A short review of recent Scientific Committee issues relating to large whales in the North Pacific that might assist in setting priorities for a co-operative series of cruises

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ABSTRACT

At the 2009 IWC Scientific Committee (SC) meeting, a mid- to long-term research programme involving sighting surveys to provide information for cetacean stock management in the North Pacific was presented. To assist in the development of this research programme the IWC SC established an intersessional group. One of its tasks was to 'review the SC issues in the North Pacific and circulate a paper before the next Annual Meeting'. A document responding this TOR was presented by the first two authors to the informal intersessional meeting (IM) held in Tokyo in September 2009. The present paper updates the information presented to the IM. It focuses primarily on stock structure and abundance of sei, common minke, Bryde's and right whales. Since the Scientific Committee has spent little time on blue, humpback and fin whales in recent years, we have attempted to suggest some areas of research.

INTRODUCTION

At the 2009 IWC Scientific Committee meeting, a mid- to long-term research programme involving sighting surveys to provide information for cetacean stock management in the North Pacific was presented. The Committee recognised that an important starting place for the planning process of this programme was (1) to review key recent issues in the Scientific Committee discussions relevant to large whales in the North Pacific issues on large whales within the SC that are relevant to the proposed mid- long-term research programme and (2) a careful examination of available information and identification of gaps in knowledge (IWC, 2009a). An informal intersessional meeting (IM) was held on 27-28 September in Tokyo. A paper summarizing the SC issues on North Pacific sei, common minke and Bryde's whales was presented to the meeting (Matsuoka and Pastene, 2009). The IM recommended that the paper should be revised and updated to incorporate SC issues on other large whales in the North Pacific (IWC, 2010). This paper responds to that recommendation from the IM.

SEI WHALE

Distribution

Sei whales were widely distributed in the western, Central and Eastern North Pacific according to the Japanese catch data by Masaki (1976), (Fig 1). The Soviet catch data are still incomplete for the North Pacific. The previous studies of sei whale distribution were based on the Japanese commercial catch record (1952-1972), the Japanese Scouting Vessel (JSV) data (1965-1996), and the US sighting data (1986-2006) in the North Pacific. The most recent distribution study was based on JARPN and JARPNII sighting data (1994-2007) in the western North Pacific as well the British Columbia sighting data (2004-2005) in the inshore waters.

The SC is planning an in-depth assessment of the North Pacific sei whale. Several data sources for this assessment were identified in Appendix 4 of the IA Sub-Committee this year (IWC, 2009b, see Appendix of this report attached). Regarding stock structure and abundance the following needs have been identified.

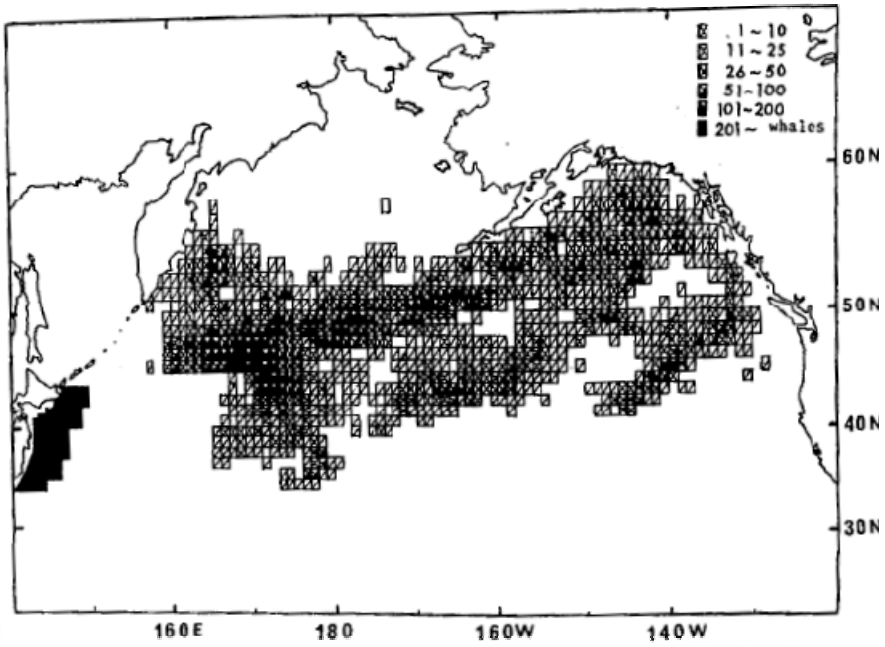

Fig.1. Summer distribution of accumulated number of sei whales caught by Japan from 1952 through 1972 seasons (Masaki, 1976).

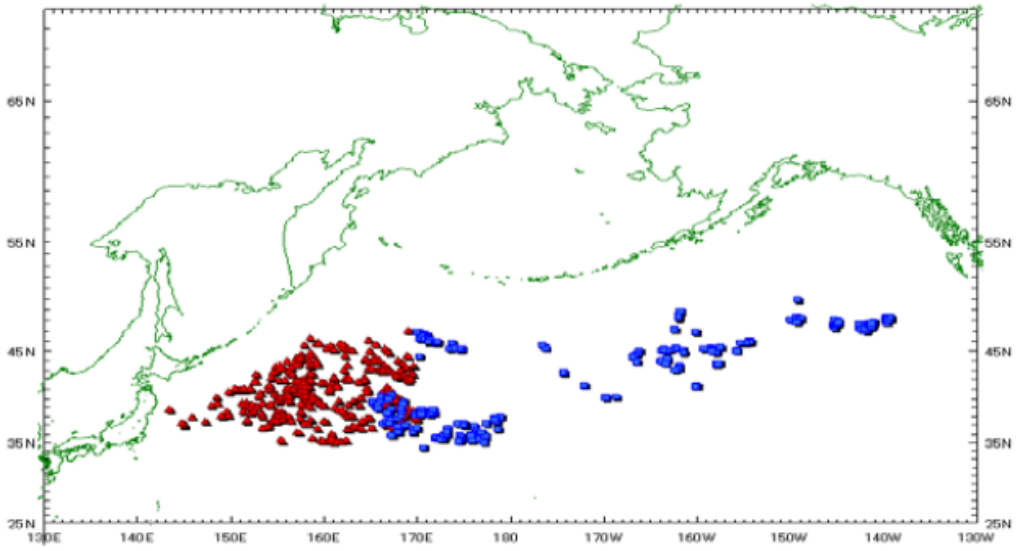

Fig.2. Sampling locations of sei whales in the North Pacific. Triangle: JARPNII, Square: commercial whaling. (Kanda *et al.*, 2009a).

Need for sighting surveys for abundance estimation

Offshore parts of the central and eastern North Pacific (north of 35°N, east of 170°E) have not have been surveyed in recent years and thus there are no estimates of current abundance in these areas. Although the Committee has not identified specific areas/months for the sighting survey of sei whale abundance estimation, it is clear that any surveys undertaken should focus, at least initially on areas closest to recently surveyed areas.

Need for surveys for investigation of stock structure

The most recent studies of stock structure were based on JARPN samples in the western North Pacific and past commercial samples in the central and eastern North Pacific. These studies suggested a single stock of sei whales.

However there are some important data gaps (Fig 2). As for other baleen whales, stock structure should be much more easily elucidated if the breeding grounds are known and sampled, but these grounds remain unknown.

Collection of the following new data would assist in resolving stock structure issues:

- Collection of additional biopsy samples (and sightings data) from areas away from the western North Pacific to investigate possible additional structure:
    - in the eastern North Pacific, along the coast the North America
    - in the central North Pacific particularly in the longitudinal sector 170°E -170°W.
- Sighting surveys in low latitude to investigate location of breeding grounds (telemetry work would be valuable in locating appropriate areas to cover)

COMMON MINKE WHALE

Distribution

Based on the JSV data in July and August, common minke whales are widely distributed in the Sea of Okhotsk and Sea of Japan (Miyashita *et al.* 1996). Common minke whales are also distributed in the western North Pacific as showed by JARPN & JARPNII catches west of 170°E (Fig 3). They also occur in the eastern North Pacific although sighting effort there is more limited .

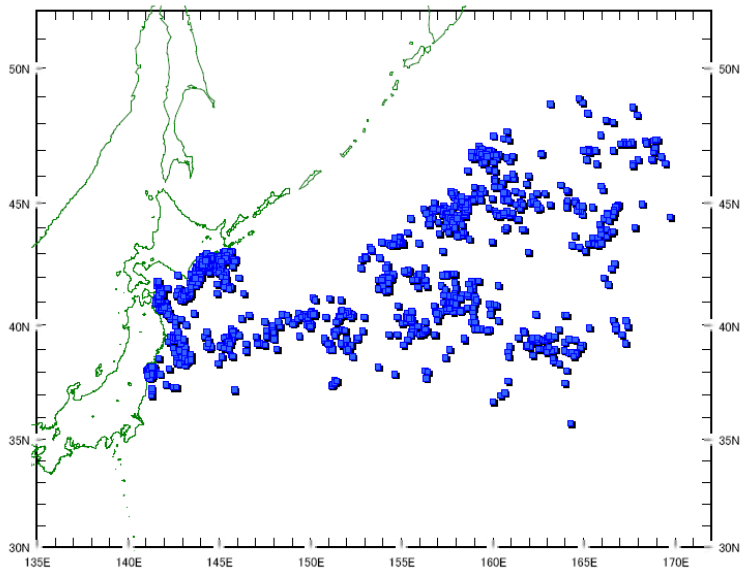

Fig.3. Sighting positions of the collected Common minke whales during the JARPN and JARPNII surveys during 1994 to 2007 seasons. Both the offshore and coastal component samples are included (Kanda *et al.*, 2009b).

Several meetings associated with the RMP *Implementation* completed in 2003, as well as discussions in workshops considering the JARPN and ongoing JARPNII programmes and the more recent work on an in-depth assessment of western North Pacific have all considered common minke whales and research needs. The primary identified needs with respect to abundance estimations and stock structure are summarised below.

Need for sighting surveys for abundance estimation

As was the case for sei whales, offshore parts of the central and eastern North Pacific have not have been surveyed in recent years and thus there are no estimates of current abundance in these areas. Although the Committee has not identified specific areas/months for additional sighting surveys for this species, it is clear that any surveys undertaken should focus, at least initially, on areas closest to recently surveyed areas.

Need for surveys for investigation of stock structure

The four stock structure hypotheses for the western North Pacific were considered during the 2003 RMP *Implementation* (IWC, 2004) and subsequent discussions have resulted in further hypotheses (e.g. IWC, 2010). Figures describing these can be found in IWC (2010 p.31 and p.215, respectively).

Collection of the following new data would assist in resolving stock structure issues related to the western North Pacific and elsewhere:

- collection of additional biopsy samples (and sightings data) to further elucidate stock structure:
    - as a high priority, collection of additional samples throughout the Okhotsk Sea, to investigate the proportions of different stocks (e.g. 'O' and 'J' on those feeding grounds)
    - in the central North Pacific particularly to the east of 170°E (especially with respect to possible 'W' stock)
- collection of additional biopsy samples at different times of the year in areas of suspected mixing (telemetry work would be valuable in examining migration timing and routes and thus appropriate sampling)
- sighting surveys in low latitude to investigate location of breeding grounds (telemetry work would be valuable in locating appropriate areas to cover)

BRYDE'S WHALE

Distribution

Bryde's whales are widely distributed in summer in the western North Pacific south of 40ºN (e.g. Fig. 4 based on recent Japan/NRIFSF and US/NOAA sighting data (Shimada, 2008; Jackson, 2003) and JARPN/JARPN II catches (Fig. 5; Pastene *et al*., 2009, respectively). They also occur in the eastern North Pacific but the sighting effort is more limited, but data are available from the eastern Tropical Pacific. Wade and Gerrodett 1993, Jackson 2003).

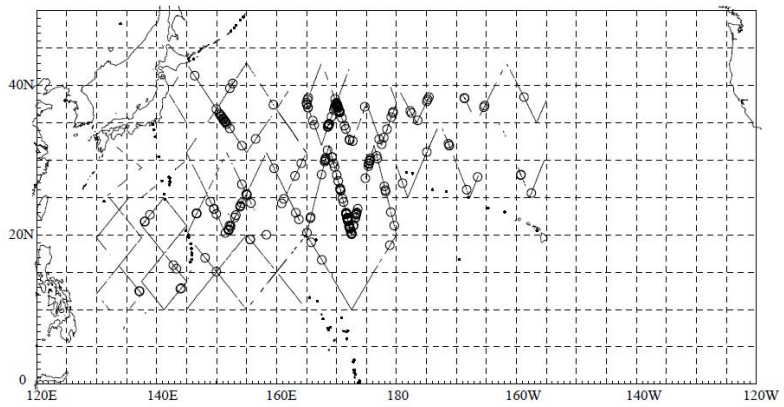

Fig.4. Primary sighting positions of Bryde's whale and the predetermined cruise track lines on effort in the Bryde's whale sighting survey in August and September, 1998-2002 (Shimada, 2008).

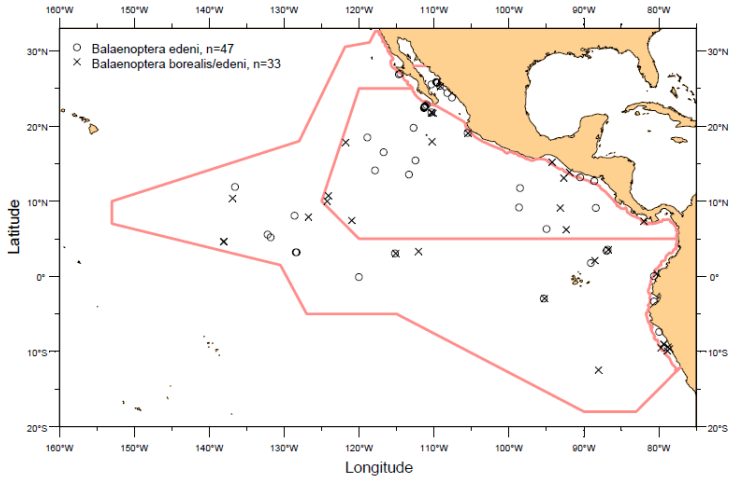

Fig.5. Bryde's and unidentified Sei/Bryde's whale sightings, STAR03 (Jackson, 2003).

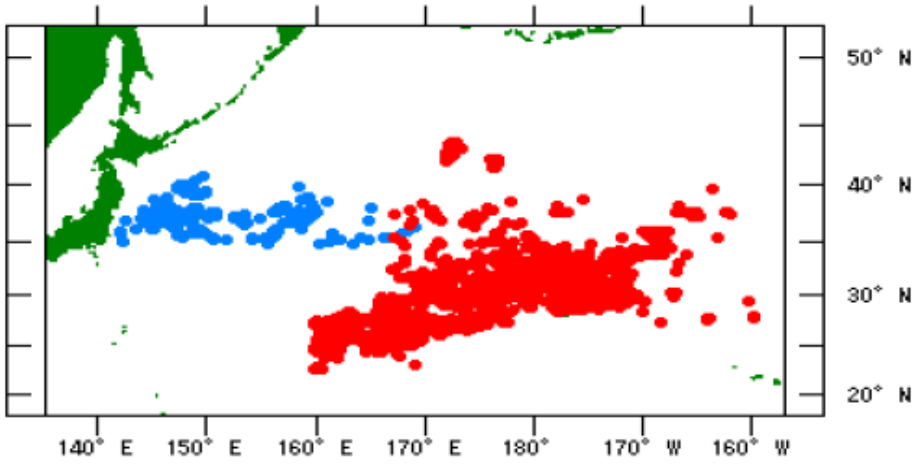

Fig.6. Catch distribution of Bryde's whales in the western North Pacific. Red corresponds to catch by pelagic whaling operations conducted between 1971 and 1979; blue corresponds to catch by JARPN II between 2000 and 2005 (Pastene *et al*., 2009).

The RMP *Implementation* for western North Pacific Bryde's was completed in 2007. The following research needs on abundance and stock structure remain (IWC, 2008).

Need for sighting surveys for abundance estimation

As for sei whales, offshore parts of the central and eastern North Pacific (east of 155°W) have not have been surveyed in recent years and thus there are no estimates of current abundance in these areas. Although the Committee has not identified specific areas/months for additional sighting surveys for this species, it is clear that any surveys undertaken should focus, at least initially, on areas closest to recently surveyed areas.

Need for surveys for investigation of stock structure

Four stock structure hypotheses were considered during the RMP *Implementation* (IWC, 2008). Not all were assigned high plausibility and thus clarification of stock structure remains a priority. The primary questions relate to: (a) whether or not sub-stocks occur in sub-area 1 and (b) whether or not a different stock occurs in sub-area 2.

Collection of the following new data would assist in resolving stock structure issues related to the western North Pacific and elsewhere:

- collection of additional biopsy samples (and sightings data) to further elucidate stock structure:
- in the central North Pacific particularly to the east of 180°E
- sighting surveys in low latitude to investigate location of possible breeding grounds for Bryde's whales (telemetry work would be valuable in locating appropriate areas to cover)
- telemetry work in sub-area 1 to investigate mixing of whales between sub-areas 1W and 1E

RIGHT WHALES, BLUE WHALES

The Committee has considered North Pacific right whales a number of times for conservation purposes, and in particular during the Workshop held in 1998 on the worldwide status of right whales (IWC, 2001). There is a paucity of recent information on right whales in the North Pacific although they were one widespread. Even in areas where there have been surveys, it is clear that densities are low (apart from, perhaps, from some areas of the Sea of Okhotsk). The eastern North Pacific population is critically endangered and is being studied *inter alia* by US scientists (Wade *et al*. 2010).

The situation is similar for the blue whale i.e. there is a paucity of recent information on right whales in the North Pacific although they were one widespread. Even in areas where there have been surveys, it is clear that densities are low, except in waters off California and Baja California, Mexico. The current abundance is estimated for the eastern side at 1,548 (Barlow and Forney, 2007) or 2,000 to 3,000 (Calambokidis and Barlow, 2004)

For both these species, it would not be practical (except perhaps for right whales in the Okhotsk Sea) to dedicate a cruise to abundance or biopsy sampling. However, given their rarity, then it would seem appropriate to allocate high priority to obtaining photo-id and biopsy data when encountered

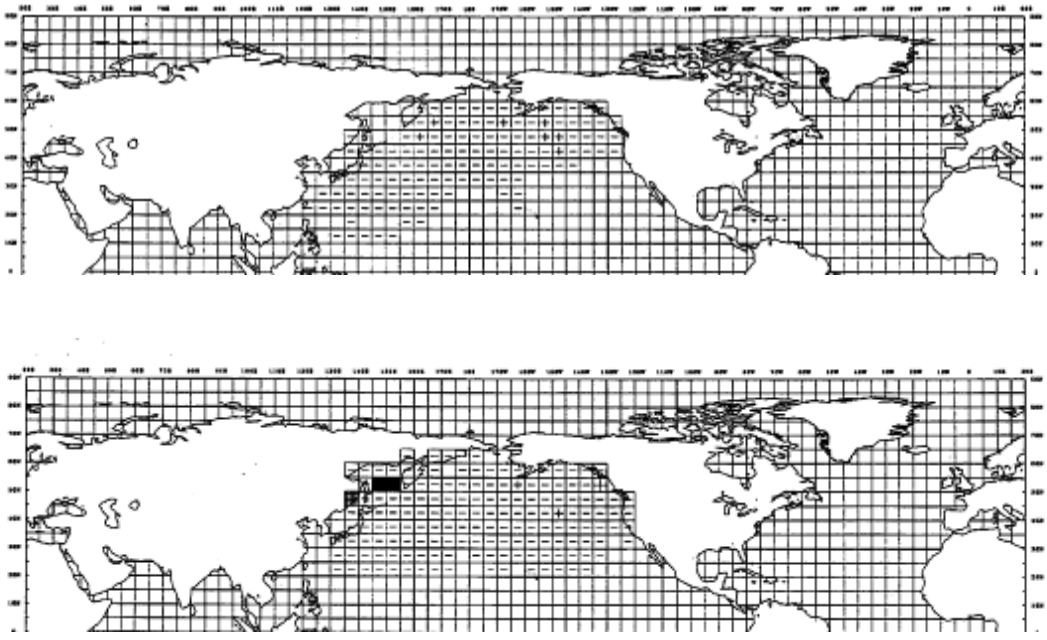

Fig.7. Distribution of right whales in the North Pacific between 1966 and 1990 seasons. Top : July, Bottom: August. (Miyashita *et al*., 1995).

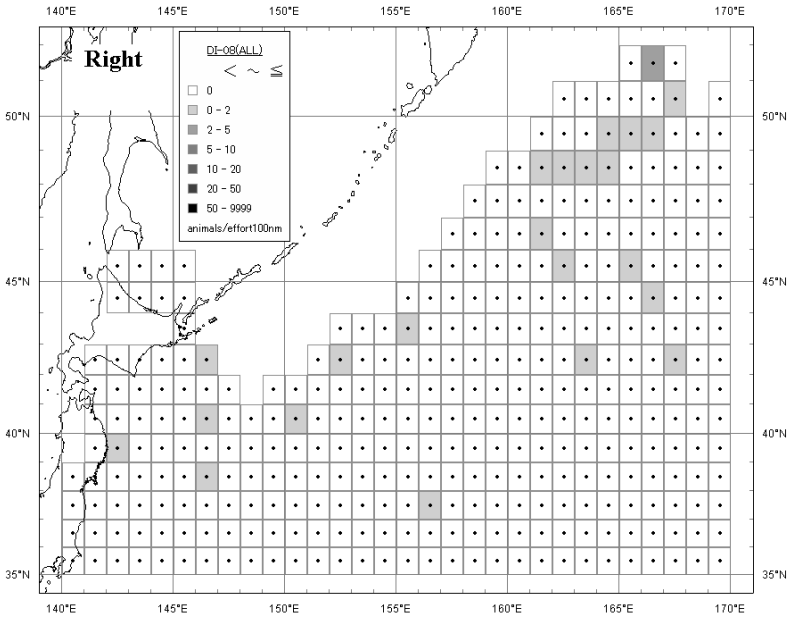

Fig.8. Right whale distribution of the Density Index (number of primary sightings of individuals / 100 n.mile) during JARPN and JARPN II from 1994 to 2007 surveys by Lat.1°× Long.1°square (Matsuoka *et al*., 2009).

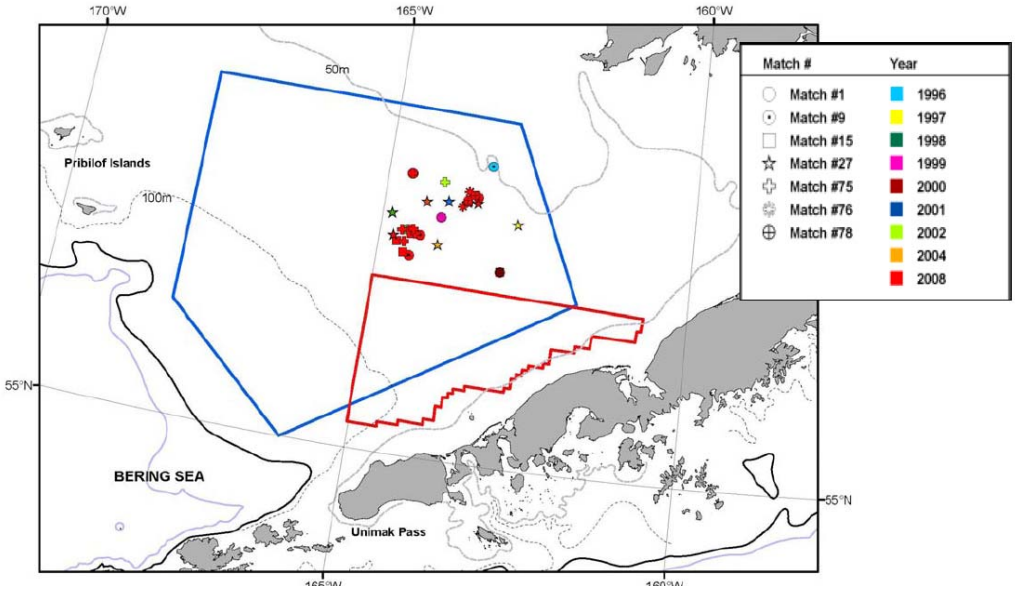

Fig.9. Positions of within-year and between-year resightings of North Pacific right whales in the Bering Sea from 1996-2008 (Clapham *et al*., 2009).

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Appendix
(from 61st SC report, Annex G, Annex 4)

DATA SOURCES AND WORK PLAN FOR THE IN-DEPTH ASSESSMENT OF NORTH PACIFIC SEI WHALES

1. Data sources

1.1 Catch history

The IWC Secretariat has apportioned past catches in the western North Pacific into sei and Bryde's whales, and the same apportionment can be used for the sei whale catch series.

The catches for the eastern North Pacific (east of 160°W) have not yet been apportioned, but it appears that an approximate apportionment will be relatively easy because: (i) the Japanese pelagic catches occurred mainly in the period since sei and Bryde's whales were distinguished in Japanese statistics (but not BIWS); (ii) the USA and Canadian land station catches included no Bryde's whales. Small catches by other pelagic whalers may have included mixtures of sei and Bryde's whales.

The Soviet catch data are still incomplete for the North Pacific. The only data sources known to the Secretariat are the official statistics submitted to BIWS and some alternative summary data by Doroshenko (2000). With this information, the best that can probably be done is to place reasonable bounds on the total sei/Bryde's catch (for a low and high catch series) and use the Japanese pelagic catch data to determine the areas and seasons of sei/Bryde's occurrence. If overlap is limited the apportionment may be unproblematic, but the totals remain uncertain.

1.2 Abundance, distribution and trends

1.2.1 SIGHTINGS DATA: JAPAN

- Commercial scouting vessel data 1965-75
- Chartered JSV data 1976-82
- Dedicated surveys from 1983 onwards
- JARPN II surveys 2002-07 (W 170°E, N of 35°N)

The data to 1990 are summarised by 5° square by Miyashita *et al.* (1995). The data prior to 1982 can probably only be used as relative indices of abundance and distribution. Data from 1983 onwards are in principle suitable for absolute abundance estimation (as has been performed for the JARPN II data in SC/J09/JR15), but the variable geographical and seasonal coverage over much of the period will probably necessitate the use of spatial models (see, for example, SC/J09/JR19), with the added complexity of modelling the shifts in distribution over time.

1.2.2 SIGHTINGS DATA: USA

Since the regime shift in the mid-1970's sei whales seem to have become rare in the USA continental EEZ and there have been few sightings in recent surveys (Barlow and Forney 2007). Surveys of southwest Alaska and the Aleutians also failed to yield sufficient sei whale sightings for abundance estimation (Zerbini *et al.* 2006). The coverage of USA surveys during 1986-2006 is available from NOAA SWFSC [map=SCWP2].

1.2.3 SIGHTINGS DATA: BRITISH COLUMBIA

The inshore waters (out to the Queen Charlotte chain) were surveyed in 2004-05 but resulted only in a single sei whale sighting (Williams and Thomas 2007). There appears to have been no survey of the full B.C. EEZ out to 200nm.

1.2.4 SIGHTINGS DATA: GAPS AND NEGATIVE INFORMATION

The offshore parts of the central and eastern North Pacific appear not have been surveyed in recent times.

If abundance data are to be extrapolated beyond surveyed areas using spatial models, then it is important that negative information (surveys with zero or very few sightings) be taken into account. This is a potential concern with respect to analyses such as that in SC/J09/JR36.

A rough quantification of the negative information could be obtained by using a more frequently sighted species, such as fin whales, to provide a (potentially positively biased) estimate of the effective search area.

An alternative is not to extrapolate beyond surveyed areas, and to treat area with negative information (effort and no sightings) as having zero abundance. It would probably be inappropriate to extrapolate densities into areas of no information (no effort) adjacent to areas of negative information (effort with no sightings) without incorporating the negative information.

1.3 Stock structure

1.3.1 JARPN II

mtDNA and microsatellite analyses from 489 whales were collected during JARPN II in western North Pacific (SC/J09/JR32).

1.3.2 JAPANESE COMMERCIAL CATCH

mtDNA and microsatellite analyses from 301 whales were collected during 1972-73 commercial catches in central and eastern North Pacific JARPN II in western North Pacific (SC/J09/JR32).

1.3.3 USA COMMERCIAL CATCH

From Californian land stations operating during 1959-70, samples from 184(?) whales are held in the USA but have not yet been analysed (Rice 1977).

1.3.4 CANADIAN COMMERCIAL CATCH

4,000 sei whales were taken from land stations in British Columbia, mainly in the 1960s, but no samples are known to exist (Gregr *et al.* 2000).

1.4 Biological parameters (age and reproductive data)

Age and reproductive samples have been obtained from 489 sei whales collected under JARPN II during 2002-07 but these have not yet been worked up and presented (SC/J09/JR1).

Analyses of Japanese and American historical data are published by Masaki (1976) and Rice (1977). More detailed data may be available in Masaki's 1975 thesis (in Japanese).

2. Proposed Work Plan

The first phase of the in-depth assessment could start at the 2010 Scientific Committee annual meeting and based on the above data sources could focus on abundance and distribution (present and past), and stock structure.

The in-depth assessment should initially address the entire North Pacific. Subdivision of the region may be possible later depending on progress with stock structure.

Biological parameters should be considered after the first phase has been completed, if new information becomes available.

2.1 Tasks to be completed before the start of the first stage

1. Construction of an inventory of existing data holdings
2. Quantify search effort from USA surveys for use as negative information.
3. Genetic analysis of a subset of the historical Californian samples.
4. Preliminary analyses of the historical sightings data, treating them in a way appropriate to the nature of the data.
5. Complete the catch history, using best approximations for the Soviet component as suggested above.

2.2 Agenda items for first meeting

1. Stock structure (historic and current)

   (Existing and new genetic analyses would be presented and discussed in detail).

2. Abundance and distribution data

   a. Recent dedicated surveys (detailed review of existing and new analyses).

   b. Analyses of historic sightings data, with a view to understanding relative ocean-wide distribution and shifts over time

3. Review and adopt catch history (an upper and lower bound if appropriate).

Each of the above discussions may result in recommendations for further work.

2.3 Data availability

Members wishing to pursue analyses should request access to data under the terms of the Data Availability Agreement. If it is later decided to proceed with an RMP Implementation, the data to be used for the implementation would then have to be submitted to the Secretariat.

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