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New Scientific Whale Research Program in
the Antarctic Ocean (NEWREP-A) in
2015/16

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INTERNATIONAL
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ABSTRACT

This paper presents an overview of the first field survey of the New Scientific Whale Research Program in the Antarctic Ocean (NEWREP-A) conducted in the eastern part of Area IV and whole Area V (south of 60°S, 115°E to 170°W) during the 2015/16 austral summer season. The two main objectives of NEWREP-A, viz. i) Improvements in the precision of biological and ecological information for the application of the RMP to the Antarctic minke whales, and ii) Investigation of the structure and dynamics of the Antarctic marine ecosystem through building ecosystem models, require data and samples from multidisciplinary surveys, as was the case for those conducted in 2015/16: a) biological sampling survey for Antarctic minke whales, b) a dedicated whale sighting survey based on the IWC guidelines, and c) krill and oceanographic surveys. For the biological sampling survey, a total of 333 Antarctic minke whales (103 males and 230 females) was sampled and several biological samples and data, included earplugs for age determination, were obtained from each individual whale. During the dedicated sighting survey, 141 primary sighting of 425 Antarctic minke whales were made. Following recommendations from the NEWREP-A review workshop, feasibility-related biopsy and telemetry studies on Antarctic minke whales were started during this survey. The whale dedicated sighting vessel-based krill and oceanographic surveys also commenced as part of this survey, and the results will be presented to the IWC SC as well to CCAMLR specialist's workshops. Whale and environmental data collected from this survey are available for the national (Japan) and international scientific community following established protocols - see a summary of the data and samples collected and guidelines for research collaboration and access to the data in the following link: <http://www.icrwhale.org/NEWREP-AProtocol.html>. Details of the survey methods and results for the biological survey of Antarctic minke whale, dedicated sighting survey, and krill and oceanographic survey, are presented by Mogoe *et al.* (2016), Isoda *et al.* (2016) and Wada *et al.* (2016), respectively.

KEYWORDS: SCIENTIFIC PERMITS; ANTARCTIC; SURVEY-VESSEL; FEEDING GROUNDS

INTRODUCTION

The Government of Japan decided to stop the Japanese Whale Research Programs in the Antarctic-Phase II (JARPAII) after the 2013/14 austral summer survey in response to the International Court of Justice (ICJ) Judgment in the case concerning Whaling in the Antarctic. It is important to note the following relevant aspects of the Judgment. First the Court confirmed that the objects and purpose of the International Convention for the Regulation of Whaling (ICRW) include sustainable exploitation of whale stocks and that special permit whaling under Article VIII, paragraph 1, of the ICRW is legally permissible under certain conditions. Second, the Court maintained that, for the use of lethal methods, the programme's design and implementation of special permit whaling need to be reasonable in relation to achieving its stated objectives. Third, the Court provided seven guidelines on the issuance of future special permit whaling by Japan. Finally, in its reasoning part, the Court stated that 'it is to be expected that Japan will take account of the reasoning and conclusion contained in this Judgment as it evaluates the possibility of granting any future permits under Article VIII, paragraph 1, of the ICRW' (paragraph 246 of the Judgment).

The Government of Japan decided to develop the New Scientific Whale Research Program in the Antarctic Ocean (NEWREP-A) following guidelines offered in the ICJ Judgment for granting special permit whaling under Article VIII, paragraph 1. The research plan for NEWREP-A was submitted to the IWC in November 2014, and reviewed by a panel of international experts in February 2015 (NEWREP-A review workshop), and by the whole IWC SC in May 2015.

The first multidisciplinary NEWREP-A survey was carried out during the 2015/16 austral summer season in Areas IV (70°E-130°E) and V (130°E-170°W). Detailed results of the different components of this multidisciplinary survey were presented in Mogoe *et al.* (2016) for the biological survey of Antarctic minke whale (*Balaenoptera bonaerensis*); Isoda *et al.* (2016) for the dedicated sighting survey involving some feasibility-related non-lethal studies on Antarctic minke whale; and Wada *et al.* (2016) for the results of the krill and oceanographic surveys. Results of the krill and oceanographic surveys will be also presented in a CCAMLR specialist workshop in June/July 2016.

The objective of this paper is to present an overview of the first field survey of NEWREP-A in 2015/16, emphasizing the overall achievements in the context of the program's main objectives.

BACKGROUND

Need for whale and ecosystem research in the Antarctic

As explained in the research plan of NEWREP-A (GOJ, 2015), the Antarctic Ocean has a unique marine ecosystem and offers great potential for sustainable utilisation of its abundant living resources for food and other purposes. In recent years, the surrounding Antarctic region has been substantially affected by climate change and the resultant fluctuations in the oceanographic environment are known to have influenced the global environment. In order to achieve conservation of its resources while pursuing their sustainable utilization, and to understand and predict the effects of factors such as climate change, it is scientifically imperative to obtain an accurate understanding of many aspects of the Antarctic marine ecosystem including its animals and their dynamics through collection, accumulation, and analysis of scientific data.

Long term research surveys in the Antarctic are scarce. Systematic sighting surveys were conducted during the International Decade for Cetacean Research/Southern Ocean Whale and Ecosystem Research (IDCR/SOWER) under the auspices of the IWC SC over four decades (Matsuoka *et al.*, 2003; IWC, 2008). These surveys produced important sighting data to inform the study of the the abundance and abundance trends of large whales in different IWC Management Areas. The JARPA/JARPAII were the only comprehensive long-term systematic surveys that collected biological information from whales and data from their environment using both lethal and non-lethal approaches. The comprehensive biological and environmental data collected by these programs for around 27 years (including abundance trends for several whale species) have been very important to understand the dynamics and interaction of whale species in the ecosystem, as has been recognized by the IWC SC reviews of those programs (IWC, 2014).

Under this context the Government of Japan developed the NEWREP-A, with two main research objectives. The first main objective is 'improvement in the precision of biological and ecological information for the application of the Revised Management Procedure (RMP) to the Antarctic minke whales'. This is aimed at contributing to the consideration and work of the IWC SC in improving the IWC's RMP that is the single-species management procedure adopted by consensus of its members in 1994 to calculate catch limits for baleen whales for commercial whaling. The IWC SC continues to work on several issues related to improvement and implementation of the RMP. The program under this proposed research plan will collect and estimate the parameters required for *Implementation* and *Implementation Reviews* of the RMP to the Antarctic minke whale. It will also contribute to the improvement of the RMP itself (GOJ, 2015).

The second main objective is "investigation of the structure and dynamics of the Antarctic marine ecosystem through building ecosystem models". Previous research programs have found that distributions and abundances of Antarctic minke, humpback, and fin whales, which are important components of the Antarctic marine ecosystem, have been changing appreciably and that there could be competitive interactions among those whale species in terms of food (Matsuoka *et al.*, 2011; Matsuoka and Hakamada, 2014; Hakamada *et al.*, 2013; Murase *et al.*, 2014). It can be hypothesized that this phenomenon has been caused by increased pressure on Antarctic minke whales from the recovering populations of humpback and fin whales that had been overexploited up to the 1960's. This resulted in a stabilisation and then decrease of the Antarctic minke whale populations that had previously experienced a strong increase given improved food availability as a result of the overexploitation of larger whales. Changes in the abundance of whale species may also be caused by fluctuations in the abundance of krill populations that are the common food resource for these three species of whales or possibly as a result of changes in the ocean environment associated with climate change. Investigation of the causes and current dynamics is essential for improved future conservation and management of the whale resources as well as for understanding of the Antarctic marine ecosystem (GOJ, 2015).

Under these two main objectives, NEWREP-A attempts to achieve a sustainable balance between the maintenance of the unique marine ecosystem and the utilization of its abundant resources and this is, as is common for all seas and oceans, an important challenge for the Antarctic Ocean. This is also consistent with the objectives of the ICRW stipulated in its preamble: "to provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry".

JARPAII and NEWREP-A

It should be noted here that the research objectives of the previous JARPAII (see Pastene *et al.*, 2014) were not judged as unreasonable by scientists at the JARPAII review workshop (IWC, 2015a, 2015b) and by the ICJ

Judgment (see paragraph 127 of the Judgment). Therefore the JARPAII objectives remain relevant and were taken into account in the development of the NEWREP-A.

IWC SC recommendations on NEWREP-A

As noted above, the NEWREP-A research plan was reviewed in a specialist workshop in February 2015, and by the whole IWC SC during the 2015 annual meeting. The review workshop made a total of 29 recommendations, nearly all of which were considered useful by the NEWREP-A proponents. Recommendations were related to field, laboratory and analytical work (IWC, 2015b). Some of the recommendations were considered of higher priority, and the proponents have made efforts to substantially advance work related to those recommendations before launching the first NEWREP-A survey. The other recommendations will be addressed during the NEWREP-A survey period, under a specific timeline (GOJ, 2016a; 2016b).

The work of some of the field recommendations was started during the 2015/16 NEWREP-A survey (see below).

OVERVIEW OF THE 2015/2016 NEWREP-A SURVEY

Research area and vessels

It should be noted again that for addressing the main objectives of the NEWREP-A, multidisciplinary surveys are required. The first multidiscipline survey of NEWREP-A was carried out in part of Area IV (115°E-130°E) and in Area V (130°E-170°W) as shown in Figure 1. The dedicated sighting survey, which included krill and oceanographic surveys, was conducted in the eastern part of Area IV. The biological sampling survey for Antarctic minke whales (target sample size: 333) was conducted in Area V.

The 2015/16 survey involved three research components: i) a sampling survey for Antarctic minke whales using two Sampling and Survey Vessels (SSVs: *Yushin-Marū*, YS1: 724GT and *Yushin-Marū No.2*, YS2: 747GT), and one research base vessel (*Nisshin-Marū*, NM: 8,145GT); ii) a dedicated whale sighting survey using one Sighting Vessel (SV: *Yushin-Marū No.3*, YS3: 742GT); and iii) a krill survey and oceanographic observations along with the dedicated sighting survey. A summary of the research period, research area and related research topics for the three components is shown in Table 1, while their itineraries are shown in Figure 2.

Details of the survey methods and results for the biological survey of Antarctic minke whales, the dedicated sighting survey, and the krill and oceanographic survey, are presented by Mogoe *et al.* (2016), Isoda *et al.* (2016) and Wada *et al.* (2016), respectively.

Narrative of the survey

The 2015/16 NEWREP-A survey was carried out in the period between 1 December 2015 and 24 March 2016 (115 days). Transit sighting surveys in low and middle latitudes were carried out from 14 to 26 December 2015, and from 26 February to 8 March 2016 by the sampling vessels. The dedicated sighting survey was carried out from 27 December to 14 February 2016 (50 days in the research area). A krill survey for abundance estimation and oceanographic observations were carried out in the same period as the dedicated sighting survey, and included testing of equipment. The sampling survey for Antarctic minke whales was carried out from 23 December 2015 to 25 February 2016 (65 days in the research area) (Figure 2).

Overview of the dedicated sighting survey

This survey was carried out in the eastern part of Area IV (115°-130°E), a sector not covered by the sighting survey in the same Area in the 2014/15 season. The sighting survey was designed and implemented following the recommendations from the NEWREP-A review workshop (IWC, 2015b) and IWC SC guidelines (IWC, 2015a). One dedicated Sighting Vessel (SV) participated in the survey. Blue (*Balaenoptera musculus*), fin (*B. physalus*), humpback (*Megaptera novaeangliae*) southern right (*Eubalaena australis*), and Antarctic minke whales were sighted while completing a total searching distance of 1,542.7 n.miles. The trackline covered on-effort corresponded to 88.4% of the planned trackline. Abundance of large whale species for the entire Area IV will be estimated in the near future based on the sighting data collected during the 2014/15 and 2015/16 surveys (which together covered the entire Area IV).

In response to recommendations from the NEWREP-A review workshop, feasibility-related experiments on biopsy sampling and satellite tracking of Antarctic minke whales were started. Such experiments will be conducted during the three first NEWREP-A surveys, and progress will be reported to the IWC SC in 2016 and 2017 with final conclusions to the IWC SC in 2018. Routine photo-ID and biopsy sampling was conducted on other large whale species (see details in Isoda *et al.*, 2016).

Sampling survey of Antarctic minke whale

The planned target of 333 Antarctic minke whales (103 males and 230 females) was randomly sampled during the survey in Area V. The total searching distance by the Sighting and Sampling Vessels (SSVs) was 2,394 n.miles. The trackline covered on-effort corresponded to 11.2% of the planned trackline.

A large number of data and samples were obtained from each whale sampled, as originally envisioned in the NEWREP-A research plan. In particular earplugs for age determination were collected from all whales sampled. Some preliminary biological analyses were conducted based on the 333 whales sampled. Apart from the lethal sampling of Antarctic minke whales, the SSVs collected sighting data for all cetacean occurring along the trackline. Furthermore routine photo-ID and biopsy experiments were also conducted for large baleen whales (see details in Mogoe *et al.*, 2016).

Krill survey and oceanographic observation

A krill survey based on echosounder and net sampling was started this season along the tracklines of the dedicated sighting survey. Furthermore oceanographic observations were made using a CTD. Following recommendations from the NEWREP-A review workshop, calibrations of the echosounder were carried out in Japan as well in the Antarctic research area. Analyses of the data and samples collected are underway. Design of the krill survey and oceanographic observations together with the preliminary results of the first survey will also be presented to a CCAMLR specialists' workshop in June/July 2016. Feedback from the specialists will be useful for planning the survey next year (see details in Wada *et al.*, 2016).

GENERAL REMARKS AND SUGGESTIONS FOR FUTURE SURVEYS

The first multidisciplinary survey of NEWREP-A was successfully conducted in a part of Area IV and whole Area V in 2015/16. The biological survey of Antarctic minke whales, the dedicated cetacean sighting survey, and the krill survey and oceanographic observations were conducted in terms of the NEWREP-A research plan and the field recommendations from the NEWREP-A review workshop. The list of data and biological samples collected are shown in Tables 2, 3, 4 and 5.

The dedicated sighting survey data (weather, effort, sighting, distance and angle experiment) have already been submitted to the IWC secretariat. Catch data will also be submitted to the IWC secretariat. Whale and environmental data collected on this survey are available for the national (Japan) and international scientific community following established protocols - see a summary of the data and samples collected and guidelines for research collaboration and access to the data in the following link: <http://www.icrwhale.org/NEWREP-AProtocol.html>.

It should be noted that the actual coverage of the sampling survey of Antarctic minke whale was low. The actual coverage was less than half compared with predetermined track-line due to bad weather, especially in the northern part of the research area. The survey in the western part of the Ross Sea was cancelled to avoid a high vessel traffic zone and to avoid meeting a vessel from an anti-whaling NGO.

For the 2016/17 survey, larger coverage is expected because 15 research days will be added (80 days for the research area in contrast to 65 days for the present survey).

An update of the scientific work conducted by the proponents on the recommendations on NEWREP-A from the IWC SC was submitted to the IWC SC in 2016 (GOJ, 2016).

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Table 1. The major survey components and their related research topics for NEWREP-A in 2015/16.

Component	Period	Research area	Vessels	Research topics
1 Sampling survey for Antarctic minke whale	23 December 2015 – 25 February 2016	Area V	YS1, YS2, NM	Biological sampling survey of Antarctic minke whales
2 Dedicated sighting survey	27 December 2015 – 14 February 2016	a part of Area IV (115°E - 130°E)	YS3	Dedicated sighting survey for whale abundance estimates, feasibility of telemetry and biopsy sampling in Antarctic minke whale
3 Krill abundance survey and oceanographic survey	27 December 2015 – 14 February 2016	a part of Area IV (115°E - 130°E)	YS3	Krill surveys for biomass estimate, oceanographic survey,

Table 2. List of data collected during NEWREP-A 2015/16.

Items	Data
Abundance estimate*	
Weather data***	115 days
Effort data***	115 days
Sighting record of whales***	1,472 schools (all species)
Angle and distance experiments***	320 times
Ice edge line ***	115°E–170°W
Environmental data	
Hydraulic pressure, temperature, salinity, chlorophyll, oxygen (CTD)**	37 stations
Seawater sampling	4 stations
Echosounder data (krill distribution/abundance)**	31 days
Net sampling	37 stations
Marine debris (sea surface)	0 observations
Antarctic minke whale*	
Catching date and location***	333 individuals
Photographic record of external characteristics	333 individuals
Record of internal and external parasites	333 individuals
Sex and body length***	333 individuals
Body proportion for stock structure*	333 individuals
Skull measurements (length and breadth) for stock structure*	310 individuals
Satellite tracking for stock structure and feeding ecology*	3 individuals
Body weight for feeding ecology**	333 individuals
Organ weight including fat weight for feeding ecology**	5 individuals
Diatom film record for feeding ecology**	333 individuals
Blubber thickness for feeding ecology**	333 individuals
Stomach content: freshness and weight for feeding ecology**	333 individuals
Diving behaviour for feeding ecology**	–
Testis weight for reproductive study***	103 individuals
Mammary gland: lactation status and measurement for reproductive study	230 individuals
Foetal number, sex, length and weight for reproductive study	158 individuals
Marine debris (stomach)	0 individuals
Gross pathological observations and sampling	333 individuals
Other large whales	
Photo-ID	82 individuals

* Data or samples to be used for Main Objective I;

** data or samples to be used for Main Objective II (Other items will be used for other research purposes);

*** data or samples to be used for Main Objective I and II.

Table 3. List of samples collected during NEWREP-A 2015/16.

Items	Sample
Antarctic minke whale*	
Prey species in stomach for feeding ecology**	47 individuals
Faeces and contents from the large intestine for feeding ecology**	0 individuals
Testis for reproductive study***	103 individuals
Ovary for corpora counting and reproductive study***	230 individuals
Mammary gland and endometrium for reproductive study	230 individuals
Earplug for age determination***	333 individuals
Ocular lens for age determination***	333 individuals
Baleen plates for age determination and stable isotope study ***	26 individuals
Tissue samples for genetic study***	333 individuals
Tissue and organ samples for chemical study***	333 individuals
Tissue and plasma samples for physiological study***	333 individuals
Vertebral epiphyses for physical maturity	307 individuals
Skin sample (biopsy)	10 individuals
Other large whales	
Skin sample (biopsy)	40 individuals

* Data or samples to be used for Main Objective I;

** data or samples to be used for Main Objective II (other items will be used for other research purposes);

*** data or samples to be used for Main Objective I and II.

Table 4. Number of whales sighted during NEWREP-A 2015/16 (schools and individuals).

Species	Transit to RA				Research area				Transit from RA				Sub total				Total	
	Primary		Secondary		Primary		Secondary		Primary		Secondary		Primary		Secondary		Sch.	Ind.
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.				
Blue whale	0	0	0	0	14	25	6	9	0	0	2	2	14	25	8	11	22	36
Fin whale	2	2	0	0	14	37	10	25	0	0	0	0	16	39	10	25	26	64
Sei whale	1	2	0	0	0	0	0	0	4	4	0	0	5	6	0	0	5	6
Antarctic minke whale	1	1	0	0	476	1,339	80	219	0	0	3	4	477	1,340	83	223	560	1,563
Like Antarctic minke whale	0	0	0	0	7	7	0	0	0	0	0	0	7	7	0	0	7	7
Humpback whale	0	0	0	0	525	1,128	136	302	0	0	7	22	525	1,128	143	324	668	1,452
Southern right whale	0	0	0	0	1	1	0	0	0	0	1	1	1	1	1	1	2	2
Baleen whale	0	0	2	2	18	24	2	2	0	0	0	0	18	24	4	4	22	28
Sperm whale	4	4	0	0	19	19	2	2	0	0	2	2	23	23	4	4	27	27
Southern bottlenose whale	0	0	0	0	2	4	0	0	0	0	0	0	2	4	0	0	2	4
Arnoux's beaked whale	0	0	0	0	2	20	1	7	0	0	0	0	2	20	1	7	3	27
Unid. beaked whale	1	2	1	3	15	17	2	2	4	5	0	0	20	24	3	5	23	29
Killer whale	0	0	0	0	26	241	3	18	0	0	0	0	26	241	3	18	29	259

Table 5. Number of photo-identified whales and number of biopsies taken during NEWREP-A 2015/16.

Species	No. of individuals photographed	No. of individuals biopsied
Blue whale	24	8
Fin whale	0	7
Humpback whale	36	15
Southern right whale	1	1
Killer whale	21	9
Total	82	40

*: Results of the feasibility biopsy sampling and telemetry for the Antarctic minke whales are presented by Isoda *et al.*, (2016).

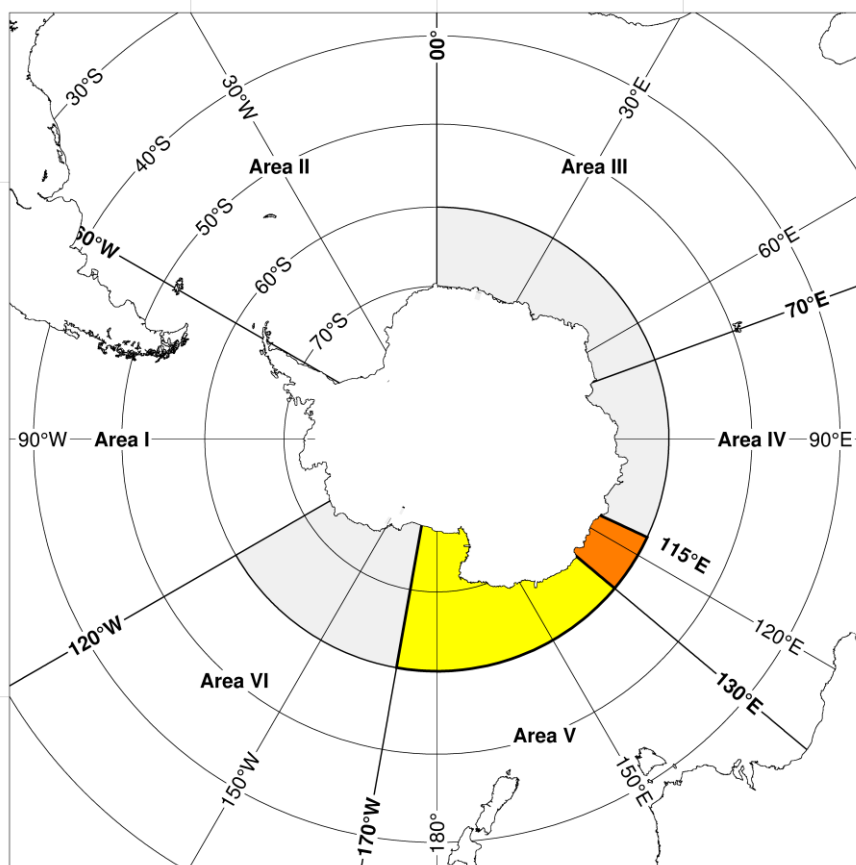


Figure 1. Research area for NEWREP-A in 2015/16. The orange colour shows the research area for the dedicated sighting survey and krill/oceanographic surveys. The yellow colour shows the research area for the sampling survey for Antarctic minke whales. The grey colour shows the total research area for NEWREP-A.

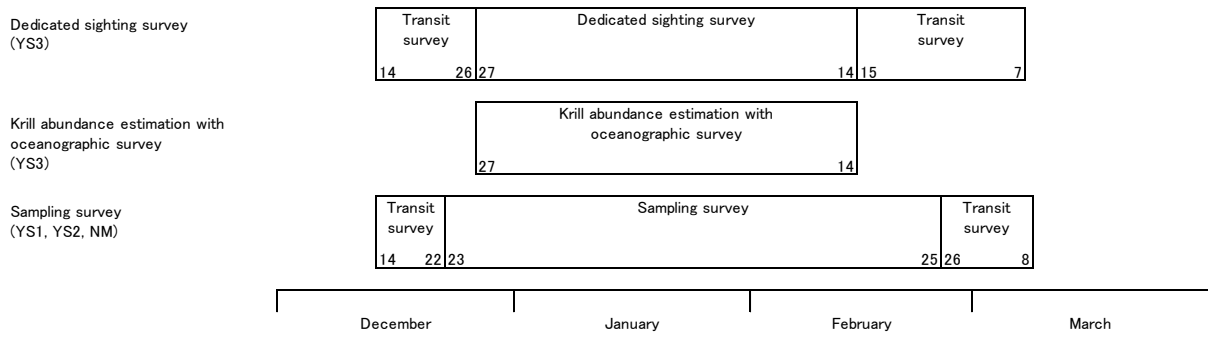


Figure 2. Survey period for each major survey component of NEWREP-A in 2015/16.