in protecting populations, assess the efficacy of different policy responses in different sectors, pin-point emerging issues in particular areas and so forth. The indicators might have general relevance in indicating something about trends in marine ecosystem health and of the status of other marine biodiversity. One can imagine arguments both for and against using population trends of albatrosses and petrels as an indicator of marine wildlife.

Some thought may be needed from ACAP as to the specific purpose, or purposes, of composite species trend indicators.

It is worth pointing out that an indicator is usually a surrogate measure for a parameter that is too ephemeral or difficult technically or practically to measure and capture directly, like 'marine ecosystem health'. A historic example is the Canary in the coalmine. Miners kept caged Canaries, a small finch, as an early warning of the presence of poisonous gases. Canaries are much more sensitive to deadly fumes than humans so their death signaled danger and saved many miner's lives. The Canary in the coalmine analogy is often applied to environmental damage. Other less dramatic examples include lichens indicating air quality, plant species indicating soil moisture or soil fertility, or bird of prey populations reflecting pesticide contamination. For biodiversity indicators to be effective, they need to meet a range of sometimes competing practical and scientific criteria (Table 1). Such indicators are often used in research and environmental management as diagnostic tools. The terms indicator, indicator species, signal species, bio-indicator, bio-monitor, keystone, umbrella, and focal species tend to have different and sometimes overlapping meanings. Many of these concepts, especially when a single species is chosen to represent and protect a wider community, have proven unworkable. The focal species concept, in which a group of species is used as a conservation tool, for example, in site selection has proved far more effective. This concept is consistent with the way we have developed and used multi-species indicators for bird populations in Europe (Buckland *et al*. 2005; Gregory *et al*. 2003, 2004, 2005, 2007, 2008, 2009; Gregory & van Strien 2010) and North America (US NABCI Committee 2009).

If standardized bird counts are made at a series of sites through time, one can use standard methods of trend analysis to estimate time trends in the form of indices of year effects. A number of methods are available in standard and bespoke statistical packages that deal with the potential problem of missing counts in the time series that can seriously bias trend estimation. We chose to use TRIM (Trends and Indices for Monitoring data: Pannekoek & van Strien 2001) for ease of use and because it deals with the problem of over-dispersion and serial correlation in trend data, and because it produces ready to use outputs. The indices any such programs produce are relative and so they are anchored to a base year when the index is set usually to a value of 1 or 100 for ease of communication.

When indices of this kind are computed for a group of species one is then able to average the trends by year to describe the average population behaviour of the constituent species. An arithmetic mean is inappropriate here because of the way the indices are scaled; a doubling index from 1 to 2 needs to be equivalent but opposite to an index halving from 1 to 0.5. A geometric mean achieves this and can be easily computed (e.g. in Excel). It is also recommended for a number of other statistical properties. Multi-species population indicators, as have been developed and used extensively in Europe and North America, treat each species equally and this means that an increase is treated as desirable, while a decline is undesirable. At first sight, this approach might seem too simple, but this simplification has greatly aided comprehension and this form of indicator has proven highly effective in Europe (Gregory *et al.* 2003, 2004, 2005, 2007, 2008, 2009; Gregory & van Strien 2010) and North America (US NABCI Committee 2009). Here is it used both as a tool in scientific research and as a measure to inform policy and decision-making on the environment, and communicate messages about nature. Note, however, that an increasing number of opportunistic, or generalist, species that respond positively to anthropogenic change and degradation, will most often be judged undesirable, so we need to select species carefully for inclusion in a multi-species indicator. This would apply in a marine as well as in a terrestrial environment. The work on terrestrial species has tended to select species for inclusion in a particular indicator based on their habitat preference so that the indicators describe the trends of habitat specialists thought most prone to anthropogenic changes in the environment.

This thinking is driven partly by a process termed 'biotic homogenization' (McKinney & Lockwood 1999). This describes a process of anthropogenic change where some generalist species that respond positively to human-induced change, progressively out compete the many specialist species that respond negatively to land use change and fragmentation. In this way, it is suggested a few 'winners' replace many 'losers' in wholesale change in the environment. The result is a more homogeneous environment with lower biodiversity at national, regional and global scales (McKinney & Lockwood 1999). No doubt, the same process might apply in some fashion to marine ecosystems too, and some thought is required as to how ACAP indicators might select species for use within indicators. One can imagine grouping species trends by island and island groups, by ocean sectors, by feeding guild, feeding strategy, for albatrosses and petrels, both combined and separately, by conservation status, by degree of endemism; in fact, by any sensible geographical, political, policy or ecological grouping of sites and species.

The composite geometric mean captures the average behaviour of the constituent bird species trends. It balances both the number of species increasing and declining as well as the magnitude of their trends. Imagine a situation where albatross either increase or decrease at a constant rate, if more species decline than increase, the index goes down, if more species increase than decline, it goes up. In reality, of course, indices are likely to describe complex species trends and it is important to understand the contribution of individual species and particular periods, to make sense of the resulting indicators. Bear in mind also that composite trends have the ability to mislead and to be misused too, as is the case for any statistic, so they need to be treated with care.

In this paper, we analysed albatross trends from 28 island populations for 13 species of albatross (Appendix 1). We calculated trends by islands and combined these into multi-species indicators in a simple fashion chaining the indices together using a geometric mean (ignoring the problems of how species counts from separate islands are best combined statistically and how to estimate statistical error around the trends and indicators).

Methods

Species data for albatrosses were compiled from both published and unpublished sources as set out in Appendix 1. We made a particular effort to find historical counts that were directly comparable with recent ones in order to assess medium- and longer-term trends. Our specific focus in this analysis was trend estimation and in that respect, incomplete time series are still extremely valuable in understand the longer-term patterns.

We have equivalent trend data for Northern and Southern Giant Petrel too but have not included analysis of those data in this report.

Data were analysed using TRIM version 3.53 (Pannekoek & van Strien 2001) fitting a simple Time Effects model (model 3: Effects for each time points) with over dispersion and serial correlation turned on. For single sites with missing data, we fitted an equivalent Time Effects model with over dispersion and serial correlation turned on. To do so practically we fitted a Linear model (model 2: switching trend) with change points for each year with data. This reasonably assumes a linear trend between years with missing data.

In this report, we did not combine species trend data from separate islands to calculate an average species trend, although this would have been perfectly possible. Instead, we treated each of the 28 species islands time series as independent (this is different from the wild bird indicators described above that combine individual species trends with equal weight). Our motivation in doing this was in recognition of the very different species trends in different island groups and ocean sectors, and partly out of uncertainty over how the trend data were best combined. For example, species data from different sites could be combined by re-running TRIM (using the modelled time totals), but to do so, TRIM would impute missing values in the time series and there was unease among ACAP experts as to whether that was wise at this stage. We need to explore this issue further with statistical advice on the implication of such procedures. Note that the European wild bird indicators combine species trend data in a hierarchical fashion using a modified version of TRIM (http://www.ebcc.info/index.php?ID=378) and a similar approach could be adopted for albatross data. Note also that although we assess statistical error in the indices for species' island populations, we did not assess error in the composite trends or indicators. Again, we would need statistical advice.

Here we create provisional multi-species indicators for albatross populations by combining species' island trends using a geometric mean. Specifically, we take the geometric mean of species' indices output from TRIM (S1 files) and combine them for all species trends available (28), or for the ocean sectors separately. This is straightforward when data run over the same period, but becomes more complicated when time series run over different periods, as is the case for the albatross trends. In this case, we chain the indices together such that new indices enter an indicator at the geometric mean value of the indices already within the indicator (a standard approach). So new trend data is fixed to the value of the indicator in the first year but then on contributes to the composite trend.

Results

We examined trends in 28 island populations for 13 species of albatross (Appendix 1 & 2). Seventeen populations showed positive trends and 11 negatives ones. Trend data were very sparse in the early part of the time series; only one time series was available in the 1950s, just four in the 1960s, 10 in the 1970s, 16 in the 1980s, and over twenty from 1990 onwards. The mean species trend taken across all species and periods available was slightly positive (Table 2: 0.85% pa). The same mean trends for the Indian Ocean and South Atlantic colonies were negative (-0.87% pa and -2.0% pa respectively), and those for North and South Pacific were positive (1.63% pa and 3.85% pa respectively). Note, however, that most data available to us came from the Pacific and Indian Ocean and only two colony counts came from the South Atlantic, data were extremely limited in the early part of the time series so these mean trends need to be treated with considerable caution.

Provisional multi-species indicators paint a relatively similar picture of albatross trends, but the magnitude of changes is quite different (Figure 2a, Table 2). These provisional indicators provide a more accurate description of the underlying albatross trends available to us than the mean figures above because they incorporate temporal information in their calculation, as well as the magnitude of changes. An overall indicator constructed from the 1950s suggests a very large rise in average population levels of 569%, an average annual rate of 3.52% (Figure 2b, Table 2). The indicator rises rapidly in the 1950-60s, is stable from 1970 to 2000, and seems to rise again from 2000 (Figure 2b). This indicator weights the 28 island population trends equally, regardless of the proportion of the population for which the trend was calculated at each site, or the population size at a site. Trends in the indicator for the Indian Ocean and South Atlantic colonies were negative (-1.41% pa & -1.92% pa respectively), and those for North and South Pacific were positive (4.82% pa & 1.26% pa respectively).

An alternative way of constructing an overall indicator is to combine the four indicators for the ocean sectors. The resulting 'sectors combined' indicator again suggests a very large rise in average population levels of 577%, an average annual rate of 3.54%, following the pattern of the all species trend indicator very closely (Figure 2b, Table 2). The sector-based indicator weights species trends in the four regions equally and this kind of stratification might be very valuable in reducing geographical bias. Clearly, the trends described above are driven very strongly by island populations in the North (and South) Pacific, and especially by the spectacular recovery of the Short-tailed Albatross on Torishima Island.

Given the nature of the data available to us, we have also constructed multi-species indicators from 1980, a period when multiple species trends were available for all the sectors. Thus, it is easier at this scale to compare the ocean sectors, the only limitation being sample sizes per region, and for the South Atlantic, we have just two time series available. An overall indicator constructed from 1980 suggests a modest rise in average population levels of 23%, an average annual rate of 0.72% (Figure 3, Table 2). Trends in the indicator for the Indian Ocean and South Atlantic colonies were negative (-1.07% pa & -2.0% pa respectively), and those for North and South Pacific were positive (1.88% pa & 1.99% pa respectively). A combined sectors indicator suggests a modest rise in average population levels of 31%, an average annual rate of 0.93% (Figure 3b, Table 2). Overall, the pattern of trend is roughly linear from 1980 to 2009 (Figure 3b).

Discussion

Taken at face value, and based on the albatross trend data available to us, overall population trends appear quite positive for many species and overall albatross populations appear to be increasing. Albatross populations in the Pacific appear to be doing best, those in the Indian Ocean and Atlantic worse, although our data for the Atlantic were very thin and overall our dataset should not be viewed as being complete or representative of albatross populations in any sense. We recommend that if similar trend analyses and indicator development goes forward then ACAP works with relevant data holders across the globe to mobilise additional species trend data where possible, even where such data contains many missing values.

In this analysis, we calculated species trends by islands and combined these into multi-species indicators in a simple fashion using a geometric mean. We ignored the problem of how species counts from separate islands are best combined statistically into a single global population trend per species, and also ignored the problem to how to estimate statistical error around these trends and indicators. We did this partly because of a lack of time, but partly because of uncertainty about what would be most useful to ACAP and how the work might develop. There are several ways in which species trend data from different islands might be combined, and some guidance is needed on what would be most appropriate from relevant experts. In doing this, we need to know, or at least reasonably assume, something about the relationships between the island populations, and any relevant geographical or geopolitical groupings. We might think about whether trends from island populations of the same species might be weighted in some fashion and whether the trends can be combined in TRIM, or in another fashion. We also need to understand the implications of imputation in TRIM, since imputation does not affect the trend estimation because missing values are only calculated from observed changes. Such imputation makes it possible to compare years in a fair way and avoid artefacts so producing figures that are more reliable. The major drawback to imputing is that it creates wider confidence limits, but that simply reflects the nature of these incomplete datasets.

We also need to give some thought to how multi-species indicators might be constructed from the species trends and what stratification or weighting might be applied in that case, if any.

The European wild bird indicators combine species trend data in a hierarchical fashion using a modified version of TRIM to create supranational indices for species with associated error and although the datasets are very different, one can imagine a similar hierarchical model could be applied to trend data for albatrosses and petrels. Arco van Strien at Statistics Netherlands provides statistical advice for the European indictor work. He has expressed willingness to advise indicator work for ACAP and may be in a position to help implement a more complex analysis using a modified version of TRIM.

A question for the ACAP Status and Trends Working Group is whether they see purpose in developing the very provisional trend analyses here further to extend data collection and extend the analyses. It would be helpful for ACAP to spell out their potential use of both individual species trend information and potential use or uses of multi-species indicators for albatrosses and petrels.

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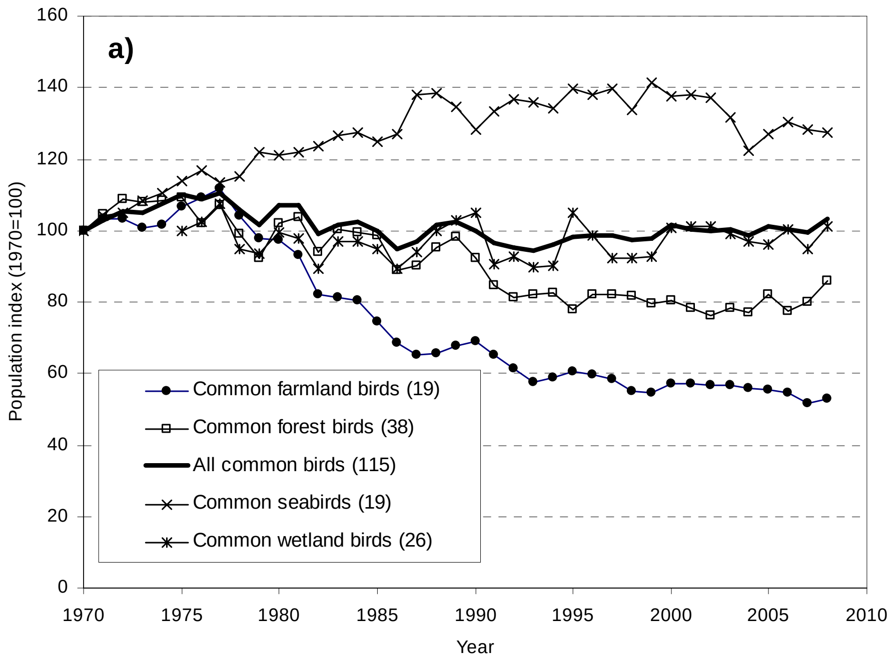
Table 1. Key attributes of an effective biodiversity indicator.

Attribute	Details
Representative	Includes all species in a taxon or a representative group
Immediate	Capable of regular update, ideally on an annual basis.
Simplifying	Reduces complex information into an accessible form.
Easily understood	Simple and transparent to a range of audiences.
Quantitative	Accurate measurement with assessment of precision.
Responsive to change	Sensitive to environmental change over short time scales.
Timeliness	Allows rapid identification of patterns and early warning of issues.
Susceptible to analysis	Data can be disaggregated to understand the underlying patterns.
Realistic to collect	Quantitative data can be collected within the resources of manpower and finance over medium to long term.
Indicative	Representing more general components of biodiversity than the constituent species trends, ideally reflecting ecosystem health.
User Driven	Developed in response to the need of policy and decision makers.
Policy relevant	Allow policy makers to develop and adapt policy instruments.
Stability	Relatively buffered from highly irregular natural fluctuations.
Tractable	Susceptible to human influence and change.

Table 2. Summary of albatross trends 1954-2009.

Trends	**Years**	**Mean or final index**	**Population change %**	**Population change % PA**
a) Mean trends from start year				
Mean trends	1954-2009	1.2604	26.0	0.85
Indian Ocean (12)	1976-2009	0.9085	-9.1	-0.87
South Atlantic (n=2)	1972-2007	0.5355	-46.5	-2.01
North Pacific (n=7)	1954-2009	2.1246	112.5	1.63
South Pacific (n=7)	1964-2009	1.6738	67.4	3.85
b) Indicator trends from start year				
All species colonies (28)	1954-2009	6.6944	569	3.52
Indian Ocean (12)	1976-2009	0.5548	-45	-1.41
South Atlantic (2)	1972-2007	0.5070	-49	-1.92
North Pacific (7)	1954-2009	13.2522	1225	4.82
South Pacific (7)	1964-2009	1.7593	76	1.26
Sectors combined (28)	1954-2009	6.7700	577	3.54
c) Indicator trends from 1980				
All species colonies (28)	1980-2009	1.2328	23	0.72
Indian Ocean (12)	1980-2009	0.7325	-27	-1.07
South Atlantic (2)	1980-2007	0.5792	-42	-2.00
North Pacific (7)	1980-2009	1.7179	72	1.88
South Pacific (7)	1980-2009	1.7723	77	1.99
Sectors combined (28)	1980-2009	1.3065	31	0.93

Figure 1. Examples of Wild Bird Indicators being used by European governments and the European Union to assess progress within strategies that assess sustainable development and environmental health: a) United Kingdom and b) Europe. Numbers in parenthesis are the number of species in each grouping. Indices are fixed to a value of 100 in their first year (1970 & 1980 respectively) and plotted on an arithmetic axis. The figures show the composite population trends of widespread bird species in UK and in Europe as a single group, and then grouped by their preferred habitat.



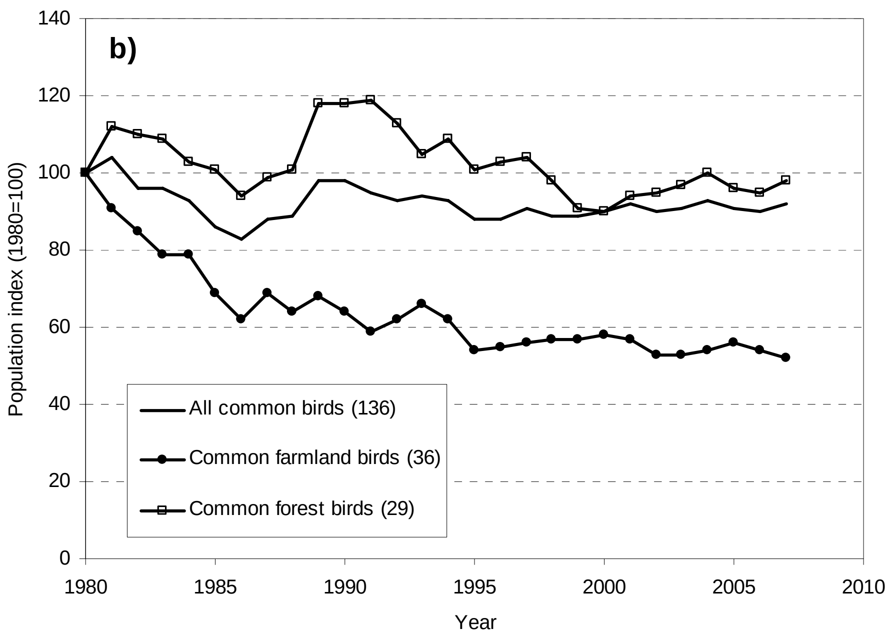
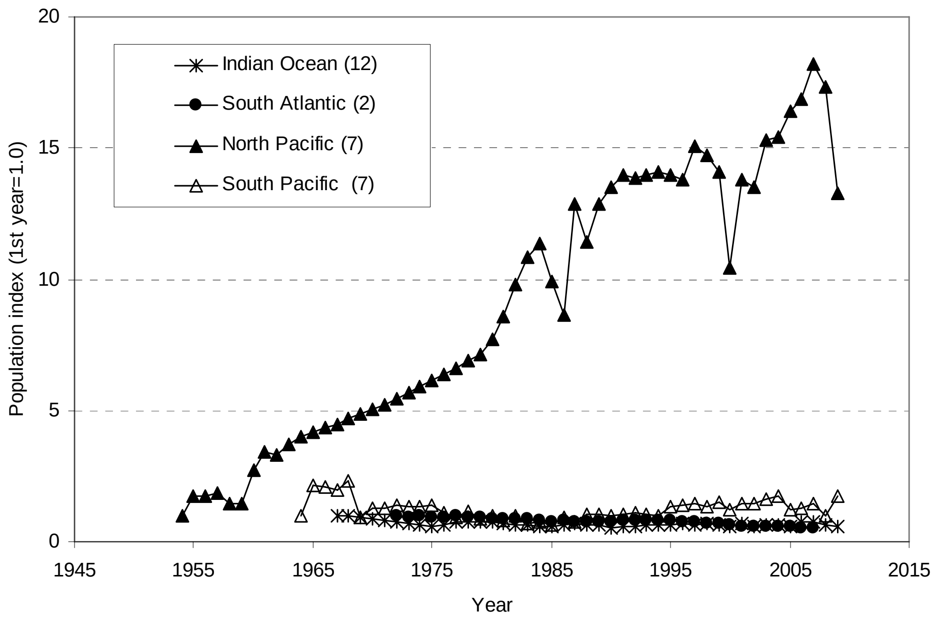


Figure 2. Composite multi-species indicators showing albatrosses trends for a) ocean sectors and b) overall from the 1950s onwards (see text). Numbers in parenthesis are the number of species colonies in each grouping. The indicators are set to a value of one in the first year and plotted on an arithmetic axis.

a)



b)

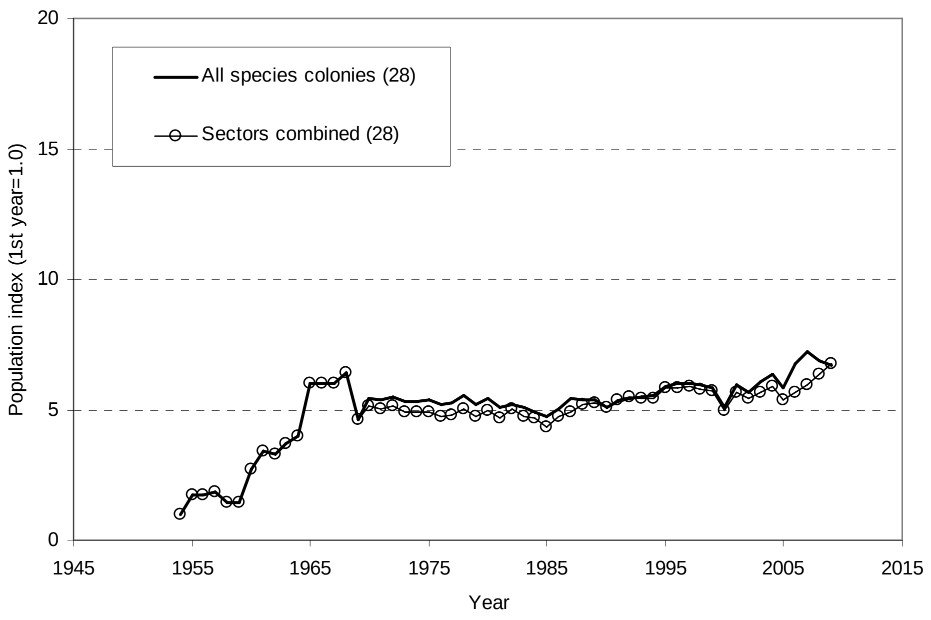
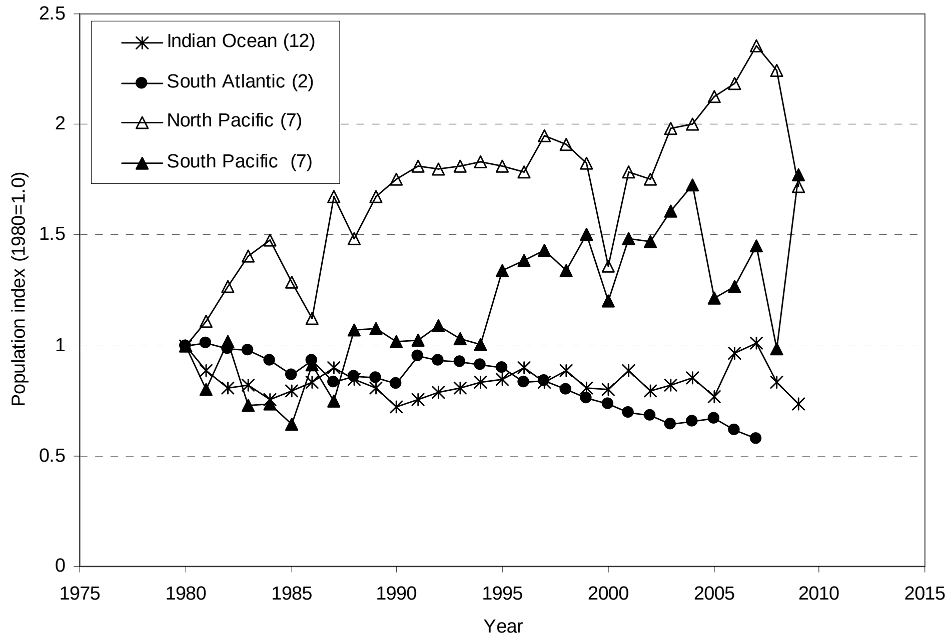
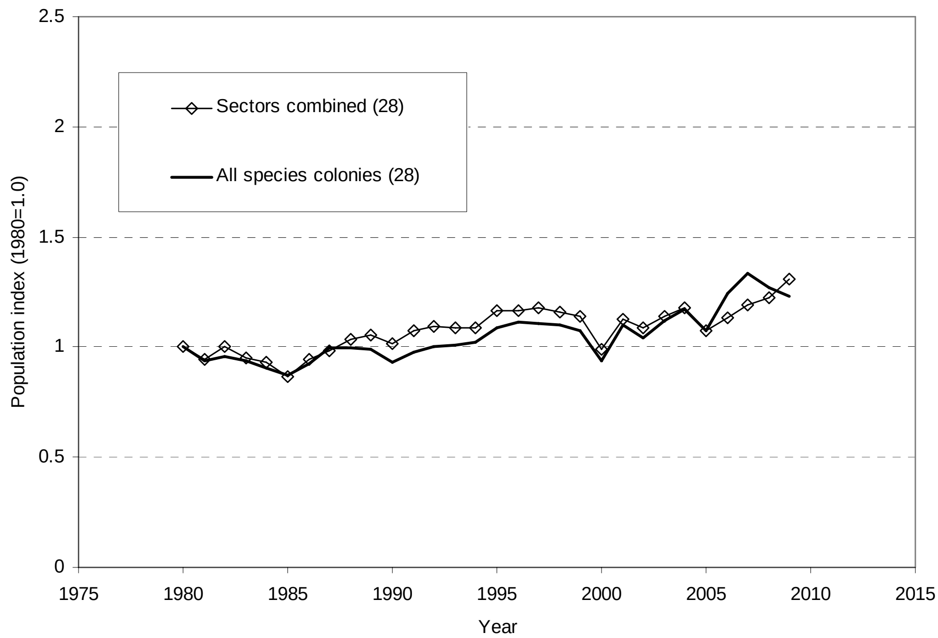


Figure 3. Composite multi-species indicators showing albatrosses trends for a) ocean sectors and b) overall from 1980 (see text). Numbers in parenthesis are the number of species colonies in each grouping. The indicators are set to a value of one in 1980 and plotted on an arithmetic axis.

a)



b)



APPENDIX 1. Data sources for albatross trends.

Species	Breeding site	Sector	Sites	Years	Years counted	Global population on island %	Reference & data holder
Amsterdam Albatross	Amsterdam Island	Indian Ocean	1	21	1983-2003	100	Weimerskirch 2004
Antipodean Albatross	Antipodes Island	South Pacific	1	12	1994-2005	50	Walker and Elliott 2005 Notornis 52: 206-214
Antipodean Albatross	Adams Island	South Pacific	1	7	1991, 1993-1995, 1997	50	Walker and Elliott 1999 Emu 99: 239-247
Black-browed Albatross	Macquarie Island	South Pacific	1	15	1995-2009	<1	DIPIPWE, unpublished
Black-browed Albatross	Jean d'Arc Peninsula	Indian Ocean	1	3	2005-2007	0.2	Henri Weimerskirch, unpublished
Black-footed Albatross	Midway Atoll	North Pacific	1	18	1992, 1993, 1995-2009	40	US Fish and Wildlife service, unpublished
Black-footed Albatross	Laysan Island	North Pacific	1	12	1998-2009	30	US Fish and Wildlife service, unpublished
Black-footed Albatross	French Frigate Shoals	North Pacific	1	30	1980, 1981, 1983-2005, 2007-2009	9	US Fish and Wildlife service, unpublished
Buller's Albatross	Snares Islands	South Pacific	5	36	1969-2004 (with gaps)	30	based on Sagar and Stahl 2005
Grey-headed Albatross	Macquarie Island	South Pacific	1	15	1995-2009	<1	DPIPWE, unpublished
Grey-headed Albatross	Marion Island	Indian Ocean	1	33	1975, 1977, 1988, 1989, 1991-2007	10	RJM Crawford and PG Ryan, unpublished
Grey-headed Albatross	Bird Island	South Atlantic	1	28	1977, 1978, 1990-1992, 2003, 2004	5	BAS
Indian Yellow-nosed Albatross	Amsterdam Island	Indian Ocean	1	20	1978, 1981, 1983, 1986-2002	65	based on Weimerskirch 2004
Laysan Albatross	Midway Atoll	North Pacific	1	18	1992, 1997, 2001, 2002, 2004-2009	70	US Fish and Wildlife service, unpublished
Laysan Albatross	Laysan Island	North Pacific	1	18	1992-2009	20	US Fish and Wildlife service, unpublished
Laysan Albatross	French Frigate Shoals	North Pacific	1	27	1980, 1981, 1983-2005, 2007, 2009	0.5	US Fish and Wildlife service, unpublished
Light-mantled Albatross	Ile de la Possession	Indian Ocean	1	28	1980, 1987, 1993-2008	5.6	Delord et al 2008, Henri Weimerskirch, unpublished
Light-mantled Albatross	Marion Island	Indian Ocean	1	8	1989, 1998-2007	2.5	RJM Crawford and PG Ryan, unpublished
Light-mantled Albatross	Macquarie Island	South Pacific	1	12	1998-2009	6.3	DPIPWE, unpublished
Short-tailed Albatross	Torishima Island	North Pacific	1	55	1954-1964, 1979-2008	90	Hasegawa, unpublished
Shy Albatross	Albatross Island	Indian Ocean	1	9	1999, 2000, 2002, 2004, 2006, 2007	40	DPIPWE, unpublished
Shy Albatross	Pedra Branca	Indian Ocean	1	15	1993, 1995-1997, 1999-2007	2.1	DPIPWE, unpublished
Sooty Albatross	Ile de la Possession	Indian Ocean	2	27	1979-2005 (with gaps)	0.5	Delord et al 2008
Sooty Albatross	Marion Island	Indian Ocean	1	21	1987, 1988, 1997-2007	9	Crawford et al unpublished
Wandering Albatross	Macquarie Island	South Pacific	1	46	1964-2009	0.1	DPIPWE
Wandering Albatross	Bird Island	South Atlantic	1	36	1972-1974, 1976-2007	10	BAS
Wandering Albatross	Ile de la Possession	Indian Ocean	1	39	1967, 1968, 1975, 1976, 1980-2005	4.3	Delord et al 2008
Wandering Albatross	Marion Island	Indian Ocean	1	28	1975, 1977, 1982-2007	20	RJM Crawford and BM Dyer, DAAF, unpublished

APPENDIX 2. Albatross species trends by island group derived from TRIM (see methods). Trends highlighted in blue are declines.

Species	Breeding site	Sector	Sites	Years	Years counted	Final Index	Population change %	Population change % PA	Global population on island %
Amsterdam Albatross	Amsterdam Island	Indian Ocean	1	21	1983-2003	2.222	122	4.07	100
Antipodean Albatross	Antipodes Island	South Pacific	1	12	1994-2005	1.4942	49	6.92	50
Antipodean Albatross	Adams Island	South Pacific	1	7	1991, 1993-1995, 1997	1.8509	85	5.76	50
Black-browed Albatross	Macquarie Island	South Pacific	1	15	1995-2009	1.6486	65	3.64	<1
Black-browed Albatross	Jean d'Arc Peninsula	Indian Ocean	1	3	2005-2007	0.8631	-14	-7.1	0.2
Black-footed Albatross	Midway Atoll	North Pacific	1	18	1992, 1993, 1995-2009	1.2129	21	1.14	40
Black-footed Albatross	Laysan Island	North Pacific	1	12	1998-2009	0.8554	-14	-1.41	30
Black-footed Albatross	French Frigate Shoals	North Pacific	1	30	1980, 1981, 1983-2005, 2007-2009	1.1439	14	0.47	9
Buller's Albatross	Snares Islands	South Pacific	5	36	1969-2004 (with gaps)	3.0524	205	3.24	30
Grey-headed Albatross	Macquarie Island	South Pacific	1	15	1995-2009	1.7164	72	3.93	<1
Grey-headed Albatross	Marion Island	Indian Ocean	1	33	1975, 1977, 1988, 1989, 1991-2007	3.3336	233	3.83	10
Grey-headed Albatross	Bird Island	South Atlantic	1	28	1977, 1978, 1990-1992, 2003, 2004	0.5656	-43	-2.09	5
Indian Yellow-nosed Albatross	Amsterdam Island	Indian Ocean	1	20	1978, 1981, 1983, 1986-2002	0.4392	-56	-3.37	65
Laysan Albatross	Midway Atoll	North Pacific	1	18	1992, 1997, 2001, 2002, 2004-2009	0.9246	-8	-0.46	70
Laysan Albatross	Laysan Island	North Pacific	1	18	1992-2009	0.9712	-3	-0.17	20
Laysan Albatross	French Frigate Shoals	North Pacific	1	27	1980, 1981, 1983-2005, 2007, 2009	3.071	207	3.95	0.5
Light-mantled Albatross	Ile de la Possession	Indian Ocean	1	28	1980, 1987, 1993-2008	1.6859	69	1.95	5.6
Light-mantled Albatross	Marion Island	Indian Ocean	1	8	1989, 1998-2007	2.5224	152	5.59	2.5
Light-mantled Albatross	Macquarie Island	South Pacific	1	12	1998-2009	1.4225	42	3.26	6.3
Short-tailed Albatross	Torishima Island	North Pacific	1	55	1954-1964, 1979-2008	59.7143	5871	7.87	90
Shy Albatross	Albatross Island	Indian Ocean	1	9	1999, 2000, 2002, 2004, 2006, 2007	1.3429	34	3.75	40
Shy Albatross	Pedra Branca	Indian Ocean	1	15	1993, 1995-1997, 1999-2007	0.2441	-76	-9.58	2.1
Sooty Albatross	Ile de la Possession	Indian Ocean	2	27	1979-2005 (with gaps)	0.215	-79	-5.74	0.5
Sooty Albatross	Marion Island	Indian Ocean	1	21	1987, 1988, 1997-2007	0.579	-42	-2.7	9
Wandering Albatross	Macquarie Island	South Pacific	1	46	1964-2009	1.08333	8	0.18	0.1
Wandering Albatross	Bird Island	South Atlantic	1	36	1972-1974, 1976-2007	0.507	-49	-1.92	10
Wandering Albatross	Ile de la Possession	Indian Ocean	1	39	1967, 1968, 1975, 1976, 1980-2005	0.584	-42	-1.41	4.3
Wandering Albatross	Marion Island	Indian Ocean	1	28	1975, 1977, 1982-2007	1.1111	11	0.33	20