

Annex G

Report of the Sub-Committee on Environmental Concerns

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The sub-committee agreed that DeMaster and Genov would serve as co-convenors of E. It was agreed Plön would serve as the primary rapporteur, but that other members of E may be asked to help with the rapporteurship as needed.

Documents available to the sub-committee included SC/69A/E/01-16.

1. CHEMICAL POLLUTION

1.1 Review intersessional work

The sub-committee received the work of the intersessional Steering Group (SG) on Pollution 2025 (SC/69A/E/04). In order to address the Scientific Committee’s numerous recommendations related to the issue of chemical pollution and move forward with the work plan of the SG, the SG compiled information from scientific studies published in recent years. These studies were mainly provided by members of the SG and the participants of the workshop on cumulative effects and multiple stressors held in November 2021 (SC/68D/REP/02). A number of studies were conducted, predominantly on exposure to chemical pollutants (heavy metals, trace elements, legacy and emerging chemical contaminants) and their effects on cetacean health, demographic parameters and other indicators. To assess cumulative risks of multiple stressors to populations, development of models and new methods are being pursued as are interdisciplinary collaborations, as well as co-production of knowledge with indigenous and local stakeholders. It is recommended this kind of overview be updated regularly.

The sub-committee welcomed SC/69A/E/04, commended the authors for pulling together research done over past few years to address the recommendations, and found this a very valuable exercise.

In order to better comply with the mandate of the SC, namely 'to provide comprehensive scientific advice to inform the Commission's policy-making', and to help close the science-policy gap, the intersessional groups, the sub-committees, SWG's and the SC itself formulate recommendations. Such recommendations are designed to highlight and support effective measures such as management approaches, prevention/mitigation strategies or target-oriented activities to reduce or eliminate harm on cetaceans. Some recommendations are restricted to specific addressees for a distinct action, others are broader and open ended. Relevant recommendations should be brought to the attention of the Commission as appropriate, the Secretariat and – in the effort to bridge the science-policy gap – to the stakeholders in general, such as civil society, industry and the research community.

The sub-committee noted an ongoing difficulty in assessing and addressing progress on previous recommendations and found this approach of producing a single document summarising the relevant information highly valuable. Such a document could be used at each meeting to help determine which recommendations have been addressed and even assist with closing some recommendations.

The sub-committee noted that this exercise should be carried out on a regular basis (e.g., perhaps at a 4-year interval). This document would prove useful to IWC Commissioners interested in the issue of effects of pollution on cetacean populations. The authors were requested to revise the format of this report to be consistent with the IWC Communications Initiative discussed in plenary by the SC.

Attention: SC

The sub-committee **recommended** that at future meetings, all conveners of sub-committees, working groups and intersessional groups produce a similar document to SC/69A/E/04, wherein recent research, from Committee members and outside researchers, is collated and summarised, highlighting the elements of the paper(s) that are responsive to the recommendations relevant to each convener. While this would be a work-intensive effort, it would directly address the Committee's need to note tangible progress on recommendations and close them when possible.

1.2 New information on pollution

SC/69A/E/01 reported on the investigations of the presence and the amounts of four phthalate esters in abdominal adipose tissue (i.e., blubber) collected from 24 *Pontoporia blainvillei* carcasses. Phthalates are a group of chemicals used to make plastics more durable. An extraction method involving organic solvents and sonication of the blubber samples was developed, followed by gas chromatography analysis. Certain phthalate esters, DEP and DEHP, were present in 100% of samples, with lesser frequency levels found for DMP (66.66%) and DBP (58.33%). The presence of phthalates in cetacean tissues reflects a potential concern regarding the health of animals exposed to these chemicals. Efforts to better understand their impact and mitigate potential adverse effects are needed.

The sub-committee thanked the authors and noted that microplastics were ubiquitous in the marine environment. Concerns regarding the impacts of microplastics in the food web included likely metabolic impacts to individual animals, the duration of these chemicals in the food web, the degree to which they occur in the prey of cetacean species, and the lack of information on concentration levels in cetacean tissue that would likely be associated with health risks to individual animals.

SC/69A/E/02 noted that during 2003-2013, calf mortality of right whales at Península Valdés, Argentina, averaged 55 deaths per breeding season, almost seven times higher than the numbers recorded in the previous decade (1993-2002). Persistent organic pollutants were analysed from the blubber of 35 mothers and calves, and in 14 juveniles and non-calving adults. A total of 16 organochlorine pesticides were found. In calves, the mean pesticide concentration was on average 2–13 times higher than in mothers, and in adults and juveniles the concentrations were 2–10 times higher than in reproductive females. These findings indicate that females offload some of these chemicals onto their calves through gestation and lactation. All the pesticides found during the analysis are already banned for agricultural use in Argentina. The authors noted that persistent pesticides could affect calf physiology and health, and potentially reduce survival, thus affecting efforts for the recovery of the right whale population in this region.

In discussion, the authors were requested to clarify the units being reported in the document and whether the concentrations reported were normalised to lipid content. Further, the authors were requested to compare pollutant concentrations from different age and sex classes from years of high reported mortality levels and years of low reported mortality levels.

SC/69A/E/05 reported on samples collected from organs and tissues of gray whales, *Eschrichtius robustus*, killed by Chukotka Natives for subsistence purposes between 2008 and 2022. Samples were then processed to determine heavy metal concentrations and radioactivity levels. The results indicated that concentrations of heavy metals and radioactivity levels in the tissues of gray whales never exceeded maximum permissible levels.

Polyakova *et al.* (2023) discussed a phenomenon of 'stinky whales'. To understand this problem, various tissues from stinky and non-stinky whales were collected and analysed. The authors reported that the most likely source of the iodoformic odour was bromophenols (specifically, 2,6-dibromophenol), which were 500-fold higher in stinky whale tissues. The source of these bromophenols was identified, and is likely to be colonial, near-shore polychaetes. The authors consider the issue now resolved.

The sub-committee congratulated the authors and highlighted the importance of this, as this issue has been discussed at the SC for over 20 years, with many recommendations and many international collaborations trying to resolve it.

SC/69A/SM/06 reported on the bioaccumulation and temporal trends in organochlorine pollutants in Lahille's bottlenose dolphins (*Tursiops gephyreus*) in southern Brazil. A total of 28 bottlenose dolphins were biopsied and the tissues analysed for organic pollutants. Concentrations were in excess of existing published toxicological thresholds. It was further noted that the pattern of PCB and DDT levels was difficult to explain and further research was necessary. Finally, it was pointed out that the population abundance has been stable over the past 20 years.

2. DISEASES OF CONCERN

2.1 Review progress in intersessional work on emerging diseases

Stimmelmayer presented a report on Emerging Pathogens in the Context of Marine Mammal Health. She noted that cetacean diseases of concern (CDOC) are a standing topic for the Environmental Concerns sub-committee. Recent emerging pathogens of concern include SARS-CoV-2 and highly pathogenic avian influenza (HPAI) both of which are viruses that have successfully spilled over into mammals. Although SARS-CoV-2 has not been found in cetaceans at this time, testing is still underway to evaluate exposure or infection in wildlife¹. In response to the increasing evidence for Highly Pathogenic Avian Influenza (HPAI) spillover events in marine mammals (including cetaceans and pinnipeds) in recent months², in March 2023 the World Organization for Animal Health (WOAH) convened an *ad hoc* expert group to develop a Guidance Framework for HPAI outbreak management in marine mammals. Several members of the IWC CDOC intersessional working group are included in the WOAH working group. A final draft of the guidance document is expected by the end of May 2023.

In discussion, it was queried as to how researchers should behave around marine mammals that may be infected with HPAI/H5N1. The group was advised that there have been cases of low pathogenic avian influenza in pinnipeds and that researchers have been working with a One Health perspective, developing guidelines for carcass disposal, for protective measures during necropsies and for handling of animals in rehabilitation until they are cleared by PCR for influenza. It was noted that this is a virus that mutates rapidly. The sub-committee was informed that a great deal was learned about viral transmission during the COVID-19 pandemic. It was reported that the H5N1 virus has a long resistance on skin. Therefore, contact transmissions are typical, requiring mucosal protection and gloves. Further, food safety precautions are necessary as the virus persists in frozen food.

Attention: SC

Recognising that correlating cetacean health data with ongoing ecosystem changes is needed to evaluate the relative vulnerability of cetaceans in a changing ocean, the sub-committee:

- (1) recommends that the long-term monitoring of impacts of known and emerging pathogens, toxins, pollutants of concern and anthropogenic activities remains a standing recommendation for the E sub-committee.*
- (2) recommends further investigation of the individual and cumulative effects of these threats on health, reproduction and survival at an individual and population level, and reporting the findings to SC69B; and*
- (3) recommends that prospective and retrospective health and risk assessments be carried out within the context of rapidly changing marine ecosystems to inform management.*

2.2 Special primer on coronavirus surveillance in aquatic wildlife

No report was received under this item.

2.3 Review new information on Diseases of Concern

The sub-committee received a report summarising a presentation regarding the threat *Toxoplasma gondii* poses to the management and recovery of Hector's and Maui dolphins. In a paper by Roberts *et al.* (2019), it was reported that the threat to populations of Hector's and Maui dolphins from toxoplasmosis was significant. The author of the report recommended that there was an urgent need to increase the number of dolphin carcasses being screened for *T. gondii* and that screening programs related to the ecology of this organism (e.g., feral and domesticated cat populations, prey species of dolphins) be established. The author also reported that polyparasitism is an important predictor of disease potential and severity, and therefore requires further monitoring.

The government of New Zealand is preparing a Toxoplasmosis Action Plan, which should be available shortly. Others noted that species-specific vaccines for toxoplasmosis were either under development or currently available. Furthermore, it was recognised that in the Roberts *et al.* (2019) report mortality caused by bycatch and toxoplasmosis were confounding factors. That is, in the model used to assess risk of multiple factors to dolphin populations, positive bias in the risk of bycatch would lead to negative bias in the risk to *T. gondii*, and vice versa. It was further noted that at present there is no prevalence of toxoplasmosis in any other cetacean species in New Zealand, whereas it has been reported in pinniped species.

¹<https://www.woah.org/en/joint-statement-on-the-prioritization-of-monitoring-sars-cov-2-infection-in-wildlife-and-preventing-the-formation-of-animal-reservoirs/>

² <https://www.woah.org/en/statement-on-avian-influenza-and-mammals/>

The most recent World Toxoplasmosis annual conference was held in January 2023, where a report was presented on a toxoplasmosis vaccine being developed, which can be given intranasally and has been used experimentally in zoo animals. It was speculated that it may be possible to administer vaccines to free-ranging cetaceans through the use of drones.

The sub-committee received a report on recent research findings on the prevalence of herpesvirus in cetaceans in waters off Korea. It was noted that the virus was found in the most common species off cetaceans in Korean waters and was found in skin, lung and liver tissues. No signs of clinical symptoms or skin and mucosal detections were reported.

SC/69A/CMP/09/Rev1 reported on the paralytic shellfish poisoning and mortality of southern right whales (SRW, *Eubalaena australis*) in Golfo Nuevo, Península Valdés, Argentina in 2022. A total of 28 adult (22 females) and 2 juvenile whales died acutely between 24 September and 11 October 2022. The neurotoxin producing *Pseudo-nitzschia australis* diatom and *Alexandrium catenella/tamarense* complex dinoflagellates were identified in gut content from four whales. Domoic acid was not detected. Paralytic Shellfish Toxins (PST) were found in 19 out of 24 samples tested. Saxitoxin was the most frequent toxin ($n=14$), followed by neosaxitoxin, and gonyautoxins 3 and 2. Evidence of toxin metabolism following ingestion was found. The highest toxicity levels ($\mu\text{g STX eq.g}^{-1}$) were measured in intestinal content, blood and faeces. Whale mortality overlapped in time and space with a Harmful Algal Bloom (HAB) and unprecedented values of PST in shellfish and plankton in Golfo Nuevo. Adult females were the most affected group, coinciding with high energy demands from nursing newborn calves and urge to feed on spring plankton blooms. This is the largest known adult SRW mortality event to date for the species. Although HABs are widespread along the Patagonian Shelf, their occurrence at Península Valdés raises concern for SRW conservation given increasing adult and juvenile mortality since 2019.

In discussion it was queried whether there was any investigation of links between the HAB occurrences and eutrophication levels. It was noted that additional research was needed to address this concern. The sub-committee noted that SC/69A/CMP/09/Rev1 was also further discussed in the sub-committee on Conservation Management Plans.

3. STRANDINGS AND MORTALITY EVENTS

3.1 Review progress of steering committee for IWC Strandings Initiative

A paper outlining progress between May 2022-April 2023 was submitted to the Scientific Committee (SC/69A/E/12) by the Strandings Co-ordinator on behalf of the Chair of the Strandings Expert Panel (SEP) and Chair of the Strandings Steering Group (SSG). It was noted that Sandro Mazzariol stepped down as Chair of the Strandings Expert Panel in September 2022 and Andrew Brownlow was unanimously voted in as the new Chair for the next two years. A progress report was presented to the Whale Killing Methods & Welfare Issues Working Group (WKM&WI) at IWC68 and subsequently the Commission endorsed the following recommendations: (1) the intersessional progress made by the Strandings Initiative was noted; (2) the new Strategic objectives and SI structure (IWC, 2021a) were endorsed; (3) the proposed workplan for 2021-24 (IWC, 2021b) was endorsed; (4) the funding application for an in-person SEP workshop in spring 2023 was supported; (5) the funding application for the salary of the Strandings Coordinator was supported; and (6) the details of the strandings network contact information were to be supplied to the Secretariat.

In discussion it was clarified that the Global Strandings Network (GSN) was initiated at the World Marine Mammal Conference (WMMC) in Barcelona in 2019 and is still relatively nascent. Currently scientists around the world somewhat independently collate stranding response information for cetaceans and pinnipeds. The aim is for the GSN to be inclusive and partner with all other groups that aspire to work in this area. GSN representatives will be taking part at the workshop of the Strandings Expert Panel (SEP) in Venice (following SC69A) to discuss emergency response and capacity building. There are no budget implications as the budget was agreed at SC and endorsed by the Commission.

Further, there is a need for a global database and the development of such a database is valued by the SC, CC and others outside the IWC. SC/69A/E/13 provided an overview of the purpose of the database by summarising current data holdings as well as current and future data use. The paper outlined the steps to develop a data management framework to implement a global strandings database and recommended next steps be taken to continue planning the development of the database.

It was noted that there are several national databases that would need to be integrated into the global database and work would need to align with any other ongoing efforts to create regional strandings databases, such as, *inter alia*, in ACCOBAMS and ASCOBANS regions. Data sharing guidelines will need to be developed. Data from non-member countries can be included through members of the SEP who have linkages with stranding networks in non-member countries. It was remarked that the sub-committee is supportive of this activity, as it remains a priority to develop capacity for regional stranding networks. Finally, it was recognised that the Secretariat will be the lead for the SC regarding database management.

It was recognised by the sub-committee members that in the past responses to mass strandings of cetaceans have only been successful when in-country partnerships and international experts worked together. The Mauritius mass-stranding in 2020 showed that such an approach is required for a successful response.

The relationship between the IWC and GSN was discussed in detail. The Barcelona agreement in December 2019 identified the need for a GSN as a forum for collaboration to ensure initial stranding response. It was highlighted that the IWC SEP needs to remain involved and that a partnership between IWC and GSN will be developed. It was recognised that the GSN will respond to all marine mammal taxa, while the IWC SEP deals with cetaceans only.

Attention: SC, S, C

The Committee reiterates its strong support for the Strandings Initiative and welcomes the new Chair of the Strandings Expert Panel (SEP). The Committee commends the work of SEP and its chair over the last intersessional period and endorses the efforts to re-evaluate and prioritise the current workplan, recognising that some work has been delayed due to unforeseen circumstances. The priorities should be part of the Progress Report presented at SC69B.

The Committee is pleased that the first in-person meeting of the SEP will occur shortly after SC69A. The Committee:

- (1) **recommends** that this workshop review the workplan and prioritise activities to better focus the near-term effort, with consideration for which tasks might be more uniquely suited for an intergovernmental organisation, and which might be supported by the IWC but best implemented by another group;*
- (2) **agrees** that the SEP should continue to develop the necessary networks and connections to build a robust global stranding response programme;*
- (3) **acknowledges** that stranding events are not limited to cetaceans but may affect multiple taxa and thus recommends that the SEP work with the Global Stranding Network to develop a global stranding collaboration workshop at the next Society for Marine Mammalogy biennial conference; and*
- (4) **recommends** that the SEP and Stranding Coordinator continue to identify and pursue priority partnerships that would leverage opportunities for emergency response coordination and capacity building. The Committee encourages a full report of the workshop along with a costed workplan with relevant funding proposals at SC69B.*

The Committee commends the work on the scoping of the IWC stranding database and recommends work commence to identify the data and information to be included in this database and report findings to SC69B. In particular the Secretariat should work with the convenors to identify stranding data needs for information from stranded animals or priority activities regarding stranding data needs for each of the sub-committees, taking into account the instructions from the Commission in Resolution 2022-1.

3.2 New information on unusual mortality events

SC/69A/E/08 presented an update of information regarding the Unusual Mortality Event (UME) during 2019-23 for eastern North Pacific gray whales (*Eschrichtius robustus*). The sub-committee noted that this paper was also further discussed in the sub-committees on Conservation Management Plans and Aboriginal Subsistence Whaling. From 17 December 2018 through 5 April 2023, a total of 638 Eastern North Pacific gray whales stranded along the Pacific coast of North America across three countries (Canada, Mexico, and United States). A total of 216 whales were reported in 2019 (including two whales from December 2018), 172 in 2020, 115 in 2021, 105 in 2022, and 30 as of 5 April 2023. On the West Coast of the United States, the 122 stranded whales reported in 2019, 79 in 2020, 55 in 2021, and 47 in 2022 exceeded the annual mean stranding rate of 29 ± 10 whales during 2001-18. Strandings occurred along the entire range of the Eastern North Pacific gray whale, including in the wintering, migratory, and feeding areas, with most whales recorded in U.S. waters documented in spring and early summer when gray whales are near the end of their seasonal fast.

It was noted that the mortality of animals dropped in 2020 (during the COVID-19 pandemic) but was still significantly higher than in previous years. However, estimates of stranded animals in 2020 may have been negatively biased due to reduced monitoring effort, as it was more difficult for stranding responses to happen. Toxoplasmosis was not investigated in these animals. The authors of this paper anticipated being able to finalise recommendations on the closure of the UME later this year.

During discussion, it was noted that in the 20 years between the last UME and the most current UME, the population of gray whales recovered to pre-decline levels. It was further noted that the environmental conditions associated with the two UMEs were very different.

The sub-committee was informed that a research paper looking at an integrated population model for the eastern North Pacific population of gray whales has been submitted for publication. In this paper, the authors estimate both

abundance and the carrying capacity on an annual basis. It was clear to the authors that UMEs were occurring during periods when carrying capacity had been reduced. During discussion, it was recognised that it would be useful to look at changes in other whale populations elsewhere to investigate any possible parallel events on a larger scale. Further, and to the extent possible, animals foraging or breeding in different regions during and before the UME should be compared as to body condition and calf production. Finally, it was noted that larger than average numbers of stranded pinniped species were reported during this same time period.

Two papers from the CMP sub-committee were also discussed under this agenda item. The first paper (SC/69A/CMP/16) reported on the body condition of gray whales in Laguna San Ignacio (LSI), Baja California Sur (BCS), Mexico between 2019 and 2023, which was during the UME for gray whales reported above. The second paper reported on the number of stranded gray whales in Mexico between 2019 and 2023.

The authors noted that the evaluation of whale body condition provides an indicator of health and reproductive condition in these animals and is indirectly an indicator of the environmental health. During the 2023 season in LSI, 618 gray whales were photographed, from which the body condition of 444 single adult whales (male or female without a calf) and 82 mothers with calves (MC) were evaluated. The percentage of single adult whales with 'good body condition' was 70% (n=311), 'fair' 21.2% (n=94) and 'poor' 8.8% (n=39). The body condition of mothers with calves was 82.9% 'good' (n=68), 13.5% 'fair' (n=11) and 3.6% 'poor' (n=3). The percentage of single whales with 'good' and 'fair' body conditions increased in 2023 compared to the 2019-2022 period; meanwhile, the percentages of whales with 'poor' body condition decreased, being the lowest since the UME began in 2019. The percentage of MC with 'fair' and 'poor' body condition was the highest from the last 3 years. Still, the number of MC observed in 2023 was the highest in the last 5 years. The data suggest an improvement in gray whale body condition and an increasing reproductive (calving) rate.

It was noted that UMEs occur when mortalities of marine mammals increase above an average annual rate. In 2019, the U.S. National Oceanic and Atmospheric Administration (NOAA) declared a gray whale UME along the North Pacific Coast of North America, which continued until 2022. Gray whale stranding records were collected in Mexico between January 1st and April 11 of 2023 and documented at least 33 gray whales stranded along the Pacific coast of Baja California, Mexico. As in previous years, most strandings (n=27) occurred in the Ojo de Liebre lagoon (LOL) and the surrounding areas. Of the total number, 19 were females, and 14 were males. The age classes of the dead whales were: 8 adults, 4 subadults, 5 yearling whales and 16 calves. The number of strandings in 2023 was similar to the stranding numbers before the UME started in 2019. The primary age class of stranded whales was calves, as is usually the case in the non-UME years.

It was clarified that the number of photo-identified individuals used to estimate body condition was based on the amount of effort available for photo-identification efforts and was not in proportion to the number of whales that occurred in the lagoon throughout the season. Further, it was noted that satellite imagery was currently being considered for this project and it is being compared with counts from boat surveys.

3.3 Update on next steps to implement the 4-year workplan (focus of SEP workshop in May 2023)

It was recognised that the work plan for the Strandings Initiative for 2021 – 2024 has been endorsed by the Commission (IWC, 2021b). It was further noted that following SC69A a meeting of the SEP in Venice will take place. During this meeting, additional decisions regarding the implementation of the 4-year work plan will be discussed, as well as the relationship between SEP and GSN and any future funding considerations and reported back to the SC at SC69B.

The sub-committee noted that the pending change from annual to biennial meetings of the SC, starting after SC69B, will require adjustments to the implementation of a workplan for 2025 and beyond. This will also be discussed at the SEP workshop in Venice following SC69A.

3.4 Update on efforts to expand regional representation on the SEP

It was noted by the sub-committee that the issue of adequate regional representation on the SEP would be addressed at the SEP workshop in Venice, which follows SC69A. It was further noted that intersessional progress had been made in improving representation from coastal African countries specifically. Finally, it was agreed that the IWC Stranding Coordinator, following the SEP workshop in Venice, would reach out to scientists and other relevant experts from regions that are under-represented in the SEP.

3.4.1 Other information and recommendations

SC/69A/E/03 reported on the increase in the numbers of euthanised large whales in southern Brazil. It was noted that between 2019 and 2022 four humpback whales stranded alive in southern Brazil and were euthanised. Two whales had encephalitis and were positive to Morbillivirus, confirming that refloating would not be indicated. In all cases, euthanasia was accomplished by use of the low residue euthanasia protocol, which served as a guideline for drug choice and dosage. Some adaptations to the base protocol were implemented. The authors noted that the protocol used was effective.

SC/69A/CMP/11 reported on high mortality rates of southern right whales at Península Valdés, Argentina, during 2018-2022 (with no data for 2020 due to COVID-19 restrictions). A total of 928 dead whales were recorded since 2003. The annual number of dead whales for the study period was 23 (2018), 17 (2019), 45 (2021) and 73 (2022), totalling 157 individuals in four calving seasons. Most of the dead whales were calves (63%), followed by adults (30%) and juveniles (7%). As in previous years, the majority of dead whales were recorded in Golfo Nuevo (GN, 70%) and the remaining whales died in Golfo San José (GSJ, 30%). However, the distribution of strandings was very different among years. For instance, in 2019 all ten calves died in GN and all six adults died in GSJ. However, in 2022 dead calves were distributed between the two gulfs (29/42 or 69% in GN and 13/42 or 31% in GSJ) and contrary to 2019, all but one adult died in GN (27/28 or 97%). All whales were dead when reported or found. Post-mortem examinations were performed when carcass condition allowed and when strandings were not on public beaches where only non-invasive sampling is performed.

In discussion it was noted that toxins associated with HABs (e.g., domoic acid) can be transmitted from an adult female to its calf in some cetacean species; however, this transference associated with ingestion of PSP has not been reported previously. Several sub-committee members commented that given the likely link between climate change (increased ocean temperatures) and HAB events, large whales and other marine mammals could serve as effective sentinels for environmental health and ocean conditions. It was further noted that the largest mass-mortality event of baleen whales was reported off the Mexican coast due to HABs a few years ago. There was general agreement that the IWC should be a repository of information regarding such events. Finally, it was noted that a NOAA publication in 2021 summarised marine mammal strandings in US waters and describes a database used to store such information³.

A sei whale stranding on an island in the Yellow Sea off South Korea was reported to the sub-committee. It was the first official sei whale stranding record in South Korea over the last 30 years. The carcass was moved to a dissection facility and fully examined. The carcass was that of a young male with a body length of 9.4m and a weight of 6mt. After examination, it was reported that there were no large wounds, no signs of inflammation or infection, and no obvious cause of death. Overall, the animal had relatively good body condition. The cause of death was undetermined. Further analyses related to the cause of death are underway.

The sub-committee was informed of a survey that was sent to members of the United States stranding network in May 2022 to start to assess the impacts of the COVID-19 pandemic on marine mammal strandings. In this survey, potential impacts of the pandemic were investigated in two areas: reporting of strandings (decrease or increase) and response to strandings (potentially affecting information collection). Network members completed the set of questions twice, one time for 2020 and again for 2021. Results are still being analysed and will be used to provide context for annual reports of stranding numbers. In 2022, the Scientific Committee recommended that the Stranding Expert Panel undertake such a survey (SC2258). This approach or set of questions might serve as a model for adoption if it is still relevant for the IWC stranding effort.

The sub-committee discussed that monitoring of COVID-related marine debris would also be helpful, and that changes in stranding numbers are important to monitor in relation to the COVID-19 pandemic.

4. CLIMATE CHANGE

4.1 Review any reports from intersessional workshops on climate change that pertain to cetaceans

SC/69A/E/07 synthesised the relevant information, taking into account the recent literature, with a particular focus on the Mediterranean. It noted that ocean warming progressed faster over the past century than at any other time since the end of the last deglacial transition and there is a growing scientific literature that considers the ways that climate change may be affecting cetaceans.

Climate change affects cetaceans both directly and indirectly, the latter by affecting their prey, habitat, food webs and ecosystems. Among the multitude of impacts now observed and predicted are: shifts in cetacean distribution and abundance; loss of habitat; altered species and trophic interactions; altered inter- and intraspecific competition; reduced reproductive success; changes in phenology and migrations; relocations of feeding and/or breeding grounds; trophic mismatches; increased exposure to pollution, pathogens, extreme weather events, marine heatwaves, and toxic algal blooms; changes in behaviour; and increased stress levels and higher susceptibility to diseases or other anthropogenic stressors. Climate change impacts can also negatively affect the health, body condition, immune system, and survival of individuals and reduce the adaptive capacity and genetic variability within populations or species. It was noted that a spreadsheet of published works describing and categorising observed and predicted impacts of climate change on cetaceans is available from the authors.

³ <https://media.fisheries.noaa.gov/2021-03/2017-National-Marine-Mammal-Stranding-Report-Final-1-.pdf?VersionId=null>

Snell *et al.* (2023) investigated the effects of climate change on baleen whale distribution in the British Isles. During the period 1990-2020, baleen whale strandings increased significantly between 51°N and 61°N and minke whales were the main driver of the observed trends. Whilst such strandings data are subject to many variables, these results are in line with other research showing what appears to be climate change driven population shifts.

In discussion it was noted that climate change impacts on cetaceans should be considered a subset of the impacts of human-induced global change (which would also consider the impacts of chemical pollution, noise pollution, stress related to habitat degradation, etc.). That is, it is not possible to consider the impacts on cetaceans of climate change without integrating information on other changes in the ocean environment due to anthropogenic activities. It was noted that to a large extent, this is what the One Health approach to stewardship encompasses (see Item 1.10 in this report).

The sub-committee noted that temperature changes are most likely to impact cetaceans indirectly through prey distribution effects rather than through impacts related to thermal tolerance. Some species may be more vulnerable to changes in water temperature than others, and the potential effects of direct thermal stress are not clear. It was recognised that a number of studies on the impacts of climate change on cetaceans have indicated a general poleward movement associated with ocean warming over the last few decades. However, it was noted that cetaceans in the Mediterranean Sea and other semi-enclosed bodies of water may not have this opportunity given they are limited by land mass to the north.

The sub-committee drew attention to a recent review by Gulland *et al.* (2022) on the effects of climate change on marine mammals in U.S. waters. While the review is focused on the U.S. and effects of climate change and cumulative stressors will inevitably vary across different parts of the world, the review provides a valuable overview of existing and potential effects of climate change on cetaceans. The sub-committee also noted that the planned shift to biennial meeting schedule of the SC will provide challenges in keeping up with the growing body of literature on climate change effects on cetaceans. Intersessional meetings may be required to adequately keep the SC and the IWC abreast of the most recent findings and their implications. It was noted that existing management regimes may have to be revised to incorporate changes in distribution or productivity associated with climate change and allow adaptive management. An example of this was the recent change in North Atlantic right whale distribution, which resulted in a mismatch between marine protected areas and the seasonal distribution of the population. It was further noted that cetacean species that have specialised habitat requirements or prey requirements were more at risk from changes to the ocean environment caused by climate change than other species.

4.2 Review new information and recommendations

The Climate Change ICG met in the margins of the SC meeting and discussed its work programme. It was noted that Resolution 2009-1 on climate change was adopted at IWC63. This directs the SC to continue its work on studies of climate change and the impacts of other environmental changes on cetaceans. The Commission has also noted the importance of collaborating with other relevant international bodies on this topic and initiating specific activities in the future. Climate change is identified as a priority area in the Conservation Committee's (CC) Strategic Plan. To date, the IWC has held four in-person and one virtual workshop on climate change in 1996, 2010, 2011 (focused on small cetaceans), 2014 (focused on the Arctic) and most recently 2021 (virtual meeting).

In 2020, Scientific Committee approved a proposal to hold an in-person workshop on climate change and the Conservation Committee subsequently agreed to partner in this. However, the workshop format had to be changed to a smaller virtual workshop (i.e., three three-hour sessions on 30 November and 1 and 3 December 2020). There were 20 presentations and 66 participants from 21 countries. Following review by participants, the workshop report was posted online in March 2021. The report acknowledged that, due to the workshop's shortened and virtual nature, not all elements of the planned agenda had been completed. The workshop suggested prioritising research and conservation measures in regions experiencing particularly intense climate-driven environmental and biological changes, especially on cetacean habitat (for example, where these regions overlap with IUCN-defined Important Marine Mammal Areas - IMMAs). It was emphasised that climate change acts in concert with other stressors and that it is particularly challenging to understand the resulting cumulative effects which needs multi-disciplinary approaches. The workshop also explored how cetaceans can be used as sentinel species to detect or better understand marine ecosystem changes. Recommendations also included that the IWC seek funding to appoint a Climate Change Coordinator to 'generate a set of guidelines, standards and protocols for maximising the global utility of cetacean monitoring programmes and risk assessments from anthropogenic threats with respect to understanding the implications of climate change'. Workshop participants also recommended that a further workshop be convened to look at issues that had not been fully considered and to take forward some of the existing recommendations.

The following ToR were agreed for the Climate Change ICG: (1) take into account the latest information on how cetacean populations are affected by climate change; (2) provide clear advice on tools to mitigate the negative impact of climate change and build resilience; and (3) seek to develop an IWC climate change response programme. It was further noted

that the IPCC finalised the Synthesis Report for the Sixth Assessment Report in March of this year. It was agreed that the ICG would develop plans for a further workshop in 2025/6. The ICG was asked to explore the feasibility of a workshop planning meeting, which could be held in conjunction with the next Biennial Conference on the Biology of Marine Mammals in Perth, Australia (November 2024).

The ICG was also requested to provide comments to the sub-committee during SC69B on the following: (1) how to encourage further submissions to the SC regarding the impacts of climate change on cetacean populations; (2) providing a better understanding of how the work of each sub-committee interacts with climate change; (3) review progress on the recommendations of the 2021 workshop; and (4) consider how the other pressures on populations needed to be integrated into climate change focused work.

5. UNDERWATER NOISE

5.1 Review progress from intersessional work on impacts to cetaceans from underwater noise

SC/69A/E/11 provided an update on intersessional work on impacts to cetaceans from underwater noise. Since at least 2004, the IWC Scientific and Conservation Committees have been discussing the effects of anthropogenic noise on cetaceans. Cetaceans rely on sound for survival. It is their primary sense, necessary for successful foraging, migration, and reproduction. Man-made ocean noise has increased dramatically in recent years, with sources ranging from shipping to seismic exploration, drilling, and construction. Anthropogenic ocean noise is identified as a priority threat in the IWC Conservation Committee's Strategic Plan. Research is ongoing to understand the impact of noise on cetaceans and the effectiveness of various approaches to reducing exposure. Research findings to date are synthesised in the annual report to the E sub-committee by the ICG on Anthropogenic Underwater Noise (see SC/69A/E/11).

5.2 Review new information and recommendations

The sub-committee was informed of the results of investigations on the response of two species in the *Stenella* genus to seismic survey airguns, possibly to avoid the masking effect related to intraspecific underwater communication. *S. longirostris* and *S. attenuate* showed significantly different responses in whistle duration and centre frequency between the airgun states ('on' vs. 'off'). *S. longirostris* increased the whistle duration and centre frequency. At the same time, *S. attenuata* reportedly had an inverse response observed for *S. longirostris*, reduced whistle duration and centre frequency. Both species showed acoustic plasticity and changed whistle parameters in response to airgun activity but in different manners. These findings demonstrate the challenge of establishing general mitigation rules. Further investigation into the effect of distance on the acoustic response of these taxa to airgun exposure is necessary.

The sub-committee was also informed of the progress on the IWC global review of marine seismic airgun surveys. This report updated the initiative of the sub-group working on Anthropogenic Underwater Noise in the IWC's Conservation Committee. The review aims to gather information on seismic activities in various countries. In mid-February, the Secretariat circulated a questionnaire to all member states, receiving 19 responses as of 24 March. These responses provided information on seismic activities in Argentina, Benin, Brazil, Denmark, Finland, Netherlands, New Zealand, Peru, South Africa, Spain, the Republic of Croatia, the United States and Uruguay. Responses were received from 12 governmental agencies, two non-governmental agencies, two research institutions, two private companies and one intergovernmental organisation. The first round of responses helped identify areas for improvement in the questionnaire to gather more precise data and avoid ambiguity in responses. The information provided will be analysed in more detail and discussed from a global perspective. The authors wished to thank the effort of all those who have responded to the questionnaire. The authors will discuss with the Secretariat how to encourage more countries to answer the survey questions.

6. MARINE DEBRIS

6.1 Review progress on recommendations on marine debris

The ICG on Marine Debris reported on their participation at the ASCOBANS-ACCOBAMS marine debris workshop. Recommendations from that workshop were discussed under this agenda item.

6.2 Review new information and recommendations

The ICG on Marine Debris provided an update on progress of work and outlined the focus for the next intersessional period, particularly in regard to the Resolution on Marine Plastic Pollution endorsed at IWC68. The IWC's latest workshop on marine debris was held in December 2019⁴. The workshop reviewed the latest evidence on interactions with cetaceans (both ingestion and entanglement) and considered evidence for associated toxicology, discussed protocols for future research and made recommendation including developing liaison with other relevant expert bodies.

⁴ <https://iwc.int/management-and-conservation/environment/marine-debris>

The sub-committee will continue expanding on this work. The sub-committee was also asked for input on standardised data collection of marine debris-cetacean interactions; and work which could prove useful in preparing information needed to identify hotspots.

The following text is from the Commission's 2022-1 resolution on Marine Plastic Pollution:

'Therefore, the Commission ...REQUESTS the Scientific Committee to develop an approach to be considered by the IWC that would assess the current knowledge of the impact of marine plastic pollution on cetaceans and would provide a global risk assessment that identifies 'hotspots' of cetacean exposure to plastic debris.'

In an effort to be responsive to this request from the Commission, the sub-committee is requesting its ICG on Marine Debris to expand its Terms of Reference to include the following three points: (1) identify 'hotspots' of cetacean exposure to plastic debris; (2) prepare a synthesis of information related to the impacts of marine plastics on cetaceans; and (3) prepare a summary of approaches that the Scientific Committee should consider in developing global and regional risk assessments related to cetacean exposure to plastic debris. The sub-committee considers this action of the ICG on Marine Debris to be its highest priority and anticipates receipt of documents as primary documents prior to the SC meeting in 2024.

There was considerable discussion within the sub-committee regarding Commission Resolution 2022-1. It was noted that the literature on the impacts of marine plastic debris on cetaceans is rapidly increasing. Further, information on this topic from a regional perspective is inconsistent, with some regions having considerable literature published on this topic, while other regions are under-represented in the literature. It was further noted that each annual SOCER includes a section on marine debris. It was agreed that the synthesis document being prepared by the ICG should prepare a summary of the information available on marine plastic debris from the last five years. Finally, there was agreement that standardised definitions regarding marine plastic debris would be used throughout the deliberations of the ICG, as is done in the SOCER, and that the source(s) for this standardisation should be included in the summary report.

Reference was also made to the on-going work of the UN Environmental Program regarding the importance of ending plastic pollution. It was noted that the scientific underpinning of this action would serve as a useful information base from which the SC could proceed. In addition, it was noted that there is already a working agreement between members of the ICG on Marine Debris and the IWC's Conservation Committee, and that the existing agreement will have to be expanded to include the ToR mentioned above.

SC/69A/E/10 described the type and number of microplastics in faecal samples obtained from free-ranging blue whales (*Balaenoptera musculus*). The study had two main aims; to build the capacity of Sri Lankan researchers in the field of contaminant analysis and to initiate a more comprehensive study on an archive of faecal samples (blue whales and terrestrial species) held in Sri Lanka. The blue whale faecal samples used in this study were obtained from whale watching vessels that were operating in southern Sri Lankan waters. Only blue whale samples were collected and, for the purposes of this study, only 18 samples were subject to analyses for microplastics (particles < 5mm). Of the samples analysed, 45 microplastic particles were detected at an average of 0.82 items/g dry weight. The predominant material was fibre (68.9%) and the most commonly occurring colour was blue (55.6%). Fourier-transform infrared spectroscopy (FTIR) detected six polymer types, nearly half of which were polyethylene terephthalate (PET). The diversity of shapes, colours and polymer types of the particles identified demonstrates the diversity of marine microplastic present and available for ingestion, either via prey consumption or direct intake, by the top predators of the Indian Ocean. Little is documented on microplastics in free ranging cetacean species in the Indian Ocean and it is intended that this study has provided additional capacity and new interest in this field, as well as providing new insights to the health status of the blue whales of the northern Indian Ocean.

In discussion there was strong support for this sort of research to be continued, as well as expanded into other regions. In addition, it was recommended that efforts be undertaken to standardise the methods, database format and polymer identification methods.

7. HABITAT ALTERATION AS ANTHROPOGENIC IMPACT ON CETACEANS

Thompson *et al.* 2023 reviewed the potential impacts of deep-sea mining on cetaceans. The authors showed deep sea mining across vast marine areas and at varying depths has the potential for serious impacts on cetaceans and recommended research needed to better evaluate the impacts of anthropogenic noise associated with such activities, as well as other possible adverse, such as impacts related to resuspension of bottom materials and mining tailings.

A new ICG on deep-sea mining was established, with the following members: Naomi Rose (Convenor), Andre Barreto, Chris Parsons and Mark Simmonds.

The following ToR were agreed for the Deep-Sea Mining ICG: (1) review the topic and report back to the next SC with a further assessment of the likely consequences of deep-sea mining for cetaceans; (2) seek to establish contact with others who are investigating this matter; and (3) encourage further submissions on this topic to the SC.

Attention: SC, G, I, R

Noting the growing concern about the effects of deep-sea mining and its potential to adversely impact large areas of the deep seas, the sub-committee:

- i. **recommends** further independent research to help better understand the potential impacts on cetaceans and their ecosystems;
- ii. **recommends** that the potential impacts on cetaceans and their ecosystems are taken into account in new deep-sea mining developments; and
- iii. **agrees** to establish a new ICG to consider this and to present on this matter further at its next meeting.

The ICG will:

- i. review the topic and report back to the next SC with a further assessment of the likely consequences of deep-sea mining for cetaceans;
- ii. seek to establish contact with others who are investigating this matter; and
- iii. encourage further submissions on this topic to the SC.

8. SOCER REPORT (FOCUS ON INDIAN OCEAN)

Based on several IWC resolutions, the State of the Cetacean Environment Report (SOCER) was initiated to provide regular updates on environmental matters that affect cetaceans. The 2023 Report focuses on the Indian Ocean and its marginal seas.

The Ocean Health Index yielded scores below the global average for many Indian Ocean nation states. By far the greatest number of recent papers pertained to marine debris, especially plastics and microplastics. The Indian Ocean faces a major marine debris problem. A number of contributions emphasised the key role of cyclones and the monsoon season in aggravating the input of pollutants, including plastics, into coastal waters. Small cetacean bycatch is high in this region. The health status of the Persian/Arabian Gulf environment is generally considered poor. It is of a shallow, semi-enclosed nature and high temperatures make it especially susceptible to additional warming (marine heatwaves), with additional threats posed by major desalination facilities, large-scale mariculture projects, as well as eutrophication (symptoms: oxygen deficiency, algal blooms), all of which reflect a rapidly increasing human population. Poor progress was reported in creating functioning Marine Protected Areas (MPAs) in the Red Sea. On a positive note, a shipping lane off Sri Lanka was shifted to avoid an area known for high blue whale encounters, in line with past IWC efforts.

Globally, the emphasis in the literature has been on climate change, in particular glacier retreat and ice sheet melting, water temperature increases and rising sea-level scenarios. Potential impacts on the marine food chain (e.g., phytoplankton) were highlighted. To address the unsatisfactory state of the marine environment, a number of new treaties (high seas MPAs; plastics), initiatives (plastic ingestion), commitments and goals (biodiversity conservation) are being negotiated.

The sub-committee thanked the authors of SOCER for compiling this information in such a condensed way and noted that this report is the 20th annual SOCER to be received by the Scientific Committee. It was agreed that the focus of the 2024 SOCER should be the Mediterranean Sea and Black Sea regions, as well as a compilation of findings over the past 5 years.

9. REVIEW STRATEGY TO BETTER INTEGRATE E WORKPLAN WITH OTHER COMMITTEE SUB-GROUPS

It was agreed that the co-convenors of the E sub-committee would query other convenors regarding the information needs of other sub-committees. This information would be passed on to the ICG convenors early in the intersessional period.

10. REVIEW STRATEGY ON DEVELOPING AND USING A 'ONE HEALTH' APPROACH

The sub-committee discussed the 'One Health' concept and recognised that this approach: (1) is holistic to the well-being of all ecosystem components, including humans; (2) has goals to improve environmental health outcomes and to enhance the resilience of ecosystems to natural and induced challenges; (3) helps to ensure optimal environmental conditions, which are considered safe and sanitary for air, water, food and habitat; and (4) can be characterised as being successful relative to the stability of one or more of the wildlife populations in a given ecosystem, as well as by metrics of individual animal health.

In a veterinary context, the term 'One Health' captures how relationships between humans, animals and the environment may affect the spread of diseases. The United States Center for Disease Control's One Health Program has

reported that more than 70% of emerging human diseases are zoonotic, meaning they originate in animals and can cross to human and other animals. With recent pandemic diseases acting at global scales, zoonotic diseases are a critical area of research, education and outreach (CDC, 2023).

The Environmental Concerns sub-committee at SC68D (2022) encouraged the development of a case study to apply the One Health approach to a Conservation Management Plan or marine protected area, to develop a proof of concept and to show how the approach can be operationalised. At this year's meeting of the sub-committee a summary of such a case study was reported by S. Atkinson. This research program collected environmental and animal-related samples through the non-invasive technique of collecting respiratory exhalate using unoccupied aerial drones. Numerous health related factors were analysed to assess large whale health, as well as ecosystem health. Three major kinds of analyses (i.e., genetics, endocrine profiling and metagenomics for protozoan, microbial and viral communities) were undertaken. Preliminary results are available in Atkinson *et al.* (2021).

11. PROGRESS ON RECOMMENDATIONS

The sub-committee reviewed the status of recommendations from the spreadsheet provided by the Secretariat. Seventy-six recommendations were listed, where 43 were from 2019-2020, 21 were from 2021 and 12 were from 2022. Following review, 11 of the recommendations from 2021 were considered completed, while 3 recommendations from 2022 were considered completed. It was agreed by sub-committee members that recommendations from 2019-2020 years that had not already been closed would be consider superseded, unless specifically raised for discussion under this agenda item. It was further agreed that the 19 recommendations made by the sub-committee in 2021 and 2022 would be reviewed during SC69B under this agenda item.

12. BIENNIAL WORK PLAN

The sub-committee members approved the following work plan.

Table 1
Workplan for Environmental Concerns 2023 to 2026.

Topic	Intersessional	Next Meeting	Intersessional	Subsequent Meeting
Pollution 2025	Continue collecting information on legacy and emerging contaminants in cetaceans, on cumulative impacts (SC2164, SC2165, SC2257)	Review progress	Continue collecting information on legacy and emerging contaminants in cetaceans, on cumulative impacts	Review progress
Cetacean Diseases of Concern	Continue collecting information on Emerging diseases (SC23-E02)	Review progress	Continue collecting information on Emerging diseases	Review progress
Strandings	Implement Stranding Initiative, summarise agreements from SEP workshop May 2023 (SC2258, SC23-E03)	Review progress of intersessional work	Progress towards workplan	Review progress
Climate Change	Continue collecting information on impacts of climate change, follow up on workshop, adapt ToR (ICG-9), (SC2262)	Review progress of intersessional work	Continue work to follow up on recommendations	Review progress
Noise	Adapt ToR (ICG-9), (SC2183, SC2264)	Review progress of intersessional work	Continue work to follow up on recommendations	Review progress
Marine Debris	Follow up on recommendations, adapt ToR (ICG-10), develop workplan for SC response to Commission resolution 2022-1 (highest priority); (SC2185, SC2265)	Review progress; finish Workplan for Commission re resolution 2022-1	Continue work to follow up on recommendations. Implement Workplan re resolution 2022-1	Review progress
SOCER	Report compilation on the Mediterranean Sea and Black Sea regions and 5-year compilation	Review SOCER report. Address plans for biennial meetings of SC	Report compilation	Review SOCER report
Deep Sea Mining Impacts	Collect information on potential impacts of deep-sea mining on cetacean populations, ICG-11) (SC23-E04)	Review progress	Continue ICG	Review progress
One Health approach	Continue to develop recommendations; work across sub-committees, and specifically with the ecosystem functioning group	Review progress of intersessional work	Continue work across sub-committees	Review progress of intersessional work
ICG on beaked whales in conjunction with SM ICG	Develop response protocol, develop recommendations for improved data sharing (SC2181)	Review progress of intersessional work	Continue ICG if needed	Review progress of intersessional work
Integration of E workplan with other subcommittees	Co-convenors to canvas other subcommittees for information E could provide. Co-convenors to inform ICG leads, as appropriate	ICG leads to take information requests into consideration	Co-convenors to contact chairs of other subcommittees	Review progress in integrating workplan of E with others

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Appendix 1

AGENDA

1. Chemical pollution
 - 1.1 Review intersessional work
 - 1.2 New information on pollution
2. Diseases of concern
 - 2.1 Review progress in intersessional work on emerging diseases
 - 2.2 Special primer on coronavirus surveillance in aquatic wildlife
 - 2.3 Review new information on Diseases of Concern
3. Strandings and mortality events
 - 3.1 Review progress of steering committee for IWC Strandings Initiative
 - 3.2 New information on unusual mortality events
 - 3.3 Update on next steps to implement the 4-year workplan (focus of SEP workshop in May 2023)
 - 3.4 Update on efforts to expand regional representation on the SEP
 - 3.5 Other information and recommendations
4. Climate change
 - 4.1 Review any reports from intersessional workshops on climate change that pertain to cetaceans
 - 4.1.1 Review new information and recommendations
5. Underwater noise
 - 5.1 Review progress from intersessional work on impacts to cetaceans from underwater noise
 - 5.2 Review new information and recommendations
6. Marine debris
 - 6.1 Review progress on recommendations on marine debris
 - 6.2 Review new information and recommendations
7. Habitat alteration as anthropogenic impact on cetaceans
8. SOCER report (focus on Indian Ocean)
9. Review strategy to better integrate E workplan with other Committee sub-groups
10. Review strategy on developing and using a 'One Health' approach
11. Progress on previous recommendations
12. Biennial workplan