Habitat Concerns in WRIA 1

Access. Fish can be blocked from historic habitat by structures such as culverts, dams, and flapgates (gates that control water levels by allowing water to flow in only one direction). A local example is the Middle Fork diversion dam, which channels water from the Middle Fork of the Nooksack River to Lake Whatcom. The diversion dam blocks fish access to approximately 17 miles of potential habitat for anadromous salmonids, including ESA listed chinook salmon.

Channel complexity. Channel complexity includes a range of issues such as the sinuosity (curves and bends) of the streambed, the number of side channels that might provide additional fish habitat, pools and riffles, large woody debris (LWD), and so on. Removal of riparian vegetation and LWD in the channel, bank hardening (rip rap), levees, dredging, filling, and drainage for agriculture or residential and industrial development have reduced the complexity of streams. The result is a reduction in the quantity, variety and distribution of habitat types available.

Channel stability. Over time, a stream channel strikes a balance among opposing forces-the soils, the vegetation, the flows, the sediment supply, the climate, and other factors. When any of these factors are altered, such as loss of trees and shrubs along stream banks or lack of large woody debris, the channel responds and fish habitat such as pools or spawning beds may be damaged.

Estuarine habitat. Tidal sloughs, salt marshes, and other estuarine areas provide shelter and food to salmonids making the transition from fresh to salt water or vice versa. In addition, some salmon like chum and chinook may spend months in the estuary utilizing the rich food resources and growing to become more able to survive in the marine environment.

Fine sediment. Very fine sediment (fine sand and silt) can smother fish eggs, clog habitat used by juvenile fish, and kill the macroinvertebrates that are the primary food source for young salmon. Fine sediment ends up in streams through erosion (especially from stream banks that have lost vegetation and uncontrolled runoff from upland sites near streams that have been cleared of vegetation prior to development) and mass wasting (landslides).

Floodplain habitat. When a stream overflows its banks, the area that it covers is called a floodplain. Floodplain habitat includes side and overflow channels, oxbows, sloughs, beaver ponds, and wetlands that are important rearing habitats. These habitats provide a refuge for juvenile fish that is connected to the main river, where food is plentiful, where there is cover in which to hide from predators, and where the flows are not so swift for small fish. The historic ditching, draining, and filling of floodplain wetlands have impaired this type of habitat. In addition, dikes, bank hardening and other efforts to manage floods have disconnected streams and rivers from their floodplains, preventing fish from using floodplain habitat.

Instream flows. The amount of water in a stream is a key factor in determining how much and the quality of habitat available to fish. Higher flows like typically happens once a year help to maintain the channel shape and riparian vegetation. Really high flows may carry enough velocity to flush juvenile fish and to move sediment in the streambed and banks to the point that salmon redds (nests) are scoured out or

buried or where the channel form itself is altered and habitat is damaged. On the other hand, flows that are too low are also harmful because they reduce both the amount and accessibility of habitat. Low flows may also alter water quality. For instance, the water in stream may be shallow and spread out at low flows and thus more subject to solar heating and creating temperatures that are detrimental or even lethal to fish. In WRIA 1, low flows during the dry summer months, when human use is highest and fish are returning to streams to spawn, are the main concern.

Pool quantity and quality. Pools are parts of a stream where the water is much slower, and can be formed by boulders, individual pieces of large woody debris, and/or logjams. Streams are often characterized by their pool/riffle ratio-the length of its pools divided by the length of its riffles-with a diversity of pools and riffles being considered optimal for fish. In WRIA 1, it is believed that the lack of woody debris of sufficient size and numbers to function in a given stream is a key factor in low numbers of pools, especially pools that provide essential holding and hiding cover for salmon (studies have shown that fish prefer woody cover to artificial cover such as riprap), and that there are less pools being formed by large woody debris than in historic times.

Productivity. Generally speaking, productivity refers to the amount of nutrients and energy that have been captured by organisms. In the context of salmon habitat recovery, productivity is a measure of the ability of a stream to support salmonids. Questions that may be asked in evaluating the stream's productivity include: is there enough space in the habitat to support the numbers of fish present; is there the right mix of habitat types; is there enough food; is the water quality good enough; and do enough adult salmon return to ensure enough eggs are deposited and enough carcasses are left in the stream to feed the bugs, juvenile fish, and the riparian vegetation? It is documented that the productivity of Nooksack native early chinook stocks is limited by freshwater habitat conditions.

Temperature. Salmon and trout can only survive in water that is between 5° and 20° Celsius (40-68° Fahrenheit), and within that range, temperature can affect how salmonids grow, mature, and behave. For instance, water that is too warm can prevent salmonids from swimming upstream to spawn. In WRIA 1, too-high temperatures are caused by lack of riparian (streamside) cover, low flows, and alterations to the shape of the stream channels.

Turbidity. The amount of sediment suspended in water is described as turbidity, or cloudiness. Turbidity interferes with juvenile salmon's ability to find food and is an indicator of movement of large volumes of fine sediment that can smother salmon eggs and fry and also reduce hiding habitat for salmon fry. High turbidity levels are a significant factor in some areas of the WRIA 1 such as the south fork of the Nooksack River.

Water quality. Pollutants such as heavy metals, pesticides, and some chemical compounds have been linked to health problems and mortality in fish. In addition, low levels of dissolved oxygen also have negative effects on fish. These water quality issues are mostly a concern in the tributaries of the lower Nooksack River with the exception of temperature and dissolved oxygen, which has also been documented in the upper reaches and tributaries.