Annex H

Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks

Members: Zerbini (Chair), Allison, Baker, Bannister, Borodin, Branch, Brandão, Brownell, Burt, Butterworth, Carlson, Childerhouse, Chilvers, Clapham, Clark, Corkeron, Dalla Rosa, Double, Edwards, Ensor, Fujise, Funahashi, Gales, Gallego, Galletti, Gedamke, Goto, Groch, Gunnlaugsson, Hakamada, Hammond, Hatanaka, Hayashi, Hedley, Hester, Holloway, Hucke-Gaete, Hyugaji, Ilyashenko, Iñíguez, Ipatova, Ivashchenko, Jackson, Kato, Kock, Lauriano, Leaper (Rebecca), Magloire, Marcondes, Martin, Mate, Mattila, Miller, Miyashita, Murase, Nakamura, Nishiwaki, Ohsumi, Øien, Okada, Okamura, Pastene, Ponce, Robbins, Rosenbaum, Senn, Simmonds (M), Simmonds (J), Skaug, Strbenac, Tamura, Tichotsky, Urban, Van Waerebeek, Weinrich, Yamakage, Yasokawa, Yoshida, Young, Zelensky.

1. INTRODUCTORY ITEMS

1.1 Opening remarks
Zerbini welcomed participants. He noted that the sub-committee would have eight sessions in which to complete its work.

1.2 Election of Chair
Zerbini was elected Chair.

1.3 Appointment of rapporteurs
Clapham and Jackson undertook the duties of rapporteurs.

1.4 Adoption of Agenda
The adopted Agenda is given as Appendix 1.

1.5 Review of documents
Documents identified as containing information relevant to the sub-committee included: SC/59/SH1-24, SC/59/IA10, Cerchio *et al.* (2006), Collins *et al.* (2006), Branch *et al.* (2007), Branch *et al.* (in press), LeDuc *et al.* (in press), Branch (submitted), Jackson *et al.* (submitted).

2. FINALISATION OF SOVIET CATCH DATA SERIES

Last year, the sub-committee recommended that the IWC catch series be finalised with the revised Soviet catches. Allison informed the sub-committee that Dmitry Tormosov had found previously missing data (involving some 3,500 individual catch records) for the 1969/70 season of the factory ship *Yuri Dolgorukiy*. These catches have been coded but need to be validated. It was noted that the IWC also allocated some money to finalise the complete Soviet series through collaboration with Mikhalev; this is expected to be completed before the end of this year. Allison further noted that Tormosov reports he has found new data relating to Soviet marking of whales (not recoveries), and that these will be processed shortly. The sub-committee welcomed the report from Allison and **recommended** that the catch series be finalised.

3. ISSUES RELATING TO N_{MIN} AND DEPENSATION FOR MODELLING OF HUMPBACK WHALES

Jackson *et al.* (submitted) was presented in response to the sub-committee's previous year recommendation for further development of issues relating to minimum abundance (N_{min}) and depensation for modelling of humpback whales (IWC, 2007, p.200). This document reported a novel genetic approach to estimating N_{min} of a historical population trajectory for a species undergoing a population bottleneck. This parameter is also estimated in standard demographic models being used to assess the status of Southern Hemisphere humpback whales by the sub-committee (Jackson *et al.*, 2006; Johnston and Butterworth, 2006; Zerbini *et al.*, 2006a). The work presented repeated the southern right whale assessment previously performed by the IWC (2001) using a Bayesian implementation of an age and sex aggregated logistic population model. The IWC (2001) base case scenario (7.5% growth rate and 1.35x struck but lost correction for coastal whaling) was compared with demographic scenarios where growth rates were 4%, and 10% and the number of whales struck but lost was 2.4x. Estimated historical trajectories from all demographic scenarios suggested a substantial loss of mtDNA haplotype richness as a result of 19th and 20th century whaling. Demographic estimation of N_{min} by the IWC base case assessment suggests that approximately 67 mature females were present at the bottleneck. There are currently 37 haplotypes identified in 275bp control region of southern hemisphere right whales. This haplotype number was adjusted in order to take into account the influence of population sampling (discovery curve correction) and the number of haplotypes resolvable for given sequence lengths of the control region (empirical correction). Thus adjusted, a conservative current estimate of 68 haplotypes was predicted for southern right whales. Two pre-bottleneck neutral distributions were then simulated, comprising 60,000 individuals and with haplotype richnesses of 100 and 150 haplotypes respectively. Repeated sub-sampling from these distributions provided two expectations of the minimum bottleneck size ($N_{min(f)}$) at which 68 present-day haplotypes would be captured. These distributions were further corrected upward by four times in order to approach an estimate of census bottleneck size, and yielded minimum population abundance estimates (N_{census}) of 656-1676 or 400-560 for 100 and 150 haplotypes respectively. The genetic estimate of N_{min} suggests that the minimum abundance estimated by the population demographic model is implausibly small for the base case and high growth rate scenarios. Only scenarios where growth rates are around 4% produce minimum abundance estimates compatible with the genetic data. These results point to a need to better integrate evolutionary processes into population dynamic models, to account for uncertainty in catch records, the influence of maternal fidelity on metapopulation dynamics and the potential for inverse density dependence (an 'Allee effect') in severely depleted populations.

In discussion, two assumptions of the work were questioned: first, the pre-exploitation diversity of 150 haplotypes was considered rather large; if this diversity was set instead at 100, the resulting bottleneck size would be 276 (rather than 219 for an upper bound of 150 haplotypes) and probably more realistic of this population. Second, the biological basis for scaling the female numbers to total numbers (a factor of four times N_{min}) assuming that some haplotypes have been lost between the bottleneck and the present; if this is not correct then the scaling factor could be greater. In response, Jackson agreed that these assumptions could be questionable, but felt that they were likely to be defensibly realistic. The results reflected a likely minimum abundance estimate derived from the genetic modelling, as opposed to an observed absolute minimum. It was proposed that in addition to a likely minimum, it should be possible to set an upper bound to N_{min} for incorporation into demographic models. It was suggested that the genetic estimate of N_{min} should be used to set a prior for minimum abundance in population models. It was also suggested that although application of this method to the various humpback whale stocks under consideration by the sub-committee was not possible at this meeting, it could possibly be achieved intersessionally for some populations, and that prioritisation of these should be discussed. A working group under Jackson was established to discuss the practical implementation of N_{min} estimation to the humpback assessment models. The group concluded that the parameterisation of the models was not sufficiently resolved to allow for the approach in Jackson *et al.* (submitted) to be currently applied to humpback whale assessments, and that further work should be conducted intersessionally. The sub-committee agreed with this plan.

4. HUMPBACK WHALE DISTRIBUTION AT MID LATITUDES BASED ON HISTORIC CATCH AND JSV DATA

Last year, the sub-committee recommended that the JSV and the historic catch data be examined to improve knowledge of humpback whale distribution at mid-latitudes. The main intent was to assess whether information on the proportion of whales found in these regions could be incorporated into analyses of abundance. In response, Nishiwaki presented information from Figure 10 in Matsuoka *et al.* (2006), which illustrated the IWC catch data from 1913-73 and the JSV sighting data from 1965-88. In discussion, it was noted that an earlier analysis of these data had already been conducted (Butterworth and Geromont, 1996), and it was unlikely that new analyses would substantially alter the conclusions of that work, given the bias associated with the non-systematic nature of the JSV data.

5. IN-DEPTH ASSESSMENT OF SOUTHERN HEMISPHERE HUMPBACK WHALES

The Chair appointed a Working Group (Jackson [convenor], Butterworth, Double, Hammond, Johnston, R. Leaper, Martien, Rosenbaum, Weinrich and Zerbini) to review research requirements to complete the assessment of Southern Hemisphere humpback whale breeding stocks B and C. The terms of reference of this group were: (1) identify key issues regarding stock structuring, (2) identify necessary steps towards the provision of revised abundance estimates, (3) determine other parameters which merit further exploration in the upcoming assessment models and, (4) identify and prioritise tasks needed and those who could undertake the work for the assessment to be completed by SC60. The conclusions of this group are reported under the relevant items below.

5.1 Stock structure in the feeding grounds

SC/59/SH24 provided estimates of the genetic structure of feeding aggregations of humpback whales in the southern ocean using 10 microsatellite loci and mitochondrial control region data. Previous work on this topic has been presented from some of the IDCR/SOWER samples along with those collected as part of the JARPA Program (Pastene *et al.*, 2006). The present study covers IWC Management Areas I to IV and VI in the Antarctic (Donovan, 1991) using samples from the IDCR/SOWER program (through the 2005/2006 cruise), the SO-GLOBEC program, and the Chilean Antarctic Program. Genetic structuring was explored using F_{st} and ϕ_{st} scoring both between Management Areas and between the Naïve/Core feeding areas associated with each humpback whale breeding stock (IWC, 1998, p. 191; IWC, 2006). A total of 371 samples (332 individuals) defined 110 distinct haplotypes. F_{st} scores did not detect significant differentiation between feeding areas corresponding to breeding stocks B and C, and between areas corresponding to stocks C and D. In contrast, the feeding area associated to breeding stock G was found to be significantly different (for F_{st} and ϕ_{st}) from all other feeding areas; the feeding ground associated with breeding stock F was significantly different from feeding grounds associated with breeding stocks B and C (for F_{st} only). Lack of genetic structure among the neighbouring feeding grounds associated with breeding stocks B and C and C and D (feeding grounds associated with breeding stocks B and D were significantly different for F_{st} only) may reflect interchange of breeding stocks on the feeding grounds, as well as poorly understood migratory processes occurring between breeding and feeding stocks across regions. This research is concordant with a recent genetic capture-recapture of a whale between breeding stocks B and C, which suggests that inter-annual migration of animals from one breeding stock to feeding grounds associated with other stocks may be more common than has been detected by demographic analyses. Lack of structuring between feeding grounds associated with breeding stocks C and D is also an interesting result as the potential for mixing between these Indian Ocean stocks has not been previously or sufficiently examined. The genetic evidence suggests this should be an area for closer scrutiny, and clearly has implications for catch allocation, trend estimates, and estimates of abundance from the feeding grounds in the Antarctic.

The sub-committee welcomed this paper as it addressed some of the work recently recommended. In discussion, it was noted that results obtained from feeding grounds associated with breeding stock A (n=7) and E (n=8) should be considered preliminary in view of the small sample size. The sub-committee recommended that efforts are increased to collect samples in the feeding areas associated with these two breeding stocks. It was noted that there are a number of JARPA biopsy samples available from the feeding grounds associated to stock E, which could further inform the analysis. However, the authors of SC/59/SH24 indicated adherence to a policy of not using biopsy samples which have been obtained through lethal research programs. It was also questioned whether an effect of sex bias in these data could be tested; if migration patterns differ between males and females the present analyses would not be able to discriminate them. While the current Antarctic dataset prohibited analyses of sex-specific population structure, it was observed that previous analyses using sex data have provided useful information for examining stock structure (Pomilla *et al.*, 2006 and Rosenbaum *et al.*, 2006). It was also noted that there are plans to revisit this question using existing samples not yet transferred (2006/07 SOWER), and others that will be collected in 2007/08. Additional lines of evidence for breeding stock mixing on feeding grounds were discussed. The sub-committee agreed that boundary allocation for different feeding grounds associated to breeding stocks remains uncertain and a more complete understanding will probably require better knowledge of humpback whale distribution, movements and habitat (e.g. oceanography, sea-ice extent) in high latitudes. Given the availability of genetic data from both breeding and feeding grounds, an alternative genetic approach was suggested; development of a mixed demographic model accounting for the observed genetic proportions of each breeding population in the feeding grounds. Authors of SC/59/SH24 explained that further genetic studies on the connectivity of the southern hemisphere breeding and feeding grounds are ongoing and have the potential to better inform as to appropriate historical catch allocation and feeding ground mixing. A study of the degree of connectivity and interchange between these regions is planned, and results will be presented next year provided sufficient funding is secured. The sub-committee was informed of a developing collaboration effort among researchers working on feeding grounds associated with breeding stocks C and D (Rosenbaum and colleagues and the Australian Antarctic Research Program), as interchange between these populations merits further investigation.

Martin reported on a recent work conducted in collaboration with the Humpback Whale Institute, Brazil. Photographs of individually identified humpback whale from the South Sandwich Islands (25 individuals) were compared with photographs from Bouvet Island (32 individuals) and from Brazil (2387 individuals). No matches were obtained between Bouvet and Brazil and between Bouvet and the South Sandwich Islands. However, four whales were matched between the latter and Brazil, confirming previous migratory connections between these two areas (Stevick *et al.*, 2006; Zerbini *et al.*, 2006b). It was noted that no comparison with West Africa has been done at the present time and the sub-committee agreed this should be pursued. The sub-committee thanked Martin for bringing this information forward.

It was also noted that the IDCR/SOWER cruises were conducting surveys near the Bouvet Islands both to the north and south of 60°S, yielding biopsy samples, photographs and acoustic data on humpback whales. It was questioned whether estimates of abundance from these surveys would assist with the assessment. The sub-committee agreed this information would be useful, considering the high number of sightings recorded.

Potential IWC participation in the upcoming CCAMLR-IPY survey was discussed. An offer was made by a Norwegian project to place two observer on board of a research vessel operating in the Bouvet Island area (~50°-60°S, 5°W-5°E) in February 2008. Hedley was thanked for bringing that to the attention of the sub-committee. It was agreed that this would be useful to clarify uncertainties in regard to the stock structure of humpback whales in the feeding grounds. However, it was pointed out that extensive sampling has recently occurred in this region by the IDCR/SOWER cruises, which have provided humpback whale samples. The sub-committee agreed to accept this offer only if the collection of biopsy samples is possible.

5.2 Breeding Stock B

5.2.1 Distribution, movements and stock structure

Rosenbaum provided evidence that breeding stock B may be sub-structured (e.g. Barendse *et al.*, 2006; Pomilla *et al.*, 2006; Rosenbaum *et al.*, 2006), but the extent of this was poorly understood (IWC, 2006). The Intersessional Workshop for Comprehensive Assessment of southern hemisphere humpbacks (hereafter referred to as the Hobart Workshop) provisionally agreed that a B1/B2 border in the vicinity of 18°S (where the Walvis Ridge meets the African coast and the Angola Current- Benguela Current Front) was consistent with the available evidence (IWC, 2006). It was concluded that sub-stock B1 is likely a breeding ground, while sub-stock B2 is a summer feeding ground and winter migration corridor. Significant genetic differences between B1 and B2 have been identified for females (Rosenbaum *et al.*, 2006), suggesting that more than one breeding stock may occur in the region. However, the degree of current interchange is unknown. It was suggested that given this uncertainty, any assessment performed at this time should combine information from both sub-stocks B1 and B2. It was observed that satellite tracking and acoustics would be able to help further with regards to elucidating stock structure.

5.2.2 Abundance estimates

Collins *et al.* (2006) was presented at the Hobart workshop but not reviewed due to time limitations. Preliminary closed population mark-recapture abundance estimates for breeding stock B1 (the Gulf of Guinea, north of 18°S) were computed from both photo-identification and genetics. Photographs and biopsy samples were collected between 2001 and 2004. The Chapman’s modified Petersen estimate provided independent estimates of genetic and photo recapture. Weighted mean values over 2001-2004 resulted in an abundance of 5,317 (CV=0.21, 95% CI = 3,538-7,989) from photographs and 3,785 (CV=0.34, 95% CI = 1,980-7,237) from genetic samples.

In discussion it was noted that the two estimates are not significantly different (due to the substantial uncertainty associated with low recapture rates). It was also noted that there was potential negative bias due to the survey timing because surveys were performed over the same time during the season in different years and therefore animals that are present in the region outside this period are necessarily missed by the surveys. However, if additional sub-stocks are found in the region (e.g. individuals migrating through) abundance could be biased high. Therefore, if multiple stocks occur within breeding area B1, a population estimate of 4000-5500 for B1 alone may be too high.

Branch (submitted) updated previous information from Branch (2006) and provided abundance estimates of humpback whales in the Antarctic from the IDCR/SOWER surveys. It now includes a review of the northern breeding ground estimates of abundance and compares them to the corresponding Antarctic feeding ground estimates. Some breeding ground estimates are far greater, and others far lower, than the corresponding IDCR/SOWER feeding ground estimates, in a pattern apparently related to the latitudinal position of the Antarctic Polar Front. The sum of the breeding ground estimates in 1999–2005 is approximately 53,000; if the rate of increase in the feeding grounds is assumed to be greater than 5%, the sum of the IDCR/SOWER estimates would exceed 50,000 individuals. The latest estimate of abundance for the feeding grounds associated with breeding stock B (20°W-10°E) was obtained in 1996/1997 and resulted in a total of 595 whales. This estimate is biased downwards because the survey did not extend north of 60°S, where humpback whales are known to occur in the summer (SC/59/IA1). Ratios calculated between previous breeding ground estimates of stock B (Collins *et al.*, 2006) and the latest feeding ground estimate indicate that only 14-28% of whales are found south of 60°S.

5.2.3 Trends in abundance

Branch (submitted) estimated an annual increase in abundance of 0.059 (95% CI = -0.059, 0.176) between 1979/80 and 1996/7 for the feeding grounds associated with breeding stock B (20°W-10°E). This trend is not significantly different from zero. In discussion, it was noted that the large uncertainty associated with this estimate is likely going to have very low influence on population assessment models, but the sub-committee agreed that the sensitivity of these models to the trend data should be explored.

5.2.4 Preliminary assessment

Paper SC/59/SH3 provided a preliminary stock assessment of Southern Hemisphere humpback breeding sub-stock B1 whales. These initial Bayesian analyses suggest this population to be currently within the range of 60-90% of its pre-exploitation size. Due to time constraints, it was agreed that discussion of the results of this paper should be conducted in the Working Group appointed under item 5 above. Given the concerns identified with the existing abundance estimates for stock B in the breeding grounds (item 5.2.2), the Working Group recommended that an updated abundance estimate for sub-stock B1 be computed before the assessment is completed. In the absence of estimates for stock B2, this estimate could be used to provide a conservative abundance estimate for a combined B (B1+B2) breeding stock assessment. It was also agreed that an upper bound estimate of abundance cannot be provided for this stock at present.

SC/59/SH3 also explored the influence of variation in the Antarctic catch data allocation on estimated recovery for breeding stock B1. It was suggested that further options regarding the allocation of catch in this area should be considered in the light of SC/59/SH24, which suggests low population differentiation between this and neighbour feeding areas. The working group therefore recommended that overlap and fringe models of catch allocation be applied in future modelling.

The group also recommended that genetic data from breeding grounds be compared with genetic data from their associated feeding grounds in order to determine levels of stock mixing on feeding grounds. The working group recognised low confidence in obtaining realistic trend information from IDCR/SOWER data in modelling of this stock. Since no other data are currently available, the group agreed that alternatives should be explored including use of intrinsic growth rate information obtained from other populations as priors.

The sub-committee endorsed the recommendations of the working group.

5.3 Breeding Stock C

5.3.1 Distribution, movements and stock structure

Movements and stock structuring within breeding stock C were discussed in the Working Group. Present data indicate that C1 is a migratory corridor and potential breeding area for humpbacks along the east African coast, while C2 (central Mozambique channel islands, represented by Mayotte) and C3 (Antongil Bay, Madagascar) may overlap as breeding grounds. Previous genetic analyses of samples from these regions show no significant differentiation between C2 and C3, but uncertainty as to the level of differentiation between C1 and C3, and between C1 and C2 still exists (Pomilla *et al.*, 2006; Rosenbaum *et al.*, 2006). Preliminary microsatellite data identified one genetic recapture between C1 and C3, but a substantial number of samples from these regions remain to be analysed. However, it was noted that large areas within regions C1 and C2 (IWC, 2006) have not been sampled. The working group agreed that a more in-depth comparison is required to resolve the degree of interchange between C1 and C3, given that the migratory destination of C1 whales has not been confirmed. Clarification of the connections between stocks C1 and C3 (by photographic or genetic means) was strongly recommended by the working group. The sub-committee endorsed the recommendations of the working group.

5.3.2 Abundance estimates

Cerchio *et al.* (2006) presented photographic and genetic estimates of mark-recapture abundance from humpback whales from Antongil Bay, Madagascar (breeding area C3) using closed population models for the period 2001-2004. As for stock B, recaptures were low. Yearly sample sizes ranged from 92 to 165 individuals based on photographic identification for recapture-quality flukes photographs (lowest sample being 17 in anomalously low year of 2002) and 53 to 158 individuals for the genetic dataset. Between-year recaptures of individuals ranged from 0 to 3 for photographs and 0 to 5 for genotypes. There was evidence in the photographic data for a strong individual consistency in capture date each year: among 21 between-year recaptures, 16 (76%) were recaptured within 10 days of the date of their initial year's capture, 13 (62%) were within 5 days, and 7 (33%) were within 1 day. It was noted that this tendency can introduce potentially severe bias to abundance estimates, either negative or positive depending on the timing of sample collection between years. For this reason data from 2002 was eliminated from final abundance estimation. Abundance was estimated using pair-wise (2 year) and multi-year estimators. Point estimates ranged from 767 to 8,115 for photographs and 649 to 8,455 for genotypes, with broad and overlapping confidence intervals. Precision was relatively poor, with CV's ranging from ca 0.50 to 1.36 for pair-wise estimates, and 0.24 to 0.35 for multiple year estimates. The latter may violate assumptions for closed population estimate models. There were substantial differences between the genotypic and photographic recapture estimates, of about 1,400 for years 2000-2001. However, these numbers are not inconsistent given the high uncertainty associated with the estimates. For the purposes of the assessment, a low bound estimate of 5,197 whales (95% CI = 2,669-10,118) and an upper bound estimate of 7,458 whales (95% CI = 4,237-13,016) were recommended. However, given the potential bias to these estimates, the numbers should be considered preliminary.

In discussion, it was noted that the geographic area represented in these estimates was unclear. Due to recent information on connectivity of sub-stocks C2 and C3, the estimates may correspond to Madagascar and the islands of the Mozambique Channel. There is also evidence of exchange between C3 and C1, suggesting there may be some overlapping of sub-stocks between these regions. It was suggested that estimates from C1 and C3 should not be combined to compute abundance of stock C. Recent evidence of exchange between breeding stocks C and B (Pomilla and Rosenbaum, 2005) must also be taken into consideration when evaluating these estimates.

Improvements to the abundance estimates provided in Collins *et al.* (2006) were discussed in the Working Group. It was agreed that that the current estimates are likely unreliable due to the extremely low recapture rates and potential bias in temporal sampling.

5.3.3 Trends in abundance

Branch (submitted) provided abundance estimates from IDCR/SOWER surveys of the feeding area associated with breeding stock C (10^{o}E-60^{o}E). These were 1,043 (95% CI=349-3,189) for CPI (1979-1980), 926 (95% CI = 327-2,618) for CPII (1987-1988) and 2,391 (95% CI=1,104-5,177) for CPIII (1992-1993 and 1994-1995), after adjustment for comparable areas. An annual rate of increase of 0.066 (95% CI=-0.038-0.169) was computed from these abundance estimates. The rate of increase is not significantly different from zero. As for stock B, the sub-committee noticed that the large uncertainty associated with this estimate is likely going to have very low influence on population modelling, but the working group agreed that the effect of these trend data should be explored as a sensitivity test in the population assessment.

5.3.4 Preliminary assessment

SC/59/SH4 reported further stock assessment results for breeding stock C and its component sub-stocks, defined here as C1 and C2+3. Two modelling approaches are applied: one treated the stocks independently, and another allowed for mixing on the feeding grounds. Multiple trend/CPUE indices are available for sub-stock C1, resulting in relatively good model fits. Preliminary results suggested that sub-stock C1 presently to be within the range of`74-82% of its pre-exploitation size.

In discussion, the working group agreed that conclusions about recovery levels are premature until more precise inputs have been obtained. For sub-stocks C2+3, there are insufficient data and substantial uncertainty surrounding population abundance estimates with the current data (e.g. Cerchio *et al.*, 2006). It was noted that the inclusion of some past whaling operations CPUE indices provide good fit to the overall population trajectory. It was suggested that these types of data might merit inclusion as supporting information in other population assessments. However, it was also observed that the point estimates for the IDCR/SOWER (~7%/year) and Cape Vidal (~12%/year) rates of increase (Findlay and Best 2006) differ. The Working Group further discussed the CPUE and trend information and recommended that sensitivity analysis be conducted on all existing trend and CPUE data for this stock.

In discussing the assessment of stock C the working group agreed that an updated abundance estimate should be used in further assessments of this stock. It was recommended that one of these abundance estimates (C1 or C3) be used to represent a lower bound for the abundance of this stock (C1+C2+C3). This is based on the conservative assumption that either all humpbacks breeding in the C2 and C3 region are included in abundance estimates derived from C1, or that all humpbacks migrating past C1 breed in C3. The group also discussed whether estimates of C1 and C3 could be pooled to provide an upper bound estimate of abundance for stock C. It was agreed that the interchange between C1 and C3 required further investigation before pooling be considered an appropriate approach. Therefore, the group recommended that photographs and genetic comparisons between these two regions be made.

In respect to the catch allocation, it was recommended that overlap and fringe models (IWC, 1998) be applied in future modelling. In the light of uncertainty as to how Antarctic catch should be allocated among stocks, it also was recommended that genetic data from breeding grounds B and C be compared with genetic data from their associated feeding grounds in order to determine levels of stock mixing on feeding grounds.

The sub-committee endorsed recommendations from the working group.

5.4 Other Southern Hemisphere humpback whale Breeding Stocks

SC/59/SH2 was presented a re-analysis of the population models used in the assessment of breeding stock G, in response to a mistake found in the trend data used for the assessments presented last year (IWC, 2007, Annex H, p. 31, footnote 8). Population dynamic models in SC/59/SH2 provided new estimates of the population status parameters using the same absolute abundance estimates (Felix *et al.*, 2006; Branch, submitted), sensitivity scenarios and assumptions presented in Johnston and Butterworth (2006), but with the (corrected) IDCR/SOWER trend information adjusted for comparability with respect to aerial coverage. New parameter estimates for different model scenarios assessed are summarised in Table 1. The sub-committee noted that the new estimates provide slightly more pessimistic results, but agreed that they do not change the overall conclusions for the status of stock G reported in IWC (2007, p. 197).

Table 1 – Corrected[1] estimates of parameters of interest for the assessment of breeding stock G.

Historic Catch *r* prior Recent abundance Trend information	Fringe *r*~ U[0, 0.106] N=2,917, CV=0.19 IDCR/SOWER trend	Fringe *r*~ U[0, 0.106] N=3,337; CV=0.21 IDCR/SOWER trend
r	0.060 [0.023; 0.088]	0.062 [0.024; 0.091]
K	11,677 [10,697; 13,889]	11,600 [10,571; 14,018]
N_{min}	390 [150; 1,232]	636 [747; 264]
N_{2006}	3,452 [2,454; 4,682]	5,708 [3,568; 7,916]
N_{min}/K	0.033 [0.014; 0.089]	0.055 [0.025; 0.120]
N_{2006}/K	0.277 [0.185; 0.391]	0.489 [0.263; 0.725]
N_{2020}/K	0.593 [0.290; 0.849]	0.831 [0.374; 0.979]
N_{2040}/K	0.950 [0.458; 0.997]	0.990 [0.556; 1.000]

[1]Sensitivity scenarios equivalent to Cases A and B in Table 3, IWC 2006, p.196.

SC/59/SH11 presented information on the genetic characterisation of humpback whales breeding in Ecuadorian waters (breeding stock G). Mitochondrial data was extracted and sequenced from 43 samples collected between 1994 and 2006. These were resolved as 20 haplotypes, of which five were unique to this region in comparisons with six southern hemisphere breeding grounds and two feeding areas associated with stock G. One haplotype has only otherwise been identified in west Australia. Genetic diversity was estimated to be 0.884+/-0.042% at the haplotype level and 1.84+/-0.96% at the nucleotide level. Phylogenetic analysis showed that Ecuadorian humpbacks were distributed in three of the four described clades in the southern hemisphere. Pairwise analyses of molecular variance showed significant differentiation at both haplotype and nucleotide levels with all southern Pacific breeding grounds except Colombia. Comparison with feeding areas determined significant differences with the Magellan Strait, but not with the Antarctic Peninsula. While the AMOVA analysis suggests panmixia in stock G, a larger sample is needed to better define this.

SC59/SH12 reported on the newly formed Latin American Humpback Whale Photo-identification Network. This network is a cooperative effort between countries in South and Central America to improve the knowledge of humpback whale breeding populations A and G. The first Workshop on the current status of humpback whale photo-identification in Latin American breeding grounds was held on March 2007 in Ubatuba, Brazil. This workshop was organised and attended by institutions from Brazil, Colombia, Ecuador, Panamá, Costa Rica and Peru. The objectives of the Network are: to identify, prioritise and complete research on humpback whales to support management, to develop a standardised format for exchange of data and key information, to provide a forum for sharing skills and enhancing research techniques, to facilitate peer-reviewed publications of humpback whale research and to improve protocols for managing humpback whale photo-identification datasets and databases. Members are currently working on the definition of the structure, membership, operating guidelines and protocols for sharing intellectual property of this network. Creation of the Latin American Humpback Whale Photo-identification Network represents a very important initiative for developing collaborative working relationships between humpback whale researchers in this region and will be an effective tool to support research and conservation of humpback whales in Latin American waters.

In SC/59/SH14, movements of individual humpback whales between the winter breeding grounds of Oceania (South Pacific) were documented by individual identification photographs collected from 1999 to 2004. Photographs were collected with comparable effort across the six years in four primary island breeding grounds: New Caledonia, Tonga (Vava'u), the Cook Islands and French Polynesia (Mo'orea and Rurutu), with some smaller effort in a few adjacent regions: Vanuatu, Fiji, Samoa, Niue, and American Samoa. Interchange among wintering grounds was assessed using regional catalogues of fluke photographs, and represented 776 annual sightings of 659 individual whales from Oceania. Most resightings occurred within regions (n = 78) but 20 individuals were sighted in two (mostly adjacent) regions. Previously undocumented exchanges were highlighted within central Oceania and the west Pacific. No individual was sighted in more than two regions during this six-year period. The documented movement between regions was one-directional except for one individual sighted first in French Polynesia, then in American Samoa and then back in French Polynesia. Only one whale was resighted in more than one region during the same winter season. No directional trend was apparent and movement between regions did not seem to be sex specific. The movement of individuals across the longitudinal borders of the Areas V and VI has important implications for the allocation of historical catches from the Antarctic.

SC/59/SH15 was presented, in which the interchange and isolation of individual humpback whales between wintering grounds of Oceania (South Pacific) and the east coast of Australia were documented by individual identification photographs collected from 1999 to 2004. Interchange was assessed using regional catalogues of fluke photographs, totalling 692 individuals from Oceania (represented by New Zealand, New Caledonia, Vanuatu, Fiji, Samoa, Tonga, Niue, Cook Island, French Polynesia and American Samoa) and 1242 individuals from Hervey and Byron Bay representing the southbound and the northbound migration along the east coast of Australia (EA). Overall, there were seven documented movements between EA and Oceania. Four instances of movement by four individuals were documented between EA and Oceania, all between EA and the closest breeding grounds of New Caledonia. A further three movements were recorded between EA and a small catalogue (n = 13) from the New Zealand migratory corridor. During this same period, 20 cases of interchange were documented among nine breeding grounds: French Polynesia, Cook Islands, Niue, American Samoa, Samoa, Tonga, Fiji, Vanuatu and New Caledonia. The low level of interchange between Oceania and the east coast of Australia and the movement across Oceania (including interchange across the boundaries of Areas V and VI) have important implications in understanding the stock structure and abundance of humpback whales in the South Pacific. Future work is planned to expand the synoptic network and gather more photographs.

The sub-committee welcomed papers SC/59/SH14 and SC/59/SH15 as they address issues previously identified as critical for the assessment of humpback whales in breeding stocks E and F. In discussion, it was suggested that the photo identification data be combined with other methods such as satellite tagging and genetic data in order to more fully elucidate stock structure. In response the authors described an extensive genetics project in progress across the region, along with a forthcoming satellite tagging program in New Caledonia and the Cook Island. Another upcoming project in southeast Australia (Eden) plans to deploy satellite transmitters in whales migrating north at the start of the breeding season, in order to determine their final breeding ground destination.

SC/59/SH16 reported on the first successful satellite-monitored tracking of a humpback whale from breeding stock F, in the Cook Islands. A female accompanied by a first-year calf was tagged on 10th September 2006, off Rarotonga. The tag initially transmitted for 15 days, during which the whale remained in the vicinity of Rarotonga. The tag did not return data for three months, then resumed transmissions on 24th December, at which point the whale was approximately 3000 km south of French Polynesia and heading towards the Antarctic. The tag continued to transmit for another 31 days, during which time the whale migrated steadily south or southeast, covering an average of 90 km per day. The last position was recorded on 23rd January 2007 at approximately 900km north of West Antarctica and the Amundsen Sea, and some 7 degrees of longitude west of the eastern boundary of Area VI. This is the first confirmation of the migratory destination for a whale from breeding stock F, and implies that at least some humpbacks wintering in the Cook Islands feed in the waters of Area VI. However, given that the whale's last recorded location was only about 400km from the Area VI/Area I boundary, some interchange between these two management areas appears likely. The whale appeared to still be migrating at the time the last transmission was received, suggesting that she had not yet reached her summer feeding ground.

It was observed that this paper provides an argument for moving the IWC boundary delineating feeding Areas VI and I from 120°W to 110°W. Some agreed with this observation but strongly cautioned conclusions based on a single individual. In discussion, it was noted that whales have been known to cross boundaries of the IWC Management Areas (e.g. Discovery Mark data) and that data from a much greater sample size over a longer period of time would be needed before justifying moving boundaries. The reasons for lack of transmission over three months were discussed. It was noted that photographs of the whale in the first two weeks after deployment showed that the transmitter was migrating into the whale's body. It was assumed that the transmitter remained unexposed throughout that period and began to transmit after exposure. It was observed that by back-tracking from the time transmission was regained, assuming that the whale maintained speeds similar to that observed during migration, an approximate date that the whale left the Cook Islands and began to travel south could be estimated.

SC/59/SH18 documented the migratory movements of three humpback whales between the E1 breeding area (eastern Australia) and the Area V Antarctic feeding grounds through photo-identification. Comparisons between a Balleny Island fluke catalogue (11 individuals), and fluke catalogues from Hervey Bay (1556 individuals), Byron Bay (916 individuals), Ballina, (648 individuals), New Zealand (41 individuals), Fiji (3 individuals) and Samoa (2 individuals) yielded three matches between the Balleny Islands and Hervey Bay, Byron Bay and Ballina. Only three previous individual matches have been reported between the E1 breeding grounds and Antarctic Area V feeding grounds.

The report of the 2007 annual meeting of the South Pacific Whale Research Consortium was presented in SC/59/SH19, and it continues to grow in size and scope. The Consortium consists of 100 or more scientists and their affiliates in a wide variety of locations ranging from eastern Australia to Oceania and western South America. The report summarised the activities during 2006 of Consortium scientists in their various study areas as well as broader collaborations and management-related activities throughout the Oceania region. Some of the more significant results of Consortium activities are reported in SC/59/SH12 as well as in SC/59/SH14-16.

SC/59/SH20 presented evidence of Soviet humpback whale catches in Tonga and Fiji. The source of this information was a local whaling story from Tonga, but no details were available with regard to dates or catch size or which factory fleet had been involved. In discussion, it was noted that the most likely candidate was *Sovietskaya Rossiya*, which could easily have transited these areas en route to/from her home port of Vladivostok; efforts to seek records or people to confirm this report were underway. Such catches, if they occurred, would further explain the lack of recovery in these two locations, notably Fiji, where recent surveys had found very few whales relative to the situation during Dawbin's surveys there in the late 1950's. A few alternative candidate factory ships that might have whaled in Tonga were mentioned. However, given that the home port of the *Sovietskaya Rossiya* is Vladivostok and the captain had a reputation for opportunism, this ship seems a particularly likely candidate. It was noted that humpbacks remain very low in abundance in Fijian waters (Gibbs *et al*. 2006).

The sub-committee also expressed its appreciation for the papers presented above and encourages further development of the research reported.

6. ANTARCTIC HUMPBACK WHALE CATALOGUE

SC/59/SH17 provided an interim progress report of the Antarctic Humpback Whale Catalogue (AHWC). During the contract period, the AHWC catalogued 418 photo-identification images representing 288 individual humpback whales from Antarctic and Southern Hemisphere waters. These images were submitted by 38 individuals and research organisations bringing the total number of catalogued whales to 3023. Photographic comparison of submitted photographs to the AHWC during the contract period yielded 85 previously known individuals. Matches made during the contract period to previously sighted individuals include resightings between Ecuador and the Antarctic Peninsula (3), and within-region resightings in the Antarctic Peninsula (9), Brazil (59), Ecuador (15) and E. Australia (1). Analysis of photographs from the IWC SOWER cruises (2001 to 2006) almost is complete and will be made available, according to IWC policy, in the public access catalogue. Efforts continue to stimulate submission of opportunistic data from eco-tourism cruise ships in the Southern Ocean, as well as from research organisations and expeditions working throughout this region and in the Southern Hemisphere. AHWC provides a unique clearing house for such data, making the photographs and analyses available to other researchers.

The sub-committee welcomed this report and recommended that this work continues.

7. IN-DEPTH ASSESSMENT OF SOUTHERN HEMISPHERE BLUE WHALES

7.1 Report of the intersessional email group

Bannister presented a report on the intersessional email working group on blue whales with a compilation of a synthesis document, which incorporated new data from papers presented to the present meeting. The sub-committee thanked Bannister for the work of his group.

The Chair indicated that a Working Group (Bannister [chair], Branch, Brownell, Butterworth, Donovan, Double, Ensor, Galletti, Hucke-Gaete, Kato, Nishiwaki, Zerbini) should meet after the discussion of papers presented to this meeting to identify future work towards blue whale assessments. The terms of reference of this group are: (1) identify populations/geographical groups for which assessments could be undertaken, (2) identify those for which assessments can be initiated now, (3) identify tasks needed, those who could undertake the work and timeline for the work to be completed, and (4) prioritise the tasks identified in (3). This further discussed in the work plan under item 9 below.

7.2 Distribution, movements and stock structure

SC/59/SH1 summarised preliminary results of land- and boat-based studies of blue whales off Isla de Chiloé, Chile, in 2007. During 36 days of land based observations, a total of 547 groups comprising 653 individuals were recorded, with group sizes ranging from 2 to 44 individuals (mean 18.1). A total of 123 groups (156 individuals) were sighted during 15 photo-id surveys; 74 and 80 whales were identified from right and left side markings. These included 9 between-year and 14 within-year recaptures (right side) and seven between-year and 16 within year (left side). The current photographic catalogue includes 143 individuals (left side) and 137 (right side). The surveys provide evidence that the feeding area off southern Chile is extensive and dynamic; there was an overall return rate of 10.8% (left side) and 11.4% (right side). A total of 42 out of 80 individuals recorded in 2007 were skinny, the highest proportion recorded to date; it is not clear whether this is a significant problem in this population.

In response to a question, it was observed that mark-recapture analysis and line transect aerial surveys are underway and abundance estimates should be presented in the future. It was noted the sub-specific identity (true vs. pygmy blue whale) of whales in Chilean waters was currently unresolved. In this regard, it was mentioned that it was possible to distinguish between the subspecies by examining photographs of the shape of the head (rounded in true blue whales versus more pointed in pygmy blue whales). It was suggested that photographs from the aerial surveys conducted off Chile be examined to address this question. It was observed that skinny blue whales had also been observed off California, and that in some cases (including in Chile) the condition of individually identified whales had been observed to improve over the course of the feeding season, or in different years. The sub-committee encouraged further research (e.g. examination of full-core blubber biopsies) to assess the long-term health status of these whales.

Hucke-Gaete presented information from a land-based platform (elevation 77 m) in the Corcovado Gulf, southern Chile, obtained from 25 January to 7 April 2007. A total of 205 groups comprising 326 animals were observed, with from 0 to 19 groups (mean = 5.5, 95% CI = 3.5-7.5) seen per day. Mean group size was 2 (range: 1-8) and sighting distances ranged from 4 to 20 nautical miles (mean 13 nm). Sightings varied considerably and blue whales frequently move between local feeding areas as suggested by satellite transmitters. Diel variations in sighting rates could be related to availability of krill in the water column.

In discussion, the reliability of identifying whales to species at considerable distances (e.g. 20 miles) was highly questioned. There were opposite views to this matter from Hucke-Gaete. It was suggested that species determination conducted independently from land and from a boat should assist to clarify this issue. In response to a question about the presence of blue whale calves in the area, it was noted that 11 calves had been observed from aerial surveys or from boats. Galletti presented additional information on the 2007 field season off Isla de Chiloé, which indicated that species identification was not possible unless whales were relatively close to shore.

SC/59/SH5 examined the seasonal occurrence of low-frequency whale vocalisations across eastern Antarctica and southern Australia. A three-year hydro-acoustic record (<~100 Hz) from the Comprehensive Nuclear-Test Ban Treaty Organisation was obtained from lower latitude waters off Western Australia between January 2004 and February 2007. Bottom mounted autonomous recording packages (ARPs) were deployed off eastern Antarctica in the waters near Casey station from February 2004 through February 2005, and near Prydz Bay and the southern Kerguelen Plateau from February 2005 through February 2007. The ARPs continuously recorded low frequency (<250Hz) sounds over these periods. Three additional acoustic loggers (recording <2000Hz) were deployed roughly along a line of longitude between Tasmania and the Antarctic continent between October 2006 and February 2007. Power spectral density (PSD) analyses of the frequency bands of blue (Antarctic and pygmy) and fin whale calls was carried out. The peak acoustic presence of pygmy blue whales that occurred at the more northerly recording sites was consistently earlier (March-May) than peak Antarctic blue whale acoustic presence (May-August) at these sites. At the northerly CTBTO site, fin whale and Antarctic blue whale acoustic seasonal presence appeared nearly identical. Fin whale acoustic presence in the Antarctic data appeared to be over a much shorter time (April-June) than Antarctic blue whales, which maintained some acoustic presence nearly year round, but had seasonal peaks between March and July/August.

In discussion, it was noted that the distance over which whale vocalisations could be detected varied depending on environmental conditions and also the methods and assumptions of analysis, but that underwater sound can travel distances on the order of thousands of kilometres and therefore it was theoretically possible that some energy from vocalisations originating in the Antarctic could add to the acoustic power measured off Australia. The sub-committee encouraged the authors to attempt to assess distances of calls whenever possible using arrays, although they acknowledged that there would be large errors in determining distances for very distant vocalisations. The low occurrence of blue whale vocalisations in the Antarctic in the summer feeding season was noteworthy.

In SC/59/SH23, blue whale calls were detected from data recorded over one year (2003/04) from six hydrophones from the International Monitoring System deployed offshore from Possession Island, Crozet Archipelago in the Indian Ocean. The low frequency (< 100Hz) sea noise spectrum was dominated by a band of sound at 18-35 Hz corresponding to abundant balaenopterid vocalisations, which exhibited a variation in intensity over the study period. Among the calls detected, Antarctic blue whales and “Madagascar-type” pygmy blue whales were clearly identified. The variation in call number over one year revealed different patterns of whale occurrence. Antarctic blue whale calls were the most commonly recorded and their year-round detection suggests an annual presence in the sub-Antarctic/Antarctic area. Pygmy blue whale calls exhibited a strong seasonal pattern with no calls in winter. These results suggest either an interruption in vocal activity or that whales leave the sub-Antarctic waters to go north.

SC/59/SH7 provided information length and ovarian corpora from Soviet expeditions to the Antarctic and throughout the Indian Ocean during 1961–71. This was not previously available for analysis, but was translated and encoded. Ovarian corpora are added during ovulation and remain as permanent marks. The Soviet data allow for estimates of length at sexual maturity for pygmy blue whales as a whole and divided into regions and small areas. The estimated length at which 50% of females reach sexual maturity (L50) is 19.2 m (95% Bayesian interval 19.1–19.3 m), and 95% reach maturity at 20.5 m (95% interval 20.4–20.7 m). Soviet vessels recorded 32 times more data under the legal minimum length of 70 ft (21.3 m) compared to Japanese vessels, thus these estimates are more precise than possible from the Japanese data. Regional estimates of L50 differ little, but are all much shorter than in the Antarctic region. The L50 of northern Indian Ocean whales were significantly shorter but this difference was only 0.5–0.6 m. Finally, there was some evidence of a small proportion (<1%) of both Antarctic blue whales north of 52°S and pygmy blue whales south of 56°S.

Branch *et al.* (in press) examined the catch lengths of sexually mature female blue whales to estimate the proportions of pygmy and Antarctic blue whales. A mixture model was fitted to the data, and estimates made of the proportion of pygmy blue whales in different areas and time periods (pre- and post-1937, when the minimum length regulation was introduced). The data indicated substantial rounding to the nearest 5-ft interval, therefore the proportion of rounding as also estimated in the model. Antarctic blue whales dominated catches south of 52°S (99.2%), while pygmy blue hales dominated (99.9%) catches north of 52°S and in 35°–180°E. South of 60°S, where the IDCR/SOWER surveys were conducted, only 0.7% (95% credibility interval 0.5–1.0%) of catches were pygmy blue whales. Shore-based catches from SW Africa, and in early years from South Georgia and the South Shetlands were estimated to contain 0–2% Antarctic blue whales. Actual proportions in these areas were probably higher but rounding (up to 19% of records), poor length estimation methods and other problems likely introduced bias to the estimates. The mixture model provided good fits to all regions except Chile, where the mean length (23.5 m) was intermediate between pygmy blue whales (21.0 m) and Antarctic blue whales (83.4–86.3 m), and there was no suggestion of bimodality in the lengths. A good fit to the Chilean data was only obtained by assuming that these blue whales are a separate subspecies or distinctive population. This finding is consistent with their discrete distribution, and differences in genetics and call types compared to Antarctic and pygmy blue whales. South-east Pacific blue whales should therefore be managed as a separate entity by the IWC.

Branch *et al.* (2007) is an update of SC/58/SH16. It reviewed past and present distribution, densities and movements of blue whales in the Southern Hemisphere and northern Indian Ocean. Several new data sources were included: JARPA and Chilean sightings, acoustics data, and a comparison of the distribution with oceanographic processes. New maps showed the effort expended during the IDCR/SOWER and JSV databases, and the proportion of catches that were blue whales in the widespread Soviet pelagic catches. Sighting effort was 7,480,450 km plus 14,676 days of unmeasured effort; and this is added to 303,239 catch locations, 103 strandings, 2191 Discovery mark locations and 95 recoveries, and many acoustic records. Crude sighting rates were much higher in the northern regions inhabited by pygmy blue whales, and in the south-east Pacific, than in the Antarctic or on the east coast of South America. Blue whales are not found throughout the region, but are almost absent from the oligotrophic central gyres of the Indian, Pacific and Atlantic Oceans. Antarctic blue whales were exceedingly rare and concentrated closer to the pack ice than historical catches. At least four groupings of pygmy blue whales were identified: northern Indian Ocean, from Madagascar southwards to the Sub-Antarctic, Indonesia to western and southern Australia, and from New Zealand northwards to the equator. South-east Pacific blue whales were distinctive in their distribution, acoustics, length frequencies and genetics, and should be managed separately from Antarctic and pygmy blue whales.

LeDuc *et al.* (in press) summarised analyses of genetic variation in Southern Hemisphere blue whales, in an effort to distinguish true and pygmy blue whales, and detection of mixing of the two subspecies on the feeding grounds. There was no attempt to detect population differentiation within ocean basin, but instead samples were divided into three large areas: the Southern Ocean, the Indian Ocean and the southeast Pacific. Analysis focused on mtDNA (control region) and seven microsatellites. Each of the three strata was highly differentiated from each other in both markers. In response to a question about whether Chilean blue whales were genetically different from other groups, it was noted that it was not possible to assess this with existing samples, notably given that the southeast Pacific sample set came from places other than Chile and that the northernmost sampling area (Ecuador) could conceivably have included incursions by northern animals. It was noted that no attempts to screen for multiple sampling of the same individuals were made in the paper. It was also noted that as yet there was no comparison between Southern and Northern Hemispheres. In this respect, the sub-committee was informed that since the analysis presented in LeDuc *et al.* (in press), there have been a large number of biopsy samples collected from southern hemisphere blue whales, including samples from Australia, Chile and Antarctica. These samples, plus ones to be collected, will be used to conduct research projects on regional variation in Australian waters, and for similar studies in Antarctica and the eastern North and South Pacific and within the eastern South Pacific. It is expected that the interested genetic researchers from Australia (Double, Moller), and the US (LeDuc, Rosenbaum) will collaborate by exchanging samples from the Southern Hemisphere, including data and markers. The Australian researchers will conduct research on geographic variation in that region, the US (LeDuc and Brownell) in all the eastern Pacific, Rosenbaum and Hucke-Gaete in the eastern south Pacific (Chile; and possibly the Ecuador, Peru and the Eastern Tropical Pacific). The Chilean researchers (Galletti Vernazzani, Hucke-Gaete and others) will work with LeDuc and Rosenbaum on regional studies, and the US researchers on the Antarctic blue whales collected from SOWER cruises. For some of these populations, the sample size relative to the population size may be large enough to enable individual-based analyses, such as mark-recapture or relatedness. In addition, an analysis of global variation, incorporating samples from the north Pacific, will be conducted as an extension of the LeDuc *et al.* (in press) paper.

7.3 Abundance estimates

SC/59/SH8 presented blue whale abundance west of Chile. The 1997/98 SOWER cruise surveyed from the 12 nautical mile Chilean territorial waters westwards at latitudes of 18°30'S to 38°S between December and early January. Estimated abundance of blue whales in this region was 452 (95% CI = 160–1,300) using line transect analyses in the Distance program. When transit legs were additionally included, the estimate is higher but is not considered reasonable because the resulting search half-width was much narrower than in previous blue whale analyses. When applied to the entire Chilean population of blue whales, this estimate is substantially negatively biased because inshore regions, including Chiloé Island and the Gulf of Corcovado (38°S to 44°S), were not surveyed.

In discussion, the extent to which the negative bias occurred was questioned. It was noted that while some whales could be presented in inshore waters, it was unlikely that animals were in the Isla de Chiloé region at the time of the 1997/98 SOWER survey. Evidence was presented that whales move south and arrive to the feeding grounds near Chiloé in late January to late February. It was also observed that a major El Niño

Southern Oscillation event occurred in the eastern Pacific during 1997/1998 and this could have played an important role on the distribution on blue whales at the time of the survey. In contrast, 20th century whaling and sighting data showed that whales were recorded in southern Chile during winter months (Tønnessen & Johnsen, 1982), suggesting some individuals may be year-round residents. It was suggested that a regime shift that occurred in the South Pacific after 1985 could have influenced distribution patterns in recent years. It was concluded that the presence of whales in inshore (or offshore) areas likely resulted in a negative bias in the abundance estimate, but the question of whether whales were in Chiloé during the survey remains unresolved. It was noted that the data analysis in SC/59/SH8 were conducted with design-based methods, which may not be appropriate given the non-uniform coverage of the survey region. It was then suggested that this estimate could be revised with more appropriate data analysis methods (e.g. a model-based approach).

SC/59/SH10 summarised distribution and abundance estimates of pygmy blue whales off the southern coast of Australia from a joint Japanese/IWC cruise from 4 December 1995 to 3 January 1996. The main purpose of the cruise was to obtain information relevant to developing shipboard identification methods for separating true and pygmy blue whales, including acoustics, biopsy samples, photo-identification, video and photogrammetry. A total of 60 blue whales including 40 pygmy blues were found in inshore waters off Western Australia; abundance estimation had not previously been completed. Abundance was estimated at 671 (95% CI = 279-1,613) for waters bounded by latitude 35ºS and 45ºS, and longitude 115ºE and 125ºE; the estimate was based on 23 sightings of 28 pygmy blue whales obtained from a joint Japanese/Australian project in 1993.

In discussion, it was noted that the estimate in the same paper for southern right whales was likely biased high, it was questioned whether the same bias was likely to be present in the blue whale estimate. In response, it was noted the CVs of the blue whale estimate was high, but the abundance should not be biased. After some discussion, the sub-committee was notified that that the methodology and analysis of SC/59/SH10 were being reviewed.

SC/59/SH9 contained an update of blue whale abundance estimates south of 60°S from the IDCR/SOWER sets of circumpolar (CP) surveys: 1978/79–1983/84 (CPI), 1985/86–1990/91 (CPII) and 1991/92–2003/04 (CPIII). Strata totalled 64.3%, 79.5% and 99.7% of the ice-free area south of 60°S. Blue whales were rarely sighted during the surveys, with sighting rates (schools per 1000 km of primary effort) averaging 0.24 (CPI), 0.36 (CPII), and 0.78 (CPIII). Abundance estimates were 453 (95% CI = 212-963), 559 (5% CI = 232-1,341) and 2,280 (95% CI = 1,150-4,519) with approximate mid-years of 1980/81, 1987/88 and 1997/98. The CPIII abundance estimate is the most recent, and most complete, for Antarctic blue whales. These estimates are negatively biased because they exclude some blue whales north of 60°S and because a small number of blue whales on the trackline may have been missed. Although these estimates are assumed to apply to Antarctic blue whales, a small proportion, no more than 1%, may have been pygmy blue whales.

7.4 Trends in abundance

SC/59/SH9 provided an estimate of the trend in abundance of blue whale in the Antarctic based on abundance estimates from IDCR/SOWER adjusted for unsurveyed northern areas. A rate of increase of 8.2% (95% CI 3.8–12.5%) per year between 1978/79 and 2003/4 was computed.

7.5 Preliminary assessments

SC/59/SH8 provided a preliminary assessment of the status of the south eastern Pacific (Chilean) blue whale population. A simple logistic model was used to fit the abundance estimate (presented in Item 7.3), under three growth rate scenarios (r = 0%, 5% and 10%) and two historical catch scenarios. In the first, only catch allocated to Chile (as described in the IWC catch database) was used. In the second, all catches taken in Chile, Peru and Ecuador were used. Unspecified cetacean catch in Chilean waters was assumed to comprise 31.5% blue whales. According to the scenarios explored, this population was at a minimum of 7-23% of pre-exploitation levels in 1997. This suggests that blue whales found in Chilean waters are less depleted than those found in Antarctic waters (which remain at less than 1%, Branch *et al.*, 2004). In discussion, it was noted that previous work by Chilean scientists (reference) suggests the IWC catch data may be incomplete and the sub-committee recommended that further work be conducted to examine this issue.

7.6 Other

SC/59/SH21 described three types of skin lesions on blue whales found off the north western coast of Isla de Chiloé observed from an examination of identification photographs of 68 individuals. Lesions can be classified in three types: (1) lesions caused by cookie-cutter shark bites, (2) blister (or vesicular) lesions (possibly caused by chalisivirus, a type of poxvirus), and (3) 'tattoo-like' skin lesions, similar to poxvirus lesions. The second type of lesion was observed on 52 animals, while the third type was observed on one animal. Blister lesions and chalisivirus infections have been reported for other cetaceans. Skin tattooing is characteristic of cetacean poxvirus infections. If poxvirus is present in the Chilean blue whale population, this has implications for conservation management and the authors suggest that photographs and stranding data from these species are examined with a view to detecting the extent of infection. Mattila noted that lesions with similar appearance have been observed on humpback whales in American Samoa. The sub-committee agreed that populations of large whales should be monitored in order to better understand the implications of these lesions for the populations.

SC/59/IA10 described the archiving and analysis of blue whale photographs collected from 18 IDCR/SOWER cruises. Over 21,000 photographs have been collected from all 6 IWC management areas and represent 309 individually identified animals. Digitising of these photographs is currently under way. Photographs taken from IWC management Area IIIW have been cross-referenced and yield a within-year re-sighting rate of 11% in 2005/2006 and 6% in 2006/2007. All re-sightings were made between 4-15 days apart and over distances of between 58-134nmi. No between years re-sightings have yet been observed. This work is considered preliminary as a full analysis of these photographs has not been completed. In response to a question about the potential bias on sight-resight rates due to re-surveying of the same area, it was noted that the additional years of data would assist in clarifying the extent of this bias. The sub-committee welcomed the work presented and recommended its continuation in the future.

8. OTHER

SC/59/SH13 summarised recent sightings of sei whales in the western South Atlantic Ocean, where historical records are scarce. Opportunistic sightings of these animals were made from land in Golfo San Jorge, Argentina, and from an airplane near the Malvinas/Falkland islands between 2004 and 2006. A total of 17 sightings of groups containing up to 20 individuals were reported. Feeding was observed in the same region in

February and March. No calves were reported. The paper indicated that further studies of sei whales in this region would provide a better understanding of the status of these whales.

SC/59/SH22 reported on a summer sighting of a loose aggregation of 11 smallish fin whales off Callao, central Peru, on 3 March 2007. All whales were photo-identified. The low-latitude summer occurrence raises questions about seasonality, but 20th century whaling records of fin whales off Peru confirmed that they are present year-round; in the 1960-70s catches peaked in summer months. Whalers reported most were juveniles due to their small size, however no physical evidence of maturity status exists. The Callao fin whales were also smallish and showed a nondescript, dusky colouration without marked head blazes or chevrons, although the lower right jaw was characteristically light in colour. Clarke (2004) suggested the existence of a dark, small-bodied ('pygmy') fin whale, possibly with black baleen, in the Southern Hemisphere, he referred to as *B. physalus patachonica*. A critical reading of Burmeister's (1865) description of *B. patachonica* points to an unusual combination of fin whale morphological features while others, including of nasal bones, do not match *B. physalus*. Follow-up work, amongst others, will include a re-examination of *B. patachonica* type specimens, fin whale biopsy sampling and photo-identification effort off Peru, but also off Ecuador and northern Chile and sound recordings. The taxonomic position of *Balaenoptera tschudii* Reichenbach, 1846 or 'Peruvian finner' (Gray, 1866) should also be revisited.

In discussion, it was suggested that these whales may not correspond to a sub-species, but to be members of a fin whale species complex (for example 'fin-like whales') similar to what is seen for Bryde's whales (e.g. *Balaenoptera omurai*, 'a Brydes-like whale'). It was questioned whether these whales could correspond to blue/fin whale hybrids, which have been observed in other areas. The preliminary nature of these observations was stressed and it was noted that a comparison with other balaenopterid species has not yet been performed.

9. WORK PLAN AND BUDGET REQUESTS

Given discussions in item 5 regarding the research required to advance with the assessment of Southern Hemisphere humpback whales, the sub-committee identified that the following work needs to be conducted intersessionally for the completion of assessment of stocks B and C. The items in the section below are listed in order of priority, with those identified to undertake the work in parentheses. Items numbers (1) to (3) require completion before SC60.

(1) Abundance be estimated from populations B1 and C3 using available photographic and genetic data (Rosenbaum, Cerchio and Collins with cooperation from Hammond)

(2) Use available genetic and photographic data from areas B1 and B2 and C1 and C3 to estimate recaptures between these regions.

(3) Re-examine the genetic data available for B1 and B2, in order to determine the level of differentiation between these two areas. Temporal differentiation will be explored, both in terms of allelic turnover, and by testing for differentiation between summer and winter samples of B2 (Rosenbaum)

(4) Compare genetic data from B1 and B2, and C1 and C3, with genetic data from the Antarctic feeding grounds associated with B and C in order to estimate proportional representation on the feeding grounds. (Rosenbaum)

(5) Population assessment modelling to be conducted on completion of steps (1) to (3) above following recommendations in items 5.2.4 and 5.3.4 (Johnston and Butterworth).

These items have financial implications for the sub-committee. A funding proposal to conduct this work by SC60 is presented in Appendix 3. Another item with financial implications is the Antarctic Humpback Whale Catalogue with a budget of £6,600.

The sub-committee received a report of the Working Group formed under item 7.1 to review research requirements needed to proceed with the assessment of Southern Hemisphere blue whales. The working group reviewed the groupings designated in a summary table prepared intersessionally and updated by information available at the meeting. It further amended the table by including 'Indonesia' within 'East Indian Ocean', and adding 'Western South Atlantic', 'South West Pacific, including New Zealand' and 'Eastern Tropical Pacific' (i.e. separate from Peru). The revised table is attached as Appendix 2

The group recognised that to undertake assessments it is necessary to have acceptable abundance estimates. The Working Group agreed that while the existing estimates for several areas (Eastern Indian Ocean, Chile, Western Indian Ocean) could be regarded as minimum estimates, only those for the Antarctic as a whole are currently sufficient for assessment purposes. It might be possible to consider the Western Indian Ocean as a candidate, but the extent to which the Madagascar Plateau estimate is representative of the whole population is unknown; in the current state of knowledge extrapolation would not be appropriate.

For an assessment of the Antarctic as whole, the following would be necessary, in order of priority; those who should undertake the work are indicated:

(1) to investigate possible stock structure:
   a. match existing photo-id catalogues, including JARPA (Olson)
   b. analyse existing Antarctic (true) blue biopsy samples, including JARPA (LeDuc)
   c. investigate JSV sightings data for possible aggregations (Japanese scientists)

(2) analyse catches, both from the Antarctic and elsewhere, to separate Antarctic from pygmy blue whales (Branch)

(3) locate the CPUE data used by the sub-committee of Three/Four in the early 1960s (IWC Secretariat)

(4) to obtain biological parameters:
   a. investigate likely increase rates (Branch)
   b. investigate age at maturity (from Soviet earplugs - Branch)

(5) update JARPA abundance estimate/s (Japanese scientists)

The sub-committee agreed with the proposed work plan.

Item (2) above has financial implications with a budget of £3,300. A proposal to conduct this work is presented as Appendix 4.

10. ADOPTION OF REPORT

The Report was adopted on 14 May 2007 at 9:20pm. The Chair thanked the participants for all their hard work and expressed particular appreciation to the rapporteurs. The sub-committee thanked the Chair and the rapporteurs for the successful completion of the report.

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Appendix 1

AGENDA

1. Introductory Items
   1.1. Opening remarks
   1.2. Election of Chair
   1.3. Appointment of rapporteurs
   1.4. Adoption of Agenda
   1.5. Review of documents
2. Finalisation of Soviet catch data series
3. Issues related to N_{min} and depensation for modelling of humpback whales
4. Humpback whale distribution at mid-latitudes based on historic catch and JSV data
5. In-depth Assessment of Southern Hemisphere humpback whales
   5.1. Stock structure in the feeding grounds
   5.2. Breeding Stock B
      5.2.1. Distribution, movements and stock structure
      5.2.2. Abundance estimates
      5.2.3. Trends in abundance
      5.2.4. Preliminary assessment
   5.3. Breeding Stock C
      5.3.1. Distribution, movements and stock structure
      5.3.2. Abundance estimates
      5.3.3. Trends in abundance
      5.3.4. Preliminary assessment
   5.4. Other Southern Hemisphere humpback whales Breeding Stocks
6. Antarctic Humpback Whale Catalogue
7. In-depth Assessment of Southern Hemisphere blue whales
   7.1. Report of the intersessional email group
   7.2. Distribution, movements and stock structure
   7.3. Abundance estimates
   7.4. Trends in abundance
   7.5. Preliminary assessments
   7.6. Other
8. Other
9. Work Plan and Budget Requests
10. Adoption of the Report

Appendix 2

SOUTHERN HEMISPHERE BLUE WHALES: SUMMARY OF CURRENT KNOWLEDGE

(1) 'Grouping'		**(2) Feeding grounds**	**(3) Migration routes**	**(4) Breeding grounds**	**(5) Commercial**	**(6) Subsistence**	**(7) Population abundance**	**(8) Population trend**	**(9)-(11) Biological parameters**	**(12) Env concerns**	**(13) Ass. models**	**Remarks**
Antarctic	Antarctic (Antarctic blue) All Areas	Areas I-VI	At Crozet Archipelago (*ca* 48°S) Antarctic blue calls detected year round[1] Near Kerguelen (*ca* 62°S, 81°E), Casey (*ca* 64°S, 112°E) and Prydz Bay (*ca* 66°S,75°E), Antarctic blues acoustically detected nearly year-round but peaking March-August[2]		See IWC database		1980/81, 453 (CV 0.40); 1987/88, 559 (CV 0.47); 1997/98, 2280 (CV 0.36) (all negatively biased). Still <1% of pre-exploitation abundance[3]	8.2% (3.8-12.5%)[4]	Length @ sex. maturity, (50% mature) 23.4m (22.9, 23.9)[5]		Line transect/ DISTANCE analysis	See Branch *et al* SC/59/For Info 26 for overview of blue whales in S Hemisphere
	Antarctic Areas IIIE to VIW (Antarctic blue)	Areas IIIE-VIW			See IWC database		2003/04, Area IIIE 546 (CV 0.34), Area IV 78 (CV 0.74). 2004/05, Area V 489 (CV 0.75), Area VIW 152 (CV 0.38)[6]				Line transect/ DISTANCE analysis	
East Indian Ocean [Pygmy blue]							1993, for area 35°S-45°S, 115°-125°E, 671 (289-1557)[7]		Length @ sex. maturity, (50% mature) 19.4m (19.2, 19.6)[9]		Line transect/ DISTANCE analysis	
	W. Australia – Perth Canyon/Geographe Bay [presumed pygmy blue]	Perth Canyon[10]	At least *ca* 30°S to 45°S At C. Leeuwin, Western Australia, (*ca* 34°S, 115°E), pygmy blues peaked acoustically March-May[11]		Soviet catches 1965, +?, see IWC database		a) 1995/96, shipboard survey, 12 (1-100)[12] b) 2000-2006, aerial survey, Perth Canyon, peak season Feb-March: average abundance over the 7 yr period 30 (18-49)[13]		Length @ sex. maturity, (50% mature) 19.3m (19.1, 19.6)[14]		a) Line transect/ DISTANCE analysis b) ditto	
	Southern Australia, Bonney Upwelling region, Vic/SA [presumed pygmy blue]	Bonney Upwelling, Vic +?[15]			Soviet catches 1965, +?, see IWC database		1995/96, shipboard survey, 12 (7-18)[16] 50 (max no seen in one day excluding resights)[17] 20 (max seen in one day 2006)[18]			Seismic activities[19]	Line transect/ DISTANCE analysis	Research info and metadata available
	Indonesia											
West Indian Ocean [Pygmy blue]	Madagascar Plateau	Off southern Madagascar+?[20]	Pygmy blue calls detected at Crozet Archipelago , *ca* 48°S,		Soviet catches, see IWC database		424 (CV 0.42) or 474 (CV 0.48), possibly only 1/3 of total pop[20]		Length @ sex. maturity, (50% mature) 18.9m		Line transect/ DISTANCE analysis	

(1) 'Grouping'		(2) Feeding grounds	(3) Migration routes	(4) Breeding grounds	(5) Commercial	(6) Subsistence	(7) Population abundance	(8) Population trend	(9)-(11) Biological parameters	(12) Env concerns	(13) Ass. models	Remarks
			mainly Dec-July, almost absent in winter[21]						(18.6, 19.2)[22]			
Central Indian Ocean	Kerguelen, ca 50°S, 70°E [pygmy blue]	Kerguelen area[23]			[see IWC database]		Initial 7600-11000, reduce- ed to 6000 by 1963/64, for area N of 54°S, 0°-80°E[24]					
South Indian Ocean									Length @ sex. maturity, (50% mature) 19.3m (19.2, 19.5)[22]			
North Indian Ocean									Length @ sex. maturity, (50% mature) 18.8m (18.6, 19.0)[22]			
SE Atlantic												
WS Atlantic												
E. Tropical Pacific												
Eastern South Pacific	Peru [presumed pygmy blue]	S of 4°S, E of 83°W, within 60nm of the coast[25]			See IWC database?		16 separate individuals sighted, Dec 1982[25]					
	Chile (18°30'S-38°S)						452 (160-1300), SOWER survey 1997/8, minimum 7-23% of pre-exploitation level (excludes S. Chile as below)[26]				Line transect/ DISTANCE analysis	
	Southern Chile	Southern Chile, 41-44°S[27]	Between Corcovado Gulf (43S;74W) and the Nazca Ridge (20S;80W) off Antofagasta, Chile[28]		See IWC database?		143 individuals from photo-id (left side); 137 (right side)[27]	?	?	Shipboat strikes, Fisheries interactions Effects of marine debris and habitat degradation from productive activities such as salmon farming[29][		Of 80 individuals in 2007, 42 (56.8%) 'skinny'[30]
Western South Pacific, incl New Zealand												

References [1] SC/59/SH23; [2] SC/59/SH5**;** [3] SC/59/SH9; [4] SC/59/SH9; [5] SC/59/SH7; [6] SC/D06/J7; [7] SC/59/SH10; [8] SC/59/SH7; [9]SC/59/SH9; [10] SC/59/Progrep Australia; [11] SC/59/SH5**;** [12] SC/59/SH10; [13.] SC/59/Progrep Australia; [14] SC/59/SH7; [15] SC/59/Progrep Australia; [16] SC/59/Progrep Australia ; [17] SC57/Progrep Aust; [18] SC/59/Progrep Aust; [19] Morrice *et al*, 2004; [20] Best *et al.*, 2003**;** [21] SC/59/SH23; [22] SC/59/SH7; [23] Ichihara, 1966; [24] Ichihara and Doi, 1964; [25] Donovan, 1984; [26] SC/59/SH8; [27] SC/59/SH1; [28] Hucke-Gaete, 2004; Distribución, preferencia de hábitat y dinámica espacial de la ballena azul en Chile: 1997-2004. Doctoral thesis, Faculty of Science, Universidad Austral de Chile, 145+ pp.; Mate and Hucke-Gaete, in prep; [29] Hucke-Gaete, pers. Comm.; [30] SC/59/SH121

Appendix 3

SUMMARY PROPOSAL FOR THE ASSESSMENT OF SOUTHERN HEMISPHERE HUMPBACK WHALE

BREEDING STOCKS B AND C

Howard Rosenbaum

SHORT TITLE

Refining sub-stock structure questions and improving abundance estimates and assessment models for Southern Hemisphere humpback whales Breeding Stocks B and C

RELEVANT AGENDA ITEM (NO. AND TITLE)

Agenda Item 5. In-depth Assessment of Southern Hemisphere humpback whales

5.1 Stock Structure on the feeding grounds

5.2 Breeding Stock B (and most sub-items, especially 5.2.4, Preliminary Assessment)

5.3 Breeding Stock C (and most sub-items, especially 5.3.4, Preliminary Assessment)

BRIEF DESCRIPTION OF PROJECT AND WHY IT IS NECESSARY TO YOUR SUB-COMMITTEE

Stock Structure and Abundance Estimates

Expectations for completing the Comprehensive Assessment of Humpback Whales for Breeding Stocks B (BS B) and C (BS C) were laid out by the SH sub-committee in the SC58 work plan, along with the scale of work required to complete specific tasks recommended for BS B and BS C at the Intersessional Workshop on the Comprehensive Assessment of Southern Hemisphere Humpback Whales (IWC, 2006). At SC59, new information (SC/59/SH24) and previous reports (SC/A06/HW9 and HW10) were reviewed and discussed. The SH sub-committee identified a number of improvements that could be made intersessionally to provide additional and updated inputs for the modelling exercises presented in SC/59/SH3 and SH4. Previously, the Scientific Committee has indicated and endorsed that "…highest priority research is for studies of stock structure and movements for Breeding Stocks B, C, E and F, particularly those that will allow appropriate allocation of catches from the feeding grounds to breeding stocks" (IWC, 2006 – report from Hobart).

This emphasises the critical need for further data collection and basic research, beyond the reanalysis of existing data. Additionally, given the presentation and discussion of SC/A06/HW9 and HW10, remaining stock structure hypotheses in IWC (2006), recommendations from SC/58/Annex H, and the recommendations of the Working Group, we propose to refine sub-stock structure questions, assess the degree of interchange between sub-stocks in B and C using genetic and photographic information, and generate revised abundance estimates using additional years of genetic and photographic data. Specifically, we propose the following to be completed before SC60 as agreed by the SH sub-committee during SC59, listed in order of priority:

(1) A revision of the photographic (including data from 2004-2006) and genetic (including microsatellite samples mentioned in #1 above) capture-recapture abundance estimates for B1 and C3. Genetic samples are already available for this study (see #1). This will provide the best available information for abundance estimation and allow comparison for consistency

(2) Conduction of a complete comparison of photographs and genotypes between sub-stocks B1 and B2, along with C1 and C3 samples to assess the connectivity and exchange of individuals between these sub-stocks and thus to better quantify potential overlap in relation to the abundance estimates.

(3) A more in-depth analysis examining sub-stock structuring in the Breeding Stock B region (sub-stocks B1 and B2) accounting for temporal effects of sampling, as well as structuring on the feeding grounds in terms of mixing of whales between B1, B2, and IWC Management Areas IIE and III in the Antarctic. This will be accomplished using microsatellite loci and mtDNA sequences from samples from these regions that have yet to be analysed (2003-2006). This will not only augment the existing samples presented in SC/A06/HW38 and HW41, but will be used to focus on the degree of sub-structure using a larger sample.

(4) Examine genetic samples acquired in Antarctica (SOWER 2006/2007) and investigate genetic associations between these and breeding stocks B and C, in order to determine relative proportions of each stock on the feeding grounds. This will refine preliminary results (e.g. SC/59/SH24) with the purposes of: (a) investigating if there is any evidence of interchange between breeding stocks that is mediated through the feeding grounds and (b) assessing the extent of genetic signal between breeding and feeding regions that will help inform catch allocation in core, overlap, and fringe scenarios.

Population Modelling

Given the information above, population models using methods similar to those applied in SC/59/SH3 and SC/59/SH4 need to be developed, in particular to take account of further insights into mixing proportions on the Antarctic feeding grounds and overlap in abundance estimates for feeding grounds. Novel approaches might be required to relate matches between C1 and C3 photographs to the extent of any overlap in existing abundance estimates.

TIMETABLE

The researchers of this proposal will aim to have these results complete by SC60 and will exchange information at least two weeks before the meeting in Chile, including in the Convenor of the SH sub-committee. A proposed time lines is specified below:

July 15, 2007	Initial Planning meeting to review objectives of contract Start Genetic data collection

	Secure C1 photographs for analysis Initiate photographic analysis
December 1, 2007	Review progress and data on genotypic and photographic capture-recapture analyses (SMM meeting, Cape Town).
April 15, 2008	Complete microlocus genotype analysis (abundance, stock structure, and interchange) and undertake error check Initiate testing sub-stock structure questions Complete photographic-capture data for abundance estimation and C1 and C3 interchange.
May 15, 2008	Complete all revised analyses related to abundance estimation, stock structure, and interchange Provide information to Butterworth and Zerbini Email/Conference call to discuss model inputs Write reports
June 1, 2008	Rosenbaum group to present reports Butterworth/Zerbini Butterworth group to present revised analyses Develop plan to re-run analyses Meet Day before IWC SC60 to finalise results/reporting

RESEARCHERS' NAME

Dr. Howard C. Rosenbaum (Principal Investigator), Dr. Doug Butterworth, Dr. Salvatore Cerchio, Dr. Ken Findlay, Tim Collins, Dr. Sue Johnston.

ESTIMATED COST WITH BREAKDOWN AS NEEDED (E.G. SALARY, EQUIPMENT)

Total budget request: UK £37,000

Item	Purpose	Justification	Requested Budget (£)	
			Salary	Lab work/Other
(1)	Abundance estimation, B1 and C3	Graduate student to work full-time on analysis of microsatellite data. Additional advice from capture-recapture consultant	9,000	3,000
(2)	Estimate exchange between populations C1/C3 and B1/B2	Photo matching and genotyping of samples. Two photo matchers required. One lab technician.	12,000	5,000
(3)	Analysis of temporal stock structuring	Analysis of data from (2) above.	2,000	
(4)	Comparison of breeding ground genetic data with Antarctic data	Genotyping of SOWER samples (lab technician). Analysis of data.	2,000	3,000
(5)	Modelling	Conduct an assessment integrating existing data with those provided under (1)-(4)	1,000	
Cost			26,000	11,000

Appendix 4

SUMMARY PROPOSAL FOR ANTARCTIC BLUE WHALE ASSESSMENT

Trevor Branch

SHORT TITLE

Antarctic blue whale assessment

RELEVANT AGENDA ITEM (NO. AND TITLE)

Item 7. In-depth Assessment of Southern Hemisphere Blue Whales

BRIEF DESCRIPTION OF PROJECT AND WHY IT IS NECESSARY TO YOUR SUB-COMMITTEE

The sub-committee on Other Southern Hemisphere Whale Stocks agreed that sufficient data were available to produce an updated assessment of Antarctic (true) blue whales. The proposed here work would involve three main tasks:

1) Updating the catch series for this subspecies by splitting the historical catches between Antarctic and pygmy blue whales;

2) Updating a biological informative prior for the maximum rate of increase based on new data for biological parameters for blue whales;

3) Conducting an assessment of the population incorporating the revised IDCR/SOWER, JARPA and JSV data.

For item (2), some work would be required to estimate the age at sexual maturity from newly available Soviet earplug data. Approximate breakdown of the work involved would be 40% for the catch series, 10% for the biological prior, and 50% for the assessment itself.

TIME TABLE

Results would be presented at SC/60.

ESTIMATED COST WITH BREAKDOWN AS NEEDED (E.G. SALARY, EQUIPMENT)

The estimated cost of this proposal is £3,300