Trout and the Trout Angler II

Radisson, LaCrosse, Wisconsin
July 6-8, 2000

The workshop and these proceedings were dedicated to the memory of Dr. Bob Jackson. Bob's dedication to understanding the trout angling experience and improving our stewardship of the resource provided leadership and inspiration to us all.

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NOTE

We believe prompt publication of the proceedings to be an essential component of the symposium concept. To this end, authors were asked to submit their manuscripts under tight deadlines. Manuscripts did not receive conventional editorial processing; rather, we elected to edit "with a light penstroke" to preserve the essence of each author's presentation. Thus, these papers represent a wide range of styles, approaches, breadth of topics, and depth of analysis. We believe this unevenness in presentation style is outweighed by the advantages of quick publication. The views expressed in each paper are those of the author and are not necessarily shared by the technical editors or the sponsoring agencies.

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TROUT AND THE TROUT ANGLER II

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TROUT AND THE TROUT ANGLER II

PROCEEDINGS OF THE WORKSHOP

Radisson Hotel LaCrosse, LaCrosse, Wisconsin

July 6 - 8, 2000

Technical Editors:

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Summary

Trout and the Trout Angler II: Introduction

Robert B. DuBois[1] and David C. Fulton[2]

The concept of a trout and trout angler workshop to be held in the Upper Midwest was spawned by the fertile mind of the late Bob Jackson, then of the University of Wisconsin, LaCrosse, in the mid-1980s. The first Trout and Trout Angler in the Upper Midwest Workshop was held in LaCrosse, Wisconsin, in June of 1988. It was sponsored by the departments of natural resources of the states of Michigan, Minnesota, and Wisconsin; the chapters of the Federation of Fly Fishers from these states, the chapters of Trout Unlimited from Minnesota and Wisconsin, and the University of Wisconsin - La Crosse. The objectives of the planners of the first workshop were to:

1). To review the state of the art of trout management and human dimensions research.
2). To define and clarify problems and issues related to trout angling.
3). To foster communication among the diverse groups involved in trout angling, research, management, and administration.
4). To preserve and enhance the unique and distinctive aspects of trout angling.
5). To develop action plans for trout angling in the 1990s.

Recognizing that the issues to be addressed were complex and capable of touching sensitive emotional nerves, it was crucially important to the organizers that these objectives be reached by a process that would build consensus and unity, rather than promote division and confrontation. They were adamant that a sense of collective responsibility permeate the workshop, first to the natural resource, second to all other anglers and non-anglers, and finally with a special sense of obligation to the sport of trout angling. The workshop was comprised of three paper sessions and a comparable amount of time allotted for small group discussions of the problems and issues of trout fishing and the development of recommendations for the future. At the conclusion of the workshop, individuals from the three sponsoring states met to create action plans for the next decade. A sense that the workshop had successfully achieved its objectives was prevalent, with many individuals expressing how they were stimulated in developing their action plans through ideas communicated by other workshop participants.

Now, the time has come to revisit the status of trout resources and the human dimensions aspects of trout angling in the Midwest, and to evaluate progress made on the action plans developed over a decade ago. Trout and Trout Angler II was created to provide a forum for agency administrators, biologists, and anglers to exchange information and ideas about trout ecology, trout fishing, and trout management in the new millennium. It was formed around a much broader base of agency support than the first workshop and has an expanded focus geographically that includes the entire Midwest, but has retained the same commitment to unity and consensus, and same philosophy of collective responsibility to the resource, to each other, and to the sport.

Broadly, our intent was to focus on two key questions: “What factors affect the quality of trout, trout habitat, and trout fishing?” and “How do we identify and ensure diverse trout fishing opportunities?” An excellent agenda was assembled by the program subcommittee to address these questions that invited papers from national experts in related fields. Papers were presented in three sessions that focused on the ecological dimensions of trout management, the human dimensions of trout management, and the role of trout anglers in the 21st century.

Workshop attendees also participated in two sets of small group exercises using nominal group processes. These exercises identified and prioritized the ecological/biophysical issues and

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the human dimensions issues important in trout management.

Trout anglers are being called upon more and more frequently to partner with management agencies in managing trout resources. With this privilege comes the responsibility for trout anglers to develop their understanding of the relevant social and ecological issues so that they can participate in these partnerships more effectively. For this reason, and to keep management agencies up to date on recent developments in the field, we anticipate a continued need for trout workshops in the Midwest, probably at five-year intervals. Significant representation by angling groups will be critical to the success of future workshops. Unfortunately, attendance was lower at the Trout and Trout Angler II than it had been at the first workshop, probably for a variety of reasons. Despite a timely agenda featuring nationally known speakers, anglers appeared to be reluctant to commit to a three-day workshop. Planning efforts for future workshops will have to examine innovative ways to draw greater angler participation.

Ecological Dimensions Plenary Presentation: Trying to Put it all Together

Robert Behnke[1]

Abstract - The biological basis of fisheries management is often constrained by socio-political realities; for example, conflicts over wild trout vs put-and-take management and associated regulations. There is much to be desired and we have a long way to go before we more fully utilize and apply knowledge from evolutionary ecology, evolutionary genetics, and natural resources economics to manage our fisheries more effectively. Some blame can be assigned to the fact that government agencies practice a form of socialism whereby competition to produce a better product is lacking, and there is little incentive, sometimes disincentive, to be creative and innovative. It would seem insane for General Motors or the Ford Motor Company to spend 50% of their annual budget on a product that returns 10% of gross sales (as some states do by analogy with put-and-take fisheries). Corporate boards of directors wouldn't stand for such economic suicide. It must be recognized, however, that Fish and Game Commissions differ from corporate boards. In western states it is common to have a commissioner who represents livestock interests and whose actions can be directly opposed to the best interest of fish, wildlife, and environmental quality. A challenge for the millennium concerns how to more fully utilize theories, principles, and knowledge for more effective fisheries management.

I retired from teaching last year but remain active in all other respects. My activities have actually increased in relation to participating in meetings, conferences, workshops, lectures, and serving on panels. It appears that, to some, at least, I am considered as a spokesperson or an authority on fishes in general and trout in particular. There is a slightly disturbing aspect in playing the role of an authority because in the education of students of fisheries and natural resources I have urged students to question prevailing authority and conventional wisdom. Today's authority and conventional wisdom are likely to change. As Einstein said, "We cannot solve today's problems with the same level of thinking that created them." Thus, my advice on questioning the prevailing authority is not meant to encourage a rude display of rebellion, but to keep one's mind open to new ideas and new levels of thinking based on new knowledge.

What should be the ideal curriculum to prepare students for managing fisheries and natural resources as we enter the 21st century? In 1948, the Wildlife Management Institute produced a manual on careers in fisheries and wildlife with recommendations on college curricula. Many changes occurred over the following 50 years including the development of computers and all associated ramifications. Students of fisheries and wildlife in the 1950s, the so-called "hook and bullet" era, were exposed to the conventional wisdom and prevailing paradigms of natural resource management that still largely reflected the utilitarian view of nature. Species were considered as good, bad, or useless. There was a considerable lag time before Aldo Leopold's holistic ideas of a land ethic as a basis for natural resource management became part of curricula at most universities. Students graduating with degrees in fisheries and wildlife 30 to 40 years ago and becoming professional biologists and agency administrators might have faced severe adjustment problems during the recent era of emphasis on biodiversity and ecosystem

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management. The paradigm has shifted from utilitarian values to ecocentric values. The students of 40 to 50 years ago are now old timers. Had they learned to keep their minds open to new ideas, new knowledge, and new ways of thinking, the transition from old to new paradigms on resource management should have been rather easy. They would not likely have become cynical old gaffers, grouching about how things were better in the old days. Thus, an "ideal" curriculum for the 21st century should assume that new knowledge, new ways of thinking, and new paradigms will continually occur and students should be prepared to assess and evaluate new information with an open mind. Be prepared to question prevailing authority, but such questioning should be based on an understanding of the new knowledge. One should also be aware of the danger of inductive reasoning or jumping to wrong conclusions, whereby a specific instance is extrapolated to a broader universe where it might not apply.

Lastly, I would stress extreme caution to avoid being deluded by the "illusion of technique" (the old "technological fix"). This phenomenon is likely to occur with people wanting to appear modern and progressive by blindly embracing new technologies such as computer modeling and molecular genetics without an adequate understanding of the subject matter involved. For example, anyone familiar with the current ecological paradigm of non-equilibrium or dynamic equilibrium (as contrasted with "balance of nature stability"), with the new emphasis on recognizing uncertainties and unknowns, will realize that any "predictions" from ecosystem models should be treated as part of a learning process, a means to an end rather than an end in itself.

I will illustrate examples of some of the points brought out above with issues discussed in my columns during the past two years. My 1999 columns were devoted to Trout Unlimited's fortieth anniversary topics.

One of the first actions taken by Trout Unlimited (TU) in 1959 was to establish a National Board of Review (predecessor of the Scientific Advisory Board). The first four members were Karl Lagler (University of Michigan), Paul Needham (University of California, Berkeley), Dwight Webster (Cornell University), and Albert Hazzard (Assistant Executive Director, Pennsylvania Fish Commission). Volume one, number one, of the Trout Unlimited Quarterly (Winter 1959) announced the formation of the board of review and stated it was "...made up of the most renowned and reputable trout researchers in the country." TU had established an "authority" on matters pertaining to trout biology and trout fisheries.

In the late 1950s and early 1960s, the long term data on brook trout (*Salvelinus fontinalis*) populations in small streams in Michigan and Wisconsin were not encouraging to TU's mission stressing wild trout management with restrictive angling regulations ("limit your kill"). The small stream environments inhabited by these brook trout populations dictated a short life span and rapid turnover of the population. This resulted in high annual production rates (the amount of new growth each year), but most of the production was of age zero (young-of-year) and yearling fish that were too small to be attractive to anglers. Over-winter mortality was extremely high between ages one and two and two and three so that virtually no age three fish (in fourth year of life) remained in these populations. No kind of protective angling regulations, even complete closures of a section of stream, could produce more age three trout in these populations. At the time, the prevailing utilitarian paradigm was that a fish dying of natural causes was "wasted" because it was not caught and consumed by humans (leading to the management concept of maximum yield - to the creel). The research data from small stream brook trout populations did not bode well for making the case for angling regulations that assumed if mortality due to angling was reduced or eliminated, individuals in a population would continue to grow and survive for many years. In 1960, TU's first policy statement endorsed research to determine "....the causes of the high annual winter mortality of all trout in streams."

Note the classic example of inductive reasoning. Because of the data demonstrating that brook trout populations in small streams are made up mostly of small, young fish with high over-winter mortality, therefore this phenomenon applies to "all trout" in (all) streams." Note also an example of what I classify as part of the illusion that funding and research can solve any problem.

No "authority," neither TU's National Review Board nor any fisheries authority to my knowledge, pointed out the fallacy of taking the specific examples from small stream brook trout populations in Michigan and Wisconsin and applying them to all trout species in all streams. The controversy over the efficacy of restrictive angling regulations continued for many years. In the 1970s, studies on cutthroat trout (*Oncorhynchus clarki*) populations that lived in environments that produced good growth and a long life span (7-8 years) showed amazing responses to restrictive regulations. Population numbers and biomass increased several-fold after angling mortality was greatly reduced. There was a lag time of about 20 years (ca. 1960 to 1980) before special angling regulations with a firm biological basis began to be implemented.

Another example of indefensible lag time concerns the wild trout/hatchery trout debate (especially catchable trout and put-and-take fishing). This was the main issue responsible for the creation of TU in 1959. As I have discussed in several columns, 25 years after the founding of TU, catchable trout production in federal and state hatcheries increased by 55% in numbers and about 100% in weight. It has since leveled off, but last year (1999) I was shocked to read in a California Fish and Game draft strategic fisheries plan ("a plan for the future") that catchable trout production, to meet future demand, should be increased by 300%! Wild trout fisheries that recycle relatively large trout in special regulation fisheries have a much greater economic value per angler day than put-and-take fisheries. Yet some states still spend 30% to 50% of their total fisheries budget to raise and stock catchable trout that support no more than 10% to 15% of their total angler days. This is comparable to the Ford Motor Company or General Motors spending half of their total budgets to produce 10% of total vehicle sales. I would be tempted to blame the lag time for implementing more progressive, biologically and economically based fisheries programs on the fact that state natural resource agencies are socialist enterprises shielded from competition to produce the best product at the most reasonable cost. To some extent this is true, but it must be recognized that state fish and wildlife agencies are constrained by commissioners and legislators who are largely ignorant of scientific considerations. Special interests representing land and water development and agriculture, especially livestock in the West, often make up the governing body. Their interests are often opposed to the best interests of fish, wildlife, and the environment on which they depend.

My final word of warning concerns the constraints that political and special interest influences can have to frustrate attempts to bring about meaningful changes for the better. It can be frustrating to the best and most ambitious of agency personnel. My advice is to persevere and take to heart Ralph Waldo Emerson's aphorism that nothing great can be achieved without enthusiasm.

Historical Changes in Trout Distribution

Robert Behnke[1]

Abstract - Transplants of fishes from one drainage basin to another began in colonial times. The completion of a transcontinental railroad in 1869, the establishment of the American Fish Culturists' Association in 1870, and the creation of the United States Fish Commission in 1871, resulted in the rapid expansion of the distribution of "valuable" (nonnative) species around the country. The eastern brook trout *(Salvelinus fontinalis)* has been commonly replaced in its native range in the United States by brown trout *(Salmo trutta)* and rainbow trout *(Oncorhynchus mykiss)*, but in turn , brook trout are now the most common trout found in small mountain streams. Cutthroat trout *(O. clarki)* have been largely replaced by brown trout and rainbow trout. The establishment of lake trout *(Salvelinus namaycush)* in large western lakes has had a devastating impact on cutthroat trout and bull trout *(S. confluentus)*. Many of the most notable tailwater fisheries are found in areas where no species of Salmonidae ever occurred before new flow and temperature regimes were created.

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Habitat-fish Relationships across Local to Watershed Scales

Bruce Vondracek[1], Kristen L. Blann[2], and Brian Nerbonne[3]

Abstract - We examined the relationship between fish distribution and landscape variables at three scales across southeast Minnesota. In the Whitewater River, we assessed fish communities, that included brook *Salvelinus fontinalis* and brown trout *Salmo trutta,* with an index of biotic integrity across 27 sites classified by riparian type (grass, grazed, or wooded). For five additional watersheds, we analyzed Minnesota Department of Natural Resources stream data specifically to identify patterns in trout distribution. Relationships between fish and landscape variables were examined using redundancy analysis. Local, instream habitat differed across riparian type; riparian width was negatively correlated with percent fines and embeddedness. Grass riparian areas had significantly lower percent fines, embeddedness, and exposed stream banks, and higher percent cover and pool area. IBI scores were negatively correlated with percent fines and embeddedness, and positively correlated with width-to-depth ratio. Landscape characteristics at the riparian and catchment scale accounted for 20-40% of the variance in trout metrics. However, land use variables explained only a small portion of variance at the catchment scale. Percent deciduous forest, slope, stream gradient, and bedrock associations were positively associated with trout distribution, whereas cultivated land use was negatively correlated with trout distribution at the riparian and catchment scales.

INTRODUCTION

Stream ecosystems are linked to and structured by the terrestrial landscape in numerous, complex ways. Different processes are governed at different spatial and temporal scales (Frissell et al. 1986), and consequently the perceived relative importance of different environmental factors may depend strongly on the spatial scale of observation (Lanka et al. 1987). Factors at the catchment, reach, and macrohabitat scales have been used to predict life-history characteristics of stream fish and assemblage structure (Imhof et al. 1996). However, most empirical studies of fish ecology have been conducted at smaller spatial scales, more amenable to research designs (Matthews and Heins 1987). Empirical studies at larger scales have been hindered in the past by the sheer volume of data and analysis required. Recently, Geographic Information System (GIS) analysis has allowed the potential for assessing the link between fish distribution and land use at a watershed scale (Giles and Nielsen 1992).

Across the country, watershed approaches to surface water restoration and management have begun to receive a large amount of attention both from local and regional government agencies as well as citizens groups and nonprofit institutions (Williams et al. 1997). Much of the focus on watersheds has resulted from the relative success of addressing point sources of water

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pollution compared to non-point sources, in which agriculture is often heavily implicated. Despite major improvements in land management practices (Thorn et al. 1997), many point and nonpoint-source pollution problems remain, including overgrazing of riparian areas, widespread nutrient and fecal coliform contamination, expansion of large animal confinement facilities, suburban and urban development, and periodic fish kills. Assessment and understanding of these nonpoint-source problems requires an approach that encompasses several spatial scales.

Topography and land use mediate stream biota both through their influence on channel form and on stream hydrology and discharge. Geology and soils affect streams through sediment size, gradient, width:depth ratios, sinuosity, and vegetation characteristics. Land use within a watershed can account for much of the variability in stream water quality and quantity (Omernik 1977). Land cover, or vegetation patterns at both the catchment and riparian scale can mediate hydrology, water quality and sediment input. The impact of land use on stream integrity is also scale-dependent. Instream habitat structure and organic inputs are influenced by site-level conditions such as riparian vegetation (Sovell et al. 2000, Nerbonne and Vondracek 2001), whereas channel morphology, water chemistry, hydrology, and sediment inputs are influenced by hydrologic characteristics of different land uses within the catchment (Allan et al. 1997). The surface and subsurface soils through which water flows en route to aquifers or springs also affects instream water volume, chemistry, and quality. In southeastern Minnesota, stream water quality and fish biomass have been attributed to environmental characteristics associated with subsurface geology and land use patterns (Krueger and Waters 1983, Troelstrup and Perry 1989).

Catchment-scale variables correlate significantly with a broad range of fish microhabitat characteristics (Hubert and Kozel 1993). Stream order, gradient, and elevation have all been correlated with brook or brown trout abundance in studies in eastern and western mountain regions of the United States, but have not been well studied in the Midwest. Somewhat weaker or perhaps different relationships may exist for these parameters in Minnesota (Thorn 1992, Weigel 1994).

The goal of this research was to determine the relevant scale at which physical and abiotic factors exert the greatest influence on stream fish communities in southeastern Minnesota, and to identify the characteristics that correspond with the greatest amount of fish assemblage variation across several scales. We had two specific objectives; to examine the importance of land use/land cover at the catchment and riparian scale in influencing fish communities and instream physical and to identify geologic and hydrologic variables that exert a strong influence on habitat and fish assemblage characteristics. Our research focused on brook *Salvelinus fontinalis* and brown trout *Salmo trutta* because of the interest among anglers, biologists, and managers, but we evaluated fish communities broadly. If land use could be shown to be a significant effect on the ability of streams to sustain trout and/or natural reproduction of trout without continuous stocking, this finding would be of interest to managers and citizens interested in maintaining high quality trout streams. By examining how fish communities and habitats respond to variables at multiple scales across an entire region, we intended to separate as much as possible the effects of land use from the related influences of catchment size, soil, geology, slope, and other abiotic characteristics of watersheds and riparian ecotones.

METHODS

The study area included several major watersheds of the Mississippi drainage of southeastern Minnesota (Figure 1), including the Cannon, Root, Whitewater, Zumbro and smaller drainages in between. Geology of the watersheds have been shaped by glacial history

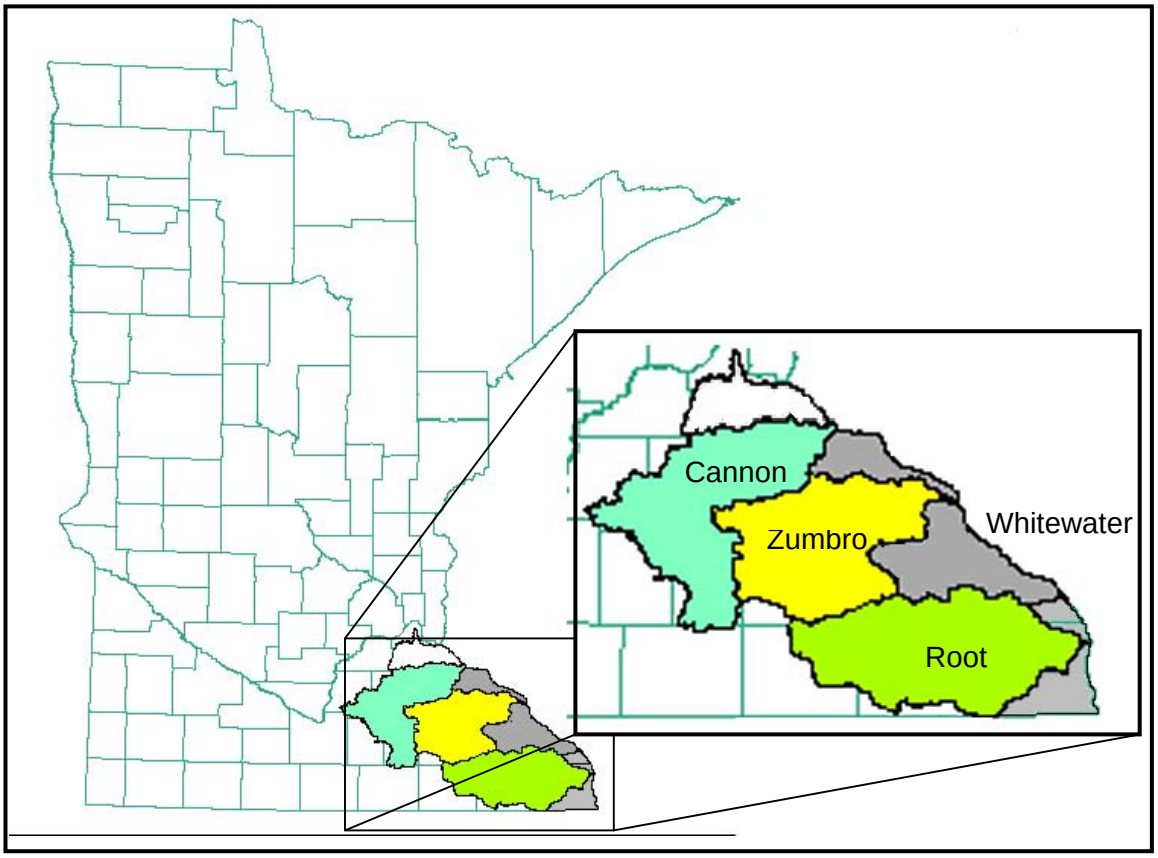

Figure 1. Study area in southeast Minnesota, includes the Cannon, Root, Whitewater, and Zumbro watersheds

(Broussard et al. 1975). The watersheds lie within a relatively unglaciated region that Omernik and Gallant (1988) termed the Driftless Area Ecoregion. However, the main branches originate in a glaciated, relatively flat area, the Western Corn Belt Plains (Omernik and Gallant 1988). The streams meander slowly through rolling plains before entering deep, unglaciated valleys in the middle portion of the watershed. The unglaciated valleys receive significant inputs of groundwater from underlying limestone and sandstone bedrock. As the streams descend into the valleys, the major streams take on the characteristics of coldwater, trout streams due to abundant groundwater flow from springs and seeps, but transition gradually back to warmwater streams.

Early explorers in Minnesota described clear streams writhing with abundant brook trout and other fishes, flowing through prairie country alternating with heavily timbered areas. A mid-nineteenth century journal account gave the following description of the Root River: “clear and cold and flow[ing] over a pebbly bottom. Copious springs of clearest water are to be found in nearly every valley and the brooks flowing from them are alive with the finest speckled trout”, (Bishop 1858, cited in Johnson et al. 1949). However, the notoriously unwary “speckled trout”, as they were then known, were rapidly harvested, so that by the 1870s one writer was already referring nostalgically to their “former” abundance.

Following European settlement in the second half of the nineteenth century, most of the watershed was converted to agriculture. Poor agricultural practices led to severe erosion and consequent stream degradation in the early 1900s (Waters 1977) and contributed to the almost complete extinction of brook trout. Sediment movement was most evident in stream channels in the Western Corn Belt Plains Ecoregion (Trimble 1993, Waters 1977), and from tributaries to upper main valleys in the Driftless Area Ecoregion. Improvements in erosion control practices begun in the 1940s and the acquisition and reforestation of many of the steepest hillsides have led to a slow but steady improvement in many streams (Thorn et al. 1997). As better soil conservation practices were implemented in upland areas under cultivation, the range of cold water fishes has increased over the past three decades (Thorn et al. 1997). Natural reproduction by wild trout -- both brook and brown trout -- now occurs in a majority of cold water streams. However, despite improvements in land management practices (Thorn et al. 1997), many point and non-point source pollution problems remain.

We used two datasets to characterize the fish assemblage. The first was a database of presence/absence of all fish species as well as physical habitat was obtained from William C. Thorn of the Minnesota Department of Natural Resources (hereafter referred to as the MNDNR stream survey data). This database contains stream survey records for 413 stream reaches throughout southeastern Minnesota for the period 1975-1992. Physical habitat data include erosion and cover (categorical), and % fines, % pool, %riffle, flow, gradient, sinuosity, and alkalinity recorded at each reach immediately following fish collection.

We also used a database specific to the Whitewater River which was more intensive than the MNDNR stream survey data (Nerbonne 1999; hereafter the WWR database). In the Whitewater River, study sites were selected and classified based on upland and riparian land use. Upland land use at a site was classified as best management practice (BMP) if no-till, reduced tillage, or contouring was in place; otherwise, the site was classified as conventional. Riparian buffers were classified by their dominant vegetation type: ungrazed grass, grazed grass, or wooded within 150 m of the stream. Eight sites were located in the coldwater portion of the watershed, and all others were in warmwater portions of the watershed. Sites were located in the three main branches of the Whitewater, as well as along two tributaries. Fish were collected in late June/early July in 1996 and 1997 using a backpack electrofisher in 150-m stream reaches, rather than the minimum of 35 times MSW recommended by Lyons (1992a). Only for sites that were < 4.3-m wide did we satisfy Lyons' (1992a) protocol, but for the following reasons we contend an adequate distance was covered in the streams that were > 4.3-m wide. Species diversity was low, especially at coldwater sites, making it easier to capture all species present. Also, sampling three riffle/pool sequences is considered adequate (Lyons 1992a), and we fulfilled this condition at all sites. For physical habitat, sampling was conducted in August and

September each year using a transect method following the protocol of Simonson et al. (1994).

We used several ARC/INFO coverages for landscape-level characterization for the MNDNR stream survey (Table 1). The MNDNR stream survey data were linked directly to the streams coverage using ARC/INFO's dynamic segmentation model based on the distance of the survey reach from stream's mouth. The landscape characterization was carried out to facilitate analysis at two hierarchical spatial scales: riparian (a 100 m buffer on either side of a reach) and catchment (the drainage area above the most downstream point of a survey reach). The riparian scale was created by generating a 100m buffer on either side of each stream reach was derived from the Minnesota Department of Transportation (MNDOT) streams coverage using dynamic segmentation with ARC/INFO's stream networking capability. The landscape characterization used five categories: topography/hydrology, land use/land cover, bedrock geology, geomorphology, and soil type.

For warmwater sites in the Whitewater River, we used an Index of Biological Integrity (IBI) developed by Lyons (1992b). For coldwater sites, we used a coldwater IBI developed by (Mundahl and Simon 1999). We used a subset of metrics from the coldwater IBI (Mundahl and Simon 1999) to characterize the fish assemblage based on the MNDNR stream survey data.

Several IBI metrics had to be excluded when we used the MNDNR stream survey data, because they depend on abundance or relative abundance data. Number of intolerant species was used rather than number of intolerant individuals. We specifically evaluated presence/absence of brown trout, brook trout, brook YOY, and brown YOY (hereafter, trout presence/absence data).

We used Redundancy Analysis (RDA) to identify the relative importance of the land use, geology, soils, and topography variables at the riparian and catchment scales and to evaluate physical habitat at the reach scale. RDA is a constrained form of multiple regression of a multivariate set of predictor variables on a multivariate set of response variables (ter Braak 1987-1992). Each axis of the ordination is a linear combination of the response variables, constrained by the predictor variables. RDA was performed using CANOCO software (ter Braak 1987-1992). Response variables for the analyses were primarily fish assemblage metrics from the MNDNR stream surveys and WWR database. Landscape variables and instream physical habitat measures were our explanatory variables. The significance of the RDA model was tested using a Monte Carlo permutation (ter Braak 1987-1992). F-values generated from each Monte Carlo permutation are compared with the F- value for the original set. If the original F-value was among the highest 5% of 100 random sets, the ordination was considered significant (ter Braak 1987-1992).

Variables were transformed if not normally distributed using either log transformations or arcsine square-root transformations (for percentages), and then standardized to unit variance for use in RDAs. Percentages that were not normally distributed following transformation, such as the less common bedrock geology categories, were omitted from ordinations.

Many of the landscape variables are correlated (Blann 2000). When data are collinear, standard errors on regression coefficients are large, leading to few individual predictor variables having significant coefficients in ordinations. Partial RDA, a method of partialling out components of ecological variation (Borcard et al. 1992) was

Table 1. Data sources for GIS analyses of MN DNR stream survey data.

Coverage	Class	Scale	Source/Information
Land use/land cover	polygon	1:24,000	International Coalition/MNDNR
National Wetlands Inventory	polygon	1:24,000	US Fish & Wildlife Service
Bedrock Geology	polygon	1:24,000	MN Geological Survey
USGS DEMs (II)	raster	1:24,000	MN DNR
Hydrography	line	1:24,000	MN Department of Transportation
Geomorphology	polygon	1:110,000	MN DNR, University of Minnesota-Duluth, and MN Geological Survey
STATSGO	polygon	1:250,000	Natural Resource Conservation Service

used to address correlation among variables to separate out relative proportion of shared variance. In Partial RDA, a set of variables are held constant to remove the variance components shared between the covariables and the explanatory variables of interest (ter Braak 1987-1992). We used forward selection to identify variables that contributed the majority of variance.

For RDA, bedrock geology information was unavailable for several counties in the study area, which led to the elimination of sample sites from the MNDNR stream survey; our final number of sites in the analysis was 121.

RESULTS

Landscape variables, all five categories evaluated simultaneously, explained about 43% of the variance in presence of trout (by age and species) at the catchment scale and 48% of the variance for all fish metrics (Table 2). At the riparian scale, landscape characteristics explained about 29% of the variance for trout metrics and 36% for all fish metrics (Table 2). When examined separately, land use explained about 10% of the variance on the first two axes at the catchment and riparian scales for both trout and all fish metrics (Table 3).

Forward selection using partial RDA analysis indicated a mix of all five landscape variables that explained the distribution of the fish community at the catchment and riparian scales (Blann 2000). There was little overlap in explanatory variables at the catchment and riparian scales for fish metrics (Table 4). Several land use variables including % grass/pasture, % cultivated land, and % forest were positively correlated with fish community metrics (Table 4). Trout metrics were often positively related to % forest, but % grass, % wetland and % urban land use were also implicated (Table 5). Interestingly, there was little overlap in the variables that explained the distribution between YOY and age-1 and older brook trout, and age-1 and older brook and brown trout (Table 5). YOY brown trout were not significantly related to any landscape variables at either the catchment or riparian scales (Table 5).

Landscape variables accounted for about 50% of the total variance in physical habitat. The majority of the variance explained was related to channel characteristics such as width, depth, and discharge to distance from headwaters, peak discharge, and alluvium. Reaches with greater width, depth, and discharge predictably occurred in larger catchments, farther from headwaters. When width and depth were omitted to remove this dominant component of variance, habitat variables remaining included gradient, discharge, percent riffle, and percent fines. Percent fines were associated with distance from headwaters, higher values for erosion potential, lower percent bedrock, and lower gradient. Percent riffle and stream gradient from the stream survey were also associated with percent bedrock geomorphology.

The first two axes of the RDA of physical habitat on MNDNR coldwater fish metrics explained 26% of the variance (Table 6). The first axis primarily related variance in numbers of benthic, tolerant and total species to discharge, width, and depth. The second

Table 2. Variance explained by ordinations of coldwater fish assemblage metrics (n = 121) in relation to landscape variables at catchment and buffer spatial scales.

	% Variance explained			Monte Carlo F-test
Analysis	RDA Axis 1	RDA Axis 2	All axes	p-values
All fish metrics				
Riparian Buffer	22	10	36	<0.01
Catchment	30	12	48	<0.01
Trout presence/absence				
Riparian Buffer	14	6	29	<0.01
Catchment	15	11	43	<0.01

Table 3. Variance explained by ordinations of fish assemblage metrics (n = 121) in relation to land use at catchment and buffer spatial scales.

	% Variance explained			Monte Carlo F-test
Analysis	RDA Axis 1	RDA Axis 2	All axes	p-values for 1st axis and all axes
All fish metrics				
Riparian Buffer	4.5	1.7	6.9	NS
Catchment	8.3	1.8	11.0	<0.01, <0.01
Trout presence/absence				
Riparian Buffer	5.7	3.0	10.0	<0.01, <0.01
Catchment	4.6	2.6	9.7	<0.03, <0.01

Table 4. Summary of fish metrics in relation to landscape variables at the catchment and riparian scales based on forward selection.

Metric	Catchment	Riparian
Total species, benthic fish, minnow, and tolerant fish	+ distance from headwaters, % grass,/pasture, % Galena, glacial till	+ reach length and area, % cultivated, % alluvium,
		- soil erosion potential
Coldwater, intolerant	+ % bedrock	+ gradient, % forest, % bedrock, % Jordan, HSGA
	- % terrace, soil erosion potential, JDNSTL	- % grass, % terrace

HSGA = % hydrologic group A (highest infiltration and lowest runoff potential)
JDNSTL = contact between Jordan and St. Lawrence bedrock layers

Table 5. Summary of trout metrics in relation to landscape variables at the catchment and riparian scales based on forward selection.

Metric	Catchment	Riparian
Age-1 + brook trout	+ slope, SEDI, % forest, % grass, bedrock porosity, HSGA	+ gradient, % forest
Age-1 + brown trout	+ area, % Galena	+ % forest
YOY brook trout	+ slope, % forest, % wetland, % urban, % Galena	+ % Decorah shale, % grass, % wetland, soil erosion potential
	- HSGA	- % forest

SEDI = sediment transport index
HSGA = % hydrologic group A (highest infiltration and lowest runoff potential

Table 6. Fish metrics in relation to physical habitat (n = 121). Astericks indicate –values *=<0.10, **=0.05, ***=<0.01.

	RDA1		RDA2	
Fish metrics	Total species	-0.55	Brook trout	-0.21
	Benthic fish	-0.52	Intolerant fish	-0.41
	Tolerant fish	-0.44	Coldwater	-0.40
	Coldwater fish	-0.24	Tolerant	0.25
	Brown trout	-0.41		
	Intolerant fish	-0.27		
Physical habitat variables	Gradient**	0.36	% Riffle	-0.23
	Depth***	-0.27	Fines	0.22
	Width***	-0.41	Cover***	-0.34
	Discharge	-0.31	Bank erosion	0.21
	Bank erosion**	-0.25		
Percent variance explained		19%		7%

axis separated tolerant species from numbers of coldwater species, intolerant species, and presence of brook trout. Brook trout presence, number intolerant species, and number of coldwater species were positively associated with the amount and variety of cover and negatively associated with percent fines and degree of bank erosion along the second axis. Both axes differentiated between those metrics that weight positively in the coldwater IBI (intolerant and coldwater species) and those that are associated with lower scores (total number of species and number of minnow species).

No significant differences were noted in physical habitat variables between sites with different upland land use for the WWR database. However, significant differences in physical habitat measures were detected among sites with different riparian buffer types. In general, physical habitat characteristics along grass-buffer sites were significantly different from wood-buffer sites, whereas grazed buffers were intermediate.

Instream substrate was significantly different across buffer types; percent fines were significantly lower along grass-buffered sites than along wooded sites or grazed buffers. Embeddedness was significantly lower along

grass-buffered sites than along grazed or wooded sites. Although embeddedness was lower, mean values along grass buffers were > 40%. The amount of exposed stream bank was significantly different across buffer types; percent exposed stream bank was significantly lower along grass-buffered sites than along wood-buffered or grazed sites.

IBI scores were positively correlated with width-to-depth ratio (Figure 2), and negatively correlated with percent fines (Figure 3) and embeddedness (Figure 4). When percent fines or embeddedness (which explained relatively low variance) were entered with width-to-depth ratio in a multiple regression versus IBI scores increased variance explained to 70 - 71%.

DISCUSSION

Land use and other characteristics of a stream's catchment and riparian ecotone exert significant influences on fish assemblages and physical habitat in coldwater streams of southeastern Minnesota. Differences in physical habitat we noted across buffer types in the Whitewater River can be viewed as responses within a hierarchical structure where finer-scale physical characteristics are nested within larger-scale influences (Frissell et al. 1986, Hawkins et al. 1993). Landscape characteristics at catchment and riparian scales in our broad-scale analysis explained significant variance in fish metrics as well as presence/absence of age-1+ and YOY trout, but explained variance was under 50%. Whereas large-scale processes determine the potential range of states for nested levels, local-scale processes can exert considerable influence on conditions within that range. Within the constraints set at the watershed level, local-scale riparian land use had a significant influence on instream physical habitat in our study of the Whitewater River.

In general, landscape characteristics at catchment and riparian scales differed between reaches occupied by brook trout versus those occupied by brown trout, and between reaches with YOY trout versus age-1+ trout. However, these differences appeared to reflect relative positions in an upstream-downstream continuum rather than signalling clear mechanisms linking the landscape to streams. Age-1+ brook trout and brown trout were associated with more forested, higher gradient reaches where geomorphology is dominated by bedrock. Catchment and riparian characteristics of the smaller, headwaters streams occupied by YOY trout indicate a transition from the lower gradient agricultural or grass/pasture uplands of the Western Corn Belt Plains to the coldwater, forested reaches of the upper and lower main valleys. Water quality and quantity in these smaller streams may be dominated by spring flows from the Galena, Prairie du Chien or Jordan aquifers rather than by overland runoff. YOY trout may be dispersing upstream into these smaller, less forested transitional streams to avoid predation by larger fish (*sensu* Schlosser 1987).

Although the large sample size of the DNR stream survey data allowed for us to explain significant variance among fish metrics and landscape characteristics, land use at catchment and riparian scales did not differentiate consistently between reaches with brook trout, brown trout, trout YOY, and intolerant species. Blann (2000) found significant differences in land use between coldwater and warmwater streams at catchment and riparian scales, with coldwater streams having higher percent forest, but these differences were closely correlated with geology and topography.

The influence of landscape characteristics such as geology, topography, and land use on variables characterizing coldwater fish assemblages was significant and land use accounted for similar amounts of variance. The proportion of variance explained and the relative role of different classes of environmental variables did not differ substantially between spatial scales. Thus, our study failed to lend strong support for the hypothesis that influences exerted by land use and other characteristics of a stream's

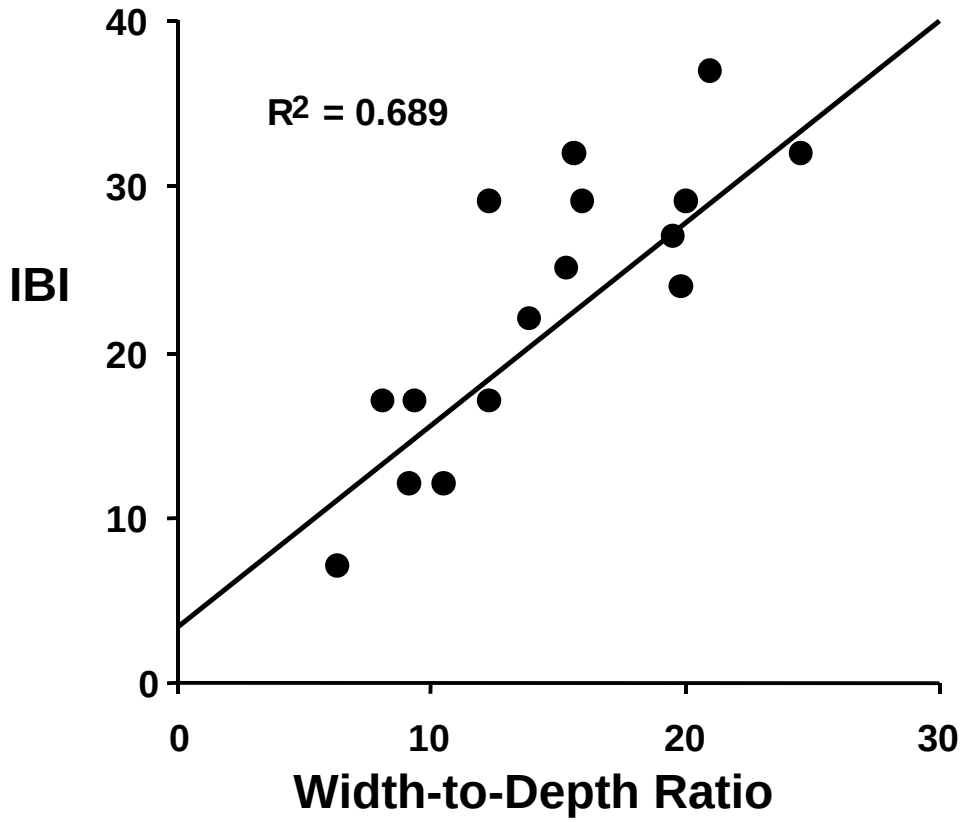

Figure 2. IBI score in relation to width-to-depth ratio in the Whitewater River.

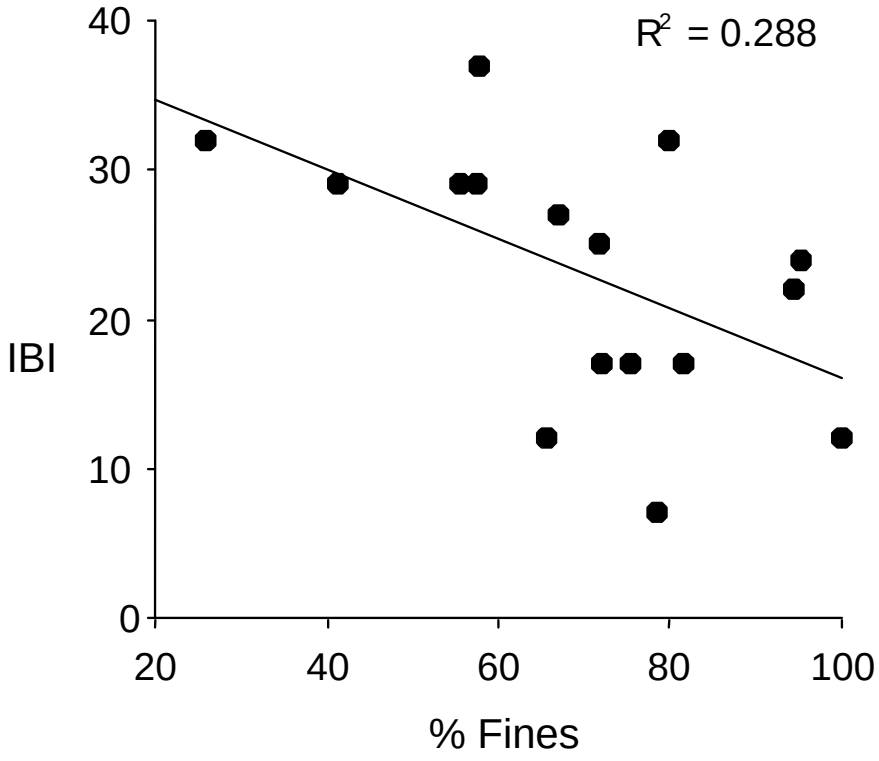

Figure 3. IBI score in relation to percent fines in the Whitewater River.

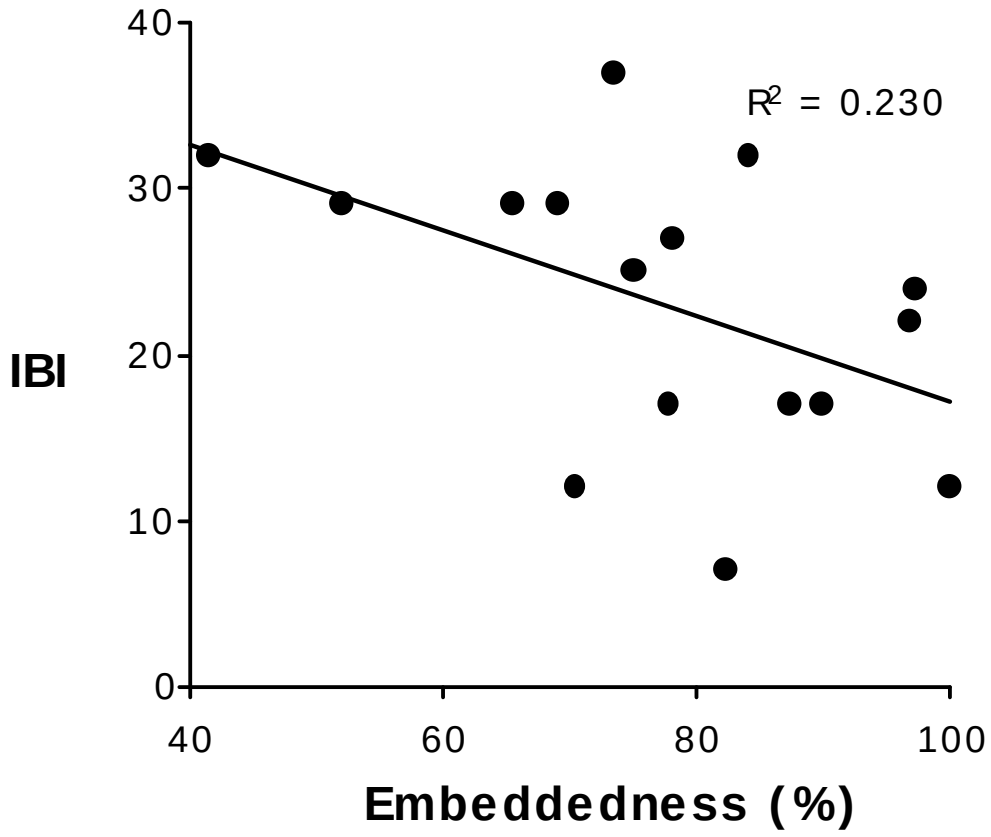

Figure 4. IBI score in relation to embeddedness in the Whitewater River.

catchment and riparian zone on the presence/ absence of stream fish are scale dependent.

Land use at catchment and riparian scales was significant in differentiating among reaches in relation to fish community characteristics and in indicating presence/ absence of age-1+ brook trout and brook trout YOY. Based on research in the Midwest and elsewhere, we would have expected to see a negative effect on stream fish metrics in relation to percent cultivated and urban/developed land at catchment and riparian scales, and a positive effect as percent forest increased (Lenat and Crawford 1994, Wang et al. 1996, Allan et al. 1997, Lammert and Allan 1999). To some extent, this result was observed. Coldwater metrics and presence/absence of age-1+ trout were positively related to percent forest at the riparian scale, and percent forest was positively associated with age-1+ brook trout at riparian and catchment scales. Percent cultivation, urban/developed, and grass/pasture were associated with fish metrics that lead to lower scores for the coldwater index of biotic integrity. However, age-1+ brown trout were not negatively associated with percent cultivation at the catchment scale, and YOY trout were negatively associated with percent forest at the catchment and riparian scales.

It was not surprising that percent grassland, which did not distinguish between fallow or natural grassland and heavily pastured land, was not consistently associated with trout presence when viewed at the landscape scale. Additional research as well as different approaches to analysis might lead to improved understanding of mechanisms underlying these relationships. Differentiating between land use types at a finer scale, for example, pasture vs. grassland, might lead to less ambiguous relationships between fish metrics and land use. In fact, when viewed at a local scale, as in the Whitewater River, physical habitat factors and associated IBI scores in relation to grass buffers often were significantly different than along grazed pastures. Furthermore, stratifying samples according to geomorphology or location in the upstream-downstream continuum might help remove confounding effects of geology and location.

Collinearity limited our ability to sort out interacting effects of geology, topography, and land use. Low discriminatory power may have resulted from collinearity, insufficient resolution of source data (GIS, habitat, and fish), errors in source data, lack of resolution in land use/cover data distinguishing important differences in management practices, and interacting effects of geology, topography, and land use. However, unexplained variance may also be due to past land use (Harding et al. 1999), the dispersal ability of stocked and naturally reproducing trout and other species, differences in management practices among similarly defined land use types, biological interactions such as competition, and other important spatial and temporal relationships and processes that were not or could not be measured.

In general, relationships between coldwater fish assemblages and landscape characteristics reflected broad-scale patterns, suggesting zonation of reaches on an upstream-downstream continuum: a) warmwater uplands, particularly in northern and western catchments, with higher percent grassland/ pasture and cultivation, b) high gradient, coldwater reaches in the more forested middle valleys, and c) larger, downstream reaches with lower gradients. YOY trout were associated with transitional zones between the uplands and high quality and more forested middle reaches. Overall, the observed patterns suggest that a classification scheme based on ecoregion, stream size, gradient, and thermal regime, as Lyons (1996) suggested for coldwater streams of Wisconsin, would be appropriate for southeast Minnesota. Analysis examining influences of land use and geology at the riparian scale should be stratified to remove the confounding effect of catchment-scale drivers.

GIS represents a potentially powerful tool for managers, but to be used effectively to detect relationships between watershed processes and biotic communities, databases characterizing stream habitat and fish communities should be designed for integration in GIS. Ultimately, developing a GIS capable of determining the amount and quality of trout habitat based on landscape or watershed-scale variables should be possible (Isaak et al. 1996).

Expanding analysis to include existing data on production, growth, and biomass differences between streams could help to refine understanding of factors governing the baseline potential of coldwater streams, and to facilitate targeted or individual-based stream management.

In conclusion, the results of this study suggest that to reduce sedimentation in agricultural areas, riparian management may show greater effectiveness at the local scale than upland management. However, in southeastern Minnesota, the effectiveness of local management intervention is likely to depend on the position of the site or reach within the entire watershed. Likewise, the position of the reach within the watershed should be taken into account in determining the type of riparian management. Although upland land use did not explain more than 10% of the variance in fish distributions in this study, the expansion of trout to their former range after improvements in upland management practices (Bill Thorn, Minnesota Department of Natural Resources, personal communication) indicates the importance of maintaining and perhaps expanding upland BMPs. The ability of grass buffers to maintain stream bank stability and low sediment content in stream substrates suggests they may be a viable riparian management option (Lyons et al. 2000).

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Constraints on Carrying Capacity and Abundance of Trout in Midwest Streams

Robert L. Hunt[1]

Abstract - Along the continuum of fluvial habitats suitable for trout - from creeks to streams to rivers - those habitat reaches constituting "streams" are probably the most important category to trout fishers in Midwest states. I will briefly describe these three somewhat arbitrary size distinctions of flowing water habitats and then focus on the myriad of physical, chemical, and biological environmental components that influence abundance of trout in Midwest streams. Management strategies to restrain or bolster impacts of some of these environmental attributes on trout carrying capacity will be briefly reviewed, especially in relation to four attributes I consider to be especially important: annual base flow regime, natural year class recruitment, stream channel shape, and angler harvest.

From a biological perspective, successful trout fisheries management is largely the result of blending two complex, intertwined processes. The first involves identifying, prioritizing, and constraining (if possible) those physical, chemical, and biological factors that reduce the abundance and average size of trout in a given body or reach of water. The second process involves bolstering or protecting those environmental attributes that beneficially impact trout carrying capacity. Do both, and do as much as possible of both.

Ideally, this simply stated, but complex, management objective would be addressed at a watershed or larger geographic scale whenever possible. Unfortunately, in the Midwest region, watershed and/or larger ecosystem scales of holistic management of flowing water habitats are seldom possible. Intact watersheds are uncommon.

Nevertheless, much benefit can be accomplished to restore or increase trout carrying capacities, even when management is confined to stream channels and their bordering riparian corridors. Substantial healing of wounded stream channels and their corridors is better than no healing at all.

Along the continuum of fluvial habitats suitable for trout - from creeks to streams to rivers - those flowing water habitats constituting "streams" are probably the most important category to trout fishers in Midwest states. Management strategies to influence four attributes seem to me to be especially important to sustain good trout fishing in Midwest streams: annual base flow regimes, natural year class recruitment, stream channel shapes, and angling mortality due to harvest and voluntary or mandatory release.

Several long term field studies of wild trout populations in Midwest streams have demonstrated strong correlations between increasing volume of base flow (ground water discharge) and standing stocks of trout during overwintering periods and during summer periods. During successive years of drought this relationship between base flow and trout carrying capacity is especially prominent. As a generality, there is no surplus of base flow to squander.

Four of many constraints on natural year class recruitment deserve special fisheries management attention and amelioration if possible: low base flow (which shrinks available spawning habitat and the amount of stream edge habitat for emerging fry), lack of good spawning habitat even in years of good base flow, lack of adult spawners (often due to

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overharvest), and perhaps the most common midwestern constraint, unnaturally excessive sedimentation that smothers developing embryos.

Deformed, distorted stream channels (the "containers" of flow) have especially harsh impacts on carrying capacity for adult trout due to reductions in two essential habitat components, instream security and feeding cover (especially overhead bank cover) and pools, especially lateral scour pools along current bearing banks. Fortunately, several effective habitat improvement techniques have been devised and refined to reduce deformed channel shape constraints in Midwest streams.

Excessive angler harvest can override any and all other positive fisheries management initiatives. A regional shift to more restrictive harvest regulations has reduced this threat in the past decade, but managers must remain vigilant to maintain this trend and encourage vigorous enforcement. The concurrent trend of voluntary release of captured trout by anglers should also receive continued fisheries agency support.

Enforcing and Communicating Fishery Regulations in Wisconsin: A Conservation Warden's Perspective

Steve Dewald[1]

Abstract - We are here today due to opportunity, not because of serious problems. Trout fishing in Wisconsin is a success story. Conservation wardens have a good feel for what the public wants because they are the most visible employees of the Department of Natural Resources. Issues of public concern include landowner conflicts, rule simplification, differing priorities between bait anglers and catch-and-release anglers, effective use of law enforcement officers, and season structures. Landowner conflicts result, in part, from the economic gap that often exists between farmers and trout anglers. Changes in trespass laws have also created animosity. With the exception of the more active trout anglers, most people, including bait anglers and often the courts, believe regulations are too complicated. There is a philosophical gap between bait anglers and catch-and-release anglers that must be bridged to ensure a high level of interest in trout angling in the future. Law enforcement staffing levels do not permit a significant amount of patrol time on trout streams. Wisconsin ranks last in the nation in warden staffing per thousand licensed anglers. Trout populations are healthy in Wisconsin, giving us the opportunity to simplify season structures to make trout fishing more inviting to all groups.

INTRODUCTION

Conservation wardens are keenly aware of problems that develop in outdoor recreation. Due to our uniforms, we are the most visible representatives of the Department of Natural Resources (DNR). People upset about resource issues often come to us. As a result, it is sometimes misinterpreted by fisheries managers that wardens are unhappy with season structures or other management decisions when in fact we are simply passing on the messages we hear from the public. Wisconsin trout fishing is a success story in many ways. The best hunting and fishing opportunities in generations are now available to us.

MANAGEMENT ISSUES

Fisheries personnel have done a fine job of managing trout resources in Wisconsin. We have excellent trout populations, especially in the southwestern part of the state with which I am most familiar. Fishing easements have been purchased on many miles of outstanding trout streams permitting easy public access. Habitat improvement projects have been made possible through private donations from groups like Trout Unlimited. In general, there is no real problem with a lack of fish or a lack of fishing opportunities. The problems that challenge us are manageable but need to be dealt with none-the-less. They include landowner conflicts, rule simplification, polarization of trout fishermen, using law enforcement personnel effectively, and season structures.

Landowner Conflicts

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The relationship between landowners and trout fishermen has both positive and negative aspects. It is important to examine the circumstances now affecting rural landowners. The agricultural community is scraping its way out of a lengthy agricultural commodity recession at the same time that the rest of society has experienced an economic boom. As a result, it is common for a farmer to observe trout fishermen arriving at his farm in expensive sport utility vehicles while the farmer struggles to find enough money to buy seed for spring planting. This problem seems to be worst in areas of the state where good trout waters are an hour or two drive from large urban areas. Many farmers are also upset about recent changes in Wisconsin's trespass law. Fishermen are now allowed to walk on "dry land" below the ordinary high water mark, without permission, on a farmer's land. This law was passed without debate as an "add-on" to the state budget. Landowners tend to see this as a "taking" of their property rights without any opportunity to voice their concerns. I am not suggesting that anglers give up any legal rights they have when fishing Wisconsin's trout streams. But anglers should be aware of the difficult position farmers are in right now. If a landowner is engaged in an aspect of his farming operation that an angler does not approve of, the angler should notify the DNR rather than confront the landowner. Taking the time to say thank you to a landowner when done fishing or sending a gift certificate to a landowner for allowing access are small things anglers can do to create good will. Always consider yourself to be an ambassador for your sport while fishing. Avoid being the bad example a landowner will remember for the next twenty years.

Rule Simplification

Are trout regulations too complex? The answer one receives to this question depends upon who is asked. An avid fly fisherman is likely to answer no because he is seeing more large fish. On the other hand, a farmer who only fishes on opening day, a district attorney, or a judge, is likely to respond in the affirmative. I am aware of judges who have openly told defendants from the bench that they don't like DNR regulations because of their complexity. This situation puts wardens in an awkward position, because when a trout fisherman appears in court, the warden is in the courtroom supporting the states' case, not the fisheries manager or special interest group who promoted the special regulation.

In the late 1980s, trout groups lobbied the legislature to make it a crime to take trout during the closed season (this was popularly referred to as "criminalization" of trout violations). The result was that people apprehended for these violations were often not convicted of anything because district attorneys and judges were reluctant to give someone a criminal record for catching one illegal fish. The law has since been changed back to a simple conservation citation. This is a good example of how a special interest group of anglers can be off the mark regarding what the rest of society holds to be appropriate.

Polarization of Trout Fishermen

In this currently robust economy, people often have the money to recreate, but are pressed for time, so they tend to specialize in one or two hobbies. More disposable income and rapid advances in technology in recent years have allowed the serious angler to become much more advanced in his sport than the average angler who fishes only a few days a year. There isn't anything inherently wrong with this dichotomy as long as anglers within each group recognize the need to accept the viewpoints and preferences of the other. However, it is easy to see how this dichotomy has created friction in Wisconsin. The dedicated angler who cares a lot about his sport, spends a lot of money on equipment, and fishes every chance he gets, is also more likely to be vocal about issues

pertaining to his or her sport. Therefore, it is the point of view of the dedicated angler that fisheries managers, politicians, and natural resource board members tend to hear. I believe this explains why we are losing some trout fishermen at a time when trout fishing couldn't be better. There is a large group of fishermen who would like to fish for trout, but feel intimidated by the complexity of the rules. This is especially true for the father or mother who wants to take their children fishing, perhaps just on opening day. They worry about differing size limits, bag limits, and changing classifications on the same stream. They don't keep up to date on recent rule changes designed to maximize the production of trophy fish. They simply want to have fun one day of the year and have the chance to catch enough fish for a meal for the family. These are the people we are losing. There are also multicultural issues to consider. Newer citizens, such as some among the Hmong population, often don't even try to fish for trout in this part of the state because they find the rules too intimidating.

Efficient Use of Law Enforcement Personnel

Although the Wisconsin DNR has approximately 3,000 employees, only about 180 of these employees are game wardens. In a nationwide study, Wisconsin was found to rank last in the number of wardens per 1000 licensed fishermen. Thus, current staffing levels do not allow wardens to spend much time on trout streams and patrol time in general is very limited. The wardens in the team I supervise are assigned some of the best trout fishing areas in the Midwest, yet are allocated less than 40 hours for trout stream enforcement the entire year. This total includes both the early catch-and-release season as well as the entire regular season. In 2000, each warden on my team had 5 days of trout enforcement patrol time from March 1 to September 30; hardly an overwhelming enforcement presence.

It is therefore imperative that wardens spend their limited time investigating serious violations such as people taking multiple bag limits per day, taking trout during the closed season, and releasing agricultural waste into trout streams. However, the most common complaints we investigate relate to use of illegal gear. Wisconsin presently has an early catch-and-release trout season that requires anglers to use barbless hooks. Although recent research indicates that barbed-hook restrictions are more of a social regulation than a biological necessity, this restriction was part of the commitment trout groups made in a deal with other fishermen to establish the early season. Despite the fact that this rule has been in effect for years, wardens in western Wisconsin still find that on any given day of the early season, between 25 – 40% of fishermen checked are fishing with barbed hooks. Some anglers have broken off their lines or bent down the barbs on their hooks as wardens approached, while others have actually tried to wrestle with wardens to prevent their bait from being examined. Wardens attempted to solve the problem by asking for a rule that would simply ban the possession of barbed hooks during the early catch-and-release season. Unfortunately, legislators did not understand the goal of wardens in the proposed rule which led them to pass a state statute that prevents the DNR from enforcing any rule prohibiting the possession of barbed hooks during the catch-and-release season.

Season Structures

While serving on a statewide committee that re-examined the early trout season, it became evident to me that there is little agreement, even among fisheries managers, as to the types of seasons that are needed on a statewide basis. My opinion on the situation is as follows. We have a lot of trout these days. If we have a lot of trout, shouldn't the message be that we have the opportunity to simplify the season structure? Do we need five different categories of streams to maintain present populations? I agree that we should have some streams that offer trophy opportunities, but we also need an easy solution for that family who fishes one day a year and wants to catch fish to eat. If there is no biological reason to carry over more trout from year to year, should we not consider a rule allowing a person to take three trout no matter what the size in some streams? Is it feasible to have three classes of streams rather than five? Do we need a minimum size limit in stocked ponds when all of the fish stocked are

gone by fall and the size of the fish in the pond is determined by department stocking trucks? Sometimes in past years, trout stocked in ponds have included individual fish that were 8.5 inches or less in length in a pond that had a 9-inch size limit. That isn't a situation where we want to be enforcing size limits. I also question whether it is good idea to encourage a fisherman to take multiple limits of trout from different stream classifications in one day to reach an overall bag limit of 10 fish. Isn't one bag limit in one day enough? These are the questions that to my knowledge, most wardens would like to see addressed. We feel that with some simplification of season structures and rules, we would see more interest by the average fisherman in trying trout fishing.

SUMMARY

In conclusion I would first invite the participants in this conference to find ways to reach out to the fisherman who would simply like to go trout fishing one or two days a year just to catch a meal of fish to eat. Don't criticize fishermen who are using worms on opening day. It may be the only day all year they will be on the stream. By making these people feel welcome, they will continue to support the sport which translates into more habitat money that will benefit everyone. Second, I ask that you consider simplified season structures. Wardens believe we can still have plenty of opportunities with less than five categories of streams. Third, wardens enjoy working trout streams. We would like to spend more time on them, but without added staffing, that isn't possible. If anglers want to see more warden patrol time on trout streams, they will have to either lobby their state legislators for more warden positions, or they will have to get them to earmark funds to warden budgets for increased trout enforcement. Finally, wardens prefer to work on serious violations. If ways can be found to eliminate the "social rules" so we can put our efforts into violations that hurt the resource, we will all benefit.

Successful Restrictive Regulations for Brown Trout: Why Are They Rare?

William C. Thorn[1], Charles S. Anderson[2], and Deserae L. Hendrickson[3]

Abstract - Many special or experimental regulations that restrict harvest of stream trout were implemented for social reasons. This is unfortunate because it may fuel the tendency of many anglers to overestimate the potential biological benefits from proposed regulations. Because predicting biological results is uncertain, regulations need to be treated as experiments, and the results need to be effectively explained to anglers. We will explain what we have learned from experimental regulations for brown trout *Salmo trutta* in southeast Minnesota, what variables we now quantify, and make suggestions to improve the success rate of regulations. Equally important to improving success of regulations is for anglers to better understand the factors limiting trout populations and the potential for conflicts among angler groups.

INTRODUCTION

Anglers in Minnesota commonly disagree with each other and with fisheries biologists over the effectiveness of regulations (Cunningham and Anderson 1992). For example, some trout anglers requested a catch-and-release regulation for all streams in southeast Minnesota to increase abundance of large brown trout *Salmo trutta*. Professionals opposed the request because it ignored the previous ineffectiveness of regulations for this objective (Thorn 1990; Bushong and Anderson 1996), a "one-size-fits-all" regulation is usually not a solution (Gauvin 1999), and the majority of anglers opposed this proposal (Anthony 1997).

Behnke (1987) recommended that agencies treat restrictive regulations as experiments and build better biological evidence necessary for more effective communication of results to anglers. Our objectives were to summarize evaluations of regulations by the Minnesota Department of Natural Resources (MNDNR), explain the biological reasons for successes and failures, and to identify uncertainties that need further investigation.

STUDY AREA AND METHODS

Streams of southeast Minnesota are spring-fed and fertile (alkalinity greater than 200 ppm), and have degraded habitat from agricultural development that began in 1850. Water courses begin in rolling uplands and end in steep-walled valleys. Coldwater springs (48°F) provide permanent flow in the lower watershed, where gradients are less than 1%.

Presently, 711 miles in 140 Minnesota streams are managed for trout (MNDNR 1997). Most streams sustain wild brown trout fisheries, and abundance is usually limited by adult cover (Thorn et al. 1997). Biomass and abundance have increased from 1970 to 1999 (MNDNR 1997). Biomass ranges from less than 50 lbs/acre in poor quality habitat to more than 200 lbs/acre in excellent quality habitat. Habitat quality for brown trout is poor in 33% of the streams, fair in 50%, good in 16% and excellent in 1% (Thorn and Anderson, in prep.). Most of the stream reaches with good and excellent

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habitat quality have been in state ownership for some time or have been improved by the Minnesota Department of Natural Resources.

We examined the MNDNR evaluations of experimental regulations on seven stream reaches since 1984 (Table 1). From 1984 to 1991, anglers had to fish with artificial lures and flies on these streams. From 1992 to 2000, barbless hooks were required and bait fishing was legal. The standard regulation was a daily bag limit of five trout, including three longer than 16 inches before 1990 and one longer than 16 inches since 1990. This daily bag also applied to streams with experimental regulations and allowed some harvest (except under no-kill regulations).

RESULTS AND DISCUSSION

Abundance

Biologists estimate trout abundance in streams by electrofishing. Abundance is evaluated by comparing it to that in other streams. For example, abundance may be considered low when it is in the lower quartile for regional streams (MNDNR unpublished) or for its stream class (Thorn and Anderson 1999). Many anglers assume that low abundance is due to high angler harvest. Low abundance may also be due to poor habitat quality and limited forage abundance (MNDNR 1997).

To evaluate a regulation, MNDNR biologists measure preseason and postseason abundance on treatment and control reaches for several years before the regulation is imposed and for several years after, and compare the changes. If abundance in the treatment reach increases relative to abundance in the control reach, the increase should be due to the regulation, not natural changes in abundance (Solazzi et al. 2000). From these abundance estimates, biologists calculate seasonal mortality rates. The estimates of summer and winter mortality (includes migration) are needed to show that fish saved from harvest were not lost to winter mortality (Clark et al. 1981). Trout migration may confound the mortality estimates, especially if the regulation applies to a short stream reach.

Abundance of trout in streams fluctuates naturally (Hall and Knight 1981; Platts and Nelson 1988), and abundance in many southeast Minnesota streams increased during the 1980s (MNDNR 1997). Five regulations were evaluated in southeast Minnesota during a period of naturally increasing abundance. Abundance increases in the Main Branch Whitewater River, the Middle Branch Whitewater River (1991 to 1995), and the South Branch Whitewater River could not be attributed to the regulation (Bushong and Anderson 1996).

In Hay Creek and the Middle Branch Whitewater River (1991 to 1999), abundance increased under the no-kill regulation (Table 1). Regulations failed on other streams because of low exploitation, limited habitat quality, angler non-compliance, and poor growth potential.

Habitat Quality

Biologists determine habitat quality to evaluate the potential of a stream reach for an experimental regulation. If habitat is unavailable for fish saved from harvest they will move or die, abundance will not increase, and the regulation will fail. A stream reach with poor or fair habitat quality is a poor candidate to increase trout abundance with regulations.

Habitat quality for brown trout less than 15 inches in length can be measured from stream survey variables (Thorn and Anderson in prep.). Large brown trout (longer than 15 inches) need more cover and more kinds of cover than small- and medium-sized brown trout (Thorn 1988; Thorn and Anderson 1993). MNDNR biologists have assumed that the best habitat for large trout was in medium-sized streams with habitat improvement, and in large streams. However, regulations have failed to

Table 1. Evaluations of experimental regulations for brown trout in southeast Minnesota streams.

Stream	Length (mile)	Dates of Evaluation	Regulation	Objective (Failure/Success)	Reasons for Failure
Trout Run Creek[a]	1.2	1984-1986	11 inch minimum size limit	Increase abundance of trout >14 inches by 400% (Failure)	Poor growth potential
South Branch Root River[a]	1.6	1984-1986	No-kill	Increase abundance of trout >14 inches (Failure)	Limited habitat quality
Hay Creek[b,c]	0.7	1985-1995	No-kill	1985-90 Increase abundance of trout >12 inches, increase catch rate to 1.0/hr (Success) 1991-95 Increase abundance of trout >12 inches from 50 to 150/mile, increase catch rate from 0.5 to 1.0/hr (Success)	
East Beaver Creek[b]	0.5	1986-1988	10 inch maximum size limit	Increase abundance of trout >12 inches from 127 to 153/km, and catch rate to 1.0/hr (Failure)	Low exploitation
South Branch Whitewater River[b,c]	1.0	1985-1995	10 inch maximum size limit	1985-90 Increase abundance of trout >12 inches 1991-95 Increase abundance of trout >12 inches from 115 to 175/mile (Failure)	Limited habitat quality
Main Branch Whitewater River[c]	3.1	1991-1995	10-18 inch protected slot, 1 >18 inches	Increase abundance of trout >12 inches from 45 to 70/mile (Failure)	Non-compliance
Middle Branch Whitewater River[a,c]	3.3	1991-1999	No-kill	Increase abundance of trout >12 inches from 90 to 135/mile (Success), and catch rate for trout >12 inches from 0.08 to 0.12/hr	

[a] MNDNR, unpublished data
[b] Thorn 1990
[c] Bushong and Anderson 1996

increase abundance of large trout in these streams (Thorn 1990; Bushong and Anderson 1996). A measure of habitat quality should be developed for large trout to reduce the uncertainty of using qualitative observations.

An alternative to measuring habitat quality from habitat variables is to estimate habitat quality from biomass (MNDNR 1993; Thorn et al. 1997). Abundance of brown trout longer than 15 inches in length in the upper quartile of the regional data may indicate good to excellent habitat quality for large trout. However, abundance should not be the sole indicator of habitat quality because of large natural fluctuations in fish abundance (Van Horne 1983).

Biologists have not effectively communicated the importance of degraded habitat and habitat quality for large trout when discussing regulations to increase trout abundance. For example, some anglers claimed that harvest was limiting abundance of large brown trout because their abundance increased about 100% from the 1970s to 1990s, rather than 500% as total adult abundance had (MNDNR unpublished file data). These anglers were unaware that habitat needs differ between large and smaller trout.

Growth Potential

An evaluation of growth and maximum length is the first step in evaluating the potential of the stream for regulations for large brown trout (longer than 15 inches). Modeling of regulations by MNDNR biologists predicted the best results would be in streams where brown trout would grow to 12 inches at age-3 and to a maximum length greater than 15 inches (MNDNR 1997). This growth data should be acquired for each stream reach.

The coldwater food chain in some southeast Minnesota streams has been altered, and availability of prey varies among streams. Amphipods often are the principal invertebrate food of both trout (Waters 1982) and sculpins (*Cottus spp*. - Petrosky and Waters 1975). Trout become piscivorous at 10 to 12 inches in length (Behnke 1987), and sculpins are the native prey of trout in the spring-fed streams of southeast Minnesota (Eddy and Underhill 1974). Agricultural chemicals have been blamed for fish kills (Schneider 1979) and for reduced invertebrate abundance (Muck and Newman 1992). Kwak (1993) found no amphipods in 3 of 13 streams, and no sculpins in eight streams. Thorn and Anderson (1999) reported the presence of sculpins in 43 of 154 streams. The presence of amphipods and sculpins should be determined for each stream reach.

Angler Harvest

Anglers can limit abundance when they harvest (exploitation) more than 40 to 50% of the preseason adult population (Hunt 1985; Thorn 1990). The two successful regulations in southeast Minnesota were on Middle Branch Whitewater River with exploitation of 48% (Wiechman 1991) and Hay Creek with exploitation of 55% (Thorn 1990). Exploitation for ten stream reaches in 1998-99 averaged 23%, was less than 20% on six reaches, 26% on one reach, and ranged from 49 to 53% on three reaches (Weiss 1999, 2000). A 12- to 16-inch protected slot was imposed on two of the three reaches with exploitation near 50% in 1999.

Anglers can influence the success of restrictive regulations. When the voluntary release rate exceeds 10%, the influence of angler harvest on fishing mortality decreases (Clark 1982). The mean voluntary release rate was 61% (range 32 to 87%) in the 1980s (Thorn 1990), and 81% (range 57 to 99%) in 1998 and 1999 (Weiss 1999, 2000). When illegal harvest exceeds 15 to 20%, benefits from catch-and-release fishing may be lost (Gigliotti and Taylor 1990). Illegal harvest (estimated at 25%) was listed as a cause for regulation failure in the Main Branch Whitewater River (Bushong and Anderson 1996).

Rates of exploitation of larger trout are difficult to measure with standard creel surveys. Although many anglers (52%) preferred to keep trout between 12 and 16 inches (Anthony 1997), exploitation of brown trout longer than 12 inches in two streams was 10% and 13% in 1999 (Weiss 2000). Biologists are uncertain if this low rate of exploitation for larger trout is representative of regional streams.

Factors Limiting Abundance

After evaluating abundance, habitat quality, growth potential, and harvest, biologists determine the factor limiting abundance of trout in a given stream and formulate a management plan. Because restrictive harvest regulations succeed when angler harvest, not habitat, is limiting abundance (Hunt 1975), these regulations usually are a management option for streams with good and excellent habitat quality. Habitat management is recommended for most streams with poor and fair habitat quality. In streams with poor growth potential, forage management should be investigated before regulations to increase large trout abundance are implemented.

Developing Objectives for Management

After the factor limiting abundance has been identified, biologists develop the objective for management. The MNDNR has an internal review process to insure that scientific objectives for regulations are achievable and measurable. Vague objectives "to increase abundance" are now replaced by specifications "to increase to a stated abundance or catch rate," or "to increase by a stated percent."

Objectives have not always been achievable or measurable. For example, an objective of a 400% increase in the abundance of brown trout longer than 14 inches for one stream was not achieved because trout only grew to maximum length of 13 inches. For another stream, a 10- to 18-inch protected slot was implemented after simulation modeling predicted a 26% increase in abundance of brown trout longer than 15 inches. A later reviewer noted this was only an increase from about 4/mile to 5/mile, or an unmeasurable change. The objective was changed to a more measurable increase of 100%.

As angler interest for regulations increases, so does political pressure for regulations. Where regulations are implemented or changed for social reasons, perhaps to promote a diversity of angling opportunities, the objectives should be clearly stated, and not sold on inappropriate biological grounds.

CONCLUSIONS AND RECOMMENDATIONS

Biologists of MNDNR have an abundance of knowledge to evaluate the potential of streams for restrictive regulations, to evaluate regulations, and to convey limitations of management-by-regulation to anglers. Biologists evaluate abundance, habitat quality, growth potential, and harvest. Then they determine the factor limiting abundance and management option, and set an achievable and measurable objective.

Regulations should be treated as experiments. There are uncertainties about estimating trout abundance in larger waters, measuring habitat quality for large trout, evaluating growth potential, measuring exploitation of larger trout, and angler responses to regulations. Nevertheless, the best candidate streams can be identified.

Trout anglers differ widely in values that influence their angling motivation and satisfaction (Jackson 1988). Failure to understand these different values can lead to conflict among anglers (Behnke 1987; Graff 1984) that can prevent cooperative solutions for common problems (Cunningham and Anderson 1992).

This review shows that the most appropriate management to increase trout abundance in many southeast Minnesota streams is habitat management. Streams with requirements for successful restrictive regulations, especially for large trout, are not common, but the best candidates can be identified.

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Human Dimensions Plenary Presentation: The Human Dimensions of Trout Fisheries

Robert B. Ditton[1]

Abstract - Although I have never been a trout angler nor completed any studies of the trout angler population, my presentation today will address what I "know" from a conceptual perspective about trout anglers, the fishing experiences they seek, and some of the challenges they will face in the future. This stands in contrast with my providing a review of previous trout angler studies; overall, there are few studies to review. The fact that there has been so little attention to the human dimensions research on trout fisheries is worth reflecting on too. Fishery management agencies have asked me to design and carry out studies of angler groups according to the species they seek to catch. These have spanned a wide range of freshwater and saltwater fisheries. Despite a lack of meaningful classification (one must only fish for one or more days for trout in the previous twelve months to be a trout angler), biologists need to know as much about trout anglers as they do about trout populations and their habitats. Therefore, management agencies and non-governmental organizations representing these groups of anglers have invested heavily in knowing more about angler groups including trout anglers and their use of fishery resources. Particular types of human dimensions data are needed to answer important management questions, justify allocation decisions, and otherwise support fisheries management decision making.

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Recreation Specialization

Robert B. Ditton[1]

Abstract - Hobson Bryan first proposed the concept of recreational specialization in 1977. He defined specialization as a "continuum of behavior from the general to the particular, reflected by equipment and skills used in the sport and activity setting preferences." Further, from a series of interviews with trout anglers, he inferred four types of anglers along this continuum: at one extreme were occasional anglers, followed by generalists, technique specialists, and at the other extreme, technique and setting specialists. He suggested the typology and location of anglers along the continuum were reflected in their fishing frequency, setting preferences, technique preferences, choice of equipment, importance of catch, social unit participation, and resources management preferences. Specialization provides a conceptual means for understanding various angler market segments based on their respective levels of development; this stands in stark contrast to any "average angler" approach. Today the term "specialization" is often misused in the fisheries management community to where it lacks much meaning. Likewise, in the human dimensions research community, there are differences as to which variables constitute this mega-concept as well as the most appropriate analytical techniques.

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Using Stakeholder Processes to Manage Conflict

Kevin Kayle[1]

Abstract - Managing fish populations and maintaining appropriate fisheries management strategies and regulations in light of various user group demands can be challenging. The Division of Wildlife of the Ohio Department of Natural Resources has employed a systematic program of developing informed consent to minimize conflict and foster understanding between diverse interests. This program involves training employees at many levels in specific techniques and procedures to create opportunities for involvement and buy-in of all potentially affected interests. The techniques include methods for various types of public involvement and how to best present options and management strategies. This type of management style can be directly applied to all business and public operations, both internal and external. Examples of its use in Ohio by the Division of Wildlife include the 1998 Dove Hunting referendum, and closer to this group's interests: implementation of a trout stocking program in a southeastern Ohio stream and examination of potential special regulations on Ohio's brown trout (*Salmo trutta*) and steelhead (*Oncorhynchus mykiss*) streams. Ohio's new point-of-sale licensing program also adds another facet in understanding our user groups, and can assist us in planning for angler recruitment and retention. Combined with stakeholder processes, we have used this information to provide what we (and our anglers) think is a quality trout program for Ohio's anglers given limited resources.

CONFLICT AND PROJECT IMPLEMENTATION

There exists in current day thinking a boilerplate view of conflict resolution that employs the following technique: Get parties from all viewpoints, gather issues and concerns, and find common ground. This amelioration process works well for relatively simple issues and a small number of affected parties. In today's fisheries management realm though, problems can be difficult and the number of parties or factions can be complex. Fisheries managers and administrators must learn procedures and techniques to bypass or eliminate conflict that could defeat or delay necessary programs or projects. Two points to remember when trying to implement a new project or program and seek the approval of all parties are: 1) virtually every solution to a big and/or complex problem will hurt some interests and 2) virtually every affected interest, if really determined, has the means to stall, derail, shelve, water-down the project, *i.e.* they have de-facto veto power.

Today, effective management in any organization must have a two-prong approach to problem solving and project implementation: 1) *Technical Problem-Solving and Decision Making* that is rigorous, thorough and systematic and 2) *A Systematic Development of Informed Consent*; an objectives-driven citizen participation program. The fallacy of rigorous technical analyses is that high quality technical work by itself produces the most obvious solution(s) to problems or always presents the best opportunity. By completing technical work that addresses perceived problems or opportunities in a vacuum, we neglect the opinions, wants and desires of our internal and/or external stakeholder or user groups. In this process, the result is a stage called "All hell breaks loose" where people oppose your work because they did not participate in the

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generation or review of issues and propose alternate strategies. By completing a citizen participation process concordant with the technical analyses and decision-making processes, concerns, problems and strategies are heard and addressed (but not necessarily agreed or acted upon). Participants or affected parties are less likely to attempt to derail or veto the process if they are familiar with the problems or opportunities that are being addressed and are a part of the process forged toward a palatable, workable (not necessarily agreeable) solution.

Hans Bleiker from the Institute for Participatory Management and Planning in Monterey, California, has initiated a continuing education program that offers workshops for public administrators, managers, biologists, and officers in the Systematic Development of Informed Consent (SDIC). His program is aimed at making government more effective and establishing and maintaining the legitimacy and credibility of public officials and their offices.

Tantamount to the Bleiker philosophy in citizen participation is the identification of interested or affected parties, which he defines as Potentially Affected Interests (PAIs). PAIs are stakeholder parties that may or may not have an interest in your project, proposal, regulation, etc. Usually PAIs are the sources of past, current or potentially future conflict(s) if they are not addressed now or may not have been addressed in the past. The PAIs should be invited to participate even if you don't think they would provide input. No response, or passing on providing a reply, is a valid stakeholder option and leaves the public administrator in a better situation than neglecting PAIs only to have them rise up and veto a project or proposal because they found another route to get their input into the process.

Also crucial in the Bleiker philosophy is that of seeking *consent* rather than *consensus.* It is obvious in a large and complex issue that deals with many diverse interests that consensus, where all parties totally agree on a course of action, is rare. Rather we should seek consent, where differing parties are heard and their concerns are addressed, but following that an appropriate decision is made. In consent building with SDIC, all parties don't have to agree, but they all must choose not to exercise their veto power or take an "over my dead body" approach.

Implementation of SDIC should include each of the following components:

- Mission Statement(s) - out front and visible for the public to see and understand.

- Strategic Plan - sets a course of action for a fixed time period, say five or ten years. The best ones define goals, objectives, problems and strategies, and incorporate a thorough public review process.

- Operational Plans - a course of action for a shorter time period, usually one to two years that address specific problems, strategies, projects and opportunities of a technical nature.

- Address concerns of and inclusion of PAIs- internal and external stakeholders.

- Process of Public *Involvement*- the process that includes stakeholder participation and identification of problems and opportunities. The most easily accepted process seeks to get involvement *early and often* along the way to discussing alternatives and solutions to implementation.

One other component that needs to be defined during this process is a definition of the Null Alternative. This is the sequence of events that will most likely take place if no workable solution is implemented. It is different from the “status quo” because it incorporates a view of the future. The Null Alternative should be spelled out for all PAIs to see, and discuss why it is or is not a favorable alternative to any other solutions to the given problems or opportunities.

Hans and Anne Marie Bleiker (1998) have coined a "Life Preserver" that all public officials should employ and remember when implementing the SDIC stakeholder process. Make sure that whatever you do, your PAIs know and understand:

– This is a SERIOUS PROBLEM or an IMPORTANT OPPORTUNITY; one that HAS to be addressed.

– You are the RIGHT ENTITY to address it; in fact it would be IRRESPONSIBLE for you given your Mission not to address it.

– The approach you are taking is REASONABLE, SENSIBLE, and RESPONSIBLE.

– You ARE listening, you DO care…about the costs, the negative effects, the hardships that your actions will cause people, but always be honest - brutally honest.

By remembering these four points as you implement your stakeholder participation process, you can minimize the possibility that conflicts will emerge to disable your project, or cause any PAI to take an "over my dead body" position.

Bleiker (1998) and Maslow (1954) discuss the sources and causes of conflict from the differing of opinions, to different perceptions of "Reality," to differing values, wants, needs or "meta-values." The structure of SDIC defines a process that all participants (including PAIs) can follow and contribute if they so choose no matter their opinions or values. The information generated by the process- the content- is also available for all to see. Direction - how we get from problem or opportunity definition to generation of plausible solutions - is also clearly visible for any PAI or SDIC participant.

Citizen participation in SDIC can take many different forms. No longer is the public input process limited to a hearing style meeting where citizens comment about a set of predetermined solutions. Also, one would expect the elimination of useless meetings that don't serve to gain some progress on generating solutions toward existing problems or opportunities. Rather we see new avenues to facilitate *open discussion* and information *exchange.* Several techniques in citizen participation include:

- Open Houses
- Town Meetings/Roundtable Discussions
- Committees and Workshops
- Using Existing Organizations and Media (including new technology like the Internet, Websites, Tele- and Video-Conferencing and Bulletin Boards)
- Organizations operating in a "Fish Bowl."

REAL WORLD APPLICATION OF STAKEHOLDER PROCESSES

Some examples of SDIC include the Ohio mourning dove hunting issue, a new brown trout (*Salmo trutta*) stocking program in a southeastern Ohio stream, a proposal for special regulations on several northeast Ohio steelhead (=rainbow trout, *Oncorhynchus mykiss*) streams, and special regulation changes on inland Ohio brown trout streams.

In the Ohio mourning dove referendum, a voter-led initiative sought to repeal the two-year old dove hunting season. The Division of Wildlife, without direct campaigning or lobbying, provided factual information to the public about dove populations and exploitation. Division personnel worked on the aspects of credibility and legitimacy, to establish that wildlife management professionals had the most knowledge about the subject and were the correct group to manage the resource appropriately. Sportsmen's clubs and wildlife associations led with raising money and media campaigns to defeat the issue. By addressing all facets of the issue (from farmers, to backyard bird feeders, to anti-hunting factions), and dispelling preconceived notions, the issue repealing the dove season was soundly defeated statewide - and defeated in each of Ohio's 88 counties.

In the new brown trout stream fishery example, we used the stakeholder process to bring another stream into our stocking program (Greenlee and Kayle 1998). From our field surveys, we determined that Clear Creek had water temperatures, water quality, and habitat suitable for brown trout. We also knew that seven miles of stream access were in public ownership (Franklin County Metroparks). We used the stakeholder process to hold discussions and roundtable sessions with landowners, user groups, and administrators to develop a potential stocking program and promote a future fishery.

It was important in this case to realize that PAIs are not always external groups, but can include your own section's personnel and administrators.

In the northeast Ohio steelhead regulation example, we addressed the desire of a local (Lake County) Metroparks to propose special regulations due to perceived over-exploitation of migrating steelhead (Kayle et al. 1998). The objectives were to determine if more stringent regulations were necessary to maintain the quality fishery and increase stream fishery opportunities, gain angler opinions on satisfaction levels about the fishery and regulation options, and gather demographic information. We used the stakeholder process to present the project to user groups and the media, seek opinion and gather survey data, and present management options after the survey was completed. In this case, there was no biological justification for special regulations because anglers already released most (72%) of the harvestable-sized fish voluntarily, and fishing pressure was not a factor.

In the sociological part of our surveys, we found that a large majority of anglers (76%) were satisfied with existing regulations (12" minimum length limit and a daily bag of two). A more in-depth analysis of the special regulation questions showed that those anglers traveling from greater distances desired the specialized regulations. This was explained by their being more specialized anglers, and their desire to have fish available for them to catch. They desired some assurance of fish availability for them to justify traveling the longer distance. Our stakeholder process then showed us that a better strategy would be to provide steelhead fishing information, promote that most anglers release fish and are satisfied with the existing program, and advertise that fish are available to anglers during a long portion of the season.

The Division of Wildlife also used the stakeholder process to remove special regulations implemented several years ago by the Director of the Ohio Department of Natural Resources (ODNR) that required use of artificial lures only with barbless hooks on designated stream reaches. Seeing that overexploitation of small fish in a put-grow-and-take brown trout fishery was reducing opportunities for longer periods of success and larger fish, we proposed implementing alternate regulations to the existing regulations. In the stakeholder process, we included angler and field surveys to determine an appropriate course of action. One of the first results in this process was proposing the elimination of the barbless hooks regulation because data that showed they did not significantly reduce mortality (R. DuBois, Wisconsin Department of Natural Resources, pers. comm.), and because it was difficult for our officers to enforce. We also completed presentations, held meetings and roundtable discussions with internal and external stakeholders during field surveys and after results were analyzed. We proposed removal of the designated special regulation areas (which were not reducing exploitation) in favor of reducing the daily bag limit from five to two, and increasing the minimum size limit from 10 inches to 12 inches on all brown trout streams. Our anglers were satisfied with the process and supported these regulation changes which took effect in 2000.

New technology available with the point-of-sale fishing and hunting license system and customer survey database development also adds to our ability to identify users and PAIs. Using the latest cluster analysis software (like *A Classification of Residential Neighborhoods* from CACI Marketing Systems), we can track external customers and avidity for fishing and help us make management decisions regarding limited resources. For example, the point-of-sale and demographic cluster analyses have helped the Division of Wildlife choose a lake in southwestern Ohio to receive catchable (put-and-take) rainbow trout (D. Maloney, ODNR, pers. comm.). Given that lake size and access between candidate lakes were similar, we looked at the proximity of avid anglers to each of the lakes before selecting a water area. This analysis process is important because angler avidity and recruitment (and hence, utilization of the resource) may not necessarily reflect population base trends. In fact, angler avidity and license purchasing in Ohio is higher in smaller towns and rural areas than large cities and their immediate suburbs (M. Costello, ODNR, pers. comm.). Since human dimensions technologies and cluster analysis techniques regarding stakeholders are relatively new, more work needs to be completed in the use and application of these data to regulation proposals,

management strategies, and recruitment and retention programs.

CONCLUSION

- PAIs are Potentially Affected Interests-those that could use veto power on your work.
- Present your project (problems/ opportunities) and null alternative thoroughly to all the PAIs.
- You should aim for consent, not consensus.
- Remember the four keys to consent-building:
  1) that a serious problem/opportunity exists,
  2) that you are the right entity to address the problem/opportunity,
  3) that your approach to the problem/opportunity is reasonable, sensible, responsible,
  4) that you do listen and care about PAI concerns, but you must be brutally honest.
- Get PAIs involved early and often.
- Use the best Citizen Participation techniques to achieve consent.
- Use the latest technology to identify and know more about your PAIs.
- Build on your successes; sometimes adversarial PAIs become your best allies.

By building a working relationship with your stakeholders, everything from your organization's mission down to your problems, strategies and opportunities will be recognized and understood by any PAI. This can minimize the chances that any group or individual could wield veto power to any important project that addresses a critical problem or opportunity.

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Integrating Social Information into Decision-making

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Abstract - In the past 30 years, the field of human dimensions of fish and wildlife has grown in size and importance in fisheries and wildlife management. Despite this growth, natural resource scientists and decision-makers continue to face the challenge of how to best integrate human dimensions, or social science, information with biophysical information. Social science data continues to be unfamiliar information to many natural resource managers and decision-makers. Although social science information is widely recognized as being as important as biophysical information to addressing management problems, just how the information will be used continues to be a struggle. In the past few years, human dimensions research has begun to shift to more directly respond to this issue. This paper provides an overview of a planning framework for integrating social science information into decisions about fisheries management.

INTRODUCTION

While there are a variety of tools and techniques for gathering and analyzing information about the recreational use of trout resources and other "human dimensions" information concerning trout and trout habitat management, integration of human dimensions information into decisions about the management of trout fisheries requires effective natural resources planning. Numerous planning and policy frameworks have emphasized the importance of considering social factors when making natural resource decisions such as the management of trout (Crowe 1983; Kellert and Clark 1991; Decker et al. 1992). This paper focuses on a planning framework developed by Bev Driver and his colleagues for managing natural resource recreation activities such as backpacking, camping, hunting, viewing wildlife and trout fishing (Driver 1985; Driver et al. 1991; Fulton et al. *in* press).

The ideas behind this planning framework have been identified by various terms including *experienced-based* management and *benefits-based* management. In this paper, they are referred to as *outcomes-based* management. The term outcomes-based management emphasizes that the planning framework is focused on developing and managing for specific outcomes for individuals, groups, communities, or the environmental resource. This paper provides a general review of the challenge of fisheries planning and a short review of the ideas and concepts behind outcomes-based recreation management. Next, the steps and processes used to implement outcomes-based management will be described along with examples that are specific to the management of trout fisheries in a stream setting.

THE CHALLENGE OF EFFECTIVE FISHERIES PLANNING AND MANAGEMENT

What is planning? At it's simplest, planning involves developing a scheme to achieve a particular objective (Loomis 1993). Crowe (1983:1) defined planning as "an integrated system of management that includes all activities leading to the development and implementation of goals, program objectives, operational strategies, and progress evaluation." Four basic questions must be addressed when making planning decisions concerning the

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management of fisheries resources (Crowe 1983). These questions include: What are the desired goals and objectives in managing the resource? Where are management programs in relationship to these goals and objectives? What actions need to be taken to achieve the goals and objectives? And, how do we know if and when we achieved the desired goals and objectives?

Ideally, objective, science-based information is used to address each of these questions in a continuous, cyclical process, and management actions that provide the greatest benefits with the least costs are implemented to achieve desired goals and objectives. Planning and problem-solving using such a rational process sounds pretty simple and straightforward. But, experienced fisheries managers know that planning and management almost never goes so smoothly.

Planning and management are more complex and difficult than they initially appear for two primary reasons. First, planning occurs in the context of social and political conflict that makes the definition of specific management goals and objectives tenuous. Such conflict is unavoidable and is the context for much of social interaction. Our conflicts over desired goals and objectives for fisheries resources are managed through a process of reasonable argument. Information used in this process may include appeals and statements of personal values as well as factual information concerning the social and biophysical environment. Usually, the greater the degree of agreement concerning the factual information, the easier conflicts are to resolve. However, a lack of objective information is the second item of complexity in planning and management. Objective information is often scarce, or there is little agreement concerning the facts. The process of science is a self-corrective one in which agreement may not be reached for years or decades, and the facts are subject to change with new information. Furthermore, science-based information can be difficult, time-consuming, and expensive to gather.

Because of the inherent conflict surrounding social decision-making about fisheries resources and the challenge of gathering and utilizing science-based information, effective planning relies on both science-based research, and analysis and collaboration among the many stakeholders with an interest in the management of fisheries resources. Fisheries planning involves information and decisions from three arenas. The "scientific" arena, involving science-based information from the biophysical and social sciences, provides explanatory and descriptive information concerning facts about the resource and resource users. Decisions concerning how these resources "should" be managed are also influenced by normative information involving two other arenas: 1) vested stakeholders (agencies, sports and conservation groups, politicians) and 2) the general public. Thus, fisheries planning and management decisions represent an integration of both rational, science-based, "is" information, and normative, "should be" information.

OUTCOMES-BASED RECREATION MANAGEMENT

Before outlining a planning process for fisheries resource management, the idea of outcomes-based management for recreation resources will be described. Natural resource management has a fundamental policy paradox involving the emphasis of using natural resources for human benefit while at the same time providing for the sustained protection of those resources. Outdoor recreation management and fisheries and wildlife management tend to emphasize different ends on this philosophical spectrum. Fisheries managers have training that tends to emphasize protecting the fisheries resource. Recreation managers tend to emphasize managing the resource to optimize human enjoyment and benefit (Manfredo et al. in press). Although outcomes-based recreation management emphasizes a service philosophy of producing valued recreational experiences and benefits, it also represents a planning strategy that helps bridge the gap between an emphasis on recreational enjoyment and resource protection. Along with positive psychological and social outcomes for people, outcomes-based management identifies protection or enhancement of environmental resources as one potential outcome of management for recreation.

Outcomes-based management begins with the recognition that recreation is more than

just participating in a recreational activity such as angling for trout. From the perspective of outcomes-based management, recreation is viewed as a complex social and psychological activity in which people engage to meet fundamental needs or motivations that we have as humans. By engaging in recreation, we satisfy these motivations and produce recreational experiences that lead to psychological benefits for ourselves. In addition, recreation provides social benefits to our families and other groups to which we belong by improving us as individuals. Recreation also brings benefits to our communities, to the economy, and to the natural environment. In short, recreation is not about fluffy stuff that we do in our spare time. Instead, recreation and recreational experiences are all about ensuring that we are healthy productive members of our families, neighborhoods, towns, and societies, and that we help maintain the resource base that ensures recreational opportunities in the future. Producing or providing recreational opportunities such as fishing for trout, then, is something that should not be taken lightly, but rather it is a tool that agencies possess that can improve the quality of the lives of our citizens, and, in turn, improve our society.

Outcomes-based management begins with the assumption that demand for recreation involves four essential factors (Driver and Bruns 1999):

1. Demand for specific recreational activities.

2. Demand for specific physical, social, and managerial settings.

3. Demand for specific psychological and social experiences.

4. Demand for long-term social and personal benefits.

The outcomes-based approach recognizes that quality fishing opportunities and outcomes require more than just provision of fisheries resources by managers. Producing quality fishing experiences requires active, collaborative effort by managers and the larger public to identify the preferences for experiences and outcomes that are produced through management of the recreational fisheries. Under this approach (see Figure 1), a diverse range of quality fishing opportunities are defined by the mixture of anglers' preferences for:

- Activities (defined by target species, equipment, specialization etc.)

- Setting (which includes resource, managerial and social attributes)

- Experiences (outcomes desired by anglers)

The desired opportunities for recreational fishing are defined by examining each of these factors as an overlapping set. "Activity Opportunity" refers to the specific species, equipment, methods, or level of specialization involved with a fishing experience, such as fly-fishing for native brook trout (*Salvelinus fontinalis*) using a dry fly. The "Setting Opportunity" involves three setting attributes: resource/biophysical attributes, social attributes, and managerial attributes. Resource attributes include things such as available species, type of water body, water conditions, and biophysical factors. Social

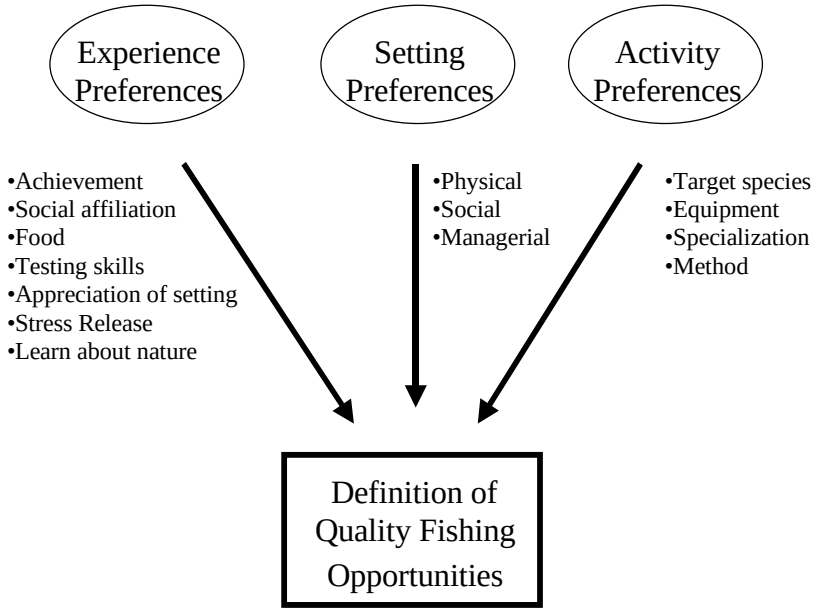

Figure 1. Factors affecting definition of quality fishing outcomes.

attributes of fishing settings include things such as the number of other people at a location and the types of people fishing there (e.g., bait or fly anglers). Managerial attributes include things such as the level of development at a site and the management rules and regulations that pertain to a particular setting. The "Experience Opportunity" focuses on the social/ psychological motivations for participating in recreation and the desired outcomes that people want to achieve by participating in recreation. Examples include such things as enjoying nature, escaping stress, learning, and solitude.

Outcomes-based management seeks to define a typology, or range, of quality angling opportunities based on these three classes of angler preferences. Defining the opportunity typology is accomplished through research with anglers, analysis of appropriate existing data, stakeholder processes, and other dialogues with anglers and angling groups. The opportunity typology provides a conceptual framework for organizing subsequent management objectives and actions. A process for defining, developing, and implementing this framework is described in the following section.

A PLANNING PROCESS FOR OUTCOMES-BASED TROUT FISHERIES MANAGEMENT

Implementation of Outcomes-Based Management for trout angling is accomplished through a six-stage planning process. These stages include:

1. Clarifying the Mission
2. Visioning and Goal-Setting
3. Defining Objectives
4. Constructing Allocation Alternatives
   a. Supply and demand assessments
5. Designing, Evaluating and Selecting Alternatives
6. Implementation, Monitoring and Evalution (Potential revision of steps 1-4).

The stages or steps suggest that planning is a serial process that begins at one point and ends at another. Planning, however, is also typically a cyclical process, and planners often have to revisit their goals and objectives as actions and alternatives are debated or new information is developed concerning the link between actions and indicator variables.

Inclusion of monitoring and evaluation as a final step in the planning process highlights the fact that planning is a cyclical process.

Clarifying the Mission

Mission statements provide a concise summary of the fundamental social benefits that the agency has been charged to provide. Such mission statements represent a direct expression of social values without an attempt at providing specifics related to resource management. While mission statements do not provide much specificity for management actions, it is the mission of the agency that indicates whether or not social outcomes approaches to fisheries management have the potential to work within the context of a particular agency. Because a philosophy of providing service to people is central to outcomes approaches, agencies that do not have a mission that clearly focuses on providing benefits or enjoyment to people are unlikely to successfully adopt outcomes-based trout fisheries programs. For example, the mission statement of the Wisconsin Department of Natural Resources stipulates that the agency is "to ensure the right of all people to use and enjoy these resources in their work and leisure." Such a statement provides a foundation for an outcomes-based management strategy focusing on social benefits and enjoyment.

Visioning and Goal Setting

The fundamental action in outcomes-based planning is identifying and developing a partnership among the stakeholders who have an interest in the resources that are the subject of the planning action. Stakeholders include, for example, the trout anglers, representatives from local communities, and others who may be impacted by decision regarding management of trout and trout streams. A partnership among these entities is essential to developing a shared vision of trout fishing opportunities and resource conditions that are desirable for the future. Such a vision provides direction for defining a desirable range of goals representing the desired outcomes from trout fisheries management. Such goals are developed through community and stakeholder workshops in which agency managers and planners interact directly with public stakeholders as well as through social science research involving focus groups and user and public surveys. Direct interaction with stakeholders is crucial to gaining support for any information gathered through social science research techniques such as public surveys.

Defining Objectives

Objectives provide a specific link from goals to management actions. Objectives are more concrete statements that specify the intentions of goals in clear terms. To assure clarity in providing future direction (Manning 1999; Schomaker 1984), objectives should be: 1) quantifiable in discrete terms (e.g., not simply more or less of this, but 25% more or 30% less), 2) bounded in space and time (i.e., should clearly specify when and where the quantifiable objective is to be reached), 3) realistic (i.e., objectives must be plausibly attainable based on known information and technology, but they must also be somewhat challenging to obtain), and 4) outcome oriented (i.e., objectives should focus on what is being produced through management and not what resources are used in the management process).

Objectives are expressed through a system of indicators and standards reflecting social, managerial, and resource conditions. Indicators are measurable social or biophysical variables that are closely linked to a trout angling opportunity. Standards on an indicator define a range of social and biophysical conditions under which a particular angling opportunity is produced.

Objectives should be defined with appropriate trout angling opportunity classes in mind, and they must also be developed with the direct involvement of stakeholders. Tools for defining objectives include the professional judgment of managers, collaborative stakeholder groups as well as experimental and correlational research focused on understanding how potential indicators and standards are related to trout angling opportunities.

Constructing Allocation Alternatives

Potential management alternatives for trout angling opportunities are developed using

knowledge about desirable outcomes for experiences and resource conditions. These alternatives are not pre-existing and must be created by the resource managers in collaboration with interested stakeholders. Such alternatives also represent decisions about how resources will be allocated for various uses. The basis of this kind of allocation decision, and one principal task of the planner, involves two key activities: 1) assessing the demand for specific experience opportunities and the supply of resources and settings that produce such opportunities, and 2) comparing the level of demand and supply of such opportunities. Assessing supply involves identifying what resources are available, including biophysical habitat and trout populations, social conditions, and managerial settings. It can also include the potential to expand supply availability through habitat management or through increasing access to fishing locations. Assessing demand requires defining the service population of interest and identifying the specific experience opportunities and outcomes that this service population desires from trout angling.

Designing, Evaluating and Selecting Specific Alternatives

Based on the demand and supply assessments, resource managers working with stakeholders define a range of specific management actions designed to achieve the desired objectives. If alternatives are going to address the specific experiences desired by the service population of trout anglers, then very specific knowledge concerning the demand for, and supply of, experiences and the conditions producing those experiences is required. Potential actions should clearly detail how, when, and where trout angling experiences, and conditions encouraging those experiences, are going to be produced.

Implementing, Monitoring and Evaluation

Regardless of the specific allocation decision, the management actions selected must form a readable plan that provides a clear blueprint of explicitly what trout angling experiences or outcomes will be produced, where and when they will be produced, the quality and quantity that will be produced. This plan must also specify the means of production, or what actions will be specifically taken to achieve the objectives defined by the indicators and standards. Successful application of outcomes-based management depends on the degree to which plans adhere to and incorporate (1) the specific objectives and (2) the descriptions of recreation opportunities classes. The objectives and recreation opportunity classes developed by research, and agreed to by the involved stakeholders, are the key to assuring plans that achieve the desired outcomes of the public.

In order to determine whether or not planning actions were successful, monitoring and evaluating consequences of the plan must follow implementation. Monitoring and evaluation are the key to identifying and correcting problems with management action and adapting decisions to what has actually occurred on the ground. Through monitoring and evaluation, planning actions become learning opportunities. Monitoring and evaluation are directed by the specifically defined management objectives that describe the specific quantitative outcomes desired through management and the specific actions that will be taken to achieve those outcomes. These desired outcomes are quantified through the use of indicators and standards, and it is these specific, quantitatively expressed standards that are used as the basis for monitoring and evaluation. At a minimum, evaluation should address the following questions:

- To what extent did management actions produce desired trout angling opportunities?
- How did anglers evaluate the quality of these opportunities?
- What level of satisfaction did anglers have with these opportunities?
- Did resource conditions stay within the bounds of standards that were established?

To answer these questions, an array of evaluative systems must be developed and

implemented throughout a visitor use season. This might include actions such as visitor registration, observation of use or wildlife movements, regular inspection of site facilities, and post-visit evaluations of users. Stakeholders are also a central part of monitoring and evaluation efforts. Use of volunteers from stakeholder groups to help design and implement monitoring projects is an invaluable way to retain the interest and energy of the community of stakeholders. Evaluation of the plan also includes all parties who helped develop the plan and continue to have a stake in management and decision-making. Through such efforts, evaluation becomes the foundation for a recurring cycle of "fine-tuning" action plans and for periodic revision of allocation planning involving all stakeholders.

SUMMARY

This proposed planning process focuses on integrating human dimensions information into decision-making. Past experience in the field of natural resource recreation has demonstrated that this approach can provide valuable direction for managers and decision-makers. This approach allows management decision to be made with an eye to providing a range of outcomes for both trout anglers and managers charged with the stewardship of the resource.

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Building Community Through Conflict Management

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Abstract - Natural resource agencies are placing an increasing emphasis on making natural resource decisions through collaborative processes that include multiple public stakeholders as well as the public agencies that are formally responsible for the decisions. As public agencies adopt collaborative decision-making approaches, understanding the conditions that lead to technically competent and socially just decisions is increasingly important. This study focuses on understanding the antecedents and consequences of socially just, or fair, decision processes. Research on the social psychology of procedural justice has examined the roles of instrumental and relational factors in influencing perceptions of procedural justice. This past research suggests that relational factors such as shared trust and mutual respect among stakeholders are fundamental to feelings of procedural satisfaction. This paper focuses on the role of relational factors in building a community of decision-makers that can effectively address issues of mutual concern. Interview information from stakeholders involved in developing the Lake Superior Management Plan is used to illustrate the concepts of importance in this community-building framework, and to suggest future direction for agency stakeholder relations in the Upper Midwest. While this study does not solely focus on the management of trout fisheries, it provides valuable lessons concerning building a community of public and private stakeholders to accomplish effective stewardship of public resources such as trout fisheries.

INTRODUCTION

In recent years, collaborative planning in natural resource management has been the focus of a large body of literature. This paper presents one concept that has been of growing interest over the past decade — procedural justice. I will first provide a review of this concept. In doing so, I will discuss two aspects of procedural justice — instrumental factors and relational factors — focusing primarily on the latter. I will present preliminary data gathered from interviews from stakeholders involved in developing the Lake Superior Management Plan of the Minnesota Department of Natural resources (MNDNR) in order to help clarify some of the concepts. The major focus of this paper is on the theoretical framework behind the project. I will begin with basic concepts and then move toward some of the most current research on procedural justice.

LAKE SUPERIOR MANAGEMENT PLAN

The Lake Superior Management Plan (LSMP) was developed by the MNDNR, in collaboration with stakeholders, over the course of approximately three years in the mid-1990s. It was developed for the purpose of creating a coherent planning document to guide the management of fisheries in Minnesota waters of Lake Superior. This plan encompassed management strategies for a wide range of fish species including trout and other salmonids. It was a collaborative effort, with representatives from various stakeholder groups providing input. The LSMP was chosen because it was

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widely considered to be an exemplary case of successful participatory natural resource planning in the state of Minnesota. Understanding what made the Lake Superior Management planning process a success is helped by understanding the concept of procedural justice.

Procedural Justice

The concept of procedural justice posits that the acceptability of outcomes is linked to perceptions of fair procedures (Tyler et al. 1997). In other words, if a person feels that a certain decision-making process is carried out in a fair manner, he or she will be more likely to accept an outcome, even if it is not the outcome desired from the decision. This is very important in natural resource planning, where, due to limitations on a particular resource, all parties probably will not get what they want in a final management plan.

I would like to make very clear at this point that I am making a distinction between process and outcome. Research has shown that people who have participated in decision-making processes readily distinguish between process and outcome in terms of their feelings of fairness (Roberson et al. 1999). In the case of the LSMP, stakeholders have reported that despite their sense that elements of the final plan were unfair to their particular interest, they felt that, for the most part, the process used to reach that decision was in fact fair.

Perceptions of fairness are linked to voice (Van den Bos et al. 1998). Voice is simply the amount of input a person or party has in the process. The idea here is that if a person is able to contribute to the process in any meaningful sense, then he or she will be more likely to view the process as being fair. The successful application of procedural justice involves consideration of both instrumental and relational concerns.

Instrumental Factors

The instrumental concerns of procedural justice primarily reflect concerns of self-interest — people care about justice because it may improve their position. Early procedural justice literature focused heavily on these concerns. Rawls (1971) discussed the concept of procedural justice in terms of his "veil of ignorance" — if a person has no information about his or her relative position or standing within a group, he or she will desire to distribute a certain good fairly. Subsequent work by Thibaut and Walker (1975) found that people desire to have control over both the process used and the decision reached. In many agency decision-making processes, citizens have less decision control; therefore they want to maximize input to get better outcomes. More recent research, however, has moved away from such an instrumental focus.

Relational Factors

The importance of relational concerns has received increased interest in the procedural justice literature over the past decade. Tyler and Lind (1992) found that people are often more concerned with being treated fairly during the course of a decision-making process than they are with having control over making the actual decision. In fact, in many cases, people are willing to turn over this decision control to an authority. This is because fair treatment communicates respect. One explanation for this effect is the group-value model (Tyler and Lind 1992).

Group-Value Model

The group-value model (Figure 1) is based on the natural desire of people to have membership in groups. Within a group, people interact with each other. Also, within more formal processes, such as agency decision-making, there will exist a group authority — the MNDNR for our purposes. This authority,

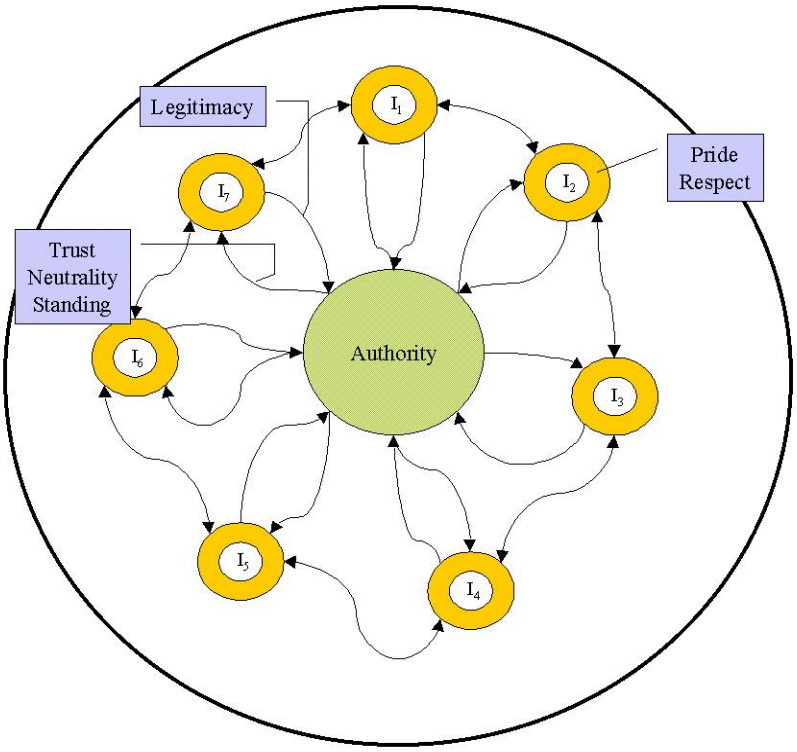

Figure 1. The group-value model of authority (adapted from Tyler and Lind 1992)

through the implementation of fair procedures, communicates to the other members (stakeholders) of the group a sense of trust, neutrality and standing. These feelings, along with interactions among each other, let the group members know that they are valued in the group and allow them to develop a feeling of pride and general sense of respect within the group. This leads the members of the group to give the authority legitimacy and long-term support.

Mediating Factors

There are a few mediating factors that come into play with the application of this model. The first is the history of trust between group members and the authority. Van den Bos et al. (1998) found that fair procedures have less effect on the acceptability of decisions and building of trust and relationship, if there already exist strong feelings of trust or mistrust among the parties and the group authority. In the case of the LSMP, there had previously existed a fair amount of distrust between parties, especially between consumptive users and the agency.

Another factor that comes into play is the degree to which group members identify with the authority. Smith et al. (1998) found that people were less likely to give legitimacy or even trust an authority if that authority is not perceived as being part of that group. This concept is exemplified by the "us versus them" mentality prevalent in natural resource management. A third factor is the existence of other sources of identity within a group. Thompson et al. (1998) found that the implications of the group-value model had greater effect on groups made up of friends than on groups consisting of people with no prior relationship. In the case of the development process for the LSMP, a consortium of concerned user groups had been put together before the planning process, allowing several of the groups that eventually participated in the planning process to build relationships across group boundaries.

However, because some groups did not participate in the consortium, varying amounts of group cohesion were reported after the formal process.

These three factors imply that increased acceptability of decisions and improved relationships among agencies and stakeholders through the application of procedural justice may be a long-term process with minimal immediate effectiveness, given the current rift between groups and natural resource agencies.

Trust and Communities of Interest

The sense of group membership can be related to the creation of a community of interest among a group of agency and non-agency stakeholders through the course of a planning process. According to the implications of the group-value model, trust among group members and the authority increases through fair decision-making processes (Figure 2). In such communities of interest, trust can be viewed as a currency of this social capital. Much the same as the investment adage ("it takes money to make money"), trust is necessary for a sense of community, which in turn builds further trust. If, however, the community disintegrates or fair procedures fail to be implemented, the store of trust can be depleted.

This relationship among trust, procedural justice and communities of interest is demonstrated by the relational outcomes of the process of developing the LSMP. Many of the stakeholders have reported the development of a sense of community in the course of the process; as a result, the various interests, for the most part, feel more comfortable speaking with one another and with the MNDNR. Most have also stated that their feelings of trust for the MNDNR either remained relatively high or increased as a result of the process. Several of the stakeholders reported gaining a greater understanding of the positions of others, including those of the MNDNR.

IMPLICATIONS FOR NATURAL RESOURCE MANAGEMENT

By paying attention to concerns about procedural justice, natural resource agencies can build trusting relationships with stakeholders and increase the acceptability of the decisions made (Lauber and Knuth 1999). That being said, however, there are several lessons should be learned from the procedural justice literature:

- *Building trust with a distrustful public will be a long process.* Public involvement techniques that emphasize procedural justice have the least effect on people who strongly distrust the authority (Lawrence et al. 1997; Van den Bos et al. 1998).

- *Group membership is essential to perceptions of fair process.* The role of procedural justice in the acceptance of unfavorable outcomes cannot be explained without the group-value model (Tyler and Lind 1992). Therefore, it is essential for participants in a decision-making process to be made to feel part of a community through feelings of pride and respect. This can be accomplished simply by giving them the opportunity to voice their opinions, as well as feedback on their comments (Lawrence et al. 1997).

- *The decision-maker must be part of the group.* According to the findings of Smith et al. (1998), authorities with which group members do not identify are not as effective in building respect within the group. This means that the resource manager must become involved in the local community.

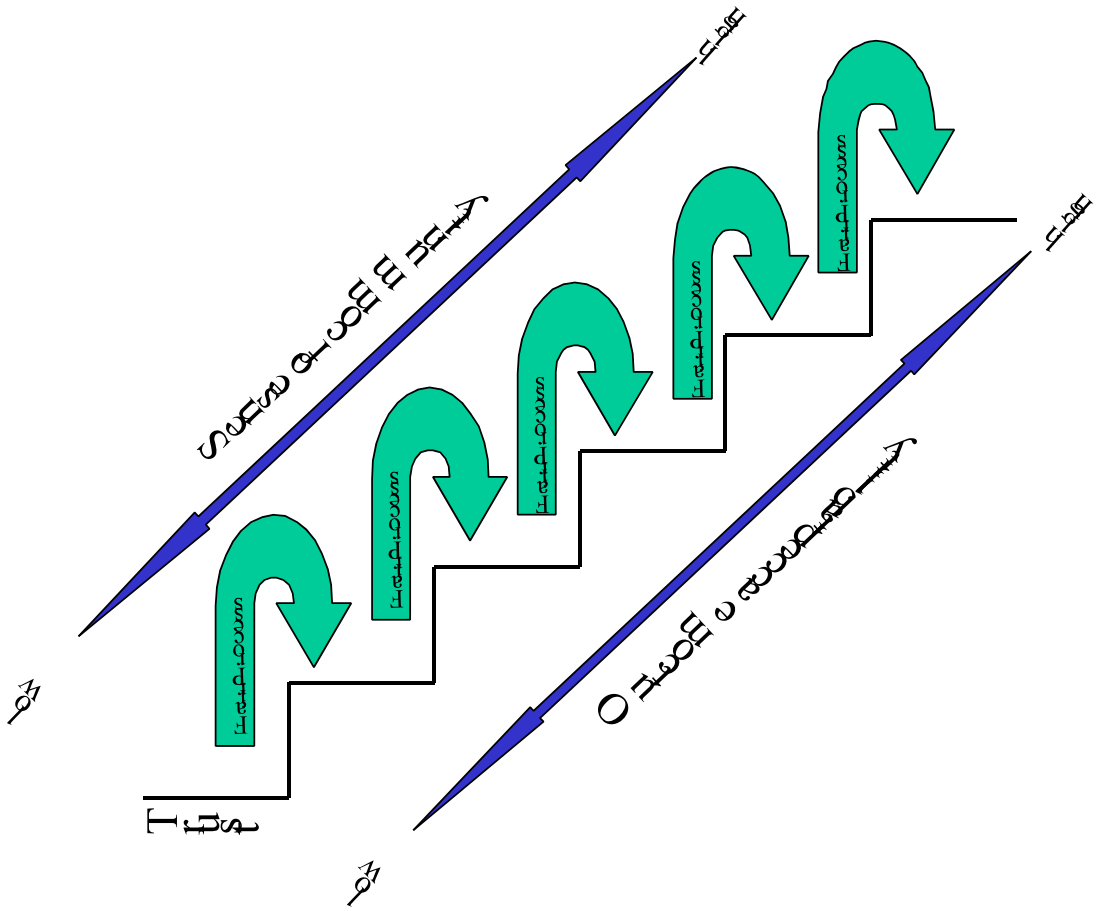

Figure 2. Stair-step model of building social capital

- *Input from the participants must be used in the development of a plan.* This is vital in that it communicates to the participants that they were important in the development of the plan and therefore are respected members of the group (McClaran and King 1999). This also avoids the perception by the public of the agency just going through the motions and not being truly sincere in its involvement in participatory planning. This can lead to the "frustration effect" (Lawrence et al. 1997).

- *Further research is needed on the application of the concept of procedural justice in natural resource management.* Lawrence et al. (1997) raised four issues in need of further research for applicability in natural resources management: 1) the impact of procedural justice on interest groups, 2) the impact of procedural justice on non-participants, 3) the effects of historical mistrust, and 4) measures of procedural justice.

These five points are important for natural resource professionals to keep in mind in the course of applying methods concerned with procedural justice.

CONCLUSION

The concepts that I have presented provide a basis for the project of which the case study of the Lake Superior Management Plan is

a part. By testing, then revising and enhancing this conceptual framework, we hope to develop a refined model that will help us understand what factors lead to decision-making processes that are successful in two important ways: successful in terms of providing a fair process; and, successful in building social capital and a community of interest.

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Gender Diversity in the Angling Community

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Abstract - In the United States, women comprise only about one-third of all anglers, and they fish for fewer days annually, on average, than do men. However, the proportion of women in the United States who participate in angling has been increasing, while the angling rate among men has remained stable. Clearly, fisheries managers are interested in reasons for differing participation trends and activity rates. Research on angler recruitment and retention has identified that there are gender differences in how individuals are socialized into fishing activity patterns. Furthermore, leisure and recreation researchers have learned that motivations for and meanings from the recreation experience differ between the genders. Interestingly, however, recent research has dispelled the widely held myth that single parent/family trends and increasing numbers of female-headed households contribute to declines in angling recruitment. New programs such as "Becoming an Outdoors Woman", Fly Girls", Casting for Recovery", and "Ladies, Let's Go Fishing" have emerged over the past decade. Because these programs are popular, and some have been evaluated as positively impacting angling participation for certain audiences, fisheries agencies now recognize that demand for meeting the needs of female anglers is high. Within these programs, there is significant interest among females in trout fishing in particular. Future directions for fisheries management will include consideration of increasingly diverse angler segments.

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Role of Anglers Plenary Presentation: The Role of Trout Anglers in the 21st Century

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Abstract - The primary role for anglers in the next century, as it is now, will be to serve as the "voice" not only for trout angling, but for environmental stewardship of coldwater rivers, streams, and lakes, and their inhabitants. To be successful in this role, anglers and resource management professionals need greater insights into a number of key questions: 1) "Who are these 21st century anglers?" and "How is the angling community changing?" 2) "What's likely to be new or different about the context and setting in which trout angling and resources management takes place?; and 3) What is new in our message, who is it aimed at, how is it delivered, and by whom?" To illustrate the complexity embedded in these questions, some of the contextual changes warranting consideration by anglers/resource managers as they plan coldwater resource conservation strategies for the coming century include: possible climate change impacts on coldwater fisheries; continuing urbanization, population growth and development in sensitive watersheds; devolution of increased responsibilities to "grassroots" levels and increased involvement of watershed groups and other kinds of partnerships in resources management; changes in resource management tools and strategies (e.g., more biologically-socially sophisticated regulations, more integrated environmental management approaches, and expanded use of non-regulatory collaborative approaches); a much greater focus on land conservation and management as the key to coldwater resource conservation and protection; and more controversy over fundamental, but potentially divisive angling issues such as public access to and use of the resource. This paper addresses many of the critical factors that must be carefully considered and addressed by the 21st century angling community if they are to effectively carry out their conservation role as stewards of the coldwater resource.

My assignment with this paper is to be a prognosticator, but I have to tell you at the outset that it is a risky undertaking. Any effort at looking into the crystal ball of the future is something one ought to approach with great deal of humility. I think there is a broad answer to the question of what the trout anglers' role in the 21st century will be. Their primary role now and in the next century, besides occasionally catching one of those tricky salmonids, will be to serve as the *voice*, not only for trout angling, but also for coldwater rivers, streams, lakes and their inhabitants. Hereafter, this paper will address more specific questions about who these trout anglers in the 21st century might be; how the angling community is changing; what's new in the context and setting in which trout angling and resources management may take place in the next century; how these changes will affect the message of trout anglers, how that message will be delivered, and to what end. All of these avenues of change will influence the anglers' role in the 21st century.

WHO ARE THESE 21st CENTURY ANGLERS?

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Who will the *voice* belong to? The number of anglers relative to the general population will likely decline over the next couple of decades, and that probably will be true for trout anglers as well. But, in spite of the fact we are barely holding even, we are now crowding each other, even more on the well known rivers and streams - the well advertised trout waters. It is not just a question of our recreational and leisure time desires. To some degree, we have all become captive of the "fishing industry" infrastructure and advertising, which targets where our activities take place. Many of us curse Robert Redford daily for the film "A River Runs Through It," but it isn't clear at all if there will be many more, or in fact any more, trout anglers a hundred years from now. What is clear is that trout anglers who populate trout streams over the next century, will be quite different from today's trout angling community; strictly in response to changing demographics in the United States.

We can expect to see a more urban, and perhaps more affluent, angler profile. I think the model people have seen over the years—the traditional family unit, where the father introduces children (usually sons) into the angling world, will change. That scenario will be different because there will be different conceptions of what constitutes a family (e.g., single household heads, merged families, etc.).

I think the expansion of women into the angling arena, particularly the trout angling arena, is going to be greater than what anybody today expects. This sport is very conducive to participation by women and I think the infrastructure is being put in place now to encourage their entry. I think we are going to see the ethnic and racial composition of anglers change in parallel with population changes. Those of you who have populated urban fly shops in Milwaukee now see African-American anglers, Asian-American anglers, all selecting flies, walking out and fishing for steelhead (*Oncorhynchus mykiss*) and exotic Pacific salmon. It is a very different angling community than it was a short time ago. I expect the angling populations will look a lot different in the year 2100. One need only to look around this room to count the two or three women here and the fact there are no faces with a complexion much different than mine, to recognize that there will be some dramatic changes. And, I think these changes will be absolutely necessary if anglers are to be a legitimate societal force.

I think the trout angling community will also be different in terms of the level of experience. A recent study from nearby Timber Coulee and the Kickapoo Valley, revealed that a large number of anglers, almost 40 percent, had less than 5 years of experience (Marcouiller et al. 1995). They often haven't had the years of experience developing their streamcraft like some of you old "gray-beards." They haven't developed the same understanding and respect for Mother Nature and perhaps they have yet to learn the stream etiquette we take for granted. On the other hand, in some incongruous ways, they tend to be more sophisticated anglers than those who preceded them. They have had the benefit of angling seminars, books, videos, Internet, modern equipment, and guides. There will be a lot of new entrants and many in the room today won't be here in 10 or 20 years.

The new generation of anglers over the next century will be more mobile and more traveled than the present generation. They will have a wide geographic range of angling experiences, often on "storied" waters. Last night, 29-year-old Jason Borger talked to us about fishing in England, New Zealand, Patagonia, the Kamchatka Peninsula. This new generation has enormous mobility. In fact, they will be readily accessing places that are now largely inaccessible, either because they are private or because they are unaffordable for many anglers.

However, there are consequences tied to this mobility. These anglers are less tied to home waters, to a sense of place. For those of you working in river or stream conservation, you can almost invariably find that old timer who knows what has been going on in that stream for 30 or 40 years; who has lived along its banks and watched the changes in ownership, and who understands trout. That person is often the primary conscience and steward of the watershed - the “river keeper.” With this new generation of mobile, well-traveled anglers, who view Alaska as much their backyard as Black Earth Creek, will they have that same sense of local stewardship? That will be an issue for us.

This sharply increased mobility also brings a very different type of angler to local waters. Studies show that non-local anglers assign a much greater importance to the angling experience in their overall lifestyle. Non-locals generally have more income, higher levels of education (which ought not to be confused with being smarter), and are often from professional occupations. These differences have the potential to set up a two-tier or two-class situation in local waters. There is real potential for divisiveness between these two different cultures. In some quarters, trout angling, which used to be the domain of trout bums and introspective loners, now becomes the outdoor equivalent to the business lunch. Who these anglers are or will be and how they get along is critical. The future of the coldwater resource directly ties to people who are passionate and knowledgeable about these very valuable environmental resources. I believe the most fragile resource we have are people who care deeply about our trout resources, and are ready and willing to act to protect those resources. However many trout anglers there will be in the future, however different these populations will be, trout anglers cannot allow themselves to be divided at the expense of shared goals to ensure that the resource is protected. Working together is what our sport depends on.

CONTEXT AND SETTING OF TROUT FISHING IN THE NEXT CENTURY

What is likely to be new or different about the setting in which the next century's trout angling and resource management takes place? This is not going to be a synoptic view of the future. I have selected a few examples to illustrate the potential for changes in the socioeconomic and environmental settings along with changes in the social and resource management settings, that will influence the message and role of anglers.

Climate change is probably at the extreme edge of these potential changes. Recently I received a call from a reporter, who asked if I was worried about climate change. He had been talking with a global climate modeler who pointed out that over the next 100 years there was a fairly high probability that the northern cities are going to warm enough to shift a number of streams, now coldwater resources, into being warmwater resources. Does that really matter? A smallmouth bass (*Micropterus dolomieu*) fisherman would probably be happy. But, if you look at the next century and the prospect of climate change and a diminished resource, could these changes affect the number of anglers or the number of angling opportunities? The answer is yes.

Not speculative at all, however, is the continuing growth of our population - the continuing urbanization; the continuing development. We are encroaching into sensitive watersheds, particularly vulnerable headwater regions. Along with this growth comes the critical recognition of the importance of land conservation, and really the connection of land use to healthy watersheds. At some risk, I suggest that the management of our coldwater resources greatly transcends fishery biology. It extends outside the purview of many of those who have spent a lifetime training for and managing our coldwater resources. Effective management now requires a much wider swath of interests and disciplines. Part of this grows out of the importance of the connection we have to make between the land and watershed health. Anglers want to fish. The last thing they want to do is attend zoning meetings, planning meetings - the interminable, endless governmental meetings that go on and on. Yet if we don't participate at a far higher level in land use planning and growth management activities, streams that are in the path of urban development - the Kinnickinnic River, Black Earth Creek, the Twin City Metro Council waters, the LeTort Spring Run - these streams are in so much jeopardy that they may be unsalvageable. It is only by working toward smart growth in our communities, with the inevitable growth in our population, that we are going to be able to intelligently guide development so as to protect coldwater resources.

There is also going to have to be far greater support for often-controversial, local, state or national land acquisition and protection initiatives. Rolling rocks is a lot of fun; those projects build sweat equity, a sense of community for our clubs, groups, and organizations. But if we put the same amount of

time into, for example in Wisconsin, helping reauthorize half a billion dollars for land acquisition for our state Stewardship program, or at the federal level getting the Conservation and Reinvestment Act (CARA) enacted, or making sure the Conservation Reserve Enhancement Program (CREP) comes into being in a responsible way, there will be a far higher payoff for the resource than the important things we do for our local streams. It shouldn't be an either/or situation, but we are going to have to extend more energies into activities with longer term and broader consequences.

The conservation of private land is going to become increasingly more important as time goes on. A lot of us now work with private landowners, but there will be increased cooperation with foresters, ranchers, and with farmers in order to achieve benefits for parts of the aquatic ecosystem.

I think we will see increased involvement with non-governmental land protection initiatives, particularly the land trust movement. This is growing by leaps and bounds, and in many places, you will see small land trusts playing pivotal roles, acting where state agencies can't to protect important spring heads, riparian corridors, and other critical, ecologically significant areas.

In the institutional and political resources management environment, the next century will see continuous de-evolution of more environmental management responsibilities, not only to lower levels of government, but to non-governmental entities, such as watershed councils. This movement is driven by numerous factors, ranging from governmental spending cutbacks, the notion of trying to get more acceptable management solutions at the local level supported by those that are impacted most by the decisions, and better implementation of our programs.

I think, in the context of this evolution of responsibility, that there are many pros and cons associated with this grassroots stewardship. Some worry that local watershed entities will not “bite the bullet” and take the strong biologically-sound conservation steps they must take to protect/restore ecosystems. In fact, many are worried about the watershed council movement in general, akin to putting a fox (local interests) in charge of the chicken coops (rivers and streams).

There will be new alliances and new relationships undertaken at increasing rates at the watershed level in the future. And strangely enough, all these alliances will not involve just trout anglers. We all know it is a lot easier to form an alliance with a group of people who have the same values, the same general interests that we have. United Wisconsin Anglers is working to reach across the gulf from trout anglers to someone who might fish for walleyes (*Stizostedion vitreum*), or muskellunge (*Esox masquinongy*), creating a forum for anglers to speak with one voice. That movement is still far narrower than what I'm describing. Partnerships are going to be partnerships of "unlikes" - people who share very different values, very different interests, and a very different perspective on what constitutes a desirable outcome. You will find yourself sitting at the table and working collectively with environmental advocacy groups, some who you may regard as zealots; tribal interests that you haven't always been on the same page with; resource users and extractors; businesses; local governments; and landowners. Collaboration will be the order of the day - trying to work through issues, to get cooperative agreements. The process may not produce optimal solutions, but the chances of implementation will be higher.

We will also see the use of new and innovative resource management tools and strategies, of which I will touch on four. In spite of our good friends, the wardens, we are going to see more biologically sophisticated trout angling regulations. It is unthinkable to me that we would go in another direction largely to appease enforcement agencies. Aquatic biology is complex; social products are differentiated. Let's get real about enforcement! Enforcement does not rely solely upon that very meager number of wardens out there. Enforcement comes largely out of consensus from the user community about what are acceptable behaviors, i.e., through peer enforcement. The presence of a warden can help us, but that is not the only way we have to define cultural norms. One can expect future regulations to be responsive to both biological and social needs.

We are also going to see increasing efforts in integrated environmental management. Trout management, trout habitat improvement, is too narrow a view of the world in terms of environmental management in the 21st century and beyond. We are going to have to be thinking about inter-relationships: the overall water quantity and quality relationships; the conjunctive management of ground and surface water; ecosystems versus single species management. I exalt trout - they are atop my pinnacle of values! But I ought to be equally worried about an endangered toad, or lizard, or turtle, or butterfly - a part of that same system. We are going to increasingly see, because we have to see, the linkage of land management with water management. These are holistic approaches.

Bob Ditton said yesterday, that for better or for worse, in many agencies, fisheries management is being absorbed into other functions. And these consolidations are accompanied by identity loss. I work with states all across the country. This is the way it is going, and this is the way it has to go. We cannot afford to treat resources management as a series of little fiefdoms ("hardening of the categories" - you're the trout management guy, you're the ground water guy, etc.). These are interrelated issues, and they have to be managed that way, with or without an identity crisis. We don't have the same relationship in Wisconsin with our trout fishery managers that we had 20 years ago. They have been made part of basin teams. There are some real concerns about dilution of relationships with long-standing constituencies, but we are going to have to work through this. We are also going to see expanded use of collaborative voluntary consensus approaches such as the watershed council movement. Trout anglers are going to not only play a role, but step up and lead this movement. Some individuals have put this cooperative approach forward as an alternative to regulations. That is hogwash. It will be supplemental to regulations. We will have to be involved in both.

Finally, there will be changes in fish propagation practices; you have already seen changes, and Wisconsin is a terrific example. We will see hatcheries used for recovery of wild native fisheries, versus "put-and-take, Purina-trout-chow fisheries." In localized situations, hatcheries and stocking are appropriate, but there are some huge battles coming, even in states that are forward thinking in fish propagation management, like Wisconsin. The issue of exotics and native fisheries is coming home to roost. For example, in the Lake Superior basin, we are going to be talking about bringing back natives; coaster brook trout *(Salvelinus fontinalis)*; and lake trout *(S. namaycush)*. We are going to have to re-examine how valuable splake (brook trout X lake trout hybrids) are; whether or not exotic Pacific salmonids belong in those systems regardless of the sport they provide anglers. That is going to be a very, very contentious battle.

DELIVERING OUR MESSAGE

Anglers are going to be asked to really think in deeper ways about the health of the ecosystem. I would like to touch on what I think is going to be a critical issue in the future: the increasingly sharp battles about public access to coldwater and other resources, privatization, and property rights. This is not just going to be a small skirmish, involving the trout community. It is part of a national, even international dialog on property rights and the social construction of property rights. It worries me when national leaders seek out property rights economists, who champion privatization of all public lands as a way of achieving efficiency, as their advisors. The bottom line usually comes at the expense of our resources. All of this suggests that there will be some new targets for our message. I think we will continue to address state and federal governmental agencies.

There are all kinds of issues needing attention - public lands, new legislation, making sure we get fiscal resources for programs. I think there will be increased attention, consistent with the de-evolution of responsibility and with our focus on land resource concerns, on local governments, where we haven't focused much attention. Historically, trout streams have been minimal concerns in local governmental decisions; local governments are going to have to step up and be partners in protecting these resources. That's happening in some places, where people are recognizing that

urban trout streams are environmental gems and economic assets as well.

I think we are also going to have to turn our message away from government and start looking at other entities in the non-governmental sector for fiscal support for coldwater conservation. Businesses and individuals are going to have to step up in a bigger way. Dave Nolte (this issue) described the role foundations have begun to play, but if you want a sobering moment, the assets of the nation's richest foundations grew by sixteen percent last year to about 180 billion dollars. Thirty-five or so foundations gave out significant grants for conservation. Coldwater anglers have to begin targeting them for assistance.

And, finally, the message has to go to youth. A number of organizations, such as the Federation of Fly Fishers, Trout Unlimited, and others, target programs toward youth. The socialization of the next generation of trout anglers is going to be critical or we won't have the assets to do the job.

Who's going to be the messenger? Anglers will continue to be the messenger; fishing groups will play a role. But to create sufficient clout we are going to have to increasingly work beyond simply being trout anglers. New coalitions; new alliances, will demand the involvement and support of more than trout anglers. The point was made in our group session yesterday that this will take a lot of collaboration and anglers may have to be as interested in wetlands, endangered species, intelligent flood plain management, healthy rural communities, or whatever to accomplish their coldwater resource objectives.

Conservation organizations are changing rapidly. And, they are going to have to change rapidly if they are going to be that *voice* in the future. The organization I'm most familiar with is Trout Unlimited. I just want to briefly touch on the changing face of that organization, as an example of the capabilities it is building to be allies with state and federal resource management agencies; and sometimes to be constructive critics, giving them “wiggle room” to be creative in there own enterprises. Trout Unlimited has recognized the need for a number of new directions. I think this is typical of good, strong conservation organizations, to plan strategically and look at themselves and what they have to do to have an impact in the future. We are using much more sophisticated strategies than those used even five short years ago:

- Collaborative arrangements resulting in Federal Energy Regulatory Commission (FERC) relicensing, provide an example where Trout Unlimited, as part of a coalition, worked with a utility (Washington Water Power) that had done great damage to salmonids in western rivers. The collaboration, which was risky for both sides, has resulted in almost a quarter of a billion dollars in the next 45 years for habitat work in the Clark Fork system.

- Interactive media campaigns, e.g. stories in Denver Post showing fish stranded as the result of dewatered streams to influence water allocation decisions.

- More effective use of volunteers to communicate positions and policies to their politicians.

- A much higher reliance on additional resource science and economic analysis so that the Army Corps of Engineers and utilities don't overwhelm environmental and fisheries management agencies in decision-making processes.

Trout Unlimited is in the process of capitalizing a coldwater conservation foundation to the tune of several million dollars. This is essentially venture capital for economic and scientific resource work in support of coldwater conservation. One other thing Trout Unlimited has come to recognize: you have to become more business-like, more fiscally prudent at every level of the organization, to stay efficient, to stay solvent. Otherwise you will not have the staying power for conservation and you won't be able to get your job done.

Finally, we are in the process of making the link between our resource advocacy and organizational development work. It's nice to win a battle here, to stop a dam there, get water

back in a stream there, impact whirling disease, all of these things are good. But at the same time, we have to connect our resource advocacy activities with strengthening the organization and its volunteers to better fight the next fight for trout. We are in the process now of making a million dollar investment over the next few years in this whole arena, the top national Trout Unlimited organizational priority.

Advances in communication technology have been amazing and I won't prognosticate what things will look like a hundred years from now. What has happened is absolutely incredible. For those of you who are not from Wisconsin, the power of the Internet for communications and mobilization of resource advocates to protect our wetlands has been remarkable. At one time Nicolet Mining/Exxon was looking at developing the largest massive sulfide ore body in North America in the headwaters of the Wolf River. A coalition of environmentalists came out of the woodwork with Websites and e-mail interconnections. It was a way of organizing to fight a battle that just hadn't happened in the past. When Perrier, the bottled water company, came in and threatened the headwaters of the Mecan River, you saw new strategies of fax-blasted new releases leading to headlines shaped by the natural resource people and not the development/extraction community.

I can't imagine what the next technology will be in terms of enhancing the capability of trout anglers and other grass root partners to share information, to organize, and to deliver the message in support of strong resource planning and management. The things that I'm talking about are critical factors and forces and must be addressed by the 21st century angling community. It's essential that we carry out our roles as stewards and spokespersons for coldwater resources. As we contemplate what the specific roles of the angler will be, we must recognize that our voice, along with resource managers and others, will be pivotal in shaping trout angling in the 21st century.

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The Role of Private Foundations in Trout Management in the 21st Century

David A. Nolte[1]

Abstract - About 900 foundations appear to be potential sources of grant money related to fisheries. Many have missions and visions that most of us are unaware of. Most foundations are interested in ecosystem-wide restoration at a watershed level. Foundations are very interested in funding initiatives that induce changes in management processes at larger scales and those that involve the public in stronger roles in the management process. Projects that promote new concepts and technologies, and that have the potential to dramatically improve fisheries, are also likely candidates for funding. This paper examines representative foundations and other nonprofit organizations that fund trout-related projects, and discusses the benefits of outside assistance.

INTRODUCTION

The word "philanthropy" comes from two Greek words meaning, "love of people." The United States has the largest system of giving in the world. In 1993, there were more than 500,000 Internal Revenue Service approved (501 [c3]) non-profit organizations and over 400,000 additional tax-exempt organizations (501[c4]). There are over 53,000 foundations and over 210,000 grant opportunities in the United States (The Foundation Center website). To differentiate, a tax-exempt organization includes service clubs, political action committees, and other types of organizations. Tax laws differ between tax-exempt and nonprofit organizations. A nonprofit status is a public trust. Specific tax breaks are given as long as the organization meets criteria set forth in the United States tax laws.

It is interesting to ask who donates and who gives the most to nonprofit causes. Most people believe that private corporations and foundations represent the premier "givers" to nonprofit causes. In reality, this is a myth. More public dollars come from the private sector (Klein 1996). The largest giver is the taxpayer through the United States Government. The second largest giving entity is individuals. People actually give more in direct donations than corporations and foundations combined. That aside, foundations continue to represent a portion of giving that does have an effect on how nonprofit organizations approach their mission and work.

This paper examines representative foundations and other nonprofit organizations that have shown strong interest in supporting fisheries projects, especially those involving trout fisheries. I also discuss the missions and visions for future involvement in trout projects in the 21st century of a representative range of private foundations.

METHODS

I conducted a review of foundations and other institutions that give financial support, products or services (technical, consulting, and/or equipment) to nonprofit organizations. I interviewed two nonprofits, Trout Unlimited (TU) and the National Fish and Wildlife Foundation (NFWF), that are strongly engaged in fishery management activities and fishery restoration. The two were selected based upon my direct experience with both. The objectives of the interviews were to: 1) determine if there were other foundations that supported fisheries that I may have missed during my data searches, and 2) discuss trends in foundation giving as it related to fisheries and fishery management.

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I searched databases and directories including online websites (see websites consulted), annual reports, and foundation directories. The Foundation Center website was particularly useful. This search created a base of foundation information. This information was reviewed and summarized in Tables 1 and 2. For the online databases, I defined keyword search criteria designed to produce a summary that had a larger number of "hits" from the databases. Keywords included: habitat, fisheries, management, wildlife, riparian, wetlands, water resources, threatened and endangered species, environmental education, interpretative, inland fish, and marine. No search preference was given to type of assistance, grant use/restrictions, or geographic location.

RESULTS

Based upon search criteria, out of 1,080 foundations investigated, 900 foundations appear to be potential sources of grant money related to fisheries. These potential sources were then reviewed and state or federal grant assistance was separated in order to more fully focus on nonprofit sources. Results of the search are summarized in Table 1.

Only twenty of these sources are strongly interested in fisheries and only five are strongly interested in inland fisheries (W. Fosburg, Trout Unlimited, pers. comm.). Each search result was then reviewed to ensure that the foundation or source of potential funding did indeed fund fisheries, fisheries management or habitat projects.

Table 1. Number of foundations that may be sources of grants according to fishery-related categories.

Search	Total Hits	Federal Agencies	State Agencies
Wildlife/Fisheries/ Habitat	317	39	33
Wetlands	41	14	11
Water Resources	185	60	23
Threatened & Endangered Species	27	5	5
Riparian	39	9	15
Environmental Ed/Interpretation	291	23	18

DISCUSSION

Review of the information collected presented interesting subsets of information that reflected those foundations that were most interested in fisheries and fish-related issues (Table 2).

Examples of Foundation Support

The following examples of foundation support reflect what I believe to be a new trend in giving. Foundations are very interested in ecosystem-wide restoration at a watershed level. If there is a focus on species, it is in the context of the ecosystem. Foundations also desire to effect changes in management processes at larger scales and to involve the public in stronger roles in management.

National Fish and Wildlife Foundation - Bring Back the Natives

Bring Back the Natives (BBN) is a public/private partnership involving federal agencies, the National Fish and Wildlife Foundation (NFWF), and Trout Unlimited (TU). This key aquatic program partners the Bureau of Land Management, U.S. Forest Service, U.S. Fish and Wildlife Service, and the Bureau of Reclamation with state and private partners to restore the health of riverine systems and the recovery of native freshwater species. A fund from each of the federal partners is administered by NFWF. About $1.5 million per year is administered for BBN.

Table 2. Foundations strongly interested in fisheries.

Organization	Comments
National Fish and Wildlife Foundation	Strongly supports inland fisheries and marine fisheries
Packard Foundation	Mostly marine fisheries
Homeland Foundation (California)	Fisheries and restoration
Rockefeller Foundation	Marine fisheries
Pew Chartiable Trusts	Marine fisheries, issue-oriented processes like Save Our Wild Salmon and the Theodore Roosevelt Conservation Alliance, Heritage Forest Campaign, and some projects directly related to fishery conservation
Kendall Foundation - (Boston)	Marine fisheries
Bullitt Foundation	Strongly supports fisheries
Brainerd	Very salmon focused
Wilburforce Foundation	Provides excellent infrastructure support for nonprofits
Compton Foundation	
REI	Provides a wide range of support including fishery issues
Patagonia	Strongly supports fishery related issues
Fish America Foundation	Strongly supports fishery related issues
Flintridge Foundation - similar to Wilburforce	Excellent infrastructure support
Hewelett Foundation	
Packard Foundation	
Turner Foundation	Strong support of fishery conservation
Kendall Foundation	
Trout Unlimited Embrace-A-Stream	Specific grants for Trout Unlimited chapters and state councils. Strongly supports fishery related issues.
Norcross Foundation	Strongly supports fish issues - mostly via habitat projects and equipment needs.

Criteria for funding of projects by BBN follow guidelines established by Williams and Rinne (1992), who recommended broad changes to achieve long-term sustainability of public resources while conserving biological diversity. These guidelines specified that: 1) the primary goal must be ecosystem integrity; 2) planning must be on an ecosystem or a watershed basis; 3) management must be on an ecosystem basis; 4) management must be directed for ecosystem processes; and 5) management programs must be evaluated. Criteria for BBN grants thus include:

- an ecological approach to stream and watershed restoration and/or cooperative efforts with multiple partners coupled with revised land management practices,
- a watershed-level scale, and
- the ability to gain at least a 1:1 match of cash, materials or in-kind services to the grant.

This program does target individual species such as bull trout (*Salvelinus confluentus*), but it is done in a watershed context. During 1992-1994, BBN supported 15 watershed-level projects that aided in recovery of bull trout and their habitat (Nolte 1997). For more information on the Bring Back the Natives program, contact:

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National Fish and Wildlife Foundation
1120 Connecticut Ave. NW Ste 900
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Amy Harig
Trout Unlimited / BBN Coordinator
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Boulder, CO 80302
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Email: aharig@tu.org
Web: www.cotrout.org/BBN

Pew Charitable Trusts - Theodore Roosevelt Conservation Alliance

The Theodore Roosevelt Conservation Alliance (TRCA) was launched in January 2000. It is being funded by a $2.3 million grant from Pew Charitable Trusts. The alliance consists of founding trustee member groups: Mule Deer Foundation; Rocky Mountain Elk Foundation; Izaak Walton League; Trout Unlimited; Wildlife Management Institute; and Wildlife Forever. Its mission statement is:

"To inform and engage Americans to foster our conservation legacy while working to nurture, enhance and protect our fish, wildlife and habitat resources on our National Forest System."

TRCA is an alliance dedicated to informing, galvanizing, and engaging individuals plus local, regional and national organizations who care about the future of wildlife and sporting activities on public lands. With changing times, today's sportsmen are rightfully worried about the future of their activities. Many are concerned about access to hunt, fish or shoot and whether their children and grandchildren will experience the joy and adventure that they have known through hunting, fishing, and shooting sports.

Currently, TRCA is creating mechanisms to engage its members. Membership in TRCA is free, and well over 19,000 people and 25 organizations have pledged since the alliance startup in January. TRCA has created a major web site with information on National Forests, issues and mechanisms for direct citizen response via email.

This effort by Pew Charitable Trusts, for the first time, brings hunting, fishing and conservation groups together with singular purpose — to engage Americans in the management of public lands. Each of the trustee organizations will continue their respective missions and activities including habitat enhancement. This TRCA Alliance is one of the first foundation-funded activities that is helping to create a better-informed and involved public. For additional information on the TRCA, contact:

Theodore Roosevelt Conservation Alliance
Attn: Sunnie Kaufmann, TRCA Receptionist
10365 West 70th St.
Minneapolis, MN 55344
(612) 833-1522
Web: www.trca.org

Trout Unlimited Embrace-A-Stream Program

For more than ten years, Trout Unlimited has provided grant opportunities for its member chapters and state councils through an innovative program, Embrace-A-Stream (EAS). The program offers $1,000 to $10,000 grants to Trout Unlimited chapters and state councils in three broad areas: resource, research, and education. Chapters or state councils can apply through a grant application process that starts in September with proposals due in December. Grants are awarded by April of the following year. Over the past few years, the total funds available have grown to well over $270,000 per year. The bulk of this funding comes directly from donations from our individual members and a few corporate sponsorships. For more information contact:

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Summary of Foundation Missions and Types of Giving

The review of data regarding foundations indicates new trends in foundation giving. Foundations may be more likely to fund projects that 1) implement new ideas or concepts, 2) promote rapid infusion of new technologies, research results, or changes in management approaches, or 3) may be of high risk but have great potential for improving fisheries. As an example, The Wilburforce Foundation (see website) has a clearly defined mission, objectives and funding goals. It does have geographic priorities but is also willing to fund organizational structure building. Watershed-level restoration activities often require additional administrative support and

function that smaller organizations may not have.

The National Fish and Wildlife Foundation criteria are also clearly defined. It supports aquatic restoration at a national scope. It has strong intent to help change fishery management processes. There are stricter guidelines about funding use, federal partners and reporting procedures. Both of these examples demonstrate the depth of financial support that is available through foundations.

Sixty-nine percent of all freshwater fish species listed as endangered or threatened in the United States occur on public lands managed by federal agencies such as the United States Forest Service (USFS) and the Bureau of Land Management (BLM). Increasingly, federal, public and private agencies and organizations are turning towards private foundations to assist in the management of salmonids through grants, in-kind donations, public policy review, education, co-operative partnerships, and volunteer assistance.

Clearly, foundations can have a major influence on management approaches regarding trout fisheries. Therefore, fisheries managers, and trout anglers desiring to partner in management of trout resources, should familiarize themselves with the potential sources of foundation support.

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Williams, J. E. and J. N. Rinne. 1992. Biodiversity management on multiple-use federal lands: an opportunity whose time has come. Fisheries 17:4-5.

WEB SITES CONSULTED

Council on Foundations. (http://www.cof.org/)

Environmental Grantmaking Foundations. (http://www.environmentalgrants.com/)

Internet Nonprofit Center. (http://www.nonprofit-info.org/)

National Fish and Wildlife Foundation. (http://www.nfwf.org/)

Sonoran Institute - Community Stewardship Exchange. (http://www.sonoran.org/)

The Foundation Center. (http://www.fdncenter.org/)

Wilburforce Foundation. (http://www.wilburforce.org/)

How Do Private Groups Work With State and Federal Agencies?

Donald A. Duff[1]

Abstract - Partnering between groups and organizations helps build and achieve long-term relationships and commitments for the purpose of achieving the goals and objectives of each partner. It is important for each partner to understand the other's social and organizational structure and goals. Most groups share an interest with the agency, either from an environmental aspect or as a citizenry interested in how "their" resources are being managed "in trust" by the government. An effective working relationship is built on an open dialogue of issues or concerns, regular communications, and a relationship based on trust, respect, dedication to common goals, and an understanding of each other's individual (and/or group and agency) expectations and values. Groups and agencies must share a common belief of their importance (the individual and organization) with neither proffering a dominating or intimidating attitude. They need to share in "sensemaking," or building on the interpretative processes that allow individuals to understand and share understandings about their organizations' mission, what their organizations do, and how their collective, common, or not-so-common goals, issues, and problems should be resolved. Communication between them should strive to be direct and open in all matters, have teamwork with mutual respect for each other (while realizing that disagreement is not bad), and conduct business with uncompromising integrity and professionalism. Agencies must realize that groups represent a collective mass of citizenry and are an asset to the community. Agency business requires continuous improvement of performance to nurture both public support and group acceptance. Support from the public is essential to government programs at all levels. Strive to continuously learn, develop, and improve in relationship building, and…have fun!

Emerging management concepts in fisheries, wildlife, and ecosystem management, and related paradigm shifts in natural resources management, have left private and/or non-profit groups and many natural resource managers struggling to maintain their competency and communication with each other. Americans spend $300 billion annually on outdoor-related recreation - which is a large chunk of the $430 billion travel and tourism industry. Fisheries, wildlife, and recreation-related activities are one of the most popular forms of recreation in the United States. In 1991, annual participants in fishing, hunting, and wildlife-related activities totaled more than 109 million. By comparison, total attendance at all major league baseball, football, and hockey games that year in the United States numbered around 106 million.

With this interest in fishing alone, groups and agencies (state and federal) share a common interest in fisheries and aquatic-habitat-related management on public lands managed in trust for the public's use and enjoyment. Hence, in the last decade, increasing numbers of groups have sought out agencies at all levels (local, state, regional, and national) for a voice in how they "do business." These interests stem from an environmental or recreation-related aspect, or as just a citizenry concern for management of how "their" resources are being managed for the public good.

[1] National Partnership Coordinator, U.S. Forest Service, Trout Unlimited Partnership Program, Salt Lake City, UT.

Agency planning and decision-making are becoming increasingly political as human population rise, people require more of their natural environments, and communities demand a greater voice in fisheries and land management decisions. Groups need to enhance their skills in communicating interests, issues, and concerns to agency professionals and administrators. Agency professionals need to enhance their knowledge of natural resource ecology and management while at the same time also developing skills in public communications, problem assessment, interdisciplinary collaboration, and adaptive management. Groups and agencies should focus interactions between social systems and biophysical processes, thereby creating a network of concerned individuals and managers that can join together using insights of science with expectations and knowledge of the public.

Groups with an interest in fisheries should consider forming a "partnership" with the agency involved to build and achieve long-term relationships and commitment for the purpose of achieving the goals and objectives of each. For the purpose of this discussion, I will relate examples of group works or partnerships with angler groups, such as Trout Unlimited (TU) and the Federation of Flyfishers (FFF) to the U. S. Forest Service (USFS) and the states. Partnerships are not new to the natural resource community. A resurgence of partnerships, or groups dealing with agency management of public resources, came about a decade ago at the urging of concerned citizens and conservation groups for a better and more viable fisheries voice for management of aquatic habitats and fish populations on National Forest Systems (NFS) lands. Changes in land and species management in both agency land management plans and in state fisheries management plans hastened the public's concern over having a voice in decision-making. Groups and citizens wanted to help agencies in monitoring of resources and in fisheries and riparian habitat improvement. These were essentially citizen monitoring programs (CMP) which defined, through partnerships, the role of citizens and the agency in meeting agency management goals for aquatic ecosystems, fisheries (i.e. native, wild, and recreational), and for water quality.

Partnerships between groups and agencies are the foundation for productive, sustained relationships. These relationships allow for joint collaboration to reach common goals and build knowledgeable and supportive constituencies. The key to successful partnerships is mutual benefits. For an agency to be successful in management, favorable public perception is needed. Partnerships help provide groups and publics a better understanding of the agency management mandate. And when partnerships are successful they build agency integrity and support for decision-making from groups that have participated and understand the public participation process.

A generic definition of a "partnership" would be a voluntary, mutually beneficial, and desired arrangement or agreement entered into between a group and agency(s) to accomplish mutually agreed-upon objectives that are consistent with both parties' missions and serves the public interest. While agencies deal with many publics, they generally consider as partners those with whom they have a formal partner agreement. Groups usually begin contacts with the local fisheries biologist, but in most cases it is beneficial to have the support of "top management" or an authorizing individual of the agency as well as the support from the group's leadership so that there is a commitment from each entity to communicate. Groups usually have goals in mind for accomplishment that are usually in line with agency mandates, but may be on a "faster track" than those of the agency. In this regard, a partnership or structured communication and interest by a group may be the "sparkplug" needed to get the agency to begin work on an activity, which they may otherwise have scheduled for a later date. In many cases, the groups have funds available and can "cost-share" with the agency to make budgets acceptable for an activity to proceed.

Generally, a partnership agreement should include:

- a written agreement between the parties to ensure commitment.
- desired and future goals and objectives for habitat and fish management.
- designated contacts in each party for implementation of the agreement.
- voluntary participation by the group(s).

- consistency with agency plans and evidence of public benefit.
- agreed upon activities, projects, and planning for management and monitoring needs.
- realistic timeframes and sufficient time to acquire funding, materials, and approvals.
- annual meeting dates and coordination times for routine communications.
- coordinated media releases for joint recognition of both parties.

In general, partnering is a way of unifying both or all parties or stakeholders into a team for better resource management in the public's interest. Partnering also:

- encourages the partners to recognize common interests and knowledge, thus forming a common ground for effective communication.
- builds trust and teamwork between the parties and encourages early and open communications.
- helps eliminate surprises through early and open communication.
- improves morale and professionalism, and generates harmonious relationships by application of mutual interests.
- enables parties to anticipate and resolve problems, and avoid most disputes and litigation through use of the alternative dispute resolution processes.
- establishes an understanding and knowledge of each parties mission and policies.
- allows public groups to have a "voice" in management of their resources.
- encourages joint projects or activities for working together with others.
- helps spawn more standardized and consistent program coordination.
- enhances an agency's public image, builds on its integrity as a responsible resource management agency, and increases visibility to the scientific credibility of staff professionals.
- helps agencies understand a groups mission, the reasons and/or concerns for getting involved, and the knowledge and commitment of both individual members and the entire group.
- helps partners build on successes and learn from mistakes.
- helps reduces an agencies administration and oversight time through regular meetings with partners.
- helps reduces time and cost of agency budget, planning, and contract requirements if no partners involved. Agencies sometimes seem to disregard or fail to see and acknowledge the value and knowledge that a group(s) brings "to the table."

In the example of TU and FFF, both groups have national partnership agreements with the U. S. Forest Service that helps get them involved with the agency at all levels. For TU specifically, the partnership also includes some 39 additional agreements between individual TU state councils, National Forests in the state, and the State Wildlife Agency. In some cases, additional partners are signatory to these agreements, by state, such as the BLM, Bureau of Reclamation, and FFF. These agreements cover collectively some 96% of all the coldwater fisheries habitat on NFS lands in the United States and provide a mechanism for groups and agencies to jointly work on projects of need and interest. They provide stakeholders with some "ownership" for management of public aquatic resources, and provide agencies with a needed support base when public scrutiny tends to question agency motives and decision making.

Usually, for groups and agencies to work through a partnership process, there are some actions generally considered necessary for the process to survive and thrive. These can be listed as:

- Follow the partnering agreement principals agreed upon. Without trust, there can be no teamwork, no collaborative effort, no open communication, and participation will fail. Strong value should be placed on long-term relationships. Agency and group discussion should focus on the truth, science-based fact, and professionalism. Commitments made by each partner should be kept unless joint consensus is made to change or revise. Agency "top level" administrators, as

well as staff, need to stay committed to the partnership.

- Each partner must stay actively involved. A designated "champion" for each party can help keep the effort in focus.

- Strive for open communication between parties. Open, honest, and timely communication builds trust. Face-to-face communication is usually the best, when feasible. Groups should seek to facilitate or begin initial communications with the agency partner rather than wait for the agency. This may help the agency since "routine workloads" or the unfamiliarity of a process for dealing with groups may delay their initial involvement. Partners need to nurture this communication process to ensure a "comfort level" between them so future communications are looked at as routine and needed. Commitment builds on teamwork and effective working relationships that are needed when unanticipated hurdles arise to challenge partner activities. Agency staff and managers should "talk straight" with facts not reneging on agreed upon plans or activities, and be consistent with their policy at all administrative levels. Agencies that seek to enter into partnerships only for "financial" benefits that partners can provide while not realizing or accepting the partners interests or concerns will be quick to lose support of their much needed constituency, and could end up in litigation processes. Failure to treat partners with respect and as equals can sabotage partnering effectiveness.

- Identify problems, and solve them in a timely manner. Some compromise or "give and take" may be necessary to achieve agreed upon goals and objectives of both partners. Partners should be receptive to new and innovative ideas. "No" is a bad word for agencies to use (if used frequently and without justification) if they wish to be sensitive to new resource user needs. Agencies need to disclose all pertinent public information during any joint problem-solving process. Blaming partners for problems or failures should not be tolerated. Groups should realize that agencies have specific state or federal mandates to adhere to and decision-making may have to be guided within these mandates and constraints.

In summary, it is incumbent for agencies and groups to communicate and partner to meet desired public resource management objectives. Essentially, to be a "winner" in resource management, as well as in business, agencies must truly understand what kind of "business" they are in and clearly identify their customers. As elementary as this might appear, lack of consensus about the nature of the business and the identity of customers appears to be more common than many would believe. A key ingredient is consensus, which in turn, can lead to focused commitment, and profitability for protection or restoration of aquatic resources. Generating good partner relations and commitment is not a one-time exercise, but rather a continual process for both partners where each success serves as a "point of departure" for renewed commitment rather than complacency, and each failure serves as a learning experience - not a fault-finding or scapegoating ritual. Partners, especially groups, should encourage a positive attitude despite possible agency delays - you never fail unless you stop trying!

In resources management, and fisheries management specifically, agencies and groups should cherish and nurture good partnerships to help in the management of public resources and promote wise stewardship to ensure the perpetuation and inheritance of fisheries resources for the next generation of people. An ancient Chinese Proverb seems to me a good illustration of the value of groups and agencies working together…

"Tell me, I forget.
Show me, I remember.
Involve me, I understand."

Conservancy versus Rock Rolling: Getting the Most from Limited Private Dollars in the 21st Century

Laura Hewitt[1]

Abstract - Conservancy, or land protection, usually involves acquiring land or buying easements to control future development. Rock rolling, shorthand for river restoration, is used to return habitat or ecological functions to a reach of river that has been degraded. Both conservancy and rock rolling can be extremely expensive and require the expertise of biologists and channel restoration specialists. Yet, these are extremely important tools for protecting trout habitat and enhancing the health of trout fisheries. Unfortunately, there are few organizations that have the financial resources to do both land protection and river restoration. Therefore, we must make judicious choices about how to best spend money on trout resources. This paper briefly describes what is entailed in implementing both land protection efforts and river restoration projects, including cost estimates, necessary areas of expertise, approximate time frames, and materials and labor needs. The discussion highlights some of the advantages and shortcomings of each approach. Finally, I suggest some criteria for deciding whether to use land protection or river restoration in a given situation. Things that require consideration in making this decision include: the conservation objectives for an area, the location of the site in a watershed, the health of the resource and ability to control limiting factors, available expertise and financial resources, opportunities for partnerships, and landowner willingness. There is no simple formula. Each situation requires a unique analysis, but these criteria increase understanding of the benefits and shortfalls of each approach in a specific site leading to more strategic land protection and river restoration decisions.

LAND PROTECTION

A conservancy is an organization or area designated to conserve and protect natural resources. In order to have a conservancy there must first be land protection. Land protection involves acquiring land for conservation ownership or securing its protection by legally limiting future development. In relation to conservation, protection means to maintain an area's status or integrity through financial or legal guarantees.

There are a number of tools for land protection including land acquisition, conservation easements, and limiting development rights. Land acquisition either through outright donation, bargain sale, or purchasing property at full market value is the strongest and surest land protection tool. The natural resource agency or land trust and the landowner can feel assured that the property will be protected in perpetuity. If transferring ownership of the property is not an option, then conservation easements or limiting development rights can ensure a good measure of protection for land. Conservation easements are voluntary legal agreements between a landowner and a natural resource agency or land trust that limits present or future uses of the land. Easements are flexible tools that are frequently donated but may also be purchased. The landowner retains ownership while the easement holder assumes the responsibility for maintaining its conservation value. Limiting development can be done a number of ways. A property can be divided to allow development on less sensitive

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areas while protecting those that are more sensitive. Alternatively, the land trust or natural resource agency can actually purchase the development rights from the landowner or transfer the rights to another area (Gathering Waters. "Conservation Options for Landowners". http://www.gatheringwaters.org/resource_options.html).

Land protection can be an extremely expensive endeavor; obviously the costs involved vary widely with the circumstances and location. In the ideal situation a conservation-minded landowner is willing to donate his or her property or an easement. Some land trusts only accept donated easements and may even require an accompanying endowment to aid with future stewardship costs. For instance, the Minnesota Land Trust prefers donated easements and requests a $2,500 endowment for future monitoring costs (G. Wright, Minnesota Land Trust, pers. comm.). In many cases, the landowner needs the income that would come from the sale of their land or an easement. In those cases it might be possible to negotiate a bargain sale where the property or easement is sold for less than market value. In the case of a donation or bargain sale the landowner could receive significant tax benefits. If the only option is to pay full market value for an easement or a piece of property the cost can vary widely depending on its size and location. For example, in southwest Wisconsin the Department of Natural Resources (WDNR) purchased about 100 acres along Camp Creek for approximately $150,000 (R. Kerr, WDNR, pers. comm.). The Mississippi Valley Conservancy purchased about 36 acres of lowlands near the Mississippi for approximately $68,000 (C. Olmstead, Mississippi Valley Conservancy, pers. comm.). Areas that are important for conservation might also be prime for development in quickly growing areas. In these cases, parcels could cost hundreds of thousands or even millions of dollars. In fact, the cost of an easement could be close to the cost of the entire piece of property! The WDNR purchased an easement covering 9.4 acres along about 1 mile of Marshall Creek for $21,000 (R. Kerr, WDNR, pers. comm.). The easement cost per acre on Marshall Creek was more than the per acre cost of purchasing the land on Camp Creek.

Negotiating a land protection deal is a delicate process of developing a relationship with a willing landowner and working out an acceptable arrangement. Land protection is usually undertaken by natural resource agencies or land trusts where conservancy of land and water resources is part of their mission. Typically negotiating a land purchase or conservation easement could take six months to a year or more. It also requires the services of an appraiser, real estate agent, legal counsel, and possibly a biologist or other conservation specialist. Finally, all of this hinges upon working with a cooperative and willing landowner.

There are several notable advantages as well as limitations to land protection. On the positive side, land protection ensures long-term protection of a property. Full acquisition of the property or its development rights should ensure permanent protection. In addition, easement terms can be negotiated for any length of time, but typically range from 20 to 40 years or in perpetuity. When easements are recorded they are connected to the property deed, not to the landowner, so even if the property changes hands, the easement or deed restriction will remain in effect. Plus, landowners who choose to donate their property or an easement can enjoy significant tax benefits. Finally, the landowner and the natural resource agency or land trust can have peace of mind knowing that the property has been protected.

On the other hand, there are downsides to land protection as well. First, it can be expensive, particularly in areas that are in the most need of protection. Second, negotiating the deals requires real estate expertise and sound legal counsel, which could add significantly to the cost of the project. Third, monitoring easements over time to make sure there is continued compliance requires time and resources from an organization. In addition, land may need future stewardship that can be costly. Finally, having control over one parcel provides little or no control over neighboring or upstream land uses that could damage the integrity of the land.

RESTORATION

Restoration (rock rolling) involves bringing or putting something back into a former or original state. In the case of stream stewardship this usually involves restoring lost or degraded ecological function. Typical stream restoration tools include erosion control using vegetation planting or rip rap; installation of instream habitat such as overhead cover, deep pools, or spawning habitat; channel redesign and reshaping; and dam removal.

As with land protection, stream restoration can be extremely expensive. Intensive stream restoration work costs can range from $30,000 – 250,000 per mile. For instance, the WDNR undertook an intensive stream restoration project on the west branch of the Sugar River. The project cost approximately $218,000 and covered just less than two stream miles (R. Hansis, WDNR, pers. comm.; M. Melchior, NES Consultants, pers. comm.). Likewise, small dam removal can typically cost between $55,000 and $500,000. For example, the Waterworks Dam in Baraboo cost about $214,000 to remove (B. Graber, Trout Unlimited - Upper Midwest Office, pers. comm.). However, dam removal usually costs one-third to one-fifth less than the cost of dam repair.

The actual construction for stream restoration projects can take anywhere from one day to several weeks. The planning process takes much longer, often ranging from 3 months to a year or more. Successful stream restoration projects usually require planning and advice from a fisheries biologist and a channel design specialist. The best projects also have the services of a skilled heavy equipment operator. Generally, natural resource agencies, conservation organizations and clubs, and occasionally private landowners undertake stream restoration projects. Of course, any stream restoration project requires the cooperation of a willing landowner. Finally, stream restoration work always requires some sort of permit, usually from a state natural resources agency or the U. S. Army Corps of Engineers.

As with land protection, there are advantages and limitations to stream restoration. If done correctly it can restore important ecological function that had been previously lost or degraded. Restoration can take place on private property and the landowner need not give up any ownership or control. It can also be an outstanding way to get volunteers involved in hands-on projects. Regrettably, it too can be an expensive endeavor and requires scientific and technical expertise to maximize success. Depending on the type of techniques used, periodic maintenance or repair may be required. Finally, restoration along an isolated reach of river or stream may not address the crucial factors limiting the health of the stream and fishery. Restoration should not be used like a band-aid – a superficial solution where much greater underlying problems exist. Although, when done judiciously it can serve much like a cast on a broken bone - stabilizing and supporting critical areas allowing the natural healing processes to take place around them.

CRITERIA FOR PROTECTION OR RESTORATION DECISIONS

In a perfect world, natural resource agencies, land trusts, and conservation organizations would be able to protect all the important areas and do restoration work everywhere it is needed. Unfortunately, there are few organizations that have the financial resources to do both land protection and river restoration. Therefore, we must make judicious choices about how to best spend money on trout resources. Using sound criteria will simplify decisions of whether to use land protection or river restoration in a given situation. Things that require consideration in making this decision include: the conservation objectives for an area, the location of the site in a watershed, the health of the resource and ability to control limiting factors, available expertise and financial resources, opportunities for partnerships, and landowner willingness.

Conservation Objectives

Before making decisions about whether to protect or restore an area, it is extremely important to have a firm grasp about the condition and potential of the site as well as the influences from the larger landscape. Knowing what problems need to be addressed and what your organization hopes to achieve in an area will determine the conservation objectives.

Setting conservation objectives for a larger project area – a watershed, for instance – will help determine the most appropriate decision for a particular site and should guide all subsequent decisions. For instance, if there is rampant development fragmenting the landscape, protection should probably be the first priority. On the other hand, if development trends are fairly stable and there are remediable problems limiting the fishery, then restoration should probably be the top priority. Each opportunity that presents itself must be critically analyzed to determine if it will meet the conservation objectives, otherwise it could mean squandered resources.

Location of the Site in the Watershed

Where the site is located in the watershed might also influence a decision about whether to pursue protection or restoration. Headwaters areas are the usually most sensitive and important areas in a watershed, influencing the health of the rest of the river system. Therefore, in headwater areas protection should be a top priority. Along the lower reaches of a stream or river, the conservation objectives will help determine the most appropriate action. Protection is a good course of action if the new area expands upon existing protected areas or if the physical in-stream conditions are fine. Restoration should be explored if there are in-stream conditions that can be repaired and other limiting factors can be controlled or mitigated.

Health of the Resource and Ability to Control Limiting Factors

Knowing the general health of the resource helps to determine conservation objectives and make decisions about whether to restore or protect a site. It is necessary to identify the factors limiting the health the stream or fishery and assess your organization's ability to help address those limiting factors. An entire river system could be degraded because of land use practices that lead to excessive run-off and high peak flows. The river will likely have problems with unstable flows and temperature, and sedimentation and erosion. In this case it is most important to begin with protection and to work in concert with other land use improvement programs. Otherwise, restoration efforts will have a very limited impact. On the other hand, if limited reaches have very specific problems that can be addressed by current restoration technologies, then restoration work should be pursued. In-stream habitat such as overhead cover, spawning beds, and deep pool and riffle habitat can be recreated with appropriate techniques. Channel redesign and streambank erosion control can be a good investment if neighboring and upstream land use health is satisfactory.

Available Expertise, Resources, and Partnership Opportunities

Available resources will play an enormous role in an organization's decision to pursue land protection or stream restoration efforts. What is the mission of the organization? Does the mission specifically emphasize protection and/or restoration? Does the group have access to legal and real estate expertise, or are there better linkages with area fisheries biologists and channel restoration specialists? Are there other conservation groups or natural resource agencies that might be interested in being partners on the project? Is the funding available to follow through on either protection or restoration work? What grants or potential donors are available to help raise the necessary funds, and what are their main objectives? Are there volunteers that could help with the labor and reduce project cost? The answers to these questions will help determine whether it makes more sense to engage in land protection or restoration for a specific site.

Landowner Willingness

Last, but certainly not least, a great deal depends on the wishes of the private landowner. They may be happy to sell, donate, or provide an easement for their property. If protecting the property will help meet the conservation objectives, then that is a clear choice. On the other hand, many landowners do not wish to give up any control of their property, but are glad to support restoration activities. Likewise, if restoration on that property will further the conservation objectives then that opportunity should be seized. Even if a landowner offers to

cooperate on a protection or restoration project, it should not automatically be accepted unless it will meet the conservation objectives for an area. Resources are too precious to waste on unnecessary work.

CONCLUSION

There is no simple formula to making a decision about whether to protect or restore a particular area. Each situation will require a unique analysis, but these criteria increase understanding of the benefits and shortfalls of each approach in a specific site leading to more strategic land protection and river restoration decisions. Ideally, a strategic combination of protection and restoration efforts yields the best results. And the rewards can be great – a healthier and more attractive landscape, a healthier stream and fishery, clean water, and improved recreation opportunities for canoeing and fishing among other things.

Private Land, Public Fishing:
The Joys and Frustrations of Owning Land Along a Trout Stream

John VanVliet[1]

Abstract - In 1997, I acquired a 200-acre farm in southeast Minnesota with approximately two miles of trout stream flowing through it. The portion of the stream on my farm has a permanent fishing easement and is a popular destination for local anglers, which has resulted in a rich and sometimes tragic history. Since buying the property, I added new conservation easements, enrolled tillable acres in the Conservation Reserve Program (CRP), and made improvements in wildlife habitat in the uplands. Since I became a landowner with a permanent fishing easement attached to the deed, my perspective on public fishing access has changed. I have also had to battle a local government over plans for building a public road along the stream. I will give a brief history of my farm, discuss the pros and cons of private land ownership, and give my perspective on the responsibilities of landowners and anglers. Whether you are dreaming of owning land along a trout stream, or are content to fish on other people's land, or are responsible for managing the public resource, I hope to give you a fresh insight into the complex issues of public fishing access to private land.

Thirty miles southwest of where we are meeting today, in a quiet valley rimmed with limestone bluffs and filled with remnants of the once-vast Big Woods, lie 220 acres, give or take, to which I hold title. If you stand atop the hill I call High Meadow, with your back to the Big Woods, you can trace the course of Wisel Creek as it flows through the farm in a broad arc nearly two miles long from where it enters the property in the southwest corner to where it leaves the farm in the northwest corner.

The property was once a handful of smaller farms, an old grist mill and even a settlement called Chickentown. All are gone now, and little remains to indicate to the passerby the rich and tragic history of this quiet valley, nor the current struggle to protect the creek from the local town government's plan to build a road along its banks.

Wisel Creek was not always known by that name. The creek was a major tributary to the Root River to the north, which the Lakota Sioux called the Hokah or Hutkan, meaning "root." Early white settlers called this tributary the South Fork or, more commonly, Chickentown Creek.

In 1832, the U.S. government, tired of the squabbling of four rival Native American groups in the area and eager to open the area to settlement, commissioned an army officer named Nathan Boone to draw a line from a point here in LaCrosse, Wisconsin, to what is now Clear Lake, Iowa, one hundred miles to the southwest. Boone, the youngest son of the legendary Daniel Boone, led a group of soldiers and surveyors across the heart of the Driftless Area and into the Big Woods, cutting a physical line on the landscape. This line, designed to delineate the U.S. territory to the south and Indian lands to the north, passed scarcely two hundred yards from the corner of our farm. The line, which crossed the creek in several places, attracted Native Americans and white settlers alike. As a result, early white settlement in the valley was on the creek immediately along this line. The Native Americans continued to hunt and travel along the line, and as recently as the beginning of the 20th century, buried their dead

[1] 1Landowner, Trout Angler, and Fly Fishing Author, Eagan, MN.

chiefs in our high meadow overlooking the creek.

By 1866, the creek was the focus of settlement in the area. There was a string of grist mills along the stream, and the curiously named town of Chickentown boasted a church, a number of houses and a drinking establishment or two. Downstream, to the north of our farm, the Wisel family worked a small acreage and had built their house on the banks of the Chickentown Creek.

On the afternoon of August 6, 1866, the Wisels were hosting a large family gathering at their place on the creek. After sunset that night, a storm erupted on the prairie to the west and rolled over the valley. No one knows how much rain fell on the 300-square mile watershed of the creek, but it filled the deep, narrow valley and breached the mill dams one by one. A wall of water more than twenty feet high swept down the valley, washing away an entire family and leaving behind a stream with a new name and a new respect. Today, the common grave of the Wisel family, marked by a single cracked headstone, stands on a gentle slope high above the creek a mile from the nearest road, and all but forgotten except by the handful of locals who know how the creek got its name.

In 1924, in his report to the Minnesota State Game and Fish Commissioner, biologist and superintendent of fish propagation, Thaddeus Serber (1924), wrote that Wisel Creek was "a considerable creek, with several spring-fed tributaries, rising in the forested valleys near canton and prosper." But he noted that the high water mark was 16 feet, "doing considerable damage" and making it "questionable" for trout stocking. Nonetheless, the state stocked the creek and in 1981 acquired a permanent fishing easement on both sides of the creek for the princely sum of $20,200 - practically the value of the entire 230-acre farm, as it was then. Today, despite continued floods, the creek routinely produces some of the largest brown trout in the region and attracts anglers from as far away as the Twin Cities, Des Moines, Madison and Chicago.

When I purchased the farm in 1997, the current owner had harvested some of the best old growth from the Big Woods on the south side of the creek. And, though the ninety or so tillable acres had been enrolled in the Conservation Reserve Program (CRP) for a decade, he'd paid each year to pull much of it out of the program and hay it. This repeated haying reduced or eliminated its value as nesting cover. He had allowed unlimited hunting and camping on the land, which resulted in a recorded harvest of 23 deer in the valley in a single season. This unlimited permission also resulted in heavy fishing pressure. We heard stories of fishermen who would camp on the farm for days, and each day catch their limit, eat it for breakfast, then harvest another limit for their freezer. The remote and isolated character of the property only encouraged violations of game and fish regulations.

During our first season on the farm, we repaired several miles of barbed-wire fencing, reseeded eroded hillsides, and dramatically limited the number of hunters. We retired an old creek crossing and re-enrolled the tillable acres in CRP. And we met with Jim Wagner and Steve Klotz of the Minnesota Department of Natural Resources (MNDNR) to begin to develop a plan for improving the creek habitat for trout.

We drafted and recorded our own conservation easements limiting future development and restricting further subdivision of the property. With the proceeds of the CRP, we put in food plots and planted trees. As a result, the pheasant and deer populations have rebounded, turkeys and grouse are plentiful, and the bird population in general has improved dramatically. We continue to welcome anglers, but we keep tabs as best we can on their harvest, and encourage catch-and-release.

A fairy tale ending for a wasted old farm? Unfortunately, not yet.

For nearly as long as I've been a trout fisherman, I've fished other people's land. As a writer and publisher, I've been fortunate enough to have been invited to fish some of the finest private water in the world. I have fished a royal chalk stream in southern England, Tom Brokaw's 48,000-acre ranch in Montana, and the million-acre estancia of the Benetton family in Patagonia. But I've always resented posted water. I wrote a magazine article several years ago critical of private water that prompted the angriest response I've ever received. I used to rail against private waters by pointing out that the United States had revolted against England

in part because, under British Rule, the Crown owned everything from the fish in the streams to the swans in the sky.

Then I bought my own land, and everything changed. One morning, not long after I bought the property, I awoke to find two older gentlemen fishing in the very spot I'd planned to fish. What's more, they had built a fire on the bank with oak from my woodpile, oak I had cut and split myself. But there was a fishing easement on the stream. I couldn't chase these two old men off; I could only scold them for stealing my firewood.

Later that season, I met a husband and wife flyfishing along the stream. It was the wife's first day with a fly rod and they had packed a picnic lunch. I enthusiastically pointed out a place where I knew they could catch fish. They thanked me and hiked on to where I had pointed them. A few hours later I saw them coming back. They had both caught fish and the wife was ecstatic. They thanked me and walked happily around the hill, back toward their car. Buoyed by their high spirits, I grabbed my fly rod and hiked downstream to where they had been fishing. But I couldn't believe my eyes. There on the bank was the remains of their picnic lunch, including two empty beer bottles sitting in the grass.

Suddenly, I understood why private land gets posted. It doesn't happen right away, but it almost always happens. And I, like the older couple, may have been unwittingly responsible. Thinking back over the years, I don't think I ever left a beer bottle along a stream, but I'm sure I did something to upset a landowner. Maybe I failed to latch a gate properly, or dropped a plastic spool of tippet material; maybe I caused a dog to bark too early or too late; maybe I took a shortcut across a May cornfield, or parked in front of a farmer's mailbox. But now I see. I try to remember my humble roots when I see fishermen crossing my land, but it's becoming more difficult. Anglers seem increasingly thoughtless toward landowners these days. They seem to believe, as I may have once, that a fishing easement grants broad rights - to fish, to linger, to camp, to drive, to litter, to own. Given the chance, I don't think I would revoke the fishing easement, but if I could go back to my pre-landowner days, I'd like to believe I would be more respectful.

On balance, the pleasure of owning such beautiful land outweighs the burden of public access, but the greatest test of my rights as a landowner is currently being played out in the Fillmore County courthouse.

For more than forty years, a locked gate has stood across an old field road that runs along the creek on our farm. Before we purchased the property, the field road had been used occasionally and with permission by a small group of the previous owner's relatives who owned land downstream. But the old field road was eroding into the creek and the folks downstream had another way in, so we asked them not to use the old field road, and they agreed. For almost a year and a half, the old gate and trail went unused. Just before deer season, we sank two new fence posts and sealed off the old gate to prevent trespassing. Two weeks later we received a letter from the local town board stating that we had blocked a public road, and they wanted us to remove the fence. We asked them for evidence of the alleged road, but they were unable to produce any. Then, suddenly, we discovered that someone had torn down our fence, destroyed the gate, and had begun bulldozing and graveling a road across the farm. We went to court to secure a temporary restraining order, and the Fillmore County judge quickly granted one. Then we filed suit against the township seeking damages and a permanent injunction.

To date, the township has been unable to produce evidence of a road across the farm, but the greater issue is with the authority of the MNDNR and the trout stream itself. This alleged road, were it allowed to be built, would fall within the MNDNR easement for almost a mile, and would in fact cross the creek at one point. The MNDNR is not willing to acknowledge the road for a number of reasons. First, it is against the law for the MNDNR to spend public money to acquire an easement where the public already has access. If there was a road along Wisel Creek when the landowner was paid more than $20,000 for an easement, then that money was paid out illegally. Either the MNDNR erred, or it was defrauded. Second, any new road construction would threaten a designated trout stream which is slated for habitat improvement work. Third, we've already established that the high water mark is at least

16 feet, and perhaps over 20 feet. The recent flood in June of this year reached at least 15 feet and did considerable damage to the property and the old trail.

All of this has fallen squarely on our shoulders as landowners. So far, we have spent over seventy-five thousand dollars in legal fees to fight this road, with no end in sight. The MNDNR has not yet taken a position in this dispute; we hope they will join us in protecting a stream they once deemed valuable enough to designate as a trout stream and on which they secured an easement. The outcome of this case will determine not only our rights as landowners, but your rights as the fishing public and as stewards of the stream. Can a township build a road across private property within the boundaries of a fishing easement? We'll see.

One hundred years from now, mine will be little more than a name on an old abstract of an older farm along a quiet stream in a wooded valley in the Driftless Area. If my efforts have had any lasting effect, there will be pheasants in the high meadow, grouse and deer and turkeys in the Big Woods, and wild trout in the stream. There will be no road along the creek, and the old gravel creek crossing will be indiscernible in the streamside vegetation. Perhaps an angler fishing the stream will pause and look around and see, as I did one hundred years earlier, that it is a place worth fighting to protect.

Aldo Leopold, who honed his conservation ethic on an old farm not far from here, once wrote:

> *"The privilege of possessing the earth entails the responsibility of passing it on, the better for our use, not only to the immediate posterity, but to the unknown future."*

That is my goal as a landowner and as an angler. I hope it will be yours as well.

REFERENCE

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Limited Entry to Public Trout Water: The Connetquot Experience

Gilbert Bergen[1]

Abstract - The Connetquot and Nisequogue rivers flow through state park lands on New York's Long Island, and are within 100 miles of 30 million people. Historically, these fisheries were controlled by private fishing clubs, but for the past 27 years public angling access to these waters has been available through a system of reservations and fees. Anglers may reserve fishing sessions by phone with fishing sites assigned on a first-come, first-choice basis on the day of the reservation. Angling fees are used to defray the costs of management, including hatchery operations and stocking. Because of this system, a quality angling experience has been maintained in proximity to a large urban area. Controls on angling access have also helped protect sensitive wetlands, endangered species, and allowed parks to be managed for multiple resource use. Special efforts have been necessary to establish local support and public acceptance of the angling reservation system and fee structure as well as resolving complaints and conflicts between user groups.

The Connetquot River State Park Preserve is located near the hamlet of Oakdale, New York, on the south shore of Long Island. Long Island is a drift of material deposited by glacial activity on the North American continent. The Island is 120 miles long and 16 to 20 miles wide. The south shore is typical of a glacial outwash plain. The barrier beach is washed by the Atlantic Ocean, with bays and marshes behind the dunes. The many streams and small rivers feeding into the bays are fed by the rains that fall on the island, and gradually filter out through this great sand sponge. These pure waters were ideal habitat for brook trout (*Salvelinus fontinalis*) that sometimes went to the brackish waters to feed.

As early as 1700, the Connetquot was harnessed for use as power for a grist mill by William Niccoll, first proprietor of Islip Grange. The resulting pond formed by the damming of the stream for the mill also provided excellent habitat for trout, and by 1820, anglers were coming to Snedecors Tavern for the fishing.

After the Civil War, the fishermen found they had trouble getting a room at the Inn, so they did the only logical thing; they purchased the property and most of the watershed. On April 6, 1866, the South Side Sportsmen's Club of Long Island was chartered. This Club was made up of wealthy sportsmen who enjoyed fishing and shooting along the Great South Bay of Long Island. As true conservationists, they improved the area, established a trout hatchery on the property in 1868, and gradually increased their holdings to 3,473 acres to protect the watershed. The club survived until 1963, when the property was purchased by the State of New York, with a ten-year lease-back provision. In August of 1973, the Connetquot River State Park Preserve was opened as a limited use facility with various programs for outdoor recreational activities. Programs included outdoor education, environmental interpretation, nature study, bird watching, hiking, bridle paths, cross country skiing, jogging and fly fishing for brook trout, brown trout (*Salmo trutta*), and rainbow trout (*Oncorhynchus mykiss*) for a fee.

The fee fishing program was put into effect after numerous meetings and consultations between the previous owners; Trout Unlimited; the New York State Department of Environmental Conservation (DEC); local anglers; the Office of Parks,

[1] Park Ranger, Connetquot River State Park Preserve, Oakdale, NY.

Recreation, and Historic Preservation; local historic societies, conservation organizations and neighboring landowners. Maintaining the historic nature of the property was deemed to be a most important factor in all decisions. The tradition of fly fishing dating back to the early 1800s was also considered critical to the acceptance of the rules protecting the sensitive freshwater wetlands. In addition, all other user groups voiced their environmental concerns to preserve a bit of Long Island as it used to be in the midst of urban sprawl.

The fee structure was based on the cost of maintaining a recreational resource based on a quality fly fishing experience. Thirty sites were created along the river, with each angler having the use of a site for four hours, and a limit of two trout for the session. Those wishing to catch and release fish may do so as long as they do not have two fish in possession. The current permit fee is $15.00 for each session. The number of permits sold per year averages 12,000 anglers, with revenue amounting to $180,000 per year. The preserve also provides trout for Caleb Smith State Park, with a similar fee charged for the 4,000 fishermen per season and an additional revenue of $60,000. The fees produce almost one-quarter of a million dollars in revenue annually for the State of New York.

The Preserve also provides facilities for handicapped fishing programs for the disabled, and produces trout for special fishing projects at other state parks and for the DEC. The Preserve has functioned in this fashion for the past 27 years. As we leap into the new millennium, let us hope that Connetquot River can serve as a model to protect our natural resources and historic treasures for an ever increasing population in our nation.

Closing Plenary Presentation: Integrating the Ecological and Human Dimensions of Trout Management

Robert A. Bachman[1]

Abstract - It is the role of state fisheries agencies to integrate the ecological and social dimensions of trout management. State agencies are mandated by law to act as stewards of fish and wildlife within their respective states. As trout resources respond to reclaimed habitat and progressive management, anglers are getting more involved in trout management. For anglers to be effective they must be well informed and aware of alternative management objectives. It is the duty of state trout managers to document the existing status of trout populations and to elucidate alternative, attainable management goals. More information is needed with regard to hooking mortality of trout in streams on different gear types and about the apparent conflict between fly anglers and other types of anglers on heavily fished streams in order to make informed decisions regarding alternative management strategies for this popular form of recreation.

Preceding papers at this workshop have discussed the ecological and human dimensions of trout management and the role that trout anglers will play in the 21st century. The ecological dimensions are what are commonly referred to as the physical, chemical and biological sciences of trout management. Included under that broad category are such things as the genetic make-up of the various species and strains of trout that exist in our waters, the factors that determine the carrying capacity, growth rates and structure of trout populations in lakes and streams, and the differences in the survival and interaction of trout of wild and hatchery origin. By and large the documentation, quantification and hypothesis testing involved in the ecological dimensions of trout management have primarily been the purview of the academic community. State and federal agencies have of course also contributed to this body of knowledge through field inventories and experiments that document the effects of habitat alteration and harvest under various regulatory regimes.

There is a long history of scientific inquiry into the ecological dimensions of trout and trout management, much of which was acquired the hard way - by making egregious mistakes. The introduction of the common carp (*Cyprinus carpio*) from Europe and the stocking of *Mysis sp*. in Lake Pend Oreille in northern Idaho readily come to mind. But on the whole, much has been learned and great strides are being made to restore trout populations that were severely depleted or eradicated by bad land stewardship, pollution and over-harvest.

Scientific inquiry into the human dimensions of trout management is still in its infancy and, in my opinion, much less well understood. The ever-increasing human population and the growing popularity of angling for trout, especially fly-fishing, has resulted in increased demand for trout angling and increased conflict among the various angling constituencies. At the very time that great strides are being made in restoring stream habitat for trout through enlightened environmental regulations and wise land use practices, the sheer burden of humanity threatens to overtake such gains.

It is the role of state fisheries agencies to integrate the ecological and social dimensions

[1] 1Director, Fisheries Service - retired, Maryland Department of Natural Resources, Annapolis.

of trout management. State fisheries agencies, under various state administrative structures, are charged by law as stewards of trout populations in this country. Fish and wildlife in the United States are common trust resources owned by all the people in common. Balancing the desires of these "owners" and the impacts on fish and wildlife resources brought by the growing numbers of these very same people is a very challenging job. The successful fisheries administrator must have a good understanding of fisheries science, social science and politics. He or she must know and understand enough of the ecological dimensions of trout management to assess the limits and options available to the anglers and to communicate these options in a persuasive manner. It is simply not enough to ask the anglers what they want. The anglers must first know what the options are. It is the job of the fisheries manager to provide that information.

All too often anglers take what I would characterize as a "FIRE, AIM, READY" approach to trout management. They are quick to seize on a solution without an appreciation or even any thought of what they want to achieve. As a result, fisheries managers may, under pressure from top-level administrators or legislators, implement regulations designed to appease a particularly vocal or influential group only to find that the issue has been aggravated to the detriment of the resource. This has a snowball effect resulting in distrust and antagonism between the anglers and the fisheries agency.

So why do anglers sometimes make unreasonable demands on fisheries managers? Why are fisheries managers sometimes forced to implement ineffective regulations? One reason may be that some important elements of fisheries science have not yet been adequately documented. In my opinion, two of the most contentious issues remaining within trout management are the utility of minimum size limits and hooking mortality among various angling methods. For example, Allen (1954) demonstrated that minimum size limits could be used to maintain sufficient breeding stock where harvest is high but advised against the use of minimum size limits where the maximum number of large fish is desired. Wydoski (1977) cautioned that "minimum size limits may be useless in a quality fishery if repeated hooking increases the mortality of undersized or trophy-sized fish." Nevertheless, anglers often call for, and managers implement, high minimum size limits "to allow the fish to spawn at least once" only to find truncated populations at or near the size limit in effect as a result of over-harvest of quality-sized trout. On the other hand, maximum size limits and slot limits have been shown to be effective in improving the population structure and providing a greater proportion of quality-sized trout without impacting recruitment (Wells 1987).

More than 30 papers are commonly cited with regard to the hooking mortality associated with fishing for trout with artificial flies, artificial lures and bait (Taylor and White 1992). Many of these studies were designed to investigate the effects of worms and flies (Shetter and Allison 1955; Warner and Johnson 1978), worms alone (Hulbert and Engstrom-Heg 1980), barbed versus barbless hooks (Schill and Scarpella 1997), single versus treble hooks (Klein 1965), but with the exception of Shetter and Allison (1958), and Pavol and Klotz (1996) few have attempted to directly investigate the differential hooking mortality of wild trout in streams caught on artificial lures and flies. In his wide-ranging review of the hooking mortality literature existing at the time, Wydoski (1977) reported a mean hooking mortality of fish (NOT JUST TROUT) caught on artificial flies of 4.0% (range 0.0 to 11.3%) and artificial lures of 6.1% (range 1.7 to 42.6%). A second study by Mongillo (1984), more narrow in scope, based on essentially the same literature but including studies involving only salmonids, concluded that there was no difference in hooking mortality between trout caught on flies and lures. Fisheries managers, sometimes under pressure to be "politically correct", or not wishing to antagonize a portion of their constituency, commonly cite one or both of these papers to justify their position, failing to observe or take into account that the numbers were averages of many studies and that important underlying data were thereby obscured.

Few of these studies reflect actual angling practices commonly used today for wild trout in streams. Many involved hatchery fish, fish that were electrofished and held in hatchery

raceways, fish not fed so they would be easier to catch or fed with worms for a week so that they "readily accepted the baited hooks when the experiment started," and fish intentionally allowed to take the bait deeply (Mason and Hunt 1967). Still others used hatchery-reared landlocked salmon (*Salmo salar*), caught and released in a hatchery until "by the end of the day, it was difficult to catch a fish despite the presence of over 4,000 salmon in the raceway" (Warner 1976). The latter report goes on to say "the salmon took the worms very gingerly and rarely ingested the bait." In this study, there was no attempt to allow the salmon to swallow the bait and playing time was negligible. I do not mean to denigrate these fine papers, but to merely point out the danger of blindly transferring the results of these papers directly to actual angling practices or to obtain meaningful information by averaging the hooking mortality rates of fish caught under such diverse and artificial circumstances.

Of the 28 papers on hooking mortality reviewed by Wydoski (1977), only two involved wild trout caught on artificial lures or flies in a stream (Shetter and Allison 1955; 1958). None of the 79 wild brown trout (*Salmo trutta*) caught on artificial flies in these two studies succumbed to hooking injuries. A study conducted by Pavol and Klotz (1996), using procedures similar to those of Shetter and Allison, produced similar results. In their study, none of 69 wild brown trout or 130 wild brook trout (*Salvelinus fontinalis*) caught on conventional flies in a stream died as a result of hooking. By contrast, 17 of 197 (8.7%) wild brook trout in this stream (which is managed for trophy trout) died as a result of hooking when caught on Mepps and Panther Martin spinners and other artificial lures equipped with treble hooks. These results compare favorably with the 8.3% mortality of trophy wild brook trout caught on Mepps spinners and Cleo spoons, also equipped with treble spoons, reported by Nuhfer and Alexander (1989). Both papers attributed this high mortality to the tendency of the trout to engulf the treble hook causing serious damage to the gill arches and esophagus. Interestingly, only one of 40 wild brown trout (0.7%) in the study conducted by Pavol and Klotz (1996) died as a result of hooking mortality on the same artificial lures used to catch the brook trout.

Pavol and Klotz (1996) recorded catch rates during the study for each method of angling for both species of trout. They also had excellent population estimates of both young-of-year and older trout for the period in which their hooking mortality studies were conducted. Using the 8.7% hooking mortality rate, they calculated that at a catch rate of 1.7 trout per hour, 50% of the adult population of brook trout estimated to reside in the 3.2 miles of stream would be lost each year as a result of hooking mortality with artificial lures by a mere 13.5 angling hours per day.

The meta-analysis of hooking mortality conducted by Taylor and White (1992) showed that brown trout had lower mortality rates than other species of nonanadromous trout, undoubtedly strongly influenced by the two papers by Shetter and Allison (1955, 1958) included in their analysis. Of all the hooking mortality studies conducted to date, only two, Shetter and Allison (1958), and Pavol and Klotz (1996) compared the hooking mortality of wild trout caught on flies and lures in streams directly, and both reported no hooking mortality of wild brown trout caught on flies. The large difference in the mortality of wild brook trout caught on artificial flies and artificial lures in the Savage River and the high mortality reported by Nuhfer and Alexander (1989) cast doubt on the existing conventional wisdom: "There are no differences in hooking mortality between any artificial lures or flies, with or without barbless hooks on any salmonid species" (Mongillo 1984).

Why have so few studies been done on this very important aspect of fisheries management? I suspect there are at least three reasons: 1) there is the mistaken idea that this information already exists; 2) it is a potentially explosive, contentious issue; and 3) it is costly, time consuming and difficult to obtain adequate sample sizes for wild trout in a stream. Many experienced anglers, the very ones upon which trout managers must depend for support, suspect that in some cases lures cause a greater hooking mortality than flies, but they too, for social reasons are often reluctant to speak up for fear of being labeled as "elitists." The result is distrust of the fishery manager.

A number of authors have contended that hooking mortality, even with the use of bait,

is not likely to be significant at the population level. Carline et al. (1991) concluded that hooking mortality associated with bait fishing "had to be relatively low" for the fishery to support the high densities of brown trout and high catch rates in a catch-and-release stream in Pennsylvania. But the length frequency data presented in their study showed a marked decline in the number of trout greater than 350 mm in length after catch-and-release went into effect. Hooking mortality would have the most pronounced effect on larger, older fish because of the higher risk associated with multiple captures over a number of years. Bachman (1984) showed that wild brown trout in a highly fertile stream such as the stream studied by Carline et al. (1991) are much older than scale analysis indicates.

The conflict among trout anglers is further exacerbated by an unwillingness on the part of fisheries managers and angling organizations such as Trout Unlimited to acknowledge, at least formally, that there are legitimate differences of preference and attitude among fly anglers, spin (or lure) fishermen, and anglers who use bait to fish for trout. I believe that if these differences were documented and acknowledged, fisheries managers would have less difficulty in properly allocating resources among these important angler groups. It was said earlier in this workshop that there are important philosophical differences among these three groups. I would state it differently. I propose, rather, that these groups have very different, but equally legitimate and obtainable goals. Most anglers who use bait to catch trout are interested in taking some fish home to eat. So, too, are many, but perhaps a smaller proportion, of lure anglers, who, with increased skill, can and often do catch as many or more trout than bait fishermen. Although many fly anglers also want to and do eat trout, a growing number of these anglers voluntarily release most or all of the trout they catch, and they seek out waters that are managed under special regulations such as "catch-and-release."

Although some of these angler preferences are beginning to be documented in angler surveys, what I have never seen documented is the social conflict that arises among these three angler types. My experience has been that there is little conflict between lure or "spin" fishermen and bait anglers. Both methods are similar enough to minimize conflict, especially with respect to space. But flyfishing is another matter. Most flyfishers are quite conscious of the need to give other flyfishers time and room to fish effectively. I believe that anglers who are not familiar with flyfishing are no less polite or considerate than fly anglers, but are simply not aware of the different needs of the fly angler. The technique of flycasting, so different from any other form of angling, sets the fly-angler apart, and this technical difference undoubtedly affects and reflects the attitude of the angler.

Failure on the part of fisheries managers to acknowledge this fundamental difference in angler characteristics has, I think, been a principal cause of conflict within the angling community, setting flyfishers at odds with other anglers and with trout managers. This has, in turn, led to stereotyping the fly-angler as being "elitist" and the fly-angler, often in anger, denigrates other types of anglers and fisheries managers. It is time, I think, for fisheries managers to accurately document and acknowledge the different impact that bait, lure and fly angling have on trout populations, especially in streams, and use the newly acquired stakeholder processes to resolve these issues.

There is much more that anglers can do to help fisheries managers restore trout fisheries and to provide an equitable allocation of the resource among the various angling constituencies. Anglers need to better understand the function of the fisheries agency. They need to be aware of how the political process works, and assist the fisheries manager in his or her endeavor to protect trout habitat from the pressures of development and competing demands for water such as irrigation, electrical power generation, and mining. All too often the angler assumes that the fisheries manager has a veto power over such destructive actions and should just say no. This is not only unrealistic but it undermines the relationship that should exist between the angler and the manager. More than ever, it is paramount that fisheries managers and anglers work hand-in-hand to identify the fisheries issues that need to be addressed and to seek workable solutions.

Most governors and agency administrators dislike conflict. We often hear at workshops that one of the goals is to minimize conflict. Conflict is a way by which important issues are identified. It is not, in itself, a bad thing. Conflict can be minimized in two ways: remove the source of the conflict by addressing the issue in a constructive way or paper over the issue by downplaying its importance. The first approach leads to progress, the latter often harms the resource. Anglers can help fisheries managers by demanding that real problems be addressed, not merely dismissed as social issues too difficult to address.

Anglers need especially to be quick to recognize a bias on the part of one or the other parties in a dispute. Contrast, for example this statement: "We will do everything we can to help you mine your coal (or cut your timber or build your road) with the least impact on the trout resource," with "We will do everything we can to protect the trout resource with the least impact on your ability to mine your coal." In the first instance, coal mining takes precedence over protection of the trout resource, whereas in the second instance, protection of the trout resource is paramount. But even in the second instance, "everything we can" may be "nothing." In such cases, compromise inevitably results in a lost resource. But compare the above with "We *will protect* the trout resource with as little impact as possible on your ability to mine coal..." (or build the road, etc.). That constitutes a commitment.

I think it is important that managers and anglers alike take note of the tremendous gains that have been made in trout management within the past 40 years. There have been major paradigm shifts associated with the recognition that wild trout can no longer be thought of primarily as a commodity but as a treasured recreational resource. I think there is a tendency among many managers and anglers to make problems and issues appear more complex than they really are. I urge all people interested in the art of trout management to engage in open, direct and vigorous dialogue. Clarify the issues. Say what you mean and mean what you say. Stand up for what you believe and above all, guard against compromise when protection of the resource is at stake. There is much to be gained and much to be lost.

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Trout and the Trout Angler II: Summary

David Zentner[1]

Trout and the Trout Angler II was broadly based and peppered with presentations ranging from the private, non-profit perspective of coldwater resource management, to a conservation warden's plea for all of us to understand the difficulties enforcement faces with complex regulations, to a property owner's plea to incorporate into the "picture" property owner rights, concerns and interests. Demographics, social patterns, and watershed management were all key areas. A field trip to visit excellent habitat improvement work and a great steak fry, both coordinated by Dave Vetrano of the Wisconsin Department of Natural Resources (WDNR), topped off an outstanding time in LaCrosse, Wisconsin. However, we missed more anglers than we would have liked to miss. Workshop organizers are now considering strategies for bringing more anglers into the next conference, but that awaits another day.

A hallmark of this workshop was its emphasis on variety. It also emphasized the vital connection we have with understanding our history if we are to put appropriate management formulations into proper perspective today. We were reminded, and we need to be reminded, that while adequate human and financial resources are imperative to improve trout fisheries, there are no quick fixes. Reliance on large fiscal budgets and technology in the past have not always resulted in the rehabilitation of depressed fish stocks. We were reminded that it is extremely difficult, if not impossible, to maintain optimum fish populations over extended periods of time. We were reminded that what works very well in southeast Minnesota and southwest Wisconsin may not be successful in northeast Minnesota.

A good bit of discussion centered around the issue of public access, without clear consensus being reached, except on the notion that the United States is still the world's best example of providing public access for fishing. There were some very different perspectives discussed on issues relating to the numbers and composition of people fishing. These perspectives ranged from concerns over the lack of growth in numbers of people fishing for trout, to those who felt that the resource cannot stand any more pressure and that limiting entry must be discussed soon if not immediately, to those who had concerns about under-representation by lower social/economic members of the population and by women.

Several of the presentations alluded to the danger of excessive reliance on inductive reasoning, "jumping to wrong conclusions," where specific studies or examples are extrapolated broadly to other areas where they might not apply. This issue was illustrated with a discussion of whether or not barbless hooks actually reduced hooking mortality.

In one way or another, social issues/politics formed a large part of most discussions. We discovered again that people, not science, would continue to dominate fisheries agendas. This is not to say that the people making resource decisions shouldn't incorporate the best science available into those decisions. Indeed, we were challenged to have them do so. We need to realize that each of us at this workshop is individually and collectively responsible for improving the social/science relationships.

One of the non-profit private presentations emphasized that our time is too valuable to do as we often do, which is to focus on our disagreements. We must spend most of our time on that 80% of the agenda that is mutually acceptable. The same presenter pointed out that the private groups who have dedicated themselves to coldwater fisheries are often as derelict in communicating with one another and with public agencies as are our public partners.

Politics fashions much of what is committed to coldwater resource management. It affects dollars, personnel, and citizen

[1] Izaak Walton League, Duluth, MN.

attitudes. It was generally agreed that the level of issue examination, and the manner in which coldwater issues are processed in the political sector, leaves much to be desired. Given that transactions around trout management are often badly hampered before dollars get to the resource, the results are predictable and often mediocre, featuring missed opportunities and under-supported programs. Decisions are sometimes based on politics and fifty-year-old perceptions instead of good science based on todays state-of-the-art knowledge. The workshop concluded that a great challenge in the next ten years, both for the private volunteers who attended and for the public servant partners, is to elevate the level of transactions our fisheries depend upon for survival. It is the responsibility of all of us to build close relationships with politicians and to help them understand that there is broad support for watershed stewardship and blue-ribbon, coldwater fisheries management.

The WDNR in southwest Wisconsin has done a terrific job rehabilitating habitat on Timber Coulee and elsewhere. The field trip showed an impressive example of how habitat improvement efforts can be used to rehabilitate damaged watersheds much quicker than at least I thought. It was observed during our field trip that habitat improvement projects are sometimes challenged by those in the general population who have developed an anti-management bias, who feel that the projects are too focused, too narrow, and not ecosystem oriented. This will be an increasing challenge in the future, however, it is also an opportunity to be more inclusive - both the private organizations and the public agencies charged with management must be more skilled in including these people in future projects.

Finally, it was recognized in a plenary presentation that a critical part of all this is to build an environment for our public agencies that encourages risk taking. There is no magic formula. Good, solid relationships, broad support, and mutual agendas will encourage public leaders to take risks since such an environment may cause at least a few of them to truly believe that if they go out on a limb for the best in the resource, there will be some support when the limb starts to fall from the tree.

In sum, we heard some excellent talks, had some great discussions, saw an interesting electrofishing demonstration, witnessed an actual flyfishing demonstration, and had fine company at the steak fry. There were plenty of opportunities to meet new friends and talk about all manner of trout-related activities. It was indeed a good conference, with a lot of emphasis on the “angler,” where it was needed. But with much work left to be done, let’s not wait another ten years for the next one.

Summary of Small Group Discussions

David C. Fulton[1]

One important product of this workshop included the results from small group discussions that involved all attendees. There were two sets of small group exercises. One set focused on identifying and prioritizing ecological and biophysical issues that are of most importance for managing trout and trout anglers. The second set focused on identifying and prioritizing the social, "human dimensions," issues that are of most importance to trout and trout angler management. Five separate small group discussions were conducted for each topic area for a total of 10 sessions. These small group discussions were conducted using the nominal group process procedures detailed below.

This process was designed to elicit a list of Top 7 priorities from each group on each set of topics as well as to keep track of all issues any individual felt was important (see our web site [http://www.dnr.state.oh.us/odnr/wildlife/trout workshop] for a complete listing of all issues).

NOMINAL GROUP PROCESS PROCEDURES (75 MINUTES)

- Introduce yourself and tell the group you will be facilitating the session. Prior to the session, select a person to record responses. Have your "recorder" introduce him or herself. Tell the group the purpose of the session—to generate a list of issues/concerns related to trout and trout fisheries management. Tell them everyone will need a sheet of paper and a pen/pencil for the session. The nominal group process is designed to allow everyone to participate equally and to arrive at consensus. Present the group with the question you want them to focus on. YOU should write the question ahead of time on a flip chart. Tell the group you're going to use a technique called nominal group process to generate the list, rank order items on the list, and reach consensus on what they think are the seven most pressing issues. (5 minutes)

- Allow time for each participant to silently write a list of issues/concerns relevant to the question on the flip chart. Ask them to limit each issue/concern they list to about seven words. (10 minutes)

- Proceed around the group asking each individual to give you one of the issues/concerns they have listed on their sheet of paper. The recorder writes the issue EXACTLY as the individual gives it. DO NOT NUMBER OR LETTER THE LIST. Doing so gives the appearance of ranking issues/concerns. If the individual gives you a paragraph, ask them to say it in seven words. Continue going around the room from one individual to the next until you have exhausted the issues on everyone's lists. During this part of the process, DO NOT allow discussion of any issue/concern. (20 minutes)

- After all the issues/concerns are listed, tell the group they may now ask for clarification of any issue/concern listed. Anyone can clarify or ask for further clarification of an issue/concern. It does not need to be the person who originally gave it. Don't let any one person monopolize the discussion. Clarification may result in combining some issues that are listed, BUT you can combine the issues/concerns only if EVERYONE agrees. If one person does not think they should be combined, then you cannot combine them. (20 minutes)

- Once issues/concerns have been clarified, you ask each individual to look at the list and write down the seven issues/concerns

[1] 1Assistant Unit Leader, Minnesota Cooperative Fisheries and Wildlife Research Unit, University of Minnesota, St. Paul.

that they feel are most important. When they have done this, ask them to give the issue/concern they think is most important a "7", the issue/concern they think is next most important a "6" and so on. Once this step is completed, have them get up and put their numbers opposite the relevant issue/concern on the flip charts. (10 minutes)

- After everyone has completed this step, sum up the individual scores given to each issue/concern. When you have each issue/concern's score, circle and label from 1 to 7 the top seven scores. The issue/concern with the highest total score is #1; the issue/concern with the seventh highest total score is #7. (5 minutes)

- Call the group back to order, have them consider the ranking. Ask if anyone has strong objections to the ranking. Ask if the list reflects what they think. If it does, the process is completed. If it doesn't, ask them what they think you should change. (5 minutes)

RESULTS

Results for both sets of small group discussions are summarized for each group in the following sections. Topics are ranked according to the sum of scores they received (in parentheses).

Ranking of Ecological and Biophysical Issues for Trout Management and Trout Angling

Green Group

1. Land use and land cover (96)
2. Hydrology and hydrologic function (83)
3. Water quality/non-point source pollution (78)
4. Instream habitat (60)
5. Monitoring and inventory (44)
6. Genetic strains and "wild" trout (27)
7. Long range planning (25)

Yellow Group

1. Urbanization (41)
2. Habitat rehabilitation / river restoration / dam removal (34)
3. Non-point source pollution (31)
4. Riparian zone management (31)
5. Groundwater withdrawal/degradation (28)
6. Land use / farming (27)
7. Apply a watershed model for management (26)

Blue Group

1. Habitat protection (46)
2. Non point source pollution (38)
3. Urban and recreational development (32)
4. Protection of headwaters and springs (27)
5. Protecting undeveloped land in riparian corridors (26)
6. Small dam removal (24)
7. Land use practices / planning (23)

Orange Group

1. Watershed management and land use practices (53)
2. Maintain / improve instream habitat (40)
3. Non-point source pollution (36)
4. Beneficial riparian buffers are needed (30)
5. Dams (28)
6. Protecting thermal and flow regimes from landuse impacts (especially agriculture and urbanization) (22)
7. Wetland preservation (21)

Red Group

1. Erosion (especially agriculture), livestock, chemicals (35)
2. Land-use management (public and private) (33)
3. Improper riparian land-use (32)
4. Aquatic habitat protection and restoration (22)
5. Nitrogen, phosphates and turbidity (19)
6. Animal waste runoff (16)
7. Protect naturalized or wild populations (16)

Social/Human Dimensions Issues in Trout Management and Trout Angling

Red Group

1. Communication — how to translate "ologies" to practical, understandable language (17)
2. Gain input from the silent majority (16)
3. Understanding/acceptance of different values/techniques (15)
4. Recruitment of young anglers (14)
5. Identify and work with special interest groups (12)
6. Landowner/agency relations (11)
6. Educate watershed users for resource protection (11)
7. Developing trust between agencies and stakeholders (10)
7. Female participation (10)
7. Simplify perception of trout angling and what is needed to trout fish (10)

Blue Group

1. Are trout anglers satisfied with their experiences? (26)
2. Providing a variety of angling opportunities (24)
3. Matching angler groups with products desired (18)
4. Loss of clientele / kids (16)
5. Private versus public access (15)
6. Education of non-anglers about land use/ riparian issues (13)
7. Perception of elitism (12)
7. Conflicts with other user groups (12)
7. Better communication between resource managers and anglers (12)

Yellow Group

1. Education/planning for land use effects on streams (34)
2. Need human dimensions information on trout anglers (29)
3. Marketing our product to specific user groups (22)
4. Need to foster and enable advocacy for good policy (20)
5. Involving non-angler groups in habitat protection (19)
6. Acquiring public access (19)
7. Counteract anti-groups to assure opportunities (18)

Green Group

1. Public education and information (not just trout anglers) (43)
2. Politics: informed, active representation: decision-making (40)
3. Continuous communications with constituent groups (37)
3. Recruitment, retention of trout anglers, stakeholders (37)
4. What role stakeholders will play and devote proper resources to it (30)
5. Improve image of natural resources agencies and other government agencies (legitimacy, credibility) (26)
6. Angler access (25)
7. Acceptance of regulations and voluntary compliance (24)

Orange Group

1. Increasing amount of permanent angler access (28)
2. Angler recruitment (25)
3. Encouraging/funding (23)
4. Address contaminant (20)
5. Increase angler and community education (trout/watersheds) (18)
5. Funding fisheries management with general revenues (18)
5. Communication among agencies and public (18)
6. Gaining constituent confidence in agency (good science design) (14)

7. Agency survey's of constituents (market analysis) (13)

SUMMARY

Key issues concerning ecological/ biophysical issues that seemed consistent across the groups included:

- agriculture land use issues,
- urban and recreation development,
- non-point sources of pollution affecting stream quality,
- instream habitat issues,
- protection of riparian areas, and
- concerns about the effects of naturalized salmonids on "wild" trout populations.

Key issues concerning social/human dimensions included:

- improving communication with the public concerning management issues,
- improving angler access,
- recruitment and retention of anglers including a diverse population of anglers,
- understanding anglers desires and matching them to resource capabilities,
- generally understanding anglers better.

Trout and the Trout Angler II: Attendees and How to Contact Them

Name	Organization	Address	City	State	ZIP	Phone	E-mail
Anderson, Charles	MN DNR	500 Lafayette Rd.	St. Paul	MN	55155	651-297-0793	charles.anderson@dnr.state.mn.us
Avery, Ed	WI DNR	11084 Stratton Lake Rd.	Waupaca	WI	54981	715-258-3430	averye@dnr.state.wi.us
Bachman, Robert	MD DNR	Tawes State Office Bldg B-2	Annapolis	MD	21401	814-364-1391	rbachman@dnr.state.md.us
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Busacker, Greg	MN DOT	395 John Ireland Blvd, MS 620	St. Paul	MN	55127	651-284-3759	greg.busacker@dot.state.mn.us
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Crook, David A.		166777 Elk Hollow Dr.	Viola	WI	54664	608-538-3140	duraframe@mwt.net
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Franke, Dennis	TU (WI)	4765 CTH KP	Cross Plains	WI	53528		
Fulton, David	MN Coop. FWRU	U of M, 1980 Folwell Ave.	St. Paul	MN	55108		
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Marolf, David	IA DNR	22693 205th Ave.	Manchester	IA	52057	319-927-3276	
Mueller. Ross		400 S. Court	Appleton	WI	54911		
Van Vliet, John	Speaker/Author/ Landowner	895 Knollwood Ct.	Eagan	MN	55123		
Welter, John	TU (WI)	2211 Frona Place	Eau Claire	WI	54701		
Wisler, Bill	TU(WI)	2831 Mt. Hope Rd.	Dodgeville	WI	53533		