Convention on the Conservation of Migratory Species of Wild Animals

2nd CMS Workshop on Conservation Implications of Animal Culture and Social Complexity

Part II, Parma, Italy, 3-4 April 2023

UNEP/CMS/Culture-2/Report Part II

REPORT – Part II

1. Opening of the Meeting

The Chair of the CMS Expert Group on the Conservation Implications of Animal Culture and Social Complexity, Philippa Brakes (University of Exeter/Whale and Dolphin Conservation), opened the meeting and warmly welcomed all participants. She was very pleased that almost all sub-groups were represented in person, and thanked everyone for the intersessional work.

The list of participants is available in Annex 1.

2. Adoption of the Agenda and Schedule

The Chair briefly outlined the agenda, which was adopted without amendments (Annex 2).

3. Background, Mandates and Definitions

The Chair drew attention to CMS Decisions 13.102 to 13.105, which mandate work on social learning and culture. She highlighted some key definitions that had previously been agreed by the Working Group or are defined by the Convention:

- For CMS, 'migratory species' means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries.

- Social learning: any learning process that is influenced by the observation of, or interaction with, another animal or its products (Whitehead & Rendell, 2015;[1] Hoppitt & Laland, 2008;[2] Heyes, 1994[3]).

- Culture: information or behaviour – shared within a community – which is acquired from conspecifics through some form of social learning (Whitehead & Rendell, 2015[1])

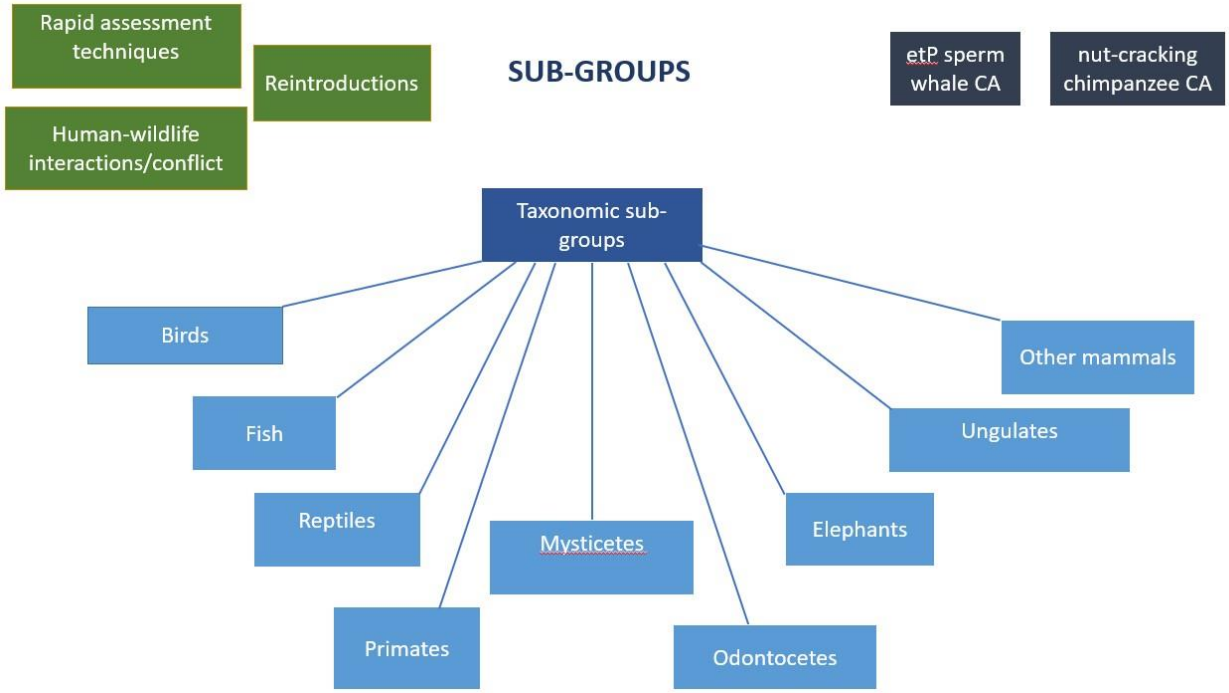
The Chair explained that Part 1 of the workshop had been held in October 2022, during which a number of sub-groups were established to take forward work intersessionally (see Figure 1). The current meeting, Part 2 of the workshop, would review the sub-group reports and agree recommendations to be presented to the Scientific Council in July 2023 and then to the CMS Conference of the Parties (COP14) in October 2023.

[1] Whitehead H, Rendell L (2015) *The cultural lives of whales and dolphins*. Chicago, IL: The University of Chicago Press

[2] Hoppitt W, Laland KN (2008) Social processes influencing learning in animals: a review of the evidence. *Adv Study Behav* 38: 105–165

[3] Heyes CM (1994) Social learning in animals: categories and mechanisms. *Biol Rev Camb Phil Soc* 69: 207-231

Figure 1: Sub-groups established in October 2022



During Part 1 of the workshop, a series of criteria had been agreed against which taxonomic groups could be reviewed to determine priorities. The work of the sub-groups was guided by these criteria, which included whether: the main Range States for the species or population were Parties to CMS or Parties/Signatories to daughter agreements; the species or population was listed on CMS Appendix I and/or II; there was direct evidence of social learning or it could be inferred; there was evidence – or a likelihood – that social learning or culture in this species or population might interface with conservation through one of a number of channels.

The sub-groups had distilled a high volume of information, and the Chair highlighted the importance of developing recommendations that CMS Parties could enact, and which were complementary to work that was already going on.

4. Reports of the Taxonomic Sub-Groups

Each of the taxonomic sub-groups gave a presentation followed by a discussion.

4.1. Birds

Lucy Aplin (Max Planck Institute of Animal Behaviour/University of Zurich) and Peter McGregor (ISPA – Instituto Universitário) led the sub-group on birds and introduced document UNEP/CMS/Culture-2-2/Doc.4.1 and its Annex.

Ms Aplin highlighted substantial evidence for culture and social learning in birds across multiple domains, including migration, movement, vocalization, foraging and tool use. She noted that many bird species had attributes that might be expected from cultural species, including long lifespans, overlapping generations, an ability for learning, parental care and long juvenile periods.

Ms Aplin explained that a key focus of the sub-group was on migration, which as well as being important for survival and reproduction, was a risky part of an individual's life. In birds, there was evidence of social learning in departure, stopover and termination decisions, as well as evidence, for some species, of in-flight decisions such as learning how to soar.

Ms Aplin summarized the steps taken by the sub-group:

- *Step 1: Stocktake of birds in the CMS Appendices*
  The sub-group noted that 20 orders covering 40 families and 197 species of birds were listed on the CMS Appendices. However, most of the evidence on culture and social learning in birds related to species that were not listed and, for this reason, an alternative approach was taken (Step 2).

- *Step 2: Assess for presence of social learning and culture at the family level*
  The sub-group assessed taxa at the family level to enable them to generalize based on evidence from species that had been researched, which could then be applied to those that had not. The sub-group chose four domains to focus on: migration, movement, vocalization, and foraging (including tool use). The sub-group looked at whether there was evidence for social learning and culture in these domains, and categorized them as follows: known; likely; unlikely; no; insufficient data (see the annex to the sub-group report).

- *Step 3: Relationship between culture and conservation threats and actions*
  The sub-group then considered the relationship between culture and conservation threats and actions. They found that, in many cases, cultural learning acted as a buffer or mitigating factor for species so that there was less of a conservation concern but, in other cases, cultural learning increased conservation risk.

Ms Aplin noted that many local cultures in birds spread horizontally (e.g. some foraging cultures) and therefore could be re-invented as long as the capacity to do so was maintained (e.g. large group sizes in well-connected populations). In contrast, specific migratory routes and movement patterns might be lost if local populations were exterminated and therefore these should be considered in the management and conservation of migratory species. That said, there was growing evidence (e.g. for several species of geese) that new routes could be formed in response to changing environments, and lost routes regained, although this might take multiple generations. In conclusion, the sub-group found that sub-populations that exhibited specific migratory routes could be considered a priority when considering units to conserve.

The sub-group reviewed threats to the species and their impact on social learning and *vice versa*. For example, there was extensive evidence that cultural evolution in passerine birds could occur in response to anthropogenic noise, with songs shifting in frequency to avoid overlap. Vocally learning birds were therefore most likely to be able to adapt to the impacts of anthropogenic noise, whereas taxa that did not exhibit vocal cultures were most likely to be vulnerable to it.

- *Step 4: Highlighting groups for prioritization*
  The sub-group identified six families for prioritization, the *Anatidae* (geese, ducks and swans), the *Gruidae* (cranes), the *Otididae* (bustards), the *Accipitridae* (hawks, eagles and kites), the *Pelecanidae* (pelicans) and the *Laridae* (gulls). Ms Aplin gave examples from the first four families.

Discussion

Participants thanked the sub-group for its excellent work. They noted that many birds migrate long distances without crossing international borders (e.g. migration within Australia) and so did not meet the CMS definition of migratory. It was suggested that these species should nonetheless be included in the work of the Expert Group as they also offered valuable information on social learning and culture.

Responding to a question on why 'movement' and 'migration' were treated separately, Ms Aplin explained that bird migration was considered to be long distance migration from one point to another (e.g. for breeding or feeding), whereas 'movement' was used to describe foraging movements (e.g. foraging in large areas of the open ocean).

Participants discussed the linkages between mating behaviour, sexual selection and culture. In their review, the birds sub-group did not consider aspects such as predator recognition and mate choice and instead focused on vocalizations. Mr McGregor noted that changes in vocalization could happen relatively quickly and can substantially affect the chances of mating. However, he noted that, although learned vocal behaviour had been well documented, determining the conservation implications relating to resource defence or mate attraction was more challenging. Vocalization acted in parallel with other aspects of communication, e.g. plumage. Hal Whitehead (Dalhousie University) noted that culture could have a genetic impact, for example, a culturally learned song prescribes mating and so the cultural differences might lead to genetic differences.

Mr McGregor explained that much of the extensive literature on bird song was from 20-30 years ago and some of it was not digitized. This was likely to be the case for other taxa too.

Mark Simmonds (CMS COP-appointed Scientific Councillor) drew attention to ongoing CMS discussions on light pollution, and asked how light pollution might impact culture. Mr McGregor noted that night migration was the main behavioural domain likely to be impacted by light pollution. In addition, patterns of singing and foraging activity could be affected by artificially extending the period of daylight, although this was poorly understood. Ms Aplin added that, while light pollution was a huge problem for migratory birds and movement, it might be a larger problem for non-social learning species, as species with social learning might have more capacity to adjust.

The importance of the role of species in their ecosystems was highlighted, including along their migratory routes. Globally, the value of natural capital and ecosystem services was increasingly recognized by governments and the private sector. It might be harder to restore the ecosystem if the migratory culture has been lost.

Unit to conserve

There was extensive discussion on an appropriate "unit to conserve" with respect to social learning and culture.

Participants noted that the first step in identifying a cultural "unit to conserve" might be to recognize unique or unusual behaviours. Participants noted the challenges in determining whether a socially learned behaviour had created enough distinction between groups to identify a "unit to conserve", especially as social groups could be dynamic. Ms Aplin explained that, in birds, culture in one behavioural domain did not predict whether there would be culture in another behavioural domain. For example, in some birds there might be a very strong migratory culture (e.g. water fowl), but no evidence for a vocal culture.

Participants noted that a "unit to conserve" might be genetic or cultural or both, and for many species it might not be clear which it is. Ms Aplin noted that for some geese there might be genetic subpopulations or subspecies along migratory routes which could be defined as a "unit to conserve". Mr Whitehead noted that cultural differences could set up barriers to the movement of other cultures. For example, in whales, there might be sympatric populations that did not associate with each other because they had different culturally learned markers for their social groups. Because of this, they did not learn from each other. There was deliberation on whether there was a conceptual distinction where the 'units to conserve' were genetically the same but culturally distinct.

There was extensive discussion on the practicalities of using "units to conserve", and the need to prioritize – for example, which of the migration routes of a species should be conserved and what would be the consequences if certain migratory routes were lost. It was noted that a CMS Concerted Action for the Western Chimpanzee had been agreed on the basis of its culturally learned nut-cracking behaviour. However, concerns were also raised about focusing on one particular culture, when there were also many other cultures for that species (see also section 9.2).

Mr Whitehead summarized the approach taken by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), of which he was a member. Following a status assessment, a species would receive a formal status designation. COSEWIC aimed to conserve populations that were 'discrete' (i.e. there was no information exchange) and evolutionary significant. The application of this could be challenging, particularly where populations might have cultural differences (e.g. different migration routes) but were not genetically distinct.

From a US perspective, Sarah Mesnick (NOAA) noted that through the US Marine Mammals Protection Act (MMPA), animals were conserved as functioning parts of their ecosystems. The concept of "units to conserve" was important under both the US Endangered Species Act (ESA) and the MMPA. In the ESA, the subspecies and species were the units to conserve, but work was ongoing to see whether cultural units could also be incorporated as management units – e.g. for Sperm Whales for which they were developing a cultural line of evidence to inform and define the "unit to conserve".

Participants agreed that, when discussing the "unit to conserve", it was important to think about the conservation context and what managers were being asked to do. This could range from putting in place protections for a species or habitat, ensuring culture was incorporated during a translocation (e.g. ensuring the availability of certain plants for a particular foraging culture), or seeking to maintain cultural diversity and processes.

There was discussion on whether a word like 'tribe' might help communicate why a particular group of animals was united by their behaviour. A number of challenges with this were highlighted, including sensitivities with language and the fact that culture does not necessarily create separation between groups.

Capacity for culture

Participants agreed that maintaining the capacity for culture was important, particularly where culture was acting as a buffer against threats and/or providing resilience in a changing environment. Participants discussed the need to focus on the processes for social learning and culture, rather than trying to conserve every unique behaviour in itself. The learning processes that helped species to adapt might be more important for the long-term conservation of the species.

A key question was how to retain cultural capacity in populations – i.e. what was needed to create the conditions for cultural diversity and whether there were conditions (e.g. small population size) under which innovation would not happen or would be lost. Conservation targets could include management to maintain a behaviour (e.g. migration) and to maintain innovation potential for future adaption to environmental change.

Participants discussed whether horizontally transmitted culture might be particularly beneficial as a buffer against a changing environment. It was suggested that for poorly understood species, identifying horizontal or vertical culture might help inform management action. Ms Aplin noted that, in birds, the evidence suggested that transmission of migratory information tended to be vertical, whereas foraging culture was horizontal. Conservation priority should be given to migratory routes which are more vulnerable to being lost.

Management advice

The importance of identifying practical action that CMS Parties could take was highlighted by many participants. Fernando Spina (COP-appointed Scientific Councillor) asked whether culture should be considered as part of the listing criteria for the CMS Appendices, in addition to current conservation status, given the evidence on culture as a tool for animals to respond to threats.

Participants discussed the various approaches that could be taken to use social learning to manage threats and the advice to give to wildlife managers, which could include focusing action on the groups with the best knowledge of culture, or on the groups with the greatest conservation need. Participants noted that biases could be introduced for conservation action in species that were particularly well studied. For example, chimpanzees were very well monitored and therefore distinct cultures had been identified for several populations. It was likely that general thresholds would not work, since each case needed to be evaluated separately. Accordingly, it was suggested that advice could be given on the particular conditions that managers should be looking for on the ground, e.g. social structure or unusual behaviours.

Reflecting on how the conservation of particular cultures could be achieved, Ian Redmond (CMS Ambassador) noted that for the Western Chimpanzee, the ability to crack nuts enabled the animals to exploit forests that might otherwise be lacking in food, which might allow better adaption as climate change affects their habitat. However, other socially learned skills might not have any conservation impact or a more subtle relevance. Where culture provided an obvious benefit, then that could be promoted as a means of encouraging conservation action – e.g. to

reduce the human harvest of nuts in key habitats of nut-cracking chimpanzees, or to restrict development at key sites for migratory birds. In this way, culture is incorporated into conservation decision-making. Mr Redmond stated that he would welcome the inclusion of this as part of the CMS process.

Mr McGregor suggested that one approach was to use well-studied species as a proxy for other species of interest where it was reasonable to do so. For a bird species of conservation concern closely related to vocal learning groups of another species (e.g. a passerine), it was reasonable to infer that the patterns in the well-studied species would be followed. One practical application of this would be in cases of reintroduction of a species of conservation concern. The Chair asked the group to consider whether guidelines could be created around plausible phylogenetic inference. Although challenging, it could be a useful starting point.

It was agreed that consideration of social learning and culture in management measures such as population restocking and translocation could help ensure these measures were more successful, helping to save both time and money.

4.2. Fishes

Culum Brown (Macquarie University) led the sub-group on fish and introduced document UNEP/CMS/Culture-2-2/Doc.4.2.

Mr Brown explained that fishes were a relatively poorly understood group, with more than 32,000 described species and many more undescribed. Of the described species, only around one third had been assessed in the IUCN Red List, with 25 per cent of assessed freshwater species and 37 per cent of assessed sharks and rays at risk of extinction.

A high proportion (likely around 50 per cent) of both freshwater and marine fishes are migratory. Fish migrations varied over space (tens of metres to thousands of kilometres) and time (daily, seasonal) as well as vertically. However, despite migrating huge distances, many species did not cross international boundaries and therefore did not meet the CMS definition of migratory. Fishes also played a very significant role in their ecosystems, moving energy and nutrients around habitats.

Mr Brown noted that just a small number of fish species were listed in the CMS Appendices: 21 species of ray-finned fishes, 19 of which were sturgeon; and 37 species of sharks and rays, 11 of them mobulids and 5 saw sharks. Mr Brown summarized the key threats to fishes, which included competition with humans for water for industry, farming, transport and energy production; waste and pollution; overfishing; catch in bather protection programmes; dams, weirs and other impediments; urbanization and land clearing; climate change; and noise and light.

Social learning and culture in fishes was well known, with much of the evidence about the detailed mechanisms of social learning coming from carefully controlled studies on fishes in a laboratory environment. Social learning seemed to be reasonably widespread including for commercially important species (salmonids, tuna, etc.), especially in the context of movement and migration, and for other key fitness traits such as mate choice, foraging and predator avoidance.

However, knowledge on social learning and culture in fishes was limited to very few species. Little was known about the importance of culture and social learning for many economically important species and for the CMS-listed species. Nonetheless, it was likely that cultural processes were

involved in the migration of salmonids, tuna and other commercial species. There were unique overwintering, foraging and breeding grounds that were likely culturally transmitted.

Mr Brown noted a conversation with an elder in Australia who remarked that, when fishing migratory species of fish, indigenous fishers always let the first individuals go past, on the basis that these were the leaders and therefore they had the cultural knowledge. A similar understanding had been reported for indigenous people in North America.

While culture in itself was important for survival, it could also be used as a tool in conservation. Social learning protocols were used in conservation reintroduction programmes – e.g. in 'life skills training' for animals ahead of introduction. In addition, cultural information could help inform harvest models for fisheries.

Mr Brown emphasized the challenge of expanding the understanding of social learning and culture to cover more species of fish, noting that a phylogenetic approach (as had been done for birds) would not work as not enough was known about fishes across the phylogeny. He also noted the challenges of balancing the conservation needs with the economic interests around commercially valuable fish.

Discussion

Participants thanked the sub-group for its excellent work.

In response to a question on action for CMS to take, Mr Brown emphasized the need for a greater focus on fishes. He suggested that additional species could potentially be listed in the CMS Appendices. As an example, all salmonids migrate, and as a commercially valuable group, they were well studied, and cultural knowledge had already been used to inform efforts to reintroduce some species. Also tuna were highly migratory, but very little was known about their social learning. While research was more challenging for this group, a phylogenetic approach could potentially work.

James Williams (CMS Scientific Councillor) noted that listing proposals for commercially important species can be challenging, and the benefits of a CMS listing needed to be clear. Proposals needed to be submitted by Parties. Melanie Virtue (CMS Secretariat) concurred that a CMS listing decision was a political process driven by decisions made by Parties, but based on scientific advice and conservation concerns for a species or population. She drew attention to discussions in 1990 to list the sturgeon and, more recently, commercially important shark species.

Picking up from the discussion related to birds, participants considered whether it would be helpful to propose a process to include social learning as a line of evidence for a CMS listing. This seemed a useful approach, though Mr Brown noted that one of the challenges for fishes was the lack of specific lines of evidence for most species. While different wintering grounds and migration routes had been observed for some populations, there was a lack of concrete evidence that this was driven by cultural processes.

Fishes presented a good example of conservation bias for species that were not particularly well studied. A question was raised on whether, in the face of rapid species declines, it might be possible to show that there is the potential for fishes to have culture, without the prerequisite to demonstrate specific cultural behaviours *per se*. Mr Brown agreed that it would be possible to develop a list of lines of evidence that suggested that fish were socially learning animals and had culture, e.g. for all salmonids, many of which were of conservation concern.

The importance of social learning in helping to maintain stocks of commercial species was suggested as a way to encourage study of poorly known commercial fishes. Mr Brown drew attention to a forthcoming review on that issue, explaining that, while culture in fish had been recognized for many years, it had not led to management change. The need to stimulate the dialogue between the scientists, managers and Regional Fisheries Management Organizations (RFMOs) was highlighted. This was a role that the CMS could help to play.

The group also discussed the role of social complexity and culture in fisheries models. Current models operated on the basis of maximizing harvest through modelling population growth, with the aim of maintaining the population at the point of maximum growth. However, consideration should also be given to the roles/knowledge of individuals in the population to ensure sustainable management of that population. Changing these models would be very challenging, though.

The value of case studies on the role of social learning and culture was highlighted as a way to support communication between fishery ecologists and fishery managers. These could demonstrate the importance of culture in better studied taxa and/or CMS-listed species, while also demonstrating the relevance of culture to other less well-studied species or non-CMS-listed species of conservation concern. Examples for case studies could include sturgeon, great white sharks and other sharks, while also bringing in the salmonids and tunas.

Participants expressed an interest in the life skills training mentioned earlier, welcoming the recognition of social learning in these. Mr Brown gave two examples: the first related to flatfishes in Japan, which were reared in hatcheries under commercial conditions, with feeding at the surface. When the fishes were released into the wild, they had continued to seek food at the surface as they had been trained to do and were easily predated. A change to hatchery feeding practice was undertaken to address the issue. The second example related to salmonids, in both Australia and Canada, which were trained to recognize live prey and where to find it, with improved survival rates after training. Mr Brown explained that in that field, there was recognition that social learning and cultural processes were important, and while it might offer a foothold for discussion, it has not been taken on board in many countries.

4.3. Reptiles

Anna Wilkinson (University of Lincoln) led the sub-group on reptiles and introduced document UNEP/CMS/Culture-2-2/Doc.4.3. She thanked Daniel Noble (Australian National University) and Martin Whiting (Macquarie University) for their work in the sub-group.

Ms Wilkinson emphasized the need for a greater focus on reptiles. She noted the eight reptile species listed on CMS Appendix I: the Green Turtle, Loggerhead Turtle, Hawksbill Turtle, Kemp's Ridley Turtle, Olive Ridley Turtle, Leatherback Turtle, South American River Turtle and Gharial. Six of these species were sea turtles that migrated from feeding to overwintering to breeding grounds, but nothing was known about their social learning and culture. There was a huge gap in knowledge regarding social learning and culture in reptiles of CMS interest, with nothing known for these taxa.

Ms Wilkinson reflected on knowledge of closely related species (chelonians and crocodilians) that could be used to infer social learning in the CMS-listed species. Recent research had revealed evidence of complex social cognition in chelonia, including gaze-following (aligning gaze direction with that of another individual), which was considered adaptive as it was likely to alert individuals

to the presence of important stimuli in the environment. It also included geometric gaze-following (following gaze behind a visual barrier) which was considered complex. Gaze-following had been observed in chelonians and crocodilians, and geometric gaze-following in chelonia (Red-footed Tortoises) but not crocodilians.

Ms Wilkinson explained that there was evidence in chelonia that they could learn from observing other individuals. No evidence of social learning in crocodilians had been identified in a literature search, although they were known to have flexible communication. The South American River Turtle vocalized when migrating to nesting beaches and during communal nesting events, and there was evidence that embryos vocalized prior to hatching.

Ms Wilkinson concluded by emphasizing the need for basic social cognition experiments to assess the following key abilities for focus species, starting with sea turtles:

- Gaze-following
- Responding to stimulus and local enhancement
- Training an animal to learn a novel food location/colour and see if and how it spreads

Discussion

Participants thanked the sub-group for its excellent work.

It was noted that there was some research on social learning in other reptile taxa, e.g. skinks and varanids. Ms Wilkinson explained that the sub-group focused on chelonians and crocodilians as they were CMS-listed, and that the absence of evidence for these groups was likely to be due to lack of research. Michael Noad (University of Queensland) drew attention to work at his University on the sociality of crocodilians. The Chair noted work on foraging strategies in water dragons, reflecting on the challenge of disentangling ecological behaviour from socially learned behaviour.

Participants asked whether there was likely to be social learning involved in the highly migratory behaviour of sea turtles. Ms Wilkinson explained that, while some sea turtle individuals took the same migratory route, there was a lot of variation in the routes that were taken. Social learning might play a role but further investigation was needed.

Ms Heidrun Frisch-Nwakanma (CMS Secretariat) recalled a presentation at the 2023 International Sea Turtle Symposium on the vocalizations of sea turtles, which were found to vary in different scenarios. Another study investigated interactions between a resident group of Hawksbill Turtles in which individuals were previously thought not to interact with each other, but this research found otherwise. Similarly, Mr Brown noted that it had been previously thought that sharks were not social, but tagging and social network analyses had found that almost every shark species had a social structure. Social structure could predict when animals left for and arrived at breeding grounds. He wondered if an analysis could be done on sea turtles using tracking data to investigate social structure – and Ms Wilkinson agreed that this could be very enlightening.

4.4. Elephants

Vicki Fishlock (Amboseli Trust for Elephants) led the sub-group on elephants. Speaking on behalf of the sub-group, Lucy Bates (University of Portsmouth) introduced document UNEP/CMS/Culture-2-2/Doc.4.4 and thanked members of the sub-group for their hard work.

There are currently three recognized elephant species: African savannah and forest elephants, and the Asian elephant. The Indian sub-species, *Elephas,* was listed in CMS Appendix I, and both *Loxodonta* species were in CMS Appendix II. Ms Bates noted that elephant Range States included a mix of both CMS Parties and non-Parties, and that crossing international borders was common in all three species.

Ms Bates explained that, while it was generally assumed that elephants had culture, in her view this assumption was based on indirect rather than direct evidence; however, she highlighted differing views in the sub-group on this point. Much of the evidence relating to elephant culture was derived from studies of savannah elephants. This species inhabited a wide range of niches, from deserts to savannah to moist woodland, which was important both from the perspective of the "unit to conserve" and the policy actions required.

The sub-group looked at the following three topics:

- Evidence for social learning and/or animal culture
- Interactions of social learning/culture with conservation
- Precautionary approach and management implications

In terms of opportunities for social learning, the sub-group noted that elephants had a long lifespan and long juvenile dependency; a multi-generational, highly interactive social structure; a strong tendency to aggregate when resources permitted; individual recognition of family and associates; and elders as '*repositories of knowledge*' (e.g. older matriarchs had greater social knowledge and more appropriate threat responses). While it was not known if accruing knowledge was acquired individually or socially, there was extensive opportunity for vertical, horizontal and oblique transmission of information.

Ms Bates gave examples of indirect evidence of social learning in elephants including: the key role of knowledgeable elders (noting that it was unlikely younger associates did not learn from this); the social proximity of calves to elders (which might be functionally equivalent to peering behaviour); consistent/traditional use of travel paths to social resources in forest elephants; and possible 'teaching' (demonstrations) of oestrus behaviour in savannah elephants. However, there was very little direct evidence: captive elephants that were tested with a 'two-action' task, did not copy the demonstrator, but did show some evidence of local enhancement; Asian elephants learned to cooperate in a rope-pulling task; and both savannah and Asian elephants showed evidence of vocal imitation.

There were many indications of culture including likely socially learned familial network positions, with ongoing analysis into population differences in social behaviour, population differences in temperament/reaction to humans (e.g. after civil war), and learning related to migration, ranging, feeding and evasive behaviour. Whether or not socially learned, it was clear that these behaviours affected conservation outcomes. For example, in savannah elephants, there was good evidence that the loss of older females resulted in reduced social cohesion, erratic behaviour, maladaptive responses to threats, and lower reproductive success. In both savannah and Asian species, calf survival increased with extra females, particularly the presence of older females. And there was an impact on habitat use, with good evidence for savannah elephants that ranging and drought survival was impacted by loss of elders. Families without older matriarchs were less likely to get through a period of drought.

Due to their complex social structure, translocations were often unsuccessful, resulting in death or (attempted) return to the natal area. While small-scale translocations were no longer used

much as a management tool, there were now attempts to undertake larger translocations (e.g. hundreds of elephants at a time).

Ms Bates summarized some initial sub-group recommendations, explaining that further deliberation was needed. Noting that the loss of mature elephants impacted the wider population, she advised that a key conservation aim should be to maintain a stable social and demographic structure. Additionally, it was imperative that assessments of evolutionary and culturally significant units (ESUs and CSUs) were undertaken and incorporated into future management strategies. This was especially important given the extensive habitat diversity in which elephants existed. Finally, she highlighted the need for further work on the influence of human interactions as a driver of learning (e.g. cultures of avoidance), as well as to understand the management implications of elephant social structure and behaviour. Population numbers alone were not sufficient to draw conclusions about how elephants were faring.

Discussion

Participants thanked the sub-group for its excellent work.

The group reflected on the widely held assumption of culture and cultural units in elephants. Many participants noted that, for a species with such a complex social structure and behaviour, it was hard to argue against social learning and culture. Mr Redmond gave two examples. One was the Mount Elgin elephants, which exhibited a unique behaviour going into deep caves to mine minerals. Young elephants travelled with their mothers and learned this unique part of their culture. Some other elephants create shallow caves when they tusk into a cliff, but no other elephants went deep into the mountains the way this particular group did. He also highlighted the example of a translocation of elephants in South Africa in 1994, in which the lack of familiar plants in the new habitat led to confusion and destructive behaviour by the elephants as they had not learned which plants to forage.

Participants discussed the role of particular individuals in elephant social structure. The understanding that female elephants had of their rank in a group, and the passing on of that knowledge, indicated something about culture. Ms Caitlin O'Connell-Rodwell (Stanford University) suggested that consistent individual differences and personalities might drive certain behaviours that tended to make one group distinct from other groups. For elephants, chimpanzees, sharks and other taxa there had been observations that removing a key individual could have a catastrophic impact on the population.

Noting that it can be challenging or unethical to do experiments on elephants or other large animals (e.g. whales, tuna) in the wild, looking at social complexity or other indirect factors could be a line of evidence worth considering. Participants agreed that, even if mechanisms were not fully understood or evidenced, where disruption of social structure and behaviour had a conservation impact, this should be incorporated into management approaches. Population structure and social complexity were also important to consider in population dynamic models, in addition to the size of the population itself.

This could apply to many other taxonomic groups as well. Participants noted that, although many questions remained for elephants, compared with the other taxa, there was substantial evidence of the fitness impacts and real-world consequences of elephant social structure and behaviour. It was clear that when elephant social culture was interrupted or broken down, the conservation impacts could be severe.

Participants suggested that by combining and analysing various data sets, it should hopefully be possible to draw some evidenced conclusions on culture in elephants. The challenge of separating ecological differentiation from social learning was noted, with discussion on the processes for social learning, detecting patterns and optimal foraging theory. There was discussion on whether evidence had been generated from Asian working elephants (e.g. in training). Ms Bates agreed that the experience of elephant trainers was a resource that should be explored, noting that trainers might be reticent given the controversy around elephant training.

In response to a question on vocalizations, Ms Bates noted that elephants did have contact rumbles which were still poorly understood and it was not known whether they had dialects. Ms O'Connell-Rodwell added that Artificial Intelligence was being used to help understand vocalizations, and it appeared that slightly different vocalizations were used depending on motivation and emphasis, as well as the presence of bonded individuals. It also appeared that vocal coordination was much more sophisticated than previously understood.

4.5. Ungulates

Brett Jesmer (Virginia Tech) led the sub-group on ungulates and thanked the sub-group, including Matthew Kauffman (University of Wyoming) for his intellectual contribution. He introduced document UNEP/CMS/Culture-2-2/Doc.4.5.

Mr Jesmer explained the reasons for ungulate migration, drawing attention to the Forage Maturation Hypothesis, which states that energy and nutrient gain was highest at intermediate biomass, with younger plants more energy-rich but low in biomass, while older plants less digestible but higher in biomass. An extension of this was the Green Wave Hypothesis, whereby ungulates employ a foraging strategy to track (or ‘green surf’) waves of intermediate biomass across space to maximize energy and nutrient gain.

Mr Jesmer noted that there was limited evidence for social learning in ungulates but that their migration has long been hypothesized to be socially learned. Indications that supported this theory included their life histories, which included extended maternal care, with juveniles following their mothers for the first year of life. There was some evidence of inheritance of migratory vs. resident behaviour demonstrated in White-tailed Deer, although the process for this inheritance was not clear (i.e. whether it was genetic mechanisms or social learning). In addition, indigenous knowledge assumed transfer of knowledge from mother to offspring. Mr Jesmer described an experimental test of the hypothesis that ungulate migration was socially learned and culturally transmitted, using translocations of Big-horn Sheep and Moose. The results implied that there was no strong evidence for a genetic basis for migratory timing or routes, and that social learning was probably an important mechanism for this. The study had found that ‘green wave’ surfing knowledge increased over time, but learning to migrate seemed to require a substantial length of time, taking 90 years for 50 per cent of the population to begin migrating, with some initial individuals starting to migrate in two or three generations (20-30 years). This was attributed to cumulative cultural evolution where each generation learned from the previous one.

In terms of inferences to other ungulate species, Mr Jesmer noted that the ability to learn about ‘green waves’ required spatial memory (encoding of spatial relationships) and attribute memory (encoding of locale-specific characteristics). Both spatial and attribute memory have been demonstrated across a diverse array of ungulate taxa including mule-deer, white-tailed deer, elk, caribou, zebra and others. The combination of cognitive capacity and life histories suggested it was likely that these taxa had social learning, even if there was not yet definitive evidence.

Mr Jesmer explained that ungulates have migratory populations, resident populations and partially migratory populations, with fitness benefits to each migratory strategy depending on environmental factors. The diversity of migratory cultures interacted with vital (birth and death) rates to maintain populations over time. He emphasized that phenotypic variation should be maintained to buffer populations from environmental variability. From a conservation perspective, any threat to the ability to track 'green waves' (e.g., reduced landscape connectivity, loss of migratory diversity) threatened both traditional knowledge (or culture) and population viability of species or populations.

Important first steps were to understand which of the 205 species of ungulates were migratory, including within the context of the CMS definition of migratory, and to identify which Parties to CMS were stewards of which species. An initial analysis was provided in the annex to the sub-group report, which showed that there were 81 species of migratory ungulates that occurred in countries that were party to CMS, 19 of which were listed on the CMS Appendices.

Discussion

Participants thanked the sub-group for its excellent work.

Participants welcomed opportunities for natural experiments during translocations of ungulates to understand more about what drives movement and migration. Mr Jesmer reported that a suite of metrics for the 'green wave' had been compiled – for example, the size of the 'green wave' (amplitude and distance travelled); however, these factors did not determine whether or not a population was migratory, indicating perception alone was not driving migratory behaviour, and instead social learning over generational time was required for populations to develop migratory behaviour.

Mr Jesmer noted that there was some evidence to suggest that some migratory movements were related to body condition. Although this had not been tested in the translocation study he had reported on, he noted that some animals were not able to track the 'green wave', so their body condition deteriorated and they subsequently died. In the context of the discussion on migration versus movement, Mr Jesmer was not aware of evidence linking social learning with more unpredictable movements (e.g. to escape storms).

Participants discussed whether some ungulates were effectively forced to migrate due to a lack of dietary flexibility and whether more flexible species could switch between food sources locally and adopt different dietary strategies, enabling a switch between migratory or resident behaviours. Mr Jesmer noted that there might be greater rates of migration in grazing species as compared with browsers. Browsers tended to migrate less, have smaller body sizes, and specialize more in particular leaves. He noted that in the context of unpredictable landscapes and nomadic species, migration could be risky and knowledge on where to go was needed.

Participants discussed parallels with other taxonomic groups, noting similarities between whales and ungulates, and with salmon in the US. There was ongoing work on the term 'migratory herd' for humpbacks, and on whether the migratory herd could be the 'unit to conserve'. Mr Jesmer recalled research that found baleen whales did track 'green waves'.

Participants asked whether culture and social learning in ungulates had been considered from a management perspective. Mr Jesmer noted that there has been some work on mapping migrations with ungulate populations in some places managed according to the attributes of

specific migratory segments (based on where they winter versus summer) rather than of the population as a whole.

Ms Aplin reflected that, in birds, there was discussion on collective migration (social facilitation of movement) versus cultural migration (transmission down family lines). Mr Jesmer responded that both collective and cultural migration might operate in ungulates, but there was some evidence that, post dispersal, offspring followed the same route as their parents, indicating vertical transmission of migration routes.

Mr Spina noted that in birds there were some examples where the non-migrating part of populations was increasing relative to the migrating components, most likely as a response to climate change. Mr Jesmer was aware of similar trends in ungulates, but suggested that instead, there were regular and, apparently, fluid changes in the proportion of a population migrating over time.

Participants discussed whether data from translocation of elephants would enable an analysis similar to that of the ungulates. Ms Bates noted that there had been substantial tracking of elephants in the wild revealing aspects such as how families behaved when elders died or how young orphans explored their landscape after release. However, these kind of data were not available from translocation projects and it would be very useful to have data from the large-scale translocations that were planned by African Parks. Several elephant specialists reported that when elephants were translocated, they attempted to find their way home and therefore translocations were often unsuccessful. Elephants spent decades learning about their social environments and moving across landscapes, and disrupting that was a concern. Ms Fishlock gave an example of where a whole population had been moved to Shimba Hills in Kenya and they all lost body condition and died. Larger-scale translocations might offer some buffer if the individuals were moved with other familiar animals, but, in general, the first response was to get back to where they came from.

Participants noted that other species exhibited similar behaviours. In translocations of large carnivores, for example, many would seek to return to their original habitat. Anchoring techniques could help to retain animals after a translocation but were often more successful in animals that had tight-knit social groups. Understanding socially learned mechanisms helped determine a successful outcome.

Mr Brown highlighted a study on salmonid populations which found that wild salmonids delayed migration if they were provided with supplementary food locally. A similar effect had been reported in ungulates and Mr Jesmer gave an example of a project to reduce cattle–elk conflict, which showed that the elk delayed their spring migration and returned earlier if supplementary food was available. The challenge of separating a physiological trigger from a social learning cue was noted. In addition, participants noted that, although the physiological cue might be the hunger stimulus, this would not account for the rise in ‘green wave’ surfing skill over time.

Participants discussed whether a difference in movements of a source population before the translocation might have influenced their post-translocation behaviour. Mr Jesmer reported that they knew all the source populations were migratory although they only had movement data on a couple of the source populations.

4.6. Mysticetes

Ellen Garland (University of St Andrews) thanked the mysticetes sub-group for its work and presented document UNEP/CMS/Culture-2-2/Doc.4.6.

Noting that mysticetes were huge animals that migrated thousands of kilometres, Ms Garland explained that controlled field or laboratory experiments were not possible or ethical. In addition, because they spent most of their time under water, observing their behaviours was challenging. For this reason, there was a reliance on indirect evidence using observed/inferred (correlative) patterns of behavioural expression to infer the presence of cultural processes and apply the precautionary principle. She noted that some patterns of behaviour were very convincing indicators of culture in whales.

Ms Garland reported that the sub-group looked at case studies, focusing on three behavioural domains: migration (including all movement); foraging (including the physical capture of prey or the sequencing of behaviours); and communication. The sub-group had reviewed the available evidence and discussed whether it could be applied to other mysticete species.

The case studies included: migratory traditions using examples of the North Atlantic Right Whales, Southern Right Whales and Blue Whale; foraging culture with examples of foraging tactics for Humpback Whales and foraging behaviours for Bryde's Whales; and vocal dialects and song culture in Humpback Whales and Bowhead Whales.

The sub-group had compiled a table for 15 species across four families for potential indicators of social learning and culture. The species were categorized by whether there was evidence, no evidence (i.e. it had been looked for but not found) or it was unknown (i.e. there was insufficient information to know either way). The direction of flow of social learning was also considered, including whether it was horizontal, vertical or maternal learning. The variation in behavioural traits within the populations and the variation between populations was reviewed along with the persistence of that variation. The sub-group also compiled a table of species, with recommendations for where social learning and culture could be incorporated into conservation decisions. The table also included the IUCN Red List categories to help indicate priority.

Ms Garland noted that very little was known about some species, and the sub-group's work was ongoing including liaison with experts for feedback.

Discussion

Participants thanked the sub-group for its excellent work.

Ms Garland clarified that site fidelity was when the animals went back to the same breeding ground and sometimes the same feeding grounds, year after year, and this was learned from their mother in their first migration. Mr Noad concurred that site fidelity was very strong for most baleen whales, with site fidelity to areas within a feeding site as well as more broadly. Although there were well defined migration routes, there was variation and some animals left the migration path. For example, in Australia and in New Caledonia, there were well-described populations with different routes and different song patterns, and it was assumed they were genetically distinct. However, animals from one population mixed with the other population, meaning the migrations were likely to be a mix of social learning (which determined basic migratory patterns), with some additional switching between groups.

Participants reflected on ‘non-conforming whales’ and whether the tendency of some animals to deviate from the ‘norm’ could be equivalent to improvisation or innovation and might be a quality that needs protecting. Populations might benefit from such individuals to help with adaption. Mr Simmonds reported on some work to look into animals that showed up in unexpected places – for example, recent appearances by walruses in various places in Europe. Ms Garland noted that it was unclear what motivated animals to choose a different feeding or breeding ground, and the capacity for this to happen might be part of a strategy to find suitable breeding grounds. Mr Brown highlighted social learning experiments involving fish in which animals had been trained to go to the same location, but every so often they deviated and explored. This could be a beneficial strategy, because learning something socially did not mean it was always the best option. The Chair noted that some populations (e.g. of killer whales) were very conservative to the point that resilience might be reduced.

Ms Bates noted that, in elephants, this kind of behaviour was usually seen in young males, followed by older males, with family groups being the most conservative and least willing to try new things. Mr Simmonds noted that of the small number of walruses observed out of habitat, three were young males and one was a young female. The Chair noted similarities with solitary sociable young male Bottlenose Dolphins and Ms Mesnick noted that for elephant seals, young males were most likely to show up in new places, followed by young females. These could be the prospectors that would start new colonies.

Recalling that, for birds, culture in one domain did not predict culture in another domain, Ms Aplin asked about whether that was also the case for whales. Ms Garland noted whales tended to have culture across several domains and many had a song culture. Humpback Whales appeared to have a song culture, site fidelity, and a migratory and a foraging culture. Song cultures in humpbacks were found in the corresponding breeding and feeding grounds for those animals. Mr Noad added that humpback song tended to be population-wide and changed each year. For example, in eastern Australia, in a population of 40,000 whales, all males would sing the same song in a given year, and then that song would change across the population the following year, and so on. Meanwhile, that song might emerge in another population the following year, and somewhere else again the year after. There was little doubt that song was learned socially, as the population all sang the same song, and then it changed consistently across the population. Research was ongoing on the level of cognitive ability required to learn that amount of song over such short a period of time. Ms Garland noted that humpback song is a well-known example of rapid learning of song, but much less is known about other baleen whales.

Ms Mesnick remarked on the importance of using whale song to help define the ‘units to conserve’. She commented that, like birds, the more pressure on time or space or mates, the more complex the song; i.e. the complexity of the song could help indicate selection pressures. For blue whales, there might be an intersection between natural selection and sexual selection, and as the whales recovered, what might at first have been a simple song, might be replaced by something more complex as males compete with other males. However, the idea of a population-wide song weakens that argument. Ms Garland highlighted an eight-year fellowship looking at how to reconcile song conformity with sexual selection, specifically for humpbacks. She agreed that Blue Whale song needed further investigation, noting the challenges around integrating whale song into defining populations.

Mr Whitehead drew a parallel between the ‘green wave’ surfing of ungulates and the foraging behaviour of Humpback Whales. Similar to ungulates, humpbacks moved hundreds of miles over the summer feeding on different food sources over time. He referred to a theory that whale populations that were heavily reduced by whaling lost important cultural information on movement

between different foraging places and at different times in their migration. Mr Garland noted that the Fijian population of humpback and the Southern Right Whales in New Zealand were both lost after whaling

Participants noted that vertical transmission of information was important given that all except 2 of the 15 species had maternally directed migration. For many species, sociality might not seem obvious, but there was a multi-year mother calf relationship where they learned routes and sites for breeding and feeding with high site fidelity.

Participants discussed the difficulty in monitoring large baleen whales, noting that communication over very long distances might not always be obvious. Songs could be heard across distances of tens of kilometres and, for lower frequency songs in clear waters, much further. In addition, there could be a chain of acoustic contacts, with songs passing from one singer to the next, and social structures over distances that we could not yet study.

4.7. Other Mammals

The Chair presented on behalf of Alex Thornton (University of Exeter) who had undertaken a review of the relevance to the work for this group.

'Other mammals' included all mammals listed in the CMS Appendices that had not been reviewed by other sub-groups (i.e. excluding primates, mysticetes, odontocetes, elephants and other ungulates). Drawing from Arbon and Thornton (in press),[4] the Chair explained that there were many behavioural domains in which there was evidence for social learning in 'other mammals', including foraging, communication and habitat use. A mix of experimental evidence, observational evidence and anecdotal evidence was available, although many 'other mammals' were relatively poorly represented in the literature for social learning.

The Chair gave a number of examples to demonstrate social learning in 'other mammals'. Anti-predator responses were socially learned in meerkats; and Belding's Ground Squirrel and Tamar Wallabies showed increased vigilance after exposure to a trained demonstrator. There was literature on social learning of foraging in bats; in Canid species there was some evidence that sub-adults joined hunting activities to learn; meerkats were more likely to try new food types if shown by an adult demonstrator; and for Felid species there was tentative observational evidence of social learning in cheetahs, with a need to undertake more research or further analyse existing data.

The Chair explained that when considering the definition of social learning and the sharing of social information, both the behaviour and the 'products' of the behaviour could be included. For example, meerkats dug in holes left by adult helpers; i.e. they were using 'the products' of conspecifics. In Bechstein's Bats, the location of new roost sites was communicated across the communities.

There was experimental and/or observational evidence of vocal learning across a diverse group of species, including Mole Rat, Egyptian Fruit Bat, Greater Spear-nosed Bat, Greater Sac-winged Bat, Grey Seal, Harbour Seal and Elephant Seal (anecdotal). Pinnipeds were often poorly represented in social learning studies, although this did not mean they do not have social learning.

[4] *Social learning and culture in mammals*. Josh J. Arbon, Alex Thornton (In press)

Many of these conclusions were based on older studies, which could be looked at again through a social learning lens.

The Chair explained that social learning could be used to inform responses to human-wildlife interactions and reintroductions/translocations – e.g. training to recognize predators before reintroduction improved survival rates. She added that studies of innovative species such as racoon and foxes could provide useful information on social processes in urban environments, even if these species were not themselves a conservation concern.

There were three groups of 'other mammals' in CMS Appendix I of particular interest, namely sirenia (Dugongs and manatees), chiroptera (bats), and carnivora (mostly canids and cats). For sirenians, very little was known on social learning, potentially because they were challenging to study, but there might be other reasons. There was a lot of evidence for bats that could potentially be used to inform the work of the CMS and other conservation action. The Chair recommended that bat experts be invited to join the group's conversations on social learning. Other than the cheetah, there were no published lines of evidence on social learning for the other carnivores, and it would be useful to understand more.

The Chair indicated that phylogenetic inference could play an important role when considering such a broad group. The plausibility of phylogenetic inference (i.e., gaining insights on social learning from related taxa) was likely to vary, and she suggested that it would be useful to develop guidelines on phylogenetic inference. She proposed forming a sub-group to try to formulate some basic questions around phylogenetic inference, and put it out to the group to discuss.

The Chair summarized the recommendations from the sub-group, which were broad given that 'other mammals' was such a broad group with a diverse set of issues:

- Provide guidance on phylogenetic inference
- Collect/compile data from other sensory sources – for example, the role of olfactory communication
- Address data gaps and encourage collaborations, including through inviting bat experts

Discussion

Participants thanked the sub-group for its excellent work.

Participants discussed the metrics and information needed to develop lines of evidence that demonstrated social learning and culture, and that could inform phylogenetic comparisons. A starting point was whether or not the animal had social learning; the next step, from a conservation perspective, was whether or not the social learning said something about a population unit that needed conservation action – i.e. what would be the practical application of that social learning.

It was suggested that a scale of evidence, with different degrees of certainty, might be useful, particularly when it was to inform conservation management. As long as the evidence was plausible, and particularly given how many poorly understood species there were, this could be useful for informing management. It was also noted that phylogenetic inference would not be feasible for many taxa (e.g. fishes), given the gaps in our knowledge.

There was discussion on whether a precautionary approach should be taken, and whether it was more precautionary to assume animals did have social learning or to assume that they did not. For example, if the success of a conservation action depended on social learning, but there was

no evidence of social learning in that species, then the action might be detrimental to the survival of the animals (e.g. for reintroductions). Conversely, when a social group was separated during a translocation and that lead to a less successful outcome than when social groups were kept together, it could be hard to state with certainty if that was due to culture or social learning. Nonetheless, documenting that social complexity is an issue for the species is an important line of evidence to inform the management of the species.

The challenge of identifying the threshold for deciding on whether to be precautionary was highlighted. Some participants felt that the precautionary principle would mainly apply to the identification of a unit – i.e. conservation of a distinct behaviour regardless of whether it was genetic or culturally transmitted. Genetics were easier to test for, although it was harder to recover genetic diversity if lost compared to behavioural diversity. Participants also discussed whether it could be inferred that behaviour was socially learned if genetic or ecological causation were excluded.

Participants discussed the importance of other sensory modalities for communication. Chemical signalling and communication was well established in mammals, and it might be important for fish, amphibians and aquatic reptiles. Electrical communication in fishes was also highlighted as an area to consider.

Participants suggested bat experts that could be approached, including one of the two CMS COP-appointed Councillors for Terrestrial Mammals, a bat ecologist in Israel and a researcher who had worked on flying foxes in Australia.

Social learning in invertebrates was discussed, noting that there was one invertebrate (the monarch butterfly) listed by CMS. Bees learned socially, although they were not migratory. Cephalopods might be another example, although very little was known about this.

Pinnipeds were discussed as a poorly understood group, noting that it was challenging to investigate their behaviour underwater. Pinnipeds did not generally have a long period of parental care, although longer periods of interaction are seen in otariids. There had been work on vocalizations and dialects, with the potential to analyse tracking data and older data from a social learning perspective. It was proposed that pinniped experts could be invited to provide input.

5. Work of Other Sub-Groups (Primates, Odontocetes, Rapid Assessment)

Martha Robbins (Max Planck Institute for Evolutionary Anthropology), who had led the primates sub-group, was in the field and had sent apologies. Although there were only two primates listed by CMS (Chimpanzees and Gorillas), the Chair suggested that further work on primates more broadly could be useful, especially with respect to reintroductions. She noted the extensive experimental evidence on social learning in primates which offered a rich stream of evidence and the foundation for a lot of what the group was considering. Participants noted that species with a long maternal dependency were likely to have that dependency period because of the importance of social learning. It would be valuable to look further at primates as long-lived species in which information transfer might be intergenerational (i.e. not just between parent and offspring, but also grandparents and offspring). In addition, other primates could be proposed for CMS listing if they met the criteria. Many populations were transboundary movers, even if not migratory in the stricter sense.

Participants noted that many primates were rescued and then reintroduced to the wild. The IUCN reintroduction guidelines required that reintroduction should be into a population that had been extirpated and the cause of that extirpation had been removed. However, participants noted that the upbringing experienced by an animal in a sanctuary was very different to the upbringing experienced in the wild, and learned behaviours might not be appropriate for survival in the wild. In that context, the discussion about culture would become critical and determined whether release to the wild would be successful. When releasing animals back into the wild where there was already a population, there were also concerns about the impact of introducing a new culture to any conspecifics. There were many useful lessons to learn from primate reintroductions – e.g. the Golden Lion Tamarind project of the National Zoo in Washington. Participants proposed bringing this information together, some of which was anecdotal and some in the grey literature, to help better understand these experiences. In addition, there had been a number of reviews recently of pre-release training across taxonomic groups, especially anti-predator training.

The sub-group for Odontocetes was also unable to provide their report to this meeting as many of the team involved had been at sea. Quite a few Odontocetes were listed in the CMS Appendices, and while there was a lot of information available, it was time-consuming to compile, with a suggestion that it could make a good graduate student project. The group recommended that the paper on Odontocetes from the previous workshop was still useful as a reference, noting that further work and prioritization was needed going forward. In addition, the Sperm Whale Concerted Action provided a useful example.

Participants discussed whether proposals to list additional species of Odontocetes in the CMS Appendices were expected and, if so, whether a social learning component could be introduced. Ms Frisch-Nwakanma reminded the group that listing proposals to be considered by COP14 needed to be submitted by CMS Parties, with a deadline of 26 May. A consultation with Range States should be undertaken for all listing proposals. She suggested that if the Expert Group had suggestions on species to prioritize, these could be brought to the Scientific Council to enable further discussion in the next intersessional period.

The Chair noted that, for Rapid Assessments, it was recommended that a table of Rapid Assessment Techniques be compiled, as it was a key part of the COP mandate for the group (see section 7.3).

6. Synthesis

Mr Simmonds led a discussion to review the key issues raised during the workshop so far.

Discussions on the “unit to conserve” had taken place throughout the workshop, including how to identify and define such a unit, and the implications of whether a unit was heritable or shaped by social learning. It was noted that many animals were likely to use social learning at some point in their lives, but that this was quite a low threshold on which to decide to take action. Some animals had unique behaviours such as migratory herds which could be used to inform the “unit to conserve”.

Some participants suggested that a next step would be to develop a definition of a ‘culturally significant unit’. Other participants felt that introducing the concept of a culturally significant “unit to conserve” added a layer of complexity to management and would be challenging for cases where the evidence of culture was not clear cut. Instead, it was suggested that a simpler approach should be adopted – one that was more straightforward for policymakers and managers. For

example, social learning and culture could be integrated into the criteria for existing management units (e.g. evolutionary significant unit or distinct population segment).

Participants discussed the relevance of animal culture to conservation, noting a mix of fitness impacts (e.g. reproduction, dispersal, etc.) and the need to maintain cultural processes which might provide flexibility for species to adapt to a changing environment. The challenge of incorporating conservation of cultural diversity and capacity for culture was highlighted. It was suggested that managers might be more inclined to factor culture into conservation management when the fitness or ecological function of a population was impacted. For example, using social learning and culture to inform translocations might offer a potential route into management discussions. A fairly high threshold for lines of evidence might be needed in addition to guidance on assumptions when substantial evidence was not available. The importance of recognizing the role of individuals in socially complex species was highlighted, with particular roles played by older females, dominant males, etc. Many current demographic models did not capture the complexity of social structure.

Participants discussed the CMS listing criteria for Appendix I and II and opportunities for incorporating social learning and culture into these criteria. Although a species approach was generally taken in the Appendices, some listings were at the subspecies or population level. This had often been for political reasons; nonetheless, it might be appropriate to list populations or subspecies separately when they had different migratory paths (regardless of whether this was genetically driven or cultural). More broadly, culture could be incorporated as a line of evidence in CMS processes and definitions.

Work undertaken through the CMS Agreements for cetaceans (ASCOBANS and ACCOBAMS), and for birds through AEWA was noted. These Agreements were not restricted to CMS Parties; non-Parties could join the Agreements providing opportunities for Range State cooperation. Opportunities for conservation and cooperation through CMS Concerted Actions were also highlighted as a way to focus action on a particular species and as a place to integrate social learning.

Participants discussed how to prioritize next steps. On the one hand, it would be valuable to develop knowledge on poorly known taxa and to develop guidance on phylogenetic approaches to help fill gaps in knowledge. On the other hand, there were many taxa that were of critical conservation concern and for which action was urgently needed. The importance of finding ways to operationalize solutions was highlighted. The group agreed that all of these should be highlighted as priorities, and funders should be encouraged to support them.

Opportunities for collaboration with IUCN were discussed extensively. Mizuki Murai (IUCN) welcomed the work undertaken by CMS on animal culture. She explained that in a recent restructure of the IUCN Secretariat, the Heritage, Culture and Youth Team had been established, presenting an opportunity to develop work on animal culture building on the ongoing work on human culture. For IUCN, the link to conservation was a key consideration, and while this link was evident at the CMS workshop, it was often not reflected in wider conversations on conservation. She reported on discussions with the Arcus Foundation on the issue of culture and conservation. There was also an opportunity to work with the World Heritage Convention on animal culture. Ms Murai was keen to explore the issue with IUCN commissions, especially the Species Survival Commission (SSC), as well as connecting with indigenous peoples.

The Chair reported on initial discussions on a potential side event at the forthcoming CMS COP, run jointly with IUCN. One option might be to focus on a species of relevance to the host

government (Uzbekistan). Dao Nguyen (IUCN) added that the Chair of the SSC would be attending the CMS COP.

Ms Nguyen said that, together with CMS colleagues, there had been discussions on establishing a Task Force on culture in the IUCN SSC. She welcomed the involvement of the SSC network, noting the range of opportunities for collaboration including with the numerous specialist taxonomic groups, the Translocation Specialist Group, the Conservation Planning Specialist Group and in the red listing process. Ms Nguyen said that she would update the forthcoming SSC Steering Group on the work of the Expert Group and suggested that the workshop results be shared within the SSC. This could include, among other things, a call for experts and case studies. The Chair offered to discuss the most effective way to share the outputs of the workshop with the Chair of the SSC.

Participants remarked that social behaviour and culture were of relevance to the Red List, both in terms of species declines and because the recovery of highly social species could take longer (several generations). In addition, the recent IUCN conference on human-wildlife conflict offered opportunity for further dialogue.

Participants agreed that the work of the Expert Group on the Conservation Implications of Animal Culture and Social Complexity should continue. With its focus on migratory species, the CMS Expert Group could feed into an IUCN Task Force, which would focus on the issue more broadly.

7. Reports of the Cross-cutting Sub-Groups

Each of the cross-cutting sub-groups gave a presentation followed by discussion.

7.1. Human-wildlife Interactions (HWI)

Ms Mesnick introduced document UNEP/CMS/Culture-2-2/Doc.7.1 on behalf of the sub-group leaders. She reported that HWI often referred to issues such as crop raiding (e.g., elephants eating corn) or depredation of fish in fisheries (e.g., marine mammals taking fish from long lines). She explained that these and many other complex interactions between animal and human culture were central to the work and recommendations of the sub-group.

She recalled that the report of the 2018 CMS Workshop on Animal Culture called HWI “Worlds that Collide” and participants in that workshop had included recommendations on improving communication, using animal social learning to facilitate better conservation outcomes, and to move beyond counting numbers when assessing the status of highly social species. She presented a simplified graphic of a social learning curve in humans and showed how it could also be used to inform behaviour of social learning animals.

Ms Mesnick asked for input on whether the term ‘human-wildlife conflict’ (HWC), ‘human-wildlife co-existence’ or ‘human-wildlife interactions’ (HWI) should be used in the name of the sub-group, noting that each had a slightly different meaning and connotation. She noted that IUCN used the term ‘human-wildlife conflict and co-existence’ whereas the sub-group preferred ‘interactions’ as it was a neutral term that included positive interactions as well as conflict and co-existence.

Ms Mesnick outlined the opportunities to address human-wildlife interactions for CMS, indicating that the group was in a unique position to look at human and animal social learning and culture.

This would be increasingly important in the face of climate change, public health crises and biodiversity loss, and there were likely to be types of human-wildlife interactions that had not been seen before. She noted that human dimensions were central to the approach, which had to make use of participatory approaches and should include local and indigenous knowledge. The HWI work also provided opportunities for cross-species comparisons.

To help demonstrate how understanding animal behaviour could help manage human-wildlife interactions, Ms Mesnick noted that the sound of the bees, which elephants tried to avoid, was used to keep elephants out of areas where they were not wanted. Other examples included using bee alarm pheromones or broadcasts of females in oestrus.

Ms Mesnick presented the following recommendations of the sub-group, noting that at this stage these mostly related to human-wildlife conflict:

- Recognize the diversity of language used to describe human-wildlife interactions
- Collate a HWC database that identifies animal behaviours and mitigation measures across species
- Integrate sensory information to better understand and mitigate HWC
- Explore linkages between climate change and HWC
- Investigate integration of behavioural change theory into HWC

The sub-group proposed a workshop on HWI and animal culture/social complexity, potentially co-convened by CMS and IUCN, which should involve a broad range of participants including indigenous groups and experts in fields beyond biology (human rights, justice, sociology, economics, etc.). The scope of the workshop could be based on species identified by the taxonomic sub-groups that interact with humans, and the workshop would develop case studies and identify cultural behaviours and mitigation methods that could inform conservation efforts. Several opportunities for collaboration were identified following on from the International Conference on Human-Wildlife Conflict and Co-existence (30 March–1 April 2023) hosted by the IUCN Species Survival Commission (SSC) Human-Wildlife Conflict & Coexistence Specialist Group along with FAO and UNDP.

Discussion

Participants thanked the sub-group for its excellent work.

Participants discussed terminology and agreed that, generally, ‘human-wildlife interactions’ should be used. They noted that the word ‘conflict’ implied a negative interaction, whereas human-wildlife interactions were more complex and wide-ranging than that, and the negative aspect could be human- or wildlife-driven.

Participants acknowledged the complexity of the topic, noting that human-wildlife interactions could evolve over time, as animals learned to overcome deterrents and as humans changed their patterns (e.g. changing planting areas). The current trend in conservation was to find ways for humans and animals to coexist as peacefully as possible, rather than separate them in time and space.

Mr Williams drew attention to other work under the CMS of potential relevance. This included a forthcoming review of the impact of climate change on migratory species undertaken under the leadership of Colin Galbraith, the COP-appointed Councillor for Climate Change. Similarly, CMS

work on ecotourism was ongoing, noting that the impacts of tourism could be direct or indirect, could have varying levels of intensity, and might be positive, negative or neutral.

The group discussed how to identify problem interactions early enough to avoid escalation. Ms Mesnick noted that management of human-wildlife interactions tended to start when the problem was already firmly established. She suggested that lessons could be learned from other species or situations, highlighting an example in Alaska where there had been a change to the temporal duration of the fisheries so that they overlapped with periods that Sperm Whales were present in the area, resulting in Sperm Whales depredating catch. Initial interactions were observed, but no early action was taken. If the movements of predators such as Sperm Whales had been considered when the fishery was implementing the changes, and action had been taken earlier, the problem could have been avoided. The group noted that this could be a useful case study. Ms Brakes suggested that this issue could be considered as part of discussions on Rapid Assessment Techniques.

Mr Brown drew attention to ongoing work on sharks in the context of cage diving, looking into how quickly sharks make associations between the sound of boats and smell of the food in the water, etc., and how much food is eaten and how frequently, before they become addicted to these food sources. He explained that sharks and rays learn very quickly; even if they were only fed for three or four weeks, it took four to five weeks or more before they stopped coming back day after day at the same time and to the same place once the feeding had ceased. The problem was accelerated because the animals learned very quickly, learned from each other and retained information for a long time. There was a need to understand the early warning signs and stages of the learning process to manage. He added that bait depredation was a problem associated with sharks, with many case studies available.

Participants discussed ways to document social learning and the many good examples. In addition, the group noted the opportunity of using human-wildlife interactions as a way of capturing the public's imagination. Ms Mesnick noted that the use of the social learning curve for Sperm Whales helped to demonstrate that the temporal and spatial patterns showed social learning. Other participants noted that, while crop raiding by elephants or net depredation by whales could cause challenges that were difficult to manage, nonetheless the intelligence of these animals could be recognized and was compelling. The example of the nut-cracking chimpanzee could be used to demonstrate culture in animals and help engagement in conservation more generally. Storytelling to help people see how animals are learning from each other could help promote human-wildlife coexistence. Other examples where this might be helpful included the lobster fishery sector in the US and 'out of habitat' walruses in Europe. Positive stories were highlighted such as the African honey hunters that go out and work with birds to find honey.

Ms Mesnick concluded by noting the scale of the issue. She emphasized the importance of bringing additional expertise to the proposed workshop, including local knowledge.

7.2. Reintroductions / Translocations

Alison Greggor (San Diego Zoo Wildlife Alliance), co-lead with Thomas Mueller (Senckenberg Biodiversity and Climate Research Centre) of the reintroductions/translocations sub-group, presented document UNEP/CMS/Culture-2-2/Doc.7.2. She thanked all those who had provided input to the document. She highlighted the relevance of the reintroductions and translocations work to many of the taxonomic groups at the workshop.

She explained that conservation translocation was defined by IUCN as “the deliberate movement of organisms from one site for release in another”. It included wild-to-wild and human-care-to-wild movements, and might be done for a number of reasons including population reinforcement or supplementation, reintroduction, assisted colonization or ecological replacement.

As a first step, the sub-group revisited the recommendations from the workshop in 2018, which had focused discussions on re-introductions and had developed guidance and case studies. To build on the previous work, the sub-group ran an online survey to understand the uniqueness of culture, barriers to the use of culture as a tool, and to develop examples.

Ms Greggor presented several examples that the sub-group had developed to explore the issue. In instances where the whooping crane had lost migratory knowledge, it had been possible to train them in novel migration strategies (short stopping) and introduce them to new habitats (agricultural lands), helping reintroduced birds to expand their range. Cranes trained by parents could be very site specific, but those trained by humans were able to populate more areas and had a wider spread in their potential habitat. In ungulates, loss of cultural knowledge on ‘green wave’ surfing had been shown in translocations, including wild-to-wild translocations; it could take decades for translocated populations to rebuild cultural knowledge on local foraging and begin migrating again. Ms Greggor stated there was a likely link to culture in fish (salmonids), noting that social learning was used to teach anti-predator and foraging behaviour in broader pre-release training. Indeed, social learning was commonly used as a tool in hatchery rearing, although this might not be full-fledged culture.

Ms Greggor emphasized the importance of understanding the impacts of ruptures to culture and summarized the potential impacts if social learning was disrupted in a translocation context. This included impacts on migratory, foraging and anti-predator behaviour with direct fitness consequences, as well as the potential for accelerating human-wildlife conflict. Sometimes released animals might not have the suite of behaviours needed (e.g. the ‘wrong’ vocal dialect), which could have fitness impacts and inadvertently propagate detrimental behaviours (e.g. interactions with humans). She also noted potential benefits – e.g. if practitioners could seed or help spread a fitness-enhancing novel behaviour. She noted that the prevalence of issues in translocations was highly under-reported, which was a barrier to obtaining evidence.

There were many stages of the translocation cycle where culture might play a role (e.g. the goal of the translocation, communication). The sub-group had focused on the implementation of translocations including how and when to explicitly monitor or manipulate culture. The sub-group had reviewed the common tactics for translocation, which included animal selection and preconditioning, through to environmental release design and post-release environmental management. The sub-group found that animal culture was relevant in 26 of 30 common tactics and strategies, with the analysis provided in its report.

Ms Greggor summarized the challenges with using culture to support translocations. These included lack of experimental data or evidence; perceived irrelevance; lack of understanding of where small changes to translocation protocols might help (e.g. time of year, gender balance); the scale and level of precision required in interventions; and rushed timelines and limited resources. She noted that defining translocation success around ‘culture’ may be ambiguous and questioned the importance of calling it culture.

In conclusion, many translocations likely face difficulties due to ruptures in culture. While culture could be monitored or manipulated with almost any translocation strategy and tactic, substantial barriers to use currently remain.

Discussion

Participants thanked the sub-group for its excellent work.

Participants discussed the IUCN Guidelines on Translocations. Ms Greggor noted that there were a couple of references to social behaviour or survival-relevant behaviour in the guidelines, but these were not framed as culture. Research on behaviour had advanced significantly since the guidelines were published in 2013. Ms Murai explained that development of the IUCN Translocations Guidelines was led by the IUCN Commission. She recognized the value of updating older guidance documents to incorporate advances in knowledge, also noting funding considerations. In addition, Ms Murai expected that the SSC Chair would reach out to the SSC to get feedback on the value of looking at animal culture, which would be a good opportunity for members of the SSC to submit their views. She drew attention to the World Conservation Congress in 2025 as a key opportunity to put forward IUCN resolutions. Ms Mesnick remarked that in a recent IUCN publication on human-wildlife interactions, social learning was mentioned only once. The group agreed that it would be useful to collaborate with IUCN, and strongly encouraged consideration of culture in any updates to IUCN guidelines, which could be integrated into the recommendations and a proposed Decision for the CMS COP.

Ms Wilkinson reflected on re-wilding opportunities and the use of ecological replacements. Tortoises were often used in this context and she noted that ecological factors such as what animals ate, whether they could digest it, and whether they would spit out the big seeds were generally considered. However, cognitive aspects were often not taken into account, such as how animals learned and how they shared information. There had been work to look at how cognitive function has an impact on some ecological processes such as seed dispersal, but the issue has not been discussed by the sub-group. Ms Greggor suggested that if those cognitive processes led to different patterns of ecological impact, this would be a compelling line of evidence for conservation managers.

Participants discussed the context of introductions/translocations, with differences in wild-to-wild release as compared to captive-to-wild release. They asked whether social learning might atrophy in a captive environment because certain skills were not needed, highlighting the importance of nurturing capacity for social learning. Participants agreed the domains for social learning should be used to inform captive rearing including around migration, upbringing, foraging, etc. For example, in the whooping crane releases, the seeding of the migratory route had been successful, but the animals had difficulty rearing their young, indicating the need to provide information on a suite of domains.

Ms Aplin noted that selection processes might occur quickly in captivity. For example, the wing shape of captive-reared Orange-bellied Parrots changed within just a few generations so that the migration of these captive-reared birds was less successful compared to wild-born ones. It was possible that cognition might change in captivity in the same way. Mr Brown drew attention to research on domestication syndromes in fishes from hatcheries. The hatchery environment had an impact on the brains and behaviour of fishes over short periods of time, though it could also be rescued relatively rapidly. He was not aware of examples where social learning was used as an aspect of cognition in these studies.

Participants discussed the role of interspecies relationships in translocations. Ms Aplin noted that in mixed species flocks of birds, individuals from one species might rely on other species for information on predators, an idea which has been well explored for birds. Ms Greggor noted that

her research group had been considering seeding conspecific interactions, but this idea was still a fairly novel concept in translocations.

Participants agreed that the role of social learning and culture in improving the success of reintroductions and translocation offered an opportunity for promoting its inclusion. Given the cost of undertaking translocations, anything that increased success was likely to be of interest to those involved.

7.3. Rapid Assessment

The Chair explained that CMS Parties needed specific advice on how to use information on social learning and culture in conservation decision-making and practice. Parties had limited time and resources, so the concept of Rapid Assessment Techniques could offer a way to provide information about conservation practice in relatively short time frames.

Mr Simmonds chaired the session and explained that the intention was to develop suggestions for rapid assessment tools and emerging technologies that could provide direct and indirect evidence of social transmission, migration routes and social networks, as well as anthropogenic effects on behaviour, to inform conservation and management. He highlighted the recommendations from the 2018 workshop, which listed a range of potential tools and techniques, including the use of acoustics and acoustic monitoring; biologging, movement and activity tracking; genetic and genomic techniques; stable isotopes, fatty acids and other biochemical markers; and proxies of culture that can be assessed more easily.

Additional suggestions made by participants included cataloguing and monitoring cultural variants; inclusion of data that may be evidence of socially learned behaviours (e.g. nut-cracking sites for chimpanzees, evidence of elephant mining) which is collected when tracking populations; documentation of disruption to behaviour due to anthropogenic disturbance; and population modelling (e.g. vulnerability assessment based on loss of traits). Migration atlases were available for many taxonomic groups and these could provide the basis for a phylogenetic approach for species whose migration had already been mapped.

Participants discussed the practical application of these tools and techniques. Noting the focus on species that were listed on the CMS Appendices, some participants suggested that a starting point would be to identify the listed species for which there was knowledge of social learning and cultural transmission. However, in many groups, most species use social learning, therefore the key factor was how that impacted management (i.e. what should be done differently). Participants noted that identifying which species learn socially was a first step, but it did not explain what needed to be done.

Several participants questioned whether these tools and techniques were rapid. Many could take years and some required equipment and specialized expertise. Instead, helping managers to look for something that seemed amiss or was unusual might be the first step. For example different songs in different but neighbouring areas could be a sign of vocal dialects, or signs of tool use in a population could be a sign of a behaviour of interest. Developing guidance on the potential signs or lines of evidence for social learning could be useful as a means to identify species for which social learning and culture should be taken into account in management. Again, the challenge of how to take the information into account was also raised – i.e. what needed to be done from a management perspective.

Participants noted the challenges of identifying culture in a population. Novel behaviours were easier to detect, but culture was harder to identify where social learning and culture learning was well established. Opportunities could arise to explore the implications of social learning in management – for example, when a translocation did not succeed or where a problematic behaviour spread in instances of human-wildlife conflict. Case studies could be useful to illustrate instances where it was known or suspected that social learning and culture had played a role in management.

Participants emphasized that traditional knowledge of local and indigenous communities could play a key role in identifying social learning and help to inform management, and should be used as a starting point, where local knowledge exists.

The role of citizen science was highlighted, with some participants suggesting it could help with rapid data collection or data collection over large landscapes or as a way of detecting unusual patterns. Others sounded a note of caution with respect to citizen science as a means to report innovations, which can be both time-consuming and unproductive.

Participants discussed the use of the Rapid Assessment Tools to support the management of CMS-listed species. For example, the related CMS Concerted Actions applying these techniques might highlight issues of interest to inform the management of these species. CMS also had a suite of ongoing work on connectivity and this work could potentially help with understanding connectivity between species and populations. In addition, use of these tools could generate information to support arguments for bringing forward new proposals for listing in the CMS Appendices.

Participants discussed developing a decision tree that could be used to help decide on a management approach. This could include identifying social learning and culture or potential signs of social learning and culture (i.e. where something is different); the lines of evidence that could be used; and consideration of the conservation implications if that social learning is lost. The challenge of working with different taxa and in different ecosystems was noted. The Expert Group agreed that further work was needed to develop this approach.

8. Integrating Cross-cutting Issues: HWI and Reintroductions

Participants agreed that, to a large degree, they had already explored the issues under this agenda item, and wished to consider the reports of the remaining sub-groups first before developing recommendations during discussion of agenda item 12.

9. Review of Concerted Action Sub-Group Reports

9.1. Eastern Tropical Pacific Sperm Whales

Ms Mesnick introduced document UNEP/CMS/Culture-2-2/Doc.9.1 submitted by the sub-group on the Concerted Action for Sperm Whales (*Physeter macrocephalus*) of the Eastern Tropical Pacific (etP) and thanked all those that had contributed to the report.

As background, Ms Mesnick noted that the etP Sperm Whale population is structured around cultural clans with distinct vocal and social behaviours, distributions, movement patterns and

foraging strategies. These cultural clans were directly targeted by whalers throughout the etP between the 18th and 21st centuries, with a slow population recovery.

The 2017 Concerted Action for etP Sperm Whales, which was renewed in 2020, had the following aims:

- To create collaboration across Range States for data gathering within their jurisdictional waters
- To determine whether and how clans should be conserved separately according to their differing responses to environmental and anthropogenic pressures

Ms Mesnick gave an update on progress to date, which included:

- *Creation of a collaborative network across Range States*
  In November 2022, the first Cachalotes del Pacífico virtual workshop was held, with 35 participants sharing knowledge and tools for Sperm Whale research, including discussion on ways to standardize methodologies. The meeting led to the establishment of the Cachalotes del Pacífico Network, a collaborative network dedicated to studying etP Sperm Whales, and promoting and consolidating research and conservation efforts in the region.

- *Updates on the status of Sperm Whale clans in the etP*
  Recent research suggested at least seven clans inhabit the Pacific Ocean, identified by their acoustic communication. All seven clans inhabited the etP, making it the most culturally diverse Sperm Whale region currently known in the Pacific Ocean. The clans were nomadic and could be sympatric, with some found throughout the Pacific and some found only in certain areas. The number and identity of clans in the etP varied by year, and in any given year, multiple clans were present, though the composition of these could change. A social structure was apparent, with acoustic clans comprised of a number of groups of Sperm Whales, which, in turn, were made up of animals that were long-term associates.

- *Quantifying regional threats*
  Documented potential threats to etP Sperm Whales include: entanglement with fishing gear; vessel collisions; marine pollution; oceanographic changes affecting the distribution of prey; and direct catches/kills. The overall population decreased by an estimated 4 per cent a year between 1986 and 2000, thought to be a legacy of whaling in which large males were targeted for removal, reducing fecundity and disrupting social structures. It was now likely to be stable or slowly increasing.

- *An environmental niche model for Sperm Whales in the etP*
  The development of an environmental niche model was crucial for understanding the potential distribution of the species and for predicting changes in distribution based on environmental and temporal data. It would support management in the context of changing oceans.

Progress was made towards the aims of the Concerted Action, but Ms Mesnick noted that many questions remained, and that there were several ongoing challenges. There were only two long-term monitoring projects in the etP; otherwise, data were only collected opportunistically through collaborations with whale-watching organizations. In addition, there was a critical lack of financial

and logistical support in most Range States for the intensive fieldwork necessary to document and characterize Sperm Whales at a clan level.

The recommendations of the sub-group included to :

- Extend the Concerted Action
- Continue to establish and build collaboration mechanisms that direct funds towards research in low-income Range States
- Mobilize science and community-based conservation outreach with remote, coastal communities and peoples of the etP to foster capacity-building and raise awareness to champion Sperm Whale conservation
- Expand efforts to better understand the distribution, abundance and type of groups in the region as a basis for mitigating current threats
- Fund long-term photo-identification monitoring
- Fund and deploy autonomous hydrophone recorders to collect key data on clans in the etP

Discussion

Participants thanked Ms Mesnick, along with Ana Eguiguren (Dalhousie University) who drafted the sub-group report, and all those that contributed.

Ms Isabel Avila (University of Hanover/ Sperm Whale Action Plan Expert Group) emphasized that the etP was one of the most culturally diverse Sperm Whale areas. Most of the research had been undertaken in and near the Galapagos archipelago, with predominantly opportunistic data available for other parts of the region, such as Colombia or Peru. More research was needed in these areas. She noted that many threats to the species in the etP were likely under-reported – e.g. many collisions and entanglements were probably not documented. She welcomed recent work to collect genetic data in Colombia.

Participants noted that survey work was logistically difficult and expensive. In response to a question on why the population in the Galapagos was better studied, Ms Mesnick noted that there had been long-term work in this area by Hal Whitehead and his team. Mr Whitehead added that the population had several interesting characteristics. It was a productive region with a relatively high Sperm Whale density; however, it had also been subject to particularly intense whaling up until 1982. Large males had almost been wiped out from the region, with females also heavily impacted, resulting in disruption to social structure and cohesion. Research had been ongoing since 1985, so there were valuable long-term data on the population since soon after the end of whaling. He emphasized the importance of long-term data sets more generally which could help our understanding of how cultures changed. He reported that work to digitize these etP data was under way. From a CMS perspective, the animals were moving back and forth across national boundaries, mostly between Parties to CMS.

Participants asked whether competition with fisheries was a threat. Mr Whitehead noted that there was competition with fisheries in this region and Ms Mesnick recalled previous discussions on human-wildlife interactions (section 7.1), noting that Sperm Whales around the world had learned to depredate nets. Ms Avila noted that there were reported interactions with fisheries in Chile in the Patagonian toothfish longline fisheries.

Participants asked whether individuals changed clan or spoke more than one dialect. Mr Whitehead explained that one possible case was known of an individual changing clan, but it was not well understood. A previous study on the genetics of clans indicated that the females almost never switch clans. Clans seemed to avoid each other even when they were in the same area.

Participants discussed the interaction between culture, threats and conservation. Ms Mesnick explained that one goal of the Concerted Action was to identify differences between clans, noting that some clans seem to be able to adapt better to environmental change than others, meaning that in the face of climate change the survival of groups might differ. While conservation work was mainly done on a geographic basis, the etP Sperm Whales provided an example of where an alternative “unit to conserve” might be needed, focused on these culturally significant units.

9.2. Chimpanzees

Erin Wessling (Harvard University) and Crickette Sanz (Washington University) introduced document UNEP/CMS/Culture-2-2/Doc.9.2 submitted by the sub-group on the Concerted Action for Nut-Cracking Chimpanzees. They thanked all involved in the work.

They gave an update on the affiliations and relationships in IUCN, noting that over 200 individuals were involved in IUCN Primate Specialist Group, and highlighted several relevant working groups which serve as forums for discussion and information exchange, and which work on guidelines for best practices and action plans.

Despite its wide distribution, there was only one species of chimpanzee, which was listed in CMS Appendix I and II. The CMS Concerted Action, adopted in 2020, covered the nut-cracking populations of the western chimpanzee. There was strong evidence that nut-cracking in chimpanzees was a socially learned behaviour. The Concerted Action recognized that conservation targeting animal cultures was a new concept. It might have wide application for many species and therefore the Concerted Action was intended to serve as a pilot project to test the effectiveness of the idea. Much of the range of the western chimpanzee included countries that were Parties to CMS.

The activities and expected outcomes of the Concerted Action included: planning meeting(s) to determine next steps; further data collection on nut cracking and, hopefully, behavioural diversity; public engagement with science and conservation; and direct conservation actions.

The Western Chimpanzee was listed as ‘Critically Endangered’ in the IUCN Red List. The population was estimated to have declined by 80 per cent between 1990 and 2014 and has been extirpated in 3 of the 11 countries where it ranged historically. Threats included subsistence agriculture, poaching, industrial and artisanal mining, disease, human-chimpanzee interactions, industrial agriculture and infrastructure development.

Ms Wessling and Ms Sanz gave an update on the Western Chimpanzee Action Plan (IUCN, 2020) which has been recently updated through a process involving a range of stakeholders. Reflecting the range of chimpanzee habitats, the new Action Plan had conservation targets that included: chimpanzees in large, connected forests; chimpanzees in small, fragmented forests; chimpanzees in savanna mosaics; chimpanzees in agricultural mosaics; and cultural diversity of chimpanzees. Strategies with particular relevance to cultural diversity included filling research and data gaps and awareness-raising.

A detailed update was provided on each of the following tasks relevant to the Concerted Action:

- *Define conservation targets of the use of culture in chimpanzee conservation*
  The Working Group on Chimpanzee Cultures reached consensus that behavioural diversity should be operationalized as a conservation target to be prioritized alongside, and complementary to, traditional targets. Nut-cracking best served as an advocacy tool rather than as a stand-alone or supplementary metric of chimpanzee population health or population prioritization. They noted that nut-cracking was one aspect of behavioural diversity in western chimpanzees, and advocating for one particular culture or population might lead to neglect of others that also needed conservation action.

- *Delineate practical avenues for the use of chimpanzee cultures in conservation*
  This included consideration of ways to: operationalize behavioural diversity as a conservation target, in addition to existing targets (e.g. spatial targets); garner enthusiasm for species conservation, including to help focus conservation on behavioural diversity more broadly; and increase recognition of human cultural beliefs towards chimpanzee behaviours. However, a number of key questions remained on how to take these issues forward.

- *Convene a workshop on the establishment of a regional framework for Western Chimpanzee biomonitoring and coordination*
  A biomonitoring workshop was held in Liberia, in October 2022, and included wide-ranging discussions on decision hierarchies. Next steps included targeted monitoring of data gaps (a priority in a rapidly changing region); regional standardization of monitoring protocols; submission of camera trap data to a centralized database; and the establishment of a lending library for camera traps to facilitate monitoring across the region.

- *Advocate for inclusion of culture in biomonitoring initiatives and conservation applications*
  A pre-workshop survey of practitioners and other stakeholders found that monitoring chimpanzee behaviour was felt to be of little conservation consequence nor a priority for biomonitoring schemes. However, a presentation by Dr. Serge Soiret (Co-Chair for Cultural Diversity on the Implementation Committee) on the extent of chimpanzee cultures in West Africa, monitoring methodologies, and potential avenues for incorporating metrics of culture and behavioural diversity in chimpanzee conservation, helped generate interest and enthusiasm.

- *Engage in discussions to fortify existing databases to better integrate information on chimpanzee culture and behavioural diversity*
  The IUCN Working Group on Western Chimpanzees, the A.P.E.S. Database and Wiki Groups have engaged in ongoing discussions about including chimpanzee culture into existing databases. The IUCN SSC A.P.E.S. database was a very useful resource that included data from transects, camera traps and other sources. The A.P.E.S. Wiki enabled submission of more detailed information, including variables that could address cultural diversity and chimpanzee behaviour.

- *Identify and prioritize areas of greatest conservation concern for western chimpanzees*
  The Western Chimpanzee Action Plan's Implementation Committee outlined key actions to address remaining topical gaps in implementation of the Action Plan, many of which overlapped with the current needs of nut-cracking populations specifically, or which explicitly contributed to the stated goals and approaches of the CMS Concerted Action.

The proposed next steps for the Concerted Action for Nut-Cracking Chimpanzees included:

- Forming a steering committee for the Concerted Action
- Supporting local stakeholders to eliminate gaps in key biomonitoring and chimpanzee nut-cracking data
- Developing “Best Practice Guidelines for Cultural Monitoring” within ongoing monitoring methodologies
- Facilitating training opportunities for regional stakeholders in best practices for cultural monitoring
- Continuing to integrate behavioural diversity into centralized databases
- Broadening efforts to raise awareness and involve local stakeholders in defining the role of culture in conservation

The recommendations of the sub-group included:

- Operationalizing behavioural diversity
- Holding discussions with local practitioners about possible approaches
- Standardizing monitoring tools and integrating them into existing frameworks (e.g. if a head count survey is being done, can behaviours also be observed)
- Maximizing the use of culture as a concept in conservation advocacy
- Forging stronger partnerships with key stakeholders

Discussion

Participants thanked the sub-group for its excellent work.

Participants discussed the opportunity to update the Concerted Action ahead of the forthcoming Scientific Council. Ms Virtue explained that CMS Concerted Actions covered one triennium, after which time proponents could propose amendments to the existing Concerted Action, or a new Concerted Action if needed. Ahead of the forthcoming Scientific Council meeting, proponents of existing Concerted Actions had been requested to provide update reports, which would subsequently be presented to the COP.

A central repository for data was welcomed as a very useful step. Mr Brown noted that fishes travelled huge distances, and bringing together the data from multiple laboratories and researchers had been transformative in providing information on behaviour and potentially other ecological information. Ms Wessling noted the difficulty in creating a repository for big data sets (such as camera trap data) in a way that was useful scientifically and for managers. She added that data could also be requested from the A.P.E.S. database. In response to a question on whether the database held data on individual animals, she explained that the A.P.E.S. database and the Wiki had been established in response to the need to create a repository of monitoring data and the species distribution model was derived from the database. It did not generally include data on individual animals, although the Wiki enabled additional information to be submitted; going forward, data collected on individuals and behavioural variants could be included.

Participants discussed whether a Concerted Action focused on one behavioural variant, i.e. nut-cracking, was limiting and meant overlooking other important behaviours and cultures. This was the risk with approaches that protected one particular culture. Ms Sanz explained that the Concerted Action for nut-cracking had been designed as a pilot study for behavioural diversity

and suggested that it would be useful, as a next step, to broaden it to behavioural diversity more widely, and possibly extend the geographic range covered. She indicated that it was a good opportunity to show progress and there were aspects that could be generalized for other Concerted Actions on the basis of the work that had been done. Mr Whiten added that the Concerted Action was intended to be an exploratory step that could be remodelled based on experience to date of those working in the field.

Mr Redmond explained that, from the range of chimpanzee behaviours, nut-cracking had been chosen for the Concerted Action because there were specific management actions that should be taken to ensure this culture would survive – e.g. the sustainable harvesting of fruit and nut trees, and habitat protection in the case of a development project. Nut-cracking was a skill that might enable chimpanzees to adapt to a changing climate and environment. Ms Wessling agreed that the Concerted Action was useful for conversations on Environmental Impact Assessments for developments, and suggested that the Concerted Action did not need to be restricted to a particular behaviour for it to be used in this way. By encompassing behavioural diversity from across the region, a more holistic approach could be taken to make recommendations for developers or practitioners.

Ms Murai noted the many natural World Heritage Sites in West Africa that were home to chimpanzees, including nut-cracking populations. She noted that the cultural behaviours of the chimpanzees were not reflected in the official statements for these sites. This represented an opportunity for researchers, scientists, non-government organizations and others to encourage proponent governments to include animal culture in World Heritage Site documentation. Other participants welcomed this approach, noting similar suggestions in other forums. Mr Simmonds recommended that CMS considers how to reflect culture in the template for Concerted Actions.

Participants agreed that it would be useful to update the CMS website with information on animal culture, including any educational tools and resources.

10. Incorporating Practical Conservation Measures, Stakeholder Engagement and Monitoring

Drawing on the previous presentations and discussions, participants discussed the practical advice that managers need to enable them to integrate social learning and culture into conservation management. Participants agreed that there were many useful lessons to be learned from the work on the Western Chimpanzee Concerted Action, which could be broadened for other taxonomic groups and regions. The need to be clear on the group's goals was highlighted: whether the intention was to provide information to managers so that they could take action, or to get information from managers.

Other suggestions included:

- Collaborating with those working on the ground
- Elucidating a process to incorporate traditional knowledge of local and indigenous communities
- Ensuring involvement of a broad range of stakeholders
- Providing support for funding and other resources, e.g. a lending library
- Effective story telling including for less charismatic species
- Raising awareness of why social learning and culture is important, with different messages for different audiences; complementing existing work and not replacing it

It was noted that engaging with a wider group of stakeholders could be done through CMS Concerted Actions. Stakeholder engagement should be involved in the early stages of developing a Concerted Action or a CMS species listing proposal, with online engagement offering new opportunities.

11. Next Steps

11.1. Engagement with Other CMS Initiatives and Daughter Agreements

Ms Frisch-Nwakanma provided a brief background on CMS Initiatives, Agreements and Memoranda of Understanding (MOUs), some of which were legally binding, while others were not. There were seven legally binding Agreements covering European cetaceans, albatrosses and petrels, African-Eurasian migratory birds, European bats, Gorillas, and Wadden Sea seals. In addition, there were numerous MOUs, Special Species Initiatives and Action Plans covering a wide range of migratory taxa. Some were very active, and others less so.

Participants noted that the Gorilla Agreement worked closely with GRASP, managed by UNEP, with less activity through CMS processes. Mr Simmonds noted that CMS Daughter Agreements such as ASCOBANS and ACCOBAMS were very active and offered a useful opportunity for communication between topic experts and country representatives. These Agreements were effective at bringing countries and other stakeholders together, with a regular flow of recommendations.

Participants agreed it would be useful to open dialogue with the CMS Agreements and MOUs on social learning and culture. This could involve bringing a paper to their meetings and/or giving a short presentation, which could be done in discussion with the CMS Secretariat and the Chair of the meetings. When reaching out, a personalized approach should be taken to help explain the relevance of the work of the Expert Group to each group. A useful first step would be the development of a table of CMS Agreements/MOUs/Initiatives to identify the species of highest priority.

Participants agreed that educational materials should be developed to facilitate communication with the CMS Daughter Agreements and MOUs. This could include a one-page document that synthesized the issues, followed by a guidance document that could be shared. Carefully considered case studies could paint a compelling picture of why social learning and culture were important. Participants also proposed the development of factsheets that could be added to the CMS website. Some participants proposed that scientific journalists and story-telling professionals could be approached; however, caution was expressed by others about potential copyright and cost issues. Links to existing online resources, including YouTube videos, could also be used to support communication.

The forthcoming CMS Conference of the Parties provided an excellent opportunity to highlight social learning and culture, underlining the importance of producing communication materials in good time.

Ms Frisch-Nwakanma agreed to set up a page on the CMS website on the topic. Documents and other links could be added as they became available.

11.2. Strengthening the Relationship with IUCN

The Chair noted that this topic had already been well covered under several previous items. Recommendations stemming from these discussions would be included in the overall recommendations of the workshop.

11.3. Other

Participants discussed how social learning and culture could be incorporated into place-based initiatives, including those being developed through the IUCN: Important Marine Mammal Areas (IMMAs) and Important Shark and Ray Areas (ISRAs). In the IMMA criteria, there was a sub-criterion on distinctiveness (Criterion D Special Attributes, Sub-criterion D1 Distinctiveness - *Areas which sustain populations with important genetic, behavioural or ecologically distinctive characteristics*), and it would be useful to explore opportunities to consider culture in these. Participants agreed that the link with IMMAs and ISRAs (as well as other mechanisms enabling place-based management) should be explored.

Participants also discussed potential linkages with GEO-BON (the Group on Earth Observations - Biodiversity Observation Network), who were looking at ways to improve the acquisition, coordination and delivery of biodiversity observations to users, including decision makers and the scientific community. Mr Williams noted that GEO-BON were looking at the biodiversity monitoring needed to show progress against the targets in the Global Biodiversity Framework (GBF), and he drew attention to work at UNEP-WCMC and the Secretariat on the Convention on Biological Diversity (CBD) on measuring progress towards the GBF.

12. Recommendations

Participants reflected on the discussions during the workshop. Noting the importance of maintaining behavioural diversity, and based on the outputs of the sub-groups presented at the second workshop (Part II) in April 2023, they agreed the following recommendations:

<u>For the Expert Group:</u>

- Explore shortcuts for incorporating social learning into management, complementing traditional management techniques
- Continue to review updates on the work initiated under the Concerted Actions on Chimpanzee and Eastern Tropical Pacific Sperm Whales
- Conduct a review that identifies instances in which social learning is involved in animal behaviours and mitigation measures in human-wildlife conflict (HWC) and identify which populations/culture might be most at risk of HWC
- Develop guidance for engagement with stakeholders to illustrate why animal culture/social learning is important, customize messages for different audiences and publish an educational brochure, translated into the three languages of the Convention
- Develop guidance on methodologies for detecting social learning and provide advice on phylogenetic inference
- Encourage incorporation of a variety of ‘lines of evidence’ on social learning and animal culture, including exploring traditional knowledge of local and indigenous communities
- Develop a table of CMS Agreements/MOUs/Initiatives to identify the species of highest priority

- Compile examples into a document outlining the relevance of animal culture and social learning to be passed on to CMS Agreements/MOUs/Initiatives for all upcoming meetings (for example, the connectivity booklet)
- Increase collaboration with IUCN on matters related to animal culture, including the development of a CMS-IUCN side event for CMS COP14 and collaboration for the 2025 IUCN World Conservation Congress
- If possible, in collaboration with the IUCN Species Survival Commission (SSC) Human-Wildlife Conflict & Coexistence Specialist Group, convene a workshop to further explore Human-Wildlife Interactions (HWI) in connection with social learning
- Explore link with Important Marine Mammal Areas (IMMAs) and Important Shark and Ray Areas (ISRAs) (and other place-based management): distinctiveness
- Explore linking with the GEO BON global biodiversity observation network
- Collaborate with IUCN to develop strategies to integrate non-human culture and social learning into conservation assessments and management
- Explore opportunities for using animal culture for conservation advocacy (storytelling with multimedia)
- Support work in the next triennium and convene next workshop before CMS COP15

For Parties:

- Encourage funding of research (countries and other funders), including Concerted Actions, where appropriate
- Apply a precautionary approach: if there is direct or indirect evidence for social learning, or it seems likely that cultural processes are creating behaviour or patterning, it may be appropriate to apply precaution and assume that these processes are in play when developing management strategies. Such strategies should complement (not replace) existing conservation efforts
- Consider that threats and conflicts with humans can be specific to particular animal cultures and therefore need specific attention
- Provide financial and/or technical support to facilitate the Expert Working Group on Animal Culture and Social Complexity to convene a face-to-face meeting during the intersessional period before COP15

For researchers:

- Encourage more taxonomically diverse research (e.g., fish, especially sturgeon, reptiles) on social learning
- Research into the application of animal culture in conservation and develop best practice guidance, including for maintaining cultural capacity
- Recognize the value of long-term data sets, provide continued support, consider re-examining old data sets with a cultural lens
- Empower local researchers, involve local students (while also recognizing the need for funding), provide support with publishing, etc., and integrate indigenous knowledge

Regarding translocations:

- Integrate management informed by non-human cultural and social processes into existing IUCN tactics and strategies where possible
- Explore shortcuts for incorporating social learning into management, complementing traditional management techniques
- Develop trait-based implementation approaches (e.g., domains, sensitive periods, community dynamics)

- Develop predictions for socially-transmitted innovations to assist translocation planning and monitoring (i.e., their capacity to seed novel beneficial behaviours or lead to human-wildlife conflict)
- Develop metrics for determining where social learning (or lack thereof) contributes to translocation failures

Human-wildlife interactions:

- Recognize the diversity of language used to describe human-wildlife interactions – consult with the wider expert group and review literature/discourse to choose the most appropriate language
- Conduct a review that identifies instances in which social learning is involved in animal behaviours and mitigation measures for human-wildlife conflict (HWC)
- Integrate sensory information to better understand and mitigate HWC – conduct a review on sensory information involved in human-wildlife conflict
- Explore linkages between climate and HWC – conduct a review of examples at the intersection of social learning and changes in behaviour related to climate change in HWC
- Investigate integration of behavioural change theory into HWC – review behaviour change methods that may be relevant to mitigation of HWC and how normative behaviour and culture are required for design of such interventions
- If possible, in collaboration with the IUCN Species Survival Commission (SSC) Human-Wildlife Conflict & Coexistence Specialist Group, convene a workshop to further explore HWI in connection with social learning

13. Any Other Business

Ms Frisch-Nwakanma requested that sub-groups update and finalize their reports for inclusion on the CMS website. The Secretariat would produce a workshop report, which would be circulated for comment. The Secretariat, in collaboration with the Chair and Steering Group for this workshop, would also produce a document for consideration by the Scientific Council and COP14, which would report on the progress made and include the recommendations agreed here. The process for this, and associated deadlines, would be circulated by email.

Ellen Garland (University of St Andrews) explained that she was on the editorial board of the high-impact journal, *Philosophical Transactions of the Royal Society B* (Biological Sciences), and suggested there might be an opportunity to bid for a special issue on culture and social complexity and how that related to conservation and management. This could be interdisciplinary in nature and draw on the extensive expertise at the workshop and beyond. Participants welcomed this idea and felt that the publication of the initial sub-group reports in the grey literature (i.e. on the CMS website) should not preclude the publication in a special issue.

The local hosts arranged a very well-attended public event on the evening of 4 April 2023, during which several case studies on animal culture and social learning were presented by Expert Group members on issues as diverse as humpback whale song, algae fishing in chimpanzees and the opening of urban dustbins by cockatoos.

14. Closing of the Meeting

As Chair, Ms Brakes warmly thanked all participants, online and in-person, for their contributions to the meeting, and the CMS Secretariat and local hosts for their work organizing the meeting and their generous hosting. Participants expressed gratitude to Ms Brakes for her excellent chairing.

Annex 1

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Annex 2

Agenda

1. Opening of the Meeting

2. Adoption of the Agenda and Schedule

3. Background, Mandates and Definitions

4. Reports of the Taxonomic Sub-Groups
   - 4.1 Birds
   - 4.2 Fishes
   - 4.3 Reptiles
   - 4.4 Elephants
   - 4.5 Ungulates
   - 4.6 Mysticetes
   - 4.7 Other Mammals

5. Work of Other Sub-Groups (Primates, Odontocetes, Rapid Assessment)

6. Synthesis

7. Reports of the Cross-Cutting Sub-Groups
   - 7.1 Human-Wildlife Interactions (HWI)
   - 7.2 Reintroductions / Translocations
   - 7.3 Rapid Assessment

8. Integrating Cross-Cutting Issues: HWI and Reintroductions

9. Review of Concerted Action Sub-Group Reports
   - 9.1 Eastern Tropical Pacific Sperm Whales
   - 9.2 Chimpanzees

10. Incorporating Practical Conservation Measures, Stakeholder Engagement and Monitoring

11. Next Steps
    - 11.1 Engagement with Other CMS Initiatives and Daughter Agreements
    - 11.2 Strengthening the Relationship with IUCN
    - 11.3 Other

12. Recommendations

13. Any Other Business

14. Closing of the Meeting