Habi-Trout

Objectives

Students will be able to use field methods to gather data for analysis and record physical data about a given aquatic ecosystem. Students will be able to examine, assess, and describe suitable trout habitat.

Method

Streams are often evaluated by the PFBC and interested angling clubs to assess the availability and condition of the habitat and to help choose methods of improving the stream for trout. Students will assess the habitat components of a stream, looking for many of the same biotic (living) and abiotic (non-living) features the PFBC does in its field evaluation.

NOTE: It is important that this lesson not be completed at a time when fish eggs are incubating in gravel and when young larvae and fry may be harmed. Check with the local PFBC district office for the timing of a field trip if you have any doubts.

Grade Level: 5-8

Subject Areas: Geography, Environmental Science

Standards:

Duration: two hours (plus travel time)

Group Size:

Setting: classroom and stream site

Key Terms: abiotic, bank vegetation, bank-full width, biotic, cover, flat, habitat, pool, riffle, run, shelter, stream bottom, stream shading, temperature

Materials

For each group: Student Worksheets I to 6; thermometers; scoops; topographic map or sketch of study site

Background

Trout and other animals have a certain set of needs that must be present for them to live and grow. These needs can be summarized into four elements: food, water, shelter and space, which together comprise an animal's habitat. Each species or group of related species requires a certain combination of things from each element in their preferred habitat. Even within the same species, different combinations of these elements are required for nursery areas, feeding and spawning. Understanding the four elements will help to better determine the stream's current ability to support trout, its potential for trout and locations most likely to benefit from protection and/or rehabilitation.

Naturally reproducing populations of rainbow, brook and brown trout are found in Pennsylvania. Brook trout have the widest distribution across the state. Rainbow trout are less well distributed and brown trout have the most restricted range. The three species differ in their spawning requirements and life histories although their egg development and some habitat requirements are similar.

Read the Student Worksheets for more specific information on each of the habitat features the students will be exploring. The temperature assessment is most applicable at the hottest time of the year; hence, you may decide not to complete this test.

Advance Preparation

1. Scout local streams or rivers for suitable sites. You may wish to examine the stream's water chemistry. If the water quality is poor, you may wish to choose another site for the examination of habitat factors. Be absolutely sure to check sites for any dangerous features. Obtain any necessary permissions.

2. Find topographic maps of selected sites if possible, otherwise prepare a sketch of the study area. Topographic maps are available from the PFBC.

3. Choose a week and date of your trip in consultation with students and other staff to reduce conflicts. Advise students about clothing and boots required for the trip. Discuss safety rules with the class.

4. Arrange for adult helpers.

5. Prepare a master data sheet, and prepare and laminate (if possible) field worksheets.

Procedure

In the classroom:

1. Using the trout as an example, list the elements of its habitat, food, water (quality), shelter and space. Discuss each element and have students suggest factors or components that would be needed for top quality trout habitat. Hand out the student worksheets, and discuss how these stream characteristics relate to the four basic habitat elements. Note that some habitat requirements relate to specific life cycle stages, e.g. spawning. Explain that later on they will examine an actual stream and may then refine their answers based on their observations.

2. Using an overhead projector and a topographic map, analyze as best you can the stream you will be exploring. Have students discuss the pros and cons of assessing habitat using only maps vs. going out to the stream before they complete the field study. Re-evaluate after the field study.

3. If resource materials are available, have students research the life cycle of a selected species of trout prior to the field study.

At stream site:

1. Discuss safety rules.

2. Divide class into groups of six and distribute a set of Student Worksheets to each group. Have each student in the group choose one sheet to use in their assessment role. Divide the stream into sections so that each group has a 50 pace section of stream to assess. An alternative method would involve having each group of students evaluating only one characteristic of the stream site.

3. When the groups have finished, have each one list its ratings under the following headings:

   Stream Shading

   Temperature

   Bank Vegetation

   Channel Characteristics

   Shelter

   Stream Bottom

4. To assist the students in arriving at a final "rating" for their section of the stream, explain that if they had five or more "A" scores out of the six in the list, the trout habitat at that site was probably excellent. With two or more "A" scores or five "B" scores, the stream has good potential and would probably improve with the application of some stream management techniques.

5. Have students review their original lists of trout needs food, water, shelter and space. Ask them whether, in light of their experience assessing the habitat of an actual stream, they would make any refinements to their initial list.

Extension

Contact a local fish and game club and determine if the class can volunteer to help the club with a Community Fisheries Improvement Program (CFIP) project.

Evaluation

Have students identify four abiotic factors that are important for trout habitat, then describe a change that might be made to improve that factor in a trout stream.

Student Worksheet 1

Stream Shading

Background

Bank vegetation not only stabilizes banks but also shades water surfaces and regulates water temperatures. This stream shading can become critically important in mid-summer when temperatures begin to soar. Too much shading in a stream will reduce production of aquatic invertebrates and ultimately result in less food for trout and other fish species. Too little shading will encourage solar heating of the stream and raise temperatures. The percentage of shading suitable for fishes varies from stream to stream and depends upon the amount of spring water available to cool the stream, the stream's width and depth, and valley development. In general, however, it is best to maximize shading along a trout stream

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Procedure

Stand on the bank of the stream and join your thumbs and forefingers to form a round window. Raise your arms and look straight up through the window at the vegetation hanging over the stream. Estimate the percentage of the window that is covered by vegetation. Repeat at least five times and average your results.

If vegetation covers 50% or less, give a C rating.

If vegetation covers 50% to 75%, give a B rating.

If vegetation covers 75% to 100%, give an A rating.

Student Worksheet 2

Temperature

Background

Temperature is perhaps the most limiting factor in trout habitat. Stream temperatures are regulated by springs, shading and channel width. Most streams begin as springs bubbling out of the ground. Spring water comes from the melting snow and rainwater that have percolated into the soils of the surrounding hillsides. Springs help to maintain cool water temperatures during the summer and warmer temperatures in the winter. Brook trout may die if water temperatures exceed 22°C for more than several consecutive days. Rainbow and brown trout can tolerate warmer temperatures (to a maximum of 24°C) than brook trout. Theoretically, a productive trout stream should never reach such temperatures.

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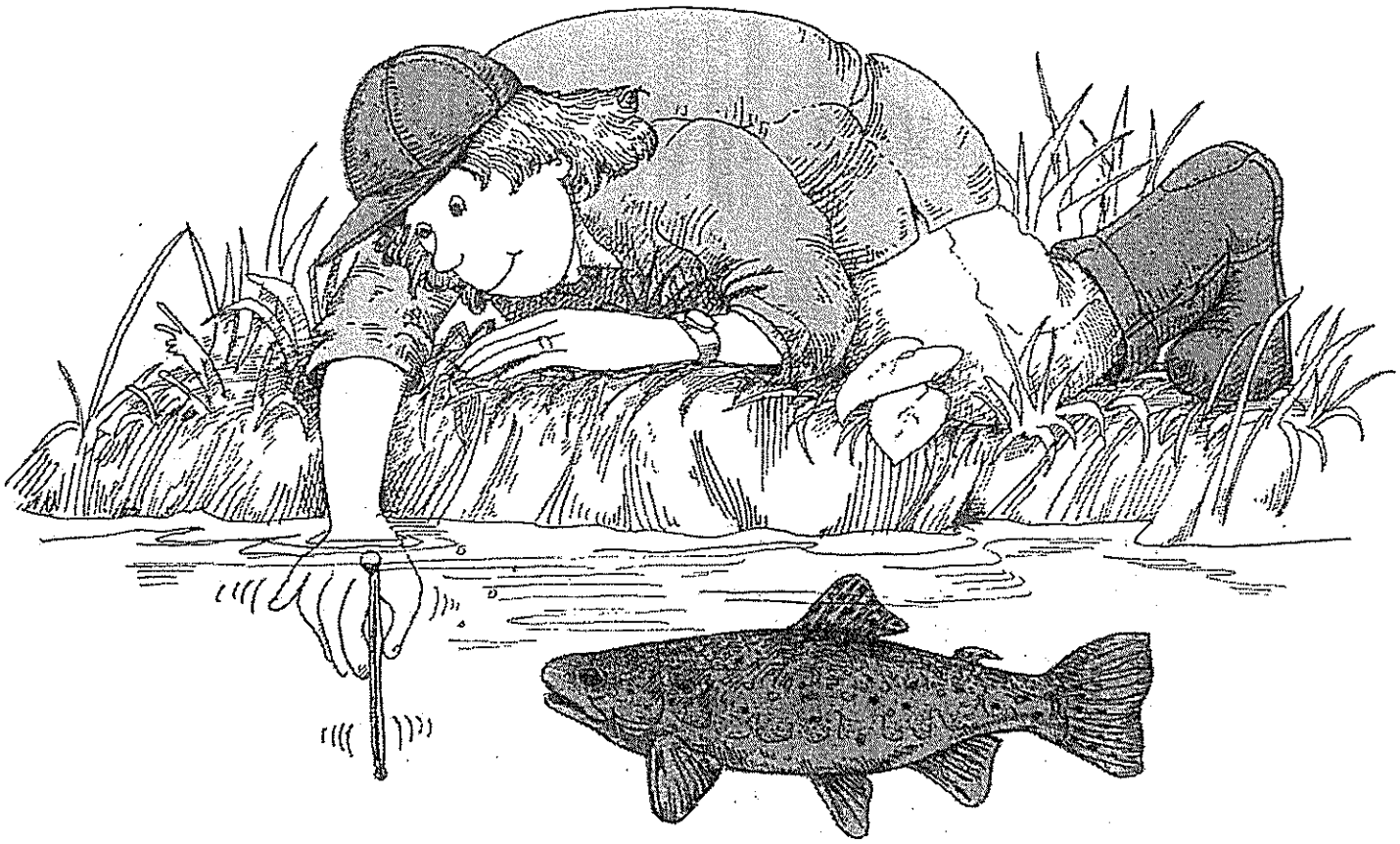
Procedure

Using a thermometer, take the temperature of the water in three locations and calculate the average.

If the water is 20°C or greater, give a C rating.

If the water is 12°C to 19°C, give a B rating.

If the water is 11°C or less, give an A rating.



Student Worksheet 3

Bank Vegetation

Background

Extensive use of valley land for agriculture or housing can create temperature and water quality problems for trout. Removal of vegetation in a stream's catchment, poor ploughing practices, poor drainage patterns and loss of bank vegetation can release material from the land during snowmelt and rainstorms. These materials may include fine particulate silt, fertilizers, manure and pesticides. Bank vegetation near spawning sites is critical to ensure low sediments from the banks. A minimum of six meters of healthy vegetated fringe on either bank reduces overland runoff and decreases the likelihood of it entering the stream.

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Procedure

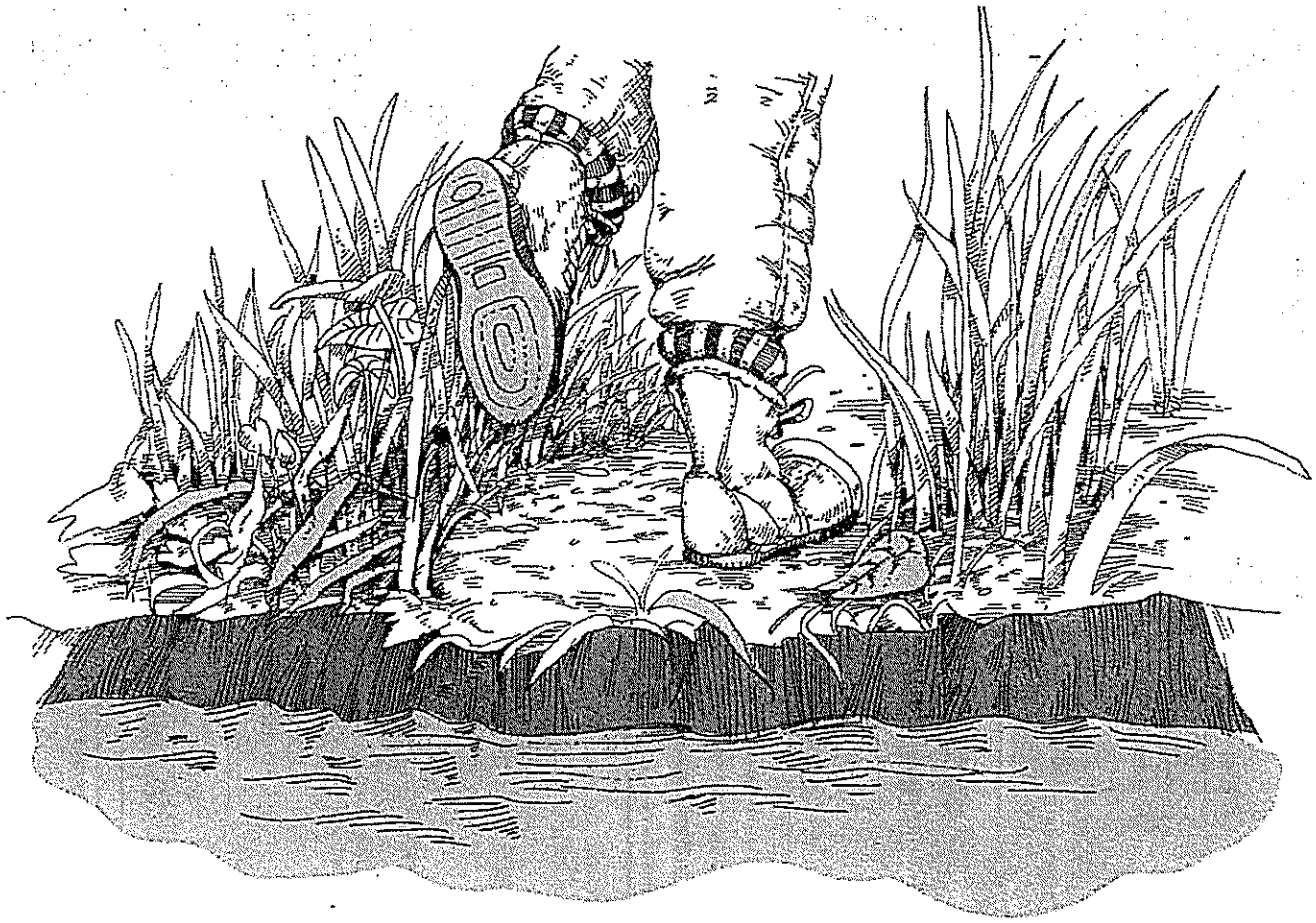
Start at the streambank and, with your back to the stream, walk in a straight line away from the water (perpendicular to stream). Count your paces as you walk through undisturbed vegetation.

If you walked six paces or less until you came to bare ground, pasture or ploughed field, give a C rating.

If you walked seven to 12 paces through natural vegetation, give a B rating.

If you walked 13 paces and were still in natural vegetation, give an A rating.

Repeat in several places on both sides of the stream and average your results.



Student Worksheet 4

Channel Characteristics

Background

Four features commonly called riffles, pools, runs and flats occur in a stream or river. Their characteristics are described below.

Riffle: Swift, shallow portion of a stream or river where the flow of water is broken; rocks often protrude through water surface. The substrate is usually gravel, rubble or rock. Riffles add oxygen to the water through turbulent mixing, and provide the best habitat for the aquatic invertebrates that both brook trout and minnows feed on. Trout also spawn in the riffles, and fingerlings and young trout live along quiet riffle margins where rocks, logs and plants offer shelter.

Run: Swift, deep portion of a stream or river. Although the flow of water may be as swift as in a riffle, the water is deeper. Runs can range in depth from 20 cm to 2 m depending on stream size. The substrate is usually rock, rubble or boulder. Month-old trout move into the shallower runs, resting in eddies behind rocks and logs, darting out to grab floating invertebrates brought down from the riffle areas by the current.

Pool: Slow-moving, deep (compared to width) portion of a river or stream. Pools can be various depths, but are usually the deepest areas of a stream. The bottom can be gravel, rock, boulder, silt or logs. Pools provide both a winter refuge and the depth needed to give protection from predation to larger trout. The deeper parts of runs are also used by these bigger fish.

Flat: Shallow, slow-moving portion of a stream or river, usually located at a point where it widens. Flats can be as shallow as riffles, but do not have the current speed.

A healthy stream or river will have a combination of the above four physical features.

The width of a stream or river can determine the distance between riffles, runs, pools and flats. A healthy stream will show at least 3 of these features along a length equal to 5 to 7 times its bank-full width. The 50 pace sequence suggested here will work well with a stream that is 7 to 10 paces (approx. 7 to 10 meters) wide when its banks are full during an average spring runoff. This width can usually be determined by seeing where water-swept branches and debris are caught in vegetation along the sides of the stream.

Modify the Procedure to allow for more or less space as needed at each site by measuring the bank-full width and multiplying by an averaged factor of 6.

Habi-Trout

Procedure

Select a location on the streambank and walk downstream 50 paces. Observe the channel of the stream and count how many times you see each of the following features.

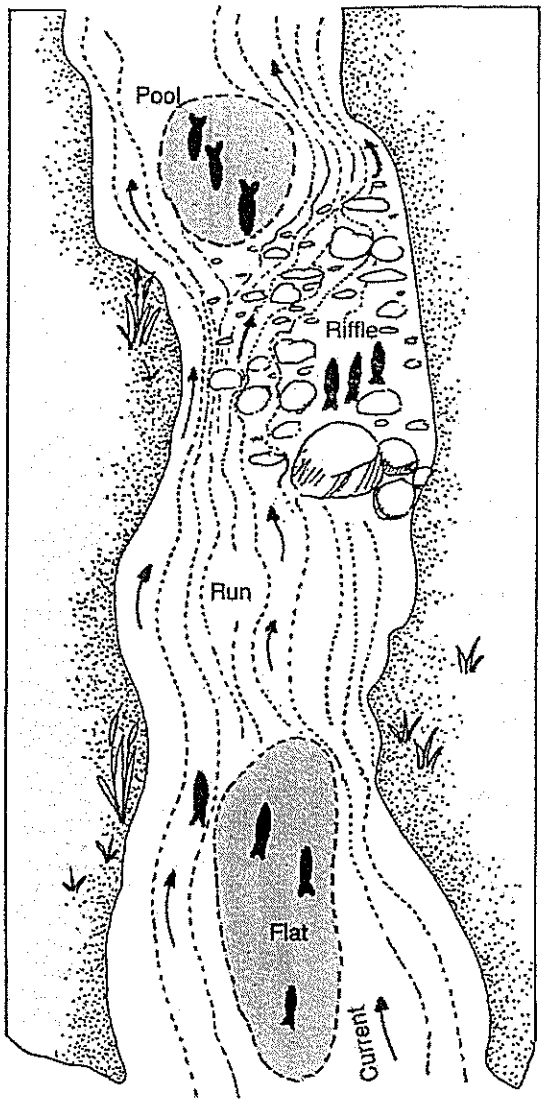
Riffle _____ Run _____

Pool _____ Flat _____

If you observed only one of the above, give a C rating.

If you observed two of the above, give a B rating.

If you observed three or four of the above, give an A rating.



Student Worksheet 5

Shelter

Background

Shelter is critical to a trout's survival in a stream and, like space, varies depending on the trout's size. Ideally, trout like to be sheltered on three sides, which usually means top, one side and bottom (e.g., an undercut bank). They also require a shelter that is a fairly close fit for their size. A shelter should break the flow of the water creating a "dead space" in or around the shelter.

Even the most torturous rapids will have dead spaces as long as there is a structure that acts as a buffer to the current. In the shallows, woody debris (such as branches, twigs and small fallen tree limbs) can provide many nooks and crannies for small fishes. Where this material is absent, jumbles of large sticks and small boulders can also provide good shelter areas. Larger, older trout look for shelter that is more substantial in the deeper areas of the stream. Undercut banks, log jams, stumps and boulders all offer hiding locations for larger fishes.

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Procedure

Select a location on the streambank and walk upstream 50 paces. Observe the channel of the stream and count how many times you see each of the following features in the water.

Undercut bank _____ Log jam _____

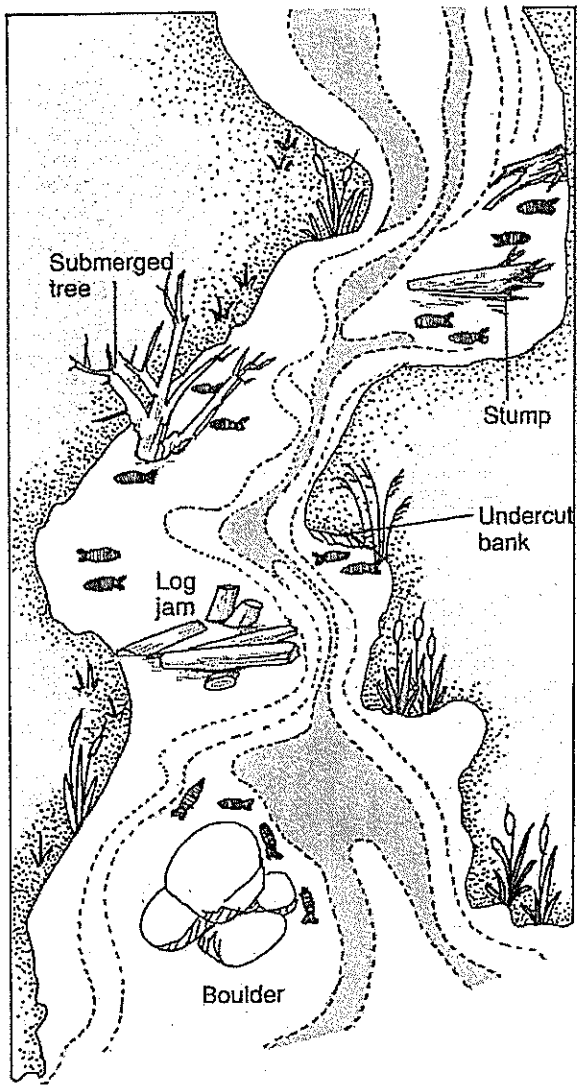
Stump _____ Boulder _____

Submerged tree or branches _____

If none or one of the features is present, give a C rating.

If two of the features are present, give a B rating.

If three or more of the features are present, give an A rating.



Student Worksheet 6

Stream Bottom

Background

The best stream bottom for trout is a mixture of gravel, rubble, rock and boulder with a liberal sprinkling of sunken logs and stumps. The rock/gravel bottom, especially in riffles and runs, offers the best habitat for aquatic invertebrates upon which the trout population feeds.

Rainbow trout spawn at the heads of riffles or at the tails of pools. Spawning rubble varies between 1 and 8 cm in size although a medium size — about 2.5cm — is preferred.

Brown trout begin to spawn as temperatures decrease in the fall. Females search out riffles at the tail of a pool or run that has suitable depth and gravel size (1 to 4 cm).

Because of their smaller size, brook trout prefer "pea" gravel (0.4 to 2 cm), a smaller spawning gravel than brown or rainbow trout. In most streams wider than 1 m, this gravel is found in the inside bend of curves or inside channels of the main river. In slow-flowing streams that are not prone to flooding, this fine gravel may be found throughout the stream.

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Procedure

Using a scoop or small shovel, remove a small quantity of bottom material from the stream, preferably from the head of a riffle or tail of a pool. Sort out all the stones and pebbles that range in size from 0.4 to 4.0 cm. Use the samples drawn below to size your sample quickly.

If there are no pebbles within the size range, and the bottom is mostly sand or mud, give a C rating.

If there are a few pebbles within the range, give a B rating.

If the sample is mostly composed of samples within the range, give an A rating.