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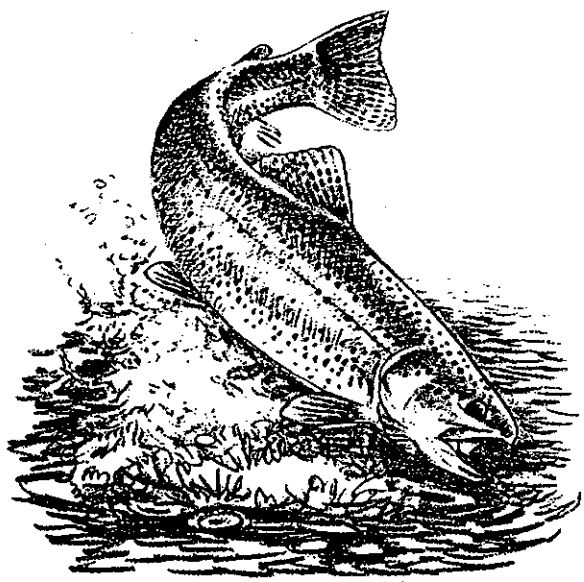
A Trout Management Plan for Connecticut's Rivers and Streams



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A TROUT MANAGEMENT PLAN

FOR CONNECTICUT'S

RIVERS AND STREAMS

A Trout Management Plan for Connecticut's Rivers and Streams

Table of Contents

Introduction

Trout are the most sought-after gamefish in Connecticut, accounting for 2.1 million fishing trips, or 54% of all inland angler trips annually. This exceeds both the 1.7 million trips/year that the State's anglers spend in pursuit of largemouth and smallmouth bass, and the 1.7 million trips/year spent in search of saltwater fish (all species combined). Approximately 1.4 million of these trout fishing trips are to Connecticut's rivers and streams. Most stream trout fishing is sustained by the stocking of 452,000 adult size (9-12 inches) and 48,000 yearling size (6-8 inches) trout that are raised by the DEP in the Quinebaug Valley and Burlington State Fish Hatcheries (300,000 additional trout are stocked in lakes and ponds).

A comprehensive statewide survey of Connecticut's streams was undertaken from 1988 to 1995 to gather detailed site-specific information with the purpose of determining whether or not current Inland Fisheries programs could be enhanced. This survey provided extensive data on trout populations, physical habitat, water quality, and angler effort and catch.

This Trout Management Plan was developed for Connecticut's rivers and streams based upon evaluation of the data collected during the Stream Survey, the results of past research done in Connecticut, and from information in the scientific literature. The overall placement of streams into management categories (Wild Trout Waters, Trophy Trout Waters, etc.) was guided by consideration of available resources, and our understanding of angler demand and desires.

The plan was developed in three distinct steps. In the first step, streams were classified based on their trout populations and existing fisheries. Data on growth rates, stream size, wild trout biomass, and predicted carrying capacity (carrying capacity is the quantity of trout that can be supported indefinitely) were added to provide a simplified snapshot of each stream which included most of the information needed for trout management decisions. In the second step, staff biologists used this information along with their knowledge of individual waters, angler access, and research results, to select appropriate fishing regulations and stocking options for each stream (see Appendix A). In the third step, the Department will seek input from anglers on the recommendations proposed in this report. Following review of public comments and discussions between DEP staff and anglers, a final report will be issued and proposed regulations will be drafted.

This plan has been developed to guide Connecticut's trout fisheries into the 21st century based on the results of recent research combined with the wisdom gleaned from over 125 years of ongoing work. Implementation of this plan will enhance an already successful program. More specifically, this plan will result in more efficient use of hatchery trout, increased awareness of wild trout, greater angler satisfaction, and increased and more diverse angling opportunities.

History of Trout Management in Connecticut

Populations of native brook trout were widespread and abundant throughout Connecticut during the early colonial period. Many of the region's coastal streams supported runs of "Salter" brook trout which grew to large size in estuarine waters (Bergin 1984, Ryther 1997). By the 1800s, however, deforestation, erosion, dam construction, industrial development, and water pollution, had greatly degraded Connecticut's riverine habitat and depleted it's native trout populations. The Connecticut Fish Commission was established by an Act of the General Assembly in 1868 with the stated objective of re-establishing salmon, trout, and shad populations in Connecticut's waters. Brook trout fry were soon imported, made available to property owners, and stocked in many of the State's streams. Length limits and creel limits were added in the late 1800s in response to concerns over further depletion of brook trout populations by over-harvest.

A number of small state-owned and private trout hatcheries were in operation by the end of the 19th century. The importation and propagation of many non-native species was made possible by improvements in transportation and advancements in fish culture. Among other exotic species, brown trout were introduced to the state in the 1860s (Behnke 1990) and rainbow trout were introduced in the 1870s (Whitworth 1996). Other salmonid species stocked between the 1870s and 1920 include lake trout, kokanee salmon, coho salmon, chinook salmon, landlocked salmon, and Atlantic salmon.

Trout management efforts during the 20th century continued to emphasize stocking additional fish to satisfy angler demand and to mitigate for the ongoing loss of wild populations and habitat. This approach maximized harvest and provided for a growing number of anglers irrespective of the capacity of the resource. State Fish Hatcheries were constructed in the 1920s and 1930s, to produce a large and steady supply of trout for stocking. By 1940, approximately 250,000 - 350,000 trout were being grown at three hatcheries (Burlington, Kensington, and Windsor Locks) and 50,000-100,000 additional fish were being purchased from out-of-state. Research done in the 1940s on the performance of brook, brown, and rainbow trout in Connecticut's put-and-take fisheries demonstrated that all three species provided good return rates to anglers; whereas, brown trout were able to sustain a fishery over a longer time period (Thorpe 1944). These results enabled managers to adjust hatchery production to better achieve fisheries objectives.

From the mid-1950s into the 1970s, Connecticut worked to develop experimental fisheries for sea-run brown trout. Several domestic and wild sea-run strains were stocked as juveniles in the lower reaches of coastal streams. Returns of sea-run fish were obtained and a small scale fishery for large trout was produced in Latimers Brook (Jones 1965, 1966). This program was abandoned as numbers of returning fish could not be sustained.

Angler demand for trout fishing continued to grow in the second half of the century and, in 1972, with the completion of the Quinebaug Valley State Fish Hatchery, trout production capacity was more than doubled. From this point, every sizable stream with suitable habitat and public fishing access was stocked with catchable size trout. Continued improvement in fish culture operations,

and major renovations to the Quinebaug Valley Hatchery (in the 1990s), have enabled the DEP to stabilize production at 800,000 catchable size trout per year.

Until the mid-1970s trout management consisted almost entirely of put-and-take stocking of yearling and adult-size hatchery-reared trout. Streams were stocked well beyond their natural carrying capacity while harvest regulations were relatively liberal (five-per-day creel limit, no length limit) and were designed primarily to distribute the harvest of stocked fish among more anglers. Wild trout were managed similarly by default. Over the past 25 years, however, increasing numbers of anglers have become interested in non-consumptive "catch-and-release" fisheries. As a result, Connecticut's first Trout Management Area (TMA) was created on the Willimantic River in 1976. Additional areas were added in 1981 and 1988. These TMAs quickly became popular with anglers due to higher catch rates and increased catches of large trout. Subsequent studies of these TMAs clearly demonstrated the popularity and success of this approach (increased angler trips, total catch, catch rates, and numbers of large trout). As a result, six additional TMAs were created in the 1990s.

In the late 1980s, some groups of anglers indicated an increasing awareness of, and appreciation for wild trout. At the same time the Statewide Stream Survey was discovering and documenting the state's wild trout resources (Hagstrom et al. 1996). Subsequently, Connecticut's first Wild Trout Management Area was created on the Tankerhoosen River in 1993. This fishery is managed exclusively for wild trout under catch-and-release regulations. The area has provided good quality fishing and has been well received by anglers.

Data collected during the Statewide Stream Survey (1988-1995) has provided detailed information on the physical habitat, flow levels, and water quality in Connecticut's streams along with information on populations of wild and stocked trout. Angler surveys have been conducted to collect data on fishing effort, catch rates, and angler satisfaction. This information, along with the results of recent DEP research comparing the performance of different strains of rainbow trout and brown trout, and of stocking different sizes of brown trout (fry, fingerlings, yearlings), have provided valuable insight into how to best enhance Connecticut's trout fisheries.

Overview of Current Trout Management Program

Natural reproduction by trout, though common, is not adequate to support the current level of trout harvest in Connecticut streams. Most of the 1.4 million fishing trips per year to Connecticut's streams are sustained by the stocking of trout that are raised by the DEP in the Quinebaug Valley and Burlington State Fish Hatcheries.

Connecticut's existing trout program includes put-and-take trout fisheries, fly fishing only areas, and a variety of special Trout Management Areas. Angling regulations and trout stocking have been adjusted to produce the following program elements.

1) **Streams Under Statewide Regulations**: Open third Saturday in April through the last day in February. Five trout per day creel limit with no length limit. No gear restrictions.

   a) **Stocked Streams under Statewide Regulations**: Approximately 140 streams are stocked with adult size (9-12 inches) brook, brown and rainbow trout and surplus broodstock (2-10 lbs). All are stocked preseason (March-April) and most receive supplemental inseason stocking (April-May). Twenty streams are also stocked in late September or early October. Portions of the Farmington River are stocked during the summer due to the river's cool water temperatures.
   Approximately 130 streams are stocked once preseason (March-April) with yearling size brook trout (6-8 inches).

   Intended purpose: To provide recreational fishing opportunities, for as many anglers as possible, to catch and harvest trout in all waters open to the public which have suitable habitat for trout.

   b) **Nonstocked Streams under Statewide Regulations**: Wild trout inhabit a significant percentage of CT's nonstocked streams. Wild brook trout are found in approximately 52%, and wild brown trout inhabit approximately 28% of streams in Connecticut. These fisheries are managed under CT's statewide trout regulations.

   Intended purpose: To provide recreational trout fishing opportunities.

2) **Fly Fishing Only Areas**: Three Fly-Fishing-Only areas are open from the third Saturday in April through the last day in February. Angling is restricted to Fly-Fishing-Only with a five trout per day creel limit and no length limit. Four other Fly-Fishing-Only areas are included within seasonal or year-round Trout Management Areas.

   Intended purpose: To provide recreational trout fishing opportunities for fly anglers in traditional Fly-Fishing-Only areas.

3) **Trout Management Areas under seasonal catch-and-release regulations**: Five areas (Farmington River TMA, Hammonasset River TMA, Mianus River TMA, Mill River TMA, Salmon River TMA) are managed under catch-and-release regulations for portions of the year and open to harvest during the remainder. Seasons, length limits and creel limits are specific to each area. Angling is restricted to Fly-Fishing-Only on a portion of one area (Salmon River). All areas are stocked with adult and/or juvenile trout.

Intended purpose: To enhance recreational fishing opportunities by providing increased catch rates for adult size stocked trout during portions of the year and catch-and-release fishing for smaller (<9 inches) trout throughout the year. To allow harvest prior to periods of high natural mortality (summer).

4) **Trout Management Areas under year-round catch-and-release regulations**: Five areas (Bladens Brook TMA, Willimantic River TMA, Housatonic River TMA, Moosup River TMA, West Branch-Farmington River TMA) are managed under year-round catch-and-release regulations. Angling is restricted to Fly-Fishing-Only on all of one area (Willimantic River) and portions of two (Housatonic River and Moosup River). All areas are stocked with adult and/or juvenile trout.

Intended purpose: To enhance recreational fishing opportunities by providing increased catch rates for adult size stocked trout throughout the year. To provide increased opportunities to catch holdover trout.

5) **Wild Trout Management Areas**: One area (Belding Wild Trout Management Area, Tankerhoosen River) is managed solely as a wild trout fishery. No stocking is allowed and angling is restricted to catch-and-release using barbless single hook artificial lures and flies. A closed season is in place from October first through the last day in December to protect spawning fish.

Intended purpose: To enhance recreational fishing by providing anglers with opportunities to fish for wild trout.

Of 687 miles of state-stocked streams, approximately 140 adult-stocked streams make up 73% (500 miles), 130 yearling-brook-trout-stocked streams total 23% (164 miles), and 10 TMAs account for 3.3% (23 miles). Approximately 452,000 adult size trout (9-12 inches), 48,000 yearling size trout (6-8 inches), and 1,500 surplus broodstock trout (2-10 lbs) are stocked into these rivers and streams each year. Roughly 60% of these fish are stocked before Opening Day. The majority of the remaining fish are stocked later in the spring during the open season (37% of the total) and a small percentage are stocked in larger more popular streams in the summer and fall (3% of the total).

During the spring period, anglers catch 81% of all adult trout stocked into streams managed

under statewide general regulations. Sixty-five percent of the fish that are caught in these streams are harvested (approximately 250,000 trout). Productive trout fishing in most of these waters is limited to springtime angling for recently stocked fish. This is due to the high harvest rate combined with losses due to natural mortality and hooking mortality.

Hatchery production of catchable size trout is currently at capacity**.** Hence, our ability to increase the total amount of fishing generated by put-and-take trout stocking is limited. As a result, catch-and-release fishing has been successfully applied in CT's TMAs to increase the amount of angling supported by a limited number of stocked trout. The Fisheries Division also regularly stocks 50,000-200,000 surplus hatchery brown trout fry, fingerlings, and yearlings into a wide variety of streams having populations below carrying capacity, or limited potential for natural reproduction. Several different strains have been stocked and evaluated for survival and growth in the wild. In some streams, stocking surplus juvenile trout has been a cost effective way to increase production of high quality catchable-size trout.

All of the Fisheries Division's trout stream management activities are predicated on public access to stream resources. Angler access to stocked streams on private property is being lost due to land sales, development, and non-renewal of short-term leases for fishing access. Working within this tightening constraint has limited trout stocking and other management to a shrinking subset of the State's streams with suitable trout habitat.

The annual costs associated with trout hatchery operations (1.4 million dollars/year) are substantial, comprising 44 % of the Inland Fisheries budget. Other programs associated with trout, including management evaluations, surveys, and administration, cost an additional $360,000/year, bringing the total expenditures for trout management to 1.76 million dollars annually (55% of the Inland Fisheries budget; 33 % of the entire Fisheries budget). In addition, a recent upgrade of the Quinebaug Valley Hatchery, at a cost of $14.5 million dollars, was necessary to rejuvenate a failing water supply, and to restore and modernize hatchery infrastructure.

Expenditures[1] by trout anglers have a net economic impact of $21.80 to $45.78 for each day of fishing on Connecticut streams, resulting in an annual net economic impact of $4.9-$10 million. In addition, the average trout angler places an additional value (consumer surplus) of approximately $20.00 per angler-day on a fishing trip, resulting in an annual total of $4.1-$8.4 million (Consumer surplus is the value of the trip above expenditures and is roughly equivalent to the "ticket price" of a free market commodity. This value was estimated by asking how much greater an angler's expenses would have to become before they would have decided not to go fishing on a particular day).

[1] Expenditures include money spent on fishing equipment (rods, reels, line, flies, bait, lures, waders, hip boots, creels, bait containers, fishing vests, wading staffs, etc.), food, travel expenses (e.g. gas, tolls), lodging, guide services, etc.

Trout Research in Connecticut

A) The Statewide Stream Survey

A comprehensive survey of Connecticut's rivers and streams was done over a seven year period between 1988 and 1995 (Hagstrom et al. 1996). Data on fish populations, physical habitat and water chemistry were collected from 978 sites on 800 streams. These samples covered 98.3 km or roughly 0.9% of the total length of perennial streams in Connecticut. Invertebrate populations were assessed by collecting 4,141 samples from 855 sites. Fishing effort, catch and socioeconomic value were determined by doing 85 angler surveys on 53 streams.

The objectives of the Stream Survey were to: 1) quantify the state's coldwater and warmwater stream fishery resources, 2) compile a database which allows timely and accurate completion of environmental permitting and reviews, 3) develop models which accurately predict species composition and biomass in Connecticut streams, 4) make this information available to the general public, and 5) provide the information necessary to develop a Trout Management Plan for Connecticut's streams. The first three objectives were achieved by collecting physical, chemical, biological and angler survey data, by developing a computerized database, and by analyzing the data. The fourth objective is being achieved by making six progress reports and a Statewide Summary report available to the public upon request, and by the publication of a text for the general public. The fifth objective is addressed by this report, wherein data collected during the Statewide Stream Survey are used as the basis for developing a Trout Management Plan.

The findings of the Statewide Stream Survey have enabled the Fisheries Division to prepare a trout management program which can be sustained by Connecticut's stream resources and which meets the needs of Connecticut anglers. Information on available habitat, wild trout, stocked trout, angler effort, catch, and angler attitudes, are presented in the following sections (all from Hagstrom et al. 1996). In addition, results of other trout research studies done in Connecticut and elsewhere, are presented to address critical topics outside the scope of the Statewide Stream Survey.

B) Trout Habitat in Connecticut

There are at least 6,500 miles of perennial streams in the State of Connecticut. Approximately 75% or 4,900 miles of this total provide habitat which typically supports trout during at least part of the year.

Data collected from the 800 streams sampled during the Statewide Stream Survey identified 668 which were inhabited by trout and 495 that supported some level of trout reproduction. Based on extrapolation of these data, wild trout are believed to inhabit 4,000 stream miles in Connecticut. Many of these stream miles (approximately 2,800) are in 1st order streams which are typically small and able to support only limited fishing. The remaining 1,500 - 2,000 miles are mostly 2nd and 3rd order streams (medium sized) and account for the majority of habitat available for trout management in Connecticut. Fishing in most of these larger streams is dependent on stocked trout. Only 300

stream miles contain enough wild trout to support a significant amount of angling. Unfortunately, many of these stream miles are on private property which is closed to public fishing.

C) Wild Trout in Connecticut

Wild populations of brook trout and brown trout are found in many Connecticut streams, and are often the dominant fish species in small cold brooks. The 4,000 miles of stream in Connecticut which are populated by wild trout contain an estimated 3 million trout of which 88% are brook trout and 12% are brown trout.

A total of 286 streams currently support notable populations of catchable-size wild trout (at least 160 yearling and older fish/mile). This population density is adequate to maintain significant fisheries (176 or more hours/mile) under catch-and-release regulations. Of the total (286), 221 streams have brook trout, 22 streams have brown trout, and 43 streams have a combination of brook trout and brown trout. The number of streams that could currently support a wild trout harvest rate of 160 or more fish/mile, equivalent to a lightly-stocked Connecticut stream, is 5 for brown trout, 44 for brook trout, and 9 for a combined catch of brooks and browns.

Wild trout resources are not evenly distributed throughout the state. Wild trout populations with balanced age distribution and high densities are more common in the northwest corner of the state due to fewer impacts from human activities, more topographic relief (i.e. higher gradient streams), and cooler summer temperatures. Conversely, healthy wild trout populations are rare in some other areas of the State (e.g. lower Fairfield County).

Brook trout are the most commonly occurring species of trout in Connecticut. Most brook trout populations are only lightly fished and offer abundant opportunities to catch (and harvest) small wild trout. Natural mortality of yearling and older wild brook trout is high (83% per year), with very few fish reaching age 3 and no fish older than age 4. Because of the small size of the fish (6-8 inches) and difficult nature of the fishing, pursuit of wild brook trout is of interest to a limited number of trout anglers. Still, given the quantity and wide distribution of the resource, potential utilization is significant. Providing anglers with information on locations and appropriate fishing techniques for wild brook trout may increase the popularity of these fisheries. Harvest restrictions and careful monitoring, at least initially, may be necessary to maintain brook trout populations near carrying capacity in the most popular fisheries.

Because brown trout generally live longer and grow more quickly than brook trout, brown trout populations have greater potential to produce large wild fish (which are most desirable to anglers). Natural mortality of yearling and older brown trout is approximately 60% per year, with many streams containing 3 and 4 year old fish. Some wild brown trout survive beyond age 6. Fishable wild brown trout populations are much less common than brook trout populations, and their distribution within the State is limited. Additionally, wild brown trout mature at older ages and consequently are subjected to a longer period of harvest before reaching spawning age. This makes brown trout even more susceptible to overfishing than brook trout. Harvest restrictions are necessary

to maintain brown trout populations near carrying capacity in accessible waters.

Wild rainbow trout are extremely rare in Connecticut, and are found in only six streams. Wild rainbows are not abundant in any of these streams. None of the populations contain both young-of-year and significant numbers of older fish. New York and Vermont have healthy self-perpetuating rainbow trout populations which have been established for many years. It is possible that wild rainbows are lacking in Connecticut due to the inability of domestic hatchery strains to survive and reproduce in the wild. Connecticut streams may also lack some physical or chemical component critical to the species' survival. Regardless, since wild rainbow trout resources are scarce, potential for management is low unless suitable genetic strains are identified, obtained, and established. The value of doing this is questionable, as existing wild brook trout and brown trout resources already provide ample opportunity for wild trout management.

One of the main objectives of the Stream Survey was to determine the quantity of trout that could be supported indefinitely in each of the State's streams. This "carrying capacity", expressed as pounds-of-trout-per-acre, can serve as a useful guideline for both trout stocking and wild trout management. As a measure of carrying capacity, we examined the pounds-of-trout-per-acre, or "standing crop" of wild trout in unfished or lightly fished streams with high quality habitat. Standing crops in these streams ranged widely (0-166 lbs/acre), but indicated a conservatively calculated average carrying capacity for trout of approximately 49 lb/acre. The amount of cover for adult trout was found to be the most important determinant of carrying capacity.

The existing population of trout in most Connecticut streams is less than the average carrying capacity determined from unimpacted waters and less than predicted based on available adult trout habitat. It appears that many wild trout populations are currently below carrying capacity due to a variety of reasons including angler harvest, insufficient spawning stocks, degraded spawning habitat, and/or stocking of domestic strains of trout. Wild trout populations in stocked streams are often heavily exploited because stocking trout generates greater levels of angler effort, and consequently, increases the harvest of wild fish (Moring 1993). In addition, stocked fish themselves may adversely impact wild trout populations through aggressive behavior and competition for food and space (Bachman 1994). Thirty-nine stocked streams have significant natural reproduction and some larger wild trout. In these streams, wild trout contribute only 5.5% of the total catch; however up to 66% (mean = 40.6%) of wild trout larger than 6 inches are caught. In stocked streams with wild brown trout, the abundance of age 2+ and older wild fish is generally lower (range: 0-128/acre, average 7/acre) than nonstocked (and consequently more lightly fished) streams with wild brown trout (range: 0-226/acre, average 20/acre). Hence, if wild trout are to be managed effectively in stocked streams, regulations which restrict harvest may be necessary, and/or stocking rates may have to be reduced.

Wild trout management alone could never replace the current levels of fishing effort and harvest achieved through prudent State hatchery management and stocking efforts. However, wild trout in Connecticut are a significant renewable natural resource. Because of the quantity of these resources, the prospects for improvement, and the evolving desires of the angling public, efforts to

conserve and enhance wild trout populations and fisheries are justified.

D) <u>Stocked Trout in Connecticut</u>

The Connecticut DEP stocks 452,000 adult size (9-12 inches) and 48,000 yearling size (6-8 inches) trout into the state's streams each year to provide recreational angling. Most of these fish are stocked to provide "instant" fishing. Long-term growth and survival are not necessary to achieve management goals. However, in select streams, information on the survival and growth of stocked trout, and on their impacts to wild trout, is needed to maximize the benefits of stocking.

Survival of stocked trout in most Connecticut streams, including year-round catch-and-release waters, is poor with few fish surviving from one year to the next. Reasons for this are not completely clear, particularly since many streams support wild trout year-round. However, it is likely that high harvest rates, less-than-optimum habitat during critical times of the year (summer low-flow period and winter ice-up period), and the effects of domestication (generations of breeding for performance in the hatchery rather than in the wild) combine to cause high mortality of stocked trout in most streams.

Stream Survey sampling has shown that there are only two large streams in the state, the Housatonic River and the Farmington River, that are capable of supporting large numbers of holdover stocked trout. Late summer holdover (from the previous year) densities range from 7 to 22 trout per acre in the Farmington TMA (including some large wild holdovers), and from 0.7 to 23 trout per acre in the Housatonic TMA. Other sections of these rivers that could produce significant numbers of holdovers currently do not because of harvest (Farmington) and lack of stocking (Housatonic).

More stocked brown trout survive until the fall or the following spring than other species of trout due to their lower catchability (Thorpe 1944; Cooper 1953) and higher tolerance of warmer water (Elliot 1994). Harvest and natural mortality of stocked brook trout and rainbow trout is higher, with virtually no stocked brook trout surviving a full year in any of the states streams, and only a limited number of rainbows holding over in the Housatonic and Farmington TMAs. This is due, in part, to a higher vulnerability to angling. Due to genetically based behavioral differences, brook trout and rainbow trout are easier to catch than brown trout. Also, more stringent thermal and habitat requirements, and a naturally shorter life span (even wild brook trout in Connecticut rarely live beyond age 3) contribute to higher mortality for brook and rainbow trout.

Different strains of the same trout species exhibit dissimilar survival rates and percent return-to-the-creel. The Fisheries Division has evaluated a number of rainbow trout and brown trout strains to determine which fish are best suited to achieve fisheries management objectives. Anglers consistently caught a higher percentage of Kamloops strain rainbow trout than of three other rainbow strains (Schluntz and Bender 1993). Erwin-strain rainbow trout are reported to be less migratory than other rainbow strains, and have been used successfully in Connecticut to enhance catch rates in catch-and-release areas. Bitterroot and Cortland brown trout were found to provide similar long-

term survival and growth in Trout Management Areas (Orciari and Phillips 1986). In our hatcheries, Rome strain brown trout are being cultured to an increasing extent due to their superior resistance to the trout disease, furunculosis.

Seeforellen brown trout are a lake-adapted strain that is known for greater longevity, faster growth rates, and later maturation than other brown trout strains. Seeforellens have been propagated in Connecticut hatcheries since 1992. Yearling Seeforellens have been stocked into four trophy trout lakes, and fingerlings have recently been stocked into six streams on an experimental basis. In streams, long-term survival of Seeforellen fingerlings may be better than that of our standard hatchery strains of brown trout. In addition, hatchery-raised Seeforellens may have retained the migratory tendency necessary for a stream-spawning, lake-dwelling life history. If so, Seeforellens may be well suited for establishing sea-run populations in coastal streams.

The Fisheries Division has been stocking surplus juvenile trout into streams, and evaluating survival and growth for a number of years. Of 46 spring fry-stocking efforts since 1987, 21 produced fall fingerling densities greater than 80/acre and 12 produced densities over 200/acre. Of 45 fingerling stocking efforts, 12 produced densities of large fingerlings or yearlings over 80/acre, and five produced densities over 200/acre. Wild young-of-year densities of 80/acre have been adequate to produce fishable densities of catchable size (yearling and older) wild brown trout in some streams, and young-of-year densities of 200/acre generally are adequate to saturate habitat for yearling and older fish. Yearlings stocked in the spring in year-round catch-and-release TMAs regularly comprise a significant number of the remaining trout in late-summer (up to 56% in the Farmington TMA, 40% in the Housatonic TMA, 80% in the Willimantic TMA, and 33% in the Moosup TMA). When stocked as juveniles, some species and strains appear to survive better than others. Most successful juvenile stocking results were achieved with brown trout. These results demonstrate that juvenile trout stocking can produce fishable densities of catchable-size trout. Successful results, however, require careful consideration of conditions in individual streams so that correct sizes and numbers of fish are stocked into appropriate available habitat.

E) Angler Survey Results

Connecticut's anglers are a diverse group. They range from the "Opening Day/early-spring-only" angler who seeks to harvest a few trout without having to make a large investment in the sport, to the fly fishing purest who fishes year-round and invests large amounts of time and money into trout fishing. Despite this wide range of interest and participation, opinion surveys have shown that most trout anglers rank time spent outdoors in pleasant surroundings, camaraderie with fellow anglers, catching trout, and opportunities to catch large trout as being most important. Harvesting and eating fish are important to many anglers, however some anglers prefer to release most or all of their fish.

The vast majority of stream trout fisheries in Connecticut are harvest-oriented, and are of short duration in the spring. In Connecticut, 13.3% of spring-time trout fishing effort and 20% of total trout catch occurs on Opening Day. Opening Day and the first two weeks account for 61% of the effort and 58% of the catch. The popularity of fishing during this time period is due primarily

to the fact that 60% of adult fish (and 100% of yearling brook trout) have been released. There are more catchable-size trout in the streams than at any other time, and most of these streams are open to legal harvest. Catch rates of trout during the first 2 weeks of the season, and during the first 4 days after in-season stockings were higher than at other times during the spring. Studies of the removal rate of stocked fish (Butler and Borgenson 1965, Thorpe 1944) have shown that in put-and-take fisheries, a high percentage of stocked fish are removed during the first four days of the season, or the first 4 days after in-season stocking. Consequently, in many streams open to harvest, fishing effort declines as stocked fish are depleted and catch rates drop. Additional stocking of adult fish later in the spring helps maintain high catch rates and extends the period of high angler use.

Connecticut anglers will continue to fish as long as stocked trout are present in adequate numbers. In addition to the peak trout fishing activity during the first few weeks of the regular season, pre-season, summer, and fall trout fishing is popular in waters having abundant trout populations. During March and early April, when most streams are closed to fishing, 24,000 hours of catch-and-release angling occur on the State's 10 TMAs. On the Housatonic and Farmington TMAs, where fishing mortality is reduced and stocked trout survive throughout the year, fishing pressure during the summer and fall is significant. Angler surveys found 16,185 hours and 13,700 hours of effort respectively on these two rivers during the period from June 15 to September 1. This accounted for 43% of the total annual effort on the Housatonic, and 39% of the effort on the Farmington.

Catch Rates: Catch rate is an important component of trip satisfaction. Angler survey data have shown a clear relationship between angler catch rates of trout and ratings of fishing success. At a catch rate of 0.77 trout per hour, 80% of anglers surveyed on streams stocked with adult trout responded that they had average or better fishing success; whereas, at a catch rate of 0.30 trout per hour 70% of anglers rated their success as poor or terrible. Mean catch rates of trout in streams stocked with adult fish ranged from 0.28 to 1.6/hour and averaged 0.74/hour, and catch rates in streams stocked with yearling brook trout ranged from 0 to 2.47/hour and averaged 1.1/hour. Catch rates in Trout Management Areas averaged 0.5 prior to Opening Day, and 1.25 thereafter. Despite these encouraging averages, many anglers report poor fishing success. Of 961 anglers interviewed on trout streams between opening day and June 15, 51% had caught nothing. Consequently many anglers are not satisfied with their angling success. Improved angling success could increase satisfaction levels and trip quality for many unsuccessful anglers. Increasing the frequency of stocking could improve success for some anglers, and increase participation in trout fishing.

Angler Effort: Of approximately 1.1 million hours of *springtime* fishing effort on *state-stocked* streams, 83.9% is on adult-stocked streams, 13.5% is on TMAs, 2.0% is on yearling-stocked streams, and 0.6% is on Fly-Fishing-Only areas (not including Fly-Fishing-Only TMAs). Angler effort on individual Connecticut streams ranged from undetectable on most nonstocked streams, to a high of 12,122 angler hours/mile on the Salmon River Fly-Fishing-Only Area.

Most of Connecticut's best trout streams currently open to the public are heavily fished. Effort in streams managed under statewide regulations (five-fish creel limit, no gear restrictions) and stocked with adult size trout ranged from 160 to 10,483 angler hours per mile. There was a strong

positive relationship between the number of trout stocked in a given stream and the level of angling effort on that stream. Also, trout streams on State Park property attracted greater numbers of anglers and drew people from greater distances (Average one-way travel distance was 10.9 miles vs. 4.6 miles for yearling streams, and 12.7 miles vs. 6.7 miles for adult-stocked streams). Other states (e.g. Missouri) have combined frequent stocking and high stocking rates with a state park atmosphere to create "Trout Parks" which have attracted exceptionally high fishing effort (as high as 80,000 angler hours per mile annually).

The popularity and cost effectiveness of "catch-and-release" areas is well documented in Connecticut (Orciari and Phillips 1986; Orciari and Leonard 1990; Hyatt 1992; Hagstrom et al. 1996) and elsewhere (Hunt 1981, 1991; Schill 1986; Billingsley and Haase 1990; Thorn 1990; Clark and Alexander 1992). Angler surveys have shown that Connecticut's catch-and-release Trout Management Areas are heavily utilized. The West Branch Farmington River TMA is the most heavily fished section of stream in the state with annual angler effort measured at up to 12,960 hours/mile. The hours of fishing provided per trout stocked was highest in Trout Management Areas (2.8 hours per adult trout stocked), followed by Fly-Fishing-Only areas (2.0), adult stocked streams managed under statewide regulations (1.6), and streams stocked with yearling brook trout (0.5). Greater fishing per fish stocked (and higher catch rates) in TMAs was due to "recycling" of stocked trout. In Trout Management Areas each fish was caught two or more times on average as a result of catch-and-release regulations and reduced creel limits. The popularity of TMAs demonstrates that many anglers are willing to forego the opportunity to harvest fish in return for higher year-round catch rates and, in some TMAs, opportunities to catch large holdover trout.

Fishing Gear Types: Bait is the most often used gear type for fishing in Connecticut trout streams. Bait fishing accounts for 60.4% of fishing effort, while lure fishing accounts for 25.0%, and fly fishing accounts for the remaining 14.6%. Use of these gear types in not evenly distributed among seasons or fishery types. In TMAs during catch-and-release periods the vast majority of effort is *fly fishing* (74%); whereas, only 16% of effort is bait fishing, and 10% is lure fishing. This is due, in part to gear restrictions on some of these waters. Conversely, on waters open to harvest, 67% of effort is bait fishing, 27% is lure fishing, and 6% is fly fishing. These percentages suggest that harvesting trout is more important to bait anglers and less important to fly anglers, and that most bait anglers may not participate in catch-and-release fisheries. Examination of the actual harvest patterns by gear type further substantiates this conclusion. On waters open to harvest, 75% of bait anglers and 38% of fly anglers who caught fish harvested at least one fish. Conversely, 23% of bait anglers and 62% of fly anglers who caught fish released at least one fish, while 11% and 44%, respectively, released all fish caught.

Overall, bait anglers account for 62% of the catch and 78% of harvest, lure anglers account for 15% of catch and 14% of harvest, and fly anglers account for 22% of catch and 8% of harvest. In summary, bait anglers are responsible for the majority of the effort, catch, and harvest in the State's stream trout fisheries that are open to harvest (96% of stocked streams), while fly anglers comprise the majority of effort in catch-and-release fisheries.

Angler Interest in New Trout Fishing Options

Anglers often make unsolicited trout management recommendations to Fisheries Division staff. These discussions often provide information which is ancillary to quantitative creel survey data. Records of conversations are not maintained; however, four topic areas stand out among those most frequently mentioned by Connecticut anglers.

Catching larger trout appears to be important to many anglers. Each spring, many trophy fish award applications are sent in by anglers who have caught large trout (mostly surplus hatchery broodstock). Angler desire for large fish obviously contributes to the popularity of the Farmington and Housatonic TMAs, of the surplus broodstock trout and Atlantic salmon stocking programs, and of the Trophy Trout Lakes. Telephone and mail-in angler surveys conducted in Pennsylvania (Pennsylvania Fish Commission 1987), Massachusetts (Loomis 1993), Vermont (Vermont Department of Fish and Wildlife 1993), and New Hampshire (Loomis 1995), indicate that most anglers would rather catch larger fish even if it meant catching fewer fish. These data support the widely held notion that most anglers place substantially higher value on catching larger fish. Stocking a higher percentage of larger fish in a select set of streams would increase angler satisfaction.

There appears to be a growing desire for wild trout among the angling public, and an increasing demand for wild trout management, particularly from organized angler groups. Reasons provided for esteeming wild trout include physical appearance and coloration, culinary superiority, and the chance to catch a larger than average size fish. There is also a sense that wild trout are natural products of healthy stream ecosystems. Angler use of Connecticut's only wild trout management area (285 hours of fishing effort per mile) was comparable to an average yearling stocked stream (average = 245 hours/mile), but without the cost of stocking. Hence, wild trout populations can be managed at relatively low cost to provide diversity and additional fishing opportunities for Connecticut anglers.

Many organized trout anglers continue to express interest in sea-run brown trout fisheries despite the DEP's termination of the program in the mid-1970s. This program, which was active from the mid-1950s into the 1970s, produced some limited fisheries for large trout (Jones 1965, 1966). Quantitative angler survey data for these fisheries is scant, however anecdotal information indicates that there was significant utilization of these specialized seasonal fisheries. The Fisheries Division continues to receive reports of catches of large sea-run trout in the lower reaches of several Long Island Sound tributaries, and during the fall a limited number of anglers continue to fish some of these areas specifically for sea-run trout. The present fishery is apparently the product of standard hatchery trout and/or wild trout which have become migratory. Due to angler interest in these fisheries, efforts to increase numbers of sea-run brown trout in a small number of coastal streams are warranted.

Fly anglers continually express interest in expanding the number of Fly-Fishing-Only areas. The sentiment most commonly expressed is that fly-only regulations reduce hooking mortality and

thus increase trout abundance and catch rates. However, data collected in Connecticut and elsewhere do not support this conclusion (see page 18, Gear Restrictions).

Potential Management Tools for Trout Fisheries

Anglers desire many different "products" from Connecticut's trout program. Appropriate application of management tools to natural resources can, within constraints, produce many of these products. Examination of stream resources reveals that most wild and stocked trout streams in Connecticut are below carrying capacity during much of the year. This is due to a variety of reasons including harvest, insufficient spawners, and insufficient habitat for cover and spawning. As a result, there are many opportunities to improve and diversify the state's trout stream fisheries. The most effective tools for improving trout fisheries include trout culture and stocking (adjusting the number, size, species, strain, and frequency of stocking), angling regulations (length limits, creel limits, and gear restrictions), and habitat improvement. Information collected during the statewide Stream Survey has provided the database needed to develop a scientifically sound management plan that addresses all reasonable options for improving and diversifying trout stream fisheries. The Stream Survey also established baseline data and assessment methods to determine the effectiveness of different tools used in management initiatives.

1) Trout Culture and Stocking

The most effective and widely used management tool for enhancing trout fisheries is stocking catchable trout. This management tool is expensive relative to other tools (80% of the trout management budget goes to trout stocking), however virtually all of Connecticut's moderate to larger trout fisheries (including put-and-take streams *and* catch-and-release areas) are primarily or totally dependent on the stocking of catchable-size fish. Numerous stocking options are available to accomplish various trout management objectives. These include adjusting the size, numbers, species, strains, and frequency of stocking**.**

Larger trout can be grown in hatcheries and stocked to enhance angler interest, enthusiasm, and satisfaction. In addition, stocking larger trout produces a greater return-to-the-creel in that the larger the fish at the time of stocking the greater the percentage which will ultimately be caught by anglers (Butler and Borgeson 1965). However, the production capacity of a hatchery is constrained by the total weight of trout produced regardless of the size of the individual fish. Hence, increases in the size of the trout have to be balanced by concurrent reductions in the number of fish produced. Anglers typically do not favor reducing the number of trout stocked, however reducing numbers to provide larger fish in a select number of streams may be acceptable.

Numbers of fish and frequency of stocking can be adjusted to meet fishery management objectives for specific streams. For example, increasing the numbers and frequency of trout stocking will support higher and more stable catch rates (Butler and Borgeson 1965). Once again however, increases in one location have to be balanced by reductions in the number of fish and number of stockings done elsewhere since capacity for production and distribution is limited. Larger fish and/or

increased numbers can improve angling success and increase satisfaction levels and trip quality for many unsuccessful anglers and increase participation in the sport. The challenge is to balance these conflicting demands for size and numbers with available stream habitat to ensure that overall benefits are maximized.

Stocking different trout species can help achieve different management objectives. Trout species differ in their vulnerability to angling and ability to survive in Connecticut streams (Thorpe et al. 1944: Cooper 1953). In waters where maximizing short term catch rates and/or harvest is important, the greater angling vulnerability of rainbow and brook trout can be exploited. In streams, or during seasons where extended survival, growth, and holdover potential are important, brown trout should make up the bulk of the stocking allotment (Thorpe et al. 1944; Engstrom-Heg 1990).

Different strains of the same trout species also exhibit dissimilar survival rates (Borawa 1990; Alexander 1985; Flick and Webster 1964), migratory tendencies (Jonsson 1985; Moring 1978; Elliot 1994), and percent return-to-the-creel (Fay and Pardue 1986; Moring 1978; Schluntz and Bender 1993). As a result, strains, as well as species, may be selected to achieve specific fisheries management objectives. Efficient hatchery production requires the selection of strains which are disease resistant and fast growing, and hence, can be quickly raised to large size in a crowded environment. For stocking put-and-take fisheries, strains which are easier to catch and provide a greater percentage return to the creel are preferred; whereas, strains which exhibit greater long-term growth and survival are the best choice for catch-and-release and put-and-grow fisheries. Most domestic trout strains possess characteristics well suited to both hatchery production and put-and-take fisheries. Strains that retain characteristics which increase survival in the wild are often less well adapted to existence in the hatchery. Therefore, in cases where special strains are needed to improve long-term performance in the wild, hatchery constraints may dictate cutbacks in total production.

Selective breeding of holdover and wild brown trout broodstock has been used to produce hatchery reared fish which may have better potential for long term survival and growth in the wild. Trout which have been maintained in hatcheries for many generations have been shown to develop behavioral characteristics and physical traits which differ from wild fish (Vincent 1960; Moyle 1969; Bergin 1990). As a result, domestic hatchery fish typically exhibit poor survival outside of the hatchery compared to wild trout (Shetter 1944, Bachman 1984). Use of wild or specially developed strains may improve survival of stocked juveniles, and may increase the holdover rate in catch-and-release areas. Selection of the correct species and strain are critical to the success of trout management efforts which require stocking.

Stocking younger and smaller trout (fry, fingerlings or yearlings) is generally more expensive per fish harvested than stocking catchable size fish (Butler and Borgenson 1965; Pennsylvania Fish Commission 1987). This is because many trout are lost to natural mortality during the time that is required for them to grow to catchable size. However, put-and-grow stocking is beneficial in some situations. For example, small trout can be used to further enhance a stocking program in instances where hatchery production of catchable trout is at capacity while surplus small

fish can still be produced. Small trout can also be used to enhance wild trout populations in otherwise good quality streams which are lacking in spawning habitat (Engstrom-Heg 1990; Pennsylvania Fish Commission 1987).

Stocking is the most valuable fisheries management tool available for enhancing trout fishing in Connecticut. Unfortunately, however, trout stocking can negatively affect wild trout populations (Butler 1975; Thuember 1975; Vincent 1975, 1984; Kruegar and Menzel 1978). The introduction of hatchery fish typically results in an increase in fishing pressure and harvest of wild trout (Butler and Borgeson 1965; Hagstrom et al. 1996). The resulting increase in mortality can greatly reduce the abundance, size distribution, and viability of wild populations (Shetter and Hazzard 1940). Furthermore, competition with large and aggressive hatchery fish frequently causes displacement of wild trout (Bachman 1984) and a reduction in natural trout reproduction (Vincent 1987; Petrosky and Bjornn 1984). Due to these potentially adverse effects, it is important that trout stocking be done prudently in waters where the maintenance and enhancement of wild trout populations is an objective.

2) <u>Angling Regulations</u>

Regulations are some of the least expensive and most effective tools for enhancing fish populations and diversifying fisheries, however regulations are viewed negatively by some anglers because they impose restrictions on an angler's behavior and freedom. Overly restrictive, ineffective, or unnecessary regulations should always be avoided. Simple regulations with sound biological justification are most likely to be embraced and complied with by anglers.

Length limit regulations have been demonstrated to be effective in improving trout fisheries elsewhere in the United States (Clark et al. 1981; Cooper et al. 1961; Marcinko et al. 1988; Hunt 1975). In Connecticut, these management options offer promise for improvement of selected stocked and wild fisheries by restricting harvest. Responses of trout populations and fisheries to various minimum length limits have been described in detail by Clark et al. (1980). Minimum length limits protect small fish from harvest, allowing them to grow to a more desirable size and, in some cases, to reach spawning age and size. Consideration of growth rates and natural mortality is important when setting minimum lengths. Trout populations with rapid growth rates, relatively low natural mortality, and relatively high pre-regulation harvest rates respond best to minimum length limits. When reproduction is not a limiting factor, minimum length limits maximize the harvest of fish at and above the length limit. For example the greatest harvest of fish 12 inches and over is achieved with a 12 inch minimum length limit. Minimum length limits also generate higher overall catch rates due to catch-and-release and recycling of sub-legal-size fish. High minimum length limits can be very effective. They are similar to catch-and-release regulations because they virtually eliminate legal harvest (except for a few trophy size fish). Excessive hooking mortality, or lack of compliance, can diminish the positive effects of length limits. Slot length limits (where trout within a specific size range either can be harvested or are protected) are not widely used in streams. They have been tested on trout stream fisheries in other states and the results have been equivocal. Growth of trout in streams does not typically increase following reductions in density. Hence, slot

length limits are most frequently ineffective at increasing numbers of large fish (Clarke and Alexander 1984; Hunt 1991).

Creel limits are used to restrict the number of trout an angler can harvest per day. When applied without accompanying length limits, creel limits usually do not affect the long term structure of fish populations (unless the creel limit is zero) (McFadden 1961; Shetter 1969; Hunt 1975). Moderate to low creel limits (2-5 trout/day) prevent skilled anglers from harvesting excessive numbers of fish, and promote some catch-and-release fishing. As a result, the harvest is spread among more anglers, and catch rates and angler participation can be extended later into the spring (Hunt 1975).

Catch-and-release regulations, which are equivalent to a creel limit of zero or a very high minimum length limit, provide the highest level of protection to fish populations without eliminating fishing entirely. Minimizing fishing mortality by eliminating harvest produces the most natural age structure of fish populations, the greatest number of large holdover and wild fish, the highest year-round catch rates, the highest levels of angler effort, the highest effort per stocked trout, and the highest number of catch events per stocked trout (Behnke 1989; Anderson and Nehring 1984; Hunt 1981; Orciari and Leonard 1990; Clark and Alexander 1992; Carline et al. 1991). At no additional production cost, sizes and numbers of trout caught could be increased in many streams with stocked or wild fisheries by eliminating harvest. When considering implementation of catch-and-release regulations, however, the benefits must be weighed against the cost of completely eliminating an anglers freedom to harvest fish for consumption. In addition, while catch-and-release regulations have increased the amount of fishing on all Connecticut streams where applied to date, the total number of anglers willing to participate in these fisheries is unknown. Hence, expansion of catch-and-release must be done judiciously. Regulation changes should be accompanied by assessment and monitoring to ensure that management objectives are being met and to guard against a net loss in angler effort and/or participation.

Gear restrictions which dictate the type of terminal tackle that may be used are frequently applied to reduce hooking mortality of released fish. In some situations, gear restrictions can significantly reduce hooking mortality. A review of the literature reveals considerable variability from study to study (Wydoski 1977; Mongillo 1984; Schill et al. 1986; Taylor and White 1992); however, it is generally concluded that hooking mortality for flies (1-5%) and artificial lures (3-10%) is less than for bait (5-40%). Differences in mortality from barbed vs. barbless hooks, and single vs. treble hooks are less clear, with some studies finding no difference (Wydoski 1977) and others finding slightly lower mortality with barbless hooks (Taylor and White 1992).

In most trout fisheries, harvest rates are high and gear restrictions would not reduce hooking mortality of released fish enough to justify implementing such regulations (Shetter and Alexander 1962). However, in waters where harvest is eliminated via catch-and-release regulations, mortality due to the release of bait hooked fish may be significant. Still, empirical studies clearly indicate that gains in total population size and numbers of large trout resulting from the elimination of bait fishing are often small due to compensatory changes in mortality and/or emigration (i.e. when a modest

number of fish die from hooking mortality the remaining individuals are more likely to survive or stay in the area) (Carline et al. 1991; Schill 1996; McFadden 1961; Orciari and Leonard 1990; Hyatt 1992). However, in high use wild trout fisheries that rely exclusively on natural reproduction and are managed with catch-and-release regulations or length limits, reduction of hooking mortality by elimination of bait fishing (artificials-only regulation) is a valid consideration for ensuring the best possible survival, population structure, and fishery. It appears that the trout population in Connecticut's one Wild Trout Management Area has been maintained at carrying capacity under catch-and-release regulations which limit use to barbless single hook artificial lures and flies.

Fly-Fishing-Only regulations are not justified by hooking mortality considerations. Fly-only areas are very popular with some fly anglers for various sociological reasons. Due to the popularity of these areas and the tradition associated with them, the Fisheries Division has maintained seven stream sections with fly-only gear restrictions.

Seasonal closures are used either to provide protection to trout during vulnerable time periods (e.g. spawning runs, egg incubation, or in summer thermal refuges), or to provide a no-fishing period when trout can be stocked. The majority of Connecticut's trout streams are closed to fishing from March 1 through the third Saturday in April to allow time for trout to be stocked, acclimated, and spread out prior to "Opening Day". Having a closed season followed by an Opening Day ensures all anglers an equal opportunity to fish for large numbers of stocked trout and provides beginners and skilled anglers alike with a high probability of success. For some anglers, fishing on this day is a tradition. In Massachusetts, a significant decline in license sales followed elimination of Opening Day. This is a strong indication that the tradition and high catch rates associated with Opening Day are important to many anglers. Opening Day may also serve as a reminder to many anglers that they need to buy a new license.

At present only a few stream sections have specific closed seasons intended for protection of trout. The closed season on the Belding Wild Trout Management Area (Tankerhoosen River) runs from October 1 through December 31. This closure is intended primarily to prevent anglers from trampling incubating trout eggs. Thermal refuge areas on the Housatonic River TMA are closed from June 15 through August 31 to protect trout which are stressed by high water temperatures and concentrated in the inflow from cooler tributary streams. In warm summers the entire Housatonic River TMA may be closed to fishing to eliminate handling stress and minimize mortality.

Delayed harvest involves establishing a relatively dense population of stocked trout in a suitable stream and allowing anglers to catch-and-release these fish for a period of time prior to opening the area to harvest (Weirich 1985). Some of Connecticut's TMAs are managed as catch-and-release areas from September 1 through Opening Day (or from March 1 through Opening Day), and are open to harvest during the remainder of the regular season. This seasonal regulation provides fishing opportunities for stocked trout when most other waters are closed or have few trout left in them, and also provides harvest opportunities during most of the regular trout fishing season. This type of regulation encourages the harvest of trout prior to periods of high natural mortality (summer).

3) <u>Habitat Restoration and Enhancement</u>

Most of Connecticut's streams have been impacted by non-point source pollution. In addition, rivers and brooks have been negatively impacted by development in riparian zones. As a result, there are many streams where trout fisheries might benefit from implementation of habitat improvement techniques. Habitat restoration and enhancement have been demonstrated to be effective in improving trout fisheries elsewhere in the United States (Hunt 1988). Many traditional habitat improvement techniques focus on creation of cover and deep water for adult trout (White and Brynildson 1967). Connecticut Stream Survey data show a strong relationship between carrying capacity for adult brown trout, and quantity of deep water with cover. These findings suggest that trout populations in many Connecticut streams impaired by loss of deep water and cover, would benefit from traditional habitat improvement. Unfortunately, instream habitat alteration and the proper construction and placement of stream improvement structures, are expensive and labor intensive efforts (Hunt 1987; Seehorn 1985). Hence, it is not practical or cost effective for Fisheries Management staff to fund and perform these tasks. Fortunately, several angler groups have expressed a strong desire to provide volunteer labor for improvement projects. Funding is sometimes available from other sources, and Fisheries staff with specialized skills in habitat improvement can provide technical assistance. As a result, some limited habitat improvement work is possible.

In recent years, water quality and habitat have become more suitable for trout in some streams and conditions in other streams are likely to improve in the near future. Recommendations regarding buffer zones to protect riparian habitat and water quality have been disseminated to town planners, and riparian protection and conservation measures are being implemented on a wider scale than ever before. Water quality, and habitat quality and quantity are improving in many historically degraded streams due to sewage treatment plant upgrades, point and non-point source pollution abatement programs, and habitat enhancement projects. As a result of this wide array of habitat restoration and enhancement activity, opportunities for trout management are increasing. By monitoring fish populations and habitat in streams where improvements are anticipated, the Fisheries Division can expand trout fishing opportunities.

Data collected during the Statewide Stream Survey and other routine fisheries investigations provides baseline information which is useful to individuals and organizations working to conserve Connecticut’s stream resources. Stream habitat conservation and/or enhancement efforts can be enhanced by having fisheries data available via print and/or electronic media.

Summary of Key Findings

- Trout fishing in Connecticut accounts for 2.1 million fishing trips annually or 54% of the State's freshwater trips. Approximately 1.4 million of these trips are to Connecticut's rivers and steams.

- Trout fishing in Connecticut is primarily sustained by the stocking of 500,000 catchable size fish raised by the DEP at Quinebaug Valley and Burlington State Trout Hatcheries. These hatcheries are at full capacity.

- Bait fishing accounts for 60% of the total fishing effort on Connecticut trout streams; lure fishing accounts for 25%, and fly fishing accounts for the remaining 15%.

- Opening Day accounts for 13% of springtime trout fishing effort and 20% of total trout catch. During the first two weeks of the trout season 61% of the effort and 58% of the catch occurs.

- Brook and rainbow trout are easier to catch than brown trout and they are less tolerant of warm water. Brown trout are more difficult to catch and have a higher tolerance of warm water.

- The hours of fishing provided per trout stocked is highest in special management areas: Trout Management Areas (2.8 hours per trout stocked); Fly-Fishing-Only Areas (2.0 hours); followed by areas stocked with adult trout under statewide regulations (1.6 hours); and streams stocked with yearling brook trout (0.5 hours).

- Angler surveys have shown that both put-and-take and catch-and-release trout fisheries are heavily utilized. Trout Management Areas (TMAs) provide higher year-round catch rates and larger fish whereas put-and-take fisheries enable anglers to harvest trout.

- Surveys in other states (Vermont, Massachusetts, and Pennsylvania) indicate that most anglers would rather catch larger fish even if it meant catching fewer fish.

- The Housatonic River TMA and the West Branch Farmington River TMA are among the most heavily fished rivers in Connecticut and are the only two large stream sections where significant numbers of holdover trout have been sampled. These rivers are also recognized nationally as high quality trout fisheries.

- The stocking of surplus hatchery brown trout fry, fingerlings, and yearlings into streams having standing stocks below carrying capacity, or limited potential for natural reproduction, has produced fishable densities of catchable size trout.

- Considerable interest has been expressed, by anglers, for developing a sea-run brown trout program. Seeforellen brown trout currently raised at DEP hatcheries may be well suited for

re-establishing sea-run populations. The habitat in select coastal streams is suitable to support this fishery.

- Increasing the frequency of stocking in selected stream reaches will provide more stable catch rates and has the potential to attract greater numbers of anglers.

- Wild populations of brook trout and brown trout are found in many Connecticut streams. The population of catchable size wild trout in some of these streams is adequate to support significant fisheries under catch-and-release regulations.

- Because of the small fish size (6-8 inches) and difficult nature of the fishing, pursuit of wild brook trout is of interest to a limited number of anglers. However, due to the quantity and wide distribution of the resource, potential utilization is significant.

- Wild brown trout generally live longer, grow more quickly, and reach larger sizes than brook trout. Hence, wild brown trout populations have greater potential to support large fisheries.

- Wild trout are heavily exploited in stocked waters. Up to 66% (mean = 41%) of all wild trout larger than six inches are caught during the spring in stocked streams managed under statewide trout regulations (5/day creel limit, no minimum length limit).

- Many wild brook and brown trout populations are below carrying capacity. Tools available to make use of this unused carrying capacity include stocking adult hatchery-reared trout, stocking juvenile trout, reducing or eliminating current trout stocking, restricting harvest, and improving spawning habitat.

- The popularity and cost effectiveness of catch-and-release areas is well documented in Connecticut and elsewhere. At no additional production cost, sizes and numbers of trout caught could be increased in selected streams with stocked or wild fisheries by eliminating harvest.

Summary of Key Conclusions

- Trout are the most popular gamefish sought by anglers in Connecticut. The vast majority of trout fishing in the state is put-and-take fishing supported by DEP hatcheries.

- New or expanded angling opportunities based on put-and-take management are limited by production at the hatcheries and cannot be greatly increased.

- The majority of stream trout fishing occurs from Opening Day through the first two weeks of the season.

- Trout Management Areas are very popular with anglers.

- Fly-Fishing-Only areas attract considerable angling effort; however, restricting angling to Fly-Fishing-Only is not necessary to achieve most biological or fisheries management objectives.

- There is great diversity in the type of fishing (bait, artificial lure, and fly) and strong angler support for both catch-and-release and put-and-take fisheries.

- By the creation of new programs (wild trout management, trout parks, sea-run brown trout re-establishment) and through various management measures (catch-and-release, length limits, and changing the size of fish, numbers, species, strains, and frequency of stocking) greater diversity can be provided and opportunities to catch fish can be increased.

- Many trout streams would benefit from habitat improvement.

- Rainbow and brook trout should be stocked in streams where maximizing short term catch rates and/or harvest are the management goals.

- Brown trout should be stocked in streams where extended survival, growth, and holdover potential are the management objectives.

- Stocking a higher percentage of larger fish in a select set of streams is likely to increase angler satisfaction.

- Increased frequency of stocking in certain areas such as Trout Parks or High Yield areas could improve success for some anglers, and increase participation in trout fishing.

- Wild trout in Connecticut are a significant renewable natural resource and have the potential to add quality and diversity to Connecticut's trout fisheries if carefully managed.

- Wild trout in larger, more easily fished waters, require protection from harvest in order to

maintain abundance, size distribution, and fishing quality.

- In high use wild trout fisheries that rely exclusively on natural recruitment, reduction of hooking mortality by elimination of bait fishing (artificials-only regulations) may be required to sustain wild trout populations.

- Stocking surplus juvenile trout into streams is a cost effective way to increase production of high quality catchable-size trout.

- Sea-run brown trout fisheries can be established in selected coastal streams by stocking suitable strains.

- Trout Management Areas on the Housatonic and Farmington Rivers should receive special status.

- New trout fishing opportunities have and will become available due to water quality improvements in streams that historically were unsuitable for trout fishing.

Recommendations for Action

Our approach to management of Connecticut's trout fisheries will be to optimize fisheries value by taking full advantage of each stream's natural capacity to produce and/or grow trout. This approach requires knowledge of habitat quality, water quality, wild trout population size, growth rates, potential carrying capacity, existing fisheries and angler demand. The Statewide Stream Survey database provides extensive quantitative information on trout biology and habitat in most of Connecticut's streams with significant fisheries potential, as well as current information on angler participation, attitudes, and preferences regarding many of the state's current fisheries. This database provides a strong foundation from which to build a resource-based plan of action for optimizing Connecticut's stream trout fisheries to produce the most angler benefit, and satisfy angler demand.

1) Continuation of Existing Programs: Purpose: Maintain the current level of opportunity to fish for trout in rivers and streams.

Recommendation 1: Maintain the current level of opportunity to fish for stocked trout in streams in all regions of the state.

Justification: Trout are the most popular gamefish in Connecticut. The vast majority of trout fishing in the state is put-and-take fishing supported by DEP hatcheries, which are currently at maximum production capacity. Consequently, angling opportunities based on put-and-take management, while extremely important, cannot be greatly increased.

Actions Required: Continue to plan, schedule, and coordinate the distribution of 470,000 adult and yearling-size trout into 270 rivers and streams**.**

Recommendation 2: Continue to manage seven stream sections as Fly-Fishing-Only areas (see Appendix A).

Justification: Fly-Fishing-Only regulations are implemented or maintained for purely sociological reasons. Differences in hooking mortality between flies and lures is insignificant, and data from TMAs have shown that eliminating bait fishing is not necessary to provide high quality angling. Fly-only areas foster a sense of camaraderie among fly anglers, and often attract high densities of anglers. Maintaining the existing fly-only areas is a matter of tradition. It is plausible that angler effort in some of these areas could drop if gear restrictions were lifted. There is no biological reason for restricting gear to fly fishing, and consequently little justification for implementing this regulation in new areas.

Actions Required: Maintain Fly-Fishing-Only regulations on seven stream sections.

Recommendation 3: Continue to manage five stocked stream sections (with modified regulations) as seasonal catch-and-release/delayed harvest areas.

Justification: Continuing to provide catch-and-release fishing on these streams in the fall and winter, and prior to the Opening Day of trout season in the spring, would maintain fishing opportunities for CT anglers during time periods when few other stream trout fishing opportunities are available. These streams are unable to support significant numbers of trout through the summer, and allowing harvest prior to the warm summer months will provide additional benefit to anglers before natural mortality claims these fish. A two-per-day creel limit will spread the harvest among more anglers, and extend the harvest over a longer period. A 9-inch minimum length limit will allow put-and-grow management with stocked juveniles. TMAs presently open to catch-and-release fishing in the fall and prior to the traditional Opening Day of the trout season have been popular with anglers. Partially as a result of early season catch-and-release fishing, these TMAs support greater numbers of angler hours per stocked trout.

Actions Required: Maintain existing seasonal catch-and-release periods (9/1-Opening Day) on two TMAs, and make regulation changes to expand catch-and-release periods on three TMAs (from 3/1-O.D. to 9/1-O.D). Implement regulation changes necessary to manage all of these areas with a 9 or 12 inch minimum length limit, and a two-per-day creel limit.

Recommendation 4: Maintain current year-round catch-and-release management on five stocked stream sections.

Justification: TMAs presently managed with year-round catch-and-release regulations support high catch rates and high levels of effort throughout much of the year. These TMAs also support greater numbers of angler hours per stocked trout.

Actions Required: Maintain existing year-round catch-and-release regulations on five stocked TMAs.

Recommendation 5: Continue to manage a section of the Tankerhoosen River as a Wild Trout Management Area.

Justification: Currently the Belding Wild Trout Management Area on the Tankerhoosen River is the only stream section managed specifically for wild trout. Angler use of this area is comparable to a small stocked stream, but without the cost of stocking. Statewide regulations and stocking policies are not designed to provide maximum benefit from wild trout populations. In order to sustain maximum recruitment and desirable length-frequencies under moderate or heavy fishing pressure, wild trout require additional protection from harvest. Wild trout management in this TMA allows us to increase the quantity of trout available to anglers at a time when hatchery production of adult trout is at capacity.

Actions Required: Evaluate recreational fisheries and trout populations periodically, and adjust management as necessary to achieve goals.

<u>Recommendation 6:</u> Continue to monitor streams where habitat and water quality are improving to determine if trout can be stocked. Stock trout if conditions warrant.

Justification: As a result of sewage treatment plant upgrades, and point and non-point source pollution abatement programs, water quality has improved in a number of historically degraded streams. Some of these streams have recovered to the point where they could be managed to provide trout fishing opportunities. Physical trout habitat has been improved in other streams as the result of efforts of the Fisheries Division's "Habitat Conservation and Enhancement" staff, volunteer groups, and mitigation requirements for development projects. Water quality, trout habitat, and fish population sampling are needed to assess the suitability of candidate streams for trout stocking and other management.

Actions Required: Continue to monitor habitat, water chemistry, and fish populations in streams where conditions have improved or are likely to improve in the near future, and where potential for fishery management is significant. Make assessments regarding trout stocking and other fishery management options for these streams.

<u>Expansion of Existing Programs</u>: Purpose: Increase angling opportunities and quality by expanding selected elements of the existing trout program.

<u>Recommendation 1</u>: Improve put-and-take trout fisheries by adjusting stocking density and species mix to meet site-specific objectives (such as increased return rates, higher initial catch rates, increased duration of the fishery, etc.).

Justification: Put-and-take stocking is the most effective and widely used management tool for enhancing Connecticut's trout fisheries. "Fine-tuning" this program could result in increased efficiency and significant benefit to anglers. Reallocating fish from streams or stream sections with low return rates to streams or sections with high return will increase the overall harvest efficiency and angler benefit from put-and-take stocking. Increasing stocking density with reallocated fish can generate higher catch rates and increase angler satisfaction.

Use of different trout species can help achieve different management goals. The higher angling vulnerability of rainbow and brook trout can be exploited to increase catch rates and return rates. In streams, or during seasons where extended survival, growth, and holdover potential are important, the superior survival of brown trout can be put to use. Similarly, the lower angling vulnerability of brown trout makes them the preferred species in waters where it is important to maintain fishing quality for longer periods between stockings.

Actions Required: Evaluate current put-and-take fisheries using the Stream Survey database, stocking records, access information, and any other available knowledge or data. Adjust stocking numbers and species mix as necessary to improve overall angler benefit.

Recommendation 2: Create two additional seasonal catch-and-release/delayed harvest areas.

Justification: Providing additional catch-and-release fishing in the fall and winter, and prior to the Opening Day of trout season in the spring, would increase fishing opportunities for CT anglers. These streams are unable to support significant numbers of trout through the summer, and allowing harvest prior to the warm summer months will provide additional benefit to anglers before natural mortality claims these fish. A two-per-day creel limit will spread the harvest among more anglers, and extend the harvest over a longer period. A 9-inch minimum length limit will allow put-and-grow management with stocked juveniles. TMAs presently open to catch-and-release fishing in the fall and prior to the traditional Opening Day of the trout season have been popular with anglers. Partially as a result of early season catch-and-release fishing, these TMAs support greater numbers of angler hours per stocked trout.

Actions Required: Implement new catch-and-release regulations (9/1-O. D.), a 9-inch minimum length limit, and a two-per-day creel limit on two additional streams (see Appendix A) Post signs at each area describing management objectives and regulations. Evaluate results with angler surveys and fish population surveys.

Recommendation 3: Create one additional year-round catch-and-release area.

Justification: TMAs presently managed with year-round catch-and-release regulations support greater numbers of angler hours per stocked trout. Managing an additional section of the Housatonic River as a year-round catch-and-release fishery will provide new high quality angling opportunities where anglers can fish a large stream and experience high catch rates for trout of all sizes in aesthetically pleasing surroundings. Due to PCB contamination, this area can only be managed with catch-and-release regulations if trout are stocked.

Actions Required: Implement new year-round catch-and-release regulations on the Bulls Bridge Section of the Housatonic and Tenmile rivers. Post/maintain signs at each area describing management objectives and regulations. Evaluate results with angler surveys and fish population surveys.

New Initiatives: Purpose: Increase angling opportunities and quality by adding new elements to

the trout program.

<u>Recommendation 1</u>: Develop Trophy Trout Fisheries on five to eight stream sections having suitable habitat conditions, which are distributed among all regions of the state, by stocking large trout. Reduce the creel limit to provide a more equitable distribution of fish among anglers.

Justification: Trophy Trout Fisheries will provide anglers with increased opportunities to catch highly-prized large trout. Most of CT's best trout waters are small to medium sized streams which produce few trout over 12 inches. Most larger streams do not grow significant numbers of large fish. Trophy trout fisheries can be produced in selected streams by stocking larger sized hatchery trout. Restrictive regulations can be used to maintain angling quality and to better distribute the catch.

Actions Required: Stock five to eight stream sections (see Appendix A) with up to of 15,000 larger trout (12-14 inch, and an increased allocation of surplus broodstock). Implement regulation changes required to manage three to six of these areas under a two-per-day creel limit. Maintain seasonal catch-and-release regulations on two of these stream sections that are currently TMAs. Post signs at each area describing management objectives and regulations.

<u>Recommendation 2</u>: Create Trout Parks on four to six stream/pond areas located on easily accessible DEP controlled property and distributed among all regions of the state, by increasing the frequency of stocking. Reduce the creel limit to provide a more equitable distribution of fish among anglers.

Justification: Trout Parks will provide anglers with increased opportunities to fish for and harvest recently stocked trout. Intensive management of selected trout waters on State Park property will provide more fishing opportunities with a finite amount of resources. Efficiency of stocking efforts will improve as the percent-return-of-stocked-fish increases, thus providing more angler benefit per stocked trout. The reduced creel limit will distribute the catch and harvest among more anglers, and maintain higher catch rates between stockings. Angler expectations will be met on a regular basis, and consequently satisfaction will increase. Implementation of this management option will increase the diversity of trout fishing opportunities available to Connecticut anglers.

Actions Required: Increase the stocking frequency and the percentage of rainbow trout in the species mix on four to six State Park stream\pond sites (see Appendix A) with exceptionally good public access and facilities and adequate trout habitat. Implement regulations which restrict harvest to two trout per angler at these sites. Post signs describing the management objectives and regulations. Add a section in the Angler's Guide promoting Trout Parks, and giving locations and directions. Evaluate the success in achieving management goals, and adjust management activities as necessary.

<u>Recommendation 3</u>: Create Intensive/High Yield Areas on five stream sections distributed

among all regions of the state by increasing the frequency of stocking. This will provide anglers with increased opportunities to fish for and harvest recently stocked trout. Reduce the creel limit to provide a more equitable distribution of fish among anglers.

Justification: Intensive/High Yield Areas will provide anglers with increased opportunities to fish for and harvest recently stocked trout. Intensive management of selected stream sections will provide more fishing opportunities with a finite amount of stream resources. Efficiency of stocking efforts will improve as the percent-return-of-stocked-fish increases, thus providing more angler benefit per stocked trout. The reduced creel limit will distribute the catch and harvest among more anglers, and maintain high catch rates between stockings. Angler expectations will be met on a regular basis, and consequently satisfaction will increase. Implementation of this management option will increase the diversity of trout fishing opportunities available to Connecticut anglers.

Actions Required: Increase the stocking frequency and the percentage of rainbow trout in the species mix at four stream sites with good public access and adequate trout habitat. Implement regulations which restrict harvest to two trout per angler at these sites. Post signs describing the management objectives and regulations. Add a section in the Angler's Guide promoting Intensive/High Yield areas, and giving locations and directions. Evaluate the success in achieving management goals, and adjust management activities as necessary.

Recommendation 4: Develop and implement a Wild Trout Fisheries Program including up to 17 stream sections having suitable habitat and wild trout populations by implementing site-specific regulations to control harvest. No stocking will occur in order to maximize wild trout numbers. This will provide anglers with increased opportunities to experience quality wild trout fishing.

Justification: The Statewide Stream Survey identified numerous wild brook trout and brown trout populations throughout the state, including those having the most promise for supporting wild trout fisheries. Currently only one of these (the Belding Wild Trout Management Area on the Tankerhoosen River) is managed specifically for wild trout. Angler use of this area is comparable to a small stocked stream, but without the cost of stocking. Organized trout anglers have expressed much enthusiasm about the prospects of wild trout fisheries. Statewide regulations and stocking policies are not designed to provide maximum benefit from wild trout populations. In order to sustain maximum recruitment and desirable length-frequencies under moderate or heavy fishing pressure, wild trout require additional protection from harvest. Different protective length limits and creel limits are appropriate for different species, growth rates, and objectives. Wild trout management would allow us to increase the quantity of trout available to anglers at a time when hatchery production of adult trout is at capacity.

Actions Required: Implement length limit, creel limit, and gear restriction regulations selected

to optimize wild trout fisheries on up to **17** streams (to be announced at a later date) that were identified as having the best potential for supporting significant wild trout fisheries open to the public. Promote these new Wild Trout Management Areas in the Angler's Guide, and post stream sections with appropriate signs describing management objectives and regulations. Evaluate fisheries and trout populations regularly, and adjust management as necessary to achieve goals.

Recommendation 5: Develop Wild/Put-and-Grow Trout Fisheries on up to 26 stream sections having suitable habitat and wild trout populations by implementing site-specific regulations, and by supplementally stocking fry, fingerling, and yearling trout. This will provide anglers with increased opportunities to fish for wild trout and for trout which appear to be wild.

Justification: In many trout streams recruitment of wild fish is limited or eliminated by a variety of factors including degraded spawning substrate, insufficient numbers of spawners, and reduced egg viability. Many of these streams have a great deal of unused habitat suitable for juvenile and adult trout, and favorable conditions for trout growth. By stocking juvenile brown trout in these areas it is possible to bypass poor natural recruitment and take advantage of unused trout production potential and carrying capacity. Additionally, trout that have grown in a stream from juvenile size are more brightly colored than recently stocked fish and have natural-looking fins. These wild-looking fish are more desirable to many anglers. Preliminary experimentation with fry and fingerling stocking has produced some encouraging results, and has enabled Division biologists to refine methods to maximize success. In most years, surplus fry and fingerlings are available (or can be made available) as a result of regular hatchery production procedures. Additionally, juvenile stocking and harvest restrictions may generate self-sustaining wild populations eliminating the need for further juvenile stocking.

Actions Required: Evaluate and prioritize streams for juvenile stocking. Stock excess juveniles according to prioritization. Implement length limit and creel limit regulations as appropriate to restrict harvest. Evaluate survival and growth in each stream stocked with juveniles.

Recommendation 6: Develop experimental Sea-Run Trout Fisheries in three coastal streams having suitable habitat by stocking fry, fingerling, and/or yearling Seeforellen brown trout and by protecting the young trout with minimum size limits.

Justification: Establishment of sea-run brown trout fisheries would provide anglers with new opportunities to catch a large anadromous salmonid in a stream environment. Anglers have continually expressed interest in restarting this program since it was discontinued in the 1970s. Some results of earlier studies were encouraging. Division biologists believe that these fisheries could be established with surplus Seeforellen-strain fingerlings or yearlings. Brown trout are better suited than native brook trout for the development of sea-run fisheries because they mature at older ages, live longer, and hence attain greater size (sea-return brook trout average age III+ and 12-14 inches; whereas, Seeforellen brown trout typically mature at age V+).

Actions Required: Stock surplus fall fingerling or spring yearling Seeforellen brown trout at high densities in three coastal streams. Implement 9-inch minimum length limit regulations to protect stocked juveniles. Evaluate returns, and modify procedures and regulations as necessary.

Recommendation 7: Create a new trout stream designation, Blue Ribbon Trout Waters, and apply it to streams in the state which are capable of supporting significant numbers of large holdover trout.

Justification: This designation will elevate Connecticut's best trout waters to a unique status that will help attract attention from outdoor writers and out-of-state anglers.

Actions Required: Implement changes necessary to designate the Housatonic and Farmington TMAs as Blue Ribbon Trout Waters. Continue to manage both areas under catch-and-release regulations. Post new "Blue Ribbon Waters" signs at each area describing management objectives and regulations. Apply Blue Ribbon status to other sections of these two rivers (and possibly to other streams) as new management initiatives produce good numbers of holdover trout.

Recommendation 8: Develop and implement an evaluation and assessment protocol for the trout management program which includes annual data collection and analysis, and a five-year program review.

Justification: Regular sampling of managed stream trout populations is necessary to determine long term trends, and to assess the impacts of management actions. Wild Trout Fisheries and Wild/Put-and-Grow Trout Fisheries will require frequent sampling to ensure that populations are maintained (Wild Trout) and that enhancement efforts are effective (Put-and-Grow). Also, additional information is needed for some wild trout streams. Angler survey data will need to be collected from a subset of streams managed under each of the new initiatives to ensure that fisheries objectives are being achieved. In addition to the new initiatives, many waters managed under the existing trout program require continued monitoring (ex. Housatonic River TMA, Farmington River TMA, and waters where habitat and water quality are being improved). Managing a greater number of waters as part of a more diverse program will increase the need for monitoring and assessment and the need for more formalized data collection and management procedures.

Actions Required: Prioritize streams for data collection based on information needs for current and near-future management decisions, completeness and timeliness of available data, and importance of maintaining intact time series. Schedule high priority streams for one-time or periodic sampling. Standardize data collection, data recording, data entry, error checking, quality control (QC), and quality assurance (QA) protocols by developing and distributing "Standard Operating Procedures" (SOP) manuals for regularly performed tasks.

Future Monitoring and Assessment

New programs and regulations must be evaluated. In order to determine the effectiveness of this Trout Management Plan, and to get feedback for improvements and modifications, we will use the following evaluation methods: 1) on-site angler surveys to determine fishing effort, catch, and catch rate, 2) sampling of trout populations to determine growth, abundance, and survival of wild and stocked trout, and 3) determination of public acceptance/approval of the new programs. The methods used and the amount of time required for evaluation will differ for each of the proposed trout management recommendations. In addition, anglers will require time to become aware of and accustomed to regulation changes.

Trout Parks, Intensive/High Yield Areas, Seasonal Catch-and-Release/Delayed Harvest, and Trophy Trout Areas can all be evaluated by doing on-site angler surveys within three years of implementation (provided personnel are available). In these programs, changes in trout stocking result in "instant" changes to the numbers and sizes of trout available to anglers. These changes should be reflected in the recreational fisheries almost immediately. Year-round Catch-and-Release, Wild Trout, and Wild/Put-and-Grow areas can only be assessed from angler surveys and stream sampling done at least three years after management changes are made. In these areas changes in growth or survival may not stabilize until 3-5 years after implementation. Long-term acceptance/approval of areas by anglers can be assessed only after several years.

Angler Surveys:

Roving angler surveys will provide information on angler use, catch, and catch rates. Methods used will be as described in Hagstrom et al. (1996). On streams where angler surveys were not done prior to regulation changes, fishing effort can be accurately estimated based on the number of fish stocked (Hagstrom et al. 1996 showed that number stocked and fishing effort were highly correlated (r^2=74)). This will enable us to evaluate changes in angler usage for areas where prior surveys were not done. Angler survey data will also be used to adjust stocking frequencies, densities, and species mixes as necessary to achieve objectives.

Biological Sampling:

Trout populations will be evaluated by electrofishing as per procedures described in Hagstrom et al. (1996) or Hagstrom et al. (1997). Data on growth, survival, and abundance will be used to quantify the affects of management changes on populations of wild or stocked trout.

Determination of Public Acceptance of New Regulations:

Prior to making regulation changes, public input will be solicited at meetings of organized fishing clubs and through public informational meetings. Following public comment, our recommendations will be reevaluated. Proposed regulations will then be developed and subject to a public regulation hearing. Following implementation, it is important to determine if anglers feel

that their angling opportunities have been increased and their fishing experiences have been improved as a result of the management changes. Anglers will be interviewed during roving angler surveys at various sites to provide this information. Public sentiment will also be assessed informally based on feedback from typical day-to-day public interaction.

IMPLEMENTATION SCHEDULE

1999 Complete data collection on streams proposed for regulation changes. This will be the pre-regulation change population information used in evaluations.

2000 Draft regulations to implement recommendations, and hold a public hearing.

2001 Implement new regulation changes. Prioritize streams for data collection.

2001-2004 Conduct **angler surveys** on selected fisheries, as resources permit as per methodology used on statewide stream survey (Hagstrom et al. 1996):

- ♦ Put-and-Take fisheries which have been altered
- ♦ Trophy Trout Waters
- ♦ Trout Parks
- ♦ Seasonal Catch-and-Release/Delayed Harvest Areas.

Determine angler utilization and satisfaction over a 3 year period.

Begin stocking fry, fingerlings, or yearlings in Wild/Put-and-Grow Trout Waters.

2001-2006 **Sample trout populations** in selected waters as resources permit as per electrofishing procedures used in Hagstrom et al. (1996) or Hagstrom et al. (1997):

- ♦ New Year-Round TMA on the Housatonic River
- ♦ Wild Trout Waters
- ♦ Wild/Put-and-Grow Trout Waters
- ♦ Sea-Run Brown Trout Waters
- ♦ Evaluate wild trout populations in other waters.

2004 Review data and evaluate effectiveness of Trout Park Waters, Trophy Trout Waters, and modifications to Put-and-Take fisheries. Determine if objectives are being met and make recommendations.

2005-2007 Review data and evaluate effectiveness of regulations in Wild Trout Waters and Wild/Put-and-Grow Trout Water. Determine if objectives are being met and make recommendations.

2007 Evaluate supply and demand for trout fishing in Connecticut. Recommend appropriate changes or additions to the trout program.

Estimated Additional Annual Resources Needed to Implement Recommendations in the Trout Management Plan

1. Continuation of Existing Programs: Resources are needed to implement a new trout distribution program. This is necessary to replace labor, local stream knowledge, and logistical support previously provided by the Law Enforcement Division.

	New Personnel	Operations & Equipment
Fish Distribution Expenses:		
Personnel: Resource Technicians (2)	$83,000	
Seasonal Workers (3 month)(4)	$16,000	
Operating & Equipment*		$35,000
Fish Culture Expenses:		
Annual 3% inflation (personnel & operating):		$35,000
Fish Management Expenses:		
Annual 3% inflation (personnel & operating):		$15,000
	$99,000	$85,000
TOTAL (New Personnel + Operating)	**$184,000**	

*Operating & Equipment includes: 12 month lease of 4 PU trucks, gasoline; raingear, supplies, communications-10 cell phones & 6 GPS units.

2. Expansion of Existing Programs: Resources are needed to assess trout stocking and regulation changes for three new management areas and to assess changes to put-and-take trout program. Accurate assessment requires that trout populations and/or fisheries be monitored.

	New Personnel	Operations & Equipment
Fish Management Expenses:		
Personnel: Seasonal Resource Assistants (2)	$14,000	
Operating & Equipment		Minimal
	$14,000	Minimal
TOTAL (New Personnel + Operating)	**$14,000**	

3. New Initiatives: Resources are needed to assess trout stocking and regulation changes for more than 65 stream sections. Accurate assessment requires that trout populations and/or fisheries be monitored.

		New Personnel		Operations & Equipment
Fish Management Expenses:				
Personnel:	Biologist I (Sea Run)	$52,000		
	Resource Technicians (2)	$83,000		
	Seasonal Resource Assistants (2)	$14,000		
Operating & Equipment				$32,000
		$149,000		$32,000
TOTAL (New Personnel + Operating)			**$181,000**	

Summary of Resource Needs

	New Personnel	Operations & Equipment	Total
1. Continuation	$99,000	$85,000	$184,000
2. Expansion	$14,000		$14,000
3. New Initiatives	$149,000	$32,000	$181,000
Totals	**$262,000**	**$117,000**	**$379,000**

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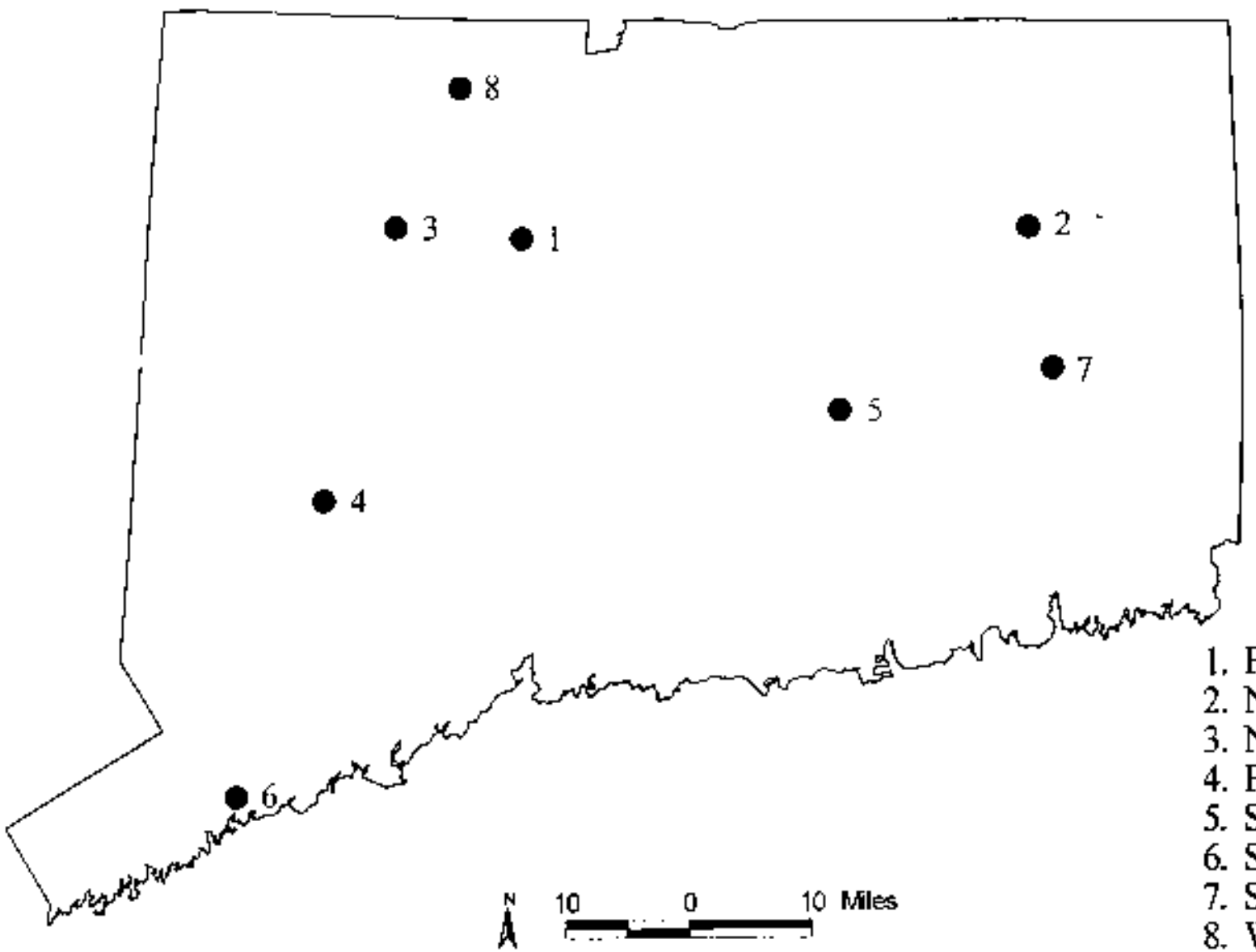
Appendix A: The Streams

Appendix B: Maps

B-1

PROPOSED TROPHY TROUT WATERS

DRAFT



1. Farmington River
2. Natchaug River
3. Naugatuck River
4. Pomperaug River
5. Salmon River
6. Saugatuck River
7. Shetucket River
8. W. Br. Farmington River

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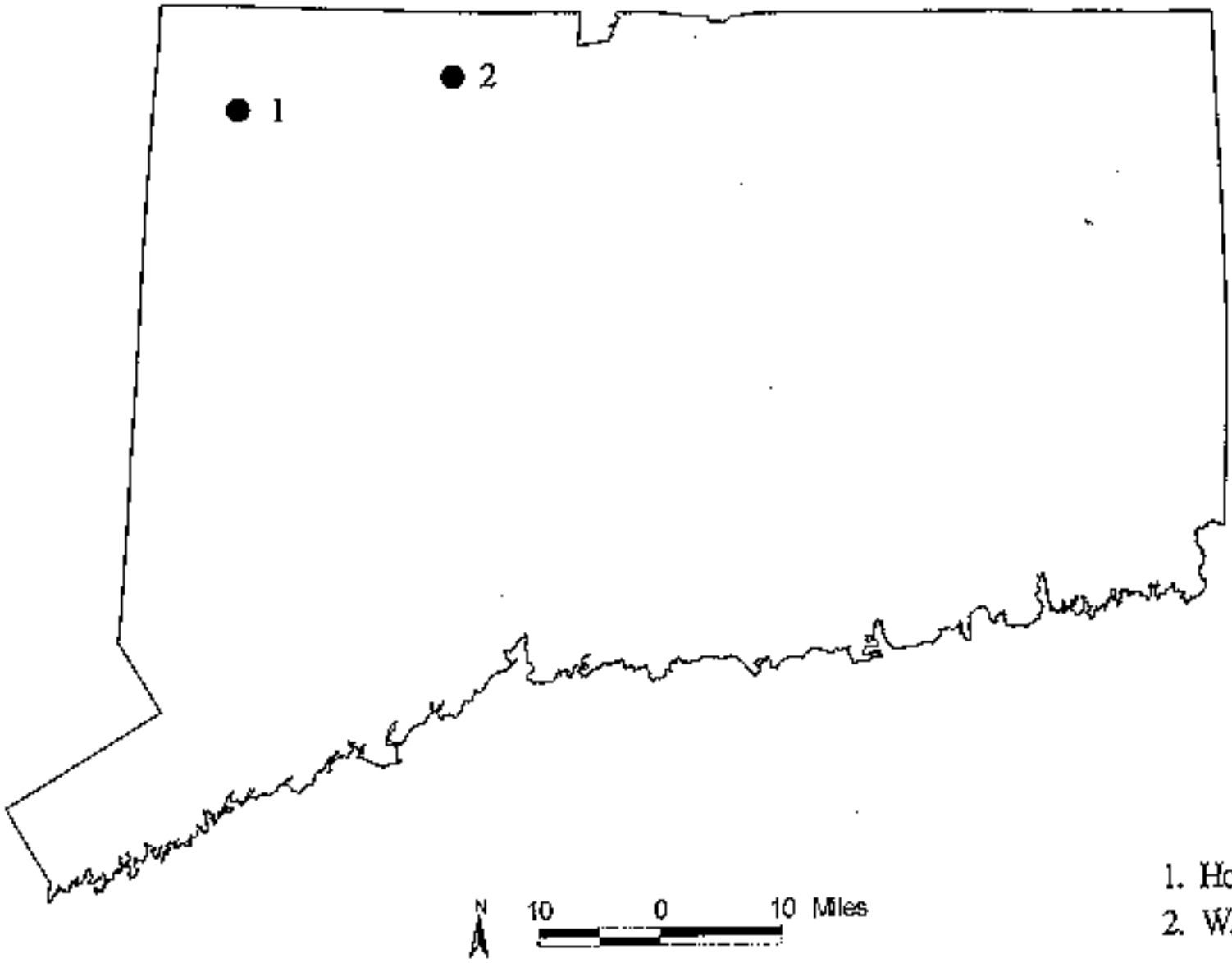
PROPOSED BLUE RIBBON TROUT WATERS



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1. Housatonic River; TMA
2. W. Br. Farmingtn River; TMA

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PROPOSED YEAR-ROUND CATCH-AND-RELEASE TROUT WATERS

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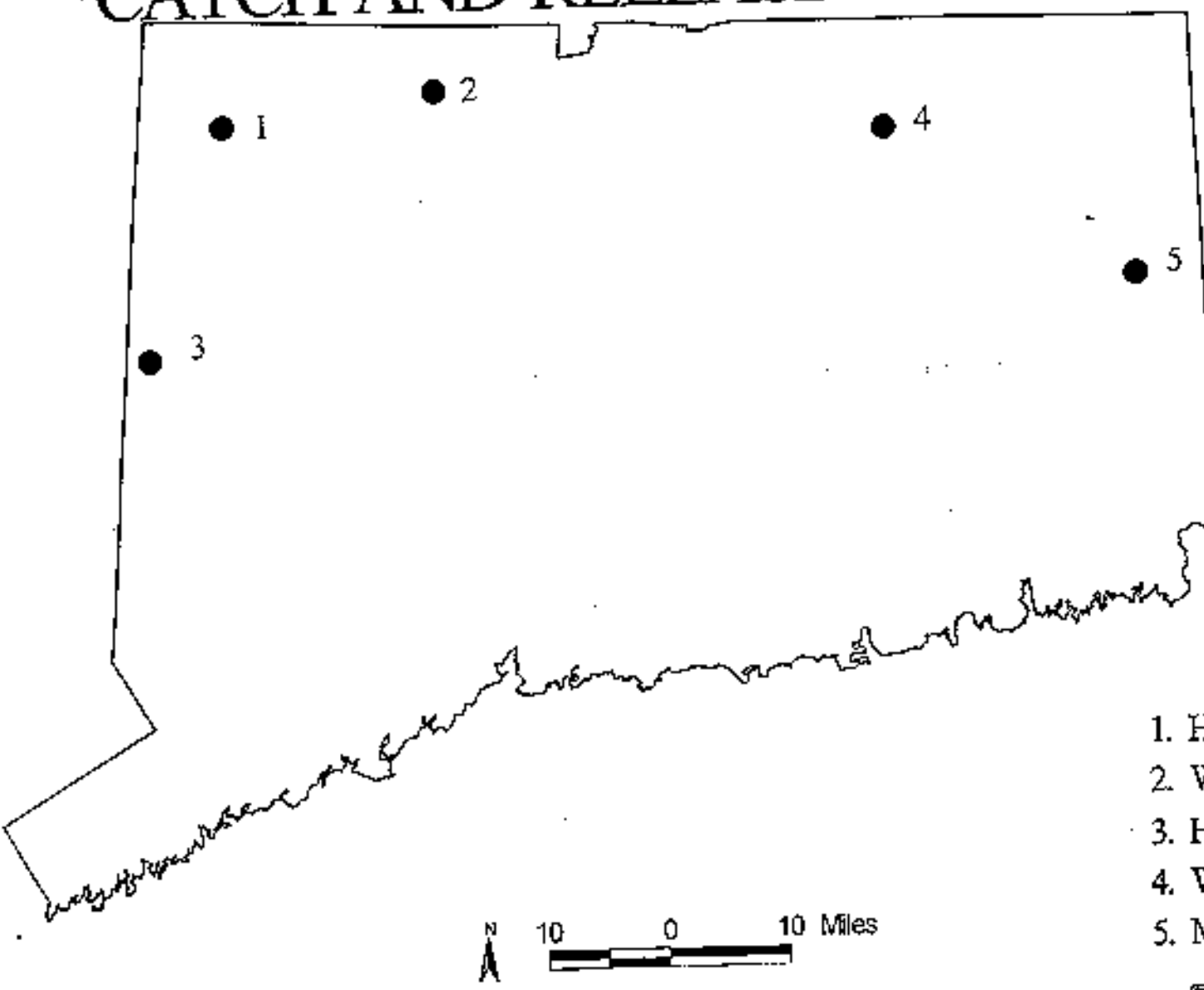

1. Housatonic River; TMA
2. W. Br. Farmington River; TMA
3. Housatonic River/Ten Mile River
4. Willimantic River TMA
5. Moosup River TMA

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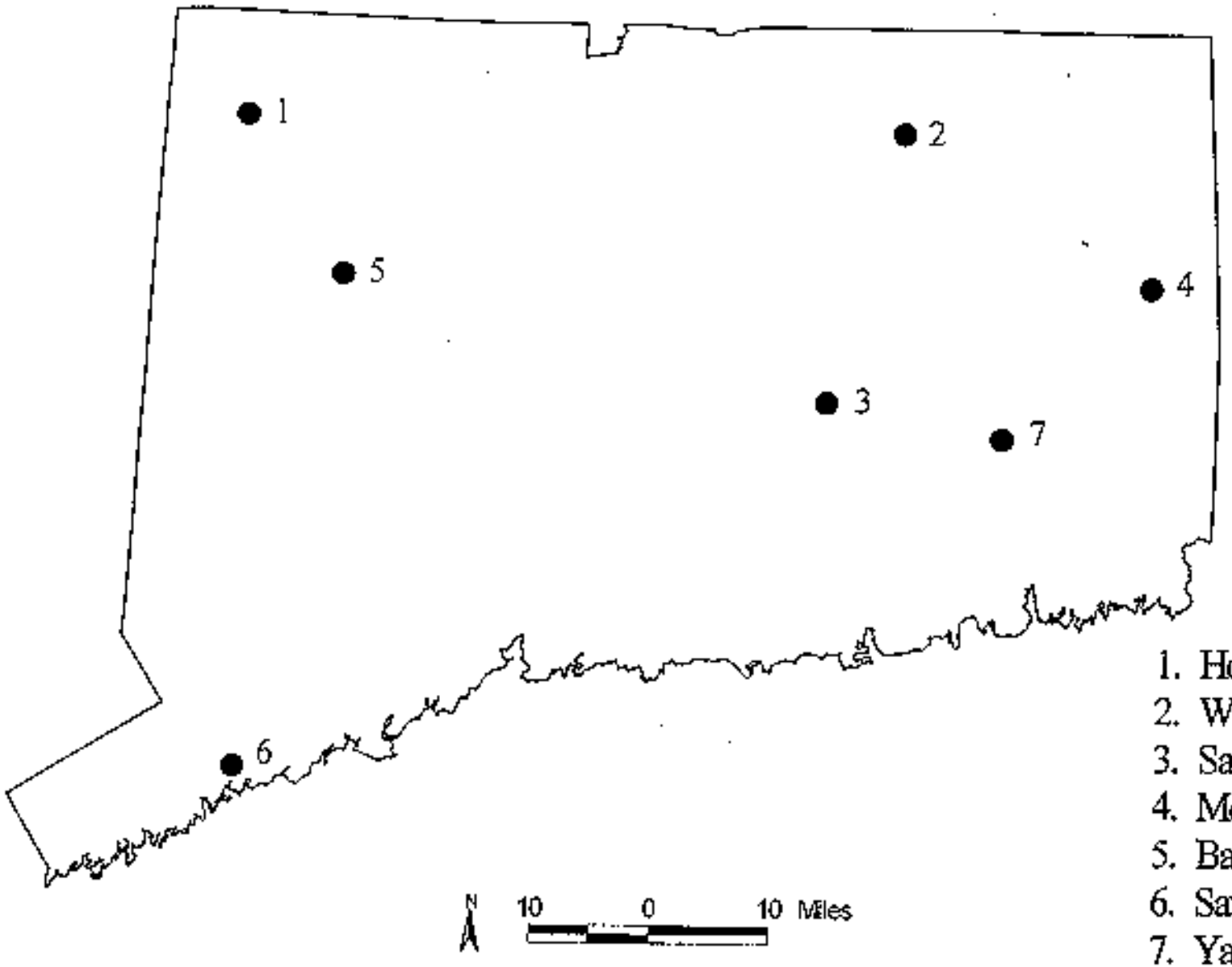
EXISTING FLY-FISHING-ONLY WATERS



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1. Housatonic River FFO
2. Willimantic River TMA
3. Salmon River FFO
4. Moosup River FFO
5. Bantam River FFO
6. Saugatuck River FFO
7. Yantic River FFO

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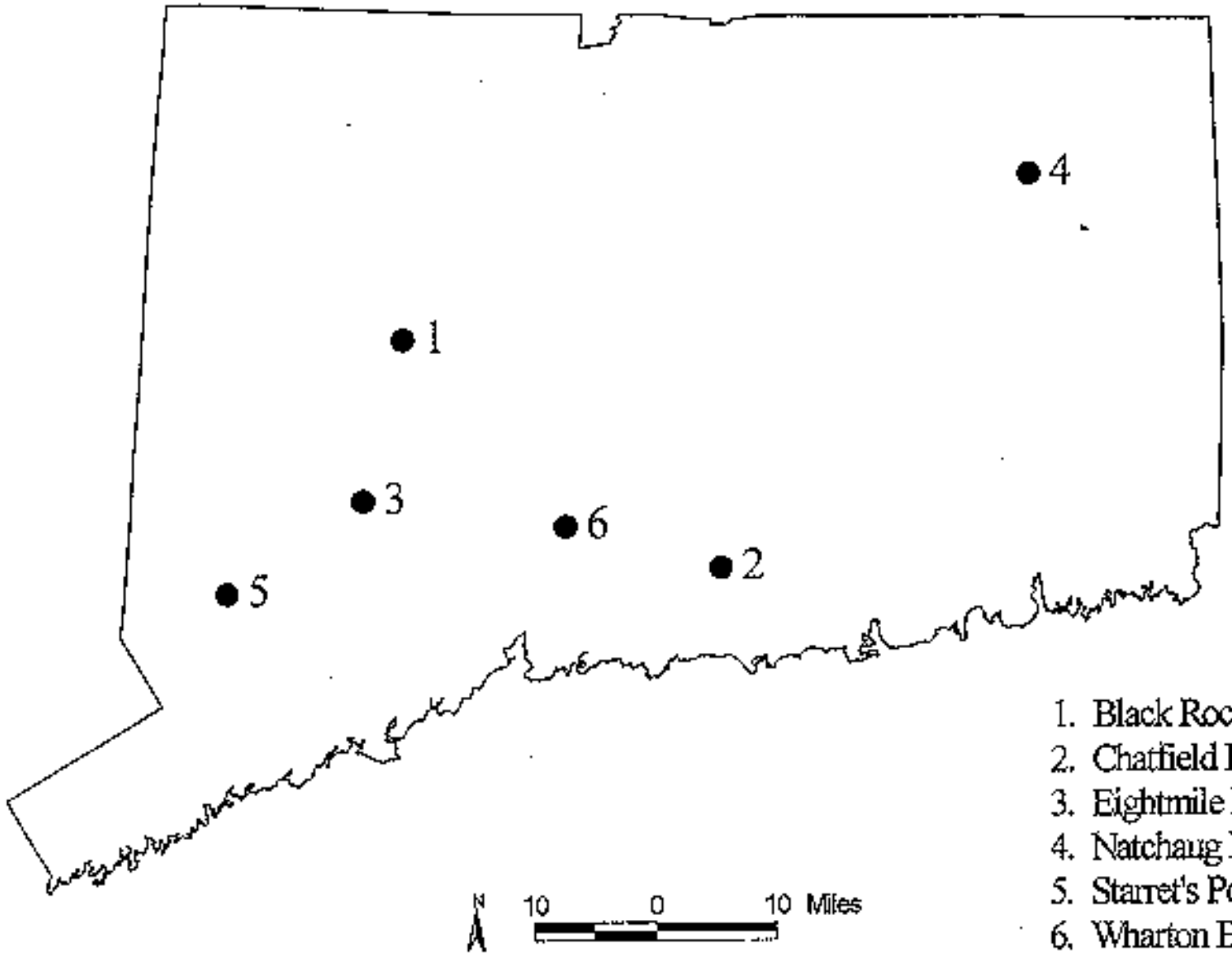
PROPOSED TROUT PARK WATERS



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1. Black Rock Pond
2. Chatfield Hollow Brook & Ponds
3. Eightmile Brook & Papermill Pond
4. Natchaug River
5. Starret's Pond
6. Wharton Brook State Park Pond

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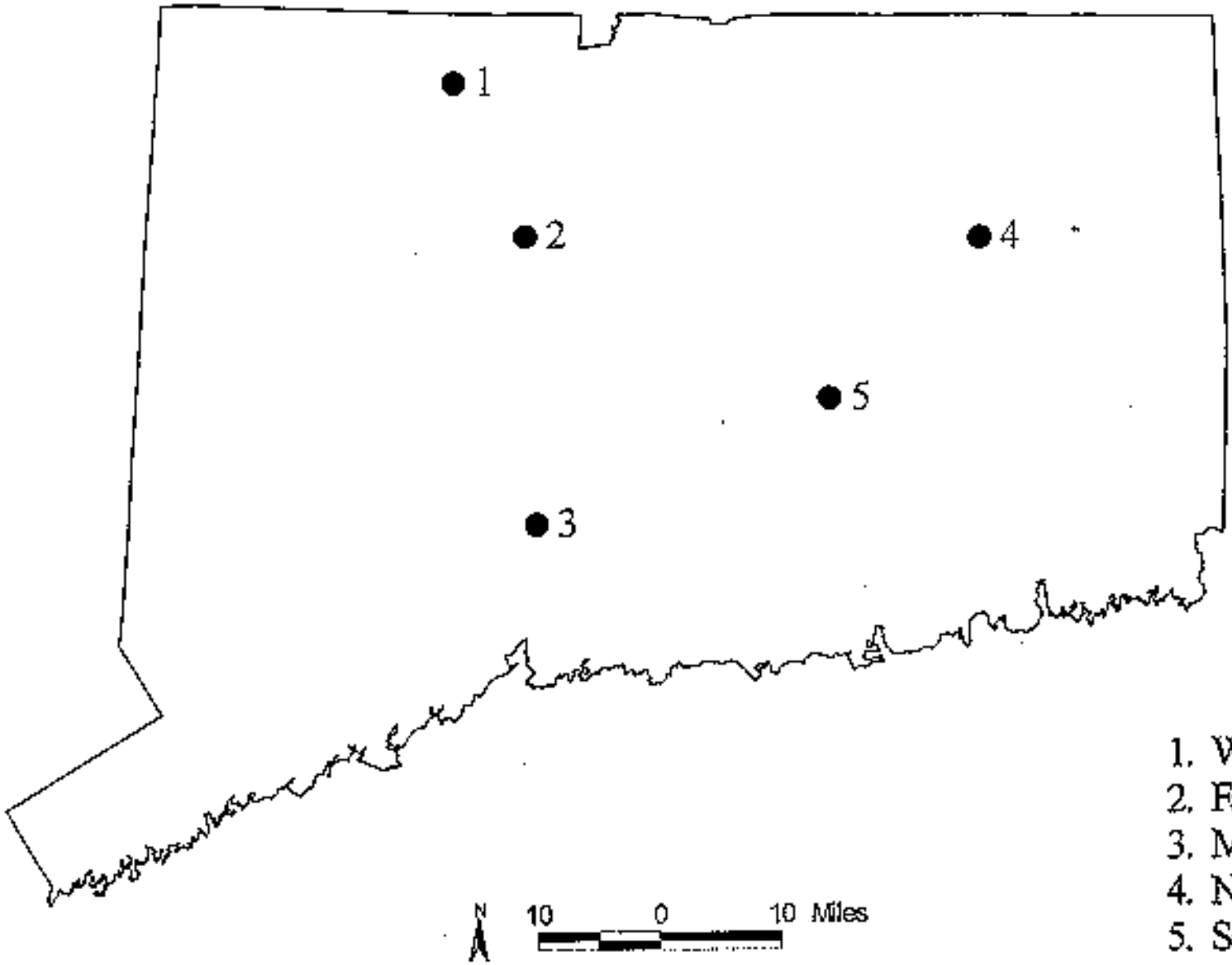
PROPOSED INTENSIVE/HIGH YIELD AREAS



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1. W. Br. Farmington River
2. Farmington River
3. Mill River
4. Natchaug River
5. Salmon River

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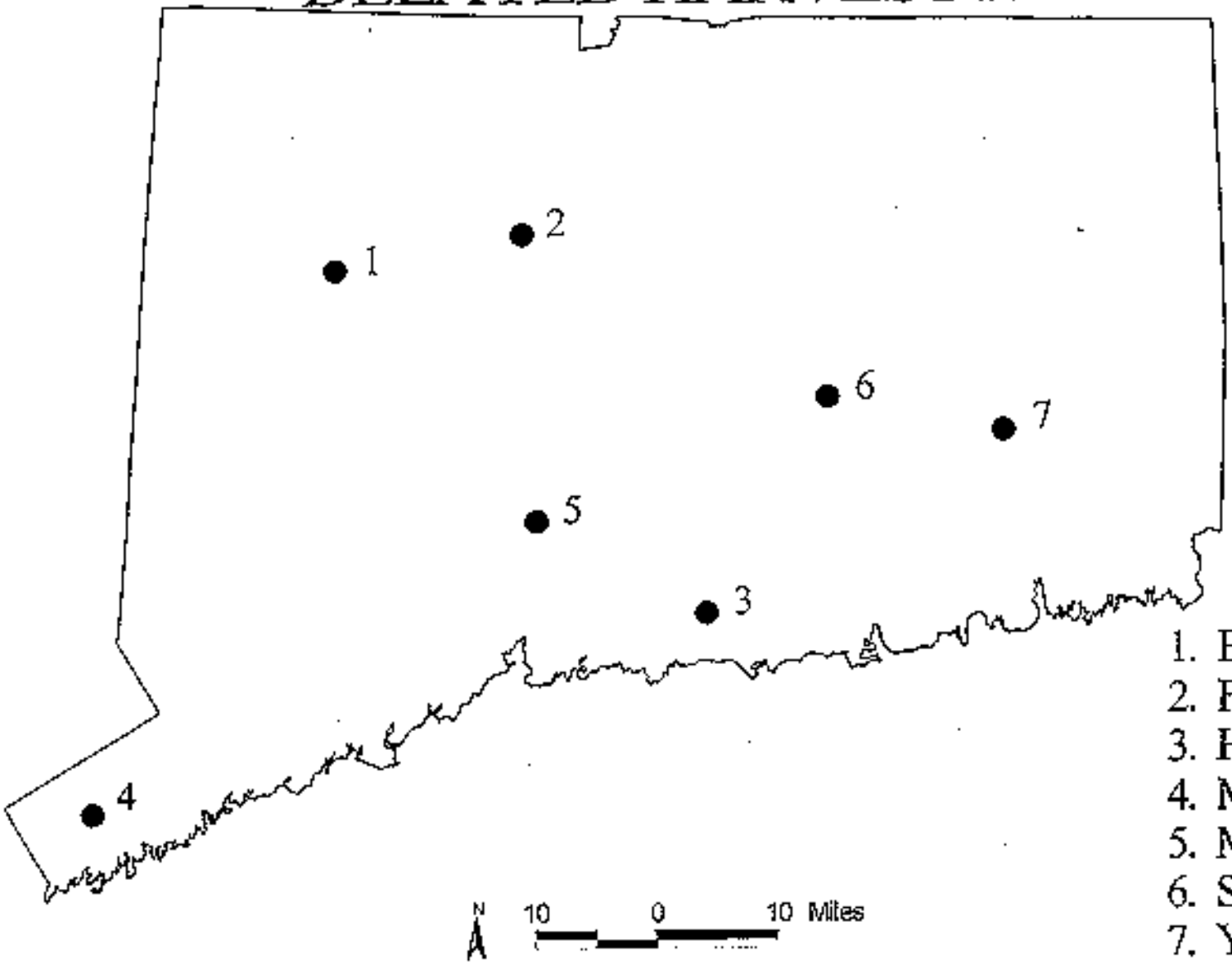
PROPOSED SEASONAL CATCH-AND-RELEASE DELAYED HARVEST AREAS



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1. Bantam River
2. Farmington River
3. Hammonasset River
4. Mianus River
5. Mill River
6. Salmon River
7. Yantic River

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PROPOSED SEA-RUN TROUT WATERS

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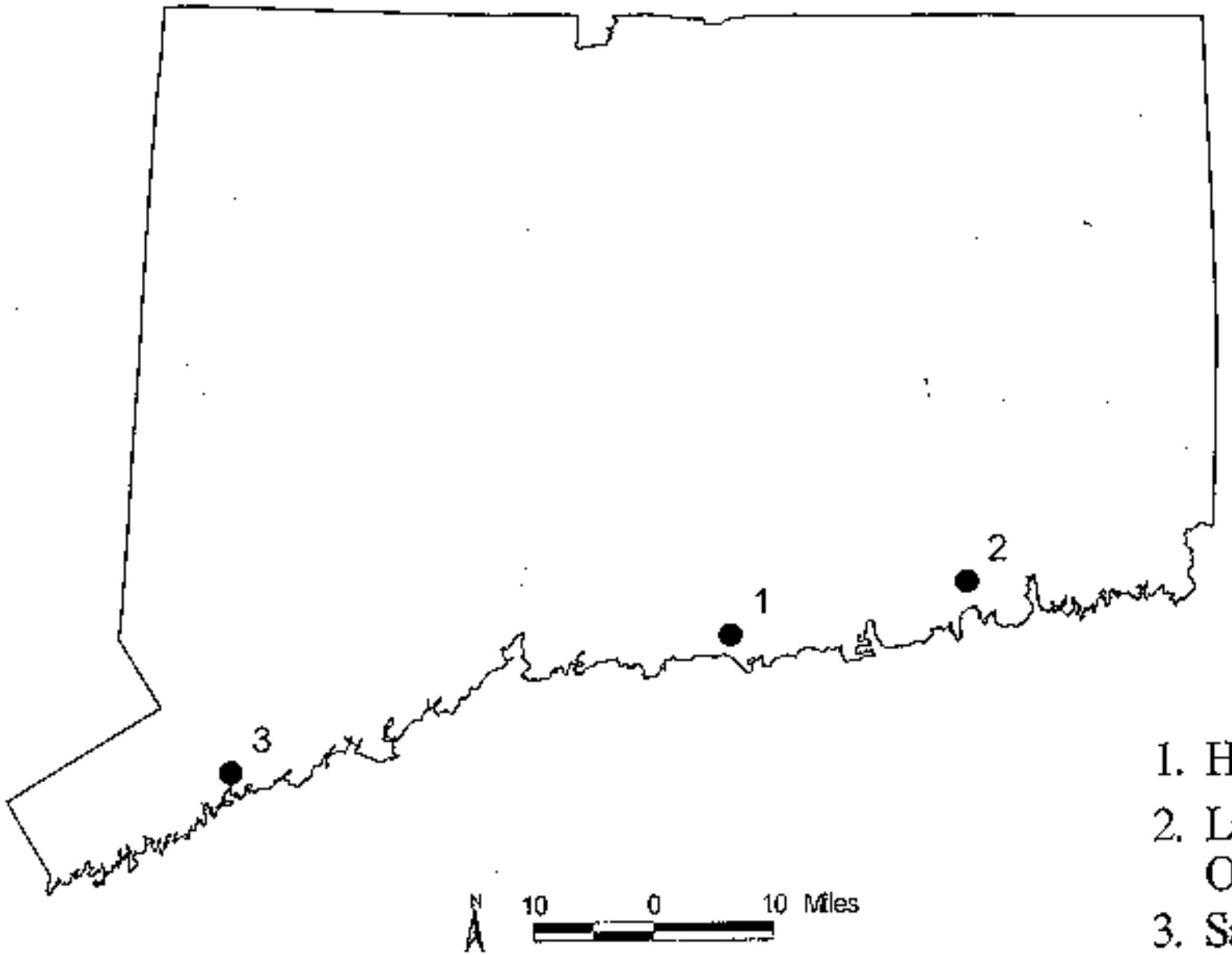

1. Hammonasset River
2. Latimer's Brook and Oil Mill Brook
3. Saugatuck River

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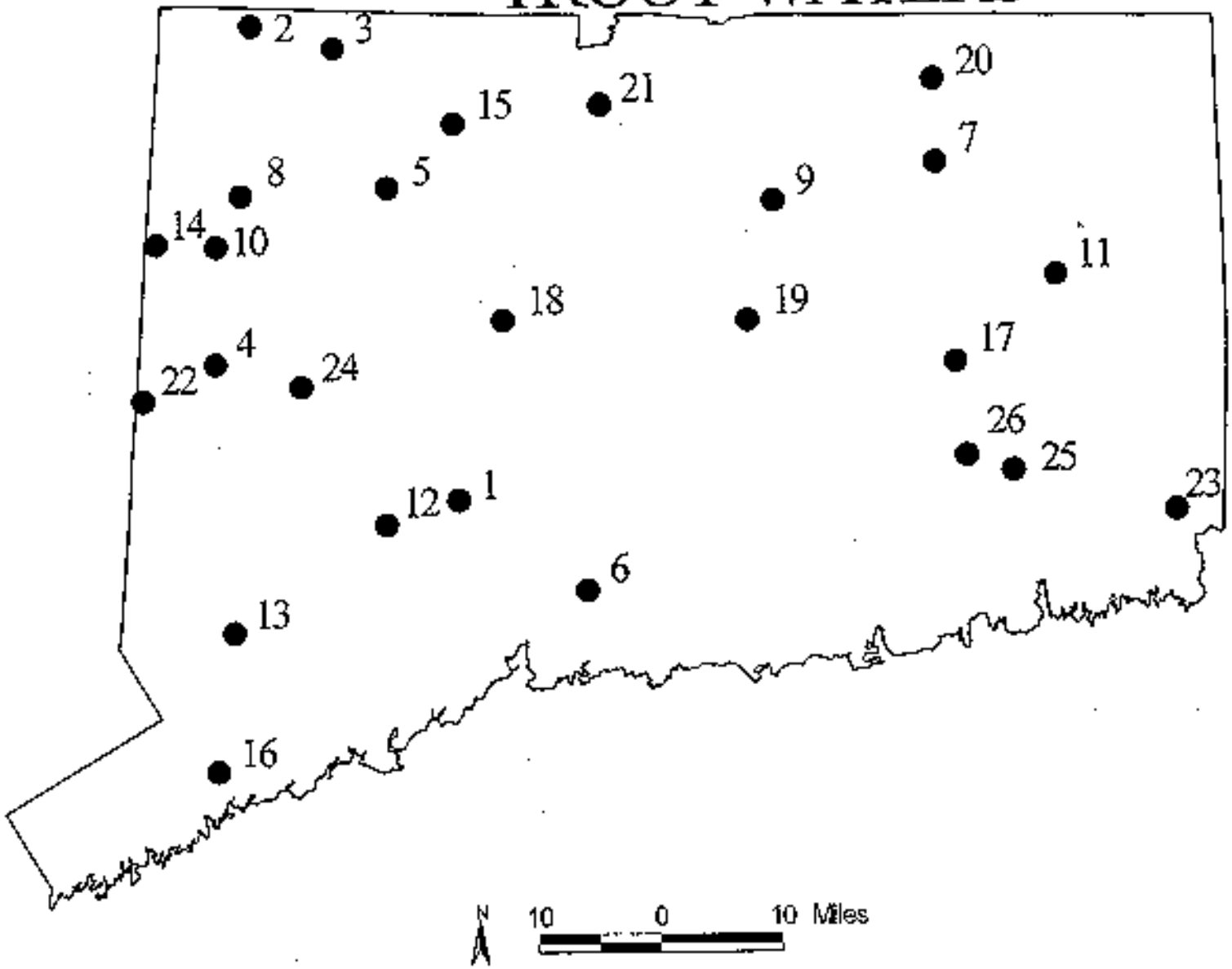
PROPOSED WILD/PUT-AND-GROW TROUT WATERS



1. Beacon Hill Brook
2. Blackberry River
3. Blackberry River
4. East Aspetuck River
5. E. Br. Naugatuck River
6. Farm River
7. Farmington River
8. Furnace Brook
9. Hockanum River & Lower Tankerhoosen River
10. Kent Falls Brook
11. Little River
12. Little River
13. Little River
14. Macedonia Brook
15. Morgan Brook
16. Norwalk River
17. Pease Brook
18. Pequabuck River/ Coppermine Brook, Roaring Brook
19. Roaring Brook
20. Roaring Brook
21. E. Br. Salmon Brook
22. Sawmill Brook
23. Shunock River
24. Sprain Brook
25. Stony Brook
26. Trading Cove Brook

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