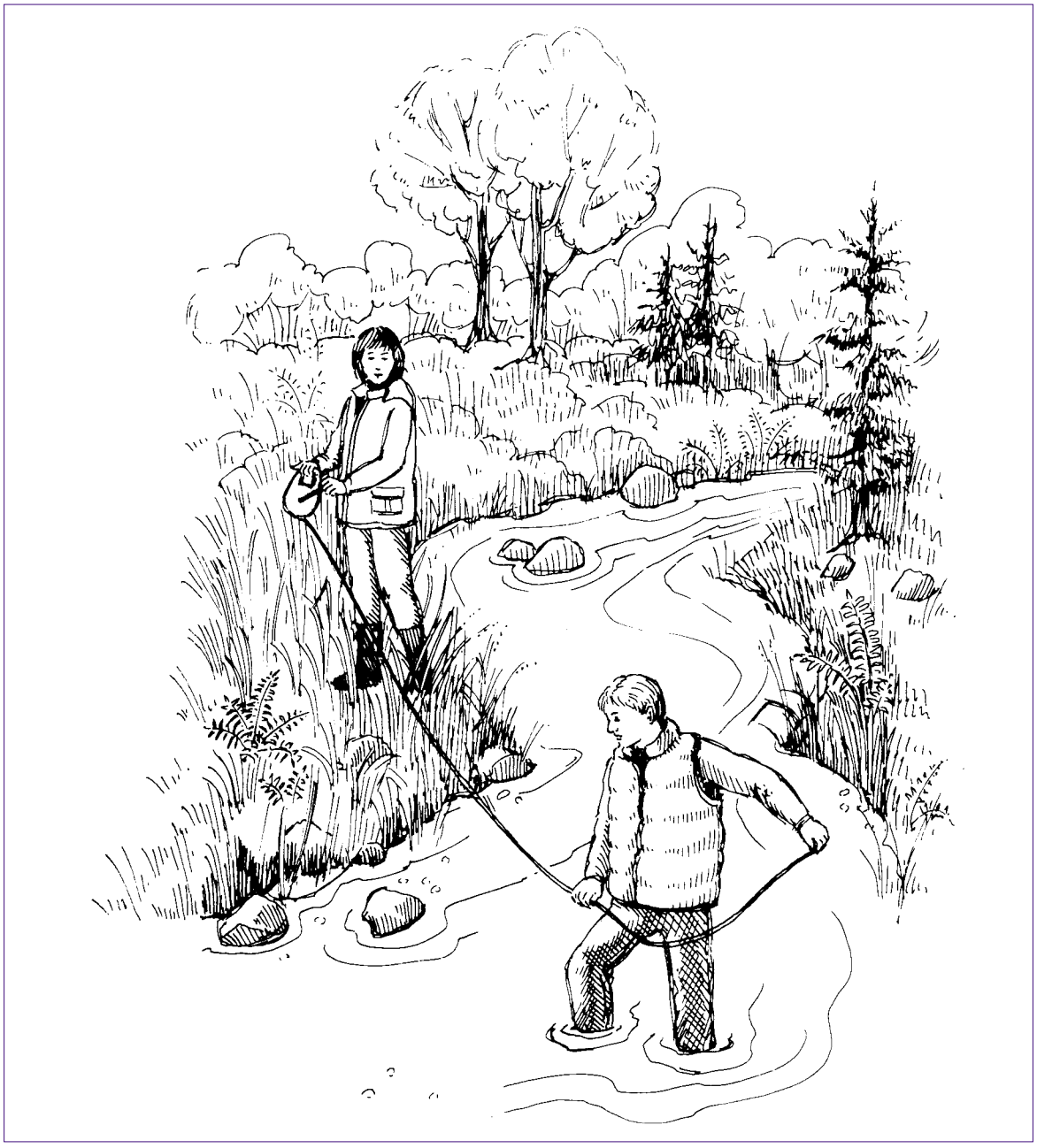
The **Stewardship** Series

The Streamkeepers Handbook

A Practical Guide To Stream And Wetland Care



Canada

Province of British Columbia

STREAMKEEPERS

Module 13
Creel Surveys

Project Approval Required	Training	Time Commitment (per year)	Number Of People	Time of Year
yes	Not necessary	A few weeks or more	2 or more	Year round

Fisheries and Oceans Pêches et Océans

Canada

MODULE 13

Creel Survey

Welcome to the Streamkeepers Program! The Department of Fisheries and Oceans Community Involvement Program provides these Streamkeepers training modules. These modules encourage "hands on" environmental activities in watersheds in British Columbia. Volunteer groups, schools, and individuals are using this material to monitor and restore local waterways. Your local Fisheries and Oceans Community Advisor can provide more information.

Acknowledgements

Mike O'Neill (manager of the Toboggan Creek Hatchery, Smithers) and Brenda Donas (Community Advisor, Department of Fisheries and Oceans) provided the information for this module.

Project Activity and Purpose

In this module you will conduct a creel survey to estimate the number of anglers on a stream and the number of fish caught. You will visit the stream regularly during the fishing season and collect information about anglers' catch and fishing effort. By accurately sampling during part of the available angling time, you can estimate total angling effort and catch. A reliable survey should account for at least one-sixth of the catch and effort at each fishing spot on a stream. You can design the survey to recover data from tagged fish, find out whether anglers are local or visiting, or provide answers to other questions.

Data from creel surveys help fisheries managers manage fish stocks effectively. Data provides information about the impact of angling on a particular fish population and is used to assess the health of the population if there are no other stock assessment data available.

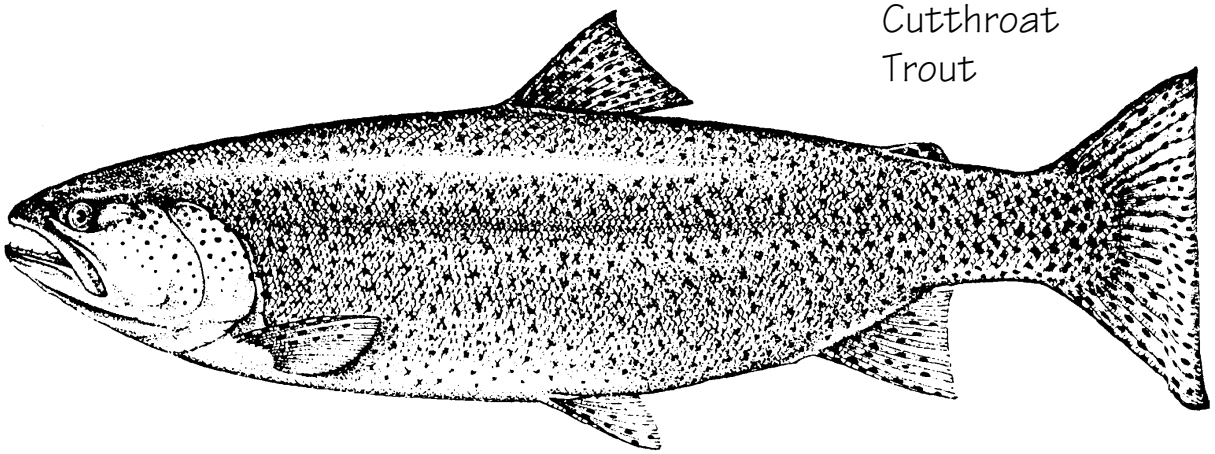
Introduction

Information about angling effort and success is important in understanding the health of a stream's fishery and in designing effective fishing regulations. Fishery management strategies are aimed at keeping streams filled to capacity with native breeding stocks and allowing anglers to take fish that are surplus to breeding requirements. If hatchery-reared fish supplement the stock, managers may wish to use a creel survey to recover valuable tag data.

Angling is a growing recreational activity throughout British Columbia. Fish stocks in streams as well as oceans are facing increasing pressures. Overfishing can reduce the number of potential spawners to a level so low that the population is in danger of collapsing. Fish stocks take many years to recover from such a decline. Some stocks have become extinct.

Complete knowledge of angling effort and harvest on every stream is ideal, but too costly to consider. The creel survey was developed to study angling effort in a statistically reliable way. It uses consistent methods, so you can compare results from year to year and, sometimes, from stream to stream.

Once you have established the timing and frequency of your survey, you can choose the kinds of observations you wish to make or the questions you wish to ask. Catch success is calculated from the number of hours fished and the number of fish caught. You may wish



to collect tags, or find out the sex, length, and age of the fish. You also may wish to know whether the anglers are local or from out of town. Such information can demonstrate the importance of the stream to the local economy, and local businesses will find the information useful.

To obtain statistically reliable results, you will need to survey all potential angling locations on a stream. If you spend four hours every other day at each fishing location, you will have surveyed one-sixth of the potential fishing hours, assuming twelve hours of daylight.

Several practical matters affect the time commitment and the accuracy of your results. The first is the length of the fishing season. Obviously, a stream with a one-month fishery requires fewer survey days than a stream with a three-month fishery.

The second practical matter is the size of the stream and distribution of fishing spots. Short streams with a few well-known fishing spots are easy to survey. Long streams with many angling locations are much more difficult to survey. A survey of a large area requires more volunteers and more coordination.

The third matter to consider is access to your stream. On most streams, there are vehicle access points where anglers park then walk to fishing spots. These locations are convenient for anglers and surveyors alike. Your task is more complicated when anglers travel by boat or hike long distances to fishing locations.

Creel surveys usually are not done every year on the same stream. Trends in fish populations can be followed adequately by repeating surveys every three to five years.

Project Guidance and Approval

You need approval from your Community Advisor or the local office of the Ministry of Water, Land and Air Protection (WLAP). You also should notify DFO and WLAP enforcement officers and biologists of your survey plans. They may be able to help you design your survey or may even wish to include a few questions of their own.

Level of Effort

A creel survey requires a considerable time commitment. The sport fishing season for your stream may be several weeks or months long. You probably will wish to organize and train several volunteers. Each fishing location is surveyed for at least one-sixth of the total daylight hours, so a creel survey during the long summer days can be a big job.

Time of Year and Working Conditions

Creel surveys are done during the fishing season. If the season is long, make sure you survey at least during the peak fishing weeks. A shortened survey still provides useful information about trends. Depending on fish stock, you may be working in the middle of winter or the heat of summer. You will need to be in good physical condition if your survey involves much hiking. There may be bears or other potentially dangerous wildlife in the area of your the stream.

Safety

PERSONAL SAFETY

Concern for personal safety is essential when working outdoors. Always tell someone where you are going and when you will return. Work in pairs, never alone. Carry emergency phone numbers for police and ambulance.

Do not attempt to wade fast water or water deeper than your knees. Watch out for slippery stream beds, undercut banks, waterfalls, and fast flowing areas. Log jams can be unstable, so take care to walk around them.

Get permission to cross or use private property. Beware of domestic animals and wildlife. Bears may be common and bold during the fishing season.

HEALTH

Do not drink stream water. Although it may look pristine, it can harbour bacteria or parasites that will make you sick. Do not expose cuts and wounds to stream water. Know the symptoms and treatment for hypothermia.

EQUIPMENT

Carry a first aid kit. When working in isolated areas, carry a survival kit containing at least a lighter, fire starter, candle, and flares. Take a cellular phone if you have one.

CLOTHING

Dress for the weather and stream conditions. Wear highly visible clothing. Wear waders with felts when walking in the stream.

WARNING

Do not confront anyone you suspect may be violating fishing or other regulations. Follow the Observe Record Report procedure described in Module 9.

Materials and Equipment

waders, or boots
first aid kit
waterproof paper
pencils
rain pants and coats
knife
data sheets

If collecting tags or physical data:

ziploc bags
Tweezers
tape measure
tag labels
scale books

For surveys on long rivers, consider adding:
boats and fuel life jackets
rope radio (for remote locations)
bear spray extra food and clothing

Procedure

Step 1. DESIGN THE SURVEY FORM

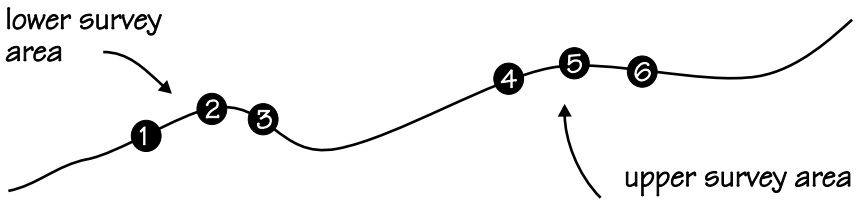
Select the information you wish to collect. At the very least, you will wish to record the number of anglers, the amount of time each angler spends fishing, the number of fish caught during the survey period, and the species caught. When you combine data from the whole survey period, you will be able to calculate total angler effort and catch success, or catch per unit effort. The Field Data Sheet provides space for these basic data. You may wish to add additional questions, such as where the anglers reside or how often they fish. If you are collecting physical data from fish that have been caught and killed, local fisheries staff will provide you with the appropriate data sheets and equipment.

Step 2. WORK OUT A SURVEY DESIGN AND SCHEDULE

If your stream is long, with many fishing spots, you will need to work out a schedule of volunteers to survey all locations throughout the season. You will need to design your survey according to number of sites, length of fishing season, and number of volunteers available. To be statistically reliable, someone should survey each site for at least one-sixth of the available angling time. This can be done by sampling each site every other day for one-third of the available daylight hours. When there are twelve hours of daylight, you can divide the day into three four-hour shifts (7 to 11 a.m., 11 a.m. to 3 p.m., and 3 to 7 p.m.). During the summer or winter, change the lengths and times of the shifts according to the total hours of daylight.

The following example is for a fall coho fishery on a hypothetical stream. The fishery occurs for sixty days during September and October. The lower 3 km of the stream is open to angling, and contains six good angling spots. Divide the stream into upper and lower survey areas, with three survey sites in each area (Figure 1). Because the sites are close together on this hypothetical stream, you may decide that one person can cover three sites in the upper or lower survey areas in one shift.

Figure 1
Angling Sites (1-6) on a Hypothetical Stream



For a 60-day fishery, each area is surveyed on thirty dates. You may choose to survey the upper area on even dates and the lower area on odd dates. Make sure you assign morning, afternoon, and evening shifts randomly but equally in both the upper and lower survey areas. This type of experimental design is called random stratified sampling.

To assign shift times randomly, prepare thirty pieces of paper. These represent the thirty days at the lower survey area. On ten pieces, write the morning shift time, on another ten write the afternoon time, and on the last ten write the evening time. Throw the pieces into a hat and mix them. Pull out one piece and write the shift time on the first odd day on the calendar (September 1). Continue drawing papers and writing times on the odd dates to the end of October. When you are done, put the pieces of paper back in the hat and repeat the procedure for the even dates for the upper site.

You will need seven volunteers to cover the week. Perhaps each person will volunteer to do one four-hour shift each week. When fishing spots are more spread out, you will need one volunteer at each spot.

Step 3. DURING EACH SURVEY PERIOD

Using waterproof paper, record the number of anglers you observe during each shift. Record how much time each angler spends fishing and the number of each species caught in that period. Appendix 1 is a key to adult salmonid identification. Do not include fish caught before or after the survey period. Interview anglers for any information you cannot get by observation.

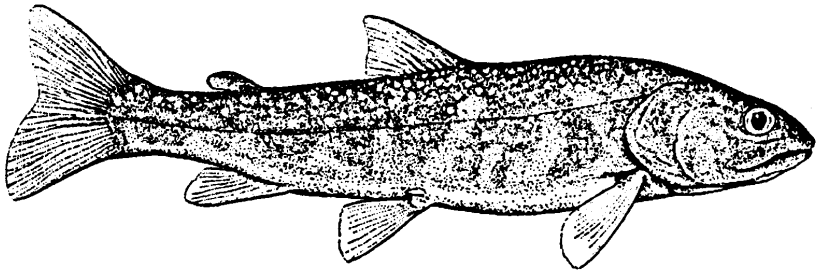
Keep the data for each angler separate and transfer it to the Creel Survey Site Data Sheet at the end of the day. Use a separate data sheet for each site. Here is an example of a field data sheet partly completed for the hypothetical coho survey.

Angler #	Hours fished	Number Caught Per Species (See code below)							Marked Fish	
				co					Species mark	
1	3			0					co/ADIPOSE	
2	4			2						
3	1			0						
.....										
TOTALS	8			2						+

species code: co = coho, st = steelhead

Also, complete the Conditions and Locations Data Sheet. These conditions will change during the survey period, so use new sheet for each date. Record the exact survey location, weather, water temperature, turbidity, and percent bankfull. Measure turbidity in a deep pool area, using the tape measure. Turbidity is the maximum depth in centimetres that you see the "one" at the end of the tape. Estimate the percent bankfull: the amount of water compared with the bankfull channel size. The boundaries of the bankfull channel are defined by the edge of perennial vegetation growth.

Dolly Varden Char



Collecting, Reporting, and Evaluating Information

As the survey progresses through the weeks, combine the data for all survey locations on the Summary Sheet. At the end, total the number of anglers, hours fished, and number of fish caught. In the example, these totals represent one-sixth of the total effort and catch possible, so use an expansion factor of six to get the total effort and catch. If you surveyed during more or less than one-sixth of the available time, use the appropriate expansion factor. Find the catch rate by dividing the total number of fish caught by the total number of angler hours. This also is known as catch per unit effort. A sample completed Summary Sheet is included below.

Date	# Anglers Ob-served	Total Hours Fished	Total Catch (#) And Catch Rate (#/hr) By Species (see codes on field sheet)									
			co									
			#	#/hr	#	#/hr	#	#/hr	#	#/hr	#	#/hr
Sept. 15/95	50	150	75	0.5								
Sept. 17/95	25	75	15	0.2								
.....												
Sept. 30/95	15	30	3	0.1								
total number	900	6000	3000	.05								
expanded total	4, 800	36, 000	18, 000	0.5								

expansion factor	6

You can compare estimates obtained from this creel survey with those from previous creel surveys, as long as the same methods were used. The total number of fish caught, hours fished, and catch rates will give some insight into whether the level and quality of angling have changed since the last survey. This data also provides an indication of the total harvest in the fishery and is useful in assessing stock abundance.

Send a copy of your Creel Survey Summary Sheet to the Streamkeepers Database, the Community Advisor, and local fisheries staff who worked with you on the project. The current address of the Streamkeepers Database is listed in the Handbook. A statistically reliable creel survey provides useful data for fisheries managers. They will find it useful for making decisions about management strategies affecting your stream.

Public Relations

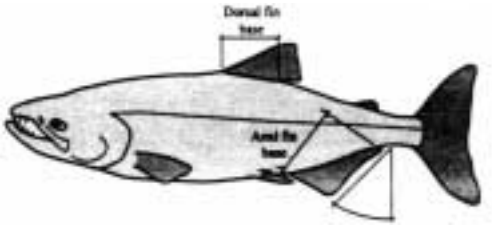
You can clean up streams, monitor their condition, and undertake enhancement projects, but you need the support of your community for these projects to succeed. Talk about your project with others whenever and wherever you can, including at schools and public meetings. Place signs at visible projects. Contact newspapers, radio stations and television stations. Module 10 contains specific information about increasing community awareness and working with the media.

Appendix 1

(from McPhail and Carveth, 1995)

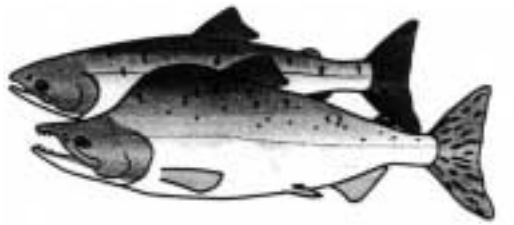
Key to Adult Salmon, Trout and Char

Family Salmonidae (subfamily Salmoninae)



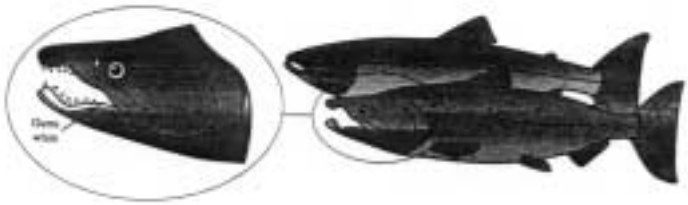
1 (10) Anal fin base longer than dorsal fin base; In profile, hind margin of anal fin slants backwards (not vertical) 2

2 (7) Distinct spots on tail 3

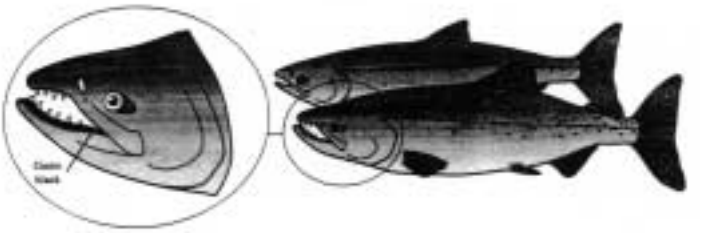


3 (4) Tail spots oblong (not round)
. . PINK SALMON (Oncorhynchus gorbuscha)

4 (3) Tail spots round (not oblong) 5



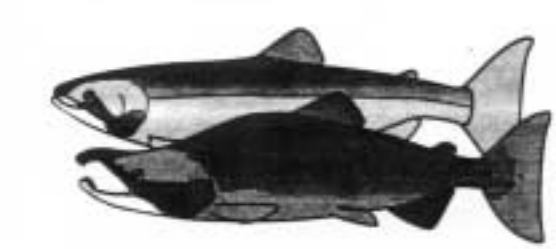
5 (6) Tail spotted on upper half; gums at base of teeth in lower jaw white.
. . . . . COHO SALMON (Oncorhynchus kisutch



6 (5) Tail spotted on both upper and lower halves; gums at base of teeth in lower jaw black.

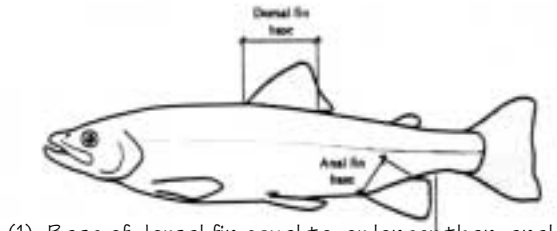
. . CHINOOK SALMON (Oncorhynchus tshawytsch)

7 (2) No spots on tail, but occasionally some fine speckles . . 8



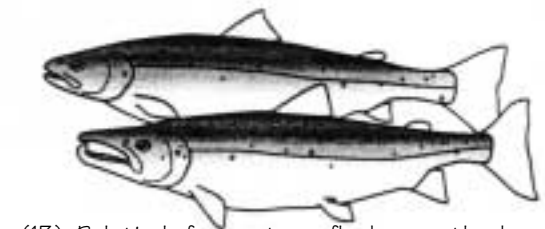
8 (9) Adults occur in fresh water both as migratory spawners (Sockeye) and as residents (Kokanee); flanks are uniformly coloured (silver in non-breeding Kokanee, usually red in breeding Sockeye and Kokanee) . . . . . SOCKEYE SALMON/KOKANEE
. . . . . (Oncorhynchus nerka)

9 (8) Adults in freshwater only as spawners; flanks in males pale with irregular red and black blotches, females with a purplish lateral strip.
. . . . . CHUM SALMON (Oncorhynchus keta)



10 (1) Base of dorsal fin equal to, or longer than, anal fin base; in profile, hind margin of anal fin is vertical (no backward slant). 11

11 (18) Background colour on flanks light (silver or golden) with dark spots 12

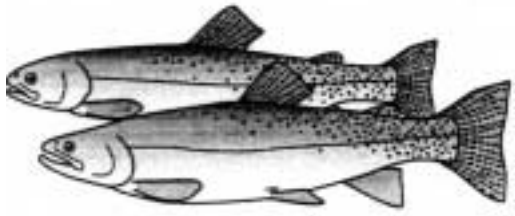


12 (13) Relatively few spots on flanks, mostly above lateral line, some spots x-shaped; caudal fin usually without spots; spawning males with conspicuously hooked lower jaw
. . . . . ATLANTIC SALMON (Salmo salar)

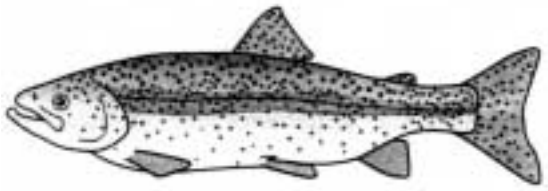
13 (12) Spots on back and sides more numerous; none x-shaped; caudal fin usually heavily spotted . . 14

14 (17) Red or orange slash under lower jaw; upper jaw extends back past hind margin of eye; tail usually yellowish with black spots 15

15 (16) Anterior flanks heavily spotted above and below lateral line, anal fin usually with spots . . . . . COASTAL CUTTHROAT TROUT . . . . . (Oncorhynchus clarki clarki)



16 (15) Anterior flanks lightly spotted (mostly above lateral line), anal fin usually without spots . . . . . WESTSLOPE CUTTHROAT TROUT . . . . . (Oncorhynchus clarki lewisi)

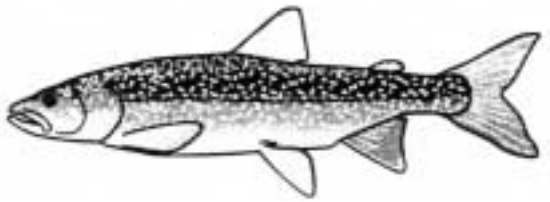


17 (14) No red or orange slash under lower jaw; except in spawning males upper jaw does not extend back beyond hind margin of eye; sides usually silver with a pink hue extending along midline; tail dusky with dark spots . . . . . RAINBOW TROUT . . . . . (Oncorhynchus mykiss)

18 (11) background colour on sides dark with light or coloured spots 19

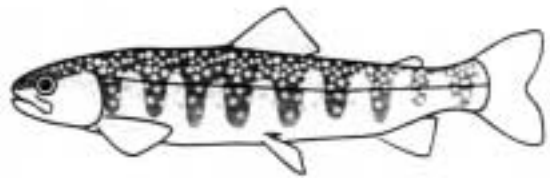
19 (20) Dorsal fin yellowish, with bold black streaks; red spots on flanks surrounded by blue haloes . . . . . BROOK TROUT (Salvelinus fontinalis)

20 (19) Dorsal fin dusky and without bold black marks; spots on sides not surrounded by light haloes 21



21 (22) Tail deeply forked, light coloured spots on both halves of tail; head and body covered in light irregular spots . . . LAKE TROUT (Salvelinus namaycush)

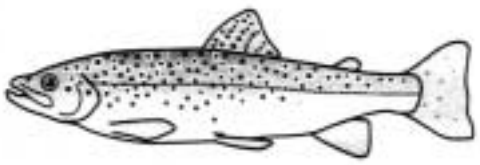
22 (21) Tail not deeply forked; spots if present only on upper half of tail. 23



23 (24) When viewed from the side snout is blunt; upper jaw short (barely reaches hind margin of eye) . . . . . DOLLY VARDEN (Salvelinus malma)*

24 (23) When viewed from the side snout is more pointed; upper jaw long (reaches well past hind margin of eye). . . . BULL TROUT (Salvelinus confluentus)*

25 (26) Background colour on back and flanks light (silver or golden) with dark spots 26



26 (25) Spots on flanks mostly dark surrounded by conspicuous light haloes; some spots along side are red . . . . . BROWN TROUT (Salmo trutta)

* This species pair is difficult to distinguish unless you have both in hand.

send the data to Streamkeepers Database

Stream Location and Conditions

(use a new data sheet for each stream segment surveyed)
(see Module 1 for additional information)

Stream Name/Nearest Town	**Date**
Watershed code	**NTS Map#**
Stream segnment order	**Length surveyed**
Organization Name	**Crew size**
Contact Name	**Phone #**

Recent weather conditions:	**Water turbidity (cm)**
Water temperature (^{0}C) ***(Leave thermometer in water 2 min)***	**Air temperature (^{0}C)**
Stream condition (%bankfull)	**Photos taken: (yes or no)**

Upstream boundary of survey (directions, distance to known landmark)
Downstream boundary of survey (directions, distance to known landmark)
IF YOU ARE SAMPLING A SPECIFIC POINT ON THE STREAM, RECORD: **Specific location of sampling station (directions, disatnce to known landmark)**

send the data to Streamkeepers Database

MODULE 13:
CREEL SURVEY SITE FIELD DATA SHEET

(use a new data sheet for each stream segment surveyed)

Stream Name	**Date**
Survey Sites(s)	
Survey Shift	**Surveyor**

Angler #	**Hours Fished**	**# Caught Per Species (See code below)**						**Marked Fish**
								species/mark

SPECIES CODES **co = coho** **ch = chinook** **so = sockeye**
pk = pink **cm = chum** **st = steelhead** **rn = rainbow**
dv = dolly varden

MODULE 13: CREEL SURVEY SUMMARY SHEET

Stream Name	**Survey Period**
Stream segment location	

Date	**# Anglers Ob-served**	**Total hours fished**	**Total Catch (#) And Catch (#/hr) By Species (See codes on field sheet)**									
			#	**#/hr**	**#**	**#/hr**	**#**	**#/hr**	**#**	**#/hr**	**#**	**#/hr**
Total number												
Expanded total												

Expansion factor used	