

Video Capture of Recreational Fishing Effort in Area 2W to Improve Creel Estimates of Effort and Catch



Prepared for:
The Pacific Salmon Commission Northern Fund
NF-2012-I-19

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25 January 2014

Executive summary

The monitoring of fishery catch and effort on Haida Gwaii is important for management of BC salmon stocks. The commercial catch is monitored by DFO through dockside monitoring programs, while the recreational fishery in Areas 1 and 2 has been monitored through the Haida Fisheries Program (HFP) Creel Program and DFO's Log Book Program for commercial Lodge operators. As part of the HFP Creel Program, fishing effort is estimated using boat counts conducted from a float plane flying over the fishing grounds which are then expanded to the total number of boats fishing based on fishing activity pattern determined from angler interviews. Rising costs have reduced the number of overflights and therefore the reliability of the estimate of fishing effort, particularly in Area 2W.

The Haida Fisheries Program (HFP) received a Pacific Salmon Foundation Northern Fund grant to purchase and test the use of remote video cameras to enumerate recreational fishing vessels, and therefore fishing effort, in Cartwright (2C) and Rennell Sound (2D) portions of Area 2W. After installation of the camera systems and a number of setbacks during the 2012 and 2013 creel seasons (June-Sept), HFP was able to compare video derived boat counts to overflight derived boat counts. Comparison of counts for 2013 revealed that the effort estimates derived from video were not significantly different from those derived using the overflights. Precision of the estimates varied across month and Area but it is expected that with more days counted using video than is feasible using overflights, precision will improve using video. Where the video system proves superior is in costs.

The results give us confidence that the video program is a suitable replacement for the overflight program and HFP recommends switching to video counts in 2014.

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Introduction

The monitoring of fishery catch and effort in Haida Gwaii is important for management of BC salmon stocks. The marine environment around the archipelago has important feeding grounds and supports both commercial and recreational fisheries on a variety of passing and resident fish species (halibut, Chinook and Coho salmon, for example). The commercial catch is monitored by DFO through dockside monitoring programs, while the recreational fishery in Areas 1 and 2 has been monitored through the Haida Fisheries Program (HFP) Creel Program since 1995. The HFP Creel Program, designed by LGL Limited and patterned after the Georgia Strait Creel Program, provides information about the effort (number of boats fishing) as well as catch and release estimates for the major species of salmon and groundfish.

In recent years, the North Coast Stock Assessment Division of Fisheries and Oceans Canada, has also utilized the HFP Creel Program as an in-season indicator for management of commercial troll fisheries. Catch and effort data collected during the first half of the season (June to mid July) is forwarded to DFO North Coast Stock Assessment and provides estimates of overall recreational catch and an indication of Upper Skeena River Coho stock strength.

Fishing effort (boat counts) in Area 1 and 2 West is currently estimated using boat counts conducted from a speed boat (Area 1) and a float plane flying over the fishing grounds (Area 2W). Each month, the desire is to obtain counts of recreational boats fishing on weekdays and weekend/holiday days, with a targeted minimum of 6 weekdays and 2 weekend days counted per month (Searing and Bocking 1996). The overflights which typically take less than 2 hours to complete are timed to coincide with when the most fishing activity occurs during the day. The counts of boats from the overflights are then expanded to the total number of boats fishing that day using activity patterns generated from angler interviews (Searing and Bocking 1996).

Unfortunately, the budget for the HFP Creel survey has been static for the past 12 years, while the cost of overflights to obtain the boat counts has increased by more than 300% since the mid 90's. To stay within budget, the number of over-flight boat counts has been reduced to 6 per month for combined weekday and weekend/holidays. Fewer flights has resulted in a smaller sample size used to estimate fishing effort, which has consequently increased uncertainty in the catch estimates generated by the HFP Creel Program. Since availability of aircraft on Haida Gwaii and weather are factors for being able to conduct the overflights, there have been cases when an insufficient number of days have been counted for the estimation of effort. For example, in some years (e.g. June 2013 for Area 2 West), no days were counted in the month which has necessitated using counts of boats from the angler interviews as a minimum estimate of the number of boats fishing. As rising costs threaten the reliability of these estimates, the use of video counting offers the potential to significantly reduce the annual program operating costs and in turn increase the reliability of recreational catch estimates generated by the HFP Creel Program.

The overall objective of this PSC project was to test the use of remote video cameras to enumerate recreational fishing boats fishing in Cartwright Sound (2C) and Rennell Sound (2D) of Area 2W. Since all fishers must pass through Skidegate Channel and Shields Bay on their way to and from the fishing grounds, these camera systems have the ability to sample 100% of

the boat traffic traveling to and from these fishing areas on all days of the month and fishing season thereby potentially increasing the accuracy and precision of estimated recreational fishing effort. If proven effective, the use of these cameras would reduce annual operational costs by approximately \$15,000 while providing an improved total estimate of fishing effort.

For Area 1, it is the intention of the HFP to continue to use boat counts via speed boat to obtain estimates of fishing effort and there is no opportunity for the use of video surveillance in this area.

At the outset, two key objectives were proposed for this PSC project:

1. Purchase and deploy a fixed-station solar powered security camera system to enumerate recreational boat traffic heading to Cartwright Sound and Rennell Sound; and
2. Compare HFP Creel Program estimates of recreational fishing effort generated from traditional over flight boat counts and the new security camera system for Areas 2C and 2D.

Methods

Video system description

In 2012, HFP used the PSC Northern Fund grant to purchase equipment and build two solar charged battery operated Digital Video Recorders (DVR). The electronic equipment is encased in a weather proof aluminum box with a security cage (Figure 1). Each unit has a Geo-Vision DVR with a terabit hard drive, Minitron hi-res colour 220x zoom digital camera (in weather proof housing), 100' camera cables, two 12 volt Marine deep cycle batteries, Blue Sky Energy Solar Boost solar charger, Morning Star SunSaver dusk to dawn load controller, Blue Sky Energy IPN ProRemote display controller, four 35m solar cables and two Canadian Solar 10 AWG RWU Outdoor photovoltaic panels (see Appendix 1 for detailed budget tracking).



Figure 1 Video creel system. Solar charging components, batteries and DVR enclosed in an aluminum weather proof box that is bolted to a concrete pad.

Haida Fisheries applied for and received a Licence of Occupation and tenure at our field sites in east Skidegate Narrows (2C) and Rennell Sound (2D). We built two concrete pads at each location to mount each video system and solar panels (Figure 2). The camera at each site was mounted in a tree and adjusted to capture all passing boat traffic in the field of view.



Figure 2 Solar panels mounted to a concrete pad.

Video data collection and review

In 2012, the video systems were not fully operational until September which did not allow for a proper evaluation of the data collected by video compared to the data collected by the overflights. However, 2012 did allow for the systems to be fully tested in preparation for a full evaluation in 2013.

In 2013, both the overflights and cameras were operated over a sufficient period to allow for a comparison of the two methods. The video systems were operational from the first week of June until the middle of September when the HFP Creel Program is finished for the year. HFP had set the video cameras to record boat traffic daily from dawn to dusk. However, each unit had a dawn to dusk load controller built into the system, which preserves the life of the battery by preventing draw down on the battery. This meant that the unit would not turn on until there is enough light in the morning to charge the batteries and the unit would shut down as light levels diminish in the evening. This was typically 1-1.5 hours after first light and before sundown. Regardless we still recorded 12-14 hours of boat traffic per day. Every 10-14 days HFP staff would head out into the field and exchange the DVR hard drives in each unit.

Video from the field units was reviewed by HFP technicians at the HFP offices. Technicians watched video from each of the two fixed-stations (Rennell Sound and Skidegate Narrows) on most days where there was a scheduled overflight. They also reviewed 4-10 extra days video each month from each location making sure the dates were the same. It typically took 1.5-3 hours for a technician to review 12 hours (or one day) of video. Technicians recorded the day of the

counts, the time the boat went out, the time the boat came back in, the type of vessel (recreational fishing, commercial fishing, tug, sailboat or other) and gave a brief description of the boat. All information was recorded on paper and then entered into Microsoft Excel.

Flight boat count

HFP has used over flights to count recreational fishing boats to estimate fishing effort since 1996 in Area 2W. Typically, HFP would charter a float plane and fly over the fishing grounds at the same time of day about 6-8 days per month (stratified by weekday and weekend/holiday). During the flight, staff would differentiate and record the number of boats in the designated regions (2A, 2B, 2C and 2D) (Figure 3). There were no float plane flights out of Queen Charlotte during the month of June 2013 and so no overflights were conducted during this month. For June, estimates of effort and catch, in the absence of video counts, were derived using information from angler interviews which is known to produce an underestimate (Searing and Bocking 1996). HFP also experienced some technical issues with the video units in June. Accordingly, June data were not included in the analyses.

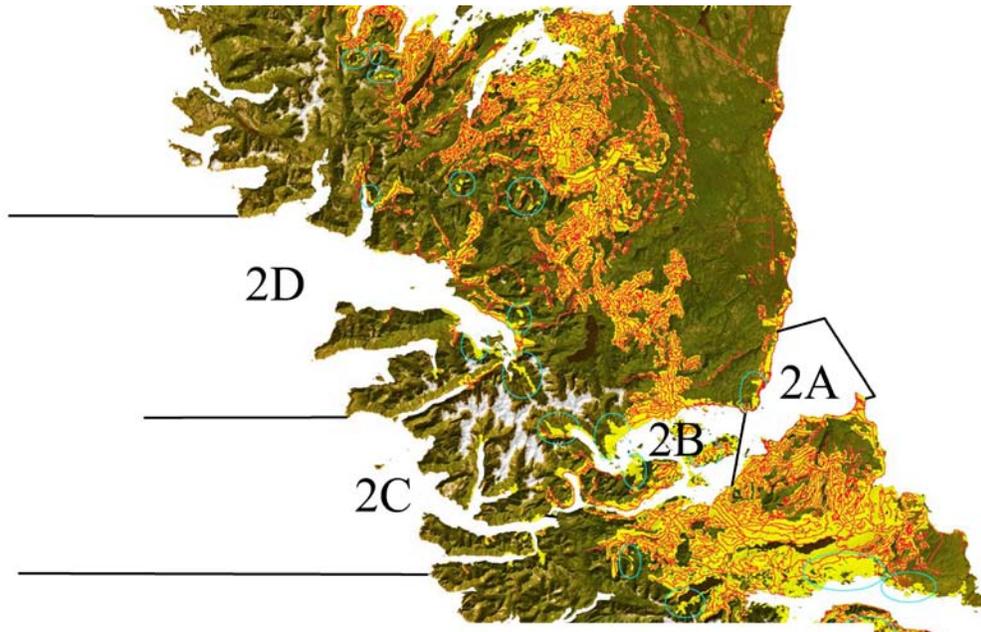


Figure 3 Map showing the Creel sub areas. Area 2A (Sandspit), 2B (East Skidegate Narrows), 2C (Cartwright Sound) and 2D (Rennell Sound).

Data analysis

We partitioned the overflight and video data into a couple different subsets: 1) Match Days (i.e., days that had both overflight and video data) and 2) All Days. Using the overflight data, we calculated the average “number of boats/day type/month” in each of the two regions which was then expanded to an estimate of the total number of boats fishing for the entire month for that day type using the activity pattern generated from angler interviews. We also calculated the total number of boats fishing in each of the two regions for the entire month for weekdays only using the video count data but without adjusting for activity pattern since it is assumed that all boats counted by the video fished in the target area on the day they were counted. The video systems count boats heading to the fishing area as well as returning from the fishing area. We chose to

use the counts of boats returning as the metric for estimating the number of boats. On three dates in August and 2 dates in September for Area 2D, the number of boats returning was zero but the number of boats heading out was one or two. For these days, we used the number of boats heading out, assuming that the video review missed the return of the boats.

Estimates were made only for weekdays as insufficient video and flight data were available for the weekends and holidays to allow for a proper comparison. It is important to note that because of this the estimates of effort and catch presented in this report are not comparable to those generated inseason as part of the HFP Creel Program in 2013 where only overflight data were used and estimates were summed across the weekday and weekend strata. The algorithms used in the HFP Creel Program to project catch for each species take into account a number of factors that are not included here for the comparison of video counts and flight counts where only the methods for generating the estimates of effort differ.

Two comparisons of the boat count methods were performed; one using only the Match Days and one using the data for All Days. For Cartwright Sound (2C), there were sufficient data to conduct the Match Day comparison for July and August (n=3 for each month). One additional day of Match Day data for Area 2C in August was not used in the analyses because of a large, as yet unexplained, discrepancy between the two counts (17 for video versus 3 for overflight). Although there was one Match Day in September for Area 2C, this was not used to generate estimates of the number of boat days per month, but it was used for examining the correlation between the two count methods (n=10). For Rennell Sound (2D) there was only sufficient data to conduct the Match Day comparison for August (n=3). For the comparison between the two boat count methods using the All Days data, sample sizes were larger and are provided in the results section.

We also compared estimates of Chinook and Coho catch generated using the video counts and the flight counts by multiplying the number of boats fished per daytype/month times the Catch per Effort (CPE) derived from the angler interviews for the HFP Creel Program for weekdays for each month.

Standard errors around the estimates of boats fishing per month were also produced for each method.

There are several key assumptions made when using video counts of boats to estimate fishing effort each month. These are:

- All boats classified as recreational fishing boats returning by the video are in fact recreational fishing boats that fished that day on the fishing grounds;
- No lodge boats are counted by video since these are also not counted by the overflights;
- The CPE derived from the HFP Creel Program interviews for Area 2C and 2D are representative of the CPW for the recreational boats counted by the video; and
- A sufficient number of days for each Area, day type and month are counted for boats by the video system such that the bias in the estimates of effort is equal to or lower than the bias in the estimates of effort for the overflight method.

Results

The count data obtained in 2013 using the video systems is provided in Appendix 2. The video systems recorded boat traffic in sub Areas 2C (Cartwright Sound) and 2D (Rennell Sound). There were no overflights conducted in June (except 1 for Area 2D), 6 (5 on weekdays) overflights in July, 6 (4 on weekdays) overflights in August, and 3 (2 on weekdays) overflights in September (first half only). A total of 37 days of video were reviewed for sub area 2C and 18 days were reviewed in 2D. The number of boats counted on the Matched Day using either methodology (overflight or video) was very similar ($n= 10$, $r^2= 0.95$, $p< 0.01$) (Table 1 and Figure 4).

Table 1 Estimates of boats fishing each day using video and flight count data for which there were separate and independent counts on the same day (week days only). Note that the estimates using flight data are expanded for angler activity patterns.

Area	Month	Date	Boat Count (video)	Boat Count (flight)
2C	July	7/4/2013	15	18.0
		7/9/2013	15	16.8
		7/19/2013	30	26.9
2C	August	8/9/2013	15	19.1
		8/12/2013	25	24.2
		8/22/2013	24	25.4
2C	September	9/10/2013	3	4.0
2D	August	8/9/2013	2	3.6
		8/12/2013	1	2.3
		8/22/2013	5	3.5

¹Note that counts from August 30 for Area 2C were not used in the analysis due to the large unexplained discrepancy (17 versus 3).

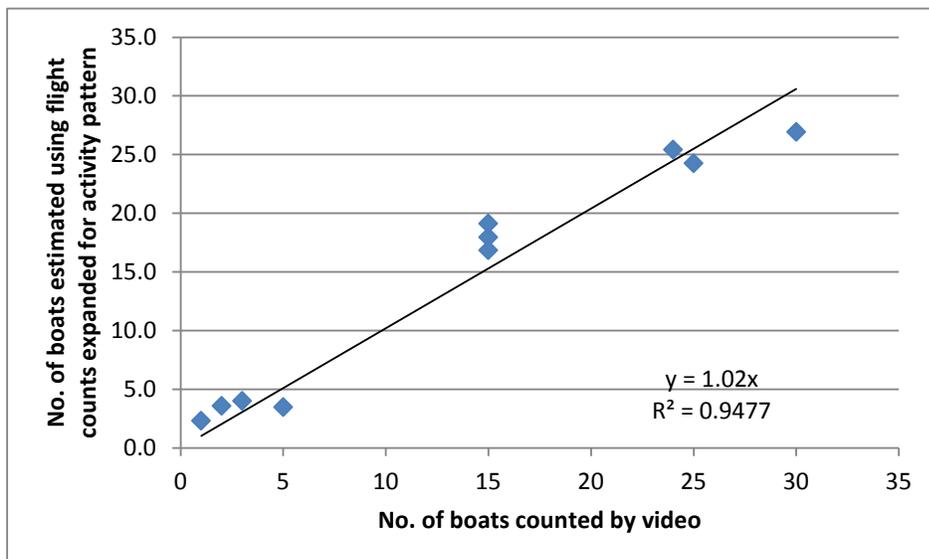


Figure 4 Regression between the number of boats counted by video versus the estimate of boats from flights and activity pattern in Area 2C ($n= 10$, $r^2= 0.95$, $p< 0.001$).

The average number of boats per weekday counted using the video systems and the number of boats estimated from the overflight data for the Match Day dataset were very similar and not statistically different (Table 2).

Table 2 Comparison of the average number of boats/day calculated from video and flight data for weekdays in Area 2C (Cartwright Sound) and 2D (Rennell Sound) using the Match Day dataset. Standard errors are in brackets.

Area	Month	Sample size (n)	Boats/day (video)	Boats/day (flight)	T-Test p value
2C	July	3	20.0 (5.0)	20.6 (3.2)	0.93
2C	August	3	21.33 (3.2)	22.90 (1.9)	0.70
2C	September	1	3.0 (na)	4.0 (na)	na
2D	August	3	2.67 (1.2)	3.1 (0.4)	0.74

The average number of boats per weekday counted using the video systems and the number of boats estimated from the overflight data for the All Days dataset were also very similar and not statistically different (Table 3).

Table 3 Comparison of the average number of boats/day calculated from video and flight data for weekdays in Area 2C (Cartwright Sound) and 2D (Rennell Sound) using the All Days dataset. Standard errors are in brackets.

Area	Month	Video (n)	Video (boats/day)	Flight (n)	Flight (boats/day)	T-Test p value
2C	July	5	18.40 (3.0)	5	19.3 (1.9)	0.81
2C	August	6	19.33 (2.6)	4	17.8 (5.3)	0.80
2C	September	8	6.38 (1.6)	2	8.0 (4)	0.76
2D	August	5	2.8 (0.7)	4	2.4 (0.8)	0.70
2D	September	5	1.4 (0.4)	2	0.5 (0.5)	0.27

Not surprisingly, upon expanding the count data to the total estimate of boats per month (weekdays only), there is little difference between the two methods when using either the Match Day or All Days dataset (Table 4 and Table 5). Given that the average number of boats/day is not statistically different the total estimates of effort per month are not either.

Table 4 Total number of boat trips per month for Area's 2C and 2D estimated from video and overflight data using the Match Day dataset (weekdays only). Standard errors are in brackets.

Area	Month	Sample days (n)	Video	Flight
2C	July	3	440 (105)	453 (67)
2C	August	3	448 (63)	481(39)
2D	August	3	56 (1)	66 (8)

Table 5 Total number of boat trips per month in Area C and Area D estimated from video and overflight the All Days dataset (weekdays only). Standard errors are in brackets.

Area	Month	Video		Flight	
		(n)	(boats/day)	(n)	(boats/day)
2C	July	5	405	5	425
2C	August	6	406	4	373
2C	September	8	57	2	72
2D	August	5	59	4	49
2D	September	5	13	2	5

Table 6 and Table 7 show estimates of catch kept for Chinook and Coho salmon using the different counting methods for effort. Estimates of standard error are not presented because without incorporating the variance due to Catch per Effort, they would not be representative. Nevertheless, as for the total effort estimates, the catch estimates are quite similar and given that the average number of boats/day is not statistically different, the total estimates of catch per month are not either.

Table 6 Estimated number of Chinook and Coho salmon caught and kept per month for Area’s 2C and 2D as estimated from video and overflight data using the Match Day dataset (weekdays only).

Area	Month	Sample days	Chinook Kept		Coho Kept	
			Video	Flight	Video	Flight
2C	July	3	1989	2046	1184	1218
2C	August	3	1676	1800	1187	1276
2D	August	3	110	129	80	94

Table 7 Estimated number of Chinook and Coho salmon caught and kept per month for Area’s 2C and 2D as estimated from video and overflight data using the All Days dataset (weekdays only).

Area	Month	Chinook Kept		Coho Kept	
		Video	Flight	Video	Flight
2C	July	1830	1920	1089	1142
2C	August	1518	1396	1076	989
2C	September	191	240	134	168
2D	August	116	97	84	70
2D	September	0	0	13	9

Discussion

The Haida Gwaii recreational fishery is a major component of the Northern BC AABM chinook fishery and the Creel Program provides a means to estimate both catch and overall Chinook encounter rates in that fishery. Haida Fisheries project, “Video Capture of Recreational Fishing Effort in Area 2W to Improve Creel Estimates of Catch” has met both our stated objectives. Using the PSC Northern Fund grant HFP purchased and deployed solar powered security camera systems in Skidegate Narrows and Rennell Sound to enumerate recreational fishers fishing in Area 2C (Cartwright Sound) and 2D (Rennell Sound).

HFP encountered a number of setbacks and technical problems while setting up the camera systems in 2012. Aside from receiving the equipment well after the Creel season had started in 2012, there serious issues with the electronic and solar components of the video systems. The main issue was caused by malfunctioning Solar Charger's in each unit's power system. It turned out that there had been a manufacturer recall of the charger's micro processors and the company we purchased the equipment from did not have this information before they shipped HFP the units. After concluding that this was the problem, HFP was sent new microprocessors, installed them and the systems worked more or less as designed. In 2012, HFP collected a small sample of video data in September but were unable to make any useful comparisons between count methods. As such, Haida Fisheries asked for and received a one year extension on the project.

In 2013, the airline that HFP used for the overflights changed ownership and was unable to provide flights for the month of June. Regardless, the video equipment was running and appeared to be working flawlessly. At the request of one of HFP's technicians reviewing the video data, HFP increased the resolution on the cameras. Evidentially, the high resolution video proved too much for the DVR, froze the system, indicated that video was recorded on specific dates but ultimately recorded nothing. After trouble shooting and numerous calls to the manufacturer we discovered that even though we increased the resolution within the DVR's own parameters, the software in the machine was unable to process the higher resolution video.

Despite the setbacks HFP were able to meet the projects second objective and was able to compare estimates of recreational fishing effort generated from traditional overflight boat counts to the new video system for Area 2C and 2D. The best data was for the overflight counts from Area 2C and video data from The Narrows. For both the Match Day and All Days datasets the boat counts between methods were very similar and not significantly different. It is also evident from the data that the precision of the estimates will improve with more days counted using video. These results give us confidence that the video program will be a reliable replacement for the overflights in Area 2C and 2D. As stated earlier, the intent is to continue with overflights in Area 1 as there is not feasible replacement.

Where the video systems prove superior to the overflights is costs. A typical overflight costs \$800, which equals about \$4,800 for 6 flights each month; which is the minimum required number. Flights for the whole season cost about \$16,800. With this budget HFP would be able to review substantially more than 6 days of video per month and meet the required sample size for each day type. HFP recommends the use of video counting in 2014. By switching to the video systems exclusively, Haida Fisheries will also be able to improve the precision of estimates of fishing effort in Area 2C and 2D.

The estimates of fishing effort, which can now be provided by our video systems, help to meet a bilateral objective of the parties which is "improvements in estimates of incidental mortality based upon direct fishery observations" (PST Chapter 3, section 3 (b)). And, the results of our video project address Goal 1 of the Northern Fund: 'projects that involve data collection, stock assessment, and research concerning fisheries and stocks in the Northern Fund's geographic area.

Appendix 1. Budget tracking

<u>Retailer/ Product/service</u>	<u>Total Cost</u>	<u>Cost Category</u>
EA-Solar/video/alum. Box	23539.04	Capital
Welder- security cage	1233.71	Site/project
AMS- concrete and supplies	591.37	Site/project
AMS-concrete and supplies	528.08	Site/project
AMS-poly pipe	369.57	Site/project
Malcolm-tech services	360.00	Subcontractor/consultant
BC-tenure application	280.00	Site/project
JOAT- locks	80.00	Site/project
Meegans- Waterline	79.98	Site/project
SSSI- power cord	76.39	Capital
Can post-Ship harddrive	26.73	Site/project
Can post-return burned	9.88	Site/project
AMS- nut/bolts	7.80	Site/project
Delmas Coop- batteries	26.95	Site/project
AMS- 3@ 1.5"x 100' water lines	246.38	Site/project
SSSI- Hard drive and accessories	1084.40	Capital
CT- battery pack, VM, wrench's	392.33	Site/project
Amazon-pelacin case	127.12	Site/project
LGL consulting	1057.00	Subcontractor/consultant
LGL consulting	492.00	Subcontractor/consultant
LGL consulting	2375.60	Subcontractor/consultant
LGL consulting	1810.50	Subcontractor/consultant
	<u>34794.83</u>	

Lisa Edwards
SNW Finance Officer

Jan 20/14

Appendix 2. Video boat count data from the Skidegate narrows (2C) and Rennell Sound (2D). Time out refers to the number of boats headed west and time in is the number of boats headed east.

Date	Day Type 1=Weekday 2=Weekend	Skidegate (2C) Narrows Time Out	Skidegate (2C) Narrows Time In	Rennell (2D) Time Out	Rennell (2D) Time In
6/4/2013	1			2	1
6/5/2013	1	10	7	3	1
6/7/2013	1	7	12		
6/10/2013	1	4	2		
6/12/2013	1	13	11	3	1
6/14/2013	1	20	24		
6/18/2013	1	17	17	2	1
6/25/2013	1	11	15	1	
6/28/2013	1	11	1	5	4
7/4/2013	1	16	15		
7/9/2013	1	19	15		
7/11/2013	1	16	14		
7/14/2013	2	22	14		
7/17/2013	1	19	18		
7/19/2013	1	27	30		
7/20/2013	2	21	22		
8/9/2013	1	2	15	2	
8/12/2013	1	21	25	1	
8/20/2013	1	11	24		
8/21/2013	1	5	9		
8/22/2013	1	14	24	3	5
8/23/2013	1	15	19		
8/24/2013	2	20	25		
8/25/2013	2	8	8	4	6
8/30/2013	1	13	17	4	4
9/4/2013	1	16	13	2	3
9/5/2013	1	2	2		
9/6/2013	1	15	14	1	
9/7/2013	2	11	14	5	6
9/8/2013	2	8	11	4	2
9/9/2013	1	5	4		1
9/10/2013	1	1	3		
9/11/2013	1	5	7	1	1
9/12/2013	1	3	3		
9/13/2013	1	4	5	1	
9/14/2013	2	16	13	1	3
9/15/2013	2	8	8		
9/16/2013	1	1			