AFS POLICY STATEMENT #15:

American Fisheries Society Position on Introductions of Aquatic Species

A. Issue Definition

The increased frequency of inter- and intranational transfers of aquatic species carried out over the last 2 decades has prompted concern relative to the potential for debasement of integrity of aquatic communities. Past introductions, intentional or otherwise, have run the full gamut from spectacular booms (e.g., Pacific salmon to the Great Lakes) to spectacular busts (e.g., the waterweed hydrilla to portions of the United States). Considering the manifestations of such extremes in terms of ecological and economical impacts, it is not surprising that opposing viewpoints exist with respect to the relative pros and cons of effectuating introductions of aquatic species. Nevertheless, natural resource managers concur that substantially improved measures can and should be taken to increase the odds that benefits of a given introduction will exceed risks. Currently, a number of international commissions have adopted or are considering adopting formal "codes of practice" for regulating the introduction of aquatic species (see Sindermann 1986; Welcome 1986; Kohler and Courtenay 1986). Implementation of such codes (protocols, guidelines, etc.) can ensure that decisions regarding future introductions are based on sound ecological evidence, and that introductions effectuated are properly evaluated.

B. Negative Impacts on Aquatic Communities

The impacts of introduced aquatic organisms on native aquatic communities in North America have been summarized by Contreras and Escalante (1984) for Mexico, by Taylor et al. (1984) for the continental United States, and by Crossman (1984) for Canada. These impacts can be classified into five broad categories: habitat alteration, trophic alteration, spatial alteration, gene pool deterioration, and introduction of diseases.

Habitat Alteration

Introduced plants such as water hyacinth (see Table 1 for scientific names of organisms cited in text), Eurasian was termilfoil, alligator weed, and hydrilla have seriously infested a number of water bodies in North America (Shireman 1984). Excessive vegetation interferes with swimming and fishing activities, upsets predator-prey relationships by providing too much cover, causes water quality problems during growth and decomposition, and is aesthetically unpleasing (Noble 1980). Ironically, exotic fishes, particularly grass carp and the tilapias, are frequently used as biological controls. Both the grass carp and the tilapias have reproducing populations in North America, although the habitat requirement for larval grass carp has so far proved to be limiting and the tilapias are basically limited to the southern extreme of the United States and to Mexico.

Although grass carp have proven to be an excellent bio logical control for aquatic vegetation, a risk exists that aquatic plants (including native forms) might become overly decimated as a result of grass carp predation which in turn would limit nursery areas for juvenile fishes, cause bank erosion, and accelerate eutrophication through release of nutrients previously stored in the plants. A risk also exists that grass carp could adversely impact waterfowl habitat and rice fields. However, no major adverse impacts associated with grass carp have yet been documented.

Although common carp was not introduced to North America for aquatic weed control, its foraging behavior results in vegetation removal both by direct consumption and by uprooting due to its proclivity to dig through substrate in search of food. The latter activity also results in increased water turbidity. The common carp is the most often cited nuisance introduced fish in North America (Kohler and Stanley 1984) with millions of dollars having been spent for control and eradication, but with little success (Laycock 1966; Courtenay and Robins 1973).

Besides grass carp, only the redbelly tilapia has been widely used in weed control programs in North America. No effects on native communities have yet been attributed to vegetation removal by any of the tilapias (Taylor et al. 1984), though increases in turbidity have been attributed to digging activities of the blue tilapia (Noble et al. 1975) and to organic enrichment through fecal decomposition by redbelly tilapia (Hickling 1961; Phillippy 1969).

Trophic Alteration

Taylor et al. (1984) speculated that the introduction of any species into a novel environment should alter community trophic structure, with the nature and extent of such changes being complex and unpredictable. Though this aspect is not well documented, there is little doubt that when an introduced fish exhibits explosive population increases, as has occurred with the tilapias (Germany 1977; Knaggs 1977; Shafland 1979), substantial changes in native communities must occur. Likewise, several dozen studies have documented dietary overlap between introduced and native fishes (see Taylor et al. 1984). However, these studies only demonstrate that the potential for competition exists. Linking dietary overlap to competition has proven to be a difficult task for all but the most controlled ecological studies regardless of whether non-native species are involved.

Documentation of predation by introduced species on native species serves as the most definitive example of impacts on communities. The most frequently cited example in North America concerns declines in populations of native trouts attributable to brown trout predation (see Moyle 1976a,b; Sharpe 1962; Alexander 1977, 1979). Several other introduced fishes have been implicated as major causes of mortality among native fishes, including pike killifish (Miley 1978; Turner 1981; Anderson 1981, 1982), oscar (Hogg 1976), and the bairdiella (Quast 1961). Though frequently cited as a potential threat of considerable consequence, predation on eggs or young by introduced fishes has not been demonstrated to be a common occurrence (Taylor et al. 1984).

Spatial Alteration

Concommittant overlap in usage of space by non-native and native fishes may lead to competitive interaction if space is in limited supply or of variable quality. Evidence exists implicating displacement of brook trout by brown trout, but in general, displacements are largely inferential (Taylor et al. 1984). Conversely, high densities of introduced fishes have been shown to exert negative effects on native fishes. For example, Noble et al. (1975) observed that largemouth bass populations in Trinidad Lake, Texas, declined with no evidence of recruitment as densities of blue tilapia rose to approximately 2,240 kg ha~' during the period 1972-1975.

Gene Pool Deterioration

Though reduction of heterogeneity through inbreeding is clearly a threat to any species being produced in a hatchery (Philipp et al. 1983), the risk is most acute with species of intercontinental origin because the initial broodstock invariably represent limited gene pools at the outset. The larger the stocking program, the more inbreeding among original broodstock is necessary. Thus species introduced to a novel habitat may or may not have the genetic characteristics necessary for them to adapt and/or perform as predicted.

Fortunately, hybridization events among introduced and native species in open waters are rare (Taylor et al. 1984). Nevertheless, the possibility of native gene pools being altered through such hybridization does exist. For example, brown trout are known to hybridize with native forms in North America (Schwartz 1972, 1981; Dangel et al. 1973; Chevassus 1979).

Introduction of Diseases

Diseases caused by bacteria, viruses, and parasites are all too often conveyed along with introduced aquatic species (see Hoffman and Schubert 1984; Shotts and Gratzek 1984 for reviews). This aspect represents one of the most severe threats that an introduced species may pose to a native community. Transfer of diseased fish was no doubt responsible for introduction of whirling~ disease into North America

from Europe. Recently, infectious hypodermal and hematopoietic necrosis virus (IHHNV) has been spread to a number of countries in conjunction with shipments of live penaeid shrimp. IHHNV was first diagnosed in 1981 at shrimp culture facilities in Hawaii among shrimp introduced from Panama (Sindermann 1986). Even "ich," one of the most common fish diseases worldwide, caused by a ciliated protozoan, is thought to have been transferred from Asia throughout the temperate zone with shipments of fishes (Hoffman 1970, 1981).

C. Courses of Action

Introductions of species to aquatic communities are commonly employed as a fisheries management tool or occur as a result of escapes from aquaculture or ornamental fish holding facilities. It is not feasible, nor desirable, to legislate against all such introductions. What is needed is more education on the role that introduced species can and should play in the context of aquatic resources management. The more informed natural resources managers are about such issues, the less likely that mistakes will be made or that legislation will be necessary to enforce an "attitude of caution." The following actions toward that end are recommended.

A. The membership reaffirms its endorsement of the 1972 "Position of the American Fisheries Society on Introductions of Exotic Aquatic Species" with modifications as indicated:

Position of American Fisheries Society on Introductions of `Introduced' Aquatic Species:

Our purpose is to formulate a broad mechanism for planning, regulating, implementing, and monitoring all introductions of aquatic species.

Some introductions of species into ecosystems in which they are not native have been successful (e.g., coho salmon and striped bass) and others unfortunate (e.g., common carp and walking catfish).

Species not native to an ecosystem will be termed "introduced." Some introductions are in some sense, planned and purposeful for management reasons; others are accidental or are simply ways of disposing of unwanted pets or research organisms.

It is recommended that the policy of the American Fisheries Society be:

1. Encourage fish importers, farmers, dealers, and hobbyists to prevent and discourage the accidental or purposeful introduction of aquatic into their local ecosystems.

2. Urge that no city, county, state, province, or federal agency introduce, or allow to be introduced, any exotic species into any waters within its jurisdiction which might contaminate any waters outside its jurisdiction without official sanction of the exposed jurisdiction.

3. Urge that only ornamental aquarium fish dealers be permitted to import such fishes for sale or distribution to hobbyists. The "dealer" would be defined as a firm or per son whose income derives from live ornamental aquarium fishes.

4. Urge that the importation of e*e~e fishes for purposes of research not involving introduction into a natural ecosystem, or for display in public aquaria by individuals or organizations, be made under agreement with responsible governmental agencies. Such importers will be subject to investigatory

procedures currently existing and/or to be developed, and species so imported shall be kept under conditions preventing escape or accidental introduction. Aquarium hobbyists should be encouraged to import rare ornamental fishes through such importers. No fishes shall be released into any natural ecosystem upon termination of research or display.

5. Urge that all species of exotics considered for release be prohibited and considered undesirable for any purposes of introduction into any ecosystem unless that ~sh species shall have been evaluated upon the following bases and found to be desirable:

a. RATIONALE. Reasons for seeking an import should be clearly stated and demonstrated. It should be clearly noted what qualities are sought that would make the import more desirable than native forms.

b. SEARCH. Within the qualifications set forth under RATIONALE, a search of possible contenders should be made, with a list prepared of those that appear most likely to succeed, and the favorable and unfavorable aspects of each species noted.

c. PRELIMINARY ASSESSMENT OF THE IMPACT. This should go beyond the area of rationale to consider impact on target aquatic ecosystems, general~ effect on game and food fishes or waterfowl, on aquatic plants and public health. The published information on the species should be reviewed and the species should be studied in preliminary fashion in its biotope.

d. PUBLICITY AND REVIEW. The subject should be entirely open and expert advice should be sought. It is at this point that thoroughness is in order. No importation is so urgent that it should not be subject to careful evaluation.

e. EXPERIMENTAL RESEARCH. If a prospective import passes the first four steps, a research program should be initiated by an appropriate agency or organization to test the import in confined waters (experimental ponds, etc.).

f. EVALUATION OR RECOMMENDATION. Again publicity is in order and complete reports should be circulated amongst interested scientists and presented for publication. in the Transactions of the American Fisheries Society.

g. INTRODUCTION. With favorable evaluation, the re lease should be effected and monitored, with results published or circulated.

Because animals do not respect political boundaries, it would seem that an international, national, and regional agency should either be involved at the start er and have the veto power at the end. Under this procedure there is no doubt that fewer introductions would be accomplished, but quality and not quantity is desired and many mistakes might be avoided.

B. The Society encourages international, national, and regional natural resource agencies to endorse and follow the intent of the above position.

C. The Society encourages international harmonization of guidelines, protocols, codes of practice, etc., as they apply to introductions of aquatic species.

D. Fishenes professionals and other aquatic specialists are urged to become more aware of issues relating to introduced species.