LAKE ERIE FISH COMMUNITY WORKSHOP

(REPORT OF THE APRIL 4-5, 1979 MEETING)

Edited by

Jerry R. Paine
Roger B. Kenyon

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LAKE ERIE FISH COMMUNITY WORKSHOP

April 4-5, 1979

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PREFACE

LAKE ERIE FISH COMMUNITY WORKSHOP

Lake Erie, of all of the Great Lakes, has been perhaps the most affected by changes in the drainage basin, water quality, and fish populations. While fish production has remained relatively high, the fish community has changed and the species contributing to that production have changed accordingly. Shifts in community structure and the cause of those shifts are obviously of great interest and, more often than not, concern to fishery managers. In 1976 it became apparent to the members of the Great Lakes Fishery Commission's Lake Erie Committee that the management strategies, primarily species-by-species approaches, were inadequate to deal with the challenges of managing species of common concern.

The recognition that a species-by-species approach was not adequate resulted in the convening of a workshop in April 1979. The objective of that workshop was not to solve specific problems nor to resolve major issues, but to begin to focus attention on the fish community as an interdependent whole rather than an assemblage of species functioning as a group of independent populations. This initial workshop dealt with very broad topics, including the status of the existing fish community, the current environment of Lake Erie, agency philosophies on fishery management, and the suitability of native, colonizing, and introduced exotic species as components of the Lake Erie fish community. The workshop was structured but not rigorously so. Every opportunity was provided for free-ranging discussion and consideration of all aspects of fish community management. The proceedings reflect the informal, discussion group approach - a workshop rather than a symposium,

Perceptions have changed substantially since this meeting of a small group of researchers, administrators, and fishery managers in 1979. Community management and recognition of the importance of consideration of the interrelationships and interdependence of all members of a fish commununity are, by now, rather well accepted tenets of Great Lake fishery management. This is reflected in the SGLFMP document which directs attention to "fish communities" and "fish community objectives". Recognizing that fish community objectives are now an accepted management approach, the Lake Erie Committee of the Great Lakes Fishery Commission is pleased to provide the proceedings of the 1979 workshop as background material on the evolvement of the community approach to fishery management on the Great Lakes. These proceedings are offered in the hope that this early workshop made a meaningful contribution to recognition that each species, each population of Lake Erie

AGENDA

LAKE ERIE FISH COMMUNITY WORKSHOP

Pelee Motor Inn, Leamington, Ontario

April 4, 1979

1. Introduction - J. Paine, OMNR

2. Assessment of the Lake Erie Environment - J. H. Leach, OMNR

3. A Review of the Lake Erie Fish Community of the Past with observations on the Fish Community of the Present - K. M. Muth, USFWS

4. Current Agency Management Philosophies
   Michigan - N. E. Fogle
   New York - Wm. Shepherd
   Ohio - C. Baker
   Ontario - A. S. Holder
   Pennsylvania - R. B. Kenyon

5. The Suitability of
   a) Percids - G. Isbell, ODNR
   b) Salmonids - Wm. Shepherd, NYS
   c) Cyprinids - K. M. Muth, USFWS
   d) Percichthyids - C. Baker, ODNR
   e) Clupeids - Wm. Bryant, MDNR
   f) Sciaenids - L. Sztramko, OMNR
   g) Osmerids - S. J. Nepszy, OMNR
   in the Lake Erie Fish Community.

6. Exotics in the Lake Erie Fish Community: a debate
   Moderator - A. Lamsa, GLFC
   Pro - R. B. Kenyon, PFC
   Con - G. R. Spangler, U. of Minnesota

April 5, 1979

7. Working Groups: Priorities within the fish community.

8. The Lake Erie Fish Community: reports of working groups by basin.

INTRODUCTION [1]

At the Great Lakes Fishery Commission's Lake Erie Committee meeting held in Toronto on March 1O-11, 1976, a workshop was suggested as a mechanism for developing a list of fish species to be managed for Lake Erie. In generating this list of species, consideration was to be given to the suitability of the species to Lake Erie, the use of the species and the demand for the species. Also, it was suggested that the introduction of exotics and the re-introduction of species which had become extinct, be given consideration.

Following the recommendation of the Lake Erie Committee, a workshop was held in July of 1977 to prepare a list of species to be managed. At that workshop, participants generated a list of species but were unable to place any priorities on individual species in order to provide guidance to fishery managers. In addition, it was questionable if all species in the list were actually of common concern. As a result, the list was classified as a "List of Kinds of Lake Erie Fish for Potential Management Considerations". Also, it was realized that a more structured approach with greater. emphasis on advance preparation would be required to improve on the list of species which was produced.

On March 10, 1978 the Lake Erie Committee agreed that an extension of the first workshop be held to identify the desired fish community for Lake Erie. This workshop was to be more structured than its predecessor and participating agencies would be required to make commitments to assist in preparation for the workshop if it was to be successful. Also, at that meeting it was suggested that the management agencies present their current policies relating to fisheries management.

Based on the foregoing, the purpose of this workshop is to identify the species of common concern and establish priorities within the fish community in each basin of Lake Erie. Consideration should be given to the suitability of particular species for Lake Erie and the desirability of the species by the users of the resource.

1/ prepared by: Jerry R. Paine, Ontario Ministry of Natural Resources, for The Lake Erie Fish Community Workshop, April 4-5, 1979.

Initially the workshop will take the form of a symposium; thus, providing an information base. Working groups will follow during which priorities will be placed on those species which are of common concern. The background information will include an update on the water quality of Lake Erie and a review of the fish community as it has been known historically and as it currently exists. The review of water quality and historical fish community will be at the basin level where feasible.

The fish community that may be desirable for Lake Erie is not only a function of the capability of the lake to support that community on a biological basis but is also a reflection of the needs of the users in each jurisdiction surrounding the lake. It is not assumed that the fish community best suited for the lake and the fish community desired by the users are the same. Presumably, the current management philosophies held by each management agency will reflect a compromise of the two types of fish communities as they are currently understood - whether that understanding is explicit or implicit in nature.

The expression of current management philosophies including goals, objectives and future expectations of the agency will provide a background for setting priorities within the fish community.

The presentations on current management philosophies purposefully occur early in the workshop as it is not intended that current philosophies be defended in light of the outcome of the workshop. Inclusion of agency philosophies will not only reflect societal interests when a fish complex is considered; but, it will identify differences in agency policies for resolution by the members of the Lake Erie Committee so that common strategies might be logically pursued.

In attempting to identify a fish community for Lake Erie, the species of fish which are of common concern to the agencies and people surrounding Lake Erie are to be specified. Based u on the lists of species generated for each basin (Table l) by participants at the preliminary workshop held in **1977,** I have selected seven families which I consider to contain species of common concern (Table 2). During the course of the workshop it should become apparent if some species occurring in Table 2 are not of common concern. Conversely by selecting seven families, I have omitted some species and should participants consider it appropriate, these species can be added to the list of species of common concern. The species omitted are not necessarily considered unimportant but either their importance was perceived as being of a localized nature or

their potential impact the the overall fish community of the lake did not warrant their inclusion as species of common concern. To provide background for the working groups, presentations on the seven selected families will expand on the suitability of the various species in the Lake Erie fish community.

Among those families of fish to be considered as part of the Lake Erie fish community are species which are not native to Lake Erie; however, some of these species, such as rainbow smelt, currently are prominent in the fish community. Other exotic species, e.g., some members of the salmonid family, are less obvious in terms of numbers and biomass but are of great interest to specific user groups. Some species native to the lake have become extinct and were subsequently re-introduced, e.g., sauger. While sauger are not exotic to Lake Erie, the genetics of the re-introduced stocks may relegate them to the status of quasi-exotic. **As** exotics have been introduced in the past, are being planted currently, and will undoubtedly be considered in the future, a debate on the pros and cons of exotics in the Lake Erie fish community is scheduled.

Utilizing the background information on water quality, the historical view of the fish community, the current management philosophies of agencies surrounding Lake Erie and the suitability of species of common concern (Appendix A) and giving consideration to the pros and cons of exotics in the fish community (Appendix B), participants will be asked to place priorities on those species making up the fish community of Lake Erie. Placing priorities on various species will assist in the preparation of future strategies for fisheries management on a lakewide basis.

I have used the term, “fish community”, freely throughout this introduction. In recent years! much attention has been given to the concept of fish community management but I believe some discussion of what constitutes a fish community is required prior to beginning this workshop.

According to Royce (1972):

> “Any community of organisms has a structure consisting of the physical distribution of its members and an age distribution of each of its populations. Thus, the structure of the community is the sum of the structure of each of its component populations”.

Odum (1971) describes a biotic community as:

> "Any assemblage of populations living in a prescribed area of physical habitat. It is an organized unit to the extent that it has characteristics additional to its individual and population components and functions as a unit through metabolic transformations".

First, as the name fish community implies, attention will be directed at a specific component of the biotic community. However, it is recognized that the remainder of the biotic community is taken into consideration where an understanding of relationships between components exists. Also, it is noted that Trautman (1970) listed 138 species from Lake Erie and its tributaries exclusive of the Detroit River and in this workshop only a selected few species will be discussed; thus, the fish community as treated herein is a simplification of the fish community as it actually exists.

In the placing of priorities on selected fish species, it is expected that the number of species to which a rank can be assigned will be limited. The inability to assign a rank to various species does not imply that those unranked species are unimportant in the fish community. The difficulty in ranking species may be a reflection of either our understanding of the fish community or the limitations of our system of valuation. Also, it should be recognized that the placing of priorities on species within the fish community is somewhat artificial, as the fish community functions as a unit in which all individuals have a role.

If the rank assigned to a given species is to reflect the importance of that species in relation to other members of the fish community, man as a consumer of the resource need not be considered. Ranking species in this manner will lead to the identification of a fish community which may be suited to the lake but not necessarily desired by those who use the resource.

Alternatively, rank can be assigned reflecting not only the importance of species in relation to other members of the fish community but also giving consideration to man as a consumer of the resource. Ranking species in this manner may lead to the identification of a fish community less suited to the lake but of greater benefit to man. The closer the latter ranking is to the former, the easier the task of the resource manager. While the validity of the approach may be debated, the ranking of species will provide a basis on which lakewide fisheries management strategies may be developed.

Table 1. List of species of Lake Erie fish, by basin, for potential management consideration.[1]

Western Basin	Central Basin	Eastern Basin
Walleye	Smelt	Smelt
Yellow perch	Yellow perch	Yellow perch
White bass	Alewife	Walleye
Freshwater drum	Freshwater drum	Whitefish
Rock bass	Rock bass	Coho salmon
Channel catfish	Largemouth bass	Chinook salmon
Sauger	Bluegill	Rainbow trout
Smallmouth bass	Sunfish	Brown trout
Largemouth bass	Crappies	Freshwater drum
Sunfish	Emerald shiner	Northern pike
Bluegill		Largemouth bass
Crappies		Smallmouth bass
Carp/goldfish		Rock bass
Gizzard shad		Sunfish
Spottail shiner		Bluegill
Emerald shiner		Crappies
		Emerald shiner
		Alewife

[1] Taken from the Lake Erie Committee Workshop held at Put-in-Bay, South Bass Island, July 12-13, 1977.

Table 2. Revision of species list (by family) suggested for management consideration at Put-in-Bay, July 12-13, 1977.[1]

Family	Species
Percidae (perches)	walleye yellow perch sauger
Salmonidae (trouts)	rainbow trout brown trout lake trout[2] white fish chinook salmon coho salmon
Cyprinidae (minnows and carp)	carp/goldfish emerald shiner spottail shiner
Percichthyidae (temperate basses)	white bass white perch[2]
Clupeidae (herrings)	alewife gizzard shad
Sciaenidae (drums)	freshwater drum
Osmeridae (smelts)	rainbow smelt

[1] Esocids, Centrarchids and Ictalurids were eliminated as they were not considered to be of common concern.

[2] Not mentioned at Put-in-Bay.

WORKING GROUP RESULTS AND DISCUSSION'

On the second day of the workshop, participants were divided into three working groups. Each working group was to consider a specific basin of Lake Erie and indicate the species which were desirable in the fish community and those species which were undesirable. Desirable species were further categorized into top predators and other desirable species. Working groups were to consider the above categories as they applied to a specific basin and its habitat and then along with the habitat consider the needs (or desires) of the users of the resource. The results of the three working groups are presented in Tables 3, 4 and 5. A record of the discussion stimulated by the presentations of the working groups is appended (Appendix C).

Consistent with the behaviour of individuals or groups given similar tasks, each working group attacked their problem in a different manner. Each working group considered families and species of fish in addition to those listed in the introduction. This was notable in the western basin and eastern basin groups. The working group on the central basin dealt with a less extensive number of species. The central basin group recognized the existence of the many species but considered species normally associated with nearshore habitat to be of local concern -not of common concern. The eastern and western basin groups included species occupying nearshore habitat as being of common concern as these species were felt to move between adjoining jurisdictions.

Working groups were asked to rank the species included in each category (Tables 3,4,5). Generally the rank of species within the categories reflected the relative importance of the species as viewed by the working group participants. One exception, noted in Table 5, was the top predators category considering the lake only. The eastern basin working group considered that certain species complexes were best suited to specific habitat types and the interaction of species complexes occupying various habitat types was limited. Exclusive of that example, the ranking system was employed. Species occurring early in each category were considered most important in the respective categories. As the length of each list increased, the rank assigned a species was less meaningful.

1/ prepared by: Jerry R. Paine, Ontario Ministry of Natural Resources and Roger B. Kenyon, Pennsylvania Fish Commission.

Table 3. Species of common concern in the Lake Erie fish community ranked according to their importance in the categories of desirable top predators, desirable and undesirable community species in the Western Basin.

		Consider The Lake		Consider The Lake and Fish Users	
		Family	Species	Family	Species
Desirable Top Predators	1	Percidae	Walleye	Percidae	Walleye
	2	Percidae	Sauger	Percidae	Sauger
	3	Percichthyidae	White bass	Percichthyidae	White bass
	4	Centrarchidae	Smallmouth bass	Centrarchidae	Smallmouth bass
	5	Centrarchidae	Largemouth bass 1/	Esocidae	Northern pike
	6	Esocidae	Northern pike 1/	Esocidae	Muskellunge
	7	Esocidae	Muskellunge 1/	Salmonidae 5/	sp.
	8	Lepisosteidae	Longnose gar 1/		
	9	Amiidae	Bowfin 1/		
Desirable Community Species	1	Percidae	Yellow perch	Percidae	Yellow perch
	2	Centrarchidae	Bluegill	Centrarchidae	Bluegill
	3	Centrarchidae	Crappie	Centrarchidae	Crappie
	4	Centrarchidae	Pumpkinseed	Centrarchidae	Pumpkinseed
	5	Centrarchidae	Rock bass	Centrarchidae	Rock bass
	6	Cyprinidae	Emerald shiner	Ictaluridae	Channel catfish
	7	Cyprinidae	Spottail shiner	Ictaluridae	Brown bullhead
	8	Ictaluridae	Channel catfish	Cyprinidae	Emerald shiner
	9	Ictaluridae	Brown bullhead	Cyprinidae	Spottail shiner
	10	Salmonidae	Whitefish	Sciaenidae	Freshwater drum 3/
	11	Percidae	Darters (sp.)	Cyprinidae	Carp
	12	Cyprinidae	Silver chub	Osmeridae	Rainbow smelt 4/
	13	Catostomidae	Suckers (sp.)	Salmonidae	Whitefish 4/
Undersirable Community Species	1	Cyprinidae	Carp	Clupeidae	Gizzard shad
	2	Cyprinidae	Goldfish	Clupeidae	Alewife
	3	Clupeidae	Gizzard shad	Percichthyidae	White perch
	4	Percichthyidae	White perch	Salmonidae 6/	sp.
	5	Sciaenidae	Freshwater drum		
	6	Salmonidae	sp.		
	7	Clupeidae	Alewife		
	8	Osmeridae	Rainbow smelt 2/		
	9				
	10				

1/ Localized in distribution but desirable as a predator in those locations eg. Detroit River.

2/ Rainbow smelt are undesirable in terms of their potential interaction with whitefish.

3/ Based on present use patterns.

4/ It was the feeling of the group that rainbow smelt and whitefish were incompatible and if the users were given a choice whitefish would be chosen and smelt eliminated.

5/ In the Detroit River for the users not the lake.

6/ Salmonids questioned in western basin if public were aware of the costs associated with maintaining salmonids in the western basin.

Table 4. Species of common concern in the Lake Erie fish community ranked according to their importance in the categories of desirable top predators, desirable and undesirable community species in the Central Basin.

		Consider The Lake [1]		Consider The Lake and Fish Users	
		Family	Species	Family	Species
Desirable Top Predators	1	Percidae	Walleye	Percidae	Walleye
	2	Percichthyidae	White bass	Percichthyidae	White bass
	3			Salmonidae	Brown trout
	4			Salmonidae	Rainbow trout
	5			Salmonidae	Coho
	6				
	7				
	8				
	9				
	10				
Desirable Community Species	1	Percidae	Yellow perch	Percidae	Yellow perch
	2	Cyprinidae	Emerald shiner	Cyprinidae	Emerald shiner [3]
	3	Cyprinidae	Spottail shiner	Cyprinidae	Spottail shiner [3]
	4	Osmeridae	Rainbow smelt [2]	Osmeridae	Rainbow smelt [2/3]
	5			Cyprinidae	Carp
	6			Sciaenidae	Freshwater drum
	7				
	8				
	9				
	10				
Undesirable Community Species	1	Petromyzontidae	Sea lamprey	Petromyzontidae	Sea lamprey
	2	Clupeidae	Alewife	Clupeidae	Alewife
	3	Clupeidae	Gizzard shad	Clupeidae	Gizzard shad
	4	Sciaenidae	Freshwater drum	Percichthyidae	White perch
	5	Cyprinidae	Carp		
	6	Percichthyidae	White perch		
	7				
	8				
	9				
	10				

1/ The group identified a list of species believed to be of common concern and proceeded to categorize the species on the list. Notably, the Centrarchids, Ictalurids and Esocids are not included although they are recognized as significant in localized areas.

2/ The compatibility of rainbow smelt and whitefish was discussed; smelt were accepted as the reality in the near future. Further discussion of the smelt-whitefish interaction is presented in the text.

3/ The order of importance of emerald and spottail shiners and rainbow smelt was believed to be different for different users. In Ontario, it was believed that smelt would take priority and in the United States the shiners would take priority.

Table 5. Species of common concern In the Lake Erie fish community ranked according to their importance In the categories of desirable top predators, desirable and undesirable community species In the Eastern Basin.

		Consider The Lake		Consider The Lake and sh Users	
		Family	Species	Family	Species
Desirable Top Predators'	1	Percidae	Walleye 1/	Percidae	Walleye
	2	Salmonidae	Lake trout 2/	Salmonidae	Lake trout
	3	Gadidae	Burbot 2/	Salmonidae	Brown trout
	4	Centrarchidae	Smallmouth bass 3/	Salmonidae	Rainbow trout
	5	Esocidae	Muskellunge 3/	Salmonidae	Chinook
	6	Esocidae	Northern pike 3/	Salmonidae	Coho
	7			Centrarchidae	Smallmouth bass
	8			Centrarchidae	Largemouth bass
	9			Esocidae	Muskellunge
	10			Esocidae	Norhtern pike
Desirable Community Species	1	Percidae	Yellow perch	Percidae	Yellow perch
	2	Salmonidae	Whitefish	Salmonidae	Whitefish
	3	Salmonidae	Lake herring	Salmonidae	Lake herring
	4	Cyprinidae	Emerald shiner	CYtwInidae	Emerald shiner
	5	Cyprinidae	Spottail shiner	CYwtnidae	Spottail shiner
	6	Acipenseridae	Lake sturgeon		
	7	Centrarchidae	sp.		
	8	Ictaluridae	sp.		
	9	Cottidae	Deepwater sculpins		
	10				
Undersirable Community Species	1	Petromyzontidae	Sea lamprey	omitted	
	2	Osmeridae	Rainbow smelts/	Percichthyidae	White perch
	3	Clupeidae	Gizzard shad		
	4	Clupeidae	Alewife		
	5	Sclaenidae	Freshwater drum		
	6	Percichthyidae	White perch		
	7				
	8				
	9				
	10				

1/ This Species was considered to lnhablt nearshore waters and as such would not interact to a large extent with Species found in other habitat types.

2/ This species was consldered to inhabit deep water and as such would not Interact to a large extent rlth species found in other habitat types.

3/ This Species was consldered to lnhablt tributary and Bay areas and as such would not interact to a large extent with Species found In other habitat types.

4/ Too predators were not catagorized on a priority Basis as the group felt that it was more appropriate to deal wlth species complexes nhlch occupied varlous habltat types (see footnotes 1, 2, and 3).

5/ Ralnbow smelt nas Included here as its removal would be conducive to the re-establishment of the herrlng-lake trout assoclatlon.

Individuals participating in the working groups expressed a range of concerns regarding the ranking exercise. Some individuals felt that ranking species as to their suitability in the fish community without regard for the users was relatively easy when compared with the same task considering the needs or desires of the users. The reason for this feeling was that agency philosophies which were in part reflective of the desires of the users were in conflict. Alternatively others felt that dealing with user desires made the exercise easier as experience with users had provided insight into their perceived needs. Regardless of whether users are considered or not, the ability to rank species with respect to their importance in the fish community is limited by the understanding of species interactions within that community.

The task of ranking species as to their desirability in the fish community without regard for the users was formidable in that without reaching for a fish community which meets the need of the users of the resource, there is no incentive to manage the fish community. In addition, it may be argued that the fish community best suited to Lake Erie under the current environmental conditions and stresses is in fact the community which exists at this very time. The ranking exercise which considered the lake exclusive of the users was, to say the least difficult, as it is unlikely that participants could evaluate the system without being influenced to some extent by the known desires of the users of the resource. An example to support this contention is present in that each working group included freshwater drum in the undesirable species category when considering the lake exclusive of the users. Freshwater drum, while acting as a predator on and competitor of species considered desirable to the users would appear well adapted to Lake Erie as they have been a component of the lake's fish community throughout its recorded history. The above critique is not intended to discredit the overall results of the exercise but to point out that even when a conscious effort is made, it is difficult to think in terms of the fish community without some consideration for the resource users.

Two topics for discussion arose in attempting to list the fish community suited to the lake without regard for the users. The first is the inclusion of two cyprinids, the emerald shiner and spottail shiner, in the category of desirable community species. Each working group included these species in that category. Based on the presentation by Ken Muth (Agenda item 5C) and group discussion throughout the workshop, the general concensus was that these two species play an important role in the fish community as forage animals. The fact that these species act as forage was never disputed but their relative importance as part of the fish community was more than once the topic of discussion. As

scientists and fishery managers, the workshop participants intuitively placed a great deal of importance on these species but the scientific data required to support these feelings were severely lacking. Further, these species, particularly emerald shiners, support sizable baitfish fisheries but the information pertaining to these operations is sparse and lacks the uniformity required for proper evaluation of these fisheries on a lakewide basis. In brief, the concensus was that more research and assessment effort should be expended on emerald and spottail shiners.

Another topic that prompted discussion was the rehabilitation of whitefish. The working group considering the fish community in the central basin was not prepared to consider the rehabilitation of whitefish under current environmental conditions and they felt that rainbow smelt were the reality. The working groups considering the western and eastern basins took a more optimistic approach and included whitefish in their lists of desirable community species; however, there was agreement that habitat improvement was a prerequisite. Habitat improvement in the central basin referred to hypolimnetic waters which currently exhibit low oxygen levels seasonally.

The condition of whitefish spawning shoals in the western basin was questioned but the current suitability of these areas for whitefish spawning was not established.

Regardless of the suitability of habitat for the rehabilitation of whitefish, the presence of rainbow smelt was considered a deterrent to rehabilitation of whitefish. At some point in the future when habitat is more conducive to the rehabilitation of whitefish, rainbow smelt may no longer preclude the occurrence of whitefish but control over the smelt population will probably be required to allow the resurgence of whitefish. While it was presumed that habitat would require improvement before whitefish could be rehabilitated, it was not determined at what point rehabilitation efforts on the part of fisheries managers should begin. There is an apparent need to determine the degree to which habitat must be improved and when that point is reached, methods of reducing the smelt population would logically follow. If the habitat was not sufficiently improved to allow whitefish to thrive and at the same time rainbow smelt were severely stressed, no gain would be made and a viable commercial fishery would be jeopardized. Also, any attempt to shift the emphasis of the commercial fishery from rainbow smelt to whitefish will require modification of user patterns and this in itself would be a major task in that the instrument used to subdue rainbow smelt would presumably be the commercial fishery. Encouraging an industry to effect the demise of one species which currently supports that same industry with the intent of making a more desirable target

species available would require fisheries managers to have a great deal of confidence in the ability of whitefish to recover.

Throughout the workshop, attention was directed at the role of salmonids, other than whitefish and lake herring, in the Lake Erie fish community. Species receiving the greatest attention were lake trout, primarily in the eastern basin and Pacific salmon, primarily coho, on a lakewide basis. Lake trout were considered a desirable species in the meso-oligotrophic waters of the eastern basin both in terms of their desirability in the lake and in terms of the users. The results of current stocking programs indicate that lake trout can survive when planted as fingerlings although proof of natural reproduction has yet to be obtained. The re-establishment of a self-sustaining lake trout population would appear to depend on two factors: firstly, the availability of suitable spawning areas and secondly, the provision of adequate numbers of genetically suited adults to allow for successful reproduction.

Coho salmon may be considered to play a role in the Lake Erie fish community at this time by virtue of large scale plantings of this species since 1968 by U.S. agencies. While coho salmon do run into a number of streams tributary to Lake Erie; the maintenance of coho at current population levels has not been credited to natural reproduction. Due to dependence on artificially enhanced reproduction, coho was not considered a major species in the fish community in terms of its suitability to the lake system. However, when users (mainly from the U.S.) were considered, workshop participants felt coho to be a desirable top predator in the eastern and central basins. Coho were recognized as desirable for users in the Detroit River but not in the western basin. Western basin summer water temperatures are not suited to coho and it was felt that users would not choose to have coho in the western basin if they were aware of the costs associated with providing these species and in light of opportunities provided by large percids in the western basin.

Based on the results of the working groups, salmonids were considered desirable in the fish community in the eastern and central basin when the users were considered. It was recognized, however, that the maintenance of salmonids on a large scale will require extensive effort in artificial propagation. The possibility exists that with an improved lake environment, those salmonids completing their life cycle within the lake may develop self-sustaining populations. Those salmonids requiring stream habitats for parts of their life cycle will continue to be reliant on artificial propagation if large populations are desired as the number of streams suitable for spawning and rearing is limited.

In developing lists of species to be considered in the Lake Erie fish community, working groups were faced with the possibility of including species which were exotic to Lake Erie. Prior to formulating the lists presented in Tables 3,4 and 5, participants were audience to a debate on the pros and cons of the introduction of exotics (Appendix B). In brief, the debate emphasized the need for an indepth comparison of the benefits derived from an introduction against the risks. Exotic species most often considered for introduction in the past were members of the genus Oncorhynchus (Pacific salmon). Members of the working groups did not include species belonging to this genus when listing desirable top predators considering the lake alone but did so when the users were considered.

Having introduced the topic of exotics, it is appropriate to examine those species categorized as undesirable in the fish community. With exception of freshwater drum and possibly gizzard shad, the species categorized as undesirable were all exotic to Lake Erie. As indicated previously, the inclusion of freshwater drum as undesirable in the fish community may be inappropriate. The fact that most species considered as undesirable were exotics is reason to carefully evaluate the potential impact of species considered for introduction. In the workshop discussion, it was pointed out that those species exotic to the lake and included in the category of undesirable species were not introduced on the recommendation of professionals in the field of fisheries and as such their potential impact was not evaluated prior to introduction. None the less, the need for caution is emphasized if exotics are considered for introduction into the fish community, Prominent in the lists of undesirable species was the sea lamprey. Presently, sea lamprey are not considered a threat in Lake Erie; however, with efforts being directed at rehabilitation of streams tributary to the lake, spawning and nursery areas for sea lamprey will be improved. Enhanced salmonid communities in concert with improved lamprey habitat would logically lead to greater concern over sea lamprey populations in Lake Erie.

SUMMARY AND CONCLUSIONS

1. Fish species of common concern were ranked in the categories of desirable top predators, desirable community species and undesirable community species without regard for users of the resource and by basin (Table 3, 4, 5). While salmonids were listed as desirable, the inclusion of this family was contingent on improved habitat conditions.

2. Fish species of common concern were ranked in the categories of desirable top predators, desirable community species and undesirable community species considering the lake and users of the resource by basin (Tables 3, 4, 5). The provision of salmonids which are unable to reproduce naturally in Lake Erie is dependant on artificial propagation if user desires are to be satisfied at this time.

3, The species considered as desirable for the lake without consideration for resource users provides a basic guideline for fisheries managers. To manage for a fish community which is desired by the users, the problems and costs associated with management will increase as the fish community desired by the users deviates further from that fish community which is best suited to the lake.

4. Our knowledge and understanding of species varies as was indicated in workshop presentations on specific family groups. The role of forage species, specifically emerald shiners and spottail shiners in the Lake Erie fish community was noted to be poorly understood and greater emphasis should be placed on research and assessment related to these species.

5. Whitefish is desirable but rainbow smelt is the reality under current environmental conditions.

6. Most species considered undesirable in the Lake Erie fish community are exotic to the lake. The introduction of exotics into Lake Erie should be preceded by an extensive evaluation of the possible benefits and risks.

7. The results of this workshop should be re-evaluated in the future as new information becomes available on the species present and on the interaction among species. Workshop participants considered species of common concern that they believed to be important in the fish community but even in the time between the workshop and the presentation of these proceedings, a new species, the pink salmon, has been observed in the Lake Erie fish community.

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Appendix A

Abstracts of Presentations

(Agenda Items 2 to 5)

Assessment of the Lake Erie Environment

Abstract

The current status of the Lake Erie environment is assessed on the basis of phosphorus and chlorophyll concentrations, hypolimnetic oxygen depletion rate and contaminant residues in sediments and biota. A clear downward trend in total phosphorus and chlorophyll levels is not evident despite some reductions in direct source loadings of phosphorus during the past five years. The dissolved oxygen depletion rate in the central basin hypolimnion, which increased steadily between 1930 and 1970, has remained fairly constant since 1970. The rate of degradation of the lake, which accelerated through the 1950s and 1960s, appears to have bottommed out. The expected upturn in water quality in the 1970s is not yet obvious, probably because reductions in direct phosphorus loads were less than anticipated and possibly due to internal loadings of phosphorus from sediments (not yet assessed). Phosphorus and chlorophyll concentrations indicate that the western basin is eutrophic, the eastern basin mesotrophic and that a gradient between these two conditions exists in the central basin. Several current models predict that a reduction to 1 mg l^{-1} in effluent phosphorus from major municipal treatment plants would lower total phosphorus 'concentrations in the central and eastern basins to levels which would preclude nuisance algal growths. To bring the western basin to an acceptable trophic state will require significant reductions in phosphorus from diffuse sources. Target loads for phosphorus from direct and diffuse sources have been established in the 1978 Water Quality Agreement and if these are attained a substantial improvement in water quality can be expected. Problems with heavy metal and organochlorine residues in fish are minor at this time. Elevated concentrations of lead in sediments and organochlorines in herring gulls have been flagged as areas of concern.

prepared by: J. H. Leach, Ontario Ministry of Natural Resources, for the Lake Erie Fish Community Workshop, April 4-5, 1979.

A Review of the Lake Erie Fish Community of the Past With Observations on the Fish Community of the Present

Abstract

The Lake Erie fish community has undergone changes in both numbers of species and abundance of individual species during the past 150-200 years. Commercial fishery production records, fish stocking reports! and various records of new species for Lake Erie provide insight to these changes. Abundance levels of high-valued species such as northern pike, lake herring, lake whitefish, sauger, walleye, and blue pike began to decline in the early 1900s. Similar declining abundance of some low-valued species such as burbot and suckers, was also apparent at this time. Populations of lake whitefish, sauger, and blue pike collapsed completely in the 1950s, nearly 30 years after the lake herring populations collapsed. Super-imposed on these changes in the fish community was the accidental or intentional addition of non-native fishes with smelt being the most important species. Commercial fishery production did not decline greatly from an average annual harvest of nearly 50 million pounds but the species composition of the catch shifted to moderate and low-valued fishes after the 1950s. The present fish community is generally characterized by improved abundance of walleye in the western basin; a high abundance of smelt; and the occurence of non-native salmonids, primarily in eastern and central basin waters, which are largely maintained by continuous stocking.

prepared by: K. M. Muth, U. S. Fish and Wildlife Service, for the Lake Erie Fish Community Workshop, April 4-5, 1979.

Michigan's Fisheries Management Policy; Great Lakes

Abstract

I. Considerations

A.	Sport - Primary [1/]	Priorities determined by the species and relationship to other species along with the desires of the public.
B.	Commercial	
c.	Forage	
D.	Other	

II. Management Philosophy (Goals and Objectives)

A. Fish Stock Maintenance - Dependent upon the Species

1. Development of natural spawning - done wherever possible.
2. Supplemental or maintenance stocking - done in conjuction with rehabilitation, to create a new fisheries or to maintain a fish stock.

B. Regulate Harvest - Lakewide Management or Total Stocks are Considered

	Sport	Regulations to limit catch, set season, limit gear, define areas of take, and regulate pressure.
3:	Commercial	

C. Control Pollution

D. Develop viable fisheries based on the above.

prepared by: N. Fogle, Michigan Department of Natural Resources, for the Lake Erie Fish Community Workshop, April 4-5, 1979.

1/ In actual practice, the maintenance of the stocks is primary with sport fishing being secondary.

Current Management Philosophies for Lake Erie

Abstract

The basic management goal of New York DEC has been stated in the draft version of "A Comprehensive Fisheries Management Plan for New York Waters of Lake Erie and Upper Niagara River" prepared in 1976,

The goal is: Maintain and enhance the existing warmwater sport fisheries, develop a major salmonid sport fishery, and redevelop a commercial fishery compatible with sport fisheries management.

Attainment of this goal will require the implementation of a variety of strategies in program areas such as: Environmental Protection, Environmental Management, Fish Species Management, Public Use and Extension Services.

prepared by: Wm. F. Shepherd, New York State Department of Environmental Conservation, for the Lake Erie Fish Community Workshop, April 4-5, 1979.

Ohio's Philosophy and Goal For Managing Lake Erie's Fishery Resources

Abstract

Ohio's philosophy is to achieve the following goal: To perpetuate and improve the fishery resource while allowing wise use to benefit people.

In managing Lake Erie's fishery resource, the Division of Wildlife has established a specific goal to: Improve capabilities for making sound management recommendations that will enhance the best use of Lake Erie's sport and commercial fish populations and also provide recommendations to reduce and/or improve the effects of man's developments on the shoreline as they affect the fishery.

To achieve the above stated goal, the Lake Erie Fishery Unit and cooperating agencies are conducting the following studies:

Status and Utilization of Lake Erie Fishes

Ohio's Lake Erie Shoreline Fish Community

Yellow Perch Movements

Yellow Perch Parasitation Investigations

Induced Mortality of Unmarketable Fishes due to Capture in Ohio Commercial Fishing Gear

Response of Fish and Invertebrates to the Heated Discharge from Davis-Besse Nuclear Power Station, Lake Erie, Ohio

Development of Markets and Methods of Marketing Freshwater Drum and Other Underutilized Species

Automatic Data Processing for Lake Erie Fisheries Information

prepared by: Lake Erie Fisheries Unit Staff, Ohio Department of Natural Resources for the Lake Erie Fish Community Workshop, April 4-5, 1979.

Fisheries Management Philosophy for Lake Erie

An Ontario Viewpoint

Abstract

Ontario has recently completed a re-examination of policies and strategies relating to its management of fisheries. A task force of Provincial and Federal fisheries staff undertook Strategic Planning for Ontario Fisheries, known by the acronym SPOF. The following embodies the major points influencing the strategy:

1. Ontario believes that the management of natural fish populations and of the habitats which will support these populations is the most cost effective method of providing benefits to the public based on fish resources.

2. To implement this belief? Ontario's fisheries management strategies should emphasize protection in less stressed usually more Northern waters and rehabilitation in the more stressed Southern waters. This latter group includes the Great Lakes.

3. Specific identification and allocation of harvestable surplus will be necessary to effect protection and rehabilitation. The old indirect or often laisser-faire approach will not achieve our goal.

4. Existing science, information and staff capability should be harnessed to act now. This will frequently be embodied in an "experimental management" approach whereby carefully planned and monitored management action will be permitted so that the reaction of the community can be measured and assessed as the basis for further management refinements. (Something akin to the walleye quota approach with which we are familiar.)

5. A much better understanding must be fostered in the general public of the important role of healthy aquatic ecosystems both as an indicator of human health and as a source of benefits from fish.

Goals For Lake Erie Fisheries Management

In 1976 and 1977 a multi-disciplinary planning team undertook an examination of Ontario's programs and expectations for the management of Lake Erie's fisheries. While the output of the study was presented as an internal document and has not been published, the management goals proposed have general agreement. They are:

(i) establish and maintain a safe rate of exploitation of Lake Erie.

(ii) restore and stabilize the percid community giving consideration to the varying composition of this community in the western, central and eastern basins.

(iii) maintain viable commercial fisheries on the lake.

(iv) maximize sport fishing opportunities in nearshore areas and tributary streams for the people of Ontario.

(V) reduce uncertainty of expected net revenues from commercial fishing by developing a long range fisheries management plan for the lake.

(vi) maximize output: input ratio in the Lake Erie fishery and return to the public sector.

(vii) provide equitable regulations and firm and effective enforcement in all the lake's fisheries.

In the future, the thrust of fisheries management on Lake Erie must be in the protection of habitat and maintenance of the resource.

prepared by: A. S. Holder, Ontario Ministry of Natural Resources, for the Lake Erie Fish Community Workshop, April 4-5, 1979.

Current Management Policy

Abstract

Pursuant to its legal authorization, the Pennsylvania Fish Commission has developed and executed management programs designed to achieve long term protection, stabilization or expansion of select species of fish. There have been obvious failures that have been documented if not completely explained. However, these are-not considered to be reflections of faulty policy but failures to administer the concepts of management guided by policy.

In the past, administration had not received clear instruction based upon intimate knowledge of the resource. Since 1970, a more adequate monitoring program has been established which is more sensitive to the biological issues of Lake Erie fish population management. Presumably, the policy as presented here, can be considered more than Utopia as our knowledge and skill expanded.

In its most general form of presentation Pennsylvania's concept of fishery management includes the following goals:

I. The maintenance of biologically stable populations of a select community of species of import to exploitive sport and commercial fisheries;

(a) Pursue studies germane to the regulation of harvest predicated on the equilibrium yield concept or an improved model.

(b) Explore the utilization of the eastern basin ecosystem for the development and maintenance of endemic and non-native species that demonstrate adaptability, minor conflict with existing fish communities and desirable qualities for harvest.

II. Promote the protection of those species whose existence is either threatened, sustain aesthetic appeal or, despite their lack of any other management attribute, species that exhibit an importance for no other reason other than their historical presence in Lake Erie.

prepared by: R. Kenyon, Pennsylvania Fish Commission, for the Lake Erie Fish Community Workshop, April 4-5, 1979.

Percids in Lake Erie

Abstract

The presentation deals primarily with percids on the western and central basin. In Lake Erie, the quality and quantity of optimum percid habitat is related to the trophic state of the lake. Of the three species considered, yellow perch, walleye and sauger are discussed in relation to habitat limitations, interaction among percids and interaction with other species. Current approaches to percid management in Ohio are discussed.

prepared by: Lake Erie Fisheries Unit Staff, Ohio Department of Natural Resources, for the Lake Erie Fish Community Workshop, April 4-5, 1979.

Suitability of Salmonids for Lake Erie

Abstract

Salmonids included for discussion are rainbow/steelhead trout, brown trout, lake trout, chinook salmon, coho salmon and whitefish. A brief history of salmonids in Lake Erie is presented.

Major portions of Lake Erie are suitable for salmonids on a year-round or seasonal basis. Salmonids are suited for existence in Lake Erie but will require annual maintenance stocking to provide direct benefits desired. There is presently no documentation of significant adverse effects on other species of concern as a result of the ongoing salmonid stocking program and strong angler support for the program exists on the southshore. Contaminants presently pose no serious problem for the fishery or its users.

Natural reproduction of lake trout and whitefish may be repressed by smelt predation and/or sea lamprey attack.

prepared by: Wm. F. Shepherd, New York Department of Environmental Conservation, for the Lake Erie Fish Community Workshop, April 4-5, 1979.

The Suitability and Role of Cyprinids in the Lake Erie Fish Community

Abstract

The suitability of cyprinids in the Lake Erie fish community is discussed for four key species. Carp and goldfish are important members of the fish community in the western basin, where they are most abundant, but they are relatively insignificant in central and eastern basin fish communities. These species account for a large percentage of the commercial fishery production in Ohio and Michigan waters and the potential for increased production exists. Emerald and spottail shiners have a dual role in the fish communities in all basins. Primarily they serve as forage fish for other members of the fish community and secondarily they have a commercial fishery value as bait minnows. These dual roles may be in conflict if forage availability is. a factor that influences the mortality and growth of other species. The availability of data for these four species in Lake Erie is limited in terms of their inter-species relationships with other fish community members and their contribution to the commercial fishery production. Additional research and survey efforts are needed for management purposes.

prepared by: K. M. Muth, U.S. Fish and Wildlife Service
for the Lake Erie Fish Community Workshop,
April 4-5, 1979.

Percichthyids in Lake Erie

Abstract

Lake Erie Percichthyids are represented by white bass (Morone chrysops) and white perch (Morone americana). Habitat in the western basin of Lake is probably not a serious limiting factor for white bass. The abundance of white bass is most likely determined by patterns of exploitation. White perch habitat requirements are quite broad. Interspecific and intraspecific interactions associated with this family are not well defined.

Information of the movements of white bass is lacking. Information on white perch is in general limited.

prepared by: Lake Erie Fisheries Unit Staff, Ohio Department of Natural Resources, for the Lake Erie Fish Community Workshop, April 4-5, 1979.

Observations on the Suitability for Lake Erie Existence Clupeids : Gizzard Shad, Dorosoma cepedianum and Alewife, Alosa pseudoharengus

Abstract

Biologists are uncertain whether the gizzard shad is native to Lake Erie or gained access to the lake in the 1800's via canal connections to the Mississippi drainage. It is known that gizzard shad stocks increased rapidly in Lake Erie since 1950 (Bodola 1966). Peak abundance occurs in portions of the western basin and along the south shore. Dramatic gains in phytoplankton production, a major food source, is believed to have been a primary reason for increased shad abundance.

Bodola (1966) has questioned whether the value of the gizzard shad as forage! at present abundance levels, has not been outweighed by their diversion of the productive capacity of the lakes into fish of very limited commercial value.

The alewife most probably gained access to Lake Erie from Lake Ontario via the Welland Canal. It was common in Lake. Erie by 1942 (Scott and Crossman 1973) but never has become a dominant species as it has in Lake Michigan and Lake Huron. Hartman (1973) suggests that the inability of the alewife to become fully established in Lake Erie may be due to abundance of predators or low winter and spring water temperatures.

The native Atlantic alewife is commercially valued for human consumption as well as for animal food. Development of markets for Great Lakes alewife have been inhibited by their small size compared to their marine counterparts. Research and development continues in both the United States and Canada with the goal of more fully utilizing this Great Lakes resource.

prepared by: William Bryant, Michigan Department of Natural Resources, for the Lake Erie Fish Community Workshop, April 4-5, 1979.

The Ecology and Management of Freshwater Drum in Lake Erie

Abstract

A review of literature was supplemented with data provided by fisheries management and research agencies to assess the ecological and economic status of freshwater drum Aplodinotus grunniens Raf.) in Lake Erie. It was found that western basin was most suited as drum habitat with suitability decreasing eastward. In the central and eastern basins, drum were generally restricted to inshore areas (<20m) during the thermally stratified period. The low dissolved oxygen levels in the cold temperature regimes in the eastern basin were substantially below the summer preferendum for drum. Drum were recognized as an underutilized species and arguments promoting development of markets for this species were considered. Interagency capability to manage for this species was assessed as similar to that of more valuable (commercial and sport) species.

prepared by: Les Sztramko, Ontario Ministry of Natural Resources, for the Lake Erie Fish Community Workshop, April 4-5, 1979.

Lake Erie and its Osmerid = Rainbow Smelt

Abstract

Rainbow smelt were first reported in Lake Erie in 1935 and were believed to have entered via the Detroit River from an introduction at the turn of the century into the Lake Michigan watershed. In the 1940s and 1950s, rainbow smelt seemed to take advantage of a niche vacated by the once abundant lake herring. A decline in the status of other fish stocks like lake whitefish, walleye and blue pike in the 1950s also contributed to the continued success of the rainbow smelt.

A general history of the species and its current status and some biological features (distribution, spawning behaviour, feeding habits) are reviewed. Some of the factors limiting the greater expansion and success of this species are discussed. They include extensive deoxygenation in the central basin, plankton blooms, predation/cannibalism as a mechanism controlling year-class success, parasitism and species interactions. Some of the more evident species interactions are with percids and salmonids as forage and with the remnant populations of lake whitefish as habitat competitors.

prepared by : Stephen J. Nepszy, Ontario Ministry of Natural Resources, for the Lake Erie Fish Community Workshop, April 4-5, 1979.

Appendix B

Exotics in the Lake Erie Fish Community:

A Debate, (Agenda Item 6.).

EXOTICS IN THE LAKE ERIE FISH COMMUNITY

In support of exotics

by

Roger Kenyon

Pennsylvania Fish Commission

Is there a niche for exotic fishes in Lake Erie? An examination of literature of the biology of Great Lakes fishes will offer examples of the conflicts between invasions of smelt and alewife and sea lamprey and endemic species. Attempts at the reconstruction of these situations has revealed much of the biology and dynamics of the incursions of exotics into the Great Lakes. Although most of these events are adequately explained by scientists, there is some room for alternative interpretations. There were not the vigorous studies underway at the time of the appearance of these earlier exotics to fully substantiate some of the explanations not in the literature. Accepting the fact that there is sufficient evidence to biologically justify condemnation of the appearance of some of the exotics, let us examine why some of these species are in the lakes. There is always the chance that we may have learned that we can avoid any further biological calamities without abandoning another ‘management tool.

Carp arrived on the North American continent, swept in with the enthusiastic supporters of fish culture. This was a new science and art, at least to North Americans and to many, carp were the vehicle for its promotion; and why not? The species was by now naturally adapted to artificial culture and a popular European food item further adding to its attractiveness. There was little financial risk in experimenting with the animal in the United States, after all, were there not encouraging experiments conducted in New York with the carp’s contemporary, the rainbow trout from western United States?

Apparently the mid-1800% was also the beginning of the U.S. Fish Commissions’s period of scientific enlightenment. Fisheries management was in its dawn light as a bon a fide science and fish culture would serve the needs of the new management concepts of protection of threatened species and re-building of dwindling stocks, perpetuation of isolated sport fish stocks and the development of species of fish adapted to farming for the urban fresh food markets. Not until the early 1930’s did these activities achieve any degree of sophistication or scrutiny from a more enlightened and active league of scientists. Therefore, it is not surprising that this new science explored and tested its many options without check before the early blunders were detected.

The earliest practitioners of fish management often did not have the wisdom and hindsight of today’s biologists, ecologists and parasitologists. Those that did not recognize the potential follies before them, were too small in number to be heard or they retreated too often to their ivory tower posts. The sea lamprey, carp, alewife and white perch probably found their way into the Great Lakes for such very

reasons ; to wit, in the 1800's would have the Welland and Erie canals been constructed over the cries of those who had forseen catastrophe of the spread of sea lamprey and alewife? Regardless, the exotic fishes, were not intentional introductions, save the carp, which have been influential in the displacement of the collapse of some native species in Lake Erie and the Great Lakes in general. Certainly no one would have opted for a plan to introduce sea lamprey into the Upper Lakes if they were aware of the damage that this animal was capable of doing to species such as lake trout. Its colonization of these lakes was due to ignorance, carelessness and lack of vigilance.

From its marine environs through the St. Lawrence River or from land-locked stocks from an ancient sea, the alewife found its way inland. The existence of alewife in the 1860's in the canal systems of New York State in very dense numbers strongly suggests that canals permitted the alewife's penetration to Lake Ontario in large enough numbers for colonization. There was little concern for the implications for wildlife during this period of rapid industrialization and the inter-connection of the Great Lakes and other water-sheds was all important. At that time it is doubtful that too many were even capable of recognizing or objecting to the inevitable spread of exotic species because of the canal's construction.

Brown and rainbow trout are exotic species in the Great Lakes Basin. These were more fortuitous than the previous introductions and endemic species of the fish community found little difficulty co-existing with them. Few will condemn their presence to-day, although the commercial fisheries find them a bother since they cannot legally market them but must handle and dispose of them as accidental catches. Some will claim that native eastern brook trout were displaced by the vigorous competitions from introduced brown trout, but it is more likely that the deterioration of the tributary stream habitats eliminated the brook trout.

It cannot be denied that these salmonids provide fisheries science with one of its most useful options in wildlife management in the Great Lakes and in Lake Erie in particular.

The eastern basin of Lake Erie has remained a refuge for. the stenothermic whitefish, remnant lake herring populations and just maybe the four-horned sculpin. It is certainly capable of more. The abundance of yearling smelt that concentrate in these deeper waters can support a sizable stock of predators equally well adopted to this type of habitat.

Coho salmon have utilized the summer hypolimnion and thermocline of Lake Erie since the late 1960's without any perceptible effects on the resident fishes of that area. Further, the winter and spring movements of salmon into shallow waters has offered an additional sport fishing opportunity without disturbing existing fish species, their community relationships, spawning or survival of young or other competitive features of the native fishes. The penetration of salmon into the tributaries in late summer permits their use of streams without disturbing the spawning or development of the young of almost all other species dependant on the same habitat in the spring. Finally, the very poor egg survival of the relatively few salmon successfully spawning in the tributaries has precluded any uncontrolled expansion of the species in Lake Erie and in fact, should it be necessary, coho salmon could be virtually eliminated from the Lake Erie system in a matter of two years time.

The use of the coho exemplifies the potential of applying salmonids to Lake Erie management without undue risk to existing fisheries. There are other possibilities as well and all that is needed is careful study of the probable inter-relationships between fish species and communities, fish parasite fauna and development of a satisfactory control over the introduced species capability to successfully reproduce. Advances in mono-sex culture and methodology in sterilization techniques will undoubtedly be available in the future and their application to the work of developing controlled expansion of stocks or populations will be invaluable. Certainly then, experimentation with terminal predator types such as striped bass, hybrid esocids, gadids or others will be more approachable.

The restoration of lake trout and Atlantic salmon in the Great Lakes will have to consider the problem of genetic exotics as well. There is already a suspicion that the lake trout stocks now involved in the restorative programs may be failing to successfully produce anticipated generations from natural spawning due to a reluctance to use historical nursery grounds to advantage. This appears to relate to lack of genetic guidance within the planted lake trout to enable them to select the most favourable spawning areas used by the now nearly extirpated natives. There may be further undefined traits that are lacking in re-introduced lake trout which the native stocks evolved that gave them a competitive advantage in the Great Lakes. At any rate, it is foolish to not attempt to restore lake trout just because we cannot duplicate the original natural form. The preservation of genetic stocks that evolved over the eons is no longer a valid reason not to look to other replacements, otherwise, fishery management has little future in the Great Lakes.

The invasions of new species into Lake Erie have not been as damaging as similar situations in the other Great Lakes. Carp are apparently abundant in isolated areas of the lake and have in fact supplemented the commercial harvest of other species, a rather redeeming feature. What effects carp alone may have had on endemic species, especially northern pike, sturgeon, muskellunge and sauger, were never really documented. They had to be minimal compared to the overwhelming influence of the changes in habitat and destruction of historical spawning grounds. Of the exotic invasions, only smelt can be cited as having possible complicity in the demise of one native species, the blue pike of eastern Lake Erie. The unauthorized appearance of alewives and sea lamprey fortunately cannot claim any association with the disruptions of Lake Erie fish populations, endemic or otherwise. The point is that there are instances where the introduction of exotic species will have minimal impact upon native species inspite of the evidence given elsewhere that these same species can raise biological havoc.

We have a responsibility to try corrective stocking to shift the community structure to provide higher valued fish and better fishing. The stresses imposed upon the historical species complex, the invaders themselves, the threatened or extinct species, all prove the pristine native community is gone and habitat and other pressures will not permit its return. We have obligations to look at possible alterations to existing situations through introductions of so-called exotics which will fit or adapt to the present environment of Lake Erie.

Roger Kenyon-Rebuttal

Opposable thumbs and all other things taken into consideration, somebody is going to have to take the risk. Why not the people who are at least undertaking a study and who have a strong dedication to the development of the biological sciences. There are going to be experiments in the future in this and it might as well be those who are most capable of undertaking these experiments. The risk anybody is ready to take will probably be in direct proportion to the concern that people have in participating in this type of experimentation. I think that there are going to be many other people, other than radicals that we used to refer to, who are going to take a longer look, a closer introspection at the problems we face, particularly with the safety aspect. Regarding the risks that we say we are confronted with, I think these people expressing concern ought to be more involved. Any science will be taking the same rationale. I don't think it's in the future to set aside the Great Lakes as an entire experiment into the introduction of exotics. But I think that there are approaches that can be used with minimal risk - there is always going to be risk. There will be risk in developing new medicines for the cure of cancer etc.

Driving species to extinction? I don't foresee this in the modern ability to manage species. I don't see pall mall races into the use of exotics. I see a more careful approach. Again, I refer to early catastrophies that we are working with now, that were products of mistakes a hundred years ago. I think we are much more enlightened and skillful than to introduce a new species of lamprey or a new parasite. Certainly there is a risk that it could be done by bringing adult fish from, we'll say, the Eurasian mountains that may have some diseases we do not know about; however, I don't foresee this happening. The concern that we have is certainly not a valid reason for not exploring the possibilities of using for example the Eastern basin to produce better recreation possibly even a flourishing commercial enterprise. I don't think that we will, see the introduction of another sea lamprey that will have catastrophic effects on existing walleye populations or whitefish populations or white bass populations.

Enhancement of existing communities is a very real possibility. I don't think that enhancement connotes the risk that many feel. We witness what has happened in Lake Michigan and to some extent in Eastern Lake Erie and we have applied the use of coho salmon and have looked at the possibility of the use of another terminal predator with considerable caution and we felt for good reason that we would reject the latter for the very reason that we would not have

full control. In the future we may be able to come very close to having full control in some species that we might wish to experiment with. Again we are not looking for an influx of 15 or 20 species into Eastern Lake Erie. I don't think advocates of the use of exotics Want to get into that. I do feel there is a vacant niche and I think that from a pragmatic biological standpoint, from the theoretical ecological standpoint, whether it be space 'or time, there is a space in the eastern basin which could be occupied by another organism without any undue long term effects upon, say, smelt or whitefish or some other organisms deemed necessary for the health of the ecosystem.

Regarding diseases and their introduction, quarantines have not proven totally adequate; however, risk of introduction of new diseases may be limited through the use of quarantined eggs or eggs that are relatively disease free.

EXOTICS IN THE LAKE ERIE FISH COMMUNITY

In opposition to exotics

by

George Spangler

University of Minnesota

It is the nature of human wants rather than human needs that brings us together today. One aspect of these desires is that they may be predicated solely on what we can have or what we think we can have. If we accept the maxim that necessity is "the mother of invention" then we must surely question the parentage of our present desires to introduce exotic species to the fish community of Lake Erie. However, speculation on parentage, entertaining though they may be, will not necessarily provide the insight by which to judge the merits of the overall proposition.

I shall turn instead to a recitation of risks. This because we have shared the common experience of risk assessment in everyday life. When you are faced with an intersection and oncoming traffic, you have to decide whether or not now is the time to get across the intersection. It is the perception of risk that we are faced with today in terms of our ability to regulate aquatic resources. Briefly, I have a list of risks which I would like to read and I will elaborate in point form. Try and keep in mind these five points:

(a) Exotics may compete with or otherwise displace endemic species;

(b) Exotics may introduce diseases or parasites which further alter the community;

(c) Exotics may escape to parts of the system where they are not welcome;

(d) Exotics may introduce greater instability into the fish community than already resides there;

(e) Exotics may not be perceived as desirable in their new environment.

I will elaborate on each of those points in turn, based mostly on an historical perspective of what has happened in the Great Lakes and elsewhere. This list should be taken as a statement of ecological risk with respect to both fish communities and to individual species.

We don't have to simply accept the contention that exotics may compete with or otherwise displace endemic species, but think if you will of how we would react if we planted an exotic animal in a lake and never saw it again. Obviously we would say, "It's a failure". That's not what we intend to happen with an exotic organism. We intend to plant it so that it might go forth and flourish.

What is the risk of driving endemic species to extinction? I am reminded of Arthur Hasler's address to the American Fisheries Society annual meeting in 1972 in which he pointed out that driving a species to extinction contrasts with mineral exploitation in that the mineral may someday become scarce but it will continue to exist somewhere on the face of the earth, though perhaps in a scrap yard or dump. Once a species is lost, it is gone forever. Hasler's contention is that no local group, in space or time, is justified in depriving future generations of species opportunities to exploit or otherwise enjoy presently underutilized species or unutilized fishes in particular, in future generations.

We also perceive an ecological risk associated with reducing the number of species in terms of the stability of the community to which those species belong. I refer you to John Magnuson's key-note address to the American Fisheries Society in 1975. He provides specific examples wherein habitat limitation has caused a decline in the number of species and a reduced complexity in the community to which those animals belong. He refers both to terrestrial and aquatic examples although the ecological theory has been best described by McArthur's school in connection with the island biogeography of birds.

One cannot help but wonder why such a risk should be taken to "enhance" a fish community. The Lake Erie community was described earlier today as one of the world's most complex assemblages of fresh-water fish, and yet we intend to somehow enhance it?

The alternative to having an exotic displace an endemic species is to postulate that a vacant niche exists in the Lake Erie community. I leave it to you to judge how likely it is that a significant vacant niche exists in the present complex Lake Erie fish community. Are we really talking about replacement of a contemporary species with yet another organism?

The second perceived risk was that exotics may introduce diseases or parasites which further alter the community. If Lake Erie harbours any desirable species of fish at all, how can we prevent exposure of these species to communicable exotic pathogens - to organisms that the present community is not adapted to resist? A list of technical solutions will undoubtedly be proposed. Someone will say, "we will quarantine the stock - that will do it. If they don't show signs of disease in 60 days, we can turn them loose and everything will be fine". We have known for years about the efficacy of quarantine procedures in public health. Are we kidding ourselves into believing that the people who culture salmonids in some of the most technologically advanced hatcheries in the world have not attempted by sterilization,

quarantine procedures, or any number of technological gimmicks to impede the progress of IPN, kidney disease and whirling disease? North American hatcheries have a disease problem of incredible complexity and it's not because the managers and biologists that are running them are not competent professionals; they are doing the best they can, and they are learning by their mistakes.

Will the exotics escape to parts of the system where they are not welcome? First of all, we will all agree that animals do not respect political boundaries. What one culture perceives as desirable may not be universally shared. We have for example, the white amur or- grass carp presently established in the Mississippi drainage. Why do we have a policy by the American Fisheries Society specifying that it would be appropriate for agencies whose jurisdictions would be influenced by the introduction of an exotic species, to be in a position to veto such an introduction?

Perhaps the grass carp or white amur and other exotic species are aberrant examples. Surely we can do our homework well enough to predict that the animal will not escape or that it is exceedingly unlikely to escape. How unlikely is that? Should we do a Norman Rasmussan style fault-free analysis to show that the probability of a nuclear accident of such and such a magnitude is 10^{-32}. What does that probability mean to the man on the street? It can be interpreted by the engineers who designed the plant, and they will say that a serious accident is virtually impossible. And last week we had Harrisburg. Alright, but that is an engineering example - we are biologists. We can study an animal and know what it's going to do in the environment. If I am a really smart Pacific salmon biologist, I ought to be able to ensure the Ontario government that if they hold pink salmon in tributaries to the Great Lakes basin, and some of those animals accidentally escape, there isn't a hope that those animals will become established in the Great Lakes. Pretend for a moment that I am such a salmon biologist, and that I really know my stuff. I am not just your average low level working biologist who just plods away. I am a leader in the field, and I say the pink salmon can't survive in Lake Superior! Who am I? I am Bill Ricker! We all make mistakes in spite of our professional preparation.

Exotics may introduce greater instability in the fish community. We have reason to believe that the sea lamprey, smelt and alewife in the upper Great Lakes have induced incalculable instabilities into the fish communities. Again I will invoke a higher authority and refer you to Stan Smith's papers on the subject. You are professionals in aquatic science, it is up to you to judge what the probabilities are that we can avoid or repeat this stream of incidents.

Exotics may not be perceived as desirable in their new environment. There is ample evidence that the common carp is different in its European environs than it is in the North American system. Who could quarrel, though, with the introduction of brown trout, or Asian pheasants, or rainbow trout. Well, I am not going to quarrel with the introduction of rainbow trout, I rather like to catch rainbow trout. But I ask you, why is the U.S. Fish and Wildlife Service spending thousands of dollars in Great Smokey Mountains National Park to eradicate this pest, Salmo gairdneri from waters in which it is judged to be competing with native trout, Salvelinus fontinalis? Predictability, I submit, is the crux of the exotic introductions issue.

We have talked of quotas, equilibrium yield, maximum sustainable yield and our ability to manage fish stocks. Are we really talking about an ability to manipulate living resources? Let us not mistake manipulation for management. Who here can predict what will happen to any of the species now present in Lake Erie if we introduce yet another? Who here can calculate what the maximum sustainable yield is for any of the species which we presently have? And having done so, who is prepared to argue that that is indeed a sustainable yield? Especially in the context of Peter Larkin's epitaph for the concept of maximum sustainable yield!

I am afraid that the issue of predictability is something that each of us must face as a professional. The man in the street is not going to have to answer the question, What is an ecological risk? Who is going to be responsible for making the decision as to whether or not to jump the light, or cross the street, or introduce a new organism into the aquatic community? It is the business of having an unknown risk imposed upon us by the will of others, rather than by our own choice, that has caused outrage in connection with issues such as nuclear power. Let not this spectre arise in aquatic ecology! I leave you with a quote from F.E.J. Fry, in which he points out that "the curse of humanity is the opposable thumb". Fry's example is that of a small boy, who when given a toy train at Christmas, finds himself content for some time to watch the train go around in circles ; in due course! he develops a burning desire to find out what makes the train go, so he takes it apart, thanks to his abilities. The boy no longer has a toy train.

George Spangler - Rebuttal

I would like to reflect back on some things Roger pointed out in connection with our opportunities to enhance Great Lakes fisheries with salmonids which are presently thought to be unable to reproduce themselves in at least replacement numbers. It was mentioned that coho provide little risk in an ecological sense because they can be "cut off", all we have to do is stop planting them. What are the consequences of cutting off a top level piscivore which we are depending upon to use a particular forage base? What are the consequences, in terms of oscillations in abundance induced in that community when you finally cut off the supply?

Smelt have been implicated not only in the decline of the blue pike, but earlier today in our discussion, in the decline of shallow-water ciscos. The reason why the 1943 year-class of lake herring in Lake Erie and whitefish in Lake Huron stand out as significant events in our understanding of the aquatic ecology of the Great Lakes is that we can't point to a mechanism by which the die-off of smelt in the winter of 1942-43 could possibly have influenced the abundance of the following year-classes of lake herring and whitefish. Yet to imagine that this was not a causal factor is to take the ostrich's approach and place one's head in the sand. You don't have to be so specific as to say, "this animal eats that one, or this one eats the young of that one," you don't have to go to that level of resolution in order to understand the overall effect. In connection with the winter die-off of smelt in 1943, what if those animals had lived to see spring? They would have consumed an enormous amount of zooplankton. Now, that is incontestable by all-that we know about biology; in fact, the smelt died off that winter. Well, what caused the die-off? We don't know if it was Glugea or perhaps, some other protozoan. It isn't because we didn't look very carefully. Highly skilled professionals were looking for the reason why the smelt died-off that winter of 42-43. Was it simply a coincidence that the following spring, when smelt were not present to eat the zooplankton, tremendous year classes of whitefish and lake herring were produced? Was this pure coincidence? Such a conclusion demands a mind-boggling stretch of the imagination. Clearly there is no limit to the interdependency between species in the fish community.

Our approach in medicine and aerophysics is not to test human beings when we have a new idea, is not to launch men into space in the hopes that they will somehow fall within the gravitational influence of the moon. We don't test potential cures for cancer on people who are showing the initial stages of disease, we test experimental "cures" when

there is no hope of recovery by conventional treatment. Who is to say that there is no hope of recovery for the Lower Great Lakes or the Upper Great Lakes or any other system that man deliberately puts his mind to better. I am not prepared to write. Lake Erie off as a lost ecosystem, a **dead** lake. I feel a professional responsibility to see to it that aquatic ecologists will strive to see some productive use and in many cases a rehabilitative or restorative use of waters that we have already damaged through human activity.

Who is to say that fishing is a better form of recreation than golf? Why do we not hand out a free pair of tennis shoe laces or golf balls to anyone who comes in to buy a fishing licence? I think it is time to heed Peter Larkin's advice. In the January (1979) issue of the Journal of the Fisheries Research Board of Canada, in a very interesting article, Larkin points out that our first responsibility is to the resource rather than to some perceived resource user. Without the resource the users don't exist.

Finally, I would like to reiterate my conviction that the opportunity to choose among alternatives, especially alternatives of risk, is a principle worth preserving. We may still have chosen to enlarge the Welland canal or to have done a number of things which in retrospect were ecologically disastrous, but I think we have a responsibility to the public we serve to advise them of what those risks entail. I quite agree with Roger that the decisions on introductions of exotic species are best made by people prepared to consider them in some detail, albeit <u>not</u> solely in the vacuum of our own discipline.

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Question Period - Agenda Item 6

Question (Bryant) - Would you make the blanket statement that you are against the introduction of exotics into any of the Great Lakes?

Response (Spangler) - No. I desperately want to do that but I think the reason I want to do that is because I have a very deep seated feeling of insecurity-that is I think that we can consider most of the factors that impinge upon exotics to the rest of the community but I don't really believe that we can consider them all and I want the options to remain open as best they can. I'm not willing to write off Lake Erie as a productive ecosystem for fishes but we may have to recognize that in the future conditions may be such that we have to do the best with what we have. We may be faced with situations that may require complete artificial support.

Question (Lamsa) - How would you define an exotic?

Response (Spangler) - Means something that does not exist in the system by virtue of having done so naturally.

Response (Kenyon) - An exotic is a subspecies level or above whose appearance in a given area has not been recorded historically (since man has been able to record).

Question (Lamsa) - Is sauger considered an exotic if it is introduced into Lake Erie?

Response (Kenyon) - No.

Response (Spangler) - No. The lake ecosystem will respond to that animal more because it is a sauger than because it is a certain kind of sauger.

Question (Howell) - What is the risk when the public knows that biologists are considering an introduction, and subsequent public pressure forces us into using

that species when we consider the risk to be too great?

Response (Kenyon) - If for instance we were to reduce our salmonid program, we would probably receive public pressure to retain the program.

Continuation (Howell) - I was more interested in the case where a new introduction was considered.

Response (Kenyon) - In that event, all we could do is rest on the facts.

Question (Holder) - Recognizing that man is part of the process of changing a lake environment and subsequently the fish community, at what point do we step in and attempt to restructure the community as opposed to just watching the changes take place?

Response (Spangler) - We have an obligation to try. There are no simple answers only philosophical ones.

Comment (Lewies) - The example of palomino trout is not an exotic but really the product of genetic engineering providing the basis for another debate with essentially the same arguments as occurred in the debate on exotics.

Question (Lamsa to Lewies) - Would you consider hybrids eg. splake to fall into this category?

Response (Lewies) - Yes.

Comment (Kenyon) - We may be on the threshold of this approach (genetic engineering) as we have the facilities and technology to pursue this line of action.

Question (Holder) - In earlier discussion to-day, it was stated in effect that salmonids were having very little effect on other species. George Spangler in his presentation said this was impossible to say. The question is, “Can we predict the effect of salmon in the complex fish community of Lake Erie? - What is the long term effect?”

Response (Fogle) - There are two schools of thought - extreme conservative and extreme liberal. In fisheries management, we have the extremes and representation between those extremes. Being in between but towards the liberal side, I feel we should look at the alternatives but not be in a hurry to change. I think we have a changing environment and a changing society. If something looks good and we have looked at the alternatives - why not change? To accomplish something you have to proceed with a certain amount of risk.

Previous problems have been caused by non-professionals. The majority of scientific introductions have been sound. Some have failed but they have not produced adverse results.

Comment (Spangler) - I agree that we have an obligation to look at the alternatives and make haste slowly. It escapes most practicing professionals that we are not dealing in a small scale. We may casually talk about alteration of Lake Huron, the fifth largest lake on the planet and it is in the same chain as the other big ones are in too. These are large engineering changes. I think that any of our (bio) engineering works are accelerating us into commitments that we would not be prepared to undertake if we understood their implications and magnitude at the outset.

Appendix C

Discussion Prompted by the Presentations of the Working Groups

Discussion Prompted by the Presentation of Results of the Working Groups

Question (Paine) - Is it safe to say that smelt are the reality and if water quality improves that smelt would logically be replaced by whitefish?

Response (Spangler) - No. But rainbow smelt may no longer preclude the occurrence of whitefish and lake herring providing we have substantial control of the fish community utilizing smelt or that component of the user group utilizing smelt.

Continuation (Paine) - So we will have smelt but we may also recognize an increase in the impact of whitefish in the fish community,

Response (Spangler) - We will have smelt and it may also be possible to have whitefish and lake herring.

Comment (Millard) - I believe there is agreement (that smelt are the current reality) but if we could rehabilitate a whitefish population... that it would not be wise for a management agency to manage for smelt. (Supporting prior comment by Holder to the effect that whitefish were desirable but smelt was the current reality).

Continuation (Paine) - It follows then that in the interim, we should manage for smelt until such a time that whitefish become a feasible alternative.

Comment (Holder) - I think the only difficulty might be that we would manage for smelt to perhaps maintain the population and I read from U.S. participants that the best strategy might be to fish the population down as in fact we don't have a strong top predator utilizing smelt in the central basin - maybe man should take that role as top predator and fish smelt down to the lowest possible level. I don't think that is an acceptable management strategy at this time.

Comment (Nepszy), - That has to coincide with environmental conditions that develop - if not, a greater problem occurs.

Comment (Holder) - The subtleness of environmental conditions may be masked by the presence of smelt.

Comment (Spangler) - Recent work in South Africa by Martin indicated that the community can be manipulated by managing the forage base and getting a response in the predators or alternatively managing the predators and getting a response in the forage base - providing there is a strong interaction between the two.

Comment (Holder) - In the central basin group, we didn't consider the centrarchids, etc. as we didn't think they were of common concern - not that we don't feel that they are part of the community but we felt that due to the shape of the basin i.e., lack of connecting waters, that these species were of local concern on each side of the lake but not of common concern.

Comment (Fogle) - The central basin may be different from the other two basins in that respect.

Appendix D

List of Participants

GLFC

A. Lamsa
M. Ross

Michigan DNR

Wm. Bryant
N. Fogle

Ohio DNR

C. Baker
G. Isbell

Ontario MNR

J. Hamley
A. Holder
D. Howell
J. Leach
R. Lewies
D. MacLennan
T. Millard
S. Nepszy
J. Paine
M. Petzold
L. Sztramko
J. Young

New York DEC

Wm. Shepherd

Pennsylvania FC

R. Kenyon

U S F W S

K. Muth

U. of Minnesota

G. Spangler