Oregon Fish Habitat Distribution Data Standard

Version 4.0
April 2020

Revision History

Version 1.0 Endorsed by the Oregon Geographic Information Council March 27, 2008

Version 2.0 Revised September 2010 – February, 2011 based on input from ODFW, BLM, Pacific States Marine Fisheries Commission, NOAA Fisheries, Oregon Dept. of Transportation and the Oregon Biodiversity Information Center. Revisions include changes to the scope of the standard, modifications to some attribute domains, the addition of two optional attribute elements and the addition of two business rules.

Version 3.0 Revised December, 2014 – March, 2015 based on input from ODFW, BLM, USFS, Pacific States Marine Fisheries Commission, Oregon Department of Transportation, Oregon Department of State Lands, Oregon Department of Environmental Quality and the Oregon Biodiversity Information Center. Revisions include changes to the minimum graphic elements, optional attribute elements, Domain of Attributes (Appendix C) and Business Rules (Appendix D). Endorsed by the Oregon Geographic Information Council June 17, 2015

Version 4.0 Revised April – September, 2019 based on input from ODFW, BLM, USFS, US Fish and Wildlife Service, Pacific States Marine Fisheries Commission, Oregon Department of Transportation, Oregon Department of State Lands, Oregon Department of Environmental Quality, Oregon Department of Forestry, Oregon Department of Agriculture, Weyerhaeuser Co., Urban Greenspaces Institute. Revisions include a new optional attribute element to identify specific habitat end extent determinations, a new optional attribute element to describe habitat access methods, a new optional attribute element to identify end extent barriers, changes related to the incorporation of modeled data, an expansion of the species domain, new business rules for designating Essential Salmonid Habitat and rules to clarify acceptable methods for standardized fish and habitat surveys. Endorsed by the Oregon Geographic Information Council April 20, 2020.

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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 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 representation of geospatial fish habitat distribution information. The scope of the standard includes current and historical fish habitat distribution in all waters of the state (ORS 536.007), including estuaries but 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 increasing their value and usefulness for supporting resource planning.

Version 1.0 of the OFHDDS was 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. Numerous additions and modifications have been made since the initial version. 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 FIT 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 and location information 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 used by both resource agencies and the public with the OFHDDS 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 in part, 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, sockeye and bull trout for the state of Oregon. Additionally, the standard draws from the StreamNet Data Exchange Standard (DES). The StreamNet DES 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 DES is designed to accept data for both anadromous and resident fish, and includes both 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. The OFHDDS 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 location, 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 information 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. Where observations of fish species do exist, they provide a greater level of certainty that a particular waterbody constitutes fish habitat for that species. The fish habitat distribution data may also be based on habitat surveys or the best professional opinion of natural resource agency fisheries biologists that suitable habitat for a specific species exists/existed within a particular waterbody and that it is/was accessible by an existing/historical population. Habitat may also be identified via models, however there are clear rules regarding the incorporation, management and integration of modeled data.

The standard provides a basic characterization of current and historical fish habitat use by species and run (anadromous), the life history exhibited and the Basis for the identification of the habitat. The ability to describe areas of historical fish habitat was added to the standard in November, 2010. Optional attributes for describing additional record Basis details (date, name, entity, project, method) were added in March 2015. September 2019 additions include a new data category for managing data developed via models. Marine fish habitat is not included in the standard at this time, however some marine species may utilize estuarine habitat, which is included.

1.4 Applicability and Intended Use of Standard

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

This standard is intended to support the automation, integration and sharing of 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 include 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 by the Department of State Lands,

the identification of salmon, steelhead and Bull Trout (SSBT) habitat for implementing water protection rules by the Oregon Department of Forestry, the establishment of water quality standards by the Oregon Department of Environmental Quality 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 their own fish habitat distribution data for internal purposes. However, shared versions of the datasets must meet the requirements set forth in this standard.

1.5   Standard Development Procedures

An outline of Oregon's process for the development and extension of geospatial data standards is posted at:
(https://www.oregon.gov/geo/standards/FIT%20Standard%20Development%20Process,%20v.1.1.pdf).

The Bio-FIT Workgroup on Fish Habitat Distribution unofficially 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 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:
https://nrimp.dfw.state.or.us/nrimp/24k/docs/finalreport.pdf

A second iteration (phase 2) of the Bio-FIT Workgroup convened in early 2008 to review the 24K Project Fish Habitat Distribution data structure. The phase 2 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. Some refinements to the initial data structure were made during that round of review and those were 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://www.oregon.gov/DAS/CIO/GEO/pages/standards/standards.aspx.

The viability of the OFHDDS was tested in February 2008 and was approved by OGIC in March 2008.

In general, as necessary changes to the data standard build up over time, the horizontal steward reaches out to appropriate stakeholders and convenes a new iteration of the Bio-FIT Workgroup.

The workgroup was convened from September to November 2010 (phase 3) and considered revisions to version 1.0 of the standard.

The workgroup was convened from December 2014 to March 2015 (phase 4) and considered revisions to version 2.0 of the standard.

The workgroup was convened from April to August 2019 (phase 5) and considered revisions to version 3.0 of the standard.

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.   Proposed revisions from this community will be considered based on 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 marine fish habitat distribution. With the adoption of the National Hydrography Dataset (NHD) as the state of Oregon Framework Hydrography data standard in September 2012, it became necessary to update the linear referencing component 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 the 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 and historical fish habitat distribution or "areas of suitable habitat believed to be used currently or historically by native, or non-native fish populations based on sampling or best professional opinion"[1]. Current habitat must also be accessible. Additionally, modeling can be used to identify potential fish habitat distribution provided that certain criteria are met. Modeled data will typically be managed separately from non-modeled data, however they may be integrated with non-modeled data if minimum graphic and attribute element requirements are met. Historical habitats identified through modeling represent potential habitats and are differentiated from habitats with known historical use via the Basis attribute. All native migratory and resident fish species as well as non-native species are included in the scope of the OFHDDS.

The OFHDDS includes vector data accompanied by required metadata. The scope of the OFHDDS includes estuarine areas, but does not include marine areas. Some data (e.g. sensitive, threatened or endangered species) may be limited in their availability to the general public and subject to a data sharing agreement.

The content of the OFHDDS 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, tribes, universities, utilities, watershed councils, 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 habitats are present within waters of the state at particular locations. The various fish observation and habitat data that are collected all have the potential to contribute toward the development of statewide fish habitat distribution data.

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[1] *Cooney, C.X., et al. 1:24K Fish Habitat Distribution Development Project Completion Report. ODFW, Salem. 2003.*

ODFW 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 and the accompanying FHD Stewardship Plan 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. Protective measures (designed to prevent harm to particular fish species) and restoration measures (intended to improve certain fish populations) will 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 OFHDDS and the process by which it will be updated / enhanced is open to all agencies and organizations interested in the development, maintenance and application of fish habitat distribution data to address fish habitat-related management issues. As with all Oregon Framework standards, public review of and comments on the OFHDDS is encouraged.

Numerous state and federal agencies, and private entities participated in phases 1 through 5 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 Department of Agriculture, Oregon Water Resources Department, Oregon Department of Transportation, Oregon Watershed Enhancement Board, Oregon State University Institute for Natural Resources \ Oregon Biodiversity Information Center, Oregon Department of Environmental Quality, Oregon Department of Administrative Services / Geospatial Enterprise Office, the US Bureau of Land Management, the US Forest Service, US Fish and Wildlife Service, Pacific States Marine Fisheries Commission, NOAA Fisheries, Weyerhaeuser Co. and Urban Greenspaces Institute.

2.4   Integration with Other Standards

The OFHDDS follows the same format as other Oregon Framework geospatial data standards.   The OFHDDS is largely dependent on the Oregon Framework Hydrography data standard (NHD) for its representation of both watercourses (streams and rivers) and waterbodies (lakes, reservoirs, estuaries), to which the fish habitat data will be attached.   As of version 4.0 of this standard, an optional attribute element was added to track barrier features when they are co-located with the end extent of a species habitat distribution. Additionally, the OFHDDS is designed to be compatible with the Oregon Fish Passage Barrier Data Standard (OFPBDS) through the linear referencing data model. The OFPBDS includes optional linear referencing attribute elements that are compatible with the NHD.

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 (NHD) Flowline 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 (NHD) waterbody layer via its identifier (ReachCode) 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 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 in Oregon 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 the Oregon Lambert (EPSG #2992) described at: (https://www.oregon.gov/geo/Pages/projections.aspx).

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 NHD Flowlines dataset or lake features that are found in the NHD Waterbody dataset. Numerous aquatic features are spatially referenced to the NHD 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 NHD-based linear referencing data model. Modeled habitat distributions (category 3 data) are exempted from the required NHD-based graphic elements of the OFHDDS (see Appendix D Business Rules).

The Fish Passage Barrier Data Standard contains optional linear referencing stream attributes that have been populated for nearly all features by the Horizontal Data Steward. Fish habitat distribution data will be integrated with fish passage barrier data so the compatibility between the two separate datasets can be improved (e.g. current anadromous fish habitat ending at a blocking barrier). Current and accurate barrier information will typically take precedence over fish habitat distribution upper extent locations in cases where incompatibilities between the two datasets occur. Additional business rules will likely need to be developed to identify the different cases of incompatibility and to clarify the process for revising the respective datasets.

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 (except modeled data) 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. The OFHDDS allows 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 OFHDDS supports 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 facilitates 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 (NHD Permanent Identifier) will be created and maintained by the Hydrography Event Management tools. 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 route (NHD Flowline) 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 is under constant development (funding contingent) and is hosted at the Oregon Department of Fish and Wildlife. Through the business rules identified in the OFHDDS and the associated FHD Stewardship Plan 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 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

ITEM NAME	TYPE	WIDTH	DESCRIPTION
Shape	Line		Fish habitat distribution feature line (generated internally by GIS software)
Permanent_Identifier	Text	40	Habitat distribution feature event record permanent ID (GUID). Maintained by the Hydrography Event Management (HEM) tools.

ReachCode	Text	14	The ReachCode value for the NHD Flowline record where the linear event record begins. Maintained by the HEM tools.
FMeasure	Double	8.3	The measure along the NHD Flowline route where the event record begins. Maintained by the HEM tools.
TMeasure	Double	8.3	The measure along the NHD Flowline route where the event record ends. Maintained by the HEM tools.
EventDate	Date	8	The date the event record was created or last modified. Maintained by the HEM tools.
ReachSMDate	Date	8	The reach spatial modification date. Maintained by the HEM tools.
ReachResolution	Integer	4	The resolution of the NHD source data.
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

ITEM NAME	TYPE	WIDTH	DESCRIPTION
Shape	Area		Fish habitat distribution feature area (generated internally by GIS software)
Permanent_Identifier	Text	40	Habitat distribution feature event record permanent ID (GUID). Maintained by the Hydrography Event Management (HEM) tools.
ReachCode	Text	14	The ReachCode value for the NHD Flowline record where the linear event record begins. Maintained by the HEM tools.
EventDate	Date	8	The date the event record was created or last modified. Maintained by the HEM tools.
ReachSMDate	Date	8	The reach spatial modification date. Maintained by the HEM tools.
ReachResolution	Integer	4	The resolution of the NHD source data.
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

ITEM NAME	TYPE	WIDTH	DESCRIPTION
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
fhdUse	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

ITEM NAME	TYPE	WIDTH	DESCRIPTION
fhdWaterNm	Text	50	Waterbody name from GNIS (NHD)
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 a watercourse or waterbody
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
fhdESH	Text	3	Oregon Essential Indigenous Anadromous Salmonid Habitat[2] Designation (yes / no / NA)
fhdNMF	Text	3	Native Migratory Fish[3] Designation (yes / no)
fhdAccess	Text	15	Method used by anadromous species to access habitats.
fhdBarrierFtrID	Long	9	Unique identifier for the Framework fish passage barrier feature when it is co-located with the end extent of a species habitat distribution.
fhdEndExtent	Text	15	Description of definitive habitat end extent determination.
fhdBasisDt	Text	8	Date of field verification or other habitat / species determination (YYYYMMDD)
fhdBasisNm	Text	30	Name of surveyor / observer; one who made determination for opinion-based data
fhdBasisEnt	Text	30	Name of survey / verification entity or organization (eg. agency, tribe, contractor, etc…)
fhdBasisPrj	Text	30	Name of agency / entity project
fhdBasisMethod	Text	254	Name of survey method or protocol (e.g. Salmon Spawning Survey)
fhdBasisD	Text	254	Detailed description of the fhdBasis attribute element (see business rule)

3.4.2   Polygons

Same as for lines (see 3.4.1)

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[2] Oregon Administrative Rule (141-102-0000), Oregon Essential Indigenous Anadromous Salmonid Habitat.

[3] Oregon Administrative Rule (Division 412, 635-412-0005). Oregon Native Migratory Fish.

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)

Term	Definition
Accessible Habitat	Habitat that fish can access on their own or via an active 'trap and haul' operation which moves fish around an existing anthropogenic blockage (dam) into habitat that was historically accessible prior to the blockage.
Accuracy	**Absolute** - A measure of the location of features on a map compared to their true position on the face of the earth. **Relative** - A measure of the accuracy of individual features on a map when compared to other features on the same map. **Positional -** An assessment of the accuracy of the positions of spatial objects.
Adfluvial	Populations that generally migrate between smaller streams (used for spawning and juvenile rearing) and lakes or reservoirs (used for adult rearing).
Anadromous	Populations that migrate from salt water to fresh water to spawn.
Areal	Two-dimensional.
Attribute	Characteristic of a **feature**.
Bed or Bed and Banks	The physical container of the waters of the 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.
Boundary	Set that represents the limit of a **feature**.
Channel	A waterway that periodically or continuously contains moving waters of the state and has a definite bed and banks that serve to confine the water.
Concurrence of Professional Opinion	A joint opinion formulated by the natural resource agency and/or tribal biologists within whose jurisdiction a change has been proposed.
Current Habitat	Existing in the area identified within the past five reproductive cycles. The maximum range of one life-cycle by species: coho (5x3 years), steelhead (5x7 years), chinook (5x6 years).
Documentation	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.
Event	Linear, continuous, or point features occurring along a base route system.
Estuary	A body of water semi-enclosed by land, connected with the open ocean, and within which salt water is usually diluted by freshwater derived from land. The estuary includes estuarine water, tidelands, tidal marshes, and submerged lands.
Family	The major subdivision of a taxonomic order or suborder consisting of one or more genera.
Feature	Abstraction (point, line or polygon) of a real world phenomenon stored within geospatial software.
Feature Delineation	Criteria or rules for defining the limits of a **feature** and how it will be represented geometrically in a dataset.

FGDC   Federal Geographic Data Committee.

Fish   Species of the vertebrate taxonomic groups of Osteichthyes (bony fishes) and Cephalaspidomorphi (lamprey).

Fish Habitat Distribution   Areas of suitable and accessible habitat believed to be used currently or historically by wild, hatchery or naturalized fish populations based on sampling or best professional opinion. Additionally, modeling can be used to identify potential fish habitat distribution.

Fluvial   Populations that generally migrate between smaller streams used for spawning and early juvenile rearing and larger rivers used for adult rearing.

Genus   The major subdivision of a taxonomic family or subfamily usually consisting of one or more species.

GNIS   Geographic Names Information System. The official repository of geographic names in the United States, managed by US Geological Survey.

Historical Habitat   Areas of suitable habitat that fish no longer access and will not access in the foreseeable future without human intervention. Historical habitats identified through modeling represent potential habitats and are differentiated from habitats with known historical use via the Basis attribute.

Horizontal Steward   The agency or organization responsible for assembling and providing access to a statewide dataset of a particular type.

Indigenous   Descended from a population believed to have been present in the same geographic area prior to the year 1800 or from a natural colonization of another indigenous population

Individual Professional Opinion   An opinion formulated by an individual biologist from a natural resource agency or tribe.

Line   A feature built of vectors connecting at least two points.

Linear referencing   A method for storing geographic data by using a relative position or measure along an already existing line feature.

Metadata   Information about data sufficient to ascertain their origin, quality and appropriate use.

Migration Habitat   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.

Model   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.

Native   Species indigenous to Oregon that were present prior to the year 1800 (European settlement).

Natural Production   Fish reproduce and complete their full life cycle in natural habitats.

NHD   National Hydrography Dataset; includes numerous geospatial datasets that map and model the surface waters of the United States.

Non-native   Species not indigenous to Oregon that were introduced to waters of the state.

NSDI   National Spatial Data Infrastructure. The effort of the FGDC to create and implement a shared data collection and maintenance resource for geospatial datasets.

Observation   A methodical or scientific record of an occurrence of a fish species or habitat, or a lack of fish presence, or a lack of suitable and accessible habitat

Origin   How the initial population came to exist within the subbasin.

Polygon   Bounded surface for which the interior configuration is not directly specified.

Professional Opinion   Opinion of a biologist from a natural resource agency, Native American tribe, or university.

Production   Means by which the population is currently sustained.

Rearing Habitat   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.

Resident   Populations that confine their migration within their natal stream or watershed, including estuaries.

Route   A measured line feature, such as a stream, which has a unique identifier.

Run   Primary timing (season) of freshwater entry for anadromous species.

Spawning Habitat   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.

Species   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.

Species Management Unit   A collection of populations from a common geographic region that share similar genetic and ecological characteristics.

Standardized Survey   The systematic observation, identification and collection of quantitative information describing fish or fish habitat, following a standardized methodology.

Stream   A body of running waters of the state moving over the surface of the land in a *channel* or *bed* including stream types classified as perennial or intermittent and channelized or relocated streams.

Suitable Habitat   Includes waters and substrate in a condition that supports successful fish spawning, rearing, migration, feeding or growth to maturity. Waters include all aquatic areas and their physical, chemical and biological properties; substrate includes the associated biological communities that make these areas suitable for fish habitats.

Taxonomy   The science or technique of describing, identifying, naming, and classifying living organisms.

Trap   The set of human-built and/or operated facilities, structures, devices, and measures that hold fish and prevent them from passing volitionally.

Type   Class of real world occurrences with common characteristics.

Unique Identifier   A reference code which is unique in the context for which it is used.

Volitional   Fish can migrate with minimal delay and without being trapped, transferred, or handled by any person.

Waterbody   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.

Watercourse   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.

Waters of the State   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.

Appendix B: Data Dictionary

Minimum graphic data elements

Shape: Fish habitat distribution feature line or area (see Appendix D, Business Rules).

Permanent_Identifier: Habitat distribution feature event record permanent ID (GUID).

ReachCode: The unique route identifier for the NHD Flowline record.

FMeasure: The measure along the NHD Flowline route where the event record begins.

TMeasure: The measure along the NHD Flowline route where the event record ends.

EventDate: The date the event record was created or last modified.

ReachSMDate: The reach spatial modification date.

ReachResolution: The resolution of the NHD source data.

fhdRefID: 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.

Minimum attribute or non-graphic data elements

fhdRevDt: Date of data entry into or revision of the Framework dataset (YYYYMMDD). This will be populated as a complete date.

fhdONm: Name of source originator (person) that provides the data.

fhdOEnt: Name of the source agency / entity that provides the data.

fhdSpNm: Species common name.

fhdRun: General run timing for anadromous fish species.

fhdLifeHst: Life history exhibited.

fhdUse: Primary use of the fish habitat.

fhdBasis: 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.

Optional attribute or non-graphic data elements

fhdWaterNm: Waterbody name from GNIS (NHD).

fhdGenus: Taxonomic classification at the genus level.

fhdSp: Taxonomic classification at the species level.

fhdSubSp: Taxonomic classification at the subspecies level.

fhdOrig: 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.

fhdESH: Determination of whether the fish habitat meets criteria for designation as Oregon Essential Indigenous Anadromous Salmonid Habitat.

fhdNMF: Determination of whether the fish habitat meets criteria for designation as Native Migratory Fish habitat.

fhdAccess: Description of the method that is used by anadromous species to access habitats.

fhdBarrierFtrID: Unique identifier for the Framework fish passage barrier feature when it is co-located with the end extent of a species habitat distribution.

fhdEndExtent: Description of definitive habitat end extent determination.

fhdBasisDt: Date of field verification or other habitat / species determination.

fhdBasisNm: Name of surveyor / observer; one who made determination for opinion-based data.

fhdBasisEnt: Name of survey / verification entity or organization (eg. agency, tribe, contractor, etc…).

fhdBasisPrj: Name of agency / entity project.

fhdBasisMethod: Name of survey method or protocol (e.g. Salmon Spawning Survey).

fhdBasisD: Detailed description of the fhdBasis attribute value under certain circumstances (e.g. when the fhdBasis = HabitatEval, specify the model used). See business rule in Appendix D.

Appendix C: Domain of Attributes

Fish habitat distribution: common species name (fhdSpNm), genus (fhdGenus), species (fhdSp), subspecies (fhdSubSp) and native migratory fish designation (fhdNMF). Unless otherwise noted, Latin names are from *Common and Scientific Names of Fishes from the United States, Canada, and Mexico, Seventh Edition, 2013* 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/docs/final/Vol%20II%20Appx%20A.pdf)

Common Name	Genus	Species	Subspecies	NMF
Salmon and Trout (Family: Salmonidae)				
Chinook salmon	*Oncorhynchus*	*tshawytscha*		Yes
Coho salmon	*Oncorhynchus*	*kisutch*		Yes
Steelhead (coastal)	*Oncorhynchus*	*mykiss*	*irideus[4]*	Yes
Steelhead (Columbia Basin)	*Oncorhynchus*	*mykiss*	*gairdneri[4]*	Yes
Sockeye salmon / Kokanee	*Oncorhynchus*	*nerka*		Yes
Chum salmon	*Oncorhynchus*	*keta*		Yes
Pink salmon	*Oncorhynchus*	*gorbuscha*		No
Alvord cutthroat trout	*Oncorhynchus*	*clarkii*	*alvordensis[7]*	No
Coastal cutthroat trout	*Oncorhynchus*	*clarkii*	*clarkii[4]*	Yes
Lahontan cutthroat trout	*Oncorhynchus*	*clarkii*	*henshawi[4]*	Yes
Westslope cutthroat trout	*Oncorhynchus*	*clarkii*	*lewisi[5]*	Yes
Rainbow (coastal) trout	*Oncorhynchus*	*mykiss*	*irideus[4]*	Yes
Redband trout (Columbia Basin)	*Oncorhynchus*	*mykiss*	*gairdneri[4]*	Yes
Redband trout (Oregon Basin / Klamath Basin)	*Oncorhynchus*	*mykiss*	*newberrii[5]*	Yes
Bull trout	*Salvelinus*	*confluentus*		Yes
Mountain whitefish	*Prosopium*	*williamsoni*		Yes
Sturgeon (Family: Acipenseridae)				
White sturgeon	*Acipenser*	*transmontanus*		Yes
Green sturgeon	*Acipenser*	*medirostris*		Yes
Lamprey (Family: Petromyzontidae)				
Pacific lamprey	*Entosphenus*	*tridentatus*		Yes
Western brook lamprey	*Lampetra*	*richardsoni*		No
Pacific brook lamprey	*Lampetra*	*pacifica[7]*		No
Western river lamprey	*Lampetra*	*ayresii*		Yes
Pit-Klamath brook lamprey	*Entosphenus*	*lethophagus*		Yes
Miller Lake lamprey	*Entosphenus*	*minimus*		Yes
Klamath River lamprey	*Entosphenus*	*similis*		Yes
Follett's brook lamprey	*Entosphenus*	*lethophagus[7]*		No
Carps and Minnows (Family: Cyprinidae)				
Oregon chub	*Oregonichthys*	*crameri*		No
Alvord Lake chub	*Siphateles*	*alvordensis[7]*		No
Blue chub	*Klamathella*	*coerulea[7]*		No
Borax Lake chub	*Siphateles*	*boraxobius[7]*		No
Umpqua chub	*Oregonichthys*	*kalawatseti[7]*		No
Columbia tui chub (aka Malheur tui chub)	*Siphateles*	*bicolor*	*columbianus[7]*	No
Hutton Spring tui chub	*Siphateles*	*bicolor*	*oregonensis[7]*	No
Sheldon tui chub	*Siphateles*	*bicolor*	*eurysomus[7]*	No
Lahontan tui chub	*Siphateles*	*bicolor*	*obesus[7]*	No
Tui chub	*Siphateles*	*bicolor*		No
Warner Basin tui chub	*Siphateles*	*bicolor*	*thalassinus[7]*	No
Northern pikeminnow	*Ptychocheilus*	*oregonensis*		Yes
Umpqua pikeminnow	*Ptychocheilus*	*umpquae*		Yes
Northern roach (aka Pit roach)	*Hesperoleucus*	*mitrulus[7]*		No
Redside shiner (aka Columbia Redside shiner)	*Richardsonius*	*balteatus*	*balteatus[7]*	No
Bonneville redside shiner (aka Snake Redside shiner)	*Richardsonius*	*balteatus*	*hydrophlox[7]*	No

Hotspring redside shiner	*Richardsonius*	*thermophilus*[7]		No
Lahontan redside shiner	*Richardsonius*	*egregious*[7]		No
Tyee redside shiner	*Richardsonius*	*balteatus*	*siuslaw*[7]	No
Chiselmouth	*Acrocheilus*	*alutaceus*[7]		No
Klamath speckled dace	*Rhinichthys*	*osculus*	*klamathensis*[7]	No
Speckled dace	*Rhinichthys*	*osculus*	*osculus*[7]	No
Coastal speckled dace	*Rhinichthys*	*nubilis*[7]		No
Umpqua dace	*Rhinichthys*	*evermanni*[7]		No
Foskett speckled dace	*Rhinichthys*	*osculus*	*robustus*[7]	No
Leopard dace	*Rhinichthys*	*falcatus*[7]		No
Longnose dace	*Rhinichthys*	*cataractae*[7]		No
Millicoma dace	*Rhinichthys*	*cataractae spp*[7]		No
Umatilla dace	*Rhinichthys*	*umatilla*[7]		No
Peamouth	*Mylocheilus*	*caurinus*[7]		No
Suckers (Family: Catostomidae)				
Bridgelip sucker	*Catostomus*	*columbianus*		Yes
Cascadian sucker	*Catostomus*	*bondi*[7]		?
Goose Lake sucker	*Catostomus*	*occidentalis*	*lacusanserinus*[6]	Yes
Klamath largescale sucker	*Catostomus*	*snyderi*[7]		Yes
Klamath smallscale sucker	*Catostomus*	*rimiculus*[7]		Yes
Largescale sucker	*Catostomus*	*macrocheilus*[7]		Yes
Lost River sucker	*Deltistes*	*luxatus*		Yes
Modoc sucker	*Catostomus*	*microps*		Yes
Mountain sucker	*Catostomus*	*platyrhynchus*		Yes
Shortnose sucker	*Chasmistes*	*brevirostris*[7]		Yes
Tahoe sucker	*Catostomus*	*tahoensis*		Yes
Tyee sucker	*Catostomus*	*tsiltcoosensis*[7]		?
Warner sucker	*Catostomus*	*warnerensis*		Yes
Smelt (Family: Osmeridae)				
Eulachon	*Thaleichthys*	*pacificus*		Yes
Longfin smelt	*Spirinchus*	*thaleichthys*[7]		No
Stickleback (Family: Gasterosteidae				
Threespined stickleback	*Gasterosteus*	*aculeatus*[7]		No
Sculpins (Family: Cottidae)				
Coastrange sculpin	*Cottus*	*aleuticus*[7]		No
Columbia mottled sculpin	*Cottus*	*hubbsi*[7]		No
Klamath Lake sculpin	*Cottus*	*princeps*[7]		No
Klamath marbled sculpin	*Cottus*	*klamathensis*[7]		No
Malheur mottled sculpin	*Cottus*	*bendirei*[7]		No
Margined sculpin	*Cottus*	*marginatus*[7]		No
Mottled sculpin	*Cottus*	*bairdii*[7]		No
Paiute sculpin	*Cottus*	*beldingii*[7]		No
Pit sculpin	*Cottus*	*pitensis*[7]		No
Prickly sculpin	*Cottus*	*asper*[7]		No
Reticulate sculpin	*Cottus*	*perplexus*[7]		No
Riffle sculpin	*Cottus*	*gulosis*[7]		No
Siskiyou marbled sculpin	*Cottus*	*polyporus*[7]		No
Shorthead sculpin	*Cottus*	*confuses*[7]		No
Slender sculpin	*Cottus*	*tenuis*[7]		No
Torrent sculpin	*Cottus*	*rhotheus*[7]		No
Trout Perches (Family: Percopsidae)				
Sand roller	*Percopsis*	*transmontana*[7]		No

[4] *Integrated Taxonomic Information System (ITIS) (http://www.itis.gov).*

[5] *Behnke, R.J. Trout and Salmon of North America. The Free Press. 2002.*

[6] *Oregon Native Fish Status Report. Oregon Dept. of Fish and Wildlife. Salem. 2006.*

[7] *Oregon Native Freshwater Species List. Oregon Dept. of Fish and Wildlife. Salem. 2019.*

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

Common Name	*Genus*	*Species*	*Subspecies*	NMF
Salmon and Trout (Family: Salmonindae)				
Brook trout	*Salvelinus*	*fontinalis*		No
Lake trout	*Salvelinus*	*namaycush*		No
Brown trout	*Salmo*	*trutta*		No
Atlantic salmon	*Salmo*	*salar*		No
Sunfishes (Family: Centrarchidae)				
Largemouth bass	*Micropterus*	*salmoides*		No
Smallmouth bass	*Micropterus*	*dolomieu*		No
Bluegill	*Lepomis*	*macrochirus*		No
Pumpkinseed	*Lepomis*	*gibbosus*		No
Green sunfish	*Lepomis*	*cyanellus*		No
Warmouth	*Lepomis*	*gulosus*		No
Redear sunfish	*Lepomis*	*microlophus*		No
White crappie	*Pomoxis*	*annularis*		No
Black crappie	*Pomoxis*	*nigromaculatus*		No
Sacramento perch	*Archoplites*	*interruptus*		No
Carps and Minnows (Family: Cyprinidae)				
Common carp	*Cyprinus*	*carpio*		No
Fathead minnow	*Pimephales*	*promelas*		No
Golden shiner	*Notemigonus*	*crysoleucas*		No
Goldfish	*Carassius*	*auratus*		No
Livebearers (Family: Poeciliidae)				
Mosquitofish	*Gambusia*	*affinis*		No
Perches (Family: Percidae)				
Yellow perch	*Perca*	*flavescens*		No
Walleye	*Sander*	*vitreus*		No
North American Catfishes (Family: Ictaluridae)				
Channel catfish	*Ictalurus*	*punctatus*		No
Flathead catfish	*Pylodictus*	*olivaris*		No
Yellow bullhead	*Ameiurus*	*natalis*		No
Brown bullhead	*Ameiurus*	*nebulosus*		No
Black bullhead	*Ameiurus*	*melas*		No
Shad (Family: Clupeidae)				
American shad	*Alosa*	*sapidissima*		No
Temperate Basses (Family: Moronidae)				
Striped bass	*Morone*	*saxatilis*		No
White bass	*Morone*	*chrysops*		No
Topminnows (Family: Fundulidae)				
Banded killifish	*Fundulus*	*diaphanus*		No
Gobies (Family: Gobiidae)				No
Amur goby	*Rhinogobius*	*brunneus*		

Fish habitat distribution run (fhdRun)

Code	Description
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
Amphidromous	May migrate from fresh water to saltwater, or vice versa, but not for the purpose of breeding
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 (fhdUse)

Code	Description
Spawning	Primarily spawning with some rearing.
Rearing	Primarily rearing with some migration.
Migration	Primarily migration.
Historical	Habitat used, or potentially used, historically but not currently
ResidentMultipleUses	Resident species only, multiple uses including spawning, rearing and migration. See Business Rule in Appendix D.
ForageMigrateOverwinter	Habitats outside primary spawning and rearing areas that support foraging and may include migration and/or overwintering use. These habitat can serve to connect isolated populations of fish (e.g. bull trout).
Unknown	Present, use unknown

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. Methods for determining the end of fish use may also include a fish observation component. A record of the habitat observation is maintained in an existing data system (e.g. database, spreadsheet, hardcopy data collection forms).
DownstreamDocObsFish	Downstream of documented observation for anadromous species
HabitatEval	Habitat evaluation based on modeling.
ConcurProfOpinion	Concurrence of professional opinion (CPO).
IndivProfOpinion	Individual professional opinion.

Fish habitat distribution origin (fhdOrig)

Code	Description
NativeLocal	Native origin. Species indigenous to Oregon that were present within the species management unit (SMU) prior to European settlement (1800).
NativeNonLocal	Native origin. Species indigenous to Oregon that were not present within the SMU prior to European settlement (1800) but are now present there due to human involvement.
NonNative	Non-native origin. Species not indigenous to Oregon that were introduced to waters of the state.
NativeLocalReintro	Native, locally reintroduced. A species from within the SMU that has repopulated an area within the SMU that had become void of that species.
NativeNonLocalReintro	Native, non-local reintroduced. The original stock within the SMU was extirpated, but native, non-local fish (fish from outside the SMU) were introduced to re-establish the historical distribution.
Unknown	Unknown origin.

Fish habitat distribution production (fhdProd)

Code	Description
Natural	Natural production. Fish reproduce and complete their full life cycle in natural habitats.
Mixed	Hatchery and natural production. Reproduction from a mix of hatchery and natural means.
Hatchery	Hatchery production. Production is the result of fish being incubated or reared under artificial conditions for at least a portion of its life.
None	No current production occurs due to local extirpation.
Unknown	Unknown production.

Fish habitat distribution access (fhdAccess) for anadromous species in streams.

Code	Description
Unassisted	Habitat is currently accessible independent of an active trap and haul operation.
TrapAndHaul	Habitat is currently accessible because of an active trap and haul operation.
NA	Not applicable (all non-anadromous species). Also applies to waterbodies such as lakes and reservoirs.
Unknown	Unknown access method

Fish habitat distribution end extent (fhdEndExtent).

Code	Description
Artificial	Habitat ends at an artificial barrier.
NaturalSSBT	Habitat ends at a location that meets SSBT physical habitat criteria according to Oregon Department of Forestry field survey guidance.
NaturalEOFU	Habitat ends at a location that meets Oregon Department of Forestry physical habitat survey criteria for end of fish use (EOFU)
NaturalOther	Habitat ends at a location that does not meet ODF SSBT or EOFU physical habitat survey criteria, however professional judgement or other evidence supports the determination of a blocking barrier or a lack of livable space.
NA	Not applicable – does not represent the upper extent of the identified habitat in the stream. Also applies to waterbodies such as lakes and reservoirs.
Unknown	Unknown.

Appendix D: Business Rules

Identification

In cases where observations of a species are made that are not obvious for inclusion in the database (e.g. uncommonly observed species in an area outside of previously mapped habitat), the following guidance should be used to determine whether a new record should be added to the database:

New records should be created if observation(s) are relatively contiguous to existing distribution (generally within a few miles for anadromous species, within anticipated range for resident species) or are recurring for a general area. New records should not be created when observations are isolated and non-recurring for anadromous species.

For fish observations that are especially difficult to classify to the species level (e.g. lamprey, sculpin, chub, zero-aged trout), non-species specific datasets are acceptable for storing observations that have been classified only to the genus level. Naming convention [*Genus_spp* (e.g. *Cottus_spp*).

To qualify for Essential Salmonid Habitat (OAR 141-102-0000) designation, records must meet *all* the following criteria. Text in quotes below are drawn from the definitions section (OAR 141-102-0020) of the rule and associated criteria within the OFHDDS database are identified.
   - "Indigenous anadromous salmonid" includes the following species (fhdSpNm = chum salmon, sockeye salmon, Chinook salmon, coho salmon, steelhead, Coastal cutthroat trout)
   - "Indigenous anadromous salmonid" includes the following life history categories (fhdLifeHst = Anadromous, AnadRes)
   - "Indigenous anadromous salmonid" includes the following origin categories (fhdOrigin = NativeLocal, NativeLocalReintro)
   - "Spawning Habitat" or "Rearing Habitat" includes the following habitat use categories (fhdUse = Spawning, Rearing)
   - "Listed as sensitive, threatened or endangered by a state or federal authority". Note: no corresponding attribute element exists in the OFHDDS database. The OFHDDS Data Steward must interpret the available lists (NOAA, USFWS, ODFW, USFS, and BLM) including the appropriate species and locations when attributing ESH records (fhdESH) in the OFHDDS database.

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 or Unnamed Hydrographic Features

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

For unnamed hydrographic features where an informal local name exists, consult the Oregon Geographic Name Board process for proposing new names. (https://ohs.org/about-us/affiliates-and-partners/oregon-geographic-names-board/proposing-a-name.cfm)

Reference

Fish habitat distribution 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.

Data Categories

General
OFHDDS data are organized into three separate categories. Categories 1 and 2 are species specific, mutually exclusive and are based on the comprehensiveness of the data. These two categories existed previous to version 4.0 of the OFHDDS. Category 3 includes modeled data which are to be managed separately unless specific criteria are met for integrating these data with either category 1 or 2 datasets. Consumers of any OFHDDS data must determine which data Categories are appropriate for meeting their specific business needs.

OFHDDS Data Category 1
Species habitat distributions that are mapped "comprehensively" (coho salmon, Chinook salmon, chum salmon, sockeye salmon, steelhead, bull trout, redband trout, Lahontan and Westslope cutthroat trout, Oregon chub, White and Green sturgeon) are considered Category 1 species. Note: the OFHDDS Data Categories are separate from ODFW's Fish and Wildlife Habitat Mitigation Policy categories. Additions and/or modifications to Category 1 species habitat distribution 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 1 data must also be approved via a "concurrence of professional opinion" process (see Basis rule below).

OFHDDS Data Category 2
Species that are not mapped "comprehensively" will be considered as Category 2 species. Note: the OFHDDS Data Categories are separate from ODFW's Fish and Wildlife Habitat Mitigation Policy categories.   These include all species not listed as Category 1 species. Additions and/or modifications to Category 2 species habitat distribution may have a basis other than "documented observation" including individual professional opinion.

OFHDDS Data Category 3
All modeled data are included as part of this category. Habitat for any species may be modeled, however in order to be incorporated into the OFHDDS database the following criteria must be met:
-   models must be peer-reviewed and published in an academic journal
    o   models to be applied over a similar species/habitat (e.g. species has similar range or utilizes similar habitats)
-   models must be validated in Oregon
-   all inputs, methods, assumptions and confidence measures must be documented
-   modeled data are not required to meet the minimum graphic elements of the standard (non-NHD stream layers are acceptable)

Observation-based data take precedence over modeled data. See business rule for the Basis - order of precedence.

Additionally, modeled data are to be managed separately from Category 1 and 2 datasets unless the following criteria are met for integrating these data:
-   minimum graphic and attribute element requirements (NHD)
-   the Basis rules for a Concurrence of Professional Opinion

Species-specific

Juvenile O. mykiss observations
Where O. mykiss juveniles are observed beyond the extent of previously mapped steelhead habitat, as identified within the OFHDDS database, the following conditions must be met in order to extend mapped steelhead habitat:
1)   The O. mykiss observation must be within reasonable proximity to known steelhead habitat and be within the expected range of anadromy.
2)   The stream reach(es) between previously mapped steelhead habitat and the juvenile O. mykiss observation must be known to be absent of impassable barriers that would prevent adult steelhead from accessing the area in question.

O. mykiss observations upstream of impassable barriers are considered resident Rainbow trout in western Oregon and resident Redband trout in eastern Oregon. Artificial impassable barriers may warrant the identification of historical upstream steelhead habitat.

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 1 data providers (see the Data Provider Group section below) may be submitted directly for inclusion in the OFHDDS dataset. Observations made by Group 2 data providers must be vetted through a Group 1 data provider (e.g. ODFW District Fisheries Biologist). Accepted survey methods include ODFW Oregon Adult Salmonid Inventory and Sampling Program (OASIS) Spawning Ground Surveys, ODFW Aquatic Inventories Program (AIP) juvenile rearing snorkel surveys, ODFW AIP fish presence surveys, USFS / BLM spawning or snorkel surveys, electrofishing and other methods vetted by ODFW. General criteria for determining acceptable survey methods include: survey method published (academic journal or at agency-level) and commonly implemented. Data are recorded in an agency / entity information system. See the FHD Stewardship Plan for additional details.
UndocObsFish	Undocumented observations of fish are subject to the same rules for updating the database as documented observations of fish. See the FHD Stewardship Plan for additional details.
DownstreamDocObsFish	The Horizontal Steward will primarily implement this Basis code. It may be applied when it will "strengthen" the confidence in either opinion-based or habitat-based data.
DocObsHabitat	Observations of suitable and accessible 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. Accepted survey methods include Coho Survey Site Verification (ODFW), SSBT Physical Habitat Criteria (ODF) and other methods vetted by ODFW. General criteria for determining acceptable survey methods include: survey method published (academic journal or at agency-level) and commonly implemented. Data are recorded in an agency / entity information system.
HabitatEval	Habitat that is identified by OFHDDS Group 1 data providers may be submitted directly to the OFHDDS. Habitat that is identified by OFHDDS Group 2 data providers must be vetted through a Group 1 data provider. If these areas conflict with actual fish observations, the fish observations will take precedence when designating the habitat. For additional criteria, consult the business rule for OFHDDS Category 3 data above.
ConcurProfOpinion	A CPO must be led by a Group 1 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 (5th 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 (5th field watershed, all private land) ODFW's opinion will be sufficient to formulate a CPO. A CPO may be used to directly update

	OFHDDS Category 1 fish habitat data. See the FHD Stewardship Plan for the suggested process to formulate a CPO.
IndivProfOpinion	Individual professional opinion (IPO) from a Group 1 data provider. An IPO may only be used to directly update OFHDDS Category 2 fish habitat data.

Fish habitat distribution Basis Date (fhdBasisDt)
When multiple surveys occur in the same reach over multiple years, the most recent survey date will be maintained.

The suggested process for formulating a CPO is spelled out in the FHD Data Stewardship Plan.

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 identified or a "lack of livable space" (e.g. insufficient pools, active channel width or gradient) determination is made within that reach, the length over which the observation will be extrapolated into recognized habitat will be truncated at that barrier or the location where a lack of livable space was determined.

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 documented fish observations will take precedence over undocumented fish observations, which will take precedence over habitat observations, which will take precedence over opinion-based data, which will take precedence over modeled data.
In some cases, protocol based habitat surveys identify a definitive end extent for accessible anadromous habitat within a stream reach. These may be at odds with non-protocol based observations that were made lower in the reach and the end extent that was delineated by the biologist (especially during the 1:24k Fish Habitat Distribution Mapping Project) extends upstream of the habitat survey end extent. In these cases, the habitat survey with a definitive end extent determination would prevail when compared to a record that includes an observation but the end extent "call" was based on opinion.

Data Provider Groups

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

Group 1 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 2 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 councils, and anyone else who does not fall into Group 1).

General

Dates (fhdRevDt, fhdBasisDt)
Data originators should populate these date elements as completely as possible; however, partial date information will be accepted. If the month and year are known, use zeros to populate the day portion of the date element. If only the year is known, use zeros to populate the month and day portion of the date element. If the date is unknown, use zeros to populate the entire element (e.g. 20011200, 20010000, 00000000).

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. The code ResidentMultipleUses should only be applied where no anadromous life history is present (e.g. coastal cutthroat above a blocking waterfall).

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 Basis Description (fhdBasisD)

If the fhdBasis attribute is coded as "HabitatEval", then the specific model that was used to generate the data should be described by the fhdBasisD attribute. The fhdBasisD attribute can also be used to describe whether historical habitat ends at a natural barrier or is due to a cutoff threshold such as modeled gradient or contributing area. It could also contain details that relate to other fhdBasis attribute values (e.g. where within a reach fish were observed when DocObsFish fhdBasis value is used).