Annex G1

Report of the Working Group on the In-Depth Assessment of Western North Pacific Common Minke Whales, with a Focus on J Stock

Members: Kitakado (Chair), An, Baba, Berggren, Borodin, Brownell, Butterworth, Fujise, Goto, Hammond, Hatanaka, Hyugaji, Ipatova, Kanda, Kasuya, Kato, Kawahara, Kim, Lawrence, Miyashita, Morishita, Murase, Nakamura, Nishiwaki, Northridge, Ohsumi, Øien, Okamura, Northridge, Park, Pastene, Peel, Shimada, Skaug, Tanaka, Taylor, Tominaga, Wade, Walloe, Yamakage, Yasokawa, Yoshida, Young.

1. ELECTION OF CHAIR

Kitakado was elected Chair.

2. APPOINTMENT OF RAPPORTEURS

Hammond was appointed rapporteur.

3. ADOPTION OF AGENDA

The adopted Agenda is given in Appendix 1.

4. DOCUMENTS AVAILABLE

Available documents relevant to the Working Group were SC/58/NPM1-5, 7-8 and SC/58/O23.

5. REPORT OF INTERSESSIONAL WORKING GROUP

Pastene presented SC/58/NPM1, the report of the intersessional Working Group. Work that had progressed during the year on distribution and abundance included: a survey in the northern Sea of Japan in May-June 2005; a survey east of the Kuril Islands and Kamchatka in August-September 2005; a survey in the northern part of the Sea of Japan in spring 2006; and an analysis of data to estimate $g(0)$. Regarding stock structure, there had been successful collaboration between Japanese and Korean scientists to conduct microsatellite and mtDNA analyses on samples from both Korean and Japanese bycatches. Papers describing the work on distribution and abundance and on stock structure were presented to the meeting. Regarding total catches, work had been initiated on collecting information on Korean bycatch by area, month and year but this is a complex task and requires more time. In summary, substantial progress had been made since last year. Data are available under the Data Agreement Procedure B. Data had not yet been updated for this year but Pastene will liaise with the relevant scientists to facilitate this.

The Working Group expressed appreciation to Pastene and the rest of the intersessional Working Group for their work during the year.

Kim gave some additional information. He noted that SC/58/NPM8 presents abundance estimates without $g(0)$ correction from the Korean survey conducted in sub-area 6 in spring 2005; future surveys were planned for a survey including a $g(0)$ experiment in spring 2007. He drew attention to Commission Resolution 2005-2, proposed by Korea, Japan, Russia and China, to facilitate closer cooperation between these countries and progress towards obtaining abundance estimates for the whole area. The Resolution called for a workshop, which is planned for September 2006.

6. STOCK STRUCTURE

6.1 Genetic analyses

Kanda presented SC/58/NPM2, the results of an analysis using nine microsatellite loci conducted on samples of minke whales from Japan (sub-area 6) and Korea (sub-area 5 and sub-area 6). The samples were bycaught in set net fisheries along the Japanese coast in sub-area 6 (n=202) from 2001 to 2004 and in coastal fishing gears along the Korean peninsula (n=278) in sub-area 5 and sub-area 6 from 1999 to 2004. After standardisation of the data between the two laboratories, the authors examined if there was any evidence of genetic differences among the samples collected in different years within Japanese and Korean samples, respectively, among the samples from different areas of Korea, and also between the samples from Japan and Korea. No evidence of statistically significant temporal heterogeneity was detected in the Japanese samples. However, the Korean sample collected from sub-area 6 in 1999 (99KBC-6) was different from both the Japanese samples and the rest of the Korean samples (KBC), although the possibility that this heterogeneity was due to a chance effect was raised. No evidence of statistically significant heterogeneity was detected within the KBC as well as between the Japanese samples and the KBC. A Bayesian clustering method did not show evidence of multiple stocks. Although heterogeneity was found in the 99KBC-6 sample, no strong evidence for the existence of an additional stock in sub-area 5 and sub-area 6 was indicated.

The Working Group welcomed the presentation of these preliminary results and raised a number of points relating to the analyses. It was suggested that a table of pair-wise comparisons with p-values would be useful to aid

interpretation of the results. The program Structure (Falush *et al.*, 2003; Pritchard *et al.*, 2000) can perform poorly when populations are only weakly differentiated (as illustrated in Waples and Gaggiotti, 2006). Population structure could thus easily be missed and chi-squared analysis is more powerful in this case. The measure used to construct the neighbour-joining tree can be biased because it does not take account of sample size. In cases where sample sizes vary, groupings with small samples will tend to look more divergent, a pattern seen in this analysis. Other measures that take account of this could be used.

It was pointed out that the results did nevertheless provide some indication of a possible additional stock. Given the significant difference between the Korean sample in sub-area 6 in 1999 and the other areas it is important to investigate these genetic differences between these areas further, as it is possible that this signal could come from two stocks. In response, the authors noted that they had expressed caution because of the possibility that this single result was due to chance effects. A number of additional analyses of these data were proposed in addition to those presented in SC/58/NPM2. These are listed below under Item 6.3.

Park presented SC/58/NPM3, which reported the results of genetic analyses conducted on samples of minke whales from Japan (Sub-area 6) and Korea (sub-area 5 and sub-area 6) using mtDNA control region sequences to examine their population structure. A total of 489 samples from by-caught animals has been collected, 287 along the Korean peninsula in sub-area 5 and sub-area 6 from 1999 to 2004 and 202 along the Japanese coast in sub-area 6 between 2001 and 2004. No evidence of statistically significant temporal heterogeneity was detected in the Japanese samples. However, the Korean samples collected from sub-area 6 in 1999 and 2000 (99KBC-6 and 00KBC-6) were different from both the Japanese samples and the rest of the Korean samples. These results were quite consistent with those of the microsatellite analyses (SC/58/NPM2). Possible reasons for the heterogeneity detected in this analysis are: (1) migration of O-stock animals to sub-area 6; (2) multiple stocks in sub-area 6; and (3) sampling bias resulting from the relatively small sizes of the 99KBC-6 and 00KBC-6 samples. The authors of SC/58/NPM3 rejected hypothesis (1) because the assignment method using a specific site to distinguish between J and O stocks detected no O-stock individuals. The authors preferred hypothesis (3) over hypothesis (2) because the genetic differences detected were due only to heterogeneity in the 99KBC-6 and 00KBC-6 samples and there was no heterogeneity between the Japanese samples and the rest of the Korean samples or within the rest of the Korean samples.

The Working Group welcomed this clear presentation of the results of this preliminary analysis. As for the previous paper on microsatellite variation, a number of further analyses were proposed (see Item 6.3). It was noted that differences found in both types of markers in 99KBC-6 reduced the likelihood that this significant finding is due to sampling bias.

In discussion of both SC/58/NPM2 and SC/58/NPM3, the Working Group requested that, if possible, a breakdown of the number of samples by year and month be made available. This information is given in Appendix 2. The Working Group thanked the authors for providing this information so quickly. It was noted that in general, bycatch occurs throughout the year. It was also noted that there were few Korean samples in summer (June-September) in the earlier years but more in later years. This imbalance of samples and the timing of migration might explain the differences seen between the 99KBC-6/00KBC-6 samples compared to the other samples.

6.2 Other analyses

No new information was available from other analyses. The Working Group encouraged the presentation of results of analyses of other biological data to inform stock structure to be presented to future meetings.

6.3 Future work

In discussion of SC/58/NPM2 and SC/58/NPM3, a number of additional analyses were proposed: an overall comparison between Korean and Japanese bycatches in sub-area 6, i.e. unstratified by year; a sample-by-sample comparison of the 99KBC-6 grouping to investigate whether the difference between this grouping and the other groupings was due to the whole sample or just a small number of different individuals; an analysis of seasonal variation (pooling over years to increase sample sizes); to increase power, the inclusion of samples from the Pacific coast of Japan, including Special Permit catches and bycatches from sub-areas 2, 10 and 11.

Concerning the seasonal analysis, the Working Group recognised that there was a trade-off between stratifying the data to do this and maintaining adequate sample sizes, but nevertheless encouraged the authors to pursue this analyses. The authors reiterated that this was a preliminary analysis but noted that further analyses would be conducted in the future. The Working Group looked forward to receiving the results of these analyses at next year's meeting.

It was also suggested that in future work it would be useful to see the data and analysis structured around the testing of some specific stock structure hypotheses. Development of such hypotheses necessarily depended on the results of exploratory analyses but the Working Group agreed that sufficient information was now available to begin specifying some plausible hypotheses that could be tested. A sub-group convened by Kanda was established to initiate this work and to consider future work; its report is given in Appendix 3. The Working Group welcomed and endorsed this report.

The Working Group continued to believe that it was very important to obtain information on the proportion of O and J stock animals in the Sea of Okhotsk. The best way to do this was to obtain biopsy samples during sighting surveys but permission had not been given during the 2003 survey. The Working Group **strongly recommended** that the Russian Federation be asked to give favourable consideration to granting permission as a matter of priority for biopsy samples to be taken on surveys in the Sea of Okhotsk and other waters of their EEZ.

7. DISTRIBUTION AND ANALYSIS

7.1 Reports on recent surveys

Miyashita presented SC/58/NPM5, which reported on the sighting surveys conducted in the waters east of the Kuril Islands and the Kamchatka Peninsula including the Russian Exclusive Economic Zone (EEZ). The former area was surveyed in 1990 and the latter area for first time. Two research vessels *Shonan maru* and *Shonan maru No. 2* were used for the survey from 29 July to 20 September. Two scientists and a Russian observer were on board each vessel. The objectives of the surveys were to get information of the distribution and abundance of large cetaceans and photo-identification of humpback and blue whales. The survey

area was divided into the Russian EEZ blocks and high seas blocks. *Shonan maru* covered the eastern blocks and *Shonan maru No. 2* the western blocks. Both vessels started in the Russian EEZ blocks and moved into the high seas area. The weather in the *Shonan maru* area was relatively better than in the *Shonan maru No. 2* area. *Shonan maru No. 2* was hindered by fog during almost the whole survey period. In the Russian EEZ blocks, *Shonan maru* covered 81% of the planned track line, and *Shonan maru No.2* covered 48%, but in the high seas blocks these figures were 41% for *Shonan maru* and only 9% for *Shonan maru No. 2*. Because of bad weather, especially for *Shonan maru No. 2*, the survey in the Russian EEZ took longer to cover than planned and therefore the coverage of the high sea blocks was reduced. During the 2,370.4 n.miles searched on effort, five species of baleen whale (common minke, fin, sei, blue and humpback) and sperm whales were found. Common minke whales were sighted in waters south of 55°N. There was no survey effort in Russian territorial waters. While it is well known that the common minke whale is distributed in higher densities in coastal waters, no sightings were made close to the Kamchatka peninsula and around some islands. In future surveys it will be important to survey the territorial waters to estimate the total abundance of common minke whales.

The Working Group welcomed this report on a successful survey in this important area, part of which had not been surveyed since 1990 and part of it not at all. It looked forward to receiving the results of analyses of the data as part of the in-depth assessment.

It was noted that the survey took place in August/September, which is the peak migration season in the western North Pacific. This will be important to consider when the Working Group discusses how these estimates are to be used in the in-depth assessment. With respect to the photo-identification information on humpback and blue whales, the authors were encouraged to collaborate with project SPLASH (*http://hawaiihumpbackwhale.noaa.gov*). In response to a question about whether data had been collected on the distribution of fishing gear, particularly static gear, Miyashita noted that no fishing gear was observed from the vessel *Shonan maru*.

An presented SC/58/NPM7, a report on the Korean sightings survey conducted in the East Sea using the research vessel, *Tamgu 3* (360G/T) from late April to May this year. During the 1,077.7 n.miles searched on effort, 24 minke whales in 21 schools including three mother and calf pairs were sighted. Minke whales were concentrated in the coastal waters of the Korean Strait where several ship-strikes on whales or whale-like drifting objects have occurred recently. There were also high numbers of minke whales seen in coastal waters in the central part of the survey area as was the case in the previous year's survey. One of three mother and calf pairs was observed in the offshore area, which was the first sighting record in the offshore area of the East Sea from a Korean survey. Common dolphins predominated in the southern part of the survey area while Dall's porpoises were spread over the northern part. There were also schools of Pacific white-sided dolphins in the northern part of the survey area and finless porpoises in the southern part.

The Working Group welcomed this report on a successful survey. It looked forward to receiving the results of analyses of the data as part of the in-depth assessment. No information on fishing gear had been collected on the survey because of no plans to do this and lack of time. It was noted that it would be valuable to obtain information on the age and sex of animals in this area, if possible. Harbour porpoises had not been seen on the survey, despite considerable bycatches in this area. Kim suggested that this may be because the surveys took place in the season when harbour porpoises were distributed elsewhere.

Miyashita presented SC/58/NPM4, which reported the results of the IO passing mode sighting survey using the research vessel *Shonan maru No. 2* conducted in the northern Sea of Japan from 12 May to 30 June in 2005. The objective of the survey was to obtain information on distribution and abundance of common minke whales. The survey covered the Japanese side twice because permission was not granted by the Russian Federation to survey in their waters. During the 1,520 n.miles searched on effort two large baleen whale species, common minke and fin whale, were found. A total of 11 schools (12 animals) of common minke whales were sighted on effort and IO data were obtained from 10 schools. They were distributed over a wide area from south to north, especially in the offshore area, which was similar to previous surveys. However the number of sightings was less than on previous surveys, possibly because surface water temperature was lower than usual, as indicated by the presence of floating ice at the entrance to the Okhotsk Sea, a very rare situation for mid-May.

This survey had been in progress during last year's meeting.

The Working Group welcomed this report on a survey. The survey had been only partly successful because permission had not been obtained to survey in the EEZ of the Russian Federation. It was noted that killer whales, Dall's porpoise and Pacific white-sided dolphins had been seen as well as minke and fin whales.

In general discussion about recent surveys, the Working Group agreed that estimation of abundance from these surveys should proceed in parallel with ongoing work on investigating stock structure. Nevertheless, it was important to obtain estimates as soon as possible because they will provide valuable information about the biology of the species in the area.

7.2 *g*(0) estimation

SC/58/NPM4 also presented an estimate of $g(0)$. IO passing mode surveys have been conducted for common minke whales in the western North Pacific since 1999. *Shonan maru No. 2* was used for all these cruises and survey procedures have been the same. There have been three surveys in the Sea of Okhotsk and one last year in the Sea of Japan. There were 85 sightings from the top barrel and also 85 from the IO platform; the number of duplicate sightings from both platforms was 45. Because the sample size on each survey was not large, $g(0)$ was estimated from total sightings using a simple mark-recapture method (Buckland *et al.*, 1993 p.206). The resulting estimate of $g(0)$ was 0.779, CV = 0.111, 95%CI = 0.568-0.904. This result shows that $g(0)$ for this species in this area is clearly less than one, and that past abundance estimates are negatively biased as a result. However, this method does not consider heterogeneity due to covariate effects and more data must be accumulated so that this can be taken into account in future analysis.

The Working Group welcomed this new information, which was an important step forward. The Working Group noted that the estimate was likely positively biased because of unmodelled heterogeneity due to surfacing behaviour of animals. It was suggested that the authors use program Distance version 5 (Thomas *et al.*, 2005) for analysis, which now allows more advanced methods of analysis for $g(0)$ to be used. The Working Group briefly discussed differences in

estimates of $g(0)$ from different surveys and in different areas. Several factors affect $g(0)$ including survey conditions. In the North Atlantic, estimates ranging from 0.25 to 0.7 have been obtained from Norwegian surveys, and the estimate from the SCANS survey in 1994 (which was conducted mostly in Beaufort 2 or less) was about 0.7. In estimating abundance of minke whales as part of the in-depth assessment, it will be important to consider how available estimates of $g(0)$ are used. Further discussion of this point is reported under Item 7.4.

7.3 Abundance estimation

An presented SC/58/NPM8, an analysis of data from the sightings survey in Korean coastal waters of the East Sea in April-May 2005. The survey covered 6.07% of sub-area 6 with conventional line transect methods. During 1,041 n.miles searched on effort, 32 minke whales in 31 primary sightings were observed. Abundance was estimated as 1,538 (CV=50.4%, 95% CI=581-4,068), without correction for $g(0)$ and smearing of distance and angle data.

The Working Group welcomed this brief paper but noted that much more detail would be required in order for the Committee to accept the estimates. At last year's meeting the Working Group had noted that it was important to show the perpendicular distance data and the fitted detection functions, and that functional forms for the detection function other than the hazard rate should be explored (IWC, 2006 p.135). The Working Group reiterated these comments. It **recommended** that this be done and looked forward to receiving this information for this and previous surveys.

It was suggested that suitable stratification of the data may help to reduce estimates of variance. It was also suggested that perpendicular distance data could be pooled over years, because the same ship had been used on all surveys and that this could allow covariates to be included in fitting the detection function.

The Working Group believed that it would be very useful to consolidate all the estimates made from Japanese and Korean cruises since 1999, and explore Generalised Linear Model (GLM) methods to attempt to combine these. It **recommended** that these be presented to next year's meeting.

7.4 Plans for future surveys

Miyashita presented SC/58/O23, the plans for Japanese surveys in the western North Pacific. Three sighting surveys are planned in the western North Pacific in summer 2006 using research vessels *Shonan maru No. 2*, *Kurosaki* and *Shunyo maru*. All vessels have a top barrel and two observers conduct sighting from there. The research area covers the waters from the East China Sea to 150°E in the offshore western North Pacific. The objective of these sighting surveys is abundance estimation of cetaceans inhabiting these waters. The survey methodology will follow the guidelines for conducting surveys to provide estimates suitable for use in the Revised Management Procedure (RMP). Distance and angle estimation training and experiments will be conducted. Biopsy skin samples will be collected for assessing stock structure. Photo-identification of large cetaceans such as blue whales will be conducted.

The Working Group welcomed these plans and appointed the cruise leader Shimada to provide Committee oversight of the surveys. An presented plans for a survey in coastal Korean waters in 2007. Since 1999, 12 sighting surveys have been conducted in Korean waters and the results strongly suggest that minke whales are relatively common in Korean waters. However, minke whale abundance will be underestimated from these surveys because they were not conducted with IO mode and consequently there are no data to estimate $g(0)$. Consequently, the survey next year will be conducted with IO passing mode using two-channel radio although the vessel, *Tamgu 3*, has no separate IO platform. The survey will be conducted in the East Sea from mid April to late May 2007. The Working Group appointed the cruise leader An to provide Committee oversight of the surveys.

It was noted that the survey was timed to coincide with the best weather. It was suggested that the amount of survey effort planned seemed optimistic given the coverage achieved in previous surveys. Questions were raised about the estimation of $g(0)$. If $g(0)$ is to be estimated from data collected by observers on partially independent platforms, the top barrel and upper bridge, then surfacing rate information will be needed. A proposal for how to estimate $g(0)$ on this survey is given in Appendix 4.

More generally, the Working Group noted that it is important to consider how estimates of $g(0)$ will be used in correcting estimates of abundance in the in-depth assessment and in any future work related to the RMP. In a real application of the RMP, the Committee would require appropriate estimates of $g(0)$. However even preliminary estimates of $g(0)$ would be very useful for consideration in *Implementation Simulation Trials*. The Working Group needs to consider this as part of the long-term planning of sighting surveys in this area.

The Working Group recalled that the last survey in the Sea of Okhotsk was in 2003 but some areas had not been surveyed because permission had not been obtained from the Russian Federation to survey in its EEZ, specifically the northern and eastern parts of the area. The Working Group reiterated its **recommendation** of previous years that the Russian Federation favourably consider granting permission for sighting surveys to take place in the waters of its EEZ as a matter of priority.

7.5 Future work

The Working Group discussed priorities for future work to make progress in the in-depth assessment. It noted that since 1999, many surveys had been conducted by Japan and Korea in sub-areas 5, 6 and 10 in April-June. The planned cruise tracks of these surveys are shown in Figure 1; areas covered are less than shown because some planned track lines were not surveyed. The Working Group expressed its appreciation to Japanese and Korean scientists for continuing to undertake this work.

Areas in sub-areas 5, 6 and 10 not yet surveyed are:

(1) the northern part of sub-area 5 (China and North Korea);
(2) the western part of sub-area 5 (China);
(3) the northwestern part of sub-area 6 (North Korea);
(4) continental waters of sub-area 10 (North Korea and Russian territorial waters).

It is evident from above that to obtain estimates of abundance for these unsurveyed areas requires cooperation from range states in the area other than Japan and Korea. The Working Group recalled the planned workshop to facilitate closer cooperation between Korea, Japan, Russia and China (see Item 5) and believed that it would be useful to make some recommendations to be considered by the Workshop.

A sub-group convened by Miyashita was established to consider future surveys to estimate abundance and the analysis of existing and new data in the context of how the

results would be used. For example, surveys have been conducted over a wide latitudinal range during migration and methods will have to be developed to generate appropriate estimates of abundance from the data.

The report of the sub-group is given in Appendix 5. The Working Group **agreed** that surveys should continue to focus in April-June in sub-areas 5, 6 and 10. Most of the existing survey effort has been during this period. At the beginning of this period the Sea of Okhotsk (sub-area 11) is mostly covered in ice and few minke whales are expected to be north of the Sea of Japan. However, the Working Group **agreed** that it would be valuable to conduct surveys in the open waters of the Sea of Okhotsk in April-June. It also **agreed** that surveys should take place in the East China Sea (sub-area 1) in this period. Surveying in parts of sub-area 5 not yet covered was important because there were Chinese catches there in spring-autumn before the 1986 moratorium. The Working Group **recommended** that Chinese scientists be contacted and requested to examine these data. Kim noted that the forthcoming workshop in Korea would be used as a focus for this.

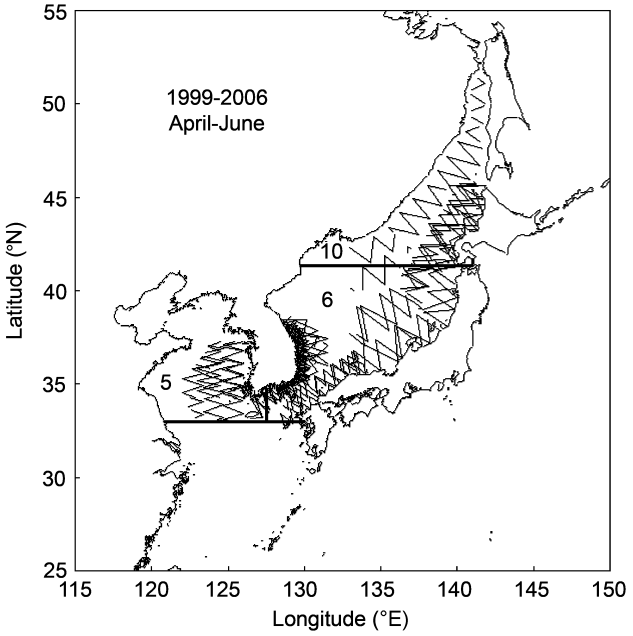

Fig. 1. Planned tracklines of sighting surveys conducted in April-June since 1999. Thin line: pre-determined track line; thick line: border of sub-areas.

The Working Group noted that some areas of the Sea of Japan have now been surveyed several times and that this will allow trends in abundance to be examined. It welcomed the continuing commitment of Korea to conduct these surveys and **recommended** that surveys continue in these areas in the same period (April-June) with as much consistency as possible.

The Working Group noted that Japan had not yet decided whether or not to conduct a survey this year in the Sea of Japan.

8. ASSESSMENTS

8.1 Catch Per Unit Effort (CPUE) analyses

The Working Group recalled that the level of detail in the available Korean CPUE data was insufficient to progress further than had been discussed at last year's meeting. Kim reported that limited time had been available to explore this since last year's meeting but that he would pursue this during the intersessional period.

The Working Group reiterated its previous view that it was important to obtain more information on fishing effort, particularly static gear, in previous years to allow exploration of standardisation of bycatch CPUE series. Kim reported that limited time had also been available since last year's meeting to pursue this but he believed that information was possibly available for static and other fishing gear and that he would renew his efforts intersessionally.

8.2 Plans for future assessments

No information was available under this Item, which was kept open for next year's meeting.

9. OTHER

The Working Group noted that no progress on investigating variation in the length and sex ratio of bycaught animals nor on the estimation of growth curves had been possible during the year. It looked forward to receiving information on these topics next year.

In the context of distinguishing J and O stock animals in the Sea of Okhotsk, Taylor enquired whether photographs of natural markings, such as cookie cutter shark scars, on bycaught animals were taken. The Working Group was informed that Japanese fishermen are requested to take photographs of bycaught animals. However, most of the bycaught animals are immature and, because small animals have no scars, cookie cutter shark scars cannot be used to distinguish J and O stock bycaught animals.

The Working Group discussed whether the numbers of bycaught minke whales reported in the Japanese Progress Report could be assigned to J and O stocks, based on genetic analysis. In response, it was noted that the numbers in the Progress Report are from Municipal Governments and there is no related information on stock. The Working Group noted that the assignment of bycatches to J or O stock will be necessary for conducting the in-depth assessment. The Working Group encouraged this information to be provided and **recommended** that it be made available, as far as genetic techniques allowed, by the time of the *Implementation Review* for western North Pacific common minke whales, expected to be in 2008. In this context, Pastene noted that work will continue to improve genetic methods for assigning animals to J and O stocks. The point was also raised that although bycatches are reported by Municipality the location is not reported so that in some cases it is not possible to know whether the animals were bycaught in the Sea of Japan or along the Pacific Coast. The strandings records are available from the website of the Institute of Cetacean Research website (*http://www.icrwhale.org*), which gives location data on Japanese bycatches.

10. WORK PLAN AND BUDGET REQUEST

For its work plan for the coming year and beyond, the Working Group noted the work on stock structure described under Item 6.3, and the work on distribution and abundance under Item 7.5. It encouraged further work to obtain more detailed information on the Korean CPUE series and level of past fishing effort. It also encouraged work on telemetry to provide information on migration.

The Working Group especially looked forward to receiving a report from the workshop in Korea in September to facilitate closer cooperation between Korea, Japan, Russia and China and to facilitate progress towards obtaining abundance estimates for the whole area. The Working Group encouraged range states and other interested parties to cooperate to make the Workshop a success.

11. ADOPTION OF REPORT

The report was adopted as amended at 18:42 on 2 June 2006. The Chair thanked the Working Group for their cooperation and patience, and the rapporteur for his assistance. The Working Group expressed its thanks to the Chair and rapporteur for their efficient running of the meeting.

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Appendix 1

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Appendix 2

SAMPLE DISTRIBUTION OF KOREAN AND JAPANESE BYCAUGHT COMMON MINKE WHALES FROM SUBAREAS 5 AND 6 USED IN SC/58/NPM2 AND SC/58/NPM3

M. Goto, J.Y. Park, Y.R. An, Z.G. Kim, N. Kanda and L.A. Pastene

Information on the distribution of samples used in documents SC/58/NPM2 and SC/58/NPM3 is provided by year and month. This seasonal information will be taken into account in future genetic analysis of population structure on J-stock common minke whales.

Table 1

Korean bycaught samples from sub-areas 5 and 6 used in SC/58/NPM2 and SC/58/NPM3 by year and month.

		Month												
Sub-area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
KBC6	1999	0	3	3	3	6	2	0	4	0	8	4	10	43
	2000	0	1	8	0	0	0	0	0	0	1	0	2	12
	2001	12	1	1	1	0	0	0	0	0	0	0	0	15
	2002	0	4	2	2	4	5	0	2	6	4	8	9	46
	2003	5	3	5	6	5	10	7	6	11	4	5	5	72
	2004	5	2	4	5	4	1	1	1	3	4	2	8	40
Sub-total		22	14	23	17	19	18	8	13	20	21	19	34	228
KBC5/6	1999	0	0	0	0	1	1	0	0	0	0	0	2	4
	2000	0	0	0	0	0	0	0	0	0	0	0	0	0
	2001	0	0	0	0	0	1	1	0	0	0	0	0	2
	2002	0	1	0	0	0	1	0	1	0	0	1	0	4
	2003	0	0	0	1	1	2	3	1	0	0	0	0	8
	2004	0	0	0	1	6	2	0	0	0	0	3	0	12
Sub-total		0	1	0	2	8	7	4	2	0	0	4	2	30
KBC5	1999	0	0	0	0	0	0	0	0	0	0	0	0	0
	2000	0	0	1	0	0	0	0	0	0	0	0	2	3
	2001	0	0	1	0	0	1	0	0	0	0	0	0	2
	2002	0	0	0	0	0	4	0	1	1	0	1	0	7
	2003	2	0	0	0	1	2	1	1	0	1	1	0	9
	2004	1	0	0	0	0	1	3	0	2	0	0	1	8
Sub-total		3	0	2	0	1	8	4	2	3	1	2	3	29
Total		**25**	**15**	**25**	**19**	**28**	**33**	**16**	**17**	**23**	**22**	**25**	**39**	**287**

Table 2

Japanese bycaught samples from sub-area 6 used in SC/58/NPM2 and SC/58/NPM3 by year and month.

		Month												
Sub-area	Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
JBC6	2001	-	-	-	-	-	-	1	6	0	2	9	8	26
	2002	9	4	5	7	5	3	1	2	4	2	2	5	49
	2003	10	9	3	5	4	5	2	1	4	7	7	5	61
	2004	16	7	7	11	8	5	1	1	4	1	2	3	66
	Total	**35**	**20**	**15**	**23**	**17**	**13**	**5**	**10**	**12**	**14**	**20**	**18**	**202**

Appendix 3

WORK NEEDED FOR FURTHER GENETIC ANALYSES OF J-STOCK STOCK STRUCTURE

Members: Kanda (Convener), An, Goto, Kim, Park, Pastene, Taylor, Wade.

SC/58/NPM2 and SC/58/NPM3 detected genetic differences between the 1999 Korean sample from sub-area 6 (99KBC-6) and the rest of the samples from Korea as well as from Japan. Two possibilities were raised by the authors: (1) this could indicate that there are genetically different stocks in this area; and (2) this could have resulted from the 99KBC-6 sample not being representative of the whole J-stock given their high genetic diversity.

On the basis of suggestions derived from discussions on these documents in the Working Group on the in-depth assessment of western North Pacific common minke whales, with a focus on J stock, a small group was formed to discuss

future work in order to better understand the source of the heterogeneity detected in the SC/58/NPM2 and SC/58/NPM3 and to set biologically feasible hypotheses in order to conduct future analyses effectively.

1. Future work

(1) Analyse samples by month and season. The heterogeneity could be due to seasonal or monthly difference in migration between two stocks.
(2) Incorporate sex into analyses. This allows us to detect sex-specific migration.
(3) Compare between all of the bycatches from sub-area 5 and sub-area 6 as well as between all of the bycatches from Korea and from Japan. This increases the sample size and hence statistical power of the analyses.
(4) Investigate whether the heterogeneity was due to general aspect of the 1999 sample or due to a few unique individuals in the sample. This allows us to distinguish between a real biological difference and a chance effect.
(5) Score microsatellites in one of the two laboratories. No data standardisation will then be required.
(6) Include samples, possibly identified as J-stock individuals, from the Pacific side of Japan. It is important to note that the initial task of our cooperative genetic analyses was to concentrate on the investigation of the stock structure in sub-area 5 and sub-area 6, but inclusion of the Pacific samples will eventually allow us to conduct a comprehensive analysis of the J-stock in future.

The small group expects Items (1) to (5) to be conducted hopefully by next year's meeting and Item (6) in the near future.

2. Stock structure hypotheses

The small group recognised that stock structure analyses should be conducted under well-stated hypotheses.

The following stock structure hypotheses were raised:

(1) one stock utilises sub-area 5 and sub-area 6. This is the original view of the stock structure in this area;
(2) two stocks migrate from their breeding grounds to the south to feeding grounds in the north through sub-area 5 and sub-area 6. However, the one stock migrates along the Japanese coast and the other stock along the Korean coast. In this case, genetic comparisons should be made between the samples from Japan and Korea;
(3) two stocks exist and one stock migrates up to sub-area 5 and the other stock migrates further north through sub-area 6. Timing of migration of the two stocks does not have to be the same. In this case, genetic comparisons should be made between sub-area 5 and sub-area 6;
(4) two stocks occupy sub-area 5 and sub-area 6 but at different times of the year. This could happen, for instance, if one stock occupies sub-area 5 and sub-area 6 mainly in summer, while the other stock occupies these areas mainly in winter. In this case, genetic comparisons should be made between Korean sub-area 6 in winter, Korean sub-area 6 in summer, Japanese sub-area 6 in winter, Japanese sub-area 6 in summer, and sub-area 5 samples.

Appendix 4

ESTIMATION OF *g*(0) IN KOREAN LINE TRANSECT SURVEYS

Hiroshi Okamura and Yong-Rock An

Korean colleagues have a plan to conduct a kind of IO mode survey in the Korean waters in 2007 to estimate $g(0)$. It is very interesting and important. One problem is where the vessel has no specific IO platform so that it is difficult to keep the independence in detection between platforms, which is usually required for $g(0)$ estimation. This working paper suggests a design and a model for estimating $g(0)$ in the Korean waters.

Without an IO platform, the protocol should guarantee independence of detection in a top barrel from an upper bridge. Then, the upper bridge is partially independent, i.e. any observer on the top barrel does not know whether the upper bridge sighted an animal, but the upper bridge knows whether the topmen sighted an animal. In the Norwegian and Antarctic minke whale surveys, the extensive simulation trials have been conducted so that hazard probability models seemed to work very successfully. This Appendix proposes a hazard probability model without an IO platform.

The probability of observing the detection pattern (u), the perpendicular distance (x), and the forward distance (y) is expressed as:

$$f_{AC}(x,y,u) = w_{A\cup C}^{-1}\begin{cases} \dfrac{\lambda}{v}Q_A(x,y)\exp\left\{-\dfrac{\lambda}{v}\displaystyle\int_y^\infty Q_{A\cup C}(x,y')dy'\right\} & u=A, \\ \dfrac{\lambda}{v}\{Q_{A\cup C}(x,y)-Q_A(x,y)\}\exp\left\{-\dfrac{\lambda}{v}\displaystyle\int_y^\infty Q_{A\cup C}(x,y')dy'\right\} & u=C, \\ \left(\dfrac{\lambda}{v}\right)^2 Q_A(x,y_2)\{Q_{A\cup C}(x,y_1)-Q_A(x,y_1)\}\exp\left\{-\dfrac{\lambda}{v}\displaystyle\int_{y_1}^\infty Q_{A\cup C}(x,y')dy'\right\} & \\ \qquad\times\exp\left\{-\dfrac{\lambda}{v}\displaystyle\int_{y_2}^{y_1} Q_A(x,y')dy'\right\} & u=C\to A, \end{cases}$$

where A denotes a top barrel, C denotes an upper bridge, and $w_{A\cup C}$ is the effective strip-half width of $A\cup C$ (a reference for the details of notation: (Okamura *et al.*, 2003)). Then, the log-likelihood function for n independent sighting data $\{(x_i, y_i, u_i), i = 1, \ldots, n\}$ is:

$$\log L = \sum_{i=1}^{n} \log f_{AC}(x_i, y_i, u_i).$$

The parameters in the detection function can be estimated by maximising the above log-likelihood function. This takes account of discrete availability of animals by surfacing behaviour, which can cause a positive correlation between detections of an animal by independent observers.

In the North Pacific, school sizes of minke whales are almost always one, as is the case for the North Atlantic, so complicated issues on school size do not need to be considered. However, it is impossible to estimate all the parameters under the above framework since we have no simultaneous duplicate without IO platform. The method therefore needs information on mean surfacing rate (λ) outside the line transect surveys. Norwegian colleagues have collected the information on surfacing rate. However, minke whales in the Korean waters tend to be young, and therefore the behaviours might be different. It is useful to conduct the (visual) dive time experiment for minke whales in the Korean waters even if it is conducted as a feasibility study.

REFERENCE

Okamura, H., Kitakado, T., Hiramatsu, K. and Mori, M. 2003. Abundance estimation of diving animals by the double-platform line transect method. *Biometrics* 59:512-20.

Appendix 5

FUTURE WORK ON SIGHTING SURVEYS FOR J-STOCK COMMON MINKE WHALES

Members: Miyashita (Convener), An, Butterworth, Hammond, Kim, Okamura, Palka, Shimada.

Item	Season, method, by whom	Matters of concern
(1) Surveys in unsurveyed areas		
(a) Northern part of sub-area 5	2008 by Korea?	Feasibility of surveys in North Korean waters is uncertain. Korea will try to contact but North Korean waters may remain as unsurveyed areas.
(b) Western part of sub-area 5	2008 by Korea	Korea will contact China under cooperative project.
(c) North western part of sub-area 6	2009 by Korea?	Feasibility of surveys in North Korean waters is uncertain. Korea will try to contact but North Korean waters may to remain as un-surveyed areas. Territorial issue between Japan and Korea.
(d) Sea of Okhotsk (sub-area 11)	May-June 2007 by Japan	Some animals might migrate into the Sea of Okhotsk at this time.
(e) East China Sea (sub-area 1)	April-June, by Korea/Japan	Some animals might remain in sub-area 1 at this time.
(2) Repeat sighting surveys		
(a) Korean coast of sub-area 6	2007 by Korea	More surveys are necessary for data accumulation and monitoring.
(b) Russian EEZ in sub-area 10	Japan/Korea, when?	
(c) Korean side of sub-area 5	Korea, when?	More surveys are necessary for data accumulation and monitoring.
(d) Japanese side of sub-areas 6, 10	Japan, when?	Vessel availability is limited but necessary for data accumulation and monitoring.
(3) *g*(0) estimation		
(a) IO passing mode survey	Japan, Korea	Standard method for the species in this area and to be used for the future sighting surveys.
(4) Possibility of synoptic sighting survey using several vessels as in NASS	When?	Low possibility because of budgetary and logistical problems.
(5) Satellite tracking	2007 by Korea	Difficulty of attachment.
(6) Dive time data collection	Direct observation, VHF, data logger	
(7) Analysis of sighting data		
(i) Timing and survey direction		
(a) Timing of survey	April - June	
(b) Analysis by month and area	GLM framework	
(ii) Accumulation of IO data and analysis		
(a) Hazard rate model framework	Okamura and An (see Appendix 4)	
(b) Extrapolation to unsurveyed areas	Spatial modelling framework	