LOGGING

and

FISH HABITAT

TABLE OF CONTENTS

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INTRODUCTION

This pamphlet, directed mainly to timber sale administrators and loggers, describes some of the major habitat requirements of trout and salmon and lists some basic practices that will help to protect the habitat.

THE FISHERY RESOURCE AND HABITAT NEEDS

Southeastern Alaskan streams support five species of salmon (king, sockeye, coho, chum and pink), two sea-run species of trout (cutthroat and steelhead), one sea-run char (the Dolly Varden), and also resident trout and char. The salmon support a large commercial fishing industry; the salmon, trout, and char support a growing sport fishery.

General Needs and Life Patterns

Salmon, "sea-run" trout and Dolly Varden spend part of their lives maturing at sea, then return to fresh water to spawn. The "resident" populations spend their entire lives in fresh water.

Upon returning from the sea, the salmon, sea-run trout and char migrate upstream varying distances to spawning areas. They have no difficulty living in and migrating through glacial waters; however, the spawning areas should be relatively sediment free for reasons which will be described later. After reaching the spawning area, the adult female uses her tail to dig a shallow (6 to 12 inches deep) nest or "redd" in the gravel. Into this nest

the fish deposits a portion of her 500 to 4,000 eggs (depending upon species). A male, close beside her, simultaneously emits a cloud of milt containing sperm, and the eggs are fertilized. The eggs then settle into spaces between the rocks and the female covers them with gravel. This process is continued until all her eggs have been deposited. The eggs develop in the gravel for varying lengths of time, depending on species and water temperature, until the fry emerge from the gravel into the free-flowing stream. All five species of Pacific salmon die after spawning. However, many of the sea-run trout and Dolly Varden survive to spawn one or more additional times.

It is during this development time in the gravel that the water quality is most critical. In order for the eggs to properly mature, they must have an adequate supply of oxygen in the water circulating through the gravel. If there is too much sediment in the stream, the spaces between the gravel become clogged. When this occurs, the water is unable to circulate freely through the gravel and the eggs can die from lack of oxygen, or be poisoned by their own metabolic waste material. Sediment, by blocking their passage, can also prevent fry from leaving the gravel.

When the fry emerge from the gravel, pink and chum salmon go directly to sea. King, coho and sockeye salmon, steelhead and cutthroat trout, and Dolly Varden, spend from one to four years in fresh water before migrating to sea.

The Importance of Small Streams and Tributaries

During the time the juveniles are in fresh water, some species live in lakes, some live in main streams, and yet others live in small

streams before migrating to sea. In the past, small streams have generally been overlooked as fish habitat. Recent research has shown these small streams (some only a few inches in width and depth) serve as important habitat for young fish during their stay in fresh water.

Tributaries often serve as a velocity shelter. During periods of flooding, the young fish often move into the side tributaries, seeking shelter from the higher velocities of larger streams.

Small spring-fed tributaries may hold the key to overwinter survival of young salmon and trout. Many stream tributaries are spring-fed and remain relatively ice-free during the winter (Figure 1). By moving into these areas of warmer water, the young fish are able to avoid the adverse effects of icing conditions in the mainstream. Many other streams suffer severe icing conditions, which can cause mass mortality. Ice forming on the stream bottom, complete freezing and slush ice, which can occur after a mid-winter thaw, can make large segments of streams uninhabitable for the young fish.

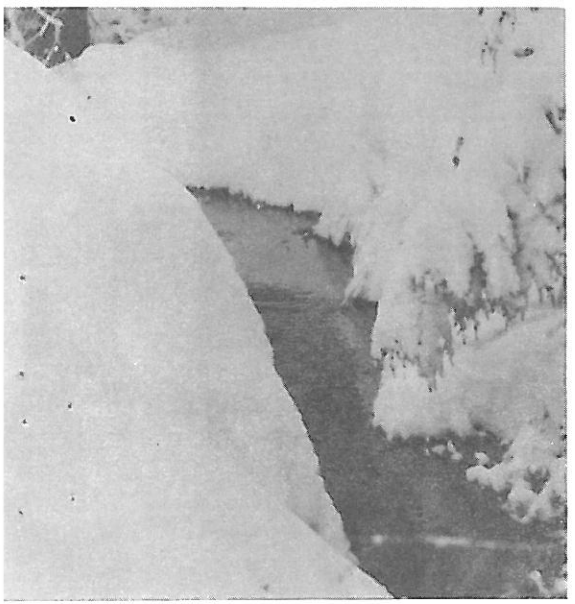


Figure 1.--Overwinter survival of young fish is often dependent on spring fed tributaries.

Escape cover from predators is also important. Small streams with brush cover, (Figure 2) undercut banks (Figure 3) and logs (Figure 4), provide an excellent escape cover from predators such as larger fish, birds and mammals.

Riffle areas provide an excellent source of food. Aquatic insects are normally more abundant in these areas. A combination of pools, plenty of cover, and riffle areas is important to good fish habitat.

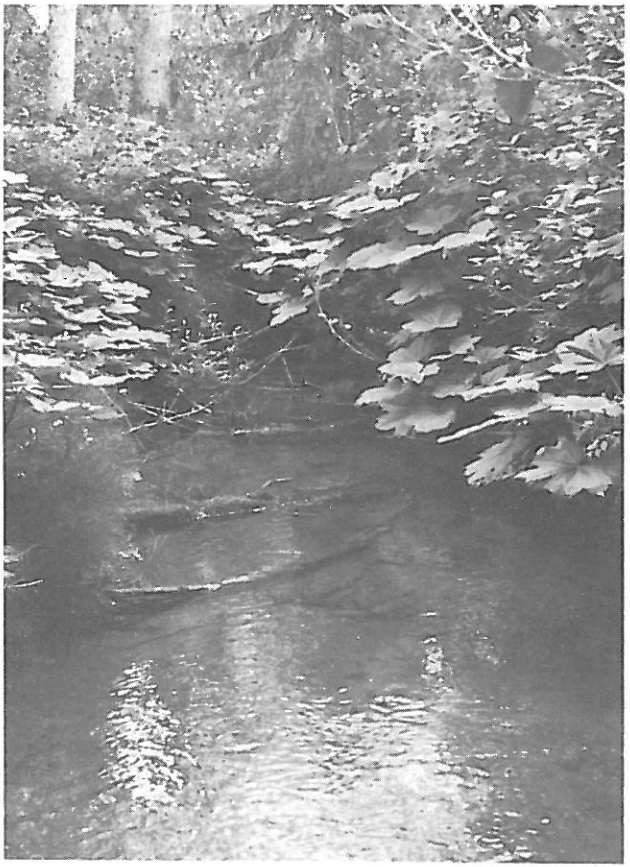
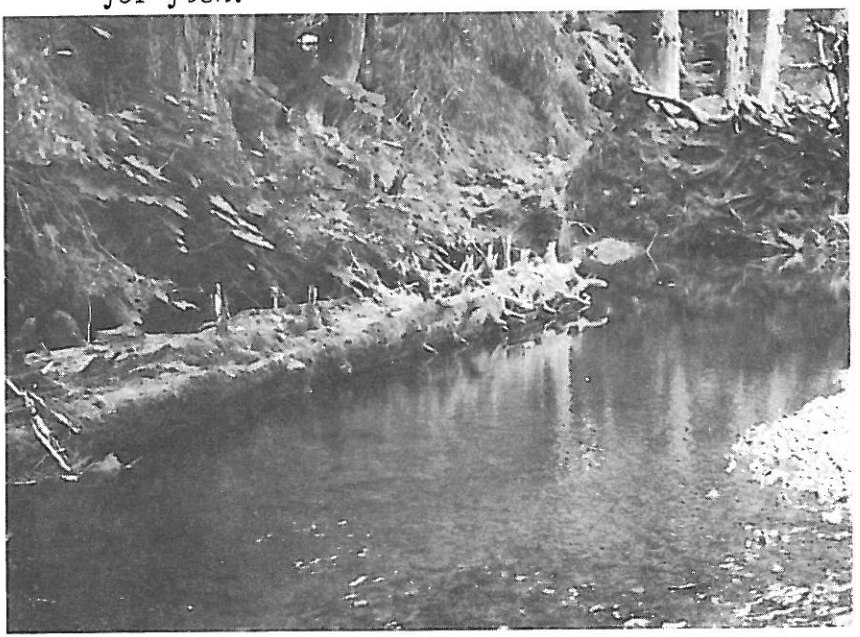


Figure 2.--Heavy brush provides good cover. Insects that fall from the brush serve as a source of food for fish.

Figure 3.--Undercut banks provide excellent cover for fish.

Figure 4.--Logs can also provide good cover for fish.



A critical time for young coho is just after they emerge from the gravel. At this time they cannot compete with older fingerling-sized coho in the stream and must seek shallow stream margins and very small streams not used by older fish. Even small intermittent streams become important for fish after they emerge from the gravel.

A major reason for limited survival of fish such as coho, is competition for space and food. There is only so much of these commodities available. As fry come out of the gravel they establish territories which they aggressively defend from intruders. Large numbers of the fry emerging later have no place to go except the sea, where they perish because they cannot adapt to salt water at this time. In other words, only a certain number of young fish will live in a given unit of space. If this space is reduced or adversely altered, the number of fish produced will be reduced accordingly.

HABITAT PROTECTION

Improper logging operations can damage the natural stream habitat used by adult fish for spawning and young fish during their fresh-water rearing stages. The following discussions and photographs illustrate some problems and show ways these can be avoided with proper logging techniques.

Debris in Streams

Excessive debris in streams (Figure 5) can lower the quality of the natural stream habitat by forcing streams underground with resultant loss of rearing and wintering areas, by blocking adult fish passage, and covering suitable spawning beds. Small streams impounded

by logging debris (Figure 6) can have increased water temperatures and reduced oxygen levels. Both might be lethal to fish.

Figure 5.--Debris jams such as this block adult fish passage and cover spawning beds.

Figure 6.--Impoundment by debris jams can cause increased water temperatures and decrease oxygen levels.

Debris such as bark, needles and small twigs (Figure 7) covering the streambed, reduces the abundance and variety of insects, thus limiting the capability of streams to support young fish.

Falling and yarding timber away from streams (Figure 8), leaving a fringe of windfirm timber along the streams (Figure 9), or, where practical, selectively logging a fringe of timber along the stream are ways of avoiding excessive debris.

Figure 7.--Excessive bark, needles and twigs is detrimental to fish habitat.

Figure 8.--Trees were felled and yarded away from this stream; note the absence of debris in the stream and lack of damage to streambeds.

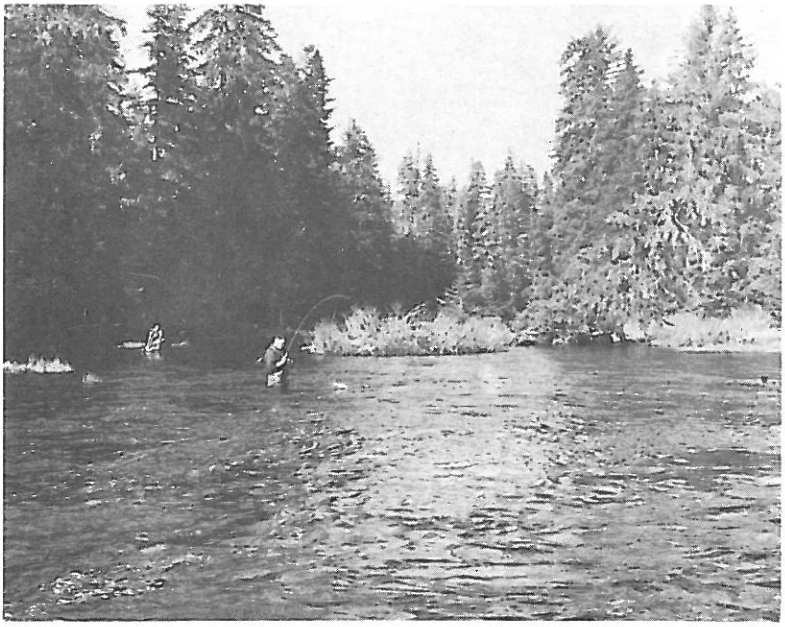


Figure 9.--On important sport-fishing streams, leave areas help to maintain slash free access and provide a more pleasing environment for the fisherman.

Stream Cleanup of Logging Debris

The best method of protecting a stream is to keep logs and debris out of it in the first place. However, if debris does accumulate in a stream, proper stream cleanup is often necessary to protect the quality of the stream for future fish production. Care must be taken during cleanup to avoid additional unnecessary damage to the fish habitat (Figure 10). Even clearing streams by hand can cause loss of habitat if too much protective area is removed (Figure 11).

Figure 10.--If equipment is improperly used during stream cleanup, the banks can be broken down causing a loss of fish habitat.

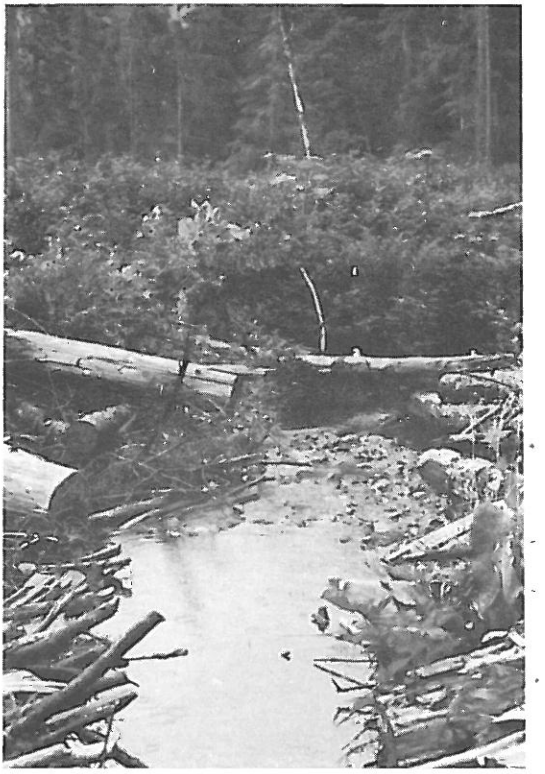


Figure 11.-- This stream was cleared by hand, but some logs which provided cover and did not create blocks should have been left in place.

In a properly cleared stream, the banks are left intact. Some logs, which are not creating blocks, should be left in place to afford protection from predators for the young and adult fish in the stream (Figure 12). In addition, logs which are partially buried in the stream bottom should usually be left in place. These logs not only create living area for young fish, but may increase water flow through the gravel necessary to the incubating eggs.

Figure 12.--In this example of a properly cleared stream, note the undisturbed banks and the cover logs left in place.

Bank Damage

Stream banks can be damaged by yarding logs from or across the stream (Figure 13), by constructing roads too close to streams (Figure 14), or by equipment improperly crossing or working in the stream (Figure 15).

Figure 13.--If logs are felled into and yarded out of streams the banks may be broken down.

Figure 14.--This road has been constructed too close to a stream; not only has it destroyed the stream bank, but it has also become a source of sediment.

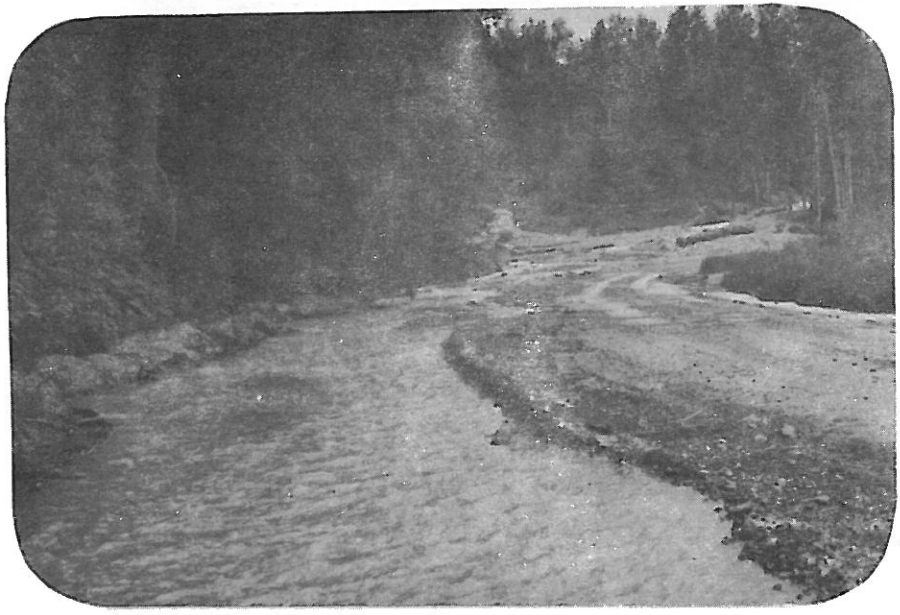


Figure 15.--Banks in this stream were destroyed by improper equipment crossing.

Figure 16.--This natural undercut bank has been protected during timber harvest. Banks are still intact.

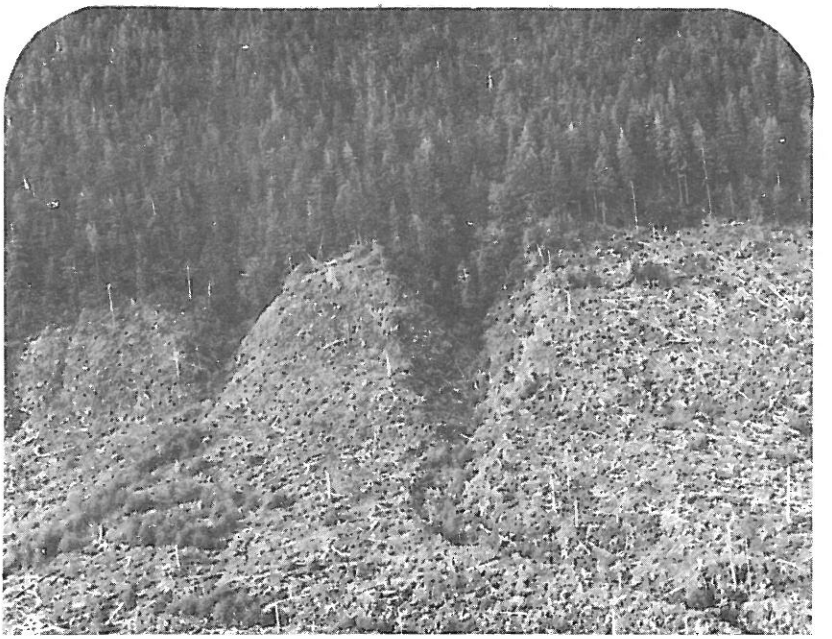
Equipment improperly crossing small streams can often cause the stream to spread out (Figure 15). If this occurs, the streams may be forced underground at low flow resulting in a blockage to fish as well as a loss of habitat.

Damage to stream banks can be minimized by not logging across streams, by using proper stream crossing structures, by orienting road-stream crossings at right angles, by restricting equipment use in streams, and by leaving a windfirm timber screen or some other means of "filter strip" between the road and the stream.

Sedimentation

There are many potential sources of sedimentation; V-notches and roads are examples. Numerous V-notches are encountered in logging areas of southeastern Alaska (Figure 17). These V-notches are generally unstable at steep slopes depending upon soil types and vegetative cover.

Figure 17.--V-notches are potential sources of sedimentation and require special consideration.



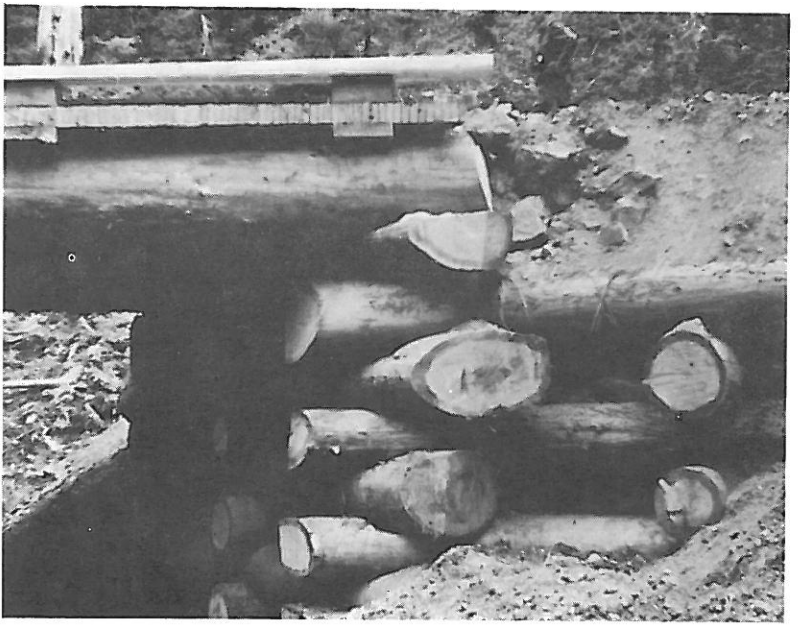


Figure 18.--This is a properly constructed crib retaining wall.

If they become clogged with debris, or are disturbed, the potential for sliding increases. Sedimentation from V-notches can be minimized by restricting cutting in critical areas and by not yarding across or out of V-notches.

Use of crib retaining walls (Figure 18) and running planks on log stringer bridges will decrease sources of sediment. For temporary log stringer bridges with rock running surfaces, small shim logs between the stringers (Figure 19) and curb logs will help retain the material on the bridge. Care during maintenance and removal of temporary bridges is also very important in minimizing sedimentation.

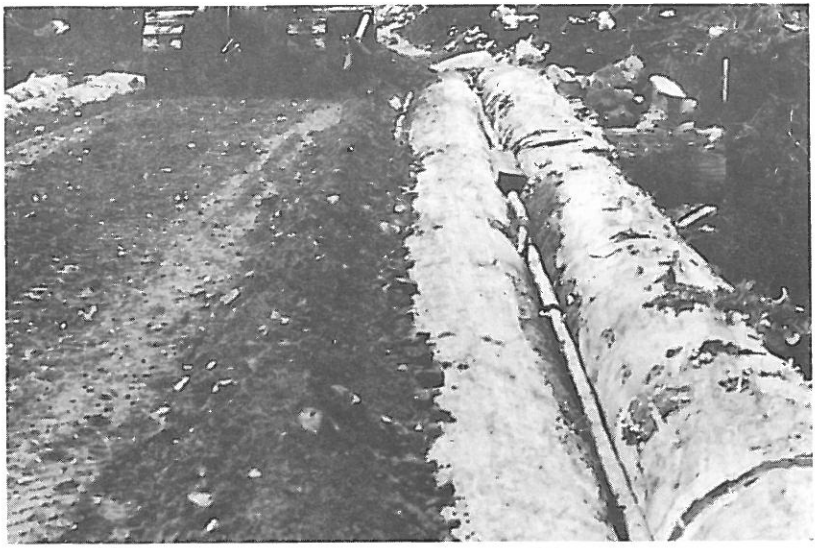


Figure 19.--Shim logs prevent fill material from falling into the stream.

Roads may expose some bare soil to erosion. This erosion can occur on cut slopes, ditchlines, or from sidecast or wasted material. The type of soil, steepness of sideslopes, steepness of grades, location of waste areas and rock pits, and frequency of ditch relief influence the erosion potential. Properly engineered road grades, alignment, cut slopes, waste areas, and culverts or cross drains will minimize the amount of sediment from roads. Maintenance can be just as critical as the initial construction. Permanently revegetated cut slopes (Figure 20) and waste areas will decrease the area of bare soil subject to erosion. Natural "filter strips" between streams and roads can allow removal of much of the sediment carried by ditch runoff before it can enter the streams.

Figure 20.--Seeding with grass usually provides erosion control within one growing season.

Blocked Fish Passage

Poor culvert installation (Figure 21, 22) can block fish passage, thereby eliminating upstream rearing areas for young fish and upstream spawning areas for migrating adult fish. Blockage occurs when the culvert outlet is inaccessible, or the culvert is too steep or too small. Culverts should be removed from abandoned roads or be properly maintained.

Figure 21.-- Small fish cannot pass through this culvert because of its elevation above the normal stream bed.

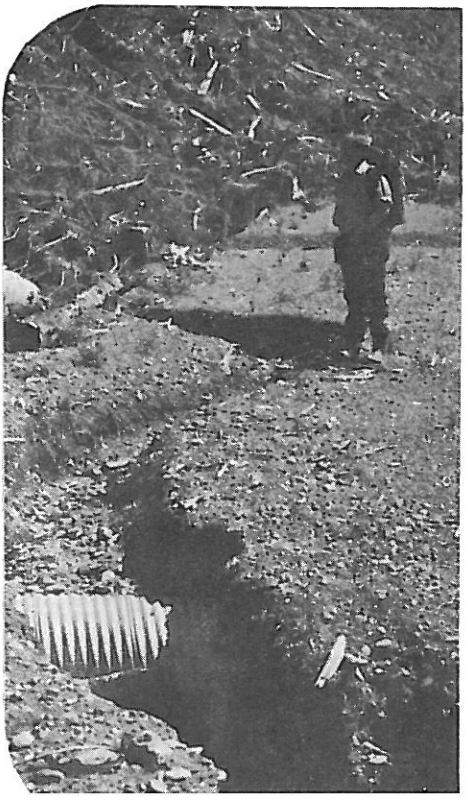


Figure 22.--Culverts which are not removed from abandoned roads, or maintained when left in, can become clogged. This could change stream channels, cause erosion, or block migrating fish.

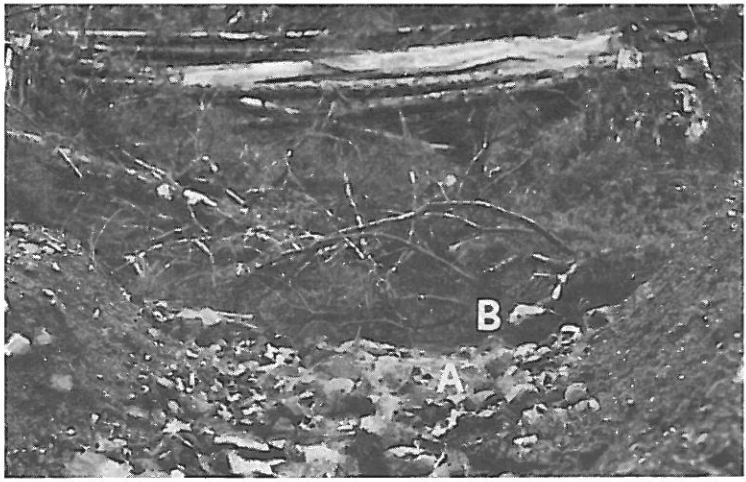


Figure 23.--Excavation following culvert removal was not deep enough (A) to reach the original streambed (B).

When the roadway is not excavated to the original streambed during culvert removal, the stream may be forced to flow through the porous roadbed (Figure 23) creating a block to fish.

Fish passage can be maintained by installing properly engineered culverts (Figure 24) and by excavating to the natural streambed when removing culverts.

Figure 24.--Culverts which are placed directly on the original streambed, and where possible, made to conform with the streambed, create the best fish passage.

SUMMARY

The following is a summary of practices which will help protect the fish habitat during and after logging:

1. Fell and yard timber away from streams when logging to streambanks.

2. Leave a fringe of windfirm timber along streams when necessary for stream protection.

3. Clear debris from streams.

4. Avoid skidding logs in, or across, streambeds.

5. Use proper stream crossing techniques for equipment.

6. Avoid using equipment in the streams.

7. Orient road-stream crossings at right angles to minimize possibility of erosion.

8. Avoid logging in critical V-notch areas.

9. Avoid yarding across or out of V-notches.

10. Provide properly engineered road grades, alignment, cutslopes, waste areas, and culvert or cross ditch location and frequency.

11. Revegetate disturbed soil.

12. Install and maintain culverts properly.

13. Restore the original level of the streambed when removing temporary culverts.

The practices outlined above are merely a reminder of items that require attention during

preparation and administration of a timber sale. Careful layout of cutting units and roads is imperative before the contract is written and the sale advertised. It is up to the logger to do the job in a manner so that the environment receives the necessary protection. On the sale administrator falls the responsibility of obtaining contract compliance, but "cooperation" is essential for a successful job.