Report of the Second 'First Intersessional Workshop' for the *Implementation Review* of Western North Pacific Common Minke Whales

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The Workshop was held from 12-16 December 2011 at the Sanban-cho Governmental Meeting Hall in Tokyo, Japan. The list of participants is given as Annex A.

1. INTRODUCTORY ITEMS

1.1 Convenor's opening remarks

Butterworth noted that because the North Pacific common minke whale trials had proved to be so complex, an extra year had been granted to achieve all the goals required of a First Intersessional Workshop in the standard *Implementation Review* framework. He thanked Allison and de Moor for their work carried out before the Workshop, which would greatly facilitate further progress. He emphasised that though many of the goals required of a First Intersessional Workshop had already been achieved, nevertheless the primary goal of achieving satisfactory conditioning of trials was still outstanding, and that this is the primary focus of the Workshop.

1.2 Election of Chair and appointment of rapporteurs

Donovan was appointed Chair. Butterworth, Punt, and Waples acted as rapporteurs.

1.3 Adoption of Agenda

The **agreed** Agenda is given as Annex B.

1.4 Review of documents

The documents available to the meeting were SC/D11/NPM1-7. In addition to the reports of the first 'First Intersessional Workshop' (IWC, 2012b) and the 'Report of the Scientific Committee' meeting in Tromsø (IWC, 2012c), relevant past meeting documents were made available as necessary.

2. HYPOTHESES FOR INCLUSION IN TRIALS

In response to a request from Allison and de Moor, for logistical reasons the Workshop **agreed** that the three stock structure hypotheses should formally be called hypotheses A, B, and C rather than I, II and III. An editorial note was added to IWC (2012b; 2012c) to clarify this.

2.1 Stock structure and mixing

2.1.1 Review of report by genetics sub-group on mixing matrix results circulated intersessionally

The G3 genetics group (Hoelzel, Gaggiotti, Waples) had reviewed an earlier draft of SC/D11/NPM4 (see Item 2.1.2 below) to determine whether additional genetic analyses might provide new insights regarding deviations detected in specific period/sub-area strata. As detailed in their report (SC/D11/NPM2), this exercise led to no major new revelations. Most of the unexpected departures from expectations were for period/sub-area strata with very small sample sizes (<10 in many cases) that made additional analyses difficult. Conversely, most of the strata with relatively large sample sizes did not show major departures from expectations. Sub-area 6W was an exception: sample sizes are relatively large (80-100) and mixing was apparent in more months than was expected based on the stock structure hypotheses; the G3 group had considered whether running Wahlund analyses for this sub-area might possibly provide additional insights into this issue, but did not carry those out as they did not have access to all of the data. During the present Workshop, the mixing matrix was adjusted to allow for mixing of stocks in sub-area 6W in further months, which accommodated this problematic result.

In summary, the G3 group considered that all the hypotheses presented are either consistent with the genetic data, or the samples sizes are too small to allow confidence in reaching any definite conclusion.

2.1.2 Re-specification of pure stocks and update of mixing proportions

SC/D11/NPM4 reported results of the application of the algorithm for estimating mixing proportions to the genetic data selected during the 2011 Annual Meeting for each period/sub-area stratum, using allele frequencies in samples from putative pure stocks to calculate mixing proportions. Estimates of mixing proportions are shown separately for mtDNA and microsatellites. The results in SC/D11/NPM4 differ from those presented to the 2011 Annual Meeting because: (1) the algorithm for estimating mixing proportions was modified to account for rare alleles that occur in areas where mixing is postulated to take place which might not occur in the existing samples used to define pure stocks; and (2) changes to the specifications of the pure stocks. These modifications led to substantial changes in the estimated mixing proportions in a few cases. The mixing proportions in SC/D11/NPM4 were used in the analyses conducted prior to the meeting. The Workshop thanked de Moor for conducting the analyses as requested at the 2011 Annual Meeting.

When reviewing SC/D11/NPM4, the Workshop compared the estimates of mixing proportions to those expected given the various stock-structure hypotheses (see Annex D for details of these hypotheses). In evaluating any statistically significant differences, it was recognised that multiple testing must be taken into account, because several hundred separate tests were conducted. Furthermore, the one-sided t-tests provided ignored sampling error in estimates of allele frequencies for the putative pure stocks, which would tend to reduce p-values. In addition, many of the departures involved period/sub-area strata with only a small number of individuals.

Consequently, the Workshop **agreed** that only differences for period/sub-area strata with at least 20 individuals would be examined in detail. It did however recognise that it would be useful to understand the reasons why strata with very small sample sizes would lead to significant differences from expectations, particularly for period/sub-area strata for which harvests have historically been high, for which future catches are likely or for which abundance is high.

*This is the second 'First Intersessional Workshop' since the complexity of the work had prevented completion of the agenda at the first Workshop. This report was presented to the 2012 Scientific Committee meeting as SC/64/Rep2.

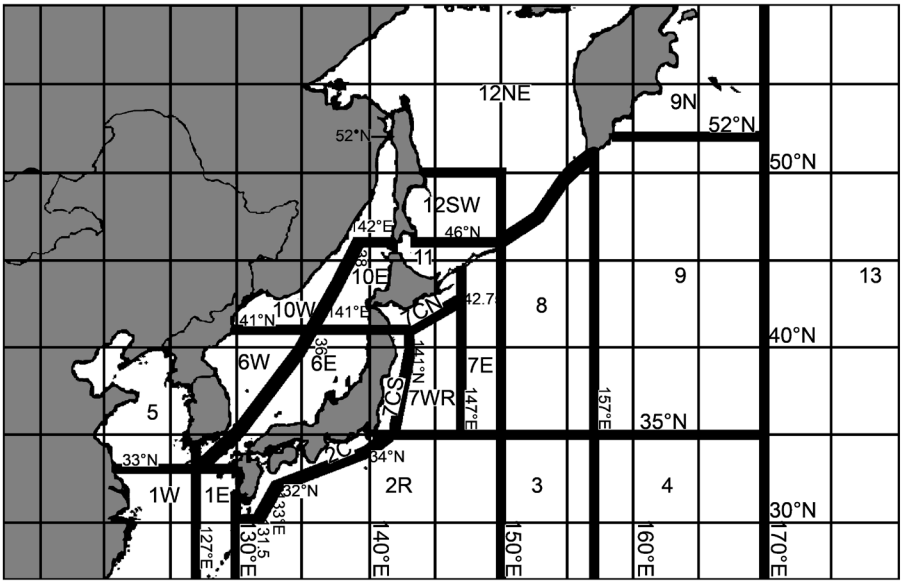

Fig.1. Sub-areas referred to in the text.

The review of the mixing matrices for the three hypotheses was an iterative process that occurred throughout the Workshop. The final **agreed** matrices for the trials will be developed by 15 January (see Item 8) and will be incorporated into the trials structure (see Annex D) where differences between the matrices developed in IWC (2012c) are also highlighted. Annex F provides a description of the space/time strata used to define pure-stock proxies (as designated at the 2011 Annual Meeting) and revised subsequently according to the work plan agreed at the 2011 Annual Meeting.

3. CONDITIONING

3.1 Conditioning software

SC/D11/NPM1 summarised efforts to identify how to modify the minimisation algorithm on which the conditioning process for *Implementation Simulation Trials* is based to reduce the possibility of failing to converge to the global minimum of the objective function. A number of modifications to the current approach for estimating the values for the parameters of operating models, including different minimisation algorithms (Nelder-Mead, Hooke and Jeeves, Broyden-Fletcher-Goldfarb-Shanno (BFGS)) and phasing the estimation were explored based on two of the *Implementation Simulation Trials* for the North Atlantic fin whales. The most severe convergence problems occurred for $MSYR_{mat}$=4%. Phasing the estimation was not found to improve convergence performance noticeably. However, sequential applications of the BFGS and Nelder-Mead algorithms reduced convergence problems to a substantial extent without unduly increasing computational demands to the extent that conditioning became infeasible.

Allison reported that the control program for the western North Pacific minke whales had been modified to include several of the approaches investigated in SC/D11/NPM1. This has led to lower values for the objective function. However, there are still some convergence problems, probably related to the nature of the objective function surface (long thin valleys with high correlations among parameters). To understand the possible consequences and implications of convergence difficulties, the Workshop **recommended** that: (a) population trajectories be produced when the minimisation algorithm is close to, but not finally at, completion as well as for the 'best estimates' for these trajectories; and (b) the operating model be conditioned for a few trials from multiple starting values.

3.2 Abundance estimates and covariances used

The abundance information used in conditioning the trials was that agreed at the 2011 Annual Meeting (IWC, 2012d); this is also incorporated in Table 6a of Annex D. The various estimates are treated as independent (i.e. zero covariance assumed throughout).

3.3 Catches

3.3.1 Direct catches

SC/D11/NPM3 reported on updates to the direct catch series that had been made since the 2011 Annual Meeting meeting (IWC, 2012d). New information from Matsuura (1936) on catches in the early 1930s has been incorporated, including numbers of whales taken by Japanese whalers off Korea, and numbers by sex, month and area off Japan. In addition, new information on catches by Korea by month and some by sex and by area for the years 1940-41, 1972-76 and 1984-85 have been taken from Park (1995). Finally, the method of allocating catches to month and area has been revised to incorporate data on catches by month from IWS and Park (1995).

The Workshop thanked Allison for further refining the catch series. It **agreed** that the 'Best' and 'High' catch series in SC/D11/NPM3 should be used for conditioning and incorporated into the final trials specification (Annex D).

3.3.2 Bycatches

The approach to estimating past bycatches was developed in IWC (2012e) (based on known or estimated fishing effort and estimated population size). The Workshop reviewed plots of the resultant bycatch estimates (see Annex E). The predicted bycatch numbers were considered by some members to be unrealistically high in some years and sub-areas, and it was noted that the abrupt change in 1970 was driven by assumption rather than data. The Workshop **agreed** that alternative sensitivity tests should be developed (see Item 3.4 below).

3.4 Review of conditioning results

Conditioning is the process of selecting the values for the parameters of the operating model such that the predictions from this model are consistent with the available data. In the case of western North Pacific minke whales these are abundance estimates and between-stock proportions pertinent to the J- and O-stocks (stock structure hypothesis A) and for JW-, JE-, OW- and OE-stocks (stock structure Hypothesis C) in various sub-areas. The Workshop noted that considerable work had been undertaken by Allison and de Moor since the last Annual Meeting to improve the optimisation algorithm in the control program, to check that the control program had been correctly coded, to refine how the entries in the mixing matrices are specified, and to provide the Intersessional Steering Group with progress reports. The Workshop thanked Allison and de Moor for their considerable work in this regard.

The Workshop explored a number of diagnostic tables and plots to examine whether conditioning had been achieved successfully for the base-case trials:

(a) time-trajectories of model-predicted 1+ and mature female abundance by stock;
(b) time-trajectories of model-predicted 1+ numbers with the available abundance estimates by sub-area;
(c) time-trajectories of model-predicted between-stock proportions with the observed proportions;
(d) time-trajectories of model-predicted by-catches by sub-area; and
(e) tables, maps and plots of 1+ numbers by month and sub-area for 1930 (the unexploited state) and 2010 (the most-recent year).

The major Workshop discussions on mixing matrices are summarised under Item 2. One important factor that had necessitated these revisions was the relative frequency of juveniles in sub-area 12NE (the results presented to the Workshop had too many juveniles in this sub-area).

The Workshop noted that for all of the hypotheses, the conditioning process leads to a relatively large number of animals being assigned to sub-area 2C, especially when compared to sub-area 7CS/CN. Some members commented that this was unrealistic given the low historical commercial catches in this sub-area (only 18 since 1930), along with the lack of sightings in this sub-area during Japanese sightings surveys conducted from 1982-96. In discussion, it was also noted that while direct catches were low in sub-area 2C, there have been larger numbers of bycatches (a total of 208 minke whales were bycaught in sub-area 2C from 2001-09). It was also noted that surveys in sub-area 7CS led to low abundance estimates even though removals (commercial and bycatch) have been high.

Inevitably, the modelling process must be constrained by data and in particular in this case by the single low abundance estimate for sub-area 7CN and the absence of an estimate for sub-area 2C. The Workshop recognised that the purpose of the process was not to attempt to represent truth perfectly but rather to capture the hypotheses sufficiently such that management variants can be evaluated in a robust manner. Where uncertainty exists, sensitivities can be explored (see below).

A full set of plots and tables for the six baseline models (stock structure hypotheses A, B and C; $MSYR_{mat}$=1%, 4%) is given in Annex E. The Workshop **recommended** that the full set of remaining results should be created and made available in electronic format well before the 2012 Annual Meeting (see Item 9 for the agreed timeline).

The Workshop noted that the time-trajectories of model-predicted bycatch differ depending on the choice of stock-structure hypothesis and the values assumed for $MSYR_{mat}$.

The Workshop evaluated the results of conditioning for the baseline trials. It **agreed** that trials would only be conducted for original definition of the O-stock because the results for the two O-stock definitions were essentially identical, i.e. the O (alt) option would be deleted (see Annex F). The Workshop also **agreed** that conditioning was adequate for all six baseline models, although further refinements and improvements may need to be made prior to the 2011 Annual Meeting. Allison and de Moor will attempt to improve the fits to the proportion of OW-stock females in sub-area 11 in Hypothesis C.

The Workshop noted some aspects related to conditioning that require further work before 2012 Annual Meeting and sensitivity tests: (a) estimated bycatch numbers (see Item 3.3.2); (b) abundance in sub-area 2C; and (c) the proportion of juvenile compared to adults in sub-area 9 (this was higher than might be expected given the biological data for the JARPN/JARPN II catches in sub-area 9). These aspects, however, arise given the available data, and are not reflective of a failure of the conditioning process. Some members suggested that the lack of juveniles in the catch data could be due to a bias towards older/larger animals by whalers; this might arise from sighting availability (if smaller animals are harder to detect) or from failure to follow protocols designed to randomise catches. Other members did not consider that this was likely and that the catches reflected the true situation. The Workshop **agreed** to develop additional sensitivity tests (see Item 5.4 for details) to evaluate the impact of these issues on the performance of the RMP variants. The Workshop also **agreed** that further investigation was required with respect to the Y stock: the model fit to scenario B was estimating a low Y stock abundance in sub-area 5 although there did not appear to be any reason for this given that the information available for conditioning for this sub-area is that its abundance should be between pre-specified maximum and minimum values[1].

4. PROJECTION ISSUES

4.1 Simulating *CLA* applications

4.1.1 Use, if at all, of minimum estimates from surveys

There are five surveys for which the abundance estimates were adjudged usable only as minimum values in the conditioning process (IWC, 2012d, table 6a). There are estimates available from surveys in other years for three of the sub-areas (sub-areas 7WR, 9 and 11) and the Workshop **agreed** that these minimum estimates will not be used when simulating *CLA* applications. However, the minimum estimates for sub-areas 5 and 6W all correspond to the same (although rather small) part of the sub-area covered,

[1]After the meeting, it was found that the objective function minimised in the conditioning process hardly changes for the 'best' fit compared to hitting the maximum or the minimum for the abundance estimate in sub-area 5, i.e. there is insufficient information content in the data provided to estimate Y stock abundance precisely for scenario B. (Note that exactly the same issue will arise for scenario C.) The Intersessional Steering Group therefore agreed for stochastic trials that the conditioning process will fit to a low variance (CV=0.1) pseudo-estimate of abundance for sub-area 5 which is drawn from a uniform distribution across [minimum; maximum] for each of the 100 simulated projections within each trial. For any 'deterministic' results required, the conditioning will fit to (maximum+minimum)/2. Furthermore sensitivities to the baseline stochastic trials will be included which replace the random draws by a fixed value for the sub-area 5 abundance estimate of either minimum, maximum, or (minimum+maximum)/2.

and these are the only abundance estimates available. The Workshop **agreed** that these should be treated as unbiased estimates of abundance for the sub-areas concerned in simulating *CLA* applications.

4.1.2 Treatment of JARPN surveys which did not have Committee oversight and use of surveys with low coverage

The Workshop **agreed** that whether and how to use estimates with low coverage or design concerns and the treatment of JARPN and any JARPN II surveys that did not have Committee oversight raised policy issues which would require a decision by the full Scientific Committee. To assist such discussion at the 2012 Annual Meeting, the Workshop requested Japan and Korea to prepare documents for that meeting containing appropriate information on the surveys whose results were accepted for conditioning (see Annex D, Table 6). This information should include:

(1) details of the basis used to design the cruise tracks, including selection of the starting points, and the survey mode(s) used;
(2) details of procedures used to complete cruise tracks, e.g. decision rules used to skip portions of the track because of delays caused by bad weather;
(3) plots of the achieved cruise track for each survey showing the position of minke whale sightings made; the direction of each cruise track and the sequence in which survey blocks were covered; and
(4) a summary of the extent to which each cruise met the RMP requirements and guidelines for surveys extant at the time of the surveys (IWC, 1997; 2005b; 2008).

4.1.3 Treatment of surveys already conducted, whose results were not available in time for consideration in conditioning

SC/D11/NPM7 provided information on a sighting survey in sub-area 7 from 11 April to 8 June, 2011. Only two sightings of common minke whales had been made during this survey, which is an order of magnitude less than normal. However, the survey followed closely on the March 2011 major earthquake and associated tsunami and aftershocks in the survey region, which probably impacted the minke whale distribution pattern. The Workshop **agreed** that because of these atypical circumstances, results from this survey should not be considered in implementing the *CLA*, either for trial purposes or in an actual application.

Table 1 lists details of surveys that took place between 2008 and 2010, i.e. after the period considered for conditioning. Information on these surveys as requested under Item 4.1.2 for earlier surveys should be reported to the next Annual Meeting to provide a basis to decide on whether they were acceptable for providing abundance estimates (whether actual or generated) in simulated *CLA* applications. The Workshop **agreed** that it is also desirable for abundance estimates from each of these surveys to be presented for review at the 2012 Annual Meeting, in cases where Committee review has not already taken place.

4.1.4 Treatment of variable coverage in a time series of surveys

The RMP specifications (footnote 21a) allow for appropriate statistical procedures to be used to extrapolate to areas not covered in some surveys in a time series, provided that they were covered in others, and that allowance is made for additional variance. This process eliminates the bias in abundance trend information that would otherwise arise from results for a series of surveys with variable coverage. The Workshop **agreed** that any specific implementation of this approach to extrapolate results from certain surveys would require review by the Scientific Committee before being considered acceptable as input to the *CLA*.

Annex F summarises three situations where this arises for existing abundance estimate series. The Workshop **agreed** that such extrapolation was not possible at this time in the case of surveys in sub-area 12NE; this is because only one past survey has covered all blocks, thus precluding the estimation of the additional variance associated with any

Table 1

Details of surveys that took place between 2008 and 2010.

Sub-area	Year	Season	Survey type[(1)]	Mode[(2)]	Areal coverage (%)	STD estimate [(3)]	CV[(4)]	Conditioning	Source
3	2010	Jul.-Aug.	JD	NC	-	-	-	No at this time	Matsuoka (2011)
4	2010	Jul.-Aug.	JD	NC	-	-	-	No at this time	Matsuoka (2011)
5	2008	Apr.-May	KD	NC	13.0	680	0.372	Min	An *et al.* (2010)
6W	2009	Apr.-May	KD	NC	14.3	884	0.286	Min	An *et al.* (2010)
	2010	May	KD	-	23.6	1,014	0.387	Min	An *et al.* (2011)
7CS	2008	Jul.	JR	NC	-	-	-	No at this time	Tamura *et al*. (2009)
7CN	2008	Jul.	JR	NC	-	-	-	No at this time	Tamura *et al*. (2009)
7W	2008	Jul.	JR	NC	-	-	-	No at this time	Tamura *et al*. (2009)
	2010	Jul.	JR	NC	-	-	-	No at this time	Matsuoka (2011)
7E	2008	Jul.	JR	NC	-	-	-	No at this time	Tamura *et al*. (2009)
	2010	Jul.	JR	NC	-	-	-	No at this time	Matsuoka (2011)
8	2008	Jul.-Aug.	JR	NC	-	-	-	No at this time	Tamura *et al*. (2009)
	2009	May-Jun.	JR	NC	-	-	-	No at this time	Bando *et al.* (2010)
	2010	Jul.-Aug.	JR	NC	-	-	-	No at this time	Matsuoka (2011)
9	2008	Aug.	JR	NC	-	-	-	No at this time	Tamura *et al*. (2009)
	2009	May-Jun.	JR	NC	-	-	-	No at this time	Bando *et al.* (2010)
	2010	Jun.-Aug.	JR	NC	-	-	-	No at this time	Matsuoka (2011)
13	2010	Jun.-Aug.	JD	NC	-	-	-	No at this time	Matsuoka (2011)

[(1)]KD=Korean dedicated survey; JD=Japanese dedicated survey; JR=JARPNII. [(2)]NC=Normal-closing, IO-PS=Passing with IO mode, IO-AC=Abeam-closing with IO mode. [(3)]Standard (STD) estimate based on 'top and upper bridge', which will be corrected by estimate of $g(0)$ for the combined platform 'top and upper bridge'. [(4)]CV does not consider any process errors.
Remark 1. STD estimates by different modes, NC, IO-AC, IO-NC, are considered comparable. Remark 2. JAPRNII estimates may change after model selection considering inclusion of covariates. Remark 3. Variance-covariance matrix should be provided soon after the meeting. Remark 4. Estimates with 'No at this time' in the 'Conditioning' column will be able to be considered at the stage of *CLA* application.

extrapolation. The 2002 survey in sub-area 8 had resulted in a zero estimate of abundance; this will necessitate use of alternative distribution models to the customary log-normal when applying generalised linear models to effect the extrapolation. The Workshop **requested** that a document presenting results for these extrapolations be presented for review at the 2012 Annual Meeting, to inform the process of finalising the specification of *CLA* application simulations.

4.1.5 Selection of catch series to use

The Workshop **agreed** that the 'Best' catch series (see Annex D) was appropriate for direct catches. Given the discussion under Item 3.3.2 regarding bycatches, further work is required before a recommendation can be made (see Item 9).

4.2 Initial discussion on the selection of catches and abundance estimates for use in actual *CLA* applications

The Workshop noted that determining the abundance estimates that are acceptable for use in the *CLA* raises policy issues as described under Item 4.1.2 above. It noted that the information specified under Item 4.1.2 will provide the necessary basis for the Committee to make decisions at the 2012 Annual Meeting. With respect to catches, the use of the 'Best' catch series is appropriate for direct catches but further work is required with respect to bycatches.

5. SPECIFICATION OF *IMPLEMENTATION SIMULATION TRIALS*

5.1 Specification of expected future operations

Hatanaka advised that no modifications were proposed to the expected Japanese operations detailed in IWC (2012c) and IWC (2012d). Land-based whaling by Japan will be conducted by small-type coastal catcher boats in sub-areas 7 and 11. O-stock minke whales will be targeted by restricting whaling to outside 10 n.miles from the coast of sub-area 7, although it was recognised that some J-stock animals are nevertheless expected to be caught. Pelagic whaling will be conducted in sub-areas 7W, 7E, 8, 9, and 11. The season for pelagic whaling will be April to October in sub-areas 8 and 9 and August to October in sub-area 11 to avoid catches of J-stock animals.

IWC (2012c) and IWC (2012d) also specified expected Korean operations. An advised the meeting that no changes were being proposed, i.e. Korean land-based whaling will be conducted by small-type coastal catcher boats in sub-areas 5 and 6W from March to November. Whaling will take place less than 60 n.miles off the coast for sub-area 5 and less than 30 n.miles for sub-area 6W (however see also Item 6).

5.2 Future survey plans

Appropriate selections for future survey plans are particularly dependent on which variant of the RMP is to be implemented (see Item 6). After some discussion, Korea and Japan both indicated that they wished to reconsider their previous advice on future survey plans and would report back to the 2012 Annual Meeting. The Workshop **recommended** that such reconsideration take the following points into account (noting that these might have conflicting implications, necessitating trade-off decisions):

(1) if *Combination Areas* with catch cascading are to be considered, surveys in all constituent *Small Areas* for such *Combination Areas* should take place at the same time of year (except in some cases where it might be appropriate to use abundance estimates from only some of the constituent *Small Areas* surveyed at one time of year for calculation of the catch limit for the *Combination Area*, but also use estimates for the other *Small Areas* obtained at different times of the year for the process of splitting that catch limit amongst all the constituent *Small Areas*);
(2) ideally surveys should take place at the time of year when the density of whales in the area is highest;
(3) the time previous surveys of an area had taken place, to provide a continued sequence (note that without an accepted survey estimate for a *Small Area*, the RMP will yield a zero catch limit);
(4) the need to specify when future surveys in sub-areas 6E, 10 and 12 are planned to take place; and
(5) proposing different future survey plans for different RMP variant applications is acceptable and probably desirable.

5.3 Performance statistics, including presentation of results

The Workshop **endorsed** the statistics and plots related to the performance of RMP variants developed for previous recent *Implementations* (e.g. see IWC, 2012d). These statistics and plots, along with the results of applying the approach for evaluating conservation and utilisation performance outlined in the Requirements and Guidelines for *Implementations* (IWC, 2005a; 2007), will need to be provided to the 2013 Annual Meeting.

5.4 Complete near-final specifications

The Workshop **agreed** the trials specifications given in Annex D, noting that some modifications might be necessary under the work plan specified under Item 9 (these would be subject to confirmation by the Steering Group identified there). Compared to those agreed at the 2011 Annual Meeting, these trials reflect the changes made to the specifications to ensure that: (a) the hypotheses match the intent of the underlying stock structure hypotheses; and (b) conditioning can be achieved satisfactorily. The set of trials has been extended to include new sensitivity tests:

(a) the number of animals bycaught is proportional to the square-root of abundance rather than to abundance (this sensitivity test examines the impact of possible saturation effects);
(b) a substantially larger fraction of ages 1-4 animals from the O-/OW-/OE-stocks are found in sub-areas 2C, 3 and 4 year-round so that the proportion of these animals in sub-area 9 is closer to expectations given the length-frequencies of the catches from sub-area 9;
(c) set the proportion of animals of ages 1-4 in sub-area 9 to zero and allow the abundance in sub-areas 7CS and 7CN to exceed the abundance estimates for these sub-areas; projections for this sub-area will need to account for the implied survey bias; and
(d) place an upper limit of 200 on the number of 1+ animals in 2009 in sub-area 2C.

In response to the Committee's agreement at the 2011 Annual Meeting that a version of Hypothesis C that did not assume multiple J stocks would be valuable, the Workshop **agreed** that should time be available (see Item 9), Allison and de Moor would investigate options in which there was: one J stock and two O stocks; and two J stocks and one O stock. This agreement was made during discussion of the report. Two participants, Wade and Baker had left the meeting early and were not present.

The Workshop established an intersessional steering group convened by Butterworth to guide the work on conditioning, coding and specifications (members: Butterworth, Donovan, Punt, Wade, Baker, Hatanaka, Pastene, An, Allison, de Moor and Hammond).

6. SPECIFICATION OF MANAGEMENT VARIANTS

IWC (2012d) specified 10 management variants. Given the inter-relationship between future survey plans and management variants noted under Item 5.2, it was **agreed** that Korean and Japanese scientists would reconsider possible management variants and present final specifications at the 2012 Annual Meeting.

7. CONSIDERATION OF DATA/ANALYSES TO REDUCE HYPOTHESES IN FUTURE

The Workshop noted the inherent complexity of the present *Implementation Review* given that the hunting is on migratory whales, the complex nature of the stock structure hypotheses and the difficulties in modelling the process which arises from a lack of data in certain areas and times of the year. It **agreed** that it was important to begin considering ways to try to improve this data-deficient situation prior to the next *Implementation Review* as early as possible.

Therefore some time was spent on an initial discussion of possible ways to reduce the number of hypotheses (and improve aspects of conditioning), noting that the results of the trials will also provide valuable input into the specifics of data collection/analysis (particularly relevant if a 'variant with research' option becomes applicable). The general areas where further data/analyses are likely to be needed are well-known and include: (a) stock structure and dispersal rates; (b) MSYR (note that the review of MSY rates is scheduled to be completed during the 2012 Annual Meeting); (c) $g(0)$; and (d) mixing and abundance in some spatio-temporal strata, such as sub-area 12SW where data are currently sparse, but abundance is estimated to be relatively high.

In relation to stock structure, further improvement of methods to assign individuals to putative stocks would enhance understanding of stock structure, which would also be facilitated by improved sampling of 'pure stock components'. This is related to another key uncertainty, i.e. the lack of knowledge of breeding grounds (and whether they represent concentrations of animals), which currently renders genetic sampling in breeding areas problematic. Research activities, such as telemetry and surveys south of the traditional survey areas might be able to shed light on this uncertainty.

The CVs for many of the abundance estimates are very large, and improved estimates and sampling CVs, particularly for the coastal sub-areas, are important. The existing design provides relatively sparse coverage in sub-areas 7CS and 7CN, and only one survey for sub-area 7N was accepted for conditioning. Given the importance of these sub-areas from a past and proposed future whaling perspective, it is important that good surveys are conducted. Particularly in relation to the coastal sub-areas, aerial survey methods that have proved successful for common minke whales in the North Atlantic should be considered.

8. SUBMISSIONS RELEVANT TO PLAUSIBILITY DISCUSSIONS AT ANNUAL MEETING

8.1 Catch per unit effort data (CPUE)

The Workshop noted that a decision will be taken at the 2012 Annual Meeting as to whether analyses of CPUE data (or sightings per unit effort data, SPUE) can be used qualitatively to inform assignment of plausibility weights to the hypotheses (stock structure and MSYR) on which the trials are based. Taking such a decision requires that a document be presented which *inter alia* outlines relevant operational factors which need to be taken into account (see IWC, 2012d). The Workshop was pleased to receive a progress report on this work (SC/D11/NPM6). The Workshop made the following **recommendations** regarding a final document.

(1) The document should be self-standing, rather than referring extensively to previous analyses of CPUE data for western North Pacific minke whales.
(2) CPUE or SPUE should be based on a measure of searching time. An attempt should therefore be made to distinguish steaming time (from port to the whaling grounds) from searching time. This will probably require certain assumptions to be made and results should be evaluated across a range of such assumptions.
(3) In principle, SPUE is subject to fewer sources of bias than CPUE. However, use of SPUE requires that sightings of minke whales are consistently recorded, rather than sightings only being recorded when the vessel is targeting minke whales. The extent to which this is true over time should be documented.
(4) The decision process to target a particular species (both overall and on a particular trip), along with all changes over time in regulations/species preferences should be documented, along with comment/analyses on how such changes would impact CPUE.
(5) Instances of when more than one whale was taken on a day (i.e. more than one trip occurred) should be documented.
(6) The locations of the whaling grounds should be mapped, along with the noon positions of each vessel and the catch locations. Analyses should be presented showing changes over time in positions (e.g. in the mean latitude and longitude of catches and the mean distance of catches from port). Although desirable for analysis, it appears that the locations of sightings were not recorded.
(7) Examples of the forms used to record the data and an assessment of how well the forms were completed should be provided.
(8) Information on the time to reach the various whaling grounds from each of the ports and any trends in searching time/environmental variables which might impact searching time should be provided.
(9) A conceptual model of how CPUE/SPUE might change given changes in the abundance of minke whales passing along the coast of Japan should be developed.

The Workshop **recommended** that analyses of the CPUE/SPUE data consider a variety of assumptions so that the robustness of any conclusions from these data can be evaluated. The Workshop established an Advisory Group (Butterworth (Chair), Donovan, Punt, Wade) to advise the Japanese scientists developing the summary document and conducting GLM analyses of the CPUE data.

8.2 Tabular summary of information relevant to the stock structure hypotheses

In IWC (2012d, appendix 9), an outline approach to summarising the relevant information for the proposed stock structure hypotheses was proposed. The Committee had agreed at the 2011 Annual Meeting that a tabular structure

should be used to summarise the evidence which can then be used to inform the assignment of plausibility to hypotheses, where the columns of the table are the 'key questions' that distinguish the hypotheses. The table could be hierarchical, with a more detailed structure wherein each row is an individual piece of information (see IWC, 2012a, appendix F-2), but with a more streamlined summary table.

The Workshop **agreed** that such a summary would be valuable to assist discussions at the 2012 Annual Meeting and requested Waples to work with Gaggioti and Hoelzel, as well as the proponents of the hypotheses, to develop such a table.

9. SCHEDULE OF WORK REQUIRED PRIOR TO THE 2012 ANNUAL MEETING (SC/64)

See Table 2 for a summary of work required prior to the 2012 Annual Meeting.

10. ADOPTION OF REPORT

Donovan thanked the participants for their co-operative approach to the Workshop. He especially thanked Allison and de Moor for their extremely hard work in producing the conditioning runs. Finally he thanked the Government of Japan for the provision of an excellent meeting venue and the interpreters for their usual excellent work. The Workshop thanked the Chair for steering them through a complex agenda. The report was adopted at 17:00hrs on 16 December 2011 with the provision: (a) that written comments could be received from those members who had left the meeting early; and (b) that time would be given to ensure that the specifications and plots annexes would be as complete as possible.

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Table 2

Tasks necessary for the completion of the *Implementation.*

Task	When	Item	Who
Essential for completion of the *Implementation*			
Coding and specifications:			
Revised baseline models distributed	22 Dec. 2011	3.4	CA&CD
Plots showing results 100 simulations for the 6 baseline cases (current specifications)	31 Dec. 2011	3.4	CA&CD
Suggestions for updated sensitivity tests distributed[2]	15 Jan. 2012	5.4	DSB
Final changes to the baseline mixing matrices[2]	15 Jan. 2012	5.4	All
Specifications finalised[2]	15 Feb. 2012	5.4	All
Conditioning results finalised	2 weeks prior to SC/64	3.4	CA&CD
Convergence tests	Start of SC/64	3.1	CA&CD
Example projection conducted and performance measures computed	Start of SC/64	-	CA
Investigate how the model is estimating the abundance of the Y stock in sub-area 5	15 Jan.		CA
Documents on plausibility distributed	1 month before SC/64	2, 8.2	All[3]
Application of the method of Annex F to the abundance data for sub-areas 8, 11 and 12NE	Start of SC/64	4	TK
Plots of survey tracks, etc. for all surveys	Start of SC/64	4.1	JPN, KOR
Select Management Variants and survey strategies	2 months before SC/64	5.2, 6	JPN, KOR
Estimate abundance for post-2007 surveys	Start of SC/64	4.1.4	JPN, KOR
Revise the specification of the Q-matrix (used to allocate future catches to sex and month) to reflect the expected timing of future catches	Start of SC/64		CA+Miyashita
Desirable			
Document outlining CPUE data and analyses[1]	2 months before SC/64	8.1	TM
Include the ability to enter a variance-covariance matrix into the *CLA*	Start of SC/64	IWC (2012c)	CA
Examine: one J stock and two O stocks; two J stocks and one O stock[2]	1 month before SC/64	5.4	CA and CD

[1]To be assisted by an Advisory Group (Butterworth, Donovan, Punt, Wade). [2]To be advised by a Steering Group (Butterworth, Donovan, Punt, Wade, Baker, Hatanaka, Pastene, An, Allison, De Moor, Hammond). [3]In addition to documents from proponents, a tabular summary of information will be developed by Waples, Gaggiotti and Hoelzel with assistance from proponents of hypotheses.

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Annex A

List of Participants

*=Interpreter.

Japan
Hiroshi Hatanaka
Luis Pastene
Norihisa Kanda
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Toshihide Kitakado
Tomio Miyashita
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USA
Paul Wade
Robin Waples

Invited Participants
Doug Butterworth
André Punt
Carryn de Moor
C. Scott Baker

Republic of Korea
Yong-Rock An
Jung-Youn Park

IWC Secretariat
Greg Donovan
Cherry Allison

Annex B

Agenda

1. Introductory items
   - 1.1 Convenor's opening remarks
   - 1.2 Election of Chair and appointment of rapporteurs
   - 1.3 Adoption of agenda
   - 1.4 Review of documents
2. Hypotheses for inclusion in trials
   - 2.1 Stock structure and mixing
     - 2.1.1 Review of report by genetics sub-group on mixing matrix results circulated inter-sessionally
     - 2.1.2 Re-specification of pure stocks and update of mixing proportions
3. Conditioning
   - 3.1 Conditioning software
   - 3.2 Abundance estimates and covariances used
   - 3.3 Catches
     - 3.3.1 Direct catches
     - 3.3.2 Bycatches
   - 3.4 Review of conditioning results
4. Projection issues
   - 4.1 Simulating *CLA* applications
     - 4.1.1 Use, if at all, of minimum estimates from surveys
     - 4.1.2 Treatment of JARPN surveys which did not have Committee oversight and use of surveys with low coverage
     - 4.1.3 Treatment of surveys already conducted, whose results were not available in time for consideration in conditioning
     - 4.1.4 Treatment of variable coverage in a time series of surveys
     - 4.1.5 Selection of catch series to use
   - 4.2 Initial discussion on the selection of catches and abundance estimates for use in actual *CLA* applications
5. Specification of *Implementation Simulation Trials*
   - 5.1 Specification of expected future operations
   - 5.2 Future survey plans
   - 5.3 Performance statistics, including presentation of results
   - 5.4 Complete near-final specifications
6. Specification of management variants
7. Consideration of data/analyses to reduce hypotheses in future
8. Submissions relevant to plausibility discussions at Annual Meeting
   - 8.1 Catch per unit effort data (CPUE)
   - 8.2 Tabular summary of information relevant to the stock structure hypotheses
9. Schedule of work required prior to the 2012 Annual Meeting (SC/64)

Annex C

List of Documents

SC/D11/NPM

1. Punt, A.E. and Elvarsson, B.T. Improving the performance of the algorithm for conditioning *Implementation Simulation Trials*, with application to North Atlantic fin whales.
2. Gaggiotti, O., Hoelzel, R. and Waples, R. Report of the G3 Review Group.
3. Allison, C.A. Direct catch data for western North Pacific minke whale simulation trials.
4. de Moor, C.L. Calculation of stock mixing proportions, including correction for 'missing alleles': unpooled results.
5. Allison, C.A. North Pacific minke whale *Implementation Simulation Trial* specifications.
6. Miyashita, T. Progress report on CPUE.
7. Miyashita, T. Result of sighting survey in the sub-area 7 in 2011 spring.

Annex D

Trial Specifications

[Available at: *http://www.iwcoffice.org*]

Annex E

Conditioning Results

[Available at: *http://www.iwcoffice.org*]

Annex F

Space/time strata used to define pure-stock proxies

(1) (a) Only O stock occur in these sub-areas under Hypotheses A and B.

(b) There is some genetic heterogeneity in sub-area 9 that is different from the heterogeneity between J and O stock animals (see table 5 of Goto *et al.*, 2009 for mtDNA; and table 7 of Kanda *et al.*, 2009 for microsatellite). This was the rationale for proposing the C stock. The source of such heterogeneity is not well understood yet, but it seems to occur temporarily (e.g. the samples from 9W in 1995 remain as a source of mtDNA heterogeneity). The source of the heterogeneity is not well understood in the case of the microsatellites. The genetic differences in sub-area 9 appear to be small and the heterogeneity only of a sporadic nature. However, we want to avoid any bias in the estimation of mixing proportion derived from any heterogeneity in sub-area 9.

Table 1

Space/time strata used to define pure-stock proxies.

Hypotheses A and B/D		Hypothesis C	
Stock	Location/time for pure sample	Stock	Location/time for pure sample
As at 2011 Annual Meeting			
Y	5 (all months)	Y	5 (all months)
J	6E (all months)	JW	6E (all months)
O[1]	7WR, 7E, 8 (all months)	JE	2C (all months)
		OW[3]	7CS (Apr.-May) and 7CN (Sep.-Oct.) [>10 n.miles]
		OE[4]	8 and 9 (all months) [excluding 9W in 1995]
Present			
Y	5 (all months)	Y	5 (all months)
J	6E (all months)	JW	6E (all months)
O[1]	7WR, 7E, 8 (all months)	JE[3]	2C (Jul.-Dec.)
O (alt)[2]	7E, 8 (all months)	OW[4]	7CN [Jun.] [>8.8 n.miles]
		OE[5]	8 and 9 (all months) [excluding 9W in 1995]

(c) Sample sizes for sub-area 7WR+7E and 8 are reasonably large: 341 for mtDNA and 342 for STR (short tandem repeats).

(2) The occurrence of J-stock animals in sub-area 7WR is sporadic. This alternative definition aims to avoid any presence of J-stock animals in the definition of pure O stock.

(3) The JE pure-stock proxy was revised to account for potential intrusion of OW or other non-JE stocks into sub-area 2C during winter migration. Restricting the pure-stock sample of JE to July-December helps reduce this potential intrusion. This assumes that a component of JE is non-migratory, as indicated by bycatch during all months of the year.

(4) The OW pure-stock proxy was revised in an effort to reduce the potential for migratory intrusion of JE and for the more 'inshore' distribution of JE, year-round (as evidenced in bycatch). Following review of genetic evidence, catches of 'offshore' whaling in June was chosen on the assumption that this would represent the time when the ratio of JE to OW was lowest, likely representing migration patterns of OW and distribution patterns of JE in 7CN. Excluding catches of less than 8.8 n.miles distance from shore was intended to reduce the number of JE in the pure-stock proxy. The choice of 8.8 n.miles rather than the 10 n.mile limit discussed elsewhere in the assessment, was due to minor corrections in 'distance from shore' calculations affecting a small number of samples.

(5) A full description of the OE pure-stock proxy is included in IWC (2012).

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Annex G

Extrapolation of abundance to unsurveyed areas

Toshihide Kitakado, Takashi Hakamada and Tomio Miyashita

APPROACH

Prediction of abundance in sub-areas which were partially covered is intended (sub-areas 8, 11 and 12NE, see Table 1). For this purpose, the following linear model is employed.

$$\log(\text{Abundance estimate}) = (\text{annual trend}) + \log(\text{adjustment} * \text{Block effect}) + \text{process error} + \text{sampling error}$$

Sampling errors may be assumed to be correlated between the estimates because of shared parameters in the detection function. A REML method is applied to estimate the variance in the process error (additional variance). The term for the annual trend is considered only if the test rejects constancy.

Table 1

Abundance data for sub-areas 8. 11 and 12NE. STD estimates by different modes, NC, IO-AC, IO-NC, are considered comparable.

Sub-area	Year	Season	Survey type[1]	Mode[2]	Areal coverage (%)	STD estimate	CV[3]	Use in Conditioning	Source
8	2002	Jun.-Jul.	JR	NC	65.0	0	-	Yes	Hakamada (2010)
	2004	Jun.	JR	NC	40.5	691	0.496	Yes	Hakamada (2010)
	2005	May-Jul.	JR	NC	65.0	177	0.749	Yes	Hakamada (2010)
	2006	May- Jul.	JR	NC	65.0	481	0.650	Yes	Hakamada (2010)
11	1990	Aug.-Sep.	JD	NC	100.0	2,120	0.449	Yes	IWC (2004: 124)
	1999	Aug.-Sep.	JD	NC	100.0	1,456	0.565	Yes	IWC (2004: 124)
	2003	Aug.-Sep.	JD	IO-AC	33.9	882	0.820	Yes	From Miyashita
	2007	Aug.-Sep.	JD	IO-PS	20.2	377	0.389	Min	From Miyashita
12NE	1990	Aug.-Sep.	JD	NC	100.0	10,397	0.364	Yes	IWC (2004: 124)
	1999	Aug.-Sep.	JD	NC	89.4	11,544	0.380	Yes	IWC (2004: 124)
	2003	Aug.-Sep.	JD	IO-AC	46.0	13,067	0.287	Yes	From Miyashita

[1]JD=Japanese dedicated survey, JR=JARPNII. [2]NC=Normal-closing, IO-PS=Passing with IO mode, IO-AC=Abeam-closing with IO mode. [3]CV does not consider any process error.

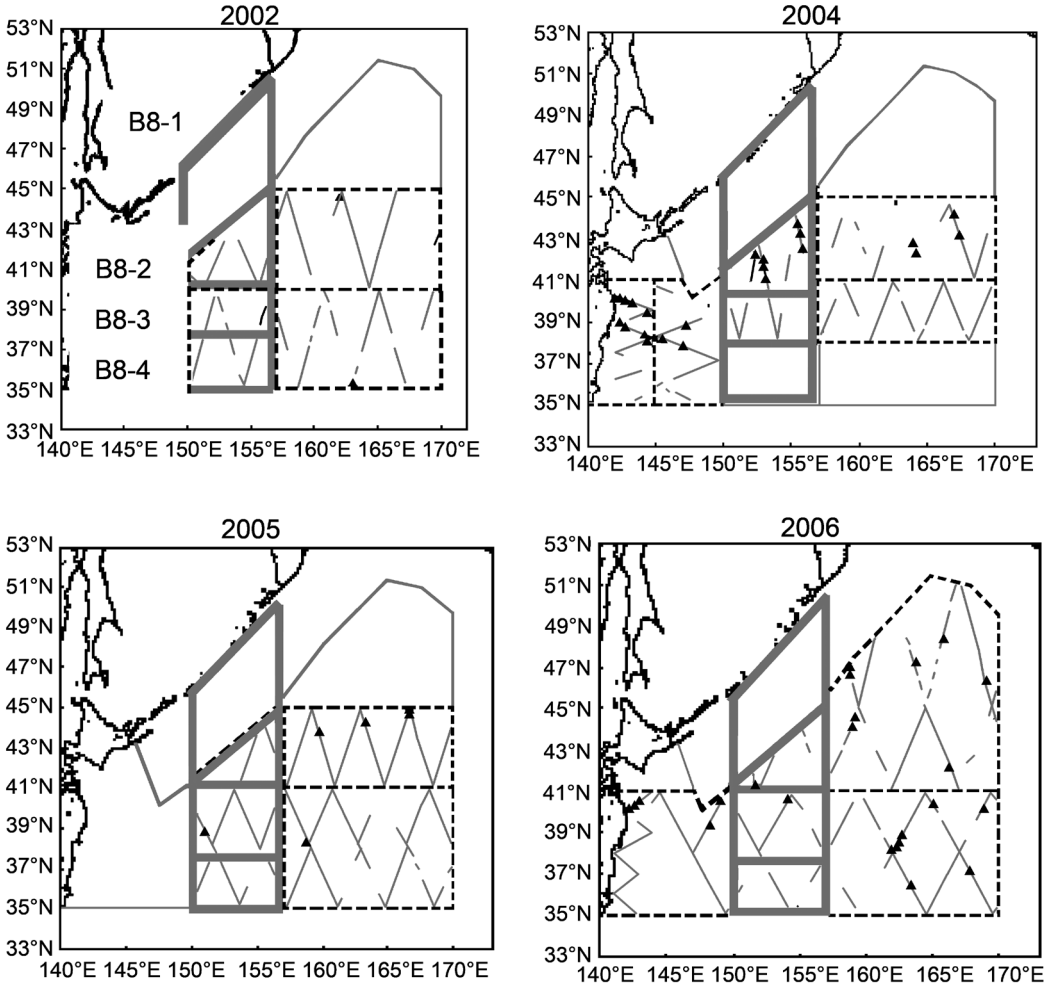
SUB-AREA 8

Blocks	2002	2004	2005	2006
B8-1 Russian EEZ (35% of sub-area)	Not surveyed at all and no extrapolation suggested			
B8-2 northern block	X	X	X	X
B8-3 southern block 1 (38-40°N or 41°N	X	X	X	X
B8-4 southern block 2 (35-38°N)	X	-	X	X

Notes:

(1) Abundance estimates in sub-area 8 in 2004 are zero for all the blocks, and therefore the log-linear model cannot be applied directly. This will either require special treatment as in the conditioning, or deletion of 2004 from the set of data for prediction or consideration of a model for count data.

(2) The definition of the boundary in sub-area 8 has slightly changed slightly over time. One approach is to develop an adjustment factor to scale the abundance level up (or down) by taking the relative difference in the size of the area into account.

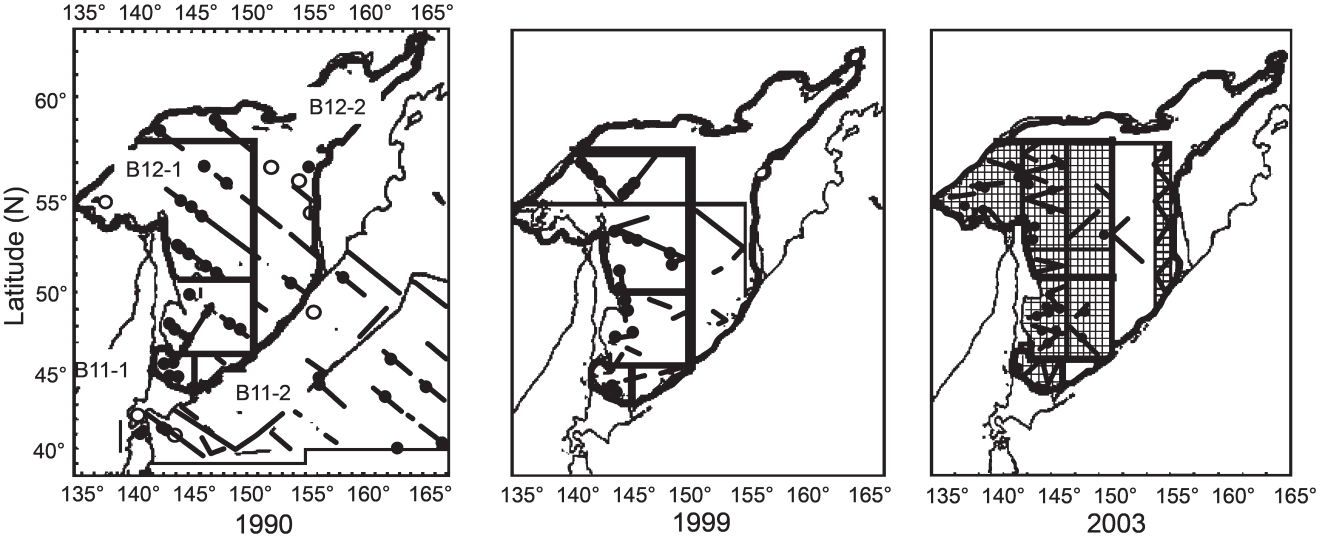


SUB-AREAS 11 AND 12NE

Blocks	1990	1999	2003
B11-1 western block	X	X	X
B11-2 eastern block	X	X	-
B12-1 western block	X	X	X
B12-2 eastern block	X	-	-

Notes:

(1) A very narrow block in 12NE was surveyed in 2003 but eliminated for this prediction exercise.
(2) The abundance estimate in B11-2 in 1990 might be 0 (consider a model for count data).
(3) Estimation of the additional variance for 12NE may be difficult because of less replication of surveys.



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