



# Oregon Fish Habitat Distribution Data Standard

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## **1.0 Introduction**

Under the direction of the Oregon Geographic Information Council (OGIC), the Oregon Bioscience Framework Implementation Team (Bio-FIT) has delegated the development of a prototype Fish Habitat Distribution Data Content Standard to its Fish Habitat Distribution Workgroup. The Bioscience Theme currently includes 15 elements. Fish Habitat Distribution is one of those elements.

The Oregon Fish Habitat Distribution Data Standard (OFHDDS) specifies a common model for representing geospatial fish habitat distribution information. The scope of the standard includes current fish habitat distribution in all waters of the state, excluding marine areas. The model is intended to facilitate integration and sharing of fish habitat distribution data. The OFHDDS will also serve to improve the accuracy and completeness of fish habitat distribution data, thus improving their value and usefulness for supporting resource planning.

The OFHDDS is based on the data structure developed through the collaborative, multi-agency 24K Fish Habitat Distribution Development Project (24K Project) led by ODFW that was completed in 2003. The OFHDDS specifies fundamental geospatial information needed by numerous entities that are working to inventory and monitor fish habitat.

### **1.1 Mission and Goals of Standard**

The OFHDDS will provide a consistent and maintainable structure for both producers and users of fish habitat distribution data. The OFHDDS will help to ensure the compatibility of datasets within the Bioscience framework feature set and also between other framework feature sets and themes. Agencies that are responsible for the creation, maintenance and distribution of fish habitat distribution data can use the standard to reduce the costs of data sharing, development and maintenance. It will also help to ensure that fish habitat distribution data attributes (including geometry) are kept as up-to-date as possible through the broad involvement of those entities with local expertise. Fish habitat distribution data will be more easily disseminated to and consumed by both resource agencies and the public once the OFHDDS is in place.

The goal of the OFHDDS is to ensure that fish habitat distribution data applications are able to acquire data from disparate sources and use the results in an appropriate manner for the required need.

### **1.2 Relationship to Existing Standards**

The OFHDDS is primarily based on the data structure that was agreed upon during the collaborative, ODFW led 24K Project. That project resulted in statewide fish habitat distribution datasets for steelhead, chinook, coho, chum and bull trout for the state of Oregon. Additionally, the standard draws from the StreamNet Data Exchange Format (DEF). The StreamNet DEF is used primarily by state Fish and Wildlife agencies throughout the Northwest to exchange and assemble fish habitat distribution data across the Columbia basin, including the complete states of Oregon and Washington. The StreamNet DEF is designed to accept data for both anadromous and resident fish including native and non-native species.

The Federal Geographic Data Committee, Content Standard for Digital Geospatial Metadata, Part 1: Biological Data Profile (BDP) is intended to support the collection and processing of biological

data. This standard will draw upon the BDP to provide a common set of terminology and definitions for the documentation of biological data.

All geospatial datasets developed under the OFHDDS must adhere to the Federal Geographic Data Committee, Content Standard for Digital Geospatial Metadata.

### **1.3 Description of Standard**

The OFHDDS includes the essential elements and data structure necessary to adequately describe, develop, exchange and use fish habitat distribution data produced in Oregon. The OFHDDS focuses on a core set of geospatial information, including geometry, to support the need for an accurate, current and complete representation of fish habitat distribution throughout the state.

The designation of fish habitat distribution is species-specific and is dependent upon a spectrum of knowledge regarding fish presence and habitat use within the streams, lakes and estuaries of Oregon. The term “habitat” is used as these data are not based solely on verified observations of fish species. The fish habitat distribution data may also be based on the best professional opinion of natural resource agency fisheries biologists that suitable habitat for a specific species exists within a particular waterbody and it is accessible by an existing population.

Due to the sheer magnitude of Oregon’s waters and the fact that only a small portion have been sampled for fish presence, much of the existing fish habitat distribution data are based on the best professional opinion. Where documented observations of fish species do exist, they provide a greater level of certainty that a particular waterbody constitutes fish habitat for that species.

The standard provides a basic characterization of current fish habitat use by species and run (anadromous), the life history exhibited and the basis for the identification of the habitat. Information describing areas of historical fish habitat or marine fish habitat are not included in the standard at this time.

### **1.4 Applicability and Intended Use of Standard**

The OFHDDS is applicable to the feature sets that represent current freshwater fish habitat distribution within the waters of the state, including estuaries.

This standard is intended to support the automation, integration and sharing of publicly available fish habitat distribution information. Having a common format to facilitate data sharing will enhance the prospects of developing a comprehensive fish habitat distribution dataset. It will also guide accurate documentation of fish habitat distribution information produced for and in Oregon. It will be available for use by all levels of government, industry, watershed councils and the general public to achieve both a consistent graphic representation and a basic set of common attributes.

Applications to be supported initially include the migration of 24k Project data to the Framework hydrography, the development of a statewide inventory of native migratory fish habitat distribution, the identification of areas for population monitoring, the designation of essential salmonid habitat to inform fill and removal permitting, the establishment of water quality standards and the designation of critical habitat for species listed under the Federal Endangered Species Act.

This standard does not preclude agencies from developing and maintaining fish habitat distribution data differently for internal purposes. However, shared versions of the datasets must meet the requirements set forth in this standard.

## **1.5 Standard Development Procedures**

The Bio-FIT Workgroup on Fish Habitat Distribution, in essence, began with the ODFW led 24K Project that was completed in 2003. As part of this effort, a multi-stakeholder pre-project workshop was conducted that included potential data providers as well as agencies and entities participating in the Oregon Plan for Salmon and Watersheds. Twelve agencies in all engaged in the process to discuss and approve of the overall project approach, including the fish habitat distribution data structure. The 24K Project completion report can be found at:

<http://nrimp.dfw.state.or.us/nrimp/24k/docs/finalreport.pdf>

A second iteration of the Bio-FIT Workgroup convened in early 2008 to review the 24K Project Fish Habitat Distribution data structure. Some refinements to the initial data structure were made during the recent round of review and those have been built into the Data Characteristics section of this document.

This team created the first draft of a standard fish habitat distribution data structure in February 2008 and published the draft standard via email lists, open meetings and through the Oregon Geospatial Enterprise Office website at:

<http://gis.oregon.gov/DAS/EISPD/GEO/standards/standards.shtml>.

The viability of the OFHDDS was tested in February 2008.

## **1.6 Maintenance of Standard**

The Oregon Fish Habitat distribution Data Standard will be revised on an as-needed basis. Revisions can be initiated by members of the standards workgroup or by anyone in the GIS or natural resource community with significant revisions, needs or expertise related to the creation, maintenance or integration of fish habitat distribution geospatial data. As fish habitat distribution data and related geospatial applications mature, this standard will likely need to be updated. The minimum attributes in the existing standard could be expanded to account for historical fish habitat distribution and possibly marine fish habitat distribution. Also, as the Framework Hydrography Standard evolves in the direction of the National Hydrography Dataset, there may be necessary updates to the linear referencing components of the OFHDDS. The Oregon Department of Fish and Wildlife will assume responsibility for maintaining the standard and the fish habitat distribution data for the state as Horizontal Steward. Work will be dependent on available funding and other partners may assist with these responsibilities.

## **2.0 Body of the Standard**

### **2.1 Scope and Content of the Standard**

The scope of the OFHDDS is for current fish habitat distribution or “areas of suitable habitat currently believed to be used by wild, hatchery or naturalized fish populations based on sampling or

best professional opinion”<sup>1</sup>. All native migratory and resident fish species as well as non-native species are included in the scope of the OFHDDS.

It includes publicly available vector data accompanied by required metadata. The scope of the OFHDDS includes estuarine areas, but does not include historical habitat or marine areas.

The content is focused on the essential data and metadata elements required for datasets that are maintained and contributed by local, regional, state or federal agencies or organizations.

## **2.2 Need for the Standard**

Multiple state and federal natural resource agencies, Soil and Water Conservation Districts, utilities, watershed councils, tribes and other entities currently collect fish observation and/or fish habitat data. These entities as well as many that do not collect fish data all have a shared need to know what fish species are present within waters of the state at particular locations. The various observation and habitat data that are collected all have the potential to contribute toward the development of statewide fish habitat distribution data.

The Oregon Department of Fish and Wildlife currently stewards statewide fish habitat distribution data. These data represent an often less than definitive biological resource and they are based on a spectrum of knowledge spanning from direct observations to professional opinion. Consequently, it is critical to have a clear set of rules for updating these data. The OFHDDS will both clarify and formalize the process for further developing and updating fish habitat distribution data.

The OFHDDS will lead to more complete, accurate and current fish habitat distribution data which will provide a greater level of certainty for the resource decisions that rely upon these data. Fish population monitoring efforts will benefit from data that more comprehensively represent fish habitat for particular species. Both protective measures that are designed to prevent harm to particular fish species and restoration measures that are intended to improve certain fish populations will also benefit from the data supported by this standard.

The implementation of this standard will also help to develop a clearer understanding of the fish species that will benefit through the removal of fish passage barriers.

## **2.3 Participation in Standards Development**

The efforts to develop a standard for fish habitat distribution-related geospatial data are rooted in the 24K Project that was completed in 2003. For the purposes of this standard, the collaborative efforts as part of the 24K Project to develop a fish habitat distribution data structure are considered as “phase I” of the workgroup process. Some additional standard development efforts have occurred related to the regional StreamNet Data Exchange Format for fish habitat distribution data. Together, these efforts laid the foundation for the “phase II” OFHDDS development efforts in that occurred in early 2008.

<sup>1</sup> Cooney, C.X., et al. *1:24K Fish Habitat Distribution Development Project Completion Report*. ODFW, Salem. 2003.

The phase II efforts included an internal ODFW meeting to ensure that the standard adequately supports the applications and needs for fish habitat distribution data within the department. Additionally, a multi-agency workgroup met to review the strawman standard with the purpose of identifying other critical, unaddressed needs or issues.

The OFHDDS and the process by which it will be updated / enhanced is open to all agencies concerned with the development, maintenance and application of fish habitat distribution data to the resolution of fish habitat-related management issues. As with all Oregon Framework standards, public review of and comments on the OFHDDS is encouraged. An outline of Oregon's process for the development and extension of geospatial data standards is posted at: ([http://gis.oregon.gov/DAS/EISPD/GEO/standards/docs/Standards\\_Development\\_Effort.pdf](http://gis.oregon.gov/DAS/EISPD/GEO/standards/docs/Standards_Development_Effort.pdf)).

Numerous state and federal agencies participated in either the phase I or phase II efforts of the Fish Habitat distribution Bio-FIT workgroup. The workgroup has been led by the Oregon Department of Fish and Wildlife and has had involvement from the Oregon Department of Forestry, Oregon Water Resources Department, Oregon Department of Transportation, Oregon Watershed Enhancement Board, Oregon State University Institute for Natural Resources, the US Bureau of Land Management, the US Forest Service, Pacific States Marine Fisheries Commission and NOAA Fisheries.

## **2.4 Integration with Other Standards**

The OFHDDS follows the same format as other Oregon Framework geospatial data standards. The OFHDDS is dependent on the Hydrography standard for its representation of both watercourses (streams and rivers) and waterbodies (lakes, reservoirs, estuaries), to which the fish habitat data will be attached. Additionally, the OFHDDS is designed to be compatible with the Fish Passage Barrier standard through the linear referencing data model.

## **2.5 Technical and Operation Context**

### *2.5.1 Data Environment*

The data environment for the OFHDDS is a vector model comprised of lines and polygons. Fish habitat distribution data for streams are also associated with the Framework Hydrography watercourse layer via the linear referencing model. The model tracks the logical relationships of fish habitat "events" (stream reaches with begin and end measures) to their respective stream routes (measured linear feature). Data for lakes are associated with the Framework Hydrography waterbody layer via its latitude/longitude identifier (wb\_llid\_nr) attribute. In cases where fish habitat could be represented as both a line or polygon feature, see the Location business rules in Appendix D for guidance.

The exchange medium for fish passage data files is the Environmental Systems Research Institute (ESRI) shapefile, which is a public domain data structure relating points, lines, polygons and feature attribution (including shape geometry). This exchange medium is supported by all known GIS software suites in use in Oregon. Information about the technical specification for the ESRI shapefile is found at: <http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf>. In designating the shapefile as the exchange format, this standard has been designed to accommodate its limitations, such as limiting attribute (field) names to ten characters. In a future version of this standard, we will investigate other formats for data exchange which are able to preserve a more flexible data model.

### 2.5.2 Reference Systems

The coordinate reference systems typically used in Oregon are the Universal Transverse Mercator (zone 10, which comprises all land in Oregon to the west of 120 degrees west longitude, and zone 11, which comprises all land to the east of 120 degrees west longitude), the Lambert Conformal Conic (the Oregon State Plane system, divided into State Plane North and State Plane South along the county boundaries near 44 degrees north latitude, and Oregon Lambert (EPSG #2992) described at: (<http://gis.oregon.gov/DAS/EISPD/GEO/data/format.shtml>).

### 2.5.3 Integration of Themes

The OFHDDS relates to the Framework Hydrography and Fish Passage Barrier data standards. All fish habitat distribution data that meet the OFHDDS are located either on stream features that are found in the PNW Hydrography Framework watercourse dataset or lake features that are found in the waterbody dataset. Numerous aquatic features are spatially referenced to the Hydrography standard streams template. Understanding the spatial relationships between fish habitat distribution and other aquatic features (e.g., fish passage barriers) will be greatly enhanced through the use of the linear referencing data model.

Although the Fish Passage Barrier Data Standard does not require linear referencing stream attributes, they are optional. Where appropriate, fish habitat distribution data will be integrated with fish passage barrier data such that the two separate datasets are compatible (e.g. anadromous fish habitat ending at a blocking barrier).

### 2.5.4 Encoding

Encoding translates user formats into standard formats, like the shapefile specified here for exchange. All GIS software used in Oregon has the capability of encoding its format to the shapefile format.

### 2.5.5 Resolution

The OFHDDS dataset resolution will meet a minimum 1:24,000 scale and will remain in alignment with the resolution of the Framework Hydrography dataset. Local data capture methods will vary as will the business applications that those data must support. It is the intention of the OFHDDS to allow for the integration of data collected at multiple spatial resolutions; however those data will need to be mapped in association with the Framework Hydrography in order to comply with the OFHDDS. The Framework Hydrography contains feature level source scale attribution.

### 2.5.6 Accuracy

As with resolution, the intention of the OFHDDS is to support varying levels of positional and attribute accuracy. However, it is essential to the success of the data standard that all aspects of fish habitat distribution data be completely documented (either at the feature or dataset level). Although the OFHDDS does not include any elements for tracking feature level accuracy, this information is tracked in the Framework Hydrography dataset.

### 2.5.7 *Edge Matching*

The OFHDDS is intended to facilitate the compilation of a comprehensive dataset for Oregon fish habitat distribution. Edge matching between jurisdictional submissions will be implemented by the Horizontal Steward according to established business rules. Where multiple data originators submit conflicting data for the same waterbodies, the Horizontal Steward will refer these back to the originators for reconciliation.

### 2.5.8 *Feature Identifier*

The feature identifier will be created and maintained by the Horizontal Steward for this element. The feature identifier will uniquely identify fish habitat distribution features and related attributes for the OFHDDS. A linear fish habitat distribution “feature” will represent a reach on a single stream that has a unique set of attributes. Similarly, polygon features will be uniquely identified, where they represent a waterbody with a unique set of fish habitat attributes.

### 2.5.9 *Features and Attributes*

There are two feature types; lines and polygons, and their associated characteristics.

#### 2.5.9.1 *Points*

Point features will not be employed in the OFHDDS.

#### 2.5.9.2 *Lines*

Lines are geospatial objects that represent fish habitat distribution features that extend throughout a length of running waters (i.e. estuaries, rivers, streams). Where lakes and reservoirs are connected to the stream network, the waterbody centerline can be used to associate data (see business rules, Location coding). Lines can be uniquely identified using the feature identifier described in Section 2.5.8 and will be based on linear-referenced events.

#### 2.5.9.3 *Polygons*

Polygons are geospatial objects that represent fish habitat distribution within standing waters (e.g., ponds or lakes). Polygons can be uniquely identified using the feature identifier described in Section 2.5.8.

#### 2.5.9.4 *Associated Characteristics*

Associated characteristics are any of the additional information that is collected and shared in relation to the representation of fish habitat distribution. These are referred to as attributes in spatial datasets. See Section 3 for the specification of minimal and optional characteristics for fish habitat distribution lines and polygons.

### 2.5.10 *Transactional Updating*

Transactional updating processes will be explored as a functional component of the Framework Fish Habitat Distribution Database. This database will be developed (funding contingent) once the OFHDDS is endorsed, and it will be hosted at the Oregon Department of Fish and Wildlife. Through the business rules identified in the OFHDDS and the stewardship plan that will be employed for managing the Framework Fish Habitat Distribution Data, it should be possible to manage the regular merging of locally managed fish habitat distribution data into a statewide data structure.

### 2.5.11 Records Management

Past versions of the Oregon fish habitat distribution dataset will be maintained and available for retrieval through the relational database management system hosted by the Horizontal Steward. This functionality is essential to the business applications that ODFW requires this database to support. The time period needed for archival copies of the database is undetermined at this time, but archiving is mandated under Oregon Rules and Statutes and through Oregon Administrative Rules. At the minimum, those mandates will be satisfied. Archived datasets may be made available through the Oregon State University Institute for Natural Resources.

### 2.5.12 Metadata

The OFHDDS follows the Federal Geographic Data Committee, Content Standard for Digital Geospatial Metadata. Metadata detailing the characteristics and quality of submitted fish habitat distribution data must be provided. Metadata must provide sufficient information to allow the user to determine if that dataset will meet the intended purpose, as well as telling the user how to access the data.

## 3.0 Data Characteristics

The data characteristics specified below are subject to revision based on the documented efforts of the Bio-FIT Workgroup on Fish Habitat Distribution to test the feasibility and usability of the OFHDDS.

### 3.1 Minimum Graphic Data Elements

#### 3.1.1 Lines

<i>ITEM NAME</i>	<i>TYPE</i>	<i>WIDTH</i>	<i>DESCRIPTION</i>
Shape	Line		Fish habitat distribution feature line (generated internally by GIS software)
fhdFtrID	Long integer	9	Framework unique identifier for the fish habitat distribution feature (generated by the Horizontal Steward)
fhdStID	Text	13	Stream route identifier (WC_LLID_NR in Framework Hydrography)
fhdStBMeas	Number	8.3	Stream route begin measure (kilometers to 3 decimal places)
fhdStEMeas	Number	8.3	Stream route end measure (kilometers to 3 decimal places)
fhdRefID	Long integer	5	Reference identifier – link to a reference for the data source (e.g. fish presence database, fish habitat survey report, documentation of a concurrence of professional opinion). Generated by the Horizontal Steward.

#### 3.1.2 Polygons

<i>ITEM NAME</i>	<i>TYPE</i>	<i>WIDTH</i>	<i>DESCRIPTION</i>
Shape	Area		Fish habitat distribution feature area (generated internally by GIS software)
fhdFtrID	Long integer	9	Framework unique identifier for the fish habitat distribution feature (generated by the Horizontal Steward)
fhdWbID	Text	13	Waterbody identifier number (WB_LLID_NR in Framework Hydrography)
fhdRefID	Long integer	5	Reference identifier – link to a reference for the data source (e.g. fish presence database, fish habitat survey report, documentation of a concurrence of professional opinion). Generated by the Horizontal Steward.

### 3.2 Minimum Attribute or Non-graphic Data Elements

#### 3.2.1 Lines

<i>ITEM NAME</i>	<i>TYPE</i>	<i>WIDTH</i>	<i>DESCRIPTION</i>
fhdRevDt	Text	8	Date of data entry into or revision in the Framework dataset (YYYYMMDD)
fhdONm	Text	30	Name of the source originator (person) that provides the data
fhdOEnt	Text	40	Name of the source agency / entity that provides the data
fhdSpNm	Text	30	Species common name
fhdRun	Text	30	General run timing for anadromous species
fhdLifeHst	Text	30	Life history characteristics
fhdUseTy	Text	25	Fish habitat use (e.g. spawning)
fhdBasis	Text	30	Basis for fish habitat distribution feature designation

#### 3.2.2 Polygons

Same as for lines (see 3.2.1)

### 3.3 Optional Graphic Data Elements

None

### 3.4 Optional Attribute or Non-graphic Data Elements

#### 3.4.1 Lines

<i>ITEM NAME</i>	<i>TYPE</i>	<i>WIDTH</i>	<i>DESCRIPTION</i>
fhdStNm	Text	50	Stream name from GNIS
fhdGenus	Text	25	Taxonomic classification at the genus level
fhdSp	Text	25	Taxonomic classification at the species level
fhdSubSp	Text	25	Taxonomic classification at the subspecies level
fhdOrig	Text	15	How the species / run came to exist in an area originally
fhdProd	Text	15	The means by which the population is currently sustained
fhdComment	Text	254	Comment that provides additional, relevant information about the fish habitat distribution feature

#### 3.4.2 Polygons

Same as for lines (see 3.4.1)

## Appendix A: Definitions of Terms

(Extracted from Parts 0 and 5 of the Geographic Information Framework Data Content Standard, state of Oregon fish passage-related OAR language and workgroup deliberations)

<b><u>Term</u></b>	<b><u>Definition</u></b>
<b>Accuracy</b>	<b>Absolute</b> - A measure of the location of features on a map compared to their true position on the face of the earth. <b>Relative</b> - A measure of the accuracy of individual features on a map when compared to other features on the same map.
<b>Adfluvial</b>	Populations that generally migrate between smaller streams used for spawning and juvenile rearing and lakes or reservoirs used for adult rearing.
<b>Anadromous</b>	Populations that migrate from salt water to fresh water to spawn.
<b>Areal</b>	Two-dimensional.
<b>Attribute</b>	Characteristic of a <b>feature</b> .
<b>Bed/Bed and Banks</b>	The physical container of the waters of this state, bounded on freshwater bodies by the ordinary high water line or bankfull stage, and on bays and estuaries by the limits of the highest measured tide.
<b>Boundary</b>	Set that represents the limit of a <b>feature</b> .
<b>Channel</b>	A waterway that periodically or continuously contains moving waters of this state and has a definite bed and banks that serve to confine the water.
<b>Concurrence of Professional Opinion</b>	A joint opinion formulated by the natural resource agency and/or tribal biologists within whose jurisdiction a change has been proposed.
<b>Current</b>	Existing in the area outlined within the past five reproductive cycles. The maximum range of one life-cycle by species: coho – 5x3 years, steelhead – 5x7 years, chinook – 5x6 years.
<b>Documentation</b>	Written information describing the life stage and/or behavior of a given species and run of fish in a specific stream or area based on actual observation.
<b>Event</b>	Linear, continuous or point features occurring along a base route system.
<b>Estuary</b>	Semi-enclosed coastal body of water with one or more rivers or streams flowing into it, and with a free connection to the open sea.
<b>Family</b>	The major subdivision of a taxonomic order or suborder consisting of one or more genera.
<b>Feature</b>	Abstraction (point, line or polygon) of a real world phenomenon stored within geospatial software.
<b>Feature Delineation</b>	Criteria or rules for defining the limits of a <b>feature</b> and how it will be represented geometrically in a dataset.
<b>FGDC</b>	Federal Geographic Data Committee.
<b>Fish</b>	Species of the vertebrate taxonomic groups of Osteichthyes (bony fishes) and Cephalaspidomorphi (lamprey).

<b>Fish Habitat distribution</b>	Areas of suitable habitat currently believed to be used by wild, hatchery or naturalized fish populations based on sampling or best professional opinion.
<b>Fluvial</b>	Populations that generally migrate between smaller streams used for spawning and early juvenile rearing and larger rivers used for adult rearing.
<b>Genus</b>	The major subdivision of a taxonomic family or subfamily usually consisting of one or more species.
<b>GNIS</b>	Geographic Names Information System. The official repository of geographic names in the United States, managed by US Geological Survey.
<b>Historical Habitat</b>	Areas of suitable habitat that fish no longer access and will not access in the foreseeable future without human intervention.
<b>Horizontal Steward</b>	The agency or organization responsible for assembling and providing access to a statewide dataset of a particular type.
<b>Individual Professional Opinion</b>	An opinion formulated by an individual natural resource agency or tribal biologist.
<b>Line</b>	A feature built of vectors connecting at least two points.
<b>Linear referencing</b>	A method for storing geographic data by using a relative position or measure along an already existing line feature.
<b>Metadata</b>	Information about data sufficient to ascertain its quality and appropriate use.
<b>Migration Habitat</b>	Areas where juvenile and/or adult fish pass through as they move between the ocean and spawning and rearing areas. While all migratory corridors provide some rearing opportunities, areas with this designation are distinguished by fish moving through fairly quickly making contributions to juvenile rearing insignificant.
<b>Model</b>	A schematic description of a system, theory, or phenomenon that accounts for its known or inferred properties and may be used for further study of its characteristics.
<b>Native</b>	Indigenous species that were present within the subbasin prior to European settlement.
<b>Non-native</b>	Any species introduced to an area where it did not exist historically.
<b>NSDI</b>	National Spatial Data Infrastructure. The effort of the FGDC to create and implement a shared data collection and maintenance resource for geospatial datasets.
<b>Observation</b>	A methodical or scientific record of an occurrence of a fish species or habitat.
<b>Origin</b>	How the initial population came to exist within the subbasin.
<b>Polygon</b>	Bounded surface for which the interior configuration is not directly specified.
<b>Positional Accuracy</b>	An assessment of the accuracy of the positions of spatial objects.
<b>Professional Opinion</b>	Opinion of a biologist from a natural resource agency, Native American tribe or university.
<b>Production</b>	Means by which the population is currently sustained.

<b>Rearing Habitat</b>	Areas outside primary spawning habitats where juvenile fish take up residence during some stage of juvenile development and use the area for feeding, shelter, and growth. Some migration also occurs as juvenile and adult fish move between the ocean and spawning grounds.
<b>Resident</b>	Populations that confine their migration within their natal stream or watershed, including estuaries.
<b>Route</b>	A measured line feature, such as a stream, which has a unique identifier.
<b>Run</b>	Primary timing (season) of freshwater entry for anadromous species.
<b>Spawning Habitat</b>	Areas where eggs are deposited and fertilized. For some species, including salmonids, this also includes areas where gravel emergence occurs and where at least some juvenile development occurs.
<b>Species</b>	The major subdivision of a genus or subgenus, regarded as the basic category of biological classification, composed of related individuals that resemble one another and are able to breed among themselves, but are generally not able to breed with members of another species.
<b>Standardized Survey</b>	The systematic observation, identification and collection of quantitative information describing fish or fish habitat, following a standardized methodology (e.g. Rosgen 1985, Frissell et al. 1986, Cupp 1989, Ralph 1989, USFS Region 6 Level II Inventory 1992, Hawkins et al. 1993, Moore et al. 2007).
<b>Stream</b>	A body of running waters of this state moving over the surface of the land in a <i>channel</i> or <i>bed</i> including stream types classified as perennial or intermittent and channelized or relocated streams.
<b>Taxonomy</b>	The science or technique of describing, identifying, naming, and classifying living organisms.
<b>Type</b>	Class of real world occurrences with common characteristics.
<b>Unique Identifier</b>	A reference code which is unique in the context for which it is used.
<b>Waterbody</b>	Framework hydrography representation of sounds, bays, lakes, ponds, reservoirs, inundation areas, the double lined portions of streams and other hydrographic features best represented as areas.
<b>Watercourse</b>	Framework hydrography representation of streams, canals, flumes, pipelines and other linear hydrographic feature centerlines. Where these features (especially streams) are represented as double lined features at the source scale they will be represented in this layer by their centerline. Streams that flow through waterbodies such as lakes and reservoirs will also be represented by a centerline.
<b>Waters of the State</b>	Natural waterways including all tidal and non-tidal bays, intermittent and perennial streams, constantly flowing streams, lakes, wetlands and other bodies of water in this state, navigable and non-navigable.
<b>Wild / natural Production</b>	Natural reproduction of indigenous and non-indigenous species.

## Appendix B: Data Dictionary

### Minimum graphic data elements

<b>Shape:</b>	Fish habitat distribution feature line or area (see Appendix D, Business Rules).
<b>fhdFtrID:</b>	Framework unique identifier for the fish habitat distribution feature (generated by Horizontal Steward).
<b>fhdStfID:</b>	Stream route identifier (Framework Hydrography).
<b>fhdStBMeas:</b>	Stream route begin measure – lines and polygons only (kilometers to 3 decimal places).
<b>fhdStEMeas:</b>	Stream route begin measure – lines and polygons only (kilometers to 3 decimal places).
<b>fhdRefID:</b>	Reference identifier – link to a reference for the data source (e.g. fish presence database, fish habitat survey report, documentation of a concurrence of professional opinion). Generated by the Horizontal Steward.
<b>fhdWbID:</b>	Waterbody route identifier (Framework Hydrography).

### Minimum attribute or non-graphic data elements

<b>fhdRevDt:</b>	Date of data entry into or revision of the Framework dataset (YYYYMMDD). This will be populated as a complete date.
<b>fhdONm:</b>	Name of source originator (person) that provides the data.
<b>fhdOEnt:</b>	Name of the source agency / entity that provides the data.
<b>fhdSpNm:</b>	Species common name.
<b>fhdRun:</b>	General run timing for anadromous fish species.
<b>fhdLifeHst:</b>	Life history exhibited.
<b>fhdUseTy:</b>	Primary use of the fish habitat.
<b>fhdBasis:</b>	Basis for fish habitat distribution feature designation. Tracks whether the feature is based on a fish observation, habitat observation, professional opinion or modeling.

### Optional graphic data elements

None specified at this time.

### Optional attribute or non-graphic data elements

<b>fhdStrNm:</b>	Stream name from GNIS.
<b>fhdGenus:</b>	Taxonomic classification at the genus level.
<b>fhdSp:</b>	Taxonomic classification at the species level.
<b>fhdSubSp:</b>	Taxonomic classification at the subspecies level.
<b>fhdOrig:</b>	How the species / run came to exist in an area originally.

**fhdProd:** The means by which the population is currently sustained.

**fhdComment:** Comment that provides additional, relevant information about the fish habitat distribution feature.

## Appendix C: Domain of Attributes

Fish habitat distribution, common species name (fhdSpNm), genus (fhdGenus), species (fhdSp) and subspecies (fhdSubSp). Unless otherwise noted, Latin names are from *Common and Scientific Names of Fishes from the United States, Canada, and Mexico, Sixth Edition, 2004* from the American Fisheries Society and the American Society of Ichthyologists and Herpetologists. For unknown species, see Appendix D, Business Rules for fhdSpNm.

**Native Fish Species** (For complete list see: <http://www.dfw.state.or.us/fish/ONFSR/final/Vol%20II%20Appx%20A.pdf>)

Common Name	Genus	Species	Subspecies
<b>Salmon and Trout (Family: Salmonidae)</b>			
Chinook salmon	<i>Oncorhynchus</i>	<i>tshawytscha</i>	
Coho salmon	<i>Oncorhynchus</i>	<i>kisutch</i>	
Steelhead (coastal)	<i>Oncorhynchus</i>	<i>mykiss</i>	<i>irideus</i> <sup>2</sup>
Steelhead (Columbia Basin)	<i>Oncorhynchus</i>	<i>mykiss</i>	<i>gairdneri</i> <sup>2</sup>
Sockeye salmon / Kokanee	<i>Oncorhynchus</i>	<i>nerka</i>	
Chum salmon	<i>Oncorhynchus</i>	<i>keta</i>	
Pink salmon	<i>Oncorhynchus</i>	<i>gorbuscha</i>	
Coastal cutthroat trout	<i>Oncorhynchus</i>	<i>clarkii</i>	<i>clarkii</i> <sup>2</sup>
Lahontan cutthroat trout	<i>Oncorhynchus</i>	<i>clarkii</i>	<i>henshawi</i> <sup>2</sup>
Westslope cutthroat trout	<i>Oncorhynchus</i>	<i>clarkii</i>	<i>lewisi</i> <sup>3</sup>
Rainbow (coastal) trout	<i>Oncorhynchus</i>	<i>mykiss</i>	<i>irideus</i> <sup>2</sup>
Redband trout (Columbia Basin)	<i>Oncorhynchus</i>	<i>mykiss</i>	<i>gairdneri</i> <sup>2</sup>
Redband trout (Oregon Basin / Klamath Basin)	<i>Oncorhynchus</i>	<i>mykiss</i>	<i>newberrii</i> <sup>3</sup>
Bull trout	<i>Salvelinus</i>	<i>confluentus</i>	
Mountain whitefish	<i>Prosopium</i>	<i>williamsoni</i>	
<b>Sturgeon (Family: Acipenseridae)</b>			
White sturgeon	<i>Acipenser</i>	<i>transmontanus</i>	
Green sturgeon	<i>Acipenser</i>	<i>medirostris</i>	
<b>Lamprey (Family: Petromyzontidae)</b>			
Pacific lamprey	<i>Lampetra</i>	<i>tridentata</i>	
Western brook lamprey	<i>Lampetra</i>	<i>richardsoni</i>	
River lamprey	<i>Lampetra</i>	<i>ayresii</i>	
Pit-Klamath lamprey	<i>Lampetra</i>	<i>lethophaga</i>	
Miller Lake lamprey	<i>Lampetra</i>	<i>minima</i>	
Klamath lamprey	<i>Lampetra</i>	<i>similis</i>	
<b>Carp and Minnows (Family: Cyprinidae)</b>			
Oregon chub	<i>Oregonichthys</i>	<i>crameri</i>	
Northern pikeminnow	<i>Ptychocheilus</i>	<i>oregonensis</i>	
Umpqua pikeminnow	<i>Ptychocheilus</i>	<i>umpquae</i>	
<b>Suckers (Family: Catostomidae)</b>			
Bridgelip sucker	<i>Catostomus</i>	<i>columbianus</i>	
Lost River sucker	<i>Catostomus</i>	<i>luxatus</i>	
Largescale sucker	<i>Catostomus</i>	<i>macrocheilus</i>	
Modoc sucker	<i>Catostomus</i>	<i>microps</i>	
Goose Lake sucker	<i>Catostomus</i>	<i>occidentalis</i>	<i>Lacusanserinus</i> <sup>4</sup>
Mountain sucker	<i>Catostomus</i>	<i>platyrhynchus</i>	
Klamath smallscale sucker	<i>Catostomus</i>	<i>rimiculus</i>	
Klamath largescale sucker	<i>Catostomus</i>	<i>snyderi</i>	
Tahoe sucker	<i>Catostomus</i>	<i>tahoensis</i>	
Warner sucker	<i>Catostomus</i>	<i>warnerensis</i>	
Shortnose sucker	<i>Chasmistes</i>	<i>brevirostris</i>	

<sup>2</sup> Integrated Taxonomic Information System (ITIS) (<http://www.itis.gov>).

<sup>3</sup> Behnke, R.J. *Trout and Salmon of North America*. The Free Press. 2002.

<sup>4</sup> Oregon Native Fish Status Report. Oregon Dept. of Fish and Wildlife. Salem. 2005.

**Non-Native Fish Species (not comprehensive)**

<b>Common Name</b>	<b>Genus</b>	<b>Species</b>	<b>Subspecies</b>
<b>Salmon and Trout (Family: Salmonidae)</b>			
Brook trout	<i>Salvelinus</i>	<i>fontinalis</i>	
Lake trout	<i>Salvelinus</i>	<i>namaycush</i>	
Brown trout	<i>Salmo</i>	<i>trutta</i>	
Atlantic salmon	<i>Salmo</i>	<i>salar</i>	
<b>Sunfishes (Family: Centrarchidae)</b>			
Largemouth bass	<i>Micropterus</i>	<i>salmoides</i>	
Smallmouth bass	<i>Micropterus</i>	<i>dolomieu</i>	
Bluegill	<i>Lepomis</i>	<i>macrochirus</i>	
Pumpkinseed	<i>Lepomis</i>	<i>gibbosus</i>	
Green sunfish	<i>Lepomis</i>	<i>cyanellus</i>	
Warmouth	<i>Lepomis</i>	<i>gulosus</i>	
Redear sunfish	<i>Lepomis</i>	<i>microlophus</i>	
White crappie	<i>Pomoxis</i>	<i>annularis</i>	
Black crappie	<i>Pomoxis</i>	<i>nigromaculatus</i>	
Sacramento perch	<i>Archoplites</i>	<i>interruptus</i>	
<b>Carps and Minnows (Family: Cyprinidae)</b>			
Common Carp	<i>Cyprinus</i>	<i>carpio</i>	
<b>Perches (Family: Percidae)</b>			
Yellow perch	<i>Perca</i>	<i>flavescens</i>	
Walleye	<i>Sander</i>	<i>vitreus</i>	
<b>North American Catfishes (Family: Ictaluridae)</b>			
Channel catfish	<i>Ictalurus</i>	<i>punctatus</i>	
Flathead catfish	<i>Pylodictus</i>	<i>olivaris</i>	
Yellow bullhead	<i>Ameiurus</i>	<i>natalis</i>	
Brown bullhead	<i>Ameiurus</i>	<i>nebulosus</i>	
Black bullhead	<i>Ameiurus</i>	<i>melas</i>	
<b>Shad (Family: Clupeidae)</b>			
American shad	<i>Alosa</i>	<i>sapidissima</i>	
<b>Temperate Basses (Family: Moronidae)</b>			
Striped bass	<i>Morone</i>	<i>saxatilis</i>	
White bass	<i>Morone</i>	<i>chrysops</i>	

**Fish habitat distribution run (fhdRun)**

<b>Code</b>	<b>Description</b>
Spring	Spring
Summer	Summer
Fall	Fall
Winter	Winter
NA	Not applicable (resident species)
Unknown	Unknown

## Fish habitat distribution life history (fhdLifeHst)

Code	Description
Anadromous	Spawning in freshwater, migrating to saltwater
AnadRes	Mixed anadromous and resident
Resident	Year-round resident only
Fluvial	Migrating within a stream / river system
Adfluvial	Lake resident that migrates to a stream / river
FluvAdfluv	Mixed fluvial and adfluvial
FluvRes	Mixed fluvial and resident
AdfluvRes	Mixed adfluvial and resident
FluvAdfluvRes	Mixed fluvial, adfluvial and resident
Unknown	Unknown

## Fish habitat distribution use (fhdUseTy)

Code	Description
Spawning	Primarily spawning with some rearing.
Rearing	Primarily rearing with some migration.
Migration	Primarily migration.
Unknown	Specific use cannot be specified.

Fish habitat distribution basis (fhdBasis). See Business Rules for specific requirements associated with each value in the domain for this attribute.

Code	Description
DocObsFish	Documented observation of fish by a generally accepted standardized survey method. A record of the fish observation is maintained in an existing data system (e.g. database, spreadsheet, hardcopy data collection forms).
UndocObsFish	Undocumented observation of fish which may include anecdotal observations.
DocObsHabitat	Documented observation of habitat by a generally accepted standardized survey method. A record of the habitat observation is maintained in an existing data system (e.g. database, spreadsheet, hardcopy data collection forms).
HabitatEval	Habitat evaluation based on modeling. Limited to the following models: Intrinsic Potential <sup>5</sup> and Habitat Limiting Factors <sup>6</sup> .
ConcurProfOpinion	Concurrence of professional opinion (CPO). Models other than those listed in the HabitatEval category would be subject to a CPO.
IndivProfOpinion	Individual professional opinion.

## Fish habitat distribution origin (fhdOrig)

Code	Description
Native	Native origin. Indigenous species that were present within the subbasin prior to European settlement
NonNative	Non-native origin. Any species introduced to an area where it did not exist historically.
NativeReintro	Native, reintroduced. A species from within the subbasin that has repopulated an area within the subbasin that had become void of that species.
NonNativeReintro	Non-native, reintroduced. The original stock within the subbasin was extirpated, but non-native fish (fish from outside the subbasin) were introduced to re-establish the historical distribution.
Unknown	Unknown origin.

<sup>5</sup> Burnett, et al. *Distribution of Salmon-Habitat Potential Relative to Landscape Characteristics and Implications for Conservation. Ecological Applications*, 17(1), 2007, pp. 66–80.

<sup>6</sup> Nickelson, Thomas E. *A Habitat-Based Assessment of Coho Salmon Production Potential and Spawner Escapement Needs for Oregon Coastal Streams. ODFW Information Report 98-4*. 1998.

## Fish habitat distribution production (fhdProd)

<b>Code</b>	<b>Description</b>
Native	Native production. Natural reproduction of the species that was present prior to European settlement (the indigenous species).
WildNatural	Wild / natural production. Natural reproduction of indigenous and non-indigenous species.
Mixed	Hatchery and non-hatchery production. Reproduction from a mix of hatchery, native, introduced, and/or wild/natural populations.
Hatchery	Hatchery production. Production is the result of fish being propagated in a hatchery and released into the wild.
Introduced	Introduced production. Production is the result of routine introductions of a species with no fish returning and naturally reproducing.
Unknown	Unknown production.

## Appendix D: Business Rules

### Location

There are three separate scenarios for representing the location component of fish habitat distribution data:

Scenario	Minimum Graphic Element	Optional Graphic Element
Habitat that is solely represented by a line in the Framework Hydrography dataset.	Line	None
Habitat that extends through a waterbody, the waterbody contains a centerline in the Framework Hydrography dataset and it is contiguous with upstream or downstream habitat.	Line	Polygon
Habitat in a waterbody where there is no contiguous upstream or downstream habitat.	Polygon	None

### Missing Hydrographic Features

If habitat is identified on water courses or waterbodies not found in the Framework Hydrography dataset, the data originator will be responsible to work through the formal process of updating the Hydrography dataset before these data can be submitted for inclusion in the Framework OFHDDS Dataset.

### Reference

#### Reference Identifier (fhdRefID)

In cases where additions and/or modifications are submitted to the Framework OFHDDS Dataset that are based on documented observations of either fish or fish habitat, the name of the data source (e.g. publication, database) and the location of the data source (e.g. USFS Regional Office) must be provided. This data source will be referenced with the fhdRefID element.

Where additions and/or modifications are submitted to the Framework OFHDDS Dataset that have a basis other than direct observation, a change request form will document the basis for the change, the details of that basis (e.g. concurrence of professional opinion details) and the form will become the document that is referenced.

## Species-specific

### Category I species habitat

Species habitat distributions that were mapped comprehensively during the 24K Project or other projects (coho, chinook, chum, steelhead, bull trout, Oregon Basin redband, Oregon chub, Lahontan and westslope cutthroat, sturgeon) will be considered as category I species. Additions and/or modifications to category I species habitat distribution will require documented observation of fish, a direct observation of habitat or a concurrence of professional opinion. The methods used for standardized surveys that will be used to modify category I data must also be approved via a “concurrence of professional opinion” process (see Basis rule below).

### Category II species habitat

Species that were not mapped comprehensively during the 24K Project will be considered as category II species. These include all species not listed as category I species. Additions and/or modifications to category II species habitat distribution may have a basis other than “documented observation” including individual professional opinion.

## Basis

### Fish habitat distribution Basis (fhdBasis)

Each value in the domain of this attribute element has specific rules that are explained in the following table:

Code	Rule
DocObsFish	Observations made by Group I data providers (see the Data Provider Group section below) may be submitted directly for inclusion in the OFHDDS dataset. Observations made by Group II data providers must be vetted through a Group I data provider (e.g. ODFW District Fisheries Biologist).
UndocObsFish	Undocumented observations of fish are subject to the same rules as documented observations of fish.
DocObsHabitat	Observations of habitat are subject to the same rules as documented observations of fish. If these areas conflict with actual fish observations, the fish observations will take precedence when designating the habitat.
HabitatEval	Habitat that is identified via the models listed in Appendix C may be submitted directly to the OFHDDS. If these areas conflict with actual fish observations, the fish observations will take precedence when designating the habitat.
ConcurProfOpinion	A CPO must be led by a Group I data provider, otherwise known as the initiating biologist (IB). The IB is responsible for coordinating with representative biologists from other natural resource agencies who have jurisdiction in the area (5 <sup>th</sup> field watershed) to formulate a joint professional opinion. An ODFW district fisheries biologist (or designated assistant) must be involved in the process and there must be no dissenting opinions. Where ODFW has the only natural resource agency presence (5 <sup>th</sup> field watershed, all private land) ODFW’s opinion will be sufficient to formulate a CPO. A CPO may be used to directly update category I fish habitat data. See below for the suggested process to formulate a CPO.
IndivProfOpinion	Individual professional opinion (IPO) from a Group I data provider. An IPO may only be used to directly update category II fish habitat data.

The suggested process for formulating a CPO will be as follows:

The biologist who initiates a change request using this approach will be responsible for coordinating the formulation of a CPO. S/he will henceforth be called the initiating biologist (IB) and those who have been solicited for their opinion will be called the representative biologists (RB).

Step 1. A professional biologist identifies a need to change Category I distribution data, but no documented observations (that prove presence of fish or habitat) exist.

Step 2. The IB determines the jurisdiction(s) present within the 5<sup>th</sup> field watershed, contacts the appropriate biologists and requests their professional opinion regarding the proposed change. The IB may use his/her discretion to determine which RB's need to be contacted.

Step 3. The RB's are given a reasonable time frame to respond to the request (4 weeks recommended). If they do not respond within that time frame, the process will move forward. A simple communication stating their dissent will prevent the change from being implemented.

Step 4. The IB assembles the various responses in order to satisfy the requirements of proposing a change based on a CPO. The names, agencies, contact information and opinions will be required for all the biologists/agencies involved in formulating the CPO. If no state or federal ownership or tribal representation occurs within the 5<sup>th</sup> field watershed then the opinion of the ODFW biologist will be adequate to satisfy the CPO requirement.

Step 5. The IB then completes a change request form and provides it to the OFHDDS Framework Dataset steward.

#### Single fish observations

For observations of resident fish species that occur at a single point along a stream, the acceptable length for extrapolating that observation into documented fish habitat (fhdBasis = "DocObsFish") will be 160 meters total, or 80 meters (.08 kilometers) upstream and 80 meters downstream. If a barrier is known to exist within that reach, the length over which the observation will be extrapolated into recognized habitat will be truncated at that barrier.

For observations of anadromous fish species under the same scenario, the same rules would apply for extrapolating the observations into habitat data where fhdBasis = "DocObsFish". However, with anadromous fish, the area in between such observations may have a different set of assumptions applied (i.e. habitat present) with associated professional opinion(s) rendered.

#### Basis - order of precedence

If conflicting fish habitat distribution data are submitted, records that are based on fish observations will take precedence over habitat observations which will take precedence over opinion-based data.

#### **Data Provider Groups**

These groups are referred to under the rules related to the fhdBasis attribute element.

Group I Data Providers

State and Federal Natural Resource Agency, Tribal Biologists (ODFW, ODF, USFS, BLM, USFWS, Tribes) or University Researchers with an advanced degree in fisheries biology. The data provider must be employed by one of these entities at the time either the observation was made or the opinion was rendered.

Group II Data Providers

Other Biologists and Non-biologists (e.g. university researchers without an advanced fisheries biology degree, SWCD's, utilities, private corporation biologists, non-biologists such as ODFW Experimental Biology Aides or USFS / BLM equivalent positions, watershed council coordinators, and anyone else who does not fall into Group 1).

**General**Fish habitat distribution Feature Identifier (fhdFtrID)

Fish habitat distribution features will have unique identifiers assigned to them.

Fish habitat distribution Data Revision Date (fhdRevDt)

Any change to the record would necessitate an update to the fish habitat distribution data revision date field.

Fish habitat distribution species common name (fhdSpNm)

All common species names must match the ones that are found in Appendix C of this document.

Within the fish species tables (Appendix C), several geographic areas are identified in parentheses to assist with subspecies identification. The information in the parentheses (e.g. coastal) should not be included in the common name.

Where a fish observation cannot be identified to the species level (e.g. Unknown salmonid), the common name may be coded as "Unknown species". When this code is used, the genus (fhdGenus) must be specified (e.g. Oncorhynchus).

Fish habitat distribution run (fhdRun)

The run code is applicable to chinook and steelhead only, including the code "unknown". Other anadromous species should not have a run code assigned (e.g. coho, coastal cutthroat) and thus should have this element populated as "NA". All resident species should be coded as "NA".

Fish Habitat distribution use (fhdUse)

Where a mix of uses occurs within a stream reach or waterbody, apply the most sensitive use in the following order of precedence: spawning, rearing, migration.

Fish habitat distribution Originator Entity (fhdOEnt)

Fish habitat distribution data originator entity names will be submitted by each originator, but will then be standardized by the Horizontal Steward (e.g., USFS – region, USFS – Mt Hood). The Horizontal Steward will share this information back to the data originators to ensure consistency for future data submissions.

Fish habitat distribution Stream Identifier (fhdStID)

Stream identification information will be based on the standard Framework Hydrography routing system.