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Final Report

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Project Title: Mixed stock analysis of U.S. Districts 106, 108, and 111 sockeye salmon gillnet fisheries, 2018

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Abstract:
The Stikine and Taku rivers in Southeast Alaska supports sockeye salmon runs important for various commercial and aboriginal fisheries in both Alaska and Canada. This project continues the use of mark- and age-enhanced genetic stock identification (GSI) of sockeye salmon harvested in the 2018 gillnet fishery in Districts 106, 108, and 111 by screening 96 single nucleotide polymorphic genetic markers in 5,415 salmon. Advances in mixed stock analysis methodologies allowed the incorporation of hatchery-marked fish and age composition into genetic-based fishery estimates. The mixed stock analysis model indicated that the *Non-Stikine* reporting group was the largest contributor in the District 106 fisheries in 2018. In the District 108 fisheries, *Non-Stikine* was the largest contributors in week 28, while the contribution of *Stikine/Taku Mainstem* dominated later in the season. The *Taku Lakes* reporting group was the largest contributor in District 111 early in the season, while the *Enhanced Snettisham* groups was the largest contributor in later weeks. The most common age group in districts 106 and 111 was age-1.2, while the most common age group in District 108 was age-1.3.

Introduction:
The Stikine and Taku rivers in Southeast Alaska (SEAK) supports sockeye salmon runs important for various commercial and aboriginal fisheries in both the United States (U.S.) and Canada. Stikine and Taku river sockeye salmon are harvested by commercial gillnet fisheries in U.S. Districts 106, 108 and 111, U.S. subsistence fisheries in the lower river, Canadian commercial gillnet in the lower and upper river, and Canadian aboriginal fisheries in the upper river.

The commercial gillnet fisheries in U.S. Districts 106 and 108 harvest wild stocks of sockeye salmon bound for Southeast Alaska (SEAK) island and mainland lakes, and for lakes and tributaries in the Stikine, Nass, and Skeena River drainages, while fisheries in District 111 harvest wild stocks of sockeye salmon primarily bound for several systems in the Taku River or to Crescent and Speel lakes in Alaska. Significant numbers of enhanced sockeye salmon bound for release sites in the Stikine and Taku rivers or to Snettisham Hatchery are also caught in these fisheries. Catches of Stikine and Taku river sockeye salmon stocks in Districts 106, 108 and 111 gillnet fisheries and the U.S. Stikine subsistence fishery are subject to a harvest sharing agreement outlined in Annex IV of the Pacific Salmon Treaty (PST), in which the U.S. is allowed 50% of the Total Allowable Catch of Stikine River and a variable proportion of Taku River sockeye salmon depending on the return of enhanced fish. Stock contribution estimates are critical to document compliance with the harvest sharing agreements, reconstruct runs of wild stocks, estimate the return of enhanced fish, forecast upcoming returns, and support sustainable management.

This project completed mark- and age-enhanced GSI analysis on sockeye salmon tissue samples collected from commercial gillnet fisheries in areas near the Stikine and Taku rivers in 2018. The analysis focused on tissue samples collected in U.S. Districts 106, 108, and 111.

Objectives:
The objective of this project is to estimate the stock composition of Southeast Alaska sockeye salmon fisheries near the Stikine and Taku rivers such that the estimates are within 10% of the true value 90% of the time. This will be accomplished through the following tasks:

- Determine the stock composition of sockeye salmon harvests from the District 106 drift gillnet fishery for 5 reporting groups including: 2 reporting groups of Stikine wild fish (*Stikine/Taku Mainstem* and *Tahltan Wild*), 2 reporting groups of Stikine hatchery-origin fish (*Enhanced Tahltan* and *Enhanced Tuya*), and one reporting group that includes all other non-Stikine wild- and hatchery-origin fish in the baseline (*Non-Stikine*). For 2018, provide estimates for:
    - Subdistrict 106-30
        - Total season, all age groups combined;
        - Total season, by age groups including ages-1.2, -1.3, -2.2, -2.3, 0-checks, and other;
        - At least 5 time strata, all age groups combined;
    - Subdistrict 106-41
        - Total season, all age groups combined;
        - Total season, by age groups including ages-1.2, -1.3, -2.2, -2.3, 0-checks, and other;
        - At least 5 time strata, all age groups combined.
- Determine the stock composition of sockeye salmon harvests from the District 108 drift gillnet fishery for the 5 reporting groups listed above. For 2018, provide estimates for:
    - District 108
        - Total season, all age groups combined;
        - Total season, by age groups including ages-1.2, -1.3, -2.2, -2.3, 0-checks, and other;
        - At least 5 time strata, all age groups combined.
- Determine the stock composition of sockeye salmon harvests from the District 111 drift gillnet fishery for 10 reporting groups including: 4 reporting groups of Taku area wild fish (*Stikine/Taku Mainstem*, *Taku Lakes*, *Tatsamenie Wild*, and *Speel Wild*), 4 reporting groups of Taku area hatchery-origin fish (*Enhanced Tatsamenie*, *Enhanced Little Trapper*, *Enhanced King Salmon* and *Enhanced Snettisham*), one reporting group of Stikine hatchery-origin fish (*Enhanced Stikine*), and one reporting group that includes all other fish in the baseline (*Other*). For 2018, provide estimates for:
    - District 111
        - Total season, all age groups combined;
        - Total season, by age groups including ages-1.2, -1.3, -2.2, -2.3, 0-checks, and other;

- At least 5 time strata, all age groups combined.

Approach:

Fishery Sampling

Landings from drift gillnet fisheries were sampled by ADF&G at fish processing facilities in Petersburg, Wrangell, Ketchikan, and Juneau, and by observers on tenders. Sampling protocols ensured that the fish sampled were as representative of catches as possible. Axillary processes were excised and placed onto Whatman filter paper for dry preservation. Associated data for each sample including fishery and capture date were recorded, and the tissue sample for each fish was paired with age, sex, and length (ASL) information and with otolith samples.

Laboratory Analysis

A single nucleotide polymorphism (SNP) baseline for SEAK and British Columbia (BC) including 45 markers was first completed in 2007. The baseline included all major sockeye salmon-producing systems in SEAK and in BC north of and including the Skeena River and from representative sockeye salmon-producing systems in BC south of the Skeena River. A cooperative project between ADF&G and DFO in 2007-2009 added several collections to the baseline for transboundary rivers (Northern Fund project no. NF-2008-I-15A). In addition, these and existing collections have been analyzed at a total of 96 SNP markers to further enhance the baseline for fishery applications. The current genetic baseline includes 238 populations and 96 markers (Table 1; Rogers Olive et al. 2018).

Samples were analyzed for 96 SNP loci. Genomic DNA was extracted using a NucleoSpin® 96 Tissue Kit by Macherey-Nagel (Düren, Germany). All SNPs were detected using a TaqMAN SNP Genotyping Assay (Life Technologies). SNP assays were generally performed using the BioMark 96.96 Dynamic Array (Fluidigm). Re-analyses of failed assays was performed on the QuantStudio™ 12K Flex Real-Time PCR System (Life Technologies). Genotype data are stored in an *Oracle* database (*LOKI*) on a network drive maintained by ADF&G computer services. Quality control measures included reanalysis from DNA extraction from 8% of each collection for all markers to ensure genotype reproducibility and to identify laboratory errors and measure rates of inconsistencies during repeated analyses.

Mixture Analysis

Mixture analyses included additional available data to help inform the genetic estimates; specifically, ages from matched scales and hatchery marks on matched otoliths. In this method ("mark- and age-enhanced GSI"), two sets of parameters are required: 1) a vector of stock compositions, summing to one, with a proportion for each of the wild and hatchery stocks weighted by harvest per stratum; and 2) a matrix of age composition, with a row for each of the wild and hatchery stocks (summing to one), and a column for each age class. This information is "completed" iteratively by stochastically assigning each wild fish to a population, then estimating the stock proportions based on summaries of assignments from each iteration. In this process, all available information is used to assign individuals to stock of origin based on age, genotype, and/or otolith information. For this method, only genotypes from wild fish are necessary to complete stock composition estimates; thus only wild fish were genotyped for 2018 fisheries.

This algorithm was run for 40,000 Markov chain Monte Carlo repetitions, discarding the first 20,000 repetitions to eliminate the effect of the initial state (burn-in). The point estimates and credibility intervals for the stock proportions and age composition are simple summary statistics of the output.

A total of 37 weekly stock composition estimates and 24 age group estimates were made for the 2018 fisheries.

Results/Findings:

Fishery sampling

A total of 9,574 sockeye salmon were sampled in districts 106, 108 and 111 gillnet fisheries. In District 106, Subdistrict 30, 1,832 fish were sampled and in Subdistrict 41, 2,709 fish were sampled for a total of 4,541 District 106 samples. In districts 108 and 111, 1,452 and 3,581 sockeye salmon were sampled respectively. Sockeye salmon were sampled from statistical weeks 25 through 35 for district 106 and 111, and 27 through 34 for District 108 (Tables 2 – 4).

Laboratory analyses

Of the samples collected in District 106, 2,964 samples were genotyped at 96 SNP genetic markers. During quality control procedures a total of 247 samples were reanalyzed at all 96 markers for a total of 23,712 comparisons. The average failure rate for District 106 was low at 1%. Few inconsistencies were found (<1% across all comparisons).

Of the samples collected in District 108, 1,013 samples were genotyped at 96 SNP genetic markers. During quality control procedures a total of 86 samples were reanalyzed at all 96 markers for a total of 8,256 comparisons. The average failure rate for District 108 was low at 1%. Few inconsistencies were found (<1% across all comparisons).

Of the samples collected in District 111, 1,438 samples were genotyped at 96 SNP genetic markers. During quality control procedures a total of 119 samples were reanalyzed at all 96 markers for a total of 11,424 comparisons. The average failure rate for District 111 was low at 0.9%. Few inconsistencies were found (<1% across all comparisons).

Mixture analysis

Mixtures of fish representing catches by statistical week, age group, and subdistrict from U.S. Districts 106, 108 and 111 gillnet fisheries were analyzed. Stock and age composition estimates can be found in Figures 1–14. Total season estimates were made for each subdistrict or district by age class and over all ages, and were weighted by harvest in each stratum. In addition, results are given for fish of all age classes over every time stratum sampled, regardless of sample size. Estimates are only reported when they met the minimum criteria for precision and accuracy accepted by the Pacific Salmon Commission (PSC) Transboundary Technical Committee (within 10% of the true mixture 90% of the time). Insufficient sample sizes were available to generate an estimate to these guidelines for Subdistrict 106-41 week 27, and for District 108 weeks 27 and 32/33/34. In addition, samples were combined for statistical weeks 32 and 33 in District 111 in order to meet defined precision and accuracy goals.

The largest component of the Subdistrict 106-30 harvest in 2018 was non-Stikine-origin fish in all weeks (range 90–99%; Figure 1). This reporting group dominated catches in every statistical week (Figure 2). All other stocks were present at low proportions (<5%) over all statistical weeks with the exception of *Stikine/Taku Mainstem* in statistical weeks 27–30 and week 35 (range 6–9%). The most common age group in Subdistrict 106-30 for the *Non-Stikine* group was age-1.2 (60% of total), followed by age-1.3 (16%; Figures 3 and 4).

Similar to Subdistrict 106-30, the harvests in Subdistrict 106-41 were dominated by the *Non-Stikine* reporting group (80% over the entire season; Figure 1). This reporting group was the largest contributor in each statistical week, though other stocks were important contributors especially early in the season (statistical weeks 25–29; Figure 5). The *Enhanced Tahltan* reporting group contributed 17% and 24% in weeks 25 and 26 before dropping to <5%, while the *Wild Tahltan* group contributed 11%, 14%, and 7% in weeks 25, 26, and 28 before dropping to <5% for the remainder of the season. The greatest contribution by the *Stikine/Taku Mainstem* reporting group was 23% in statistical week 25, but they were present even later in the season (9% in statistical week 34). The most common age group in Subdistrict 106-41 was age-1.2 (57% of total), followed by age-1.3 (21% of total; Figures 6 and 7).

Stock compositions in District 108 were quite different from District 106. The *Non-Stikine* reporting group was the largest contributor in week 28 (37%), followed by *Stikine/Taku Mainstem* (31%), *Wild Tahltan* (15%), and *Enhanced Tahltan* (15%) reporting groups (Figure 8). The *Stikine/Taku Mainstem* reporting group was the dominant contributor in statistical weeks 29–31 (range 42–68%), followed by *Non-Stikine* (range 16–36%), *Enhanced Tahltan* (range 6–15%), and *Wild Tahltan* (range 3–12%). The greatest component of the total District 108 harvest was the *Stikine/Taku Mainstem* reporting group (43%), followed by the *Non-Stikine* reporting group (29%; Figure 1). The most common age group in District 108 was age-1.3 (46%), followed by age-2.3 (29%; Figures 9 and 10).

The greatest contributor to the overall harvest in District 111 in 2018 was the *Enhanced Snettisham* reporting group (54%), followed by the *Stikine/Taku Mainstem* and *Taku Lakes* reporting groups (22% and 11% respectively; Figure 11). Samples were unavailable from Subdistrict 111-31 for statistical weeks 26, 27, 30, 31, 34, and 35; therefore, these weekly stock composition estimates were based solely on samples collected from Subdistrict 111-32. The largest contributions from the *Taku Lakes* reporting group was in weeks 26 through 30 (range 10–55%; Figure 12), with contributions in the rest of the weeks at 5% or less, while the *Stikine/Taku Mainstem* group was an important contributor throughout the season (range: 7–38%) with the greatest contribution in statistical week 26 (Figure 12). The *Enhanced Snettisham* reporting group did not show up in the harvest until statistical week 27, with contributions ranging from 15% to 84%. The *Tatsamenie Wild* reporting group was an important contributor in weeks 30-34 (range: 9–12%). All other reporting groups were present at ≤ 5% in all weeks. The most common age group in District 111 was age-1.2 (57%) followed by age-1.3 (26%; Figures 13 and 14).

Evaluation:
We accomplished the following:

- A total of 4,541 samples from District 106, 1,452 samples from District 108 and 3,581 samples from District 111 were collected from sockeye salmon gillnet fisheries during the 2018 season.
- A total of 2,964 samples from District 106, 1,013 samples from District 108 and 1,438 samples of sockeye salmon from District 111 were assayed for genotypes for the 96 SNP loci and quality control procedures revealed a low rate of inconsistencies.
- Mixture analyses estimated the contributions of 5 reporting groups including Stikine wild and enhanced sockeye salmon to 10 temporal strata in Subdistrict 106-30, 10 temporal strata in 106-41, and 4 temporal strata in District 108. Mixture analyses estimated the contributions of 9 reporting groups to 9 temporal strata in District 111.
- Mixture analyses estimated the age compositions of harvests over the entire season in Subdistrict 106-30, Subdistrict 106-41, District 108, and District 111 over 6 ages.
- Mixture analyses estimate the seasonal stock composition over all ages for Subdistrict 106-30, Subdistrict 106-41, and District 108 for 5 reporting groups and for District 111 for 9 reporting groups.
- The improved methodology (mark- and age-enhanced GSI) has allowed us to combine several sources of data when estimating stock composition for Pacific Salmon Treaty (PST) purposes. In the past, GSI was conducted on only wild fish, and stock composition estimates for enhanced fish were conducted in a separate analysis using otolith and other data. This approach allows us to combine these analyses to provide the most accurate and efficient estimates possible for Stikine and Taku area fisheries.
- Results will be incorporated into harvest estimates for PST purposes by the Transboundary Technical Committee (TTC *in prep*).

Project Products:
Results from this project have been presented both to ADF&G Commercial Fisheries management staff and to the bilateral PSC Transboundary Technical Committee. A multi-year report published in the ADF&G Fishery Data Series is expected in 2020.

Date Prepared: October 10, 2019

References:
Rogers Olive, S. D., E. K. C. Fox, and S. E. Gilk-Baumer. 2018. Genetic baseline for mixed stock analyses of sockeye salmon harvested in Southeast Alaska for Pacific Salmon Treaty applications, 2018. Alaska Department of Fish and Game, Fishery Manuscript No. 18-03, Anchorage.

TTC (Transboundary Technical Committee). *In prep*. Final estimates of Transboundary River salmon production, harvest and escapement and a review of joint enhancement activities in 2018. Pacific Salmon Commission Report TCTR, Vancouver.

Table 1. Reporting groups and collection locations defined for use in genetic stock identification of sockeye salmon caught in gillnet fisheries in Districts 106, 108, and 111 in 2018. Wild collections are ordered north to south and followed by enhanced collections.

		Reporting Groups					
	Source	***Dist 106, 108***	***Dist 111***	Region	Populations	Year(s) Collected	N
1	Wild	***Non-Stikine***	***Other***	Prince William	Bainbridge Lake	2010	95
2				Sound	Coghill Lake	1991, 1992, 2010	378
3					Eshamy Lake	1991, 2008	185
4					Main Bay	1991	96
5					Miners Lake	1991, 2009	191
6				Copper	Eyak Lk. - Middle Arm	2007	95
7					Eyak Lk. - Beaches	2007	87
8					Eyak Lk. - Hatchery Cr.	2010	95
9					Mendeltna Creek	2008, 2009	188
10					Swede Lake	2008	95
11					Gulkana R. – Fish Cr	2008	95
12					Gulkana River – E. Fork	2008	75
13					Paxson Lake	2009	75
14					Mentasta Lake	2008	95
15					Tanada Creek	2005	94
16					Tanada Lake - lower	2009	95
17					Tanada Lake - shore	2009	93
18					Klutina River	2008	95
19					Klutina Lake	2008, 2009	95
20					Bear Hole - Klutina	2008	94
21					Banana Lake - Klutina	2008	80
22					St. Anne Creek	2005, 2008	186
23					Mahlo River	2008	94
24					Tonsina Lake	2009	94
25					Long Lake	2005	95
26					Tebay River	2008	93
27					Bremner - Steamboat	2008	95
28					Bremner – Salmon Cr.	2008	93
29					Clear Creek	2007	87
30					McKinley Lake	2007	95
31					McKinley Lake	2008	95
32					McKinley Lake	1991	95

		Reporting Groups					
	Source	***Dist 106, 108***	***Dist 111***	Region	Populations	Year(s) Collected	N
33	Wild	***Non-Stikine***	***Other***	Copper	Salmon Creek	2007	93
34	(cont.)	***(cont.)***	***(cont.)***	(cont.)	Martin Lake	2007, 2008	187
35					Martin River Slough	2008	95
36					Tokun Lake	2008, 2009	189
37					Bering Lake	1991	95
38					Kushtaka Lake	2007, 2008	189
39				Yakutat	Mountain Stream	2007	159
40					Situk Lake	2013	190
41					Old Situk River	2007	163
42					Lost/Tahwah Rivers	2003	93
43					Ahrnklin River	2007	90
44					Dangerous River	2009	95
45					Akwe River	2009	95
46					East Alsek River	2003	94
47				Alsek	Datlasaka Creek	2012	95
48					Goat Creek	2007, 2012	56
49					Border Slough	2007, 2008	71
50					Border Slough	2009, 2011	70
51					Tweedsmuir	2007	48
52					Tweedsmuir	20099	46
53					Vern Ritchie	2009, 2010	114
54					Neskataheen Lake	2007	195
55					Klukshu River	2006	95
56					Klukshu River	2007	94
57					Kudwat Creek	2009, 2010, 2011	100
58					Tatshenshini – Bridge	2011, 2012	105
59					Tatshenshini - Stinky	2011	40
60					Upper Tatshenshini	2003	95
61					Little Tatshenshini Lk.	2001, 2003	65
62					Kwatini River	2011	65
63					Blanchard River	2007	89
64					Blanchard River	2009	62
65				N. Southeast	Chilkat - Bear Flats	2007	190
66					Chilkat - Mule Meadows	2003, 2007	189
67					Chilkat - Mosquito	2007	159
68					Chilkat Lake	2007	233

	Source	Reporting Groups: Dist 106, 108	Reporting Groups: Dist 111	Region	Populations	Year(s) Collected	N
69	Wild	***Non-Stikine***	***Other***	N. Southeast	Chilkat Lake	2013	251
70	(cont.)	***(cont.)***	***(cont.)***	(cont.)	Chilkoot River	2003	159
71					Chilkoot Lk. - Bear Cr.	2007	233
72					Chilkoot Lk. - beaches	2007	251
73					Vivid Lake	1993	48
74					Seclusion Lake	2014	117
75					North Berg Bay Inlet	1991	53
76					North Berg Bay Inlet	1992	100
77					Bartlett River	2013	69
78					Neva Lake	2008	94
79					Neva Lake	2009, 2013	255
80					Hoktaheen - inlet	2004	47
81					Hoktaheen - outlet	2004	49
82					Hoktaheen - marine	2014	47
83					Klag Bay Stream	2009	200
84					Ford Arm Lake	2004	207
85					Ford Arm Creek	2013	199
86					Redoubt Lake	2013	200
87					Salmon Lake	2007, 2008	185
88					Benzeman Lake	1991, 1993	95
89					Falls Lake	2003, 2010	190
90					Redfish Lake	1993	94
91					Kutlaku	2003	95
92					Kutlaku	2012	78
93					Kutlaku	2013	50
94					Lace River	2013	63
95					Berners Bay	2003, 2013	165
96					Antler-Gilkey River	2013	53
97					Windfall Lake	2003, 2007	142
98					Steep Creek	2003	91
99					Lake Cr. (Auke Cr. Weir)	2013, 2014	318
100					Crescent Lake	2003	194
101			***Speel Wild***		Speel Lake	2003	95
102					Snettisham Hatchery	2006, 2007	190
103					Snettisham Hatchery	2013	146
104			***Other (cont.)***		Pavlof River	2012, 2013	174

	Source	***Reporting Groups*** Dist 106, 108	***Dist 111***	Region	Populations	Year(s) Collected	N
105	Wild	***Non-Stikine***	***Other***	N. Southeast	Kook Lake Late	2007, 2010, 2012	194
106	(cont.)	***(cont.)***	***(cont.)***	(cont.)	Kook Lake early	2012, 2013	148
107					Sitkoh Lake	2003, 2011, 2012	351
108					Lake Eva	2012	115
109					Hasselborg Lake	2012, 2013	209
110					Kanalku Lake	2007, 2010, 2013	319
111			***Taku Lakes***	Taku	Kuthai Lake	2006	171
112					King Salmon Lake	2010, 2011	214
113					Little Trapper Lake	1990, 2006	237
114					Little Tatsamenie	2011	59
115			***Tatsamenie Wild***		Tatsamenie Lake	2005, 2006	288
116		***Stikine/Taku***	***Stikine/Taku***		Hackett River	2008	52
117		***Mainstem***	***Mainstem***		Nahlin River	2003, 2007, 2012	179
118					Taku River	2007	95
119					Takwahoni/Sinwa	2009	67
120					Shustahini Slough	2008, 2009	185
121					Tuskwa/Chunk Slough	2008, 2009	356
122					Yellow Bluff Slough	2008, 2010, 2011	81
123					Tulsequah River	2007, 2008, 2009	156
124					Fish Creek	2009, 2010	160
125					Yehring Creek	2007, 2009	171
126				Stikine	Chutine River	2008	94
127					Chutine Lake	2009, 2011	224
128					Andy Smith slough	2007, 2008, 2009	54
129					Porcupine	2007, 2011	74
130					Devil's Elbow	2007, 2008	148
131					Devil's Elbow	2009	53
132					Scud River	2007, 2008, 2009	192
133					Iskut River	1985-86, 2002, 2006, 2008-09	153
134					Iskut - Craigson Slough	2007	42
135					Craig River-CAN	2006 - 2008	38
136					Bronson Slough	2008, 2009	78
137					Shakes Slough	2006, 2007, 2009	67
138					Christina Lake	2011, 2012	70
139		***Tahltan Wild***	***Other (cont.)***		Little Tahltan	1990	95
140					Tahltan Lake06	2006	196

	Source	*Reporting Groups* Dist 106, 108	*Dist 111*	Region	Populations	Year(s) Collected	N
141	Wild	***Non-Stikine***	***Other***	S. Southeast	Petersburg Lake	2004	95
142	(cont.)	***(cont.)***	***(cont.)***		Kah Sheets Lake	2003	96
143					Mill Creek Weir Early	2007	94
144					Mill Creek Weir Late	2007	95
145					Kunk Lake	2003	96
146					Thoms Lake	2004, 2014	93
147					Red Bay Lake	2004	95
148					Salmon Bay Lake	2004, 2007	170
149					Shipley Lake	2003	94
150					Sarkar Lakes	2000, 2005	91
151					Hatchery Creek	2003, 2007	142
152					Luck Lake	2004	94
153					Big Lake	2010, 2014	161
154					McDonald Lake	1992, 2003, 2007, 2013	369
155					Karta River	1992, 2003, 2004, 2016	472
156					Unuk River07	2007	95
157					Unuk River08	2008	69
158					Helm Lake	2005	94
159					Heckman Lake	2004, 2007	189
160					Mahoney Creek	2003, 2007	154
161					Kegan Lake	2004	95
162					Fillmore Lake	2005	52
163					Klawock - Three Mile	2004, 2010	181
164					Klawock - Inlet Creek	2003, 2008	212
165					Hetta Lake	2003, 2008, 2009	281
166					Hetta Creek - middle	2009	95
167					Hetta Creek - early	2010	95
168					Eek Creek	2004, 2007	50
169					Klakas Lake	2004	95
170					Essowah Lake	2004	95
171					Hugh Smith	1992, 2013	155
172					HS - Buschmann	2004	151
173					HS - Cobb Creek	2007	99
174				Nass	Kwinageese	2001, 2012	76
175					Bowser Lake	2001	94
176					Bonney Creek	2001, 2012	164

	Source	Reporting Groups *Dist 106, 108*	***Dist 111***	Region	Populations	Year(s) Collected	N
177	Wild	***Non-Stikine***	***Other***	Nass	Damdochax Creek	2001	93
178	(cont.)	***(cont.)***	***(cont.)***	(cont.)	Meziadin Lake	2001, 2006	186
179					Hanna Creek	2006	93
180					Tintina Creek	2006	94
181					Gingit Creek	1997	94
182				Skeena	Alastair Lake	1987, 2006	118
183					Lakelelse Lake	2006	93
184					Sustut River	2001	79
185					Salix Bear	1987, 1988	94
186					Motase Lake	1987	47
187					Slamgeesh River	2006	95
188					Babine River	2006	95
189					Four Mile Creek	2006	85
190					Pinkut Creek	1994	187
191					Grizzly Creek	1987	76
192					Pierre Creek	2006	95
193					Fulton River	2006	95
194					Morrison	2007	92
195					Lower Tahlo River	1994	78
196					Tahlo Creek	2007	95
197					McDonell Lake	2002, 2006	131
198					Kitsumkalum Lake	2006	56
199					Kitsumkalum Lake	2012	94
200					Kitwanga River	2012	92
201					Stephens Creek	2001	95
202					Nangeese River	2006	40
203					Kispiox River	2002	53
204					Swan Lake	2006	93
205					Nanika River	1988, 2007	114
206				Fraser	Trembleur - Kynock	1997	94
207					Tachie River	2001	94
208					Stellako River	2007	94
209					Fraser Lake	1996	85
210					Horsefly River	2001, 2007	274
211					Nahatlatch River	2002	92
212					Cultus Lake	2002	91
213					Chilliwack Lake	2004	90
214					Chilko Lake	2001	87
215					Raft River	2001	84

	Source	Reporting Groups Dist 106, 108	 Dist 111	Region	Populations	Year(s) Collected	N
216	Wild	***Non-Stikine***	***Other***	Fraser	Adams River	2002, 2007	187
217	(cont.)	***(cont.)***	***(cont.)***	(cont.)	Middle Shuswap River	2002	91
218					Scotch River	2000	91
219					Gates Creek	2009	90
220					Birkenhead River	2007	90
221					Weaver Creek	2001	89
222					Harrison River	2007	95
223					North Thompson	2005	95
224				BC/Washington	Naden River	1995	95
225					QCI - Yakoun Lake	1993	70
226					Kitimat River	2010	93
227					Bloomfield Lake	2005	94
228					Tankeeah River03	2003	47
229					Tankeeah River05	2005	47
230					Amback Creek	2004	91
231					Kitlope Lake	2006	95
232					Great Central Lake	2002	95
233					Quatse River	2003	95
234					Mitchell River	2001	94
235					Okanagan River	2002	95
236					Lake Pleasant	1997	89
237					Issaquah Creek	1996	82
238					Lake Wenatchee	1998	95
239	Enhanced			S. Southeast	Burnett Enhanced	NA	NA
240				PWS	Main Bay Enhanced	NA	NA
241			***Enh. Snettisham***	N. Southeast	Speel Arm Enhanced	NA	NA
242					Sweetheart Lk. Enhanced	NA	NA
243		***Enh. Tahltan***	***Enhanced Stikine***	Stikine	Tahltan Enhanced	NA	NA
245		***Enh. Tuya***			Tuya Enhanced	NA	NA
246		***Non-Stikine (cont)***	***Enh. King Salmon***	Taku	King Salmon Enhanced	NA	NA
247			***Enh. Little Trapper***		Little Trapper Enhanced	NA	NA
244			***Enh. Tatsamenie***		Tatsamenie Enhanced	NA	NA

Table 2. Number of sockeye salmon sampled from Subdistricts 106-30 and 106-41 gillnet harvests during each statistical week in 2018, total genotyped samples used in analysis, and otolith-marked or aged samples not genotyped (or failed genotyping).

District	Subdistrict	Statistical Week(s)	Total Samples Collected	Genotypes Used in Analysis	Not Genotyped (otolith-marked or aged or both)
106	30	25	10	0	10
		26	81	81	0
		27	189	189	0
		28	80	80	0
		29	171	171	0
		30	300	190	110
		31	300	190	110
		32	260	190	70
		33	215	190	25
		34	142	142	0
		35	84	84	0
	41	25	240	95	145
		26	140	101	39
		27	8	0	8
		28	300	168	132
		29	300	190	110
		30	300	143	157
		31	302	190	112
		32	300	190	110
		33	300	190	110
		34	228	95	133
		35	291	95	196
Totals			4,541	2,964	1,577

Table 3. Number of sockeye salmon sampled from gillnet harvests in the sockeye salmon fisheries in District 108 during 2018 by statistical week, total genotyped samples used in analysis, and otolith-marked or aged samples not genotyped (or failed genotyping).

District	Statistical Week	Total Samples Collected	Genotypes Used in Analysis	Not Genotyped (otolith-marked or aged or both)
108	27	60	41	19
	28	302	190	112
	29	421	311	110
	30	310	228	82
	31	148	113	35
	32/33/34	211	130	81
Totals		1,452	1,013	439

Table 4. Number of sockeye salmon sampled from gillnet harvests in the sockeye salmon fisheries in District 111 during 2018 by statistical week, total genotyped samples used in analysis, and otolith-marked or aged samples not genotyped (or failed genotyping).

District	Statistical Week	Total Samples Collected	Genotypes Used in Analysis	Not Genotyped (otolith-marked or aged or both)
111	25*	66	63	3
	26*	268	190	78
	27	334	190	144
	28	476	190	286
	29	908	263	645
	30*	400	183	217
	31*	400	190	210
	32	46	15	31
	33	55	8	47
	34*	328	102	226
	35*	300	44	256
Totals		3,581	1,438	2,143

*Samples only collected from Subdistrict 111-32.

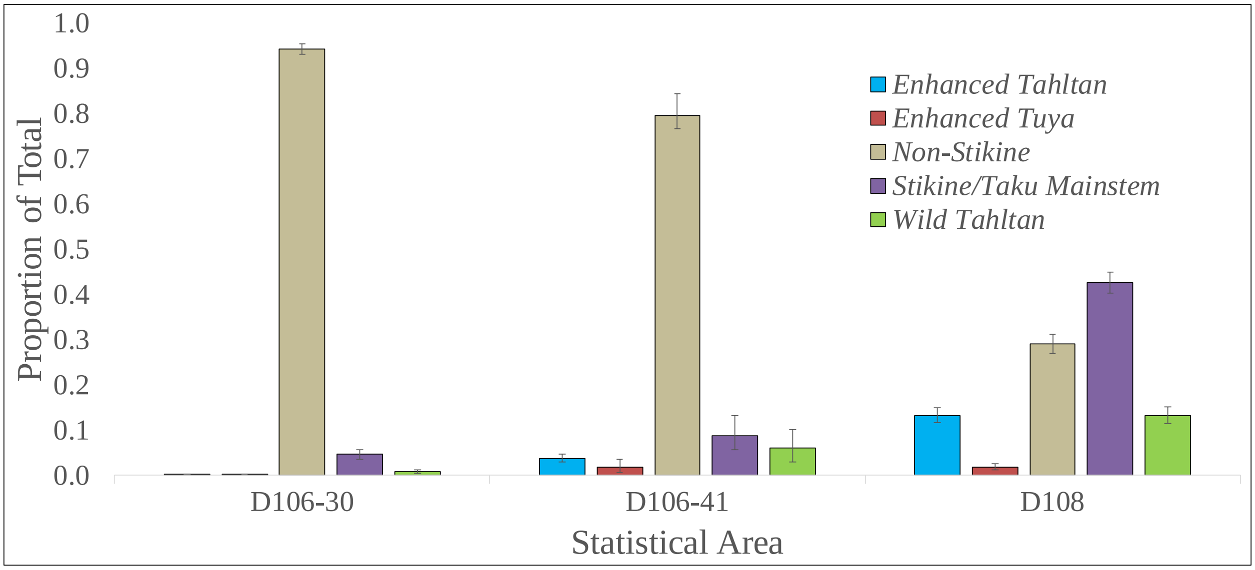

Figure 1. Total season stock composition estimates for Stikine River area fisheries 2018. Estimates were weighted by harvest per stratum. Error bars are upper and lower bounds of 90% credibility intervals.

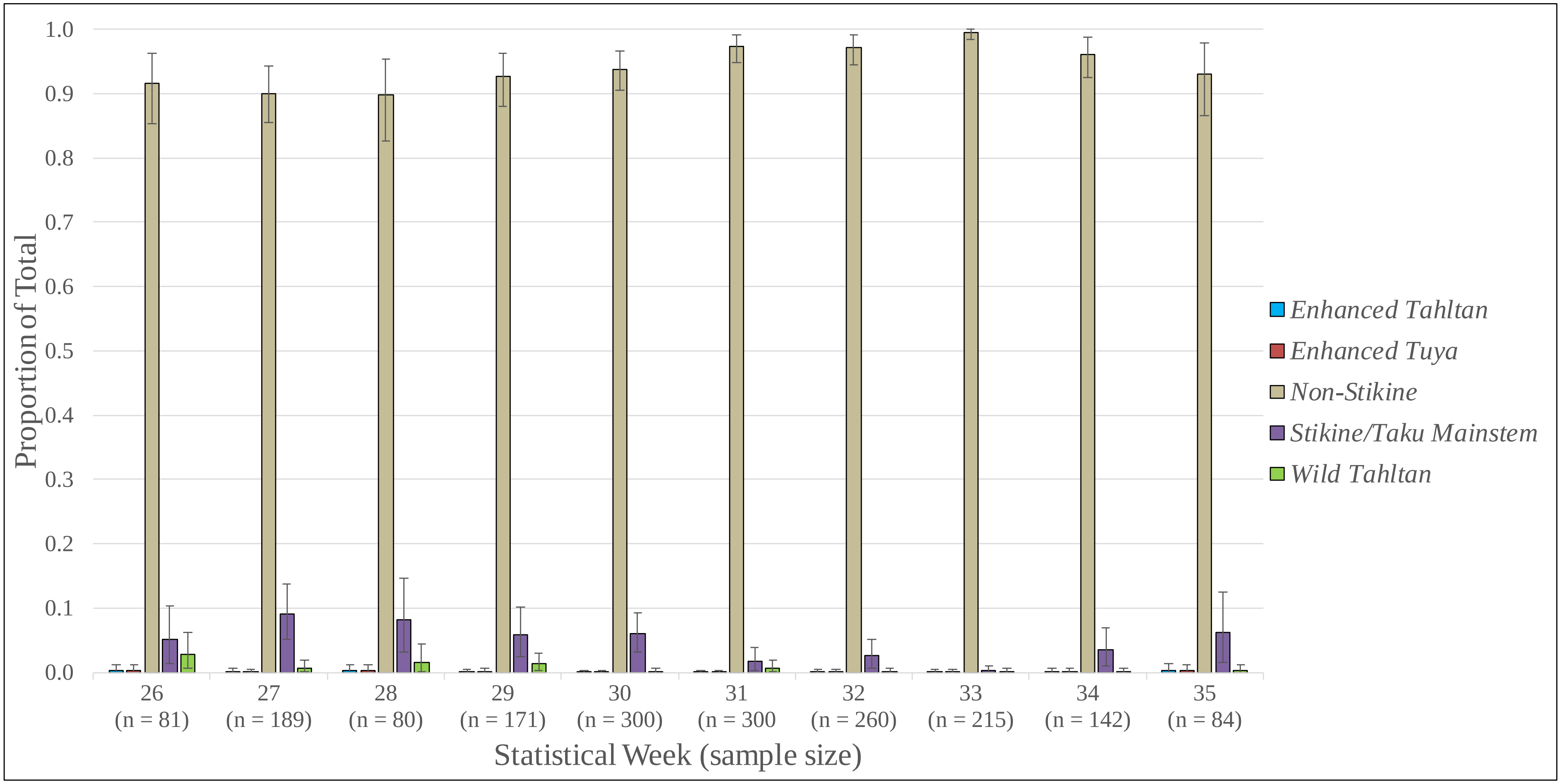

Figure 2. Stock composition estimates of sockeye salmon caught in the District 106-30 gillnet fishery in 2018. Sample size (n) includes genotyped, aged, and otolith-marked fish. Error bars are upper and lower bounds of 90% credibility intervals.

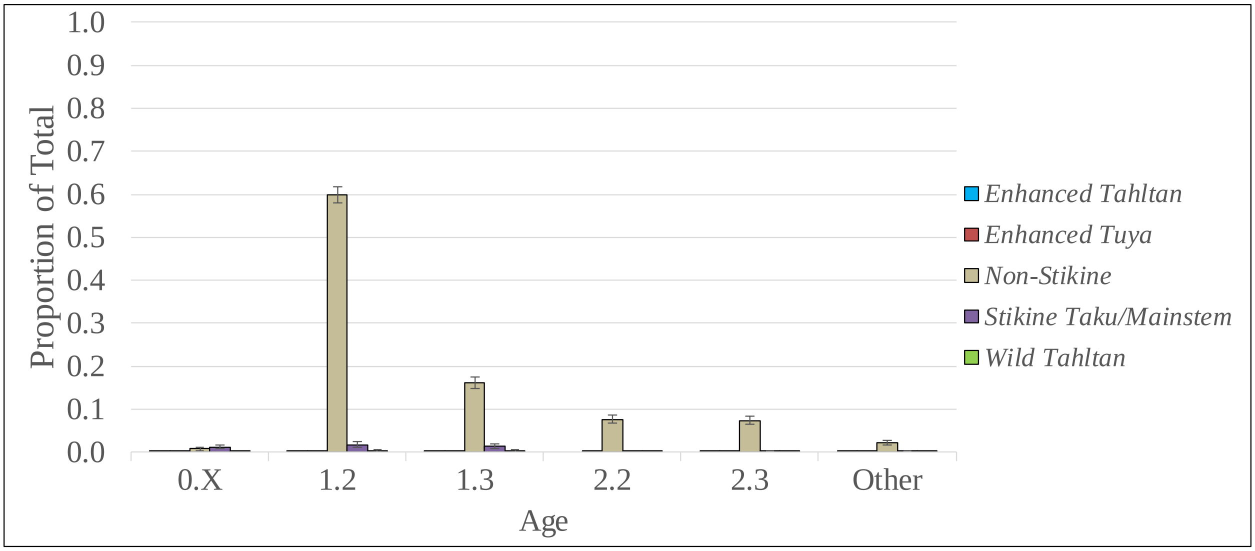

Figure 3. Age composition of sockeye salmon caught in the District 106-30 gillnet fishery in 2018 over the entire season. Error bars are upper and lower bounds of 90% credibility intervals.

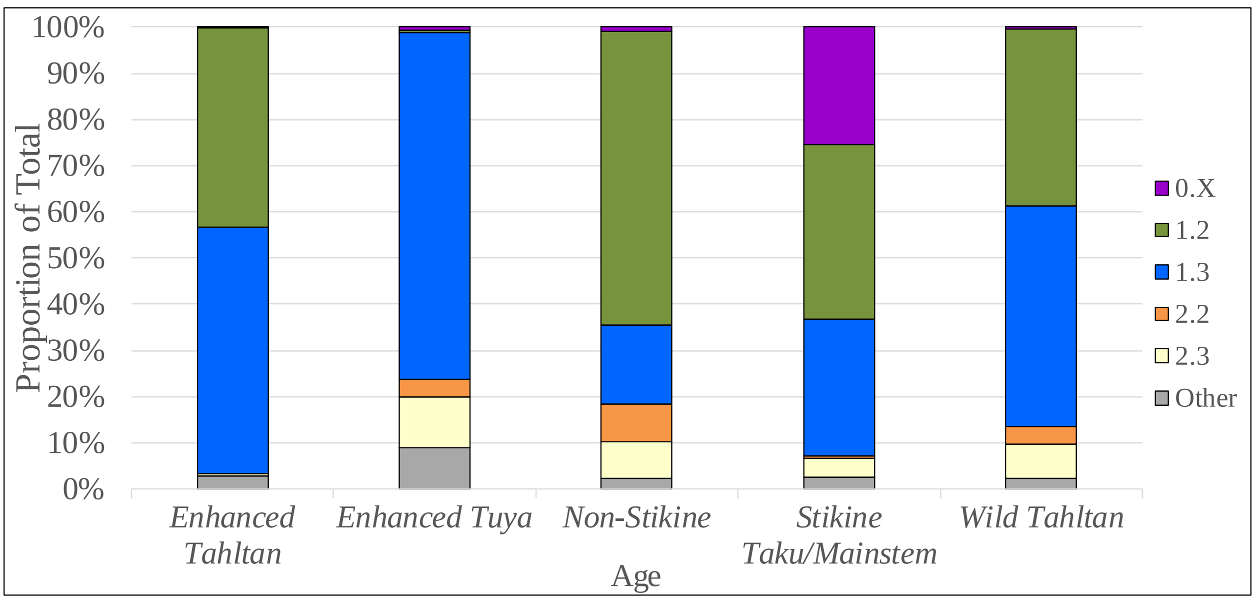

Figure 4. Age composition by reporting group of sockeye salmon caught in the District 106-30 gillnet fishery in 2018.

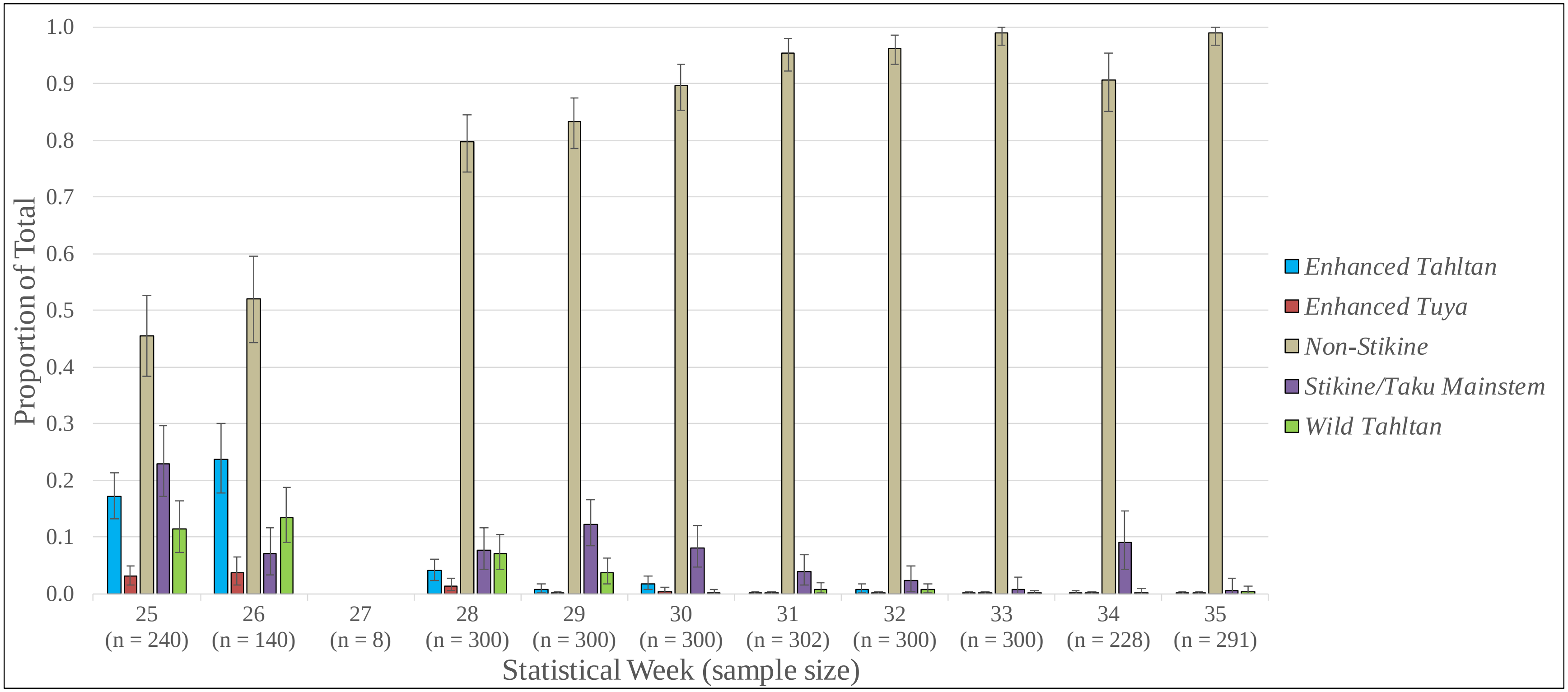

Figure 5. Stock composition estimates of sockeye salmon caught in the District 106-41 gillnet fishery in 2018. Sample size (n) includes genotyped, aged, and otolith-marked fish. Insufficient samples were collected in week 27 to generate stock composition estimates using the model. Error bars are upper and lower bounds of 90% credibility intervals.

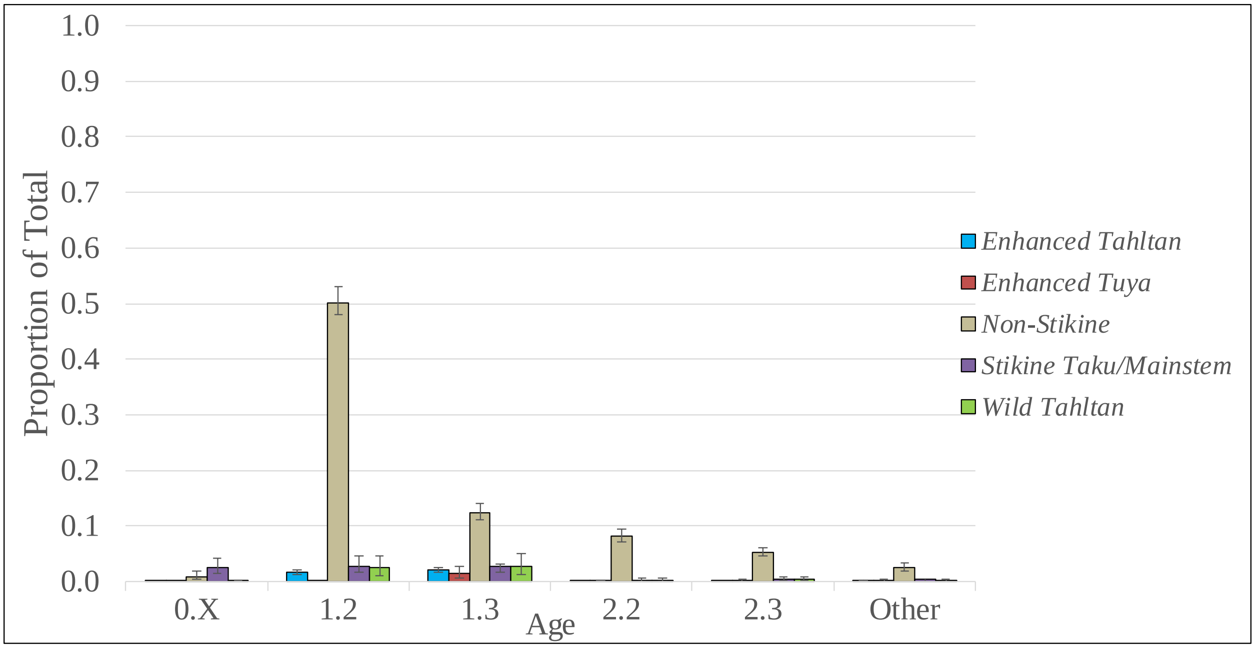

Figure 6. Total age composition of sockeye salmon caught in the District 106-41 gillnet fishery in 2018 over the entire season. Error bars are upper and lower bounds of 90% credibility intervals.

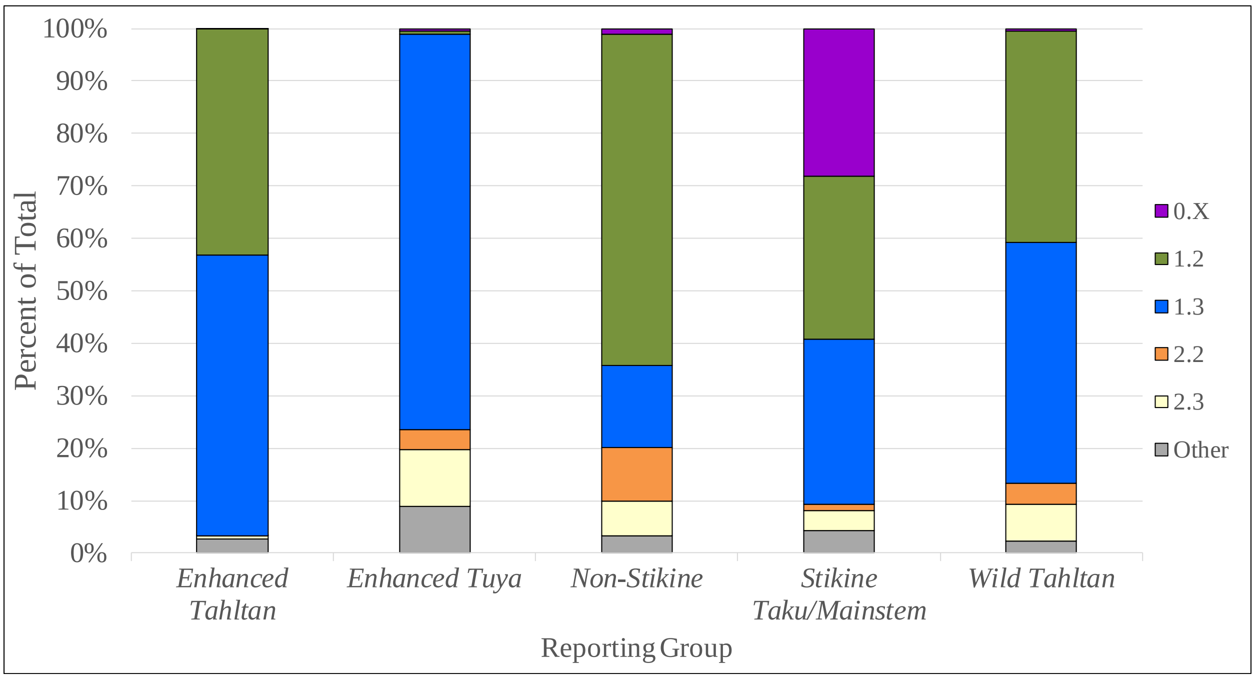

Figure 7. Age composition by reporting group of sockeye salmon caught in the District 106-41 gillnet fishery in 2018.

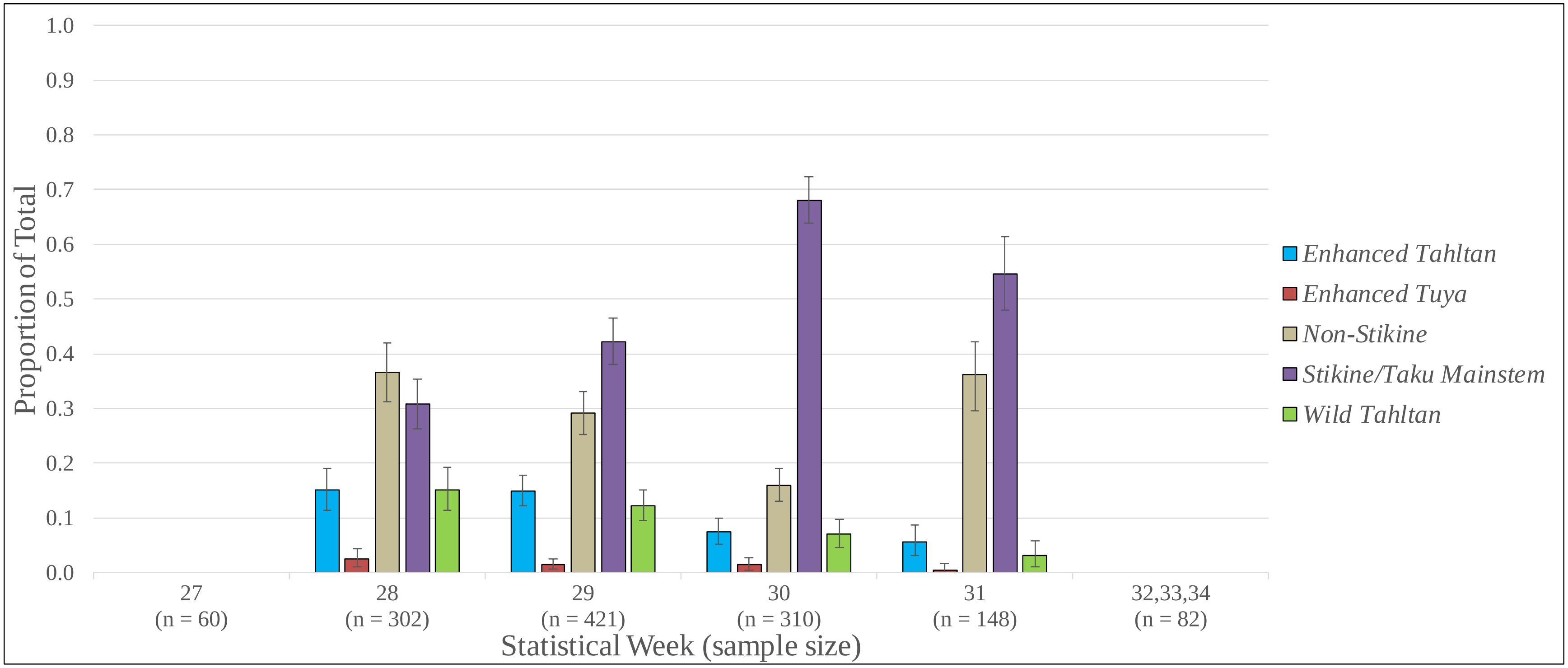

Figure 8. Stock composition estimates of sockeye salmon caught in the District 108 gillnet fishery in 2018. Sample size (n) includes genotyped, aged, and otolith-marked fish. Estimates in weeks 27 and 32/33/34 did not meet precision and accuracy goals identified by the TTC and thus are not reported. Error bars are upper and lower bounds of 90% credibility intervals.

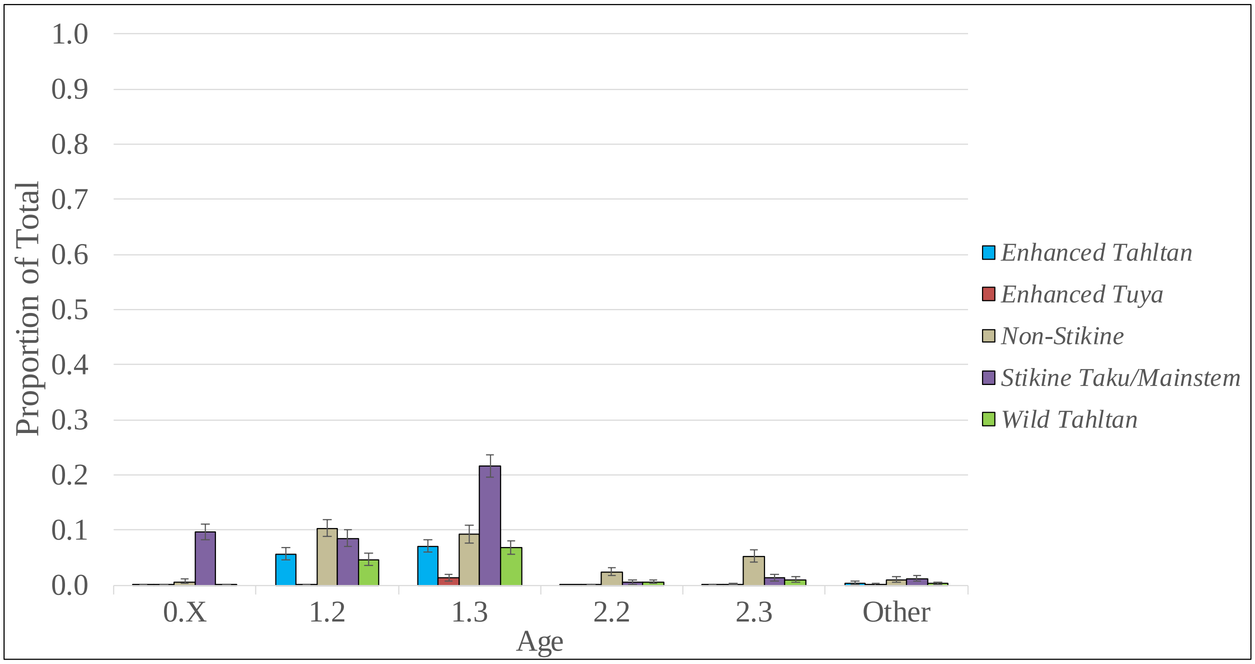

Figure 9. Total age composition of sockeye salmon caught in the District 108 gillnet fishery in 2018 over the entire season. Error bars are upper and lower bounds of 90% credibility intervals.

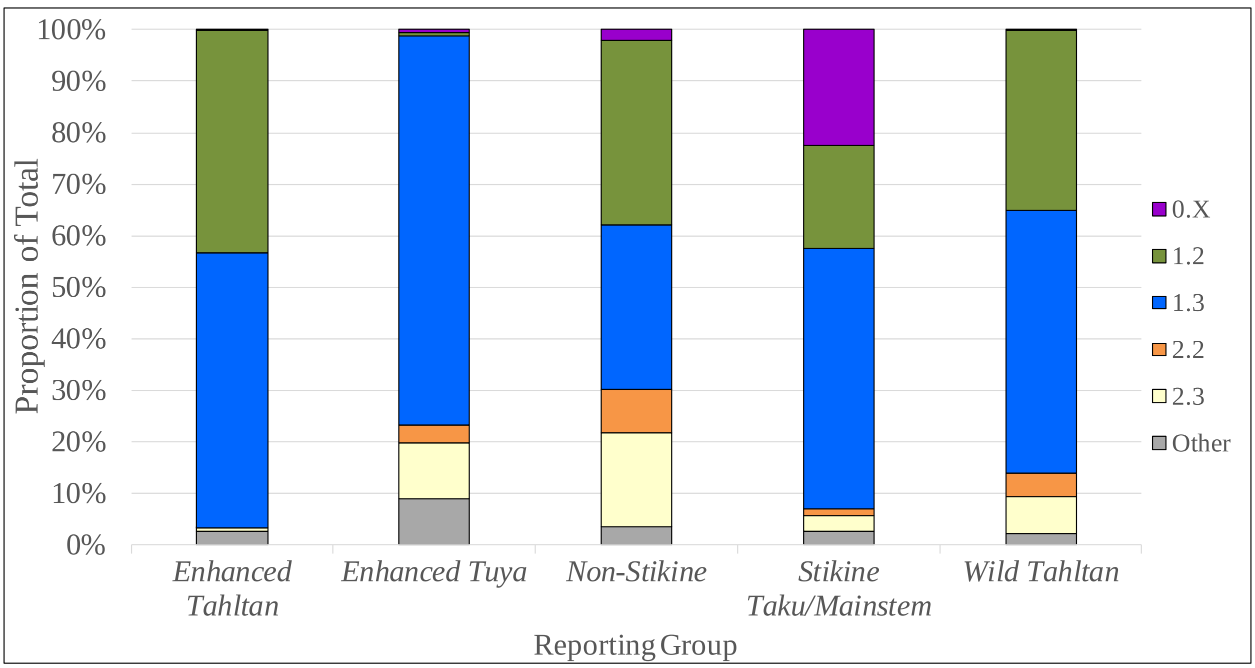

Figure 10. Age composition by reporting group of sockeye salmon caught in the District 108 gillnet fishery in 2018.

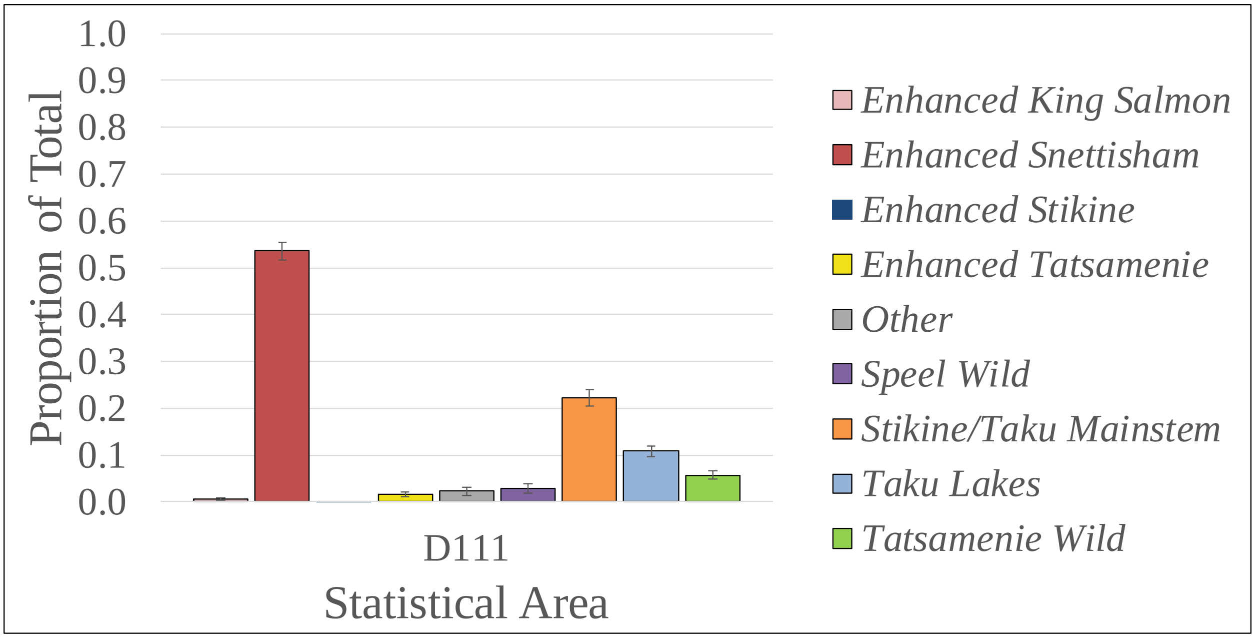

Figure 11. Total season stock composition estimates for Taku River area fisheries 2018. Estimates were weighted by harvest per stratum. Error bars are upper and lower bounds of 90% credibility intervals.

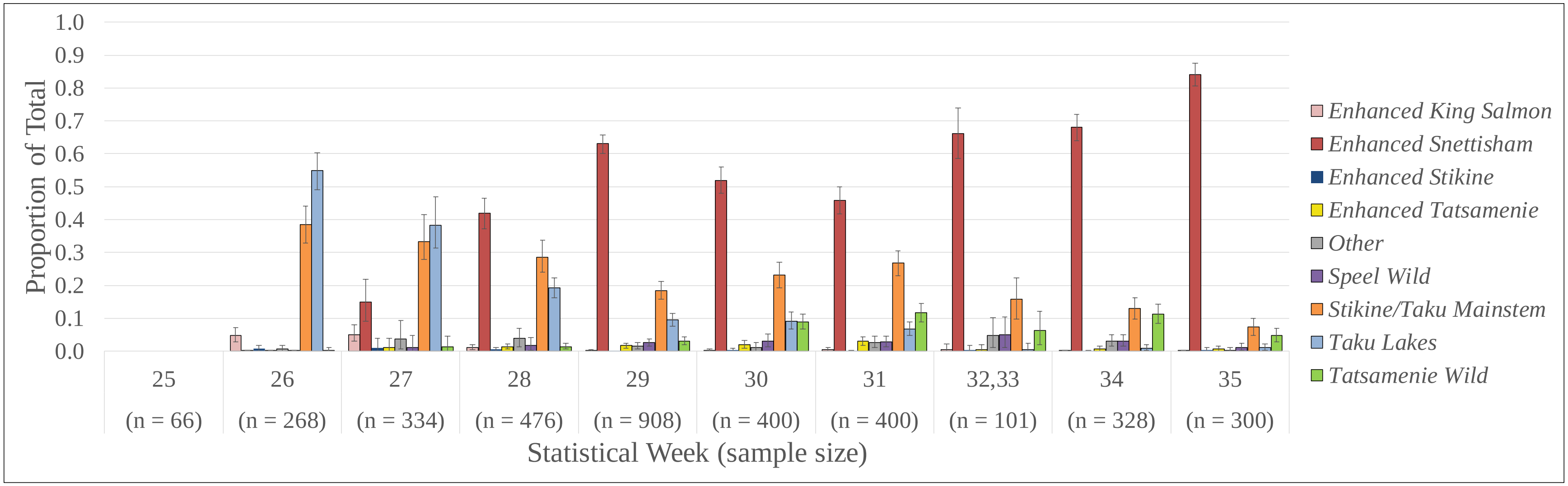

Figure 12. Stock composition estimates of sockeye salmon caught in the District 111 gillnet fishery in 2018. Sample size (n) includes genotyped, aged, and otolith-marked fish. Only samples from Subdistrict 111-32 were used in weeks 26, 27, 30, 31, 34, and 35. Estimates in week 25 did not meet precision and accuracy goals identified by the TTC and thus are not reported. Error bars are upper and lower bounds of 90% credibility intervals.

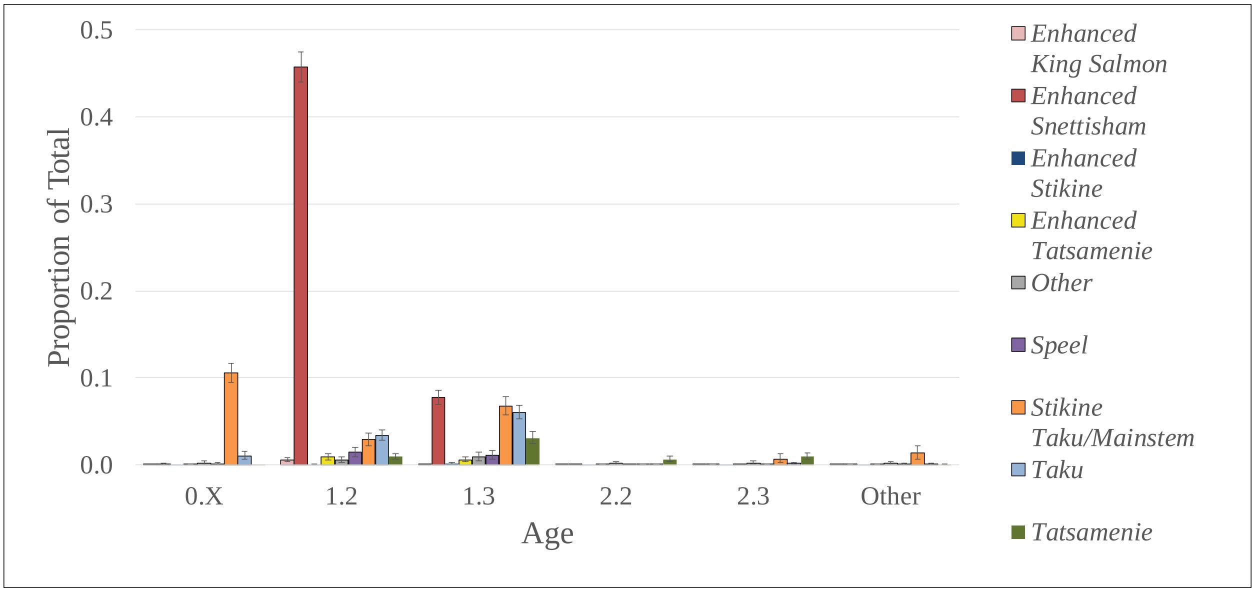

Figure 13. Total age composition of sockeye salmon caught in the District 111 gillnet fishery in 2018 over the entire season. Error bars are upper and lower bounds of 90% credibility intervals.

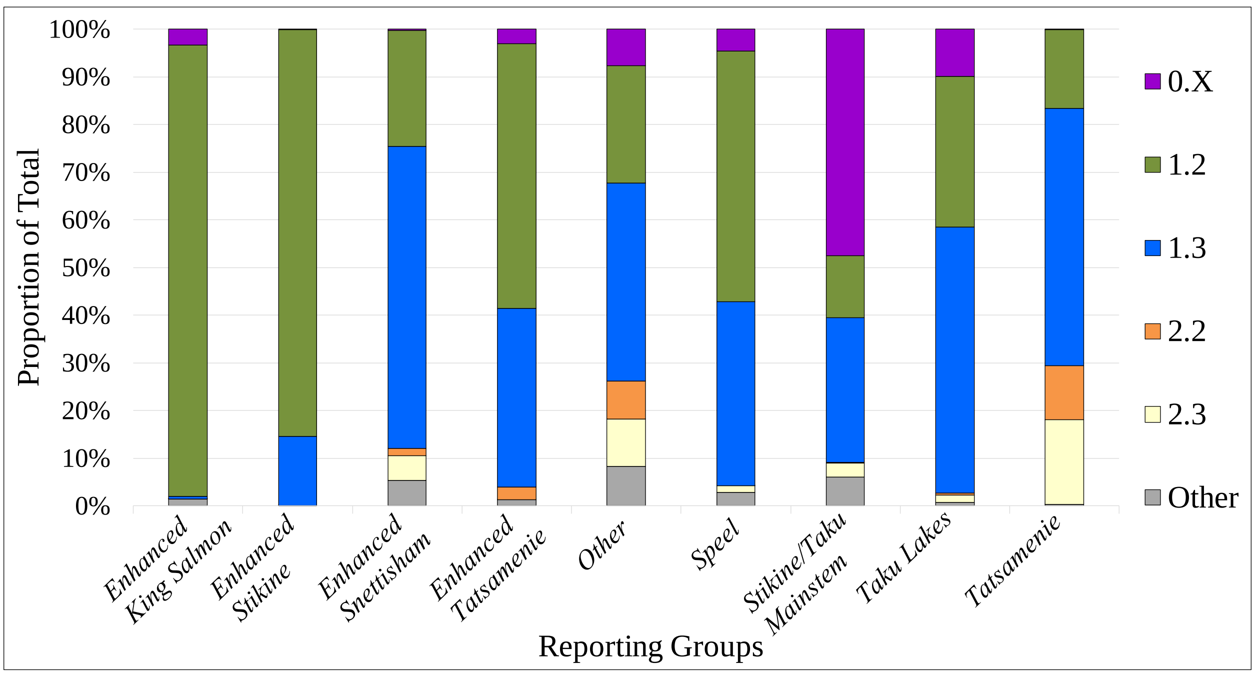

Figure 14. Age composition by reporting group of sockeye salmon caught in the District 111 gillnet fishery in 2018.