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# Re-envisioning State and Tribal Collaboration in Fishery Assessment and Restoration

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In 2007, the state of Michigan and five tribes entered into a consent decree that provides opportunity for collaborative fishery assessments and restoration activities. The struggles found in state and tribal cooperation are well known by many fisheries practitioners; less well known is the benefit, although described extensively in literature. To achieve this benefit, each participating culture must be granted an equitable and mutually beneficial role in the comanagement arrangement. To comprehend the range of perspectives and values for fishery assessment and restoration activities, we conducted semistructured interviews with state and tribal agency participants and evaluated work plan data. Similarities included focus on ecosystem sustainability and harvest opportunities; however, participants often assigned and described *value* differently through divergent western and indigenous knowledge systems. New areas for fostering cultural understanding, broader views, collaboration, and networking to develop shared priorities are proposed.

### **Reconsiderando la colaboración estado-tribus en la evaluación y restauración de pesquerías**

En 2007, el estado de Michigan y cinco tribus consensuaron un decreto que abre la oportunidad de establecer actividades de colaboración para evaluar y restaurar pesquerías. En el círculo de las pesquerías, son bien conocidas las dificultades que hay para la colaboración entre el estado y las tribus; y aunque ampliamente descrito en la bibliografía, el beneficio es menos conocido. Para concretar este beneficio, se debe garantizar que cada cultura que participe tenga un papel equitativo y mutuamente provechoso dentro de un esquema de comanejo. Para entender mejor el amplio rango de perspectivas y valores relevantes para el manejo y restauración de pesquerías, se aplicaron entrevistas semi-estructuradas a participantes tanto de las tribus como de las agencias de gobierno y se evaluaron datos de un plan de trabajo. Las similitudes surgieron en cuanto a la sustentabilidad ecológica y a las oportunidades de captura; pero con frecuencia los participantes, dentro de los sistemas de conocimiento indígena y occidental, asignaban y describían *el valor* de forma divergente. Se proponen nuevas áreas para impulsar el entendimiento cultural, para ampliar las visiones y colaboraciones así como fomentar redes de trabajo con el fin de desarrollar prioridades comunes.

### **Réinventer la coopération entre l'État et les tribus pour l'évaluation et la restauration des pêches**

En 2007, l'État du Michigan et cinq tribus ont conclu un décret de consentement permettant une évaluation collaborative et les activités de restauration des pêches. En matière de coopération, les luttes qui opposent l'État et les tribus sont bien connues de nombreux praticiens de la pêche; par contre, les avantages qui les réunissent, bien que largement décrits dans la littérature, sont beaucoup moins bien connus. Pour en tirer parti, chaque culture participante doit se voir accorder un rôle équitable et mutuellement bénéfique dans la cogestion. Pour comprendre l'éventail des perspectives et des valeurs pour l'évaluation de la pêche et les activités de restauration, nous avons mené des entrevues semi-structurées avec l'État et les agences tribales participantes et avons évalué les données du programme de travail. Nous avons trouvé des similitudes au niveau de l'accent mis sur la durabilité de l'écosystème et les opportunités de pêche. Toutefois, les participants ont souvent assigné et décrit les valeurs différemment par le biais de systèmes de connaissances occidentaux et autochtones divergents. De nouveaux domaines favorisant la compréhension culturelle, des vues plus larges, la collaboration et la mise en réseau pour développer des priorités communes sont proposés.

## **INTRODUCTION**

The fisheries profession has been criticized for marginalizing management and knowledge systems that differ from Western-based science training (Jentoft 2007). In North America, there has been recent emphasis on building partnerships with different races and cultures (Hughes 2013), but few actual strategies for implementation have resulted. American Fisheries Society (AFS) conference themes have encouraged building relationships, but postconference contacts and follow-up are needed. A growing body of national and international literature encourages adaptive comanagement, “the sharing of power and responsibility” (Berkes 2009:1692) between indigenous and state groups (Armitage et al. 2007). The hope is for incorporation of diverse values, knowledge systems, and management perspectives to increase ecological, social, and political benefits.

If the fisheries profession desires to commit to multicultural partnerships, they must recognize how indigenous rights and responsibility reach beyond natural resource issues and into the interconnected web of cultural, spiritual, social, and political elements (Nesper 2012). Comprehending this web may be one of the most difficult yet important tasks for fisheries professionals. Accordingly, indigenous management needs differ from state needs and include self-determination, sovereignty (Ohlson et al. 2008), legitimacy (Notzke 1995), research using indigenous paradigms (Wilson 2008; Hart

2010), and justice, equity, and empowerment (Doubleday 1989; Brummel et al. 2012).

Encouragingly, the essential components that professionals use in fishery management may be used to build multicultural comanagement arrangements; there is benefit from the collection and interpretation of data through biological assessment activities (hereafter “assessments”) and restoration, reclamation, and enhancement (hereafter “restoration”) projects. During an AFS symposium focused on partnership building, many participants described how comanagement could increase efficiency by coordinating implementation, enhanced funding, increased knowledge, and promote better decision making (Hartley and Reid 2006). Sociopolitical enhancements include improved relationships (Brummel et al. 2012), creative group discussions (Skogen 2003), research credibility, legitimacy (Ohlson et al. 2008), and development of shared values (Plummer and FitzGibbon 2004; Armitage et al. 2009).

In the Great Lakes region, court-ordered arrangements placed state and tribal fishery agencies into comanagement. Examples are found in the states of Minnesota and Wisconsin where the agencies have successfully managed Walleye *Sander vitreus* fisheries through very difficult sociopolitical circumstances (Mattes and Kmiecik 2006). However, there is also much risk of failure for indigenous and state comanagement arrangements because unsuccessful cases exist from North America and internationally (Jentoft 2007).

## INLAND FISHERIES MANAGEMENT IN 1836 TREATY CEDED TERRITORY

The focus of this article is a negotiated treaty agreement, the 2007 Consent Decree (hereafter referred to as the “’07 Decree”), which deals with the inland portion of the 1836 Treaty of Washington (District of Columbia)–ceded territory. This territory encompasses approximately one third of the land and inland waters in what is currently the state of Michigan (Figure 1). A separate decree was negotiated in 2000 for the Great Lakes portion of the territory. Both decrees were signed by five tribes (the Bay Mills Indian Community, Grand Traverse Band of Ottawa and Chippewa Indians, Little River Band of Ottawa Indians [LRBOI], Little Traverse Bay Bands of Odawa Indians [LTBB], Sault Ste. Marie Tribe of Chippewa Indians, the State of Michigan Department of Resources (DNR), and the United States.

The ’07 Decree recognized the tribes’ rights to hunt, fish, and gather in the entire territory, with certain limitations. Similar to other treaty cases (Cohen 1989), it recognized the tribes’ rights to conduct assessments and engage in restoration projects. These two provisions established a comanagement framework and formalized mechanisms for jointly performing management functions.

Although the ’07 Decree was deemed fair and equitable, there were compromises, hardships, and old wounds that surfaced. In the 1836 Treaty of Washington, the tribes relinquished land in “return for promises,” including the right to fish; however, these promises were progressively eroded as extensive non-Indian resource use encroached and tribal people were exempted from natural resource decision making. Because the ’07 Decree is a late recognition, or a re-recognition, of a treaty right, it has posed problems to both tribal and nontribal people. From a tribal vantage point, any diminishment of fishing rights could compromise the original treaty agreement of fishing under the usual privileges of occupancy. Constraints on tribal fishing were placed in the ’07 Decree through elaborate population models, allocation, and permitting; these conditions were likely never contemplated by the tribal treaty signatories. Non-Indian people also have faced difficulty accepting the ’07 Decree and understanding the legal significance and why after several generations their ability to fish may be restricted. Having rarely given thought to tribal rights, they are now asked to accept a negotiated settlement where they must share the fishery with people of a different culture who may use different fishing methods and bag limits.

### HISTORY OF DIFFERENCE

Effective partnerships involve trust, respect, legitimacy, and common ground (Berkes 2009; Baral 2012), attributes not often found within colonial histories of indigenous and state relations where hegemonic control and unequal power has existed (Natcher et al. 2005). These comanagement systems pose difficulty because of complex institutional arrangements (Mattes and Kmiecik 2006; White et al. 2008) and struggles for legitimacy of knowledge and rights (Rettig et al. 1989; Hall and White 2008). Each of the above difficulties exist within the ’07 Decree state/tribal institution and when combined with interactions during the ’07 Decree negotiation have led to individual bitterness and distrust (Holtgren 2014). Therefore, to create favorable conditions for collaboration, there is a need to understand the cultures of group members.

In the ’07 Decree area, difficulties arise from a history of



Figure 1. Black shading represents the inland portion of the 1836 Treaty of Washington ceded territory (excluding Great Lakes boundary).

difference compounded by divergent management capacities and characteristics of fishers. The scale of management exemplifies a large divide. The state annually issues around 1.1 million fishing licenses to anglers, whereas tribal fishers are estimated at less than 20,000 with relatively low harvest concentrated in a few counties. This has led to some tribal people viewing the ’07 Decree as overly restrictive relative to the amount of impact they have on the resource. These differences are further observable in the number of personnel employed. As of 2015, the total number of full-time employees in the DNR Fisheries Division was around 180, whereas the two largest tribal inland fisheries programs each had just over 10 for LRBOI and LTBB. Two tribes did not have more than one dedicated inland personnel.

The characteristics of the fishers for whom the DNR and tribes represent require different strategies for management. The Department of Natural Resources may need to provide immediate and diverse fishery products to its license-buying constituents, and tribal members may request long-term harvest strategies to promote culture while also providing immediate harvest opportunity. State-licensed sportfishers are often restricted to using rod and reel and often desire diverse fishing opportunities such as trophy-size fish and fly-fishing-only zones. Fishing guides and resort owners depend on quality fishing opportunities and experiences. Tribal fishers may use other fishing gear, such as spears and nets, and because they fish for subsistence, trophy fish are not necessarily desired or compatible with their world view. During the time of the ’07 Decree negotiations, there was public concern that tribal fishers, who would be allowed to fish differently than state licensed fishers, would cause overharvest. This, in part, led to the ’07 Decree having elaborate models regulating gear type, harvest distribution, and set allocations requiring extensive biological assessment.

An important question for fisheries professionals is, “Why is it so difficult for state and indigenous agencies to work collaboratively?” The answer is found in how differently indigenous and nonindigenous people view the role of humans in the world and thus the legitimacy of each other’s knowledge and authority (Kimmerer 2000; Guilmet and Whited 2002). This has been referred to as “cultural distance” (Natcher et al. 2005) and is founded within two cultural knowledge systems: the indigenous knowledge system (IKS) and the Western knowledge system (WKS). Core elements of IKS are shared by indigenous communities worldwide and are a way of life founded on forming a web of relationships with human and nonhuman parts of the environment (Holm et al. 2003; Reo and Powys Whyte 2012). The IKS is considered nonlinear, where metaphysical (spiritual and physical) realities are encouraged and considered valid. The WKS is characterized as empirical and positivist–reductionist, where complex phenomenon and processes are knowable and reduced to simpler forms for understanding (Patterson and Williams 1998).

The WKS and IKS difference was seen when participants introduced themselves during our interviews. It was similar to how individuals might introduce themselves at a professional meeting with peers (Holtgren 2014). For example, when state employees introduce themselves, they state their name followed by a rational description of *individual* qualifications, such as current institutional affiliation, educational degrees, titles held, and a description of current undertakings (boards, working groups, etc.). Personal anecdotes may be omitted, although they could be well received by the audience. Tribal members may introduce themselves using a *relational* manner in Anishinaabemowin (language of the Anishinaabe) by stating their name, tribal and clan affiliation, and where they live. Additionally, they may identify a teacher of their cultural development and ask their ancestors to provide wisdom and guidance, their personal life being indistinguishable from the professional. This example suggests two different conceptions of knowledge: the WKS, embodied as a reducible system of knowledge gathered through academia and professional experiences, and the IKS, embodied as a way of life through a web of metaphysical and social relationships with the natural world. It also suggests that for knowledge exchange and collaboration to occur, culturally appropriate models and protocols need to be considered (Ross et al. 2011).

Management perspectives based upon the two knowledge systems are expectantly different. Known as the common property principle, in the United States the fishery is owned by the entire populace and state governments have the responsibility of being trustees (Nielsen 1999; Henquin and Dobson 2006) where open access to the fishery is maintained while ensuring its sustainability and productivity. The indigenous framework is based on connectedness where humans have a relationship with *the source* (rather than the resource), which is all of creation, where they coexist and interact in balance because of their inextricable link to other creatures (Kimmerer 2000; Salmon 2000). This difference, or cultural distance, is acknowledged as being expansive, but where it is important is in elucidating alternative worldviews so that fundamental commitments to how knowledge and the world are viewed can coexist within a single management institution (Houde 2007).

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## UNDERSTANDING PRIORITIES

For many state fishery agencies, biological assessment effort has shifted from local to broad scale (Fayram et al. 2009). In the 1990s, the State of Michigan Fisheries Division developed and applied a broad-scale statewide sampling plan to (1) evaluate management actions, (2) provide information on status and trends of aquatic resources and, to a lesser extent, (3) allow for discretionary sampling (Hayes et al. 2003). Within this framework, approximately 60% of sampling is centrally administered and approximately 40% is allocated to discretionary purposes for local unit managers' needs.

Biological assessment priorities of tribal fishery management agencies are less understood. In many cases, where treaty litigation was required, the tribes have largely conducted biological assessments for development of tribal regulations (Mattes and Kmiecik 2006). Even with the increase in Western-trained biological staff working for tribes in the Great Lakes region, tribal leaders have stated that “traditional Anishinaabe culture and values were to be infused in all aspects of its work,” recognizing the unique management approach tribal agencies bring (Mattes and Kmiecik 2006:164). Therefore, culturally derived systems may have different management and biological assessment priorities. It should be noted that although tribal assessment effort has focused on regulations due to treaty litigation, to assume that this is a major desire of the tribes seems unwarranted.

The restoration provision of the '07 Decree includes fish stocking and rearing, habitat improvement, and other methods. Both the state and tribes are involved in wide-ranging restoration activities, including dam removal, fish rearing, and streambank improvements on public, state, federal, and tribal lands, and often with partners. This research was sparked by discussion with leaders within the '07 Decree area who recognized an opportunity to work together and protect the fishery resource to the benefit of all. Our objectives were to (1) elucidate values and perspectives of state and tribal participants for assessment and restoration, (2) identify and assess common and exclusive agency priorities for assessment and restoration, and (3) recommend strategies for mutually beneficial collaboration.

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## METHODS

We collected qualitative data through semistructured interviews from 2009 to 2010 and quantitative data through analysis of state and tribal work plans from 2010 to 2012 to understand participant and agency perspectives on fishery assessment and restoration. The qualitative research approach was used to gather rich detail of participant views and was well suited for working with two different knowledge systems where perspectives may not be initially apparent or previously considered by the researchers. We interviewed 14 participants from the Michigan Department of Natural Resources Fisheries Division: nine administrators and unit managers and five biologists. We interviewed 12 tribal participants. Eight were tribal member employees (TMEs) and included two chairpersons, one natural resource commissioner, two natural resource department directors, two technicians, and one legal counselor. The four nontribal member employees were three biologists and one legal counselor. There was a female participant from the state and one from a tribe. The participant list was developed purposively using key informant (Weiss 1995) methodologies to represent all institutional scales and assure broad representation of perspectives. Tribal elders were

used as key knowledge holders (Hart 2010) because of the respect, knowledge, and influence held in tribal communities. Although interviews were conducted in 2009–2010, the majority of participants are still actively employed by the agencies, and large-scale shifts in values and perspectives within agency personnel are not expected.

Each participant selected their meeting location and time. Tribal member employee interviews were held in differing locales, including around a fire after a smudge ceremony, at a tribal community center, or at an office. Department of Natural Resources and nontribal member employee interviews were held at offices and libraries. Interviews lasted 35–90 minutes and focused on the same set of questions and topics. All interviews were imported into NVIVO qualitative data analysis software, version 8 (QSR International, Melbourne, Australia), where narratives were coded and sorted by keywords in responses. Data analysis focused on finding thematic patterns between individuals and within and among groups to develop descriptive detail. To authenticate themes, we continued communication with key DNR and tribal research partners. To more fully understand assessment priorities, we conducted quantitative analyses on agency work plan data provided by LRBOI, LTBB, and DNR from 2010 to 2012. Three tribal agencies were not included in the quantitative analysis due to Sault Ste. Marie Tribe of Chippewa Indians and Bay Mills Indian Community not conducting inland fishery assessments during this study and Grand Traverse Band of Ottawa and Chippewa Indians lacking sufficient staff time to participate. Each work plan identified assessment (1) location by county/water body, (2) timing by month, (3) purpose, and, if applicable, (4) species targeted. The DNR work plans also estimated assessment effort using worker days (8 hours per worker day).

The intent of quantitative assessment was to provide information on three assessment components: geographic distribution, survey purpose, and species targeted. Data were combined from 2010 to 2012 and summarized using three-year averages. We calculated averages from the 30 Lower Peninsula treaty area counties comprising the Lower Peninsula of Michigan; the Upper Peninsula area was omitted because LRBOI and LTBB expended less than 1% of effort there. The

survey purpose was identified using categories originating from DNR work plans for standardization (Table 1). Only surveys comprising 2% or more of the average effort for each agency are presented in Table 1. We calculated effort placed on assessments targeting a specific fish species. The purpose of targeted species assessments was discerned through personal communication with biologists.

## RESULTS

### Biological Assessment Activities

A priority for both DNR and tribal participants was assessments that evaluated fishery management actions to reduce uncertainty in decision making. To accomplish this, DNR participants described broad-scale assessment *types* (such as those found in Table 1), whereas many tribal participants identified *issues* (conditions for when assessments should occur) that would need to be addressed on a broad scale. The DNR leadership explained the importance of status and trends surveys (S&T) to meet the broad-scale objective due to the immense spatial area they managed. Tribal participants explained that their assessment priorities were often localized because of financial and logistical constraints. The DNR and tribal biologists recognized the importance of discretionary assessments designed to inform on locally specific issues. In particular, DNR biologists described increasing difficulty in accomplishing locally derived discretionary surveys as S&T commitments increased.

Tribal participants described three conditions where assessments were important and embodied a localized focus: (1) water bodies near tribal reservations, (2) systems accessed by tribal members, and (3) systems where native (sometimes referred to as “cultural”) and/or subsistence fish had not been adequately assessed. The importance placed on assessments near tribal reservations was largely because tribal people interfaced with the natural world and obtained sustenance in those places.

The importance of single-species assessments varied by agency, although a common tribal theme was native species. Both DNR and tribal participants described species assessment criteria as those that (1) people showed an interest for, (2) needed protection, or (3) possessed intrinsic value. The first

**Table 1. Purpose and descriptions of select biological assessment in DNR and tribal work plans. Descriptions modified from the Michigan Department of Natural Resources Fisheries Division work plan.**

Assessment Purpose	Description
Fish Community Assessment	Discretionary survey to assess fish community, relative abundance, size structure and growth.
Habitat Evaluation	Survey to assess habitat and may include channel morphology, substrate, aquatic vegetation and woody debris.
Large Lake Surveys	Spring survey on lakes >1,000 acres to estimate fish abundance, growth, and mortality. Usually accompanied by creel survey.
Population Estimates	Survey using mark and recapture methods to estimate fish species abundance.
Recruitment Evaluations	Survey to evaluate young (age-0 or age-1) recruits, majority are fall Walleye evaluations.
Species Evaluations	Survey directed towards evaluating a certain fish species, may include information on abundance, recruitment, and behavior.
Status and Trends	Designed to provide information for local and regional management issues and includes data collection for fish (sportfish/non-game), habitat, and water quality. DNR procedures: stream sites are randomly selected and fixed (subjectively). Random selection occurs in a single year, fixed sites three years on and three years off. Lake sites all randomly selected and stratified based on size. Standardized data collection techniques. Tribal site selection and protocols have been independent of state using discretionary and fixed site selection.
Stocking Evaluations	Lake or stream survey designed to evaluate contribution/survival of stocked fish.

criteria centered upon harvest and the second and third on nonconsumptive purposes, including protection of rare, native (tribal), or intrinsically (DNR and tribal) valued. All tribal agency participants recognized native species assessments more so than nonnative because of (1) the tribal community's customary cultural connections with native species and (2) DNR's focus toward nonnative species. Although tribal participants recognized how nonnative species offered harvest opportunities, a native tribal member commented that the native species "enhanced their beings of being Indian people."

Half of DNR participants explained that assessments were focused on fish community, with species-specific assessments mostly unit specific. Additionally, they described an obligation to focus on species important to sportfishers who largely funded their work activities.

### Information Needs

The information needed to manage the fishery was expressed in five broad-scale categories of use: (1) to understand factors influencing the fishery, (2) to predict how fisheries respond to impacts, (3) to evaluate restoration techniques, (4) to refine '07 Decree fish population models, and (5) to evaluate harvest. One information need identified by the majority of participants was effects of invasive species. Notably, a few TMEs identified needing to understand invasive effects of stocking nonnative sport fish into native fish populations. Both DNR and tribal participants described the need to understand fish community dynamics and the factors that influence them. In the category of evaluating restoration techniques, both groups expressed a need to understand how and whether restoration (e.g., habitat and stocking) effects were meeting management objectives.

Refining population models and evaluating harvest revolved around population estimates and harvest allocations of Walleye, Lake Sturgeon *Acipenser fulvescens*, and steelhead *Oncorhynchus mykiss* (anadromous Rainbow Trout) developed for the '07 Decree. Some tribal participants viewed the models as unreasonably limiting tribal harvest opportunities where parameters had been accepted with little evaluation.

For the Walleye population estimate model, both DNR and tribal participants were unified in that it likely did not fully represent accurate values because it was derived from Wisconsin. However, tribal participant views varied on the need for model refinement because some believed that low tribal exploitation did not warrant large time expenditures required

for authentication. Participants identified the need to understand state and tribal fish exploitation levels in order to respond quickly to overharvest. Department of Natural Resources and tribal participants both expressed that the other agency's allowed exploitation was the unknown variable. Some DNR participants expressed that although tribal harvest did not pose a current significant risk to the fishery, it could become one. Some tribal participants expressed concern over how they needed to disprove state assumptions that tribal spearing was 100% effective in order to maintain the opportunity to fish.

### Conditions Where Collaboration Is Important for Biological Assessments

Department of Natural Resources and tribal participants commonly identified important assessments under three conditions: (1) systems where high visibility management occurred, (2) systems had allocated fisheries, and (3) when large-scale. For systems of high-visibility management, the benefit of collaboration was recognized as improving public perception of the agencies and how the public may realize and appreciate the good-faith effort of agencies working together. Participants valued collaboration on systems with joint harvest allocation (the second condition above) largely because of public perception and assessments were usually large in scale. For large-scale assessments (third above) collaboration was valued because without pooling resources, few assessments could be accomplished.

### Quantitative Work Plan Evaluation

Geographic distribution of assessment effort differed by agency with DNR's broadly distributed statewide, whereas LRBOI and LTBB were largely local to reservations (Figure 2). The Department of Natural Resources' work plan assessment effort ranged from more than 0% to 18% in 27 of 30 counties. Assessment effort by LRBOI and LTBB clustered with 89% and 63% in counties where their reservations are located, respectively. The purpose of assessments varied widely by agency with the DNR's centered on S&Ts (SD = 37% ± 0.17%), population estimates (SD = 17% ± 0.08%), and fish community assessments (SD = 14% ± 0.07%; Figure 3). In contrast, LRBOI's highest effort focused on population evaluations (SD = 28% ± 0.09%), fish community assessments (SD = 25% ± 0.09%), habitat evaluations (SD = 13% ± 0.08%), and population estimates (SD = 12% ± 0.11%). The Little

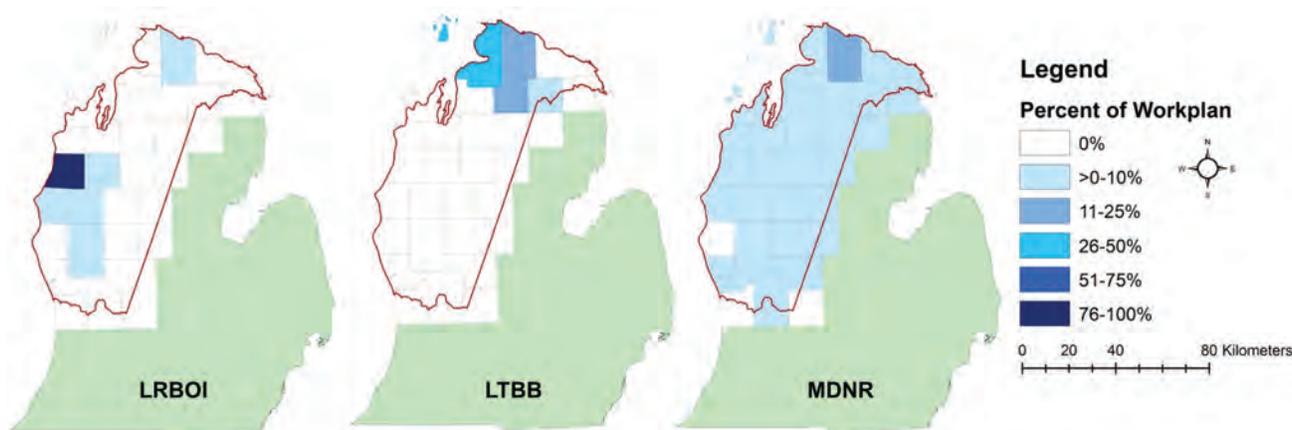


Figure 2. Percent of inland work plan effort (worker hours) per county by Little River Band of Ottawa Indians (LRBOI), Little Traverse Bay Bands of Odawa Indians (LTBB), and Michigan Department of Natural Resources (DNR) for the 1836 Treaty of Washington ceded territory in the Lower Peninsula of Michigan from 2010–2012.

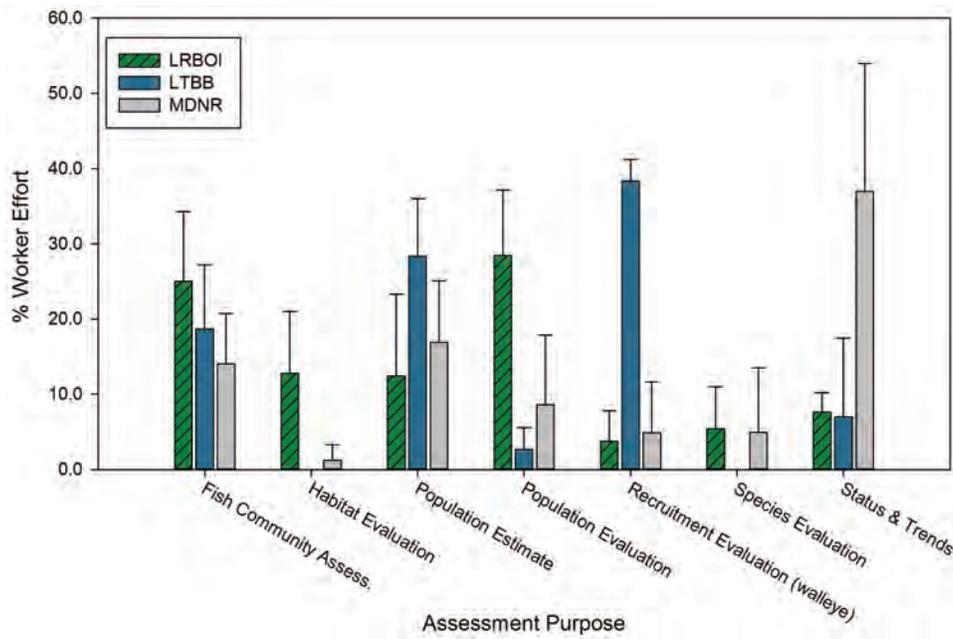


Figure 3. Average percent worker effort for specified biological assessment purposes from 2010–2012 by Little River Band of Ottawa Indians (LRBOI), Little Traverse Bay Bands of Odawa Indians (LTBB), and Michigan Department of Natural Resources (DNR). If effort for an assessment purpose comprised <4% for all three agencies it was excluded. Error bars represent standard deviations.

Traverse Bay Bands of Odawa Indians’ highest efforts included recruitment evaluations ( $SD = 38\% \pm 0.03\%$ ) and population estimates ( $SD = 28\% \pm 0.08\%$ ) for Walleye and fish community assessments ( $SD = 19\% \pm 0.09\%$ ). For the three agencies, the amount of work plan effort directed at certain species also differed (Figure 3). Walleye was a major assessment component for LTBB (>90%) and second for the DNR (38.6%) only to resident trout (43%). The LRBOI effort focused on Lake Sturgeon (59%) and Rainbow Trout (23%) but had recently shifted toward Burbot *Lota lota* instead of Rainbow Trout. The LTBB and DNR Walleye assessments were focused either on systems where data were needed for allocation or model refinement. The LRBOI’s focus on Rainbow Trout was due to tribal harvest limitations in the ’07 Decree, and focus on Lake Sturgeon was to rehabilitate a native species.

### RESTORATION PRIORITIES

Restoration priorities were identified along with problems and management actions that could be enacted (Table 2). Notably, a tribal participant cautioned, “You have to focus on areas that have the most impact but always be mindful that all of it is important.” Restoring stream connectivity was a shared high priority because of abundant unnatural barriers impeding fish movement and stream function. The DNR specifically recognized the importance of tribal input during dam decommissioning because of tribes’ special status in federal projects.

The priority of minimizing impact of invasive species was largely associated with the problem of increasing spread of invasive species while balancing the need to increase habitat for fish through dam removal. Sustainable stocking practices were commonly viewed as needing to be ecologically (and economically for DNR participants) evaluated. Some DNR and tribal participants suggested discontinuing certain stocking practices if they were not compatible with their views on

ecological and cultural sustainability. To protect and increase habitat was also identified as a priority by both DNR and tribal participants. Department of Natural Resources employees believed that for both habitat protection and supplementation, tribal coordination would be particularly beneficial, especially commenting on DNR forestry management reviews and permits for land development projects. Tribal participants were particularly concerned about water withdrawal proposals and how decreasing river flows would impact treaty protected subsistence rights. Exclusive to tribal participants was enhancing native species and concerns that stocking of nonnative fish was an unnatural approach that depleted resources for native species.

### Successful Restoration Criteria

Department of Natural Resources and tribal participants shared common criteria for successful restoration projects. An observed positive ecological response (including an improved fishery) for the public was a primary criteria. Other common criteria were recognizing accomplished objectives established prior to project implementation and quantifiably measurable. Another common criterion was that project benefits were protected and sustained to where natural function was restored and the aquatic system could take care itself; however, DNR and tribal participants often described a natural system differently. Many tribal descriptions defined natural function as minimally changed from a precolonialism reference condition, whereas DNR described maintaining natural function such as sustainable fish reproduction regardless of the presence of native fish or nonnatives.

Participants shared how successful comanagement could increase harvest opportunities. Tribal participants viewed success through protection of treaty rights for their members to subsist from fish, whereas the DNR view was to provide increased opportunities for fishing and diverse

**Table 2. Participant priorities for restoration, issues addressed, and restoration activities that should be implemented. If a priority was exclusive to either DNR or tribal participants it was noted under general priorities in parentheses.**

General Priorities	Specific Problems	Restoration
Stream connectivity and fish passage	Unnatural barriers and control structures.	Remove/improve barriers if benefit outweighs risks of invasive species.  Involvement in dam decommissioning negotiations and permitting. <sup>a</sup>
	Poorly designed road crossings	Improve road crossings-culverts. Consult during permitting of new crossing.
Minimize impact of invasive species	Loss of habitat due to invasive species (i.e. zebra mussels, aquatic plants).	Add or improve habitat (specifically spawning and nursery habitat), protect during dam decommissioning.
Sustainable stocking practices	Natural reproduction is inadequate to sustain fishery and requires stocking.	Address identified problems (sedimentation, erosion, excessive temperature, biotic interactions) to manage sustainably.
		Discontinue stocking if habitat is not appropriate for species.
<i>(Issue only identified by tribal participants)</i>	Negative impacts of stocking non-native fish on ecosystems and native species.	Prioritize native species, decrease non-native stocking.
Protect and increase habitat	Degraded riparian habitat that increases water temperature, sediment, erosion and nutrients.	Improve riparian areas by collaboration of fisheries programs and forest management division. Comment on forestry compartment reviews. <sup>a</sup>
		Increase in-stream and lake habitat (i.e. large woody debris).
	To minimize sediment implement appropriate road-stream crossings and bank stabilizations.	
	Intact quality habitat under risk of degradation due to development and increasing population pressures.	Protect from development by purchasing land and commenting on development permits, educate public on importance of natural shorelines with vegetation. <sup>a</sup>
Protect and increase water quantity and quality	High stream temperatures and inappropriate flows.	Decrease unnatural function by removing failing or inappropriate control structures (dams).
<i>(Issue only identified by tribal participants)</i>	Decreasing water levels.	Protect water levels by political action during legislation and water withdrawal proposals.
Enhance native species	Tribal participants described how native species were not prioritized highly by DNR and this posed a cultural/ecological risk (see text).	

<sup>a</sup>State participants expressed how tribes have unique political rights they could exercise.

fishing opportunities (i.e., larger fish, diverse species). Both groups included how success was gauged through the human values of existence and intrinsic qualities. For instance, state participants described preserving nongame and nonconsumptive opportunities, such as watching large spawning congregations or simply knowing that a rare species existed. Most participants described public buy-in and fostering of relationships as important for gauging success.

A unique success characteristic for tribal member participants is that cultural connections be restored. They commonly expressed how the natural world and fisheries enhanced their experience, knowledge, and memories as Indian people and strengthened their connection to sacred ceremonies, songs, and traditions. They described how native ecosystem components (e.g., species, landscape characteristics) were a reason tribal communities had been drawn to their geographic areas and how the native conditions and tribal people had coadapted in a shared history. They described a sacred responsibility to protect native species.

## DISCUSSION

Across the United States and Canada, the rights of tribes and First Nations have increasingly been recognized throughout the courts and have placed governments alongside each other in comanagement arrangements (Pinkerton 1989). People from very different cultural backgrounds were required to work together and fisheries managers, having little knowledge of the perspective of the tribal representatives, faced a wide cultural divide. In this investigation, we present the values that DNR and tribal participants shared about sustainable, interconnected ecological systems and how collaboration on assessment and restoration projects could enhance collaboration. Many DNR and tribal participants in this study described the success of fishery (or ecosystem) management as—if it mattered to people—a concept shared within multiple research disciplines, including fisheries, indigenous, and restoration ecology (Lackey 2005; Clewell and Aronson 2007; Naiman 2013). This has been identified as a most difficult issue to overcome for traditional

science and management: the merger of human subjective values and scientific objectiveness. How fisheries management matters to people was one focus of this research, and although we found encouraging similarities in responses to this overarching theme, we also noticed how a difference in values could become a divide in appropriateness of a management decision.

Throughout the natural resources literature, authors have called for managers to incorporate their own expert knowledge alongside knowledge and values from people intimately connected to the landscape (Stephenson 2008; Hansen-Møller 2009). A risk exists when there is not a clear understanding of what is valued or the background nature of those values because unintended changes to how communities interact with the landscape may occur.

This may be especially true when two distinct cultural histories exist, as is the case for the '07 Decree participants. The following example identified in this study by TME participants illustrates where a management action provided significant benefit to one culture yet damaged a way of life for the other. In 1886, only 50 years after Michigan's recognition as a state by federal land acquisition through treaties with the tribes, nonnative trout were introduced into the inland waters of Michigan. Many more stocking events followed until the multistate large-scale introduction of salmon and steelhead into the Great Lakes in the 1960s and 1970s, actions that distinctly changed the inland and Great Lakes fishery and the surrounding communities (Kuehn 2005). In Michigan, the relatively new state government and citizens viewed the management action a success as many port city communities on Lake Michigan were revitalized and found pride in a fishery that was recognized nationwide as exceptional and economically valuable. However, for many tribal communities in the Great Lakes whose ancestors occupied the lands from time immemorial, there was value to keeping the original regional conditions that existed before

statehood and the locally distinctive characteristics and cultural meanings. This fish stocking disrupted their cultural connections (i.e., ceremonies, stories, and songs) and identity from which they feel they are still recovering. This example demonstrates the breadth of socioecological impacts without comanagement.

How restoration matters includes political, economic, and ecological elements in addition to social and cultural perspectives. In the Introduction, we identified indigenous needs from natural resource management based on multicultural collaboration. In our study, we found that the needs of tribal participants for assessments and restoration were consistent with indigenous needs in natural resource management at a global scale. Accordingly, the tribes identified conditions when assessments should occur (i.e., near reservations, accessed areas, and areas where native species had not been assessed) and how they could promote opportunity toward self-determination and use of indigenous paradigms. Additionally, tribal participants described information needs that focused on gathering assessment data that could affect harvest allocations that were unreasonably limiting. This exemplified the global indigenous needs of justice, equity, and empowerment. The need for legitimacy was also identified as in the case of achieving public buy-in as a byproduct of assessments. Finally, the need to use indigenous paradigms in management was woven throughout tribal participant narratives as they spoke of restoring cultural connections and using seventh-generation success criteria during restoration activities.

Some DNR participant perspectives were often guided by the public trust doctrine (Holtgren 2014) and legislative authorities that promoted broad environmental understanding, protection, recreational opportunities, and economics. The tribal member perspectives were guided through a sacred seventh-generation philosophy, treaty rights, promotion of community connections, and subsistence. If common values and goals are

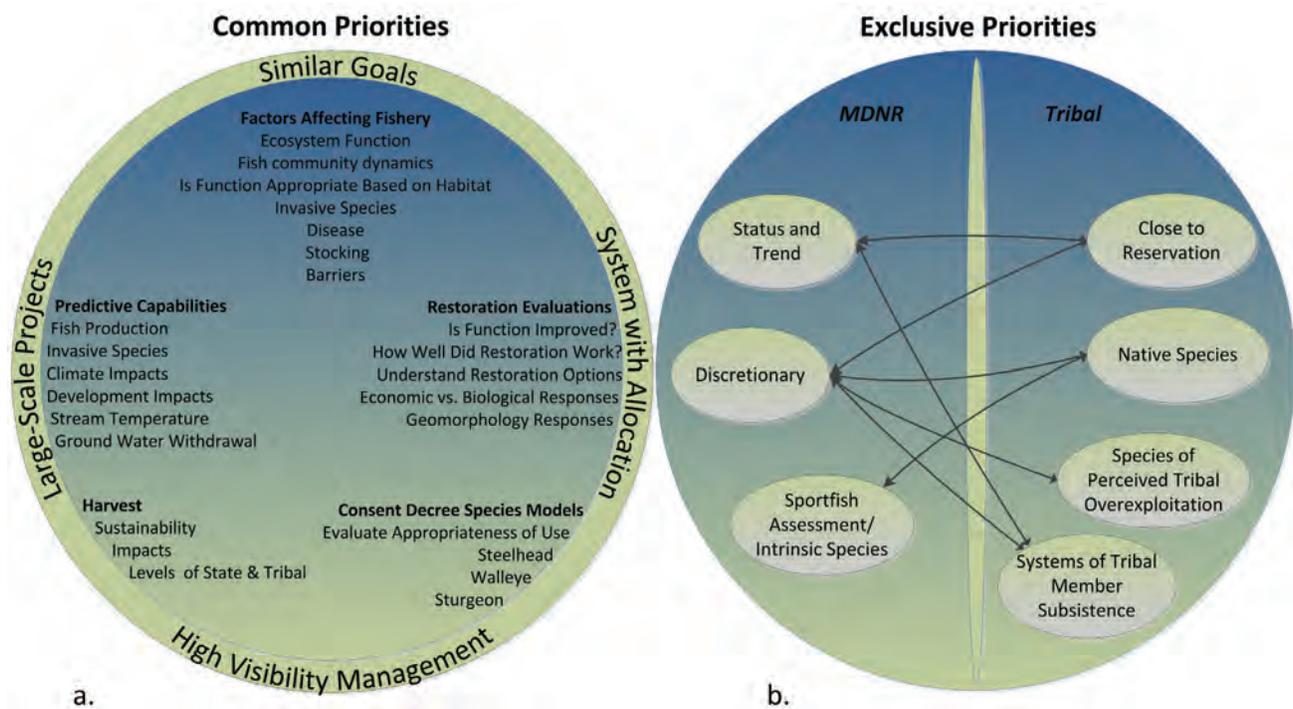


Figure 4. Common (4a) and exclusive (4b) priorities for biological assessment activities identified by DNR and tribal participants. Connecting lines in exclusive circle illustrate potential beneficial collaboration.

developed with an understanding of the diversity of values, there is opportunity to navigate toward agency and cultural understanding with a broad multidisciplinary approach to knowledge and management.

### Partnership Opportunities for Biological Assessments

Although limited, assessment collaboration between DNR and tribal agencies has occurred since signing of the '07 Decree. Notably, two collaborations were initiated out of an emerging crisis where it was hoped that cooperation could increase buy-in and transparency. Specifically, one collaboration formed because a tribe disputed the accuracy of a Walleye survey that affected tribal allocation. However, collaboration originating from common priorities, not initiated out of crisis, has been limited. Common priorities between state and tribal groups exist and establish a starting point for more meaningful collaboration. An outline (Figure 4) is designed to guide both agencies in finding potential collaborative opportunities. The outer ring of the figure demonstrates overarching principles that were commonly identified for beneficial assessment collaboration, and the inner circle demonstrates the specific information needs. The four overarching principles are mostly unique needs founded on the local context of the state and tribal collaboration, whereas the inner circle is largely consistent with standard fishery management objectives. The second circle of exclusive agency priorities (Figure 4b) is less easily characterized using overarching fishery management principles, yet partnering seems alluring because both groups could meet each other's unique needs if they could find benefit in doing so. This is the hope for comanagement where integrative solutions are created and partners recognize and reconcile differences, especially if presumed incommensurability turns into an asset.

### Example Partnership on Exclusive Priorities

Although numerous exclusive priorities exist, not pursuing common ground would seem parochial when connections appear

simple to establish. A major focus of DNR is S&T (Figure 2), whereas for tribes, assessments close to reservation areas and at intimately known locations by their members are critical. Using these exclusive priorities, it is reasonable (and supported through discussion with biologists) that the tribes could conduct S&T assessments near reservations or where tribal member harvest occurs. This would require tribal willingness to use state-developed protocols or DNR willingness for protocol modification if the tribes deemed it necessary. The agencies could add components on an individual system basis to meet their respective needs. Both agencies could collaborate on strategic planning, joint decision making and capacity building, and adding new sites while furthering the treaty-wide data set.

### Partnership Opportunities for Restoration

Our findings suggest opportunities for collaboration in restoration where common and exclusive restoration priorities exist (Figure 5). Six elements (Figure 5, center column) represent overlapping restoration priorities (Table 2). The shared priorities of river connectivity, sustainable stocking, and protection against invasive species may involve integration of inland and Great Lakes waters because management actions in either region influence the other. This demonstrates the complexity for potential projects but also enhances the spatial possibility for greater positive impacts on the fishery resources. For connectivity and invasive species, DNR participants recognized the tribes' unique legal rights and legitimacy (not simply stakeholders; see Jentoft et al. 2003; Houde 2007). Due to this recognition, collaborating on these common priorities could provide enhancements to the relationship. Another shared priority was using restoration to manage systems for natural function, viewed as self-sustaining after the action is complete. This perspective is found throughout agencies across the United States and would appear to be an ideal focus for collaboration. However, we found that participants described natural function quite differently; some tribal participants described it as minimal change in structure from a precolonial reference condition, whereas some DNR participants described moderate changes from a prior condition with ecosystem function intact. This finding seems important in a global perspective as well, because many indigenous societies worldwide assess ecosystem and community health using precolonization reference conditions because of their interrelated and interdependent heritage (Salmon 2000; Lerma 2012), and there is current debate in the scientific community regarding whether nonnative species should be viewed as an ecosystem degradation (Hermoso and Clavero 2013). How the tribes would gauge success of a project on the status of native or nonnative species should be further understood and would strengthen participants' views that prior to restoration, clear objectives be set collectively.

Exclusive priorities were also recognized (Figure 5, outer columns) and could be mutually beneficial. Department of Natural Resources participants prioritized protecting intrinsic resources for nonconsumptive purposes, whereas the tribes identified native species and their associated cultural connections. An example of this sharing of benefit is restoration where both groups are focusing on lake sturgeon. This species, described by DNR as important beyond harvest opportunities but through existence and intrinsic values, is seen in tribal societies as a clan animal and revered. Beyond the respective agency's restoration activities, the state has implemented a Sturgeon in the Classroom program in the K–12 curriculum, and the LRBOI annually hosts a community ceremony for releasing

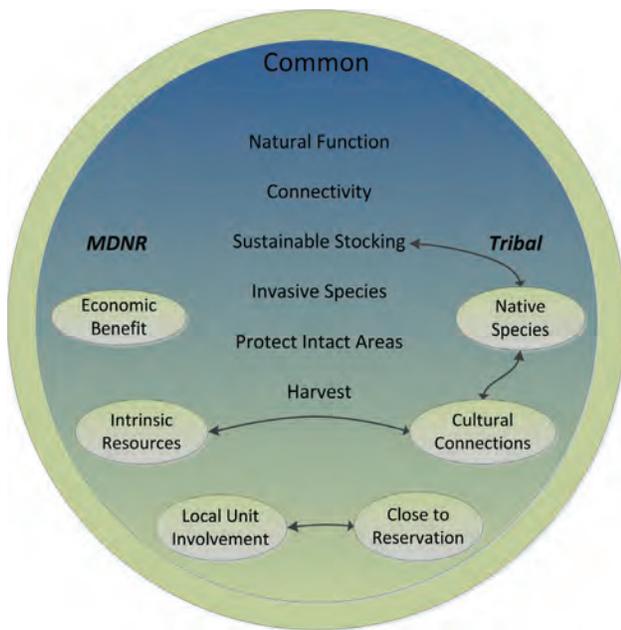


Figure 5. Common and exclusive priorities for restoration activities identified by DNR and tribal participants. Connecting lines illustrate potential beneficial collaboration.

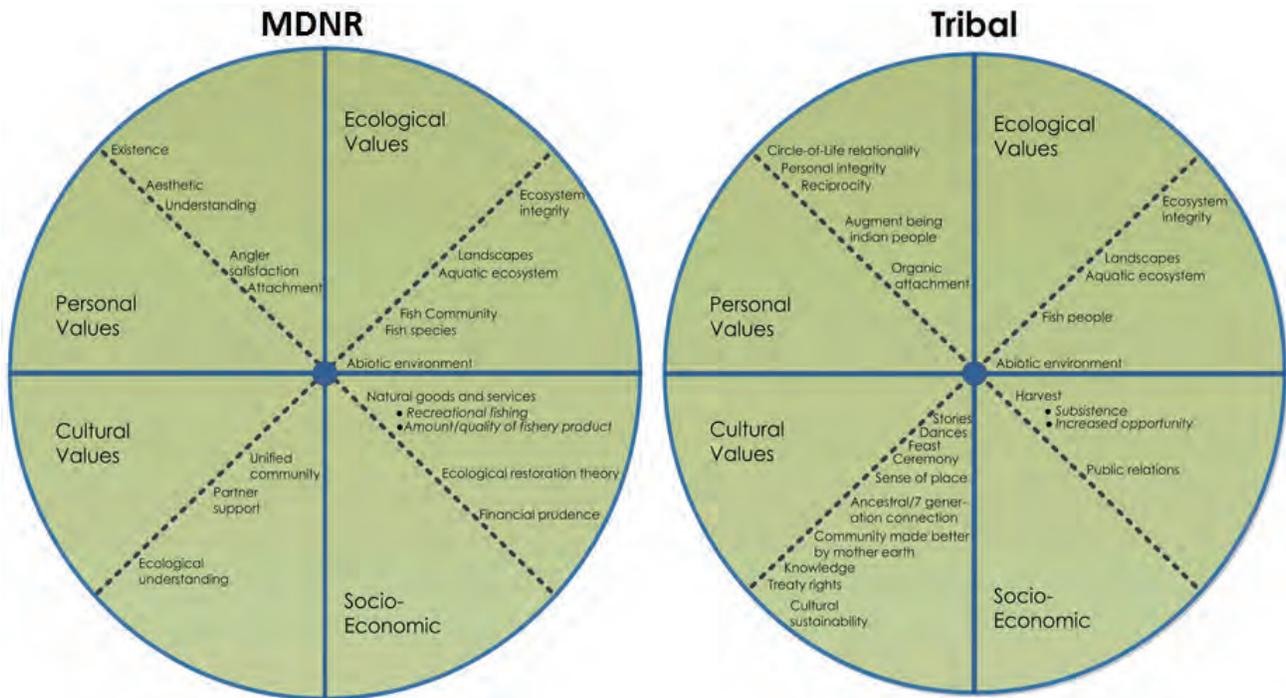


Figure 6. Typologies of restoration values described by DNR and tribal participants displayed using a four quadrant model as modified from Clewell and Aronson (2007).

Lake Sturgeon back into a river (Holtgren 2013). Projects that enhance ecological and societal values could hold vast potential for unified restoration approaches.

### Restoration Values

Perceptions of restoration actions are value laden and embedded in the context of place, history, and socioecological adaptations (Stedman 2003). To illuminate motives for ecological restoration, we present a sample of values described in this study (Figure 6). The values model includes ecological, socioeconomic, personal, and cultural, as presented by Clewell and Aronson (2007), modified from Wilber (2001). The circle consists of four axes where an initial value (participant description of success) is placed where each preceding element incorporates attributes from those earlier until the outside edge is reached with an ideal state. Although this model does not detail each characteristic, it is included to demonstrate the breadth of multidimensional restoration values.

We found similar value characteristics in the ecological and personal categories between state and tribal participants. For example, in the ecological category (Figure 6), participants shared how restoration could improve integrity of the abiotic environment (first element from center) and identified an ideal success as ecosystem integrity (last element from center). Along this continuum exist similarities and differences with the characteristic “fish people” and “fish community” for the tribes and DNR, respectively. This indicates that a healthy fish community and healthy fish people are a valued outcome of restoration. Department of Natural Resources workers shared how this meant maintaining fish diversity, key species, and sustainability, and this was common with tribal responses as well. However, TMEs used the terminology “fish people,” indicating a value absent in DNR responses. In order for managers to elucidate the range of values, this difference would need to be more understood. The use of this type of model

borrowed from restoration ecology seems useful in pursuit of understanding each other’s priorities and ideal outcomes for restoration.

### MANAGEMENT IMPLICATIONS

Current recommendations for adaptive comanagement involve multicultural institutions stressing iterative social learning opportunities in order to adapt, find common ground, and coproduce knowledge where common problems and solutions are identified (Berkes 2009). In the fishery profession, assessment and restoration activities could serve as a start for collaboration because many points of commonality were found. Furthermore, members of both agencies recognized specific benefits in collaborating because of unique rights and knowledge. Even where perceived differences exist, we suggest how these provide opportunity for mutual benefit because each agency could still meet their own needs while supporting those of the other agencies.

Collaborating on projects and developing shared objectives also pose great challenges. Specifically, tribal participants shared how they focused assessments on allocation issues in order to refute unrealistic perceptions that their community’s exploitation would be harmful to the fishery, instead of focusing on preferred assessments. Distinguishing between perception and legitimate concern will be difficult but potentially decrease effort spent on the often large-scale allocation assessments.

A tremendous amount of human and financial capital is committed annually by the state and tribes toward understanding, protecting, and improving the treaty fishery, where collaboration could produce further enhancements to the ecological, social, cultural, and personal values held by agencies and their constituents. The agencies are encouraged to develop institutional and personal learning networks and protocols designed to coproduce knowledge and shared meanings,

communicate that each other's values are important to the whole (Halvorsen 2006), and lead to strategic planning of equitably agreed-upon objectives. Those in the fisheries profession must further develop multicultural partnerships and share knowledge systems and cultural views so all people, generations, and ecosystems benefit from the efforts to protect and manage a shared fishery.

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