MODULE 3: INCORPORATION OF LOCAL AND TRADITIONAL KNOWLEDGE AND PARTICIPATORY SPECIES MONITORING

Contents

1. What is in this module?

This module provides users with information about the role and utility of local and traditional knowledge in the making of NDFs for CITES-listed species. It is complementary to the generic guidance contained in **modules 1** and **2**. Examples of current usage of local and traditional knowledge for making NDFs are provided along with best practices and considerations for including such knowledge in processes for making NDFs, and in participatory species monitoring and management.

2. What is the role of the CITES Scientific Authority in collecting and using local and traditional knowledge in NDF making?

The CITES Scientific Authority is directly responsible for assessing whether or not the export of specimens of species included in Appendices I and II is detrimental to the survival of that species. Resolution Conf. 10.3 on *Designation and Role of the Scientific Authorities* recommends *the findings and advice of the Scientific Authority of the country of export be based on the scientific review of available information on the population status, distribution, population trend, harvest and other biological and ecological factors, as appropriate, and trade information relating to the species concerned*. Resolution Conf. 16.7 (Rev. CoP17) on *Non Detriment Findings* reaffirms that *the best available scientific information is the basis for non-detriment findings*. Sources of information that may be considered include but are not limited to:

A. relevant scientific literature concerning species biology, life history, distribution and population trends;

B. details of any ecological risk assessments conducted;

C. scientific surveys conducted at harvest locations and at sites protected from harvest and other impacts;

D. relevant knowledge and expertise of local and indigenous communities;

E. consultations with relevant local, regional and international experts; and

F. national and international trade information such as that available via the CITES Trade Database; and

G. population monitoring; and

H. conservation status; and

As such, in some cases Scientific Authorities may collaborate or consult with, *inter alia,* people who are holders of local and traditional knowledge and/or experts in that knowledge (as well as with other providers of relevant information) through, for example, joint research initiatives and knowledge sharing to inform scientific assessments. CITES Scientific Authorities may also support capacity building initiatives to enhance the understanding and integration of local and traditional knowledge. This can involve training programmes, workshops, and exchanges of experiences among experts and practitioners.

During the NDF process Scientific Authorities should assess the reliability, accuracy, and relevance of local and traditional knowledge (as well as other sources of information) to ensure robust decision-making. It is important to note, however, that although CITES recognises the importance of traditional knowledge as a valuable source of information, the activities of the Scientific Authority *vis a vis* local and traditional knowledge may vary from country to country depending on national legislation, policies, and practices as described later in this module.

3. What is local, traditional, and indigenous knowledge?

As noted above, Resolution Conf. 16.7 (Rev. CoP17) lists *relevant knowledge and expertise of local and indigenous communities* as one of the *sources of information that may be considered when making a non-detriment finding*. Each of these different types of knowledge – local, traditional, indigenous - has its own definition:

- Indigenous knowledge is exclusively owned by indigenous people and has been defined as *a systematic way of thinking applied to phenomena across biological, physical, cultural and spiritual systems. It includes insights based on evidence acquired through direct and long-term experiences and extensive and multigenerational observations, lessons and skills. It has developed over millennia and is still developing in a living process, including knowledge acquired today and in the future, and it is passed on from generation to generation* (1).
- Traditional knowledge is *knowledge, know-how, skills and practices that are developed, sustained, and passed on from generation to generation within a community, often forming part of its cultural or spiritual identity* (2).
- Local knowledge is *the understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings. For local communities, local knowledge informs decision-making about the fundamental aspects of their day-to-day life* (3).

Additional, related terms, include: traditional ecological knowledge, aboriginal traditional knowledge, local ecological knowledge, user's knowledge, folk knowledge, farmers knowledge, fisher's knowledge, and practitioner knowledge. In some cases, terms are grouped together. For example, UNESCO refers to *Local and Indigenous Knowledge Systems (LINKS)* while the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES) refers to *Indigenous and Local Knowledge (ILK)*. According to IPBES, ILK is *Knowledge and know-how accumulated across generations, which guide human societies in their innumerable interactions with their surrounding environment* (4). Some Indigenous Peoples' organisations – for example the Inuit Circumpolar Council - object to this linking of terms, recognising indigenous knowledge and local knowledge as two different concepts that should not be conflated to mean the same thing.

While respecting the distinctions between these different forms of knowledge, it is clear that there are some common denominators amongst these terms. Notable characteristics are that that they are (5, 6):

- context and culture-specific,

- often developed and verified over many generations,
- based on individual and collective learned experiences,
- conveyed in many forms beyond the written word including orally, through song, dance, paintings, rituals, ceremonies, visual manifestations, symbols, and artwork, and
- reflective of specific locations.

Western science, by contrast, is analytical and reductionist and based on academic and literate transmission (7). There are, however, similarities between Western science and Indigenous/local/traditional knowledge: they both evolve over time; they both seek to understand and explain how the natural world functions; and they both can use empirical approaches.

For the purposes of this guidance, we use the term '**local and traditional knowledge**' and its working definition that was advanced at CITES CoP18 in Decision 18.300, paragraph b) iii) and reflects many of the characteristics described above, namely ***knowledge that local stakeholders or communities have about the populations of locally occurring species, through their own experience, observation or experimentation, or through non-formal and non-scientific knowledge transfer from other local stakeholders or community members***.

Perhaps a key distinction between this term and many of those reviewed above, is that the definition does not necessarily imply knowledge transmission over long (intergenerational) time periods. Valuable local **practitioner** knowledge can, for example, be developed during a single lifetime of active observation/experience (e.g., the time a local person has been harvesting a CITES-listed species). Similarly, other local knowledge may be obtained through one-off surveys, learning-by doing, teaching, etc. The key issue is that NDF assessments are based on the best available information.

4. Why is local and traditional knowledge important for conservation?

There is increasing recognition and acknowledgement of the value of local and traditional knowledge (8). It can provide information, insights, experiences and practices that can contribute to and complement the overall body of information derived from other knowledge systems including western scientific knowledge. As Sutherland et al. (2014) (8) note: ***Local and traditional knowledge can provide complementary perspectives, borne from long periods of shared observation and experimentation that are often lacking in conventional scientific knowledge. The latter commonly depends on sets of observations or experiments conducted over relatively short time-scales by groups of people disconnected from the environmental context***. Local and traditional knowledge can be particularly valuable for providing long time series data as well as for recording unusual and/or context/locality specific observations and variations (9).

Box A: CITES recognition of local and traditional knowledge

CITES has long considered the role of local and traditional knowledge as highlighted in the following:

- Resolution Conf. 13.2 (Rev. CoP14), on *Sustainable Use of Biodiversity Addis Ababa Principles and Guidelines* notes that Addis Ababa Practical principle 4 states that adaptive management should be practiced based on science and traditional and local knowledge. The Resolution further notes that the Addis Ababa Principles and Guidelines could support the guidance for the making of non-detrimental findings.
- Resolution Conf. 16.5 on *Cooperation with the Global Strategy for Plant Conservation of the Convention on Biological Diversity* notes the potential contribution of CITES to Target 13 of the GSPC (indigenous and local knowledge innovations and practices associated with plant resources, maintained or increased, as appropriate, to support customary use, sustainable livelihoods, local food security and health care), particularly in terms of NDFs, Resolution Conf. 10.19 (Rev. CoP14) on *Traditional medicines*, and the CITES Standing Committee Working Group on CITES and Livelihoods.
- Resolution Conf. 16.6 (Rev. CoP18) on *CITES and livelihoods*, CoP recommends recognising that community and traditional knowledge should be considered, as appropriate and in accordance with the provisions of the Convention and national laws, regulations and policies when empowering the rural communities.
- Resolution Conf. 16.7 (Rev. CoP17) on *Non-detriment findings*, recommends that local knowledge on trade could be one of sources of information when making a non-detriment finding.

Local and traditional knowledge can be a benefit not just to those who practice it but also to modern science, modern industry, and modern lifestyles. For example, many widely used products, such as plant-based medicines, health products, and cosmetics, are derived from traditional knowledge. Local knowledge on environmental change over time and on appropriate harvest rates and methods can also help in the development of sustainable management plans.

As well as complementing – and filling gaps in – knowledge derived from Western science, local and traditional knowledge can be a cost-effective mechanism for collecting data and developing management plans (**10**), especially when resources are constrained as is often the case in countries of the Global South (**11**, **12**).

A recent analysis conducted by the CITES Secretariat (**9**), which focussed on medicinal and aromatic plants, found that a key benefit of local and traditional knowledge was its ability to **complement global scientific knowledge with local details** including complex societal or ecosystem relations, or drivers of change. The analysis also highlighted that for some species it may be the only source of knowledge. In addition to enhancing the scientific knowledge base, the CITES Secretariat analysis notes that "including local and traditional knowledge also **increases the validity and legitimacy of assessments, monitoring, and management** from a community perspective, enhances community buy-in, and may strengthen its adherence to and collaboration in conservation efforts." This can then turn into a virtuous cycle whereby enhanced conservation success also enhances local livelihoods leading to yet further support for conservation.

5. Local and traditional knowledge and participatory monitoring

While much local and traditional knowledge is passed down from generation to generation, it also is continually evolving and accumulating. Much new knowledge, or reaffirmation of existing knowledge, arises through **local/participatory assessment and monitoring** of wild species populations, of ecosystem condition, and of the presence/absence of threats, (all of which can be a key input to adaptive management – see **module 1 section 9**). This can provide invaluable insights for the preparation of NDFs (and indeed has already been usefully used in some cases as discussed below). As noted in a recent review ***A global paucity of data, along with steep geographic and taxonomic biases in biodiversity research, mean that there is insufficient data to assess the conservation status of and develop conservation strategies for the majority of species worldwide. The evidence base is most limited in the Global South, where biodiversity is highest and conservation stakes often greatest. Participatory monitoring, including both citizen science and community-based monitoring, is regularly highlighted as a way to fill gaps in the global biodiversity evidence base while engaging local communities*** (**13**).

Examples of participatory monitoring programmes involving CITES listed species include:

- **African grey parrots (*Psittacus erithacus*):** A participatory monitoring programme in Cameroon engaged local people, including hunters, farmers, and community leaders, in monitoring parrot populations, nesting sites, and trade activities. The data collected by the communities helped inform conservation measures, including the identification of important breeding areas and the establishment of community-led conservation initiatives (**14**).
- **Seahorses (*Hippocampus* spp.):** In the Philippines, local fishers were trained to collect data on seahorse populations, including abundance, size, and habitat preferences. The project provided fishers with incentives for reporting their observations, such as access to alternative livelihood opportunities. The collected data supported the development of sustainable fishing practices and contributed to the conservation of seahorses (**15**).
- **Sturgeon (*Acipenseriformes*):** In Romania, local communities, including fishermen and conservation organizations, were involved in monitoring sturgeon populations, tracking migration routes, and reporting illegal fishing activities. The data collected through this participatory approach contributed to the development of conservation strategies and the enforcement of fishing regulations (**16**).

There are, however, many different approaches to participatory monitoring, with varying levels of local participation. Danielson et al. (2009) (**11**) describe a spectrum from externally driven, with local people only involved as data collectors (examples including many of the citizen science schemes in developed countries, for

example involving the public in garden bird surveys) to autonomous local monitoring, where the whole monitoring process—from design to use in decision-making is carried out by local stakeholders with no direct involvement of external agencies (**Table 3A**).

Table 3A. A typology of participatory monitoring approaches (**11**)

Type	Description	Examples
1. Externally driven monitoring with local data collectors	Local people (often volunteers) collect data, but design of the monitoring scheme and analysis of the data collected are undertaken by (usually remote) external scientists.	Fisher or hunter reporting schemes – for example in the US catches of pelagic sharks including the CITES-listed common thresher shark (*Alopias vulpinus*) must be reported to the National Marine Fisheries Service. When a level of 80% of the quota has been reported the fishery is closed (**17**)
2. Collaborative monitoring with external data interpretation	Local people collect data and use it in management decisions, but design of the scheme and analysis of data usually undertaken by external scientists. Analysis may therefore exclude local perspectives.	Collaboration between an international NGO, local NGOs, government and local people to monitor sites or species of particular interest. Danielsen et al. (**11**) highlight the case of Durrell Wildlife Conservation Trust working in Madagascar to manage the Alaotra wetlands, paying local people and local NGOs to undertake monitoring and then using the findings to help shape wetland management decisions
3. Collaborative monitoring with local data interpretation	Local people are involved in data collection, analysis, and management decision making, although external scientists may provide advice and training.	Community-based wildlife monitoring in communal conservancies in Namibia. Community game guards use "event books" to record wildlife sightings, poaching incidents and human-wildlife conflict incidents and use the information in the adaptive management of communal conservancies as well as sharing it with government for national level planning and management (**18**)
4. Local monitoring, interpretation and use of data	Design, collection, analysis and decision making all carried out by local people with no external involvement. Many of these schemes may be traditional and undocumented.	Indigenous monitoring – for example the traditional leaders amongst the Gitga'at people who live on the North Coast of British Columbia, Canada oversee the local stewardship, allocation, and management of resources within their territory based on their own regular monitoring of resource stocks (crab, fish, marine mammals etc) (**19**).

A recent review of the role of indigenous knowledge and participatory monitoring (**20**) highlights the need for that participation to be meaningful. In some cases, where the monitoring programme is externally driven there are potential risks that local people are engaged simply to save on costs of more expensive data collectors, or that their knowledge may be misinterpreted, misappropriated or tokenised. Similarly, Parry and Peres (2013) (**10**) note that monitoring is only genuinely participatory if local people are *active and equal participants in decision-making processes, rather than just agents of data collection*.

Meaningful participation, where local people are involved as equal collaborators or as leaders of the monitoring programme (categories 3 and 4 in the typology above) is more difficult and time consuming to establish but likely to lead to more meaningful and reliable outcomes. In addition, it can lead to more rapid translation of monitoring results into management action (**10**).

The steps to ensure participation is meaningful and equitable are discussed further in **section 8** (Key Issues) below.

6. How is local and traditional knowledge already being integrated into (non-NDF) scientific assessments?

Local and traditional knowledge is already, and increasingly, being incorporated into scientific environmental assessments at various levels.

At the global level, the landmark Millennium Ecosystem Assessment published in 2005 included sections dedicated to indigenous and local knowledge. A decade later, the first "Local Biodiversity Outlook was produced

in 2016 as complement to the fourth edition of the Global Biodiversity Outlook GBO-4). The Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) includes as one of its operating principles the need to respect the contribution of indigenous and local knowledge and at the second meeting of its plenary, established a Task Force on Indigenous and Local Knowledge (ILK) Systems specifically in order to ensure its integration into its assessments. The experience of producing the Global Assessment revealed how gaining direct participation and inputs from indigenous people and local communities (IPs & LCs) in a substantive and meaningful way was challenging. It was recognised that it requires a deliberate framework and approach from the start that facilitates recognition of different knowledge systems, identifies questions relevant at various scales, mobilises funding, and recognises time required and engages networks of stakeholders with diverse worldviews (**6**). Part way through the assessment process, in 2017, the IPBES 5th Plenary meeting adopted the *Approach to recognizing and working with indigenous and local knowledge in IPBES*. From a practical perspective the IPBES ILK Approach entails involving a number of ILK holders and ILK experts in the assessment process directly (including as contributors and authors); ensuring an explicit focus on ILK in the literature review process; and organising regional, thematic and global dialogue workshops for IPs & LCs at key stages in the assessment process for them to feed in information, review and comment on drafts, agree key findings and so on. **Fig. 3A** summarises how IPs & LCs are involved, and ILK is integrated at each step of the assessment process.

Building on the IPBES experience, the International Union for the Conservation of Nature (IUCN) has published guidance for the incorporation of ILK into Red List assessments (**21**). IUCN has also developed guidelines on integrating fishers' knowledge into policy development and assessment. Red List assessments for various fish species have incorporated local fishers' knowledge, and local fishers have been invited to become members of the relevant IUCN Species Survival Commission specialist groups, complementing the scientific knowledge of other members (**22**).

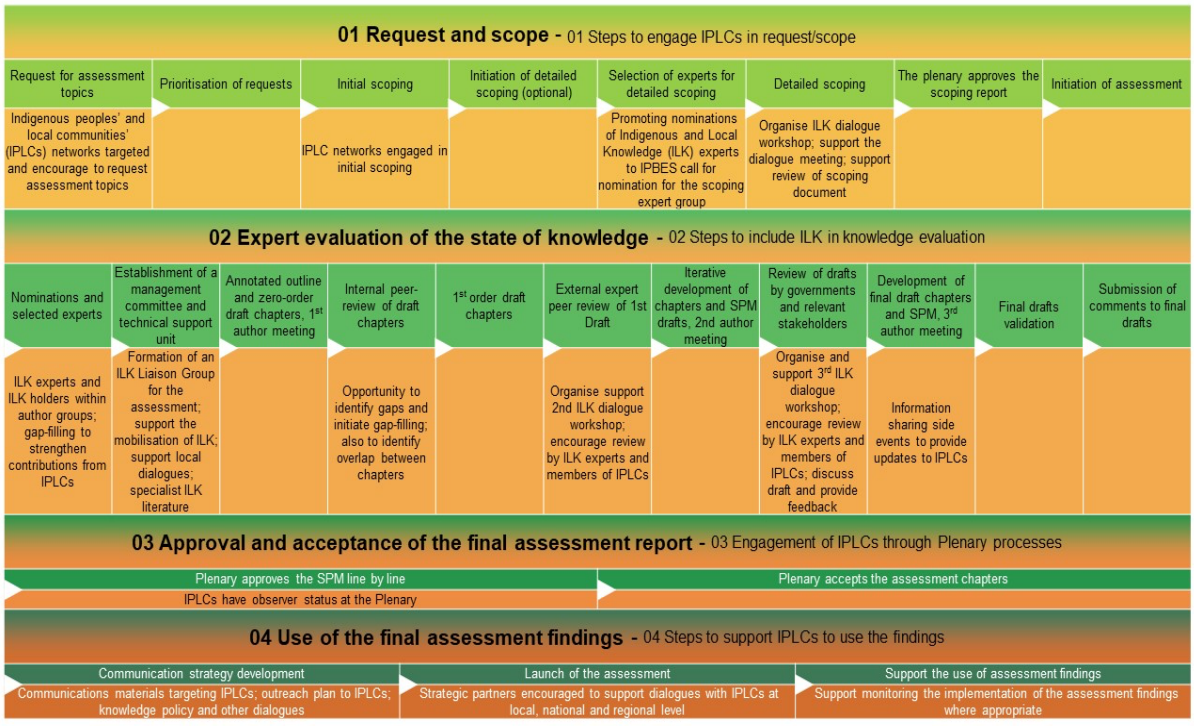


Figure 3A. Incorporating Indigenous and Local Knowledge in IPBES Assessments. Source: Replicated from (**5**).

At the **national level**, incorporation of local and traditional knowledge into scientific assessments, policy development, or practice is legally mandated or actively encouraged in some countries. In Canada, for example, the Species at Risk Act requires the Committee on the Status of Endangered Wildlife (COSEWIC) to establish subcommittees of specialists to assess the status of species. COSEWIC's Aboriginal Traditional Knowledge (ATK) Subcommittee is responsible for ensuring that indigenous knowledge) is integrated appropriately in the assessment

process (**Box B**). In Greenland, legislation regulating hunting and protection of wildlife requires that management actions take into consideration scientific advice and local knowledge. In the United States of America, the Council on Environmental Quality (CEQ) and the Office of Science and Technology Policy (OSTP) have produced government wide guidance for Federal Agencies on recognizing and including Indigenous Knowledge in Federal research, policy, and decision making.

Box B: The Canadian approach to integrating local and traditional knowledge into scientific assessments

In Canada, at the national level, the Aboriginal Traditional Knowledge (ATK) Subcommittee of the Committee on the Status of Endangered Wildlife (COSEWIC) has developed an eight-step process for incorporating aboriginal traditional knowledge into species assessments including:

- Community approvals
- Ethics review
- Completion of any required permits
- Acquisition of participant's Prior Informed Consent
- Interview(s) with Aboriginal traditional knowledge (ATK) holder(s)
- Information review with ATK holder(s)
- Integration of ATK into species status report
- Post assessment meeting communication with ATK holders

Some critics have argued however that this approach still seeks to integrate indigenous knowledge into a pre-existing, largely western scientific framework. At sub-national level, the Species at Risk Committee of the Northwest Territories has developed two sets of distinct but complementary assessment criteria for determining species at risk – one reflecting indigenous knowledge and the other scientific knowledge. Assessments are conducted by a Species at Risk Committee (SARC) comprising both Indigenous knowledge and scientific knowledge holders. Determinations of a species risk status are based on both indigenous and scientific criteria and where there is a disagreement – as inevitably there sometimes is – this is resolved through a series of meetings to examine and work through disagreement with any outstanding differences clearly documented.

Source: https://www.cosewic.ca/index.php/en-ca/assessment-process/atk-guidelines.html; (**23**)

For specific **species assessments**, there are numerous examples of incorporation of local and traditional knowledge and of participatory monitoring, including (**21**):

- Indigenous knowledge of the ecology of four rock kangaroo species in Australia (*Petrogale brachyotis, P. concinna, Macropus bernardus* and *M. robustus*) both complemented and extended that reported in the scientific literature in terms of habitat, diet, predation, reproduction, and activity patterns (**24**).
- In the Solomon Islands, local and traditional knowledge was used to build much more accurate assessments of abundance of crocodiles (**25**).
- Long-term historical local knowledge was analysed to retrospectively model the historical abundance of depleted green turtle (*Chelonia mydas*) populations in Baja California, and hence the extent of decline (**26**).
- The New Zealand Kiwi Recovery Plan engaged many *tangata whenua* (Maori groups) at each stage of its development (**27**).
- Participatory surveys of Anamalai gliding frog *(Rhacophorus pseudomalabaricus*) extended the known range of the species in India and suggested a change in its Red List status from Critically Endangered to Endangered (**28**).

Despite these examples, Singer et al. (2023) (**23**) note that inclusion of Indigenous knowledge in species assessments has remained limited and suggest this may reflect scepticism of its validity and/or challenges in its communication. They note that as such "*the inclusion of Indigenous knowledge appears to be largely limited to anecdotal, corroborating information that is subject to verification by scientists*."

7. How has local and traditional knowledge and participatory monitoring contributed to NDFs to date?

Incorporation of local and traditional knowledge and participatory monitoring into the development of NDFs is already occurring for several species, but more commonly animals rather than plants (although the case of *Aloe ferox* provides an interesting plant example – see **Box C**).

Box C: Use of local and traditional knowledge in the NDF for *Aloe ferox* in South Africa

Aloe ferox is a large succulent plant that occurs largely in South Africa and southern Lesotho. It is one of South Africa's leading wild-harvested commercially traded plants. The latest NDF, conducted in 2018, concluded that the harvest and trade was non-detrimental, posing a low to moderate risk to the population in the wild. Local and traditional knowledge fed into the NDF assessment at various stages:

- Information from harvesters and landowners provided key insights into the time taken from seed germination to the first harvest of aloe leaves.
- In both the Eastern and Western Cape, aloe harvesters reported on the population status citing concerns about declines in the Eastern Capes based on having to walk increasingly long distances (about two hours) to harvest sites.
- Tappers from the Eastern Cape reported illegal, overharvesting of aloe leaves by untrained harvesters as a major threat to the species.
- In the Western Cape, it was reported that local indigenous harvesting practices were employed to regulate the harvest. Before the tappers decide to harvest the following factors are considered:
  - There must be sufficient leaves on the plant.
  - Only a fraction of the lower leaves can be cut from each plant so that the growth point is not injured, and only the leaves that would die naturally at the end of the season should be taken.
  - Leaves must be fat / thick. Thin leaves indicate that if harvested, the plant is less likely to survive the dry period. In addition, thin leaves result in lower product yields, which acts as an economic deterrent to harvesting (i.e., low return per unit effort).
  - In winter rainfall areas, winter is the better season for harvesting (cooler and wetter); harvesting leaves in summer is not favoured as cut leaves develop a skin very quickly, which reduces the bitter yield.

Source: (29)

In Canada, decisions concerning the management of "game" animals are guided by planning processes, policy, legislation, trends in historical and recent use, scientific information and Indigenous knowledge. These processes have fed into NDFs for polar bear (see **Box D**) Grizzly bear, American black bear, and cougar (30). Canada's CITES Scientific Authority makes non-detriment findings for export permits on a case-by-case basis, informed by analysis of the biology, conservation status, trade levels and harvest management of the species, and Indigenous knowledge.

Box D: Incorporating indigenous knowledge in polar bear management in Canada

Polar bears in Canada are protected through a collaborative conservation and management approach that is shared with provinces, territories and regional wildlife management boards (established through land claims agreements). A combination of western science, experience and Indigenous Knowledge forms the basis for research; the inclusion of Indigenous Knowledge helps to provide information on polar bear abundances, movements and behaviours, and provides valuable long-term perspective on changes in the populations.

As part of Canada's approach, the Polar Bear Technical Committee (PBTC) reviews scientific research and Indigenous Traditional Knowledge and provides an annual status assessment of the polar bear subpopulations in Canada, to inform conservation and adaptive management activities. PBTC includes provincial and territorial government representatives and scientists, experts from within Indigenous user groups, Wildlife Management Boards, and other ex-officio members.

When providing advice concerning international export of polar bears, the Canadian CITES Scientific Authority (SA) takes into account overall harvest and export levels relative to population abundance and trends in Canada. The CITES SA reviews the PBTC assessments, management decisions, conservation status, and harvest and trade levels for the Canadian subpopulations, and considers participatory monitoring of populations and harvest rates involving researchers, hunters and

Indigenous people. Methods including mark and recapture surveys (physical and DNA), aerial surveys, traditional ecological knowledge, harvest data, and population viability analyses (statistical modelling).

Source: Information provided by Erin Down, Environment and Climate Change Canada, drawing on Conservation of Polar Bears in Canada - Canada.ca; Overview | Polar Bears in Canada (polarbearscanada.ca); Polar bear: non-detriment finding - Canada.ca

While perhaps not conventionally regarded as "traditional" knowledge but certainly counting as "practitioner knowledge", in Mozambique, local knowledge from professional hunters, game scouts, and safari operators is a key component of the monitoring of leopard populations contributing to the NDF of the CITES African leopard hunting trophy quota (see **Box E**).

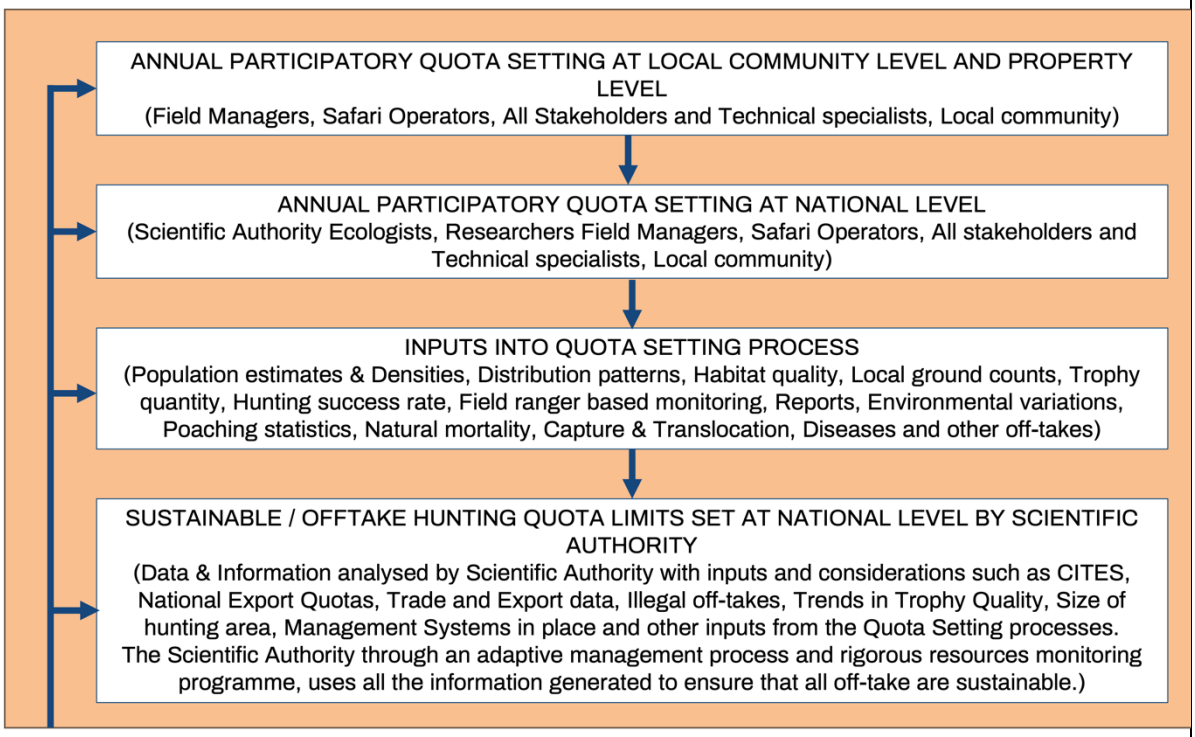
Box E: Incorporating local and traditional knowledge into NDFs for sport hunting in Southern Africa

In Mozambique, quotas for leopard hunting are set in a participatory way. Local knowledge from professional hunters, game scouts and safari operators is a key component of the monitoring of leopard populations contributing to the NDF of the CITES export quota for African leopard hunting trophies. This knowledge includes hundreds of records of sightings, kills, feeding and trophy measurements. Annual Activity Reports compiled by hunting operators are mandatory for quota setting, and are informed by surveys and local studies. The quotas are set conservatively, and it is estimated that actual offtake is generally 40-50% of the quota. In its latest (2018) assessment, based on the data collected the National Administration for Conservation Areas (ANAC) concluded that the low level of off-take generated by safari hunting was not detrimental to the survival of leopard and that safari hunting provided a net benefit to the species (**31**).

The Zambia NDF report on African Leopard Sport Hunting conducted in 2018 (**32**) provides more detail on the specific role of local communities in setting and review of the leopard quota. It notes that "Zambia has a participatory quota setting process" drawing information from aerial and ground surveys, patrol sightings, local and expert opinion and hunting monitoring. For hunting in Game Management Areas – on the borders of National Parks - Community Resource Boards (CRBs) submit a proposal for a quota to the Department for National Parks and Wildlife (DNPW) based on community-based population estimates, poaching incidents reported by Community Scouts, and any other relevant observable trends.

Zimbabwe's 2018 review of its CITES quota for leopard trophy hunting (considered to be non-detrimental) also highlights its participatory approach. Inputs are collected from a variety of stakeholders including government, NGOs, hunting operators and local communities. A series of workshops starting at the local level and working up to the national level and involving all stakeholders contribute information allowing the CITES Scientific Authority to determine an appropriate national quota (**33**).

Figure for Box E: Multi-stakeholder engagement in the quota-setting process in Zimbabwe (from ZPWMA 2018)



Beyond sport hunting, incorporation of local knowledge is also evident in fisheries NDFs. For example, in the United States of America, NDFs for Common Thresher Sharks (*Alopias vulpinus)*, Hammerhead Sharks, and Porbeagle Shark (*Lamna nasus),* all determined to be non-detrimental, highlighted fisher-reported harvest levels as providing key inputs to the necessary monitoring and management of fish stocks (17, 34). **Box F** provides an interesting case study on the integration of scientific and local and traditional knowledge in population assessments for Narwhal (*Monodon monoceros*) in Greenland.

Box F: Reconciling scientific and indigenous knowledge in narwhal NDF assessments in East Greenland

The narwhal (*Monodon monoceros*) is a medium-sized whale characterised by a long ”tusk” - an elongated protruding canine tooth. Narwhals live in the Arctic waters of Greenland, Canada, Svalbard (Norway) and the Russian Federation. In Greenland they are hunted for their meat, *mattak* (skin and blubber) and tusks. *Mattak* is considered a delicacy and can be sold within Greenland for high value.

Greenland is part of Denmark, having full autonomy regarding the management of its living resources. There is no official definition of indigenous people in Greenland, but the government is formed primarily by ethnical Inuit, who speak Greenlandic, eat traditional food and either are hunters themselves or have family which are hunters. In Greenland, indigenous knowledge is highly regarded, and is normally referred to as “user’s knowledge”.

The executive order that regulates the management of narwhals, states that quotas must be set taking into consideration: 1) international agreements, 2) biological advice, 3) user’s knowledge and 4) hearing of the hunting council and municipalities. Greenland receives scientific advice on East Greenland narwhals from the North Atlantic Marine Mammal Commission (NAMMCO), which in turn receives advice from its Scientific Committee (NAMMCO-SC) informed by the Greenland Institute of Natural Resources (GINR) – the CITES Scientific Authority. The hunting council is formed by indigenous organizations and institutions dealing with hunting. Municipal authorities are usually composed of local (indigenous) people. In addition, most management decisions concerning wildlife, including annual narwhal quotas, are subject to public hearings.

The first NDF assessment for narwhals was carried out in 2006. Narwhals did not obtain an NDF then, as catches in West Greenland were higher than the quota. In 2009, narwhal quotas and catches in all Greenland were consistent with the advice,

and GINR issued the first narwhal NDF. Since 2016, narwhals have not obtained an NDF because catches have exceeded the advice.

In 2016, a GINR aerial survey carried out in the hunting ground of East Greenland showed a population estimate of 673 narwhals (95% CI 363 – 1261) compared to 2636 (95% CI 1074 – 6565) in a previous (2008) survey. As a result of the apparent population decline, NAMMCO-SC advised the Greenland government to reduce quotas from 66 narwhals per year to 20 and then, in 2018, advised a total ban on hunting. This advice was reiterated in 2019, and in 2021, based on results over part of the narwhal's range, a declining proportion of females in the catch and the recaptures of individuals captured in nets for satellite telemetry, together with new modelling using life history parameters from narwhals in East Greenland. The models indicated that a catch of even one or two animals would lead to a population decline, with a high probability of extinction within the next 10 years, but that stocks may recover in the absence of hunting.

In reaction to the advice of a hunting ban, a delegation of narwhal hunters made their case to NAMMCO in 2021. The hunters argued that their knowledge and observations did not match the scientific results. They explained that the narwhals they hunt originate from three different stocks, two of them unknown to scientists. They said that there was a large reservoir of narwhals further north, in the protected areas of the East Greenland National Park supplying their hunting grounds, that their hunting was sustainable and that narwhal food products were needed for food security. They also questioned the aerial surveys used to estimate abundance of narwhals, suspecting that scientists have performed surveys in foggy conditions with poor visibility. They explained that they consistently observed a high number of narwhals and had seen neither a decline nor an increase in the number of animals. Based on this information, NAMMCO did not endorse the advice from the Scientific Committee on the hunting ban.

In 2021, the Greenland government granted extra funding to GINR to carry out a new aerial survey, this time with hunter involvement. The abundance estimate was planned in five phases: 1) planning workshop with scientists and hunters, 2) aerial survey with professional observers/scientists and hunters, 3) data analysis by scientists, 4) final workshop with hunters and scientists and 5) reporting to NAMMCO (NAMMCO-SC assessment scheduled for December 2023).

During the workshop, hunters and scientists agreed upon survey design, including timing and coverage. The aerial survey was carried out in August and September 2022. An additional bubble window was added to the plane, so that an experienced hunter could see the same as the 4 professional observers. Observations made by hunters during the survey were also recorded and considered in the analysis. The survey revealed a further decline in numbers to 441 (95% CI 212 – 918). At a subsequent meeting between hunters and biologists, the hunters explained that they see many narwhals, including several calves in the population and believe that narwhal numbers are stable or increasing – with many more individuals than the survey indicated - and that their catches are sustainable. Hunters appreciated the collaboration, but believed that narwhal numbers were considerably larger than suggested by the survey results.

Perhaps the most important result of this experience was that hunters and scientists could communicate and learn from each other both throughout the work and while sharing hotels and meals during the survey and the workshops. The meeting and the participation in the surveys helped to reduce hunter's mistrust, as they could contribute to the planning of the survey and verify that it was carried out during fair weather and that scientists were committed to their work and were able to detect narwhals. The scientists benefitted from the vast knowledge of hunters and gained insight into their culture and way of life, which in turn motivated their work. The major drawback to the process is that it was considerably more expensive than a survey carried out only by scientists.

In conclusion, the involvement of the hunters in the survey could to some extent bridge the gap in the understanding of the scientific background for the advice, but it may not change the scientific assessment of the status of narwhal stocks, nor the hunters view about the sustainability of their own catches.

Source: Prepared by Fernando Ugarte, Mads Peter Heide-Jørgensen & Rikke Hansen, GINR

8. Key issues to consider in incorporating local and traditional knowledge (including participatory monitoring information) in NDFs

8.1. Is local and traditional knowledge available and/or appropriate?

The first question to ask when considering inclusion of local and traditional knowledge in an NDF is whether it is actually available, and even if it is available, if its use is appropriate. For example, there may be occasions when

local and traditional knowledge holders may not wish to share information (as suggested in the IUCN Red List guidance (21):

- if the information sought is considered sacred or sensitive and not to be shared with others;
- if there is a perception that sharing knowledge may result in a restriction in species use or access or put individuals or communities at risk of reprisals from governments or other interests.

The analysis in CITES PC25 Doc 30 also highlights that, as with any other source of information, local and traditional knowledge may be missing, biased, or in some cases even purposefully incomplete or misleading, including for some of the reasons provided above. In the case of the Yangtse finless porpoise, for example, it was thought that while local knowledge was very informative for understanding patterns and trends in porpoise abundance and status, it was less useful for identifying threats since fishermen were not always able to distinguish between causes of mortality (35). The study of pepper trees in Mozambique highlighted that very few of the local harvesters interviewed had knowledge of the flowering time of *Warburgia salutaris* or its pollinators (36).

The IUCN Red List guidance (21) suggests that the relative importance of local and traditional knowledge will be higher when:

- it is a major or the only source of information on the species;
- a species' range falls wholly within an Indigenous peoples or local community territory; and
- a species has high local economic or cultural significance.

IUCN (21) further notes that local and traditional knowledge is likely to be most appropriate as a source of data on subpopulations, recent fine-scale spatial and temporal changes, and/or temporal variation over extended time frames. These insights may be similarly applicable to the production of NDFs.

8.2. If local and traditional knowledge is available, how and from whom should it be collected?

Having ascertained that local and traditional knowledge is a) available and b) appropriate, the next consideration is how to collect it, and who counts as relevant knowledge holders. Collecting local and traditional knowledge can take time and requires planning. It can sometimes be accessed informally or through similar channels to Western scientific knowledge – particularly if, for example, the target is practitioners who are not indigenous or traditional communities – for example hunting guides and hunting outfitters, commercial fishers, employed harvesters. However, where more traditional forms of knowledge are required and particularly where indigenous people are concerned, it is recommended that **established organisations or networks of local and traditional knowledge holders be the first point of contact** since these organisations can indicate the most appropriate contacts who are authorised to speak on behalf of the indigenous people and/or local communities and to share knowledge (21). As far as indigenous people are concerned, for example, there are relevant associations in each region of the world (for example the Coordinator of Indigenous Organisations of the Amazon (COICA), the Inuit Circumpolar Council or the Asia Indigenous Peoples' Pact).

In some cases, there are formally prescribed protocols; for example, the Canadian 'Committee on the Status of Endangered Wildlife's Aboriginal Traditional Knowledge subcommittee' (COSEWIC-ATK Subcommittee) described earlier (Box A). However, it should be noted that, while grounded in federal legislation, the COSEWIC-ATK Subcommittee does not replace community protocols. Heads of nations or communities are approached in a manner respectful of that group's cultural practices, language, and traditions. COSEWIC-ATK Subcommittee members are "gatekeepers" providing links to indigenous communities; to educate and facilitate interactions. The COSEWIC-ATK Subcommittee coordinates the provision and integration, and communities (those that provide the information) ensure that the ATK gathered is used in a respectful way and for the benefit of the species being assessed by COSEWIC. Once integrated, the ATK Subcommittee seeks approval from all communities that provided the traditional knowledge before the COSEWIC status report is made available to members/jurisdiction/Wildlife Management Boards for review at the species assessment stage.

Where such formal institutions do not exist, first points of contact should be respected and recognised leaders (community elders, civic leaders, religious or clerical leaders etc). The initial organisations or leaders contacted do not need to have knowledge of CITES, or wildlife trade, or NDF making. The purpose of making contact with them is firstly to follow a respectful process and ensure that there is appropriate awareness of, and support for, conducting the research endeavour. Once initial contacts have been made with these appropriate representative organisations or leaders, they may then provide referrals to other knowledge holders and resource users in a snowball effect.

Once relevant contacts have been identified, it is important to **explain transparently the purpose of the knowledge collection** and to ensure the relevant stakeholders have provided **free, prior, and informed consent** on all aspects of collaboration and knowledge utilization. It may also be necessary to establish a clear agreement on intellectual property given the legally recognised rights that indigenous people have over their traditional knowledge. At a minimum, **best practice ethical guidance should be followed** such as the International Society for Ethnobiology's Code of Ethics (**Box H**) or the CBD Mo'otz Kuxtal Voluntary Guidelines which provide a framework for fostering positive engagement between the potential users and the holders of traditional knowledge.

Local and traditional knowledge is often very context and location specific. It is thus recommended **that information should be collected from multiple sources representing geographic and cultural diversity as appropriate** (**9**).

Local and traditional knowledge is likely to be more reliable the stronger the trust between the knowledge holder and collector. It is therefore **critical to invest in building this trust**. This could mean regular meetings – perhaps annually – to collect information on an ongoing basis (for example the regular joint quota setting meetings for hunting trophies described in the case studies above) or involving local and traditional knowledge holders or representatives as permanent members of assessment committees (for example, the COSEWIC-ATK Subcommittee is comprised of members nominated by the five National Indigenous Organizations in Canada, and appointed by a federal Minister in the process described above).

However, it also means ensuring cultural protocols are followed, that feedback is provided on the use of the knowledge and the result of the assessment and that appropriate amounts of time are taken to build the relationship – that it is not viewed as a one-off extractive exercise. The CITES Secretariat analysis emphasizes the benefits of collaborating with individuals who are part of and rooted in both western (possibly even academic) education and local communities. Such persons not only facilitate the building of mutual understanding and trust and help to overcome potential cultural or language challenges, but can also be key in analysing, interpreting, and validating results.

Box H: The International Society of Ethnobiology (ISE) Code of Ethics

The ISE Code of Ethics affirms the commitment of the ISE to work collaboratively, in ways that:

- support community-driven development of indigenous peoples' cultures and languages;
- acknowledge indigenous cultural and intellectual property rights;
- protect the inextricable linkages between cultural, linguistic and biological diversity; and
- contribute to positive, beneficial and harmonious relationships in the field of ethnobiology.

The Principles and Practical Guidelines recognise traditional and customary laws, protocols, and methodologies within the communities where collaborative research is proposed.

8.3. What methods are available to collect local and traditional knowledge?

A wide range of ***methods*** can be used to collect local and traditional knowledge. These methods can vary hugely in terms of the extent to which they simply "extract" information from local people or actively involve local people through participatory approaches (and as highlighted in the section above on participatory monitoring, even the degree of participation within participatory methods can vary enormously). Extractive approaches include questionnaire surveys and key informant interviews where questions are planned in advance by the researcher. Participatory methods tend to be more visual and interactive, allowing local people to "hold the pen" or shape the direction of interviews and discussions. The Participatory Methods website has "*a range of activities with a common thread: enabling ordinary people to play an active and influential part in decisions which affect their lives". This means that people are not just listened to, but also heard; and that their voices shape outcomes .... Because respect for local knowledge and experience is paramount, the result is interventions that reflect local realities*."

Both extractive and participatory methods have advantages and disadvantages – for example extractive methods are usually quicker and easier to undertake but may result in a lack of buy-in from local people, while participatory methods are more empowering for local people but may take longer, may be culturally and socially complex, and/or may veer into unanticipated areas and issues.

In reality, species assessments – and other scientific assessments – often end up using a mixture of participatory and extractive methods depending on the information that is needed and the social and cultural context in which the assessment is taking place. Examples of methods that have been used to date include:

Key informant interviews: Interviews of "key informants" are regularly used to collect information. Interviews can be conducted on their own or as part of a broader participatory method (for example mapping). In some cases, interviewees may be offered the option of remaining anonymous. This may be relevant, for instance, if the person has information about illegal activities. Informants need to be selected carefully on the basis of relevant knowledge, connection with the focal species, role in the community, representativeness in the community and so on. In a study of hunted wildlife in the Brazilian Amazon, for example, Parry and Peres (2015) used rapid interview surveys of local hunters to estimate the landscape-scale depletion of ten large-bodied vertebrate species around Amazonian riverine settlements. Informants were asked to identify the nearest place where a species had been seen, heard, or otherwise detected indirectly using tracks or faeces - and this information was then used to also identify areas in which those species were absent. Similarly, in Australia's Northern Territories, a large series of interviews was conducted across indigenous communities to document their knowledge of changes in the status of the native mammals over the last 50 years (**37**).

Workshops and dialogues: Multi-stakeholder workshops can be effective mechanisms for both collecting local knowledge and cross-checking it against other sources of knowledge. Examples include the annual quota-setting workshops held in Zimbabwe to determine trophy hunting quotas that bring together local communities, government officials, hunters, NGOs and other stakeholders. In such situations it is important to be aware of cultural barriers which may prevent some stakeholders from speaking up (for example some community representatives may feel they cannot speak freely in front of government representatives) and to ensure there are opportunities for all voices to be heard. Workshops do not have to be multi-stakeholder – for example in IPBES assessments a regular series of dialogue workshops are held just for indigenous people and local communities (see earlier description of the IPBES process).

Focus groups: Focus groups are another mechanism to bring together many people in what may be a more cost-effective and time-efficient way than a series of individual interviews. As with workshops, it is important to ensure that focus groups are designed in a way that enables all participants to feel they are able to speak, including consideration to cultural context (see below). In a study of species abundance in the Bosawás Biosphere Reserve in Nicaragua, Miskito and Mayangna communities were invited to share their knowledge via community-level focus group discussions and this was compared with data collected by scientists on transect walks. When compared, the information provided by the focus groups was as accurate as the data collected from the transect

walk. In addition, the focus groups were found to be eight times cheaper than the transect walks as well as engendering a sense of empowerment amongst the participating communities (11).

Participatory monitoring: As discussed in section 5, participatory monitoring can be a valuable mechanism for collecting valuable local and traditional knowledge. It can, however, take many forms and can vary hugely in the degree to which it entails meaningful and equal participation of local communities. The narwhal case study described above provides an example of the value of a joint survey conducted by scientists and indigenous hunters for building trust - even if it did not resolve a disagreement as to the abundance of narwhals.

Participatory mapping: In a study of medicinal and aromatic plants in Albania (38) key informants (harvesters) were asked to identify key areas for each of the species where the species was 'rare' or 'common'. For each species, 20 plots were placed along random transects (10 in 'rare' areas, 10 in 'common' areas) and the informants were asked to assess plant abundance within the plots based on locally defined indicators for status, trends and harvest related aspects such as plant damage. Scientists carried out a similar exercise and then the results compared. Similarly in a study of fishing in the Amazon, researchers asked fishers to mark on maps the most relevant sites for spawning, fishing, and migration routes of seven fish species. The markings were made on transparency sheets, which were subsequently scanned and superimposed on georeferenced maps and the sites that were marked most often identified.

Some methods may be more or less appropriate in different cultural contexts – for example in some cultures, it may be important to have separate groups of women and men or youths and elders while in other contexts gender or age does not matter but ethnicity does. Some cultures may wish to share knowledge through formal interviews and written documents and others through pictures, song or other forms. **Understanding the cultural context is thus vital before embarking on any activities to collect knowledge**.

Particular consideration also has to be paid to **exploring sensitive issues** – for example where harvesting may be illegal. Specialised methods are available for asking sensitive questions in ways that avoid potential for recrimination thus building trust and increasing the reliability of information provided (see 39 for a review of methods). One example is the unmatched count technique (40). This involves assigning individuals randomly into two groups – one control and one "treatment". The control group receives a list of non-sensitive statements or "items" whilst the treatment group receives the same list but with one additional statement concerning an illegal activity. Participants in each group are then asked to indicate how many, but not which items apply to them and the prevalence of the illegal activity is calculated by looking at the difference between the means of the two groups. Fig. 3B provides an illustration from a study seeking to explore illegal exports of orchids.

Please read the following statements and tell us how many are True for you. You do not need to tell is which statements are true For you, just the total number

Control group	Treatment group
I have never bought orchids at an orchid show	I have never bought orchids at an orchid show
I am a member of a Facebook orchid group	I am a member of a Facebook orchid group
I have a species [orchid] collection	I have personally sent or carried an orchid across an international border without obtaining the required CITES paperwork
I have been a member of an orchid society for more than a year	I have a species [orchid] collection
	I have been a member of an orchid society for more than a year

Figure 3B. Example of use of the Unmatched Count Technique to explore illegal orchid trade (replicated from 40).

Language is always a potential barrier to effective communication and data exchange, and **local language** intermediaries may be required. This can be particularly important when collecting local knowledge since much of this is expressed in the local vernacular and much of the richness and complexity of the knowledge will be lost without also understanding the richness and complexity of the language.

In other case, **example specimens** can be useful to help clarify species being discussed. It is important to remember that local species taxonomies are not always aligned with western taxonomies and the use of pictures, specimens, and animal or plant parts such as skins, feathers, leaves fruits, and bark may be useful to ensure clarity on the species being discussed. Cases compiled by the CITES Secretariat mention the use of photographs (**35**), mounted animal skins (**37**), or field walks and herbarium specimens (Tomasini and Theilade 2019) to ensure that species identification is clear to informants. Ziembicki et al. (2013) (**37**) note for example: *As an aid to identification and to facilitate discussions, we prepared mounted skins of most species of native terrestrial mammals (and some introduced); wherever possible positioned in life-like postures... In addition to specimens, we prepared large format books containing a range of photographs of all species*. They also highlight, however, that without the context of live animals behaving naturally in the wild, identification from pictures or specimens may be artificial, challenging or ambiguous.

8.4. How can difference between local and traditional knowledge and western science be resolved?

It is important to verify and validate local and traditional knowledge – just as it is important to do so for other sources of information, triangulating against multiple sources where possible. This means, if possible, verifying it with other sources of local and traditional knowledge as well as with western scientific knowledge. Validating information collected with the people or community from whom it was collected is not only respectful, but it also provides an opportunity to check it has been correctly recorded and that there are no intra-community differences. Experts interviewed in the CITES Secretariat analysis (**10**) highlighted that, as well as being respectful, presenting and re-discussing findings with communities and informants reduces misinterpretations, and allows communities to share their interpretation of observed patterns.

In some situations, it may also be useful to validate one form of local and traditional knowledge with another. In the Australian Northern Territories, for example, Ziembicki et al. (**37**) describe how their study on the status of native mammals sought to collate local-scale information from multiple regions, cross validating between the different sources of local knowledge. They found a compelling similarity in findings across very different communities and different language groups.

When it comes to validating local and traditional knowledge against western scientific knowledge there are many methods including by direct comparison of observations made by local community members and scientists for example after transect walks, or in resource assessment maps.

In some cases, there may be no scientific knowledge against which to validate local and traditional knowledge – indeed one of the benefits of local knowledge highlighted earlier is that it can sometimes fill critical gaps and be the *only* source of knowledge for example on some local populations of some species. Experts included in the CITES (2020) (**10**) analysis suggest that in such cases overall plausibility may be able to be judged by indirect inference. For example, the scientific plausibility of local knowledge in Chinese species assessments is reviewed through specific questions of more general, verifiable nature that reveal the accuracy of informant statements (such as questions on a species' life-history). CITES (2020) (**10**) also suggests that "reliability indices" can be developed whereby informant statements are rated according to various indicators of the informant's knowledge such as their ability to correctly identify a species, the extent to which the informant's statements are confirmed by other informants; the extent to which the informant is a recognised knowledge holder, and so on – see **Box I**).

Box I: Example of a framework for assessing reliability of local knowledge

In a study to explore the decline of native mammals in northern Australia (37), indigenous information was compiled from a series of interviews. In order to account for different levels of knowledge, a system for ranking the reliability of information was devised whereby the information from each interview was assessed against five criteria:

1. Correct identification of the species or knowledge of local language name
2. Interviewee being resident, active or otherwise familiar with the specified location
3. Information provided corroborated by others in the same location
4. Consistency with scientific and/or historical data
5. Overall reliability of interviewee in terms of recognition as a knowledge holder in the community

A point was allocated for criterion resulting in a maximum score of 5. Reliability of each interview was then scored as high (4–5 points), medium (2–3 points) and low (0–1) and this reliability taken into account in drawing conclusions.

Inevitably, there may sometimes be discrepancies between different sources of local and traditional knowledge and between local knowledge and scientific knowledge. In these cases, it is helpful to explore if there are other factors affecting this discrepancy, including differing spatial or temporal observation scales, differing taxonomies, etc. In Canada, the traditional knowledge that is integrated in the COSEWIC status report, must be validated and approved by communities who provided the information to ensure it has been properly and respectfully incorporated. In the Canadian case, traditional knowledge must be weighted equally to western science and if there is a contradiction between the two this is treated the same as a contradiction between two science sources.

Triangulating across multiple sources is an important exercise for validating knowledge but where the triangulation reveals discrepancies it is important that a process is in place to explore and understand these differences to determine if they can be resolved. This may take the form of a facilitated discussion or dialogue to probe the differences and explore why there are different perceptions. In the narwhal case study, a joint survey was organised between scientists and hunters, which – while not resolving the disagreement – helped build trust between the two. Some tools exist to help with this. For example, in 2020 the New Zealand Environmental Protection Authority published the Mātauranga Framework to help decision-makers understand, test, and probe Māori traditional knowledge when it is presented as evidence.

In case of discrepancies that cannot be resolved within the timeframe for elaborating an NDF, the **precautionary approach** should be used, to ensure that trade will not be detrimental for wildlife under any of the conflicting scenarios.

9. At what stage in an NDF process should local and traditional knowledge be used?

Module 2 provides a generic framework to describe the key stages in an NDF process, but the exact process that Scientific Authorities may follow varies from country to country. In some countries, some initial scoping may be undertaken early in the process to identify key stakeholders and key knowledge holders, how best to contact and communicate with them, and what methods to use to collect their knowledge (**Box J**).

The risk assessment and impact assessment stages are the key points in the process where the best available information is compiled and assessed by the Scientific Authority. This information may include local and traditional knowledge. There may also be a role for local and traditional knowledge to inform any remedial actions or ongoing monitoring. In short, local and traditional knowledge – and knowledge holders – could be engaged throughout the NDF process as summarised in **Table 3B** – but noting it is the Scientific Authority who makes the actual NDF determination.

The local and traditional knowledge incorporated into the NDF process should be properly documented and attributed to the respective knowledge holders. Transparent reporting should highlight the contributions of

traditional knowledge, acknowledge the cultural significance, and recognize the role of indigenous and local communities in the assessment process.

Box J: Initiating NDF-making using local and traditional knowledge

In many cases, Scientific Authorities will be required to make NDFs for exports of CITES-listed species in which trade has been taking place for many years. Often, those exports may have occurred without robust NDFs being completed – sometimes even when trade occurs at high volumes. The species in question may be relatively unknown, and Scientific Authorities may not have sufficient (or any) information available to begin making an NDF.

In cases like these, local and traditional knowledge can be a significant source of information to begin the NDF-making process. For example, Scientific Authorities can call harvesters, middlemen, and exporters to their offices to explain the trade system. Doing so can provide useful information on harvest volumes, harvest seasons, harvestable sizes or parts and derivatives, locations of harvest, supply chain actors, and many others aspects of trade. This information can be useful for monitoring, management, and for regulating trade-using NDFs with conditions (see **module 1 section 5** for additional information on NDFs with conditions).

Harvesters often have a strong understanding of species' biology, so may be able to provide Scientific Authorities with information on litter/clutch sizes, habitat associations, dispersal and movements, areas or timings of high-density, and other aspects of biology and ecology.

While this knowledge will not be sufficient to complete an NDF, it can often provide Scientific Authorities with enough initial information to begin the NDF-making process, to identify which gaps need to be filled, to highlight areas that require verification, and about how to monitor and manage harvests and trade in future.

Table 3B: Stages in the NDF Process where local and traditional knowledge can be applied (see **module 2** for detailed descriptions of each stage)

NDF stage	Potential role of local and traditional knowledge?
Initial Information Gathering	**Limited**: The initial information required in this step is largely factual so there is limited need for local and traditional knowledge. However, a key requirement is the correct identification of the specimen and, given that local and western taxonomies may vary, the Scientific Authority may consider using information gathered by researchers or others on local/indigenous taxonomies to ensure correct identification and nomenclature.
Simplified Assessment	**Yes**: A simplified assessment requires consideration of annual harvest level, life history traits, the area of distribution, conservation and threat status and the levels of illegal trade. Local and traditional knowledge can help gain insights into all of these issues and can be collected including through participatory monitoring, story-telling and other sources of information, as appropriate.
Comprehensive Assessment	**Yes**: A comprehensive assessment involves a risk evaluation and an impact and management evaluation. Local practitioners can have very detailed, first-hand, knowledge of harvest impacts. Through participatory monitoring and long-term knowledge of trends local and traditional knowledge can provide insights into the impact on populations and the effectiveness of management measures. It may also provide insights into the role of the species in the ecosystem and on ecosystem impacts based on detailed knowledge of local ecosystem functioning including changes over time.
Conclusion or Decision	**No**: The Scientific Authority is responsible for making the final recommendation to the Management Authority by determining a positive or negative NDF or an NDF with conditions.
Adaptive Management and Monitoring	**Yes**: Participatory monitoring and management can form part of the remedial actions for NDFs. The Scientific Authority is unlikely to be directly responsible for carrying out these activities. See **module 1 section 9** on Adaptive Management.

10. Summary and Conclusion

1. The role of the Scientific Authority is to make a science-based NDF using the best available information that may include local and traditional knowledge. In doing so, the Scientific Authority may collaborate or consult with a wide range of stakeholders to collect information.

2. This module describes local and traditional knowledge as knowledge that local stakeholders or communities have about the populations of locally occurring species, through their own experience, observation or experimentation, or through non-formal and non-scientific knowledge transfer from other local stakeholders or community members.

3. Local and traditional knowledge is diverse and comes in many forms (written, spoken, drawn etc) and from many sources including but not limited to indigenous peoples; non-indigenous local communities; practitioners including harvesters, hunters, fishers, collectors; local scholars and researchers.

4. Local and traditional knowledge can complement scientific knowledge and may help increase the validity and legitimacy of conservation actions. Its use can signal respect and acknowledgement of the role of local stakeholders.

5. There are many different approaches to participatory monitoring, with varying levels of local participation - from externally driven (with local people only involved as data collectors) to approaches where the whole monitoring process is carried out by local stakeholders (with no direct involvement of external agencies).

6. Local and traditional knowledge has been incorporated into many scientific assessments at international, national and local levels and is already being incorporated into some NDFs with a wide variety of approaches being used. Local and traditional knowledge can be used in multiple stages of the NDF process.

7. It may not always be appropriate to include local and traditional knowledge – it may not always be available and/or the knowledge holders may not always want to share it. If local or traditional knowledge *is* available, then it is important that it is collected in respectful ways with full consent of the knowledge holders and appropriate attribution.

8. A diversity of methods can be used to collect local and traditional knowledge – the exact method used will depend on a wide range of factors including the type of information required, the cultural context, the available time and resources.

9. It is important to verify and validate local and traditional knowledge – just as it is important to do so for other sources of information.

10. In case of discrepancies between different types of knowledge that cannot be resolved within the timeframe for elaborating an NDF, by virtue of the precautionary approach, an NDF should act in the best interests of the conservation of the species.

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