

Report of the Australian Southern Right Whale Workshop

19-20 March 2009, Australian Antarctic Division, Kingston, Tasmania

1. Introductory items

a. Welcome and opening remarks

Mike Double opened the workshop and welcomed participants on behalf of the Australian Marine Mammal Centre (AMMC; www.marinemammals.gov.au) and the Department of Environment, Water, Heritage and the Arts (DEWHA; www.environment.gov.au).

b. Introductions and apologies

Lyn Maddock, Director of the Australian Antarctic Division (AAD), formally welcomed the participants and highlighted the importance of this workshop to the Australian government. This was an extremely exciting meeting of experts as it will provide the most up-to-date information about southern right whales and will be useful in guiding Australian government policy and future directions. She expressed her best wishes for a productive workshop.

Apologies were received from Patricia von Baumgarten, Kelly Waples and Scott Baker. Nick Gales could only be present for the second day.

c. Aims of the workshop

The purpose of the workshop was to assess the outcomes of recent research on southern right whales (*Eubalaena australis*) in Australia, the connectivity between Australian and New Zealand populations, and to develop recommendations for priority research and data management initiatives.

In particular, the workshop reviewed:

- current research on southern right whales in Australia;
- current understanding of the connectivity between Australian and New Zealand populations;
- current threats to southern right whales;
- priority research aims and knowledge gaps;
- the need for annual or multi-annual surveys and the appropriate survey location(s) and methodologies;
- our ability to manage, visualise and analyse existing and new datasets; and,
- sources of funding for research on southern right whales.

Following these reviews, the workshop aimed to develop a broad plan for south right whale research over the next five years (i.e. 2009-2013).

The workshop Agenda is attached as Annex A. A list of participants is attached as Annex B.

2. Presentations summarising past, current and planned research on Australasian southern right whales

a. *Southern Australia: Cape Leeuwin - Ceduna (John Bannister)*

A series of annual surveys for right whales off southwest Australia began in 1976. These surveys were in the context of increasing right whale sightings in Western Australia (WA) waters, mirroring similar increases off eastern South America and South Africa. Southern hemisphere right whale numbers had been drastically reduced by 19th century whaling: an IWC comprehensive assessment in 1998 showed that an initial population of perhaps as many as 60,000 were present in the late 1700s, and that they had declined to fewer than 1,000 between about 1820 and 1880 (International Whaling Commission, 2001). By the 1920s there may have been fewer than 300 individuals remaining. By the 1930s, under protection from whaling, there had been the beginnings of a slow overall increase that was halted in the 1960s by illegal Soviet whaling (Clapham & Ivashchenko, 2009; Yablokov, 1994). The populations started to show signs of recovery again from around 1970 (Bannister, 2001).

The WA surveys had the twin aims of providing information on biological parameters from photo-identification and on population trend and size using maximum counts of animals present close to the coast in late spring/early summer. From 1993 the surveys were extended into South Australian (SA) waters given evidence of movement between SA and WA. A fifteen year flight series to 2007, augmented by a flight in 2008 because of an anomalously low count in 2007, gave an overall annual increase rate of 6.4% (6.7% for cow/calf pairs). Population size was calculated as approximately 2100, with an estimated 2400 for the 'Australian' population as a whole (Bannister, 2008).

Bannister proposed that future work should be aimed at i) determining when the population may be approaching K (carrying capacity), and ii) investigating the effects of environmental change. Given current estimated numbers, it seems most unlikely that the population not yet anywhere near K. However, the recent fluctuations in number (e.g. the anomalously low 2007 count) are most likely to have resulted from environmental changes. Based on observations over at least 30 years, western South Atlantic right whale breeding success has been related to changes in Sea Surface Temperature (SST) (Leaper et al., 2006) and similar results have been demonstrated in Australian data but over a shorter time scale (Pirzl et al., 2008). Given the likely female cohort regime (i.e. a three-year breeding cycle) and the likelihood that the population is still well below K, Bannister posed the question whether the value of the dataset would be diminished if the surveys were conducted biannually or perhaps once every three years. He proposed that the set of annual surveys should be maintained for one more year (i.e. 2009), along the lines of the 'interim' 2008 survey, pending a 'what if' modelling exercise which would investigate:

- how much longer it would take to see evidence of a slowing growth rate with surveys at every 2, 3, or more years instead of annual surveys, and what happens if the duration of the breeding cycle increases as the population approaches K; and,

- using similar methodology to Leaper *et al.* (2006) and Pirzl *et al.* (2008), construct a model to identify what happens if, for example, every other year or 2 of every 3 years are ignored, and use those methods with the available Australian data to see if there are suitable environmental predictor covariates for the region.

Discussion

There was discussion of the reported site fidelity of right whales in the southwest area. There are three or four places that are particularly favoured by cow/calf pairs and where they can be found routinely during the calving season. This notwithstanding, there is some heterogeneity in female site fidelity with many females giving birth in the same area every three years while other females move between areas. There is considerably more heterogeneity in males and immature whales which occur more frequently and in different places. There was discussion about the recovery of whales and it was suggested that whales may slowly spread out from sites where they were not whaled or whaled in low numbers. Another observation was that whales in an area appear to reach a 'critical mass' before appear to expand to other areas.

b. South Australia (Steve Burnell)

An overview was provided of work in South Australia (SA) and the SE coast on southern right whales. The research included an 18 year research program at the Head of the Bight (HOB), SA; a three year research network to obtain sightings and photo-identification from SE Australia; and a summary of cetacean databases, collections and necropsy programs at the South Australian Museum. The HOB study has collected standardised abundance surveys, site distribution and individual life history information via photo-identification since 1991. The HOB catalogue now contains 798 non-calf individuals (plus an additional 236 calves) providing data on a range of life history parameters, reproductive success, coastal and offshore movements and residence periods (Burnell, 2008).

The SE Australian Flight network undertook 77 directed photo-identification flights over a three year period from 1995 to 1997. The study identified 68 individual right whales in the SE region and documented 32 movements between the SE region and the southwest Australian region.

Burnell emphasised that the powerful, comprehensive and well maintained photo-ID catalogue provides a clearing house for opportunistic identifications of right whales from around Australia and is a valuable resource for future work on the species in Australia. Findings of the HOB study have had direct application to the conservation and management of right whales in Australia. The research was instrumental in making the case for Great Australian Bight Marine Park and in setting the temporal and spatial boundaries of the park's zones and closures. It continues to provide ongoing information to management of the marine park.

Burnell stated that long-term biological data sets such as these built up over the last 20 years are essential to identifying population trends and other shorter term events of conservation significance. These data facilitate the early detection of changes or events that could impact recovery rates for Australian right whales and provide a critical capacity to respond to potential threats. Burnell recommended that i) the long-term HOB dataset, including annual census of whale numbers by population class, and dedicated photo-identification and impact

monitoring be continued, and ii) that the two largest photo-identification catalogues for the species be combined with the goal of progressing toward a centralised catalogue building on the consortium access model of the North Atlantic Right Whale Catalogue which is maintained by the New England Aquarium (<http://www.neaq.org/>).

Discussion

Burnell was asked if there is a difference in residency time of females sighted during 'bumper' years versus 'non-bumper' years. He pointed out that in years when females are not calving, individuals are not seen or seen for only a very short time, whereas when they are calving they are seen more regularly and for a longer period. There are some consistent patterns whereby calving intervals are extended from 3 to 4 years, presumably as a result of a previous poor year for foraging. It was highlighted that it is important to have land-based sighting programmes as well as aerial surveys, given that land-based programmes are much more likely to detect the non-calving females than aerial surveys.

c. Victoria (Mandy Watson)

Daily sightings data have been collected at Logan's Beach (the most easterly known Australian calving ground) by the Victoria Department of Sustainability and Environment (DSE) since 1985. Up to 6 cows/calf pairs (average 2.4) are resident at Logan's Beach per season. A total of 58 calves has been counted at Logan's Beach over the last 24 year period. There has been no overall increase of population size evident over this period. Photo-identification data have been collected and collated for the SE region (i.e. Port Lincoln to Queensland) from mid 1990's to 2009. To date there are over 600 images in the South East Australia Southern Right Whale Photo Identification Catalogue (SEA SRW PIC). During the 2008/09 financial year, DSE acquired BigFish database (Pirzl et al., 2007) and the transfer of images from SEA SRW PIC into BigFish is almost complete. There are still some additional collections that need to be acquired, matched and incorporated (e.g. records from SA Museum, Pin Needham, Tasmanian DPIW). Overall, approximately 90 individuals whales have been identified so far.

The population increase recorded in WA/SA and HOB (approx 6%) has not been seen not seen in SE Australia. So what is happening to the SE population? Analysis of photo-identification data from SE Australia shows little movement between locations within the region or between the SE and other regions. Results from other research in population genetics (Patenaude et al., 2007), site fidelity and habitat (Pirzl, 2008) indicate that the SE population is small, possibly isolated (i.e. shows maternal genetic differentiation) and is therefore more vulnerable than the populations in WA and HOB. Threats to the species in SE Australia include entanglement, vessel collision and noise disturbance (with particular concerns about seismic activities in the Otway Basin).

Watson suggested that further investigation into the SE population is warranted and proposed the following as priorities for research:

- Further expansion of the photo-identification project that will require funding for the coordination of increased photo-identification collection and management efforts;
- Continue and expand genetic investigation;
- Satellite tagging to investigate movements between feeding and breeding locations; and,

- Support the creation of an Australasian photo-identification database whilst also retaining broad regional sub-catalogues.

Discussion

It was suggested that seismic activities undertaken at the start of the calving season may have more of an impact than at the end of the season. This is related to the observation that females appear more sensitive to disturbance at the start of the season. Once they are on the calving grounds and give birth, they tend to be more settled. The migratory paths to and from the calving grounds remain unknown and therefore individuals may be vulnerable to seismic activities not only on the calving grounds but also while they are travelling to and from them. An unusual characteristic of the Warrnambool site is that individuals disappear for one or two weeks before birth and then return with a calf. This is commonly reported and occurs each year. At Warrnambool, individuals tend to be resident for most of the season, whereas at other SE sites, they seem to be transiting through and are only seen for a short time. It was noted that there is a lack of resighting of individuals between SE States and this is thought to be a real result, rather than a simply being a function of the small catalogue size in some areas.

d. Tasmania (Rosemary Gales)

Tasmania's sheltered bays and estuaries historically provided important calving habitat for this species. The bay whaling industry decimated the species in the area, with southern right whales rarely being recorded in Tasmanian waters until the 1980s. Recent years have seen an increase in numbers, residency times and cow-calf pairs. A 24h 'Tasmanian whale hotline' was established in 2002 to assist in increasing our understanding of the spatial and temporal patterns of whales in Tasmanian waters, as well as increasing effective response to stranding and entanglement events. Information from these reports is validated and then stored in a comprehensive cetacean database.

There is a state-wide distribution of southern right whales in Tasmanian near-shore waters, with several key favoured locations on the east coast where they are more frequently observed. The frequency of sighting events and number of whales sighted (which does not equate to number of individual whales) was presented for the period 1974-2008. The trend appears to be increasing over time, albeit with significant inter-annual variation. Consistent with other regions, 2007 was a remarkably poor year, followed by 2008 in which there were more reports of southern right whales than in any previous year. The seasonal occurrence of the species in the area shows that most whales are observed between June and August, although they have been reported in all months of the year. Recent years have also seen increasing numbers of cow-calf pairs being observed. These records also include new calves on the northern migration, with at least 5 different individual calves travelling north being photographed during 2008.

An attempt to survey the species was undertaken in 2006 and 2007 with an extensive aerial survey effort. These flights failed to detect any southern right whales, and it was concluded that at Tasmanian southern latitudes when the whales are travelling and exhibiting limited surface behaviour, aerial surveys are not a cost-effective method to monitor this species. As an alternative, response flights are conducted following reports of individuals in order to confirm species identification and obtain callosity images. The Tasmanian Callosity Catalogue contains

images of over 70 individuals sighted between 1993 and 2008. These include records of individuals sighted on different occasions both within and between years, with a high degree of site fidelity. The State's Department of Primary Industry and Water (DPIW) has also recently obtained a small number of biopsy samples from southern right whales in the area. Animal Ethics Approvals have also been gained to deploy a small number of satellite transmitters.

Current management issues relevant to southern right whales for which DPIW is responsible include increasing eco-tour operations, seismic operations, entanglements and efforts to fill important data gaps. Given the limited understanding of the population structure and dynamics of southern right whales throughout SE Australia, and the endangered status of this species, Gales suggested that these issues should be a priority at the national level.

Discussion

So far, only three biopsy samples have been collected and they have not been analysed but the holder (Gales) is looking to see where they can best be used. It was noted that without photo-id information the total number of sightings is likely to include some degree of resighting of the same individuals over time. This is a problem in all opportunistic programmes where it is not possible to identify all individuals. Another common source of bias is that sighting effort varies over time. Ideally, it would be useful to weight sightings by effort but this is not always possible when many reports are opportunistic. There are many reports of births from Tasmania and these are generally reported through the hotline and cannot be verified. The peak of sightings in Tasmania is in July/August whereas the peak in southwest Australia is in September.

e. Eastern Australia (Rob Harcourt)

Activity

Biopsy samples and photo-identifications were collected from southern right whales in Encounter Bay, SA, Warrnambool, Victoria and off the NSW coast between 2001 and 2004. In total, 64 samples were available for comparison. These included the 32 samples collected during the course of this research program from Warrnambool (WARR, n = 9) and Victor Harbour (VH, n = 23) and 29 additional samples collected previously by S. Burnell and J. Bannister from the Great Australian Bight (GAB, n = 9) and from SW Australia (WA, n = 20) respectively. Sequences from New Zealand sub-Antarctic (NZ) were also included for comparison. These included 280 new sequences and updated haplotype frequencies and designations provided by E. Carroll of Auckland University. The samples collected from New South Wales (NSW, n = 3) were too few to be included in the analysis of population differentiation. Two further samples collected in 2007 and 2008 from NSW have yet to be processed.

Genetic differentiation

The distribution of all Australian southern right whale haplotypes varied across Australia and no single haplotype was shared by all five Australian localities. One haplotype was unique to NSW, two haplotypes were unique to WA, and two haplotypes were unique to VH. One haplotype was shared between WA, GAB and VH, another was shared between NSW, WARR, VH and GAB and one haplotype was shared between GAB, VH and WARR. The degree of mtDNA differentiation between Australian localities was estimated using a hierarchical

analysis of variance (AMOVA) as implemented in the computer program *Arlequin* by conducting homogeneity tests on haplotype frequencies (i.e. Wright's F_{st} - statistics). The level of statistical significance of F_{st} was tested using a matrix permutation procedure (1,000 simulations). The genetic differentiation between localities was also tested with Fisher's exact test on haplotype frequencies using a permutation procedure (Markov chain, 10000 steps) to adjust for small sample sizes. Significant genetic differentiation for both statistics was found between WARR and VH, WARR and WA and between GAB and WA. There was no significant differentiation between GAB and other localities. Significant differentiation was found for one or both statistics between NZ and WARR, VH and WA (Patenaude & Harcourt, 2006).

Conservation and Management

Field observations have identified Warrnambool as a small but significant calving ground for southern right whales in SE Australia. Given the evidence of stock structure between Warrnambool and other localities within Australia, efforts should be directed at better describing the population and genetic status of this stock and investigating the evident lack of recovery in the area. Calving also occurs in NSW (Patenaude & Harcourt, 2004) albeit over a more diffuse area than Warrnambool. The small number of samples collected over the course of this project from NSW is in part due to financial constraints. It is important that any reports of whales remaining resident in an area for more than 2 days are sent to the appropriate authorities. This will maximise the possibility of successfully sampling in remote locations (e.g. Eden) and involve appropriate funding to cover rapid deployment, boat charter and airfares. However, the evidence of stock differentiation between several localities in Australia highlights the importance of sustained research efforts for the NSW whales.

Capacity building in the last two years

Warrnambool - long time collaborators Ian Westhorpe, Mandy Watson and Pete Gill now have a biopsy rifle on site, are trained in biopsy procedures and are on biopsy and ethics permits and scientific licences. *East Coast* - NSW Department of Environment and Climate Change (DECC) staff now have a marine mammal coordinator (Geoff Ross) and Sydney and South Coast staff now report southern right whales that are seen for more than 3 days consecutively. DECC staff in the south coast region are now trained to manoeuvre near southern right whales for sampling. Also Macquarie University has new boat that is available for whale research so reducing reliance on boat charters.

Harcourt recommended the following future work:

- The mtDNA analysis shows evidence of genetic differentiation between WARR and VH and WARR and WA. The few yearly sightings in WARR and the previous sighting of one of the four cows present in 2004 suggest that this population is certain to be very small. Effort should be directed on clearly defining this population and its habitat use.
- In order to obtain an unbiased estimate of stock structure and level of gene flow between localities, intensive coordinated efforts should be directed at obtaining samples from all whales in SE Australia, particularly in Tasmania, NSW and Victoria. Despite photographic resighting of individuals between WA and GAB (Environment Australia, 2002; Environment Australia, 2004), there is some genetic evidence of population differentiation between these two areas. Efforts should be made to reinstate biopsy sampling programs in

these areas. In order to determine the population size and rates of change, a systematic photo-identification program of southern right whales off eastern Australia needs to be instituted.

- In order to determine movements of the eastern Australia population, a satellite telemetry program should be considered. This would provide information on fine-scale movement and habitat use off eastern Australia and in particular, use of areas that are not currently surveyed. The sex differentiation found in the VH and WA samples warrants further investigation.

Discussion

As yet unpublished analyses of mitochondrial sequence data suggest WA right whales are more differentiated from SE right whales than SE right whales are from NZ sub-Antarctic right whales. This suggests that there is little interchange of females between HOB and SE Australia. Notwithstanding these results, it was emphasised that mtDNA only examines female dispersal and that the sample sizes were often very small. While there is a difference between WA and HOB, it is small. It was noted that observational studies have detected the movement of adults (including breeding females) between subantarctic New Zealand and the HOB (Pirzl *et al.*, 2009).

f. Broad scale studies of habitat choice and the influence of climate on reproduction (Rebecca Pirzl)

Spatial ecology and habitat selection

Habitat selection by Australian southern right whales has been investigated at fine (within calving grounds) and broad (Australian coastal range) scales. Spatially sensitive species-habitat models that related the fine-scale distribution of southern right whales to physical habitat characteristics were developed for two large Australian calving grounds (Doubtful Island Bay, WA and Head of Bight, SA). An information theoretic multi-model inference approach was used and transferability between locations and years compared. Whale distribution was significantly spatially aggregated within calving grounds and shallow depth was the most important habitat predictor. Breeding status, behaviour, group type, calf development and local weather modulated habitat selection.

Broad-scale habitat selection was investigated using randomisation comparisons and simple environmental envelope models. These analyses were conducted in the context of long-term (pre-post whaling) spatial use patterns to control for habitat selection misrepresentations that can arise when the distribution of a remnant population is used to infer suitable habitat. Calving grounds occurred in areas described by a wide-range of environmental characteristics, but were more often located in areas with a lower tidal range, closer to the shelf, sheltered, with a more easterly aspect than expected. In addition to physical habitat characteristics, memory (e.g. site fidelity) and social cues are likely to play an important role in habitat selection. This work was supported by funding from Woodside Energy and DEWHA.

Climate variability and reproduction

This work investigated associations between reproduction and large-scale environmental variability that may affect foraging conditions. Seasonally averaged indices for potentially influential environmental variables Southern Oscillation Index (SOI), Southern Annular Mode (SAM), Sea Ice Extent (SIE) were generated and

modelled with a) calf output and b) anomalous calving intervals. Negative SOI (e.g. warm events) was associated with decreased calf output 2.5-3 years later. Variability in SAM affected the proportion of anomalous calving intervals 3 years later. The results provide insights into the potential longer-term effects of climate change and the capacity to better interpret trends in coastal data. This work was supported by funding from DEWHA.

BigFish photo-identification data management and computer assisted matching

An integrated digital system comprising a data management component and a code-based computer assisted matching component has been developed for southern right whales. The matching component is based on callosity coding used in the North Atlantic catalogue and provides a flexible system that can deal with lateral, topside and partial images. The data management tables, initially developed to manage photo-identification data from the HOB, are adaptable for other projects. The system is available for non-commercial research and education purposes under a simple licence from kumar.saras@saugov.sa.gov.au. This work was supported by funding from Great Australian Bight Marine Park.

Discussion

The predictive power of the broad-scale model was discussed (i.e. is the model likely to perform well at predicting the location of new calving grounds as the calving range of southern right whales expands?). This work hasn't yet been done but could be done using the model and would need to be evaluated. However, although the habitat preference study is based on a combination of current and historical aggregation areas, as mentioned already in addition to physical habitat characteristics, memory and social cues are likely to play an important role in habitat selection. It was noted that there has recently been some extension outside the main aggregation areas and it was suggested that this may be related to the carrying capacity at main site and therefore individuals spread to adjacent areas or completely different areas.

g. New Zealand and population genetics (Emma Carroll)

Southern right whales in New Zealand (NZ) waters were subject to one of the most intensive and protracted hunts of the 19th century. Subsequent recovery of the stock has been spatially variable; few sightings around the NZ mainland have been made since the 1930s yet a remnant population persists in the subantarctic (Auckland and Campbell) islands, suggesting that the distribution of the stock has strongly contracted. No significant population differentiation was found between the NZ mainland and NZ sub-Antarctic populations, based on haplotypes defined by 500 bp of the mitochondrial control region ($F_{st} = 0.0$, exact test, $p = 0.548$). The NZ mainland and Auckland Island adult samples were then combined into a single NZ sample ($n = 301$) and compared to 12 samples from east Australia using a 437bp fragment of the control region, in an attempt to build on previous studies (Baker *et al.*, 1999). Significant population differentiation was found based on the exact test, an analysis which is more appropriate for small sample sizes ($F_{st} = 0.06$, exact test, $p = 0.001$). The combined NZ sample was then compared to southwest Australia (53 samples from Victor Harbour, the Head of the Bight, Twilight Cove and WA) over 289bp of the control region. This comparison also showed significant population differentiation ($F_{st} = 0.1$, exact test, $p < 0.001$), as did a similar comparison between east Australia and southwest Australia ($F_{st} = 0.12$, exact test, $p = 0.003$). Given the available samples sizes, differentiation between

regional samples based on mtDNA frequencies indicates that at least 3 stocks of whales should be considered in Australasia: New Zealand (including the Auckland Islands), East Australia (possibly including Tasmania) and SW Australia. These findings confirmed the maternal subdivision found by Patenaude & Harcourt (2006).

Current research at the University of Auckland and Oregon State University is focussing on the microsatellite genotyping of the samples collected from the Auckland Islands during two sets of winter surveys; 1995-1998, (n = 350, Patenaude & Harcourt, 2002) and 2006-2008 (n = 550, S. Baker unpublished data). This work is ongoing and the data will be used to estimate abundance, parentage, mating systems and to identify individuals moving between regions (E Carroll). In addition, genetic samples collected during these field seasons are being used in molecular ageing research at the Australian Antarctic Division (Glenn Dunshea). Photo-identification data collected during the recent field seasons will be used to estimate abundance, and potentially combined with the previously collected data, to study demographic parameters (Simon Childerhouse, Glenn Dunshea, Nathalie Patenaude).

Discussion

The NZ mainland and sub-Antarctic whales form part of the same population but have different population trajectories (e.g. sub-Antarctic growing well, mainland growing slowly/not growing). One scenario is that the mainland was extirpated whereas the sub-Antarctic population was not and that there is slow recolonisation from the sub-Antarctic to the mainland. Historical genetic samples may help to determine if the NZ mainland was different from the sub-Antarctic prior to whaling and this work is planned. Also due to their higher variability relative to mitochondrial DNA, microsatellite analyses are less appropriate when few samples are available. This needs to be kept in mind when considering future samplings and further studies.

When pooling samples from different areas, it is important to carefully consider what is being combining and how this may influence the results. In this study, there was a step wise approach in determining pooling that resulted in the differences seen between WA and EA. A different approach to pooling could generate different results. It was noted that there appears to be significant haplotype diversity between sites within WA and that broad pooling may not be the best option. Some thought although the method of pooling samples could be different, the key message is that based on this analysis, the precautionary position would be to recognise the apparent maternal population structure within Australia and to move forward on this basis. It was also emphasised that the claim of population structure within Australia would be more credible once nuclear markers, that track both male and female gene flow, have been examined.

There is only a small number of samples from east Australia and this could influence the differences seen in the results reported here. It was noted that an agreed definition for a population and/or unit to conserve is critical before considering management and conservation priorities.

Based on the available data and analyses presented here, there appears to be a limited amount of exchange between calving regions (*cf.* Pirzl *et al.*, 2009). Genetic techniques used in investigating population differences can be useful but careful thought must be applied before “drawing lines” between sub-populations (i.e.

determining management boundaries from significant F_{st} values based on population boundaries set *a priori* may be misleading).

3. Management issues and current threats

a. Overview presentation (Milena Rafic)

A summary of Commonwealth management issues and priorities was presented. For southern right whales, the management issues that are of concern include seismic surveys; coastal development; whale watching (recreational and commercial); vessel collisions; and entanglements. Southern right whales are one of the two whale species listed as endangered and the small population that comes close inshore to breed and calve is subject to anthropogenic pressures from industries such as fishing, shipping and tourism. There are a number of priorities for the future for managers to better understand how to minimise impacts on southern right whales including:

- Need to know migration paths from/to important areas;
- Need to know if whales are utilising new/historic calving areas ;
- Level of mortality – entanglements/ship strikes; and,
- Maintain Commonwealth/State/researcher communication networks.

The Commonwealth Southern Right Whale Recovery Plan is being reviewed in 2010-2011 and outcomes from this meeting will be included in the review.

Discussion

There was a discussion of shipping patterns around Australia. A recent study by Patenaude reported over 45,000 port calls per year in Australian right whale habitat. This highlights the need to consider the potential impacts of shipping traffic as well as seismic activities; given that we know ship strike is a significant issue for other right whale populations. There are five records of ship strike for southern right whales in Australia that have been reported to the IWC and recorded in its ship strike database (Van Waerebeek & Leaper, 2007). However there are known gaps in reporting and these reports should be considered a minimum. It would be useful to develop reporting requirements that can be used to establish the magnitude of the issue. With respect to the Recovery Plan, it is important to consider the scale that we are interested in managing (e.g. most of the Australian population of whales are in the west but the bulk of shipping is in the east). Considering scale is a fundamental consideration to determining management priorities; the EPBC Act, and therefore the Recovery Plan, considers the species as a whole in Australia and does not necessarily focus on sub-population recovery. The recently reviewed Rock Lobster Plan states that entanglement constitutes a low risk to right whales. There was no comment provided on this document by DEWHA but it would be useful to follow up.

b. SRWs and marine biogeographic planning (Zoe Cozens)

DEWHA is developing marine bioregional plans under Section 176 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) for five marine regions around Australia. These are the South-east, South-west, North-west, North and East Marine Regions. The Environment Minister must have regard to a bioregional plan when making decisions under the EPBC Act in relation to matters that occur in areas covered

by the plan. Marine bioregional planning will also deliver on the Government's national and international commitments to develop a representative system of Marine Protected Areas (MPAs) in Commonwealth waters.

Marine bioregional plans will focus on DEWHA's responsibility to conserve marine biodiversity. They will identify conservation values and set conservation priorities for the region's Commonwealth marine environment. To fulfil this objective, a key focus of marine bioregional planning is the collection of spatial information about biologically important areas for protected species. This work will ensure that the Department has readily available and up to date spatial information on biologically important areas for all protected species.

Marine bioregional planning is most advanced in the South-west Marine Region, including the work on biologically important areas. To ensure that the information collected is as accurate as possible DEWHA has sought expert opinion. In collecting information on biologically important areas we have explicitly differentiated between known biologically important areas and areas that are likely to be, or possibly are, important for protected species. We use specific definitions and criteria for describing biologically important areas and have collected reference information about the areas mapped. The process has included expert validation of mapped areas and peer review to ensure that the information collected is as accurate and comprehensive as possible.

Initial work by Rebecca Pirzl on biologically important areas for right whales in State waters adjacent to the South-west Marine Region has defined narrow coastal calving areas (including potential future calving habitats). Further questions of interest for marine bioregional planning in the South-west Marine Region include:

- Do these calving areas extend into Commonwealth waters?
- What do we know of the behaviour of southern right whales in the areas surrounding the calving areas?
- What do we know of the migratory routes followed by southern right whales to and from calving areas?

Are they known to rest/feed on route?

- How are biologically important areas going to change/expand as the species continues to recover?

The work is due to be completed later in 2009, and outcomes will be included in the Draft Marine Bioregional Plan for the South-west, due for release at the end of 2009.

Discussion

The information collected is peer reviewed by as many experts as possible to ensure that it represents the most up to date information. It is also important to continue to update the information as new data becomes available. Generally there is good integration between State and Commonwealth authorities. There are plans for developing marine biogeographic planning data maps for whales in WA. The setting of soft boundaries and buffer zones on maps is critical as users tend to interpret hard boundaries (e.g. lines on maps) as meaning anything outside the line is OK. Migratory routes are unknown but will be included as information becomes available in the future.

c. Seismic surveys (Meredith Hutchison)

In October 2008, the latest version of the seismic guidelines was released (EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales, September 2008). Scientific uncertainty regarding seismic/whale interaction remains an issue, and the Department is convening a workshop in April 2009 to

determine priority research needs and develop a forward research plan. Under the EPBC Act, approval is required if an action is likely to have significant impact on matters of National Environmental Significance, which includes threatened and migratory species, and the Commonwealth marine environment. Seismic surveys referred under the EPBC Act are assessed in accordance with the seismic guidelines. Specific considerations when assessing potential impacts of seismic exploration on southern right whales include the timing and extent of the survey, and the distance of seismic acquisition from coastal areas, including potential and known calving grounds. Acoustic modelling of received sound levels has proven to be a useful tool to assist in developing management measures that will reduce the likelihood of a significant impact on southern right whales.

Discussion

Acoustic modelling was used in a recent seismic survey assessment to assess the received sound levels from the seismic survey on potential southern right whale habitat. The proposed survey was not located near any known calving grounds, however there was little information regarding the distribution of southern right whales in the area. The EPBC Act provides for a precautionary approach to be taken in the absence of complete scientific certainty. In this instance modelling of the seismic sound source was considered alongside previous research on physical and behavioural responses of baleen whales to various sound levels. The received sound levels from the survey were determined to be below the level likely to result in physical impacts. Research on the behavioural response of baleen whales to seismic sounds indicated that significant behavioural responses were unlikely if the received sound level was below 140dB re 1 μ Pa. The exception was migrating Bowhead whales, which exhibit behavioural responses at received levels as low as 110dB re 1 μ Pa and at distances up to 20km from a seismic source (Southall et al., 2007). Given that there were no known calving or resting areas in the vicinity of the seismic survey, and the short duration of the seismic survey, it was considered unlikely that the survey would result in a significant impact to the southern right whale, provided the survey was undertaken with additional management measures developed in accordance with the seismic guidelines. The seismic guidelines are not designed to prevent all behavioural changes, and rely on whales avoiding the sound source as part of the standard mitigation measures. While behavioural changes near important breeding/calving/feeding/resting areas are acknowledged as potentially significant to the species, there is a reduced significance regarding unconstrained migration paths.

The timeframe for responding to a referral under the EPBC Act is statutory and is very short (20 business days). Advice on the referral is initially sought from within DEWHA, in addition to requesting comments from the public and relevant Commonwealth and State agencies. If necessary, additional information may be requested from the proponent, which may require them to seek external expertise

d. Entanglement (Cath Kemper)

A recent publication in the Journal of Cetacean Research and Management (Kemper et al., 2008) summarizes 44 records of mortalities and human interactions in Australia from 1950 to 2006. One of the difficulties in assessing cause of death for these events was that in no case of mortality was a necropsy carried that might help determine cause of death. This meant that only obvious causes were able to be determined, for example injuries sustained during vessel strikes or when gear was found on the animal indicating an entanglement. Although it is difficult to

make funds available for sporadic events, such as large whale mortalities, the case needs to be made that it is important that these events are monitored to the best possible standard. More calves than non-calves were recorded with most of the former being considered 'natural' mortality. The number of mortalities, non-fatal entanglements and vessel collisions appeared to be increasing with 22 being recorded during 1997-2006 (about 2/year). Many of the entanglements were in gear related to lines used in crustacean fishing. Only one event (non-fatal) was recorded involving aquaculture (a fish farm in Tasmania) but this type of interaction is likely to increase as whale numbers and aquaculture increase in southern Australia. A comparison with data from other right whale populations showed that Australia and South Africa have fewer anthropogenic interactions than the NW Atlantic but that within that category entanglements were slightly higher and vessel collisions lower than the northern hemisphere.

Discussion

The study combined strikes from large (e.g. ferries) and small vessel collisions but there are reports from all sizes of vessels. It would be more appropriate to use 'vessel-strike' rather than 'ship-strike', which implies that it is only large vessels when that is not the case. There were few data available on the sex of struck individuals but it was provided where available. It may be possible to investigate trends in vessel strike marks from individuals using photo-identification catalogues (e.g. BigFish provides a facility to record detailed marks and scars and to search catalogues on these criteria) and this work is being considered for the future. Southern right whales float for a period when dead, and it was questioned whether this would increase the chance of detection. There is considerable information about this from the North-west Atlantic where it is known that not all dead whales are seen. It is logical to assume that it is more likely that whales killed inshore will be seen than whales killed offshore.

e. Aquaculture (Cath Kemper)

See *Entanglement*.

f. Mitigation of threats, relative priorities and data requirements (general discussion)

There was a general discussion of relative priorities and data requirements. It was **agreed** that it would be useful to examine the cumulative effect of all impacts, rather than dealing with single impacts in isolation. Such a study should also distinguish between short and long term impacts. It was also noted that whenever possible the magnitude of any impacts should be considered on a case by case basis rather than through generic studies applied over all impact-types in all areas.

Similarly, determining what is a threat and their cumulative impact will vary between the southwest (e.g. larger population, fewer threats) and SE (e.g. smaller population, more threats) southern right whale populations.

Data deficiency when considering impacts must be carefully considered as for some impacts it may not be possible to ever get definitive results. In some cases it may be better to deploy resources into areas where we can improve our understanding rather than putting more resources into questions that cannot be answered.

Other noise effects, including ongoing noise sources, should be considered (e.g. drilling, marine turbines) as well as simply direct sources (e.g. seismic activities). Another potential source of impact that has not been considered is influence of sub-sea power cables on cetaceans (e.g. recent work on satellite tagging of pilot whales in Tasmania). There is also an increase in renewable power marine projects that could pose a threat. It was noted that a new pipeline planned for the Otway Basin that may impact on southern right whales.

Another issue that requires more consideration is prey depletion and its potential impacts on right whales.

4. AMMC Research funding mechanisms and priorities - process only

a. 2009 AMMC funding guidelines for Southern Right Whale (SRW) projects (Renata Robertson)

A summary of the process and timeline of 2009 AMMC applications was presented:

- The Minister announced funding for the AMMC in December 2008
- Applications opened in January 2009
- Applications close late March 2009
- Assessment of applications by reviewers, scientific committee and advisory committee to be completed by the end of August 2009
- Applicants to be advised of application status in September 2009

With respect to this workshop the timeframe for applications this year is very tight. This is a result of internal Government process that is beyond the control of the AMMC. A concern was raised that the timeframe does not make it feasible for funding field work this year as the decision about funding will come after the SRW season. It may be useful to consider an interim arrangement for this year and then to encourage applicants to apply for projects a year in advance to cope with the timeframe. This year it is possible to apply for multi-year studies which will greatly improve the process.

It was noted that although this meeting may identify research priorities for southern right whales in Australia all grant applications addressing these priorities will be assessed based on the quality and need for the specific science proposed, the scientific history and productivity of the research team, value for money, and the relative priority of the proposed science relative to other marine mammal research needs.

5. AMMC satellite tagging (Mike Double)

Data were presented on sixteen humpback whales that were tagged off Eden, NSW in October 2008. These tagged lasted an average of 55 days and tracked some individuals over 5000km to their Antarctic feeding grounds. The maximum longevity for these tags was 156 days.

6. AMMC new policy proposal (Mike Double)

A summary was presented on the new funding allocated by the Federal Government to a New Policy Proposal (NPP) on non-lethal whale research. The majority of the funding in NPP will be directed towards promoting conservation and non-lethal research within the International Whaling Commission, this funding will also be used to expand the annual AMMC grant scheme to \$1.5M for the next five years and fund three new three-year

postdoctoral positions. It was noted that the Government decided to bring forward \$6M of the NPP to fund research initiatives within the 2008/09 financial year.

Discussion

While noting that significant new funds are being made available through the AMMC grant scheme, it was suggested that other funds would be allocated to projects without the same scrutiny that the grant applications receive. In response it was noted that the NPP, put forward by AMMC in conjunction with the Marine Division of DEWHA, included a carefully considered five year plan which aimed to address the Australian government's marine mammal policy priorities. Although the AMMC grant scheme received continued support, other priority policies within the proposal were also allocated funding. These initiatives, managed within the Marine and Antarctic Divisions will receive both internal and public scrutiny. It was also noted that significant proportion of the funds will be allocated to international initiatives within the IWC where the IWC Scientific Committee and independent review panels will scrutinise the proposed initiatives and their final outcomes.

7. Objectives, methods and priorities for future research

a. Abundance and trends

In WA/SA, data on abundance and trends come from aerial surveys along the coast between Cape Leeuwin and Ceduna which combine counts of whales with photo-identification, and shore based photo-identification from the HOB. The overall trend in total southern right whale numbers in Australia has shown a steady rate of increase over time. Confidence limits on current estimates of this rate of increase are quite large but further analyses are likely to be able to reduce these.

Numbers in SE Australia remain low, with no clear estimates of trend.

Objectives for monitoring abundance and trends for the WA/SA calving grounds include: (i) understanding population dynamics in relation to density dependence and historic numbers (e.g. determine when the population may approach K) and (ii) investigating the effects of environmental variability on population dynamics.

There is a long time series of annual aerial surveys but there may be options for less frequent surveys. To assess the ability of data collected at different survey intervals to contribute to the two objectives above, some form of modelling exercise is needed. It was noted that in relation to objective (i), it is likely that longer survey intervals could still allow useful data to be collected. However, investigating the effects of environmental variability would be compromised by gaps in the time series. Modelling studies could be developed to investigate the implications of different survey intervals on the precision of estimates. Given the expectation that analysis objectives might be compromised by gaps in the time series, the workshop **recommended** that all efforts should be made to continue the long-term count and photo-identification series in the forthcoming season i.e. in 2009. The need for annual surveys could then be reviewed for subsequent seasons in the light of the modelling results.

There has been an observed similarity in annual calf production between different calving areas and there was some discussion as to whether a single area such as the HOB could be taken as representative of the whole

population. It was **agreed** that the relationship between different areas should be further investigated before any changes are introduced in data collection methods that might restrict the ability to examine environmental effects for the population as a whole. It was noted that work using genetic markers and stable isotopes in southern right whales in the SW Atlantic has shown maternally inherited fidelity to feeding grounds (Valenzuela *et al.*, 2009). If whales from different calving grounds predominantly used different feeding grounds then the effects of environmental variability may be different across calving grounds.

The two basic sources of data from the WA/SA region include total counts of mothers and calves and reproductive histories of individual females. Previous analyses relating southern right whale data from Australia (Pirzl *et al.*, 2008) with environmental data have used both sources of information. It was noted, however, that the study in the SW Atlantic that found relationships between climate and southern right whale breeding success (Leaper *et al.*, 2006) only used individual reproductive histories.

The workshop discussed mark-recapture estimates of total abundance of breeding females based on photo-identification on the calving grounds. This has not yet been attempted and there may be complications related to whale movements between calving areas and heterogeneity in capture probability. The potential for mark-recapture estimates could be assessed by a preliminary analysis.

Data to estimate abundance in SE Australia are more sparse. Systematic aerial surveys were flown between 1991 and 1993 but there has been no dedicated survey effort since then. Given the low probability of sighting animals, the workshop considered that aerial surveys in response to reported sightings would be more informative than planned surveys. This has proven successful in the past. For example, 33 flights were flown in 1995 in response to reported sightings and 29 of these were successful in sighting southern right whales. It was noted that mark-recapture works especially well for small populations and that a concentrated photo-id effort based on a sightings reporting network could allow sufficient images to be collected over a few years. This effort would not need to be continuous but could be repeated every few years.

There is still some uncertainty regarding historic southern right whale abundance and what might be considered as K . Further analyses reviewing catch data and incorporating these into models appear likely to suggest that the population may be more depleted relative to historic numbers than previously thought. A two stock model may also be appropriate.

b. Habitat, movement and migration including linkages between breeding and feeding areas

The priority in terms of studying habitat is to investigate human factors that affect southern right whales. Although rates of entanglement and vessel collision appear lower for Australian right whale populations than elsewhere, there have been at least four reports of collisions in recent years and it is inevitable that not all collisions are reported. Underwater noise from seismic surveys may also compromise right whale habitat although effects have not been quantified. A particular concern with respect to seismic was that there may be effects on migrating animals from small populations that compromise the ability to aggregate in reproductive

areas. It is also important to understand the likely sound exposure levels of southern right whales on calving grounds from off-shore seismic surveys, given the complex acoustic propagation conditions in shallow waters.

There are limited data on southern right whale distribution outside known calving areas, including patterns of migration and feeding areas. Satellite telemetry offers clear potential to gather such data, but potential risks to individuals need careful consideration when attaching devices to this (and other) species. Thus there is a need to resight tagged individuals in order to assess any negative effects. Ideally tagged animals should be resighted within a few weeks of attachment and subsequently have a high chance of being resighted over several years. The workshop noted that attaching tags to whales off WA could provide the best opportunities for resights to assess the effects of tagging. However, the major threats to right whales, and hence priority data for management initiatives, are in eastern Australia. It was also suggested that tagging whales which appeared to be on a northbound migration off the coast of Tasmania might be particularly informative in relation to threats within the Bass Strait, as well as allowing appropriate opportunities for resighting individuals and thus enabling short and medium term assessments of instrument attachment.

New telemetry techniques are under development, and in particular the potential for long-term acoustic tags similar to that used in fish was noted. In some areas, suitable networks of acoustic receivers may already be in place for fish studies, but these technologies are not yet available for whales.

Studies of stable isotopes in baleen have been used to identify diet and feeding areas at broad spatial scales and the workshop noted a growing body of isotope work in the Southern Ocean. New developments should allow isotope analyses from biopsy samples.

c. Connectivity and population genetics

Initial genetic studies based on limited sample sizes have indicated that there may be more than one 'Australian' population of southern right whales. These analyses suggested that animals in SE Australia may group closer to animals in New Zealand than to WA/SA. It was noted that greater sample sizes were needed for more robust analyses, with a priority for biopsy samples from SE Australia. The workshop **recommended** that genetic markers should be extended to include nuclear markers and it was noted that y-chromosome markers may be more informative about population structure. It is critical that the suites of markers are comparable across all areas. It was also noted that genetics doesn't provide all the information on population structure that is relevant to conservation. Small scale movements and site fidelity are also important factors in conserving the range and abundance of the species.

d. Life history parameters

Long-term photo-identification datasets can provide data on life-history parameters as discussed in 7(a). The modelling studies recommended in 7(a) would also help estimate the variance in estimates of life-history parameters, and how this might be affected by annual survey effort.

e. Others (e.g. diet, condition, disease etc)

Photo-identification studies in other regions have been used to assess the health of the population by examining scars from entanglement and vessel collisions. High resolution images can also be used to investigate skin diseases such as ulcers. Scarring rates in Australian populations are much lower than other populations. The workshop noted the amount of information that could be obtained from stranded carcasses and **recommended** full necropsies wherever possible. Archiving of tissue samples also needs careful consideration.

See also Item 9 for further discussion on Research Priorities.

8. Datasets and data management

a. Type of datasets

Annex C provides a summary of southern right whale research in Australia and includes details of data sets and data holders. Such information be useful for addressing matters such as Commonwealth Referrals.

Discussion

It was noted that there is a noticeable gap in Annex C - records from other Museums (including Taronga Zoo). There are also other photo-identification collections that are have not been captured here. East Australian southern right whale sighting data can be found in the NSW wildlife Atlas (*Action: Fiona to provide metadata summary from NSW*). West Australian entanglement data are also not present (*Action: Holly to approach Doug Coughran*). Callosity samples are held by Rob Harcourt and Cath Kemper.

b. Current distribution, form, scope and management of datasets

See Annex C.

c. Consideration of the potential benefits and pitfalls of an integrated and centralised database for sightings data

There are plans to coordinate and integrate cetacean sighting records from State and Commonwealth authorities. Such databases are being developed by the AMMC who will coordinate the data on behalf of the data holders. The expectation is that the contributed data will remain the property of the data owners and access will subject to the conditions set by the data holders.

At a recent State and Commonwealth workshop a centralised database was discussed, and the idea was positively received. One comment was that it needs to include data on absence rather than just presence as this is key in understanding distributions. This would include data on survey coverage as well as sightings. The database will include opportunistic (e.g. sightings from the public, tourist operators, fisherman) and systematic sighting data (e.g. dedicated land, sea and aerial surveys). It was suggested that there is an existing international source of marine sighting data, OBIS that can be used but it was noted that the AAD data centre already feeds into the OBIS database and therefore any open access marine mammal sighting data would be uploaded into OBIS. Data quality and control will be critical to the success of any database and there are provisions for this in the AAD database that is being developed. A record is considered an event and that can be used to include many forms of data including sightings photo-ID, strandings and entanglements. The database will build on existing databases

held by State and Commonwealth. There was general agreement that such a database would be appropriate for southern right whales.

d. Consideration of the potential benefits and pitfalls of an integrated and centralised database for photo-identification data

The North Atlantic Right Whale Catalogue run by the NARW Consortium is one example of a centralised photo-identification catalogue. It is run like along the lines of a Charitable Trust with a board that oversees the operation of the Catalogue. People submit images and data to the Catalogue and sign a data sharing agreement. This is an open, web based system that is run and managed by a group of people employed to do so.

Any centralised photo-identification catalogue would require centralised quality control and management, coupled with associated data sharing agreements. It would be accessible to everyone provided they sign an agreement and abide by it. Funding would be required for the establishment of such a database and also for ongoing IT support. Importantly, the host institution should have the necessary technical capacity to set up, maintain and further develop the database. The institution would also provide ongoing financial support – a user-pays system is not sufficient (as discussed below). The web-based nature of the system would allow for flexible scrutiny and management of the database content. Additionally, it is important to facilitate regional substructure even though the data are centralised.

A separate but related issue is the security and archiving of the original data records. The South Australian Museum or National Archives would be good candidate institutions to receive such records.

The workshop **endorsed** the establishment of a centralised photo-identification catalogue.

It was suggested that the role of hosting a centralised catalogue could be undertaken by the SA Museum using the system developed by Rebecca Pirzl and Steve Burnell. Another possibility would be the AMMC that is already developing a national sightings database (see above) and has the necessary IT infrastructure and support. The AMMC has employed two applications developers to support the development of such databases. The AMMC however would not be looking to manage or scrutinise the data once the database infrastructure has been established. This would best be achieved by active southern right whale researchers.

Some members believed that it would be important for the host organisation to have links to the Commonwealth. An important consideration is ongoing funding to support the operation of the catalogue. It was highlighted that the National Ageing centre at the SA Museum now requires full cost recovery for the use of this facility; it would be important that this was not the case for the centralised catalogue.

The key questions in developing a proposed centralised catalogue are i) how much it would cost, ii) who would host it, iii) who would do the matching, iv) what is the process of inputting from other catalogues, and v) what ongoing infrastructure support is available.

It was suggested that a grant application for a SRW catalogue that was put forward to the AMMC Grant Scheme last year be revised and put forward again. It was noted that this application would be more favourable received if it was supported by all Australian data holders.

e. Potential models and databases available to facilitate centralised data management and sharing

See above for discussion of centralised databases.

Computer assisted matching systems within a centralised database were also discussed and there was general support for the BigFish approach of code-based matching. It was noted that a code-based system had been used successfully for the North Atlantic right whale catalogue for many years and that a code-based system had the advantage of being able to deal with both lateral and topside images.

It was stated that it was important to consider all systems before they are implemented in a centralised database. It was also noted that most catalogue users were familiar with the range of matching systems as they had been demonstrated at previous Australasian southern right whale matching workshops and/or had been used by various people present at the meeting. It was recognised that there is no internationally accepted/universal system in place at present.

Overseas collaborators (e.g. Vicky Rowntree) are keen to develop a global photo-identification system so that images can be shared easily. It was **agreed** that it would be desirable for any centralised Australian database and matching systems should be compatible with other international systems.

9. Priority southern right whale research for the 2009 round of the AMMC grants scheme

The workshop identified and **agreed** the priority research needs for southern right whales in Australia as listed in Annex D. In particular, the workshop highlighted the need to:

1. undertake a modelling exercise to guide the frequency, nature and extent of future, long term, data series (Priority 1a, 1b & 2);
2. maintain existing, long term, data series until the modelling exercise is complete (Priority 1a & 2);
3. understand the structure and distribution of Australian southern right whale populations, and particularly, improve our understanding of the status of southern right whales in SE Australia (Priority 3 & 10); and,
4. improve our understanding of habitat utilisation, including feeding habitats and linkages between seasonal habitats (Priority 8, 9 & 10).

Central to all of these priorities, the participants highlighted the need for integrated, centralised, database(s) for sightings; and photo-identification data (Priority 11).

10. Report of the meeting – closing and posting

It was **agreed** that the report of the workshop will be revised and agreed by email.

11. Concluding remarks

The Chair thanked Renata Robertson for her assistance in organising the meeting and Simon Childerhouse and Russell Leaper for rapporteuring. All the participants were thanked for their valuable contributions. The meeting thanked the Chair for his forbearance and skill in handling the meeting.

12. References

- Baker, C.S., Patenaude, N.J., Bannister, J.L., Robins, J. and Kato, H. 1999. Distribution and diversity of mtDNA lineages among southern right whales (*Eubalaena australis*) from Australia and New Zealand. *Marine Biology*, 134: 1-7.
- Bannister, J.L. 2001. Status of southern right whales (*Eubalaena australis*) off Australia. *Journal of Cetacean Research and Management Special Issue*, 2: 103-110.
- Bannister, J.L. 2008 Population trend in right whales off southern Australia 1993-2007. 13pp. Paper SC/60/BRG14 presented to the IWC Scientific Committee, 2008 (unpublished).
- Burnell, S.R. 2008 Estimates of demographic population parameters of southern right whales off Australia. 8pp. Paper SC/60/BRG12 presented to the IWC Scientific Committee, 2008 (unpublished).
- Clapham, P. and Ivashchenko, Y. 2009. A Whale of a Deception. *Marine Fisheries Review*, 71.
- Environment Australia 2002 Report on the seminar/workshop on photo-identification comparison of Australasian right whales. Department of the Environment and Heritage, Canberra.
- Environment Australia 2004 Report of the workshop on photo-identification comparison of Australasian right whales. Department of the Environment and Heritage, Canberra.
- International Whaling Commission 2001. Report of the Workshop on the Comprehensive Assessment of Right Whales: A Worldwide Comparison. *Journal of Cetacean Research and Management Special Issue*, 2: 1-60.
- Kemper, C., Coughran, D., Warneke, R., Pirzl, R., Watson, M., Gales, R. and Gibbs, S. 2008. Southern right whale (*Eubalaena australis*) mortalities and human interactions in Australia, 1950-2006. *Journal of Cetacean Research and Management*, 10: 1-8.
- Leaper, R., Cooke, J., Trathan, P., Reid, K., Rowntree, V. and Payne, R. 2006. Global climate drives southern right whale (*Eubalaena australis*) population dynamics. *Biology Letters*, 2: 289-292.
- Patenaude, N.J. and Harcourt, R. 2002 Genetic stock identification of southern right whales off south-east Australia. Report to the Department of Environment and Heritage, 15 May 2002, 22p.
- Patenaude, N.J. and Harcourt, R. 2004 Preliminary evidence of stock differentiation within Australia's southern right whales. Report to the Department of Environment and Heritage, 7 April 2004, 11p.
- Patenaude, N.J. and Harcourt, R. 2006 Australia's southern right whales show stock differentiation. Report to the Department of Environment and Heritage, 28 Jan 2006. 13pp.
- Patenaude, N.J., Portway, V.A., Schaeff, C.M., Bannister, J.L., Best, P.B., Payne, R.S., Rowntree, V.J., Rivarola, M. and Baker, C.S. 2007. Mitochondrial DNA Diversity and Population Structure among Southern Right Whales (*Eubalaena australis*). *Journal of Heredity*: esm005.
- Pirzl, R. 2008 *Spatial ecology of E. australis: Habitat selection at multiple scales.*, Deakin University, .

- Pirzl, R., Lawton, K. and Murdoch, G. 2007 Development of a data management system for southern right whale monitoring at Head of Bight, South Australia. . Final Report to South Australian Department for Environment and Heritage, Adelaide (unpublished).
- Pirzl, R., Patenaude, N.J., S.Burnell and Bannister, J. 2009. Movements of southern right whales (*Eubalaena australis*) between Australian and subantarctic New Zealand populations. *Marine Mammal Science*, 25: 455-461.
- Pirzl, R., Thiele, D., Bannister, J. and Burnell., S. 2008 ENSO and SAM affect reproductive output in southern right whales. Attachment A. Report to the Department of Environment, Water, Heritage and the Arts (DEWHA).
- Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene, C.R.J., Kastak, D., Ketten, D.K., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A. and Tyack, P.L. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals*, , 33: 412-522.
- Valenzuela, L.O., Sironi, M., Rowntree, V.J. and Seger, J. 2009. Isotopic and genetic evidence for culturally inherited site fidelity to feeding grounds in southern right whales (*Eubalaena australis*). *Molecular Ecology*, 18: 782-791.
- Van Waerebeek, K. and Leaper, R. 2007 Report from the IWC vessel strike Data Standardization Group. 6pp. Paper SC/59/BC12 presented to the IWC Scientific Committee, 2007 (unpublished).
- Yablokov, A.V. 1994. Validity of Whaling Data. *Nature*, 367: 108.

ANNEX A – AGENDA

1. Introductory items
 - a. Welcome and opening remarks
 - b. Introductions and apologies
 - c. Aims of the workshop
2. Presentations summarising past, current and planned research on Australasian southern right whales
 - a. Western Australia (John Bannister; 30-40 minutes)
 - b. South Australia (Steve Burnell; 30-40 minutes)
 - c. Victoria (Mandy Watson; 20-30 minutes)
 - d. Tasmania (Rosemary Gales, 20-30 minutes)
 - e. Eastern Australia (Rob Harcourt; 20 - 30 minutes)
 - f. Broad scale studies of habitat choice and the influence of climate on reproduction (Rebecca Pirzl; 20 - 30 minutes)
 - g. New Zealand and population genetics (Emma Carroll, 30-40 minutes)
3. Management issues and current threats
 - a. Overview presentation (Milena Rafic)
 - b. SRWs and marine bioregional planning (Zoe Cozens)
 - c. Seismic surveys (Meredith Hutchison)
 - d. Whale watching (Milena Rafic)
 - e. Entanglement (Cath Kemper)
 - f. Aquaculture (Cath Kemper)
 - g. Mitigation of threats, relative priorities and data requirements (general discussion)
4. AMMC Research funding mechanisms and priorities - process only
 - a. 2009 AMMC funding guidelines for SRW projects
5. Objectives, methods and priorities for future research
 - a. Abundance and trends
 - b. Habitat, movement and migration including linkages between breeding and feeding areas
 - c. Connectivity and population genetics
 - d. Life history parameters
 - e. Others (e.g. diet, condition, disease etc)

6. Datasets and data management
 - a. Type of datasets
 - b. Current distribution, form, scope and management of datasets
 - c. Consideration of the potential benefits and pitfalls of an integrated and centralised database for sightings data
 - d. Consideration of the potential benefits and pitfalls of an integrated and centralised database for photo-identification data
 - e. Potential models and databases available to facilitate centralised data management and sharing
7. Priority southern right whale research for the 2009 round of the AMMC grants scheme
8. Concluding remarks

ANNEX B - LIST OF PARTICIPANTS

Name	Affiliation	Email
Catherine Kemper	South Australian Museum, SA	Kemper.Cath@saugov.sa.gov.au
Catriona Johnson	Australian Antarctic Division, DEWHA, TAS	Catriona.Johnson@aad.gov.au
Emma Carroll	University of Auckland, NZ	ecar026@aucklanduni.ac.nz
Fiona Mandelc	Department of Environment and Climate Change, NSW	Fiona.Mandelc@environment.nsw.gov.au
Glenn Dunshea	Australian Antarctic Division, DEWHA, TAS	glenn.dunshea@aad.gov.au
Ian Westhorpe	Dept of Primary Industries, VIC	Ian.Westhorpe@dpi.vic.gov.au
Jason Gedamke	Australian Antarctic Division, DEWHA, TAS	Jason.Gedamke@aad.gov.au
John Bannister	Western Australia Museum, WA	bannisj@bigpond.com
Mandy Watson	Department Sustainability and Environment, VIC	Mandy.Watson@dse.vic.gov.au
Mark Bravington	CSIRO, TAS	Mark.Bravington@csiro.au
Meredith Hutchison	Approvals and Wildlife Division, DEWHA, ACT	Meredith.Hutchison@environment.gov.au
Mike Double	Australian Antarctic Division, DEWHA, TAS	Mike.Double@aad.gov.au
Milena Rafic	Marine and Biodiversity Division, DEWHA, ACT	Milena.Rafic@environment.gov.au
Natalie Kelly	Australian Antarctic Division, DEWHA, TAS	Natalie.Kelly@aad.gov.au
Natalie Patenaude	LGL, Canada	npatenaude@lgl.com
Nick Gales	Australian Antarctic Division, DEWHA, TAS	Nick.Gales@aad.gov.au
Rebecca Pirzl	South Australian Museum, SA	rpirzl@ozemail.com.au
Renata Robertson	Australian Antarctic Division, DEWHA, TAS	Renata.Robertson@aad.gov.au
Rob Harcourt	Macquarie University, NSW	rharcour@ecosys.gse.mq.edu.au
Rosemary Gales	Dept. of Primary Industries and Water, TAS	Rosemary.Gales@dpiw.tas.gov.au
Russell Leaper	IFAW, UK	russell@ivytdemon.co.uk
Simon Childerhouse	Australian Antarctic Division, DEWHA, TAS	Simon.Childerhouse@aad.gov.au
Steve Burnell	South Australian Museum, SA	steveburnell@gmail.com
Zoe Cozens	Marine and Biodiversity Division, DEWHA, TAS	Zoe.Cozens@environment.gov.au

ANNEX C - METADATA TABLE

The full metadata table and associated references will be available from:

<http://www.marinemammals.gov.au/marine-mammal-workshops/southern-right-whale-workshop-2009>

Contact	Project name	Primary data type	Primary platform	Primary objective(s)	Geographic region
Rosemary Gales	The Population and Foraging Ecology, Management of Stranded, and Mitigation of Entangled Whales in Tasmania	photo-identification	Aerial	pop structure/movements spatial/temporal occurrence	Tasmania
Rosemary Gales	The Population and Foraging Ecology, Management of Stranded, and Mitigation of Entangled Whales in Tasmania	sightings	Aerial survey		Tasmania
Rosemary Gales	The Population and Foraging Ecology, Management of Stranded, and Mitigation of Entangled Whales in Tasmania	biopsy samples	Boat	pop structure	Tasmania
Rosemary Gales	The Population and Foraging Ecology, Management of Stranded, and Mitigation of Entangled Whales in Tasmania	Entanglements	boat, aerial	wildlife management spatial/temporal occurrence	Tasmania
Rosemary Gales	The Population and Foraging Ecology, Management of Stranded, and Mitigation of Entangled Whales in Tasmania	Sightings	land/boat/aerial		Tasmania
Rosemary Gales	The Population and Foraging Ecology, Management of Stranded, and Mitigation of Entangled Whales in Tasmania	satellite tracking	boat	migration paths	Tasmania
Rebecca Pirzl	Habitat selection of southern right whales	Location, date historic whaling data, whaling station locations	Land	habitat selection studies historical distribution of SRW, locations of importance	Doubtful Island Bay, Head of Bight, Warrnambool
Rebecca Pirzl	Historical distribution of southern right whales		incidental records	estimate minimum mortality extent of negative interactions	Australian wide
Cath Kemper	Southern right whale mortalities and human interactions	carcasses			Australia
Cath Kemper	Southern right whale mortalities and human interactions	vessel collisions			
Cath Kemper	Southern right whale mortalities and human interactions	entanglements			
Cath Kemper	Southern right whale mortalities and human interactions	incidental sightings	land	seasonality of coastal presence geographic distribution	South Australia
Cath Kemper	Distribution of southern right whales	photographs			
Cath Kemper	Distribution of southern right whales				
Cath Kemper	Museum collections of southern right whales	skeletons	carcasses	morphology	South Australia
Cath Kemper	Museum collections of southern right whales	organs		life history	
Cath Kemper	Museum collections of southern right whales	tissue samples			
John Bannister	Right whales off south west Australia	Counts	Aircraft	Abundance/trends	Coastal southern
John Bannister	Right whales off south west Australia				Western Australia
John Bannister	Right whales off south west Australia	Photo-id	Aircraft	Population parameters	
John Bannister	Right whales off southern Australia	Counts	Aircraft	Abundance/trends	Coastal southern

Contact	Project name	Primary data type	Primary platform	Primary objective(s)	Geographic region
John Bannister	Right whales off southern Australia				Australia, C Leeuwin-
John Bannister	Right whales off southern Australia				Ceduna
John Bannister	Right whales off southern Australia				
John Bannister	Right whales off southern Australia	Photoid	Aircraft	Population parameters	
John Bannister	Right whales off southern Australia				
John Bannister	Right whales off southern Australia				
John Bannister	Right whales off southern Australia				
John Bannister	Australian/NZ right whales	Biopsy samples	Power-boat	Population genetics	Coastal southern
John Bannister	Australian/NZ right whales				Western Australia
Mandy Watson	South east Australia southern right whale photo-ID catalogue	Photo-identification	Aerial, land	Population structure, abundance, survival	SE Australia
Mandy Watson	DSE sightings database	sightings	land	Abundance, survival, residency patterns, behaviour etc	SE Australia
Steve Burnell	Head of Bight southern right whale project	sightings	shore-based	relative abundance / site use	Head of Bight, SA
Steve Burnell	Head of Bight southern right whale project	photo-identification	shore-based	reproductive rate, life history parameters, movements	Head of Bight, SA
Steve Burnell	Head of Bight southern right whale project	behaviour	shore-based	baseline c/ca	Head of Bight, SA
Steve Burnell	Head of Bight southern right whale project	biopsy	boat	behaviour	Head of Bight, SA
Steve Burnell	Head of Bight southern right whale project	acoustic	boat	population structure baseline c/ca	Head of Bight, SA
Steve Burnell	Southeast flight network - southern right whales	photo-identification	aerial	behaviour	Head of Bight, SA
Steve Burnell	Southeast flight network - southern right whales	sightings	public network	population sub-structure/movements	Port Lincoln, SA to Sydney, NSW
Steve Burnell	Southeast flight network - southern right whales	sightings	public network	habitat use, directed ID	Port Lincoln, SA to Sydney, NSW
Rob Harcourt/ Nathalie Patenaude	Right whales in south east Australia	genetic samples, photo-ID	boat	stock identification	Warrnambool
Geoff Ross	Wildlife Atlas - NSW	sightings	land/boats	threatened spp records, distribution, review records of all marine mammals in NSW waters	Victoria, Encounter Bay SA, all NSW
Geoff Ross	Report for NSW Scientific Committee	sightings	land/boats		NSW
Geoff Ross	Taronga Zoo Tissue Collection - Info. Requested Fmandelc 20.3.09				NSW

ANNEX D - LIST OF RESEARCH PRIORITIES

An unranked list of research priorities for Southern Right Whale in Australian waters.

Priority number.	Proposal	Non exclusive list of justifications
1a	2009 WA/SA aerial survey	Continuation of long-term dataset Life history parameters Trend Abundance Environmental variables Connectivity
1b	'What if' modelling	Research guidance Necessity for annual aerial surveys Value of associated life-history data Loss of ability to estimate trend
2	Continuation of HOB Photo-ID	Continuation of long-term dataset Life history parameters Trend Abundance Environmental variables Connectivity
3	Opportunistic SE Australia photo-ID flights	Abundance for SE Australia Connectivity Trend
4	Review of catch history data and estimating K	Understanding recovery Future management planning
5	Quantification of shipping movements in and around SRW habitats	Threat magnitude and mitigation
6	Modelling acoustic environment of SRW calving areas	Threat magnitude and mitigation
7	Exposure experiments for SRW	Threat magnitude and mitigation
8	Small-scale deployment of satellite tags in WA	Feeding grounds Connectivity Movements
9	Isotope analysis	Feeding grounds Connectivity
10	Continuation of biopsy collection and use of genomic markers	Population structure Connectivity Movements Isotope analysis
11	Centralised databases for sightings and photo-id data	Research collaboration and coordination Data protection Data consistency Data availability Connectivity Movements Life history parameters Abundance