Feasibility assessment of available hydroacoustics data for development of a probability of encounter model of salmon smolts with the Ocean Renewable Power Company RivGen® in the Kvichak River, Alaska

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Submitted to: Ocean Renewable Power Company

Introduction

The Igiugig Village Council (IVC), in collaboration with Ocean Renewable Power Company received funding to design and install the next generation RivGen® Power System in the Kvichak River, Alaska to demonstrate reduce uncertainty around installation, operations, and maintenance. As part of this, OPRC committed to applying prior experiences with installations in Maine to this application. Part of the Maine experience included collaboration with the University of Maine School of Marine Sciences to develop a probability of encounter model for fish with the TidGen® turbine deployed in Cobscook Bay (Shen et al. 2016). Result from that study, using vertical distributions of fish relative densities collected with hydroacoustics, indicated that the probability of fish encourntering device foils was low, 0.058 (0.043-0.073 95% CI). For this project the University of Maine School of Marine Sciences and ORPC were aware of similar hydroacoustics data collected by LGL in the Kvichak River that could potentially be modified to produce a similar probability of encounter model.

The subtask during this budget period was to characterize the salmon smolt presence and distribution that can be used to develop mitigation methods to increase power system availability. More specifially, the University of Maine would review existing data to characterize smolt presence and distribution and propose summary metrics (such as a probability of encounter model) using existing equipment and monitoring methods and prior technical data to propose requirements for varying levels of risk to salmon smolts in the Kvichak River.

This report highlights UMaine's assessment of readily-available hydroacoustics data for inclusion in a probability of encounter model with suggestions for subsequent monitoring approaches for future installations of the RivGen® device in the Kvichak River.

LGL Alaska Research Associates, Inc., under contract to the Bristol Bay Science and Research Institute (BBSRI) conducted multiple studies in the Kvichak River since 2008 (Priest et al. 2015) with additional research dating back to the 1970s. Their most complete dataset is an evaluation of sockeye salmon smolt abundance of those smolts exiting Lake Iliamna using uplooking single beam hydroacoustics (Priest et al. 2015) at two sites on the river. Both sites are downstream (~2km) from the deployment site of the RivGen® Power System in the Village of Igiugig (Figure 1). Additional preliminary data were collected by LGL in 2014 and 2015 at the site of the RivGen® where they examined fish interactions directly with the device using video cameras.

The data from these two studies are somewhat consistent with those collected for the probability of encounter model: downlooking hydroacoustic surveys estimating relative fish density in vertical bins of the water column associated with the presence or absence of a turbine at a control site (1km downstream of the deployment site) and near the deployment site (Shen et al. 2016; Staines et al.

2015; Viehman et al. 2015), along with DIDSON acoustic imaging data nearfield of a similar turbine (Viehman and Zydlewski 2015).

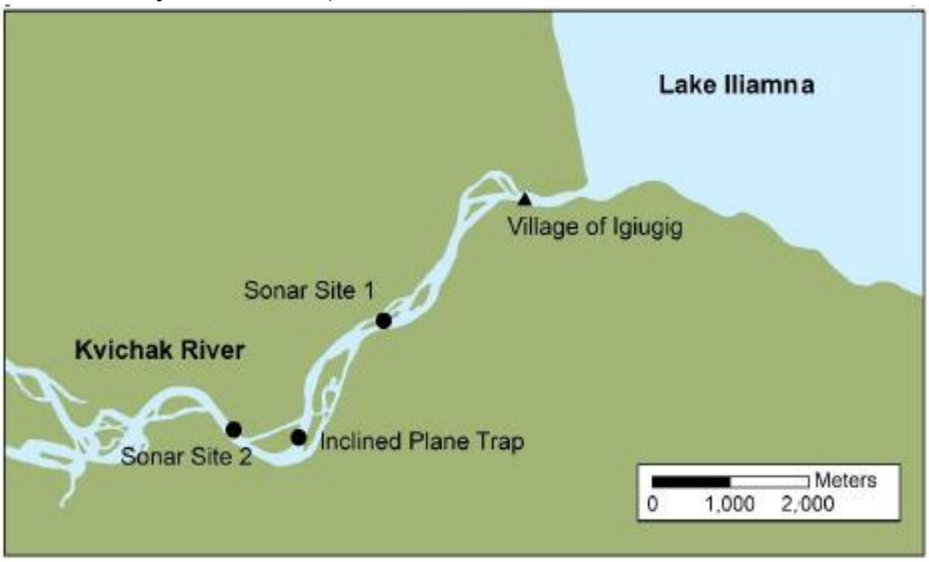

Figure 1: The Kvichak River, Iliamna Lake in Southwestern Alaska, showing locations of sonar sites 1 and 2 operated near the village of Igiugig, 2015 (Report : Sockeye salmon smolt abundance and inriver distribution: results from the Kvichak, Ugashik, and Egegik rivers in Bristol Bay, Alaska, 2015)

A major difference between the datasets includes the LGL data being specific to sockeye salmon smolts at sections that cross the river. The Cobscook data were single locations within the cross-section and included any species present in the Bay at the time. UMaine researchers expected, based on the LGL reports (Priest et al. 2015; Wade et al. 2013), that sockeye smolt numbers by depth bin could be used to determine the probability of individual smolts being at the depth of turbine foils at the IVC site. As such, these could be examined to determine whether or not the number of smolts at similar depths at the two monitoring sites were significantly different. Because the dataset included 8 years of data it may even allow predictability on how encounters would vary based on annual and daily (day-night) differences. However, all years of data, specified by depth bin would be required to develop a full model.

During this project period the data were only available in report form. Contact was made with LGL to work collaboratively with raw data, but agreements regarding data sharing between LGL, UMaine and BBSRI were not reached. As such, UMaine researchers attempted to extract smolt numbers to assess the feasibility of using those values to develop a probability of encounter model.

Available data and methods

Hydroacoustic data from the location of the two sonar arrays downstream of the turbine deployment site in the Kvichack River (Figure 1) were examined from Wade et al. (2013) and Priest et al. (2015). Along with smolt numbers at the designated sites, the depth of the turbine must be used to establish an area of the water column “at risk”, where the probability of encounter between smolts and the turbine should be estimated. The depth of the turbine at the Village deployment site is known (Figure 2) and the bottom profile of the deployment site is needed (and ORPC is reviewing existing data). The bottom profile would be used to compare the profiles at the two sonar sites (Figure 3) to test the hypothesis that the vertical distribution of smolts at site 1 and 2 would be comparable to that at the deployment site. Using the position of the RivGen in the deployment site (Figure 2), the hypothetical position/impact area was extrapolated for LGL sites 1 and 2 and added to the depth profiles (Figure 3).

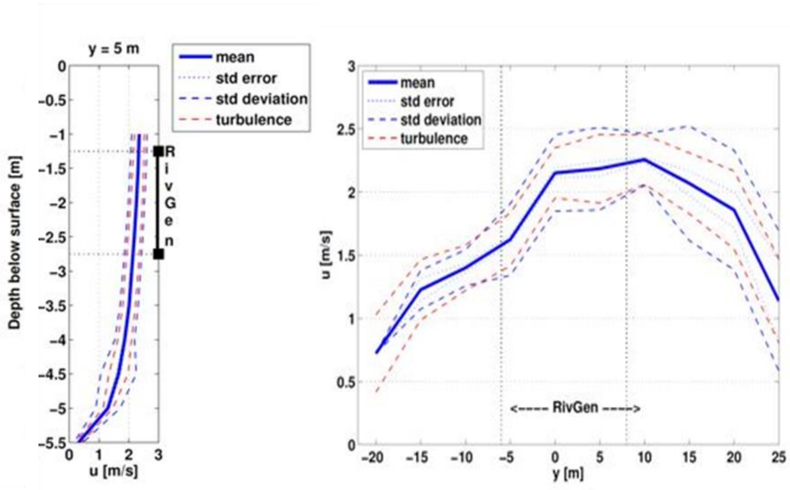

Figure 2: Depth (left panel) and cross-channel position (right panel) of the RivGen at the deployment site in Igiugug Village. Figure from ORPC.

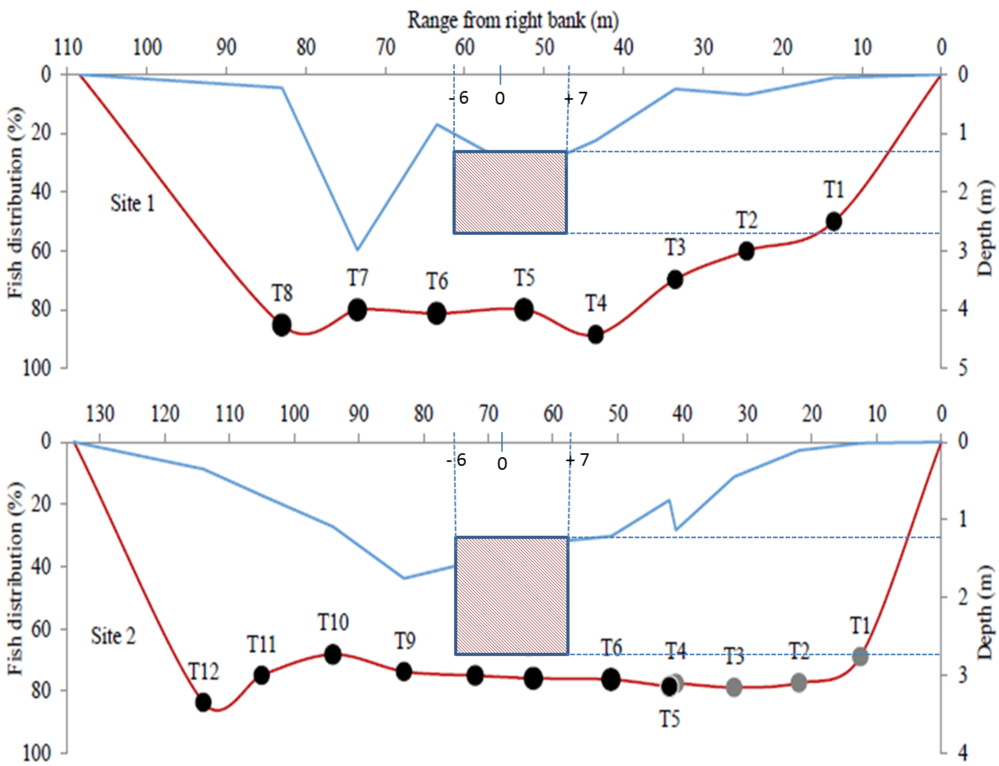

Figure 3: Cross river distribution of sockeye salmon smolts (blue line), interpolated river bed profile (red line), transducer locations (T point labels) and hypothetical RivGen® location/impact (Red hashed box) in the Kvichak River. Smolt data and river profile are extrapolated from Priest et al. 2015 and RivGen® position is extrapolated from ORPC data (Figure 2).

The optimal dataset to use for the probability of encounter model would be the **number of smolts/h/m** of river cross section sampled **at each pod** in each **0.2 m depth bin**, for **each site**, for **all days deployed**, in each **year** (Table 1).

Table 1: Example of exported data organization (column headers) which would fit to the probability of encounter model.

Year	**Date**	**Time (hour bins)**	**Site (1 or 2)**	**Echosounder/pod name/number**	**Depth (0.2m depth bins)**	**Number of smolts**

Data extrapolated from available reports

2012 data

Using the data from the BBRSI (LGL) report from 2012 (Wade et al., 2013), we were able to relate tables and figures and generate usable data (Appendix I):

- Transducer pod smolt distribution percentage plots from the report (Figure 4 and AI.1) have been converted into percentage of smolts by pod (Tables AI.2 and AI.3). In addition, smolt depth distribution plots (Figure 4 and AI.2) have been converted to percentage of smolts by depth during the night and day (Table AI.4). **The conversions of the plots to values are only estimates. The raw data would provide more accurate values for the probability of encounter model.**

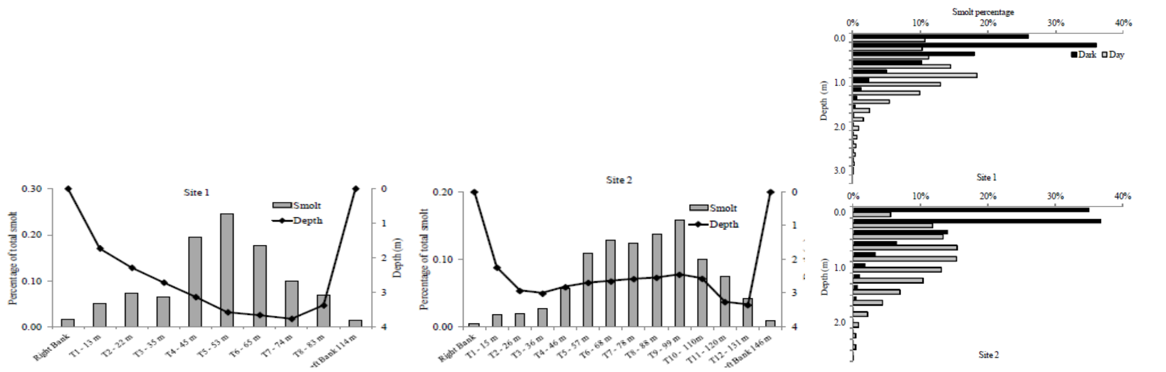

Figure 4 (AI.1 and AI.2): Water depth and percent distribution of sockeye salmon smolts at Site 1 (left) and Site 2 (center) sonar pods on the Kvichak River in 2012, showing pod distances (m) from right bank. Vertical distribution of sockeye salmon smolts migrating at night and day at sites 1 (up) and Site 2 (down) on the Kvichak River in 2012 (right).

- Applying these percentages to the daily smolt number by site (Table AI.1), we were able to obtain a **daily number of smolts by site, by pod,** and period of day (night and day), **by 0.2m depth bins** (extrapolated data are in Table AI.5)**.**
- The hypothetical presence of the turbine for each site has been added as a function of the location and the depth of the RivGen®.
- Since this is only one year of graphically extrapolated data, a full probability of encounter model could not be developed. In the interim, a generalized linear model (GLM) was used to examine the following facts as they influence smolt presence in the 2012 dataset:

$$\boldsymbol{number\ of\ smolts \sim Date + Depth + Pod + Site + Turbine + Turbine * pod + Turbine * Depth}$$

- This model was selected with the help of AIC (Akaike information criterion), the smaller the AIC is, the most the better the data fit to the model:

	AIC
Null	352649.1
Date	349379.1
Date + Depth	347355.8
Date + Depth + Pod	346949.7
Date + Depth + Pod + Site	346853.9
Date + Depth + Pod + Site + Turbine* Pod	346826.1
Date + Depth + Pod + Site + Turbine*Pod + Turbine*Depth	**346779.7**

- This model was used to compare smolt presence in the NULL model of $\boldsymbol{number\ of\ smolts \sim 1}$ to determine which variables (day, depth, river location, turbine depth) explained the greatest variability in the number of smolts.

The results of the GLM are summarized in the Table below. Df are the degrees of freedom for the test, deviance is the difference from the null model, the F-value is the test statistic and the p-value indicates significance from the null model:

	Df	Deviance	Resid.	Df	F-value	p-value
Null model	14559	2.81E+13				
date	25	5.74E+12	14534	2.24E+13	178.4477	<2.2E-16
depth	13	2.94E+12	14521	1.95E+13	175.9172	<2.2E-16
pod	11	5.64E+11	14510	1.89E+13	39.8671	<2.2E-16
site	1	1.26E+11	14509	1.88E+13	98.3097	<2.2E-16
turbine	1	2.15E+10	14508	1.88E+13	16.6789	4.45E-05
pod * turbine	4	6.98E+10	14504	1.87E+13	13.5613	4.90E-11
depth * turbine	7	3.50E+10	14497	1.86E+13	3.8857	0.0003094

- All the tested variables in the model were significant, indicating that the number of smolts was significantly different where the theoretical turbine would be present, and this variability is linked to the depth and the pod (turbine location dependent to the pod and the depth). However, the p-value indicates that the turbine variable explains the least variability in smolt presence.
- The data between sites were highly significantly different, which is not ideal if we want to assume that the depth distribution of site 1 and 2 is similar to the one where the turbine was deployed near the Igiugig Village.
- This approach shows some promise in terms of using these data to assess overall risk of salmon encounter with the turbine. However, the data put into the model was highly uncertain, and one year of data limit its utility.

2015 data

Data from the BBRSI (LGL) report from 2015 (Priest *et al*, 2015) were presented differently (Figure 5) than the 2012 report (Figure 4). We had more difficulties relating tables and figures to usable data for data in this report (Appendix II):

- Smolt cross-sectional distribution percentage plots (Figure AII.1) were converted into percentage of smolts by pod tables (Tables AII.2 and AII.3) but we were not able to obtain a total smolts distribution of 100% from the data. Instead, converted/extrapolated data resulted in 152% for site 1 and 219% for site 2. We are not sure if there are mistakes in the smolt distribution values by pods in the plots (Figure AII.1) or if we have mistakenly converted them. Regardless, ***these data are unreliable*** (Tables AII.2 and AII.3).

- Smolts distribution plots by depth (Figure AII.2) have been converted into percentage of smolts by depth for site 1 (using daytime data on Table AI.4). The plots (Figure AII.2) are suitable for a general idea of the smolt depth distribution but gain, conversion was uncertain. We managed to convert data for site 1 at day and night but were not able to assign 100% distributions.
- We could not use these wide estimates to model the data in any way. **Raw data are needed to develop a probability of encounter model using 2015 data**.

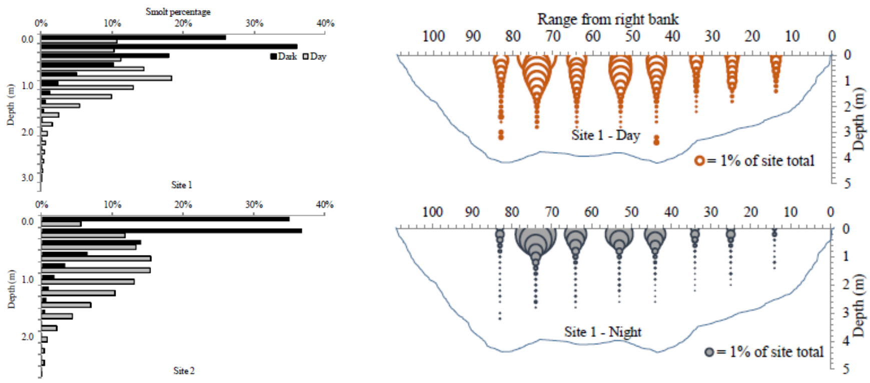

Figure 5: Vertical distribution of sockeye salmon smolts among Kvichak River on site 1 (Report: Sockeye salmon smolt abundance and inriver distribution: results from the Kvichak, Ugashik, and Egegik rivers in Bristol Bay, Alaska, 2015)

Probability of encounter model

A probability of encounter model has not yet been developed due to the uncertainty of the currently available data in hand. However, we feel confident that with the raw data we could estimate the probability that smolts would encounter the deployed device using three probabilities: the probability of smolts being at the device depth when the device is not present at the impact site (p1); the probability of smolt distributions being different between impact and control sites when the device is present (p2); smolt behavior changes to avoid the device when approaching the device (p3). The probability of smolts encountering the device would be calculated as: **p = p1 * (1 - p2) * (1- p3)** and could be further refined with data collected at the Village site, like video data or additional single beam hydroacoustics data.

Characterization of salmon smolt presence

LGL has characterized salmon smolt presence and distributions at sites downstream of the RivGen® deployment site using hydroacoustics (Priest et al. 2015). These data indicate that smolts concentrate in the center of the river both day and night with the majority being near the surface with some deeper distributions during the day. Smolt passage was characterized as higher during night, mostly within six hours of dark. Preliminary analysis of video footage at the RivGen® from 2014 and 2015 indicated multiple events of fish interacting with the turbine with salmon smolts being primarily observed in July and August at night. No evidence of passage delay or behaviors indicating injury or mortality was observed (Priest and Nemeth report to ORPC, November 2015). Raw data from these studies could be used to more specifically determine the probability of similar distributions occurring at the Village deployment site over multiple years and conditions. However, the currently available data do not allow this level of assessment.

Suggestions for monitoring

After reviewing existing data to characterize smolt presence and distribution we propose that collecting fish distribution data using similar hydroacoustic methods at the deployment site as those used downstream of the site would provide the best insight to salmon smolt interactions with the RivGen® Power System. This approach would incorporate the metric established by LGL, number of smolts per 0.2 m bin across the river channel hourly during the smolt run. Data could be collected at the deployment site (immediately upstream and downstream of the device) to enable valuable comparisons with cross-sections of the river where smolts are passing downstream of the site, as enumerated by LGL. LGL’s long term dataset could be used to predict the probability of encounter at the site and newly collected concurrent data at the deployment site would enable validation of the comparisons during earlier time periods. This could enable the assessment of varying levels of risk to salmon smolts in the Kvichak River. Adding empirical data from the nearfield video assessments could add additional information that would even more finely tune the encounter model.

References

Priest, J. T., M. J. Nemeth, J. W. Bures, D. J. Degan, and M. R. Link. 2015. Sockeye salmon smolt abundance and inriver distribution: results from the Kvichak, Ugashik, and Egegik rivers in Bristol Bay, Alaska, 2015. Report prepared by LGL Alaska Research Associates, Inc., Anchorage, AK, and Aquacoustics, Inc. Sterling, AK, for the Bristol Bay Science and Research Institute, Dillingham, AK, 90 pp.

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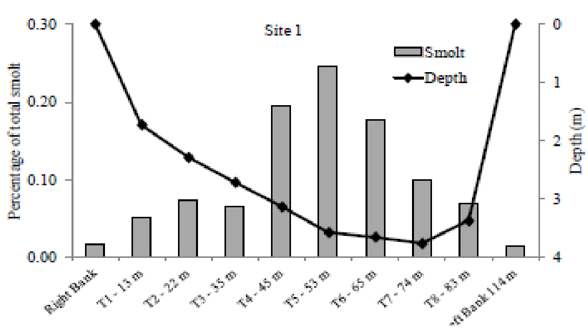
Appendix I: Raw data and figures from BBRSI 2012 report (Wade *et al.*, 2013) converted to usable data.

Table AI.1: Daily abundance and proportion of the seasonal abundance of sockeye salmon smolts at Site 1 (left) and 2 (right) on the Kvichak River, 2012.

Site 1		
Date	Daily	95% CI
24-May	105308	60838
25-May	3751124	816501
26-May	5927745	2192695
27-May	12268596	3205921
28-May	4135645	964720
29-May	4998516	881960
30-May	6151723	2082674
31-May	3005090	1219932
1-Jun	1388915	538167
2-Jun	781013	200707
3-Jun	377291	84107
4-Jun	382851	57992
5-Jun	650895	150962
6-Jun	433728	173385
7-Jun	363251	62901
8-Jun	350094	67141
9-Jun	204842	38935
10-Jun	335123	73669
11-Jun	545729	105267
12-Jun	489359	79584
13-Jun	121833	24722
14-Jun	284637	80726
15-Jun	1074500	186145
16-Jun	409679	123063
17-Jun	391080	73674
18-Jun	270264	57782

Site 2		
Date	Daily	95% CI
22-May	2661967	1152694
23-May	191437	48846
24-May	141076	36197
25-May	3686681	575671
26-May	5951055	1482534
27-May	12050563	2309981
28-May	2908647	558572
29-May	5797007	806050
30-May	4110241	638155
31-May	2364604	527784
1-Jun	1289810	280605
2-Jun	537752	145101
3-Jun	129009	19889
4-Jun	276054	29375
5-Jun	483167	117547
6-Jun	476712	99727
7-Jun	268187	49521
8-Jun	196419	26063
9-Jun	179017	26647
10-Jun	402874	55281
11-Jun	406742	100393
12-Jun	287547	49140
13-Jun	199164	34169
14-Jun	352320	55629
15-Jun	971592	102825
16-Jun	554209	80892
17-Jun	137784	24018



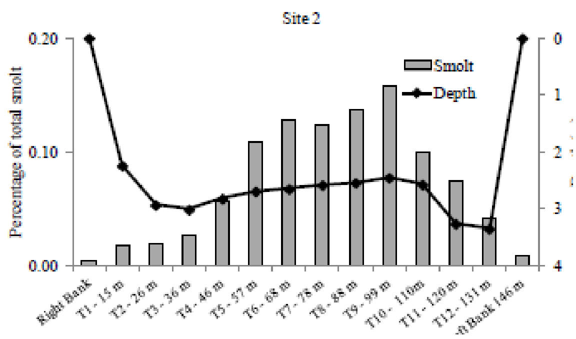


Figure AI.1: Water depth and percent distribution of sockeye salmon smolts at Site 1 (left) and Site 2 (right) sonar pods on the Kvichak River in 2012, showing pod distances (m) from right bank.

Table AI.2: Relative sockeye salmon smolts percentage by pod at Site 1 on the Kvichak River in 2012, estimated with Figure AI.1(left).

	T1	T2	T3	T4	T5	T6	T7	T8
Smolt percentage	6%	8%	6%	20%	25%	18%	10%	7%

Table AI.3: Relative sockeye salmon smolts percentage by pod at Site 2 on the Kvichak River in 2012, estimated with Figure AI.(right).

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
Smolt percentage	3.0%	2.0%	3.0%	5.0%	10.5%	12.5%	12.0%	13.0%	16.0%	10.0%	8.0%	5.0%

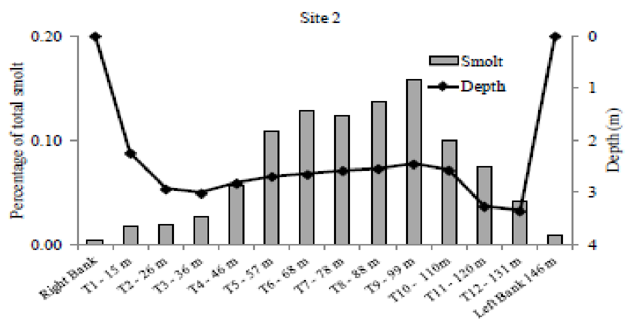


Figure 6. Water depth and percent distribution of sockeye salmon smolts at Site 2 sonar pods on the Kvichak River in 2012, showing pod distances (m) from right bank.

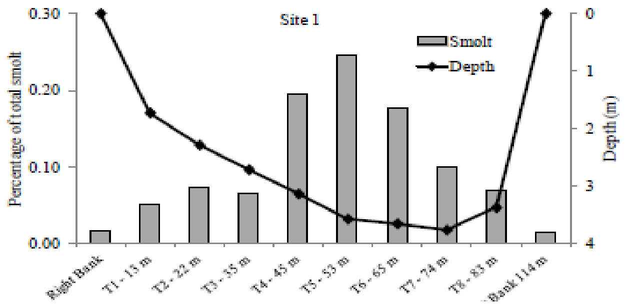


Figure AI.2: Vertical distribution of sockeye salmon smolts migrating at night and day at sites 1 (up) and Site 2 (down) on the Kvichak River in 2012.

Table AI.4: Relative sockeye salmon smolts percentage by depth (0.2m depth bins) at night and day at Site 1 (left) and Site 2 (right) on the Kvichak River in 2012, estimated with Figure AI.2.

Site 1		
Depth	night	day
0.2m depth	26%	11.00%
0.4m depth	37%	10%
0.6m depth	17%	11%
0.8m depth	10%	14%
1m depth	5%	19%
1.2m depth	2%	13%
1.4m depth	1%	10%
1.6m depth	0.50%	6%
1.8m depth	0.20%	3%
2m depth	0.20%	1.00%
2.2m depth	0.20%	0.80%
2.4m depth	0.20%	0.50%
2.6m depth	0.20%	0.50%
2.8m depth	0.20%	0.20%

Site 2		
Depth	night	day
0.2m depth	36.0%	5.0%
0.4m depth	37.0%	12.0%
0.6m depth	14.0%	13.0%
0.8m depth	6.0%	16.0%
1m depth	3.0%	16.0%
1.2m depth	2.0%	14.0%
1.4m depth	1.0%	10.0%
1.6m depth	0.5%	8.0%
1.8m depth	0.0%	4.0%
2m depth	0.0%	1.0%
2.2m depth	0.0%	0.5%
2.4m depth	0.0%	0.5%
2.6m depth	0.0%	0.0%
2.8m depth	0.0%	0.0%

Table AI.5: Preview of the usable data pulled from the report: **number of smolt by day, by site, by pod, by 0.2m depth bins**. The hypothetical location/impact of the turbine is also indicated.

Date	depth	Smolt number	pod	site	moment	turbine
24-May	0.2m	1643	T1	1	night	N
24-May	0.4m	2338	T1	1	night	N
24-May	0.6m	1074	T1	1	night	N
24-May	0.8m	632	T1	1	night	N
24-May	1m	316	T1	1	night	N
24-May	1.2m	126	T1	1	night	N
24-May	1.4m	63	T1	1	night	N
24-May	1.6m	32	T1	1	night	N
24-May	1.8m	13	T1	1	night	N
24-May	2m	13	T1	1	night	N
24-May	2.2m	13	T1	1	night	N
24-May	2.4m	13	T1	1	night	N
24-May	2.6m	13	T1	1	night	N
24-May	2.8m	13	T1	1	night	N
…	…	…	…	…	…	…
12-Jun	0.2m	22902	T6	1	night	N
12-Jun	0.4m	32591	T6	1	night	N
12-Jun	0.6m	14974	T6	1	night	N

12-Jun	0.8m	8808	T6	1	night	N
12-Jun	1m	4404	T6	1	night	N
12-Jun	1.2m	1762	T6	1	night	Y
12-Jun	1.4m	881	T6	1	night	Y
12-Jun	1.6m	440	T6	1	night	Y
12-Jun	1.8m	176	T6	1	night	Y
12-Jun	2m	176	T6	1	night	Y
12-Jun	2.2m	176	T6	1	night	Y
12-Jun	2.4m	176	T6	1	night	Y
12-Jun	2.6m	176	T6	1	night	Y
12-Jun	2.8m	176	T6	1	night	N
…	…	…	…	…	…	…
18-Jun	0.2m	676	T12	2	day	N
18-Jun	0.4m	1622	T12	2	day	N
18-Jun	0.6m	1757	T12	2	day	N
18-Jun	0.8m	2162	T12	2	day	N
18-Jun	1m	2162	T12	2	day	N
18-Jun	1.2m	1892	T12	2	day	N
18-Jun	1.4m	1351	T12	2	day	N
18-Jun	1.6m	1081	T12	2	day	N
18-Jun	1.8m	541	T12	2	day	N
18-Jun	2m	135	T12	2	day	N
18-Jun	2.2m	68	T12	2	day	N
18-Jun	2.4m	68	T12	2	day	N
18-Jun	2.6m	0	T12	2	day	N
18-Jun	2.8m	0	T12	2	day	N

Appendix II: Raw data and figures from BBRSI 2015 report (Priest *et al.*, 2015). Trial to convert it to usable data.

Table AII.1: Daily abundance and proportion of the seasonal abundance of sockeye salmon smolts at Site 1 (left) and 2 (right) on the Kvichak River, 2015.

Site 1		
Date	Daily	95% CI
15-May	NA	NA
16-May	234640	191590
17-May	616968	292131
18-May	355476	123885
19-May	2553086	1149969
20-May	793005	167579
21-May	447158	202501
22-May	1452886	537840
23-May	698542	184309
24-May	442587	145390
25-May	2223924	750022
26-May	4860983	2362957
27-May	1105964	454290
28-May	170497	59318
29-May	2044141	729799
30-May	1418469	647348
31-May	678182	265432
1-Jun	786319	294041
2-Jun	518104	187712
3-Jun	721607	241653
4-Jun	632442	218654
5-Jun	1184138	327403
6-Jun	969943	238352
7-Jun	314208	117415
8-Jun	155756	32179
9-Jun	1508518	386035

Site 2		
Date	Daily	95% CI
15-May	NA	NA
16-May	NA	NA
17-May	NA	NA
18-May	NA	NA
19-May	NA	NA
20-May	NA	NA
21-May	15139	5859
22-May	1027497	159635
23-May	780567	106113
24-May	357753	50072
25-May	2055605	300070
26-May	4563367	517723
27-May	1351982	178803
28-May	91764	21664
29-May	472636	92030
30-May	1134056	556567
31-May	366381	110779
1-Jun	575714	171367
2-Jun	422225	150175
3-Jun	470421	103282
4-Jun	455883	83602
5-Jun	457235	91466
6-Jun	901431	130007
7-Jun	292848	143373
8-Jun	114307	17420
9-Jun	744970	128261

10-Jun	1707463	649434
11-Jun	264103	61183
12-Jun	408956	110868
13-Jun	99939	41948

10-Jun	1560205	656560
11-Jun	121020	41352
12-Jun	65311	15817
13-Jun	65405	22289

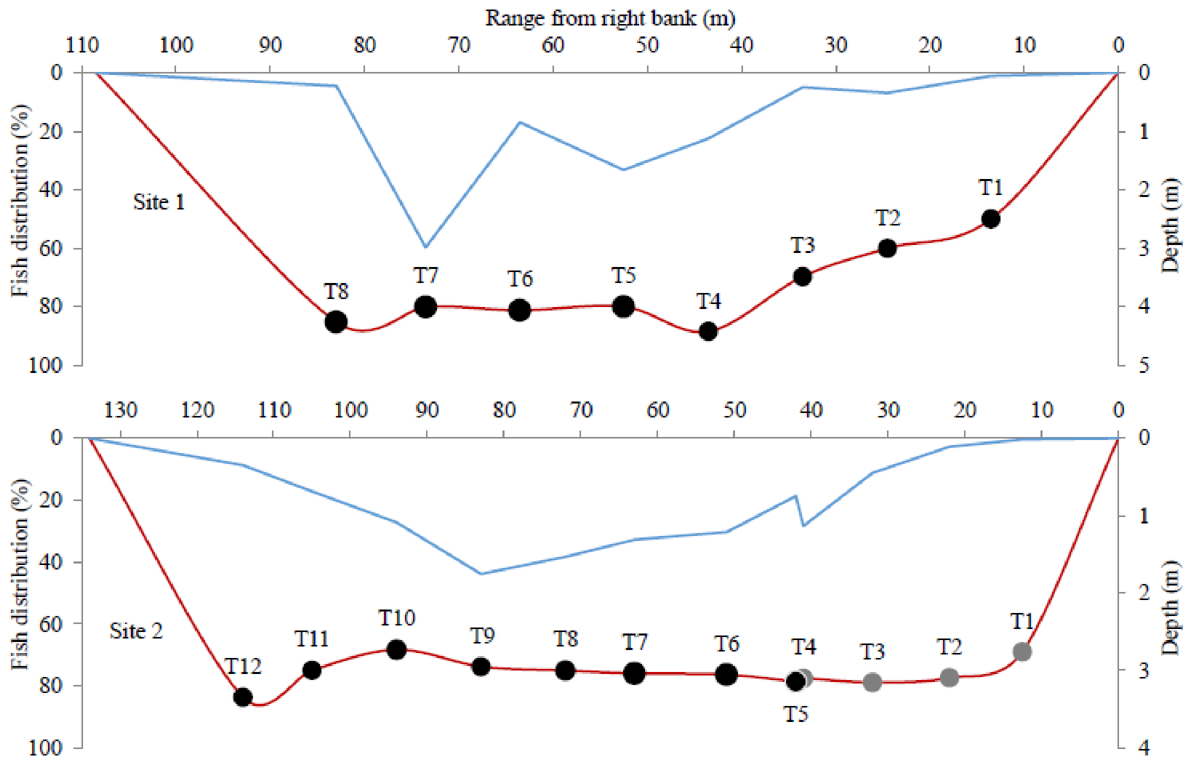


Figure AII.1: Water depth and percent distribution of sockeye salmon smolts at Site 1 (up) and Site 2 (down) sonar pods on the Kvichak River in 2015, showing pod distances (m) from right bank.

Table AII.2: Relative sockeye salmon smolts percentage by pod at Site 1 on the Kvichak River in 2015, estimated with Figure AII.1(up).

	T8	T7	T6	T5	T4	T3	T2	T1	total
smolts distribution	5%	60%	15%	35%	20%	10%	5%	2%	152%

Table AII.3: Relative sockeye salmon smolts percentage by pod at Site 2 on the Kvichak River in 2012, estimated with Figure AII.1 (down).

smolts distribution	T12	T11	T10	T9	T8	T7	T6	T5	T4	T3	T2	T1	total
	10%	15%	30%	45%	0%	32%	30%	20%	25%	10%	2%	0%	219%

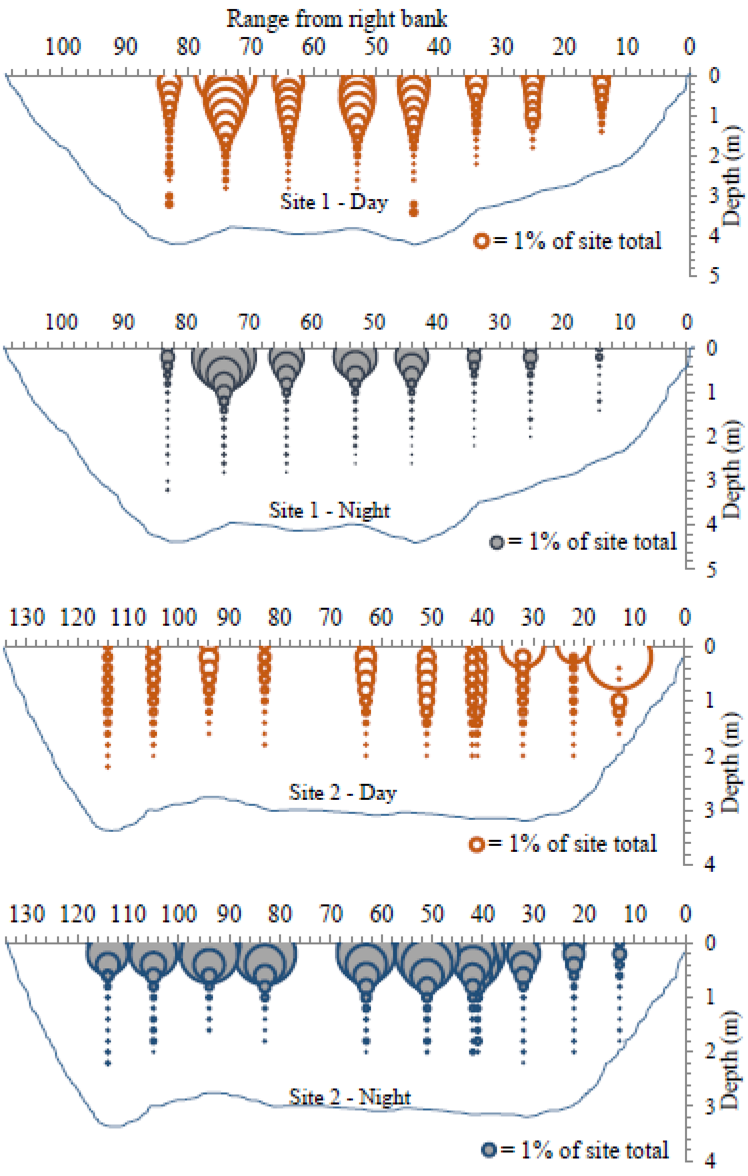


Figure AII.2: Vertical distribution of sockeye salmon smolts migrating at night and day at sites 1 (up) and Site 2 (down) on the Kvichak River in 2015.

Table AII.4: Relative sockeye salmon smolts percentage by depth (0.2m depth bins) at day at Site 1 on the Kvichak River in 2015, estimated with Figure AII.2.

DAY	**T8**	**T7**	**T6**	**T5**	**T4**	**T3**	**T2**	**T1**	**total**
0.2m depth	3%	10%	5%	5%	5%	3%	5%	1%	37%
0.4m depth	2%	7%	4%	5%	5%	1%	5%	1%	30%
0.6m depth	1%	8%	4%	5%	3%	0.50%	1%	0.50%	23%
0.8m depth	0.80%	7%	3%	3%	2%	0.50%	1%	0.50%	18%
1m depth	0.50%	5%	2%	1%	2%	0.50%	0.80%	0.40%	12%
1.2m depth	0.50%	3%	1%	0.50%	1%	0.50%	1%	0.30%	8%
1.4m depth	0.50%	1%	0.50%	0.40%	0.50%	0.30%	0.50%	0.20%	4%
1.6m depth	0.40%	0.50%	0.40%	0.30%	0.40%	0.20%	0.30%	0.20%	3%
1.8m depth	0.40%	0.40%	0.30%	0.30%	0.30%	0.20%	0.20%	0%	2%
2m depth	0.50%	0.30%	0.20%	0.10%	0.20%	0.20%	0.30%	0%	2%
2.2m depth	0.60%	0.30%	0.20%	0.10%	0.20%	0.20%	0%	0%	2%
2.4m depth	0.30%	0.30%	0.20%	0.1	0.20%	0%	0%	0%	11%
2.6m depth	0%	0.20%	0.10%	0%	0.00%	0%	0%	0%	0%
2.8m depth	0.50%	0%	0%	0%	0%	0%	0%	0%	1%
3m depth	0.50%	0%	0%	0%	0.30%	0%	0%	0%	1%
3.2m depth	0%	0%	0%	0%	0.50%	0%	0%	0%	1%
3.4m depth	0%	0%	0%	0%	0%	0%	0%	0%	0%
3.6m depth	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total	12%	43%	21%	31%	21%	7%	15%	4%	153%