

# Abundance Estimation of Common Minke Whales in the Yellow Sea using the Korean Sighting Data in 2011

Kyum-Joon PARK, Yong-Rock AN, Hyun-Woo KIM, Doo-Nam KIM, Hawsun SOHN and Doo-Hae AN

*Cetacean Research Institute, National Fisheries Research & Development Institute  
139-29, Maeam-dong, Nam-gu, Ulsan, 680-050, Republic of Korea*

## ABSTRACT

A sighting survey for the abundance estimation of minke whales was conducted in the sub-area 5 in 2011. Distance data which were collected from the survey were applied to robust models (Half-normal, Hazard-rate, Uniform) that can take the variety of detection function  $g(x)$ . Uniform model was chosen based on Akaike's Information Criterion (AIC). The value of  $g(0)$  was assumed to be 1. The abundance of minke whale was estimated at 587 individuals (95% CI=261-1,371).

## INTRODUCTION

Korea has conducted systematic sighting surveys in the East Sea and the Yellow Sea under the cooperative research between Korea and Japan since 1999. The plans of this sighting survey were presented to the SC in compliance with the guideline of the IWC. This document presents the abundance estimation of minke whales in the sub-area 5.

## SURVEY AND METHODS

A vessel-based sighting survey was conducted to estimate the abundance of minke whale in the Yellow Sea (sub-area 5) in 2011 (Figure 1). The survey was conducted on the research vessel, *Tamgu 3* (360 G/T) with a top barrel at the height of 11.5m from the sea level. Only the good weather condition with two or longer nautical miles visibility and three or smaller Beaufort scale allowed the survey to be conducted.

Density and abundance were estimated from sighting and effort data collected during the primary sighting effort using conventional line transect method. The estimates were made using the computer program DISTANCE 5.0 (Thomas et al., 2006).

The abundance of minke whale,  $N$  was estimated as:

$$\hat{N} = n \cdot f(0) \cdot E(s) \cdot A/2 \cdot L$$

Where,  $n$ : number of sightings

$f(0)$ : probability density function

$E(s)$ : expected group size

$A$ : size of the survey area

$L$ : total length of each survey

Three key functions (Half-normal, Hazard-rate and Uniform) were combined with three adjustments functions (cosines, simple polynomials, hermite polynomials) respectively, and used to estimate the detection function. Akaike's information criterion (AIC) was used to select suitable combination. Bias in the school size estimation was corrected by the regression of log (group size) on the detection probability with significance level at 0.1 (Buckland et al., 2001). Detection probability of on the line  $g(0)$  could not be estimated but assumed to be 1 in this survey because the survey was not conducted in IO mode. Five percent of perpendicular distances has truncated as suggested by Buckland et al. (2001).

## RESULTS

A total of 14 minke whales were sighted in the survey and the sighting positions of minke whales and summary of the survey result are shown in Figure 1 and Table 1, respectively. Figure 2 shows the histogram of the perpendicular distance data. The highest frequency occurred within 200 meters although it is difficult to find a spike in the histogram due to the small number of sightings.

Uniform model with cosines adjustment was selected by minimum AIC for this survey (Table 2). The effective search half-width (esw) was estimated at 555.6m. Expected group size,  $E(s)$ , was estimated to be 0.020 (CV=40.5%) individuals based on regression of log (group size) on  $g(x)$ . The abundance of minke whale was estimated at 587 (95% CI=261-1,371) individuals while half-normal model was estimated to be 759 (95% CI=310-1,860) and Hazard-rate model was estimates to be 1,085 (95% CI=268-4,391).

## REFERENCES

- Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L. and Thomas, L. 2001. *Introduction to Distance Sampling: Estimating Abundance of Biological Populations*. Oxford University Press, New York.
- Thomas, L., Laake, J.L., Strindberg, S., Marques, F.F.C., Buckland, S.T., Borchers, D.L., Anderson, D.R., Burnham, K.P., Hedley, S.L., Pollard, J.H., Bishop, J.R.B. and Marques, T.A. 2006. Distance 5.0. Release 2. Research Unit for Wildlife Population Assessment, University of St. Andrews, UK. <http://www.ruwpa.st-and.ac.uk/distance/>

Table 1. Summary of survey effort and sightings for minke whale in the Yellow Sea in 2011

Year	Surveyed area (n.m. <sup>2</sup> )	Coverage in sub-area 5 (%)	Survey effort (n.m.)	No. of primary sightings	Sighting rate (pod/n.m.)
2011	28,754.8	23.8	1227.7	14	0.0114

Table 2. Estimation summary for the minke whale sighting survey in the Yellow Sea in 2011

Model	AIC	ESW (m)	D	D CV	N	N 95% CI
Uniform	164.3	555.6	0.0204	0.4051	587	261~1,371
Half-normal	165.6	429.2	0.0264	0.4620	759	310~1,860
Hazard-rate	166.5	300.4	0.0377	0.7534	1,085	268~4,391

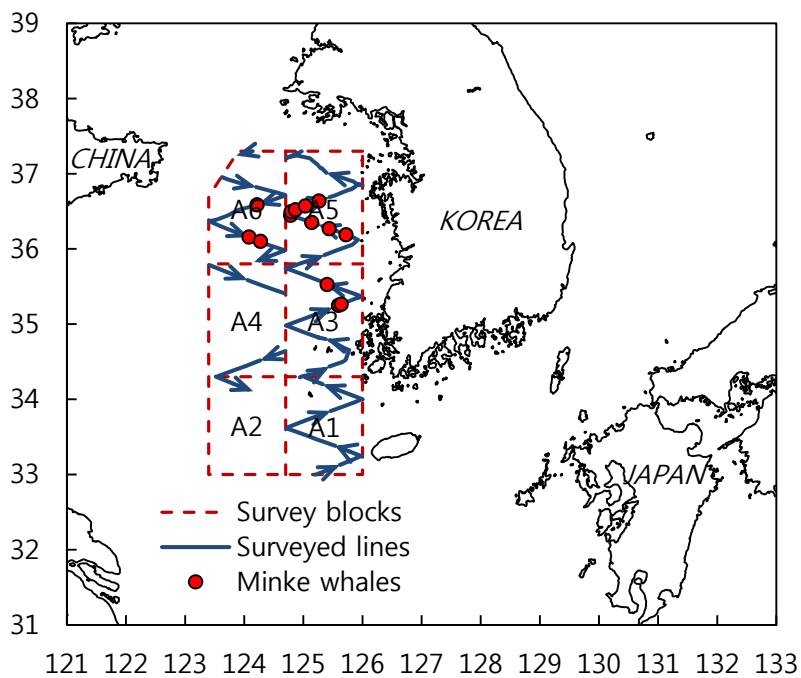


Figure 1. Surveyed lines and sighting positions of common minke whales.

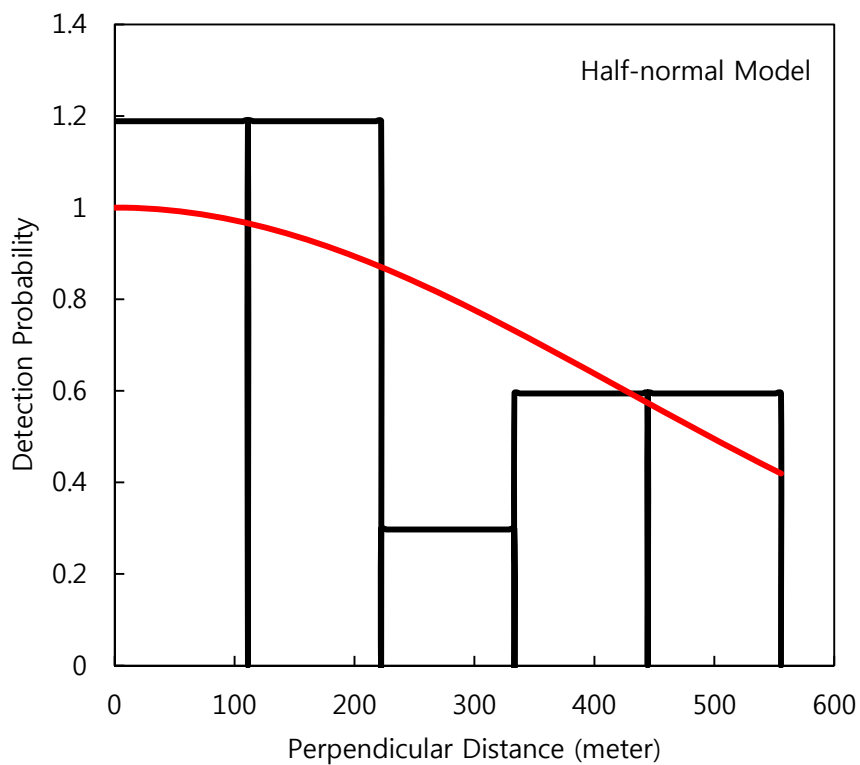


Figure 2. Frequency histogram of the perpendicular distance data for common minke whales.