Report of the IWC-POWER TAG and 2021 Planning Meeting

Virtual Meeting, November 2020

Report of the Meeting of the IWC-POWER Technical Advisory Group (TAG) and 2021 Planning Meeting: November 2020

The TAG (Technical Advisory Group) and Planning Meeting was held online via Zoom on 9-10 November 2020, from 13:00 to 16:00 GMT each day. Using multiple shorter online meetings was considered the most efficient way to conduct the necessary work that is usually accomplished at the annual in-person meeting. This report[1] covers the first online meeting that focused solely on planning the next IWC-POWER cruise. A second online meeting and/or email discussion has been proposed for spring 2021 to complete the rest of the work covering the analysis of the POWER data and preparations for the next phase of the IWC-POWER programme. The list of participants is given as Annex A.

1. INTRODUCTORY ITEMS

1.1 Opening remarks and welcoming address including notes from the IT support team

Matsuoka (Convenor) opened the meeting, welcomed the participants and thanked them for their time particularly in the current COVID-19 situation. He noted this was the first virtual meeting of the TAG and hoped it would be a success despite the challenges. Moronuki (Fisheries Agency of Japan) also welcomed the participants to the meeting. He noted that the preliminary results from the 2020 cruise were very encouraging and hoped that 2021 would be a great success.

On behalf of the IWC, Staniland thanked Matsuoka for organising the meeting and everyone for giving their time to support the IWC-POWER programme. He introduced himself as the new Lead for Science having succeeded Donovan in May this year, who was sadly unable to attend. He noted how important that programme had been to the work of the IWC and how the IWC was indebted for the international effort involved, in particular the support of Japan in providing a vessel and crew. He hoped the meeting would be productive and looked forward to a successful future for the IWC-POWER programme.

1.2 Election of the Chair

Matsuoka was elected Chair, with Kitakado as co-Chair.

1.3 Adoption of the Agenda

The adopted agenda is given as Annex B.

1.4 Appointment of rapporteurs

Staniland, Palka, Crance and Kitakado were appointed rapporteurs.

1.5 Review of documents

The list of documents is given as Annex C.

2. REVIEW OF CRUISE DISCUSSIONS AT SC68B AND THE EARLIER TAG MEETING (IWC, 2020A)

2.1 Review of Scientific Committee recommendations

The importance of IWC-POWER data was acknowledged in the report from SC68B including to the Comprehensive Assessments of North Pacific humpback and sei whales. Biopsy samples from the IWC-POWER programme were recognised to be of great value in understanding the stock structure of large whales in the North Pacific. The collection of samples, especially from blue and fin whales, was encouraged in future surveys.

At the SC68B meeting the Scientific Committee had reiterated the great value of the data contributed by IWC-POWER cruises and thanked the governments of Japan (ship, crew and researchers) and the United States

[1]Presented to the meeting as SC/68C/REP/01 Rev1.

(equipment and researchers) for their continued support of the programme. The results of the 2019 cruise (Matsuoka *et al.*, 2020) were welcomed at the SC68B meeting and the plan for the 2020 cruise (IWC, 2020b) was endorsed (see Fig. 1). In addition, the proposal for the 2021 cruise to Russian waters in the Bering Sea was endorsed, including the work to incorporate the 2019 photographs into the database (Anon., 2020).

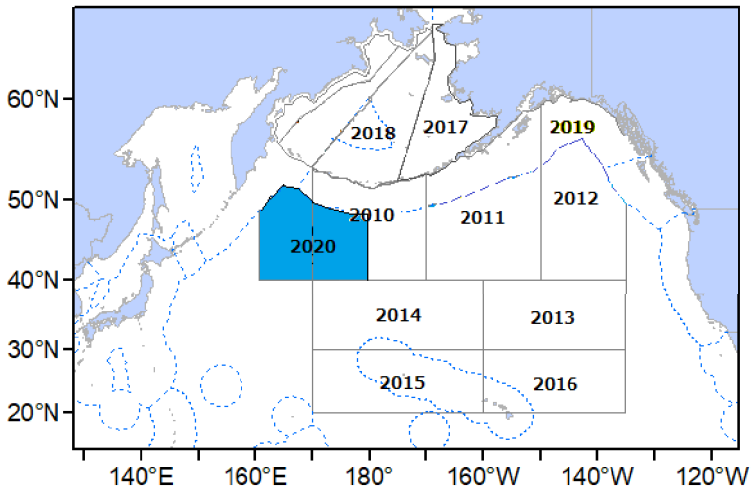

Fig. 1. Research area for the 2010-2020 IWC-POWER cruises. Blue area: 2020 research area. Dotted blue line: EEZs.

2.2 Objectives and priorities

2.2.1 Long-term

The IWC agreed (IWC, 2012a) that the long-term IWC-POWER programme:

> *'will provide information to allow determination of the status of populations (and thus stock structure is inherently important) of large whales that are found in North Pacific waters and provide the necessary scientific background for appropriate conservation and management actions. The programme will primarily contribute information on abundance and trends in abundance of populations of large whales and try to identify the causes of any trends should these occur. The programme will learn from both the successes and weaknesses of past national and international programmes and cruises, including the IDCR/SOWER programme.'*

2.2.2 Short-term

The identified 'least studied' areas of the central and Eastern North Pacific will soon have been covered under IWC-POWER (pending permission to operate in Russian waters of the Bering Sea), thereby completing the 'short-term' objectives (IWC, 2012b). Analyses of these data will form the basis of the medium-term plan and may also result in one or two more cruises aimed at filling specific knowledge gaps before implementing the medium-term programme.

2.2.3 Medium-term

The medium-term objectives were reviewed and updated by the TAG in January 2020 with regard to the results of the programme so far. These are given in table 1 of IWC (2020a). These objectives may be reviewed and updated by the TAG in spring 2021 in light of results that will be presented at that time.

3. PRELIMINARY RESULTS FROM THE 2020 CRUISE

3.1 Sightings

Murase and Matsuoka presented a summary of the preliminary results from the 11th IWC-POWER cruise that took place from 11 July to 24 September 2020 in the High-Sea of the central North Pacific; more details can be found in the cruise report presented to this meeting (WP/05). The cruise was successful and good coverage (84.0%) of the planned tracklines was achieved. Sightings of: blue (22 schools/31 individuals), fin (29/32), sei (131/181), Bryde's (6/8), common minke (3/3), humpback (7/8), sperm (56/90) and killer (18/71) whales were observed. No North Pacific right whales were seen during the cruise.

3.2 Biopsy sampling

During the 2020 cruise, a total of 65 biopsy (skin and sometimes blubber) samples were collected from 13 blue, 9 fin, 38 sei, 1 Bryde's, 2 humpback and 2 killer whales (Table 1). This year yielded a substantial increase in the biopsy samples of blue and sei whales.

Table 1

Summary of biopsy work undertaken during 2010-2020 cruising, including transit surveys between Japan and the research areas (number of individuals sampled).

Biopsy	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Blue whale	1	4	2	0	1	0	1	0	6	12	13	40
Fin whale	2	12	12	1	0	0	0	28	24	45	9	133
Sei whale	13	31	36	0	0	0	1	0	0	4	38	123
Bryde's whale	0	0	0	6	78	34	16	0	0	0	1	135
Common minke whale	0	0	0	0	0	0	0	0	0	0	0	0
Humpback whale	0	1	0	0	0	0	0	18	29	12	2	62
North Pacific right whale	0	0	0	0	0	0	0	3	3	0	0	6
Gray whale	0	0	0	0	0	0	0	9	7	2	0	18
Sperm whale	0	0	0	0	0	1	5	0	0	0	0	6
Killer whale	2	0	1	0	1	2	0	2	7	0	2	17
Total	18	48	51	7	80	37	23	60	76	75	65	540

3.3 Photo-identification

During the 2020 cruise photo-identification data were collected for: 26 blue, 3 humpback and 17 killer whales. These data are preliminary, pending further processing and photo-identification confirmation (Table 2).

Table 2

Summary of photo-identification work undertaken during 2010-2020 cruises including transit surveys between Japan and the research areas (**: estimated number of individuals photographed, requires confirmation, especially of the killer whales from 2018).

Photo-ID	2010	2011	2012	2013	2014	2015	2016	2017	2018**	2019	2020	Total
Blue whale	3	9	4	0	1	0	1	0	8	16	26	68
Fin whale	0	25	59	3	0	0	0	79	69	51	0	286
Sei whale	0	27	51	2	0	0	1	0	0	0	0	81
Bryde's whale	0	0	0	6	73	49	12	0	0	0	0	140
Common minke whale	0	0	0	0	0	0	0	0	4	0	0	4
Humpback whale	5	48	26	0	0	0	0	48	39	30	3	199
North Pacific right whale	0	0	1	0	0	0	0	12	3	0	0	16
Gray whale	0	0	0	0	0	0	0	16	41	6	0	63
Sperm whale	0	0	1	0	4	22	2	0	4	0	0	33
Killer whale	45	18	50	0	3	4	0	84	33	19	17	273
Total	53	127	192	11	81	75	16	239	201	122	46	1,163

3.4 Other

Additional duplicate sighting data of several large whale species were recorded during IO mode. The Estimated Angle and Distance Experiment was conducted as planned. A total of 67 marine debris objects were recorded. Although passive acoustic monitoring for marine mammals using sonobuoys was planned, it was not conducted because of the absence of an onboard specialist and the equipment.

Two international researchers from USA were initially nominated. However, they could not participate in the cruise because COVID-19 travel restrictions from the USA to Japan were not lifted in advance of the survey. It should be noted that Governments of USA and Japan as well as the POWER steering group tried their best to allow the participation of international researchers but were ultimately unsuccessful.

The crew of the vessel and international researchers worked well together to meet the objectives of the survey and follow IWC guidelines. The crews and researchers successfully prevented a COVID-19 infection with appropriate measures. Although this was the first POWER cruise to nominate two cruise leaders (Murase and Matsuoka), these experienced scientists successfully completed their tasks according to the research plan.

The Planning Meeting was **impressed** with the provision of the draft cruise report and **thanked** all of the scientists and crew for undertaking a most successful cruise. It also expressed thanks to the Government of Japan for the long-time provision of the vessel. The Planning Meeting **thanked** the cruise leaders, Murase and Matsuoka, for their work, dedication to the project and leadership skills.

3.5 Recommendations from 2020 cruise team

3.5.1 Data entry system

The 'onboard data collecting system' developed by ICR has been used in the POWER cruises. The researchers benefitted from the system to reduce their data entry workload. Although it is designed that weather data such as sea surface temperature and wind direction/speed are directly entered from the observation instruments to the system, data entry stopped on several occasions during this cruise. Fortunately, these troubles were fixed by rebooting the system. Currently, the main system is operated on a PC with Windows 7 which is no longer supported by Microsoft. The cruise report recommended an update of the PC to Windows 10 and all data backed up to a hard drive to ensure continuous data recording.

3.5.2 Monitor for real time monitoring of ship and sighting positions

Currently, a monitor displaying real time monitoring of ship and sighting positions is available for the captain on the upper bridge. The monitor is connected to a navigation system at the bridge and the officers enter sighting locations to it in real time. It is critical to understand spatial relationships among sightings for correct recording of duplicated sightings in IO mode, especially when the survey is conducted in a whale high-density area. The cruise report recommended that an additional monitor for real time monitoring of ship and sighting positions be supplied for researchers at the upper bridge.

3.5.3 Photographic database processing in Lightroom (LR)

As in the case of the 2019 cruise, images collected during the 2020 cruise were uploaded to LR and preliminarily coded. By processing images directly in LR, post-cruise processing time is greatly reduced. Furthermore, it allows for real-time photo-analysis summaries and expedites image access/sharing. The cruise report recommended that researchers on future cruises continue LR processing. However, processing images would overwhelm researchers if a large number of images are taken in a high-speed consecutive shot mode. The cruise report recommended that photographers try to take only 'high-quality images' as much as possible to minimize number of images for LR processing. The cruise report recommended that guidance documents specific for photo-processing during the cruise and the IWC LR Photographic Database Manual are kept up-to-date and that hard and electronic copies are made available on future cruises. The cruise report recommended that LR be installed on the IWC-POWER laptop with an up-to-date catalogue prior to the future POWER cruises.

3.5.4 Camera equipment

A Canon 7D Mark IV camera (on loan from the ICR) was used as one of the primary cameras for photo-identification during the 2020 POWER survey. The cruise report recommended that either an SD card or compact flash memory card with higher writing speed be supplied for the future cruises if available so that a series of high-speed consecutive shots from large body size animals (e.g. blue whales) can be taken. Because the 2019 cruise report noted that the IWC Nikon D7000 (with 70-300mm lens) was found to have problems with the shutters (hanging up at times while engaged in taking cetacean photographs) and GPS unit (working intermittently), it was not used in the 2020 cruise.

The meeting **recognized** the importance of the practical improvements suggested by the 2020 cruise crew and made the following **recommendations:** Matsuoka will investigate the possibility of software upgrades and provision of additional monitoring equipment; Staniland and Matsuoka will ensure that an updated manual and the most recent version of the database are available on the IWC laptop prior to the 2021 cruise and they will investigate the possibility of repairing or purchasing a new IWC camera.

4. 2021 CRUISE: GENERAL ISSUES

4.1 Availability of research vessel(s) from Japan and elsewhere

For the 2021 survey Japan provisionally offered the same type of vessel as used in the 2020 survey. However, because of the current budget cycle the final decision by the Government had not yet been made. The current COVID-19 restrictions meant no US research vessels were currently operating and it was therefore unlikely any US vessel would be available to support the programme next summer.

4.2 Budget (including accommodation and food costs).

The IWC had approved a core allocation from the commission of £12,500 which, when combined with the balance of previous funds, gave a total budget for the TAG programme of £59,814.

4.3 Research permit for Russian waters

The previous experience with applications for Russian EEZ entry permits were discussed. In the case of National Research Institute of Far Seas Fisheries (NRIFSF) in Japan, from 1986 to 2014, 24 applications have been made for 29 vessels and permission granted 12 times for 19 vessels. Six months prior to the survey was the recommended application submission date. The 2021 survey is tentatively scheduled for summer of 2021. For planning purposes, it would be necessary to know if the study area was able to survey in Russian waters by April 2021. Thus, it was agreed that the application would need to be submitted in November 2020 to meet the April 2021 time schedule.

A response to the application for the 2020 survey was not received until 23 July 2020. The response comprised two main points. The first stipulated that the filed application must conform to their rules and be completed on an official form that was provided (see WP/12). The second point stated that it was required that a detailed map of the cruise route be attached including transit to and from the home port.

The IWC Secretariat will provide a letter of support to the new application which will be rewritten from the previous versions to strengthen the case but will continue to emphasise the importance of the POWER cruises.

The need for a Russian scientist to be named on the form, and to co-ordinate the involvement of Russian researchers on the cruise itself, was recognised. Dr Zharikov had been very helpful in this regard until now but due to illness no recent correspondence had been received. No obvious replacement was identified and Brownell agreed to explore possible candidates who might be approached.

The meeting **reiterated** the importance of completing a survey in Russian waters and the importance of receiving a notification of the outcome of the Russian permit application in time to plan a survey in Russian or another region. It was thus **agreed** to file a submission using the official form provided by Russia before the end of November 2020 in hopes of receiving an outcome by April 2021. The application will provide a list of participants, including Russian participants, and a detailed map of the proposed cruise track including the transits. A small working group under Brownell will explore possible Russian participants.

4.4 Research permit for US waters

Given that the proposal of the Plan C as a backup plan only involves research in the high seas and not within US waters the understanding was that it would not require a permit. It was noted that it was unknown if the port at Kodiak was currently open for ship calls or would be open at the time of the cruise.

5. 2021 SURVEY - PRIORITIES AND CRUISE PLAN

5.1 Research priorities (Original and back-up plan)

The IWC POWER short-term plan identifies 'least studied' areas of the Eastern North Pacific that depend on permission to operate in Russian waters and these remain the current objectives (IWC, 2012b).

5.2 Research area(s) (Original and back-up plan)

The TAG and Planning Meeting **reiterated** the importance of completing the Bering Sea survey areas as agreed by the Scientific Committee in the last three years. However, given the difficulties previously experienced, the Planning Meeting **agreed** that it was important to consider a backup plan for the 2021 cruise. If the Russian Bering Sea area cannot be covered in 2021 then every effort should be made to cover this in 2022 given its importance to meeting the objectives of the IWC-POWER programme.

Three research areas were discussed: (A) the western Bering Sea; (B) East of Kuril archipelago; and (C) North of 40°N and south of Gulf of Alaska. These were considered priority areas for the following reasons:

- they had either not been surveyed: at all (A), not for 15 years (B) or not within 9 years (C);
- they represent an important information gap for several large whale species;

- IO mode data are not available for these areas; and
- COVID-19 may limit port calls and or the travel of researchers.

Covering these areas would make a valuable contribution to the work of the IWC-SC on the conservation and management of large whale species in the North Pacific by providing: (a) information for the in-depth assessments of sei, humpback, gray and sperm whales in terms of abundance, distribution and stock structure; (b) information on the critically endangered North Pacific right whale population; (c) baseline information on distribution, stock structure and abundance for a poorly known area for several large whale species/populations, including those that were known to have been depleted in the past but whose status is unclear (e.g. blue and fin whales); and (d) essential information for the development of the medium-long term international programme in the North Pacific in order to meet the Commission's long-term objectives.

Discussions were held around the choice between areas A and B (both within the Russian EEZ) with regard to the research priorities and the likelihood of permission being granted. It was noted that several recent applications to work in area A have been unsuccessful and the US pollock survey had also failed to get permission to work in this area. Area B offered a number of potential advantages as: it was adjacent to the area surveyed in 2020, a previous survey had encountered many species of high importance (sei, humpback, blue, and right whales; Miyashita (2006) and it is close to an area where Japan previously conducted research whaling operations.

It was **agreed**, whilst area A remained a top priority, that, with the support of the IWC Scientific Committee, an application to survey in area B would be made for 2021. It was noted the Japanese need to submit the research application to Russia by the end of November. Area A would remain the priority for future cruises in line with the advice and recommendations from the IWC Scientific Committee. It was **agreed** that area C would act as a backup if permission to survey area B was not granted or received in time. Given the current uncertainty surrounding COVID-19 and access to ports the decision on whether ship calls to Kodiak, AK or elsewhere would be included in the survey plan for area C will have to be made at a time closer to the departure time by the steering group. Ideally, the ship would call somewhere to refuel and thus extend the amount of time collecting data in the survey area.

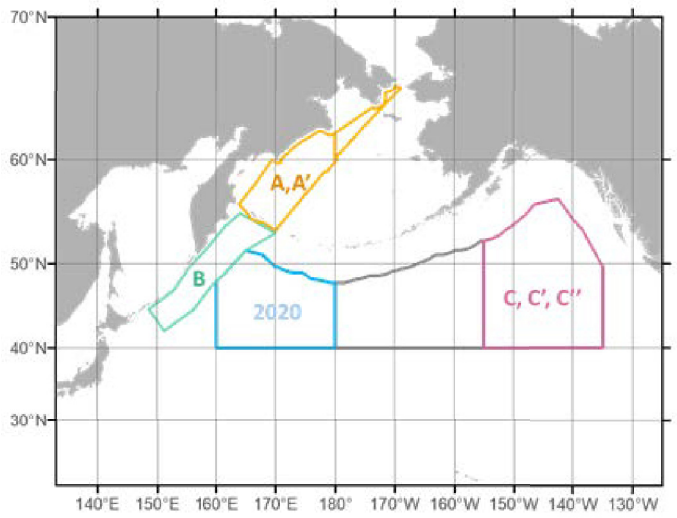

Fig. 2. 2020 plan (blue area) and proposed plans for 2021
(A: Western Bering Sea, B: East of Kuril archipelago, C: North of 40°N and south of Gulf of Alaska).

Table 3

Proposed plans for 2021.

Plan	Option	Number of days	Research area	Home port	International researchers	Biopsy	Acoustic	Remarks
A	A	76	Western Bering Sea (Russian EEZ)	Shiogama/Petero-pavlovsk-Kamchatskiy/ Shiogama	Russia (1-2), Japan (2), US (0-1)	No	No	This is the 4th application. To get permission first, the application should be a visual sighting survey only.
	A'	60	Western Bering Sea (Russian EEZ), (No port call)	Shiogama/Shiogama	Russia (1-2), Japan (2), US (0-1)	No	No	Same above
B	B	60	East of Kuril archipelago and Kamchatka Peninsula (Russian EEZ), (No port call)	Shiogama/Shiogama	Russia (1-2), Japan (2), US (0-1)	No	No	To get permission first, the application should be a visual sighting survey only.
C	C	76	North of 40N, south of Gulf of Alaska, 155W-135W (US EEZ)	Shiogama/Kodiak	US (2), Japan (2),	Yes	Yes+	+Under review, considering permission application procedure
	C'	80	North of 40N, south of Gulf of Alaska, 155W-135W (US EEZ)	Shiogama/Kodiak	US (2), Japan (2),	Yes	Yes+	+ same above
	C''	60	North of 40N, south of Gulf of Alaska, 155W-135W (US EEZ) (No port call)	Shiogama/Shiogama	US (2), Japan (2),	Yes	Yes+	+ same above

Table 4

Itinerary for the IWC-POWER cruise assuming 60 days (no port calls).

*: All researchers will be arrived at Shiogama port before 31 July, and join the pre-cruise meeting.

Original plan		**Back-up plan (Switch survey blocks)**	
Date	**Event**	**Date**	**Event**
1 August 2021	Pre-cruise meeting* in Shiogama	1 August 2021	Pre-cruise meeting* in Shiogama
2 August	Vessel departs Shiogama	2 August	Vessel departs Shiogama
08 August	Vessel starts research area survey	17 August	Vessel starts research area survey
27 September	Vessel completes survey	16 September	Vessel completes survey
30 September	Vessel arrives Shiogama	30 September	Vessel arrives Shiogama
01 October	Post-cruise meeting in Shiogama	01 October	Post-cruise meeting in Shiogama

5.3 Research vessel and days available (general itinerary)

For each proposed plan, a total cruise period of 60-80 days (including transit time) using home ports with refuelling/resupplying/researchers on-offboard has been allowed (Table 1). Based on experience elsewhere in the North Pacific (e.g. north of 40°N), and allowing for poor weather conditions and time for other work an average of around 45-50 n.miles per day are expected to be covered in primary searching effort. Experiment days are estimated as approximately 6 days; 1 day for the Distance and Angle Experiment, and 5 days for photo-ID (and biopsy experiments in area C only).

5.4 Cruise track design (Original and back-up plan)

It was suggested that choice of the optimal cruise track for the back-up area C should be based on maximising the survey effort within the area. The possibility of minimising transit time whilst taking advantage of surveying areas of interest on route were discussed. A small group convened by Matsuoka was tasked with considering these options after further analysis. Uncertainty surrounding access to the ports would also be a consideration and it was agreed that a flexible plan be developed that would enable a decision to be made at the last minute. As a result, the following tracklines were agreed (Figures 3 and 4).

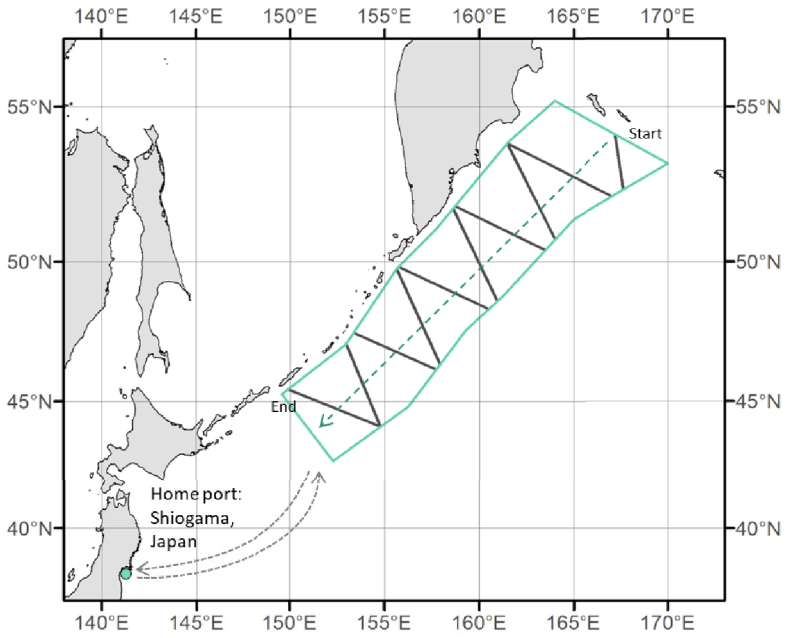

Fig. 3. Proposed tracklines for 2021 Plan B (East of Kuril archipelago).

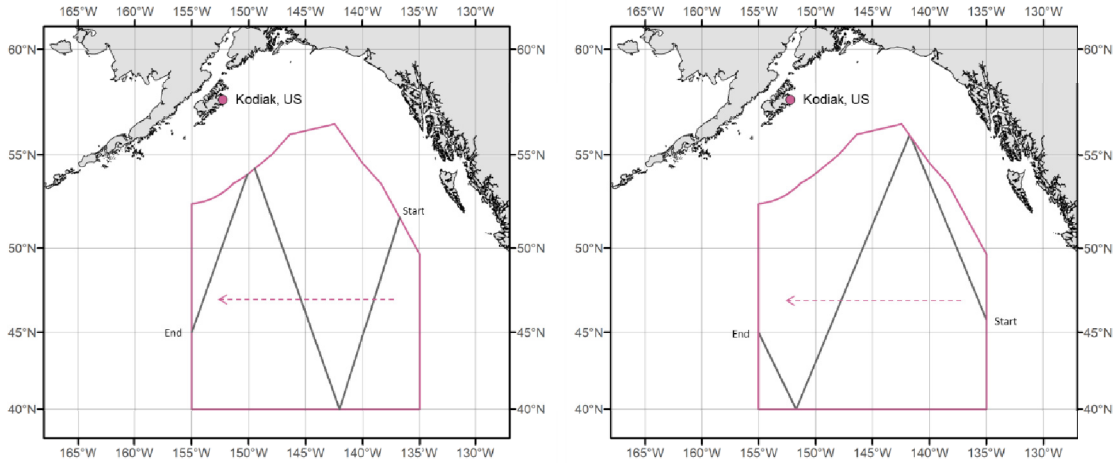

Fig. 4. Proposed tracklines for 2021 Plan C (North of 40°N and south of Gulf of Alaska). Plan C (left figure), Plans C' and C" (right figure).

5.5 Sighting survey (including transit)

On-effort sightings survey research is conducted by the Passing Mode – which are scheduled for specific legs during the survey of the research area. Sighting effort is conducted by the two primary observers, researchers and the chief engineer or deputies are also present. Primary search effort is only conducted in acceptable weather conditions. These conditions are used as guidelines; in some circumstances, less severe conditions may still be inappropriate for search effort.

5.5.1 Survey modes and allocation of effort (including number of crew, research speed)

For the 2021 survey, following advice from the Scientific Committee and the TAG, the survey will alternate modes between NSP and IO mode (*ca*. every 50 n.miles). However, as with previous POWER cruises, the introduction of IO mode should be considered carefully because many high-density areas of large whales (e.g. fin and humpback whales) are expected. When the density of whales in the area causes problems for the observers in discriminating between different schools while conducting IO mode survey, searching mode will be changed to NSP.

Research hours during the cruise will be the same as on recent POWER cruises (a maximum 12 hours per day between 6:00 and 19:00 (including 30 minutes meal times (lunch and supper) during only IO mode; beginning 60 minutes after sunrise and end 60 minutes before sunset). As in the POWER programme, for biopsy sampling/photo-identification work on priority species (blue, fin, sei, North Pacific right, and humpback are higher priority for these cruises) there may be occasions when it is beneficial to extend research outside the normal research hours. The basis for such special extension of research hours will involve mutual agreement between the captain and cruise leader and an allocation of equivalent time-off the following morning or evening. Details of photo-identification and biopsy work are shown in 5.6 and 5.7.

The research day during transits will begin 30 minutes after sunrise and end 30 minutes before sunset, with a maximum of a 12-hour research day. Time-zone changes will be in 30-minute intervals, coming into effect at midnight.

As in the previous cruises, two topmen will observe from the barrel at all times in passing mode. Two primary observers will be in the TOP barrel (and IOP barrel when IO mode) whenever full searching effort using reticle binoculars and angle board is conducted. Two primary observers (Captain and Helmsman) will be at the upper bridge with binoculars with reticules, regardless of the research mode. Also present on the upper bridge, whenever the sighting survey is conducted, will normally be the Chief Engineer (or an alternate). With four researchers on board, the Cruise Leader should ensure that the number of researchers searching from the Upper Bridge is standardised.

5.5.2 Acceptable conditions

As in 2020, 11.5 knots (through the water) will be maintained during research. It was noted that in conditions of heavy swell, searching speed might have to be reduced. The usual guidelines for acceptable conditions will apply, i.e. visibility (to see a minke whale) is greater than 2.0 n.miles and wind speed is <21 knots; the sea state should be <Beaufort 6.

5.5.3 Angle and distance experiment

The experiment is designed to calibrate and identify any biases in individual observers' estimation of angle and distance. The experiment should be conducted during weather and sea conditions representative of the conditions encountered during the survey. Following the TAG recommendations, the experimental procedure was improved from that used in the 2015 cruise through the use of; (1) relatively inexpensive GPS technology on the buoy to improve detectability: (a) at greater distances; and (b) in more realistic sea/weather conditions than may be possible using the present radar system; (2) two buoys which can: (a) reduce the potential lack of independence with one buoy under the correct experimental protocols; and (b) allow increased efficiency and a greater distance range by including both researchers and crew in the experiment (multi-buoy experiments have been successfully conducted in the North Atlantic). With respect to the additional buoy, the TAG suggested that a smaller buoy than the one currently used (to simulate a whale's body rather than the blow) was provided on the vessel in 2015. The detailed protocol was discussed in the planning meeting and can be found in the Guide for Researchers [Anon./IWC, 2010].

5.5.4 Data recording and format

The survey will be conducted using the same data forms (see the Guide for Researchers) as the 2020 POWER cruise (WP/05).

5.6 Biopsy sampling

It was agreed that because of issues with the import and export of samples no biopsy sampling would take place before or within areas A or B (if either were surveyed).

5.6.1 Priority species

As appropriate and decided by the Cruise Leader, research time will be given for biopsy sampling of blue, fin, sei, common minke, humpback, North Pacific right and gray whales. Biopsy of killer and sperm whales will be attempted on an opportunistic basis.

5.6.2 Equipment

Projectile biopsies will be collected using the Larsen system. During any single encounter, no more than five biopsy sampling attempts per individual will be made. It is rare that an animal would be targeted for biopsy more than twice during one encounter, but we conservatively request five sample attempts to allow for

occasional low success rates. If signs of harassment such as rapid changes in direction, prolonged diving and other behaviours are observed from an individual or a group, the biopsy activities will be discontinued on that individual or group. The animals to be sampled will either approach the vessel on their own or be approached by the main research vessel during normal survey operations. The projectile biopsy sample will be collected from animals within approximately 10 to 50m of the bow of the vessel.

For large cetaceans, small samples (<1 gram) will be obtained from free-ranging individuals using a biopsy dart with a stainless steel tip measuring approximately 4cm in length with an external diameter of 9mm and fitted with a 2.5cm stop to ensure recoil and prevent deeper penetration (so that only 1.5cm of the tip is available to penetrate the animal). Between sample periods, the biopsy tips will be thoroughly cleaned and sterilized with bleach. Biological samples may be collected from adults, juveniles, females with calves, and calves. The same size biopsy dart would be used for calves as for adults. No biological samples will be taken from newborn calves. The age of a calf would be determined by the subjective judgment of our field biologists who have up to 20+ years' experience in the field.

5.6.3 Sample storage

For the 2021 US research area C, samples for molecular genetic analyses are to be divided in half, with one half of the sample for IWC (to be sent to the SWFSC) and the other half for Japan (ICR). All samples will be frozen. In addition, when biopsy samples have a significant amount of blubber attached, the blubber is to be separated from the skin, wrapped in aluminium foil, and frozen. Details can be found in the 'Information for researchers' [IWC, 2010].

5.7 Photo-identification studies

5.7.1 Priority species

As appropriate and decided by the Cruise Leader, research time will be given for photo-identification and/or video taping of right, blue, and humpback whales during this cruise. Killer whales are 'non-target' species which are lower priority and will be photographed on an opportunistic basis. As noted in Item 5.5.1, the estimated daily number of miles to be steamed in searching mode has a built-in allowance for such work. Photographs will be available under the standard IWC Guidelines. Generally, large whales will be approached within approximately 15-20 meters. Photo-identification of adult and juvenile males and females will occur. If the opportunity arises, females accompanied by calves may be approached for photo-identification, but efforts will cease immediately if there is any evidence that the activity may be interfering with pair bonding, nursing, reproduction, feeding or other vital functions.

5.7.2 Equipment and collection

The rules for data availability, shipping and storage will be the same as for the previous POWER cruises in the North Pacific. It also noted that existing IWC equipment used in the 2020 cruise could be used on the 2021 cruise if allowed/required. All records will be discharged in Japan and will be sent to the IWC Secretariat under the responsibility of the cruise leader.

5.7.3 Analysis and archiving

All photo-ID digital photographs of this cruise are to be sent to IWC and shared to Japan (ICR) as with previous IWC/SOWER and POWER cruises. The TAG reiterated the importance of the IWC-POWER photographic database, and confirmed that in terms of data availability, Japan and the IWC share all the data from IWC-POWER cruises, and that these are available to Scientific Committee members upon request (IWC, 2020a).

5.8 Acoustic studies

5.8.1 Sonobuoy deployments

It was **agreed** that within areas A or B no acoustic survey would take place to avoid issues with permit applications. If area C is surveyed, passive acoustic monitoring using sonobuoys will occur (pending approval from the Government of Japan). Sonobuoys will be deployed every ~25 n.miles along the trackline to ensure even coverage within the survey area. If target species are acoustically detected (e.g. North Pacific right and blue whales), the acoustician will alert the Chief Scientist, and at their discretion, the vessel will cease standard visual survey ops and break trackline. Additional sonobuoys will be deployed simultaneously to attempt to localize on the calling animal. If an estimated position is obtained, the acoustician will alert the Chief Scientist, and the vessel will proceed to that location.

5.8.2 Analysis and archiving

Sonobuoys will be monitored and analysed in real time, and all recordings will be saved to an external hard drive that is backed up daily. Raw acoustic data will be stored at the Alaska Fisheries Science Center in Seattle, WA. Digitized datasheets of sonobuoy deployment, recording, and species detection information will be given to the Chief Scientist at the end of the survey.

5.9 Other studies

5.9.1 Marine debris

The protocol adopted for recording such material (15 minutes at the beginning of every hour) will continue in 2021 to prevent compromising cetacean sightings searching effort.

5.9.2 Oceanographic studies

Only basic oceanographic information (e.g. SST) is to be collected during the cruise. However, the TAG noted that oceanographic data from remote sensing has proved valuable in spatial modelling approaches.

5.9.3 Satellite tagging studies

The potential of carrying out satellite tagging studies was considered and agreed that it may be a way to address specific questions in the future, and voluntarily done by Japan. It will be conducted at the cruise leader's discretion with the understanding that the line transect survey is the highest priority. The application of these methods should be discussed in reference to the future work of the IWC POWER programme.

The meeting **agreed** that Staniland and Matsuoka will update the Guidelines for Researchers as necessary for the 2021 cruise.

6. 2021 CRUISE-LOGISTICAL ISSUES (PLANS B AND C)

6.1 International researchers and allocation of research personnel

All researchers will join the vessel in Japan. For the backup plan C there is the possibility of the researchers leaving or joining the vessel at the refuelling port in the middle of the cruise.

For 2021, the following framework for researcher involvement was agreed, depending upon destination:

Russian Plan B		Backup Plan C	
Matsuoka	Cruise Leader	Murase	Cruise Leader
Russian scientist*	Russia	US Scientist	USA
Scientist	Russia/other	US scientist	USA, Acoustician
Yoshimura	Japan	Katsumata or Japan B	Japan
		US scientist	If no acoustics

*To be determined by Russian IWC Commissioner. A maximum of 2 Russian scientists are planned to be onboard. The travel fee of the Russian scientists to and from the port of departure and their daily allowance will be paid in accordance with the regulations of the International Whaling Commission.

6.2 Transportation of data, samples and equipment including permits

6.2.1 Home port organiser and entry/exit permits

The home port will be Shiogama and the home port organiser in Japan will be Takahashi. For Plan C, Crance will act as home port organiser.

6.2.2 Sightings: equipment, data, permits and responsible persons

As in previous years, ICR (Matsuoka) and Kyodo Senpaku (Yoshimura) will check the sightings equipment to ensure that all is working/available. Within two months of the end of the cruise, all validated sightings data will be forwarded to IWC by the Cruise Leader (Matsuoka).

6.2.3 Biopsy: equipment, samples, permits and responsible persons

No biopsy samples will be taken under Option B before and during surveying in Russian waters. When biopsying is appropriate, the biopsy samples will be taken using the Larsen gun system or a compound crossbow for the backup option; no biopsy sampling will occur if the Russian option is implemented. Matsuoka will ensure that the necessary equipment, including darts, plugs and vials are available. ICR (Taguchi and Matsuoka) will ensure that the IWC samples are sent to the SWFSC in accordance with CITES procedures.

6.2.4 Photo-identification: equipment, permits and responsible persons

As in previous years, ICR (Matsuoka) and Kyodo Senpaku (Yoshimura) will check the camera equipment to ensure that all is working/available. Staniland and Matsuoka will ensure that the additional equipment agreed under Item 3.6 is purchased/serviced as possible. No permits are required. Matsuoka will submit all identification photographs/videos and accompanying data to IWC within three months of the cruise.

6.2.5 Acoustics: equipment, permits and responsible persons

Sonobuoys will be provided by the Alaska Fisheries Science Center. The use of sonobuoys on Japanese vessels falls under Japanese law and requires the equipment to be certified by the Ministry of Internal Affairs and Communications. Crance has provided a wealth of data on this but the ministry has requested data on the sonobuoys including their frequency by each channel, occupied bandwidth and maximum antenna power output from actual measurements and not the general specifications in the manual. Crance agreed to keep working on getting the required data and investigating getting equipment to test the sonobuoys themselves at the Alaska Fisheries Science Center. Suzuki and Crance will remain in contact to try and resolve this matter.

6.3 Communications

6.3.1. Safety aspects (daily report etc.)

The vessel will be equipped with AIS. Daily vessel position reports will be submitted to ICR, NRIFS, the Fisheries Agency and Kyodo Senpaku Co Ltd. For the Russian option, daily reports may be necessary depending on the area, and in this case the designated Russian representative (formally Zharikov) will be responsible for contacting the relevant authorities. For the backup Plan C, the US researcher will coordinate regular communication with the US Coast Guard when in the US-EEZ.

6.3.2 Between Cruise Leader and IWC

As in previous years, weekly reports (every Monday) will be provided to the IWC Secretariat and members of the Steering Group.

6.3.3 Weather and sea temperature information

It was agreed that fog information will be required and this will be obtained as usual via a Japanese agency as official communication.

6.3.4 Other official communications

For the Russian option, arrangements will be made to comply with any requirements specified in the permit. Suzuki and Staniland will investigate this. There are no additional requirements for the backup option.

6.3.5 Private communications

Researchers may send and receive private communications, including e-mails, at their own expense. Prepaid cards such as the KDDI card (super world card) can be used for private voice communications. Private accounts must be paid by researchers before departing the home port at the end of the cruise. Payment must be in cash (Japanese yen).

6.4 Meetings (including responsible persons)

6.4.1 Pre-cruise Meeting

For both Plan B and Plan C, all researchers will join the vessel in Japan and the pre-cruise meeting will be held in Shiogama and organised by Takahashi. If there is a change in personnel in Kodiak under the backup plan, there will need to be a mid-cruise meeting to facilitate the handover. The venue is to be decided.

The Cruise Leader will ensure that the report of the pre-cruise meeting(s) is/are circulated to the IWC-POWER Steering Group when completed.

6.4.2 Post-cruise Meeting

For the Russian option, the post-cruise meeting will be held in Shiogama when the vessel returns to port; it will be organised by Takahashi. For the backup option, the post-cruise meeting will be held in Shiogama, and organised by Takahashi.

6.5 Reports

6.5.1 Planning meeting report

This planning meeting report will be uploaded onto the IWC website as a Scientific Committee report for SC68C.

6.5.2 Cruise report

As usual, the cruise report will be drafted on the return journey of the cruise following the previous guidelines. The report will be discussed at the next planning meeting and then a final version will be sent to the Secretariat for submission to SC69A in 2022.

6.6 Press releases

The Cruise Leader (or representative) in consultation with the IWC (Kate Wilson and Iain Staniland) and, if necessary, Russia will prepare a press release before and after the cruise. The IWC, ICR, Russia if required, and Japan Fisheries Agency press releases should be released simultaneously. The IWC website will also include a press release pointing to the relevant IWC-POWER cruise web page; consideration will be given to providing a weekly or bi-weekly review of activities on the IWC website as the cruise progresses, along with a summary at the end of the cruise. Any additional press releases during the cruise precipitated by unusual observations (e.g. the finding of right whales) will be circulated for comment and approval to the Steering Group and the Cruise Leader prior to release.

6.7 Security

For the Russian option, the Fisheries Agency, ship agents and the designated Russian representative will investigate the situation for Petropavlovsk-Kamchatskiy and ensure that adequate security measures are in place. No security problems are anticipated for the backup option. The IWC banner will be readily visible.

7. OTHER

7.1 Data validation and analysis

Work on data validation continues at the Secretariat. Where difficulties arise, these are dealt with in cooperation with the Cruise Leader.

7.2 IWC website

The Secretariat will ensure that the IWC website is updated as appropriate.

8. WORK PLAN

8.1 Task list for 2021 cruise

A summary of the tasks and timeline needed to complete to prepare for the 2021 IWC-POWER cruise are given in Table 5.

Table 5
Task list for the 2021 cruise.

Item	Task	Responsible persons (lead in bold type)	Timeline
(1)	Update IWC-POWER pages on the website	**Secretariat** and Steering Group	Continuing task
(2)	Prior consultation on how to apply for permission (IWC secretariat route and Japanese Government route). Preparing the letter from IWC secretariat to the Russian Commissioner.	**Staniland**, Matsuoka, **Suzuki**, Moronuki,	By end of Nov. 2020
(3)	Researchers allocations	**Brownell** and Matsuoka	By end of Nov. 2020
(4)	Apply to the Russian Government in the default format including transit course between Japan and the research area, with the letter from the IWC secretariat	**Matsuoka**, Suzuki, Moronuki, Staniland	By end of Nov. 2020
(5)	Decide where the 2021 cruise will be in light of permit situation	Steering Group based upon advice from Japan	By the end of May 2021
(6)	Determine logistics and permissions for acoustic work for the backup plan	**Crance**, Murase, Brownell and **Suzuki**	By the end of May 2021
(7)	Update 'Guide for Researchers' including the Lightroom manual, purchase new equipment in light of budget and update IWC computer	**Matsuoka**, Murase, Donovan and Staniland	By SC68C

8.2 Work plan to complete TAG meeting

The objectives of the usual in-person TAG meeting held annually in September or October that have not been discussed in this virtual Planning Meeting include documenting the status of analyses of IWC-POWER data, a review of new analyses, and discussion on the planning for the Workshop to develop the medium-term IWC-POWER programme. Because of the COVID-19 situation, it is planned to accomplish these objectives using email correspondence in combination with a further virtual TAG meeting in the spring 2021. A detailed list of action items to discuss at the spring 2021 TAG meeting are in Table 6.

Table 6

Workplan for IWC-POWER related work.

Item	Activity	Responsible persons (lead in bold type)	Time
Data			
(1)	Complete validation of IWC-POWER sightings and effort data for the period up to the 2020 cruise and submit GPS and shape files	**Matsuoka** and Hughes	By end of December 2020
(2)			
(3)	Complete importation and classification of 2020 IWC-POWER photographs into the IWC photographic database	Taylor, **Matsuoka** and **Donovan**	Report progress to SC68C
Analyses			
(1)	Complete review of angle/distance experiments, following the guidance provided in IWC (2019, item 6.2.1) and IWC (2020a), then publish	**Kitakado** and Team DAE	Submit revision to SC68C and then publish
(2)	Develop updated abundance estimates (design-based) for humpback, blue, fin, sei and Bryde's whales following the advice provided in IWC (2020a) (incorporating estimates from (4) below if available).	**Matsuoka, Kitakado,** and scientists from TUMSAT/ICR	By 2021 Spring TAG meeting (virtual or via email) and SC68C
(3)	Develop updated abundance estimates (model-based) for humpback, blue, fin, sei and Bryde's whales following the advice provided in IWC (2020a) (incorporating estimates from (4) below if available).	**Kitakado, Matsuoka** and scientists from TUMSAT/ICR	By 2021 autumn/2022 Spring TAG meeting and SC69A
(4)	Provide updated estimates of $g(0)$ for those species it is considered possible (including fin, sei and humpback) following the advice provided in IWC (2020a).	**Hakamada** and scientists from TUMSAT/ICR	By 2021 Spring TAG meeting (virtual or via email) and SC68C
(5)	Develop abundance estimates for small cetacean species (killer etc.)	**Matsuoka, Kitakado** and others	Initial paper to 2021 Spring TAG and then 2021 autumn/2022 Spring TAG meeting
(6)	Continue simulation work investigating spatial modelling approaches following advice provided in IWC (2020a).	**Kitakado** and Palka	Submit revision to 2021 autumn/2022 Spring TAG meeting.
(7)	Continue work on power analyses following advice provided in IWC (2020a).	**Kitakado,** Palka and Donovan	Submit revision to 2021 Spring TAG meeting.
(8)	As needed, update summary overview paper of results of genetic studies that have included data from IWC-POWER (Pastene *et al.*, 2020) and develop proposal for additional analyses of genetic data, including those from IWC-POWER, to inform *inter alia* stock structure discussions related to medium-term plans	**Pastene** and colleagues	Progress report at SC68C with a draft to 2020 autumn TAG meeting
Future			
(1)	Develop a summary document of the results of IWC-POWER up to 2020 focussing on achievements and how to develop the next phase	**Donovan** and Steering Group	Present at SC68C
(2)	Hold virtual intersessional meeting after 2021 Spring TAG meeting, to focus on the next phase of IWC-POWER in light of medium-term priorities (see Table 1 in IWC (2020a)) and results of the analyses of the data thus far	Steering Group	Develop proposal for workshop to design the next phase prior to SC69A (~May 2022)

8.2 Pre-meeting and workshop to develop a medium-term IWC-POWER programme

Last year, the TAG discussed (IWC, 2020a) and the SC at SC68B agreed to hold a pre-meeting in 2021 to develop a detailed proposal for a workshop to design the next phase of the IWC-POWER programme. The

workshop would develop detailed plans for the post-2021 cruises in light of the medium-term priorities (see table 1 in IWC (2020a) where there would be an emphasis on participation from all range states and include consideration of more methodologically focussed cruises in some years (e.g. use a towed acoustic array, telemetry work, use of a SeaGlider etc.).

Such a workshop could only be successful after preparatory work had been undertaken. Thus, the objectives of the pre-meeting was to: (a) collate all data from the IWC-POWER programme including abundance, distribution, genetics, photo ID and marine debris; (b) identify where the IWC-POWER results have been used to assist the SC; and (c) start identifying the scientific questions, in light of the medium-term priorities, that could be addressed in the next phase of the IWC-POWER programme.

As there is currently uncertainty as to the format of the SC68C meeting (virtual, in-person or delayed) the decision of when to hold the pre-meeting and workshop was postponed with the ambition of holding the pre-meeting in autumn 2021 (most likely virtually) and the workshop as a pre-meeting to the 2022 SC meeting (SC69A), hopefully in person. To stick to this schedule, it is important to complete the work plan in Table 4 before the SC68C meeting in May 2021.

9. CONCLUDING REMARKS AND ADOPTION OF REPORT

The meeting closed at 3pm on 10 November 2020. The report was adopted by correspondence.

Matsuoka thanked the participants for their hard work over the two days. The participants in turn thanked Matsuoka for his excellent chairing of the meeting. Kato remembered Dr Ohsumi and hoped he would be pleased with the continuing efforts of the IWC POWER programme, hoping that it would continue for a long as possible. On behalf of the IWC, Staniland thanked everyone for helping to plan for the 2021 survey. He stressed the importance of the POWER programme to the IWC and expressed how honoured he was to be involved.

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Annex A
List of Participants

Robert Brownell	Southwest Fisheries Science Center, USA
Jessica Crance	Alaska Fisheries Science Center, USA
Greg Donovan**	Emeritus Head of Science, IWC
Yurie Hosoda	Fisheries Agency of Japan
Hidehiro Kato	Institute of Cetacean Research, Japan
Natalie Kelly	Australian Antarctic Division, Australia
Toshihide Kitakado	Tokyo University of Marine Science and Technology, Japan
Koji Matsuoka	Institute of Cetacean Research, Japan
Tomio Miyashita	National Research Institute of Far Seas Fisheries, Japan
Joji Morishita	Tokyo University of Marine Science and Technology, Japan
Hideki Moronuki	Fisheries Agency of Japan
Hiroto Murase	Tokyo University of Marine Science and Technology, Japan
Makana Nio	Fisheries Agency of Japan
Debra Palka	Northeast Fisheries Science Center, USA
Iain Staniland	Lead for Science, IWC
Shinichi Suzuki	Fisheries Agency of Japan
Megumi Takahashi	Institute of Cetacean Research, Japan
Kirill Zharikov**	VNIRO, Russia
Midori Ohta	Interpreter, Japan
Hiroko Yasokawa	Interpreter, Japan

** Unable to attend

Annex B
Agenda

1. INTRODUCTORY ITEMS
    - 1.1 Opening remarks and welcoming address including notes from the IT support team
    - 1.2 Election of the Chair
    - 1.3 Adoption of the Agenda
    - 1.4 Appointment of rapporteurs
    - 1.5 Review of documents

2. REVIEW OF CRUISE DISCUSSIONS AT IWC 68B AND THE TAG MEETING (SC/68B/Rep01)
    - 2.1 Review of Scientific Committee recommendations
    - 2.2 Objectives and priorities
        - 2.2.1 Long-term
        - 2.2.2 Short-term
        - 2.2.3 Medium-term

3. RESULTS OF THE 2020 CRUISE
    - 3.1 Sightings
    - 3.2 Biopsy sampling
    - 3.3 Photo-identification
    - 3.4 Other
    - 3.5 Recommendations from cruise team

4. 2021 CRUISE: GENERAL ISSUES
    - 4.1 Availability of research vessel(s) from Japan and elsewhere
    - 4.2 Budget (including accommodation and food costs)
    - 4.3 Research permit for Russian waters
    - 4.4 Research permit for US waters

5. 2021 SURVEY - PRIORITIES AND CRUISE PLAN
    - 5.1 Research priorities (original and back-up plan)
    - 5.2 Research area(s) (original and back-up plan)
    - 5.3 Research vessel and days available (general itinerary)
    - 5.4 Cruise track design (original and back-up plan)
    - 5.5 Sighting survey (including transit)
        - 5.5.1 Survey modes and allocation of effort (including number of crew, research speed)
        - 5.5.2 Acceptable conditions
        - 5.5.3 Angle and distance experiment
        - 5.5.4 Data recording and format
    - 5.6 Biopsy sampling
        - 5.6.1 Priority species
        - 5.6.2 Equipment
        - 5.6.3 Sample storage
    - 5.7 Photo-identification studies

5.7.1 Priority species
5.7.2 Equipment and collection
5.7.3 Analysis and archiving
5.8 Acoustic studies
5.7.1 Priority species
5.7.2 Equipment
5.7.3 Analysis and archiving
5.9 Other studies
5.9.1 Marine debris
5.9.2 Oceanographic studies
5.9.3 Satellite tagging studies

6. 2021 CRUISE-LOGISTICAL ISSUES (ORIGINAL AND BACKUP PLAN)
6.1 International researchers and allocation of research personnel
6.2 Transportation of data, samples and equipment including permits
6.2.1 Home port organiser and entry/exit permits
6.2.2 Sightings: equipment, data, permits and responsible persons
6.2.3 Biopsy: equipment, samples, permits and responsible persons
6.2.4 Photo-identification: equipment, permits and responsible persons
6.2.5 Acoustics: equipment, permits and responsible persons
6.3 Communications
6.3.1. Safety aspects (daily report etc.)
6.3.2 Between Cruise leader and IWC
6.3.3 Weather and sea temperature information
6.3.4 Other official communications
6.3.5 Private communications
6.4 Meetings (including responsible persons)
6.4.1 Pre-cruise Meeting
6.4.2 Post-cruise Meeting
6.5 Reports
6.5.1 Planning meeting report
6.5.2 Cruise report
6.6 Press releases
6.7 Security

7. OTHER
7.1 Data validation and analysis
7.2 IWC website

8. WORK PLAN
8.1 Task list for 2021 cruise
8.2 Work plan to complete TAG meeting
8.3 Pre-meeting and workshop to develop a medium-term IWC-POWER programme

9. CONCLUDING REMARKS AND ADOPTION OF REPORT

Annex C
List of Documents

TAG-PLANNING/NOV2020/

WP01 Excerpt from SC report (SC/68B)

WP02 Excerpt from ASI report (SC/68B/ASI)

WP03 Report of the 2020 meeting of the IWC-POWER Technical Advisory Group (TAG) (SC/68B/Rep01)

WP04 Report of the Planning Meeting for the 2020 IWC-POWER cruise (SC/68B/Rep02)

WP05 Cruise report of the 2020 IWC-POWER (Murase *et al*)

WP06 Proposal for the backup plan of 2021 IWC-POWER survey (Matsuoka and Takahashi)

WP07 NO PAPER

WP08 Proposals for improving the timing of switching between Russian sea area and backup plans (Miyashita)

WP09 Task list for the 2021 cruise

WP10 Option A vs B in the Russian EEZ (Brownell)

WP11 Letters sent from IWC

WP12 Russian application form

Annex D

Summary of Effort and Sightings Information from 2010-2020

Compiled by Koji Matsuoka

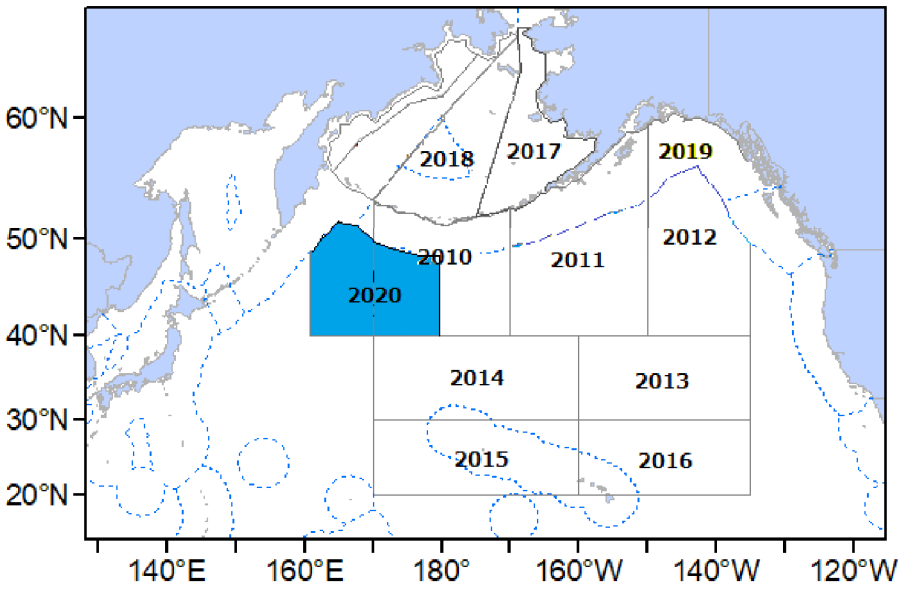


Fig. 1. Research area for the 2010-2020 IWC-POWER cruises. Blue area: 2020 research area. Dotted blue line: EEZs

Table 1

Summary of total searching effort and sightings made by species in each research area during 2010 to 2020.

Year	2010		2011		2012		2013		2014		2015		2016		2017		2018		2019		2020		Total	
Vessel	KK1		YS3		YS3		YS3		YS3		YS3		YS3		YS2		YS2		YS2		YS2			
Searching effort (n.miles)	1,986.3		3,097.7		2,676.6		4,342.2		3,761.1		4,305.6		3,443.8		1,989.9		1,934.3		2,556.1		3,466.9		33,560.5	
Species	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.
Blue whale	5	5	10	10	4	4	0	0	1	1	0	0	1	1	0	0	8	12	19	21	22	31	70	85
Fin whale	28	55	82	141	149	210	3	3	0	0	0	0	0	0	145	198	135	199	266	458	25	28	833	1,292
Like fin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	20	19	22	20	30	2	2	58	74
Sei whale	62	118	58	95	87	164	4	4	1	1	0	0	1	1	0	0	5	7	26	43	105	138	349	571
Like sei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	3	12	12	16	17
Bryde's whale	0	0	0	0	0	0	54	64	118	140	46	52	28	32	0	0	0	0	0	0	3	4	249	292
Like bryde's	0	0	0	0	0	0	0	0	3	3	12	14	8	8	0	0	0	0	0	0	1	1	24	26
Common minke whale	8	8	2	2	2	2	1	1	0	0	0	0	0	0	23	23	17	17	6	6	3	3	62	62
Like minke	1	1	2	2	0	0	0	0	0	0	0	0	0	0	2	2	2	2	0	0	0	0	7	7
Humpback whale	5	8	76	133	21	33	0	0	0	0	0	0	0	0	136	165	86	122	173	402	7	8	504	871
Like humpback	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	12	3	3	7	15	0	0	19	30
North Pacific right whale	0	0	0	0	1	1	0	0	0	0	0	0	0	0	7	15	3	3	0	0	0	0	11	19
Like right	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	2	2
Gray whale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	22	27	88	6	15	0	0	48	125
Like gray	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	1	4
Sperm whale	75	92	95	119	50	57	67	99	78	155	32	93	32	115	25	33	35	36	50	61	40	51	579	911
Like sperm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1
Killer whale	10	102	7	70	17	99	0	0	1	3	1	4	0	0	32	134	20	136	55	269	14	55	157	872
Unid. cetacean	6	16	3	3	1	1	11	66	10	11	2	2	7	7	6	6	4	4	0	0	4	10	54	126
Total	200	405	335	575	332	571	140	237	212	314	93	165	77	164	419	632	368	658	630	1,323	238	343	3,044	5,387

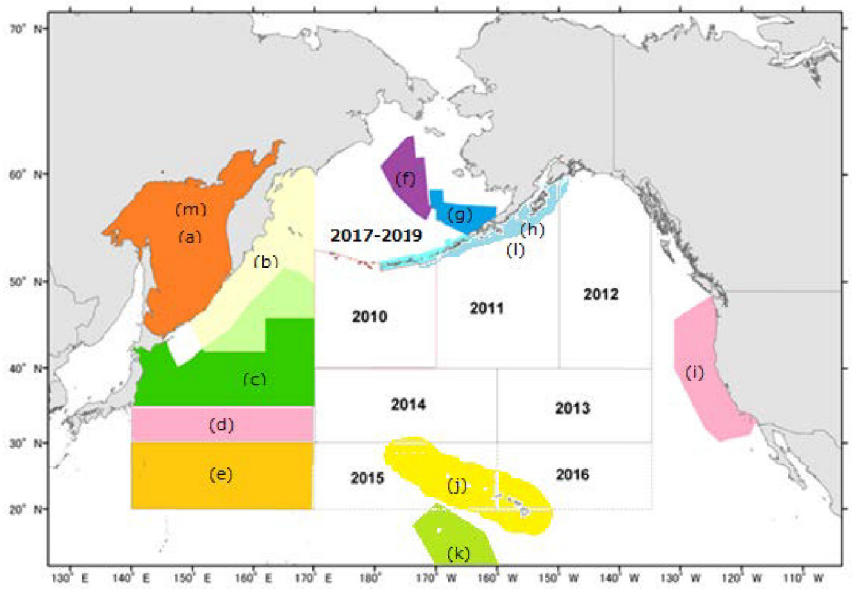
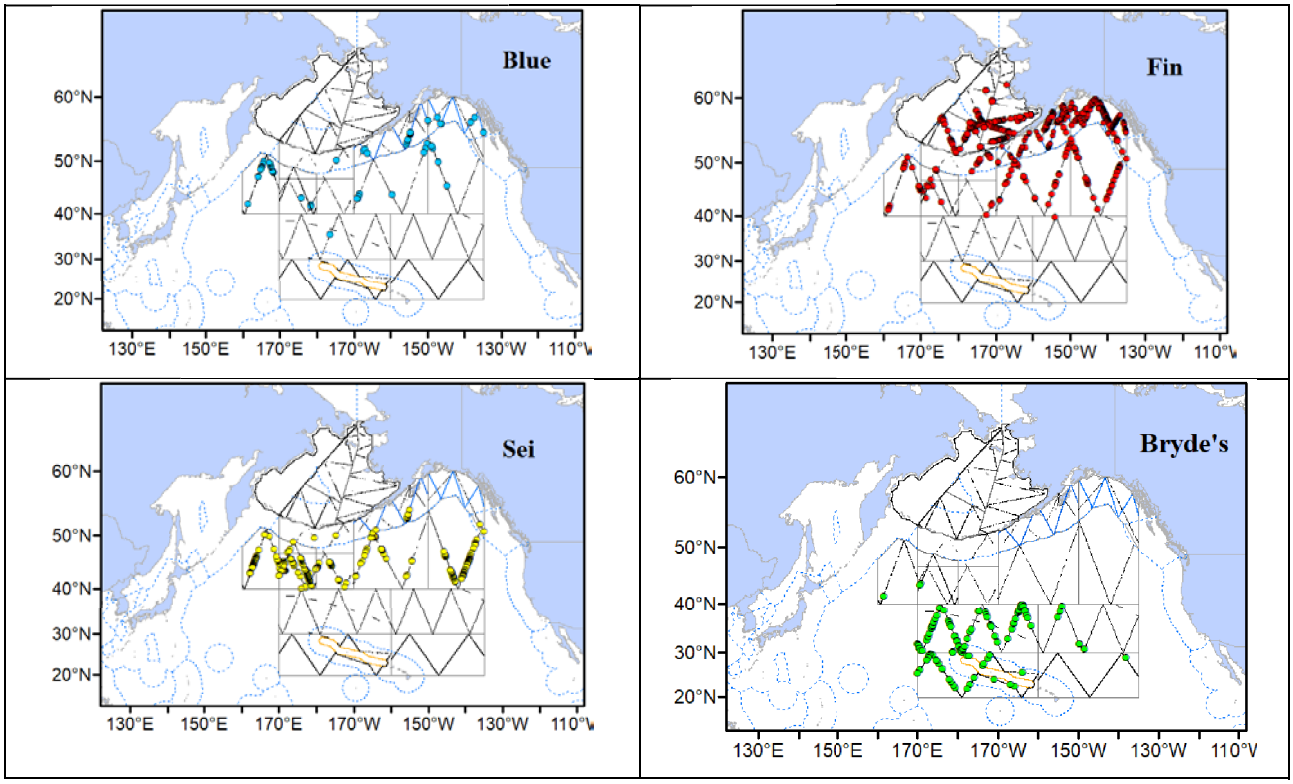


Fig. 2. Schematic showing the proposed areas for coverage in the 2017-2019 period, prior to the start of the medium term period in 2021. Coloured areas represent surveys conducted in the North Pacific in recent years: (a): Miyashita and Berzin (1991), (b): Miyashita (2006), (c): Pastene *et al.* (2009), (d): Matsuoka *et al.* (2013), (e): Matsuoka *et al.* (2014), (f): Moore *et al.* (1999), (g): Moore *et al.* (2002), (h): Zerbini *et al.* (2007), (i) Barlow and Forney (2007), (j): Barlow (2006a), (k): Barlow (2006b), (l): Rone *et al.* (2016), (m): Myasnikov *et al.* (2016). The US and Canadian surveys in 2015 and 2018 will be added for the published version.



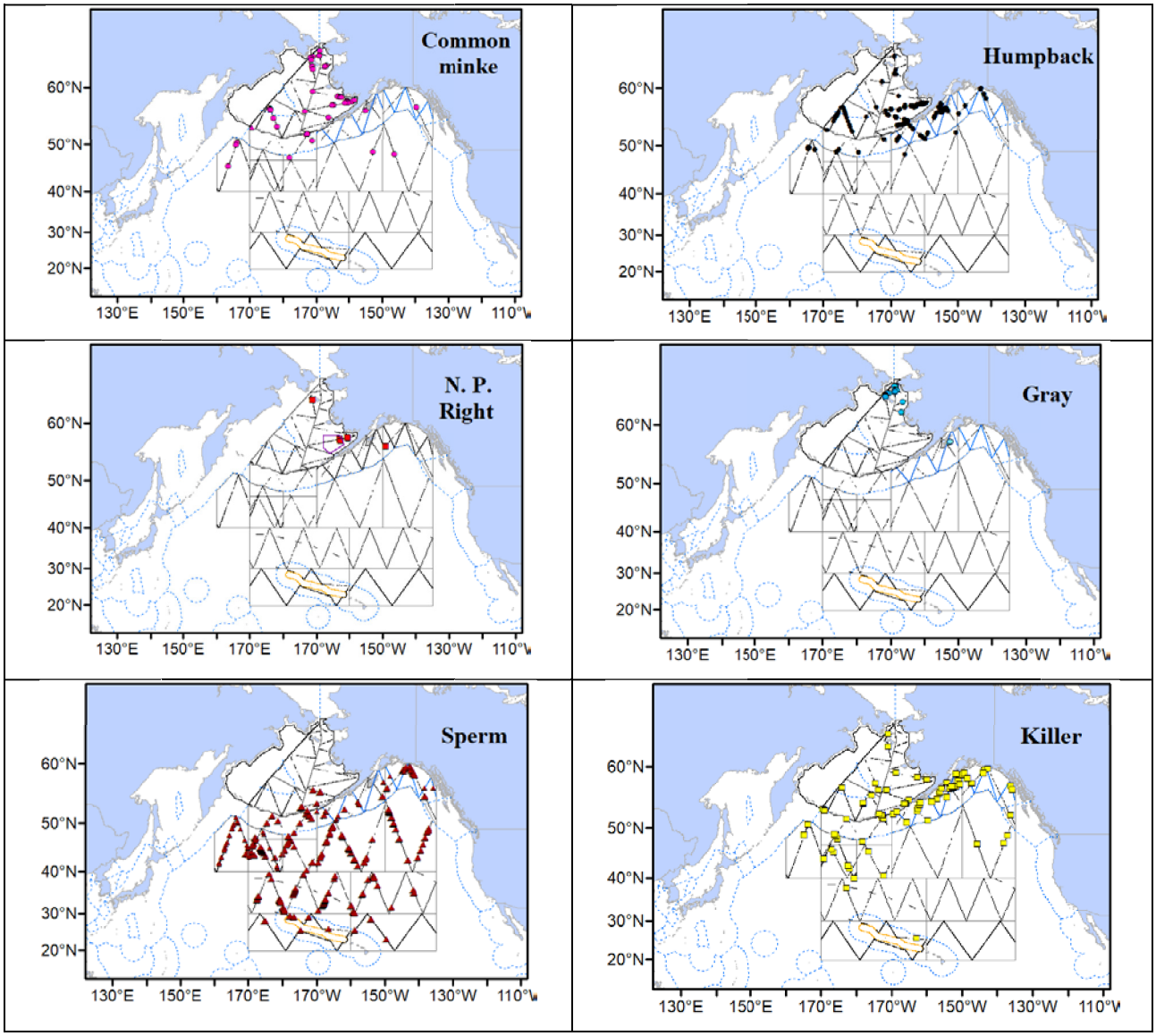


Fig. 3. The searching effort (black thin line) and main sightings by species for the 2010-2020 IWC-POWER cruises. Dotted blue line: EEZs, Thin orange line: Hawaii, Papahanaumokuakea Marine National Monument area (PMNM).

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