Introduction

B. J. Finlayson
California Department of Fish and Game
Pesticide Investigations Unit
1701 Nimbus Road, Suite F
Rancho Cordova, California 95670
bfinlayson@ospr.dfg.ca.gov

Fisheries managers rely on a wide variety of tools including piscicides for the management and assessment of fish populations to maintain diverse and productive aquatic ecosystems and high quality recreational fisheries. As many as 30 piscicides have been used for fisheries management in the United States and Canada. Only four are currently registered for use, two lampricidies, Lamprecide® and Bayluscide® and two general piscicides, antimycin and rotenone. Rotenone is by far the most commonly used piscicide in North America today with a current average annual use of 9,474 kg (as active ingredient) (McClay 2000).

Despite the ongoing need for rotenone, its continued use has become a concern for environmental and animal rights groups, and its use has been challenged, halted, and discouraged. In response to these increased concerns, the U.S. Fish and Wildlife Service in 1997 funded the American Fisheries Society's (AFS) sponsored Rotenone Stewardship Program. The Rotenone Stewardship Program has produced a number of products designed to promote its safe and effective use and ensure its continued availability as a fish management tool. These include the *Rotenone Use in Fisheries Management Administrative and Technical Guidelines Manual* (Finlayson et al. 2000) and the symposium *Rotenone Use in Fisheries: Are the Rewards Worth the Risk* that was held at the AFS 2000 National Meeting in St. Louis, Missouri.

Nine years previously, an AFS symposium focused on the use of fishery management chemicals. The *Chemical Rehabilitation Projects Symposium: Procedures and Issues* was presented at the Western Division Annual Meeting in Bozeman, Montana (July 15-19, 1991) and the National Annual Meeting in San Antonio, Texas (September 8-12, 1991). It was clear from these earlier presentations that there was a need for guidelines for the safe and effective use of rotenone. It was anticipated that the guidelines would minimize the occurrence of situations that have caused or have threatened the prohibition of its use as a fishery management tool. Thus, the concept of the Rotenone Stewardship Program was borne. This current symposium proceedings contains eleven papers covering a wide variety of topics including stewardship and use policies, environmental safety issues and several case histories from California to New York. Several of the papers included in these proceedings were originally given in 1991 but have been revised.

Three papers discuss stewardship and use policies. The paper *American Fisheries Society Rotenone Stewardship Program* details how products of the program will assure the continued availability of rotenone for fisheries management. These products are grouped into four areas (1) technical and administrative guidelines, (2) public information program, (3) electronic information program, and (4) long-term strategies. The paper *Programmatic Approach for Rotenone Projects Funded Through the Federal Aid in Sport Fish Restoration Program—Options for Balancing Risk with Environmental Compliance and Administrative Efficiency* proposes to programmatically approve, under the National Environmental Policy Act, rotenone projects using Federal Aid in Sport Fish Restoration Program funds that meet

specific criteria. The proposed criteria include use in standing (non-flowing) waters with application by surface methods, rates not to exceed 200 parts per billion, and excluding use when threatened or endangered species or domestic water sources are involved. It is anticipated that the impact of the Environmental Assessment will be a reduction in environmental compliance paperwork by the states for projects that are covered under this bureaucratic umbrella. The paper *The Use of Rotenone on National Forests* discusses United States Forest Service policy that sets strict environmental controls to assure minimal environmental impact. The policy includes elements of project planning, biological assessment, public review, and approval.

Two papers discuss environmental safety issues. The paper *Rotenone Neutralization Methods* describes why attempts to neutralize rotenone have been inconsistent and have occasionally resulted in becoming highly publicized failures. These incidents can be traced back to a lack of understanding of the factors influencing the efficacy of the potassium permanganate or inaccurate projections of rotenone concentrations being neutralized. The paper details application methods, rates, and equipment used to apply potassium permanganate to effectively and successfully neutralize rotenone. The paper *Chemical Residues in Surface and Ground Waters Following Rotenone Application to California Lakes and Streams* summarizes 15 years of environmental monitoring data. These data show that effects can be confined to the treatment and neutralization areas, the chemicals in surface waters generally persist for less than seven weeks, the synergist piperonyl butoxide may persist for up to nine months in cold water, little persistence of chemicals in sediments, and ground waters were not contaminated from the use of rotenone.

Three papers characterize different aspects of the Strawberry Reservoir treatment, one of the largest chemical rehabilitation projects undertaken. The paper *Overview of a Large-Scale Chemical Treatment Success Story: Strawberry Valley, Utah* provides the statistics of the treatment that involved the application to 875,000 pounds of powdered and 4,000 gallons of liquid rotenone to a basin over 170 square miles at a cost of $3,800,000. Several innovative procedures for handling and applying the rotenone were developed for this treatment. The paper *Utah's Procedure for Mixing Powdered Rotenone into a Slurry* describes the aspirator that revolutionized the use of powdered rotenone by allowing for the safe application of large quantities in short periods of time. The paper U*tah's Rotenone Sandmix: A Formulation to Maintain Fish Toxicity in Seeps and Springs* describes the gelatin-sand-rotenone mix that provided a cheap and effective way of maintaining lethal levels of rotenone in seeps and springs containing upwelling ground water thus, preventing the target fish from using these areas as refugia.

Finally, there are three papers describing very different case histories using rotenone in fisheries management. All three stress the importance of soliciting public input and gaining public support prior to beginning a project. The paper *The Use of Rotenone to Restore Brook Trout in the Adirondack Mountains of New York–An Overview* details how the anthropogenic impacts including acid deposition in high elevation lakes and the introduction of competing nonnative fishes have caused drastic declines in brook trout abundance. New York began removing non-native and undesirable fish species to restore brook trout, and rotenone has been the only viable alternative that can restore degraded habitat. Rotenone has also been used extensively in the Western United States in restoration of cutthroat trout populations. The paper *Knife Lake and Knife River Rehabilitation Project* describes a Minnesota treatment to eliminate common carp and reintroduce walleye. Environmental review for the project fostered a close working relationship and sense of cooperation between governmental agencies and the public. This removal of carp resulted in improvements in water quality, reestablishment of aquatic macrophytes, and the successful reintroduction of game fish. In the paper *Northern Pike Control at Lake Davis, California*, the political and biological impacts of invasive species are discussed. A chronology of northern pike in California and their control

efforts are given. Effective policies to provide consistent direction for management of detrimental and undesirable fish are being minimized as political forces attempt to alter decisions based on scientific facts.

Hopefully this symposium proceedings will increase the understanding of fish toxicants and further promote the safe and effective use of rotenone.

References

Finlayson, B.J., R.A. Schnick, R.. Cailteux, L. Demong, W.D. Horton, W. McClay, C.W. Thompson, and G.J. Tickacek. 2000. Rotenone use in fisheries management: administrative and technical guidelines. American Fisheries Society, Bethesda, Maryland.

McClay, W. 2000. Rotenone use in North America (1988-1997). *Fisheries* 25(5):15-21.