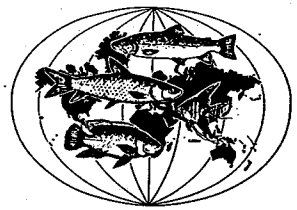


NEWSLETTER

of the Introduced Fish Section
American Fisheries Society

June 1990 Hiram W. Li, Editor Volume 10, Number 2

NEWSLETTER CONTENTS

PRESIDENT'S CORNER

This newsletter provides important commentaries on species introductions; commentaries that stimulate an appreciation for just how complex the topic of fish introductions really is. Recently, I was asked to give a talk on the good, bad and ugly of exotic fishes and, although I opted out of the ugly (can a fish really be ugly?), I found the assignment every bit as difficult and contradictory as the good/bad title suggests. Fortunately, I found many useful ideas in old newsletters that led me to consider some following enigmas: (1) The more I learn about introductions, the less I know about them (e.g., the same species might be judged good in one place, bad in another and/or vice versa if we ask different people or wait 50-100 years and ask them again). (2) Are abundant and or widespread exotic fishes 'symptoms' of environmental problems or could they be symptoms of even more serious problems. If true, what should the proper scientific perspective on exotics be (causes or symptoms), and how do we differentiate these? (3) All exotics are native somewhere. (4) Should a native species 'always' be uncritically accepted as something good until it's moved somewhere else, at which time it automatically becomes bad? (5) If all fish introductions are as detrimental as some assume, why is there so little definitive and universally accepted proof? Does the complex nature of introductions coupled with little definitive data lead to sensationalism, controversy and a lack of accountability? Might we sometimes pursue exotic fish assessments like reincarnated journalists who think the only newspaper in town is the National Enquirer? After reading these, hyperventilated enigmas, I don't expect anyone to ask me about the good, bad and ugly again!

Please don't confuse my mumbo-jumboing as an indication that I believe exotics are less important than what others believe, as this is the topic I have found important enough to ponder with little interruption for more than 15 years. Furthermore, my 'entire' pay check depends on convincing my employer that exotics are as important as I believe them to be. Nonetheless, some will consider these notions irreverent and hypocritical but, if given a chance, others may at least find them interesting, if not deserving of consideration.

A few people have asked about the purposes of this year's IFS committees. Briefly, some of the committee's objectives and respective chairpersons are: 1. Purposefully Introduced Fishes (Al Zale)--assesses socioeconomic and biological aspects of past planned introductions, and provides expert opinion and guidance to those who may be considering a planned introduction. 2. Aquarium Fishes Committee (Herb Axelrod)--promotes research into all aspects

of aquarium fish production and marketing, encourages international use of descriptive standards, and attempts to reduce the number of aquarium fishes released into public waters. 3. Grass Carp (John Cassani) and Tilapia (Ron Gulau)--assesses the status and future applications of these important exotic fishes in North America (see elsewhere in this newsletter for more information on the Grass Carp Committee's activities). 4. Genetics (Jim Seeb)--provides expert opinions on the genetic implications of fish introductions, and serves as a liaison with the Fish Genetics Section and 5. Introduced Fishes in Aquaculture (Nick Parker)--assesses current and future trends in the use of non-native species in the North American food fish culture industry. If you are interested in assisting with any of these committees, please notify the chairperson directly.

I am convinced that the candid and diverse opinions expressed in our newsletter are contributing to better understanding, information exchange and respect among segments of our profession that had previously simply ignored each other. If this is true and if it continues, we will all benefit; more importantly, the fisheries resources we are committed to protecting and enhancing also will benefit.

FROM THE EDITOR

Peer review is frequently overlooked as an important management tool. I have raised this issue in sessions on professionalism and ethics held by different AFS chapters. Rigorous examination from qualified, independent, outside referees is an excellent check on various ideas and proposals, especially controversial ones. Especially in a profession such as ours, where review boards of professional practice are nonexistent, such a practice ensures a high standard of professional conduct and protects the profession from vested interest groups able to mount substantial financial and political pressures on management agencies. The review provides a "paper trail" to examine how different policies arrived at a particular decision. Dr. Peter Larkin, in one of many insightful comments concerning fisheries management, decried the degree to which assumptions governing decisions are lost. This means that we often do not learn from our successes or our failures and to paraphrase the famous quote from George Santayana goes, those that do not learn from history are doomed to repeat the mistakes of the past.

The spotted owl report is a dramatic example of the benefits of peer review. The original report was reviewed by independent referees and these referees were able to detect censorship of that report by Department of Interior officials appointed by the Reagan administration. This enabled GAO to conduct an investigation concerning the listing of the spotted owl and allowed scientific opinion to be expressed freely. Another good example is the tact taken by Paul Reimers, the district biologist given charge of managing the Tenmile Lake fisheries in Oregon. Tenmile Lake has a remnant run of coho salmon (Oncorhynchus kisutch), and a substantial largemouth bass and bluegill fishery. There is a tremendous conflict between the sportsmen and the commercial fisherman concerning the management of this lake. The sportsmen want to maintain introductions of hybrid striped bass-white bass, but the commercial fishermen point out that introduction of largemouth bass has been detrimental to their species of interest and would counteract the substantial volunteer effort to improve habitat of nearby streams. Paul was able to reduce political pressure on him by doing two things: (1) have previous management programs (before Paul inherited that responsibility) analyzed by a graduate student in Public Policy and Management and to have that student raise issues that to be addressed as new policy was being developed. (2) Paul sent drafts of that analysis to four independent, outside reviewers. Criticisms were considered and the document revised. Neither interest group can legitimately accuse Paul of bias as he has documented the decision making process.

What does all this have to do with our section? The Purposeful Introductions Committee (Bob Howells and Al Zale) recently completed a review of Utah's proposed rainbow smelt introduction into Lake Powell. Neither scientist could be construed to have conflicts of interest and the state of Utah received different perspectives from each scientist. The state of Utah is to be commended for their courage and farsightedness in inviting criticism. Bob Howells and Al Zale, thank you for providing this service from our section. Are there others who would give a hand on an ad hoc basis? A summary is given in the section on committee reports.

RETRACTION: My apologies to the scientists of the Great White North, especially to Bruce Barton. No, you were not reading the National Enquirer. My telephone notes were inaccurate. The rainbow smelt (Osmerus mordax) is not in Lake Winnipeg proper, but in the drainages waters upstream from Lake Winnipeg. The ruffe, moreover, is surviving and reproducing in Duluth Harbor, a portion of Lake Superior, but may not have expanded to any appreciable extent into Lake Superior proper.

GOOD RETORT: Bill Harvey of the Texas Parks and Wildlife Department, in response, to my acid comment that "contamination with purity" is an oxymoron, points out that water can be contaminated with pure mercury. Bill also sent information presented to the Texas parks and Wildlife Commission (see regional reports). Thanks Bill!

As your editor, I will avoid the "Star Trek" model: "to boldly go where man has never gone before". It has a split infinitive. I'll try to go boldly, but haul me back with your letters, if I stray too far!

COMMITTEE REPORTS

Purposeful Introductions Committee (Al Zale, Bob Howells):

The section recently completed their review of a proposal (Gustaveson et al. 1990) by the Utah Department of Natural Resources to introduce rainbow smelt (Osmerus mordax) into Lake Powell. The proposal provided justification for Utah's plan to introduce this deep, coldwater, planktivorous forage fish to enhance forage conditions for the reservoir's piscivores (especially striped bass and Walleye). The committee raised a number of concerns about the proposed introduction including questions about the rainbow smelt's thermal preferences and requirements, interactions between smelt and native fishes in tributaries, unauthorized introductions of the smelt elsewhere by anglers, and whether the introductions would in actuality elicit its desired effects on the piscivore populations. However, the real news here was Utah's competent, rigorous, and exhaustive proposal and their effort to solicit critical reviews; it is clear evidence that they are dealing with this introduction in the serious and professional manner it deserves. The actions of Utah represent an important milestone wherein an independent fisheries agency has invited objective criticism of a potentially controversial management plan. We applaud their insight, effort and candor.

[Editorial comment: Interestingly, both the reviews of Bob and Al pointed out that it may be too much to expect much forage production from an oligotrophic system. As Phil Pister once said, "it's like trying to get two cuttings of alfalfa off a concrete tennis court". Both gave excellent reviews from different perspectives; both were skeptical that the introduction would solve the predator-prey imbalance of the system. If anyone would like a copy of either review, send a self-addressed envelope with 25 cents postage to AFS, 5410 Grosvenor Ln, Bethesda, MD 20814. Volunteers: Al Zale's address is the Oklahoma Cooperative Fish and Wildlife Research Unit, 404 Life Sciences West, Oklahoma State University, Stillwater OK 74078, (405) 744-6342.]

References:

Gustaveson, A.W., H.R. Maddux, and B.L. Bonebrake. 1990. Assessment of a forage fish introduction into Lake Powell. Utah Department of Natural Resources, Salt Lake City. 51 pp.

Grass Carp Committee (John Cassani):

The grass carp, as you probably know, is one of those introduced species that has been around for a relatively long time (since 1963) and has developed somewhat of a controversy over such issues as reproduction, stocking rates and effects on non-target communities etc. The posture of state regulatory agencies is quite variable even to this day.

Since this fish has a rather high public profile, (even the Wall Street Journal has published an article on it) and is widely distributed, it makes sense at least to me that the IFS have a committee to deal with it. The primary purpose of the Grass Carp Committee, as I see it is to be able to provide information possibly as a report or pamphlet on grass carp stocking rates, triploid certification and spawning procedures, and administrative

protocols, etc. to regulatory personnel or any interested parties seeking the information. There is a possibility that this information could be used by other AFS committees such as the Small Impoundment Committee (AFS Southern Division). If I remember correctly, there has already been some discussion among the SIC members about grass carp stocking rate recommendations. The Fisheries management Section also may be interested in such a report.

I am presently compiling a preliminary draft that would address some of these issues. Mr. David Clapp (Florida Game and Fish) and Mr. Andrew Leslie (Florida Department of Natural Resources) are the other committee members reviewing and or adding to the report. Other interested individuals will have the opportunity for input after IFS approval. I hope to have a draft ready in time for the annual meeting in August. Also, I hope to have present and new committee members meet sometime during the annual meeting. As far as I am concerned, anyone who wants to be on the committee is welcome since it's of an ad hoc nature anyway.

Another project of the long range nature would be to compile an extensive bibliography on grass carp that could be distributed through the IFS. There is going to be a symposium on grass carp at the annual meeting and I've enclosed a copy of the program, give me a call if you need more information [(813) 694-2174].

Session 6. **SYMPOSIUM. GRASS CARP: EVOLUTION OF A RESOURCE MANAGEMENT TOOL.** Organized by John R. Cassani (Lee County Hyacinth Control District, Fort Myers, FL 33906). Sponsored by the Introduced Fish Section. Monday, 27 Aug. 90.

Cassani, J.R. Introduction

Hestand, R.S., C.L. Phillippy, and R.J. Wattendorf. Florida's triploid grass carp program.

Mitchell, A.J. A history and current update on triploid grass carp inspections from a national perspective.

Shireman, J.V. and D.E. Colle. Long term impact of grass carp on Florida Lake fauna.

Mizumoto, M.R. and R.K. Stocker. Introduction of grass carp into California: a coordinated agency approach.

Bonar, S.A., F.L. Thomas, and G.B. Pauley. Recent advances on an interactive data base model to predict grass carp stocking rates for aquatic plant control.

Tichacek, G.J. Grass carp: the Illinois experience.

Noble, R.L, P.W. Bettoli, and W.G. Klussman. The Lake Conroe, Texas experience: the vital role of public relations to controversial research.

de Kozlowski, S.J. Grass carp stocking in Lake Marion, South Carolina: public support is key to success.

Lowery, D.R. Grass carp stocking evaluation in a large embayment of a Tennessee River reservoir.

Cassani, J.R. A review of grass carp culture and polyploid induction techniques.

HOW MUCH DO WE KNOW AND WHEN DID WE KNOW IT?

The following is excerpted from Michael Gilpin's book review, published in Science (248:88-89), of Biological Invasions, A Global Perspective. J.A. Drake et al. (ed.) Published for the Scientific Committee on Problems of the Environment, International Council of Scientific Unions by Wiley, NY, 1989, SCOPE, 37.

. . ."A central theme of this final volume is predictability---which species will fail to establish themselves in a new biogeographic region and which will

succeed and with what consequences---and it is this topic I single out for review.

Biological invasions have been the ecological problem of the second half of the current millennium. Driven primarily by the movement of Western humans over the planet, exotic invaders have been the single greatest cause of species extinction, and certainly the major nexus between economics and ecology. Thus the intellectual focus of the SCOPE (International Council of Scientific Committee on Problems of the Environment) exercise was defined at the outset with two simple, seemingly straight-forward questions: what are the factors that determine whether a species will be an invader or not? and What (sic) are the site properties that determine whether an ecological system will be relatively prone to, or resistant to, invasion? Answers to these questions would be invaluable to efforts to prevent invasion and to control invasive species....Unfortunately, in chapter after chapter failure to answer the key questions is variously acknowledged. There are complaints that insufficient information has been collected concerning failed invasions or introductions. There are references to the inherent complexity of ecology. Some think that the timing, location, and initial population size of the invading propagule are important considerations. Brown sees an unbridged gulf between academic ecologists who are satisfied with generalities and applied ecologists who must manage on a case-by-case basis.

...I find this ambiguity unsettling; the participants in this thorough study have reached a conclusion they seem unwilling to accept. Population biology has always had difficulties with prediction, even for the simpler single-species systems with undisturbed environments. The problem of predicting invasion success stretches its capacities beyond the breaking point. Species X of ecological system Y is to invade ecological system Z---will it succeed? A major misconception is that species X has intrinsic properties or factors independent of its resident ecological context (system Y). Also, we must understand that we have never characterized any ecological system, Y or Z, at the level of species-species interactions; that is, we cannot predict the dynamics of an undisturbed Y or Z. in any case, X invading system Z is a complete unknown [Editorial note: therefore, there is no such thing as filling a vacant niche]. We have no knowledge of the coupling parameters between X and Z, and we are also ignorant of the nonequilibrium dynamics that will result from the initial growth of X in Z.

To underscore this fundamental ignorance concerning invasion, I and other have shown that we cannot predict, from summary statistics alone, species-invasions success for differential-equation systems modeled on a computer. The same is true for well-characterized Drosophila species in laboratory ecosystems. Though field ecologists are right to be suspicious of the "successes" of such models, they should not let the lessons of the limits and failures of these models be lost on them: we are never going to have a scheme to predict the success of invading species.

Given that we must renounce our quest for case-by-case predictability, what should we do? There is pattern in the data we possess on invasions. The next efforts in the study of invasion should be self-consciously statistical, with and emphasis on characterizing the probability distribution of outcomes for classes of invasions. But for this we will need the raw data on-line in computer data-bases accessible to all researchers."

[Editorial note: This highlights the need for our society to participate in building up a computer based, information system based on the efforts of the USFWS group in Gainesville FLA]

IFS DATA BASE

IFS has a project to develop a computerized database for introduced fishes in North America. We can take advantage of the work of Dawn Jennings and Jim Williams of the U.S. Fish and Wildlife Service National Fisheries Research Center-Gainesville. Since 1979, they have been monitoring the status and distribution of exotic fish species from open waters of the USA and are using PC-File 5.0, which is fully compatible with dBASE files. As of 1989, most of the data base concerned Florida. IFS can expand the base to include nonindigenous species to various drainages and open bodies of water. We need volunteers. We can share the same software, develop our own data banks as

well as interact with NFRC-Gainesville and speed the development of this useful information bank. Cooperators will be able to have access to the data bank and the software for their efforts. To obtain a copy of the format, please contact either Dawn Jennings or Hiram Li. To participate, please contact Dawn Jennings or Jim Williams.

BALLAST WATER HITS THE ATLANTIC

Atlantic Monthly, that is. The latest issue. July 1990. [You sure Hemingway got his start this way? Writing a newsletter in short, clipped sentences and phrases? Oh, Milo Hemingway.] "Invasion of the zebra mussels" by Matthew Hart has a leader [editor talk] that entices the reader, "Among the various foreign imports that America needs to worry about is a tiny but fecund mollusk that could infest fresh water (sic, even Atlantic Monthly makes mistakes) almost everywhere". A good read, as they say. Read it and be prepared for the next cocktail party. You will be questioned by your friends and neighbors. Assure them that Lake Woebegone, MINN. will be the last to know. The public is being educated on some of the problems exotics can cause. Dreissena polymorpha is reproducing with peak densities more than 200 individuals m^{-2}. The specific name is apt, Hebert et al. (1989) found that the zebra mussel populations are polymorphic at 73.9% of the loci examined and that individual heterozygosities averaged 31.6% for the allozymes tested.

Ballast water introductions are serious. Much of what we have as tools of management have been adapted from the principles we learn from natural systems. It is therefore frightening to realize that our perceptions of natural systems may have been adulterated by invasions into "natural sanctuaries" by exotics, as illustrated by the invasion of exotics into the National Estuarine Reserve Research System. This is one of the messages of Jim Carlton. in the September 1989 issue of Conservation Biology.

References:

Carlton, J.T. 1989. Man's role in changing the face of the Ocean: biological invasions and implications for conservation of near-shore environments. Conservation Biology 3:265-273.

Hebert, P.D.N., B.W. Muncaster, and G.L. Mackie. 1989. Ecological and genetic studies on Dreissena polymorpha (Pallas): a new mollusc in the Great Lakes. Canadian Journal of Fisheries and Aquatic Sciences 46:1587-1591.

ROBOCOP AS ENVIRONMENTAL MANAGER

Correspondent: Dirty Harry Callahan

Two wildlife biologists, Stanley Temple and Bruce Coblentz have short articles on the need to eradicate exotics. The basic message is that we have to take draconian measures to eliminate pests, sometimes this means biological control. Paul Shafland and I would like to address this issue and its ramifications in some future newsletter. Anyone with ideas, opinions, case histories? This is an advanced notice that we are looking for contributions. Bruce Coblentz has been active in eradicating feral mammals from island ecosystems in the Caribbean, the Galapagos, Catalina, Santa Barbara Islands, and the Seychelles. Bruce Coblentz IS Dirty Harry! If you're going to talk, talk! If you're going to shoot, shoot!

References:

Temple, S.A. 1990. The nasty necessity: eradicating exotics. Conservation Biology 4:113-115.

Coblentz, B. 1990. Exotic organisms: a dilemma for conservation biology. Conservation Biology 4: In Press.

RUDD WATCH

The rudd (Scardinius erythrophthalmus) is a member of the minnow family Cyprinidae, native to Europe and Central Asia. This species was apparently first imported into the United States during the end of nineteenth century, and was imported again in the late 1960's for use as an ornamental fish.

Recently, however, it has become quite popular as a bait minnow. To date, the rudd has been distributed to at least 16 states, either directly from Europe or by interstate shipments, and fish have been liberated in at least eleven of these states, (AR, IL, KS, ME, MO, NJ, NY, OK, PA, VA, WI). The introductions into Kansas and Virginia were the most recent. The sources of rudd in most states appear to be bait dealers. The rudd is popular because it is very hardy and perhaps because it is a pretty fish. [Editor's note: what ever happened to the notion of becoming self-sufficient, weaning ourselves from the dependency on foreign products like oil and bait minnows? See also the note from Jay Stauffer about the Pennsylvania experience.]

DO TRIPLOIDS PRACTICE SAFE SEX?

Correspondent: Jackie Collins

Do triploid grass carp practice birth control? As part of the public response to the Texas Parks and Wildlife Department's solicitation of views on management of exotic species, Dr. Clark Hubbs had a chance to express his views on the fecundity of triploids to Dr. Gary Matlock. The following is an exert from that letter.

". . . A triploid would have 3 copies of each chromosome. During meiosis it is equally probable that a nucleus would get one or two chromosomes thus a probability of 1/2. If we have 46 chromosomes in the organism the probability of all chromosomes in a gamete being haploid (or diploid) would be 1/2 to the twenty-third power or in effect 1/8,000,000. This seems to be an impressive number that suggests sterility. That presumption is based on a consideration of individuals but the model is on gametes. Under these circumstances the male is expected to produce normal haploid gametes - a common number would be 800,000,000 sperm or 100 haploid male gametes per breeding time.

The female is a more limiting factor. If she produces 500,000 eggs (a rational grass carp number) she would have a 1/16 chance each spawning of having a haploid gamete. If one had 16 females it is rational to expect a normal haploid gamete each year. The same assumptions apply to diploid gametes and thus tetraploid zygotes. This probability is less likely because the sperm motility (= speed) is proportional to light weight and a 46 chromosome sperm would be the slowest in that assortment and the 23 chromosome sperm the fastest."

REGIONAL UPDATES

[Editor's note: The following are four abstracts from the Ecological and Genetic Implications of Fish Introductions (FIN) Conference, held at the Great Lakes Institute, University of Windsor May 17th-19th]

Africa

Ogutu-Ohwayo, R.[1], and R. Hecky[2]. The state and known impacts of fish species transferred to or within continental Africa.

Fish introductions have been made in Africa on various scales from individual fishponds to the largest lakes and reservoirs. The primary intent of these introductions has been to sustain or increase fish production although numerous introductions to high altitude lakes have been made to develop sport fisheries. In many cases these introductions have fulfilled their objectives in the short term, but several of these "successful" introductions have created uncertainties about their long term sustainability. Lake Victoria and Lake Kyoga had introductions of Lates niloticus, Oreochromis niloticus, O. leucostictus, Tilapia melanopleura, and T. zilli in the 1950's. By the 1980's L. niloticus, and O. niloticus dominated the fisheries of these lakes, virtually eliminating a number of endemic fish species.

In the world's second largest lake, the loss of genetic diversity in the fish community has also been accompanied by a loss of trophic diversity. The transformation of the fish community in Lake Victoria has coincided with a profound eutrophication (algal blooms, fish kills, hypolimnetic anoxia) which might be related to the alteration of the lake's food web. In contrast the introduction of a planktivore, Limnothressa miodon, into Lake Kivu and the Kariba Reservoir has established highly successful fisheries with little documented effect on the pre-existing fish community or trophic ecology of the lakes. The highly endemized, species-rich African Great lakes may be particularly sensitive to species introductions and require special consideration and caution when introductions are contemplated because species extinctions, introgressive hybridizations and ecosystem alterations have likely occurred following fish introductions into African Waters.

1. Uganda Freshwater Fisheries Research Organization, P.O. Box 343, Jinja, Uganda.
2. Department of Fisheries and Oceans, Freshwater Institutes, 501 University Crescent, Winnipeg, Manitoba R3T 2N6, Canada.

Europe

Holcik, J.[1] Fish introductions in Europe with particular reference to it central and eastern part.

We recorded at least 104 exotic species of fish introduced to 30 out of 33 European countries. Included are 25 cyprinids (introduced to 22 countries), 16 salmonids (16), 9 coregonids (14), 9 cichlids (6), 7 centrarchids (18), 4 ictalurids (16), 4 poeciliids (7), 3 catostomids (5), 3 mugilids (1), 3 percids (7), 2 acipenserids (1), 2 clariids (3), 2 umbrids (6), 2 eleotrids (1), 2 pleuronectids (1) and one species each from the families Anguillidae (introduced to 1 country), Atherinidae (1), Channidae (2), Engraulidae (1), Esocidae (2), Mullidae (1), Osmeridae (1), Polyodontidae (1), Siluridae (5), and Thymallidae (2). Most of them were intentionally released since the second world war to enhance sport, commercial, or subsistence fishery, for fish farming and aqua-culture, but also for biomanipulation purposes such as mosquito, macrophytes and algal blooms control. Poor success has been registered in most cases along with adverse or unexpected effects on the native fishes and their habitat. Only a few species are generally accepted as having been beneficial introductions.

1. Institute of Fishery Research and Hydrobiology, Drienova 3 826 24 Bratislava, Czech and Slovak Federative Republic.

Tropical Asia and America

Fernando, C.H.[1] Impacts of fish introductions in tropical Asia and America.

Invasions are integral features of the evolution of biotas (Fryer, in press). Freshwater fishes which can be considered as living fossils (Elton 1958), have been introduced widely especially in the past 150 years. Impacts of fish introduction must be viewed against the massive and worldwide reservoir building enterprise and the pervasive influence of high human densities on the freshwater ecosystem. Past and prevailing attitudes and objectives have influenced the choice of fish and the ornamental fish trade and accidents have contributed their share to introductions (Welcomme 1988).

Rivers are old and lakes are young and usually ephemeral like reservoirs. Lacustrine fishes are thus restricted to some old lakes like L. Baikal and African rift valley lakes. Riverine and marsh dwelling fishes colonize rivers but live close to the shore and at river mouths and give only low to modest fish yields in the tropics (Fernando and Holcik, 1982, 1989).

In Asia, fish have been moved by humans in ancient times, as they have been in Europe in historical times. In tropical Asia and America, the enterprise of fish introductions has been intensified and came as a series of overlapping waves. The earliest introductions were of coldwater species like trout and bass for sport in upland tropical streams. These piscivores have had a destructive effect on the indigenous fishes while creating a sport fishery of negligible proportions. The common carp followed by Chinese and Indian carps were the next wave which overlapped with the first. All these carps came from

non-tropical regions and their impacts on tropical capture and fisheries, though not negligible is nevertheless small. About 50 years ago the search for tropical fishes suitable for introduction began in earnest, and it is this enterprise that has had a major impact on fish composition and yields in the tropics. Incidentally, while a few extra-tropical species like common carp have survived in the tropics, tropical tilapias have colonized lakes and reservoirs and thrive in culture in subtropical to Mediterranean climates.

The impacts of fish introductions can usually be predicted on simple biological principles, common sense and the experience of the past. Fryer (in press) is rightly skeptical about theoretical pronouncements and modelling as predictive tools for fish introductions. Change rather than genetic attributes alone seems more important in the success of invaders. In the case of freshwater fishes, the chance combination of lakes (rift valley), the preadapted fish (tilapias, clupeids) and time were responsible for the evolutionary exuberance in freshwater fishes, helped by the tropical conditions that accelerated the changes. The importance of chance and being in the right place at the right time has also been stressed very eloquently as the most potent factors in evolution by Gould (1989).

The disastrous impacts of fish introductions in tropical Asia and America have occurred almost exclusively where piscivores have been used. Even here, human induced change has been a contributory cause. Recovery of the so-called eliminated species has occurred sometimes (Welcomme 1988). In Asia, fish introductions, largely of herbivores for food has had minimal impacts on indigenous species (De Silva 1989). In contrast Singapore had lost 38 of its 70 freshwater fish by 1961, largely due to urbanization (Alfred 1961).

Among the many ecological impacts, herbivorous tilapias speed up mineralization, thus maintaining high fish yields (Lowe-McConnell 1975). Raising of the trophic status by herbivores coupled with human induced eutrophication has apparently enhanced indigenous cyprinid yields in Sri Lanka. Eutrophication favors Cyprinidae in temperate regions and also perhaps in the tropics. Overfishing of the high yielding tilapias could deplete nutrients needed for plant growth thus reducing fish production (Beauchamp 1964).

Elton (1958) in his classical work on invasions by animals and plants considered exotics as an integral part of conservation strategy. Lowe-McConnell (1987) has pointed out that Cichlidae (unlike other fishes) are eminently adapted to take advantage of new lacustrine habitats (reservoirs). These views are based on a wealth of evidence. However, there have been predictions of disaster due to the introduction of tilapias into Central America (Myers 1955) and labelling of these fishes unequivocally as pests (Arthington 1988). These latter views appear to be based not on evidence but on prejudice.

1.Department of Biology, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada

Australia and New Zealand

Arthington, A. and D. Bluhdorn [1]. The ecological impacts and genetic aspects of introduced and translocated freshwater fishes in Australia and New Zealand.

Australian inland waters have been successfully colonized by about 20 freshwater fish species introduced to the continent; there are 6 poeciliids, 5 salmonids, 4 cyprinids, 3 cichlids, 1 percid and 1 cobitid. Concern about the consequences of fish introductions and translocations was first expressed in the late 1960's, although the earliest introductions of sport fishes were made in the latter part of the 19th century. This paper reviews information on the impacts of introduced fishes-hybridization problems, habitat and water quality alterations, competition for space and food, predation and the introduction of exotic parasites and diseases. These themes are also addressed in the context of translocating endemic Australian fishes between drainage systems to supplement recreational fishing. The fascinating case of the Lake Eacham Rainbowfish, supposedly brought close to extinction in its natural habitat by introduced Australian piscivores, will be reviewed, ending on a new and positive note. Throughout the paper, parallels are drawn between Australian and New Zealand experiences with fish introductions. The final topic

addressed in the paper is the need for new research initiatives concerning the functional characteristics of Australian aquatic ecosystems, their resistance and susceptibility to biological invasions, their resilience after invasion, the significance of habitat disturbance as a factor in fish invasions, and strategies for the management of introduced and translocated species.

1. Griffith University, Nathan, Brisbane, Queensland 4111 Australia.

North America

Alabama Correspondent: Dawn Jennings

A red piranha (Serransalmus natteri) was caught in the Elk River, Limestone County, Alabama in September 1988. The specimen measured 9.5". This is the first record of an exotic fish taken from this river and almost certainly represents the release of someone's pet piranha. (Athens News Courier).

Arizona

Channel catfish (Ictalurus punctatus) and flathead catfish (Pylodictis olivaris), introduced sport fishes, are inhibiting the recovery of the razorback sucker (Xyrauchen texanus) by preying upon newly stocked juveniles of this very rare fish in the Gila River.

Reference:

Marsh, P.C. and J.E. Brooks. 1989. Predation by ictalurid catfishes as a deterrent to re-establishment of hatchery-reared razorback suckers. The southwestern Naturalist 34:1898-195.

California Correspondent: Peter Moyle

California Fish and Game is trying to manage problems of illegal transfers by enforcing a new law that prohibits transporting live game fish. They are preparing to eradicate a population of northern Pike in Frenchman Reservoir that they recently discovered. Unfortunately, this resulted in postponing the eradications of another introduced species, yellow perch, from lafayette Reservoir in the San Francisco Bay Area. Both introductions were illegal from persons unknown.

Cascadia Correspondent: Hiram Li

Devil's Lake, Oregon was, historically, the most important overwintering habitat for waterfowl along the central Oregon Coast. The lake has undergone cultural eutrophication stemming from nutrient input from domestic discharge and a dairy farm. This created both a boon and a curse. The massive beds of macrophytes are a source of high quality forage for waterfowl, but a nuisance for local land owners. Triploid grass carp were introduced in the mid-1980's despite concerns that negative impacts on waterfowl might result. Since then, Mike Hansen, a research associate for the Oregon Cooperative Wildlife Research Unit has evidence that these concerns may have been entirely justified. Overall, the waterfowl population has decreased 27% since the introduction, although the trend along the Pacific Flyway is an increase of approximately 50%. The impact of grass carp on the elimination of aquatic macrophytes is significant. Work by Gilbert Pauley of the University of Washington's Cooperative Fishery Research Unit indicates that the more palatable, high protein species of plant have declined but that Brazilian waterweed is expanding in Devil's Lake. For more information contact Mike Hansen (manuscript in progress) or Gilbert Pauley (Washington Coop. Fish and Wildlife Unit, University of Washington, Seattle 98195).

Florida Correspondent: Dawn Jennings

Two pacus (Colossoma sp.) were caught by fishermen in the area of the Indian River, Florida. One specimen (15" TL) was taken from a borrow pit in Vero Beach in November 1988, but the specific identity was not reported. The second specimen, C. macropomum, (10.5" TL) was caught from canal c-24 near SR 709, Fort Pierce, in December 1988.

A walking catfish (Clarias batrachus) was recently collected in Lake Russell, Osceola County, Florida. This is the northernmost record for this species in the Kissimmee River drainage.

Manitoba Correspondent: Arthur Derksen

Rainbow smelt are not in Lake Winnipeg (Editor's note: a mistaken attribution, henceforth known as Li's Phenomenon). So far, rainbow smelt have only been found in the English River in northwestern Ontario, some 300 or 400 miles upstream from Lake Winnipeg. Monitoring is presently being done on the Winnipeg-English river system to determine the spread of smelt in northwestern Ontario. Some additional sampling will also be done on Lake Winnipeg to see if smelt have reached the lake by other routes. (See also North Dakota)

Michigan Correspondent: John Stanley

An editorial entitled "Beware the Tube Nose Goby" (The Detroit News 21 May 90) described the dangers of the Soviet Policy of openness. It seems that we have another uninvited and perhaps unwanted guest via the "open valves" discharging ballast water. The tube nose goby from the Black and Caspian Seas was found in the water intake of Detroit Edison's Belle River Power Plant. It is not known what type of significant impact, if any, will result from this accidental introduction. The editorial goes on to describe the problems caused by the zebra mussel in the Great Lakes, the most dramatic of which is that the mussels have choked off 23% of the water treatment plant's intake pipe for the city of Monroe, Michigan and three other townships. This forced them to install another intake pipe at a cost of $600,000. The editorial concludes that the only environmentally responsible solution is to ream it with a mechanical augur. (Editorial note: Hey, doesn't Robocop live near Detroit?)

Missouri Correspondent: Dawn Jennings

Larval grass carp (Ctenopharygodon idella) were collected by University of Missouri Department of Fisheries personnel from two tributaries of the Missouri River in May 1987. A total of 44 specimens were taken from Moreau River and 167 from Auxvasse Creek at locations 8 km, 4 km, and 2 km from the mouth of each stream. The fish ranged in total length from 6.5-8.0 mm. The identification of these fish was verified by Colorado State University's Larval Fish Laboratory.

Another collection of grass carp larvae was reported by Mr. Sam McCord, Hunter Environmental Services, St. Louis, Missouri. Four specimens (approximately 6 mm TL) were collected from the Ohio River Channel in July 1987 near river mile 945, in the vicinity of Metropolis, Illinois. To the best of our knowledge, this is the first record of natural grass carp reproduction in these river systems.

New York Correspondent: Dawn Jennings

The state of New York is experimenting with stocking a laucustrine strain of brown trout (Salmo trutta) called the Seeforellen. This fish is native to Germany, Austria and Switzerland. The overall goal of stocking the Seeforellen is to improve sport fishing in the state. This strain has been shown in Europe to exhibit a larger size and greater longevity (i.e. 40-50 lbs. and 10-12 years). The state introduced yearlings into 8-9 natural bodies of water during 1989.

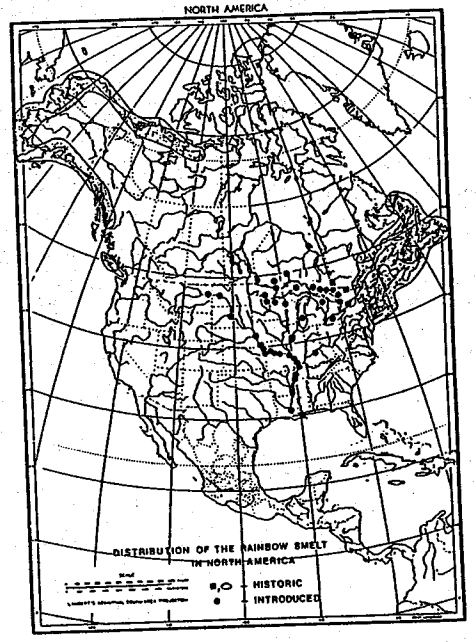
North Dakota Correspondent: "Deep Throat"

The following is the summary from a manuscript by Bruce Barton et al. (ask for reprints: Dept. of Biology, University of North Dakota).

Rainbow smelt presence is now confirmed in 17 lakes of the Hudson Bay drainage as a result of 1989 surveys; 10 of theses are in northwestern Ontario and 7 are in northern Minnesota; all of these are on the Rainy River system. The most likely colonization route of rainbow smelt into Lake Winnipeg and other Manitoba lakes is from waters of the English River system that now contain established populations of this fish. Rainbow smelt in the Rainy River system, particularly with the new occurrence in Lac La Croix are of more

immediate concern to Rainy Lake and Lake of the Woods. Rainbow smelt may be able to move downstream in the mainstem Rainy River from Lac La Croix with relatively few barriers to prevent such a movement. A possible alternate route of migration is from Eagles nest Lakes, which drain into Lake Vermilion and the Vermilion River. This system flows through Crane Lake and into the barriers that might prevent downstream movement from the latter.

Reference:
Barton, B.A., W.G. Franzin, R.A. Remnant, D.B. Wain, S.J. Barcome. 1990. Pages 325-342 in Proceedings of the 2nd North Dakota Water Quality Symposium, Fargo, North Dakota. North Dakota State University Extension Service, Fargo.



Pennsylvania Correspondent: Jay Stauffer

The rudd, Scardinius erythrophthalmus (Linnaeus) is beginning to appear in bait-shop facilities in the Pocono Mountain area of eastern Pennsylvania. Based on the history of this species, it should not be too long before it becomes part of the fauna of the upper Delaware River basin.

Texas Correspondent: Bill Harvey

Bill sent me a package of materials dealing with the Texas experience in the management of introduced and exotic fishes. I was extremely impressed with the high degree of professionalism and thoroughness of the Texas Parks and Wildlife effort. I will present the material Bill sent me in a serial fashion, in different newsletters. There is too much interesting material to deliver in just one newsletter. Among the documents is one, anonymously authored, titled "Potential and Realized Effects of the Introduction of 'Exotic' fish, shellfish and plants." Ask Bill [Texas Parks and Wildlife Department 4200 Smith School Road, Austin, TX 78744] for a copy, it is an excellent background document that informs the public on all sides of the management of species introductions in a manner that is relatively free of scientific jargon, but sophisticated in ideas communicated. A neat model for others to follow, an example:

> **"FORAGE SUPPLEMENTATION**
> Only one fish, the wakasagi (Hypomesus nipponensis), has been released solely as a forage supplement. However, the Tilapia species were introduced as a culture organism, as a vegetation control agent and as a forage supplement. Introduced tilapias have repeatedly demonstrated remarkable capacity for range expansion and explosive population increases.
>
> Such occurrences must be accompanied by substantial changes in the composition--terms of both diversity and biomass of native communities. These changes, in turn, may have significant consequences for food web structure and stability of sportfish populations. In evaluation of potential effects of the blue tilapia in Florida, researchers speculated that its major impact on native fishes may well be exerted through alterations in the forage base available to the largemouth bass: a fish that supports an annual multimillion dollar industry and tourist trade in Florida."

The Texas Parks and Wildlife (TPW) Commission convened a meeting between staff members and various interest groups including the Sierra Club, Texas Audubon Society, Sportsmen conservationists of Texas, Texas A & M University, Texas Agricultural Extension Service, Soil Conservation Service, Texas Black Bass Unlimited, Texas Association of Bass Clubs, the aquarium industry, and various legislative bodies. Whereas, few were completely satisfied with the new rules, my reading of the report is that TPW was very even handed and used much common sense in forming policy.

Utah Correspondent: Dawn Jennings

A new cichlid (Cichlasoma managuense) commonly called the jaguar guapote, was found in Boiler Spring, St. George, Washington County, Utah in October 1988. The population consisted of at least 500 specimens representing 4 year classes. State Personnel rotenoned the spring in an attempt to eradicate the population. The status of the population is uncertain at this time.

ELECTION OF IFS OFFICERS

Candidates for President Elect
Capsule biographies by Peter B. Moyle.

Hiram W. Li is presently newsletter editor for IFS and is willing to do the job for an extra year if elected. In a recent campaign speech, he promised "This time I will do the job right". Dr. Li obtained his B.S. from the University of California, Berkeley, his M.S. from Colorado State University, and his Ph.D. from the University of California, Davis. After serving on the faculty of at UC Davis, he moved to Oregon State University, where he is now Professor and Assistant Leader of the Oregon Cooperative Fishery Research Unit. The effects of introduced fishes and fish communities is a major area of his research and he is co-author of several review papers on the subject, including a chapter on managing introduced species in the forth-coming AFS fisheries management text. He has served on the Ecology Panel of the National Science Foundation. He is a longstanding member of IFS and a frequent contributor to its newsletter.

John R. Cassini is supervisor-aquatic biologist for the Lee County Hyacinth Control District, Fort Myers, Florida. He obtained a B.S. in fisheries from Michigan State University and an M.S. in aquatic ecology from Central Michigan University. He is responsible for the design, implementation and supervision of a research program on the biological control of aquatic weeds, including the use of grass carp and other exotic species. He is presently chairman of the Grass Carp committee of IFS and a member of the small impoundments committee of the Southern Division of AFS. In 1990, he organized the AFS symposium "Grass Carp: Evolution of a Resource Management Tool." In the last six years he has published 15 papers and major reports dealing with weed control and/or grass carp.

Candidates For Secretary Treasurer

John L. Dentler is Chief of the Trade and Industry Services Division, Southwest Region, National Marine Fisheries Service. Prior to joining NMFS he served as a policy analyst for the Metropolitan Water District of Southern California, a staff member for the Committee on Merchant Marine and Fisheries, U.S. House of Representatives; and a fishery biologist for the Oregon Department of Fish and Wildlife. In all these jobs, he dealt with problems created by introduced species and worked with developing solutions for the problems, including drafting legislation. He obtained a B.S. in Fisheries and an M.S. in ecology from the University of California, Davis. he is an active member of IFS, making frequent contributions to the newsletter.

Alexander Zale is the Assistant Unit Leader/Fisheries at the Oklahoma Cooperative Fish and Wildlife Research Unit at Oklahoma State University. He has been a charter member of IFS since 1980 and is currently Chairman of IFS Purposefully Introduced Fishes Committee and has chaired our Membership Committee. His current research in conjunction with the Oklahoma Department of Wildlife Conservation, focuses on management-oriented problems concerning introduced striped bass and hybrid striped bass in large rivers and reservoirs. He received his B.S. from the University of Massachusetts, his Master's degree from Virginia Tech and his Ph.D. from the University of Florida in 1984. His doctoral research involved investigation of a variety of applied aspects of the thermal biology, ecology, and life history of the exotic blue tilapia in Florida.

Ballot

Mail to: Bill Loftus, Chairman
IFS Ballot Committee
Everglades National Park
P.O. Box 279
Homestead FL 33030

President Elect

Hiram W. Li _____

John R. Cassini _____

Write-in_____

Secretary Treasurer

John L. Dentler _____

Alexander Zale _____

Write-in_____

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WANTED: NEWS ITEMS, REPORTS, LETTERS, OPINIONS--CONTACT HIRAM LI

WANT TO SEND A COPY OF THE NEWSLETTER TO A PROSPECTIVE MEMBER? DROP A LINE OR PHONE HIRAM LI OR DAWN JENNINGS.

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