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EXOTIC AQUATIC PLANTS-SOME GOOD; SOME BAD

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Aquatic Exotics: the Good, the Bad, and the Ugly

Editor's Note: Three papers were presented in the aquatic exotics concurrent session, but only one paper was submitted for publication in the proceedings.

The following titles were presented in the session but not submitted for publication:

Dennis Lassuy, U.S. Fish and Wildlife Service—Finfish
James Shelton, University of Georgia—Shellfish

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Aquatic plants, like all other plants, may be weeds in one location and a source of income and therefore coveted in another location. Introduction of exotic aquatic plants to the United States has always proceeded at a rapid rate. Many plants were brought in for horticultural or agricultural purposes. A greater number of aquatic species were brought in as aquarium plants and then accidentally or purposely introduced into the wild as a future source of income. A much lesser number have been introduced into natural waters from ballast pumpage. Most are of tropical or semi-tropical origin and initially were confined to waters in Hawaii, Florida, or California. Expansion of their range to other states has progressed until many exotic aquatic plants have become both a problem to water managers and a source of profit to the aquarium industry.

As a rule exotic plants are not considered pests unless they are highly invasive. It is generally recognized that the nonindigenous aquatic plant species which are most invasive include hydrilla (*Hydrilla verticillata*), Eurasian watermilfoil (*Myriophyllum spicatum*), waterlettuce (*Pistia stratiotes*), alligatorweed (*Alternanthera philoxeroides*), parrot-feather (*Myriophyllum aquaticum*), egeria (*Egeria densa*), and waterhyacinth (*Eichhornia crassipes*). The latter is recognized as the world's worst aquatic weed and in many areas the most prolific.

Very few aquatic plant species are reported to have been accidentally introduced. These are usually from ship's ballast and include waterlettuce, alligatorweed, and salvinia (*Salvinia minima*). Horticulturists are credited with the introduction of the waterhyacinth for its showy flowers. Hydrilla, egeria, parrotfeather, Eurasian watermilfoil, limnophila (*Limnophila sessiflora*), and hygrophila (*Hygrophila polysperma*) were all introduced by the aquarium trade and often sold as oxygenators. In areas where water conditions are favorable and the native vegetation is disturbed, these invasive species rapidly become the dominant species.

FLORIDA

The best current book on the situation in Florida is *Nonindigenous Aquatic and Selected Terrestrial Species in Florida* by McCann, Arkin, and Williams. The authors present a well-balanced and in-depth review. Most aquatic biologists and the general public are unaware of the magnitude of the aquatic plant industry. In Florida alone over 1,000 entities engaged in collection, culture, sale, research, or restoration are recognized and catalogued. The same information is not available for other states, but if retailers are included most states have at least ¼ to ½ of this number. A cursory check of a major wholesaler in the Houston area indicated shipments to 44 different states. This indicates the possibility of rapid transport of most plants to any place in the nation within 24 hours. This ease of transmission makes control of problem species possible only with the cooperation of the aquarium industry. Unfortunately many of the "supermart" type stores use personnel without training in identification of problem species. Therefore, sales are made on the basis of how "pretty" the plants are or will be. Then the aquarium or ornamental fish pond owner cultivates the plants until they exceed the needs of the system or the system is terminated. In these instances, the closest water course is the recipient of unwanted plants. In this way plants get spread throughout many ecosystems with no concern about potential harm.

The rapidity of spread of an introduced species is determined by factors such as speed of growth, multiple reproductive methods, and tolerance to a variety of water conditions. In addition the density of the native aquatic plant community and the stress or disturbance of the system may favor the introduced species over the endemic species. Control measures have traditionally been expensive, ongoing, and of limited effectiveness. It has been reported that between 1980 and 1991 over $98

million was spent in Florida public waters for the control of waterhyacinth, waterlettuce, and hydrilla. Other plant control efforts have been less expensive but nevertheless the total costs are quite high.

CALIFORNIA

Based on information from Mr. Nathan Dechoretz of the California Department of Food and Agriculture, the only two aquatic plants giving serious problems in that state are alligatorweed and hydrilla. They recognize that both of these are potentially of great economic consequence. Therefore, they have devoted massive efforts to eradicating any infestations found. Their annual report indicates they are spending in excess of $2 million per year to eradicate these two species, which is more than all other plant eradication efforts combined. Further discussion indicated that purple loosestrife, *Lythrum salicaria,* and yellow water lily, *Nymphaea mexicana,* are minor problems in localized areas.

The eradication effort on hydrilla in Lake Murray, California has centered on quarantine and denial of public access to control spread of the plant. Dredging and mechanical removal by hand was practiced, and in 1994 the stand was marked eradicated after no plants had been found for 3 years.

Chemical applications and drawdowns have been used on other lakes, including Clear Lake and the All American Canal system. More recently the Imperial Valley Water system has become infested, and this is being partially controlled using triploid grass carp at rates of 100 fish per mile of flowing system and 100 fish per acre in ponds. In addition chemicals (Komeen and Mariner), mechanical (mud pumps, draglines, and backhoes), cultural (drawdowns prior to treatment and excavation), plus physical (roguing by hand and shovel) are being employed. At this time they expect to eradicate the hydrilla by the end of 1996.

At this time California is reporting only six counties, Imperial, Shasta, Calaveras, Madera/Mariposa, Tulare, and Lake, with active populations of hydrilla. All of these are being treated with chemicals, triploid grass carp, and/or drained. Success in controlling hydrilla in California is apparently due to their ability to quickly respond to new infestations. This includes delimiting the infestation, quarantining the water body to reduce spread, and a rapid response to stop the plant from production of tubers.

HAWAII

The best information that I have found on exotic aquatic plant introductions into Hawaii is contained in *Perspectives in Aquatic Exotic Species Management in the Pacific Islands*. Volume 1 entitled *Introductions of Commercially Significant Aquatic Organism to the Pacific Islands* was written by L. G. Eldredge and was published by the South Pacific Commission. An interesting paragraph indicates "To these is added a newly recognized period: The past decade, when greater westernization and more affluence allowed for the development of the aquarium-ornamental aquatic plant and animal industry. Presently, this is seen in only a few islands—Guam, Saipan and Oahu (Hawaii)—but should be a warning for other developing areas. During this period numerous aquarium organisms have 'escaped' into ponds and streams, becoming established." The paper goes on to document the numbers and extent of these arrivals and those now established.

Munro in 1993 reported that for Hawaii, the number of introductions for commercial aquaculture with subsequent escapees has not been overly detrimental. This is apparently due to the fact that commercial aquaculture is more or less confined to red algae, pearl oysters, and penaeid shrimps. In contrast the release of aquarium or ornamental plants provides many examples of destructive results from decline of native animals, alteration of the environment, and introduction of new diseases and parasites. By definition most freshwater aquarium organisms are intentionally introduced. Though legislation controlling importation exists, enforcement is often lacking.

Eldredge indicates that 17 species of macroalgae have been introduced to Oahu, and two have displaced native species. *Hypnea musciformis* has been the most disruptive introduced species. He states "The majority were deliberately transplanted for commercial interests for chemical or agar production; two were accidentally carried in oyster shipments. . ."

BIOLOGICAL CONTROL

The advantages of using biological control agents have been discussed in many workshops. These include (if the organism is safe and effective) longevity, constant effort, low costs, possible selectivity, and for some species the possibility of a desirable food product. Chemical or mechanical methods, though more traditional, have been limited in long-term efficacy. In addition the labeling of new aquatic herbicides by the Environmental Protection Agency has become more complex and costly to pursue. It is generally recognized that the time and resources required for evaluation, testing, and gaining approval of a biological control agent for release into the field is also considerable. At this time biological control agents are either available or being tested for alligatorweed, waterlettuce, water hyacinth, hydrilla, Eurasian watermilfoil, parrotfeather, hygrophila, and limnophila.

SUMMARY

Many aquatic plants have been introduced into the United States with a limited amount of investigation of undesirable traits. This should be rectified. At the same time there is a tendency to brand all exotics as bad, and ignoring the fact that many domesticated animals and food plants in use in the United States are exotics. As Extension specialists we must be aware of the dangers of poorly-thought-out introductions, but at the same time we must be open to the possibilities of improved plants and animals for the public that we serve.