

NOAA Fisheries and National Ocean Service Guidance and Best Practices for Engaging and Incorporating Traditional Ecological Knowledge in Decision-Making

Introduction

Traditional ecological knowledge (TEK) has the potential to inform and enrich many aspects of NOAA's work, allowing us to better understand Earth and ocean systems and fulfill our management responsibilities. As a continuation of our commitment to engage meaningfully with federally recognized Tribes, non-recognized Tribes and other indigenous people, NOAA Fisheries and the National Ocean Service (NOS) are building upon the "NOAA Procedures for Government-to-Government Consultation with Federally Recognized Indian Tribes and Alaska Native Corporations" (Consultation Handbook) to provide guidance on including TEK in decisions. Indigenous people (e.g., American Indian, Alaska Natives, Native Hawaiians, Chamorro, American Samoans, and Taíno) have a rich body of knowledge, accumulated over generations through repeated interaction within tightly associated social and environmental systems. While the Consultation Handbook applies specifically to federally recognized Tribes and Alaska Native Corporations, this document is broader and applies to the collection and use of TEK from indigenous people regardless of Federal recognition status.

NOAA Fisheries and NOS encourage, as appropriate and to the extent practicable and permitted by law, the inclusion of TEK in the line offices' environmental science, policy and decision making process, to better facilitate consultations as required by E.O 13175, understand environmental justice concerns as directed by E.O. 12898, inform agency decision making, and build partnerships with indigenous people.

There is no single universally accepted definition of TEK. The term is ambiguous since the definitions of "traditional," "ecological" and "knowledge" are themselves ambiguous. The NOAA Consultation Handbook, defines TEK as "a cumulative body of knowledge, practice and belief evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment."¹

Knowledge systems consist of agents, practices and institutions that organize the production, transfer, and use of knowledge. Knowledge systems are the foundation for all societies, in that they support and guide behavior, communication, decision-making, and other aspects of life, including governance. In relation to indigenous peoples, different types of TEK (e.g., taxonomic, spatial, temporal) are often held by specific knowledge holders (agents) and manifested in the various parts of their unique cultural traditions, such as language, customs, and social institutions. Like all knowledge, TEK and its systems are dynamic and evolve over time, integrating new information and experiences.²

This guidance focuses on TEK associated with indigenous peoples, as distinguished from "local ecological knowledge" held by long-time residents in an area, or long-term participants in an activity or industry.

¹ Berkes F., J. Colding, and C. Folke. (2000). Rediscovery of Traditional Ecological Knowledge as Adaptive Management. *Ecological Applications*, 10(5), 1251-1262.

² Tengö, M., R. Hill, P. Malmer, C. M. Raymond, M. Spierenburg, F. Danielsen, T. Elmqvist, and C. Folke. (2017). Weaving knowledge systems in IPBES, CBD and beyond – lessons learned for sustainability. *Current Opinion in Environmental Sustainability*, 26-27, 17-25.

Although such local knowledge has importance to the work of NOAA Fisheries and NOS, the focus of this guidance is on the incorporation of knowledge from indigenous peoples.

Objective

NOAA recognizes the importance of indigenous peoples' traditional knowledge for understanding the environment, adapting to environmental change, and mitigating negative environmental impacts. Although the integration of TEK can improve the knowledge foundation upon which federal level decisions are made, indigenous communities may be reluctant to share this type of information out of concern that it be misused or mis-appropriated, or because sharing certain parts of this knowledge to those outside the group or who lack specified training and understanding of the cultural context may be forbidden. Examples of potential risks of sharing TEK include misuse of intellectual property, confiscation of physical property such as artifacts, confidentiality concerns, restricted resource access, misaligned expectations, social retaliation, damaged social networks, and restricted research opportunities. Engaging with indigenous peoples and their knowledge systems "involves encounters of different world views, identities, practices, and ethics, in a context of asymmetries of power and rights."³ Therefore, NOAA Fisheries and NOS have developed this guidance document to provide best practices designed to ensure that the collection and use of TEK is responsible, effective, and mutually beneficial.

This guidance and its implementation does not create enforceable rights or a cause of action under law. This guidance is not intended to supersede any obligation of NOAA Fisheries or NOS to consult TEK holders with whom they are collaborating. Nor is this guidance intended to supersede any Executive Orders, policies or laws requiring consultation with federally recognized tribes and Alaska Native Corporations.

Responsibilities

This guidance is premised upon two foundational principles applicable to the use of TEK by decision makers: "Cause No Harm" and "Free, Prior and Informed Consent." These principles are intended to guide the motivation, character, and intent of collaborative initiatives undertaken by NOAA Fisheries or NOS and TEK holders. These principles recognize that each indigenous community has its own customs, practices and requirements that may guide TEK interactions with outside entities and may restrict how different facets of TEK are shared and used by tribal and non-tribal entities.

"Cause No Harm." This principle involves identifying and avoiding risks that could lead to misappropriation of TEK. Specifically, it includes identifying any potential intellectual property concerns that may result from sharing TEK information related to natural and/or cultural resources. To do this successfully, NOAA Fisheries and NOS staff are encouraged to:

1. Consult with the NOAA Office of General Counsel on the potential intellectual property and data confidentiality implications of any prospective TEK collection;
2. Consult with NOS and NOAA Fisheries Tribal Liaisons;

³ Tengö, M., R. Hill, P. Malmer, C. M. Raymond, M. Spierenburg, F. Danielsen, T. Elmqvist, and C. Folke. (2017). Weaving knowledge systems in IPBES, CBD and beyond – lessons learned for sustainability. *Current Opinion in Environmental Sustainability*, 26-27, 17-25.

3. Consult with the Institutional Review Board for any partner agencies, organizations, or universities that may be subject to Human Subjects Review;
4. Consult with the NOAA GC for data collection that involves asking identical questions to 10 or more individuals;
5. When individuals voluntarily participate in a scientific process that involves TEK, it may also be considered citizen science. Examples include individuals assisting in gathering TEK or documenting traditional practices involving natural resources. Citizen science as defined by the Crowdsourcing and Citizen Science Act (15 U.S.C. § 3724) is “a form of open collaboration in which individual or organizations participate voluntarily in the scientific process.” Define clearly and carefully, in conjunction with indigenous peoples, the roles and responsibilities of all partners;
6. Define, in conjunction with indigenous peoples, what information will be shared and under what context;
7. Establish at the outset of the project, in conjunction with indigenous peoples, the acceptable use and means to interpret or share information; and,
8. Treat members of the indigenous community with respect, honesty, accountability, equity and empowerment.

“Free, Prior and Informed Consent.” The principle of Free, Prior and Informed Consent (FPIC) is a critical element of TEK collection efforts involving indigenous peoples. Following is a summary of these concepts:

- **Free:** TEK holders should not be coerced or pressured into sharing TEK with the federal government.
- **Prior:** This term ensures that, procedurally, TEK holders should be involved at the earliest practicable stage. Prior refers to a process to obtain consent before TEK is accessed. For some undisclosed knowledge, consent may not be given.
- **Informed:** Existing treatments of the meaning of “informed” have emphasized the need to address costs and benefits, risks and opportunities, and the facts surrounding any given situation.
- **Consent:** This term ensures that processes for obtaining consent should first affirm the right of TEK holders to decline to engage in mobilizing TEK for cooperative projects, and that saying “no” should have no legal implications for respecting indigenous rights and interests or fulfilling any trust obligations.⁴

Guidance

Best available science can incorporate TEK and other related indigenous practices. Ensuring ongoing two-way communication with TEK holders through transparent processes and good governance at all levels, including through appropriate coordination mechanisms, is essential to establishing the trust necessary for responsible collection and integration of TEK into decision-making. Depending on the

⁴ Although FPIC draws upon the concepts outlined in the United Nations Declaration of Rights and Indigenous Peoples (UNDRIP), as used in this guidance FPIC is relied upon specifically to guide TEK collection activities. As noted in the “Announcement of U.S. Support for the United Nations Declaration on the Rights of Indigenous Peoples,” the United States recognizes the significance of UNDRIP’s provisions on free, prior and informed consent, which the United States “understands to call for a process of meaningful consultation with tribal leaders, but not necessarily the agreement of those leaders, before the actions addressed in those consultations are taken.”

situation, it may be inappropriate to suggest that TEK should be “validated”.⁵ Rather, indigenous peoples’ own internal methods of defining, valuing, and validating their own knowledge/knowledge systems should be respected.

Starting a TEK Dialogue:

NOAA Fisheries and NOS respect the inherent value of TEK and intend to include and give appropriate weight to TEK that indigenous groups agree is relevant to specific projects and management issues. If a community chooses to discuss TEK with NOAA Fisheries or NOS, the following questions will help to clarify the scope of and process for the discussions:

- 1) Should we be aware of any tribal/native laws or policies established regarding the use of TEK?
- 2) Does the TEK holder believe the knowledge to be subject to any applicable intellectual property rights (e.g., copyright, patent)?
- 3) What specific role would the indigenous group like to have in the identification of relevant TEK related to a specific area or question?
- 4) How will the indigenous government or their duly designated representative(s) prefer to transmit the information?
- 5) Is the TEK holder(s) requesting confidentiality for the TEK? Have they been informed that there are limitations on the agency’s ability to protect TEK from public disclosure (which includes NOAA’s obligations under the Freedom of Information Act)?
- 6) Is anonymity being requested by individuals sharing TEK?
- 7) Have you discussed how the TEK will be incorporated with existing information and processes to impact decision-making?
- 8) How does the TEK holder wish to be credited or cited for the use of their knowledge in the decision-making process?
- 9) Should an Memorandum of Agreement or other documentation be required or recommended to memorialize FPIC prior to collection of TEK?

Methods for Identifying and/or Collecting TEK⁶:

Below are some of the methods utilized by social scientists for collecting TEK. The methods are not necessarily represented in priority order. Ideally, no data would be collected until a preferred method is established with indigenous group leaders and, through them or previous fieldwork, with local TEK holders. TEK data is best collected by experienced social scientists, ideally someone who has existing knowledge of and/or relationships with the indigenous group in question.

- *Literature review* is an important component in any TEK Collection (Bernard 2017:76-82). Many publications are publicly available, either on the web, through NOAA Library sponsored subscription services, membership in scientific associations, and through inter-library loan. Many indigenous groups in the United States have been studied by socio-culturally-focused disciplines such as anthropology and sociology at one time or another. Some indigenous scientists and their communities have published their own documents on their own history and cultural practices. During a literature search, ethnographies as well as collections of stories,

⁵ It should be noted that many large-scale environmental changes described by indigenous populations can, in fact, be tied to events from thousands of years ago that are known to us through science (Nunn, P. (2018). *The Edge of Memory: Ancient Stories, Oral Tradition and the Post-Glacial World*. London, Bloomsbury.).

⁶ Bernard, H. R. (2017). *Research methods in anthropology: Qualitative and quantitative approaches*. Lanham, MD: Rowman & Littlefield.

myths, legends, and songs will be instrumental to one's research on societies, clans, keepers of knowledge, ceremonies, uses, processes, and interactions.

- *The semi-structured interview* is a standard ethnographic method for gathering information. Semi-structured, or in-depth interviewing uses open ended questions, but follows a general guide and covers a list of topics (Bernard 2017:164-165). Use of a guide allows for collection of reliable, comparable qualitative data across multiple interviewees. For example, a guide about a particular species may include such topics as its habitat, interactions with other species, related traditions and ceremonies, who or what positions hold knowledge of and rights to the species, taboos, cyclical events, and vocabulary. These will not necessarily be addressed in any specific order. Begin with the open-ended topic questions (e.g., Can you tell me about... or How did you learn about...). Ask additional probing questions as necessary (to ask for more information or clarification on a point) throughout the interview. But the detail of content and flow is directed by the interviewee. Some topics may be discussed in-depth while others are only touched upon.
- *Focus groups* are a group interview (usually 6-12 people), facilitated around set topics and materials (Bernard 2017:179-183).⁷ The group dynamic of a focus group can allow for the discovery of additional topics of interest that might not come up in individual interviews. A focus group can also be used to explore the normal variations between general rules and specific behaviors under varying conditions. In general, focus groups can be helpful in determining who within a community is most knowledgeable about the species or ecosystem being studied. However, for TEK research it is often best to go through existing official contacts with a particular indigenous group to request the names of TEK holders who hold specific types of knowledge. This is a matter of respect and proper procedure.
- *Participant observation* is a research method, often used in anthropology and sociology, which involves a researcher studying a group by sharing in their lives and activities. Information is recorded about what people do and say, and how they describe specific topics and under what circumstances. Every culture has standard norms of behavior that anyone can articulate and these may be readily provided in interviews. There may be some exceptions within the culture. Participant observation can help the researcher identify these normal inconsistencies and ask about them more specifically in order to fully understand the complexities of the behavior in question. It can also provide awareness of apparent rules for behavior in each culture (including your own) that no one may have mentioned because they were so deeply engrained in the culture that no one would think to mention them. If it is what people do, it may never occur to anyone that it might be done differently. There are similar "obvious" rules for interacting with the environment that may not come up in an interview, but may be noted when participating in daily activities (re. Becker and Geer 1957).
- *Language* can provide insight into a culture and its view of the natural world. Some indigenous people now have written dictionaries for their languages. A native speaker can provide information about words, their meanings, associations and similarities.

⁷ Note that standard questions posed to ten or more individuals by the federal government may trigger the requirement for prior approval by the Office of Management and Budget pursuant to the Paperwork Reduction Act. 44 U.S.C. §§ 3051 *et seq.*

- *Oral history* is, in this context, the process by which indigenous people interpret their lifeways and beliefs to outsiders, or teach or remind other members of the group about them. The person providing the information during an interview, often an elder, will be sharing lifeways surrounding the topic in question. Often, this person is highly respected in that culture. The researcher should begin by asking about a general topic (e.g., Please help me to understand salmon). Bernard (2017:168)⁸ notes that the rule for oral histories is: “Get people onto a topic of interest and get out of the way. Let the informant provide information that he or she thinks is important.” This technique of asking open-ended questions will also help avoid inadvertently offending the person being interviewed.

Data Quality:

If communities understand the intended uses of data, they may be more likely to provide access and/or contribute their knowledge and data to the process. Once data have been collected, and a preliminary analysis is conducted, NOAA Fisheries and NOS should share these results with the indigenous communities and provide opportunities for feedback before finalizing results. Final results used to inform Federal decision making and policy development should also be shared. Knowing that the data they submitted was integral to Federal decision making - particularly resource allocation and service provision decisions – is essential for establishing a long-term relationship of scientific collaboration.

In documenting knowledge processes (those of defining, valuing, and validating knowledge) the information should go through a systematic vetting process, established in the methods section, but different levels of “validation” may be appropriate or inappropriate depending on the research question (or form of TEK), method for collecting TEK, and research and management goals.

Communication and Training:

Working with TEK holders and community leaders to develop a shared understanding of why the research and data are needed, the expected relationship between the researchers and the community, and planned uses of the data prior to collecting data is essential. The data collection process should be discussed and agreed upon prior to data being collected. Data forms and requested information should be clearly defined and reviewed by relevant tribal and indigenous representatives, when necessary, training should be provided to communities regarding collection of information.

NOAA Fisheries and NOS can help to improve the quality and quantity of data collected in communities by providing clear instructions and definitions of agreed upon data variables to communities and by offering organized training sessions or other forms of technical assistance regarding data collection. Initial scoping meetings may be necessary to define the kinds of TEK that are available and that may be shared. For example, it may be helpful to include contact information on data forms for a specific staff member who is available to guide communities through data collection. Training is key for survey technicians, scientific staff, and community data collection personnel to ensure that best practices for conducting surveys, interviews, or other data collection methods are being used and we are ensuring respectful interactions with our native communities. Whenever possible, researchers with a prior relationship to the indigenous group should be involved or consulted to facilitate good working relationships.

Data Confidentiality:

⁸ Bernard, H. Russell. (2017). Research methods in anthropology: Qualitative and quantitative approaches. Rowman & Littlefield.

Prior to collection or use of TEK, it is strongly recommended that a clear understanding and agreement are established about data confidentiality between and among all parties directly involved. NOAA Fisheries and NOS programs should consult with NOAA General Counsel before meeting with a TEK holder to avoid potential issues related to data confidentiality. Communication with communities regarding TEK should include NOAA's purpose for collection and any intended uses. Communication about data use should also include ways in which data will not be used and any applicable procedures in place to protect sensitive data and the identity of individual communities or informants. It is important to communicate precisely about the ways in which data will be secured and protected, and the circumstances in which data may or may not be used, including being made publicly available. It is important to tell the community that their data, generally, may nonetheless be subject to release under the Freedom of Information Act (FOIA) or other legal requirements.

Best Practices for Collecting and Using TEK:

Collecting TEK:

- Respect and seek to understand each unique indigenous group and their knowledge system(s).
- Recognize that TEK holders are the authorities on their own knowledge systems, and deserve to be treated as such. Ensure that the people tasked with working with communities have knowledge, experience and training in working with indigenous peoples and TEK and are aware of the fact that trust must be developed first, which can often be a long process.
- Be humble and open to getting advice from those who know the communication protocols and how to identify community authorities and experts.
- Find out how to follow communication protocols and respectfully identify authorities in order to develop an appropriate approach for working with TEK systems in a partner community (e.g., what are common terms used in the community? What types of questions are appropriate for outsiders to ask? Who will delegate authority to speak for the indigenous community and how is that decision made? Who is a contact person/go-between in the community who will help educate researchers?)
- Understand and clearly disclose any constraints or limitations regarding the ability to protect sensitive or confidential information before seeking access to TEK. Consult with NOAA General Counsel, and specify what measures will be taken to protect sensitive or proprietary information (understanding that there are often legal limits to what protections can be provided by NOAA Fisheries and NOS for information in the government's possession). Remember to discuss and come to agreement about any concerns from the community prior to beginning conversations around TEK.
- If the indigenous government or knowledge holder requests protection for TEK that may be shared, agency staff should not write down or electronically record confidential or sensitive information. Agency staff should also discuss with the TEK holder the advantages and disadvantages of keeping TEK confidential. For example, if information is not recorded as part of the administrative record, the agency cannot rely on that TEK as part of its basis for the federal decision.
- Respect the right of indigenous governments and/or TEK holders to withdraw participation and access to TEK at any time during the collaborative process. Some reasons for withdrawing participation may not be evident to those not operating within a given TEK system and the communities, governments, or individuals should not be penalized for doing so.
- NOS and NOAA Fisheries should work to share and archive any data collected. Any confidential or proprietary data that has been provided for public release solely in aggregate form must not be shared in disaggregated form -- except under any legal requirement and never without prior notification of the provider of that particular TEK.

Using TEK:

NOAA Fisheries and NOS make decisions based on multiple factors and considerations, such as statutory requirements, best available science, and other factors. TEK will not be the sole determining factor in agency decision-making, but should be integrated into the best available science to support decision-making. The following should be considered best practices when using TEK:

- Collaborate with project partners to develop pre-determined methods for each step of bringing TEK into initiatives, rule makings or other Federal actions.
- When appropriate and only with the Free, Prior and Informed Consent of TEK holders, decision-makers should consider and use TEK.
- The extent that tribal treaty rights, government-to-government consultations, and TEK help inform agency actions should be explained and documented, as appropriate, in decision documents and administrative records.
- Understand community standards, protocols, and legal requirements for all federal project team members participating in projects related to TEK.

Example of Incorporating TEK:

The NOAA Preserve America Program funded a project titled: *Traditional Ecological Knowledge: Reconstructing the Historical Run Timing and Spawning Distribution of Eulachon Through Tribal Oral History*. This was a joint TEK project by the NOAA Fisheries' West Coast Region and the Cowlitz Indian Tribe located in Longview, Washington.⁹

Coastal Indian Tribes, such as the Cowlitz Tribe, and First Nations of the Pacific Northwest have fished and traded for eulachon (*Thaleichthys pacificus*) in tributaries of the Columbia River for many generations. The cultural significance of this species is immense to these tribes, "and eulachon appears as a prominent figure in ancestral native myths." Historically returning to Columbia River tributaries in the late winter and early spring when other food supplies were scarce, this species is commonly known as the "savior" or "salvation fish".

The rest of the world was introduced to eulachon in February 1806, when Meriwether Lewis described this previously "unknown" fish as "superior to any other fish I ever tasted." Since then, settlers to the Columbia River Basin identified eulachon as an important resource and developed extensive commercial and recreational fisheries that continue to the present.¹⁰

Despite the economic, cultural, and ecological importance of the southern distinct population segment (DPS) of the Columbia River eulachon run, the timing and distribution of this species was poorly known. The goal of the joint Federal/Tribal TEK project was to reconstruct historical run timing and spawning distribution of eulachon through the use of tribal oral history gathered from elders of the Cowlitz Indian Tribe and other Tribal elders who traveled to the tributaries of the Lower Columbia River to fish. In a summary report of eulachon, NOAA's Northwest Fishery Science Center specifically stated, "...there is a largely untapped store of knowledge on eulachon residing in the culture and traditions of Native American Tribes and First Nations of Canada..." Native American tribal oral histories aided in the

⁹ NOAA Fisheries and Cowlitz Indian Tribe. 2010. *Traditional Ecological Knowledge: Reconstructing the Historical Run Timing and Spawning Distribution of Eulachon Through Tribal Oral History*. National Marine Fisheries Service and the Cowlitz Indian Tribe. NOAA Preserve America Program 2010. Order Number: AB133F10SE3168.

¹⁰ At its height, the Columbia River Basin eulachon fishery produced commercial harvests in excess of 3 million pounds and supported large recreational harvest as well (NOAA Fisheries and the Cowlitz Indian Tribe 2010).

identification of key spawning habitat, timing of eulachon runs, and run differences between tributaries. The joint TEK project was described as "...an invaluable resource that can capture much more information than simple presence/absence or extent of distribution."⁶ This information directly enhanced NOAA Fisheries and Native American Tribes in their efforts to identify and protect critical habitat, increase abundance of the species, and achieve species recovery.

NOAA Fisheries issued a Final Listing Determination for the southern DPS of eulachon as a threatened species under the Endangered Species Act in March 2010.¹¹ TEK provided by the Cowlitz and other Columbia Basin Tribes was used in designation of proposed critical habitat for the Southern Distinct Population Segment of Eulachon¹² and to develop actions listed in the *Endangered Species Act Recovery Plan for the Southern Distinct Population Segment of Eulachon (Thaleichthys pacificus)* completed in 2017.¹³ The results of the TEK project jointly developed by NOAA Fisheries and Native American Tribes had an immediate and direct effect on important efforts to protect (through designation of critical habitat) and guide actions to recover (through development of a recovery plan), this listed species.

Measuring Effectiveness

TEK has the potential to facilitate improved relationships among indigenous peoples and Federal or State governments (Cronin and Ostergren 2007). While, in some cases, including TEK has proven beneficial in improving resource management, some challenges have been identified, including a basic lack of trust, institutional barriers, mission conflicts, cultural differences, and the ambiguity of terms (Berkes et al. 2000). To successfully include TEK, these challenges should be understood and addressed (Cronin and Ostergren 2007).¹⁴ In addition, any assessment of effectiveness should include outcomes related to how often and how well TEK is used in decision-making and whether reasonable attempts were made to identify and include TEK from indigenous groups with relationships to the resource in question.

Conclusion

Although the collection of TEK is itself not government-to-government consultation (but may be part of it in some circumstances), TEK is one way federal agencies can begin to fulfill the federal trust responsibility to federally recognized tribes with regard to the management of agency trust resources. More broadly, the integration of TEK can contribute to a mutually beneficial partnership between agencies and indigenous people and communities. A critical aspect of environmental management is acquiring information that is not only accurate but trusted by those who make and abide by decisions

¹¹ Federal Register, Vol. 75, No. 52. March 18, 2010. Endangered and Threatened Wildlife and Plants: Threatened Status for Southern Distinct Population Segment of Eulachon. Final Rule. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 13012-13024.

¹² Federal Register, Vol. 76, No. 3. January 5, 2011. Endangered and Threatened Wildlife and Plants: Designation of Critical Habitat for Southern Distinct Population Segment of Eulachon. Proposed Rule; request for comment. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 515-536.

¹³ National Marine Fisheries Service. September 2017. Recovery Plan for the Southern Distinct Population Segment of Eulachon (*Thaleichthys pacificus*). National Marine Fisheries Service, West Coast Region, Protected Resources Division, Portland, OR, 97232.

¹⁴ Cronin, Amanda E., & Ostergren, David M. (2007). Democracy, participation, and native American tribes in collaborative watershed management. *Society and Natural Resources*, 20(6), 527-542.

based on that information. The understanding and incorporation of TEK offers one important way of bridging gaps in perspective and understanding, especially when used in conjunction with knowledge derived from ecological and social sciences. The effective participation of indigenous and local communities in the development and implementation of actions can facilitate support of measures, reduce conflicts during implementation and contribute to the recognition of the rights of federally recognized tribes and other indigenous groups (Wiber et al. 2004¹⁵; Röckmann et al. 2012¹⁶; Msomphora 2015¹⁷).

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¹⁵ Msomphora, Mbachi R. (2015). Stakeholder participation and satisfaction in the process of developing management plans: The case of Scottish Inshore Fisheries Groups. *Ocean & Coastal Management* 116:491-503
¹⁶ Röckmann, Christine, Clara Ulrich, Marion Dreyer, Ewen Bell, Edward Borodzicz, Päivi Haapasaari, Kjellrun Hiis H. Hauge, Daniel Howell, Samu Mäntyniemi, David Miller, George Tserpes, and Martin Pastoors. (2012). The added value of participatory modelling in fisheries management—what has been learnt? *Marine Policy* 36(5):1072-1085.
¹⁷ Wiber, Melanie, Fikret Berkes, Anthony Charles, and John Kearney. (2004). Participatory research supporting community-based fishery management. *Marine Policy* 28(6):459-468.