Technical Recovery Team Spatial Data for Salmon and Steelhead Populations

Identification Information:

Originator: NMFS Northwest Regional Office and the Northwest Fisheries Science Center
Publication Date: January 2008
Title: All spatial data layer in TRT geodatabase for salmon and steelhead
Geospatial Data Presentation Form: vector digital data
Contact Organization: Northwest Fisheries Science Center
Contact Person: GIS Coordinator
Contact Voice Telephone: (206) 860-3433
Contact Electronic Mail Address: nwfsc.gis@noaa.gov
Hours of Service: 9:00 - 5:00 PST
Native Data Set Environment: Microsoft Windows XP Version 5.1 (Build 2600) Service Pack 3; ESRI ArcCatalog 9.3.1.4000

Spatial Data Organization Information:
Direct Spatial Reference Method: Vector

Spatial Reference Information:
Horizontal Coordinate System Definition:
Geographic:
Latitude Resolution: 0.000000
Longitude Resolution: 0.000000
Geographic Coordinate Units: Decimal degrees
Geodetic Model:
Horizontal Datum Name: North American Datum of 1983
Ellipsoid Name: Geodetic Reference System 80
Semi-major Axis: 6378137.000000
Denominator of Flattening Ratio: 298.257222
Vertical Coordinate System Definition:
Altitude System Definition:
Altitude Resolution: 0.000100
Altitude Encoding Method: Explicit elevation coordinate included with horizontal coordinates

Abstract:

These data represent the final delineated population boundaries associated with salmonid Evolutionarily Significant Units (ESU) for the four recovery domains in the Pacific Northwest. These boundaries were designated by federally-mandated Technical Recovery Teams (TRTs) each covering a recovery domain; Puget Sound, Willamette-Lower Columbia, Interior Columbia, and the Oregon/Northern California Coast. The teams were formed for the purpose of assisting in recovery planning for Endangered Species Act (ESA)-listed species of salmon in the Pacific Northwest. Each TRT consisted of regional fisheries scientists and managers meeting over a period of 7 years. The population boundaries were delineated by members and technical staff from each of the TRTs following Ricker's definition of a stock and McElhany's description of a Viable Salmonid population (see below for further explanation). Data attributes were generalized for the purpose of consistency, but the majority of details put forth by the TRTs are maintained in this spatial data set. These metadata include details and methodologies of boundary determinations, which differed by TRT (due to slight differences in delineation methodologies and availability of process documentation), as well as supporting references and attribute definitions. Actual population boundary geometry for three of the four TRTs (with the exception of Oregon

Coast Coho) was standardized to 6th field hydrologic unit boundaries from the Regional Ecosystem Office (REO) or 5th and 6th field hydrologic unit boundaries from Idaho Department of Water Resources (IDWR) for this data product, unless edits are noted in Domain-Specific narratives. See Data Quality section for more information.

There are currently multiple salmon population boundaries available from various state and federal agencies which may overlap with these boundaries. Therefore, it is important to clarify the definitions used in the creation of these. The definition of a "population" applied in the creation of these spatial population boundaries follows Ricker's (1972) definition of a stock, as "a group of fish of the same species that spawns in a particular lake or stream (or portion thereof) at a particular season and which, to a substantial degree, does not interbreed with fish from any other group spawning in a different place or in the same place at a different season." An independent population, as described in the viable salmonid population (VSP) report (McElhany et al. 2000), is indicated where groups are "isolated to such an extent that exchanges of individuals among populations do not substantially affect the population dynamics or extinction risk of the independent populations over a 100-year time frame." Such populations are "units for which it is biologically meaningful to examine extinction risks that derive from intrinsic factors such as demographic, genetic, or local environmental stochasticity." A viable salmonid population is "an independent population of any Pacific salmonid (Oncorhynchus spp.) that has a negligible risk of extinction over a 100-year time frame" from various threats (McElhany et al. 2000).

For more information on domain-specific methods or population viability in each domain, please see citations in the domain-specific metadata narrative section.

McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C.Wainwright, and E.P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-42,156 p.

Ricker, W. E. 1972. Hereditary and environmental factors affecting certain salmonid populations. In R. C. Simon and P. A. Larkin (eds.), The Stock Concept in Pacific Salmon, p. 27-160. University of British Columbia, Vancouver, B. C.

Purpose:

These data were generated by NOAA to reflect salmonid population delineations identified and used by the Technical Recovery Teams. These data represent the geographic extent of individual listed ESU salmonid populations in the Pacific Northwest, typically delineated by the extent of their spawning areas. Determination of spawning extent is dependent on the quality and scale of historic and current surveys and studies; quality and availability of this may vary by TRT region and may be more fully described in the domain-specific metadata narrative citations. Identifying independent populations is a key component of identifying current and future extinction risk, as well as patterns of diversity within and between ESUs. Understanding the extent of historically independent populations, along with abundance and life history information can provide a framework to compare historic and present status and to study limiting factor impacts. These data may be helpful in identifying and prioritizing specific recovery actions within ESUs (e.g., barrier removal).

These data may differ substantially from other depictions/data of salmonid populations produced by other entities (e.g., other Federal, tribal, state, and local agencies). These data are intended to be used by federal, tribal, state, and local recovery planners, other co-managers, NGOs and the general public for any activities related to anadromous salmonid recovery and conservation. These data are intended to assist users, but do not constitute the legal description of salmon and steelhead populations listed under the ESA. Users in need of a legal description should instead consult the agency. Every effort has been made to ensure that these data are as accurate as

possible.

Supplemental Information:

DOMAIN-SPECIFIC NARRATIVE

These feature datasets contain population boundaries and associated attributes for coho (Oncorhynchus kisutch), chum (Oncorhynchus keta), sockeye (Oncorhynchus nerka), chinook salmon (Oncorhynchus tschawytscha) and steelhead (Oncorhynchus mykiss) populations for the Lower Columbia and Willamette Basin Evolutionarily Significant Units (ESUs) and Distinct Population Segments (DPSs). Due to spatial extent differences in run-timing for chinook, spring, fall (Tule), and upriver brights (late fall chinook), each are provided as separate population sets, though all belong to the same ESU. This is also the case for steelhead, which have two distinct population delineations within a single DPS - one for summer run and one for winter run steelhead.

These delineated historical populations are intended to represent the range and diversity of populations in ESUs. The historical populations document, along with a population identification workgroup (2003) formed the basis used to delineate spatial population boundaries for all species and populations in the jurisdiction of the Technical Recovery Teams. The population identification workgroup identified rules for the spatial delineation process. This narrative describes the process and rules applied in delineating the species-level population boundaries Columbia TRTs. It is extensive because it is not published elsewhere.

DOMAIN-SPECIFIC METHODS

Two population segments were generated for each population. One specified the area of the drainage (potentially or documented) used for spawning and initial rearing, or the proportion of the basin directly (potentially) occupied by fish. The other delineates the entire hydrologic watershed associated with the population, as conditions in headwater areas impact abundance and life history strategies of downstream fish assemblages in the population. The workgroup developed a hierarchical scheme for describing spatial extent differences between hydrologic areas of habitat influence and areas that were historical accessibility, as follows: 1.) species-specific population accessibility polygons by ESU or DPS, which include historically or currently accessible 6th field HUs, 2.) upstream watershed areas that are not physically accessible (due to large, documented natural barriers, naturally limiting access), considered an essential part of the population extent because quality of this habitat influences the primary physical habitat downstream. 3.) watershed areas that do not have a primary documented impassable natural barrier (Table 2), but do have a substantial amount of habitat (100% of linear stream length) upstream of a gradient higher than the natural gradient cutoffs to each species (Table 1). This final category only influenced chum designations significantly, as we used a 5% stream gradient cutoff for the chum populations. Chum populations had many hydrologic units within the original physical habitat that were not accessible due to in-stream gradients above 5 percent.

Multiple data sources were used to identify accessible stream reaches for our fish-based population boundaries, including in-stream gradient (Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, as referenced in Sheer and Steel 2006). Where possible, we used direct observations of fish presence from tribal, state, and local management agencies. In lieu of direct observation, species-specific stream gradients thresholds were used to designate and locate passage barriers (Table 1)(Washington Department of Fish and Wildlife 2000). Major historical passage barriers such as (Willamette Falls, Shearers Falls, Dougan Falls, Salmon Falls, Punchbowl Falls) were incorporated into designating the accessible area of population-specific watersheds (Table 2).

Most populations were originally constructed using a combination of intact 6th field HU's, from 2004 Regional Ecosystem Office (REO) hydrologic boundaries. In some cases, 6th field HUs were cut or split to keep boundaries consistent with those described by Myers et al. (2006) and reviews by the workgroup. For these "special case" HUs in the floodplain of the Columbia River, the hydrologic boundary was manually edited to reflect the most appropriate ridgeline using USGS 1:24,000 Digital Raster Graphics. Some special case modified or split 6th field HUs were due to documented historic accessibility blockages, i.e. impassable waterfalls (Table 2), as decided on by the workgroup. Upstream of the cut was considered "Naturally Blocked". Other natural barriers are reflected in the boundaries, when a natural blockage excluded migration for the entire HU, this upstream area was considered "Naturally Blocked" to fish migration.

For ESUs with populations adjacent to the mainstem Columbia River and its floodplain, a riverine polygon was delineated for each affected population. These are wetted area segments within the mainstem Columbia River. The workgroup used this method so that mainstem salmonid activity in the mainstem could be represented individually by population. The riverine segments are tributary deltas that extends into the Columbia River, or backwater areas associated with mouth of the main population watershed which may be important for rearing, migration, or upstream accessibility for the population. Riverine segments of the population follow the shoreline of the main population polygon, extend across the Columbia River to the opposite state border. The river thalweg of the mainstem river was used as this boundary, except in cases where the population was extended to include particular in-river islands, etc. This riverine section overlaps the migration corridor for the majority of salmon and steelhead populations in the Willamette-Lower Columbia and Interior Columbia TRTs. The mouth of populations along the Columbia River were based on mean high water data boundaries from the US Army Corps of Engineers, Portland District, which were more accurate than the REO hydrologic boundaries at the time of delineation.

DOMAIN-SPECIFIC UPDATES

Edits to the population boundaries in 2007 for the purpose of creating the seamless population data set required incorporating accessibility details from the original populations into two new attributes. These identify similar features at a finer scale than the original delineated populations, and includes information on anthropogenic barriers, which were not included in the original population boundaries described above. Two fields were created to facilitate merging the original population habitat categories into the multi-TRT data integration product. Data from Sheer and Steel (2006) were used to identify the appropriate attributes for individual 6th field HUs. Sixth field HUs were designated as "Naturally Blocked" or "Anthropogenically Blocked" if 100% of the stream length within the 6th field (as represented by the 1:24,000 streams used in Sheer and Steel 2006) was upstream of a natural or anthropogenic barrier. Entire HU's were considered naturally blocked only if species-specific gradient cut-offs limited the spatial linear extent of the population by the entire 6th field HU.

Further edits were made (August 2011) to update population polygons to more recent 6th field hydrologic unit boundaries (NRCS 2009). Corrected hydrologic unit delineations resulted in slight changes in geometry and size of the 6th field-level population information and boundaries. Other changes included updates to the "Access_huc" category (based on updates to fish passage status information), limiting population boundaries to above the high water mark on the Columbia River (large islands in the Columbia are no longer included with a particular population), and reduction of split 6th field hydrologic units. The NRCS hydrologic units were still split in some cases, where the hydrologic delineation was inaccurate, or where a split would greatly improve accuracy of the "Access_Huc" field or the boundaries between neighboring populations within an ESU.

Species-specific stream gradient utilization and passability, from Washington Department of Fish

and Wildlife (2000). We used a 5% gradient cutoff for chum salmon, a 16% cutoff for chinook salmon, and a 20% gradient cutoff for steelhead. This table has been translated into a narrative version for the purpose of this metadata, please see original in WDFW 2000. Gradient (stream gradient percent) utilization using in these populations is as follows ("passable" may mean partially passable):

CHUM (0 - 3%, useable: 3 - 5%, passable: >5% impassable)
COHO (0 - 7%, useable: 7 - 16%, passable: > 16%, impassable)
CHINOOK (thresholds same as coho)
STEELHEAD (0 - 12%, useable: 12 - 20% passable: >20%, impassable)

Important natural migration barriers incorporated into the population boundaries for Columbia ESU populations. Examples of natural barriers are listed here if substantial enough to warrant modifying hydrologic boundaries in the delineation process; additional barriers are reflected in the population boundaries. Please note that specific barrier name OR population name is used to identify the barrier. If a barrier is not shared across species/run, there may not be a population of that species/run present in the particular watershed, this does not necessarily reflect passability differences. This table has been translated into narrative form for the purpose of this metadata, as follows:

CHUM
Kalama/Lewis, Lower Kalama Falls, Salmon/Washougal, Willamette Falls, Punchbowl Falls, Shippard Falls, Klickitat/Lyle Falls, Celilo Falls
COHO
Toutle, Kalama/Lewis, Lower Kalama Falls, Salmon/Washougal, Willamette Falls, Punchbowl Falls, Shippard Falls
FALL CHINOOK (TULE)
Kalama/Lewis, Lower Kalama Falls, Salmon/Washougal, Willamette Falls, Punchbowl Falls, Shippard Falls
EARLY FALL CHINOOK (brights) - none
SPRING CHINOOK
Kalama/Lewis, Upper Kalama Falls
UPPER WILLAMETTE SPRING CHINOOK - none
SUMMER STEELHEAD
Kalama/Lewis, Upper Kalama Falls, Salmon Washougal
WINTER STEELHEAD
Toutle, Kalama/Lewis, Lower Kalama Falls, Salmon/Washougal, Willamette Falls
UPPER WILLAMETTE WINTER STEELHEAD - none

Entity and Attribute Information:

Details for object All Spatial layers for species/run/region
* Type   Feature Class
* Row count   144

Field NWR Population NAME
* Alias   NWR_NAME
* Data type   String
* Width   125
* Precision   0
* Scale   0
Field description

Population name as defined by the Northwest Regional Office. Full ESU and population run description contained in this name.

Field **ESU or DPS**
*Alias ESU_DPS
*Data type String
*Width 100
*Precision 0
*Scale 0
Field description
        ESU Name or Distinct Population Unit
List of values
        Value Full Name of ESU
        Description official legal ESU name
        Enumerated domain value definition source Note that species may have multiple runs included within one ESU. Data for run-specific populations may overlap in these cases. Refer to this web site for list of names: http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/

        Value Outside legal (fill in ESU name) boundary
        Description for example, "Outside legal Lower Columbia River Chinook Salmon ESU boundary"
        Enumerated domain value definition source The TRT population delineation process includes historical segments of populations. This sometimes differs in extent (ie, is upstream of) the current legal ESU boundary. Original ESU boundary spatial delineations were done using lower spatial resolution than current population boundaries. Polygons that fall outside of appropriate ESU boundaries are labelled as "Outside legal (fill in ESU name) boundary". These are still part of the TRT analysis area, but fall outside the original ESU boundaries outlines. The ESU boundaries are being reviewed with regards to this, and where warranted the ESU boundaries will be updated to incorporate higher resolution watershed boundaries, and any pertinent management decisions regarding historical habitat.

Field **MPG**
*Alias MPG
*Data type String
*Width 100
*Precision 0
*Scale 0
Field description
        Sub-ESU biogeographic stratum. Ecological strata or other strata types from from TRTs. Stratum typically represents biological or ecological groupings of populations within an ESU. Each TRT has strata names specific to their region. These are described in various TRT documents.

Field **Population**
*Alias POP_NAME
*Data type String
*Width 50
*Precision 0
*Scale 0
Field description
        Final population name as defined by the TRT. Does not contain ESU or run timing details in name.

Field **RUN TIMING**
*Alias RUN_TIMING
*Data type String

Width 50
Precision 0
Scale 0
Field description
        Population run timing (ESU may have multiple runs of chinook or steelhead).
List of values
        Value Spring
        Value Summer
        Value Fall
        Value Winter
        Value Spring/Summer
        Value Early
        Value Late
        Value Early/Late
        Value Late fall
        Value Fall/late fall
        Value Summer/fall
        Value Null

Description no data on run timing

Field TRT_POPID
Alias TRT_POPID
Data type String
Width 25
Precision 0
Scale 0
Field description
        TRT derived population code (abbreviated code or numeric code).
List of values
        Enumerated domain value definition source Some TRTs include a designated population code in their final boundaries. This field is null where population codes were not used, or were not deemed important to include in this final product. Please refer to the field "POP_NAME" to decipher these codes.

Field NWR_POPID
Alias NWR_POPID
Data type String
Width 20
Precision 0
Scale 0
Field description
        Northwest Regional Office Salmon/Steelhead population code.
List of values
        Enumerated domain value definition source First five letters indicate ESU, next two letters indicate run timing, last three are abbreviated population names. Check field "ESU_DPS" for the ESU name alone, and "Run_Timing" for full run timing ID. Hucs outside of current boundary but considered by the TRT may have an ESU/run/pop label - in this case, these hucs are associated with the particular ESU listed, but not inside (ie, see "ESU_DPS" label). Those missing values for a label are outside of ESU boundary.

***Field Population* ACCESS**
* Alias   ACCESS_POP
* Data type   String
* Width   50
* Precision   0
* Scale   0
Field description
       Access of the current population
List of values
       Value   Extant
       Description   Species are present and have near full access.

       Value   Blocked within Extant
       Description   Species are present for part of historic population range but excluded from the rest of their range within the population due to barriers.

       Value   Blocked within Extant; Transported
       Description   Species are present via truck in part or all of their historic range.

       Value   Extirpated via Barriers
       Description   Species were historically present but currently absent due to manmade barriers.

       Value   Artificial; Transported
       Description   Species present currently, but historically not present due to natural barriers; fish transported into area via truck, fish ladders, etc.

       Value   Functionally Extirpated
       Description   Species were historically present. Areas accessible but population currently absent. Extirpated due to impaired habitat, water quality, other factors (Interior Columbia).

***Field* Population TYPE**
* Alias   POP_TYPE
* Data type   String
* Width   50
* Precision   0
* Scale   0
Field description
       Type of population. Category describing the relative persistence and degree of isolation of each population. Oregon coast coho is the only ESU that contains POP_types other than Independent. Definitions for non-Independent populations are from Lawson et al 2006.
List of values
       Value   Independent
       Description   Populations that historically would have had a high likelihood of persisting in isolation from neighboring populations for 100 years.

       Value   Dependent
       Description   High-persistence populations whose population dynamics may be substantially influenced by periodic immigration from other populations. In the event of the decline or disappearance of migrants from other populations, a Potentially Independent population could become a Functionally Independent population.

       Value   Functionally Independent

Enumerated domain value definition source   high-persistence populations whose population dynamics or extinction risk over a 100-year time frame is not substantially altered by exchanges of individuals with other populations. These populations are net "donor" populations that may provide migrants for other types of populations. This category is analogous to the "independent populations" of McElhaney et al. (2000).

Value   Potentially Independent
Enumerated domain value definition source   High-persistence populations whose population dynamics may be substantially influenced by periodic immigration from other populations. In the event of the decline or disappearance of migrants from other populations, a Potentially Independent population could become a Functionally Independent population.

Field ACCESS_HUC   *(NOTE: this information was moved to the Subwatershed Reports under the field "Comment".*
* Alias   ACCESS_HUC
* Data type   String
* Width   50
* Precision   0
* Scale   0
Field description
        Accessibility of the 6th field Hydrologic Unit (HU)
List of values
        Value   Accessible
        Description   Streams in HU are currently accessible to fish, and were historically.

        Value   Artificial
        Description   Streams in HU are artificially accessible through anthropogenic methods (passed upstream of natural barrier).

        Value   Naturally Blocked
        Description   Blocked by natural barriers. Each TRT used slightly different definitions/cutoffs to define natural gradient cutoffs impacting accessibility of the huc/population.
        Enumerated domain value definition source   IC = 20% slope for 200 m segment (all species) OR documented barrier feature (eg. waterall, cascades); WLC = natural gradient barriers 16% (chinook and coho); 20% (steelhead) OR documented features (eg. waterfalls); PS = natural gradient barriers based on professional assessment; OC = natural gradient barriers based on professional assessment

        Value   Limited Accessibility
        Description   Less than complete access (mix of other categories) such as a barrier just upstream from the HU outlet.

        Value   Anthropogenically Blocked
        Description   HU blocked by anthropogenic barrier(s).

        Value   Trap and Haul
        Description   HU only accessible through manual passage methods; upstream of weir, dam, other obstruction.