An update of Antarctic minke whales abundance estimate based on JARPA data.

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ABSTRACT

This paper presents updated abundance estimates for Antarctic minke whale based on JARPA sighting data and IWC standard methodology. All estimates assumed g(0)=1. Estimated abundance in Areas IV and V were 44,564 (CV=0.291) in 2003/04 and 72,087 (CV=0.146), respectively and those for I and P stocks are 118,956 (CV=0.164) in 2003/04 and 91,819 (CV=0.147) in 2004/05, respectively. Estimated annual rates of increase and their 95% confidence intervals in Areas IV and V are -0.42% [-4.02%; 4.59%] (1989/90-2003/04) and -1.54% [-4.91; 2.18%] (1990/91-2004/05), respectively. For I and P stocks are 7.93% [-0.05%; 11.45%] (1995/96-2003/04) and -5.88% [-12.19; 0.18%] (1996/97-2004/05), respectively. No significant increase or decrease in abundance trend was detected. In order to address some recommendation and comments made at the 58th IWC/SC meeting, the following adjustment and sensitivity test were conducted. The effect of closing mode and of sampling activities on abundance estimates were investigated using linear model to take into account of some comments made at the 58th IWC/SC meeting. Further, we investigated the effect of tracklines along with ice edge on abundance estimate Analyses showed that tracklines along with ice edge do not produce overestimate of abundance. We recalculated the area size to reconsider boundary of survey strata. As a significant effect of the sampling activity and skipping was detected, we corrected the bias due to this effect using estimated correction factors of SVC/SVP=0.759 (CV=0.126) and SSV/SVC=0.821 (CV=0.084). These two correction factors enabled to obtain abundance estimates from JARPA that were comparable to those from IDCR/SOWER. Underestimate of the abundance that pointed out at the JARPA review meeting in 1997, is adjusted.

KEY WORDS: ANTARCTIC MINKE WHALE, ABUNDANCE ESTIMATE, TRENDS

INTRODUCTION

The Japanese Whale Research Program under Special Permit in the Antarctic (JARPA) had been conducted sighting surveys and biological research of minke whales in Antarctic since 1987/1988. Estimation of the biological parameters to improve the stock management of the Antarctic minke whale is one of the main objectives of JARPA. Because biological samples were collected by two-stage random sampling, estimates of abundance based on these data were necessary for the estimation of biological parameters (Kishino *et al*., 1989). Abundance estimation for the minke from JARPA data had been conducted (Kasamatsu *et al*, 1990; 1991; Kishino *et at*., 1991; Nishiwaki *et al*., 1992; 1994; 1997). At the JARPA review meeting in 1997, it was pointed out that bias of abundance estimate results from the higher-density-under-surveying feature of the JARPA survey design. Burt and Borchers (1997) proposed a method to correct the bias, but there were discussions that adjustment approach in Burt and Borchers (1997) may be unreliable at this meeting (IWC, 1998). Since then, some analyses to examine appropriate methods of adjusting the abundance estimates were conducted (Tanaka, 1999; Clarke *et al*., 1999; 2000). Tanaka (1999) showed that adjustment approach in Burt and Borchers (1997) results in overestimate. Clarke *et al*. (1999; 2000) investigated the performance of GAM-based estimator by simulation. Marques *et al*. (2003) and Burt *et al*. (2005) estimates abundance in Areas IV and V derived from spatial modelling, respectively.

On one side, abundances for Antarctic minke whales (*Balaenoptera bonaerensis*) from IDCR/SOWER data have been estimated taking the effect of closing mode on the estimate into consideration (Branch and Butterworth, 2001). On the other side, the abundance from JARPA data had been estimated without taking this effect into account because sighting survey in passing mode had not been conducted up to 1996/97. In Hakamada *et al*. (2005), it was suggested that (1) the effect of sampling activities（comparison between SSV and SV in closing mode） and (2) the effect of closing mode (comparison between SV in closing mode and that in passing mode) were significant and that abundance should be corrected by a method in Haw (1991).

At the 58th IWC/SC meeting, it was suggested that in addition to the approach discussed in Hakamada *et al*, (2006b), the authors should consider a generalised linear modelling (GLM) approach with survey mode (SSV, SVC and SVP) as a factor. It should be noted that correction of the effect of the skip type (C) (Hakamada *et al*., 2006a) on abundance was dealt with in this paper.

MATERIALS AND METHODS

Survey methodology

For details, see Nishiwaki *et al*., (2005) and SC/D06/J2. In this section, type of survey vessels and survey mode are explained for understanding this paper.

Sampling and Sighting Vessel (SSV)

Sighting surveys by Sampling and Sighting Vessels (SSV) had been conducted since the beginning of JARPA. Researchers search for school until a school is detected and confirm its species and school size after the detection. It is the same survey procedure as that of Sighting Vessel (SV) in closing mode. Different from SV, SSVs try to catch targeted minke whales after confirmation. As it takes much time to catch and carry a sample to research base ship, SSVs could not cover planned distance in high density area. In the first four seasons, (1989/90-1992/93), they proceed the rest of the distance without surveying to the starting point of the next day survey, but this kind of skipping was abolished thereafter and SSVs started sighting survey from the point at the end of the survey of previous day in principle.

Sighting Vessel (SV)

Sighting Vessel was introduced in southern strata in 1991/92 and sighting surveys by SV have been conducted in all strata since 1992/93. Fundamentally, survey protocols of JARPA follow that of IDCR. All sighting survey was conducted in closing mode by 1996/97, but sighting survey in passing mode has been conducted science 1997/98. Except in 1997/98, passing mode is conducted for first 8 hours in a day and closing mode is conducted during rest of the day. Therefore, allocation of effort in passing mode and closing mode is systematic similar to IDCR/SOWER. SV seldom surveys with skipping except due to bad weather conditions, therefore the effect of sampling activity and skipping due to under-surveying in higher density area can be examined by comparing whale density from SSV data to that from SV in closing mode.

As for comparison between SSV and SV in closing mode, the sighting data in 1991/92 or later were used. As for comparison between SV in closing mode and SV in passing mode, data in 1997/98 or later were used.

Abundance estimation

Methodology of abundance estimation used in this study was described by Burt and Stahl (2000) which is the standard methodology adopted by IWC. The program DISTANCE (Buckland *et al.*, 1993) was used for abundance estimation correspond to each track line. Following formula was used for abundance estimation.

$$P_i = \frac{AE(s)n_i}{2wL_i} \qquad (1)$$

where,

P_i = abundance in numbers as estimated from the *i* th trackline

A = area of stratum

$E(s)$ = estimated mean school size

n_i = numbers of schools primary sighted in the *i* th trackline

w = effective search half-width for schools

L_i = search effort in the *i* th trackline

The total of P_i is calculated by each track line as follows;

$$P = \frac{\sum_i L_i P_i}{L} \qquad (2).$$

Then CV of combined P was calculated for each stratum using formula (3).

$$\mathrm{CV}(P) = \sqrt{\left\{\mathrm{CV}\left(\frac{n}{L}\right)\right\}^2 + \{\mathrm{CV}(E(s))\}^2 + \{\mathrm{CV}(w)\}^2} \qquad (3)$$

where L is sum of L_i for all tracklines and n is sum of n_i for all tracklines. CV of n/l was calculated by

$$\mathrm{CV}\left(\frac{n}{l}\right) = \frac{\sqrt{\sum_i \left\{\mathrm{Var}\left(\frac{n_i}{L_i}\right)\left(\frac{L_i}{L}\right)^2\right\}}}{P} \qquad (4)$$

where variance of (n_i / l_i) was calculated by

$$Var\left(\frac{n_i}{L_i}\right) = \sum_j^{k_i} \frac{1}{(k_i - 1)} \left(\frac{L_{i,j}}{L_i}\right)^2 \left(\frac{n_{i,j}}{L_{i,j}} - \frac{n_i}{L_i}\right)^2 \qquad (5)$$

where k_i is the number of survey days and j is index of day. Assuming abundance is log-normally distributed, 95% confidential interval of the abundance estimate was calculated as (P/C, CP);

$$C = \exp(Z_{0.025}\sqrt{\log_e[1 + \{\mathrm{CV}(P)\}^2]}) \qquad (6)$$

where,

$Z_{0.025}$ represents 2.5-percentage point of standard normal distribution. Details of the analyses methods were described by Buckland *et al.*. (1993) or Branch and Butterworth (2001).

Distance and angle estimation experiment

To correct biases of distance and angle estimation, distance and angle estimation experiment was conducted on each vessel. Bias was estimated for each platform. Linear regression models with standard error proportional to true (radar) distance were conducted to detect significant bias of estimated distance at 5% level. In order to correct significant biases, estimated distance was divided by the estimated slope through the origin. Linear regression models with constant variance were conducted to detect significant bias of estimated angle at 5% level. In order to correct significant biases, estimated angle was divided by the estimated slope through the origin.

Smearing and truncation

The radial distance and angle data for each sighting are smeared using the method II of Buckland and Anganuzzi (1988). Smearing parameter was shown in Table 2. After smearing, the perpendicular distance distribution is truncated at 1.5 n.miles. The smeared and truncated number of detection was substitute to formula (1).

Effective search half-width

Hazard rate model with no adjustment terms was used as a detection function model. It was assumed that $g(0)=1$ (i.e. Probability of detection of whale on the track line is 1.). Effective search half-width was estimated for each stratum.

Mean school size

Only the sightings for which school size is confirmed are used for estimation. We used the method of estimation of mean school size described Buckland *et al.* (1993). Regression of log of school size on $g(x)$ was conducted to estimate mean school size. If the regression coefficient was not significant at 15% level, mean of observed school size for sightings within the truncation distance of 1.5 n.miles was substituted to formula (1). If estimated school size is less than 1, mean of observed school size was substituted to formula (1) even if the regression coefficient was significant. Similar to the case for IDCR/SOWER, we use SV closing mode data for estimation of mean school size for SV passing mode.

Stratification

SV abundance was estimated for each stratum. From 1997/98 to 2003/04, abundances were estimated from data in closing mode and those in passing mode, respectively. And SSV abundances were estimated for each track line. SSV abundance for each stratum was estimated by effort-weighted average of that for each track line.

Unsurveyed area between southern and northern strata due to unexpected movement of ice edge.

In case that surveying northern strata was earlier than surveying southern strata, southern boundary of northern strata was defined as 45 n.miles of north from ice edge when northern strata were surveyed and northern boundary of southern strata was defined as 45 n.miles of north from ice edge when southern strata were surveyed. If ice edge moved to south substantially, unsurveyed area was occurred between northern and southern boundary. The IWC Scientific Committee recommended that consideration be given to other treatments of apparently unsurveyed areas within strata when converting density estimates to abundance. To cover the recommendation, treatment of such unserveyed area was reconsidered. Such unsurveyed area should be included as northern strata because they are north of 45 n.mile line from ice edge. Area size of each stratum was recalculated and therefore abundance estimate was recalculated.

Examination for the effect of including tracklines those look like along with ice edge

At the 58th IWC/SC meeting, the Committee recommends that as a sensitivity analysis, calculations be repeated including only the perpendicular transects, or at least exclude segments that appeared to track the contours of the ice edge, to investigate implications for bias and precision. Some of tracklines not parallel to longitudinal line could lead overestimate of abundance because they are nearly parallel to the ice edge in strata where saw-tooth type tracklines were designed (e.g. south-west and south-east strata in Area IV and south-west in Area V). To examine the effect, sensitivity analyses of abundance estimation were conducted for two data sets. One is excluding tracklines those look like along with ice edge (Option B). Another is excluding all tracklines not parallel to longitudinal lines (Option C).

First, we estimated abundance incase of excluding tracklines along to ice edge (Option B) and excluding tracklines not parallel to longitudinal lines (Option C). Then, we estimated ratio of abundance in case of Option B and C to estimates using all tracklines (Option A) and investigated if the average of the ratio is significantly different from 1 or not.

Estimation of correction factors

We estimated correction factors due to mode effect and use them to correct abundance by two approaches. One is method in Haw (1991) and another is method using linear model.

Method in Haw (1991)

A ratio ($R1$) of whale density for SSV to that for SV closing mode and a ratio ($R2$) of whale density for SV closing mode to that for SV passing mode were estimated by using the method of Haw (1991). $R1$ and $R2$ were estimated for each stratum by calculating inverse-variance-weighted average of $R1$/$R2$-values for all years. We show formulas in the case of estimate of a ratio of whale density for SSV to that for SV closing mode. The index i indicates strata. For simplicity, we wrote $R1$ and $R2$ as R in rest of this section.

$$\overline{\ln R} = \sum_i \frac{\{\mathrm{Var}(\ln R_i)\}^{-1}}{\sum_j \{\mathrm{Var}(R_j)\}^{-1}} \ln R_i \qquad (7\text{-}1)$$

$$\mathrm{Var}(\overline{\ln R}) = \left\{ \sum_i \{\mathrm{Var}(R_i)\}^{-1} \right\}^{-1} \qquad (7\text{-}2)$$

$$R = \exp(\overline{\ln R} + \mathrm{Var}(\overline{\ln R})/2) \qquad (7\text{-}3)$$

$$\mathrm{se}(R) = \sqrt{R\{\exp(\mathrm{Var}(\overline{\ln R})) - 1\}} \qquad (7\text{-}4)$$

where $$R_i = \frac{D_{i,\mathrm{SSV}}}{D_{i,\mathrm{SV\text{-}closing}}} \quad (7\text{-}5)$$

$$\mathrm{CV}(R_i) = \sqrt{\{\mathrm{CV}(D_{i,\mathrm{SSV}})\}^2 + \{\mathrm{CV}(D_{i,\mathrm{SV\text{-}closing}})\}^2} \quad (7\text{-}6)$$

$$\mathrm{Var}(\ln R_i) = \ln[\{CV(R_i)\}^2 - 1] \quad (7\text{-}7)$$

R for whole Area IV and whole Area V also estimated by 'super-strata' method described by Haw (1991). To conduct this method, D_w for 'super-strata' (weighted by Area of each stratum) is estimated by

$$W_i = \frac{A_i}{\sum_i A_i} \quad (8\text{-}1)$$

$$\overline{D} = \frac{1}{2\hat{w}} \sum_i W_i \left(\frac{n}{L}\right)_i \quad (8\text{-}2)$$

$$\mathrm{CV}(\overline{D}) = \sqrt{\{\mathrm{CV}(\hat{w})\}^2 + \frac{\sum_i W_i^2 \left(\frac{n}{L}\right)_i^2 \left[\mathrm{CV}\left\{\left(\frac{n}{L}\right)_i\right\}\right]^2}{\left\{\sum_i W_i \left(\frac{n}{L}\right)_i\right\}^2}} \quad (8\text{-}3)$$

where $\hat{w}$ is pooled estimate of effective search half- width. R for 'super-strata' is estimated similarly.

Combining abundance estimates

For the purpose of adjusting SSV abundance that might be affected by sampling activity, SSV abundance was divided by estimated *R*1. CV of 'Pseudo SV-C' abundance was calculated by

$$\mathrm{CV}(P_{PseudoSV-C}) = \sqrt{\{\mathrm{CV}(P_{SSV})\}^2 + \{\mathrm{CV}(R)\}^2} \quad (9\text{-}1)$$

Next, inverse-variance-weighted average of P_{Pseudo} and P_{SSV} (P_1) and its CV was calculated by following formula,

$$P_1 = \frac{\mathrm{Var}(P_{PseudoSV-C})P_{SV-C} + \mathrm{Var}(P_{SV-C})P_{PseudoSV-C}}{\mathrm{Var}(P_{SV-C}) + \mathrm{Var}(P_{PseudoSV-C})} \quad (9\text{-}2)$$

$$\mathrm{CV}(P_1) = \frac{\sqrt{\{\mathrm{Var}(P_{PsedoSV-C})\}^2 \mathrm{Var}(P_{SV-C}) + \{\mathrm{Var}(P_{SV-C})\}^2 \mathrm{Var}(P_{PseudoSV-C})}}{\{\mathrm{Var}(P_{SV-C}) + \mathrm{Var}(P_{PseudoSV-C})\}P_1} \quad (9\text{-}3)$$

Similarly, in order to consider the effects of closing mode on abundance estimates, the combined estimate of P_1 and $P_{\mathrm{SV\text{-}P}}$ (the abundance estimates for SV in passing mode) (P_{combined}) and its CV are obtained. The formulas are

$$P_{combined} = \frac{\mathrm{Var}(P_{PseudoSV-P})P_{SV-P} + \mathrm{Var}(P_{SV-P})P_{PseudoSV-P}}{\mathrm{Var}(P_{SV-P}) + \mathrm{Var}(P_{PseudoSV-P})} \quad (9\text{-}4)$$

$$\mathrm{CV}(P_1) = \frac{\sqrt{\{\mathrm{Var}(P_{PsedoSV-P})\}^2 \mathrm{Var}(P_{SV-P}) + \{\mathrm{Var}(P_{SV-P})\}^2 \mathrm{Var}(P_{PseudoSV-P})}}{\{\mathrm{Var}(P_{SV-P}) + \mathrm{Var}(P_{PseudoSV-P})\}P_1} \quad (9\text{-}5)$$

where $P_{\mathrm{pseudoSV\text{-}P}}$ is P_1 divided by estimated $R2$.

Using linear model

To examine the effect of the "survey modes", a linear model assuming log-normal error is applied.

$$\log(p(y,a)) = \log(p_{true}(y,a)) + MODE + \varepsilon \quad (10)$$

where y is year, a is Area, $p(y,a)$ is observed abundance estimate, $p_{\mathrm{true}}(y,a)$ is unbiased abundance (i.e. free from survey mode effect) in year y and in Area a. and *MODE* is mode effect on abundance standardised to SVP. An intercept term was included the estimated unbiased abundance index. In this formula, we deal all covariate as categorical one. Further we also considered random effect of year and Area on 'mode' factor in order to consider if assumption that mode effect is constant for all years and areas caused underestimate of CV of $p_{\mathrm{true}}(y,a)$.

If we don't take the precision of $p(y,a)$ in formula (9) into account on the application of the linear model, the CV of $p_{\mathrm{true}}(y,a)$ would be underestimated. To take this into account, CV of $p_{\mathrm{true}}(y,a)$ were estimated by using a parametric bootstrap. Variance of $\mathrm{p}_{\mathrm{true}}(y,a)$ was estimated by

$$\mathrm{var}(p_{true}(y,a)) = \mathrm{var}(E(p_{true}(y,a) \mid n)) + E(\mathrm{var}(p_{true}(y,a) \mid n) \quad (11).$$

The first term represented variance of estimated $p_{\mathrm{true}}(y,a)$the second term did mean of variance of $p_{\mathrm{true}}(y,a)$of each bootstrap. Comparing an usual bootstrap, the formula (11) includes the second term.

Abundance estimation for I and P stock

In this study, we defined I stock as an area between 35^{o}E and 165^{o}E and P stock as an area between 165^{o}E and 145^{o}W. As for I stock, western part of Area V and rest of I stock area was not surveyed in same year. So we add abundance estimate in western part of Area V to those in Area IIIE and IV. For example, to estimate abundance for I stock in 1995/96, we add abundance estimate in western part of Area V in 1996/97 to those in Area IIIE and IV in 1995/96.

Estimation of abundance trend

We used two approaches. One is linear regression model between year and corrected abundance estimate derived by Haw's method shown in Table 5 weighted by inverse-variance of logarithm of abundance estimate. In order to estimate of CV taking the correlation between correction factors and corrected abundance estimates into account, parametric bootstrap was conducted. pseudo samples of abundance estimates in each area and in each survey mode/vessel were generated assuming they were log-normally distributed. We denote abundance estimated from SSV in year *y* as $P_{1,y}$, abundance estimated from SV in closing mode in year *y* as $P_{2,y}$ and abundance estimated from SV in passing mode in year *y* as $P_{3,y}$. Superscript *p* indicate that it was Pseudo data. Pseudo data set was produced according to equations (12-1) – (12-3).

$$(\sigma_{i,y})^2 = \ln(1+\{\mathrm{CV}(P_{i,y})\}^2 \qquad (i=1,2,3) \qquad (12\text{-}1)$$

$$P_{i,y}^p = P_{i,y}\exp(\varepsilon_{i,y}^p) \text{ where } \varepsilon_{i,y}^p \text{ is a random number from N (0, } (\sigma_{i,y})^2\text{) } (i=1,2,3) \qquad (12\text{-}2)$$

and for the simplicity, it was assumed that CV of $P_{i,y}^p$ (i = 1,2) is constant. Standard errors of $P_{i,y}^p$ (i = 1,2) are calculated by

$$\mathrm{se}(P_{i,y}^p) = P_{i,y}^p\mathrm{CV}(P_{i,y}) \qquad (i=1,2,3) \qquad (12\text{-}3)$$

Combined abundance estimate was calculated from the Pseudo data set and estimated trend similarly.

Another is using linear model described by

$$\log(p(y,a)) = \log(p_{true}(0,a)) + MODE + (\alpha + \beta * Stock)Y + \varepsilon \qquad (13)$$

where *Y* is year, α is a parameter to be estimated that represents for increasing rate in I stock and β is a parameter to be estimated that represents for increasing rate for P stock subtracted from that for I stock. By including this term, we can obtain instantaneous increasing rate by stock. We set Y=0 represents year of 1988/89. CV's of the coefficients were estimated in similar way as formula (11).

RESULTS

Abundance estimate from SSV, SV in closing mode and SV in passing mode

Table 1-a, 1-b, 1-c and 1-d shows abundance estimate from SSV in Area IV, Area V, the eastern part of Area III and the western part of Area VI, respectively. Estimates from SSV were tend to be much smaller than those from SVbut they were occasionally more than estimates from SV in some recent years.

Table 3-a and 3-b shows uncorrected estimates in Areas IV and V and eastern part of Area III and western part of Area VI, respectively.

The effect of change in treatment of unsurveyed area on abundance

Comparing Table 2 with Table 3, abundance estimate differ by at most about ±10 % of previous abundance estimate in Table 3. Therefore, change in treatment of unsurveyed area would not change abundance and probably also abundance trend estimates substantially.

Sensitivity test to examine the effect of tracklines nearly parallel to ice edge

Table 4 shows that average ratio of abundance in Options B and C to that in Option A. Average of P_B/P_A is not sigfinicantly different from 1 in each cases. Average of P_c/P_A is sigfinicantly larger than 1 in some case. But there is no case that Average of P_c/P_A is sigfinicantly smaller than 1. Therefore, it was suggested that including such tracklines would not cause overestimate of abundance.

Estimate of *R*1 and *R*2 and corrected abundance in Areas IV and V

In Haw (1991)'s method, estimated correction factor between SSV and SV in closing mode is *R*1=0.821 (CV=0.084) and estimated correction factor between SV in closing mode and SV in passing mode is *R*2=0.759 (CV=0.126). Both *R*1 and *R*2 are significantly different from 0. This means that the effect of sampling activity and that of closing mode is significant.

In case of linear model, correction factors between SSV and SV in passing mode was 0.886 (CV=0.199) and estimated correction factor between SV in closing mode and SV in passing mode was 1.063 (CV=0.244) estimated by linear model, which were not significantly different from 0.

Abundance estimates in Areas IV and V and abundance estimate for the minke whale of I and P stocks

Table 5 is corrected abundance estimate in each Area derived from Haw's correction method. Table 6 is that derived from using linear model. Table 7 shows abundance estimate in I and P stock from 1995/96 to 2004/05 based on the estimates in Table 5. Abundance estimates in I stock (west of 165^{o}E) are 76,343 in 1995/96 (CV=0.145), 115,945 (CV=0.239) in 1997/98, 77,479 (CV=0.184) in 1999/2000, 203,772 (CV=0.172) in 2001/02 and 118,596 (CV=0.172) in 2003/04. Abundance estimates in P stock (east of 165^{o}E) are 130,868 (CV=0.233) in 1996/97, 79,110 (CV=0.202) in 1998/99, 163,262 (CV=0.185) in 2000/01, 87,569 (CV=0.177) in 2002/03 and 72,087 (CV=0.146) in 2004/05.

Abundance trend in Areas IV and V and in I and P stocks

Table 8 shows estimated annual increasing rate in Areas IV and V based on abundance estimates in the south of 60^{o}S. The estimates and their 95% confidence intervals are in Areas IV and V are -0.42% [-4.02%; 4.59%] (1989/90-2003/04) and -1.54% [-4.91; 2.18%] (1990/91-2004/05), respectively. Estimated abundance and their 95% confidence intervals are in I and P stocks are 7.93% [-0.05%; 11.45%] (1995/96-2003/04) and -5.88% [-12.19; 0.18%] (1996/97-2004/05), respectively. It is shown that no significant increase or decrease of the abundance is detected. Table 10 showed annual increasing rate in I and P stock are 2.60% and -2.12%, respectively. Both estimates were not significantly different from 0.

DISCUSSION

Difference in estimated correction factor of survey mode between Haw's method and linear model.

One of the possible reasons is because abundance data applied in each method is different in stratification. On the application of Haw's method, abundance estimate in southern part of Area IV and V are used so as not to pool strata whose density is very different. But on applying to linear model, Area based abundance was used to make estimation process easier. Other possible reason is because the effect of lack of data (i.e. passing mode wasn't conducted up to 1996/97.) on each method could be different. It should be noted that this difference could hardly differ.

Abundance estimate obtain from Option C

Tracklines used in Option C are designed very systematically. This is because they are allocated equal longitudinal interval and parallel to a longitudinal line and because they have equal length (45 n.miles). There is no doubt that there is no bias in abundance estimate from such systematic trackline. But searching effort in Option C was much less than that in Option A and abundance estimate in Option C has sometimes less precision. Considering this, abundance estimate in Option A was adopted.

Abundance trend

Abundance trend in Areas IV and V and in I and P stocks showed no significant increase or decrease. Abundance trend in Areas IV and V were estimated based on estimates in eight years therefore it is suggested JARPA abundance data provide more reliable abundance trend than IDCR/SOWER which were less frequent than JARPA. Abundance trend in I and P stock were based on estimates in five years. This is because the abundance trend in I and P stock has less precision than those in Areas IV and V. Further investigate is necessary to examine abundance trend in I and P stock. JARPA II will provide sighting data to this investigation.

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Table 1. Antarctic minke whale abundance for each stratum estimated from SSV, SV in closing mode and SV in passing mode, respectively.

1-a. SSV in Area IV

Year	Stratum	area	period	TL	n	L	n/L*100	CV	esw	CV	E(s)	CV	D*100	P	CV	95% CI LL	95% CI UL
1989/90	NW	222,563	2/8-16	TL1	14.1	646.9	2.174	0.382	0.452	0.399	1.360	0.066	3.272	7,282	0.557	2,630	20,159
				TL2	17.4	656.8	2.655	0.488	0.452	0.399	1.360	0.066	3.996	8,893	0.634	2,845	27,793
				TL3	18.0	683.9	2.626	0.350	0.452	0.399	1.360	0.066	3.951	8,794	0.535	3,291	23,503
				combined	49.5	1987.6	2.489	0.240	0.452	0.399	1.360	0.066	3.745	**8,334**	**0.336**	4,392	15,816
	NE	219,245	1/11-19	TL1	15.0	684.2	2.192	0.359	0.585	0.121	2.250	0.119	4.218	9,247	0.397	4,371	19,563
				TL2	17.0	710.0	2.394	0.465	0.585	0.121	2.250	0.119	4.606	10,099	0.495	4,033	25,287
				TL3	17.0	570.2	2.981	0.116	0.585	0.121	2.250	0.119	5.736	12,575	0.206	8,436	18,744
				combined	49.0	1964.4	2.494	0.199	0.585	0.121	2.250	0.119	4.799	**10,521**	**0.222**	6,842	16,177
	SW	35,878	1/21-2/1	TL1	30.4	877.1	3.464	0.234	0.474	0.233	1.963	0.070	7.169	2,572	0.338	1,351	4,897
				TL2	21.2	823.5	2.568	0.217	0.474	0.233	1.963	0.070	5.315	1,907	0.326	1,022	3,557
				TL3	32.0	817.7	3.912	0.146	0.474	0.233	1.963	0.070	8.096	2,905	0.284	1,684	5,010
				combined	83.5	2518.3	3.317	0.116	0.474	0.233	1.963	0.070	6.864	**2,463**	**0.184**	1,724	3,519
	SE	41,143	12/31-1/10	TL1	49.6	495.7	10.010	0.267	0.698	0.115	2.208	0.060	15.833	6,514	0.297	3,687	11,510
				TL2	49.9	431.3	11.568	0.251	0.698	0.115	2.208	0.060	18.298	7,528	0.282	4,376	12,951
				TL3	32.8	398.5	8.223	0.677	0.698	0.115	2.208	0.060	13.006	5,351	0.689	1,576	18,166
				combined	132.3	1325.5	9.980	0.217	0.698	0.115	2.208	0.060	15.785	**6,494**	**0.230**	4,162	10,134
	PB	36,488	2/3-6	TL1	14.0	308.6	4.533	0.925	0.734	0.190	1.756	0.093	5.420	1,978	0.949	411	9,507
				TL2	12.0	308.4	3.887	0.428	0.734	0.190	1.756	0.093	4.647	1,696	0.477	698	4,122
				TL3	15.6	214.9	7.262	0.039	0.734	0.190	1.756	0.093	8.682	3,168	0.215	2,087	4,808
				combined	41.6	831.9	4.999	0.335	0.734	0.190	1.756	0.093	5.976	**2,181**	**0.357**	1,106	4,298
	Total	555,317			355.9	8627.7							5.401	**29,993**	**0.135**	23,058	39,013
1991/92	NW	219,713	2/15-25	TL1	23.5	748.8	3.143	0.253	0.438	0.198	1.710	0.108	6.139	13,488	0.339	7,068	25,737
				TL2	25.3	845.8	2.995	0.220	0.438	0.198	1.710	0.108	5.850	12,853	0.315	7,039	23,470
				TL3	25.7	888.1	2.897	0.250	0.438	0.198	1.710	0.108	5.658	12,432	0.337	6,539	23,636
				combined	74.6	2482.7	3.005	0.139	0.438	0.198	1.710	0.108	5.868	**12,894**	**0.191**	8,904	18,672
	NE	216,299	1/1-9	TL1	11.9	632.5	1.879	0.382	0.504	0.566	1.273	0.106	2.374	5,136	0.691	1,510	17,473
				TL2	6.5	684.7	0.943	0.464	0.504	0.566	1.273	0.106	1.191	2,576	0.740	706	9,402
				TL3	4.0	856.7	0.467	0.384	0.504	0.566	1.273	0.106	0.590	1,276	0.692	375	4,348
				combined	22.3	2173.9	1.028	0.253	0.504	0.566	1.273	0.106	1.299	**2,809**	**0.443**	1,225	6,437
	SW	37,191	1/27-2/6	TL1	23.9	606.8	3.935	0.293	0.654	0.235	2.015	0.088	6.061	2,254	0.385	1,087	4,674
				TL3	32.6	592.6	5.509	0.214	0.654	0.235	2.015	0.088	8.485	3,156	0.330	1,682	5,922
				combined	56.5	1199.4	4.713	0.175	0.654	0.235	2.015	0.088	7.259	**2,700**	**0.250**	1,665	4,378
	SE	39,732	1/16-26	TL1	19.7	641.6	3.063	0.337	0.486	0.248	1.865	0.091	5.879	2,336	0.428	1,045	5,222
				TL3	19.0	716.1	2.653	0.191	0.486	0.248	1.865	0.091	5.093	2,024	0.326	1,085	3,774
				combined	38.7	1357.7	2.847	0.196	0.486	0.248	1.865	0.091	5.464	**2,171**	**0.270**	1,290	3,655
	PB	36,569	2/9-14	TL1	31.4	209.0	15.043	0.738	0.577	0.324	2.305	0.099	30.058	10,992	0.812	2,725	44,341
				TL3	29.9	161.4	18.514	0.713	0.577	0.324	2.305	0.099	36.994	13,528	0.789	3,458	52,925
				combined	61.3	370.4	16.556	0.514	0.577	0.324	2.305	0.099	33.081	**12,097**	**0.567**	4,299	34,039
	Total	549,503			253.4	7584.1								**32,670**	**0.228**	21,021	50,774
1993/94	NW	232,794	2/15-3/3	TL1	28.1	1191.5	2.359	0.323	0.567	0.151	1.391	0.072	2.895	6,739	0.364	3,376	13,454
				TL3	25.0	1301.8	1.920	0.174	0.567	0.151	1.391	0.072	2.357	5,487	0.242	3,440	8,752
				combined	53.1	2493.3	2.130	0.190	0.567	0.151	1.391	0.072	2.614	**6,085**	**0.224**	3,946	9,384
	NE	163,135	1/5-20	TL1	30.4	965.2	3.154	0.238	0.482	0.230	1.614	0.082	5.281	8,616	0.341	4,501	16,492
				TL3	28.1	959.5	2.933	0.215	0.482	0.230	1.614	0.082	4.910	8,011	0.325	4,305	14,905
				combined	58.6	1924.7	3.044	0.161	0.482	0.230	1.614	0.082	5.096	**8,314**	**0.333**	4,405	15,692
	SW	40,280	1/22-2/4	TL1	58.2	650.4	8.950	0.269	0.697	0.178	1.838	0.059	11.795	4,751	0.328	2,540	8,886
				TL3	43.7	702.5	6.225	0.423	0.697	0.178	1.838	0.059	8.204	3,305	0.463	1,394	7,836
				combined	101.9	1352.9	7.535	0.238	0.697	0.178	1.838	0.059	9.930	**4,000**	**0.273**	2,366	6,763
	SE	42,206	12/21-1/4	TL1	39.2	627.2	6.243	0.470	0.645	0.231	2.516	0.094	12.168	5,136	0.532	1,930	13,665
				TL3	24.0	791.9	3.031	0.267	0.645	0.231	2.516	0.094	5.907	2,493	0.366	1,245	4,991
				combined	63.2	1419.1	4.450	0.309	0.645	0.231	2.516	0.094	8.675	**3,661**	**0.358**	1,854	7,230
	PB	34,506	2/6-14	TL1	22.6	283.0	7.997	0.368	0.447	0.275	2.079	0.069	18.593	6,416	0.464	2,699	15,249
				TL3	21.7	316.3	6.847	0.347	0.447	0.275	2.079	0.069	15.919	5,493	0.448	2,377	12,695
				combined	44.3	599.3	7.390	0.253	0.447	0.275	2.079	0.069	17.181	**5,929**	**0.323**	3,199	10,989
	Total	512,920			321.1	7789.3								**27,989**	**0.143**	21,167	37,010

(Table 1-a continue)

Year	Stratum	area	period	TL	n	L	n/L*100	CV	esw	CV	E(s)	CV	D*100	P	CV	95% CI LL	95% CI UL
1995/96	NW	199,426	1/10-26	TL1	16.5	893.0	1.849	0.622	0.883	0.127	1.908	0.085	1.997	3,983	0.640	1,263	12,563
				TL2	21.0	921.1	2.277	0.400	0.883	0.127	1.908	0.085	2.461	4,907	0.428	2,195	10,967
				TL3	19.0	922.8	2.059	0.309	0.883	0.127	1.908	0.085	2.225	4,438	0.345	2,301	8,559
				combined	56.5	2736.9	2.064	0.257	0.883	0.127	1.908	0.085	2.230	**4,447**	**0.272**	2,637	7,502
	NE	230,678	2/10-19	TL1	18.9	715.1	2.641	0.374	0.482	0.347	1.623	0.090	4.446	10,256	0.518	3,946	26,659
				TL2	22.7	697.4	3.254	0.375	0.482	0.347	1.623	0.090	5.478	12,636	0.519	4,856	32,884
				TL3	20.2	711	2.840	0.244	0.482	0.347	1.623	0.090	4.781	11,029	0.433	4,892	24,864
				combined	61.8	2123.5	2.909	0.196	0.482	0.347	1.420	0.074	4.897	**11,297**	**0.285**	6,529	19,547
	SW	39,500	12/22-1/9	TL1	54.6	827.5	6.600	0.420	0.638	0.206	1.875	0.052	9.698	3,831	0.471	1,594	9,208
				TL2	49.8	623.2	7.985	0.211	0.638	0.206	1.875	0.052	11.733	4,634	0.300	2,608	8,234
				TL3	36.4	686.3	5.309	0.357	0.638	0.206	1.875	0.052	7.800	3,081	0.415	1,410	6,732
				combined	140.8	2137	6.589	0.202	0.638	0.206	1.875	0.052	9.682	**3,824**	**0.237**	2,419	6,045
	SE	33,783	2/20-29	TL1	39.6	469.2	8.432	0.246	0.767	0.121	2.104	0.067	11.566	3,907	0.282	2,273	6,717
				TL2	45.4	502.9	9.019	0.234	0.767	0.121	2.104	0.067	12.370	4,179	0.272	2,477	7,050
				TL3	32.2	489.4	6.585	0.275	0.767	0.121	2.104	0.067	9.032	3,051	0.308	1,692	5,502
				combined	117.1	1461.5	8.016	0.144	0.767	0.121	2.104	0.067	10.994	**3,714**	**0.165**	2,693	5,123
	PB	25,969	1/27-2/6	TL1	26.9	341.5	7.879	0.592	0.794	0.221	1.328	0.046	6.588	1,711	0.634	548	5,343
				TL2	33.4	247.3	13.492	0.596	0.794	0.221	1.328	0.046	11.282	2,930	0.637	933	9,198
				TL3	27.1	257.8	10.495	0.494	0.794	0.221	1.328	0.046	8.776	2,279	0.543	842	6,168
				combined	87.3	846.6	10.315	0.329	0.794	0.221	1.328	0.046	8.626	**2,240**	**0.354**	1,141	4,396
	Total	529,356			463.6	9305.5								**25,523**	**0.145**	19,241	33,854
1997/98	NW	219,550	1/1-15	TL1	25.1	845.2	2.974	0.443	0.910	0.205	1.914	0.105	3.129	6,869	0.499	2,726	17,308
				TL2	20.5	909.7	2.251	0.385	0.910	0.205	1.914	0.105	2.368	5,200	0.449	2,246	12,036
				TL3	24.7	861.4	2.862	0.395	0.910	0.205	1.914	0.105	3.011	6,611	0.457	2,814	15,535
				combined	70.3	2616.3	2.686	0.239	0.910	0.205	1.914	0.105	2.826	**6,204**	**0.273**	3,666	10,499
	NE	221,192	1/31-2/13	TL1	19.9	812.1	2.451	0.254	0.641	0.327	1.732	0.166	3.314	7,330	0.446	3,179	16,902
				TL2	19.7	894.7	2.207	0.273	0.641	0.327	1.732	0.166	2.983	6,599	0.458	2,807	15,515
				TL3	16.0	936.5	1.712	0.265	0.641	0.327	1.732	0.166	2.315	5,120	0.453	2,196	11,938
				combined	55.7	2643.3	2.106	0.153	0.641	0.327	1.732	0.166	2.848	**6,300**	**0.262**	3,800	10,445
	SW	32,922	2/14-3/1	TL1	29.5	815.6	3.617	0.400	0.757	0.178	1.492	0.068	3.568	1,175	0.443	513	2,691
				TL2	28.7	864.6	3.317	0.561	0.757	0.178	1.492	0.068	3.272	1,077	0.592	368	3,156
				TL3	23.9	965.2	2.476	0.890	0.757	0.178	1.492	0.068	2.443	804	0.910	175	3,686
				combined	82.1	2645.4	3.103	0.355	0.757	0.178	1.492	0.068	3.061	**1,008**	**0.372**	498	2,041
	SE	34,271	1/16-30	TL1	27.4	814.4	3.362	0.185	0.549	0.289	1.184	0.058	3.626	1,243	0.348	641	2,410
				TL2	22.8	822.3	2.772	0.308	0.549	0.289	1.184	0.058	2.990	1,025	0.426	460	2,283
				TL3	29.8	733.7	4.060	0.202	0.549	0.289	1.184	0.058	4.379	1,501	0.357	761	2,960
				combined	80.0	2370.4	3.374	0.132	0.549	0.289	1.184	0.058	3.639	**1,247**	**0.216**	820	1,895
	PB	3,820	2/2-9	TL1	33.2	140.2	23.685	1.428	0.383	0.210	2.634	0.101	81.416	3,110	1.446	388	24,957
				TL2	20.0	136.1	14.695	1.505	0.383	0.210	2.634	0.101	50.514	1,930	1.522	226	16,507
				TL3	14.7	78.6	18.754	0.615	0.383	0.210	2.634	0.101	64.469	2,463	0.657	761	7,973
				combined	67.9	354.9	19.145	0.837	0.383	0.210	2.634	0.101	65.812	**2,514**	**0.849**	593	10,654
	Total	511,756			356	10630.3								**17,272**	**0.186**	12,021	24,816
1990/00	NW	228,269	12/28-1/13	TL1	14.0	522.0	2.680	0.508	0.885	0.195	1.174	0.072	1.777	4,056	0.549	1,483	11,089
				TL2	16.5	679.1	2.427	0.262	0.885	0.195	1.174	0.072	1.609	3,672	0.334	1,940	6,951
				TL3	15.8	625.1	2.524	0.393	0.885	0.195	1.174	0.072	1.673	3,819	0.445	1,661	8,784
				combined	46.2	1826.2	2.532	0.224	0.885	0.195	1.174	0.072	1.679	**3,832**	**0.255**	2,345	6,262
	NE	226,325	1/14-27	TL1	31.7	843.0	3.755	0.322	0.790	0.122	1.212	0.038	2.879	6,516	0.347	3,366	12,614
				TL2	31.6	850.4	3.715	0.246	0.790	0.122	1.212	0.038	2.849	6,448	0.277	3,784	10,985
				TL3	32.8	813.7	4.036	0.370	0.790	0.122	1.212	0.038	3.094	7,003	0.392	3,339	14,687
				combined	96.1	2507.1	3.833	0.184	0.790	0.122	1.212	0.038	2.939	**6,651**	**0.198**	4,527	9,771
	SW	46,682	2/19-3/1	TL1	72.2	556.2	12.978	0.404	0.856	0.081	3.019	0.061	22.886	10,684	0.416	4,879	23,392
			3/7-9	TL2	93.2	515.6	18.067	0.325	0.856	0.081	3.019	0.061	31.862	14,874	0.341	7,766	28,487
				TL3	62.2	594.1	10.472	0.276	0.856	0.081	3.019	0.061	18.468	8,621	0.294	4,903	15,158
				combined	227.6	1665.9	13.659	0.200	0.856	0.081	3.019	0.061	24.088	**11,245**	**0.208**	7,509	16,841
	SE	35,018	1/28-2/18	TL1	102.1	575.2	17.749	0.383	0.830	0.111	4.999	0.837	53.443	18,715	0.927	3,997	87,635
				TL2	103.1	696.7	14.804	0.373	0.830	0.111	4.999	0.837	44.576	15,610	0.923	3,351	72,704
				TL3	77.9	612.9	12.711	0.227	0.830	0.111	4.999	0.837	38.275	13,403	0.874	3,060	58,709
				combined	283.1	1884.8	15.022	0.204	0.830	0.111	4.999	0.837	45.233	**15,840**	**0.532**	5,957	42,119
	PB	20,531	3/2-6	TL1	40.3	240.6	16.744	0.285	0.796	0.107	2.677	0.115	28.155	5,780	0.326	3,103	10,767
				TL2	59.6	379	15.720	0.424	0.796	0.107	2.677	0.115	26.432	5,427	0.452	2,332	12,626
				TL3	30.7	233.3	13.154	0.241	0.796	0.107	2.677	0.115	22.119	4,541	0.287	2,615	7,886
				combined	130.6	852.9	15.307	0.220	0.796	0.107	2.677	0.115	25.738	**5,284**	**0.239**	3,329	8,387
	Total	556,825			783.6	8736.9								**42,852**	**0.210**	28,539	64,343

(Table 1-a continued)

Year	Stratum	area	period	TL	n	L	n/L*100	CV	esw	CV	E(s)	CV	D*100	P	CV	95% CI LL	95% CI UL
2001/02	NW	221,285	12/26-1/10	TL1	28.4	802.1	3.539	2.770	0.734	0.174	1.400	0.069	0.034	7,466	2.776	418	133,444
				TL2	18.5	751.8	2.458	0.411	0.734	0.174	1.400	0.069	0.023	5,186	0.451	2,230	12,064
				TL3	20.8	793	2.625	0.395	0.734	0.174	1.400	0.069	0.025	5,538	0.437	2,442	12,560
				combined	67.7	2346.9	0.029	1.173	0.734	0.174	1.400	0.069	0.027	**6,084**	**1.178**	977	37,890
	NE	242,188	1/11-26	TL1	51.4	768.7	6.691	0.755	0.854	0.107	1.444	0.048	0.057	13,702	0.764	3,626	51,767
				TL2	40.3	735.1	5.483	0.700	0.854	0.107	1.444	0.048	0.046	11,228	0.710	3,209	39,280
				TL3	39.4	746.3	5.283	0.866	0.854	0.107	1.444	0.048	0.045	10,818	0.874	2,472	47,342
				combined	131.2	2250.1	0.058	0.449	0.854	0.107	1.444	0.048	0.049	**11,937**	**0.454**	5,107	27,900
	SW	33,562	2/12-22	TL1	37.5	438.9	8.545	0.192	0.727	0.160	1.386	0.052	0.082	2,736	0.255	1,672	4,476
				TL2	27.3	530.7	5.148	0.305	0.727	0.160	1.386	0.052	0.049	1,648	0.349	849	3,200
				TL3	31.1	500.9	6.200	0.285	0.727	0.160	1.386	0.052	0.059	1,985	0.331	1,056	3,731
				combined	95.9	1470.5	0.065	0.147	0.727	0.160	1.386	0.052	0.062	**2,087**	**0.177**	1,480	2,945
	SE	38,128	1/27-2/11	TL1	87.8	642.8	13.661	0.207	0.827	0.086	1.992	0.060	0.164	6,270	0.232	4,001	9,828
				TL2	73.8	699	10.563	0.295	0.827	0.086	1.992	0.060	0.127	4,848	0.313	2,662	8,831
				TL3	85.8	709.8	12.087	0.234	0.827	0.086	1.992	0.060	0.146	5,548	0.256	3,386	9,092
				combined	247.4	2051.6	0.121	0.141	0.827	0.086	1.992	0.060	0.145	**5,536**	**0.153**	4,109	7,459
	PB	28,374	2/23-27	TL1	56.0	142.4	39.348	0.073	0.468	0.204	2.114	0.063	0.889	25,220	0.226	16,297	39,029
				TL2	67.5	279.5	24.160	0.288	0.468	0.204	2.114	0.063	0.546	15,485	0.359	7,829	30,628
				TL3	60.0	146.2	41.043	0.202	0.468	0.204	2.114	0.063	0.927	26,306	0.294	14,973	46,217
				combined	183.6	568.1	0.323	0.127	0.468	0.204	2.114	0.063	0.730	**20,710**	**0.177**	14,675	29,227
	Total	563,537			658.1	5843.4								**46,355**	**0.210**	30,827	69,704
2003/04	NW	282,038	12/27-1/11	TL1	14.0	794.0	1.763	0.354	0.747	0.130	1.228	0.055	1.449	4,088	0.382	1,985	8,419
				TL2	22.0	744.3	2.956	0.161	0.747	0.130	1.228	0.055	2.430	6,852	0.214	4,525	10,377
				TL3	16.0	854.0	1.874	0.194	0.747	0.130	1.228	0.055	1.540	4,343	0.240	2,730	6,911
				combined	52.0	2392.3	2.174	0.132	0.747	0.130	1.228	0.055	1.787	**5,039**	**0.156**	3,721	6,824
	NE	183,402	1/12-24	TL1	13.0	831.7	1.563	0.324	0.879	0.257	1.318	0.064	1.172	2,149	0.418	979	4,721
				TL2	14.0	906.5	1.544	0.323	0.879	0.257	1.318	0.064	1.158	2,124	0.418	967	4,663
				TL3	16.2	861.4	1.886	0.452	0.879	0.257	1.318	0.064	1.414	2,594	0.524	988	6,811
				combined	43.2	2599.6	1.664	0.222	0.879	0.257	1.318	0.037	1.247	**2,288**	**0.270**	1,360	3,847
	SW	38,491	2/12-28	TL1	62.3	318.3	19.563	0.525	0.829	0.080	2.374	0.056	27.991	10,774	0.534	4,039	28,737
				TL2	87.4	574.4	15.212	0.774	0.829	0.080	2.374	0.056	21.766	8,378	0.780	2,170	32,342
				TL3	56.8	396.2	14.324	0.952	0.829	0.080	2.374	0.056	20.495	7,889	0.957	1,625	38,308
				combined	206.4	1288.9	16.014	0.448	0.829	0.080	2.374	0.056	22.913	**8,819**	**0.452**	3,790	20,524
	SE	41,349	1/25-2/11	TL1	38.4	823.8	4.658	0.627	0.523	0.186	1.828	0.082	8.147	3,369	0.660	1,037	10,939
				TL2	34.4	875.7	3.925	0.964	0.523	0.186	1.828	0.082	6.865	2,839	0.985	565	14,261
				TL3	23.7	899.0	2.631	0.655	0.523	0.186	1.828	0.082	4.603	1,903	0.686	563	6,428
				combined	96.4	2598.5	3.710	0.454	0.523	0.186	1.828	0.047	6.489	**2,683**	**0.470**	1,118	6,437
	PB	37,680	2/29-3/1	TL1	3.0	4.1	73.171	0.577	0.597	0.559	1.952	0.109	119.627	45,075	0.811	11,194	181,505
				TL2	9.7	12.1	80.159	0.321	0.597	0.559	1.952	0.109	131.052	49,380	0.653	15,348	158,875
				TL3	7.4	13.8	53.626	0.368	0.597	0.559	1.952	0.109	87.673	33,035	0.677	9,905	110,175
				combined	20.1	30.0	66.999	0.223	0.597	0.559	1.952	0.068	109.536	**41,273**	**0.420**	18,738	90,911
	Total	582,959			418.1	8909.3								**60,102**	**0.297**	33,993	106,266

Table 1-b. SSV in Area V

Year	Stratum	area	period	TL	n	L	n/L*100	CV	esw	CV	E(s)	CV	D*100	P	CV	95% CI LL	95% CI UL
1990/91	FNW	239,688	1/21-31	TL1	42.0	887.0	4.735	0.216	0.358	0.169	1.57	0.065	0.104	24,943	0.282	14,508	42,883
				TL2	56.5	951.4	5.941	0.241	0.358	0.169	1.57	0.065	0.131	31,296	0.302	17,552	55,801
				TL3	50.0	888.4	5.628	0.239	0.358	0.169	1.57	0.065	0.124	29,647	0.299	16,698	52,637
				combined	148.5	2726.8	0.054	13.647	0.358	0.169	1.57	0.065	0.120	**28,692**	**0.172**	20,521	40,117
	SNE	348,822	2/16-26	TL1	25.1	681.1	3.685	0.248	0.256	0.498	1.56	0.091	0.113	39,258	0.563	14,032	109,837
				TL2	20.0	893.2	2.239	0.344	0.256	0.498	1.56	0.091	0.068	23,857	0.612	7,904	72,012
				TL3	16.7	924.6	1.805	0.915	0.256	0.498	1.56	0.091	0.055	19,227	1.046	3,567	103,635
				combined	61.8	2498.9	0.025	28.912	0.256	0.498	1.56	0.091	0.076	**26,342**	**0.414**	12,084	57,424
	FSW	64,431	1/11-20	TL1	32.2	556.1	5.789	0.188	0.601	0.188	1.81	0.071	0.087	5,603	0.275	3,299	9,518
				TL2	37.6	470.3	7.998	0.306	0.601	0.188	1.81	0.071	0.120	7,742	0.366	3,866	15,504
				TL3	38.6	608.6	6.337	0.234	0.601	0.188	1.81	0.071	0.095	6,134	0.308	3,399	11,070
				combined	108.4	1635	0.066	14.599	0.601	0.188	1.81	0.071	0.100	**6,416**	**0.187**	4,464	9,221
	SSE	188,136	2/5-14	TL1	55.4	589.0	9.408	0.225	0.557	0.147	1.83	0.055	0.155	29,173	0.247	18,113	46,985
				TL2	75.7	576.3	13.128	0.327	0.557	0.147	1.83	0.055	0.216	40,706	0.341	21,234	78,034
				TL3	80.6	504.7	15.963	0.222	0.557	0.147	1.83	0.055	0.263	49,499	0.283	28,719	85,314
				combined	211.6	1670	0.127	15.561	0.557	0.147	1.83	0.055	0.209	**39,296**	**0.175**	27,947	55,251
	Total	841,078			530.3	8530.7								**100,745**	**0.138**	77,031	131,759
1992/93	NW	325,234	1/25-2/5	TL1	21.0	707.2	2.969	0.467	0.451	0.155	1.51	0.075	0.050	16,209	0.497	6,450	40,734
				TL3	18.0	664.0	2.711	0.304	0.451	0.155	1.51	0.075	0.045	14,797	0.349	7,613	28,762
				combined	39.0	1371.2	0.028	28.768	0.451	0.155	1.51	0.075	0.048	**15,525**	**0.313**	8,534	28,243
	NE	348,822	12/30-1/11	TL1	14.5	481.2	3.013	0.415	0.696	0.219	1.53	0.100	0.033	11,557	0.480	4,735	28,206
				TL3	19.3	463.0	4.177	0.226	0.696	0.219	1.53	0.100	0.046	16,021	0.330	8,531	30,085
				combined	33.8	944.2	0.036	21.968	0.696	0.219	1.53	0.100	0.039	**13,746**	**0.279**	8,037	23,509
	SW	59,869	1/15-24	TL1	36.2	468.2	7.724	0.273	0.936	0.156	2.69	0.103	0.111	6,654	0.331	3,537	12,518
			2/8-13	TL3	35.9	434.5	8.267	0.427	0.936	0.156	2.69	0.103	0.119	7,122	0.467	2,984	16,995
				combined	72.1	902.7	0.080	25.324	0.936	0.156	2.69	0.103	0.115	**6,879**	**0.286**	3,973	11,911
	SE	210,194	2/14-3/6	TL1	60.6	640.8	9.459	0.785	0.668	0.225	2.01	0.066	0.142	29,884	0.820	7,333	121,789
				TL3	53.9	564.8	9.536	0.272	0.668	0.225	2.01	0.066	0.143	30,126	0.359	15,217	59,641
				combined	114.5	1205.6	0.095	43.510	0.668	0.225	2.01	0.066	0.143	**29,997**	**0.466**	12,587	71,488
	Total	944,118			259.4	4423.7								**66,147**	**0.233**	42,159	103,784
1994/95	NW	211,503	1/4-19	TL1	23.9	1003.4	2.385	0.336	0.749	0.160	2.36	0.111	0.038	7,935	0.388	3,806	16,542
				TL3	30.6	1059.1	2.893	0.365	0.749	0.160	2.36	0.111	0.046	9,625	0.414	4,417	20,974
				combined	54.6	2062.5	0.026	25.236	0.749	0.160	2.36	0.111	0.042	**8,803**	**0.288**	5,062	15,307
	NE	348,822	1/20-2/5	TL1	28.2	847.1	3.332	0.253	0.661	0.187	2.00	0.037	0.050	17,604	0.317	9,598	32,290
			2/13-18	TL3	33.8	720.9	4.684	0.826	0.661	0.187	2.00	0.037	0.071	24,746	0.848	5,850	104,684
				combined	62.0	1568.0	0.040	46.447	0.661	0.187	2.00	0.037	0.060	**20,888**	**0.484**	8,503	51,313
	SW	41,509	12/18-1/3	TL1	44.3	801.7	5.522	0.329	0.833	0.210	2.29	0.085	0.076	3,148	0.399	1,482	6,685
				TL3	38.0	782.6	4.860	0.328	0.833	0.210	2.29	0.085	0.067	2,771	0.398	1,306	5,875
				combined	82.3	1584.3	0.052	23.272	0.833	0.210	2.29	0.085	0.071	**2,961**	**0.283**	1,720	5,099
	SE	173,180	2/8-9	TL1	73.8	263.0	28.071	0.569	0.889	0.104	2.30	0.066	0.364	62,962	0.582	21,838	181,522
			2/23-3/11	TL3	68.4	343.6	19.921	0.751	0.889	0.104	2.30	0.066	0.258	44,681	0.761	11,880	168,049
				combined	142.3	606.6	0.235	46.663	0.889	0.104	2.30	0.066	0.304	**52,607**	**0.475**	21,746	127,267
	Total	775,013			341.1	5821.4								**85,258**	**0.317**	46,447	156,502
1996/97	NW	285,547	2/5-20	TL1	15.0	731.0	2.052	0.225	0.536	0.329	1.52	0.074	0.029	8,310	0.405	3,868	17,851
				TL2	13.6	773.4	1.762	0.327	0.536	0.329	1.52	0.074	0.025	7,134	0.470	2,974	17,112
				TL3	23.5	568.6	4.139	0.174	0.536	0.329	1.52	0.074	0.059	16,760	0.380	8,165	34,402
				combined	52.2	2073.0	0.025	13.266	0.536	0.329	1.52	0.074	0.036	**10,189**	**0.241**	6,398	16,226
	NE	337,779	1/5-20	TL1	35.3	735.0	4.799	0.108	0.657	0.220	1.58	0.057	0.058	19,512	0.251	12,013	31,692
				TL2	34.0	773.8	4.399	0.257	0.657	0.220	1.58	0.057	0.053	17,888	0.343	9,311	34,366
				TL3	31.6	818.5	3.857	0.062	0.657	0.220	1.58	0.057	0.046	15,681	0.235	9,951	24,710
				combined	100.9	2327.3	0.043	9.656	0.657	0.220	1.58	0.057	0.052	**17,625**	**0.163**	12,837	24,198
	SW	56,628	1/21-2/4	TL1	36.8	846.1	4.347	0.538	0.631	0.235	2.10	0.075	0.072	4,105	0.592	1,402	12,018
				TL2	33.1	784.2	4.215	0.713	0.631	0.235	2.10	0.075	0.070	3,980	0.755	1,068	14,837
				TL3	39.5	801.7	4.929	0.439	0.631	0.235	2.10	0.075	0.082	4,654	0.503	1,834	11,810
				combined	109.4	2432.0	0.045	32.308	0.631	0.235	2.10	0.075	0.075	**4,245**	**0.353**	2,168	8,313
	SE	187,983	2/21-3/12	TL1	45.9	481.7	9.534	0.721	0.596	0.207	3.24	0.141	0.259	48,713	0.763	12,919	183,682
				TL2	48.4	411.2	11.760	0.547	0.596	0.207	3.24	0.141	0.320	60,085	0.602	20,208	178,655
				TL3	52.6	415.5	12.659	0.267	0.596	0.207	3.24	0.141	0.344	64,676	0.366	32,285	129,566
				combined	146.9	1308.4	0.112	30.397	0.596	0.207	3.24	0.141	0.305	**57,356**	**0.337**	30,179	109,009
	Total	867,936			285.3	8140.7								**89,415**	**0.221**	58,320	137,091

(Table 1-b continue)

Year	Stratum	area		TL	n	L	n/L*100	CV	esw	CV	E(s)	CV	D*100	P	CV	95% CI LL	95% CI UL
1998/99	NW	314,848	1/30-2/3	TL1	14.0	268.1	5.222	0.341	0.422	0.259	1.82	0.081	0.113	35,482	0.435	15,681	80,289
				TL2	17.9	311.1	5.738	0.845	0.422	0.259	1.82	0.081	0.124	38,987	0.887	8,755	173,617
				TL3	19.0	254.4	7.469	0.440	0.422	0.259	1.82	0.081	0.161	50,748	0.516	19,568	131,609
				combined	50.9	833.6	0.061	0.352	0.422	0.259	1.82	0.081	0.132	**41,449**	**0.386**	19,983	85,974
	NE	326,943	1/24-29	TL1	11.8	194.9	6.058	0.291	0.503	0.202	2.24	0.103	0.135	44,054	0.369	21,869	88,745
				TL2	15.7	204.9	7.678	0.252	0.503	0.202	2.24	0.103	0.171	55,834	0.339	29,240	106,615
				TL3	18.0	174.3	10.325	0.236	0.503	0.202	2.24	0.103	0.230	75,086	0.327	40,187	140,292
				combined	45.5	574.1	0.079	0.148	0.503	0.202	2.24	0.103	0.176	**57,680**	**0.199**	39,196	84,879
	SW	48,304	2/4-25	TL1	67.1	548.2	12.245	0.234	0.517	0.174	2.40	0.068	0.284	13,719	0.300	7,721	24,378
				TL2	68.9	522.2	13.197	0.273	0.517	0.174	2.40	0.068	0.306	14,787	0.331	7,856	27,831
				TL3	60.5	488.6	12.389	0.291	0.517	0.174	2.40	0.068	0.287	13,881	0.346	7,180	26,836
				combined	196.6	1559.0	0.126	0.154	0.517	0.174	2.40	0.068	0.292	**14,128**	**0.188**	9,806	20,354
	SE	26,627	2/26-3/15	TL1	33.8	425.2	7.937	0.715	0.594	0.120	1.98	0.062	0.132	3,523	0.727	982	12,635
				TL2	44.8	370.9	12.084	1.009	0.594	0.120	1.98	0.062	0.201	5,364	1.018	1,027	28,001
				TL3	35.9	387.6	9.259	0.352	0.594	0.120	1.98	0.062	0.154	4,110	0.377	2,011	8,399
				combined	114.5	1183.7	0.097	0.461	0.594	0.120	1.98	0.062	0.161	**4,292**	**0.468**	1,795	10,264
	Total	716,722			309.8	4150.4								**117,548**	**0.170**	84,477	163,567
2000/01	NW	272,525	2/10-25	TL1	20.0	843.7	2.366	1.537	0.571	0.369	1.90	0.137	0.039	10,714	1.586	1,190	96,493
				TL2	16.6	914.4	1.817	1.448	0.571	0.369	1.90	0.137	0.030	8,229	1.501	979	69,149
				TL3	11.0	930.6	1.182	1.719	0.571	0.369	1.90	0.137	0.020	5,352	1.763	521	55,019
				combined	47.6	2688.7	0.018	0.911	0.571	0.369	1.90	0.137	0.029	**8,013**	**0.940**	1,684	38,128
	NE	348,528	1/2-23	TL1	69.1	888.1	7.783	0.406	0.625	0.164	1.69	0.044	0.105	36,647	0.441	16,054	83,658
				TL2	75.0	898.0	8.349	0.205	0.625	0.164	1.69	0.044	0.113	39,315	0.266	23,551	65,630
				TL3	80.6	918.7	8.778	0.258	0.625	0.164	1.69	0.044	0.119	41,336	0.309	22,877	74,692
				combined	224.7	2704.8	8.309	0.170	0.625	0.164	1.69	0.044	0.112	**39,126**	**0.196**	26,730	57,270
	SW	78,685	2/27-3/19	TL1	64.3	769.7	8.358	0.363	0.737	0.166	1.42	0.036	0.081	6,349	0.401	2,980	13,525
				TL2	62.9	770.9	8.154	0.387	0.737	0.166	1.42	0.036	0.079	6,193	0.422	2,799	13,700
				TL3	70.3	727.1	9.663	0.217	0.737	0.166	1.42	0.036	0.093	7,340	0.275	4,324	12,460
				combined	197.5	2267.7	8.707	0.187	0.737	0.166	1.42	0.036	0.084	**6,613**	**0.211**	4,390	9,964
	SE	148,828	1/24-2/9	TL1	81.4	404.5	20.116	0.307	0.713	0.156	2.64	0.063	0.372	55,312	0.350	28,408	107,696
				TL2	74.7	515.5	14.487	0.433	0.713	0.156	2.64	0.063	0.268	39,836	0.464	16,759	94,687
				TL3	72.9	388.6	18.752	0.403	0.713	0.156	2.64	0.063	0.346	51,562	0.436	22,756	116,832
				combined	228.9	1308.6	0.175	0.220	0.713	0.156	2.64	0.063	0.323	**48,102**	**0.240**	30,239	76,516
	Total	848,567			698.7	8969.8								**101,854**	**0.156**	75,219	137,921
2002/03	NW	266,480	2/11-21	TL1	24.0	615.2	3.900	0.288	0.751	0.099	2.03	0.067	0.053	14,042	0.312	7,724	25,528
				TL2	38.0	571.9	6.645	0.436	0.751	0.099	2.03	0.067	0.090	23,924	0.452	10,268	55,742
				TL3	42.0	650.5	6.455	0.284	0.751	0.099	2.03	0.067	0.087	23,242	0.308	12,876	41,953
				combined	104.0	1837.6	0.057	0.207	0.751	0.099	2.03	0.067	0.076	**20,374**	**0.219**	13,326	31,149
	NE	345,003	1/4-26	TL1	44.8	1219.2	3.677	0.223	0.817	0.198	1.64	0.054	0.037	12,706	0.303	7,110	22,706
				TL2	48.0	1181.8	4.059	0.282	0.817	0.198	1.64	0.054	0.041	14,026	0.349	7,219	27,249
				TL3	35.3	1172.0	3.016	0.314	0.817	0.198	1.64	0.054	0.030	10,422	0.375	5,123	21,203
				combined	128.1	3573.0	0.036	0.157	0.817	0.198	1.64	0.054	0.036	**12,393**	**0.197**	8,449	18,179
	SW	79,679	2/26-3/8	TL1	42.6	302.8	14.058	0.378	0.368	0.281	1.89	0.074	0.362	28,812	0.476	11,877	69,895
				TL2	47.0	231.1	20.347	0.849	0.368	0.281	1.89	0.074	0.523	41,701	0.897	9,249	188,026
				TL3	34.6	230.2	15.022	0.577	0.368	0.281	1.89	0.074	0.386	30,787	0.646	9,680	97,916
				combined	124.2	764.1	0.163	0.382	0.368	0.281	1.89	0.074	0.418	**33,306**	**0.418**	15,178	73,082
	SE	70,816	1/27-2/9	TL1	157.3	234.4	67.125	0.465	0.760	0.065	2.61	0.044	1.155	81,772	0.471	33,983	196,760
				TL2	166.8	202.3	82.467	0.512	0.760	0.065	2.61	0.044	1.419	100,461	0.518	38,628	261,276
				TL3	190.3	298.2	63.823	0.512	0.760	0.065	2.61	0.044	1.098	77,750	0.518	29,890	202,241
				combined	514.5	734.9	0.700	0.289	0.760	0.065	2.61	0.044	1.204	**85,284**	**0.293**	48,607	149,639
						6909.6								**151,357**	**0.192**		
2004/05	NW	278,357	2/19-2/24	TL1	2.0	234.0	0.855	0.999	0.989	0.221	2.20	0.265	0.009	2,645	1.057	484	14,445
				TL2	1.0	226.3	0.442	2.717	0.989	0.221	2.20	0.265	0.005	1,368	2.739	78	24,056
				TL3	2.0	237.9	0.841	0.918	0.989	0.221	2.20	0.265	0.009	2,602	0.981	521	13,005
				combined	5.0	698.2	0.007	0.768	0.989	0.221	2.20	0.265	0.008	**2,216**	**0.795**	562	8,743
	NE	336,130	12/27-1/13	TL1	22.0	745.2	2.954	0.575	0.512	0.297	1.45	0.061	0.043	14,081	0.650	4,400	45,057
				TL2	28.3	735.7	3.847	0.496	0.512	0.297	1.45	0.061	0.060	18,338	0.581	6,368	52,806
				TL3	29.5	713.5	4.134	0.682	0.512	0.297	1.45	0.061	0.064	19,707	0.746	5,347	72,629
				combined	81.7	2288.8	0.036	0.338	0.512	0.297	1.45	0.061	0.055	**17,337**	**0.388**	8,318	36,135
	SW	51,297	2/24-3/8	TL1	32.2	160.8	20.051	0.325	1.019	0.121	4.57	0.146	0.455	23,049	0.376	11,301	47,012
				TL2	38.0	155.3	24.451	0.183	1.019	0.121	4.57	0.146	0.548	28,107	0.264	16,901	46,743
				TL3	34.6	169.8	20.372	0.180	1.019	0.121	4.57	0.146	0.455	23,419	0.262	14,146	38,770
				combined	103.9	485.9	0.214	0.135	1.019	0.121	4.57	0.146	0.484	**24,795**	**0.173**	17,704	34,726
	SE	212,147	1/16-2/15	TL1	203.0	1675.6	12.113	0.179	0.870	0.068	1.85	0.032	0.132	27,304	0.194	18,724	39,815
				TL2	183.9	1841.5	9.986	0.105	0.870	0.068	1.85	0.032	0.109	22,508	0.129	17,487	28,972
				TL3	165.1	1906.2	8.660	0.178	0.870	0.068	1.85	0.032	0.094	19,519	0.193	13,411	28,409
				combined	551.3	5423.3	0.102	0.092	0.870	0.068	1.85	0.032	0.111	**22,939**	**0.101**	18,811	27,974
	Total	877,931			741.9	4310.7								**67,288**	**0.126**	52,581	86,109

Table 1-c. SSV in the eastern part of Area III.

Year	Stratum	area	period	TL	n	L	n/L*100	CV	esw	CV	E(s)	CV	D	P	CV	95% CI LL	95% CI UL
1995/96	FIIIE	253,343	12/8-22	TL1	26.8	804.0	3.336	0.330	0.444	0.189	1.298	0.054	0.049	12,356	0.384	5,977	25,543
				TL2	22.8	798.4	2.855	0.259	0.444	0.189	1.298	0.054	0.042	10,575	0.325	5,687	19,665
				TL3	19.6	828.8	2.366	0.398	0.444	0.189	1.298	0.054	0.035	8,761	0.444	3,818	20,106
				combined	69.2	2431.2	0.028	0.190	0.444	0.189	1.298	0.054	0.042	**10,546**	**0.222**	6,860	16,211
1997/98	FIIIE	250,985	12/16-31	TL1	22.0	949.6	2.321	0.485	0.761	0.239	1.649	0.072	0.025	6,310	0.545	2,322	17,146
				TL2	31.7	1092.8	2.898	0.520	0.761	0.239	1.649	0.072	0.031	7,876	0.577	2,754	22,530
				TL3	22.9	1195.7	1.919	0.642	0.761	0.239	1.649	0.072	0.021	5,217	0.689	1,539	17,687
				combined	76.7	3238.1	0.024	0.320	0.761	0.239	1.649	0.072	0.026	**6,435**	**0.352**	3,293	12,574
1999/00	FIIIE	357358	12/15-26	TL1	25.9	490.0	5.287	0.793	0.765	0.155	1.679	0.070	0.058	20,736	0.811	5,145	83,571
				TL2	34.3	402.8	8.528	0.460	0.765	0.155	1.679	0.070	0.094	33,446	0.490	13,463	83,086
				TL3	35.2	363.2	9.680	1.092	0.765	0.155	1.679	0.070	0.106	37,965	1.105	6,593	218,610
				combined	95.4	1256.0	0.076	0.485	0.765	0.155	1.679	0.070	0.083	**29,794**	**0.495**	11,895	74,629
2001/02	FIIIE	355282	12/9-25	TL1	39.7	772.2	5.137	1.174	0.696	0.162	2.770	0.136	0.102	36,308	1.193	5,742	229,573
				TL2	50.4	741.2	6.802	0.749	0.696	0.162	2.770	0.136	0.135	48,077	0.779	12,472	185,321
				TL3	33.2	689.4	4.817	0.970	0.696	0.162	2.770	0.136	0.096	34,044	0.993	6,713	172,664
				combined	123.3	2202.8	0.056	0.552	0.696	0.162	2.770	0.136	0.111	**39,560**	**0.566**	14,078	111,161
2003/04	FIIIE	324,032	11/30-12/23	TL1	48.9	1129.4	4.328	0.404	0.835	0.148	2.083	0.059	5.401	17,501	0.434	7,758	39,480
				TL2	53.0	1115.4	4.749	0.516	0.835	0.148	2.083	0.059	5.926	19,201	0.540	7,125	51,745
				TL3	44.5	1132.9	3.930	0.874	0.835	0.148	2.083	0.059	4.904	15,890	0.889	3,562	70,882
				combined	146.4	3377.7	0.043	0.352	0.835	0.148	2.083	0.034	5.407	**17,522**	**0.364**	8,783	34,957

Table 1-d. SSV in the western part of Area VI

Year	Stratum	area	period	TL	n	L	n/L*100	CV	esw	CV	E(s)	CV	D	P	CV	95% CI LL	95% CI UL
1996/97	FVIW	205,180	12/15-1/4	TL1	24.0	831.8	2.887	0.227	0.744	0.162	1.785	0.078	0.035	7,110	0.290	4,075	12,407
				TL2	31.6	905.1	3.496	0.274	0.744	0.162	1.785	0.078	0.042	8,608	0.328	4,600	16,107
				TL3	21.1	888.6	2.376	0.507	0.744	0.162	1.785	0.078	0.029	5,852	0.538	2,177	15,728
				combined	76.8	2625.5	0.029	0.193	0.744	0.162	1.785	0.078	0.035	**7,201**	**0.220**	4,702	11,027
1998/99	SVIW	316,727	3/16-31	TL1	25.0	175.8	14.217	0.406	0.788	0.149	1.235	0.051	0.111	35,304	0.435	15,608	79,854
				TL2	20.7	239.4	8.662	0.721	0.788	0.149	1.235	0.051	0.068	21,511	0.738	5,907	78,336
				TL3	23.9	157.3	15.180	0.516	0.788	0.149	1.235	0.051	0.119	37,696	0.540	13,991	101,567
				combined	69.6	572.5	0.122	0.314	0.788	0.149	1.235	0.051	0.095	**30,194**	**0.327**	16,161	56,411
2000/01	FVIW	290,908	12/11-31	TL1	40.5	903.2	4.489	0.365	0.654	0.161	1.422	0.058	0.049	14,202	0.403	6,642	30,364
				TL2	34.2	999.5	3.417	0.349	0.654	0.161	1.422	0.058	0.037	10,811	0.389	5,181	22,560
				TL3	38.1	994.8	3.830	0.369	0.654	0.161	1.422	0.058	0.042	12,118	0.407	5,627	26,095
				combined	112.8	2897.5	0.039	0.210	0.654	0.161	1.422	0.058	0.042	**12,317**	**0.232**	7,867	19,283
2002/03	FVIW	329,256	12/2-1/1	TL1	34.5	1576.2	2.187	0.238	0.510	0.139	1.209	0.038	0.026	8,533	0.278	5,002	14,557
				TL2	45.0	1426.3	3.155	0.290	0.510	0.139	1.209	0.038	0.037	12,307	0.324	6,625	22,861
				TL3	38.8	1395.8	2.777	0.474	0.510	0.139	1.209	0.038	0.033	10,831	0.495	4,323	27,133
				combined	118.2	4398.3	0.027	0.203	0.510	0.139	1.209	0.038	0.032	**10,486**	**0.219**	6,855	16,039
2004/05	FVIW	292,218		TL1	35.7	968.6	3.682	0.352	0.561	0.154	1.361	0.049	0.045	13,063	0.388	6,274	27,198
				TL2	34.5	947.0	3.639	0.529	0.561	0.154	1.361	0.049	0.044	12,910	0.553	4,691	35,529
				TL3	47.8	910.9	5.250	0.529	0.561	0.154	1.361	0.049	0.064	18,627	0.553	6,768	51,270
				combined	117.9	2826.5	0.042	0.285	0.561	0.154	1.361	0.049	0.051	**14,805**	**0.300**	8,325	26,330

Table 1-e. SV (closing mode) in Area IV.

Year	Stratum	area	period	n	L	n/L*100	CV	esw	CV	E(s)	CV	D*100	P	CV	95% CI LL	95% CI UL
1991/92	SW	36,541	1/26-2/6	48.7	1038.1	4.693	0.238	0.383	0.344	2.240	0.122	13.714	5,011	0.450	2,158	11,635
	SE	39,732	1/16-24	28.0	924.0	3.027	0.266	0.500	0.507	2.172	0.174	6.570	2,611	0.259	1,585	4,299
	PB	30,569	2/9-14	76.0	212.6	35.735	0.956	0.868	0.146	4.466	0.495	91.895	28,091	0.690	8,264	95,485
1993/94	NW	233,784	2/15-3/3	26.0	1667.4	1.559	0.267	0.295	0.255	1.280	0.106	3.378	7,896	0.416	3,612	17,263
	NE	164,829	1/5-20	22.4	1250.4	1.790	0.308	0.401	0.526	1.650	0.166	3.683	6,070	0.598	2,054	17,936
	SW	39,229	1/22-30	40.0	1024.8	3.899	0.293	0.634	0.278	1.763	0.132	5.424	2,128	0.404	993	4,559
	SE	40,500	12/21-1/4	59.8	839.8	7.121	0.988	0.477	0.354	2.221	0.111	16.572	6,712	0.807	1,676	26,883
	PB	34,506	2/6-14	27.0	477.7	5.652	0.514	0.360	0.279	1.381	0.096	10.838	3,740	0.518	1,438	9,722
	total	512,848		175.1	5260.1	3.330							**26,546**	**0.286**	15,315	46,012
1995/96	NW	197,094	1/10-26	14.8	793.6	1.867	0.386	0.328	0.796	2.267	0.169	6.452	12,717	0.940	2,672	60,525
	NE	230,267	2/10-18	17.0	856.2	1.986	0.381	0.200	0.446	2.294	0.224	11.402	26,254	0.800	6,613	104,236
	SW	41,845	12/22-1/9	41.0	714.2	5.741	0.410	0.460	0.224	2.737	0.121	17.066	7,141	0.482	2,917	17,480
	SE	34,176	2/19-29	52.7	578.4	9.112	0.172	0.526	0.168	2.350	0.133	20.363	6,959	0.300	3,917	12,363
	PB	25,971	1/27-2/5	25.0	451.6	5.527	0.254	0.375	0.373	1.174	0.132	8.661	2,249	0.399	1,059	4,778
	total	529,353		150.5	3394	4.434							**55,320**	**0.443**	24,118	126,889
1997/98	NW	215,740	12/31-1/14	20.6	551.5	3.735	0.464	0.975	0.201	2.228	0.158	0.043	9,202	0.530	3,472	24,391
	NE	218,011	1/30-2/12	10.0	702.6	1.423	0.399	0.641	0.657	1.556	0.156	0.017	3,764	0.784	969	14,616
	SW	30,308	2/13-27	10.3	530.7	1.944	0.526	0.323	1.054	1.909	0.165	0.058	1,743	1.190	277	10,980
	SE	34,477	1/15-29	18.0	602.9	2.986	0.302	0.516	0.379	1.556	0.093	0.045	1,551	0.494	621	3,876
	PB	4,994	3/2-4	2.8	88.6	3.131	0.620	0.342	1.962	2.333	0.286	0.107	533	2.077	42	6,719
	total	503,529		61.7	2476.3	2.491							**16,793**	**0.370**	8,324	33,880
1999/2000	NW	230,466	12/27-1/11	2.0	325.5	0.614	0.786	1.500	0.000	1.500	0.333	0.003	708	0.854	166	3,018
	NE	226,218	1/11-26	25.0	345.5	7.236	0.312	0.319	0.258	1.421	0.135	0.161	36,495	0.427	16,363	81,393
	SW	43,042	2/18-3/1,3/6-9	22.6	171.9	13.150	0.396	0.719	0.226	1.882	0.147	0.172	7,409	0.479	3,038	18,068
	SE	33,331	1/28-2/18	93.2	582.3	16.007	0.343	0.636	0.178	4.021	0.148	0.506	16,865	0.414	7,741	36,743
	PB	22,045	3/1-6	9.7	101.4	9.570	1.271	0.446	0.907	2.424	0.305	0.260	5,732	1.591	634	51,795
	total	555,102		152.5	1526.6	9.991							**67,209**	**0.293**	38,300	117,937
2001/02	NW	223,614	12/25-1/8	7.3	189.5	3.853	0.428	0.439	0.681	1.071	0.219	0.047	10,516	0.834	2,533	43,664
	NE	247,653	1/9-25	2.0	211.0	0.948	1.002	1.500	0.000	1.000	0.000	0.003	782	1.002	153	4,011
	SW	30,836	2/10-21,27	9.0	198.5	4.534	0.636	0.551	0.216	1.420	0.167	0.058	1,802	0.692	529	6,138
	SE	33,781	1/26-2/8	14.9	197.1	7.570	0.434	0.386	0.481	1.143	0.085	0.112	3,783	0.654	1,175	12,180
	PB	28,570	2/22-26	40.2	133.7	30.072	0.276	0.866	0.179	1.605	0.082	0.279	7,963	0.339	4,172	15,199
	total	564,454		73.4	929.8	7.897							**24,846**	**0.387**	11,949	51,664
2003/04	NW	239,688	12/26-1/10	5.0	257.1	1.945	0.349	0.427	0.300	1.667	0.200	0.038	9,098	0.502	3,593	23,037
	NE	218,714	1/11-24	6.0	329.1	1.823	0.566	1.093	0.271	1.000		0.008	1,825	0.627	590	5,642
	SW	39,461	2/7-25	4.4	257.0	1.720	1.045	0.777	0.755	2.400	0.486	0.027	1,048	1.377	139	7,910
	SE	36,554	1/25-2/7	16.6	242.9	6.836	1.128	0.379	0.685	3.042	0.366	0.274	10,032	1.369	1,339	75,172
	PB	37,394	2/26-3/2	7.5	235.5	3.183	0.352	0.622	0.901	1.571	0.129	0.040	1,504	0.976	303	7,472
	Total	571,811		39.5	1321.6								**23,506**	**0.624**	7,641	72,314

Table 1-f. SV in closing mode in Area V.

Year	Stratum	area	period	n	L	n/L*100	CV	esw	CV	E(s)	CV	D*100	P	CV	95% CI LL	95% CI UL
1992/93	NW	326,061	1/25-2/5	46.7	923.0	5.058	0.294	0.434	0.188	1.565	0.076	9.119	29,732	0.357	15,079	58,623
	NE	348,822	12/30-1/11	15.0	717.3	2.091	0.617	0.453	0.233	2.562	0.329	5.919	20,646	0.737	5,677	75,085
	SW	59,030	1/15-24,2/8-13	105.3	1004.7	10.483	0.283	0.482	0.266	2.899	0.102	31.529	18,612	0.401	8,732	39,668
	SE	210,194	2/14-3/6	172.4	1048.0	16.450	0.367	0.484	0.143	1.915	0.071	32.526	68,367	0.400	32,106	145,585
	Total	944,107		339.4	3693	9.191							**137,357**	**0.247**	85,280	221,236
1994/95	NW	208,477	1/4-19	47.6	1166.9	4.078	0.576	0.479	0.396	1.435	0.138	6.113	12,744	0.713	3,629	44,745
	NE	348,822	1/20-2/14	21.7	986.1	2.200	0.251	0.397	0.446	1.381	0.144	3.821	13,329	0.531	5,017	35,417
	SW	38,313	12/18-1/3	88.0	884.7	9.946	0.270	0.774	0.151	3.918	0.109	25.165	9,642	0.328	5,155	18,034
	SE	173,180	2/15-3/13	191.7	686.4	27.931	0.257	0.840	0.100	4.057	0.104	67.422	116,762	0.295	66,301	205,627
	Total	768,792		349	3724.1								**152,477**	**0.239**	96,070	242,002
1996/97	NW	290,846	2-4/20	14.8	711.6	2.076	0.342	0.536	0.267	4.077	0.538	7.891	22,952	0.691	6,745	78,105
	NE	337,779	1-3/20	16.0	806.1	1.985	0.414	0.236	0.279	1.563	0.181	6.584	22,239	0.530	8,380	59,017
	SW	51,292	1/21-2/3	16.4	563.3	2.914	0.660	0.899	0.525	2.742	0.327	4.442	2,279	0.904	501	10,370
	SE	187,983	2/20-3/12	107.5	790.1	13.603	0.447	0.729	0.132	3.694	0.106	34.452	64,764	0.478	26,629	157,508
	Total	867,900		154.7	2871.1								**112,234**	**0.328**	60,019	209,875
1998/99	NW	314,708	1/14-2/2	8.9	185.4	4.806	0.521	1.228	0.188	3.500	0.235	0.069	21,561	0.602	7,251	64,107
	NE	328,037	1/13-23	15.8	652.8	2.416	0.126	0.375	0.497	1.533	0.167	0.049	16,199	0.539	6,019	43,600
	SW	48,361	2/3-21	14.0	86.9	16.110	1.072	0.189	0.886	3.182	0.371	1.355	65,513	1.440	8,213	522,615
	SE	24,791	2/24-3/12	1.5	116.5	1.327	1.235	1.500	0.000	5.000	0.200	0.022	548	1.251	82	3,675
	Total	715,898		40.23	1041.6								**103,821**	**0.921**	22,347	482,331
2000/01	NW	269,652	2/10-23	2.0	254.9	0.785	0.742	0.157	1.442	1.000	0.000	0.025	6,757	1.622	730	62,539
	NE	348,541	1/1-23	13.3	333.9	3.970	0.427	0.157	1.442	6.546	0.580	0.830	289,215	1.611	31,491	2,656,137
	SW	80,503	2/25-3/18	10.0	210.8	4.744	0.948	0.12	0.991	1.889	0.299	0.372	29,942	1.404	3,874	231,425
	SE	148,828	1/24-2/7	18.7	225.0	8.328	0.449	0.264	0.728	1.685	0.130	0.266	39,574	0.865	9,144	171,280
	Total	847,524		43.99	1024.6								**365,488**	**1.284**	52,814	2,529,268
2002/03	NW	266,894	2/11-20,3/5-7	15.6	183.3	8.526	0.432	0.407	0.356	2.231	0.177	0.234	62,349	0.587	21,462	181,131
	NE	345,003	1/5-25	15.4	408.3	3.783	0.505	0.474	0.436	1.636	0.149	0.065	22,534	0.683	6,699	75,806
	SW	79,072	2/21-3/4	27.0	203.0	13.300	0.346	1.074	0.131	2.000	0.147	0.124	9,790	0.398	4,614	20,771
	SE	68,928	1/27-2/9	26.4	148.3	17.770	0.373	0.632	0.332	1.800	0.128	0.253	17,429	0.516	6,729	45,141
	Total	759,896		84.43	942.9								**112,102**	**0.365**	56,070	224,128
2004/05	NW	278,204	2/11-21	1.0	69.7	1.435	0.860	0.452	0.667	1.556	0.140	0.025	6,873	1.098	1,203	39,274
	NE	336,130	1/4-26	16.7	297.5	5.615	0.569	0.452	0.667	1.556	0.140	0.097	32,498	0.888	7,291	144,847
	SW	51,449	2/26-3/8	13.0	69.6	18.618	0.404	0.736	0.494	2.385	0.168	0.301	15,507	0.660	4,774	50,372
	SE	212,214	1/27-2/9	62.4	714.3	8.737	0.219	0.609	0.295	1.673	0.088	0.120	25,460	0.378	12,448	52,076
	Total	877,997		93.07	1151.1								**80,338**	**0.410**	37,078	174,070

Table 1-g. SV in closing mode in the eastern part of Area III and in the western part of Area VI.

Year	Stratum	area	period	n	L	n/L*100	CV	esw	CV	E(s)	CV	D	P	CV	95% CI LL	95% CI UL
1995/96	FIIIE	253,343	12/8-22	5.0	733.9	0.681	0.486	0.178	0.561	1.000	0.000	0.019	4,843	0.742	1,322	17,742
1997/98	FIIIE	250,985	12/16-30	6.0	697.0	0.861	0.440	0.372	0.984	1.000	0.000	0.012	2,902	1.078	519	16,219
1999/00	FIIIE	356,046	12/5-13,21-26	4.0	188.1	2.127	1.296	0.428	0.422	1.667	0.400	0.041	14,749	1.420	1,880	115,697
2001/02	FIIIE	354,965	12/9-24	20.0	257.9	7.755	0.548	0.384	0.265	3.889	0.249	0.392	139,277	0.658	43,018	450,932
2003/04	FIIIF	324,032	11/30-12/24	31.1	373.2	8.346	0.599	0.355	0.573	1.807	0.1112	0.212	68,853	0.836	16,534	286,735
1996/97	FVIW	206,490	12/14-1/1	29.6	1015.7	2.913	0.236	0.410	0.442	2.044	0.193	0.073	14,994	0.537	5,589	40,228
1998/99	FVIW	316,727	3/12-31	0.0	116.7	0.000	-	-	-	-	-	0.000	0	-	-	-
2000/01	FVIW	290,908	12/11-29	30.0	660.6	4.547	0.280	0.835	0.189	2.071	0.143	0.056	16,403	0.367	8,178	32,901
2002/03	FVIW	309,998	12/3-30	8.0	354.7	2.255	0.523	0.466	0.286	1.500	0.333	0.036	11,260	0.683	3,349	37,863
2004/05	FVIW	292,218	12/7-12/24	7.0	243.0	2.881	0.378	0.388	0.297	1.286	0.143	0.048	13,948	0.502	5,509	35,311

Table 1-h. SV in passing mode in Area IV.

Year	Stratum	area	period	n	L	n/L*100	CV	esw	CV	E(s)	CV	D	P	CV	95% CI LL	95% CI UL
1997/98	NW	215,740	12/31-1/14	4.8	199.4	2.404	0.394	1.382	0.218	2.228	0.158	0.019	4,182	0.478	1,720	10,165
	SW	30,308	2/13-27	8.0	256.4	3.120	0.697	0.821	0.184	1.909	0.165	0.036	1,100	0.740	301	4,016
	SE	34,477	1/15-29	6.0	222.6	2.695	0.637	1.091	0.165	1.556	0.093	0.019	663	0.665	203	2,168
	PB	4,994	3/2-4	21.6	46.5	46.426	0.215	0.523	0.567	2.333	0.286	1.035	5,167	0.670	1,566	17,047
1999/00	NW	230,466	12/27-1/11	4.0	673.6	0.594	0.490	0.540	0.291	1.500	0.333	0.008	1,901	0.660	585	6,175
	NE	226,218	1/11-26	31.4	698.2	4.504	0.236	0.579	0.202	1.421	0.135	0.055	12,499	0.338	6,555	23,833
	SW	43,042	2/18-29,3/6-	84.5	498.9	16.933	0.361	1.031	0.106	1.882	0.147	0.155	6,654	0.403	3,109	14,243
	SE	33,331	1/28-2/18	50.6	237.2	21.344	0.278	0.961	0.130	4.021	0.148	0.447	14,890	0.341	7,777	28,508
	PB	22,045	3/1-6	33.2	290.4	11.426	0.385	1.051	0.343	2.424	0.305	0.132	2,904	0.599	981	8,595
	Total	533,057		203.7	2398.3								**38,848**	**0.192**	26,773	56,368
2001/02	NW	223,614	12/25-1/8	7.0	507.2	1.390	1.110	0.744	0.873	1.071	0.219	0.010	2,238	1.429	283	17,685
	NE	247,653	1/9-25	41.9	810.5	5.175	0.585	0.312	0.195	1.000	0.000	0.083	20,560	0.617	6,754	62,586
	SW	30,836	2/10-21,27	116.1	652.8	17.783	0.354	0.875	0.065	1.420	0.167	0.144	4,446	0.397	2,103	9,404
	SE	33,781	1/26-2/8	175.3	636.5	27.543	0.223	0.517	0.091	1.143	0.085	0.305	10,293	0.255	6,292	16,838
	PB	28,570	2/22-26	173.8	331.9	52.371	0.133	1.051	0.342	1.605	0.082	0.400	11,423	0.376	5,599	23,305
	Total	535,884		514.2	2938.9								**48,961**	**0.289**	28,126	85,228
2003/04	NW	239,688	12/26-1/10	23.4	587.2	3.981	0.513	0.330	0.542	1.667	0.200	0.100	24,086	0.773	6,299	92,098
	NE	218,714	1/11-24	8.7	809.8	1.075	0.328	0.710	0.799	1.000		0.008	1,657	0.864	383	7,158
	SW	39,461	2/7-25	75.7	729.3	10.382	0.438	0.940	0.151	2.400	0.486	0.133	5,229	0.671	1,582	17,284
	SE	36,554	1/25-2/7	13.0	791.8	1.639	0.320	0.568	0.265	3.042	0.366	0.044	1,604	0.554	582	4,420
	PB	37,394	2/26-3/2	34.8	243.0	14.306	0.792	0.892	0.295	1.571	0.129	0.126	4,713	0.855	1,104	20,132
	Total	571,811		155.5	3161.1								**37,289**	**0.521**	14,264	97,485

Table 1-i. SV in passing mode in Area V.

Year	Stratum	area	period	n	L	n/L*100	CV	esw	CV	E(s)	CV	D	P	CV	95% CI LL	95% CI UL
1998/99	NW	314,708	1/14-2/2	42.8	811.6	5.268	0.457	0.536	0.239	3.500	0.235	0.172	54,102	0.567	19,236	152,164
	SW	48,361	2/3-21	86.4	560.6	15.414	0.232	0.526	0.277	3.182	0.371	0.466	22,552	0.518	8,671	58,655
	SE	24,791	2/24-3/12	30.0	260.8	11.503	0.398	0.487	0.202	5.000	0.200	0.591	14,642	0.489	5,905	36,307
2000/01	NW	269,652	2/10-23	18.0	651.9	2.761	0.595	0.452	0.254	1.000	0.000	0.031	8,240	0.647	2,587	26,245
	NE	348,541	1/1-23	31.4	902.4	3.475	0.331	0.320	0.589	6.546	0.580	0.356	123,970	0.891	27,722	554,379
	SW	80,503	2/25-3/18	34.0	674.4	5.042	0.272	0.396	0.316	1.889	0.299	0.120	9,686	0.513	3,758	24,968
	SE	148,828	1/24-2/7	152.2	721.3	21.101	0.270	0.945	0.119	1.685	0.130	0.188	28,008	0.322	15,122	51,874
	Total	847,524		265.6	3210.8								**169,904**	**0.653**	52,803	546,704
2002/03	NW	266,894	2/11-20,3/5-7	82.5	714.8	11.542	0.320	0.499	0.296	2.231	0.177	0.258	68,909	0.470	28,691	165,506
	NE	345,003	1/5-25	39.9	1065.7	3.740	0.272	0.651	0.232	1.636	0.149	0.047	16,218	0.387	7,796	33,739
	SW	79,072	2/21-3/4	213.6	491.2	43.487	0.262	0.548	0.118	2.000	0.147	0.794	62,777	0.323	33,853	116,416
	SE	68,928	1/27-2/9	335.0	704.0	47.585	0.281	0.514	0.126	1.800	0.128	0.833	57,448	0.334	30,379	108,638
	Total	759,896		936.5	6186.5								**205,352**	**0.211**	136,531	308,864
2004/05	NW	278,204	2/19-3/8	3.0	202.1	1.484	0.405	0.833	0.132	1.556	0.140	0.014	3,855	0.448	1,667	8,916
	NE	336,130	12/26-2/14	21.4	738.9	2.891	0.580	0.606	0.352	1.556	0.140	0.037	12,468	0.693	3,655	42,532
	SW	51,449	2/24-3/7	90.2	301.2	29.937	0.307	0.592	0.233	2.385	0.168	0.603	31,002	0.420	14,070	68,309
	SE	212,214	1/16-2/13	263.8	1901.6	13.874	0.235	0.766	0.110	1.673	0.088	0.152	32,151	0.274	18,968	54,495
	Total	877,997		1314.9	3143.8								**79,476**	**0.227**	51,241	123,269

Table 1-j. SV in passing mode in the eastern part of Area III and in the western part of Area VI.

Year	Stratum	area	period	n	L	n/L*100	CV	esw	CV	E(s)	CV	D	P	CV	95% CI LL	95% CI UL
1997/98	FIIIE	250,985	12/16-30	2.0	309.1	0.647	0.908	1.500	0.000	1.000	0.000	0.002	541	0.908	118	2,475
1999/00	FIIIE	356,046	12/5-13,21-26	5.0	527.8	0.947	0.610	0.361	1.415	1.667	0.400	0.022	7,782	1.592	860	70,387
2001/02	FIIIE	354,965	12/9-24	19.1	426.2	4.487	0.465	0.680	0.385	3.889	0.249	0.128	45,569	0.653	14,166	146,586
2003/04	FIIIE	324,032	11/30-12/24	154.5	1490.4	10.363	0.4024	0.7561	0.1815	1.8071	0.1112	12.384	40,128	0.455	17,141	93,938
1998/99	SVIW	316,727	3/12-31	57.0	425.3	13.402	0.329	0.742	0.134	1.222	0.120	0.110	34,941	0.375	17,147	71,197
2000/01	FVIW	290,908	12/11-29	34.4	825.5	4.164	0.406	0.425	0.301	2.071	0.143	0.101	29,494	0.525	11,207	77,622
2002/03	FVIW	309,998	12/3-30	26.9	1140.2	2.358	0.309	0.624	0.351	1.500	0.333	0.028	8,792	0.575	3,087	25,043
2004/05	FVIW	292,218	12/3-30	38.0	885.2	4.293	0.251	0.645	0.140	1.842	0.135	0.061	17,926	0.318	9,760	32,924

Table 2. Abundance estimate before considering unsurveyed area between southern strata and northen strata due to movement of ice edge during survey period in Areas IV and V

Area IV

year	SSV	CV	SV-closing	CV	SV-passing	CV
1989/90	30,657	0.142				
1991/92	29,292	0.203				
1993/94	27,362	0.145	24,919	0.273		
1995/96	24,782	0.149	54,264	0.459		
1997/98	16,837	0.168	18,039	0.370	11,112	0.369
1999/00	41,037	0.207	69,754	0.290	40,731	0.193
2001/02	52,876	0.161	31,212	0.329	67,953	0.210
2003/04	60,244	0.280	27,935	0.664	41,754	0.527

Area V

year	SSV	CV	SV-closing	CV	SV-passing	CV
1990/91	106,739	0.128				
1992/93	58,130	0.232	120,058	0.245		
1994/95	82,441	0.326	151,882	0.241		
1996/97	96,429	0.226	121,597	0.331		
1998/99	118,109	0.171	96,783	0.874		
2000/01	99,515	0.158	373,874	1.276	173,256	0.651
2002/03	158,156	0.193	116,050	0.363	214,815	0.209
2004/05	72,018	0.126	84,695	0.410	84,959	0.230

Table 3-a. Abundance estimates in Areas IV and V after reconsidering the treatment of the unsurveyed area. Estimates in this table are applied to correction method of Haw (1991) and GLM.

Area IV

year	SSV	CV	SV-closing	CV	SV-passing	CV
1989/90	29,993	0.135				
1991/92	32,670	0.228				
1993/94	27,989	0.143	26,546	0.286		
1995/96	25,523	0.145	55,320	0.443		
1997/98	17,272	0.186	16,793	0.370		
1999/00	42,852	0.210	67,209	0.293	38,848	0.192
2001/02	46,355	0.210	24,846	0.387	48,961	0.289
2003/04	60,102	0.297	23,506	0.624	37,289	0.521

Area V

year	SSV	CV	SV-closing	CV	SV-passing	CV
1990/91	100,745	0.138				
1992/93	66,147	0.233	137,357	0.247		
1994/95	85,258	0.317	152,477	0.239		
1996/97	89,415	0.221	112,234	0.328		
1998/99	117,548	0.170	103,821	0.921		
2000/01	101,854	0.156	365,488	1.284	169,904	0.653
2002/03	151,357	0.192	112,102	0.365	205,352	0.211
2004/05	67,288	0.126	80,338	0.410	79,476	0.227

Table 3-b. Abundance estimates in eastern part of Area III and western part of Areas VI. In principle, sighting data in December were used to estimate abundance. In 1998/99, the data in late March were used because survey couldn't be conducted in December due to a fire accident.

Eastern part of Area III

year	SSV	CV	SV-closing	CV	SV-passing	CV
1995/96	10,546	0.222	4,843	0.742		
1997/98	6,435	0.352	2,902	1.078	541	0.908
1999/00	29,794	0.495	14,749	1.420	7,782	1.592
2001/02	39,560	0.566	139,277	0.658	45,569	0.653
2003/04	17,522	0.364	68,853	0.836	40,128	0.455

Western part of Area VI

year	SSV	CV	SV-closing	CV	SV-passing	CV
1996/97	7,201	0.220	14,994	0.537		
1998/99	30,194	0.327	0		34,941	0.375
2000/01	12,317	0.232	16,403	0.367	29,494	0.525
2002/03	10,486	0.219	11,260	0.683	8,792	0.575
2004/05	14,805	0.300	13,948	0.502	17,926	0.318

Table 4. Result of sensitivity analysis. Confidence interval for ratio of abundance Option B and C to that of Option A.

Mean of P_B / P_A

	n	mean	sd	95%CILL	95%CIUL
whole data	**53**	**1.032**	**0.624**	**0.885**	**1.203**
SSV	20	0.860	0.286	0.739	1.001
SVC	21	1.298	0.989	0.954	1.766
SVP	12	0.925	0.627	0.626	1.367
SW in Area IV	18	0.833	0.655	0.590	1.175
SE in Area IV	18	1.115	0.516	0.896	1.389
SW in Area V	17	1.126	0.438	0.928	1.365

Mean of P_C / P_A

	n	mean	sd	95%CILL	95%CIUL
whole data	**48**	**1.463**	**0.986**	**1.227**	**1.745**
SSV	19	1.316	0.995	0.958	1.807
SVC	19	1.585	1.182	1.158	2.168
SVP	10	1.528	0.743	1.116	2.092
SW in Area IV	18	1.208	0.687	0.935	1.562
SE in Area IV	18	1.630	1.243	1.173	2.265
SW in Area V	12	1.727	1.342	1.133	2.633

Table 5. Estimated unbased abundance of south of 60°S using Haw's method. Correction factor was estimated as SVC/SVP=0.759 (CV=0.126) and SSV/SVC=0.821 (CV=0.084).

Area IV

year	P	CV(P)
1989/90	48,167	0.203
1991/92	52,467	0.274
1993/94	41,398	0.192
1995/96	42,363	0.203
1997/98	25,922	0.220
1999/00	44,931	0.151
2001/02	48,280	0.188
2003/04	44,564	0.291

Area VW

year	P	CV(P)
1990/91	56,381	0.210
1992/93	41,922	0.227
1994/95	20,113	0.248
1996/97	23,719	0.241
1998/99	84,405	0.319
2000/01	19,608	0.321
2002/03	100,775	0.205
2004/05	38,790	0.192

Area VE

year	P	CV(P)
1990/91	105,409	0.248
1992/93	82,137	0.282
1994/95	143,596	0.256
1996/97	118,335	0.256
1998/99	40,755	0.277
2000/01	141,389	0.210
2002/03	75,210	0.201
2004/05	53,387	0.177

Area III

year	P	CV(P)
1995/96	10,262	0.388
1997/98	5,618	0.637
1999/00	12,940	0.837
2001/02	54,717	0.488
2003/04	35,241	0.352

Area VI

year	P	CV(P)
1996/97	12,533	0.317
1998/99	38,355	0.296
2000/01	21,873	0.261
2002/03	12,358	0.297
2004/05	18,700	0.247

Table 6. Estimated unbased abundance of south of 60°S using model of formula (10). Correction factor was estimated as SVC/SVP=1.063 (CV=0.244) and SSV/SVP=0.886 (CV=0.199).

Area IV

year	P	CV(P)
1989/90	33,840	0.315
1991/92	36,860	0.456
1993/94	30,100	0.303
1995/96	30,626	0.317
1997/98	18,650	0.358
1999/00	46,258	0.255
2001/02	44,837	0.312
2003/04	49,747	0.451

Area VW

year	P	CV(P)
1990/91	39,611	0.329
1992/93	32,633	0.375
1994/95	14,750	0.410
1996/97	16,931	0.394
1998/99	64,298	0.539
2000/01	18,555	0.554
2002/03	84,176	0.351
2004/05	30,268	0.317

Area VE

year	P	CV(P)
1990/91	74,056	0.405
1992/93	63,317	0.476
1994/95	106,501	0.444
1996/97	83,703	0.433
1998/99	57,987	0.374
2000/01	103,201	0.336
2002/03	79,335	0.353
2004/05	45,901	0.304

Area III

year	P	CV(P)
1995/96	10,822	0.273
1997/98	4,471	0.360
1999/00	24,580	0.479
2001/02	62,212	0.395
2003/04	29,313	0.310

Area VI

year	P	CV(P)
1996/97	8,861	0.264
1998/99	34,445	0.289
2000/01	15,765	0.236
2002/03	11,273	0.248
2004/05	16,491	0.239

Table 7. Abundamce estimate of south of 60^{o}S in I and P stock derived from Haw's method.

I stock

year	P	CV(P)
1995/96	76,343	0.145
1997/98	115,945	0.239
1999/00	77,479	0.184
2001/02	203,772	0.172
2003/04	118,596	0.164

P stock

year	P	CV(P)
1996/97	130,868	0.233
1998/99	79,110	0.202
2000/01	163,262	0.185
2002/03	87,569	0.177
2004/05	72,087	0.146

Table 8. Estimated annual increasing rate in Areas IV and V obtained from abundance series of south of 60^{o}S derived from Haw's correction method. Confidential interval was obtained by bootstrap.

Area	estimate	95%CILL	95%CIUL
Area IV	-0.42%	-4.02%	4.59%
Area V	-1.54%	-4.91%	2.18%

Table 9. Estimated annual increasing rate in I and P stock obtained from abundance series of south of 60^{o}S derived from Haw's correction method. Confidential interval was obtained by bootstrap.

Stock	estimate	95%CILL	95%CIUL
I stock	7.93%	-0.05%	11.45%
P stock	-5.88%	-12.19%	0.18%

Table 10. Estimated abundance trend estimated by linear model of formula (13).

Factors	estimate	CV	p-value
P (1988/89,Area III)	14,556	0.428	<2e-16
P (1988/89,Area IV)	33,610	0.308	<2e-16
P (1988/89,Area VW	30,861	0.476	<2e-16
P (1988/89,Area VE)	106,479	0.336	<2e-16
P (1988/89,Area VI)	22,327	0.417	<2e-16
ROI in I stock	0.0257	0.021	0.216
ROI in P stock	-0.0215	0.040	0.598
SVC/SVP	0.889	0.278	0.674
SSV/SVP	0.727	0.226	0.161
ROI in P-ROI in I	-0.047	0.035	0.180

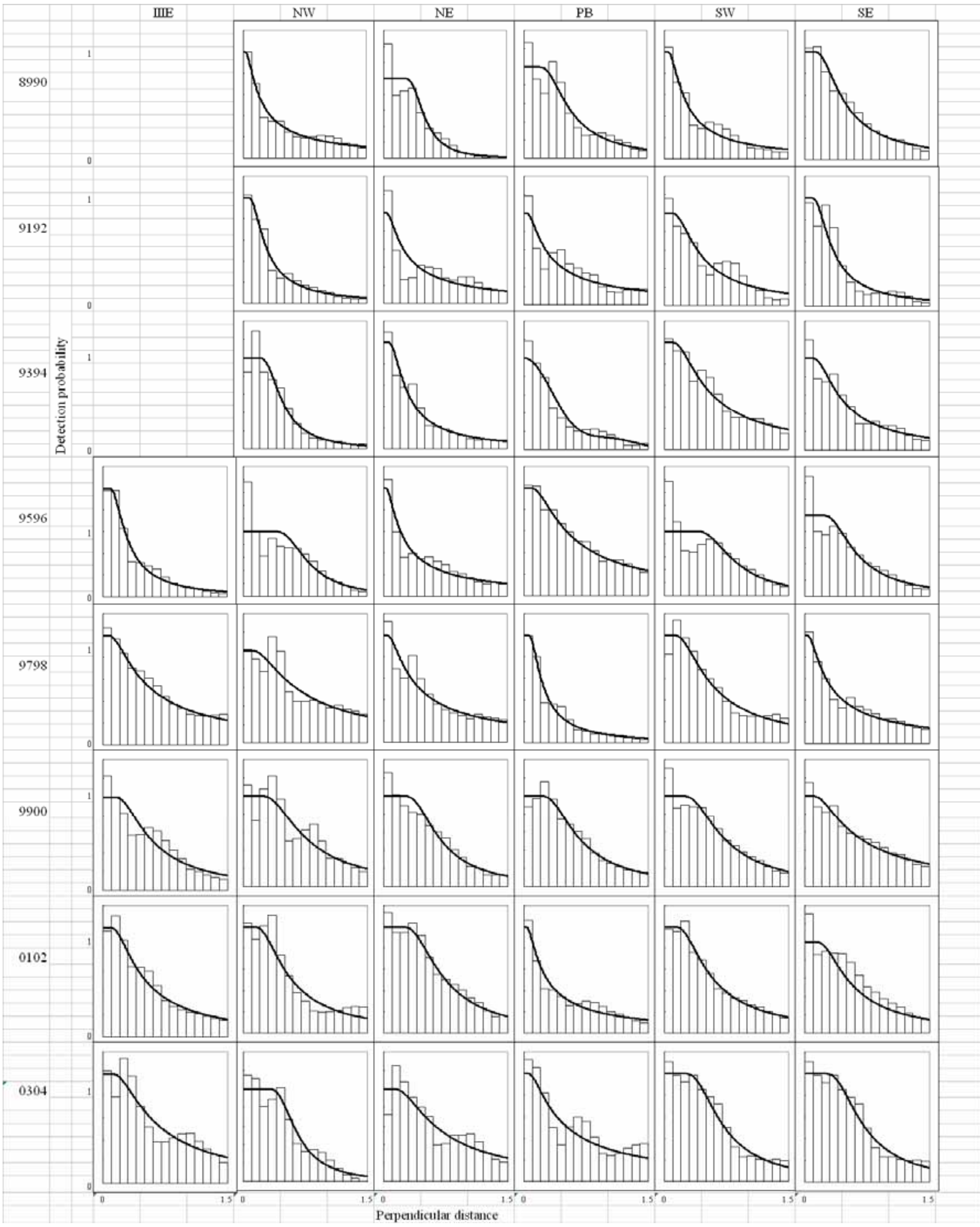
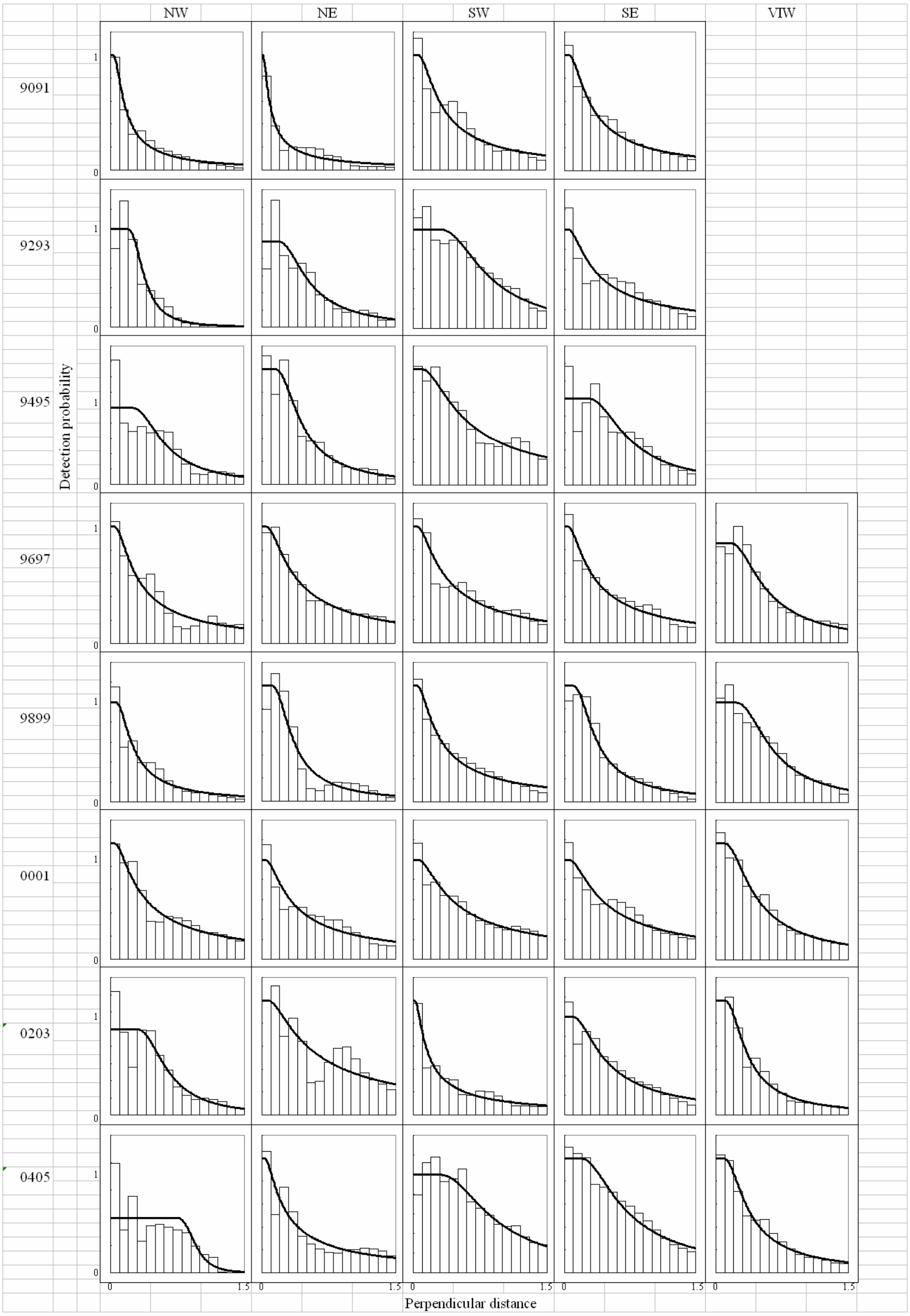
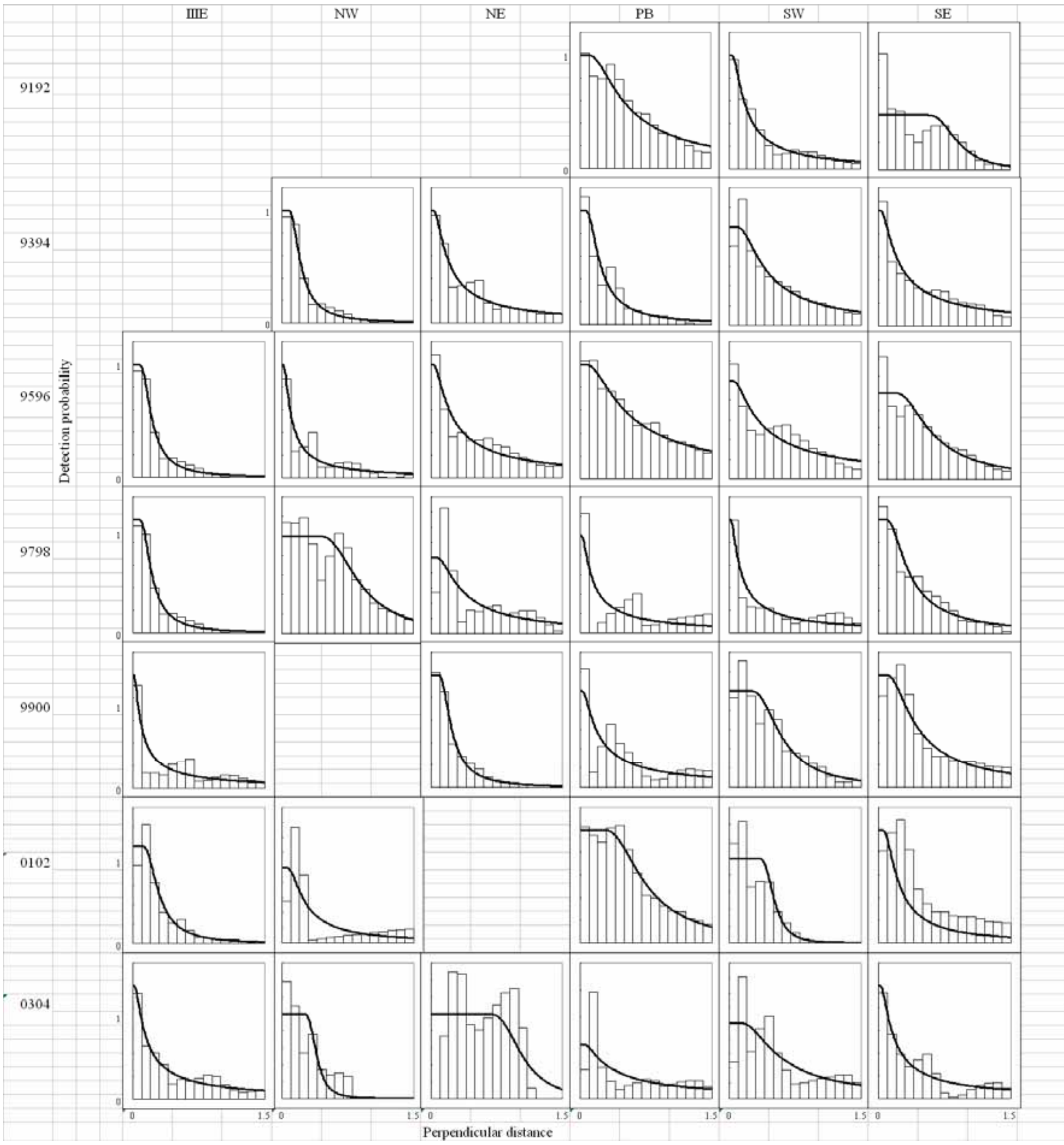


Fig. 1. Detection probability functions of the minke whale for each strata.

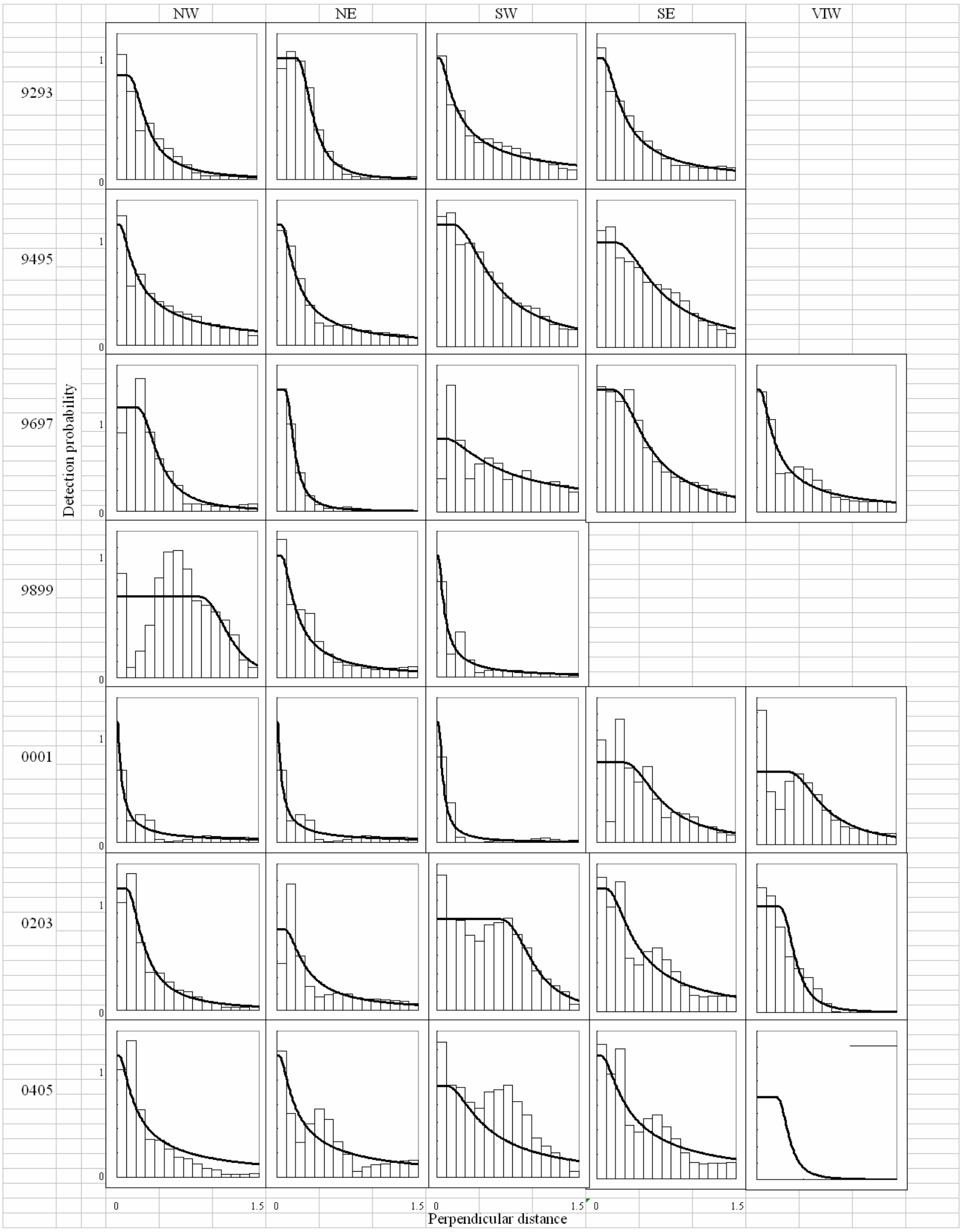
3-a. SSV in Area IV and the eastern part of Area III. (to be updated)



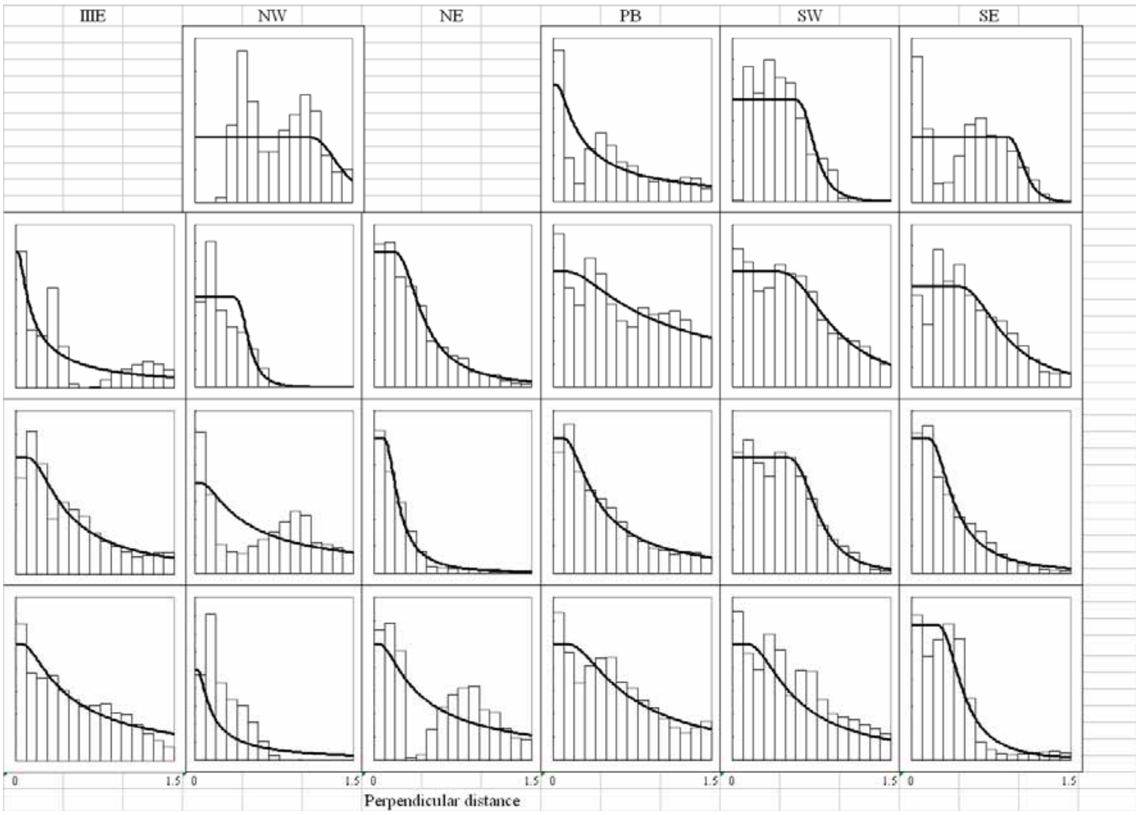
1-b. SSV in Area V and the western part of Area VI.



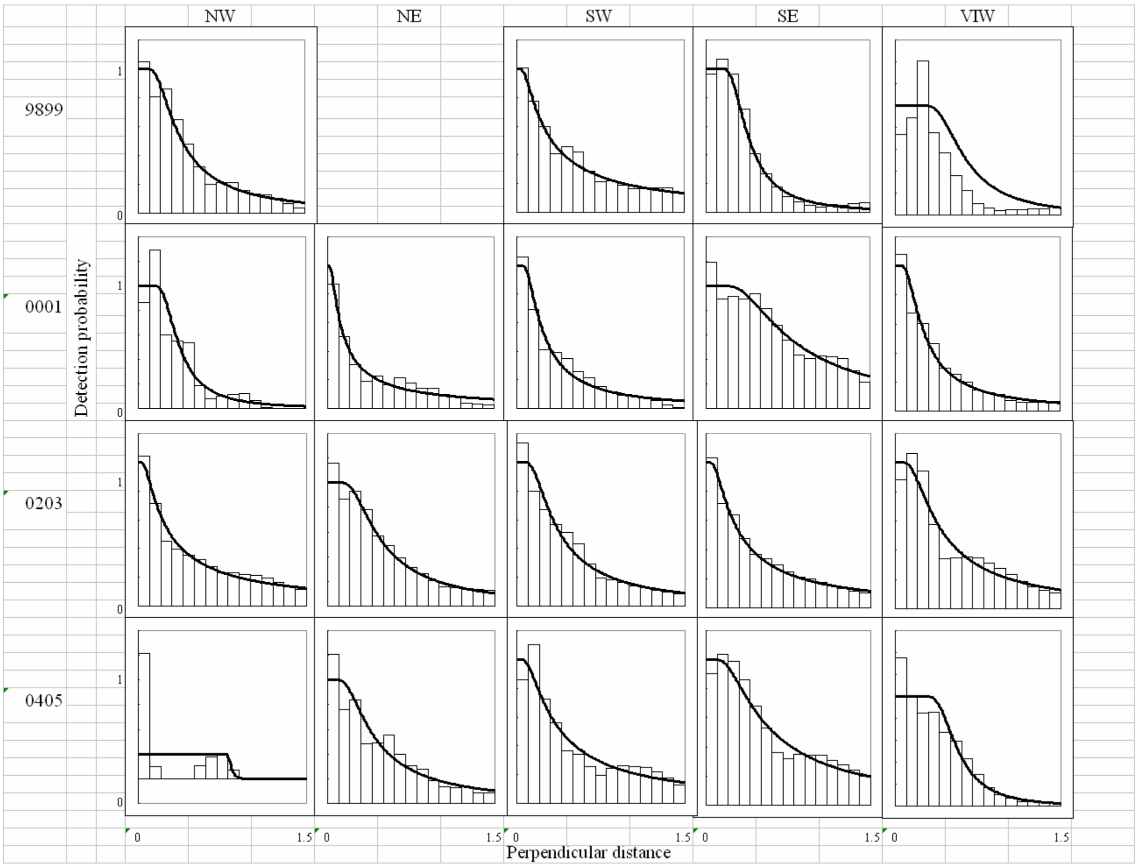
1-c. SV (closing mode) in Area IV and the eastern part of Area III.



1-d. SV (closing mode) in Area V and the western part of Area VI.



1-e. SV (passing mode) in Area IV and the eastern part of Area III.



1-f. SV (passing mode) in Area V and the western part of Area VI.

Further explanation of SC/D06/J6

Hakamada, Matsuoka and Nishiwaki

This addendum amplifies the explanation of certain paragraphs reported in this paper.

Derivation of mean and its 95% confidence intervals in Table 4.

It was assumed that the rates (P_B/ P_A) (we rote this r hereafter) and (P_C / P_A) for the various strata are log-normally distributed. The mean and variance of the natural logarithm of r are

$$\hat{\mu} = \frac{1}{n}\sum_{i}^{n} \ln(r_i)$$

$$\hat{\sigma}^2 = \frac{1}{n-1}\sum_{i}^{n}\left\{\ln\left(\frac{P_B}{P_A}\right) - \hat{\mu}\right\}^2$$

Then, mean and variance of r are

$$E(r) = \exp\left(\hat{\mu} + \frac{\hat{\sigma}^2}{2}\right)$$

$$V(r) = \{\exp(\hat{\sigma}^2) - 1\}\{E(r)\}^2$$

95% confidence interval of $E(r)$ was estimated by $\left[\frac{E(r)}{C}, CE(r)\right]$

where

$$C = \exp\left(t_{0.025}(n-1)\sqrt{\frac{\hat{\sigma}^2}{n}}\right)$$

where n is number of strata. (i.e. pairs of (P_A, P_B)).

Computation for (P_C / P_A) is straightforward.

Abundance trend in RESULTS section.

Abundance trend of -0.42% [-4.02%; 4.59%] in Area IV, of -1.54% [-4.91; 2.18%] in Area V, 7.93% [-0.05%; 11.45%] for I stock and -5.88% [-12.19; 0.18%] for P stock are based on abundance estimated by Haw's correction method and applying a log-linear model regression method of the from:

$$P = \beta \exp(\alpha y) .$$

Abundance trend for I and P stock of 7.93% [-0.05%; 11.45%] (1995/96-2003/04) and -5.88% [-12.19; 0.18%] (1996/97-2004/05), respectively in Table 10 were derived from linear model of formula (13).

Difference in estimated correction factor of survey mode between Haw's method and linear model in DISCUSSION section.

Main point of this paragraph is that difference in estimated correction factor due to using different methodology has little effect on the estimate of the abundance trend.