A NOTE ON DISAGGREGATING POPULATION MODELS BY SEX

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KEYWORDS: HUMPBACK WHALES, POPULATION MODELS, SEX

INTRODUCTION

Conventionally the following age- and sex-aggregated population model has been used for modelling the dynamics of Southern Hemisphere humpback whales in recent assessment discussions.

$$N_{y+1} = N_y + r\ N_y\left(1-(\frac{N_y}{K})^{2.39}\right) - C_y \qquad (1)$$

The standard extension of this approach to incorporate sex-structure is to replace equation (1) by:

$$N^m_{y+1} = N^m_y + rN^f_y\left(1-\left(\frac{N_y}{K}\right)^{2.39}\right) - C^m_y \qquad (2)$$

$$N^f_{y+1} = N^f_y + rN^f_y\left(1-\left(\frac{N_y}{K}\right)^{2.39}\right) - C^f_y \qquad (3)$$

where:

N_y is the total number of whales at the start of year *y*, which is given by:

$N_y = N^m_y + N^f_y$,

N^m_y is the total number of male whales at the start of year *y*,

N^f_y is the total number of female whales at the start of year *y*,

K is the carrying capacity,

C^m_y is the number of male whales caught in year *y*, and

C^f_y is the number of female whales caught in year *y*.

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DATA AND MODEL FITTING IMPLICATIONS

Equations (2) and (3) require past catches to be differentiated by sex. Often such information is available for more recent but not for earlier years. Typical practice in the IWC Scientific Committee in such cases has been to assume the sex ratio of such earlier catches to be the same as the average over some immediately following period for which this ratio is known for each year.

Sometimes information is available on the sex ratio of the whales covered by a survey, e.g. from information from biopsies. This can be taken into account in fitting the population model to the available data. For example, it has been suggested that female proportions below parity in breeding area surveys of numbers of Southern Hemisphere humpback whales indicate that not all the females migrate from the Antarctic to these breeding areas every year. If, say, only a proportion p of the females migrate each year, then abundance estimates are fitted to model predictions for $N_y^m + pN_y^f$ where p becomes a further estimable parameter of the model. The information to estimate p is provided by the annual male:female ratios λ_y obtained for each survey, for which model values of N_y^m / pN_y^f provide predictions.