# Fish Sampling and Data Analysis Techniques

# Used by Conservation Agencies in the U.S. and Canada


Fisheries Techniques Standardization Committee

Management Section, American Fisheries Society

Don Gabelhouse, Chairman

Richard Anderson
Larry Aggus
Doug Austen
Ron Bruch
Jan Dean
Frank Doherty
Dennis Dunning
David Green
Michael Hoeft
Bruce Hollender
Ken Kurzawski
Arthur LaRoche III
Gary Matlock
Paul McKeown
Bernie Schonhoff
Douglas Stang
Gregory Tichacek
Dave Willis
Charles Wooley
Dennis Workman



July, 1992

**Abstract**

In 1985-86, the Fisheries Techniques Standardization Committee of the Management Section, American Fisheries Society conducted a survey to determine how conservation agencies in the U.S. and Canada routinely sampled 15 sport fish in four water types (lakes and impoundments less than 500 acres, lakes and impoundments 500 acres and larger, streams, and rivers). Data analysis techniques were also surveyed. This document summarizes findings of the survey and provides a reference to fish sampling and data analysis techniques used by conservation agencies in the U.S. and Canada.

During the fall of 1983, the Management Section of the American Fisheries Society established as one of its objectives, Promoting sound fisheries management practices and developing new management concepts and techniques. One of three tasks identified to accomplish this objective was to, “Establish a committee to review fisheries data collection and analysis techniques and explore feasibility of standardizing techniques.” In 1984, individuals from the U.S. and Canada volunteered to be members of this committee.

The first activity of the Fisheries Techniques Standardization Committee was to develop a survey that sought information on how conservation agencies in the U.S. and Canada collected and analyzed data for 15 sport fish in four water types. Results of the survey are the subject of this report.

This report is intended to have at least two values. First, it identifies states and provinces that shared the use of common techniques. This will, hopefully facilitate communication among agencies regarding comparative results. Secondly, this report will allow conservation agencies to compare their techniques with those of their neighbors and even with those used by others in more distant geographical areas. Environmental conditions dictate appropriate sampling and analysis techniques; however, data interpretation would be enhanced if techniques were standardized over the broadest geographic areas possible. This report is intended to help stimulate such action.

## Methods

Survey questionnaires were mailed to fisheries administrators in November, 1985. A cover letter requested that the survey be completed by the person(s) in the agency most familiar with sampling and analysis techniques for each of four inland freshwater types: lakes and impoundments <500 acres, lakes and impoundments ≥500 acres (excluding the Great Lakes), streams, and rivers.

An instruction sheet requested that information on how the agency collects and analyzes data be limited to techniques commonly utilized to make management decisions. Responses that reflected coincidental catches or specialized, intensive research projects that involved sampling and analysis techniques not routinely used in management activities were not to be included.

Information was sought on sampling and analysis of 15 important species of sport fish. Appropriate sampling and analysis techniques are often dictated by the size of the fish to be captured; therefore, information was requested only for fish of ‘stock length” (Anderson 1980; Gabelhouse 1984). Sampling and data analysis techniques were sought for the following species and corresponding lengths: channel catfish (Ictalurus punctatus) ≥11 in, striped bass (Morone saxatilis) ≥12 in, white bass (Morone chrysops) ≥6 in, bluegill (Lepomis macrochirus) ≥3 in, crappie (Pomoxis spp.) ≥5 in, largemouth bass (Micropterus salmoides) ≥8 in, smallmouth bass (Micropterus dolomieui) ≥7 in, yellow perch (Perca flavescens) ≥5 in, walleye (Stizostedion vitreum) ≥10 in, northern pike (Esox lucius) ≥14 in, muskellunge (Esox masquinongy) ≥20 in, rainbow trout (Salmo gairdneri) ≥8 in, brook trout (Salvelinus fontinalis) ≥5 in, and lake trout (Salvelinus namaycush) ≥12 in.

Individuals completing the survey forms were asked to indicate which of 29 sampling techniques and 10 data analysis techniques their agency used for each of the 15 fish in each of four water types (Appendices 1-4). Spaces were also provided to report additional techniques. When results were compiled, some of these techniques were combined with similarly listed techniques, some were combined with other related additional techniques, and some were reported separately. Fishway traps and lifts were combined with weir traps, guide diaries were combined with angler diaries, and club fishing reports were combined with tournament reports. Postal surveys, catch cards, reports, and camp logs were combined as ‘other angler data’. Additional sampling techniques reported separately included tag returns by anglers, trophy citations (angler awards), angling by agency personnel, set lines, explosives, pound nets, D-traps, slat boxes, vertical gill nets, assessment of commercial catches, and underwater observation.

Data analysis techniques included both traditional and new approaches. Quantification of length distributions through Proportional Stock Density (PSD, Anderson 1976) and Relative Stock Density (RSD, Wege and Anderson 1978) was assessed; use of Relative Weight (Wr, Wege and

Anderson 1978) to calculate body condition was determined. At the time of this survey, working Standard Weight (Ws) equations used to calculate Wr had been published for channel catfish, bluegill, black crappie, white crappie, largemouth bass, smallmouth bass, and rainbow trout (Anderson 1980). Use of Wr for any of the other nine species likely indicates that a (state or province) standard weight formula was developed for that species, which would preclude comparability among states and provinces. Additional data analysis techniques included use of quality indices other than PSD and RSD; abundance relative to other species; species composition or presence/absence; sex, maturity, and fecundity; mortality (including exploitation estimates by tagging); movement (by tagging); food habits; production; timing of runs; habitat assessment; and lamprey scars and wounds.

In a 1984 survey of state fisheries chiefs, Gene Zuerlein (Nebraska Game and Parks Commission, personal communication) found standard survey manuals existed in only 11 of the 43 states that responded. Without a document that describes how an agency samples fish, responses to surveys such as the one addressed in this report may reflect one person's opinion (Table 1).

## Survey Response and Reporting Format

After two mailings and personal contacts, completed questionnaires were eventually received from all 50 states and all provinces except the Yukon Territories. However, Newfoundland reported that no established sampling program existed in that province.

Data were computerized and sorted using the Statistical Analysis System (SAS Institute, Cary, North Carolina) computer package. Initially, intentions were to portray the geographic distribution of sampling and data analysis techniques used for each of the 15 fish in each of the four water types. Such an analysis was, however, abandoned because the report document would have been approximately three times larger than this version. Instead, use of sampling techniques is portrayed in each of the four water types regardless of fish sought and sampling and data analysis techniques are discussed for each of the 15 fish regardless of water type.

## Small Lakes and Impoundments

All 50 states and 10 provinces that reported sampling fish populations in inland waters routinely sampled lakes and impoundments less than 500 acres.

### Boat Electrofishing

A total of 46 states and three provinces utilized boat electrofishing to sample standing waters less than 500 acres. In the U.S., only Hawaii, New Mexico, Minnesota, and Rhode Island did not use boat electrofishing on small lakes and impoundments. In Canada, boat electrofishing was used to sample small lakes and impoundments only in British Columbia, Alberta, and Ontario.

Of the 46 states that sampled small lakes and impoundments by boat electrofishing, 38 used DC units while 26 states used AC units. All boat electrofishing in Canada was with DC units. Samples were taken at night by 42 states and two provinces (Alberta and Ontario), while 36 states, Alberta, and British Columbia gathered daytime data. Sampling at night with DC units was most common and widely distributed geographically (Figure 1). Daytime use of DC shockers was less common than night sampling in the Southwest and Upper Midwest of the U.S. (Figure 2). Night use of AC units occurred in the Midwest and from Texas diagonally to Maine, with limited use in the West (Figure 3). Daytime use of AC units was less common in the upper midwestern and western U.S. but more common in the Southeast than night electrofishing with AC (Figure 4).

## Portable Electrofishing

Only three states and three provinces made use of portable electrofishing to sample small lakes and impoundments. These six (Alberta, British Columbia, Nevada, New Brunswick, New Hampshire, and Washington) all used DC units during the day. Nevada and New Brunswick also used AC units during the day.

## Seines and Trawls

A total of 14 states and four provinces employed manually operated seines to sample small lakes and impoundments (Figure 5). The four provinces, California, Colorado, and Hawaii used only beach seines 50 ft and longer, while Alabama, Georgia, and Wisconsin relied solely on seines less than 50 ft long. The other eight states relied on both large and small beach seines.

Purse seines were used exclusively in Hawaii and Wyoming. Maine, Minnesota, and New Brunswick used bottom trawls to sample small lakes and impoundments.

## Nets

Trap (modified fyke) nets were used by 32 states and eight provinces (Figure 6). In the U.S., use of trap nets in small lakes and impoundments was most common in northern and plains states, with little use occurring in the Southeast and Southwest.

Hoop nets were used to sample small lakes and impoundment in eight states (Arizona, Idaho, Illinois, Maryland, North Carolina, Nevada, Washington and Wisconsin) and two provinces (Northwest Territories and Ontario).

Gill nets were the most widely used gear to sample small lakes and impoundments. A total of 42 states (all but Delaware, Hawaii, Iowa, Kentucky, Maine, Mississippi, South Carolina, and Tennessee) and nine provinces (all those surveyed but Prince Edward Island) used gill nets. Experimental-mesh gill nets constructed of monofilament were used in 30 states and four provinces, ranging across the continent (Figure 7). Experimental-mesh nets made of multifilament were utilized in six provinces and 23 states which excluded the Southeast and Rocky Mountain states (Figure 8). Single-mesh gill nets constructed of monofilament were used in four provinces and 13 states; many were along the East Coast (Figure 9). Small lakes and impoundments in Ontario, Quebec, and 10 states were sampled with single-mesh gill nets made of multifilament (Figure 10). Trammel nets were used to sample small lakes and impoundments in Arkansas, Florida, and Louisiana.

## Toxicants

Small lakes and impoundments were sampled using rotenone in 12 states, primarily in the Southeast (Figure 11).

## Angler Data

Creel surveys were conducted on small lakes and impoundments in all provinces except Prince Edward Island, and all states except Alabama, Louisiana, Maryland, Massachusetts, Montana, North Dakota, Oklahoma, Pennsylvania, Rhode Island, and Utah.

Angler or guide diaries were assessed for small lake and impoundment fishing activities in 10 states and four provinces, principally in the northeastern portion of the continent (Figure 12). Furthermore, tournament or club reports were used to assess fish populations in three eastern provinces and 15 states, most of which were in the Northeast and Northwest (Figure 13). Other types of angler data were collected in Illinois, Manitoba, New York, North Dakota, and Quebec. Alaska, British Columbia, Indiana, Kansas, Rhode Island, and Washington used angling by agency personnel; California, Missouri, and Ontario assessed tag returns; and West Virginia used trophy

citations to assess fish populations in small lakes and impoundments.

### Miscellaneous Techniques

New Brunswick, Prince Edward Island, and Washington used weir traps or fishway traps and lifts to assess fish populations in small lakes and impoundments. Additional techniques included pound nets--New Hampshire; slat boxes--Alabama; underwater observation--Maine; and explosives--Florida.

## Large Lakes and Impoundments

Fish populations in lakes and impoundments 500 acres and larger were routinely sampled by 48 states and 9 provinces. Of those that sampled fish populations in inland water, only Delaware, Hawaii, and Prince Edward Island did not sample large lakes and impoundments.

### Boat Electrofishing

Distribution of types of units was similar to those used on small lakes and impoundments. Samples conducted with DC units were the same as found for small impoundments (Figures 1 and 2) except that Kansas and Michigan did not use this technique at night on large standing water and Delaware did not sample large lakes and impoundments. Samples conducted with AC units at night were the same as existed for small lakes and impoundments (Figure 3); however, North Dakota and Maine did not utilize this technique while Oklahoma and North Carolina did. Daytime use of AC units was the same in both types of lakes and impoundments (Figure 4), except that Georgia did not use this technique while Oklahoma and North Carolina did.

### Portable Electrofishing

Only two provinces and one state utilized portable electrofishing to sample large lakes and impoundments. Alberta used AC units at night, while British Columbia and Washington used DC units during the day.

### Seines and Trawls

With the exception of Northwest Territories, manually operated seines were utilized to sample large lakes and impoundments in the same western states and provinces that relied on beach seines to sample small lakes and impoundments. In addition, beach seines were used to sample large standing water in Iowa, Louisiana, New Brunswick, Quebec, Rhode Island, and Tennessee (Figure 14). Of those using beach seines to sample large lakes and impoundments, the three western provinces, New Brunswick, California, Colorado, Louisiana, and Tennessee used only seines 50 ft and longer. Iowa, Quebec, Rhode Island, and Wisconsin used only seines shorter than 50 ft, and the other seven states used both long and short beach seines.

Purse seines were employed in Nevada and Wyoming, and eight states used trawls to sample large lakes and impoundments (Figure 15); of these, all but Utah made use of bottom trawls. North Carolina, Nevada, and Utah used mid-water trawls, and Nevada also trawled the surface.

### Nets

Trap nets were used to sample large lakes and impoundments in alt the states where the gear was used to sample small lakes and impoundments (Figure 6) with the exceptions of Rhode Island and West Virginia. In addition, Kentucky, Louisiana, and Nevada utilized this gear to sample large lakes and impoundments. In Canada, New Brunswick and Nova Scotia did not use trap nets on large

lakes and impoundments; Prince Edward Island did not sample such water.

With the exceptions of Ontario and Wisconsin, the same states and provinces that used hoop nets in small lakes and impoundments utilized this gear in large standing water. In addition, New Hampshire used hoop nets in large lakes and impoundments.

Gill nets were even more widely used to sample large lakes and impoundments than small lakes and impoundments. Of the 48 states that sampled large standing water, only Alabama, Iowa, Ohio, and Maine did not utilize gill nets; all nine provinces that sampled such water used gill nets. With the exception of Kansas, all states and provinces that sampled small lakes and impoundments with experimental-mesh gill nets constructed of monofilament also used this gear on large takes and impoundments. In addition, Arkansas, Kentucky, Nevada, and South Carolina utilized experimental-mesh gill nets constructed of monofilament in large lakes and impoundments. With the exception of Ohio and the additions of Kentucky, Louisiana, and North Dakota, the same states and provinces that used experimental-mesh gill nets constructed of multifilament on small lakes and impoundments also employed them on large standing water. Single-mesh gal nets constructed of monofilament were used more frequently in large than small lakes and impoundments in the U.S., but use still occurred primarily in the East (Figure 16). Single-mesh nets made of multifilament were also used more in large lakes and impoundments than they were in small standing water, but use was geographically diverse (Figure 17). Vertical gill nets were used in Kentucky to sample large lakes and impoundments; Arizona, Arkansas, Florida, Louisiana, Mississippi, and Nevada used trammel nets on large lakes and impoundments.

## Toxicants

With the exception of Delaware, rotenone was applied to sample large lakes and impoundments in the same states that used the substance to sample small standing water. Alabama, Georgia, North Carolina, and South Carolina also used rotenone to sample lakes and impoundments 500 acres and larger (Figure 18).

## Angler Data

All of the nine provinces that sampled large takes and impoundments also conducted creel surveys on such waters. Of the 48 states that sampled large lakes and impoundments, all but Alabama, Maryland, Montana, North Dakota, Oklahoma, Pennsylvania, Rhode Island, and Utah creel surveyed such waters.

Angler or guide diaries were assessed for large lake and impoundment fishing activities in the provinces and states (except Delaware and New Hampshire) that collected such information for small standing water plus Arkansas, Michigan, Nevada, and Northwest Territories (Figure 19).

Tournament or club reports were used to assess fish populations over a broader geographic range than occurred for small lakes and impoundments, but little use of such information occurred in the southeastern or southwestern U.S. (Figure 20).

Other types of angler data were collected in the same states and provinces that compiled such information for small lakes and impoundments, plus Iowa, Ohio, Kentucky, and Maine. Angling by agency personnel provided information in Alaska, British Columbia, Indiana, and Washington. California, Kentucky, Massachusetts, Missouri, and Ontario assessed tag returns and North Carolina and West Virginia used trophy citations to assess fish populations in large lakes and impoundments.

### Miscellaneous Techniques

Other techniques used to sample fish populations in large lakes and impoundments included assessment of commercial catches--Manitoba, Michigan, and Ontario; weir traps or fishway traps and lifts—Michigan and Northwest Territories; pound nets--New Hampshire; underwater observation--Maine; and explosives--Florida.

## Streams

Of the states and provinces that sampled inland fish populations, only Alabama, Kansas, Oklahoma, and Texas did not sample streams on a regular basis.

### Boat Electrofishing

Boat electrofishing was used to sample streams primarily in the Northwest, along the Missouri, Mississippi, and Ohio River Valleys, and in some southeastern states (Figure 21). Few states in the Southwest and Northeast used this technique, and Alberta and British Columbia were the sole provinces to sample streams by boat electrofishing.

Of the 22 states that utilized boat electrofishing on streams, 20 (all except Illinois and North Carolina) used DC units; British Columbia and Alberta used DC units. All of these states and provinces used their DC units during the day; Alberta, Arkansas, Idaho, Louisiana, Missouri, Montana, South Dakota, West Virginia, and Wyoming also shocked streams with DC units at night. Ten states in the Midwest and Southeast used AC units to sample streams, all of which shocked during the day (Figure 22). Only Arkansas and West Virginia used AC units at night to sample streams.

### Portable Electrofishing

Portable electrofishing was the gear most frequently utilized to sample fish populations in streams, with 38 states and 8 provinces employing this technique. Only California, Connecticut, Delaware, and New York shocked at night. Use of DC units was widespread geographically (Figure 23), with AC units more confined to the East and West (Figure 24).

### Seines

Beach seines were used in 15 states and three provinces, with no apparent pattern of geographical distribution (Figure 25). All of these except New Hampshire and South Dakota employed seines 50 ft and longer; Maine, Manitoba, New Hampshire, South Dakota, and Washington used beach seines less than 50 ft long.

### Nets

Nets were rarely used to sample streams. Trap nets were employed by seven states and three provinces (Figure 26); hoop nets were used in seven states and Northwest Territories (Figure 27). Gill nets were utilized in four provinces, Alaska, and five southern states (Figure 28). Experimental-mesh nets constructed of monofilament were used in Alaska, Arizona, British Columbia, Missouri, and New Mexico, whereas Alaska, Missouri, New Mexico, and Saskatchewan used experimental-mesh nets made of multifilament. Alaska, Arizona, New Mexico, and North Carolina used single-mesh nets constructed of monofilament while Alaska, Arkansas, Manitoba,

New Mexico, and Quebec used single-mesh nets made of multifilament.

### Toxicants

Streams in Manitoba and 12 states, primarily in the East, were sampled with rotenone (Figure 29). Cyanide was used in Louisiana, North Dakota, Tennessee, Utah, and Wyoming.

### Angler Data

Creel surveys were conducted on streams in 30 states and seven provinces (Figure 30). Use of angler or guide diaries occurred in British Columbia and Idaho, but was most common in eastern provinces and northeastern states (Figure 31); tournament or club reports were assessed only in British Columbia, Connecticut, Quebec, Washington, and West Virginia.

Other types of angler data were collected in Manitoba, New Mexico, New York, North Dakota, and Quebec. Alaska, Arkansas, British Columbia, Idaho, and Washington assessed angling by agency personnel. West Virginia evaluated trophy citations; California and Missouri assessed tag returns; and Missouri used set lines to monitor stream fish populations.

### Miscellaneous Techniques

The northwestern states of Idaho, Oregon, and Washington as well as Alberta, Manitoba, and Northwest Territories used weir traps or fishway traps and lifts to assess fish populations in streams. Florida, Georgia, and South Carolina used explosives, and Idaho utilized underwater observation to sample fish populations in streams.

## Rivers

The same states that did not routinely sample streams (Alabama, Kansas, Oklahoma, and Texas) did not regularly sample rivers. In addition, Hawaii and Prince Edward Island did not sample rivers.

### Boat Electrofishing

Use of boat electrofishing to sample rivers was more widespread in the U.S. than to sample streams. Of the 45 states that sampled fish populations in rivers, only Maine, North Dakota, South Carolina, and Utah did not use boat electrofishing. However, of the nine provinces that sampled rivers, only Alberta and British Columbia made use of boat electrofishing. DC units were used in 36 states and the two provinces. Of these, 33 states and both provinces shocked rivers with DC units during the day (Figure 32) and 20 states shocked with DC at night (Figure 33). AC units were operated to sample fish in rivers in 24 states. Use of such gear to sample rivers was confined to the U.S. and occurred most often in the East. Daytime shocking with AC units occurred in 23 states (Figure 34) while 10 states shocked at night (Figure 35).

### Portable Electrofishing

Use of portable electrofishing gear was confined primarily to the eastern and western U.S. and Canada. Only Nova Scotia utilized portable electrofishing in rivers at night. DC units were used in 13 states and four provinces (Figure 36). AC units were used during the day in 10 states, including fewer northwestern states, British Columbia, and New Brunswick (Figure 37).

**Seines**

Beach seines were utilized to sample fish populations in rivers along the periphery of the U.S. and only in British Columbia in Canada (Figure 38). With the exceptions of Maryland and North Dakota, those that sampled with beach seines used seines less than 50 ft long. Arizona, Maine, Maryland, New Jersey, New Mexico, North Dakota, and Washington used beach seines 50 ft and longer.

**Nets**

Trap nets were used to sample rivers in three provinces and 15 states, primarily in the North (Figure 39). Hoop nets were employed in Manitoba, the Northwest Territories, and 13 states, primarily in the Missouri, Mississippi, and Ohio River Valleys (Figure 40). Gill nets were used in six provinces and 28 states. Experimental-mesh gill nets constructed of monofilament were used to sample rivers in four provinces and 17 states, geographically diverse (Figure 41). Experimental-mesh nets made of multifilament were utilized in four provinces and 13 states (Figure 42). Single-mesh gill nets constructed of monofilament were used in Northwest Territories, Quebec, and 10 states, many in the Southwest and Southeast (Figure 43). Quebec and eight states used single-mesh nets made of multifilament to sample rivers (Figure 44). Trammel nets were employed to sample rivers in Arizona, Arkansas, Iowa, Louisiana, and Quebec.

**Toxicants**

Rotenone was applied in Manitoba and ten eastern and southern states (Figure 45). Cyanide was applied in North Dakota and Wyoming to sample rivers.

**Angier Data**

Creel surveys were conducted on rivers in 34 states and six provinces (Figure 46). With the exceptions of British Columbia and New Mexico, angler or guide diaries were examined only in the extreme Northeast (Figure 47). Tournament or club reports were assessed along the coasts of both the U.S. and Canada and in Ohio and West Virginia (Figure 48). Other types of angler data were collected in Kentucky, Manitoba, New Mexico, New York, North Dakota, and Quebec. Tag returns were collected in California; trophy citations were evaluated in West Virginia; Alaska, Arkansas, British Columbia, New Brunswick, and Washington used angling by agency personnel; and Oregon used set lines to sample fish populations in rivers.

**Miscellaneous Techniques**

Weir traps or fishway traps and lifts were operated to sample fish populations in Alberta, California, Idaho, Massachusetts, Michigan, Minnesota, New Brunswick, and Washington. Maryland and Rhode Island utilized D-traps, Georgia used explosives, Idaho used underwater observation, and Manitoba monitored commercial catches to assess fish populations in rivers.

## Channel catfish

Channel catfish were routinely sampled from one or more of the four water types in all states but Alaska, Connecticut, Maine, New Hampshire, Rhode Island, and Vermont. In Canada, channel catfish were sampled only in Manitoba and Ontario.

## Boat Electrofishing

A total of 33 states employed boat electrofishing to sample channel catfish. Of these, 17 states used DC units at night (Figure 49); 27 states used DC units during the day (Figure 50); 10 states used AC units at night (Figure 51); and 21 states used AC units during the day (Figure 52).

## Portable Electrofishing

Portable electrofishing units were operated in 16 states, outside the Plains. All such sampling took place during the day with 12 states using DC units (Figure 53); AC units were used in nine states (Figure 54).

## Seines and Trawls

Beach seines were used to sample channel catfish in 12 states. Nine states used seines 50 ft and longer (Figure 55), while eight states used seines less than 50 ft long (Figure 56).

Purse seines were operated in Hawaii to sample channel catfish; Minnesota and North Carolina used bottom trawls. North Carolina also used mid-water trawls.

## Nets

Trap nets were set to sample channel catfish in 17 states, primarily toward the northern portion of the fish's range (Figure 57). Hoop nets were utilized in 17 states principally in the Missouri, Mississippi, and Ohio River Valleys (Figure 58).

Channel catfish were sampled with gill nets in Manitoba, Ontario, and all states where they were managed except California, Delaware, Hawaii, Mississippi, Montana, Ohio, Wisconsin, and Virginia. Of these, 33 states and both provinces used experimental-mesh nets. Experimental-mesh nets constructed of monofilament were used in 26 states, geographically diverse (Figure 59), while 18 states (outside the Southeast and Rocky Mountains) and both provinces used multifilament nets (Figure 60). Single-mesh gill nets were used in 15 states, primarily toward the southern portion of the fish's range. Single-mesh nets constructed of monofilament were utilized in 12 states (Figure 61) while seven states (outside the Deep South) used multifilament nets (Figure 62). Trammel nets were employed to sample channel catfish in Arizona, Arkansas, Florida, Iowa, and Louisiana.

## Toxicants

Toxicants were applied to sample channel catfish in 20 states, primarily in the Southeast. Eighteen of these used rotenone (Figure 63). Louisiana, North Dakota, and Wyoming relied on cyanide.

## Angler Data

Creel surveys were conducted to assess channel catfish populations in Manitoba and 34 states (Figure 64). Angler or guide diaries were examined in Delaware, Illinois, and New Mexico; Nevada and West Virginia assessed tournament or club reports; and some other type of angler data was collected in Manitoba, New Mexico and North Dakota. Kansas and Washington assessed channel cattish populations by angling. Missouri and Oregon sampled channel catfish with set lines; California and Missouri assessed tag returns; and West Virginia evaluated trophy citations.

## Miscellaneous Techniques

Florida, Georgia, and South Carolina used explosives to assess channel catfish populations. Other techniques employed were weir traps or flshway traps and lifts—Massachusetts; D-traps—Maryland; slat boxes—Alabama; and assessment of commercial catches—Michigan.

## Data Analysis

Of the 44 states that sampled channel cattish, only California, Massachusetts, North Dakota, and Virginia did not analyze length-distribution data; Manitoba analyzed length-distribution data, but Ontario did not. Use of PSD and RSD occurred in eight states, primarily in the Midwest (Figure 65). Michigan and Minnesota assessed channel catfish population structure using their own quality indices.

Catch per unit effort data were collected for channel catfish in all states where they were sampled except Alabama, Delaware, Maryland, Massachusetts, and Virginia; Ontario did not collect catch rate data. Population estimates were conducted in 13 states, primarily in mid-latitudes (Figure 66). Biomass estimates were developed for channel cattish in 18 states, primarily in the Midwest and Southeast (Figure 67).

Weight-length relationships were developed in Manitoba as well as 21 states, with no apparent geographic pattern (Figure 68). Indices of body condition were calculated in Manitoba and 24 states. Of these, all but Missouri calculated condition using the statistics K or C (Figure 69). Missouri, five other midwestern states, and Georgia calculated channel cattish condition using Wr (Figure 70).

Growth was calculated for channel catfish in Manitoba and 20 states (Figure 71). With the exceptions of California, New Jersey, North Carolina, and Tennessee, those that evaluated channel catfish growth also evaluated age distribution. Alabama, Minnesota, and Utah assessed age distribution, but not growth.

Other techniques used to analyze channel catfish populations included abundance relative to other species--Georgia, Indiana, Massachusetts, Mississippi, and North Carolina; species composition or presence/absence--Georgia, North Dakota, Ontario, and South Carolina; mortality estimates--California and Colorado; movement--Iowa; and food habits—South Carolina.

# Striped Bass

Striped bass were routinely sampled from one or more of the four water types in Nova Scotia and 31 states, primarily outside the country's northern tier (Figure 72).

## Boat Electrofishing

Eighteen states, which were outside the Plains and most of the Midwest, sampled striped bass with boat electrofishing (Figure 73). Of these, all but Illinois, Nevada, South Carolina, Tennessee, and Utah used DC units during the day; Arkansas, Arizona, Louisiana, Maryland, Nevada, Pennsylvania, and Utah used DC units at night. AC units were used in Arkansas, Arizona, Georgia, Illinois, Kentucky, Mississippi, Nevada, New Jersey, North Carolina, Tennessee, and Utah. All of these except Nevada shocked during the day; Arizona, Arkansas, Nevada, and Tennessee used AC units at night.

## Portable Electrofishing

Portable AC units were used to sample striped bass during the day in South Carolina and Tennessee.

## Seines and Trawls

Beach seines were used to sample striped bass in Louisiana, Nevada, New Jersey, New York, and Tennessee. Louisiana, Nevada, and Tennessee utilized seines 50 ft and longer, while Louisiana, New Jersey, Nevada, and New York used seines less than 50 ft long to sample striped bass. Nevada also employed purse seines and surface, midwater, and bottom trawls; North Carolina used midwater and bottom trawls to sample striped bass.

## Nets

Trap nets were set to sample striped bass in only Louisiana and Pennsylvania. Louisiana, North Carolina, and Nevada utilized hoop nets.

Gill nets were used to capture striped bass everywhere they were sampled except Delaware, Iowa, Massachusetts, Missouri, and Nova Scotia. Experimental-mesh nets were employed in 20 states. Of these, 18 states used monofilament nets (Figure 74), while nine states, outside the Southeast, used multifilament nets (Figure 75). Nineteen states used single-mesh nets, 17 of which used monofilament nets (Figure 76). Eight states, outside the Southeast, used single-mesh multifilament nets (Figure 77). Trammel nets were set to sample striped bass in Arizona, Arkansas, Louisiana, Mississippi, and Nevada.

## Toxicants

Rotenone was applied to sample striped bass in ten southeastern states (Figure 78). In addition, Louisiana used cyanide.

## Angler Data

Creel surveys were conducted to assess striped bass populations everywhere they were sampled except Delaware, Maryland, New Jersey, New York, Oklahoma, Pennsylvania, and Utah. Angler or guide diaries were analyzed in Arkansas, Illinois, Nova Scotia, and Nevada; Nova Scotia, Nevada, Pennsylvania, and West Virginia assessed tournament or club reports; Iowa and Kentucky collected other types of angler data; California and Missouri assessed tag returns; and West Virginia evaluated trophy citations.

## Data Analysis

Of the 31 states that sampled striped bass, only California, Massachusetts, and Texas did not analyze length-distribution data; Nova Scotia evaluated length-distribution data. Use of PSD and RSD occurred in Arizona, Kansas, Nebraska, Nevada, and Pennsylvania.

Catch per unit effort data were collected for striped bass everywhere they were sampled except Delaware, Iowa, Maryland, and Massachusetts. Population estimates were conducted primarily in the Southeast (Figure 79). With the exceptions of Louisiana and Virginia, the same states that conducted population estimates also developed biomass estimates. Texas developed biomass estimates, but not population estimates.

Weight-length relationships were developed in Nova Scotia and 16 states, primarily in the eastern portion of the fish's range (Figure 80). Indices of body condition were calculated in 20 states and Nova Scotia. Of these, only Oregon did not calculate condition using K or C (Figure 81). Georgia, North Carolina, Nebraska, Oklahoma, and Oregon used Wt to evaluate well being of striped bass.

Growth was assessed in Nova Scotia and 23 states (Figure 82). With the exceptions of California, Delaware, Iowa, and South Carolina, those that evaluated striped bass growth also assessed age distribution; New Mexico, New York and Utah assessed age distribution but not growth.

Other techniques employed to analyze striped bass populations included abundance relative to other species--Indiana, Massachusetts, Mississippi, and North Carolina; mortality estimates--California and South Carolina; and food habits--South Carolina.

## White Bass

White bass were sampled from one or more of the four water types in 34 states, which were outside the Northeast and Northwest (Figure 83). In Canada, only Manitoba routinely sampled white bass.

### Boat Electrofishing

A total of 22 states sampled white bass with boat electrofishing. Of these, 15 states used DC units at night (Figure 84), and 14 states, primarily in the East, used DC units during the day (Figure 85). AC units were used during the day in 10 states (Figure 86); however, only Arizona, Arkansas, Indiana, Kentucky, Nevada, South Dakota, and Wisconsin sampled white bass with AC units at night.

### Portable Electrofishing

Portable electrofishing units were utilized to sample white bass during the day in three states. Arkansas used AC units, Indiana used DC units, and New Mexico used both AC and DC.

### Seines and Trawls

Beach seines were used to sample white bass in eight states. Seines less than 50 ft long were used in Louisiana, Minnesota, Nevada, New Mexico, and South Dakota. Colorado, Illinois, Louisiana, North Dakota, Nevada, and New Mexico utilized beach seines 50 ft and longer. Utah used midwater trawls to sample white bass.

### Nets

Trap nets were set to sample white bass in 14 states, primarily in the northern portion of the fish's range (Figure 87). Hoop nets were used only in Indiana and Louisiana.

White bass were sampled in 23 states and Manitoba with gill nets. Of these, 16 states used experimental-mesh nets constructed of monofilament (Figure 88), and 10 states and Manitoba used experimental-mesh nets made of multifilament (Figure 89). Single-mesh nets were used in eight states toward the southern portion of the fish's range (Figure 90). Of these, all but Arkansas and Nevada utilized monofilament nets. These two states, Louisiana and New Mexico used multifilament nets. Trammel nets were employed to sample white bass in Arkansas, Arizona, and

Louisiana.

## Toxicants

Toxicants were applied to sample white bass in 15 states in the eastern portion of the fish's range. Of these, 14 states applied rotenone (Figure 91). Louisiana and North Dakota used cyanide.

## Angler Data

Of those who sampled white bass, only Alabama, Arkansas, New York, North Dakota, Oklahoma, Pennsylvania, and Utah did not conduct creel surveys to collect white bass data. Angler or guide diaries were analyzed in Illinois and New Mexico; West Virginia assessed tournament or club reports and evaluated trophy citations. Manitoba, North Dakota, and New Mexico collected some other type of angler data and Indiana and Kansas assessed white bass populations by angling.

## Data Analysis

Of the 34 states that sampled white bass, only Alabama, California, North Carolina, North Dakota, and Texas did not analyze length-distribution data; Manitoba evaluated length-distribution data. Use of PSD and RSD occurred in Arizona, Colorado, Illinois, Kansas, and Nebraska; Michigan and Minnesota used their own quality indices to assess white bass population structure.

Catch per unit effort data were collected for white bass everywhere they were sampled except Alabama and Iowa. Population estimates were conducted in Georgia, Louisiana, Michigan, and West Virginia. Biomass estimates were developed in seven states, primarily toward the eastern portion of the fish's range (Figure 92).

Weight-length relationships were developed in Manitoba and 17 states, with no apparent pattern of geographic distribution (Figure 93). Indices of body condition were calculated in Manitoba and 18 states. All of these used K or C to calculate condition (Figure 94). In addition, Georgia, Nebraska, and Oklahoma used Wr to evaluate well being of white bass.

Growth was assessed in Manitoba and 20 states, primarily outside the Southeast (Figure 95). California, Iowa, and South Carolina were the only states to assess growth data without assessing age distribution of white bass. Georgia, Minnesota, Nevada, and Utah analyzed age distribution but not growth.

Other techniques employed to analyze white bass populations included relative abundance -Indiana and Mississippi; species composition--Mississippi and North Dakota; mortality estimates--Colorado; and food habits--South Carolina.

# Bluegill

Bluegill were sampled from one or more of the four water types in all states except Alaska, Montana, and Vermont. In Canada, only Ontario and Quebec routinely sampled bluegill.

## Boat Electrofishing

Of those sampling bluegill, only Hawaii, Maine, Ontario, Oregon, Quebec, Rhode Island, and Wyoming did not use boat electrofishing. DC units were used during the day in 31 states (Figure 96) and at night in 30 states (Figure 97). AC units were utilized during the day in 26 states (Figure 98) and at night in 21 states (Figure 99).

## Portable Electrofishing

Bluegill were sampled in 20 states with portable electrofishing units. All 20 states sampled during the day; Connecticut and New York alone shocked at night. DC units were used in 14 states, outside the northwestern and central portions of the fish's range (Figure 100). AC units were employed in 13 states, in the Southwest and diagonally from Mississippi to Massachusetts (Figure 101).

## Seines

Beach seines were utilized to sample bluegill in Ontario and 20 states, primarily in the north central, southwestern, and eastern portions of the fish's range (Figure 102). With the exceptions of Alabama, Minnesota, South Dakota, and Wisconsin, all of these used seines 50 ft and longer; California, Colorado, Delaware, Illinois, Kentucky, North Dakota, and Ontario used only beach seines less than 50 ft long.

## Nets

Traps nets were set to sample bluegill in Ontario and 26 states, primarily toward the northern portion of the fish's range (Figure 103). Hoop nets were used only in Arizona, Idaho, Indiana, Louisiana, Maryland, North Carolina, Ontario, and Washington.

Bluegill were sampled in 23 states and Ontario with gill nets. Experimental-mesh nets constructed of monofilament were employed in 15 states (Figure 104); 12 states and Ontario used experimental-mesh nets made of multifilament (Figure 105). Single-mesh nets were utilized in seven states. Arizona, Georgia, Maryland, North Carolina, and New Mexico used monofilament nets, while Connecticut, Maryland, Nevada, and New Mexico used multifilament nets. Trammel nets were used in Louisiana to sample bluegill.

## Toxicants

Toxicants were applied to sample bluegill in 21 states, primarily in the Southeast. Rotenone was applied in 20 states (Figure 106) while cyanide was used in Louisiana, North Dakota, and Tennessee.

## Angler Data

Creel surveys were conducted to assess bluegill populations in Quebec and 38 states (Figure 107). Angler or guide diaries were examined in Connecticut, Delaware, Illinois, and New Mexico; Connecticut and West Virginia assessed tournament or club reports; and New Mexico and North Dakota collected other types of angler data. California assessed tag returns; West Virginia evaluated trophy citations; and Arkansas, Indiana, Kansas, and Washington assessed bluegill populations by angling.

## Miscellaneous Techniques

Other bluegill sampling techniques included explosives--Florida, Georgia, and South Carolina; weir traps or fishway traps and lifts--Massachusetts; and D-traps-Maryland.

## Data Analysis

Of the 47 states sampling bluegill, only North Dakota did not analyze length-distribution data. Ontario and Quebec did not evaluate length-distribution data for bluegill. Use of PSD and RSD occurred in 25 states, primarily toward the central and eastern portions of the fish's range (Figure 108); Michigan and Minnesota used their own quality Indices to assess bluegill population structure.

Catch per unit effort data were collected in all states sampling bluegill except Maine, Maryland, Massachusetts, and Rhode Island. Population estimates were conducted in 14 states, primarily in the eastern portion of the fish's range (Figure 109). With the exceptions of Louisiana, Ohio, and Tennessee, states that conducted population estimates also developed biomass estimates for bluegill. Alabama, Delaware, Florida, Kentucky, and Texas developed biomass estimates but not population estimates.

Weight-length relationships were developed In 26 states, primarily outside the southwestern and northern portions of the fish's range (Figure 110). Indices of body condition were calculated In 34 states. Use of K or C occurred in 27 states (Figure 111), while 14 states used Wr to calculate bluegill condition (Figure 112). In general, western, southeastern, and northeastern states used K or C while midwestern states used Wr or both Indices.

Bluegill growth was assessed in 33 states; however, this was least common in the northern and southeastern portions of the fish's range (Figure 113). With the exceptions of Nevada, North Carolina, Oregon, and South Carolina, states that assessed growth also evaluated age distribution. Minnesota, Rhode Island, and Washington assessed age distribution but not growth.

Other techniques for analyzing bluegill populations Included abundance relative to other species--Georgia, Indiana, Massachusetts, Mississippi, North Carolina, and Ontario; species composition or presence/absence--Georgia, North Dakota, Ontario, and South Carolina; and mortality estimates--California and Colorado.

# Crappies

Crappies were routinely sampled from one or more of the four water types everywhere in the U.S. except Alaska, Hawaii, Rhode Island, and Vermont. In Canada, only Manitoba, Ontario, and Quebec sampled crappies.

## Boat Electrofishing

With the exceptions of Kansas, Maine, Montana, Oregon, Virginia, and Wyoming, states that sampled crappies used boat electrofishing. DC units were used In 35 states. Of these, 28 shocked at night (Figure 114) and 27 shocked during the day (Figure 115). Night use of DC units was more common In the West and day use occurred more commonly In the Southeast. AC units were used to sample crappies In 26 states. Night use of AC units occurred In 20 states (Figure 116), while 23 states shocked using AC units during the day (Figure 117).

## Portable Electrofishing

Twelve states sampled crappies with portable electrofishing units (Figure 118). Only Connecticut shocked at night. DC units were used in nine states (all but Arkansas, New Jersey, and West Virginia) and AC units were used in nine states (all but Indiana, Michigan, and Minnesota).

## Seines and Trawls

Beach seines were used to sample crappies in 15 states, primarily outside the eastern and central portions of the country (Figure 119). Seines 50 ft and longer were used in 11 states (all but Alabama, Minnesota, South Dakota, and Wisconsin). Beach seines less than 50 ft long were used in 10 states (Alabama, Louisiana, Minnesota, Montana, New Jersey, New Mexico, Nevada, South Dakota, Washington, and Wisconsin). Bottom trawls were used to sample crappies in Florida, Illinois, and North Carolina; North Carolina also used midwater trawls.

## Nets

Trap nets were set to sample crappies in Ontario and 31 states, primarily outside the Southeast and Southwest (Figure 120). Hoop nets were utilized in Ontario and six states (Arizona, Idaho, Illinois, Indiana, Louisiana, and North Carolina).

Gill nets were used to sample crappies in Ontario and 28 states. Experimental-mesh nets constructed of monofilament were used in 18 states (Figure 121) and Ontario and 15 states used experimental-mesh nets made of multifilament (Figure 122). Single-mesh nets were employed to sample crappies in 10 states, principally toward the Southwest and along the East Coast (Figure 123). Monofilament nets were used in all of these states but Arkansas, Connecticut, and Nevada (who used only multifilament nets); Maryland and New Mexico used both monofilament and multifilament nets. Trammel nets were used to sample crappies in Arkansas, Florida, and Louisiana.

## Toxicants

Rotenone was applied to sample crappies in 19 states, principally in the Southeast (Figure 124). In addition, Louisiana and North Dakota applied cyanide.

## Angler Data

Creel surveys were conducted in all three provinces which sampled crappies. Quebec depended exclusively on creel surveys to assess crappies. All states sampling crappies conducted creel surveys except Alabama, Maine, Maryland, Montana, New York, North Dakota, Oklahoma, Pennsylvania, and Utah. Angler or guide diaries were assessed in Connecticut, Delaware, Illinois, and New Mexico; tournament or club reports were assessed in Connecticut, Illinois, Maine, and West Virginia. Other types of angler data were collected in Maine, Manitoba, New Mexico, and North Dakota, California and Missouri assessed tag returns; West Virginia evaluated trophy citations; and Arkansas, Indiana, Kansas, and Washington assessed crappie populations by angling.

## Miscellaneous Techniques

Other techniques used to sample crappies Included weir traps or fishway traps and lifts--Massachusetts; explosives--Florida and Georgia; and D-Traps—Maryland.

## Data Analysis

Of the 46 states and two provinces that sampled crappies with techniques in addition to creel surveys, only North Dakota did not analyze length-distribution data. Use of PSD and RSD occurred in 17 states, primarily in the Midwest (Figure 125). Michigan and Minnesota assessed crappie population structure using their own quality indices.

Catch per unit effort data were collected for crappies everywhere they were sampled except Maine, Maryland, Massachusetts, and New Hampshire. Population and biomass estimates were least common in the western and northern portions of the crappies' range. Population estimates were conducted in 10 states (Figure 126), and 15 states developed biomass estimates (Figure 127).

Weight-length relationships were developed in Manitoba, Ontario, and 24 states, with little geographic pattern (Figure 128). Indices of body condition were calculated in Manitoba and 29 states; of these, all but Colorado and Missouri used K or C (Figure 129). Colorado, Missouri, and seven other states, primarily in the Midwest, used Wr (Figure 130).

Growth data were collected for crappies in Manitoba and 33 states, primarily in the eastern portion of the crappies' range (Figure 131). With the exceptions of Nevada, Oregon, and South Carolina, those that evaluated growth for crappies also evaluated their age distribution. Minnesota, Utah, and Washington assessed age distribution but not growth.

Other techniques used to analyze crappie populations included abundance relative to other species--Indiana, Massachusetts, Mississippi, North Carolina, and Ontario; species composition or presence/absence--North Dakota and Ontario; mortality estimates--California and Colorado; movement--Iowa; and food habits--South Carolina.

# Largemouth Bass

Largemouth bass were routinely sampled from one or more of the four water types in all states but Alaska. In Canada, British Columbia, Manitoba, Ontario, and Quebec sampled largemouth bass.

## Boat Electrofishing

With the exceptions of Hawaii, Maine, and Rhode Island, all states sampling largemouth bass used boat electrofishing. This gear was, however, not used in Canada. DC units were used in all states that used boat electrofishing except Illinois, Massachusetts, South Carolina, and Vermont. DC units were used during the day in 34 states (Figure 132); 32 states, including several in the West, shocked with DC units at night (Figure 133). AC unit were used in 28 states (Figure 134). Of these, Georgia, Mississippi, New Jersey, New Mexico, North Carolina, and Virginia shocked only during the day, and North Dakota shocked only at night. The other 21 states sampled largemouth bass with AC units during both day and night.

## Portable Electrofishing

Portable electrofishing units were used to sample largemouth bass in 20 states. DC units were utilized during the day in three southwestern states and 11 states in the eastern half of the country (Figure 135). The same three southwestern states also used AC units during the day, but use outside this area was confined to a diagonal band of states from Mississippi to Massachusetts (Figure 136). Connecticut also used both DC and AC units at night while New York shocked largemouth bass with DC portable units at night.

## Seines and Trawls

Largemouth bass were sampled in 21 states with beach seines. Of these, 16 states used seines 50 ft and longer (Figure 137) and 14 states used beach seines less than 50 ft long (Figure 138). North Carolina used midwater and bottom trawls to sample largemouth bass.

## Nets

Trap nets were set to sample largemouth bass in British Columbia, Ontario, and 14 states, primarily in the North (Figure 139). Largemouth bass were sampled with hoop nets in Idaho, Louisiana, Maryland, North Carolina, and Ontario.

Gill nets were used to sample largemouth bass in Ontario and 21 states. Experimental-mesh nets constructed of monofilament were utilized in 14 states (Figure 140); 11 states and Ontario used experimental-mesh nets made of multifilament (Figure 141). Single-mesh gill nets constructed of monofilament were used in Arizona, Georgia, Maryland, New Mexico, and North Carolina; Connecticut, Maryland, Nevada, and New Mexico used single-mesh gill nets made of multifilament. Arizona and Louisiana used trammel nets to sample largemouth bass.

## Toxicants

Rotenone was applied to sample largemouth bass in 21 states, primarily in the Southeast (Figure 142). Cyanide was used in Louisiana, North Dakota, and Tennessee.

## Angler Data

Creel surveys were used to assess largemouth bass in all states where they were sampled except Alabama, Maryland, Montana, North Dakota, Oklahoma, Pennsylvania, Rhode Island, Utah, and Vermont. All four provinces sampling largemouth bass collected creel data; this was the only technique used to sample largemouth bass in Quebec. Angler or guide diaries were examined in nine states (Figure 143); tournament or club reports were assessed in Ontario and 21 states (Figure 144). Other types of angler data were collected in Illinois, Maine, Manitoba, New Mexico, and North Dakota. California, Missouri, and Ontario assessed tag returns; Kansas and West Virginia evaluated trophy citations; and Arkansas, Kansas, and Washington assessed largemouth bass populations by angling.

## Miscellaneous Techniques

Other largemouth bass techniques included explosives-Florida, Georgia, and South Carolina; weir traps or fishway traps and lifts-Massachusetts; D-traps-Maryland; and underwater observation--Maine.

## Data Analysis

With the exception of Quebec, all those that sampled largemouth bass analyzed length-distribution data. Use of PSD and RSD occurred in 33 states, primarily outside the West; none of the provinces used PSD and RSD (Figure 145). Michigan and Minnesota used their own quality indices to assess largemouth bass population structure.

Catch per unit effort data were collected for largemouth bass where they were sampled except in Massachusetts, Quebec, and Vermont. Population estimates were conducted in 24 states,

primarily in the eastern portion of the fish's range (Figure 146). Biomass estimates were developed for largemouth bass in the same states that conducted population estimates, with the exceptions of Louisiana, Missouri, New Hampshire, South Dakota, and Tennessee. Alabama, Kentucky, South Carolina, and Texas conducted biomass estimates, but not population estimates.

Weight-length relationships were developed in British Columbia, Ontario, and 33 states (Figure 147). Indices of body condition using K or C were calculated in British Columbia, Manitoba, and Ontario and 33 states (Figure 148). Wr was used to assess well being of largemouth bass in 18 states, with little use occurring in the North, West, and South (Figure 149).

Growth was calculated for largemouth bass in Manitoba, Ontario, and 42 states (Figure 150). With the exceptions of North Dakota, Oregon, and South Carolina, those that evaluated growth for largemouth bass also evaluated age distribution. British Columbia, Minnesota, Rhode Island, and Washington assessed age distribution but not growth.

Other techniques utilized to assess largemouth bass populations included abundance relative to other species—Georgia, Indiana, Massachusetts, Mississippi, North Carolina, and Ontario; species composition or presence/absence—Georgia. North Dakota, and Ontario; sex, maturity, and fecundity—Ontario; mortality estimates—California, Colorado, and Wisconsin; and food habits—Wisconsin.

## Smallmouth Bass

Smallmouth bass were routinely sampled from one or more of the four water types in 43 states and seven provinces (Figure 151).

### Boat Electrofishing

Use of boat electrofishing to sample smallmouth bass was limited to the U.S., where 39 states employed the technique. Of those in the U.S. that sampled smallmouth bass, only Hawaii, Rhode Island, South Carolina, and Texas did not use boat electrofishing. DC units were used in 35 states. Of these, 28 shocked at night (Figure 152) and 26 shocked during the day (Figure 153). AC units were used to sample smallmouth bass in 23 states. Twenty states used AC units during the day (Figure 154) and 17 states shocked smallmouth bass at night using AC (Figure 155).

### Portable Electrofishing

Portable electrofishing units were used to sample smallmouth bass in 22 states. DC units were used during the day in 16 states (Figure 156) and AC units were utilized during the day in three southwestern states and nine states running diagonally from Arkansas to Massachusetts (Figure 157). Connecticut also used both DC and AC units at night; New York used DC units at night to sample smallmouth bass.

### Seines

Beach seines were used to sample smallmouth bass in New Brunswick and 17 states. All but Minnesota used seines 50 ft and longer (Figure 158); ten states used beach seines less than 50 ft long (Figure 159).

## Nets

Trap nets were set to sample smallmouth bass in British Columbia, Ontario, and 12 northern states (Figure 160). Hoop nets were employed In Idaho, Maryland, New Hampshire, and Ontario.

Five provinces and 20 states used gill nets to sample smallmouth bass, all of which used experimental-mesh nets. Of these, Alberta and 12 states used nets made of monofilament (Figure 161); four provinces and 12 states used nets constructed of multifilament (Figure 162). Single-mesh nets made of monofilament were utilized to sample smallmouth bass in Arizona, Maryland, and New Mexico, while Connecticut, Maryland, Nevada, and New Mexico used single-mesh nets constructed of multifilament. Arizona used trammel nets to sample smallmouth bass.

## Toxicants

Rotenone was applied to sample smallmouth bass in 15 states, primarily in the Southeast (Figure 163). Cyanide was used in North Dakota and Tennessee.

## Angler Data

Creel surveys were conducted to assess smallmouth bass populations in 33 states and 6 provinces (Figure 164). This was the only technique used to sample smallmouth bass in Hawaii and Quebec. Angler or guide diaries were examined in six states and two provinces, primarily In the Northeast (Figure 165). Tournament or club reports were assessed in four provinces and 14 states (Figure 166). Other types of angler data were collected In Manitoba, New Mexico, and North Dakota; California and Ontario assessed tag returns; West Virginia evaluated trophy citations; and Arkansas, Kansas, Rhode Island, and Washington assessed smallmouth bass populations by angling.

## Miscellaneous Techniques

Other techniques used to sample smallmouth bass included weir traps or fishway traps and lifts--Massachusetts; explosives--South Carolina; D-traps--Maryland; and underwater observation--Maine.

## Data Analysis

Of the six provinces and 43 states that sampled smallmouth bass with techniques in addition to creel surveys, only North Dakota did not analyze length-distribution data. Use of PSD and RSD occurred in 20 states, primarily through the central portion of the fish's range (Figure 167). Michigan and Minnesota assessed smallmouth bass population structure using their own quality Indices.

Catch per unit effort data were collected for smallmouth bass in all states where they were sampled with techniques other than creel surveys except Massachusetts, North Carolina, Rhode Island, and Vermont. All provinces using techniques besides creel surveys, except Alberta, collected catch per unit effort data. Population estimates were conducted in Ontario and 18 states, primarily outside the northwestern and southwestern portions of the fish's range (Figure 168). Biomass estimates were developed for smallmouth bass In Ontario and all states that conducted population estimates, with the exceptions of Missouri, New Hampshire, South Dakota, and Tennessee. Indiana. Kentucky, South Carolina, and Texas developed biomass estimates but not population estimates.

Weight-length relationships were developed for smallmouth bass in five provinces and 27 states, primarily outside the southwestern and northern portions of the fish's range (Figure 169). Indices of body condition were calculated in five provinces and 30 states. Of these, all five provinces and 26

states calculated condition using K or C (Figure 170). Thirteen states calculated smallmouth bass condition using Wr. (Figure 171).

Growth was calculated for smallmouth bass in four provinces and 34 states across the fish's range (Figure 172). Those that evaluated growth also determined age distribution, with the exceptions of Oregon, South Carolina, and Texas. British Columbia, Georgia, Minnesota, Rhode Island, and Washington assessed age distribution but not growth.

Other techniques utilized to assess smallmouth bass populations included abundance relative to other species--Indiana, Massachusetts, and Ontario; species composition or presence/absence--North Dakota and Ontario; sex, maturity, and fecundity--Ontario; and mortality estimates--California, Colorado, Michigan, and South Carolina.

## Yellow Perch

Eight provinces and 38 states routinely sampled yellow perch from one or more of the four water types (Figure 173).

### Boat Electrofishing

Yellow perch were sampled by boat electrofishing in 25 states, but not in Canada. DC units were used in 20 states; of these, 12 states shocked at night (Figure 174) while 16 states used DC units during the day (Figure 175). AC units were used In 18 states to sample yellow perch. Of these, 11 states shocked at night (Figure 176) while 15 states sampled yellow perch during the day (Figure 177).

### Portable Electrofishing

Nine states sampled yellow perch with portable electrofishing units (Figure 178). Of these, all except New Jersey and New York used DC units during the day. Connecticut and New York used DC units at night; Connecticut shocked at night with AC units; and Connecticut, Massachusetts, Nevada, New Jersey, and New York sampled yellow perch during the day with AC units.

### Seines and Trawls

Beach seines were used to sample yellow perch in four provinces and 11 states, primarily in the north central and northwestern portions of the fish's range. Seines 50 ft and longer were used in the four provinces and seven states (Figure 179); beach seines less than 50 ft long were used in eight states (Figure 180).

In Wyoming, yellow perch were sampled with purse seines; Michigan, Minnesota, and North Carolina used bottom trawls. North Carolina also used mid-water trawls to sample yellow perch.

### Nets

Trap nets were set to sample yellow perch in British Columbia, Ontario, and 21 states, primarily in the North (Figure 181). Hoop nets were utilized to sample yellow perch in Arizona, Idaho, Maryland, North Carolina, and Washington.

Six provinces and 29 states used gill nets to sample yellow perch. Experimental-mesh nets were used in all six provinces and 28 states. Of these, Alberta, Manitoba, and 18 states used experimental-mesh nets constructed of monofilament (Figure 182), while five provinces and 17 states sampled yellow perch with multifilament nets (Figure 183). Single-mesh gill nets were used in nine states (Figure 184). Of these, all except Illinois and North Carolina used nets constructed

of multifilament. Those two states and Maryland, Michigan, and New Mexico also used monofilament nets.

## Toxicants

Rotenone was applied to sample yellow perch In 14 states, primarily In the East (Figure 185). In addition, North Dakota used cyanide to sample yellow perch.

## Angler Data

Creel surveys were conducted in seven provinces and 28 states to assess yellow perch populations (Figure 186). Angler or guide diaries were examined In Connecticut, Delaware, New Brunswick, Nova Scotia, and Quebec. Connecticut and West Virginia assessed tournament or club reports; Manitoba and North Dakota collected other types of angler data; West Virginia evaluated trophy citations; and Washington assessed tag returns.

## Miscellaneous Techniques

Other techniques used to sample yellow perch Included weir traps or fishway traps and lifts--Massachusetts; explosives--Georgia; and assessment of commercial catches--Manitoba and Michigan.

## Data Analysis

Of the 38 states that sampled yellow perch, only Idaho, New Mexico, and Virginia did not analyze length-distribution data; all of the provinces that sampled yellow perch with techniques in addition to angler data (all but Quebec) also collected length-distribution data. Use of PSD and RSD occurred in Arizona, Colorado, Illinois, Nebraska, Pennsylvania, South Dakota, and Wisconsin. Michigan and Minnesota assessed yellow perch population structure using their own quality Indices.

Catch per unit effort data were collected everywhere that yellow perch were sampled except for Alberta, Saskatchewan, and Quebec, as well as eight states along the East Coast (Figure 187). Population estimates were conducted in Manitoba and nine states, primarily in the East (Figure 188). Biomass estimates were developed for yellow perch In 10 states, primarily in the East (Figure 189).

Weight-length relationships were developed for yellow perch in five provinces and 19 states across the fish's range (Figure 190). Indices of body condition were calculated for yellow perch using K or C in five provinces and 19 states (Figure 191). Colorado, Georgia, and Nebraska calculated yellow perch condition using Wr.

Growth was calculated for yellow perch in five provinces and 23 states (Figure 192). With the exceptions of North Carolina, Oregon, Texas, and Vermont, those that evaluated growth also determined age distribution. British Columbia, Georgia, Minnesota, Rhode Island, and Washington assessed age distribution but not growth.

Other techniques used to assess yellow perch populations included abundance relative to other species--Indiana, Massachusetts, North Carolina, and Ontario; species composition or presence/absence--North Dakota and Ontario; and mortality estimates--Colorado and Michigan.

## Walleye

Walleye were sampled from one or more of the four water types In 39 states and seven provinces (Figure 193).

### Boat Electrofishing

Walleye were sampled by boat electrofishing in Alberta and 30 states across the fish's range. DC units were used In Alberta and 27 states. Of these, 21 states and Alberta shocked at night (Figure 194) and 19 states and Alberta used DC units during the day (Figure 195). AC units were used to sample walleye In 18 states. Of these, 13 states shocked at night (Figure 196) and 16 states used them during the day (Figure 197).

### Portable Electrofishing

Only seven states used portable electrofishing units to sample walleye; all shocking was done during the day. Indiana, Michigan, Minnesota, and New Mexico used DC units and Arkansas, New Mexico, Tennessee, and West Virginia used AC units.

### Seines and Trawls

Beach seines were used to sample walleye in 11 states, Quebec, and Saskatchewan. Seines 50 ft and longer were used in Saskatchewan and seven states (Figure 198); however, Quebec and seven states used beach seines less than 50 ft long to sample walleye (Figure 199). Bottom trawls were used In Michigan and Minnesota to sample walleye.

### Nets

Trap nets were set to sample walleye in five provinces and 19 states, primarily in the northern and central U.S. (Figure 200). Hoop nets were used in Illinois, Maryland, Mississippi, Nevada, Northwest Territories, and Washington to sample walleye.

Walleye were sampled with gill nets in five provinces and 33 states. Of those that sampled walleye, only Alberta, British Columbia. Iowa, Mississippi. Missouri. Ohio, Oregon, and Wisconsin did not use gill nets. Experimental-mesh gill nets constructed of monofilament were used In Manitoba, Northwest Territories, Quebec, and 24 states, including many states toward the southern portion of the fish's range (Figure 201). Four provinces and 13 states, primarily in the North, sampled walleye with experimental-mesh nets made of multifilament (Figure 202). Single-mesh gill nets were used In Northwest Territories, Quebec, and 14 states, many in the southeastern portion of the fish's range (Figure 203). Of these, Arkansas, Nevada, and Vermont used only multifilament nets; Georgia. Kansas, North Carolina, Northwest Territories, Pennsylvania, South Carolina, and Virginia used only monofilament nets. Quebec and the other five states utilized nets made of both materials. Alberta and Arkansas used trammel nets to sample walleye.

### Toxicants

Rotenone was applied to sample walleye In 12 states, primarily in the east-central portion of the country (Figure 204). North Dakota used cyanide to sample walleye.

## Angler Data

Creel surveys were conducted in six provinces and 29 states to assess walleye populations (Figure 205). Angler or guide diaries were examined in Illinois, New Mexico, Ontario, and Quebec. Nevada, North Dakota, Ontario, Quebec, Washington, and West Virginia assessed tournament or club reports; Kentucky, Manitoba, New Mexico, North Dakota, and Quebec collected other types of angler data; Missouri and Ontario assessed tag returns; West Virginia evaluated trophy citations; and Arkansas, British Columbia, Kansas, and Washington used angling to assess walleye populations.

## Miscellaneous Techniques

Alberta, Massachusetts, and Northwest Territories sampled walleye with weir traps or fishway traps and lifts. Manitoba, Michigan, and Ontario assessed commercial catches.

## Data Analysis

Of the seven provinces and 39 states that sampled walleye, only Massachusetts did not analyze length-distribution data. Use of PSD and RSD occurred in Quebec and 12 states, primarily in the Plains and Midwest (Figure 206). Michigan and Minnesota assessed walleye population structure with their own quality Indices.

Catch per unit effort data were collected everywhere that walleye were sampled except Alberta, British Columbia, Massachusetts, New Hampshire, Saskatchewan, and Vermont. Population estimates were conducted in four provinces and 13 states, primarily through the country's mid-latitudes (Figure 207). Biomass estimates were developed for walleye In Ontario, Quebec, and 11 states, many at mid-latitudes (Figure 208).

Weight-length relationships were developed for walleye in five provinces and 24 states (Figure 209). Indices of body condition were calculated for walleye using K or C in four provinces and 25 states across the fish's range (Figure 210). Colorado, Georgia, Missouri, Nebraska, Oklahoma, and Oregon calculated walleye condition using Wr.

Growth was calculated for walleye everywhere the fish was sampled except Arkansas, British Columbia, Massachusetts, Mississippi, New Hampshire, New Mexico, and Wyoming. Age distribution was assessed everywhere walleye were sampled except Arkansas, Massachusetts, Mississippi, New Hampshire, New Mexico, North Carolina, Oregon, South Carolina, and Wyoming.

Other techniques used to assess walleye populations included abundance relative to other species--Indiana, Massachusetts, and Ontario; species composition or presence/absence--North Dakota, Ontario, and South Carolina; sex, maturity, and fecundity--Ontario and Quebec; mortality estimates--Alberta, Colorado, Michigan, Northwest Territories, and Wisconsin; movement--Iowa; and food habits--South Carolina.

# Northern Pike

Northern pike were sampled from one or more of the four water types in seven provinces and 31 states, outside the West Coast, Southern Plains, and Southeast (Figure 211).

## Boat Electrofishing

Northern pike were sampled by boat electrofishing in 19 states. DC units were used in 16 states (Figure 212). Of these, Colorado, New Hampshire and Nevada shocked only at night; Iowa,

Indiana, Minnesota, Montana, Nebraska, New Mexico, and Wisconsin shocked only during the day. The other six states shocked both night and day to sample northern pike with DC units. AC units were used to sample northern pike in 14 states (Figure 213). All of these except Arkansas and Nevada shocked during the day. Indiana, Nebraska, New Mexico, and Wisconsin shocked only at night. The other eight states shocked both night and day to sample northern pike with AC units.

**Portable Electrofishing**

Northern pike were sampled with portable electrofishing units In Connecticut, Illinois, Indiana, Michigan, Minnesota, and New Mexico. All of these states used DC units during the day. Connecticut used both DC and AC units during the day and at night; New Mexico also used AC units during the day to sample northern pike.

**Seines**

Saskatchewan and eight states, primarily in the central portion of the fish's range, sampled northern pike with beach seines. Colorado, Illinois, New Mexico, North Dakota, and Saskatchewan used seines 50 ft and longer; Minnesota, New Mexico, Rhode Island, South Dakota, and Wisconsin used beach seines less than 50 ft long.

**Nets**

Trap nets were set to sample northern pike in four provinces and 20 states, primarily toward the northeastern portion of the fish's range (Figure 214). Hoop nets were used to sample northern pike In Indiana, Maryland, Nevada, Northwest Territories, and Ontario.

Gill nets were used to sample northern pike in six provinces and 21 states, all of which used experimental-mesh nets. Although four of these provinces and 13 of these states used experimental-mesh nets constructed of monofilament (Figure 215), four provinces and 13 states used nets made of multifilament (Figure 216). Single-mesh gill nets were utilized in two provinces and six states. Alaska, Maryland, Michigan, New Mexico, and Northwest Territories used monofilament nets while Alaska, Connecticut, Maryland, Michigan, Nevada, New Mexico, and Quebec used single-mesh nets made of multifilament to sample northern pike.

**Toxicants**

Northern pike were sampled with rotenone In Arkansas, Illinois, Indiana, Michigan, Rhode Island, and West Virginia. North Dakota applied cyanide to sample northern pike.

**Angler Data**

Creel surveys were conducted in six provinces and 19 states to assess northern pike populations (Figure 217). Angler or guide diaries were examined in Connecticut, Maine, New Mexico, and Quebec. Connecticut, North Dakota, Ontario, West Virginia, and Wyoming assessed tournament or club reports; Manitoba, New Mexico, North Dakota, and Quebec collected other types of angler data; West Virginia evaluated trophy citations; and Alaska and British Columbia used angling to assess northern pike populations.

**Miscellaneous Techniques**

Massachusetts and Northwest Territories used weir traps or fishway traps and lifts to sample northern pike, and Manitoba and Ontario monitored commercial catches.

## Data Analysis

Of those that sampled northern pike, only Maine and Tennessee did not analyze length-distribution data. Use of PSD and RSD occurred in Arizona, Colorado, Illinois, Nebraska, Pennsylvania, South Dakota, and Wisconsin. Michigan and Minnesota assessed northern pike population structure with their own quality indices.

Catch per unit effort data were collected in four provinces and 24 states (Figure 218). Population estimates were conducted in three provinces and seven states, primarily in mid-latitudes (Figure 219). Biomass estimates were developed for northern pike in Iowa, Massachusetts, Michigan, and West Virginia.

Weight-length relationships were developed for northern pike in four provinces and 18 states, primarily toward the northeastern portion of the fish's range (Figure 220). Indices of body condition were calculated for northern pike using K or C in three provinces and 17 states (Figure 221). Alberta and Nebraska calculated northern pike condition using Wr.

Growth was calculated for northern pike in four provinces and 22 states (Figure 222). All who assessed growth also assessed age distribution for northern pike; British Columbia and Nevada assessed age distribution but not growth.

Other techniques used to assess northern pike populations included abundance relative to other species--Indiana, Massachusetts, and Ontario; species composition or presence/absence--North Dakota and Ontario; sex, maturity, and fecundity--Ontario; and mortality estimates--Colorado, Northwest Territories, and Wisconsin.

# Muskellunge

Muskellunge were the least-sampled fish included in the survey. Only three provinces and 19 states in the northeastern portion of the continent sampled this species from one or more of the four water types (Figure 223).

## Boat Electrofishing

Only 11 states used boat electrofishing to sample muskellunge (Figure 224). DC units were used at night in Kentucky, Michigan, Missouri, Pennsylvania, South Dakota, and West Virginia. With the exception of Missouri, these states, plus Minnesota, North Carolina, and Wisconsin shocked muskellunge with DC units during the day. AC units were used at night in Iowa, Illinois, Kentucky, Michigan, Pennsylvania, South Dakota, and West Virginia. All of these states except Wisconsin also used AC units during the day to sample muskellunge.

## Portable Electrofishing

Portable electrofishing units were utilized to sample muskellunge in only two states. Minnesota used DC units during the day and West Virginia used AC units during the day.

## Seines

Maine, Minnesota, and Quebec used beach seines less than 50 ft long to sample muskellunge. Maine also used seines 50 ft and longer.

## Nets

Trap nets were set In 13 states, but In Canada, only Ontario used this gear to sample muskellunge (Figure 225). Hoop nets were employed only In Ontario to sample muskellunge.

Muskellunge were sampled with gill nets in eight states and Ontario (Figure 226). Experimental-mesh nets constructed of monofilament were used in Illinois, Michigan, Nebraska, North Dakota, and Pennsylvania, Indiana, Michigan, Minnesota, Ontario, and South Dakota utilized experimental-mesh nets made of multifilament. Single-mesh nets constructed of multifilament were used in Michigan and South Dakota; Michigan also used single-mesh nets made of monofilament to sample muskellunge.

## Toxicants

Michigan, Tennessee, and West Virginia applied rotenone to sample muskellunge.

## Angler Data

Creel surveys were conducted to assess muskellunge populations in all three provinces sampling muskellunge as well as In 11 states, primarily in the central portion of the fish's range (Figure 227). Angler or guide diaries were examined in Illinois, Maine, Michigan, and Ontario. Ontario and West Virginia assessed tournament or club reports; Illinois, Kentucky, Manitoba, New York, North Dakota, and Ohio collected other types of angler data; Missouri and Ontario assessed tag returns; and North Carolina and West Virginia evaluated trophy citations.

## Data Analysis

Of those that sampled muskellunge, only North Carolina, North Dakota, and Quebec did not analyze length-distribution data. Use of PSD and RSD occurred in Illinois, Nebraska, Pennsylvania, and South Dakota, Michigan and Minnesota assessed muskellunge population structure using their own quality Indices.

Catch per unit effort data were collected where muskellunge were sampled, except Iowa, Maine, and Quebec. Population estimates were conducted in Indiana, New York, South Dakota, and West Virginia. Biomass estimates were developed only In West Virginia.

Weight-length relationships were developed for muskellunge In Ontario and 12 states (Figure 228). Indices of body condition were calculated for muskellunge using K or C In two provinces and nine states toward the western and southern portions of the fish's range (Figure 229). Nebraska calculated muskellunge condition using Wr.

Growth was calculated for muskellunge where the fish was sampled except Quebec. Age distributions were assessed where muskellunge were sampled except Iowa, North Dakota, and Quebec.

Other techniques used to assess muskellunge populations Included abundance relative to other species--Indiana and Ontario; species composition or presence/absence--North Dakota and Ontario; sex, maturity and fecundity--Ontario; and production--Quebec.

## Rainbow Trout

Rainbow trout were sampled across the U. S. from one or more of the four water types, with the exceptions of Maine and six southern states (Figure 230). With the exception of New Brunswick all of the provinces that sampled fish sampled rainbow trout.

### Boat Electrofishing

Rainbow trout were sampled with boat electrofishing in 28 states. British Columbia, and Alberta. DC units were used In 23 states and the two provinces. Of these, 21 states and both provinces used DC units during the day (Figure 231). Alberta and 14 states shocked rainbow trout with DC units at night (Figure 232). AC units were utilized to sample rainbow trout In 17 states. Of these, 11 states outside the central portion of the country, sampled with AC units at night (Figure 233), and 13 states used AC units during the day to sample rainbow trout (Figure 234).

### Portable Electrofishing

Six provinces and 36 states sampled rainbow trout with portable electrofishing units. DC units were used In 29 states and six provinces. Night-time use of DC units occurred only In California, Connecticut, New York, and Nova Scotia. DC units were utilized during the day to sample rainbow trout in six provinces and 28 states, outside the south-central portion of the fish's range (Figure 235). AC units were used In Alberta and 19 states. Only Alberta, Connecticut, and Delaware used AC units at night. British Columbia and 17 states In the East and Southwest used portable AC units during the day to sample rainbow trout (Figure 236).

### Seines

Beach seines were employed to sample rainbow trout in seven states and four provinces (Figure 237). Seines less than 50 ft long were used in all of these except Northwest Territories and Rhode Island; beach seines 50 ft and longer were used in all but Minnesota, New Hampshire, and Quebec. Purse seines were used to sample rainbow trout In Wyoming.

### Nets

Trap nets were set to sample rainbow trout in four provinces and 16 states, primarily in the North (Figure 238). Hoop nets were utilized In Idaho, Nevada, and Northwest Territories.

Of the nine provinces sampling rainbow trout, only Prince Edward Island did not use gill nets; 33 states used gill nets to sample rainbow trout. Experimental-mesh nets were used in seven provinces and 31 states. Of these, three western provinces and 21 states, primarily In the West and East, used experimental-mesh nets constructed of monofilament (Figure 239). Experimental-mesh gill nets made of multifilament were used in four provinces and 18 states, many in the North, to sample rainbow trout (Figure 240). Single-mesh nets constructed of monofilament were used in Alberta, Northwest Territories, and nine states, many toward the southern portion of the fish's range (Figure 241). Single-mesh nets made of multifilament were employed to sample rainbow trout In Connecticut. Maryland, Michigan, Nevada, New Mexico, Quebec, and Wisconsin, Arizona and Nevada relied upon trammel nets to sample rainbow trout.

## Toxicants

Rotenone was applied to sample rainbow trout in seven states, toward the southeastern portion of the fish's range (Figure 242). Tennessee and Wyoming used cyanide to sample rainbow trout.

## Angler Data

Creel surveys were conducted to assess rainbow trout populations in eight provinces and 35 states (Figure 243). Angler or guide diaries were examined in three provinces and nine states, many in the Northeast (Figure 244). Tournament or club reports were evaluated in four provinces and four states, toward the West and East (Figure 245). Other types of angler data were collected in Manitoba, New Mexico, and New York, and North Dakota. California, Kentucky, and Ontario assessed tag returns; West Virginia evaluated trophy citations; and Alaska, British Columbia, Idaho, Kansas, and Washington used angling to assess rainbow trout populations.

## Miscellaneous Techniques

Weir traps or fishway traps and lifts were used to sample rainbow trout in Alberta, Prince Edward Island, four northwestern states, Massachusetts, Michigan and Minnesota (Figure 246). Other techniques for sampling rainbow trout Included explosives--Georgia; pound nets--New Hampshire; D-traps--Rhode Island; and underwater observation--Idaho.

## Data Analysis

Of those that sampled rainbow trout, only Delaware and Quebec did not analyze length distribution data. All of the other states and provinces analyzed length-distribution data. Use of PSD and RSD occurred in Arizona, Missouri, Nebraska, South Dakota, and Wisconsin, Michigan and Minnesota assessed rainbow trout population structure using their own quality 'indices.

Catch per unit effort data were collected in all states and provinces analyzing rainbow trout data except Alberta, Iowa, Kansas, Massachusetts, Prince Edward Island, Rhode Island, and Saskatchewan. Population estimates were conducted in six provinces and 28 states (Figure 247). Biomass estimates were developed in four provinces and 22 states, many in mid-latitudes and along the East Coast (Figure 248).

Weight-length relationships were developed for rainbow trout in six provinces and 23 states (Figure 249). Indices of body condition were calculated for rainbow trout using K or C in five provinces and 25 states, primarily outside the Midwest (Figure 250). Alberta, Georgia, Missouri, Nebraska, and Virginia calculated rainbow trout condition using Wr.

Growth was calculated for rainbow trout in seven provinces and 34 states (Figure 251). With the exceptions of Oregon and Utah, those that calculated growth for rainbow trout also assessed age distribution; Rhode Island assessed age distribution but not growth.

Other techniques used to assess rainbow trout populations Included abundance relative to other species--Indiana, Massachusetts, and Ontario; species composition or presence/absence-¬North Dakota, Ontario, and South Carolina; sex, maturity, and fecundity--Ontario; mortality estimates--California, Colorado, Idaho. Michigan, Northwest Territories, and South Carolina; food habits--South Carolina; time of the run and habitat analysis--Prince Edward Island; and lamprey scars and wounds--New York.

## Brown Trout

Brown trout were sampled from one or more of the four water types In seven provinces and 41 states, outside the Southern Plains and Southeast (Figure 252).

### Boat Electrofishing

Boat electrofishing was used to sample brown trout In Alberta, British Columbia, and 27 states. DC units were utilized in both provinces and 23 states. Of these, 13 states used DC units at night (Figure 253). Both provinces and 20 states shocked brown trout with DC units during the day (Figure 254). AC units were used to sample brown trout in 16 states. Of these, ten states outside the central U.S. used AC units at night (Figure 255) and 12 states sampled brown trout with AC units during the day (Figure 256).

### Portable Electrofishing

Brown trout were sampled with portable electrofishing units everywhere they were sampled except Kentucky, Manitoba, Missouri, Nebraska, North Dakota, Ohio, and Quebec. DC units were used in five provinces and 31 states (Figure 257). Of these, all but California shocked during the day. California, Connecticut, Nova Scotia, and New York utilized DC units at night to sample brown trout. AC units were used in Alberta, British Columbia, and 17 states, primarily in the Southwest and East (Figure 258). Of these, all but Alberta and Delaware used AC units during the day. Alberta, Connecticut, and Delaware used AC units at night to sample brown trout.

### Seines

Beach seines were used to sample brown trout in British Columbia and six states. Arizona. British Columbia, Nevada, New Mexico, and Rhode Island used seines 50 ft and longer. Arizona, British Columbia, Minnesota, Nevada, New Hampshire, and New Mexico used beach seines less than 50 ft long to sample brown trout.

### Nets

Trap nets were set to sample brown trout in 16 states, primarily in the North (Figure 259). Hoop nets were used In Idaho and Nevada.

Gill nets were used to sample brown trout in five provinces and 29 states. Experimental-mesh nets were used in five provinces and 28 states. Of these, British Columbia and 18 states primarily in the West and East, used experimental-mesh nets constructed of monofilament (Figure 260). Four provinces and 17 states (primarily in the North, Northeast, and West) used experimental-mesh nets made of multifilament (Figure 261). Single-mesh gill nets were employed in 10 states, primarily toward the Southwest and Northeast (Figure 262). Of these, all but Connecticut, Nevada, and Wisconsin used single-mesh nets constructed of monofilament. These three states, Maryland, Michigan, and New Mexico used single-mesh nets made of multifilament to sample brown trout.

### Toxicants

Seven states toward the southeastern portion of the fish's range applied rotenone to sample brown trout (Figure 263). Tennessee and Wyoming used cyanide to sample brown trout.

## Angler Data

Creel surveys were conducted in all seven provinces that sampled brown trout and 33 states (Figure 264). This was the only technique used by Quebec to sample brown trout. Angler or guide diaries were examined in three provinces and 11 states, in the West and Northeast (Figure 265). British Columbia, Connecticut, Nevada, Nova Scotia, Ontario, and West Virginia assessed tournament or club reports; Manitoba, New Mexico, New York, and North Dakota collected other types of angler data; California and Ontario assessed tag returns; West Virginia evaluated trophy citations; and British Columbia, Idaho, and Washington used angling to assess brown trout populations.

## Miscellaneous Techniques

Weir traps or fishway traps and lifts were used to sample brown trout in Alberta and seven states In the North and Northwest (Figure 266). Other techniques used to sample brown trout included explosives--Georgia; pound nets—New Hampshire; D-traps--Rhode Island; and underwater observation--Idaho.

## Data Analysis

Of those that sampled brown trout with techniques in addition to creel surveys, only Delaware did not analyze data using one or more of the techniques listed. Of the remaining six provinces and 39 states all but North Dakota, analyzed length-distribution data. Use of PSD and RSD occurred in Arizona. Missouri, Nebraska, South Dakota, and Wisconsin; Michigan and Minnesota assessed brown trout population structure using their own quality Indices.

Catch per unit effort data were collected in all states and provinces analyzing brown trout data except Alberta, Iowa, Massachusetts, Rhode Island, Saskatchewan, and Tennessee. Population estimates were conducted in four provinces and 27 states (Figure 267). Biomass estimates were developed in three provinces and 22 states, many in mid-latitudes and along the East Coast (Figure 268).

Weight-length relationships were developed for brown trout in five provinces and 21 states outside the Mississippi River Valley (Figure 269). Indices of body condition were calculated for brown trout using K or C In four provinces and 21 states, primarily outside the Midwest (Figure 270). Alberta, Georgia, Missouri, Nebraska, and Virginia calculated brown trout condition using Wr.

Growth was calculated for brown trout in six provinces and 30 states (Figure 271). With the exceptions of Oregon and Utah, those that calculated growth for brown trout also assessed age distribution; Iowa, Rhode Island, and Washington assessed age distribution but not growth.

Other techniques used to assess brown trout populations Included abundance relative to other species--Indiana, Massachusetts, and Ontario; species composition or presence/absence--North Dakota, Ontario, and South Carolina; sex, maturity, and fecundity--Ontario; mortality estimates--California, Colorado, Idaho, Michigan, and South Carolina; movement-Iowa; food habits-South Carolina; and lamprey scars and wounds-New York.

# Brook Trout

Brook trout were routinely sampled from one or more of the four water types in all provinces reporting that they sampled fish except Northwest Territories and in 35 states, outside the Lower Midwest, Southern Plains, and Southeast (Figure 272).

## Boat Electrofishing

Boat electrofishing was used to sample brook trout In Alberta, British Columbia, and 21 states. DC units were used in both provinces and 17 states. Of these, 11 states, primarily In the West, used DC units at night (Figure 273). DC units were employed during the day to shock brook trout in the two provinces and 15 states, primarily In the West and toward the northeastern portion of the fish's range (Figure 274). AC units were used to sample brook trout In 13 states. AC units were used at night in nine states, primarily in the West and Northeast (Figure 275); nine states, also mainly in the West and Northeast, used AC units during the day (Figure 276).

## Portable Electrofishing

Portable electrofishing units were used in all provinces and states that sampled brook trout except Manitoba and Nebraska. DC units were utilized in seven provinces and 28 states (Figure 277). DC units were used at night only in California, Connecticut, Nova Scotia, and New York. With the exception of California, all of those using DC units shocked brook trout during the day. AC units were used in four provinces and 17 states In the Southwest and East (Figure 278). Of these Alberta shocked only at night and Connecticut shocked both day and night. The rest shocked brook trout with AC units only during the day.

## Seines

British Columbia, Manitoba, and eight states used beach seines to sample brook trout (Figure 279). Of these, all except Minnesota and New Hampshire used seines 50 ft and longer and all except Kentucky, Maine, and Rhode Island used beach seines less than 50 ft long to sample brook trout.

## Nets

Trap nets were set to sample brook trout in four provinces and 14 states, primarily outside the Southwest and Southeast (Figure 280). Hoop nets were used to sample brook trout in Idaho and Manitoba.

Brook trout were sampled with gill nets in seven provinces and 25 states, outside the Southeast. With the exception of Virginia, all those employing gill nets used experimental-mesh nets. Of these, British Columbia, Quebec, and 15 states in the West and Northeast used experimental-mesh nets constructed of monofilament (Figure 281). Experimental-mesh nets made of multifilament were more widely used in the north central portion of the brook trout's range; six provinces and 16 states used this technique to sample brook trout (Figure 282). Single-mesh gill nets were used to sample brook trout in three provinces and seven states, toward the southwestern and northeastern portions of the fish's range (Figure 283). Of these, all but Arizona and Virginia used single-mesh nets constructed of multifilament. These two states, Maryland and New Mexico used single-mesh nets made of monofilament to sample brook trout.

## Toxicants

Manitoba, New Jersey, Rhode Island, South Carolina, and Tennessee applied rotenone to sample brook trout. Tennessee, Utah, and Wyoming used cyanide to sample brook trout.

## Angler Data

Creel surveys were conducted to assess brook trout populations in all provinces that sampled the species except Prince Edward Island; 27 states conducted creel surveys to assess brook trout populations (Figure 284). Angler or guide diaries were most commonly examined toward the northeastern portion of the brook trout's range; five provinces and eight states collected such Information (Figure 285). Tournament or club reports were evaluated In British Columbia, Connecticut, Nevada, Nova Scotia, Ontario, Quebec, and West Virginia. Other types of angler data were collected In Manitoba, New Mexico, New York, and Quebec; California and Ontario assessed tag returns; West Virginia evaluated trophy citations; and British Columbia, Idaho, New Brunswick, and Washington assessed brook trout populations by angling.

## Miscellaneous Techniques

Weir traps or fishway traps and lifts were used to sample brook trout in Idaho, Manitoba, Massachusetts, New Brunswick, Oregon, Prince Edward Island and Washington. Other techniques for sampling brook trout Included explosives-Georgia; pound nets-New Hampshire; D-traps--Rhode Island; and underwater observations--Idaho.

## Data Analysis

All nine provinces and 35 states sampling brook trout analyzed length-distribution data. Use of PSD and RSD occurred in Arizona, Nebraska, South Dakota, and Wisconsin, Michigan and Minnesota assessed brook trout population structure using their own quality Indices.

Catch per unit effort data were collected in all states and provinces analyzing brook trout data except Alberta, Iowa, Massachusetts, Prince Edward Island, Saskatchewan, and Tennessee. Population estimates were conducted in seven provinces and 28 states (Figure 286). Biomass estimates were developed in four provinces and 21 states (Figure 287).

Weight-length relationships were developed in seven provinces and 19 states (Figure 288). Indices of body condition were calculated for brook trout using K or C In six provinces and 22 states (Figure 289). Alberta, Georgia, Nebraska, and Virginia calculated brook trout condition using Wr.

Growth was calculated for brook trout everywhere the fish was sampled except Arkansas, Iowa, New Hampshire, Prince Edward Island, Quebec, South Carolina, and Washington. With the exceptions of Arkansas, New Hampshire, Oregon, Prince Edward Island, South Carolina, and Utah, those that analyzed brook trout data assessed age distribution.

Other techniques for assessing brook trout populations included abundance relative to other species--Massachusetts and Ontario; species composition or presence/absence--Ontario and South Carolina; sex, maturity, and fecundity--Ontario; mortality estimates--California, Colorado, Idaho, Michigan, and South Carolina; movement--Iowa; production--Manitoba; time of the run and habitat analysis-Prince Edward Island; and lamprey scars and wounds--New York.

## Lake Trout

Lake trout were routinely sampled from one or more of the four water types in all provinces sampling fish except Prince Edward Island; 24 states, primarily In the West, North, and Northeast, sampled this species (Figure 290).

## Boat Electrofishing

Lake trout were sampled by boat electrofishing only in Ontario, where DC units were used at night.

## Trawls

Maine, Michigan, New Brunswick, and New York used bottom trawls to sample lake trout.

## Nets

Trap nets were set to sample lake trout in Alberta, Maine, Michigan, Minnesota, New Hampshire, and New York. Gill nets were employed for sampling lake trout everywhere they were sampled except Alberta, California, Idaho, Maine, Manitoba, Nevada, and Tennessee. Experimental-mesh nets were used in seven provinces and 17 states. Of these, three provinces and 10 states used experimental-mesh nets constructed of monofilament (Figure 291); five provinces and 11 states, primarily in the North, used experimental-mesh nets made of multifilament (Figure 292). Four provinces and nine states, primarily toward the northeastern portion of the lake trout's range, sampled the fish with single-mesh nets (Figure 293). British Columbia, Massachusetts, New Hampshire, Northwest Territories and New York utilized only single-mesh nets constructed of monofilament. Ontario. South Dakota, Vermont, and Wisconsin used only single-mesh nets made of multifilament; Alaska, Michigan, New Mexico, and Quebec used both monofilament and multifilament nets to sample lake trout.

## Angler Data

Creel surveys were conducted to assess lake trout populations in seven provinces and 19 states (Figure 294). Angler or guide diaries were examined in five provinces and five states, primarily toward the northeastern portion of the fish's range (Figure 295). Tournament or club reports were assessed in British Columbia, Nevada, Ontario, and Quebec. Other types of angler data were collected in Manitoba, North Dakota, and Quebec; California, Massachusetts, and Ontario assessed tag returns; and Alaska and Washington assessed lake trout populations by angling.

## Miscellaneous Techniques

Michigan monitored commercial catches and New Hampshire used pound nets to sample lake trout.

## Data Analysis

With the exception of Vermont, all those that sampled lake trout analyzed length-distribution data. Quebec used PSD and RSD; Michigan and Minnesota used their own quality indices to assess lake trout population structure.

Catch per unit effort data were collected where lake trout were sampled except Alberta and Saskatchewan. Population estimates were conducted in Alberta, Massachusetts, and New Hampshire; however, only Massachusetts and Northwest Territories developed biomass estimates for lake trout.

Weight-length relationships were developed for lake trout in six provinces and 15 states (Figure 296). With the exception of Indiana, all those that developed weight-length relationships also calculated lake trout body condition using K or C, Alberta, British Columbia, New Mexico, and Wyoming calculated

body condition; however, they did not develop weight-length relationships. Alberta and New Hampshire calculated lake trout body condition using Wr.

Growth was calculated for lake trout everywhere the fish was sampled except Alberta, New Mexico, Washington, and Wyoming. With the exceptions of New Hampshire, Oregon, Utah, and Vermont, those that calculated growth for lake trout also assessed age distribution. Alberta and Washington assessed age distribution but not growth.

Other techniques used to assess lake trout populations included abundance relative to other species--Indiana and Ontario; species composition or presence/absence--North Dakota and Ontario; sex, maturity, and fecundity--Ontario and Quebec; mortality estimates-California, Colorado, Michigan, and Northwest Territories; food habits--Massachusetts; and lamprey scars and wounds-New York.

## Conclusions

The techniques an agency uses to sample fish and analyze data are slow to change. Even if a new, seemingly more effective sampling technique exists, the benefits of improved sampling efficiency must be weighed against the costs of supplying the new gear to the agency and loss of years of trend data with the old technique if it is eliminated from use. Conservation agencies are also resistant to changing their data analysis techniques. Changes mean modifications in computer programs and, probably more importantly, a disruption in the secure routine of "cook book" style report writing.

The Fisheries Techniques Standardization Committee could recommend how conservation agencies should sample fish and analyze data, but the decision to change must come from within agencies. Therefore, at best, this report will probably serve as a self-evaluation tool for conservation agencies. How should the information contained in this report be interpreted? It is probably as important to note who doesn't use a technique as it is to know who does use it. Within a geographical area, failure to use a sampling technique considered effective by neighboring states or provinces may Indicate missed opportunity as well as regional comparability. The environment often dictates how effective a sampling technique might be, but the possibility of improved efficiency with a sampling technique used in a different geographical region should not be ignored. Similarly, new insights might be gained by analyzing data with techniques used elsewhere. Broader geographical standardization of techniques would enhance communication among agencies improving the ability of an agency to interpret their sampling results, ultimately allowing more meaningful evaluation of management strategies. Sampling and data analysis techniques that are not widely used should not be dismissed as having limited potential. Even the greatest improvements have limited use initially.

Ideally, every state and provincial conservation agency would have a few staff members who are charged with evaluating new techniques. Such Individuals should become the backbone of the Fisheries Techniques Standardization Committee. Through their testing and communication with fellow committee members, the best techniques could be identified given environmental limitations. The "best" sampling techniques may not be those that yield the most fish. Representative size structure and statistical reliability (minimal variance among replicates) should be of utmost concern.

## Literature Cited

Anderson, R.O. 1976. Management of small warm water Impoundments. Fisheries (Bethesda, Maryland) 1(6):5-7, 26-28.

Anderson, R.O. 1980. Proportional stock density (PSD) and relative weight (Wr): interpretive Indices for fish populations and communities. Pages 27-33 in S. Gloss and B. Shupp, editors. Practical Fisheries management: more with less in the 1980's. Workshop proceedings, New York Chapter, American Fisheries Society, Ithaca, New York, USA.

Gabelhouse, D.W., Jr. 1984. A length-categorization system to assess fish stocks. North American Journal of Fisheries Management 4:273-285.

Wege, G.J., and R.O. Anderson. 1978. Relative Weight (Wr): a new Index of condition for largemouth bass. Pages 79-91 in G.D. Novinger and J.G. Dillard, editors. New approaches to the management of small impoundments. Special Publication 5, North Central Division, American Fisheries Society, Bethesda, Maryland, USA.

Table 1. Individuals who completed the questionnaire on fish sampling and data analysis techniques used by conservation agencies in the U.S. and Canada.

| State or Province | Names |
|---|---|
| Alabama | Bill Reeves |
| Alaska | Gene Roguski |
| Alberta | Leon Carl |
| Arizona | William Silvey |
| Arkansas | Larry Rider |
| British Columbia | G.D. Taylor |
| California | Charles von Geldern |
| Colorado | Tom Powell |
| Connecticut | James Moulton |
| Delaware | Roy Miller |
| Florida | Forrest Ware |
| Georgia | Russell Ober |
| Hawaii | Brian Kanenaka |
| Idaho | David Ortmann |
| Illinois | Bill Bertrand & Peter Paladino |
| Indiana. | Thomas Flatt |
| Iowa | Larry Mitzner & Vaughn Paragamian |
| Kansas | Tom Mosher & Dave Willis |
| Kentucky | Benjy Kinman |
| Louisiana | Charles Hoenke |
| Maine | Kendell Warner |
| Manitoba | Joe O'Connor |
| Maryland | Robert Davis |
| Massachusetts | David Halliwell & Bob Madore |
| Michigan | James Schneider |
| Minnesota | Dave Zappetillo |
| Mississippi | Tim Cross |
| Missouri | Kenneth Perry |
| Montana | Unknown |
| Nebraska | Brad Newcomb & Gene Zuerlein |
| New Brunswick | M. A. Redmond |
| Newfoundland | John Pippy |
| New Hampshire | Duncan Mcinnes |
| New Jersey | Robert Stewart |
| New Mexico | Michael Hatch |
| New York | Patrick Festa |
| Nevada | W. L. McLelland |
| North Carolina | James Borawa |
| North Dakota | Gene Van Eeckhout |
| Northwest Territories | Michelle Roberge |
| Nova Scotia | Barry Sabean |
| Ohio | Ken Paxton |

Table 1. Continued.

| State or Province | Names |
|---|---|
| Oklahoma | Jan Dean |
| Ontario | H.A. Schraeder & D.M. Stann |
| Oregon | Jim Griggs & Ray Temple |
| Pennsylvania | Richard Snyder |
| Prince Edward Island | Alan Godrey |
| Quebec | Camillie Pomerleau |
| Rhode Island | Mark Gibsen & William Lapin |
| Saskatchewan | John Durbin |
| South Carolina | Val Nash |
| South Dakota | Robert Hanten |
| Tennessee | C.W. Pollock & John Riddle |
| Texas | Steve Gutreuter |
| Utah | Glen Davis |
| Vermont | John Claussen |
| Virginia | Arthur LaRoche, III |
| Washington | Peter Hahn |
| Wisconsin | Larry Claggett & John Klingbiel |
| West Virginia | Fred Leckle, Jr. |
| Wyoming | John Baughman |

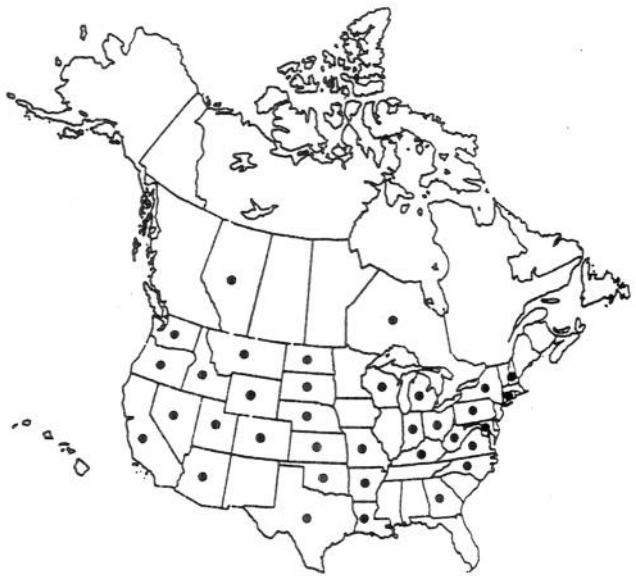

FIGURE 1. Use of DC boat electrofishing units at night to sample fish populations in lakes and impoundments less than 500 acres.

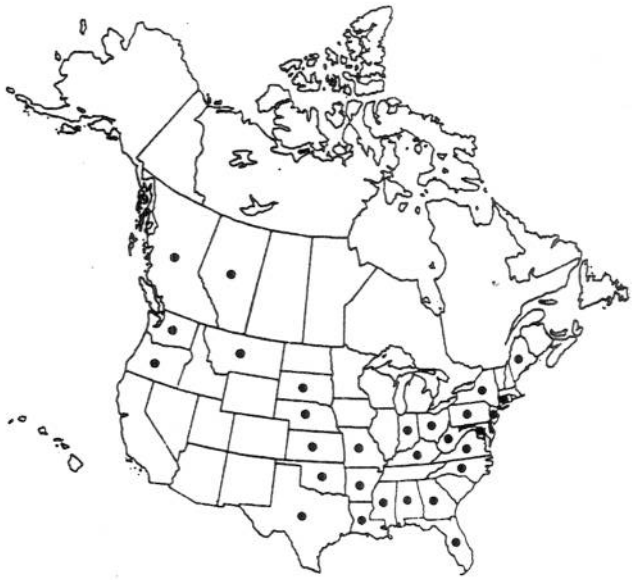

FIGURE 2. Use of DC boat electrofishing units during the day to sample fish populations in lakes and impoundments less than 500 acres.

FIGURE 3. Use of AC boat electrofishing units at night to sample fish populations in lakes and impoundments less than 500 acres.

FIGURE 4. Use of AC boat electrofishing units during the day to sample fish populations in lakes and impoundments less than 500 acres.

FIGURE 5. Use of beach seines to sample fish populations in lakes and impoundments less than 500 acres.

FIGURE 6. Use of trap nets to sample fish populations in lakes and impoundments less than 500 acres.

FIGURE 7. Use of experimental-mesh gill nets constructed of monofilament to sample fish populations in lakes and impoundments less than 500 acres.

FIGURE 8. Use of experimental-mesh gill nets constructed of multifilament to sample fish populations in lakes and impoundments less than 500 acres.

FIGURE 9. Use of single-mesh gill nets constructed of monofilament to sample fish populations in lakes and impoundments less than 500 acres.

FIGURE 10. Use of single-mesh gill nets constructed of multifilament to sample fish populations in lakes and impoundments less than 500 acres.

FIGURE 11. Use of rotenone to sample fish populations in lakes and impoundments less than 500 acres.

FIGURE 12. Use of angler or guide diaries to assess fish populations in lakes and impoundments less than 500 acres.

FIGURE 13. Use of tournament or club reports to assess fish populations in lakes and impoundments less than 500 acres.

FIGURE 14. Use of beach seines to sample fish populations in lakes and impoundments 500 acres and larger.

FIGURE 15. Use of trawls to sample fish populations in lakes and impoundments 500 acres and larger.

FIGURE 16. Use of single-mesh gill nets constructed of monofilament to sample fish populations in lakes and impoundments 500 acres and larger.

FIGURE 17. Use of single-mesh gill nets constructed of multifilament to sample fish populations in lakes and impoundments 500 acres and larger.

FIGURE 18. Use of rotenone to sample fish populations in lakes and impoundments 500 acres and larger.

FIGURE 19. Use of angler or guide diaries to assess fish populations in lakes and impoundments 500 acres and larger.

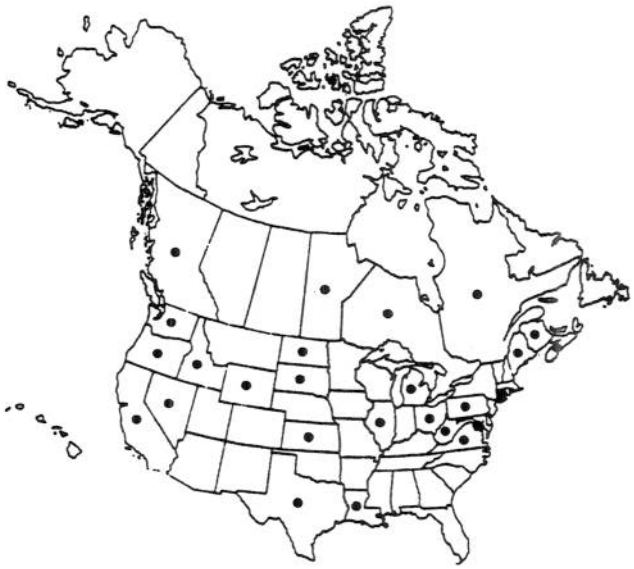

FIGURE 20. Use of tournament or club reports to assess fish populations in lakes and impoundments 500 acres and larger.

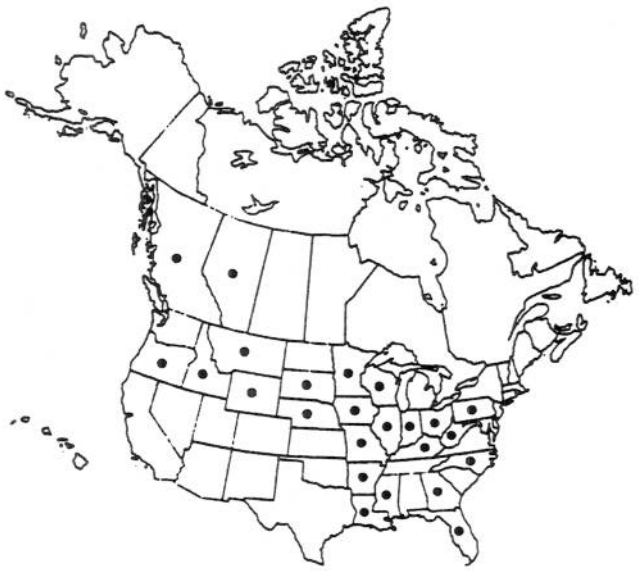

FIGURE 21. Use of boat electrofishing to sample fish populations in streams.

FIGURE 22. Use of AC boat electrofishing units to sample fish populations in streams.

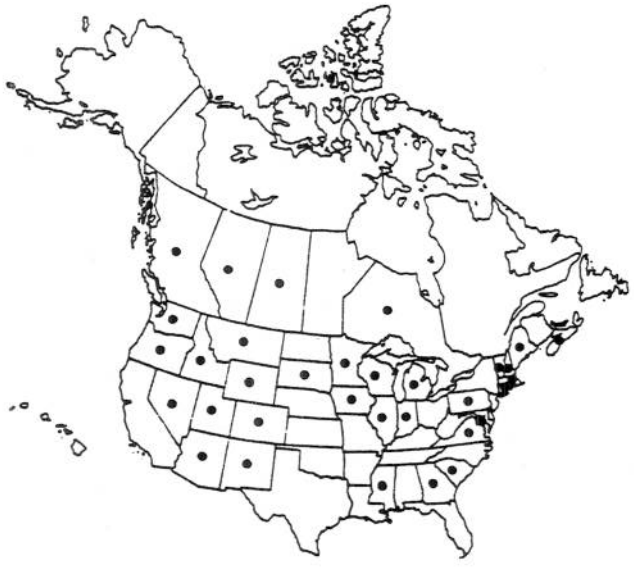

FIGURE 23. Use of DC portable electrofishing units to sample fish populations in streams.

FIGURE 24. Use of AC portable electrofishing units to sample fish populations in streams.

FIGURE 25. Use of beach seines to sample fish populations in streams.

FIGURE 26. Use of trap nets to sample fish populations in streams.

FIGURE 27. Use of hoop nets to sample fish populations in streams.

FIGURE 28. Use of gill nets to sample fish populations in streams.

FIGURE 29. Use of rotenone to sample fish populations in streams.

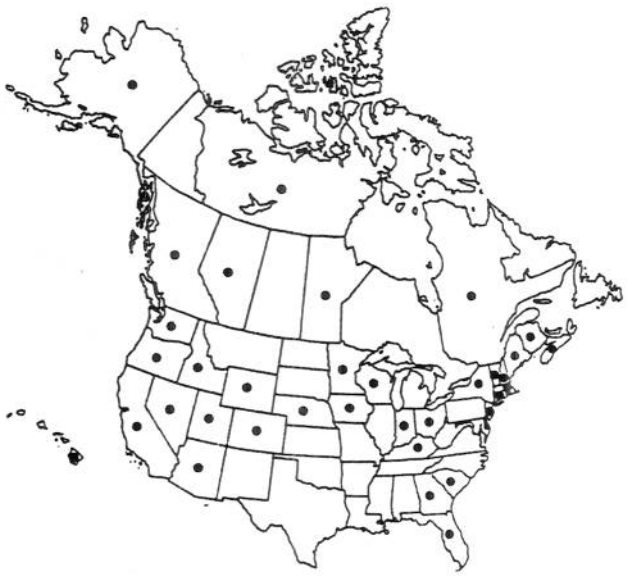

FIGURE 30. Use of creel surveys to assess fish populations in streams.

FIGURE 31. Use of angler or guide diaries to assess fish populations in streams.

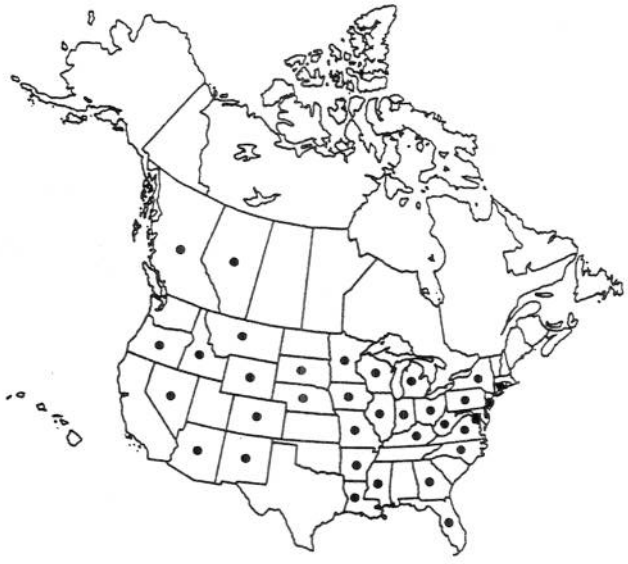

FIGURE 32. Use of DC boat electrofishing units during the day to sample fish populations in rivers.

FIGURE 33. Use of DC boat electrofishing units at night to sample fish populations in rivers.

FIGURE 34. Use of AC boat electrofishing during the day to sample fish populations in rivers.

FIGURE 35. Use of AC boat electrofishing units at night to sample fish populations in rivers.

FIGURE 36. Use of DC portable electrofishing units to sample fish populations in rivers.

FIGURE 37. Use of AC portable electrofishing units to sample fish populations in rivers.

FIGURE 38. Use of beach seines to sample fish populations in rivers.

FIGURE 39. Use of trap nets to sample fish populations in rivers.

FIGURE 40. Use of hoop nets to sample fish populations in rivers.

FIGURE 41. Use of experimental-mesh gill nets constructed of monofilament to sample fish populations in rivers.

Figure 42. Use of experimental-mesh gill nets constructed of multifilament to sample fish populations in rivers.

FIGURE 43. Use of single-mesh gill nets constructed of monofilament to sample fish populations in rivers.

FIGURE 44. Use of single-mesh gill nets constructed of multifilament to sample fish populations in rivers.

FIGURE 45. Use of rotenone to sample fish populations in rivers.

FIGURE 46. Use of creel surveys to assess fish populations in rivers.

FIGURE 47. Use of angler or guide diaries to assess fish populations in rivers.

FIGURE 48. Use of tournament or club reports to assess fish populations in rivers.

FIGURE 49. Use of DC boat electrofishing units at night to sample channel catfish populations.

FIGURE 50. Use of DC boat electrofishing units during the day to sample channel catfish populations.

FIGURE 51. Use of AC boat electrofishing units at night to sample channel catfish populations.

FIGURE 52. Use of AC boat electrofishing units during the day to sample channel catfish populations.

FIGURE 53. Use of DC portable electrofishing units to sample channel catfish populations.

FIGURE 54. Use of AC portable electrofishing units to sample channel catfish populations.

FIGURE 55. Use of beach seines 50 ft and longer to sample channel catfish populations.

FIGURE 56. Use of beach seines shorter than 50 ft to sample channel catfish populations.

FIGURE 57. Use of trap nets to sample channel catfish populations.

FIGURE 58. Use of hoop nets to sample channel catfish populations.

FIGURE 59. Use of experimental-mesh gill nets constructed of monofilament to sample channel catfish populations.

FIGURE 60. Use of experimental-mesh gill nets constructed of multifilament to sample channel catfish populations.

FIGURE 61. Use of single-mesh gill nets constructed of monofilament to sample channel catfish populations.

FIGURE 62. Use of single-mesh gill nets constructed of multifilament to sample channel catfish populations.

FIGURE 63. Use of rotenone to sample channel catfish populations.

FIGURE 64. Use of creel surveys to assess channel catfish populations.

FIGURE 65. Use of PSD and RSD to analyze channel catfish populations.

FIGURE 66. Use of population estimates to analyze channel catfish populations.

FIGURE 67. Use of biomass estimates to analyze channel catfish populations.

FIGURE 68. Use of weight-length relationships to analyze channel catfish populations.

FIGURE 69. Use of body condition indices (K or C) to analyze channel catfish populations.

FIGURE 70. Use of body condition indices (Wr) to analyze channel catfish populations.

FIGURE 71. Use of growth information to analyze channel catfish populations.

FIGURE 72. States and provinces where striped bass populations were routinely sampled.

FIGURE 73. Use of boat electrofishing to sample striped bass populations.

FIGURE 74. Use of experimental-mesh gill nets constructed of monofilament to sample striped bass populations.

FIGURE 75. Use of experimental-mesh gill nets constructed of multifilament to sample striped bass populations.

FIGURE 76. use of single-mesh gill nets constructed of monofilament to sample striped bass populations.

FIGURE 77. Use of single-mesh gill nets constructed of multifilament to sample striped bass populations.

FIGURE 78. Use of rotenone to sample striped bass populations.

FIGURE 79. Use of population estimates to analyze striped bass populations.

FIGURE 80. Use of weight-length relationships to analyze striped bass populations.

FIGURE 81. Use of body condition indices (K or C) to analyze striped bass populations.

FIGURE 82. Use of growth information to analyze striped bass populations.

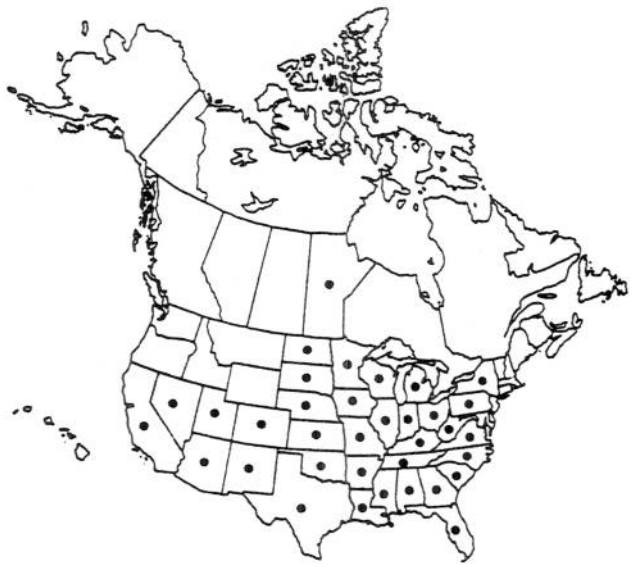

FIGURE 83. States and provinces where white bass populations were routinely sampled.

FIGURE 84. Use of DC boat electrofishing units at night to sample white bass populations.

FIGURE 85. Use of DC boat electrofishing units during the day to sample white bass populations.

FIGURE 86. Use of AC boat electrofishing units during the day to sample white bass populations.

FIGURE 87. Use of trap nets to sample white bass populations.

FIGURE 88. Use of experimental-mesh gill nets constructed of monofilament to sample white bass populations.

FIGURE 89. Use of experimental-mesh gill nets constructed of multifilament to sample white bass populations.

FIGURE 90. Use of single-mesh gill nets to sample white bass populations.

FIGURE 91. Use of rotenone to sample white bass populations.

FIGURE 92. Use of biomass estimates to analyze white bass populations.

FIGURE 93. Use of weight-length relationships to analyze white bass populations.

FIGURE 94. Use of body condition indices (K or C) to analyze white bass populations.

FIGURE 95. Use of growth information to analyze white bass populations.

FIGURE 96. Use of DC boat electrofishing units during the day to sample bluegill populations.

FIGURE 97. Use of DC boat electrofishing units at night to sample bluegill populations.

FIGURE 98. Use of AC boat electrofishing units during the day to sample bluegill populations.

FIGURE 99. Use of AC boat electrofishing units at night to sample bluegill populations.

FIGURE 100. Use of DC portable electrofishing units to sample bluegill populations.

FIGURE 101. Use of AC portable electrofishing units to sample bluegill populations.

FIGURE 102. Use of beach seines to sample bluegill populations.

FIGURE 103. Use of trap nets to sample bluegill populations.

FIGURE 104. Use of experimental-mesh gill nets constructed of monofilament to sample bluegill populations.

FIGURE 105. Use of experimental-mesh gill nets constructed of multifilament to sample bluegill populations.

FIGURE 106. Use of rotenone to sample bluegill populations.

FIGURE 107. Use of creel surveys to assess bluegill populations.

FIGURE 108. Use of PSD and RSD to analyze bluegill populations.

FIGURE 109. Use of population estimates to analyze bluegill populations.

FIGURE 110. Use of weight-length relationships to analyze bluegill populations.

FIGURE 111. Use of body condition indices (K or C) to analyze bluegill populations.

FIGURE 112. Use of body condition indices (Wr) to analyze bluegill populations.

FIGURE 113. Use of growth information to analyze bluegill populations.

FIGURE 114. Use of DC boat electrofishing at night to sample crappie populations.

FIGURE 115. Use of DC boat electrofishing during the day to sample crappie populations.

FIGURE 116. Use of AC boat electrofishing at night to sample crappie populations.

FIGURE 117. Use of AC boat electrofishing during the day to sample crappie populations.

FIGURE 118. Use of portable electrofishing to sample crappie populations.

FIGURE 119. Use of beach seines to sample crappie populations.

FIGURE 120. Use of trap nets to sample crappie populations.

FIGURE 121. Use of experimental-mesh gill nets constructed of monofilament to sample crappie populations.

FIGURE 122. Use of experimental-mesh gill nets constructed of multifilament to sample crappie populations.

FIGURE 123. Use of single-mesh gill nets to sample crappie populations.

FIGURE 124. Use of rotenone to sample crappie populations.

FIGURE 125. Use of PSD and RSD to analyze crappie populations.

FIGURE 126. Use of population estimates to analyze crappie populations.

FIGURE 127. Use of biomass estimates to analyze crappie populations.

FIGURE 128. Use of weight-length relationships to analyze crappie populations.

FIGURE 129. Use of body condition indices (K or C) to analyze crappie populations.

FIGURE 130. Use of body condition indices (Wr) to analyze crappie populations.

FIGURE 131. Use of growth information to analyze crappie populations.

FIGURE 132. Use of DC boat electrofishing units during the day to sample largemouth bass populations.

FIGURE 133. Use of DC boat electrofishing units at night to sample largemouth bass populations.

FIGURE 134. Use of AC boat electrofishing units to sample largemouth bass populations.

FIGURE 135. Use of DC portable electrofishing units during the day to sample largemouth bass populations.

FIGURE 136. Use of AC portable electrofishing units during the day to sample largemouth bass populations.

FIGURE 137. Use of beach seines 50 ft and longer to sample largemouth bass populations.

FIGURE 138. Use of beach seines shorter than 50 ft to sample largemouth bass populations.

FIGURE 139. Use of trap nets to sample largemouth bass populations.

FIGURE 140. Use of experimental-mesh gill nets constructed of monofilament to sample largemouth bass populations.

FIGURE 141. Use of experimental-mesh gill nets constructed of multifilament to sample largemouth bass populations.

FIGURE 142. Use of rotenone to sample largemouth bass populations.

FIGURE 143. Use of angler or guide diaries to assess largemouth bass populations.

FIGURE 144. Use of tournament or club reports to assess largemouth bass populations.

FIGURE 145. Use of PSD and RSD to analyze largemouth bass populations.

FIGURE 146. Use of population estimates to analyze largemouth bass populations.

FIGURE 147. Use of weight-length relationships to analyze largemouth bass populations.

FIGURE 148. Use of body condition indices (K or C) to analyze largemouth bass populations.

FIGURE 149. Use of body condition indices (Wr) to analyze largemouth bass populations.

FIGURE 150. Use of growth information to analyze largemouth bass populations.

FIGURE 151. States and provinces where smallmouth bass populations were routinely sampled.

FIGURE 152. Use of DC boat electrofishing units at night to sample smallmouth bass populations.

FIGURE 153. Use of DC boat electrofishing units during the day to sample smallmouth bass populations.

FIGURE 154. Use of AC boat electrofishing units during the day to sample smallmouth bass populations.

FIGURE 155. Use of AC boat electrofishing units at night to sample smallmouth bass populations.

FIGURE 156. Use of DC portable electrofishing units during the day to sample smallmouth bass populations.

FIGURE 157. Use of AC portable electrofishing units during the day to sample smallmouth bass populations.

FIGURE 158. Use of beach seines 50 ft and longer to sample smallmouth bass populations.

FIGURE 159. Use of beach seines shorter than 50 ft to sample smallmouth bass populations.

FIGURE 160. Use of trap nets to sample smallmouth bass populations.

FIGURE 161. Use of experimental-mesh gill nets constructed of monofilament to sample smallmouth bass populations.

FIGURE 162. Use of experimental-mesh gill nets constructed of multifilament to sample smallmouth bass populations.

FIGURE 163. Use of rotenone to sample smallmouth bass populations.

FIGURE 164. Use of creel surveys to assess smallmouth bass populations.

FIGURE 165. Use of angler or guide diaries to assess smallmouth bass populations.

FIGURE 166. Use of tournament or club reports to assess smallmouth bass populations.

FIGURE 167. Use of PSD and RSD to analyze smallmouth bass populations.

FIGURE 168. Use of population estimates to analyze smallmouth bass populations.

FIGURE 169. Use of weight-length relationships to analyze smallmouth bass populations.

FIGURE 170. Use of body condition indices (K or C) to analyze smallmouth bass populations.

FIGURE 171. Use of body condition indices (Wr) to analyze smallmouth bass populations.

FIGURE 172. Use of growth information to analyze smallmouth bass populations.

FIGURE 173. States and provinces where yellow perch populations were routinely sampled.

FIGURE 174. Use of DC boat electrofishing units at night to sample yellow perch populations.

FIGURE 175. Use of DC boat electrofishing units during the day to sample yellow perch populations.

FIGURE 176. Use of AC boat electrofishing units at night to sample yellow perch populations.

FIGURE 177. Use of AC boat electrofishing units during the day to sample yellow perch populations.

FIGURE 178. Use of portable electrofishing units to sample yellow perch populations.

FIGURE 179. Use of beach seines 50 ft and longer to sample yellow perch populations.

FIGURE 180. Use of beach seines shorter than 50 ft to sample yellow perch populations.

FIGURE 181. Use of trap nets to sample yellow perch populations.

FIGURE 182. Use of experimental-mesh gill nets constructed of monofilament to sample yellow perch populations.

FIGURE 183. Use of experimental-mesh gill nets constructed of multifilament to sample yellow perch populations.

FIGURE 184. Use of single-mesh gill nets to sample yellow perch populations.

FIGURE 185. Use of rotenone to sample yellow perch populations.

FIGURE 186. Use of creel surveys to assess yellow perch populations.

FIGURE 187. Use of catch per unit effort data to analyze yellow perch populations.

FIGURE 188. Use of population estimates to analyze yellow perch populations.

FIGURE 189. Use of biomass estimates to analyze yellow perch populations.

FIGURE 190. Use of weight-length relationships to analyze yellow perch populations.

FIGURE 191. Use of body condition indices (K or C) to analyze yellow perch populations.

FIGURE 192. Use of growth information to analyze yellow perch populations.

FIGURE 193. States and provinces where walleye populations were routinely sampled.

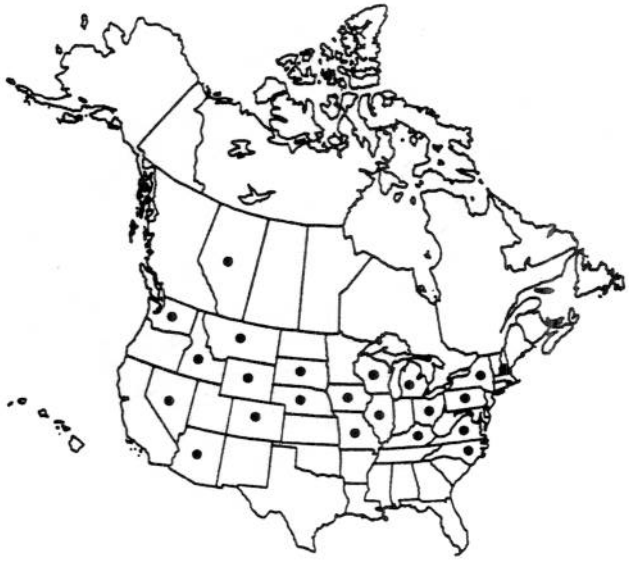

FIGURE 194. Use of DC boat electrofishing units at night to sample walleye populations.

FIGURE 195. Use of DC boat electrofishing units during the day to sample walleye populations.

FIGURE 196. Use of AC boat electrofishing units at night to sample walleye populations.

FIGURE 197. Use of AC boat electrofishing units during the day to sample walleye populations.

FIGURE 198. Use of beach seines 50 ft and longer to sample walleye populations.

FIGURE 199. Use of beach seines shorter than 50 ft to sample walleye populations.

FIGURE 200. Use of trap nets to sample walleye populations.

FIGURE 201. Use of experimental-mesh gill nets constructed of monofilament to sample walleye populations.

FIGURE 202. Use of experimental-mesh gill nets constructed of multifilament to sample walleye populations.

FIGURE 203. Use of single-mesh gill nets to sample walleye populations.

FIGURE 204. Use of rotenone to sample walleye populations.

FIGURE 205. Use of creel surveys to assess walleye populations.

FIGURE 206. Use of PSD and RSD to analyze walleye populations.

FIGURE 207. Use of population estimates to analyze walleye populations.

FIGURE 208. Use of biomass estimates to analyze walleye populations.

FIGURE 209. Use of weight-length relationships to analyze walleye populations.

FIGURE 210. Use of body condition indices (K or C) to analyze walleye populations.

FIGURE 211. States and provinces where northern pike populations were routinely sampled.

FIGURE 212. Use of DC boat electrofishing units to sample northern pike populations.

FIGURE 213. Use of AC boat electrofishing units to sample northern pike populations.

FIGURE 214. Use of trap nets to sample northern pike populations.

FIGURE 215. Use of experimental-mesh gill nets constructed of monofilament to sample northern pike populations.

FIGURE 216. Use of experimental-mesh gill nets constructed of multifilament to sample northern pike populations.

FIGURE 217. Use of creel surveys to assess northern pike populations.

FIGURE 218. Use of catch per unit effort data to analyze northern pike populations.

FIGURE 219. Use of population estimates to analyze northern pike populations.

FIGURE 220. Use of weight-length relationships to analyze northern pike populations.

FIGURE 221. Use of body condition indices (K or C) to analyze northern pike populations.

FIGURE 222. Use of growth information to analyze northern pike populations.

FIGURE 223. States and provinces where muskellunge populations were routinely sampled.

FIGURE 224. Use of boat electrofishing to sample muskellunge populations.

FIGURE 225. Use of trap nets to sample muskellunge populations.

FIGURE 226. Use of gill nets to sample muskellunge populations.

FIGURE 227. Use of creel surveys to assess muskellunge populations.

FIGURE 228. Use of weight-length relationships to analyze muskellunge populations.

FIGURE 229. Use of body condition indices (K or C) to analyze muskellunge populations.

FIGURE 230. States and provinces where rainbow trout populations were routinely sampled.

FIGURE 231. Use of DC boat electrofishing units during the day to sample rainbow trout populations.

FIGURE 232. Use of DC boat electrofishing units at night to sample rainbow trout populations.

FIGURE 233. Use of AC boat electrofishing units at night to sample rainbow trout populations.

FIGURE 234. Use of AC boat electrofishing units during the day to sample rainbow trout populations.

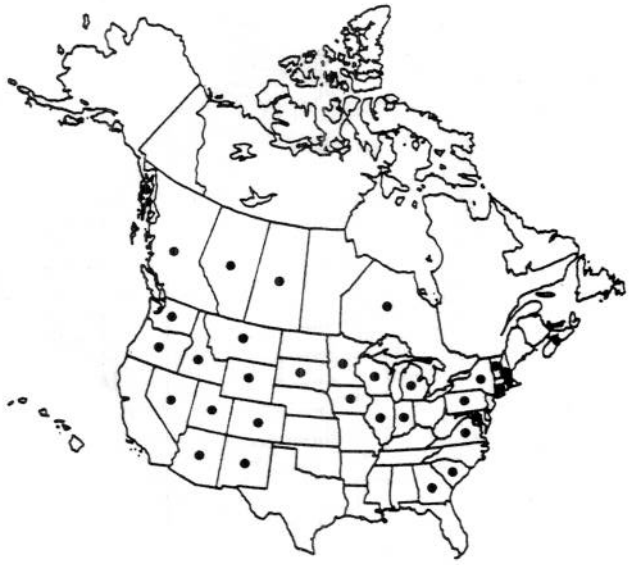

FIGURE 235. Use of DC portable electrofishing units during the day to sample rainbow trout populations.

FIGURE 236. Use of AC portable electrofishing units during the day to sample rainbow trout populations.

FIGURE 237. Use of beach seines to sample rainbow trout populations.

FIGURE 238. Use of trap nets to sample rainbow trout populations.

FIGURE 239. Use of experimental-mesh gill nets constructed of monofilament to sample rainbow trout populations.

FIGURE 240. Use of experimental-mesh gill nets constructed of multifilament to sample rainbow trout populations.

FIGURE 241. Use of single-mesh gill nets constructed of monofilament to sample rainbow trout populations.

FIGURE 242. Use of rotenone to sample rainbow trout populations.

FIGURE 243. Use of creel surveys to assess rainbow trout populations.

FIGURE 244. Use of angler or guide diaries to assess rainbow trout populations.

FIGURE 245. Use of tournament or club reports to assess rainbow trout populations.

FIGURE 246. Use of weir traps or fishway traps and lifts to sample rainbow trout populations.

FIGURE 247. Use of population estimates to analyze rainbow trout populations.

FIGURE 248. Use of biomass estimates to analyze rainbow trout populations.

FIGURE 249. Use of weight-length relationships to analyze rainbow trout populations.

FIGURE 250. Use of body condition indices (K or C) to analyze rainbow trout populations.

FIGURE 251. Use of growth information to analyze rainbow trout populations.

FIGURE 252. States and provinces where brown trout populations were routinely sampled.

FIGURE 253. Use of DC boat electrofishing units at night to sample brown trout populations.

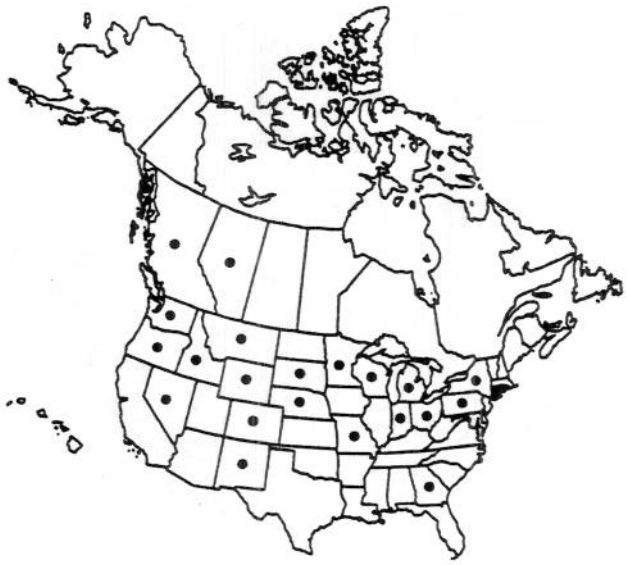

FIGURE 254. Use of DC boat electrofishing units during the day to sample brown trout populations.

FIGURE 255. Use of AC boat electrofishing units at night to sample brown trout populations.

FIGURE 256. Use of AC boat electrofishing units during the day to sample brown trout populations.

FIGURE 257. Use of DC portable electrofishing units to sample brown trout populations.

FIGURE 258. Use of AC portable electrofishing units to sample brown trout populations.

FIGURE 259. Use of trap nets to sample brown trout populations.

FIGURE 260. Use of experimental-mesh gill nets constructed of monofilament to sample brown trout populations.

FIGURE 261. Use of experimental-mesh gill nets constructed of multifilament to sample brown trout populations.

FIGURE 262. Use of single-mesh gill nets to sample brown trout populations.

FIGURE 263. Use of rotenone to sample brown trout populations.

FIGURE 264. Use of creel surveys to assess brown trout populations.

FIGURE 265. Use of angler or guide diaries to assess brown trout populations.

FIGURE 266. Use of weir traps or fishway traps and lifts to sample brown trout populations.

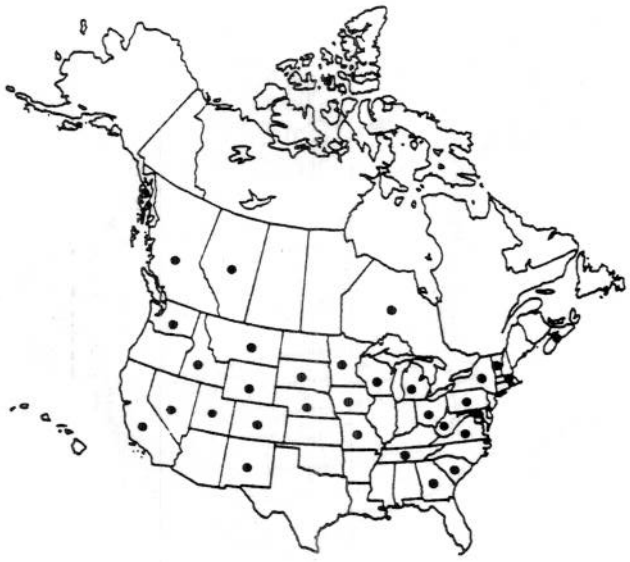

FIGURE 267. Use of population estimates to analyze brown trout populations.

FIGURE 268. Use of biomass estimates to analyze brown trout populations.

FIGURE 269. Use of weight-length relationships to analyze brown trout populations.

FIGURE 270. Use of body condition indices (K or C) to analyze brown trout populations.

FIGURE 271. Use of growth information to analyze brown trout populations.

FIGURE 272. States and provinces where brook trout populations were routinely sampled.

FIGURE 273. Use of DC boat electrofishing units at night to sample brook trout populations.

FIGURE 274. Use of DC boat electrofishing units during the day to sample brook trout populations.

FIGURE 275. Use of AC boat electrofishing units at night to sample brook trout populations.

FIGURE 276. Use of AC boat electrofishing units during the day to sample brook trout populations.

FIGURE 277. Use of DC portable electrofishing units to sample brook trout populations.

FIGURE 278. Use of AC portable electrofishing units to sample brook trout populations.

FIGURE 279. Use of beach seines to sample brook trout populations.

FIGURE 280. Use of trap nets to sample brook trout populations.

FIGURE 281. Use of experimental mesh gill nets constructed of monofilament to sample brook trout populations.

FIGURE 282. Use of experimental mesh gill nets constructed of multifilament to sample brook trout populations.

FIGURE 283. Use of single mesh gill nets to sample brook trout populations.

FIGURE 284. Use of creel surveys to assess brook trout populations.

FIGURE 285. Use of angler or guide diaries to assess brook trout populations.

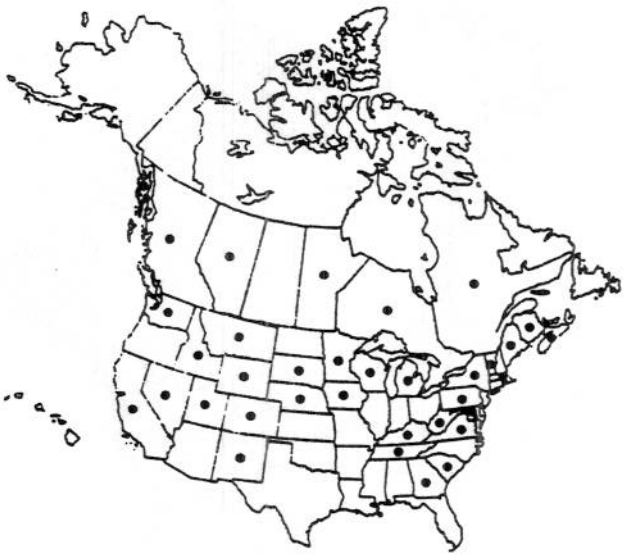

FIGURE 286. Use of population estimates to assess brook trout populations.

FIGURE 287. Use of biomass estimates to assess brook trout populations.

FIGURE 288. Use of weight-length relationships to assess brook trout populations.

FIGURE 289. Use of body condition indices (K or C) to assess brook trout populations.

FIGURE 290. States and provinces where lake trout populations were routinely sampled.

FIGURE 291. Use of experimental-mesh gill nets constructed of monofilament to sample lake trout populations.

FIGURE 292. Use of experimental-mesh gill nets constructed of multifilament to sample lake trout populations.

FIGURE 293. Use of single-mesh gill nets to sample lake trout populations.

FIGURE 294. Use of creel surveys to assess lake trout populations.

FIGURE 295. Use of angler or guide diaries to assess lake trout populations.

FIGURE 296. Use of weight-length relationships to analyze lake trout populations.

Appendix 1

# Lakes and Impoundments <500 acres

☐ Water type not sampled

State or Province

Completed by:

Name

Address

Phone

| Species and size | |
|---|---|
| Channel catfish | ≥11 in |
| Striped bass | ≥12 in |
| White bass | ≥ 6 in |
| Bluegill | ≥ 3 in |
| Crappies (both) | ≥ 5 in |
| Largemouth bass | ≥ 8 in |
| Smallmouth bass | ≥ 7 in |
| Yellow perch | ≥ 5 in |
| Walleye | ≥10 in |
| Northern pike | ≥14 in |
| Muskellunge | ≥20 in |
| Rainbow trout | ≥ 8 in |
| Brown trout | ≥ 8 in |
| Brook trout | ≥ 8 in |
| Lake trout | ≥12 in |

| Species not present or not sampled in this water type |
|---|

| Sampling Techniques |
|---|
| Boat electrofishing (D.C. night) |
| Boat electrofishing (D.C. day) |
| Boat electrofishing (A.C. night) |
| Boat electrofishing (A.C. day) |
| Portable electrofishing (D.C. night) |
| Portable electrofishing (D.C. day) |
| Portable electrofishing (A.C. night) |
| Portable electrofishing (A.C. day) |
| Beach or haul seine <50 feet |
| Beach or haul seine ≥50 feet |
| Purse seine |
| Surface trawl |
| Mid-water trawl |
| Bottom trawl |
| Trap, fyke, or modified fyke net |
| Hoop net |
| Experimental mesh gill net (monofilament) |
| Experimental mesh gill net (multifilament) |
| Single mesh gill net(s) (monofilament) |
| Single mesh gill net(s) (multifilament) |
| Trammel net |
| Weir trap |
| Rotenone |
| Cyanide |
| Other toxicants (list) |
| Creel census |
| Angler diaries |
| Tournament reports |
| Other angler-collected data (list) |
| Other (list) |
| Other (list) |
| Other (list) |

| Analysis Techniques |
|---|
| Length distribution |
| PSD & RSD's |
| Catch per unit effort |
| Population estimation |
| Biomass estimation |
| Weight-length relationship |
| Condition (K or C) |
| Condition (Wr) |
| Growth |
| Age distribution |
| Other (list) |
| Other (list) |

Appendix 2

# Lakes and Impoundments ≥500 acres

☐ Water type not sampled

State or Province

Completed by:

Name

Address

Phone

| Species and size | |
|---|---|
| Channel catfish | ≥11 in |
| Striped bass | ≥12 in |
| White bass | ≥ 6 in |
| Bluegill | ≥ 3 in |
| Crappies (both) | ≥ 5 in |
| Largemouth bass | ≥ 8 in |
| Smallmouth bass | ≥ 7 in |
| Yellow perch | ≥ 5 in |
| Walleye | ≥10 in |
| Northern pike | ≥14 in |
| Muskellunge | ≥20 in |
| Rainbow trout | ≥ 8 in |
| Brown trout | ≥ 8 in |
| Brook trout | ≥ 8 in |
| Lake trout | ≥12 in |

| Species not present or not sampled in this water type | Sampling Techniques | Analysis Techniques |
|---|---|---|
| | Boat electrofishing (D.C. night) | Length distribution |
| | Boat electrofishing (D.C. day) | PSD & RSD's |
| | Boat electrofishing (A.C. night) | Catch per unit effort |
| | Boat electrofishing (A.C. day) | Population estimation |
| | Portable electrofishing (D.C. night) | Biomass estimation |
| | Portable electrofishing (D.C. day) | Weight-length relationship |
| | Portable electrofishing (A.C. night) | Condition (K or C) |
| | Portable electrofishing (A.C. day) | Condition (Wr) |
| | Beach or haul seine <50 feet | Growth |
| | Beach or haul seine ≥50 feet | Age distribution |
| | Purse seine | Other (list) |
| | Surface trawl | Other (list) |
| | Mid-water trawl | Other (list) |
| | Bottom trawl | |
| | Trap, fyke, or modified fyke net | |
| | Hoop net | |
| | Experimental mesh gill net (monofilament) | |
| | Experimental mesh gill net (multifilament) | |
| | Single mesh gill net(s) (monofilament) | |
| | Single mesh gill net(s) (multifilament) | |
| | Trammel net | |
| | Weir trap | |
| | Rotenone | |
| | Cyanide | |
| | Other toxicants (list) | |
| | Creel census | |
| | Angler diaries | |
| | Tournament reports | |
| | Other angler-collected data (list) | |
| | Other (list) | |
| | Other (list) | |
| | Other (list) | |

Appendix 3

# Streams

☐ Water type not sampled

State or Province

Completed by:

Name

Address

Phone

| Species and size | |
|---|---|
| Channel catfish | ≥11 in |
| Striped bass | ≥12 in |
| White bass | ≥ 6 in |
| Bluegill | ≥ 3 in |
| Crappies (both) | ≥ 5 in |
| Largemouth bass | ≥ 8 in |
| Smallmouth bass | ≥ 7 in |
| Yellow perch | ≥ 5 in |
| Walleye | ≥10 in |
| Northern pike | ≥14 in |
| Muskellunge | ≥20 in |
| Rainbow trout | ≥ 8 in |
| Brown trout | ≥ 8 in |
| Brook trout | ≥ 5 in |
| Lake trout | ≥12 in |

Species not present or not sampled in this water type

**Sampling Techniques**

- Boat electrofishing (D.C. night)
- Boat electrofishing (D.C. day)
- Boat electrofishing (A.C. night)
- Boat electrofishing (A.C. day)
- Portable electrofishing (D.C. night)
- Portable electrofishing (D.C. day)
- Portable electrofishing (A.C. night)
- Portable electrofishing (A.C. day)
- Beach or haul seine <50 feet
- Beach or haul seine ≥50 feet
- Purse seine
- Surface trawl
- Mid-water trawl
- Bottom trawl
- Trap, fyke, or modified fyke net
- Hoop net
- Experimental mesh gill net (monofilament)
- Experimental mesh gill net (multifilament)
- Single mesh gill net(s) (monofilament)
- Single mesh gill net(s) (multifilament)
- Trammel net
- Weir trap
- Rotenone
- Cyanide
- Other toxicants (list)
- Creel census
- Angler diaries
- Tournament reports
- Other angler-collected data (list)
- Other (list)
- Other (list)
- Other (list)

**Analysis Techniques**

- Length distribution
- PSD & RSD's
- Catch per unit effort
- Population estimation
- Biomass estimation
- Weight-length relationship
- Condition (K or C)
- Condition (Wr)
- Growth
- Age distribution
- Other (list)
- Other (list)

# Rivers

Appendix 4

☐ Water type not sampled

State or Province

Completed by:

Name

Address

Phone

| Species and size | |
|---|---|
| Channel catfish | ≥11 in |
| Striped bass | ≥12 in |
| White bass | ≥ 6 in |
| Bluegill | ≥ 3 in |
| Crappies (both) | ≥ 5 in |
| Largemouth bass | ≥ 8 in |
| Smallmouth bass | ≥ 7 in |
| Yellow perch | ≥ 5 in |
| Walleye | ≥10 in |
| Northern pike | ≥14 in |
| Muskellunge | ≥20 in |
| Rainbow trout | ≥ 8 in |
| Brown trout | ≥ 8 in |
| Brook trout | ≥ 8 in |
| Lake trout | ≥12 in |

☐ Species not present or not sampled in this water type

**Sampling Techniques**

- ☐ Boat electrofishing (D.C. night)
- ☐ Boat electrofishing (D.C. day)
- ☐ Boat electrofishing (A.C. night)
- ☐ Boat electrofishing (A.C. day)
- ☐ Portable electrofishing (D.C. night)
- ☐ Portable electrofishing (D.C. day)
- ☐ Portable electrofishing (A.C. night)
- ☐ Portable electrofishing (A.C. day)
- ☐ Beach or haul seine <50 feet
- ☐ Beach or haul seine ≥50 feet
- ☐ Purse seine
- ☐ Surface trawl
- ☐ Mid-water trawl
- ☐ Bottom trawl
- ☐ Trap, fyke, or modified fyke net
- ☐ Hoop net
- ☐ Experimental mesh gill net (monofilament)
- ☐ Experimental mesh gill net (multifilament)
- ☐ Single mesh gill net(s) (monofilament)
- ☐ Single mesh gill net(s) (multifilament)
- ☐ Trammel net
- ☐ Weir trap
- ☐ Rotenone
- ☐ Cyanide
- ☐ Other toxicants (list)
- ☐ Creel census
- ☐ Angler diaries
- ☐ Tournament reports
- ☐ Other angler-collected data (list)
- ☐ Other (list)
- ☐ Other (list)
- ☐ Other (list)

**Analysis Techniques**

- ☐ Length distribution
- ☐ PSD & RSD's
- ☐ Catch per unit effort
- ☐ Population estimation
- ☐ Biomass estimation
- ☐ Weight-length relationship
- ☐ Condition (K or C)
- ☐ Condition ($W_r$)
- ☐ Growth
- ☐ Age distribution
- ☐ Other (list)
- ☐ Other (list)