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**Natural
Resources
Conservation
Service**

National Biology Handbook

Subpart D—Reporting Procedures for Conservation Practice Standards

Part 640 Guidance for Assessing and Reporting Stream Miles Affected by Activities Completed Under Conservation Practice Standard 396, Fish Passage

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Contents:

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640.00 Introduction

Revisions completed in October 2006 to Conservation Practice Standard 396, Fish Passage (CPS 396) resulted in changing the reporting unit from Number (No.) to Miles (Mi.). This amendment to the National Biology Handbook provides concepts, methods, and information resources required to assess and report (via the Performance Results System (PRS)) stream miles affected by passage improvement or restoration activities completed under CPS 396. The intent of this set of standardized methods is to ensure repeatability in PRS, as well as to quantifiably portray the biological benefits of a given action to migratory aquatic animals.

Many aquatic organisms (fish, crustaceans, mollusks, and amphibians) undertake daily, seasonal, or annual migrations (Gross 1987; Gross, Colman, and McDowall 1988). Migration is a natural, usually seasonal biological function where animals move singly or in large numbers from one habitat type to another to spawn, feed, grow, or seek refuge from predators. For example, anadromous trout and salmon spawn and rear in freshwater, move to saltwater environments to grow to adulthood, and return to freshwater after a period of months or years to reproduce and die (Groot and Margolis 1991). Other amphidromous fish commonly use estuaries, river mouths, and the lower reaches of rivers within a span of a few days for feeding, sheltering, or as refuge from predators (Gross, Colman, and McDowall 1988). Young (1994) found that brown trout in south-central Wyoming moved more than 60 miles during the spawning season between mainstem rivers and adjoining tributaries. Further studies by Young (1996) and Colyer, Kershner, and Hilderbrand (2005) suggest that salmonids often undertake lengthy daily and seasonal migrations to exploit feeding areas, seek refuge or resting cover, and colonize new habitats. Numerous warm-water species of fish (redhorses, carpsuckers, catfish, muskellunge, walleye, and northern pike) have been observed migrating both up- and downstream in river systems of the Mississippi Basin for foraging or spawning purposes (Warren and Pardew 1998; Illinois Department of Natural Resources 2000).

Consequently, barriers that block the movement of fish or other aquatic organisms often result in negative long-term population trends. These barriers are often instream features or water management practices that limit or prohibit the passage of aquatic organisms, deny access to important breeding or foraging habitats, and isolate populations of fish and other aquatic animals. Passage barriers are a problem for aquatic organisms trying to move upstream and downstream in an estuary, river, or stream.

640.01 Identifying passage barriers

The timing, duration, and frequency of aquatic animal migrations must be accounted for when planning and implementing passage improvement or restoration projects within a watershed. Many passage barriers to aquatic organisms are relatively easy to identify. For example, a stream reach completely dewatered by diversions or blocked by a dam poses obvious challenges to migratory aquatic organisms. However, many other subtle but just as ecologically significant passage barriers are common throughout the United States and its protectorates. Note that beaver dams generally do not prevent aquatic organism migration and should not be identified as passage barriers unless supporting information can be provided.

Both natural and manmade barriers occur within river, stream, estuary, and tidal systems. Natural physical barriers include waterfalls, cascades, large rapids, or stream reaches that seasonally dewater. Common manmade physical barriers include tide gates, dams, diversions, culverts, weirs, excessively high-grade control structures, or buried sills with broad crests. Chemical and biological barriers such as water quality (temperature, contaminants, and low streamflows) and predation from nonnative species also exist in many rivers across the United States. However, these types of passage problems are often seasonal and can be difficult to identify with limited field time and site-specific data.

Passage barriers are typically categorized by characteristics such as water velocity, water depth, and barrier height in relation to the passage requirements of a given species and/or life stage. Three commonly used barrier classes are:

- partial—impassable to some species or certain age classes all or most of the time
- temporary—impassable during some times to all or most species and/or age classes (during low flow conditions)
- complete—impassable to all fish at all times

For example, a poorly designed or damaged culvert may be a temporary barrier to upstream migrating adults when flows are high because velocities within the culvert barrel exceed their natural swimming capabilities. Some highly migratory fishes like Pacific salmonids can leap 6 feet or more to bypass a small waterfall, whereas shad in the same river will be faced with a complete barrier (Bell 1990; Groot, Margolis, and Clarke 1995; Monk et al. 1989; Haro and Kynard 1997). Thus, it is often necessary to identify a primary target species (and life stage) when evaluating passage barriers relative to a given project.

(a) Barrier examples

Numerous information resources are available to help identify passage barriers to measure and report in PRS the number of stream miles affected by the project. State game and fish agencies generally have both online resources and personnel located around each state, and these professionals are usually excellent sources of information regarding species status, distribution, and possibly barrier inventories. The Association of Fish and Wildlife Agencies (*http://www.iafwa.org*) maintains a list and contact information for fisheries and wildlife agencies in each state.

Federal agencies (U.S. Fish & Wildlife Service (FWS) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries) associated with the protection and/or management of migratory aquatic organisms often maintain online databases of information. For example, the FWS Fish Passage Decision Support System (FPDSS, *http://fpdss.fws.gov*) is an extensive, geographically referenced database containing thousands of barriers. Users can select a barrier and model the effect of its removal—including generating a report that estimates the mileage of newly accessible habitat.

If these resources do not provide the level or amount of information required to identify passage impediments, the following list contains examples of complete, temporary, and partial barriers to aquatic organism passage:

(1) Complete barriers

- waterfalls (height varies with species, but most over 8 vertical feet are complete barriers)
- stream reaches that seasonally run dry
- dams (mill, low-head, roller, irrigation, hydropower, and/or storage)
- siphon, pipeline, sewerage, or utility crossings that act as dams or broad-crested weirs
- culverts where the barrel is perched (elevated) above the outlet pool
- for most anadromous salmonids, headwater stream reaches that exceed 10 percent gradient (often coincides with the limit of anadromy because of a general lack of spawning gravels)

(2) Temporary barriers

- culverts where the barrel width is less than the bankfull channel width
- culverts where the barrel slope is greater than the channel slope
- excessively long culverts with no resting areas
- large unscreened pump intakes
- livestock and/or equipment crossings where streamflow is fast and shallow (less than 6 in) across smooth or uniform surface at least half as wide (from upstream to downstream) as the bankfull channel width. For example, a 12-foot-wide hardened vehicle ford that crosses a stream with a bankfull width of 20 feet is likely a temporary passage barrier.

(3) Partial barriers

- Culverts where:
  - barrel alignment doesn't match the stream alignment
  - inlet or outlet is plugged with debris
  - inlet or outlet shows sign of erosion or instability
- steep cascades or large rapids, especially when formed by recent slope failures or landslides
- improperly designed or damaged fishways or ladders
- false attraction flows (power or sewer treatment plant effluents, irrigated agriculture runoff, or storm water)
- all non-self-regulating tide and/or flood gates (iron or steel flap-style gates)

The preceding list outlines a few situations where natural features, manmade structures, or management practices result in passage barriers to aquatic organisms. However, variations exist, especially as geographies and target species change.

640.02 Assessing reportable miles

Reporting stream miles in PRS for passage activities completed under CPS 396 must be completed in the following manner:

Step 1 Referring to section 640.01, identify the next mainstem upstream barrier from the project. For PRS reporting purposes regarding CPS 396, any structure or management practice that creates a complete, partial, or temporary passage problem will be considered as this barrier, regardless of the target species and life stage for which the project was intended.

Step 2 Using available resources (Geographic Information Systems, U.S. Geological Survey topo maps, commercially available mapping software, FPDSS), measure the approximate mileage upstream from your project to the next mainstem barrier identified in step 1. Note the following special circumstances:

- For river systems with more than one channel or route to the next upstream barrier, select and measure the straightest natural route. Do not include ditches, wasteways, or other drainage features specifically created for supplying or draining water.
- If one or more natural channels parallel the mainstem and contain suitable habitat (side channels, braids, or oxbows), measure and include mileage up to barriers identified per step 1.
- If the project opens access to suitable tributary habitat, measure and include tributary mileage up to barriers identified per step 1.
- In the absence of identifiable barriers in headwater situations, measure up to the upstream limit of perennial flow or the drainage divide (whichever occurs first or is most appropriate for your target species).
- If the watercourse traverses a lake or reservoir to this barrier, measure the straight-line distance between the impoundment outlet and incoming stream or river.
- If the project provides or improves passage into a lake or reservoir for shoreline spawners (pike, bull trout, kokanee, or sockeye salmon), also measure and include the total mileage of suitable shoreline spawning habitat.
- If the project provides or improves passage for amphidromous organisms (migratory shrimp, killifishes, shads, gobies, and sticklebacks) that migrate between salt- and freshwater, measure and include the total mileage of suitable foraging habitat.
  - Report in PRS the total mileage measured according to steps 1 and 2 to one (1) decimal place. For smaller projects, report all linear feet as increments of a mile (800 ft = 0.2 mi).

Step 3 Project mileage reported in PRS must comply with these standard guidelines. Stream miles may only be measured and reported once, regardless of the number of species for which the project is intended to improve passage conditions. In other words, if a project opens up 10 miles of habitat for five migratory aquatic organisms known to inhabit the area, the reportable PRS mileage is 10 miles (not 50).

For additional information, call the Fishery Biologist, East National Technology Support Center at (336) 370–3331. For other information concerning aquatic ecology, call the National Aquatic Ecologist, Ecological Sciences Division, National Headquarters at (202) 690–0082.

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