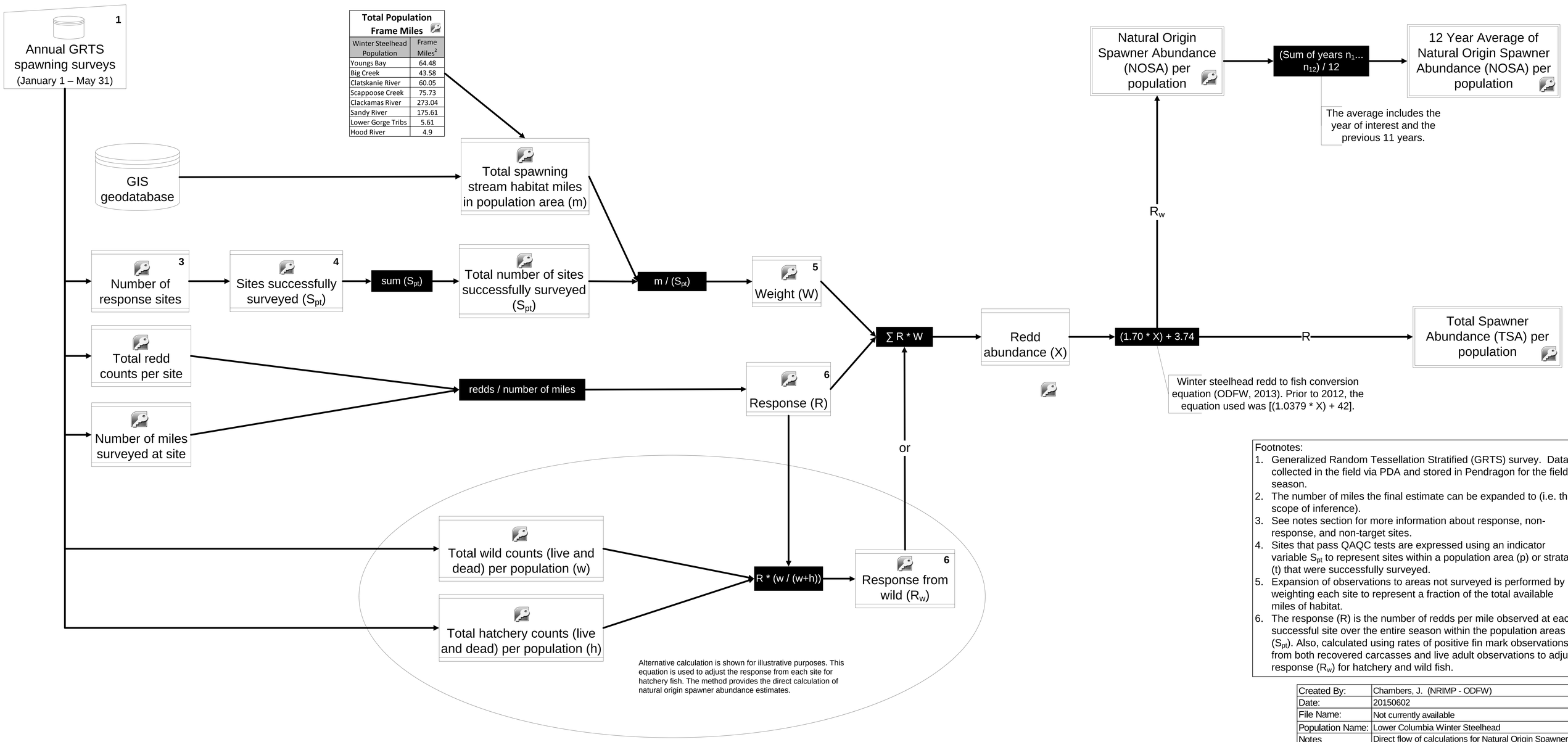
Lower Columbia Winter Steelhead – Total and Natural Origin Spawner Abundance (TSA and NOSA), including jacks – Oregon Adult Salmonid Inventory and Sampling Program (OASIS), ODFW – Spawning Years 2003-present

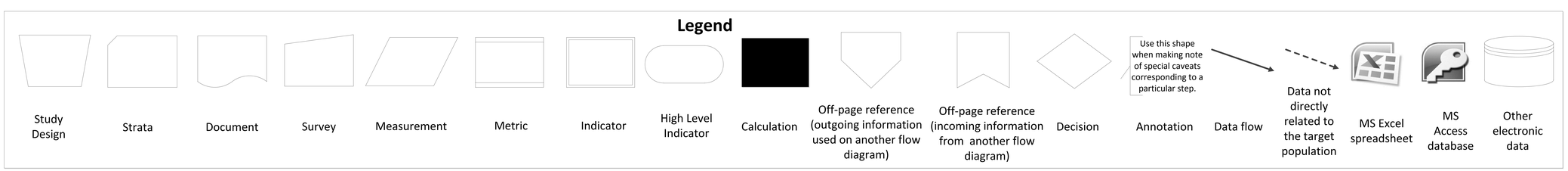
This is a continuous long-term effort. This diagram was last completed for the most recent spawning year, but should apply to following years unless changes are made to study design or calculations.



Winter Steelhead Population	Frame Miles[2]
Youngs Bay	64.48
Big Creek	43.58
Clatskanie River	60.05
Scappoose Creek	75.73
Clackamas River	273.04
Sandy River	175.61
Lower Gorge Tribs	5.61
Hood River	4.9

Footnotes:

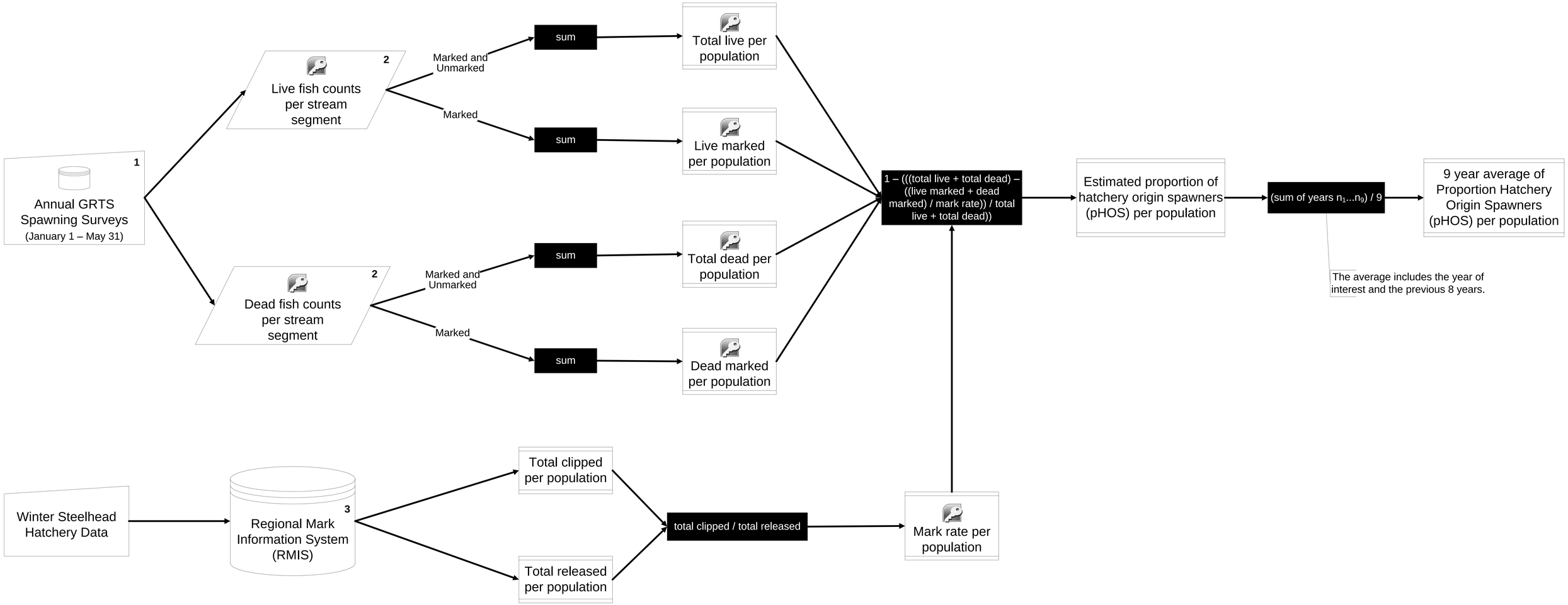
1. Generalized Random Tessellation Stratified (GRTS) survey. Data is collected in the field via PDA and stored in Pendragon for the field season.
2. The number of miles the final estimate can be expanded to (i.e. the scope of inference).
3. See notes section for more information about response, non-response, and non-target sites.
4. Sites that pass QAQC tests are expressed using an indicator variable S_{pt} to represent sites within a population area (p) or strata (t) that were successfully surveyed.
5. Expansion of observations to areas not surveyed is performed by weighting each site to represent a fraction of the total available miles of habitat.
6. The response (R) is the number of redds per mile observed at each successful site over the entire season within the population areas (S_{pt}). Also, calculated using rates of positive fin mark observations from both recovered carcasses and live adult observations to adjust response (R_w) for hatchery and wild fish.



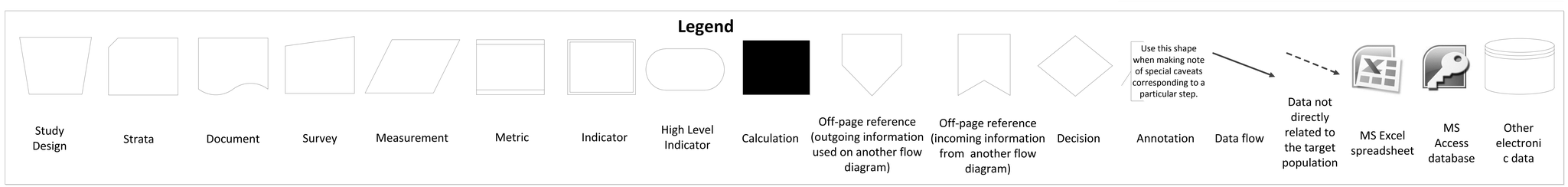
Created By:	Chambers, J. (NRIMP - ODFW)
Date:	20150602
File Name:	Not currently available
Population Name:	Lower Columbia Winter Steelhead
Notes (Annotations, general comments, references, etc.):	Direct flow of calculations for Natural Origin Spawner Abundance including jacks (NOSAIJ) and Total Spawner Abundance including jacks (TSAIJ) is derived from the workbook that is used to formulate abundance and productivity indicators. For more information on the DAFD or to obtain the dataset, contact Project Data Analyst Julie Firman - julie.firman@oregonstate.edu.
	Disclaimer: Care was taken in the creation of these themes, but they are provided "as is". The Oregon Department of Fish and Wildlife cannot accept any responsibility for errors, omissions, or positional accuracy in the digital data or underlying records. There are no warranties, expressed or implied, including the warranty of merchantability or fitness for a particular purpose, accompanying any of these products.

Lower Columbia Winter Steelhead – Proportion Hatchery Origin Spawners (pHOS) – Oregon Adult Salmonid Inventory and Sampling Program (OASIS), ODFW – Spawning Years 2003-present

This is a continuous long-term effort. This diagram was last completed for the most recent spawning year, but should apply to following years unless changes are made to study design or calculations.



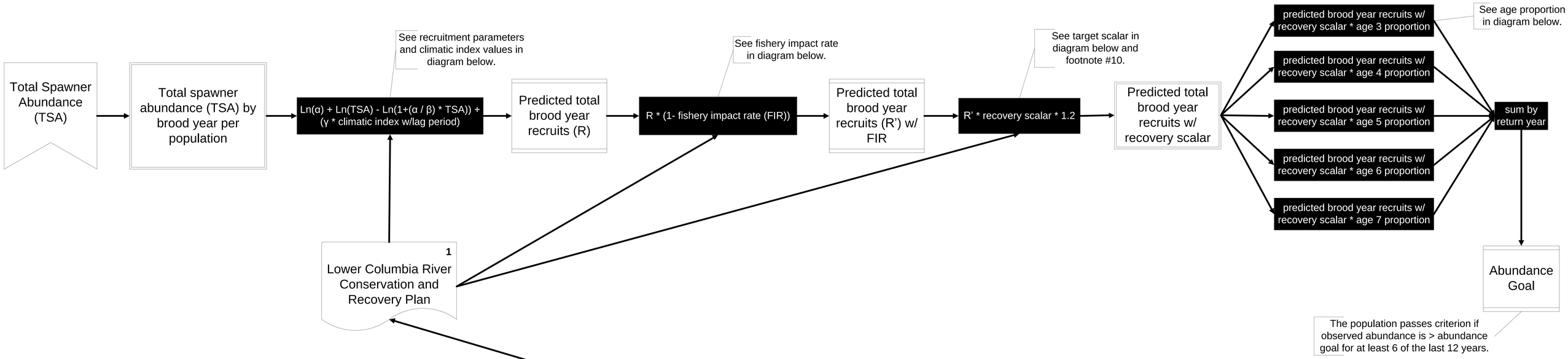
Footnotes:
1. Generalized Random Tessellation Stratified (GRTS) survey. Data is collected in the field via PDA and stored in Pendragon for the field season.
2. Marked, unmarked, and unknown.
3. http://www.rmpc.org/



Created By:	Chambers, J. (NRIMP - ODFW)
Date:	20150602
File Name:	Not currently available
Population Name:	Lower Columbia winter steelhead
Notes (Annotations, general comments, references, etc.):	Direct flow of calculations for Proportion Hatchery Origin Spawners (pHOS) is derived from the workbook that is used to formulate abundance and productivity indicators. For more information on the DAFD or to obtain the dataset, contact Project Data Analyst Julie Firman - julie.firman@oregonstate.edu.
	Disclaimer: Care was taken in the creation of these themes, but they are provided "as is". The Oregon Department of Fish and Wildlife cannot accept any responsibility for errors, omissions, or positional accuracy in the digital data or underlying records. There are no warranties, expressed or implied, including the warranty of merchantability or fitness for a particular purpose, accompanying any of these products.

Lower Columbia Winter Steelhead – Abundance Goal – Oregon Adult Salmonid Inventory and Sampling Program (OASIS), ODFW – Spawning Years 2003-present

This is a continuous long-term effort. This diagram was last completed for the most recent spawning year, but should apply to following years unless changes are made to study design or calculations.



Recruitment Parameters

Population	Estimation Method[2]	Alpha (α)	Beta (β)	Gamma (γ)	Climate Index[3]	Time Lag[4]
Youngs	Inference	4.03	4116	1.34	CLRSI	-3
Big	Inference	2.63	2398	1.34	CLRSI	-3
Clatskanie	Inference	5.54	3716	1.34	CLRSI	-3
Scappoose	Inference	5.54	4908	1.34	CLRSI	-3
Clackamas	Data	1.99	9343	2.00	CRF	-2
Sandy	Data	1.69	2652	0.45	CLRSI	-3
Lower Gorge	Inference	4.98	839	1.34	CLRSI	-3
Upper Gorge	Inference	4.98	249	1.34	CLRSI	-3
Hood	Data	9.29	969	1.68	CLRSI	1

Example Values of Climatic Index

Year	Period	Lag	Climatic Index[3]	Value[5]
2013	7	1	CLRSI	-0.213
2013	7	-3	CLRSI	-0.312
2013	7	-2	CRF	-0.489

Fishery Impact Rates (FIR)[6]

Population	Current Harvest	Delisting Scenario
Youngs	0.1	0.1
Big	0.1	0.1
Clatskanie	0.1	0.1
Scappoose	0.1	0.1
Clackamas	0.1	0.1
Sandy	0.1	0.1
Lower Gorge	0.1	0.1
Upper Gorge	0.15	0.15
Hood	0.15	0.15

Age Composition[7]

Population	Age	Proportion
Clackamas	3	0.005
Clackamas	4	0.510
Clackamas	5	0.398
Clackamas	6	0.083
Clackamas	7	0.004
Hood	3	0.021
Hood	4	0.663
Hood	5	0.248
Hood	6	0.050
Hood	7	0.000
Sandy	3	0.002
Sandy	4	0.496
Sandy	5	0.406
Sandy	6	0.091
Sandy	7	0.005

Recovery Scalar

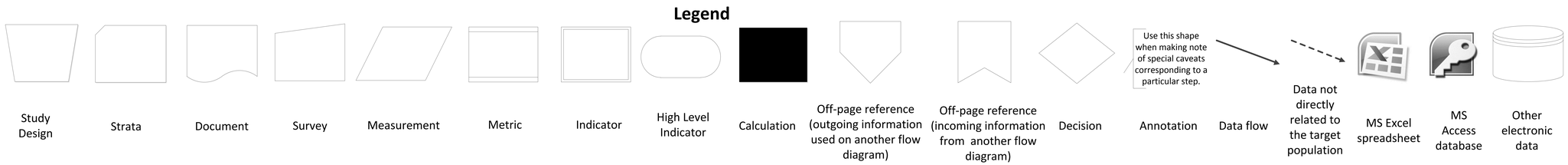
Population	Target Risk[8]	Target Scalar[9]
Youngs	VL	1.45
Big	VL	1.52
Clatskanie	VL	1.15
Scappoose	VL	1
Clackamas	L	1.94
Sandy	VL	1.29
Lower Gorge	M	1
Upper Gorge	VH	1
Hood	L	1.17

Definitions for recruitment parameters:
Alpha – for each population the value estimated for the alpha parameter describes how rapidly the population can rebound from a low abundance level.
Beta – the beta parameter represents the asymptotic upper limit for the number of fish that the habitat can produce (theoretical capacity).
Gamma – the gamma parameter controls how the recruitment process responds to annual differences in the environmental variable.

Footnotes:
1. http://www.dfw.state.or.us/fish/CRP/lower_columbia_plan.asp
2. Populations for which data were used to estimate recruitment model parameters are denoted in this column as "Data" and those for which the parameters were determined indirectly are denoted "Inference".
3. CLRSI = Crater Lake and Rainer Snow Index, CRF = Columbia River Flow, nSPDO = Negative Spring Pacific Decadal Oscillation Index.
4. Number of years the midpoint of the environmental index was lagged relative to the parental brood year that best fit the data or was inferred to provide this fit.
5. Example values of climatic index for brood years. Values change from year to year.
6. Assumed fishery impact rates (FIR) for 'current conditions' extinction risk modeling for lower Columbia River populations of coho.
7. Example age composition for Lower Columbia steelhead. Proportions change from year to year.
8. H = high extinction risk, M = moderate extinction risk, L = low extinction risk, VH = very high extinction risk, VL = very low extinction risk.
9. The recovery scalar is the amount that the current survival rate needs to be improved to get the probability of critical risk threshold (CRT) to the threshold for the risk category targeted for the population.
10. 1.2 = 20% expansion to buffer the impacts of climate change.
11. All metrics, calculations, and parameters required for the equations, reside in the Abundance Goal database.

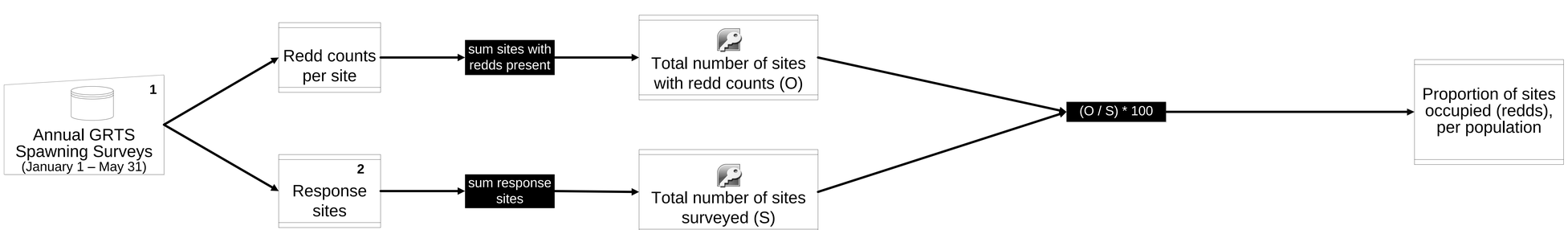
Created By:	Chambers, J. (NRIMP - ODFW)
Date:	20150602
File Name:	RecoveryTracker.mdb
Population Name:	Lower Columbia winter steelhead
Notes (Annotations, general comments, references, etc.):	Direct flow of calculations for Abundance Goals is derived from the database that is used to formulate abundance and productivity indicators. For more information on the DAFD or to obtain the dataset, contact Oregon Plan Research Analyst Julie Firman - julie.firman@oregonstate.edu.
	Disclaimer: Care was taken in the creation of these themes, but they are provided "as is". The Oregon Department of Fish and Wildlife cannot accept any responsibility for errors, omissions, or positional accuracy in the digital data or underlying records. There are no warranties, expressed or implied, including the warranty of merchantability or fitness for a particular purpose, accompanying any of these products.

Legend



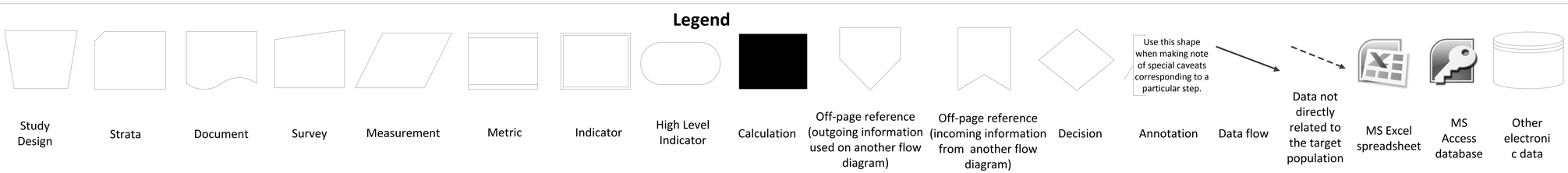
DRAFT, Lower Columbia Winter Steelhead – Percent Occupancy (redds) – Oregon Adult Salmonid Inventory and Sampling Program (OASIS), ODFW – Spawning Years 2003-present

This is a continuous long-term effort. This diagram was last completed for the most recent spawning year but should apply to following years unless changes are made to study design or calculations.



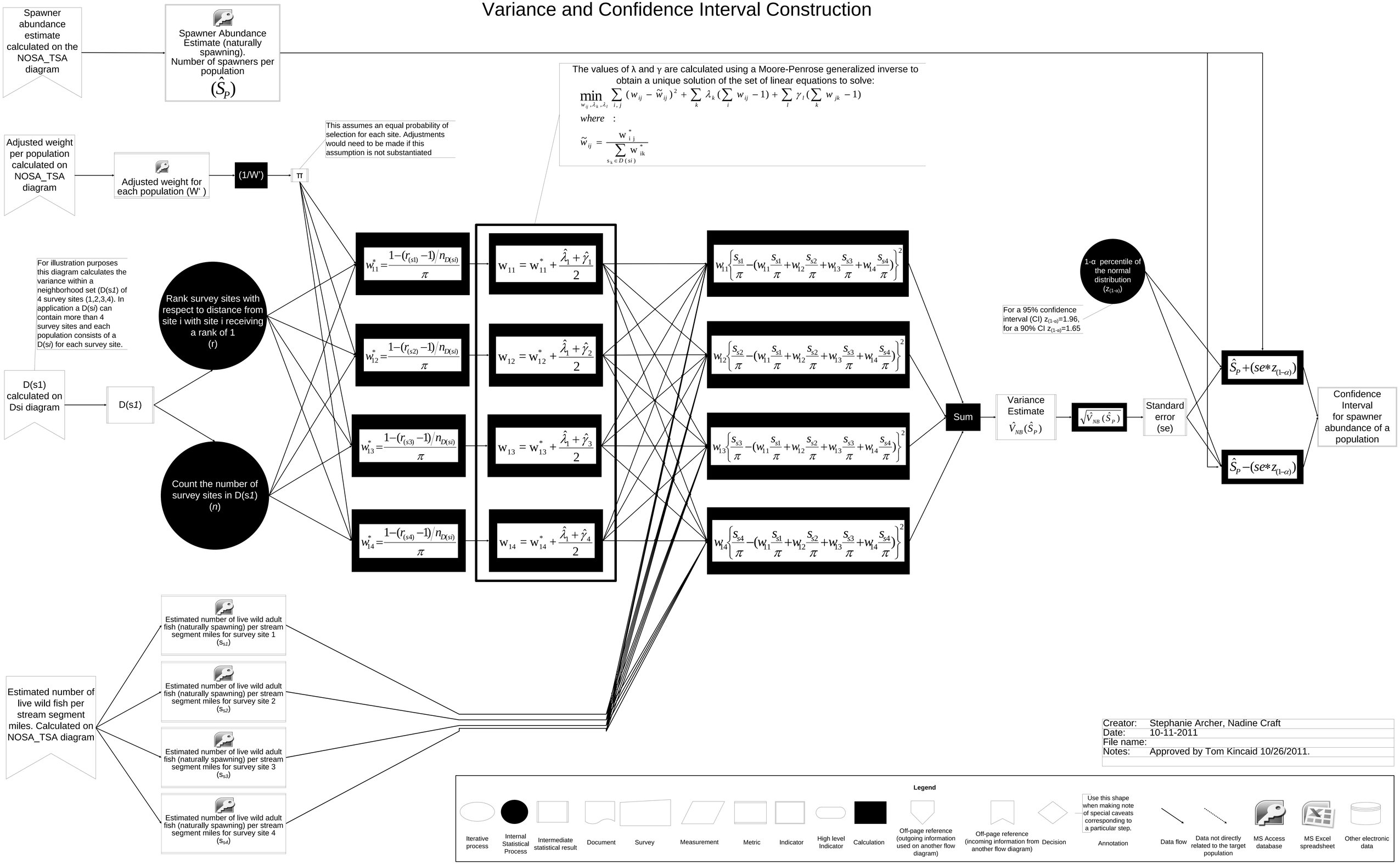
Footnotes:
1. Generalized Random Tessellation Stratified (GRTS) survey. Data are collected in the field via PDA and stored in Pendragon for the field season.
2. See notes section for more information about response, non-response, and non-target sites.

Legend



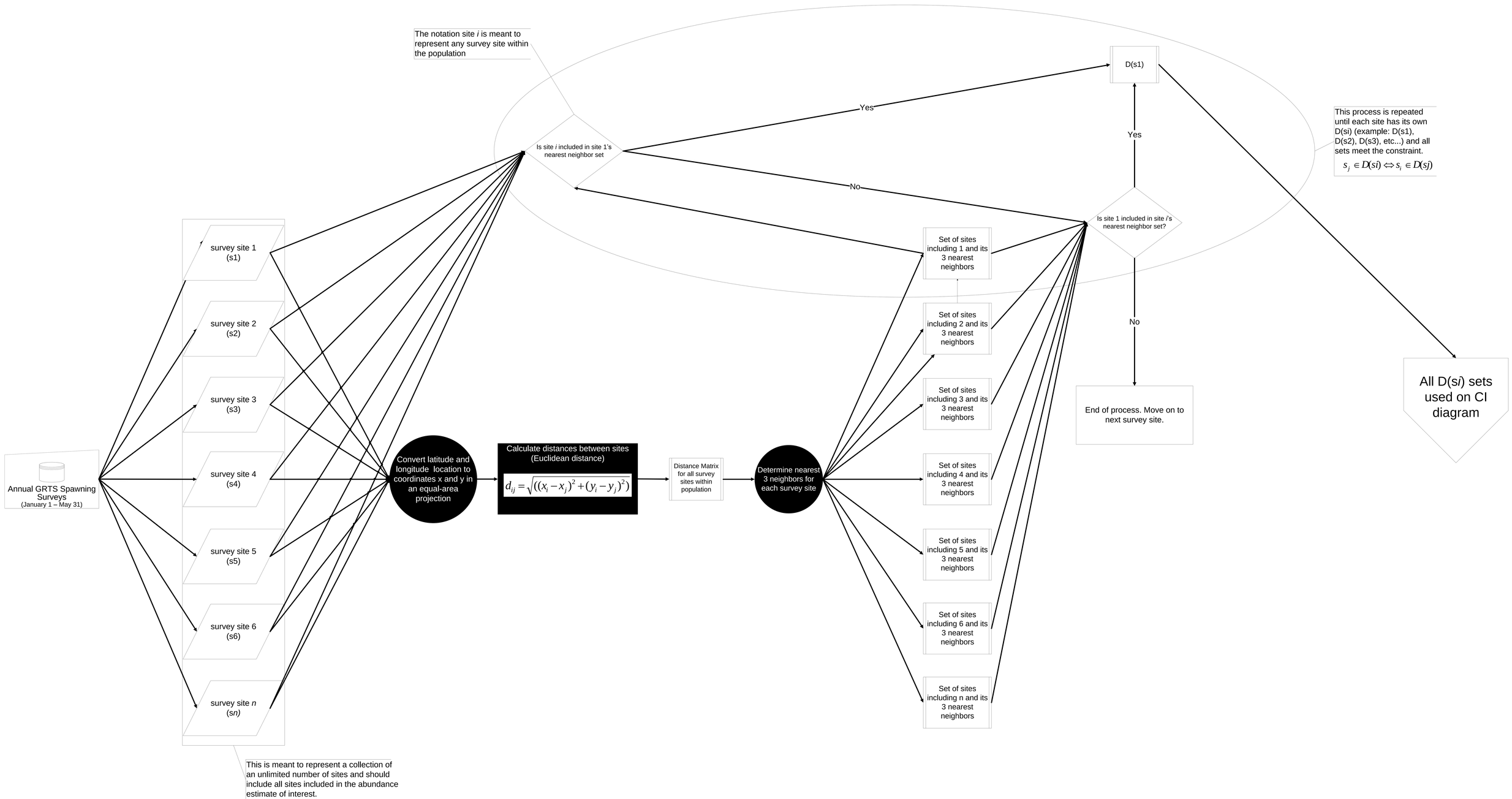
Created By:	Chambers, J. (NRIMP - CDFW)
Date:	20150602
File Name:	Not currently available
Population Name:	Lower Columbia winter steelhead
Notes (Annotations, general comments, references, etc.):	DRAFT, diagram may be updated when metrics from the Coastal Management Plan are implemented. Direct flow of calculations for Percent Occupancy is derived from the workbook that is used to formulate abundance and productivity indicators. For more information on the DAFD or to obtain the dataset, contact Project Data Analyst Julie Firman - julie.firman@oregonstate.edu.
	Disclaimer: Care was taken in the creation of these themes, but they are provided "as is". The Oregon Department of Fish and Wildlife cannot accept any responsibility for errors, omissions, or positional accuracy in the digital data or underlying records. There are no warranties, expressed or implied, including the warranty of merchantability or fitness for a particular purpose, accompanying any of these products.

Oregon Adult Salmonid Inventory and Sampling Program (OASIS)
Variance and Confidence Interval Construction

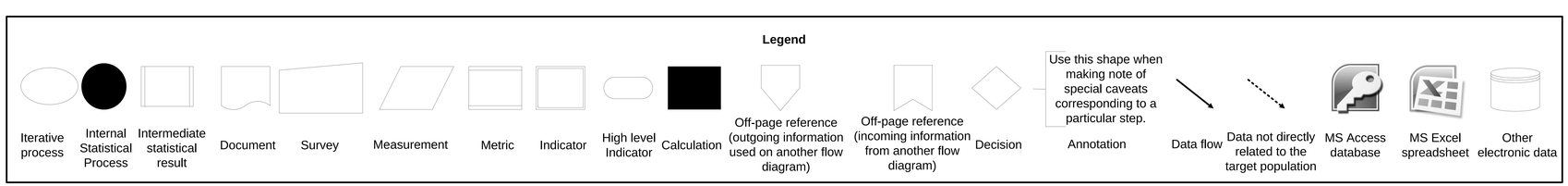


Creator:	Stephanie Archer, Nadine Craft
Date:	10-11-2011
File name:	
Notes:	Approved by Tom Kincaid 10/26/2011.

Oregon Adult Salmonid Inventory and Sampling Program (OASIS) Site Neighborhood Construction



Creator:	Stephanie Archer
Date:	10-10-2011
File name:	
Notes:	Approved by Tom Kincaid 10/26/2011. All calculations are performed internally in a statistical package.



The design is similar to that created for Oregon coast coho (Stevens, 2002). A GIS coverage of streams is used as a frame for the population. The coverage is based on USGS 1:24,000 topographic maps, modified by ODFW to correspond to the target population of streams for each population. The goal is to provide annual estimates for each of the assessment units with a 95% confidence interval of ±30%. To do this, a minimum of 30 sites or 30% (whichever comes first) of the available spawning habitat was sampled in each of the assessment units.

Inference is made for Independent Populations prior to 2008, and for Strata from 2008- present. Click here to see the current spawner assessment units monitored by ODFW Oregon Adult Salmonid Inventory and Sampling (OASIS) project (ODFW monitors only the portions in Oregon). Generalized Random Tessellation Stratified (GRTS) designs achieve a spatially-balanced random point distribution (Stevens, 1997; Stevens & Olsen, 1999; Stevens & Olsen, 2003; Stevens and Olsen, 2004) and this approach was used.

A rotating panel design was used to accommodate the need for repeat visits while continuing to expand the scope of the sample every year. Sets of panels are visited on different cycles. The design consists of 40 panels, with one panel defining sites visited every year, 3 panels defining sites visited on a 3-year cycle, 9 panels defining sites visited on a 9-year cycle, and 27 panels defining sites visited on a 27-year cycle. An equal number of sites were allotted to each panel. Due to reduction in funding, all sites conducted since 2008 are from the annual panel exclusively.

Spawning ground surveys are conducted from January through May. Visits at a site are conducted at least once every 14 days throughout the course of the spawning survey season. Surveyors either walk upstream or boat downstream, depending of the size of the stream being surveyed. On average, sample sites are roughly 1 mile long. The exact length of samples sites is determined by proximity to landmarks (such as bridge crossings and tributary junctions).The surveyors count redds, live and dead fish (by species and fin-mark), and sample carcasses for gender, length (mm MEPS), scales, fin clips and tags. For a full description of the field methods used to conduct the spawning surveys see ODFW (2015).

Because adult steelhead spawners are not reliably observable in spawning ground surveys, redd counts are used as a proxy for adult abundance. (Susac, 1998). Steelhead can be found spawning in streams over a period of several months. Because it is too costly and impractical to conduct daily counts of the number of steelhead redds deposited at all randomly selected spawning survey sites during this extended time period, it is necessary to employ statistical techniques to expand periodic counts (i.e. those conducted once every 14 days or less throughout the spawning season) to an estimate of the total number of redds deposited at the site.

Individual sites are assessed for quality of data according to methods developed by Stevens (2002) and Susac and Jacobs (1998). Sites that pass QA/QC tests are expressed using an indicator variable S_{pt} to represent sites within population area *p* or strata *t* that were successfully surveyed. This indicator variable expression is given as:

I(Spt) = 1, if (S_{pt}) meets criteria within population *p* and stratum t; 0, otherwise.

The response (*R*), which is the number of redds per mile observed at each successful site over the entire season within the population areas (S_{pt}) is calculated using rates of positive fin mark observations from both recovered carcasses and live adult observations to adjust response for hatchery and wild fish. The following equation was used to adjust response from each site for hatchery fish (Hankin 1982) for population area (S_{pt}),

$$R_w = R * (w / w + h)$$

where, R_w = response from wild, R = response from site, w = wild fish observed within population area S_{pt} and, h = hatchery fish observed within population area S_{pt}.

Expansion of observations to areas not surveyed is performed by weighting each site to represent a fraction of the total available miles of habitat. The response from each site is then multiplied by this weight to determine redd abundance over the frame. Weight is calculated using the formula:

$$W = m / \sum \boldsymbol{I} (S_{pt})$$

where W = weight, m = total spawning habitat stream miles in population area S_{pt}. Steelhead redd abundance for a population area (S_{pt}) is then calculated as follows:

$$X = \sum R * W$$

where, X = steelhead redd abundance, R = response for each site, and W = weight. Similarly, the response variable for wild fish (R_W) was used to determine redd abundance from wild steelhead. Furthermore, this redd abundance estimate is converted from redds to adults using the equation

$$N = 1.0379X + 42$$

where, N = number of adult spawners, and X = redd abundance.

Beginning in 2012, the number of adult spawners is now calculated using the following equation (ODFW, 2013)

$$N = 1.70X + 3.74$$

Citations:

Jacobs S., J. Firman, G. Susac, D. Stewart and J. Weybright. 2002. Status of Oregon coastal stocks of anadromous salmonids, 2000-2001 and 2001-2002. Monitoring Program Report Number OPSW-ODFW-2002-3, Oregon Department of Fish and Wildlife, Salem, Oregon.

Jacobsen R., J. Nott, E. Brown, M. Weeber and M. Lewis. 2014. Assessment of Western Oregon Adult Winter Steelhead – Redd Surveys 2014. Monitoring Program Report Number OPSW-ODFW-2014-09. Oregon Department of Fish and Wildlife, Salem, Oregon.

ODFW. 2013 Winter steelhead redd to fish conversions, spawning ground survey data. Oregon Department of Fish and Wildlife; Corvallis Research Office, Oregon Adult Salmonid Inventory and Sampling Project.

ODFW. 2015. Coastal steelhead spawning surveys procedures manual 2015. Oregon Department of Fish and Wildlife, Salem, Oregon. Available: http://oregonstate.edu/dept/ODFW/spawn/reports.htm

Stevens, D.L. 2002. Sampling design and statistical analysis methods for integrated biological and physical monitoring of Oregon streams. OPSW-ODFW-2002-07, Oregon Department of Fish and Wildlife, Portland, Oregon.

Susac, G. and S. Jacobs. 1998. Evaluation of Spawning Ground Surveys for Indexing the Abundance of Adult Winter Steelhead in Oregon Coastal Basins. Annual Progress Report, Oregon Department of Fish and Wildlife, Portland, Oregon.

Susac, G.L. and S. E. Jacobs. 2003. Assessment of the status of Nestucca and Alsea River winter steelhead, 2002. Annual Progress Report. Oregon Department of Fish and Wildlife, Salem, Oregon.

The total number of miles per population (or frame miles per population) is the number of miles the estimate can be expanded to (i.e. the scope of inference). It is an estimated number based on professional opinion plus extensive field verification. Original mileage estimates came from the EPA Reach File (Horn 1986) and ODFW's Planning Form File (further detail can be found in Jacobs and Nickelson, 1998). The frame is regularly re-evaluated. When changes to steelhead spawning distribution are made, existing sites are re-attributed to reflect the attributes of the underlying stream layer (e.g. if a stream reach formerly identified as rearing habitat only is found to have spawning habitat, the stream reach and any points falling on it are re-attributed as: Spawn).

The frame miles and counting stations for the 8 Lower Columbia steelhead populations are listed below. The frame miles are kept in an Access table.

Steelhead Population - Frame Miles - Counting Station:

Youngs Bay – 64.48 – Klaskanine Hatchery
Big Creek – 43.58 – Big Creek Hatchery
Clatskanie River – 60.05 – N/A
Scappoose Creek – 75.73 – Bonnie Falls Weir Trap
Clackamas River – 273.04 – North Fork Clackamas Dam
Sandy River – 175.61 – Sandy Hatchery and Marmot Dam (prior to 2007)
Lower Gorge Tributaries – 5.61 – N/A
Upper Gorge Tributaries – 3.77 – N/A
Hood River – 4.9 – Powerdale Dam (prior to 2010)

Counts from the counting stations are added to GRTS estimates and reported to the OPITT that sets harvest limits each year. The counts that are added to GRTS estimates are pulled from the Hatchery Management Information System (HMIS) for Youngs Bay (Klaskanine Hatchery), Big Creek, and Sandy. The data are error checked, but no manipulations are conducted to the data. The North Fork Clackamas Dam counts come from the following website: http://www.portlandgeneral.com/community_environment/initiatives/protecting_fish/clackamas_river/fish_count_archives.aspx or by contacting PGE directly. The Marmot dam counts (Sandy River) are also received by contacting PGE directly. The Bonnie Falls Trap count (Scappoose River) originate from the Corvallis Research Lab's Life Cycle Monitoring Project. The Powerdale Dam count (Hood River) arrive from the ODFW office in The Dalles. Counts are normally gathered twice per year; February to add to the "preliminary" estimates and again in April, May, or June to add to the "Final" estimate.

Definitions:

1) Total population frame miles = the estimated number of miles of spawning habitat per population (based on professional opinion and extensive field verification).
2) Number of sites attempted = all the random sites drawn for the year = response sites + non-response sites + non-target sites. This number can vary depending on budgets and crew availability.
3) Response sites = those sites classified as "surveyed." Meaning an estimate was generated and no survey gap rules were violated (i.e. no survey gaps > 14 days apart).
4) Non-response sites = those sites which were "denied" access, or "inaccessible" due to time constraints/survey danger, or "dropped" due to survey complications, or "No estimate due to lack of surveys/gaps in survey rotation
5) Non-target sites = those sites deemed "Zero" spawning habitat either because they are above a barrier or lack suitable spawning gravel.

Table 2. Design criteria used in selecting GRTS sampling points for **winter steelhead** spawning surveys. Points = scale for precision targets; Estimate = finest scale at which population estimates were made; Frame scale = the scale of the GIS stream coverage used to select GRTS points; Panels = sites assigned to a rotating panel design; Pop. Complex = population complex; Popn = TRT winter steelhead population.

Run Year[1]	Geographic Scale		Frame Scale	Panels
	Points	Estimate		
2002				
2003				
2004				
2005				
2006	Popn[2]	Popn[2]	1:100K	No
2007	Popn[2]	Popn[2]	1:24K	Yes
2008				
2009				
2010	Popn[3]	Popn[3]	1:24K	Yes
2011	Popn[3]	Popn[3]	1:24K	Yes
2012	Popn	Popn	1:24K	Yes
2013	Popn	Popn	1:24K	Yes
2014	Popn[2]	Popn[2]	1:24K	Yes

[1] No GRT sampling points were selected for run years that are blank.
[2] Only the Sandy and Clackamas populatins sampled in this year.
[3] Only the Sandy population sampled in this year.