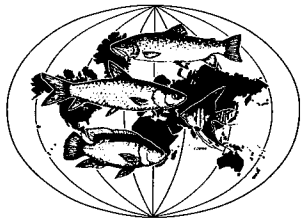


NEWSLETTER

of the Introduced Fish Section
American Fisheries Society

April 1991 Hiram W. Li, Editor Volume 11, Number 1

NEWSLETTER CONTENTS

FROM THE PRESIDENT

Before I bring you up to date on section business, I want to take the opportunity to express my thanks to Paul Shafland for the excellent job, which he did as last year's president. Paul established a series of committee's to address specific issues relative to the section. I have contacted the former committee chairs and requested that they continue to serve for the current year. The committees and chairs follow: aquaculture (Nick Parker), aquarium fishes (Herb Axelrod), ballast Water Introductions (Peter Moyle), Consensus Statement (Paul L. Shafland), Genetics (Jim Seeb), Grass Carp (John Cassani), Literature (Hiram Li), Membership Directory (Dawn Jennings), Purposefully Introduced Fishes (Al Zale), Zander (Terry Steinwand). We currently need a committee chair for the Tilapia Committee. Anyone interested in this capacity, please contact me. At the business meeting Clark Hubbs suggested that a committee be established to document the impact of putative bait fish introductions on indigenous fishes. I requested that Clark chair such a committee and he agreed. Anyone interested in helping Clark, please contact him. One of my graduate students, T.J. LoVullo, has recently completed a survey of the bait shops in Pennsylvania to determine if these establishments are a potential source of non-native fishes to the state.

Nick Parker indicated that he would like to organize a symposium for next year's meeting. I am certain that some of you will hear from Nick in the near future.

I am interested in accumulating data on the impact of the introduction of native fishes on local populations. For example, what is the impact of hatchery-raised brook trout on local populations of brook trout in Eastern streams? I would appreciate any information that any of you might have, which addresses this problem.

George Krantz, chairman, Atlantic States Marine Fisheries Commission Interjurisdictional shellfish committee contacted me and, he is interested in forming a sub-group of the section to examine the introduction of shellfish. His group has already developed a position statement on the introduction of C. gigas. Anyone interested in interacting with George and his committee, should contact him at the following address: Maryland Department of Natural Resources, Tidewater Administration, Cooperative Oxford laboratory, 904 S. Morris Street, Oxford, Maryland 21654.

I want to bring to your attention a new book published by T.F.H. Publications by Al Konings on the fishes of Lake Malawi. Lake Malawi, like all of the African Great Lakes, is threatened by the introduction of non-native fishes. This excellent work documents the high diversity of fishes in Lake Malawi,m and may provide the much needed information to convince local governments not to introduce additional species into this diverse ecosystem.

I will be in Malawi, Africa from 13 December 1990 to 22 August 1991 on a Fulbright Research Fellowship. Please address all correspondence to me at P.O. Box 11, Monkey Bay, Malawi, Africa.

FROM THE EDITOR

This is the LATE EDITION for which I must apologize. This has been a very unusual year for the leadership of your section. Jay has been out of town and have been out of circulation with a curious series of maladies have laid me low---sorry for not writing sooner. Thanks to Paul Shafland our society has not been entirely rudderless. He represented us as our representative to Excom and contacted different members for reports. Thank you Paul. This will be a double issue to make up for lost time, the first and hopefully the last issue of this type. For those of you faithful correspondents, thank you for sending in your news items.

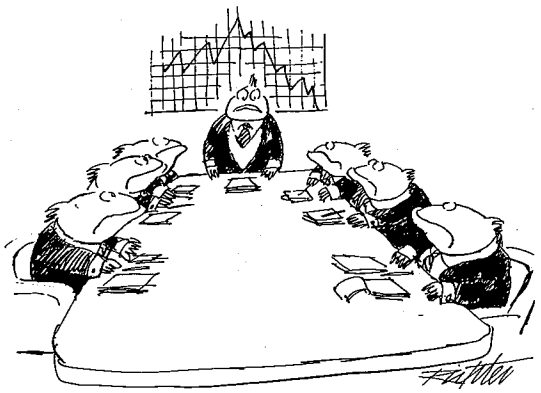
I sensed a marked awareness of issues over the introduction and use of introduced species during the past year. I cite as evidence (1) the number of papers published in TAFS and NAJFM during 1990 that discussed the biology of introduced fishes, (2) pending congressional legislation concerning the use of introduced species (a reliable source, said that congressman Saxton introduced this legislation because he was concerned that the restoration of Atlantic salmon in New Jersey might be compromised by a plan to introduced Pacific salmonids into his state), (3) Two sessions on introduced and exotic fish issues at two international meetings during 1990-91 and (4) inquiries to our section from GAO, conservation groups and students concerning the introduction of fishes.

Last year Science published two papers concerning the ecological processes. One discussed the role of the kangaroo rat as a keystone species regulating vegetation in the New Mexican desert (Brown and Heske 1990) and the other reported on trophic structure and the regulation of stream communities (Power 1990). Unfortunately, neither study reported that introduced species were important components in both assemblages. The quarrel is not that the findings were impertinent, but that the responses occurred in a complex that was not co-adapted through evolutionary time. For those of us interested in management, it is extremely important to know that stabilizing processes are found in communities that one might presume to be highly dynamic. What percentage of studies have unknowingly examined interactions among native and non-native species? To what extent do co-adapted and haphazard species assemblages differ in patterns of stability and resilience? Inquiring minds want to know.

References;

Brown, J.H. and E.J. Heske. 1990. Control of a desert-grassland transition by a keystone rodent guild. Science 250:1705-1707.

Power, M.E. 1990. Effects of fish in river food webs. Science 250:811-814.



"In a word, gentlemen, we're about to go belly up."

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Report by the Office of Technology Assessment

Several members of the section have interacted with OTA, including Walter Courtenay [(407) 367-3320] and James McCann [(904) 378-8181]. The OTA contact is Steven M. Fondriest [(202) 228-6519]. The following is draft outline received in mid-February. The anticipated date of completion is May of 1992.

NON-INDIGENOUS SPECIES IN THE UNITED STATES

[NOTE: "Supporting Materials" sections are illustrative]

SECTION I. SUMMARY AND OPTIONS (15%)

Chapter 1. Executive Summary
- A. The Situation Today
- B. Priority Technological Issues
- C. Priority Institutional Issues
- D. Gaps, Redundancies, Cooperation, and Conflict Among Institutions
- E. The Broader Context
- F. High Priority Options

SUPPORTING MATERIAL [summarized or copied from other chapters]:
- Definitions sidebar(from ch. 3)
- Relationship to other issues (from ch. 12)
- U.S. in Columbus' Time (sidebar from ch.4)
- Future scenario (summarized from ch. 11)
- "Hot Spots and Suspect Species" (list or table of problem sites/species from analogous sidebars scattered throughout chapters).

Chapter 2. Options
- A. Defining National Goals for the Regulation and Management of Living Natural Resources
- B. Improving Prevention and Control Technologies
- C. Meeting Research and Development Needs
- D. Closing Authority Gaps (incl. state, regional, and federal legislation)
- E. Improving implementation of Existing Authority (incl. congressional oversight)
- F. Increasing Accountability for Intentional and Accidental Releases (incl. liability, enforcement, education)
- G. Providing Adequate Funds (incl. taxation and appropriations)
- H. Assessing the Special Case of Bioengineered Organisms

Supporting Material:
- State goals of existing laws regarding the management of living natural resources (table or sidebar).

SECTION II. THE SITUATION TODAY (20%)

Chapter 3. Assessing the Consequences of Introducing Non-indigenous Species
- A. Defining the Problem: Issues and Terms (Exotic, indigenous, alien, and non-indigenous species; accidental, illegal, and intentional introductions, etc.)
- B. The Benefits of Introductions (crop germplasm, biological control, erosion control, horticultural novelty, hobbies, etc.)
- C. What Have Introductions Cost Economically?
- D. What Have Been the Environmental, Health and Social costs of Introductions?

Supporting material:
- The scope of OTA's study with flowchart of assessment methods (sidebar/figure).
- Related studies underway/findings (table)
- OTA and others' definitions (sidebar)
- synthesis table of all cost estimates located

Chapter 4. The New Biological Order: the Changing Causes, Pathways, and Rates of Introductions

A. Major Agents and Policies That Brought Us Here
B. How Many Terrestrial and Aquatic Species Reached U.S. the Last 10 Years?
C. What Are Current Rates of Introductions and Are They Increasing or Decreasing?
D. Geographic Pathways of Intentional and Unintentional Introductions (international, interstate, intrastate)

Supporting Material:
U.S. in Columbus' time (sidebar)
Summary of Directly-Related Legislation (Lacey Act, E.O. 11,987) (table)
Chronesky conceptual model (figure/s)
Relative importance of various routes (table)
Relative importance of various types of introductions (intentional/unintentional/illegal entries) (table)
Impact of high volume exports in countries of origin (e.g., pet and aquarium trade in rare species)
Illustrative case studies (summarized from appendix)

SECTION III. PRIORITY TECHNOLOGICAL ISSUES (25-30%)

Section Introduction: Rationale and scope, with references to others' work for what we have excluded.

Chapter 5. The Application of Decision-Making Methods to Problems of Non-indigenous Species

A. What Decisions Need to be Made? (incl. what species to exclude from entry or intentionally introduce; "clean" and "dirty" lists; which species need to be controlled or eradicated after entry and establishment; what prevention/control/eradication technologies to apply)
B. Existing Tools for Decision-Making (incl. risk assessment; cost/benefit analysis; protocols; techniques for incorporating expert opinion and public concerns; state and federal environmental impact assessment).
C. When are Decisions Made? (emergencies vs. longer-timeframes)
D. How Decisions are Influenced by Interested Parties (incl. industrial and environmental lobbyists, professional organizations, the public)
E. How Decisions are Influenced by Values: Articulating and Selecting Ecological, Aesthetic, Ethical, and/or Recreational Goals
F. Alternative Decision-Making Methods (incl. incorporating additional values into cost/benefit analysis)
G. Application of Protocols (incl. the need for protocols [are all classes of planned introductions adequately covered at present?]; existing protocols [biocontrol agents; bioengineered organisms]; proposed protocols [Amer. Fisheries Soc.]' desirable characteristics for new protocols; should protocols be voluntary or mandatory?)

Supporting Material:
Who makes decisions (summarized from chs. on federal/state/etc. roles)
Chornesky conceptual model with decision points highlighted (figure)
Differing results of C/B Analysis (matching sidebars?)
Case studies of decision-making (summarized from appendix)

Chapter 6. Technologies for Preventing Unintentional and Illegal Introductions and for Managing Non-indigenous Species-Related Problems

A. Technologies for Preventing Unintentional and Illegal Introductions: Detection, Interdiction, Containment, Quarantine, Monitoring, Education
B. Technologies for Managing Established Problem Species: Detection, Monitoring, and Control
C. Classical Biological control in Management
D. Eradication

E. Apportioning Effort Among Methods (strategic inter-and intra-agency decision making)
F. Ecosystem Approaches: Restoration, Environmental Impacts of Control

Supporting Material:
Success/failure rates of interdiction/prevention (table)
Noteworthy successes and failures of prevention, control, and eradication (sidebars)
summary of chemical and mechanical management methods (table)
Current apportionment among efforts (agency budgets; table/s)
Effectiveness of public education in prevention and management

SECTION IV. PRIORITY INSTITUTION ISSUES (25-30%)
Section Introduction: Rationale and scope

Chapter 7. The Role of the Federal Government in Domestic and International Issues Regarding Non-indigenous Species

A. The Key Federal Players (incl. USFWS, USDA, USFS, BLM, NOAA, Customs, NPS, Coast Guard)
B. Major Federal Statutes and Regulations for Preventing Illegal and Unintentional Introductions, Avoiding Harmful Authorized Releases, and Controlling Problem Species Once Established.
C. Related Federal Laws Regarding Environmental Impact Assessment
D. International Approaches (incl. treaties, trade regulation, liability law, relations with Mexico and Canada)
E. The Effectiveness of Federal and International Efforts

Supporting Material:
Flowchart/matrix of institutional responsibilities (figure or table)

Chapter 8. The Roe of States, Regional, and Local Governments in Issues Regarding Non-indigenous Species

A. The Key State Players (incl. Agriculture and Fish and Game Departments)
B. State Statutes and Regulations
C. Regional Approaches
D. Involvement of Local Governments
E. The Effectiveness of State, Regional, and Local Efforts

Supporting Material:
State survey (comparative tables)

Chapter 9. Gaps, Redundancy, Cooperation, and Conflict Among Institutions

A. What is Getting Through the System and Why: Uncontrolled Taxa and Entry Routes
B. Gaps That Need to be Filled (possibilities incl. aquaculture, non-agricultural pests, emergent aquatic vegetation, timber, designation as "native" in advertising)
C. Relationships Among Federal Agencies with Direct Authority, Proprietary Agencies, and others (incl. DOD)
D. Relationships Between Federal and State Authorities: Cooperation and Conflict (incl. inspection of 1st class mail, interstate commerce)
E. Relationships Between and Among States: Cooperation and Conflict (incl. zander [Dakotas], fruit flies [HI/CA], regional commissions)
F. The United States in the Global Arena: Gaps, Cooperation, and conflict at the International Level (incl. U.S. as exporter of exotic species via USAID)
G. Promising Approaches: Lessons Learned From States, Other Countries (incl. New Zealand), and Other Problems (incl. preventing traffic in threatened and endangered species (CITES),controlling vector-borne diseases (CDC)

Supporting Material:

Seed catalogs (inconsistency re state imports)
Comparative analysis of case studies (tables?)

SECTION V. THE BROADER CONTEXT (10%)

Chapter 10. The Relationship Between Bioengineered Organisms and Non-indigenous Species

A. A Continuum of Novel Germplasm: Bioengineered Organisms as a Special Case of Non-indigenous species
B. Should the Regulatory Approach to Bioengineered Organisms be the Same as for Naturally-Occurring, Non-indigenous Organisms?
C. A Test Case: Transgenic Fish

Supporting Material
Characteristics of bioengineered and naturally-occurring organisms (comparative table)

Chapter 11. The Look of the Future

A. Relationship of Non-indigenous Species to Broader Environmental Problems: Climate Change, Loss of Genetic Diversity, Protected Areas, Public Health, Outdoor Recreation, Soil Conservation
B. Future Scenarios: the Consequences of Not Stemming the Flow of Introductions (written by Advisory Panelists?)

Supporting Material:
Number of non-indigenous species introduced for soil conservation (table)
Goals of indirectly-related legislation (Endangered Species Act, "Multiple Use Management", etc.)

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Zebra Mussel Watch

Information Update.....Correspondents: Dawn Jennings
Jim Shafland

The following information update was taken from recent summaries.

First reported from Lake St. Clair, the zebra mussel is within the central basin area of Lake Erie (Gubanich 1989, Schoby 1990). There, reproduction begins when the water temperatures exceed 39.6°C, generally between the months of June to October (Gubanich 1989). Adults become sexually mature at age 2+ and 30-40,000 eggs are produced per female per year. Eggs are tolerant of low dissolved oxygen, but not high turbidity.

The veliger larvae (free swimming stage) are most abundant between July and August in depth contours of 3-7 meters (Gubanich 1989). This planktonic stage last for 8-10 days and optimal development occurs between 20-22°C. The mussel grows to 5-10 mm during the first year. They are most sensitive to temperature shock and low oxygen during fall and winter. Juvenile migrate from shallow water to depths defined by light penetration and temperatures approaching 4°C.

Salinity tolerances of adults were reviewed by David MacNeill of the first issue of the Dreissena polymorpha Information Review. Highest mussel densities in dutch estuaries were found at salinities less than 0.30 ppt. reports of the upper tolerance levels vary widely ranging from 0.5-6.76 ppt, but the duration of the tests may have differed among studies (MacNeill). No information is available on the salinity tolerances on reproduction, and survival of eggs and veliger larvae.

Preliminary results from Ontario Hydro suggest that 29-30°C appears to be the chronic threshold for veliger mortality (Dreissena polymorpha Information Review 1990).

The primary impact detected thus far is biofouling for which there is no effective treatment presently. The impacts of the zebra mussel have positive

impacts for water quality as a biofilter, removing suspended materials and heavy metals (Gubanich 1989). Each mussel can filter a liter of water per day. Greater water clarity will change the trophic system locally as macrophytes may be favored over phytoplankton. This should affect the fish community. Plankton feeders should decline, but those species dependent upon beds of macrophytes should be favored. Freshwater drum, yellow perch, crayfish and diving ducks feed on them and their presence may provide forage for migrating waterfowl. Thus far there is no evidence that either oxygen depletion or elevated ammonia from pseudofeces will inhibit the development of walleye eggs because sufficient flushing exists over spawning reefs (MacNeill 1990, Schoby 1990).

References:

Dreissena polymorpha Information Review. 1990 1(1).

Gubanich, J. 1989. The zebra mussel, Dreissena polymorpha a summary. Walleye, Fall 1989 p.34-continued on p. 53.

McNeill, D. 1990. Topical summaries. Dreissena polymorpha Information Review. 1990 1(1):3.

Schoby, J. 1990. Zebra mussels-where are we now? Wild Ohio, Winter 1990-91, p. 11-12.

Available for purchase: Proceedings of the International Zebra Mussel Research Conference OHSU-TS-019 ($2.00--that's no misprint--2 bucks and it includes tax, postage and handling!). Copies can be purchased from the Ohio Sea Grant Columbus office. The conference was held at Ohio State University December 5-7, 1990.

And now you can subscribe to Dreissena polymorpha Information Review (published bimonthly from NY Zebra Mussel Clearinghouse, 250 Hartwell Hall SUNY College at Brockport, Brockport NY 14420-2928. $60.00/yr. Make checks payable to Cornell University)
This looks like a worthwhile investment for managers and researchers trying to keep up with the explosion of reports and papers concerning THE BIG ZM. Among the services this newsletter will offer are: summaries of research, annotated bibliographies, calls for research proposals, request for research support, updatings of ZM distributions on maps. They are interested in contributions concerning meetings, meeting summaries, proposed legislation, research updates, in short what all newsletters hope to pry from the readership (BIG NOT SO SUBTLE HINT).

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"Goby not Gorby"

What two things live near the Caspian Sea have names that start with G and come to the new world. Hint: neither was the mentor of Boris Yeltsin. You got it! The tubenosed goby (Proterorhinus mamoratus) and the round Caspian goby (Neogobius melanostomus). The former was collected by David Jude from the screens of the Bell River Power Plant on the St. Clair River (did I read that right?), the latter by fishermen on the canadian side of the St. Clair. The round Caspian goby is reputed to feed on zebra mussels (but so does Gorby and which would you have visit us, I ask You).

Reference

Early Life History Section Newsletter. 1990 11(2)--see for very bad pun: Goby-wan-canoby.

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Grass Carp Watch

Our own John Cassani, the Grass Carp Committee Chair of IFS is interested in putting together a guide for using grass carp. The intent is to present the latest consensus on the wise use of grass carp. As such, it does not necessarily promote the use, but will attempt to provide an additional source of information to those individuals presently using carp or as a guide to first time users. John invites questions and comments concerning his project [(813) 694-2174, FAX: (813) 694-5952].

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"Sex Lives and Videotape"

Noting that the rudd, a native of Europe and central Asia, hybridizes with other European minnows (obviously it is as promiscuous as Rob Lowe--no mean feat). This sexy minnow was introduced into the United States since the 1900's, is extensively cultured in Arkansas as a bait minnow and has taken residence in at least 10 states. Concerned that introgressive hybridization may pollute populations of native golden shiners, the National Fisheries Research Center conducted an experiments to determine the extent of this potential problem. They stimulated courtship by administering hormones (candy is dandy, but hormone administration works faster) and stocked fish tanks in ratios of 2 females:1 male (menage-a-trois). The BOTTOM LINE is that hybrids can be produced but that hybrids appear to be infertile. Videotapes of lusty fish are being reviewed to examine unnatural mating behaviors (It's a dirty job, but someone has to do it!). For more information contact Jim Williams at the National Fisheries Research Center, 7920 NW 71st Street, Gainesville FL 32606 [(904) 378-8181].

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Impacts of SCUD (Salmonid Colonizing Using Drops) Missiles on High Mountain Lakes.

Two independent, large scale studies (northern Cascades, Selway Bitterroots Wilderness) suggest that introduction of trouts to fishless mountain lakes is deleterious to the indigenous fauna. Both studies found that the biodiversity of aquatic fauna was significantly lower in lakes where trout were introduced via aerial bombardment. This is a pattern that has been reported elsewhere (e.g. Sweden, northern Canada). Presumably, the aquatic invertebrates and amphibians inhabiting these lakes have evolved without predators and do not have "defenses" for them. They recommend that stocking cease to preserve the endemic fauna that is left. Perhaps some of the stocked lakes should be "reclaimed" and native fauna re-introduced (editorial comment). For more information contact Peter Bahls, Department of General Science, or Gregory Lomnicky, Department of Fisheries and Wildlife, both at Oregon State University, Corvallis OR 97331.

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"Terminator Part III".....Correspondent: Clark Hubbs

Clark shipped me a copy of the following manuscript. The title and the leading captions say it all: "Shrimp stocking, salmon collapse, and eagle displacement: Cascading interactions in the food web of a large aquatic system". "Benefits produced by introductions have come at considerable cost." We encourage you to read this article, if you have not already done so. It documents how the deliberate introduction of the mysid shrimp, Mysis relicta, resulted in widespread changes cascading through the trophic system. The introduction competed with the species it was intended to enhance, kokanee salmon (ironically, another introduced species), and caused dramatic declines in zooplankton populations and both avian and mammalian predators which are dependant upon the kokanee salmon as prey. From the evidence at hand, it is possible that an oscillating ecosystem is the end result from this unfortunate introduction.

Spencer, C.N., B.R. McClelland, and J.A. Stanford. 1991. Shrimp stocking, salmon collapse, and eagle displacement: cascading interactions in the food web of a large aquatic ecosystem. BioScience 41(1):14-21.

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REGIONAL REPORTS

Oregon

Impact of Bait bucket Introductions of Smallmouth Bass on Indigenous Fishes of the Umpqua River.

Smallmouth bass were illegally introduced into the Umpqua River during the early 1970's. Since then they have become established in over 200 miles of stream and provide a significant sports fishery. Kin Daily, a biologist for the Oregon Department of Fish and Wildlife (ODFW), has found that the size and species structure of the native fish community has changed significantly. Not surprisingly, only big fishes are left where smallmouth bass are thick. There does not appear to be a management concern at this time and smallmouth bass are managed for sport fishing, although ODFW regrets that the bait bucket introduction has occurred. No impact on the juvenile anadromous salmonids has been detected yet. What will happen if the sculpins, minnows and suckers decline further? Prey switching? Pray not. Contact Kin at ODFW headquarters, P.O. Box 59 Portland OR 97207 for further details.

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Oregon "The Fish Were Almost a Pest"

Striped bass migrated up to Oregon from California where they were introduced from the eastern sea board in the 1880's. The first record of their appearance off the Oregon coast was in 1914. Their numbers have declined from an estimated 70,000 fish in 1945 to less than 1,000 individuals. According to Bud Day, as cited in the Oregonian "The fish were almost a pest...It seemed like nothing for people to go out and come back and have their picture taken with 20 or 30 of them". In order to reverse this trend, the Fish and Wildlife Commission adopted a plan to plant young stripers off the coast (raised in hatcheries in California-released in Oregon. Californication?). The concept is presumably to raise numbers of striped bass to pestiferous levels.

Reference.

Griffith, J. Coos Bay introduces striped bass enhancement program. Oregonian 31 January 1991.

*****

Massachusetts

"Banner Year for Strange Fish" ..... Correspondent: David Halliwell[1]

1990 turned up several new exotics for the state of Massachusetts. They are included in the following list. No doubt these fish originate from personal aquariums and are a result of illegal releases from owners who no longer wish to keep them as pets. Unfortunately, the great increase in number found this past year would indicate that this practice is becoming more common, at least within the highly (human) populated portion of the state. Fortunately, all of the fish species found to date are tropical forms whose occurrences in the northeast are assumably shortlived.

The Massachusetts Department of Fish and Wildlife is in the process of promulgating new baitfish regulations which will preclude the importation of any non-native species for use as a baitfish. They are revising/strengthening regulations pertaining to general fish importation, propagation, and liberation practices.

Exotic (Tropical) Fish Occurrences in Massachusetts

walking catfish (Clarias batrachus)
Taunton River Drainage, Waldo Lake Brockton (1971).

Oscar (Astronotus ocellatus)
Westfield River Drainage, Congamond Lake, Southwick (1978)

red-bellied piranha (Serrasalmus natteri)
Charles River Drainage, Lexington Reservoir (1981)
Nashua River Drainage, unnamed pond, Westminster (1985)

murrul (Ophicephalus marulius) snakehead family (Ophicephalidae)
Shawsheen River Drainage, Pomps Pond, Andover (1990)

cichlid (Cichlasoma citrinellum)
Ten Mile River Drainage, Dodgeville Pond, Attleboro

pacu/piranha?
Charles River Drainage, Dug Pond, Natick

[1] ARC/Saris, RFD 2 Box 307, Augusta ME 04330

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Have You Seen.....Correspondents: Peter Moyle, Clark Hubbs, John Chapman, Doug Markle

Marshall, B.E. 1991. The impact of the introduced sardine Limnothrissa miodon on the ecology of Lake Kariba. Biological Conservation 55:151-165.

Abstract: The sardine Limnothrissa miodon was introduced from Lake Tanganyika into the man-made Lake Kariba where it now supports a major fishery. The suggestion that this fish could be introduced into other African lakes has been strongly criticized and this paper outlines its effects on the ecology of Lake Kariba. It may have prevented an indigenous species from becoming a pelagic planktivore but the populations of the predatory tigerfish and some piscivorous birds increased following the sardine introduction. It has caused major changes, similar to those described elsewhere, to the zooplankton. The zooplankton biomass is now very low and it is not clear how it can maintain itself in the face of intense predation by the sardine. Cascade theory suggests that the sardines should have caused changes in the phytoplankton as well but there are too few data available to demonstrate this. The sardines may also have influenced the nutrient economy of the lake and contributed to the decline of the aquatic fern Salvinia molesta, which once covered large areas of the lake. It is concluded that while this species is a suitable candidate for stocking into man-made lakes its introduction into natural lakes is undesirable. This is especially so in Lake Malawi because the sardine's capacity to change the plankton population could threaten the lake's endemic species flocks.

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Littlewood, D.T.J. and L.A. Marsbe. 1990. Predation on cultivated oysters, Crassostrea rhizophorae (Guilding), by the polyclad tubellarian flatworm, Stylochus frontalis Verrill.

Summary: Crassostrea rhizophorae is cultivated subtidally in Jamaica. A relatively high mortality rate (20-50%) has been observed each year since the inception of this enterprise in 1977. The predator is the flatworm Stylochus frontalis, newly recorded in Jamaica. (Is this an example of an introduced pest--Editorial Comment).

.....

Yamada, S.B. and R.A. Mansour. 1987. Growth inhibition of native Littorina saxatilis (Olivi) by introduced L. littorea (L.). J. Exp. Mar. Biol. Ecol. 105:187-196.

Abstract: Since its introduction to North America, Littorina littorea (L.) has become the most abundant periwinkle on New England shores. The possible effect of this introduction on the native populations of L. saxatilis (Olivi) was investigated by settling up mixed and single species cages at three tidal heights in two habitats at Woods Hole, Massachusetts.

L. saxatilis is most abundant in the upper intertidal and black lichen zones, while L. littorea is most abundant in the mid and low tidal zones. Both species grew significantly more at lower than at higher tidal levels. Food scarcity appears to set an upper limit to the vertical distribution of L. littorea. At the low tidal level the presence of L. littorea depressed the growth rate of L. saxatilis, while L. littorea grew better in the presence of L. saxatilis than conspecifics. Food competition may be the mechanism of this interaction.

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RECENT PROCEEDINGS

I.J. de Moor & M.N. Bruton (eds). 1989. The management of invasive aquatic animals in southern Africa: proceedings of a symposium and workshop organized by the Foundation for Research Development in collaboration with the J.L.B. Smith Institute of Ichthyology, Grahamstown. CSIR Ecosystem Programmes Occasional Report (44).

Chapter headings

The present status of management of invasive aquatic animals in South Africa--K.C.D. Hamman, C.J. Kleynhans and O. Bourquin.

Alien aquatic birds in southern Africa--R.K. Brooke

Introduced aquatic animals: some commercial and hobbyist viewpoints--B. Andrews

Perspectives on the ornamental fish trade in south Africa--D. van Zyl

The value of introduced aquatic organisms to the sportfishing industry--P.B.N. Jackson

The benefits of exotic aquatic animals to aquaculture--N.P.E. James and M.T.T. Davies

Current legislation and conservation policy on invasive aquatic animals in south Africa and adjacent states--R.D. Walmsley and T. Pike

Important features of foreign legislation on aquatic invasive animals--I.J. de Moor

Abstracts

The aquatic invasives problem in South Africa--M.N. Bruton and I.J. de Moor

The invasive fish problem from an international perspective, with particular reference to North America--W.R. Courtenay

Regulation of aquatic invasives in the United States of America, with emphasis on fishes--W.R. Courtenay

Factors influencing the successful establishment of invader species with case histories of aquatic insects--F.C. de Moor

*****

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NEWSLETTER

of the Introduced Fish Section
American Fisheries Society

June 1991 Hiram W. Li, Editor Volume 11, Number 2

NEWSLETTER CONTENTS

FROM THE EDITOR

We are adding a new section to the newsletter. Paul Shafland has given it the title "Perspectives". It is a good one. Our section's interests, in many ways, is the leading edge of the management challenges of the future: biodiversity, biological control, transgenic organisms (to be discussed further in a future issue), ecosystem integrity, new agricultural and medicinal products. We hope that many of you will contribute to this column, but in the meantime, Paul will graciously host this section.

The sporting public is becoming more aware of the issues of non-native species. However, it is often schizophrenic. Excerpts from Bill Monroe's column in the Portland Oregonian will serve to show. "Introduction of non-native fish is devastating many local rivers and lakes" is the title of his piece and as much as anything demonstrates Li's First Law of Fishery Biology, "NO ONE CONTRADICTS THE ADVICE OF THEIR CARDIOLOGIST, BUT EVERYONE KNOWS HOW TO RUN A FISHERY BETTER THAN FISHERY PROFESSIONALS".

> "Of Oregon's 38 freshwater gamefish, more than two-thirds, 26, are not native. Many of them were introduced illegally. Little wonder that yellow perch are crowding out what was an all-too-brief but brilliant rainbow trout fishery in Hagg Lake."
>
> "Even the illegal introduction of smallmouth bass added to the yellow perch will never make up for the attraction the fat planted rainbows once held for Portland-area anglers." [NOTE HATCHERY FISH WERE USED TO HIS SATISFACTION HERE-SEE LATER FOR CONTRADICTION IN THINKING]
>
> "Even our predecessors were guilty by today's standards of pristine native-fish mismanagement. Early this decade, the spread of trout from all over the world into the Oregon desert so diluted the genetic makeup of Oregon's desert redside trout and Lahontan cutthroats that in most streams the pure survivors can be counted on a biologist's fingers. And, the bastardized remains of the Great Basin salmonid species aren't doing as well as they would have if everything had simply been left alone." [I AGREE THAT THIS WAS A MISTAKE, BUT HOW DOES THIS SQUARE WITH HIS PHILOSOPHY ABOVE?]
>
> "Not all legal and illegal introductions have been failures, or even detrimental, of course. The spread of East Coast shad and striped

bass north into Oregon from original plants in central California are examples of accidents-gone-good, although the stripers in Oregon, while well endowed with the potential to produce world-record fish are not getting much attention. Having caught striped bass in the umpqua system, it is this writer's feeling that if stripers like to eat **steelhead smolts, well, let's grow more steelhead smolts.**" [BOLD EMPHASIS MINE. NOTE HERE THAT PROFESSIONALS ARE CONCERNED ABOUT DECLINING STEELHEAD NUMBERS. SHOULD WE PRODUCE HATCHERY FISH TO FEED STRIPED BASS?].

The above reflects the type of public we try to appease and relates to Phil Pister's concerns about value systems expressed in his contribution to the Perspective section.

Paul Shafland discusses responsible uses of introductions and this links up well to a progress report by Rich Malecki on biocontrol of loosestrife. An example of responsible research on use of exotics for biological control. Biological control biologists in entomology look for tools to solve a single problem. As agricultural pests are exotic, they look for exotic biological controls that have evolved with the pest.

We tend to use a single tool to solve many problems. For instance, attempt to control pestiferous aquatic weeds with a generic herbivore, coadaptation is not given much regard. Exotic predators that are highly coadapted to their prey may not cause much negative impact on the rest of the biological community. The care that entomologists expend in conducting experiments under an elaborate system of quarantine is impressive. Perhaps we can learn from their model.

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PERSPECTIVES

"Planned Versus Accidental Introductions".....Correspondent: Paul Shafland[1]

Hiram Li has asked that we establish a permanent column featuring member perspectives on various topics related to introduced aquatic organisms. Judging from past comments, I think most will agree that this is a good idea. BUT this undertaking will only be successful if YOU are willing to take the time and energy to make YOUR perspectives a part of this endeavor. Perspectives are really just opinions, and since we all have these, there's really no excuse for not participating in this effort.

If successful, this column could serve the important function of documenting the range of opinions that exist within our Section. Furthermore, since personal perspectives influence how we conduct research and interpret data, scientists have much to gain by critically assessing their perspectives, particularly when it comes to controversial issues such as introduced species. Given this, and my belief that such a column would be desirable, I hope many others will participate, even and especially if they've never done anything like this before...well here goes.

As I see it, accidental, unplanned or illegally introduced fished (all of which are the same thing to me) pose larger and more serious problems than do planned introductions. In Florida 18 of the 19 established exotic fishes were illegally released into open waterways, and they now exist as the result of nearly random sets of circumstances. Accidental; introductions of non-native fishes associated with the culture of food fishes is of special concern to me since these species are often selected using the same criteria that would help it survive in the wild.

Nearly everyone agrees we should do more to prevent accidental introductions, as well as, to develop more comprehensive evaluations of previously introduced species. Furthermore, objective evaluations of accidental introductions will surely contribute much useful information for evaluating planned introductions. Thus, I believe it is these issues that are of primary importance and the ones that we should be focusing most of our attention on now.

The question of purposeful, planned, intentional or legal fish introductions (again, all of which are the same thing to me) is a much more difficult question since these introductions are proposed and conducted by professional fisheries scientists with the approval of the responsible governing authority. Fisheries professionals proposing such introductions believe strongly that this tool can be used wisely and beneficially, although they also recognize it could be misused. There is another group of professional fisheries scientists that is strongly opposed to all planned introductions, and herein lies the controversy.

If you want to know where you fit in this controversy, simply determine whether or not you have supported or defended any of the hundreds of planned introductions that have taken place. If you have not, then you are likely a member of the group that opposes all introductions. If you supported some and opposed others, then you're in the middle with a tendency towards one side or the other depending on how often you supported or opposed such introductions. It is important to analyze your support or opposition to introductions using the 'past' tense; that is, if you never supported a purposeful introduction in the past you will not likely do so in the future unless your perspective fundamentally changes.

Thus, the issue of planned introductions immediately divides fisheries professionals into at least two generally antagonistic groups, which almost always leads to diverting attention from the major problems of realistically assessing and preventing accidental introductions. To me, this is the most unfortunate aspect of the entire issue.

ON BUILDING COALITIONS AND CONSENSUSES--The rate at which we make progress on matters involving introduced fishes will largely depend on whether or not we build effective coalitions that include resource managers, academicians, fishermen, naturalists, preservationists and other environmental groups. By working in areas of common agreement and building on each other's strengths, I believe we will find each other's goals and objectives to be more similar than we now think. Once begun, this process could lead to a progressive and realistic consensus that would be adopted by most if not all governmental agencies responsible for regulating introduced organisms.

A good place to start is with a willingness to clearly define our own personal perspectives (i.e., biases) based on substantive arguments and scientific objectivity <u>without</u> reference to someone else's opinions(s). Next, we can subdivide these perspectives into similar groupings which would be a major step towards consensus building based on something other than a reaction to what we perceive some other group's perspective is. I think it was Adolph Hesse that said "for a revolutionary to be remembered well by history, he must replace that which he tears down with something better." To only tear down or criticize the perspectives of other is of little permanent value, even if the other is wrong (i.e. builders not destroyers leave enviable legacies).

In pursuing this consensus we should be especially careful to avoid potentially divisive or sensationalistic statements which, if made, should not go unchallenged. Serious endorsements of unrealistic wishes such as elimination or prohibition of <u>all</u> introduced species, or that we try to return everything to the way it was 'before man messed it up' are naive, counterproductive and do little other than to fuel divisiveness. It is critical that our very real and legitimate philosophical differences not be exploited by either side, and only through new found coalitions will we begin to answer the important questions associated with introductions.

It is clear that 'legitimate' differences exist among fisheries professionals on the questions of planned introductions and what constitutes the wise and proper use of our fisheries resources. Furthermore, it is obvious that these differences are based in strongly held philosophical convictions. Nonetheless, these differences should not prevent us from joining together to work on the issues we do agree on, namely the need for more work on preventing and assessing accidental introductions.

[1] Florida Game and Fresh Water Fish Commission, 801 NW 40th Street, Boca Raton FL 33431

"We Have Met The Enemy, And They Are Us".....Correspondent: Phil Pister[2]

Aldo Leopold stated nearly 50 years ago (in A Sand County Almanac) that: "conservationists are known for their dissensions.....In each field one group (A) regards the land as soil, and its function as commodity production; another group (B) regards the land as a biota, and its function as something broader."

We find this dichotomy among fishery biologists, many of whom persist in placing catch per hour at the top of their priority list in the planning and budgetary process to the relative neglect of the biotic community. Schooled primarily in utilitarian technology and philosophy and deeply involved in attempting to meet insatiable demands for an ever-higher level of angler success, may biologists fail to extend their vision to higher and more enduring goals. They fail to realize that in the long run, the prescription necessary to best meet their obligation to an ever more perceptive and sophisticated public (to say nothing of their moral obligation to the organisms themselves) can perhaps be filled most appropriately from a stock of native species existing in secure habitats. A decrease in angling license sales in key areas of the nation, combined with a burgeoning public interest in biodiversity, tends to support this thesis.

The philosopher Goethe once observed that: "every man has only enough strength to accomplish those assignments of which he is fully convinced of their importance." This general concept is evaluated, and possible solutions are offered in an effort to make the fishery biologist a major force in maintaining biodiversity, rather than remain as a significant part of the problem.

[2] Desert Fishes Council, Bishop CA 93514.

"I came here to ponder the futility of it all, but I can see it's useless."

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MEETING ANNOUNCEMENT

FIRST INTERNATIONAL WORKSHOP-CONFERENCE ON INTRODUCTIONS AND TRANSFERS OF BIOLOGICAL AGENTS INTO THE GULF OF MEXICO AND CARIBBEAN SEA: ECOLOGICAL IMPLICATIONS

Considerable concern is now being shown over the possibility that adverse ecological effects, particularly those involving exotic species and highly virulent disease agents, may occur as a consequence of living organisms being introduced and transferred into aquatic ecosystems, such as the Gulf of Mexico and Caribbean Sea. Because of the several pressures to translocate organisms between worldwide locations, many responsible living resource and habitat managers and other decision makers have become apprehensive about designed and accidental movements, via human agency of micro- and macroorganisms from one ecosystem to another. They now recognize that degrees of risk should be evaluated and risk reduction-management strategies considered before various avenues for entry (pathways are opened, or imports permitted, of unrecognized but potentially undesirable (harmful) living organisms into local and neighboring waters. Furthermore, they feel that it may be advisable for quarantine and inspection measures to become integral parts of aquaculture programs and other fisher-related activities that involve exotic and transferred species. Therefore, this workshop-conference, now in the planning stages, is intended to provide to Gulf and Caribbean jurisdictional marine habitat and resource managers (and their representatives from the scientific community) risk assessment and risk reduction information when species translocations are involved. Such information should help maintain biological diversity, enhance living resource productivity, sustain habitat integrity, and promote fishery conservation activities.

The planned workshop-conference and future workshop-conferences will be modeled after those held by the International Council for the Exploration of the Sea's Working Group on Introductions and Transfers of Marine Organisms. Target dates for the first workshop are the spring or fall of 1992. The venue is still undecided, as are funding sources and sponsorship.

For further information, contact Dr. Aaron Rosenfield, NMFS, Oxford Laboratory, Oxford, Maryland 21654 [(301) 226-5193 FAX: (301) 2265925]

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REPORT FROM THE AQUARIUM COMMITTEE

The following is the summary of a progress report on the effects of metals in fish food on ornamental fishes. This study was commissioned by Herbert Axelrod because of his concern upon learning of the metal concentrations found in commercial fish food. The resulting work was performed under the supervision of D.L.G. Noakes, Director of the Institute of Ichthyology, University of Guelph. The purpose of this study was measure the effects of dietary metals on growth and reproduction of representative ornamental fishes.

Summary-Goldfish (Carassius auratus) and zebra danio (Brachydanio rerio) were fed either control diet (minimal amounts of metal), or control diets with added amounts of aluminum, copper, manganese or zinc. Goldfish fed the diets with added amounts of aluminum and zinc had higher mortality rates than goldfish fed control diets or control diets with added copper (manganese appeared to be intermediate in its effect). Zebra danios fed diets with any of the metals added to control diet had reduced egg production compared to fish fed only the control diet (again manganese appeared to be intermediate in its effect). Body burdens of metals in fish fed the various diets are currently being measured, as are the effects of these metals on the growth and reproduction of swordtail (Xiphophorus helleri).

Copies of this progress report can be obtained from Herbert R. Axelrod, T.F.H. Publications, Inc., One T.F.H. Plaza, Third and Union Avenues, Neptune City, New Jersey 07753

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"Farm Fresh 'Gator".....Correspondents: Carl Schreck[3]
Paolo Petry[3]

Alligator farming is a big buck operation. The hide is in demand ($35/linear foot). The meat is tasty (ever notice that most weird food tastes like chicken or pork?), low in cholesterol, high in mono-unsaturated fats and generally a full meal deal ($4.50/lb. wholesale). It takes about 14 months to rear a 4-foot gator which is worth about $155. About 400,000 hides were harvested in 1990 and it is projected that 2,000,000 hides will be needed to satisfy market demands by the turn of the century. It is no surprise then that gator farming is now big business. California, ever mindful of trends, noticed that there were 90 farms in Louisiana, 40 in Florida, began to raise gators in California. A recent state senate bill (SB 1013) will change all this, if it passes, as concerns emerged concerning animal welfare and feral gators. The bill prohibits farms in California to keep the beast for meat or hides.

Importing Nile crocodiles to Brazil may seem like hauling coals to Newcastle, but 110 of them have been imported to Porto Alegre, in southern Brazil. Local ecologists fear that declining populations of native caiman, comprising many species, will be displaced if feral crocodiles become established. A legal battle is brewing, the farm is legal presently through a last minute decree by a lame-duck governor. Involved are a veterinarian, Andreia Fillippi; his mother, Rejane, a former state justice minister and influential lawyer and the family patriarch, Nilo Schunke, a cattle rancher and owner of Contaregis, Equipes Y Controles. Ludwig Buckup, an ecologist at the Federal University in Rio Grande do Sult, challenges the crocodile farm's claim of being escape proof, noting that similar claims were made for the African killer bees (which have killed and estimated 700-1,000 people). Other critics are the Presidents of Paraguay, Peru, Columbia, the Union for the Conservation of Nature, Traffic U.S.A., World Wildlife Fund, World Conservation Monitoring Center. The plans are to raise 3,000 crocs a year. If a mating pair should escape, the lakes and swamps surrounding the Rio Grande do Sul is ideal for rearing and provides a corridor to the interior to the Pantanal swamp and ultimately to the Amazon. Ironically, proposals to rear native caiman both for market and reintroduction have been denied in Brazil (Paolo Petry, Pers. Comm.). This points out the need to promote rearing native species over exotics. The Willie Sutton principle seldom fails--feral animals eventually become established (See IFS 10(1)).

References

Dillon, S. Crocodile import scares experts: ecologists, scientists deplore Brazilian plan for killer crocs. Knight-Ridder News Service 1991.

Ray, G. 1991. Alligator farmers: an endangered species in California. California Aquatic Farming. April 1991, p. 1.

[3] Department of Fisheries and Wildlife, Oregon State University, Corvallis OR 97331

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"Downside of Ballast Water Down Under"

We are not the only country to experience problems with ballast water introductions. Whereas most of our concentration has been on the Great Lakes, the experience of Australia should alert us to potential problems in our own coastal waters. Perhaps as many as 16 species have been transported in ballast water and become established in Australia. Many more may exist as extensive coastal waters have not been surveyed. Coastal shipping and currents may spread the infestation of exotics once established off the coast. The exotics are as follows:

FISH
1. Acanthogobius flavimanus (yellowfin goby)
2. Tridentiger trigonocephalus (striped goby)
3. Lateolabrax japonicus (Japanese sea bass)
4. Sparidentex hasta (sobaity sea bream)

SEAWEED
15. Undaria pinnatifida

TOXIC DINOFLAGELLATE
16. Gymnodinium catenatum

INVERTEBRATES
Crustaceans
5. Pyromaia tuberculata (crab)
6. Eurylana arcuata (slater)
7. Neomysis japonica (mysid shrimp)
8. Tanais dulongi (tanaid)

Molluscs
9. Musculista senhousia (Asian mussel)
10. Theora lubrica (Asian semelid bivalve)+
11. Aeolidiella indica (sea slug)*+

Polychaete worms
12. Mercierella enigmatica *
13. Boccardia proboscidea*
14. Pseudopolydora paucibranchiata*+

*hull fouling an alternate mechanism for transport

+uncertain distribution may include Australia

The yellowfin goby is also established in San Francisco Bay where populations have exploded and the striped goby has been introduced in both San Francisco Bay and Los Angeles Harbor.

Further details on the Australian experience can be obtained by ordering the following document:

Jones, M.J. 1991. Marine organisms transported in ballast water: a review of the Australian Scientific Position. Bureau of Rural Resources Bulletin 11.

from
Communications Section, Bureau of Rural Resources, P.O. Box E11, Queen Victoria Terrace, ACT 2600, Phone: (06) 272-4012

This is the first document to be produced by the Ballast Water Scientific Program. It reviews the scientific data on marine introductions, possible policy and treatment options and discusses the possible impacts on marine ecosystems, commercial fisheries and human health. A well laid-out document (Siskel and Ebert give it two thumbs-up).

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"Grass Carp Guide.....Project Update.....Chairman: John Cassani

John is still looking for contributions to make this project possible. He needs co-authors for some of the chapters, new chapters (if you can provide insight not in the present chapter headings, reviewers of chapters. When the project is complete John is soliciting ideas for a publishing outlet. AFS wants publishing costs up front (too steep for the section). This could be a money maker for as well as a valuable contribution from our section. First things first! John wants top quality and a balanced presentation.

The proposed title is:
Managing Aquatic Plants with Grass Carp: A Practical Guide for Natural Resource Managers

Present chapter headings are:

"Pre-stock Considerations" (will include a discussion of public relations) --John Cassani, Lee County Hyacinth Control District, Florida

"Large Impoundments"--Andrew Leslie, Florida Department of Natural Resources

"Small Impoundments"--John Cassani, Lee County Hyacinth Control District, Florida

"Agricultural Canals"--Randall Stocker, Imperial Irrigation District, California

"Open Systems"--Mark Bain, New York Cooperative Fish and Wildlife Research Unit, Cornell University

"Grass Carp Barrier Construction and Installation--Fred Nibling, Jr., U.S.D.I. Bureau of Reclamation

"Recapture Techniques"--Rue Hestand, Florida Game and Fresh Water Fish Commission

"Administration of a State Program"--Robert Wattendorf, Florida Game and Fresh Water Fish Commission

Tentative Schedule:
First Draft Completion--January 1992
Draft Review--February-April 1992
Draft Revisions--May-June 1992
Second Review--July 1992
Final Draft--August 1992

John's address is Lee County Hyacinth Control District, P.O. Box 06005, Ft. Myers, Florida 33906. [(813) 694-2174 FAX:(813)694-5952.

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"Biological Control of Purple Loosestrife".....Contributor: Richard Malecki[4]

Background

Purple loosestrife (Lythrum salicaria) is a perennial wetland plant introduced to North America from Europe in the early 1800's. As an exotic, the plant gained a foothold in the northeastern part of the continent and has since exceeded it range over much of the temperate parts of the U.S. and southern Canada. Purple loosestrife presently is responsible for the degradation of many prime wetland habitats, where its spread has reduced the diversity and availability of native vegetation, thereby drastically impacting the biotic integrity of these systems.

The competitive advantage of purple loosestrife over other wetland plants is highlighted by such biological attributes as high annual seed production (>2M seeds/mature plant), good seed viability (almost 100% germination; 80% after 2-3 yrs submergence), high seedling densities (10,000-20,000/meter^2), and rapid growth (1 cm/day). Mature plants often have 30 or more shoots arising from the rootstock. These can reach 6-7 ft in height, forming dense canopies which severely restrict the amount of light available to plants beneath. Such stands also offer little in the way of food or cover for most forms of wetland wildlife, including waterfowl.

Strategies for controlling purple loosestrife have included physical removal of plants, mowing, burning, water level manipulation, and the use of plant competitors and chemicals. None have proven effective over a broad range of conditions. Additionally, each methodology is costly and requires continuous treatment. Biological control offers the greatest potential as a long-term, safe, economical and effective control technique.

What is biological control?
Biological control of weeds is man's use of natural enemies to reduce populations of a plant pest to an acceptable level. In nature, biological control is the norm, not the exception. Many plants are not pests because natural enemies (insects, pathogens, etc.) keep them suppressed. In turn, the abundance of the plant (host) often influences the abundance of its natural enemies. Ideally, these interactions provide a self-sustaining, balanced system. Purple loosestrife is a classic example of a plant that is flourishing outside of its native range in the absence of natural control mechanisms.

How is a biocontrol program implemented?
First, an extensive literature review on the target weed is conducted, compiling all the available data on the plant's taxonomy, biology, ecology, economics, distribution, and known natural enemies. Next, foreign exploration for natural enemies (control agents) is done in the geographical center of where the weed is believed to have originated and/or in areas where the climate is the same as that where the control program is needed. Potential control agents are then collected and screened for those that are host-specific, attacking only the target weed.

Screening involves detailed studies of the taxonomy distribution, and life history of each potential control agent followed by a rigorous series of host specificity tests to assure that other (native--editor) plants are not at risk. Testing is done at laboratories in areas where the insects (read as also: diseases, predators--editor) are native and at quarantine facilities in the U.S. in accordance with guidelines established by the Plant Protection and Quarantine Program of the U.S. Department of Agriculture's Animal and Plant Health Inspection ?Service (APHIS). Release of insects in the U.S. is subject to review and approval by APHIS and each affected state's agricultural department.

Progress to date: Purple loosestrife
Foreign Research

a. European surveys for insect biological control agents conducted during 1979 and 1980 identified 120 species associated with loosestrife, 14 of which were "probably" restricted to the plant (Batra et al.: USDA Agricultural Research Service, Rome).

b. Follow-up studies by Schroeder and Blossey (Commonwealth Institute of Biological Control (CIBC), Switzerland) reduced the list to 5 species which showed high potential as control agents.

c. Three of these species have successfully completed preliminary screening tests by the CIBC in Europe. They are:
   Hylobius transversovittatus (a root-mining weevil)
   - female deposit eggs in the lower stem of the plant or near the root surface.
   - developing larvae feed on vascular tissue in the root.
   - complete destruction of mature plants is often associated with this insect.

   Galerucella pusilla and G. calmariensis (leaf-eating beetles)
   - both species are very similar in appearance and life history.
   - adults and larvae food on shoots, leaves, and flowers.
   - with high adult and larval densities (200/plant), entire plants are destroyed or weakened sufficiently to prevent seed production.

d. Two remaining species are currently under investigation.
   Nanophyes marmoratus (flower-feeding beetle)
   - adults lay eggs on petals of flower buds.
   - larvae feed inside the flower bud and reduce or prevent seed production.

   Bayeria salicaria (gall gnat)
   - form galls on developing shoots and flower parts.
   - with high rates of attack, this species can reduce growth and suppress seed production.

e. To date, laboratory tests in Europe confirm the high degree of host-specificity observed in nature throughout the European range of these insects.

Domestic Research

a. Hylobius and the two Galerucella species are presently undergoing final screening at the Virginia Polytechnic Institute and State University quarantine facility in Blacksburg.

b. Some "grey" areas remain concerning the partial feeding, oviposition, and/or larval development to these three insects on a few plant species that are closely related to the Lythrum genus. Additional tests are planned to more fully evaluate the impact of the insects on these plants.

c. At this time, we anticipate having anywhere from one to all three insect species approved for release into the U.S. in 1991.

d. Selection of potential field release sites is in progress.

Future Plans
Successful, long-term control of purple loosestrife is dependent upon having a variety of insect species (at least 3-5) that attack different parts of the plant at different stages of its life cycle, are capable of existing over a wide geographic and climatic range, and possess good dispersal and host-finding mechanisms. We are presently on the threshold of releasing the first of such control agents. Full implementation may take 3 to 10 years. Future efforts will be directed toward: 1) continuing the screening of insects in Europe, 2) monitoring and evaluating the population dynamics, spread and impact of newly released insects on purple loosestrife, and 3) assessing effect that this program has on improving the quality of wetland environments across the U.S.

[4] New York Cooperative Fish and Wildlife Research Unit, Fernow Hall, Cornell University, Ithaca, NY 14853, [(607)255-2836]

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REGIONAL UPDATES
North Dakota
"Zander Central".....Correspondent: Terry Steinwand[5]

Contrary to the rumors, zander will not be stocked in North Dakota in 1991. The primary reason is that drought conditions preclude good survival. Stocking decisions will be based on predator density and aquatic plant growth in Spiritwood Lake. There is no truth to the rumor that zander will be stocked elsewhere. Spiritwood Lake is a closed basin and provides a good study site to examine the impacts on existing populations of fishes. There are no plans to stock zander anywhere until it is demonstrated that there will be no detrimental impacts and then extreme caution will be taken. Creel surveys and intensive test netting showed that no zander were caught in the open water fishing period in 1990 nor during the winter season of 1990-91. A lone zander was caught in one of the frame nets.

[5]Chief of Fisheries, North Dakota Game and Fish Department, 100 North Bismarck Expressway, Bismarck ND 58501-5095 [(701) 221-6300]

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Have you seen.....Correspondents: Peter Moyle[6]
John Chapman[7]
David Lonzarich[8]

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Bestgen, K.R., S.P. Platania, J.E. Brooks, and D.L. Probst. 19 .
Dispersal and life history traits of Notropis girardi (Cypriniformes: Cyprinidae), introduced into the Pecos River, New Mexico. Amer. Midl. Nat. 122:228-235.

Abstract.-The Arkansas River shiner Notropis girardi was introduced into the Pecos River, New Mexico, in 1978 and was common in collections made in 1986-1987. From collections made since 1978 in the Pecos River drainage, we analyzed patterns of dispersal and abundance, and compared life history traits with a native population of N. girardi from Revuelto Creek, New Mexico. Notropis girardi dispersed downstream, presumably from a single introduction, colonizing much of the mainstream Pecos River (260 km) by 1981. Since 1981, the distribution and abundance of introduced N. girardi has expanded slightly. Age structure, growth and mortality rates of the Pecos River population are similar to those reported in the literature and to a native population of N. girardi in New Mexico. Timing of reproduction was similar for non-native and native populations, and both may exhibit multiple spawning peaks. Notropis girardi reproduction in the Pecos River coincided with large increases in flow. High discharge presumably initiates spawning and promotes downstream dispersal. Similarity of flow regimes of the Pecos River to those formerly found in lotic systems in the native range of N. girardi (e.g. Cimarron River,

Kansas and Oklahoma) may account for the relative success of this introduced population.

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Mayekiso, M. and T. Hecht. 1988. Conservation status of the anabantid fish Sandelia bainsii in the Tyume River, South Africa.

Abstract-Sandelia bainsii is endemic to the eastern Cape and occurs only in the Kowie, Great Fish, Keiskamma, Buffalo and Nahoon River systems. The conservation status of Sandelia bainsii in the Tyume River, a tributary of the Keiskamma, was assessed by investigating its distribution, abundance, habitat preference and population structure. The species is common in the middle reaches of the river. Habitat alteration and degradation, in association with two alien species, Salmo gairdneri and Micropterus salmoides and a translocated indigenous species, Clarias gariepinus appear to be the most important threats to the survival of S. bainsii in the Tyume River. These threats and the small size of the population suggest that the species is vulnerable to local extinction in this river.

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Golani, D. and A. Ben-Tuvia. 1989. Characterization of Lessepsian (Suez Canal) fish migrants. Environmental Quality and Ecosystem Stability: Vol IV-B, ENVIRONMENTAL QUALITY. ISEEQS Pub. F. Spanier, Y. Steinberger, and M. Luria (eds). Jursalem, Israel.

Abstract-Forty-eight Lessepsian (Suez Canal) migrant fish species were categorized in respect to six characteristics: 1) abundance in the Mediterranean, 2) zoogeographical distribution, 3) feeding habits, 4) habitat, 5) depth and 6) time of first record.

Zoogeographical distribution of Lessepsian species is similar to that of Red Sea ichthyofauna. The majority of the most abundant colonizers feed upon benthic invertebrates and inhabit sandy or muddy substrate at the depths of up to 40 m, suggesting that these sites of the eastern Mediterranean ecosystem are more vulnerable to invasion.

Most of the early colonizers in the Mediterranean are among the abundant species, indicating the increase of the fish migrant populations is to a great extent a function of time.

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Beecher, H.A. and R.F. Fernau. 1983. Fishes of oxbow lakes of Washington. Northwest Science 57(2):125-131.

Abstract-Fish faunas of oxbow lakes in the Chehalis, Snoquaalmie, and Okanogan drainages of Washington were sampled with a minnow seine. for comparison, collections were made in parent streams. We collected fewer fish species from oxbow lakes than from adjacent stream reaches. Most oxbow lake ichthyofaunas were dominated by non-native fishes, while native fishes dominated streams. Numbers of native species and non-native species were not significantly correlated in oxbow lakes ($r = 0.01$), but in Chehalis drainage collections the Olympic mudminnow (Novumbra hubbsi) was collected only where we did not collect non-native fishes.

[6] Wildlife and Fisheries Biology, University of California, Davis, Davis CA 95616

[7] Hatfield Marine Science Center, Newport OR 97365

[8] Fisheries Research Institute, School of Fisheries, Seattle WA 98195

1991-1992 IFS Officers

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