Aquatic Resources

Waterbodies and Watercourses

The following is a listing of named waterbodies and watercourses within the Town of Cornwall. The list was developed from review of the U.S. Geological Survey topographic maps for the Cornwall Quadrangle (photorevised 1984), Ellsworth Quadrangle (photorevised 1969), and South Canaan Quadrangle (photorevised 1969).

Waterbodies

Cream Hill Lake
Hart Pond
Hawkins Pond
Mohawk Pond
Stony Batter Pond

Watercourses

Adams Brook
Baldwin Brook
Birdseye Brook
Bloody Brook
Bonney Brook
Clark Brook
Deep Brook
Furnace Brook
Gunn Brook
Heffers Brook
Hollenbeck River
Housatonic River
Ivy Brook
Mill Brook
Millard Brook
Ocain Brook
Preston Brook
Reed Brook
Shepuag River
Spruce Brook
Tanner Brook
Valley Brook

A search of the Inland Fisheries Division (the "Division") lake, pond, and stream databases found fish survey records for the following:

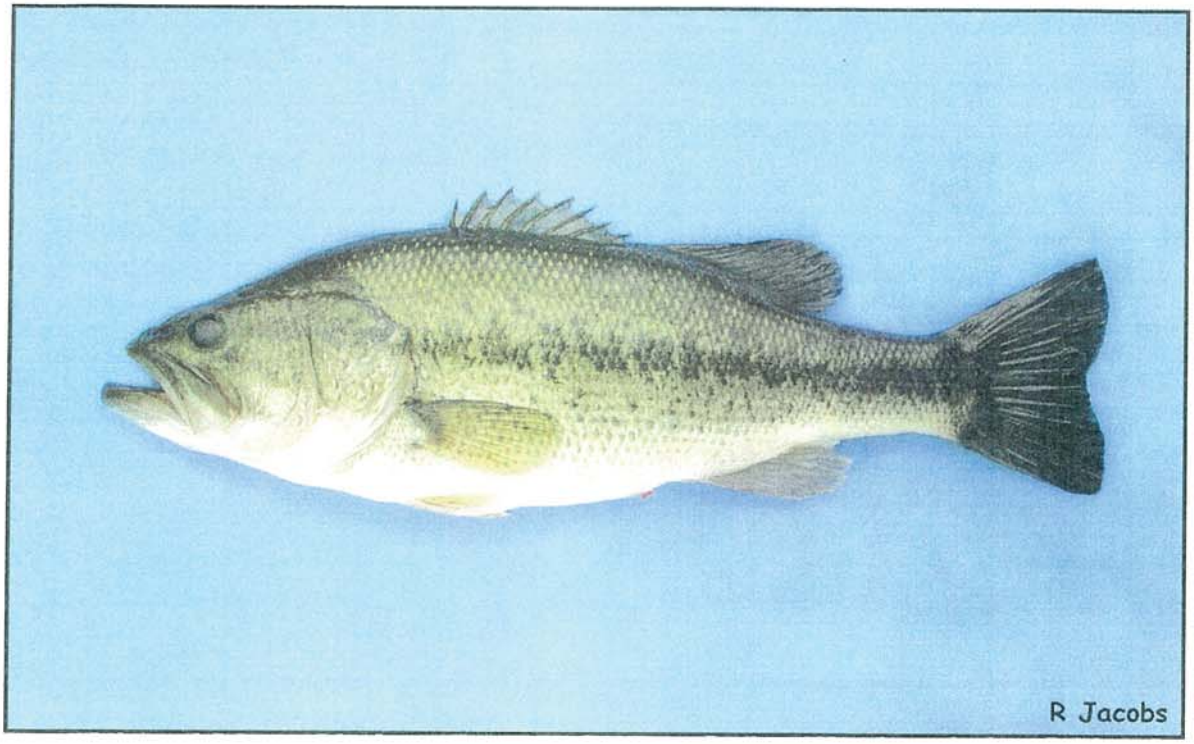
Waterbodies

Cream Hill Lake is natural in origin with the water level raised slightly by a low earthen and masonry dam. The lake has a surface area of 72 acres. Habitat and fish surveys were conducted on Cream Hill Lake by the Connecticut State Board of Fisheries and Game-Lake and Pond Survey Unit during the late 1950's. Those surveys reported the lake to have a maximum depth of 43 feet and an average depth of 15.7 feet. The lake bottom was composed of coarse boulders with dense beds of aquatic vegetation in shoal areas. At that time, as it is now, shoreline development was slight. Attached is a bathymetric map of Cream Hill Lake produced by the Connecticut State Board of Fisheries and Game-Lake and Pond Survey Unit.

Cream Hill Lake has been stocked with brook trout, brown trout, rainbow trout, largemouth bass, smallmouth bass, black crappie, chain pickerel, yellow perch, sunfish and bullhead. When surveyed by the Connecticut State Board of Fisheries and Game-Lake and Pond Survey Unit, Cream Hill Lake was found to contain a fish population composed of largemouth bass, smallmouth bass, red breast sunfish, and yellow perch. Trout were collected in the size class stocked but there were no apparent holdover-sized fish.

Statewide angling regulations for lakes and ponds apply for all species (current regulations follow).

Mohawk Pond is natural kettle pond located entirely within the Mohawk State Forest. The lake has a surface area of 16.2 acres. Habitat and fish surveys were conducted at Mohawk Pond by the Division on a number of occasions in the 1990's. Those surveys reported the pond to have a maximum depth of 26 feet and an average depth of 15 feet.



Largemouth Bass

The lake bottom was composed of coarse rubble, boulders and mud. Dense beds of emergent and submergent aquatic vegetation grow along the western and southern shores. Except for a YMCA summer camp on the northern shore, the shoreline is mostly wooded. The western shore is a wetland. Attached is a bathymetric map of Mohawk Pond produced by the Division.

The Division stocks Mohawk Pond during the spring and fall with 3,400 catchable size brook, brown and rainbow trout. Holdover trout are rare due to limited summer habitat and high fishing pressure. Largemouth bass, bluegill, white sucker, and creek chubsucker are also present.

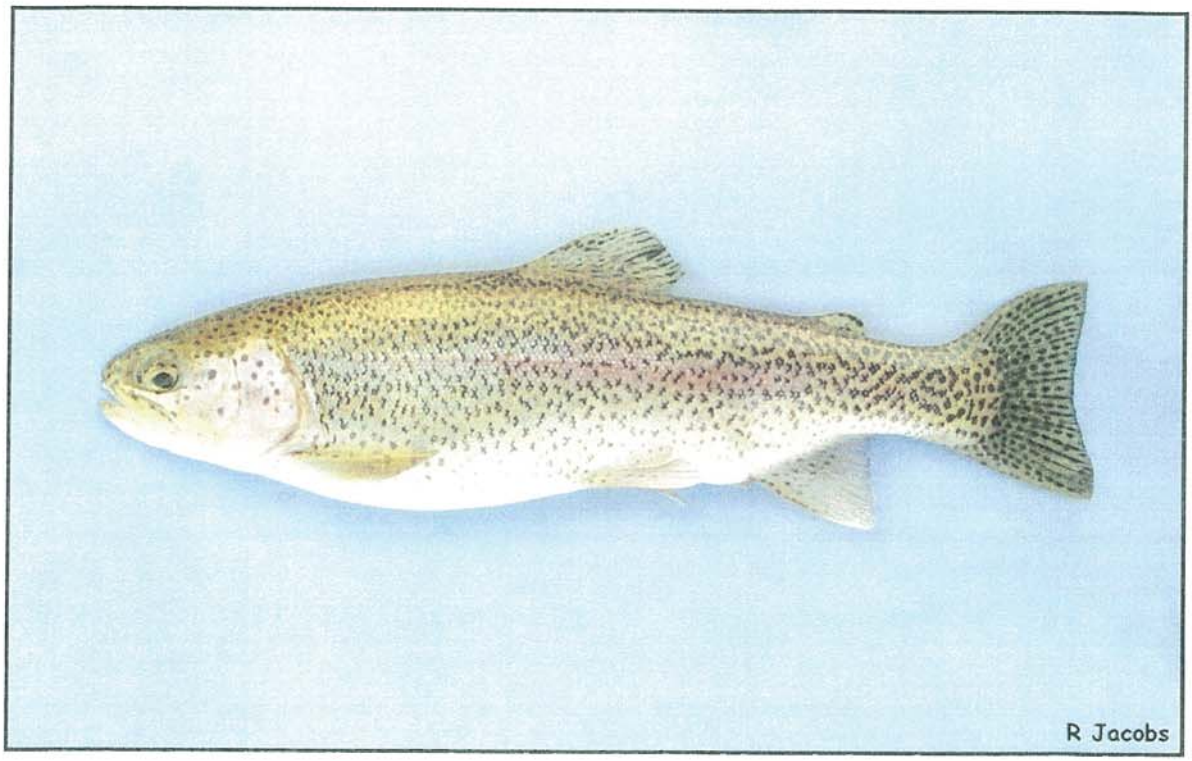
Statewide angling regulations for lakes and ponds apply for all species.

Watercourses

Birdseye Brook was surveyed once by the Division on July 27, 1992. The survey site was within the Mohawk Ski Area. The stream was reported to be of moderate grade and surface flow predominated by shallow pool. The streambed was composed primarily of gravel; instream and riparian overhead cover was limited.

The fish population of Birdseye Brook was found to be composed of blacknose dace, creek chub, common shiner, white sucker, pumpkinseed sunfish, golden shiner, and brown bullhead. This fish species assemblage is commonly associated with slow moving cool water and warmwater stream systems. The Division stocks Birdseye Brook once annually with 250 catchable size brook and rainbow trout. Over summer trout survival is rare due to elevated water temperatures and high fishing pressure.

Statewide angling regulations for rivers and streams apply for all species (current regulations attached)



Rainbow Trout

Bonney Brook was surveyed once by the Division on June 26, 1992. The survey site was immediately upstream of the Route 7 bridge. The stream was reported to be of steep grade and surface flow predominated by shallow riffle and cascade. The streambed was composed primarily of large boulder that provided an abundance of instream cover for fish. Riparian vegetation created a nearly complete canopy over the stream.

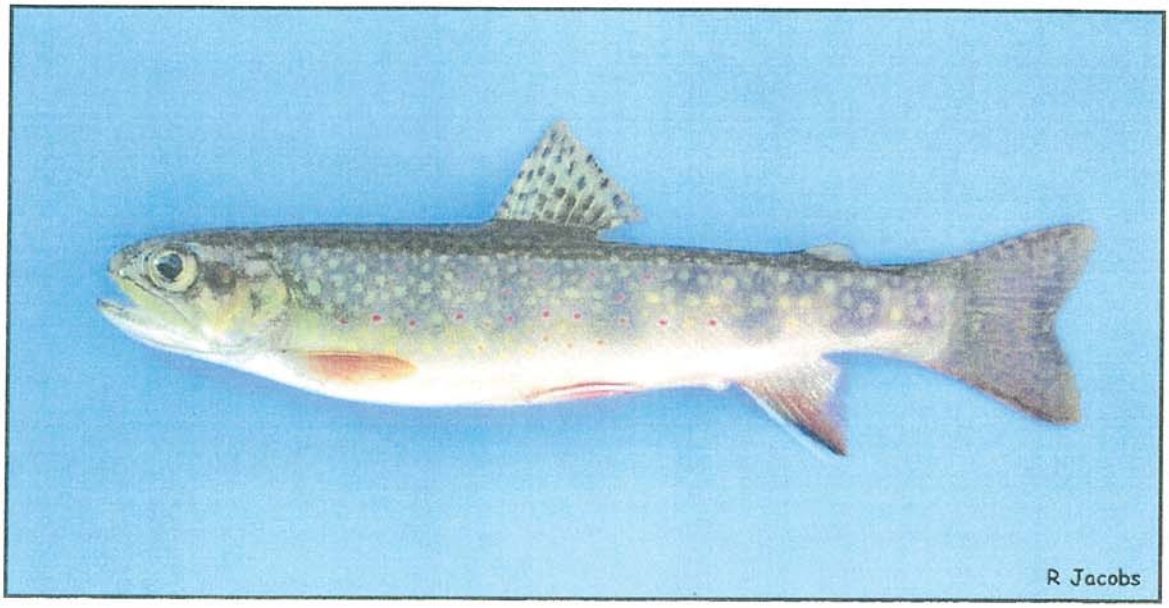
The fish population of Bonney Brook was found to be composed solely of brook trout. The Division does not stock Bonney Brook. This fish species assemblage is commonly associated with coldwater streams of high quality water and riparian habitat.

Statewide angling regulations for rivers and streams apply for brook trout.

Furnace Brook has been surveyed yearly since the initial survey of July 9, 1992. There are several survey sites along Route 4 within the Wyanteock State Forest at the base of Coltsfoot

Mountain. The stream transitions from a moderate to steep grade as it flows toward the Housatonic River. Surface flow predominated by shallow pool, shallow riffle and several cascades. The streambed was composed primarily of large boulder that provided an abundance of instream cover for fish. Riparian vegetation created a nearly complete canopy over the stream.

The fish population of Furnace Brook is composed of brook trout, brown trout, blacknose dace, longnose dace, creek chub, and white sucker. This fish species assemblage is commonly associated with coldwater streams of good quality water and riparian habitat.

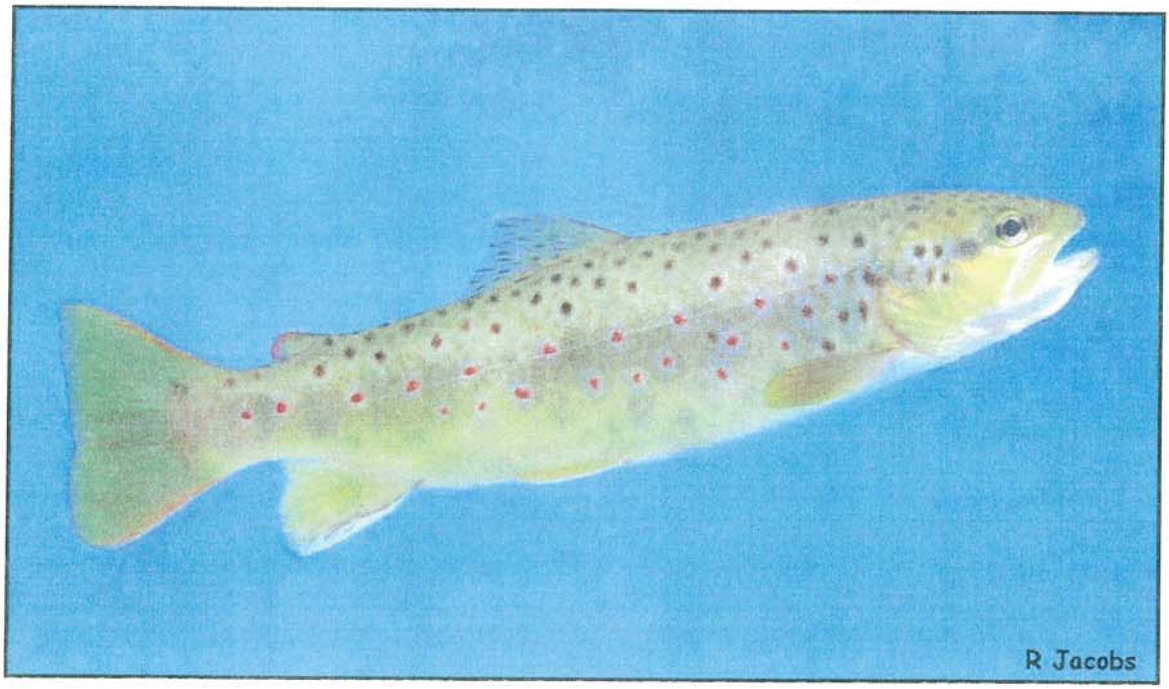


Brook Trout

The length of Furnace Brook from the Route 4 bridge upstream a distance of approximately 1 ½ miles has been designated the Heather Reaves Wild Trout Management Area. The Division manages the stream reach as a Class 2 Wild Trout Management Area (WTMA). It is one of two Class 2 WMTA's in Connecticut. Class 2 WMTA's have some wild trout and are supplemented with stocked fry and/or fingerling size trout. The Division stocks approximately 10,000 brown trout fry annually in the Heather Reaves WTMA.

Angling regulations set a daily creel limit of 2 trout that must have a minimum length of 12 inches.

The confluence of Furnace Brook with the Housatonic River is an important thermal refuge. The thermal refuges are critical for trout during the summer months when river water increases above optimum temperatures for their survival. Thermal refuges were found to be critical to trout survival in the Housatonic River Trout Management Area. Through the relicensing of the Falls Village hydroelectric facility in 2005, the mode of operation was changed from the historic "pond and release" to "run-of-river" specifically to protect the thermal refuges against warm water intrusions.



Brown Trout

Gunn Brook was surveyed once by the Division on June 17, 1992. The survey site was immediately downstream of the Swifts Bridge Road bridge. The stream was reported to be of steep grade and surface flow predominated by shallow riffle. The streambed was composed primarily of cobble. There was somewhat limited instream cover however, riparian vegetation created a nearly complete canopy over the stream.

The fish population of Gunn Brook was found to be composed of brook trout, brown trout and longnose dace. The Division does not stock Gunn Brook. This fish species assemblage is commonly associated with coldwater streams of high quality water and riparian habitat.

Statewide angling regulations for rivers and streams apply.

Heffers Brook was surveyed once by the Division on June 16, 1992. The survey site was immediately upstream of the Route 128 bridge. The stream was reported to be of moderate grade and surface flow predominated by shallow pool. The streambed was composed primarily of gravel. There was somewhat limited instream cover however, riparian vegetation created a nearly complete canopy over the stream.

The fish population of Heffers Brook was found to be composed of brook trout and blacknose dace. The Division does not stock Heffers Brook. This fish species assemblage is commonly associated with coldwater streams of high quality water and riparian habitat.

Statewide angling regulations for rivers and streams apply.

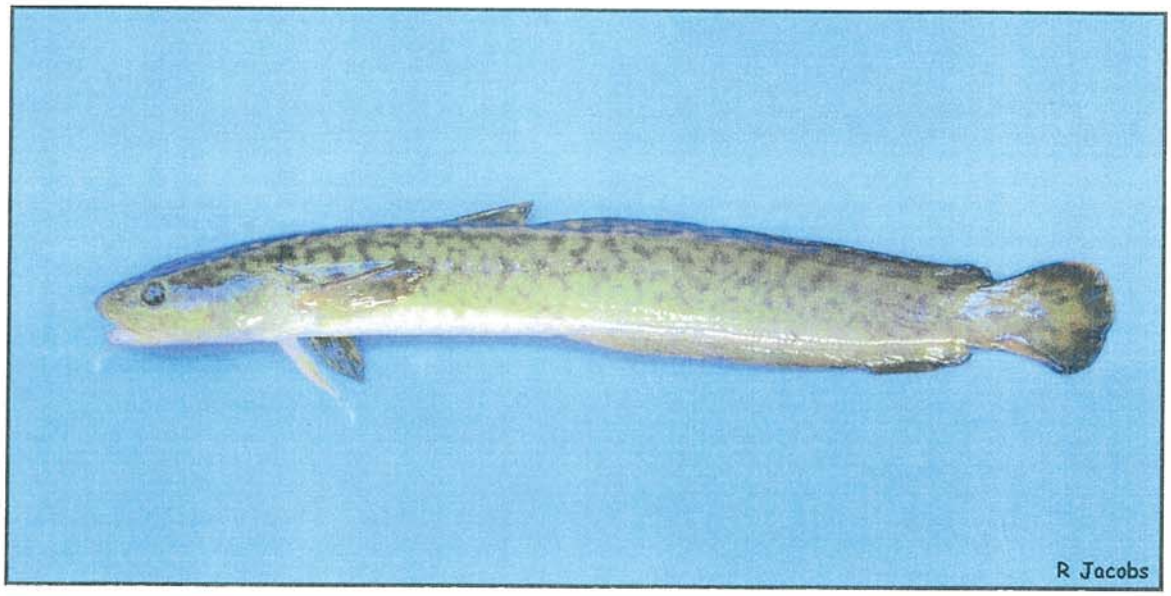
The ***Hollenbeck River*** was surveyed twice by the Division. The first survey was on July 2, 1992. The survey site was parallel to Route 63 approximately 100 yards upstream of the Brown

Brook confluence on property of the Hollenbeck Club. The stream was reported to be of low grade and surface flow predominated by deep riffle. The streambed was composed primarily of cobble. There was an abundance of instream cover however, the riparian vegetation created a somewhat sparse canopy over the stream.

In addition to the Division survey, the site was also surveyed in the mid to late 1980's by a fisheries consulting firm retained by the Hollenbeck Club and again in 2005-2006 by researchers of the University of Connecticut College of Agriculture and Natural Resources. In each survey, the Hollenbeck River fish population at this site was found to be composed of native brook trout, stocked and wild brown trout, stocked rainbow trout, blacknose dace, longnose dace, creek chub, common shiner, tessellated darter and white sucker. This fish species assemblage is commonly associated with low-gradient coldwater streams of high quality water and riparian habitat.

Burbot, a State-listed *Endangered Species* were also collected. To date, the only populations of burbot are found in the Hollenbeck River and Blackberry River.

Angling in this section of the Hollenbeck River is restricted to members and guests of the Hollenbeck Club. The club has established their own angling regulations.

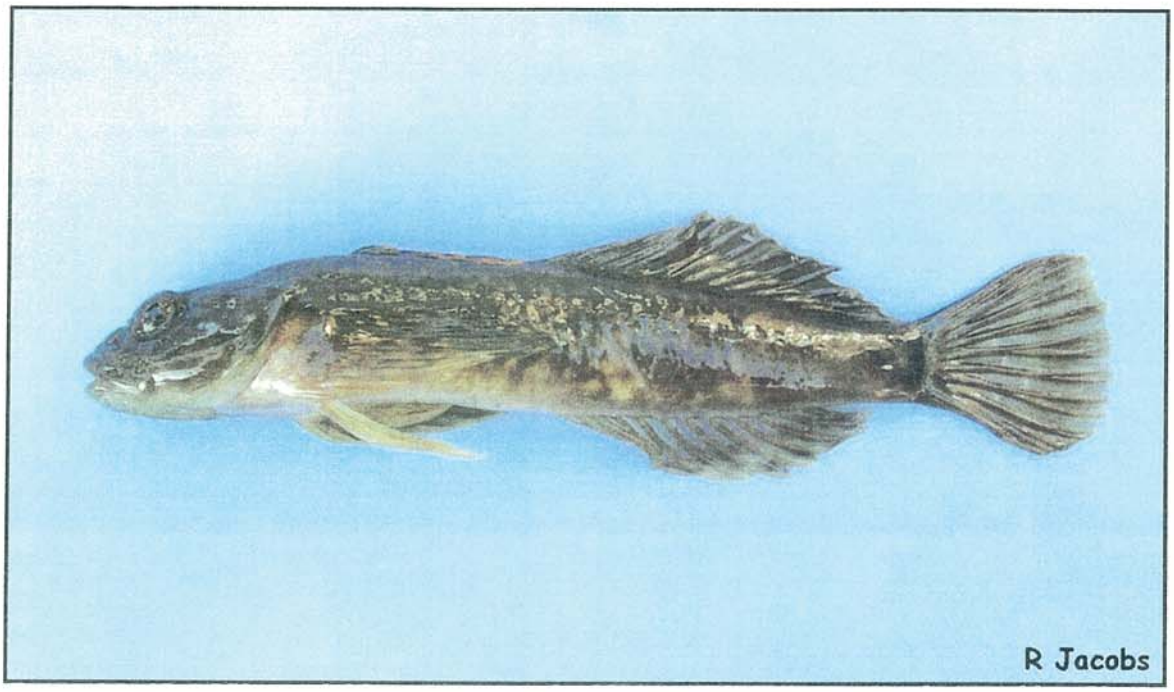


Burbot

The second Division survey site on the Hollenbeck River was at the ConnDOT "picnic area" along Route 43 immediately north of the Hautboy Hill Road intersection. The survey was on August 12, 1992. The stream was reported to be of moderate to steep grade and surface flow predominated by deep pool. The streambed was composed primarily of small boulder. There was an abundance of instream cover and a nearly complete canopy of riparian vegetation over the stream.

The fish population of this reach of the Hollenbeck River was found to be composed of native brook trout, blacknose dace, longnose dace, creek chub, common shiner, slimy sculpin, and

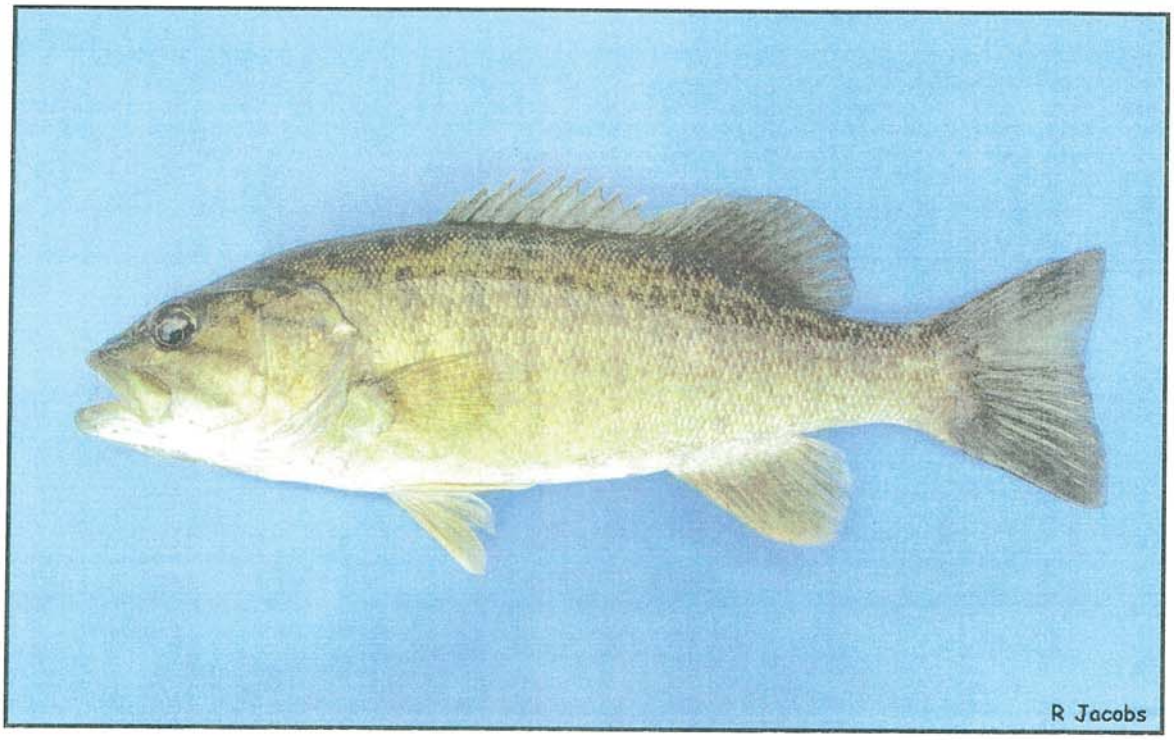
white sucker. This presence of native brook trout and slimy sculpin indicate a high quality coldwater stream.



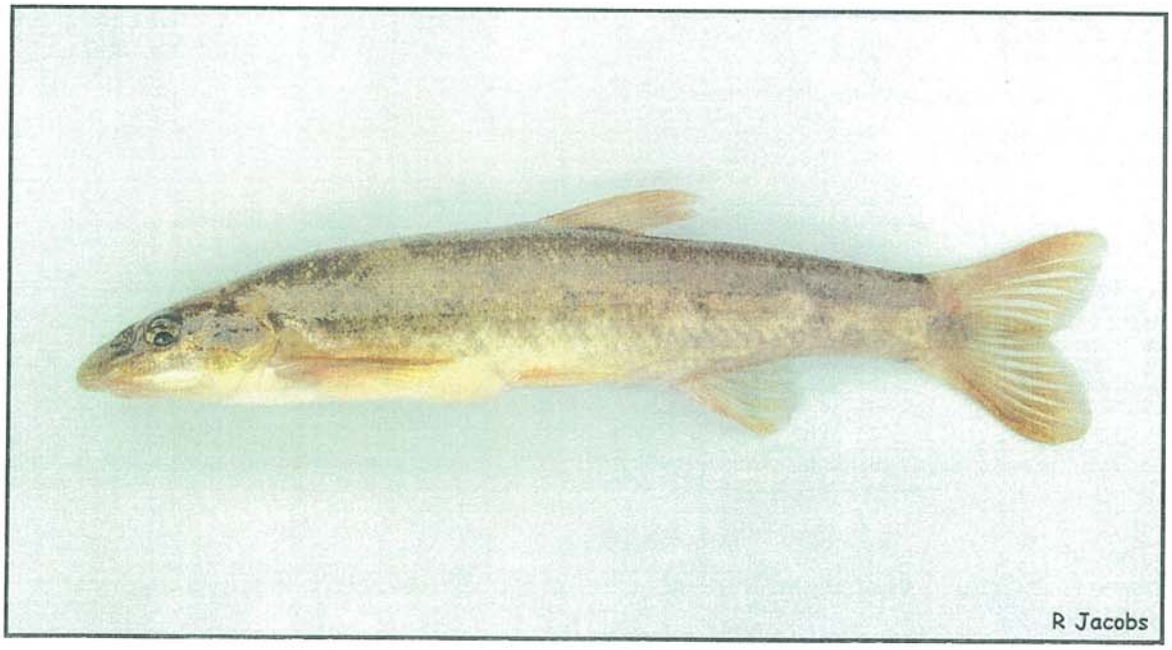
Slimy Sculpin

The Division does not stock trout into this section of the Hollenbeck River. Wherever angling is allowed, statewide angling regulations for rivers and streams apply.

The ***Housatonic River*** is the most prominent aquatic resource in Cornwall. Approximately 12 miles of the river are found within Cornwall with the midpoint of the channel forming the boundary with the town of Sharon. The river channel is approximately 200 – 250 feet in width and flows in a southerly direction. There are long riffle sections with many moderate to deep pools some of which are greater than 5 feet in depth. The riverbed is composed primarily of small boulder and cobble. The river width and its north – south direction exposes the river to the sun with little shading except in early morning or late afternoon. The water in the river is generally clear and can become extremely turbid after rain events.
The fish population in this section of the Housatonic River is not as diverse as would be expected for a river of this size. This may be in part due to daily fluctuation in flow that had historically occurred from power generation at the Falls Village hydroelectric facility. The fish population is limited to the following species: brown trout, rainbow trout, smallmouth bass, pumpkinseed sunfish, rock bass, fallfish, longnose dace, and white sucker. Longnose dace and smallmouth bass dominate the fish community.



Smallmouth Bass



Longnose Dace

The 14-mile stretch of the Housatonic River from the Route 7 bridge, Canaan and Salisbury, south to the Route4/7 bridge in Cornwall has been designated the Housatonic River Trout Management Area (TMA). This is the longest of the fourteen TMA's in Connecticut and has a

long and complex history spanning almost 25 years. The Housatonic River TMA was created in 1981 to prevent the loss of a popular fishery threatened by PCB contamination. Catch-and-release trout fishing in the TMA is allowed year round; the TMA segment from the Route 4/7 bridge northerly a distance of approximately 3-miles restricts the angling method to fly fishing only. Statewide angling regulations for rivers and streams apply to smallmouth bass fishing.

There is a health advisory for the consumption of smallmouth bass due to PCB contamination. The Connecticut Department of Health recommends that smallmouth bass not be consumed by those in a *High Risk Group* that includes pregnant women, women planning to become pregnant within one year, nursing mothers and children under the age of six. Individuals not in the *High Risk Group* are advised to consume no more than one meal of smallmouth bass per two months.

Trout fishing in the Housatonic River TMA is good to excellent with approximately 4,000 adult and 6,000 yearling aged brown trout stocked annually. Depending on the severity of summer flows and water temperatures, there can be significant numbers of trout holding over from one year to the next. Some of the trout can reach lengths of up to 20-inches.

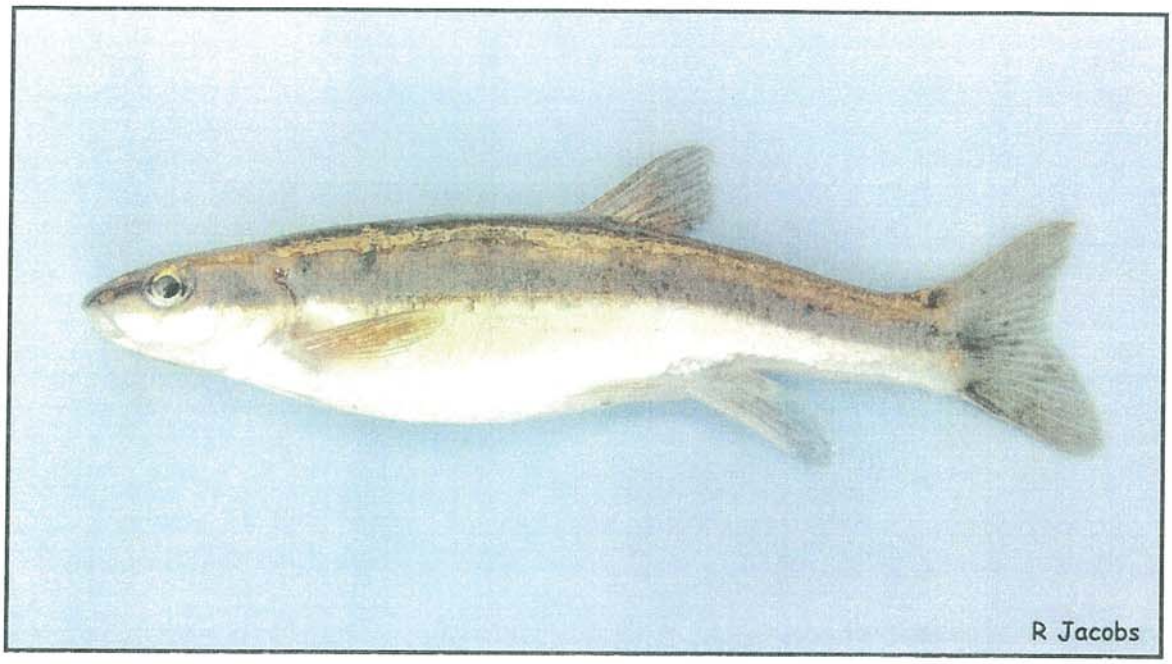
Thermal refuges, such as those at the Furnace Brook and Mill Brook confluences, were found to be critical to trout survival in the Housatonic River TMA. Through the Federal Energy Regulatory Commission relicensing of the Falls Village hydroelectric facility in 2005, the mode of operation was changed from the historic "pond and release" to "run-of-river" specifically to protect the thermal refuges against warm water intrusions. The Division's future fish surveys will focus on evaluating the effects of recently required run-of-river flows on fish populations in the Housatonic River TMA. Areas within 100 feet of the thermal refuges are closed to all fishing from June 15 to August 31 as posted.

Mill Brook was surveyed once by the Division on July 13, 1992. The survey site was immediately upstream of the Cream Hill Road bridge. The stream was reported to be of moderate grade and surface flow predominated by shallow pool. The streambed was composed primarily of cobble. There was somewhat limited instream cover however, riparian vegetation created a nearly complete canopy over the stream.

The fish population of Mill Brook was found to be composed of native brook trout, wild brown trout, blacknose dace, creek chub, common shiner, and white sucker. This fish species assemblage is commonly associated with coldwater streams of high quality water and riparian habitat.

Public fishing is allowed in the section of Mill Brook from the Housatonic River upstream along Route 128 for approximately 1-mile. The Division stocks this section Mill Brook annually with approximately 300 adult aged brook and rainbow trout. Statewide angling regulations for rivers and streams apply.

Ocain Brook was surveyed on one occasion by the Division on June 25, 1992. The survey site was not in Cornwall but nearby in Goshen. The survey site was located



Blacknose Dace

upstream of the Route 63 bridge. At this site, Ocain Brook flowed through an area maintained as pasture. The stream channel was reported to be of moderate grade and surface flow predominated by shallow riffle. The streambed was composed primarily of coarse sand and gravel. Riparian vegetation consisted of tall grasses and a sparse growth of low shrubs. Instream cover was somewhat limited and was provided primarily by undercut banks.

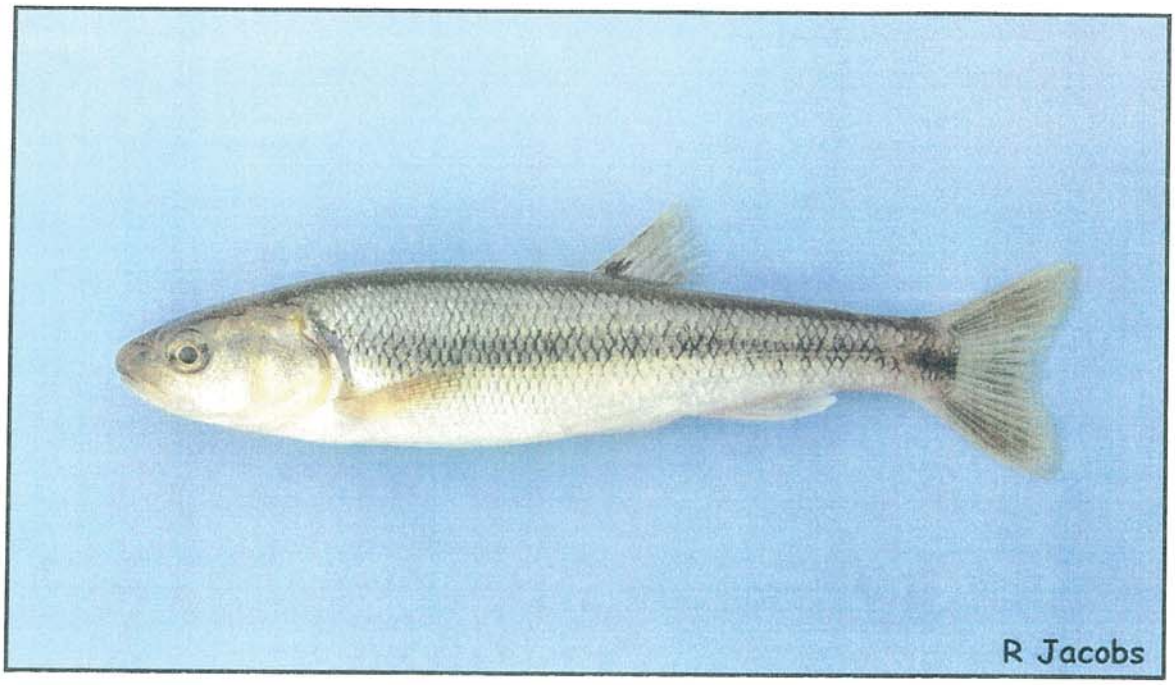
The fish population of Ocain Brook was found to be composed of native brook trout and blacknose dace. Despite the lack of riparian vegetation and limited instream cover, the stream's water is of a quality to support a coldwater fish community.

The Division does not stock trout into Ocain Brook. Statewide angling regulations for rivers and streams apply.

Reed Brook was surveyed on once by the Division on June 24, 1992. The survey site was immediately upstream of the Wickwire Road ford crossing. The stream channel was reported to be of moderate grade and surface flow predominated by shallow riffle. The streambed was composed primarily of coarse sand and gravel. Both instream cover and riparian vegetation was limited.

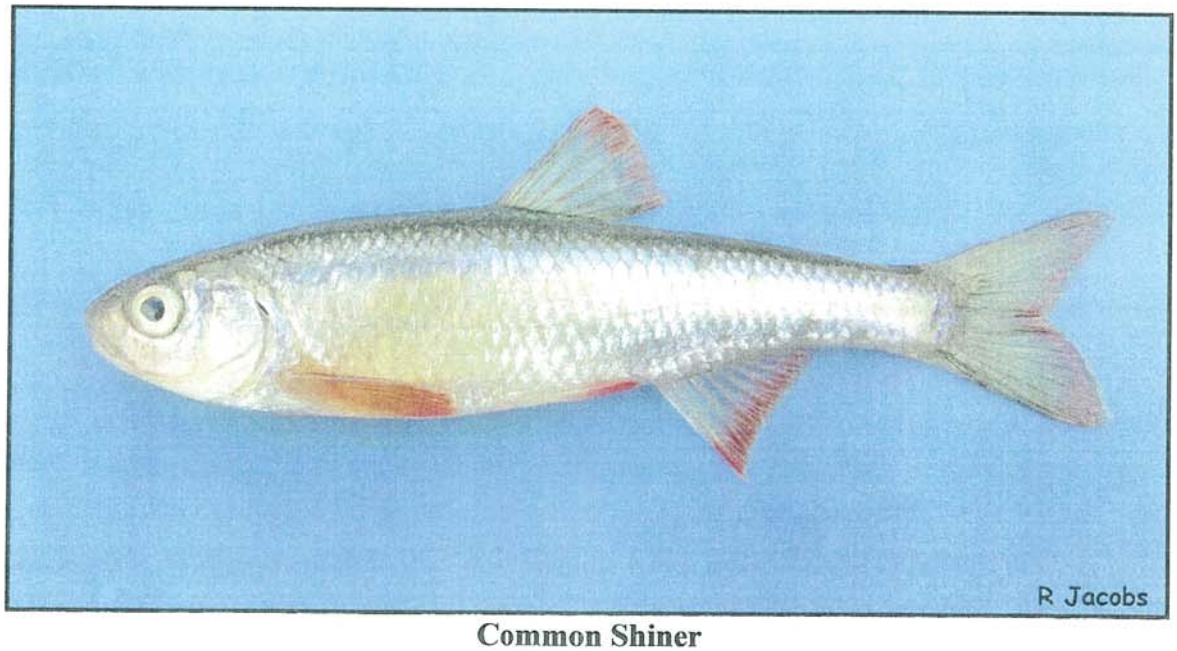
The fish population of Reed Brook was found to be composed of native brook trout and blacknose dace. Despite the lack of riparian vegetation and limited instream cover, the stream's water is of a quality to support a coldwater fish community.

The Division does not stock trout into Reed Brook. Statewide angling regulations for rivers and streams apply.

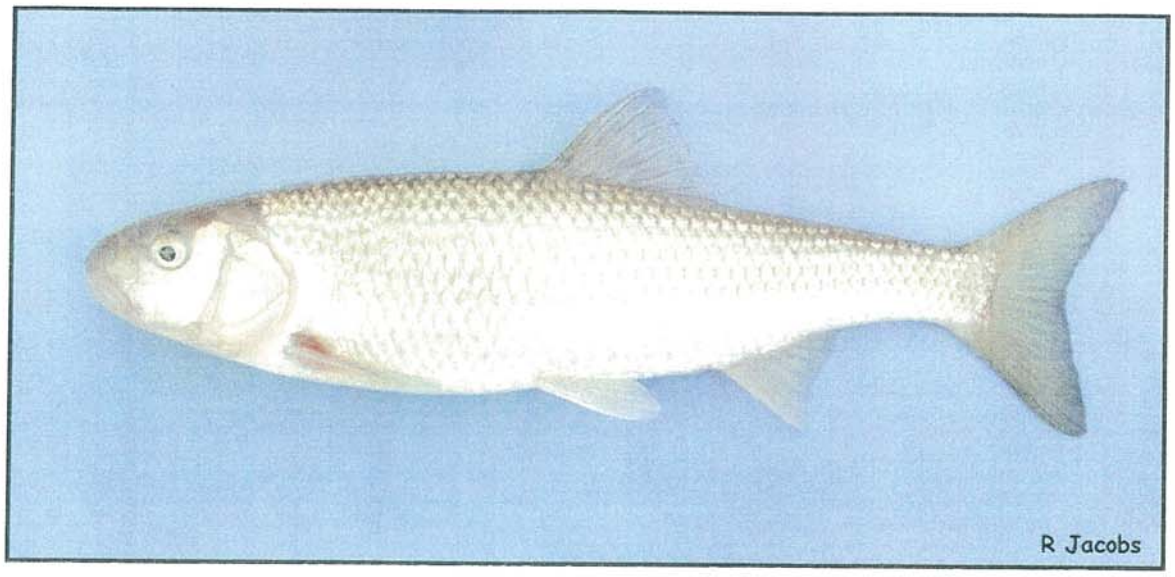


Creek Chub

Valley Brook was surveyed on once by the Division on July 29, 1992. The survey site was approximately 1-mile upstream of the Birdseye Brook confluence. The stream channel was reported to be of moderate grade and surface flow predominated by deep pool. The streambed was composed primarily of gravel. Both instream cover and riparian vegetation was somewhat limited.



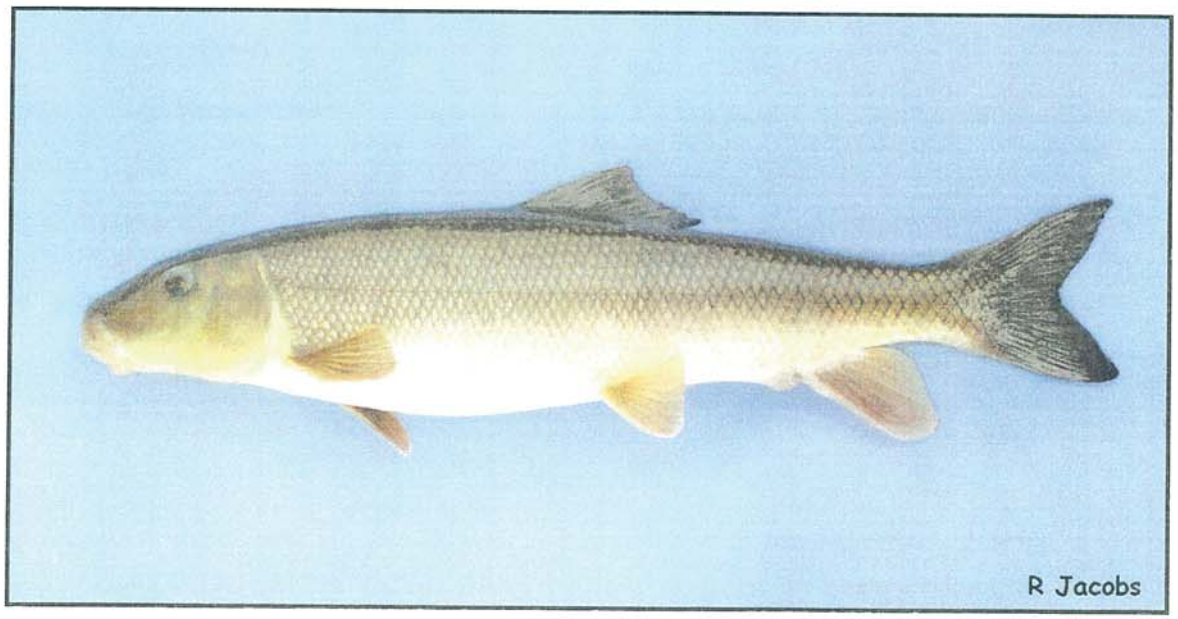
Common Shiner



Fallfish

The fish population of Valley Brook was found to be composed of native brook trout, wild brown trout, blacknose dace, creek chub, common shiner and white sucker. Despite the lack of riparian vegetation and limited instream cover, the stream's water is of a quality to support a coldwater fish community.

The Division does not stock trout into Valley Brook. Statewide angling regulations for rivers and streams apply.



White Sucker

Potential Threats to Aquatic Habitats / Resources and Measures to Mitigate Threats

As reported in *Connecticut Town Profiles (November 2001)* prepared by the Connecticut Department of Economic Development and Community Development, approximately 85% of Cornwall's 46 square mile area is open land. A review of aerial photographs and topographic maps indicate the largest amount of open land is forested with lesser (yet significant) acreage being agricultural land. As depicted on the *Cornwall Build-Out Map* recently prepared by The Nature Conservancy, there is currently sparse residential development (800 residential dwelling units) however; full build-out projections indicate the potential for 4,000+ dwelling units if every possible lot were utilized at the minimum allowed zoning standards of 1, 3, or 5 acres. The land use practices within the past century have afforded a protection to the aquatic habitats within Cornwall that sustain species diverse fish communities.

Should future build-out projects projections be accurate, the aquatic habitats and resources will be faced with the threats associated with either **riparian area degradation** or **habitat segmentation**.

A species diverse **riparian area** is critical to the ecosystem health of both waterbodies and watercourses. The roots of trees, shrubs, and grasses bind streambank and shoreline soils and provide a resistance to the erosive forces of flowing water and wave action in lakes and ponds. Stems and leaves of streambank and shoreline vegetation provide shade that prevents high water temperatures. Leaves, stems, and other plant parts that fall into the waterbodies provide food for aquatic insects. Large woody debris that fall into waterbodies or watercourses enhance physical habitat. Abundant riparian vegetation softens rainfall and enables the riparian area to serve as a reservoir storing surplus runoff for a gradual release to surface waters during low flow periods of summer and early fall. The riparian area is a natural filter that removes nutrients, sediments, and other non-point source pollutants from overland runoff.

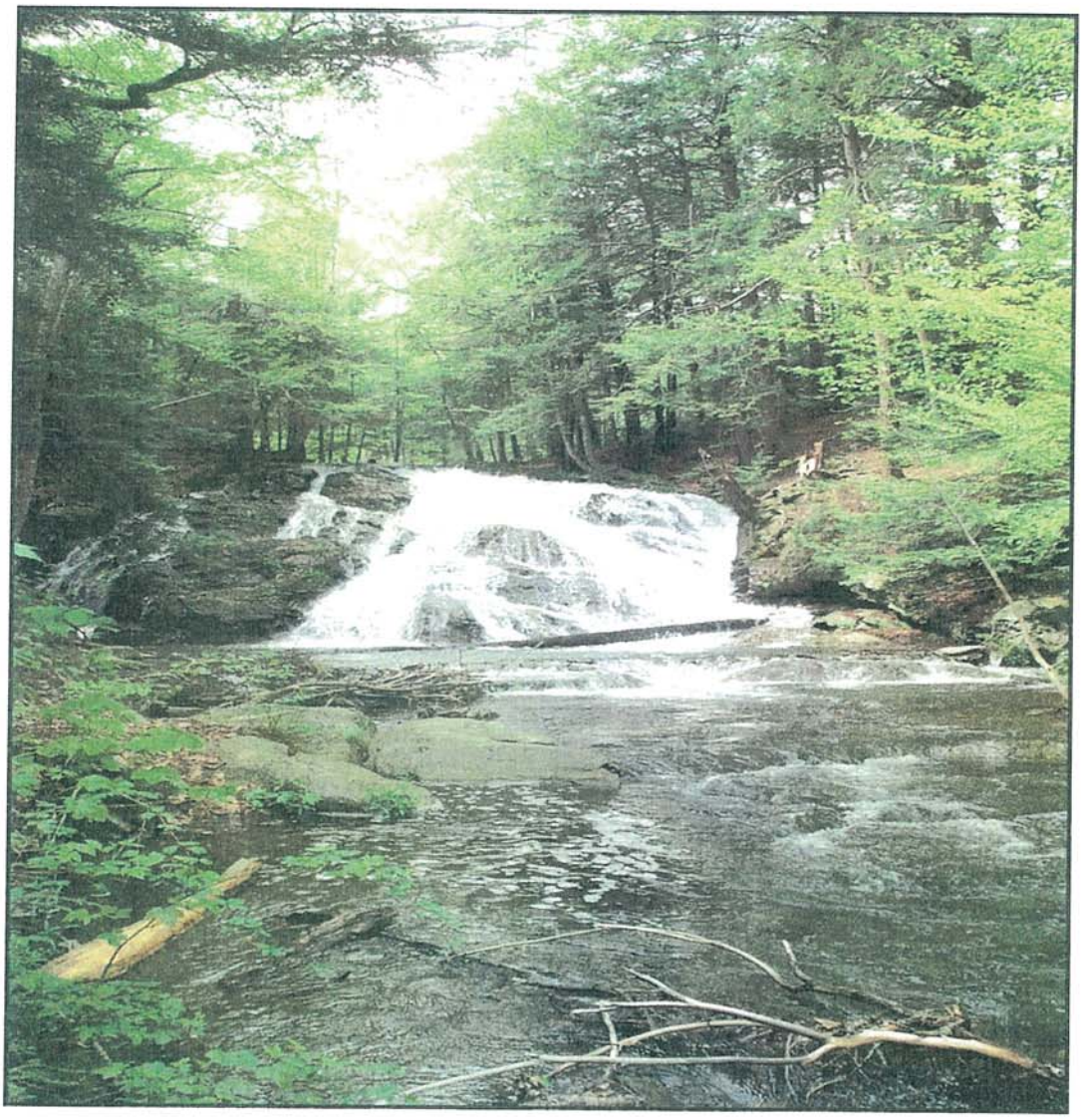
Recognizing the critical functions of riparian areas, the Inland Fisheries Division developed riparian area guidelines that are designed to bring uniformity and consistency to environmental review. In 1991, the Division issued a *Policy Statement* and *Position Statement* pertaining to the protection of riparian areas; both documents are attached. The Division recommends the following standard setting procedure to calculate protected riparian area widths for watercourses:

Perennial Watercourses: A protected riparian area of ***100 feet*** in width should be maintained along each side.

Intermittent Watercourses: A protected riparian area of ***50 feet*** in width should be maintained along each side.

The boundaries of the protected riparian area should be measured from either, (1) the edge of riparian inland wetland as determined by Connecticut inland wetland soil delineation methods or (2) in the absence of riparian inland wetland, the edge of the watercourse bank based on bankfull flow conditions. Bankfull flow is the amount of water that just fills the watercourse channel and where additional water would result in a rapid widening of the stream or overflow into the floodplain. In Connecticut, bankfull flows equate to the 1.5 to 2 year frequency storm flow.

Physical indicators of bank-full flow can be either (1) a change from a vertical bank to a horizontal floodplain, (2) bank undercuts, (3) change in bank material particle size, or (4) change in riparian vegetation.



A well vegetated riparian area along a typical coldwater stream in Connecticut.

The Division has yet to develop formal guidelines to establish protected riparian area around waterbodies (lakes and ponds) but has recommends buffer widths of ***25 to 50 feet*** in regulatory reviews.

It is recommended that Cornwall's land use commission(s) adopt no less stringent guidelines to protect riparian areas around waterbodies or along watercourses from future development. The riparian areas should be protected from development by conservation easement or similar covenant. The boundary of the protected riparian area should be delineated with signage or other marking that is clearly visible. This should be an effective means to avoid encroachment

by the property owner(s) and to aid Town of Cornwall staff in identifying and addressing violations of the protected riparian area.

It is also recommended that Cornwall's land use commission(s) enter into cooperative agreements with private landowners to protect riparian areas on their property. Cooperative efforts should be undertaken to, (1) identify riparian areas altered by prior land use and (2) develop a strategy to restore altered riparian areas to conditions similar to those found in adjacent, undisturbed riparian areas. Vegetation selected for reestablishment within the riparian areas shall be native and non-invasive.

As long and linear ecosystems, watercourses are extremely important for the movement of fish and other obligate aquatic species, and are particularly vulnerable to **habitat segmentation**. In addition to natural barriers (e.g. waterfalls), a number of human activities can disrupt the continuity of watercourse ecosystems. While the most familiar human-caused barriers are dams, there is a more recent concern about the role watercourse crossing structures (primarily culverts) in disrupting riverine ecosystem continuity. With the potential for full build-out of 4,000+ dwelling units in Cornwall, the land use commission(s) must take steps to ensure that new road and/or driveway crossings be designed to protect habitat quality and ecosystem processes that maintain aquatic habitats and resources over time.

An example of the impact of culverts: habitat loss and a fish migration barrier.

It is recommended that Cornwall's land use commission(s) carefully analyze new road and/or driveway crossings of watercourses to minimize the number of crossings. Where crossings are

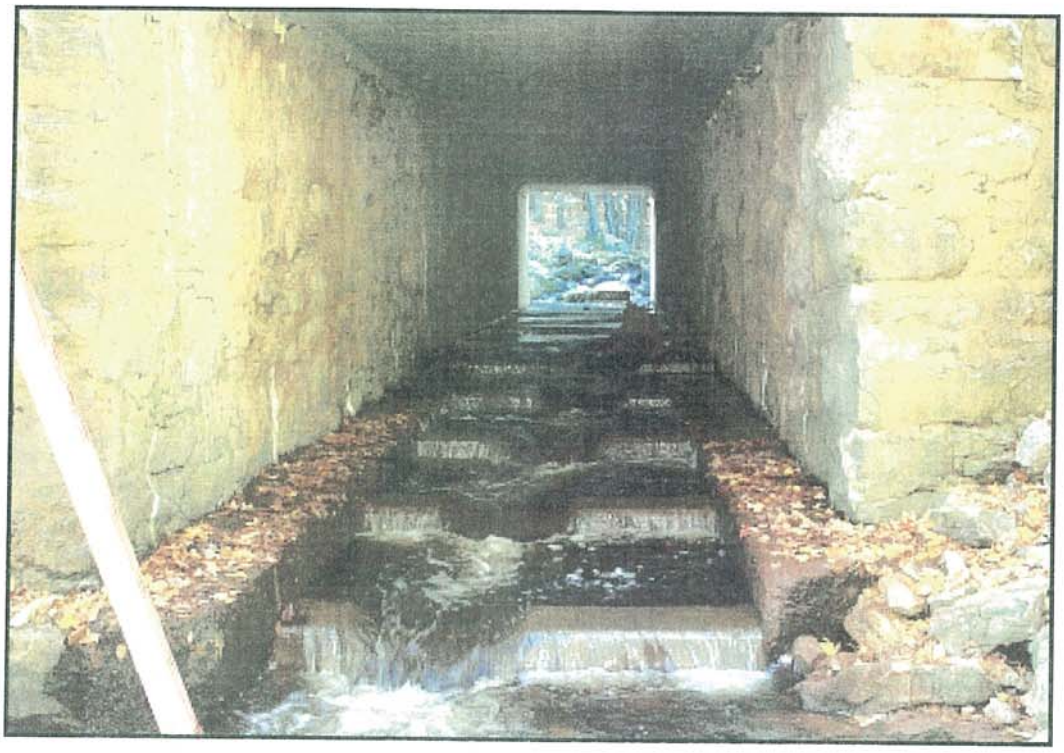
necessary, they should be located away from sensitive areas (e.g. fish spawning or juvenile rearing habitat).

After minimizing the number of crossings and locating them away from sensitive areas, attention should be focused on the design of the crossing structure itself. The Division recommends the installation of ***span bridges*** or ***arch culverts*** for the crossing of ***perennial watercourses***. Bridges and arch culverts best preserve physical aquatic habitat and do not create barriers to fish migration. In certain select situations, the Division has accepted the installation of culverts for stream crossings. However, a certain amount of modification to a culvert is required to assure the efficacy of maintaining aquatic habitat and resource integrity. Attached are the Division's *Stream Crossing Guidelines* that detail design standards for culvert installation.
Culverts installed on ***intermittent watercourses*** are evaluated based on the potential for seasonal utilization of the watercourse by fish.

Example of an arch culvert. Road crossing of an unnamed stream at the Litchfield Hollow residential subdivision, Litchfield.

It is recommended that Cornwall's land use commission(s) compile an inventory of all watercourse crossings on either town or private property and evaluate the crossing structures affect on the aquatic ecosystem (i.e. fish migration barrier). The task can be overwhelming however, the USDA Natural Resources Conservation Service has developed a community based, volunteer oriented stream survey program that can collect such data. Further information can be obtained from the Natural Resources Conservation Service, Torrington office at 860.626.8258. Upon completion of the crossing structure inventory and assessment, a strategy would then be developed to correct for any impairment the structures impart on aquatic habitat or resources.

Fishway installed by the Connecticut Department of Transportation at the Route 4 crossing of Furnace Brook, Cornwall Bridge. The fishway was installed to provide passage for brook trout and brown trout.



Baffles installed in a stone and masonry box culvert to retain streambed material and to provide fish passage.

A number of dams were created on steep gradient streams in northwest Connecticut during the 1700's and 1800's to meet many historical societal and individual needs. A number of those dams exist to today varying both in condition and in their use as originally intended. Unless they have either completely or partially breached, they remain as a barriers to fish migration and as an alteration to the natural watercourse ecosystem.

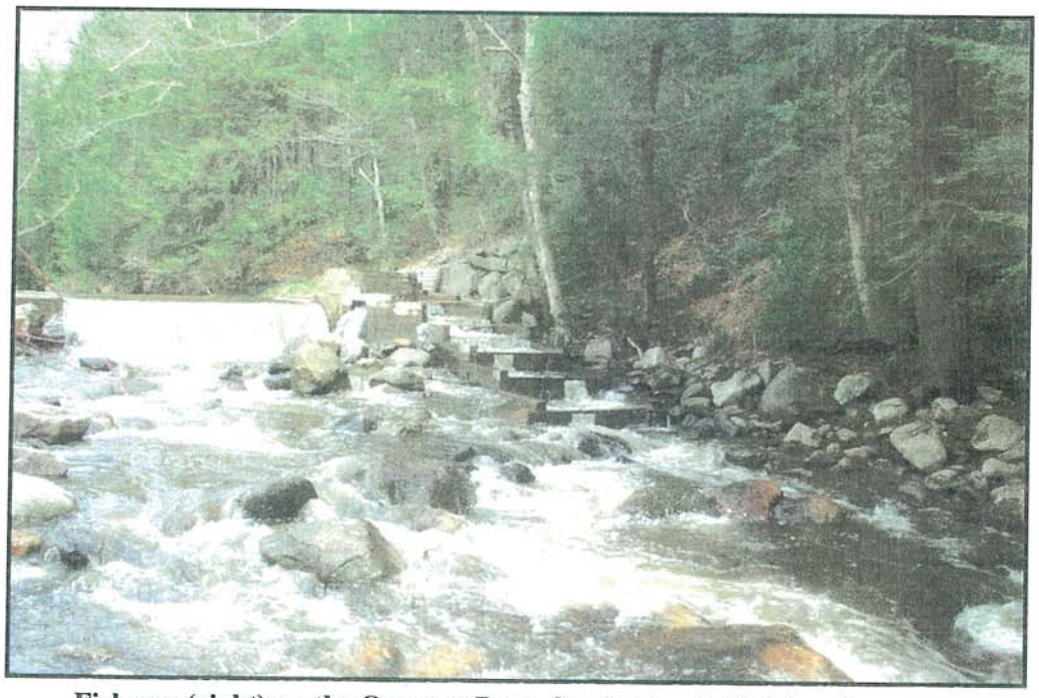
As mentioned previously with crossing structures, it is recommended that Cornwall's land use commission(s) compile an inventory of all dams on either town or private property and evaluate the dams' affect on the aquatic ecosystem (i.e. fish migration barrier).

Low head dam on Mill Brook along Cream Hill Road and immediately downstream of the Cogswell Road crossing, North Cornwall.

Remnant dam on Heffers Brook along Route 128, North Cornwall.

Again, the USDA Natural Resources Conservation Service community based, volunteer oriented stream survey program would be ideally suited to collect such data. Upon completion of the dam inventory and assessment, a strategy would then be developed to restore watercourse habitat and/or provide fish passage. Such strategies include complete or partial removal, constructing a bypass channel around the dam, or installing a fishway. The strategy selected is based on the dam owner's preference, condition of the structure, cost, and/or historic significance of the structure.

Bypass channel around the Cannondale Dam on the Norwalk River, Wilton.



Fishway (right) on the Opartny Dam, Sandy Brook, Colebrook.

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Natural Resources – Inland Fisheries Division

STREAM CROSSING GUIDELINES

The Inland Fisheries Division (the "Division") routinely recommends the installation of span bridges or arch culverts for the crossing of ***perennial watercourses***. These structures best preserve physical aquatic habitat and do not create barriers to fish migration. In certain select situations, the Division has accepted the installation of culverts for stream crossings. However, a certain amount of modification to a culvert is required to assure the efficacy of maintaining aquatic habitat and resource integrity. The modifications recommended are:

- The invert of a box culvert should be set no less than 1 foot below the existing streambed elevation. The invert of a round culvert less than 10 feet in diameter should be set 1 to 2 feet below the existing streambed elevation. For round pipe greater than 10 feet in diameter, the culvert invert should be set one-fifth of the pipe diameter below the streambed elevation.

- For multiple culvert situations, one or more of the culverts should be installed as per the guidelines for single culverts. Deflectors may need to be installed in the stream to concentrate low streamflows into and through the recessed culvert.

- The culvert gradient should be no steeper than the streambed gradient up- or downstream of the culvert.

- The culvert alignment should be similar to that of the stream and the culvert kept at a short a length as possible. Vertical headwalls rather than fill slopes should be installed at the culvert inlet and outlet to reduce the total culvert length.

- The culvert should have a width that spans an area 1.2 times the bankfull width of the stream. In Connecticut streams, bankfull width equates to the channel width wetted at the 1.5 to 2 year frequency flow. This standard also applies to arch (bottomless) culverts.

- The culvert should have an Openness Ratio of ≥ 0.25. The Openness Ratio (OR) is calculated by dividing a culvert's cross sectional area (height X width) by its length. All measurements are metric.

Embedded culverts $OR = \dfrac{[(\text{cross-sectional culvert area pre-embedded}) - \text{embedded area}]}{\text{culvert length}}$

Arch (bottomless) culverts $OR = \dfrac{\text{height x width}}{\text{length}}$

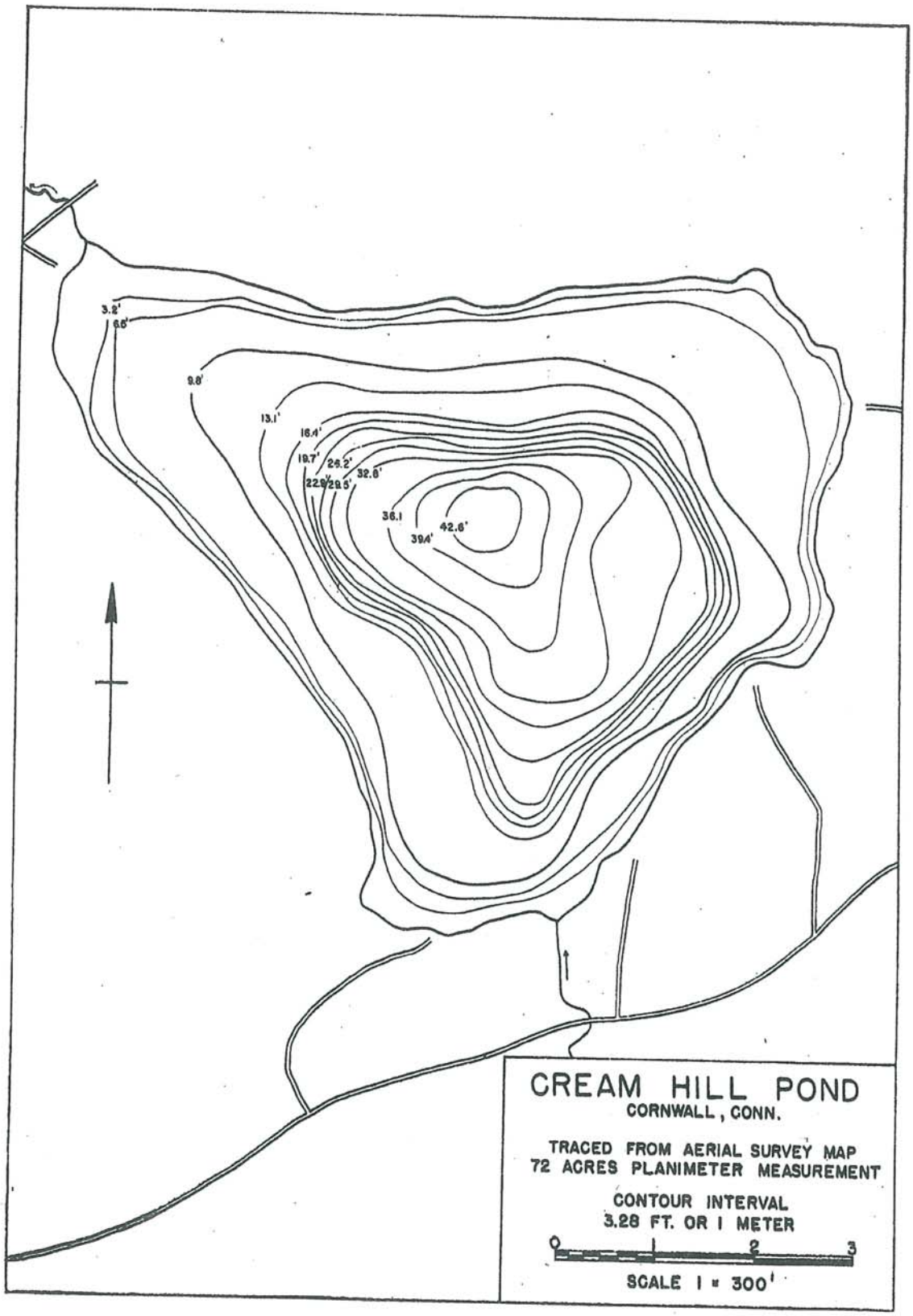
- Corrugated metal culverts rather than concrete culverts are preferred. The corrugations create a roughness that aids in the retention of streambed material.
- Streambed material excavated for the culvert placement should be stockpiled and be replaced within the culvert following its installation. The streambed material should be replaced in a manner replicating the original stream cross section with a well defined low flow channel contiguous with that existing in the stream.

Culverts installed on ***intermittent watercourses*** are evaluated based upon the potential for seasonal utilization of the watercourses by fish.

In addition to offering recommendations for structure design, the Division has developed the following measures to enhance and/or protect aquatic habitats and resources during instream and near-stream construction activities

- The placement of scour protection measures should be minimized to the fullest extent possible. Native stone should be utilized rather than quarried rip-rap.
- Unconfined instream activities should be allowed only during the time period of June 1 through September 30.
- Retaining walls should be utilized in lieu of fill slopes along roadway approaches to stream crossing structures to minimize riparian habitat loss.
- Riparian vegetation disturbed during construction should be re-established in a timely manner upon the project completion. The species of vegetation selected for reestablishment should be native to the immediate watershed and be non-invasive.
- All appropriate erosion and sediment controls should be established prior to and be maintained through all phases of construction

Revised: March 2007


3.2'
6.6'
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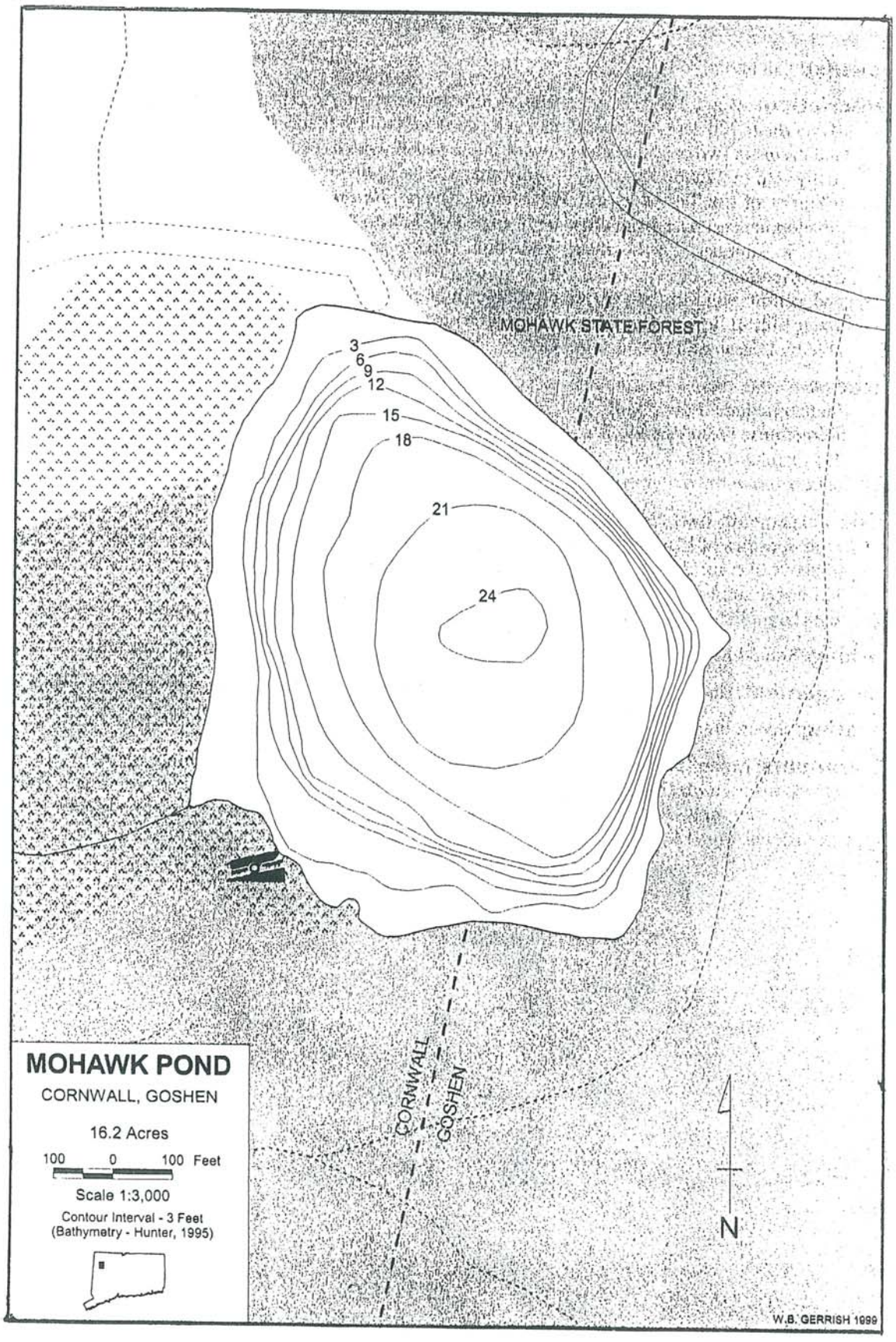
13.1'
16.4'
19.7'
23.2'
22.9'
29.5'
32.8'
36.1
39.4'
42.6'
CREAM HILL POND
CORNWALL, CONN.
TRACED FROM AERIAL SURVEY MAP
72 ACRES PLANIMETER MEASUREMENT
CONTOUR INTERVAL
3.28 FT. OR 1 METER
0
1
2
3
SCALE 1 = 300'


MOHAWK STATE FOREST
3
6
9
12
15
18
21
24
CORNWALL
GOSHEN
MOHAWK POND
CORNWALL, GOSHEN
16.2 Acres
100 0 100 Feet
Scale 1:3,000
Contour Interval - 3 Feet
(Bathymetry - Hunter, 1995)
N
W.B. GERRISH 1999

DEPARTMENT OF ENVIRONMENTAL PROTECTION
INLAND FISHERIES DIVISION

POLICY STATEMENT
RIPARIAN CORRIDOR PROTECTION

I. INTRODUCTION, GOALS, AND OBJECTIVE

Alteration and exploitation of riparian corridors in Connecticut is a common event that significantly degrades stream water quality and quantity. Inasmuch as riparian ecosystems play a critical role in maintaining aquatic resource productivity and diversity, the Inland Fisheries Division (Division) recognizes that rigorous efforts are required to preserve, protect, and restore these valuable resources. Consequently, a riparian corridor protection policy has been developed to achieve the following goals and objective:

Goals

Maintain Biologically Diverse Stream and Riparian Ecosystems, and

Maintain and Improve Stream Water Quality and Water Quantity.

Objective

Establish Uniform Riparian Corridor Buffer Zone Guidelines.

II. DEFINITIONS

For the purpose of implementing a statewide riparian corridor protection policy, the following definitions are established:

Riparian Corridor: A land area contiguous with and parallel to an intermittent or perennial stream.

Buffer Zone: An undisturbed, naturally vegetated area adjacent to or contained within a riparian corridor that serves to attenuate the effects of development.

Perennial Stream: A stream that maintains a constant perceptible flow of water within its channel throughout the year.

Intermittent Stream: A stream that flows only in direct response to precipitation or which is seasonally dry.

III. RIPARIAN FUNCTION

Naturally vegetated riparian ecosystems perform a variety of unique functions essential to a healthy instream aquatic environment. The delineation and importance of riparian functions are herein described. Vegetated riparian ecosystems:

* Naturally filter sediments, nutrients, fertilizers, and other nonpoint source pollutants from overland runoff.

* Maintain stream water temperatures suitable for spawning, egg and fry incubation, and rearing of resident finfish.

* Stabilize stream banks and stream channels thereby reducing instream erosion and aquatic habitat degradation.

* Supply large woody debris to streams providing critical instream habitat features for aquatic organisms.

* Provide a substantial food source for aquatic insects which represent a significant proportion of food for resident finfish.

* Serve as a reservoir, storing surplus runoff for gradual release into streams during summer and early fall base flow periods.

IV. RIPARIAN CORRIDOR BUFFER ZONE GUIDELINES

Recognizing the critical roles of riparian corridors, the Division provides buffer zone guidelines that are designed to bring uniformity and consistency to environmental review. The guidelines are simple, effective, and easy to administer. The following standard setting procedure should be used to calculate buffer zone widths.

Perennial Stream: A buffer zone 100 feet in width should be maintained along each side.

Intermittent Stream: A buffer zone 50 feet in width should be maintained along each side.

Buffer zone boundaries should be measured from either, (1) edge of riparian inland wetland as determined by Connecticut inland wetland soil delineation methods or (2) in the absence of a riparian wetland, the edge of the stream bank based on bank-full flow conditions.

The riparian corridor buffer zone should be retained in a naturally vegetated and undisturbed condition. All activities that pose a significant pollution threat to the stream ecosystem should be prohibited.

Where the Division policy is not in consonance with local regulations and policies regarding riparian corridor buffer zone widths and allowable development uses within these areas, local authorities should be encouraged to adopt the more restrictive regulations and policies.

12/13/91
Date

James C. Moulton
Acting Director

POSITION STATEMENT
UTILIZATION OF 100 FOOT BUFFER ZONES TO PROTECT RIPARIAN AREAS IN CONNECTICUT

BY
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TECHNICAL ASSISTANCE BIOLOGIST
INLAND FISHERIES DIVISION

I. INTRODUCTION

One tenet of the Inland Fisheries Division Policy on Riparian Corridor Protection is the utilization of a 100 foot buffer zone as a minimum setback along perennial streams. The adoption of such a policy is sure to be controversial. Laymen, developers and natural resource professionals alike will ask questions such as: Why was a standard setting method adopted? What's magical about 100 feet? Will 100 feet be sufficiently protective, or will it be overly protective? In response, this paper outlines the ramifications of adopting a riparian corridor policy including the use of a 100 foot buffer zone.

II. STANDARD SETTING VERSUS SITE SPECIFIC BUFFER ZONES

There are two approaches for determining buffer zone width; standard setting and site specific. Standard setting methods define an area extending from the streambank edge or highwater mark to some landward fixed point boundary. Site specific methods utilize formulas that incorporate and consider special site specific land characteristics, hence, the calculation of a variable width buffer zone. In both case, buffers are employed to define an area in which development is prohibited or limited.

A major advantage of standard setting methods is that they are easy to delineate and administer, thereby improving the consistency and quality of environmental assessments. Furthermore, valuable staff time would not be required to determine site specific buffer zones along each and every watercourse of concern.

The exact width of a buffer zone required for riparian corridor protection is widely disputed (Bottom et al. 1985 and Brinson et al. 1981). Buffer width recommendations found in the literature vary from as little as 25 feet to as great as 300 feet (Palfrey et al. 1982). The 100 foot buffer is widely accepted in Connecticut having been adopted by numerous inland wetland and conservation commissions as an appropriate minimum setback regulation for streambelts. In addition, Division staff have been recommending the utilization of the 100 foot buffer zone to protect streambelts since the early 1980's. Scientific research has not been generated to dispute the adequacy of utilizing 100 foot buffer zones to protect Connecticut's riparian corridors. In fact, to ensure that riparian functions are not significantly altered, recent scientific information points towards maintaining buffer zones that would be at a minimum, 100 feet in width (see section III).

Site specific methods define buffer widths according to the character and sensitivity of adjacent streamside lands. These buffer widths, also referred to as "floating buffers," consider physical site characteristics such as slope, soil type, and vegetative cover. The advantage of site specific methods is that buffer widths are designed using site characteristics and not an arbitrary predetermined width. Unfortunately, there is no "one" universally accepted formula or model and none have been developed for use in Connecticut. Most formulas are based on the degree to which sediment can be removed or filtered by natural vegetation, thus, the primary useage is sediment control. Other weaknesses of site specific techniques are (1) all areas must be evaluated on a case-by case basis and, (2) the subjectivity of different techniques (i.e. if the evaluation technique is inadequate, the buffer width will also be inadequate).

Additionally, these formulas only concentrate on one specific riparian function at a time and do not take into account multiple riparian functions, especially those of inland fisheries values as discussed in Section III. Consequently, site specific formulas approach riparian function on a single dimension rather than taking a more realistic, holistic approach.

In the absence of a scientific model to determine buffer widths suitable to protect Connecticut's riparian corridors, the utilization of a standard setting method is environmentally and politically prudent.

III. RIPARIAN FUNCTION

To assess the efficacy of a 100 foot buffer zone, the literature was searched to identify studies which have applied a quantitative approach to buffer width determination. Literature was searched for studies which both support and dispute the 100 foot zone. The following is a summary "by riparian function" of quantitative studies which assess buffer widths.

Sediment Control

Width, slope and vegetation have been cited as important factors in determining effectiveness of buffer zones as sediment filters (Karr and Schlosser 1977). Wong and McCuen (1981), who developed and applied a mathematical model to a 47 acre watershed, found that a 150 foot zone along a 3% slope reduced sediment transport to streams by 90%. Mannering and Johnson (1974) passed sediment laden water through a 49.2 foot strip of bluegrass and found that 54% of sediment was removed from the water. Trimble and Sartz (1957) developed recommendations as to width of buffer areas between logging roads and streams to reduce sediment load. They determined a minimum strip of 50 feet was required on level land with the width increasing 4 feet for each 1% slope increase. Buffer widths as determined by Trimble and Sartz (1957) have been characterized as evaluated guesses rather than empirically defined widths (Karr and Schlosser 1977). Rodgers et al. (1976) state that slopes greater than 10% are too steep to allow any significant detention of runoff and sediment regardless of buffer width. After a critical review of the literature, Karr and Schlosser (1977) determined that the size and type of vegetative buffer strip needed to remove a given fraction of the overland sediment load cannot be universally quantified. Existing literature does suggest that 100 foot riparian buffers will assist with sediment entrapment, although efficacy will vary according to site conditions.

Temperature Control

Brown and Brazier (1973) evaluated the efficacy of buffer widths required to ameliorate stream water temperature change. They concluded that angular canopy density (ACD), a measure of the ability of vegetation to provide shading, is the only buffer area parameter correlated with temperature control. Results show that maximum angular canopy density or maximum shading ability is reached within a width of 80 feet. Study sites were 9 small mountain streams in Oregon that contained a conifer riparian vegetative complex. Whether or not maximum angular canopy density is reached within 80 feet in a typical Connecticut deciduous forest riparian zone is doubtful. Tree height in Connecticut riparian zones is smaller than in Oregon (Scarpino, personal communication), therefore buffers greater than 80 feet in width would be required for temperature maintenance in Connecticut.

Nutrient Removal

Nutrient enrichment is caused by phosphorous and nitrogen transport from, among other things, fertilized lands and underground septic systems. Most research on nutrient enrichment has focused on overland surface flow. Karr and Schlosser (1977) report that 88% of all nitrogen and 96% of all phosphorous reaching watercourses in "agricultural watersheds" were found to be attached to sediment particles; thus, successful nutrient removal can be accomplished through successful sediment removal. There are conflicting reports on the ability of buffer widths to remove nutrients with most research being tested on grass plots. Butler et al. (1974) as cited by Karr and Schlosser (1977) found that a 150 foot buffer width of reed canary grass with a 6% slope caused reductions in phosphate and nitrate concentrations of between 0–20%. Wilson and Lehman (1966) as cited by Karr and Schlosser (1977) in a

study of effluent applied to 300 m grass plots found that nitrogen and phosphorous concentrations were reduced 4 and 6%, respectively. Studies on subsurface runoff as cited in Clark (1977) found high concentrations of nitrates at 100 feet from septic systems with unacceptable levels at 150 feet. Clark (1977) recommended that a 300 foot setback be used whenever possible, with a 150 setback considered adequate to avoid nitrate pollution. Environmental Perspective Newsletter (1991) states that experts who commonly work with the 100 foot buffer zone set by the Massachusetts Wetlands Protection Act are increasingly finding that it is insufficient since many pollutants routinely travel distances far greater than 100 feet with nitrate–nitrogen derived from septic systems moving distances of greater than 1000 feet. Research indicates that the adoption of 100 foot buffer widths for Connecticut riparian zones will assist with the nutrient assimilation; albeit, complete removal of all nutrients may not be achieved.

Large Woody Debris

The input of large woody debris (LWD) to streams from riparian zones, defined as fallen trees greater than 3 m in length and 10 cm in diameter has been recently heralded as extremely critical to stream habitat diversity as well as stream channel maintenance. Research on large woody debris input has mainly been accomplished in the Pacific Northwest in relation to timber harvests. Murphy and Koski (1989) in a study of seven Alaskan watersheds determined that almost all (99%) identified sources of LWD were within 100 feet of the streambank. Bottom et al. 1983 as cited by Budd et al. (1987) confirm that in Oregon most woody structure in streams is derived from within 100 feet of the bank. Based on research done within old–growth forests, the Alaska region of the National Marine Fisheries Service, recognizing the importance of LWD to salmonid habitat, issued a policy statement in 1988 advocating the protection of riparian habitat through the retention of buffer strips not less than 100 feet in width (Murphy and Koski 1989). All research findings support the use of a 100 foot buffer zone in Connecticut for large woody debris input.

Food Supply

Erman et al. (1977) conducted an evaluation of logging impacts and subsequent sediment input to 62 streams in California. Benthic invertebrate populations (the primary food source of stream fishes) in streams with no riparian buffer strips were compared to populations in streams with buffer widths of up to 100 feet. Results showed that buffer strips less than 100 feet in width were ineffective as protective measures for invertebrate populations since sediment input reduced overall diversity of benthic invertebrates. Buffer strips greater than 100 feet in width afforded protection equivalent to conditions observed in unlogged streams. The ultimate significance of these findings is that fish growth and survival may be directly impacted along streams with inadequate sized riparian buffer zones. All research supports the feasibility of implementing a 100 foot buffer zone in Connecticut to maintain aquatic food supplies.

Streamflow Maintenance

The importance of riparian ecosystems in terms of streamflow maintenance has been widely recognized (Bottom et al. 1985). In Connecticut, riparian zones comprised of wetlands are of major importance in the hydrologic regime. Riparian wetlands store surplus flood waters thus dampening stream discharge fluctuations. Peak flood flows are then gradually released reducing the severity of downstream flooding. Some riparian wetlands also act as important groundwater discharge or recharge areas. Groundwater discharge to streams during drier seasonal conditions is termed low flow augmentation. The survival of fish communities, especially coldwater salmonid populations is highly dependent upon low flow augmentation (Bottom et al. 1985). Research, although documenting the importance of riparian zones as areas critical to streamflow maintenance, has not investigated specific riparian buffer widths required to provide the most effective storage and release of stream flows.

IV. OTHER POLICY CONSIDERATIONS

Measurement Determination

The proposed policy states that buffer zone boundaries should be measured from either the edge of the riparian inland wetland as determined by Connecticut inland wetland soil delineation methods or in the absence of a riparian wetland, the edge of the streambank based on bank–full flow conditions. This boundary demarcation is absolutely necessary to ensure that all riparian wetlands are protected. For example, if all measurements were to start from the perennial stream edge and extend landward for a distance of 100 feet, many riparian zones that contain expansive wetlands greater than 100 feet in width would be left unprotected.

Also, since boundary demarcation includes wetland delineation, the ultimate width of the buffer will vary according to site specific features. Consequently, buffer width determination as stated by Division policy is a "hybridization" of both standard setting and site specific methods. This hybridization of methods is advantageous since it acknowledges the sensitivity of streamside wetlands.

Home Rule

Where the Division policy is not in consonance with local regulations and policies regarding riparian corridor buffer zone widths, local authorities would be encouraged to adopt the more restrictive regulations and policies. This feature incorporates flexibility to acknowledge the importance of local "home rule" regulations or policies already in accepted practice. Conversely, towns and cities without accepted policies and regulations could choose to enact the Division policy.

Allowable Uses in Buffer Zones

The Division policy states that "the riparian corridor buffer zone should be retained in a naturally vegetated and undisturbed condition and that all activities that pose a significant pollution threat to the stream ecosystem should be prohibited." In essence, the buffer zone becomes an area where no development should be allowed. For this policy to be effective, there should be no exceptions, a blanket restriction of all uses would be recommended. Further clarification and more precise definitions of allowable uses will, however, be required in the future if the policy evolves into a departmental regulation.

Recently, the Connecticut Supreme Court has ruled that local agencies can prohibit specific development within buffer zones. The *Lizotte v. Conservation Commission of the Town of Somers, 216 Conn.320 (1990)* decision ruled that the construction or maintenance of any septic system, tank, leach field, dry well, chemical waste disposal system, manure storage area or other pollution source within 150 feet of the nearest edge of a watercourse or inland wetland's seasonal high water level can be prohibited (Wetlands Watch 1990). If this decision is a precursor of the future, Connecticut courts will continue to the support the use of buffers, especially those which restrict or prohibit detrimental activities.

V. CONCLUSIONS

The following actions are required to preserve, protect, and restore Connecticut's riparian corridors:

1. The Inland Fisheries Division needs to adopt and implement the proposed policy so that staff can use it as a guideline to assist cities, towns, developers and private landowners with making sound land use decisions. This policy will act to solidify a collective position concerning riparian corridor protection.

2. While the proposed policy in its "current form," represents a recommendation from the CTDEP Inland Fisheries Division, the ultimate goal of the Division should be to progressively implement this policy as either a CTDEP regulation or State of Connecticut statute.

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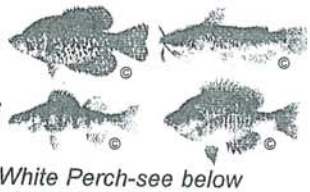
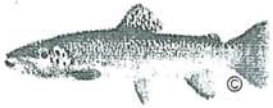
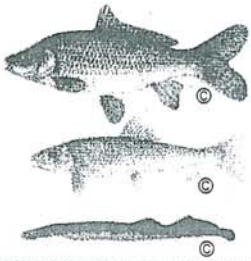
INLAND DISTRICT STATEWIDE REGULATIONS

Kind of Fish (notes)	Legal Methods	Area	Open Season[A]	Minimum Length	Daily Creel Limit
 **Kokanee**	Angling & Icefishing	All Areas	3rd Saturday in April-last day in February.	none	8
 **Northern Pike**	Angling & Icefishing	All Areas	Open Year-round[A]	26"	2
 **Panfish*** *except White Perch-see below	Angling Icefishing Bobbing	All Areas	Open Year-round[A]	none	none
 **Smelt**	Angling & Icefishing	Lakes & Ponds	Open Year-round[A]	none	50
		TAKING OF SMELT IN RIVERS & STREAMS IS PROHIBITED			
 **Striped Bass**	Angling	All Areas	Open Year-round[A]	28"	2
 **Sturgeon**		***TAKING OF STURGEON IS PROHIBITED***			
 **Trout (Brook, Brown, Lake, Rainbow)**	Angling & Icefishing	Lakes & Ponds Rivers & Streams	3rd Saturday in April-last day in February.	none	5
		Lower Rivers/ Tidal Waters	Open Year-round[A]	15"	2
 **White Perch**	Angling Icefishing Bobbing	Connecticut River (including Coves & Tributaries) Tidally influenced Rivers & Streams	Open Year-round[A]	7"	30
		Lakes & Ponds all other Rivers & Streams	Open Year-round[A]	none	none
 **Walleye**	Angling & Icefishing	All Areas	Open Year-round[A]	18"	2

[A] Except in areas closed to all fishing during a period of the year.

INLAND DISTRICT STATEWIDE SPECIES REGULATIONS

Kind of Fish (notes)	Legal Methods	Area	Open Season[A]	Minimum Length	Daily Creel Limit
 **Alewife/Blueback Herring** (Daily creel limit is for both species in aggregate)	***TAKING OF ANADROMOUS ALEWIFE & BLUEBACK HERRING FROM ALL CONNECTICUT WATERS IS PROHIBITED*** ***Emergency closure is in effect. See page 7 for more information.*** ***EXCEPTION: Landlocked alewife only may be taken from specific lakes. See page 7 for list of lakes. Methods, seasons & creel limits for these lakes are as follows:***				
	Angling	Lakes & Ponds	Open Year-round[A]	none	25
	Scoop Net	Lakes & Ponds	April 1-June 15	none	25
 **American Eel**	**Angling, Icefishing, Bobbing, Bow and Arrow, Spearing**	All Areas	Open Year-round[A]	6"	50
	Note: Spearing and bow and arrow use prohibited in all waters stocked with trott. Spearing prohibited in all lakes & ponds. The taking of elver eel, glass eel and silver eel is prohibited.				
 **American Shad**	**Angling**	Lakes & Ponds, Rivers & Streams	3rd Saturday in April-June 30	none	6
		Lower River / Tidal Waters'	April 1-June 30	none	6
 **Atlantic Salmon**	***TAKING OF ATLANTIC SALMON IS PROHIBITED*** ***Exception: Atlantic Salmon Broodstock Fisheries (see page 7)***				
 **Largemouth Bass & Smallmouth Bass** (Daily creel limit is for both species in aggregate)	**Angling & Icefishing**	Lakes & Ponds	Open Year-round[A]	12"	6
		Rivers & Streams	Open Year-round[A]	none	6
		Connecticut River	Open Year-round	12"	6
 **Carp, Suckers & Lampreys**	**Angling, Icefishing, Bobbing, Bow and Arrow, Spearing**	All Areas	Open Year-round[A]	none	none
	Note: Spearing and bow and arrow use prohibited in all waters stocked with trott. Spearing prohibited in all lakes & ponds.				
 **Chain Pickerel**	**Angling & Icefishing**	Lakes & Ponds	Open Year-round[A]	15"	6
		Rivers & Streams	Open Year-round[A]	none	none
 **Hickory Shad**	**Angling, Icefishing, Scoop Net**	All Areas	Open Year-round[A]	none	6
	Note: Daily creel limit is in aggregate with American shad				

[A] Except in areas closed to all fishing during a period of the year.