Problems In Clearance And Registration Of Herbicides For Aquatic Areas[1]

CHARLES R. WALKER[2]

Chief, Branch of Pest Control Research
Division of Fishery Research
U. S. Department of Interior
Washington, D. C.

THE PROBLEM

A major crisis faces fish culture, wildlife habitat improvement, and plant species management of aquatic areas in the development, registration, and use of pesticides, drugs and other chemicals. Congress has strengthened legislation on uses of chemicals which may result in the pollution of water or the contamination of food and feeds. Certain agencies of the U. S. Departments of Health, Education, and Welfare; Agriculture Interior and the Environmental Protection Agency have been given additional responsibilities for investigating the safe and efficacious use of chemicals. There are two basic Federal statutes: The Insecticide, Fungicide, and Rodenticide Act and The Food, Drug, and Cosmetic Act with a number of new amendments. These statutes supplement each other and are interrelated by law and practical operation as provided for in the 1964 three-way agreement among USDA, HEW, and USDI (Rohrman, 1968). Recent public concern for the use of drugs and pesticides and their attendant effects on public health and environmental quality is presenting the regulatory agencies with a tremendous task of carefully reviewing the registration of thousands of pesticide and drug formulations—these include chemicals used in water and fisheries. Lennon (1967) called attention to the registration problems facing the fish culturists and biologists in the management practices at Federal, State, and private levels. Further, in our survey of chemicals used by the Bureau of Sport Fisheries and Wildlife, 95 different chemicals are involved in various fishery management programs of which only a small handful have a legitimate status of registration and a practical label for use (Table 1). Thus, we are faced with two problems: developing chemical tools for managing and enhancing sport fisheries, wildlife, and aquatic oriented recreation, and conversely—preventing contamination of or adverse effects on either water quality, wildlife, fish, the aquatic environment and man's recreational pursuit and health.

BACKGROUND

We are responsible for researching, conserving, utilizing, and protecting the sport fishery and water resources of the United States (Table 2). Federal, State, and even local legislation authorizes the control, eradication, or restriction of distribution of many pest species. In addition to the Federal legislative statutes applying to pesticide and drug regulation of use (USDA), HEW, 1968; Rohrman, 1968), there are a number of State regulations of pesticide use (Table 3) which must be reconciled with the existing Federal and State legislative authorities responsible for pest control. In the case of aquatic weeds, there are several Federal and State laws and regulations affecting the importation, domestic movement, or quarantine of obnoxious plants. The recent 'Carlson Bill" authorized Federal agencies to conduct weed control activities and also provides for reimbursement of State weed control programs. Some uniformity in weed control laws may result as well as coordination of State and Federal control programs.

We have relied extensively on chemical tools in the establishment and maintenance of sport fisheries. In reviewing the statistics compiled in the National Survey of Needs for Hatchery Fish (1968) and the ORRRC Report (1962) we see the magnitude of both the fishery potential and the attendant fishery management needs and problems in the years 1965 to the year 2000 (Tables 4 and 5). Trends in a distribution of water available for fishing are also expected to change. Although fishing waters to be stocked and managed will exceed 90 million acres, the fishing pressure will be in excess of 1 billion man-days (Tables 5 and 6). In addition to the greater needs for hatchery production and intensive cultural techniques, greater emphasis will be placed on the management. This is especially true of warmwater reservoirs which must absorb an increase in fishing pressure of over 200 percent by the year 2000.

Fish husbandry and fishery management are essential for meeting the growing recreational needs of the increasing population of sportsmen. However, we must intensify our research on cultural and management tools. We must also reconcile ourselves to the philosophy that man has changed and will continue to alter his environment and is an integral part of the ecosystem which he must manage for survival. The use of chemical tools is required for attaining maximum yield by necessary manipulation of certain biological features of the aquatic ecosystem.

Out of the array of herbicides with aquatic use labels, previously, only copper sulfate was unrestricted for use in water and fisheries. This was primarily based on the provision that copper is one of the few pesticides which was exempt from requirements of a tolerance. However, all new herbicides and those previously registered were on a 'no residue" basis under the old registration requirements. The "no residue" provision on labels were often registered without data for 'non-food use" or when officials concluded that residues would not be expected by the analytical methods considered adequate at that time. Others, of course, were registered based on the information existing at that time when the toxicity was considered to be of a low order. However, the new amendments to the Federal Insecticide and Rodenticide Act now requires that petitions for negligible residue tolerances must be made on all labels other than those deemed a a 'non-food use" at the time application for registration of the pesticide is made to USDA. Currently no herbicide has a residue tolerance limit established in fish, shellfish or in water.

Further, we have been informed by USDA that as of the

TABLE 1. SUMMARY OF CHEMICALS USED IN BUREAU OF SPORT FISHERIES AND WILDLIFE PROGRAMS ACCORDING TO THE 1966 SURVEY OF 71 FISH HATCHERIES, 34 WILDLIFE REFUGES, FISHERY SERVICE UNITS, 14 STATE FEDERAL AID UNITS AND 2 FISHERY LABORATORIES BY SCHOETTGER AND HUNN (1967).

Chemical name (synonym) Type of use	Federal Aid	Fishery Research	Fishery Services	Fish Hatcheries	Wildlife Refuges	Total
SIMAZINE (PRIMATOL 5)®						
No. responses	8	2	2	32	—	44
No. users	—	—	—	—	—	38
pounds	3,100	3	1,000	4,337	—	8,440
gallons	—	—	—	—	—	—
COPPER SULFATE						
No. responses	7	—	2	31	2	42
No. users	—	—	—	—	—	38
pounds	11,510	—	—	—	750	34,956
gallons	—	—	—	—	—	—
2,4-D						
No. responses	4	—	2	21	14	41
No. users	—	—	—	—	—	33
pounds	20,700	—	—	—	—	12,750
gallons	167	—	—	84	12,500	23,373
DIURON (KARMEX®)						
No. responses	1	2	3	26	1	33
No. users	—	—	—	—	—	26
pounds	—	15	1,000	3,240	30	4,285
gallons	—	—	—	—	—	—
DALAPON (DOWPON®)						
No. responses	1	—	—	17		31
No. users	—	—	—	—	—	28
pounds	—	—	—	1,386	9,033	10,429
gallons	—	—	—	10	—	10
DIQUAT						
No. responses	7	—	3	11	1	22
No. users	—	—	—	—	—	17
pounds	—	—	—	—	—	—
gallons	29	—	33	92	—	154
ENDOTHAL, DISODIUM (AQUATHOL®)						
No. responses	4	—	3	8	—	15
No. users	—	—	—	—	—	9
pounds	—	—	—	2,133	—	2,133
gallons	—	—	20	80	—	100
2,4,5-T						
No. responses	1	—	—	7	5	13
No. users	—	—	—	—	—	12
pounds	—	—	—	—	6,710	6.710
gallons	—	—	—	49	—	49
SILVEX						
No. responses	1	—	2	2	8	13
No. users	—	—	—	—	—	12
pounds	—	—	—	50	2,470	2,520
gallons	2	—	14	20	24	60
SODIUM ARSENITE						
No. responses	5	—	—	5	—	10
No. users	—	—	—	—	—	9
pounds	2,800	—	—	—	—	2,800
gallons	1,375	—	—	435	—	1,810
DICHLOBENIL (CASORON®)						
No. responses	1	—	—	7	—	8
No. users	—	—	—	—	—	8
pounds	1,000	—	—	2,737	—	3,737
gallons	—	—	—	—	—	—
ATRAZINE (AATREX®)						
No. responses	—	—	2	2	2	6
No. users	—	—	—	—	—	6
pounds	—	—	1,000	620	873	2,493
gallons	—	—	—	—	—	—

TABLE 1. (cont.)

Chemical name (synonym) Type of use	Federal Aid	Fishery Research	Fishery Services	Fish Hatcheries	Wildlife Refuges	Total
DELRAD (ROSIN-AMINE D ACETATE)						
No. responses	1	—	—	5	—	6
No. users	—	—	—	—	—	5
pounds	—	—	—	20	—	20
gallons	—	—	—	155	—	155
DICHLONE (PHYGON®)						
No. responses	—	—	—	3	—	3
No. users	—	—	—	—	—	3
pounds	—	—	—	95	—	95
gallons	—	—	—	—	—	—
AMMONIA						
No. responses	2	—	—	—	—	2
No. users	—	—	—	—	—	1
pounds	500	—	—	—	—	500
gallons	—	—	—	—	—	—
AMITROLE (AMITROL-T®)						
No. responses	—	—	—	—	2	2
No. users	—	—	—	—	—	2
pounds	—	—	—	—	2,750	2,750
gallons	—	—	—	—	—	—
TRIFLURALIN (TREFLAN®)						
No. responses	—	—	—	—	2	2
No. users	—	—	—	—	—	2
pounds	—	—	—	—	125	125
gallons	—	—	—	—	40	40
CITRIC ACID						
No. responses	—	—	—	2	—	2
No. users	—	—				
pounds	—	—	—	300	—	300
gallons	—	—	—	—	—	—
PROPANIL (STAM F-34®)						
No. responses	—	—	—	—	1	1
No. users	—	—	—	—	—	1
pounds	—	—	—	—	—	—
gallons	—	—	—	—	350	350
COPPER CITRATE						
No. responses	—	—	—	1	—	1
No. users	—	—	—	—	—	1
pounds	—	—	—	250	—	250
gallons	—	—	—	—	—	—
2,4-DB (BUTYRAC®)						
No. responses	—	—	—	—	1	1
No. users	—	—	—	—	—	1
pounds	—	—	—	—	80	80
gallons	—	—	—	—	—	—
ENDOTHALL, MONOALKYLAMINE (HYDROTHOL 191®)						
No. responses	—	—	—	—	1	1
No. users	—	—	—	—	—	—
pounds	—	—	—	—	—	—
gallons	—	—	—	—	—	—

date of this WSSA Meeting, no requests for extension of the following herbicides and uses has been made—thus, they are up for cancellation:

Recently, in response to the submittals made by certain members of our Interagency Ad Hoc Committee on Use of Herbicides in Aquatic Sites, the Pesticide Regulation Division of the Environmental Protection Agency extended certain "no-residue, zero-tolerance" aquatic pesticide uses as follows:

> ". . . we are extending until further notice, but in no event beyond December 31, 1971, the effective date for finite tolerance requirements for the following chemicals when used in aquatic areas:
>
> Acrolein
> Ammonium sulfamate
> Copper sulphate
> Dichlobenil
> Dichlone
> 2,4-D
> 2,4-DP
> Monosodium and methane arsonate
> Diquat dibromide
> Diuron
> Endothall
> Monuron
> Petroleum solvents
> Silvex
> Xylene . . . ."

TABLE 2: A SUMMARY OF LAWS AND IMPLICATIONS IN THE USE CHEMICALS OR THE AUTHORIZATION TO STUDY THEIR EFFECTS ON FISHERIES.

TITLE	INTENT OR USE
Fish and Wildlife Act (1956) 70 Stat. 1119, as amended 16 U.S.C. 742a-742j	General authority for conducting investigations, and or assistance to other agencies, administer policies, procedures and programs, and report activities.
Pesticide Research Act (1958) 72 Stat. 479, as amended 16 U.S.C. 742d-1 (for latest amendment see P.L. 90-398 (82 Stat. 338) July 11, (1968)	Specific authority to undertake comprehensive continuing studies of the effects of pesticides (insecticides, herbicides, fungicides and pest control agents) upon fish and wildlife and the amounts, percentages, mixtures, or formulations that can be used safely, and thereby prevent losses of fish and wildlife from such spraying, dusting, or other treatment.
Fish and Dildlife Coordination Act (1934) 48 Stat. 401, as amended	Authorizes coordination and cooperation of agencies in the conservation, maintenance, and management of wildlife resources and conduct investigations on effects of polluting substances, provide assistance and make surveys or investigations of the wildlife resources, provide consultation on impounding, diverting, or controlling water and exercise administration over the wildlife resources.
Fish and Wildlife Coordination Act (1958) 72 Stat. 563, as amended 16 U.S.C. 661-666c	
Eradication and Control of Predatory and other Wild Animals Act (1931) 46 Stat. 1468 7 U.S.C. 426-426b	Authorization for conducting investigations, experiments and tests deemed necessary to demonstrate, determine, and promulgate the best methods of eradication, suppression, or bringing under control wildlife injurious to man's interests in cooperation with States, individuals, organizations, etc.
Cooperative Research and Training Units Act (1960) 74 Stat. 733, as amended 16 U.S.C. 753a-753b	Develop adequate, cooperative and coordinated research and training programs in cooperation with colleges and universities with game and fish departments of the States and with non-profit organizations relating to cooperative research units.
Federal Aid in Fish Restoration Act (Dingell-Johnson Act) (1950) 64 Stat. 430, as amended 16 U.S.C. 777-777k	Authorization to cooperate with the States through their fish and game departments in fish restoration and management projects with federal aid apportioned according to the provisions of Title 26 for expenses of investigations and administration, approval and regulation of research and management projects as directed by the Secretary of Interior.
Studies on Sea Lamprey Control and Eradication Act (1956) 60 Stat. 930, as amended 16 U.S.C. 921	Authorization to investigate the predatory sea lamprey develop control measures and eradicate or eliminate them from the Great Lakes.
Dogfish Shark Eradication Act (1958) 72 Stat. 1710 16 U.S.C. 758a note	Authorize the investigation of the abundance and distribution of dogfish sharks, experiments to develop control measures, and program to eliminate and eradicate them or development of economic uses of dogfish shark populations.
Research into the Diminution of Food Fishes and Research in Lessening Damage Done by Fishes (1871) 16 Stat. 594, as amended 16 U.S.C. 744-745	Authorization to prosecute investigations and inquiries into the diminution of food fishes, ascertain causes, or develop protective measures to establish the fisheries and markets for them.
Authorization to make grants for support of basic scientific research Act (1958) 72 Stat. 1793 42 U.S.C. 1891-1893	Authorize the head of each agency of the Federal Government to enter into contracts for basic research at nonprofit institutions of higher education, or at nonprofit organizations whose purpose is the conduct of scientific research.
The Water Resources Act (1964) P.L. 88-372, as amended P.L. 89-404 (April 19, 1966)	Authorizes extra-mural research on economic, legal, social, engineering, recreational, biological, ecological, and other types of activity in solving problems in water conservation.
The Federal Water Pollution Control Act of June 30, 1948 62 Stat. 1155 33 U.S.C. 446a-466b et seq The Federal Water Pollution Control Act (1961) P.L. 84-660, as amended The Water Quality Act of 1965 P.L. 89-234 The Oil Pollution Act of 1924 33 U.S.C. 431 et seq The Clean Water Research Act (1966) P.L. 89-753	Directs the Secretary to undertake research in three areas: 1) means of treating municipal sewage and other water borne wastes; 2) methods to improve identification and measurement of the effects of pollution; and 3) techniques for evaluating effects of water quality and water uses of augmented streamflows to control water pollution. We give municipalities, industry, and other private, State or Federal agencies our technical assistanve in amelioration or solution of pollution problems. Portions of pesticide research and monitoring programs are conducted in cooperation with other Federal and State agencies. Research contracts and those conducted inhouse are funded in the following broad categories: 1) physical and chemical identification of pollutants; 2) biological identification of pollutants; 3) sources of pollutants 4) fate of pollutants in surface waters; 5) fate of pollutants in ground water; 6) water quality requirements for fish and other aquatic life; and 7) dissolved refractory organics removal.

TABLE 3: A SUMMARY BY DOUGLAS F. ROHRMAN (1968) OF STATE PESTICIDE LAWS AND LEGAL IMPLICATIONS OF PESTICIDE USE.

STATE	REGISTRATION LAWS	USE AND APPLICATION LAWS
ALABAMA	Insecticide, Fungicide and Rodenticide Act (1951)	1. Alabama Professional Applicators Law (1953, as amended) 2. Regulations concerning Professional Applications (1953)
ALASKA	----------	----------
ARIZONA	Pesticide Act (1956) with rules and regulations	1. Arizona Pest Control Applicators Act (1953, as amended)
ARKANSAS	Economic Poisons Act (1947) with regulations	1. Regulations on the Control of 2,4-D 2,4,5-T (1959, as amended (amended 1966) 2. Arkansas Agricultural Application Service Licensing Law (1961) (revised 1966) 3. Pest Control License Law (1951) 4. Pest Control Law (1965) 5. Regulations of State Plant Board
CALIFORNIA	1. Agricultural Code Sections 1061-1079 2. California Administrative Code (Economic Poisons) 3. Department o fAgriculture Regulations Injurious Materials	1. California Injurious Materials Law (1949, as amended) with regulations 2. Regulations pertaining to Injurious Herbicides (1962) 3. Regulations: Agricultural Pest Control Business (1961, as amended with regulations concerning Agricultural Pest Control Operators)
COLORADO	Insecticide, Fungicide and Rodenticide Act (1947)	Custom Application Law (1961)
CONNECTICUT	Pesticide Law (1963)	1. Aerial application of Insecticides, Fungicides, Herbicides and Fertilizers (1958) 2. Connecticut Tree Expert Law (1959) 3. Connecticut Law Limiting the Discard of Pesticides (1961) 4. Custom Applicators Act (1963)
DELAWARE	----------	
FLORIDA	Pesticide Act (1953) (revised, 1966)	1. Regulations: Commercial Spraying of Lawns and Ornamentals (1959) 2. Residential Pesticide Sprayings 3. Florida Structural Pest Control Act (1959, as amended) 4. Regulations of Board of Health
GEORGIA	Economic Poisons Act (1949)	Structural Pest Control Act (1955, amended) with regulations
HAWAII	Economic Poisons Act (1945) (revised, 1966)	Herbicide Sale and Use Act (1949, as amended) with regulations
IDAHO	Economic Poisons Act (1962)	1. Illinois Herbicide Law (1959) 2. Custom Application of Pesticides (1965) 3. Custom Spray Law (1966)
INDIANA	----------	Regulations No. 2 Aeronautics Commission of Indiana
IOWA	Pesticide Act (1963) with regulations	Section 5 and 6 of Pesticide Act (1963)
KANSAS	1. Agricultural Chemical Act (1947) 2. Livestock Remedy Law	1. Kansas Aerial Spraying Law (1953, as amended) 2. Kansas Pest Control Act (1953, as amended) with regulations 3. Kansas Chemical Spray Law (1963)
KENTUCKY	1. Economic Poisons Law (1956) 2. Food, Drug and Cosmetic Law	Kentucky Termite and Pest Control Industry Law (1960) (Kentucky Structural Pest Control Act)

(Table 3 continued)

STATE	REGISTRATION LAWS	USE AND APPLICATION LAWS
LOUISIANA	Pesticide Act (1952)	1. Louisiana Herbicide Law (1954) with regulations 2. Custom Applications of Pesticides (1964) 3. Ornamental Spraying Law (1965) 4. Structural Pest Control Law (1960)
MAINE	Economic Poisons Law (1952)	Regulation of Pesticides (1963)
MARYLAND	Pesticide Law (1958)	———
MASSACHUSETTS	1. Pesticide Law (1961) 2. Labeling of DDT Preparations (1947)	1. Law Licensing Persons Applying Chemicals to Waters (1960) 2. Pesticide Board Rules and Regulations (1962)
MICHIGAN	Insecticide, Fungicide and Rdenticide Act (1949)	1. Michigan 2,4-D Act (1959) 2. Michigan Custom Applicators Law (1959) 3. Equipment Operator's Act (1959)
MINNESOTA	Economic Poisons and Devices Law (1945)	Minnesota Custom Applicators Law (1953, as amended) (revised 1966)
MISSISSIPPI	Economic Poisons Act (1950)	1. Law Regulating Application of Hormone type Herbicides by Aircraft (1952, as amended) with regulations 2. Professional Pest Control Operators Law (1938) with regulations
MISSOURI	Economic Poisons Act (1955)	———
MONTANA	Economic Poisons Act (1947, as amended)	———
NEBRASKA	Economic Poison Law (1961)	———
NEVADA	Economic Poison Law (1955) with regulations	Nevada Custom Pest Control Operators Law (1955) with regulations
NEW HAMPSHIRE	Economic Poisons Law (1949)	Pesticide Control Law (1966)
NEW JERSEY	Economic Poison Act (1951)	———
NEW MEXICO	Economic Poison Act (1951)	Pesticide Applicators Law (1965)
NEW YORK	Pesticide Law (1960)	1. Water Quality Standards Law 2. Pesticides in Grape Vineyards Law (1963, as amended)
NORTH CAROLINA	Insecticide, Fungicide and Rodenticide Act (1947)	1. North Carolina Aerial Crop-Dusting Law (1953) with regulations 2. North Carolina Structural Pest Control Act (1955)
NORTH DAKOTA	1. Insecticide, Fungicide and Rodenticide Act (1947) 2. Livestock Medicine Law (1943)	1. North Dakota Pesticides Damage Claim Act (1955) 2. Aerial Spraying, Dusting, Fertilizing and Insect Control Law (1957) 3. Regulations of the Aeronautics Commission (1957)
OHIO	1. Economic Poisons Act (1966) 2. Livestock Remedies Law (1949)	Ohio 2,4-D Law (1961)
OKLAHOMA	Pesticides Law (1955)	1. Oklahoma Pesticide Applicators Law (1961) with regulations 2. Ornamental Spraying or Pruning (1965) 3. Phenoxy Herbicides (1965) 4. Structural Pest and Termite Control Law (1955) with regulations

STATE	REGISTRATION LAWS	USE AND APPLICATION LAWS
OREGON	Economic Poisons Act (1953)	1. Control of Application of Agricultural Herbicides and Insecticides Law (1953, as amended) 2. Herbicide Tax Law (1961)
PENNSYLVANIA	Pesticide Act (1957)	————————————
RHODE ISLAND	Economic Poisons Law (1951)	Custom Applicators Act (1963)
SOUTH CAROLINA	Economic Poisons Law (1953)	————————————
SOUTH DAKOTA	1. Insecticide, Fungicide and Rodenticide Act (1947) 2. Poison Law (1939)	South Dakota Spraying and Dusting Law (1953)
TENNESSEE	Insecticide, Fungicide and Rodenticide Act (1951)	Tennessee Pest Control Act (1955, as amended) with regulations
TEXAS	1. Insecticide, Fungicide and Rodenticide Act (1963) 2. Livestock Remedy Act	Texas Herbicide Law (1953, as amended) with regulations
UTAH	Insecticide, Fungicide and Rodenticide Act (1951)	Utah Economic Poison Application Act (1951) with regulations
VERMONT	Insecticide, Fungicide and Rodenticide Act (1947)	Vermont Aeronautic Commission Regulations (1949)
VIRGINIA	Insecticide, Fungicide and Rodenticide Act (1948)	————————————
WASHINGTON	Agricultural Pesticide Act (1961)	1. Pesticide Act (1961) 2. Pesticide Application Act (1961) amended, 1967 3. Regulations Relating to Commercial Applicators (1961) 4. Regulations: Use of Toxic Insecticides (1952)
WEST VIRGINIA	Economic Poison Law (1961)	————————————
WISCONSIN	Economic Poison Law (1951)	Pest Control Operator's Law (S.3. 172 - Feb. 24, 1967) (Pending)
WYOMING	Economic Poison Law (1943, as amended)	Aerial Spraying Registration Regulations (1951)

Thus, by the first of January 1971, as previously pointed out by Hayes (1969) and McClure (1969), in order for any aquatic herbicide to be registered, they must either have a tolerance established, or judged to be exempt from a tolerance, or proven that use will not contaminate food and water to be defined as a non-food use.

Because of the lack of intensive research on cultural and management tools, fish culturists and management biologists have tended to borrow tools and techniques from other disciplines. Obviously, many chemicals are being used in fish culture and management in a very promiscuous, if not outright illegal manner. Fortunately, these uses involve small quantities of material and are isolated geographically in most instances. Some operational programs are being carried out under the guise of experimental use of these chemicals. However, the Federal Insecticide, Fungicide, and Rodenticide Act provides for exemption of pesticides used for experimental purposes without a temporary permit by State and Federal agencies. The Federal Food, Drug, and Cosmetic Act, on the other hand, is quite specific in its regulations of experimental use of drugs. The 'Miller Amendment" also is quite explicit in that the animals or food contaminated in these tests must be destroyed. This alone should negate the use of these chemicals in any operational or management program resulting in contamination of potable water, meat, eggs, poultry, milk, fish, shellfish, and irrigated crops. Since no residue tolerance limits have been established in water, shellfish or fish, even a detectable trace of pesticide or drug is an illegal residue. All pesticides had to comply with the new regulations by January 1, 1970. This applies to the former 'no residue" labels which require making a petition to establish residue tolerance limit or submitting satisfactory evidence that the use pattern does not involve food and is judged a 'non-food" use (Ward, 1960; Roe, 1960; McClure, 1969; Hayes, 1969; Cummings, 1969; Stokes, 1969). Chemicals defined as food additives and drugs, according to regulations under the Federal Food, Drug, and Cosmetic Act, now must be re-examined and classified as a new drug or as an old drug. In either case, adequate safety to public health must be assured by substantial evidence of its relative toxicity, efficacious use, and disappearance of harmful residues. The

TABLE 4: DATA FROM THE ORRRC REPORT 7 AND THE NATIONAL SURVEY OF NEEDS FOR HATCHERY FISH SHOWING TRENDS IN DATER DISTRIBUTION AND DEVELOPMENT WHICH WILL AFFECT SPORT FISHING OPPORTUNITIES.

Type of Water	Thousands of Acres Reported in the ORRRC Report 7 (1960)	Hatchery Survey (1965)
Cold waters	52,772	54,221
Public waters	52,635	54,022
Streams	6,559	4,498
49 States	1,520	993
Alaska	5,039	3,505
Lakes, ponds, and reservoirs	46,076	49,524
49 States	2,300	3,463
Alaska	7,360	7,361
Great Lakes	38,878	38,700
Private waters	137	199
Warm waters	23,610	27,421
Public waters	20,588	24,693
Streams	3,375	4,992
Lakes, ponds, and reservoirs	17,183	19,701
Private waters	3,052	2,728
Total for cold and warm waters	76,382	81,642
Total public waters	73,193	78,715
Total streams	9,934	9,490
Total lakes, ponds, and reservoirs	63,259	69,225
Total private waters	3,189	2,927
Total for coastal shoreline (3-mile limit)1/	.....	69,956
Total 22 states	.....	40,903
Total Alaska	.....	29,053
Total for freshwater and marine waters		151,598

1/ Texas owns to the 12-mile limit

petition requirements were established by USDA and HEW (FDA, 1968, Eisler, 1969; Stokes, 1969) and now administered by the Environmental Protection Agency.

Labels of many chemicals have thus been allowed to expire or have been withdrawn based on the inadequate information to support the claims (Lennon, 1967). In many instances, chemical and pharmaceutical companies now report that hundreds of thousands to millions of dollars are required to develop and register a pesticide, drug, or medication (Anonymous, 1970). This often can not be justified because of profit potentials are apt to be comparatively small in relation to the very high costs for their development (Lynn, 1960); Lennon, 1967; Meyer, 1967).

Since I am participating in this panel to discuss the specific interest of the Bureau of Sport Fisheries and Wildlife, this is an appropriate place to quote the statement of the Department of the Interior on Pesticides:

"The Department of the Interior has the responsibility of assuring maximum protection to the environment.

"The Department will use all its means to reduce pollution resulting from pesticide use.

"It will be the policy of the Department to consider safety and environmental quality as the primary factors in making the decision on whether or not to use a pesticide.

"In areas and programs under its jurisdiction, it will be the policy of the Department to:

1. Conform with all provisions of Federal and State pesticide law.
2. Not to use chemicals named on attached Prohibited List.
3. Use chemicals on attached Restricted List only when:
   a. non-chemical techniques have been considered and found inadequate, and
   b. use can be limited to small scale applications.

TABLE 5: PROJECTION OF NUMBERS OF ANGLERS AND FISHERMAN DAYS IN THOUSANDS (AVERAGE PERCENTAGE IN PARENTHESES) — AFTER ORRRC REPORT 7 (1962) AND HATCHERY SURVEY (1968).

Census area	Total number of anglers at year - 1960	1965	1976	1980	2000	Total number of fisherman days at year 1960	1965	1976	1980	2000
N.E.	1,205	.....	1,500	.....	3,000	26,269	.....	35,000	.....	70,000
E.N.C.	5,317	.....	8,000	.....	12,000	106,340	.....	170,000	.....	255,000
W.N.C.	2,855	.....	3,300	.....	6,000	41,120	.....	55,000	.....	95,000
Mt.	1,372	.....	2,300	.....	5,500	17,561	.....	35,000	.....	80,000
Pac.	2,971	.....	5,025	.....	9,000	47,536	.....	85,000	.....	125,000
Md. Atl.	2,569	.....	3,300	.....	6,000	50,352	.....	70,000	.....	120,000
S. Atl.	3,695	.....	6,225	.....	10,000	86,832	.....	160,000	.....	250,000
E.S.C.	2,207	.....	2,650	.....	4,500	34,649	.....	50,000	.....	75,000
W.S.C.	3,133	.....	4,700	.....	7,000	54,514	.....	90,000	.....	130,000
Total U.S. 25,300 (1962 data)		.....	37,000	.....	63,000	465,173	.....	750,000	.....	1,200,000
Cold water	7,295		9,0551/	10,927	15,314	70,856		86,0641/	100,877	132,388
Warm water	21,779		27,246	31,598	48,189	315,441		401,267	471,670	711,103
Salt water	12,985		16,902	20,025	29,356	100,557		131,748	170,942	269,221
Total U.S. 42,058		53,203		62,550	92,859	486,854		619,079	743,489	1,112,712
% Increase										
Cold water	.....		(25)	(50)	(120)	.....		(21)	(44)	(87)
Warm water	.....		(25)	(45)	(110)	.....		(27)	(50)	(125)
Salt water	.....		(30)	(54)	(125)	.....		(32)	(71)	(169)
Average	.....		(26)	(49)	(120)	.....		(26)	(52)	(128)

2/ The year for this column of figures is 1973

TABLE 6: TOTAL USE AND CATCH PER SURFACE ACRE OF FRESH WATERS IN THE 48 CONTIGUOUS STATES FOR THE YEARS 1960, 1976, AND 2000 (ORRRC, 1962).

Type of waters[1]/	1960				1976				2000		
	Pounds of catch	Fisherman-days	Pounds per surface acre	Percent increase in catch	Pounds of catch	Fisherman-days	Pounds per surface acre	Percent increase in catch	Pounds of catch	Fisherman-days	Pounds per surface acre
Cold-water streams[2]/	20,000,000	20,000,000	13	20	24,000,000	34,000,000	16	30	26,000,000	37,000,000	17
Warm-water streams[2]/	64,000,000	42,700,000	18.9	10	70,400,000	48,000,000	21	20	76,800,000	51,000,000	23
Cold-water lakes	85,600,000	77,800,000	37.1	10	94,160,000	94,000,000	41	30	111,280,000	111,000,000	48
Warm-water lakes	143,500,000	79,700,000	21.0	20	172,200,000	96,000,000	25	50	215,250,000	120,000,000	32
Great Lakes	18,000,000	12,000,000	0.5	100	36,000,000	24,000,000	1	300	54,000,000	36,000,000	1.5
Cold-water reservoirs:											
10 acres and less[3]/	1,200,000	600,000	87	0	1,200,000	600,000	90	20	1,560,000	780,000	100
11 acres and over	14,500,000	13,431,000	12.5	30	17,400,000	17,400,000	16	60	21,750,000	21,750,000	20
Warm-water reservoirs:											
10 acres and less[3]/	54,000,000	50,000,000	35	50	81,000,000	81,000,000	52	100	108,000,000	108,000,000	70
11 acres and over[4]/	121,050,000	83,791,000	17.5	30	157,355,000	105,000,000	23	100	242,100,000	162,000,000	35
Total	521,950,000	380,072,000	----	23	643,715,000	500,000,000		65	856,740,000	647,530,000	----
To be provided by new impoundments	----------	----------	----	----	5,115,000,000	100,000,000	23	----	5,355,000,000	277,470,000	3 5
Total, including new waters	----------	----------	----	----	758,715,000	600,000,000	----	----	1,211,740,000	925,000,000	

1/Based on 1960 water area.
2/Private streams excluded for incomplete data.
3/Includes private farm ponds.
4/Private reservoirs excluded.
5/New acreage needed by 1976: 5,000,000.
6/New acreage needed by 2000: 10,000,000.

4. Use of any chemical pesticide must be aimed at a specific pest problem and involve minimum strength and frequency of application.

Prohibited List

Aldrin
Amitrol
Arsenical Compounds (inorganic)
Azodrin
Bidrin
DDT
DDD (TDE)
2,4,5-T
Endrin
Heptachlor
Lindane
Mercurial Compounds
Strobane
Thallium Sulfate
Toxaphene
Dieldrin

Restricted List

Aramite
Arsenical Compounds (organic)
Azinphosmethyl (Guthion)
Benzene hexachloride
Carbophenothion (Trithion)
Chlordane
Coumaphos
Cyanide Compounds
Demeton
Diazinon
Dioxathion
Diquat
Disulfoton (Di-syston)
DN compounds such as dinitrocresol
Dursban
Endosulfan
EPN
Ethion
Kepone
Methyl parathion
Mevinphos (Phosdrin)
Mirex
Nicotine Compounds
Paraquat
Parathion
Phorate (Thimet)
Phosphamidon
Picloram
Sodium Monofluoracetate (1080)
Temik
TEPP
Zectran

"Guidelines for Use of Pesticides

1. Chemical pesticides should not be used alone when non-chemical or integrated chemical and non-chemical techniques offer an alternative option.
2. No pesticide will be used where there is basis for belief that:
   a. Water quality will be degraded and
   b. Hazards exist that will unnecessarily threaten fish, wildlife, their food chain or other components of the natural environment.
3. Large scale non-specific applications will not be made of any pesticide.
4. A contingency plan will be developed for all pesticide storage areas to:
   a. Prevent pesticide spills from affecting areas outside of the storage areas,
   b. Take remedial action if the spill extends out from the storage area, and
   c. Formulate disposal methods.
5. Federal, State and local authorities will be kept informed concerning pesticide research and control programs of interest to them and their views will be solicited and considered when formulating our own programs.
6. All applications of pesticides will conform to the guidelines and standards of the Pesticides Subcommittee of the Cabinet Committee on the Environment.

"Technical Assistance

The Federal Water Quality Administration, the Geological Survey and the Fish and Wildlife Service will assist in securing compliance with these guidelines.

"Review of Pesticide Programs

Each Interior Bureau which conducts or finances pesticide programs will appoint a pesticide representative to coordinate and review their Bureau's programs.

"Reporting Requirements

All Interior Bureaus and Offices are directed to report any potential or actual contamination of the environment from pesticides to that Interior Bureau having statutory authority or responsibility for the abatement of such pollution. If no Interior agency has such authority or responsibility, the condition will be reported to the Intradepartmental Pesticide Working Committee for the attention of the Secretary."

Responsibilities concerning research, however, are quite explicit and spread throughout several statutes. Thus, we conduct surveys, investigations, and research to provide basic information on the effects of pesticides, develop guidelines to reduce hazards to fish, wildlife, and their food organisms. We cooperate with the chemical industry in evaluation and development of newer and safer pesticides, seeking those which are selective, less persistent and hazardous to man and the natural environment. We make the necessary interpretations required for enhancing water quality and best uses of the nation's resources. Portions of the pesticide and monitoring programs also are conducted in cooperation with other Federal and State agencies.

The Federal Insecticide, Fungicide and Rodenticide Act of 1947 introduced the registration concept which provides for proving the safety and worth of a pesticide before it is marketed. *The burden of proof of acceptability is on the manufacturer.* The law now requires the Environmental Protection Agency to register all pesticides that meet its standards for effectiveness and safety. The law also requires that a pesticide must be registered before it can move in interstate commerce.

Research related to drugs and pesticides by the Fish and Wildlife Service and their Federal Aid programs is directed toward improving fish husbandry techniques; enhancing the aquatic environment; finding better and safer chemical, physical, or biological methods for management of fish populations, pests and diseases; and determining the acute and chronic effects of pesticides and control agents on the many different species of fish and their food organisms. These studies have focused attention on the complex problems involved in the magnification and transference of residues up the food chain and their biologically significant effects in both terrestrial and aquatic ecosystems. Much research effort also has been devoted to methods of analyzing or identifying the pesticide residues and their breakdown products, interactions of environmental factors affecting toxicity, changes in growth rates, impaired reproduction, or fecundity, adverse effects on behavior, influence of metabolism, effects on resistance to disease, performance or stamina under stress, altered physiology and pathological significance; and adverse changes in the species composition and density in populations of fish and fish-food organisms. Attention is focused especially on important freshwater, marine, estuarine and anadromous species valued for recreation or food.

Many pesticide problems are studied in various cooperative research programs which involve Federal funding. Currently, seven of the 23 Cooperative Fishery Units and five of the 18 Cooperative Wildlife Research Units are conducting pesticide studies. More than 20 universities and colleges have also received research contracts or grants for pesticide research.

We also conduct research in cooperation with industry and those agencies concerned with the development of newer and safer pesticides, integrated physical, biological, and chemical techniques, methods of reducing hazardous uses and disposal treatment and detoxification of pesticides. Through these cooperative efforts may selective control methods have been discovered and developed in our laboratories. Target organisms include oyster drill, parasitic sea lamprey, and many problem species of fish, birds, and mannals.

The Geological Survey, and Fish and Wildlife Service participate with the Environmental Protection Agency in the National Pesticide Monitoring program that involves: 190 permanent coastal stations for shellfish; intensive fish monitoring in the Great Lakes; annual sampling of fish for 57 Alaskan stream locations; following the spring sampling of fish from 50 sampling stations throughout the United States; approximately 100 water sampling stations ranging from sites used by municipal water plants for intakes to locations near mouths of rivers as they discharge tidal waters; 20 sites on streams in the Western United States is a part of the irrigation network for water quality data; 35 bench marks in the water quality network survey; special pesticide studies in Florida and herbicide treated irrigation ditches; residue analyses of 1,000 pools of duckwings from the various flyways; and field appraisal studies throughout the United States. Portions of the pesticide program are conducted in cooperation with other Federal agencies and with several State agencies. We supply facts and scientific interpretations to agencies with regulatory responsibilities to aid them in fulfilling their missions.

PERSPECTIVE OF THE WEED CONTROL PROBLEM

Timmons (1969) conducted a survey into the scope of the aquatic and marshland weed problems and the status of the use of herbicides for their control. He found that there were about 150 species of aquatic and semi-aquatic marshland plants that were problems in the more than 2 million ponds and reservoirs, 189 thousand miles of drainage ditches, and 173,000 miles of irrigation canals (Table 7). When we compare these figures with those compiled in the "ORRRS Study Report: (1962) and the "National Survey of Needs for Hatchery Fish" (1968), we find that in excess of 10 percent of the total area of these waters are affected by aquatic weed growth.

In the Sport Fishing Institute's "Fish Conservation Highlights" (Stroud and Martin, 1968), a great deal of attention is given to the chemical renovation of lakes and streams for the control of the fish populations. Excessive weed growths are often responsible for the imbalance of fish populations and the necessity for aquatic plant control. Extending fishery access by State agencies and the construction by the Federal agencies is playing an increasingly important role through creation of millions of acres of new waters in associated new fisheries. One of the primary activities pointed out in the above report is that of controlling aquatic plants by agencies such as the Corps of Engineers for which their survey shows fishing as the primary activity benefiting from their aquatic control programs (Table 8).

The type of weed infestation also influences the extent and kind of weed control program undertaken (Timmons, 1969); Table 9). In the survey conducted by the Agriculture Research Service and the Bureau of Reclamation in 1957, more than 90,000 miles or 63 percent of the canals in 17 western States were infested with aquatic weeds. More than 395,000 acres or 75 percent of the ditch banks were affected by one or more of the four kinds of bank weeds. During that year, 54 percent of the weed-infested canals and 80 percent of the weed-infested ditch banks were treated at a total cost of more than $18 million. However,

TABLE 7: PERCENT OF VARIOUS TYPES OF WEED INFESTATIONS OF INLAND FRESH WATER AREAS IN THE CONTIGUOUS UNITED STATES.[1]/

Area and aquatic situation	Percentage of inland fresh water areas infested with weeds[1]/							
	Algae		Rooted					
	Filamentous	Non-filamentous	Submersed	Emersed	Floating	Marginal	Woody	Total
North Central:								
ponds	84	---[2]/	63	62	19	38	---[2]/	
drainage ditches	23	---	23	72	7	70	---	
Southern and Western:								
ponds	46	---	60	20	5	33	---	
drainage ditches	36	---	51	42	4	56	---	
Nation-wide:								
natural lakes	2	8	7	1	2	---	1	21
impoundments	6	10	23	6	5	---	2	52
marshes	7	3	12	23	8	---	9	62
streams	4	2	1	4	3	---	6	20

1/ 1961 Survey by Timmons (1969).
2/ No data indicated.

the weed control operations were estimated to have prevented irrigation water losses and structural damage in excess of $39 million. Thus, this resulted in a cost benefit ratio of more than 50 to 1 for the costs of the weed control. In Timmon's survey of 1961 (Table 7) smaller percentages of the areas of natural lakes, streams, marshes, and large impoundments were weed infested than irrigation canals and drainage ditches (Table 9).

Weed problems are worse in the waters fished most often according to national census of the regions and types of water (Tables 5 and 6). Further, in a projection of the future population trends, fishing pressure and development in types of water through the year 2000 show that these same waters will have to be more intensively managed, requiring more intensive use of pest control agents (Tables 6 and 7). At the same time the needs for hatchery fish (Table 10) for stocking and management of our waters will also require intensive management using fish control agents, anesthetics, marking dyes, external and internal fish therapeutics, transportation aids and other management tools. As pointed out in the "Fish Conservation Highlights" 1963-1967 (Sport Fishing Institute, 1958) we have seen an increase in construction and revonation of environments to provide new fishing opportunities as well as enhance marginal or nonproductive waters (Table 11). Meeting the needs for urban fishing opportunities will place great demand on intensive management knowhow and require extensive use of chemical tools (Walker, 1969). The value of aquatic weed control just in relation to enhancement of sport fishery habitat can be summed up by quoting a recent commentary from the (January-February 1970) Sport Fishery Institute Bulletin: "In answer to an attitude-question 'Is an additional 10 percent improvement in fishing worth $100 million?' posed by Edgar B. Speer, President of United States Steel Corporation, Conservation leaders say: 'An additional 10 percent improvement in spot fishing, at current development level of the resource, is worth at least $330 million of business generated annually. In terms of corresponding capital value (6% interest rate), a 10 percent improvement is worth at least $5.5 billion.'"

TABLE 8: AQUATIC WEED PROBLEMS IN LAKES, STREAMS, AND NAVIGATION CANALS IN SOUTHEASTERN STATES IN 1963 AND SURVEYS BY THE U.S. CORPS OF ENGINEERS.[1]/

State	Kinds of weed infestation in Southeastern States		
	Waterhyacinth 1963	Alligatorweed 1963	submersed weeds 1963[2]/
Corps of Engineers Survey:			
Florida	87,281	2,597	76,132
Louisiana	70,862	55,880	64,860
Alabama	15	4,751	41,060
Carolinas	4	30,805	14,197
Georgia	460	1,838	7,443
Mississippi	30	52	3,161
Texas	3,750	1,200	-----
Total	162,402	97,123	206,853

1/ Excludes farm ponds, drainage ditches, and tidal marshes.
2/ Prior to Eurasian watermilfoil (*Myriophyllum spicatum*) and Florida elodea (*Hydrilla verticillata*) which have added more than 100,000 acres of submersed weeds in eight States.

CONCLUSIONS

Persistence of potentially harmful residues require provisions in the label for conditions for use, withdrawal

TABLE 9: AQUATIC AREAS IN WHICH WEED INFESTATION OCCUR (AFTER TIMMONS, 1969).

Region of the United States	Aquatic area infested with weeds		
	Ponds and reservoirs[1]/ (acres)	Drainage ditches[2]/ (miles)	Irrigation canals[2]/ (miles)
Northeastern	51,725	2,773	----------
North Central	682,278	106,128	17,106
Southern	1,020,689	66,225	26,678
Western	376,657	13,882	129,277
Total for 48 States	2,131,349	189,007	173,061

1/ From 1964 Agricultural Census
2/ From 1959 Agricultural Census

TABLE 10: SUMMARY OF STATE AND BUREAH OF SPORT FISHERIES AND WILDLIFE REQUIREMENTS AND PRODUCTION OF HATCHERY FISH (IN THOUSANDS) —AFTER "NATIO]AL SURVEY OF NEEDS FOR HATCHERY FISH"— BUREAU OF SPORT FISHERIES AND WILDLIFE, RESOURCE PUBLICATION 63 (1968).

	Requirements			*Production*		
	State	*Bureau*	*Total*	*Total*	*State*	*Bureau*
Trout						
1965:						
Fry	41,507	119	41,626	60,946	60,946	0
Fingerlings	128,023	6,720	134,743	124,476	103,938	20,538
Catchables	67,910	3,579	71,489	64,413	48,522	15,891
Total	237,440	10,418	247,858	249,835	213,406	36,428
1973	334,315	22,478	356,793	355,525	288,625	66,900
1980	398,825	23,206	422,031	405,069	331,526	73,543
2000	508,750	34,867	543,617	505,468	410,374	95,094
Salmon						
1965:						
Fry	57,037	206	57,243	54,306	50,289	4,017
Fingerlings	215,250	640	215,890	215,728	150,175	65,553
Yearlings	17,826	0	17,826	16,726	16,726	0
Total	290,113	846	290,959	286,760	217,190	69,570
1973	476,045	12,309	488,354	477,793	383,910	93,883
1980	704,928	25,721	730,649	709,404	606,563	102,841
2000	925,578	32,931	958,509	936,787	818,767	118,020
Warm-water						
1965:						
Fry	1,599,754	9,455	1,609,209	1,050,029	1,007,495	42,534
Fingerlings	253,242	4,702	257,944	136,133	62,455	73,678
Catchables	3,460	75	3,535	1,679	1,572	107
Total	1,856,456	14,232	1,870,688	1,187,841	1,071,522	116,319
1973	1,887,072	23,534	1,910,606	1,578,104	1,400,057	178,047
1980	2,035,672	27,530	2,063,202	1,747,645	1,551,154	196,491
2000	2,261,148	31,941	2,293,089	1,973,677	1,699,221	274,456

time, and also necessitates establishing a residue tolerance limit in a petition to the Environmental Protection Agency. Thus, in examining the more than 95 chemicals known to be used experimentally or operationally in fish culture and fishery management, we find an appalling situation with regard to specific uses and status of registration.

TABLE 11: SYNOPSIS OF STATISTICS COLLECTED BY THE FISH MANAGEMENT INSTITUTE (STROUD AND MARTIN, 1968) ON FISH MANAGEMENT CONSTRUCTION, ACCESS DEVELOPMENT, AND RENOVATION OF FISH POPULATIONS FOR SPORT FISHERIES THROUGH 1965.

Activity	Number		Area (acres)
Aquisition and development for angler access;	7,627		10,392,000
Construction of public fishing lakes	1,545		317,241
Total renovation of fish populations in:			
Cold water lakes	2,603		278,195
Warm water lakes	12,920		331,799
Total	15,523		609,994
Partial chemical renovation of fish populations in:			
Cold water lakes	41		24,034
Warm water lakes	505		167,715
Total	546		191,749
Chemical treatment of fish populations in:			
Cold water streams	4,450	(miles)	15,119
Warm water streams	1,375	(miles)	4,151
Total	5,825	(miles)	19,270

In most instances the chemical industry has little or no profit motivation nor even a proprietary position on the majority of the chemicals Thus, in many instances they cannot be expected to support the expensive process of obtaining the data required for registration. Further, the primary source for information on toxicity, efficacy and residues in fish and aquatic environments must be generated by State and Federal Research. However, this capability is limited or severely restricted by budget, personnel, and facilities to adequately generate the necessary data, properly assemble the information, and effectively pursue the registration process. This will require a cooperative effort of all concerned--State, Federal, and private agencies —with a agreement on the protocol for research needed.

We in this profession must assert our capacility to research chemical tools and use them wisely in operational programs. We must demonstrate responsibility toward other users of water and utilization of the fishery resource for food directly (commercial fishery) or incidentally (sport fishery). Although we are obligated to intensively manage the resource, we must show equal concern in pursuing the effort to prevent adverse effects of water pollution and contamination of the fishery by hazardous chemicals. The present dilemma in registration and use of chemical tools poses a real challenge to research and we must face up to the task of solving the problems.

We cannot afford a lot of wasted motion in developing good, solid data on the toxicity, efficacy, residues in our physiological, ecological and chemical studies. A well-planned experimental design and capability in both manpower and facility is another must. The generation of poor

data lends to confusion and erroneous interpretation of what might otherwise have been clear, decisive results with good statistical basis for evaluation and conclusions. This calls for developing research protocols for studies of this nature—pooling the best advice and expertise in the design of tests. These studies should yield productive results upon which administrators of the drug, pesticide and pollution authority can effectively make judgments for safe and efficacious use of chemical tools.

The Interagency Ad Hoc Committee on use of Herbicides in Aquatic sites is investigating the extent of use of herbicides in aquatic sites; is developing the necessary information to fill the information gaps; and is establishing a protocol necessary to registration, particularly, for those compounds in which a proprietary position no longer exists.

The use of chemicals, such as aquatic herbicides and any other chemical which may be deemed a water pollutant or an additive to food or feeds, comes under the scrutiny of the Federal and State regulatory agencies. Although drugs and pesticides are handled under slightly different protocols, the following information must be furnished in the petition for the clearance and registration of the chemical for a specific use:

(1) Identity of the chemical by structure and contents of the formulation.

(2) Sufficient data to support the claims for efficacy of the chemical according to the specific use.

(3) Relative toxicity to both the target and non-target organisms with supporting toxicological data for manmals.

(4) Analytical methods to isolate and definitively measure residues of the chemical and its metabolites or degradation products with appropriate sensitivity and dependability.

(5) The fate and persistence of the toxicologically significant residues in the water, fish, shellfish, irrigated crops, or any other food or feeds which may be eventually consumed by man.

I recommend that the Weed Science Society of America establish a working committee to review the problems in the registration and uses of chemical tools in fisheries and other aquatic situations. We should establish the research protocols and uniformity in regulations affecting the chemical operational programs in Federal, State and private industry. We should also review, identify and rectify the problems involved in the experimental use of pesticides and chemical tools. We need to develop an effective program for channeling the information generated in all research activities to this working committee. The chemical industry and their professional organizations can and should support the efforts of the committee in exchange of information, coordination of industrial interests in mutual problems, and even financial support for some research activities.

We are deeply committed to the management of the water resources. As an integral part of the ecosystem man and his activities must also be regulated. This does not mean that we discontinue the use of chemical tools in fisheries and equatic situations but does emphasize our responsibility to develop new and better biological or chemical techniques. We must also de a better job of researching and evaluating those chemicals presently in use.

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