‘Namgis Land-Based Atlantic Salmon Recirculating Aquaculture System Pilot Project
Milestone #7
Performance Metrics Report

March 1, 2013 - June 30, 2015

For Tides Canada
Grant #GF01088

KUTERRA

SUSTAINABILITY HAS LANDED

TABLE OF CONTENTS

The Kuterra land-based recirculating aquaculture system Atlantic salmon fish farm.

Executive Summary

The following report summarizes the performance of the first three commissioning cohorts of Atlantic salmon grown in the 'Namgis Land-Based Atlantic Salmon Recirculating Aquaculture System (RAS) Project. The reporting period extends from the introduction of smolts to Kuterra's facility in March 2013, to the completion of the harvest of the third cohort in June 30, 2015. Sales of fish commenced part-way through this reporting period, on April 22, 2014.

The purpose of this report is to provide data to enable readers to objectively assess the potential of land-based closed containment aquaculture. At the outset of the project, a multi-stakeholder Technical Advisory Committee to the Tides Canada Salmon Aquaculture Innovation Fund developed the production, environmental, financial, and social performance metrics that were to be recorded and reported by the project.

The facility is the first RAS fish farm designed and built in North America specifically to grow Atlantic salmon to market size (3-5kg) for sale as food fish, at a commercial pilot demonstration scale . Production volume was increasing through the reporting period. It is expected to reach 400MT per annum at steady state. The CAPEX to June 30, 2015 totaled $8.9 million. Operating costs totaled $1.7 million during the inventory build-up period before sales commenced. Innovations developed for the project include handling and grading equipment, in-tank CO_2 stripping, heating and cooling systems, and a low-head oxygenation system. A report titled "Capital Cost Retrospective Report" is available on the Tides Canada website at www.tidescanada.org/programs/salmon-aquaculture-innovation-fund.

Although the quarantine system began operating in March 2013 with the arrival of the first smolts, the growout portion of the farm was not completed until December 2013, at which point the heating system was turned on. The first cohort was limited to 23,000 smolts, the second 33,000, and the third 40,000 in order to slowly ramp up production and accommodate commissioning. Commissioning included unanticipated setbacks such as sub-standard pumps, low-head oxygenator modifications, biofilter adjustments, and high CO_2 levels. These issues highlight the need for a robust system warranty, a well-resourced commissioning plan, and adequate financial reserves.

The commissioning challenges impacted mortality, which ranged from 13-29% among the three commissioning cohorts, and significantly impacted revenues and fish growth in those cohorts. The "Summary of Production Metrics for All Cohorts" on page 39 shows that feed conversion rates, fish survival, and average fish size at harvest significantly improved as technical issues were solved and water quality and husbandry strategies improved. These trends are expected to continue.

The table on page 71, "Other Operating Costs", summarizes the relative size of resource inputs. Energy use (electricity) is only 9% of production costs and is less than feed, smolts, and labour. Total water use (production and harvest) has averaged less than 900lpm. Both energy and water use per kilogram of production continue to improve as the system is optimized and system biomass continues to increase. Maximum biomass will be reached in late 2015.

The Project's social metrics on page 76, indicate that more than 85% of the construction costs were paid to BC companies, which reflects the range of aquaculture suppliers and skilled tradespeople that are resident in BC. More than 20 person-years of work were generated, with 28 years of direct and indirect employment created since operations commenced.

The Project's environmental metrics are discussed on pages 59-62. Several metrics are also found within the "Independent Environmental Monitor (IEM) Final Report" from the Pacific Salmon Foundation, posted on the Tides Canada website. After monitoring the project from inception to the end of the harvest of the third cohort, the IEM concluded that the project and its RAS technology are environmentally benign.

The Project's financial metrics (from page 63) are underpinned by marketplace acceptance. Kuterra salmon have been well received by chefs and consumers alike and have garnered a significant premium price as a result of excellent product quality, effective marketing, and Best Choice sustainability ranking by Seafood Watch and SeaChoice as well as Ocean Wise designation. Kuterra's gross margin per kilogram of production has improved significantly with every cohort harvested. Harvest volumes will continue to increase until maximum biomass is reached in late 2015. Labour and maintenance costs will decrease somewhat once the commissioning modifications are fully completed and metrics reporting obligations to funders are reduced. It is expected that Cohorts 5 and onward will provide financial results that are representative of steady state operations, because those cohorts will have been grown with the system at full biomass, with commissioning substantially completed and operations further optimized. The small size of the facility has a bearing on profitability. As noted, it is a commercial demonstration pilot and so is not large enough to benefit from economies of scale. Nonetheless, steady-state results will make it possible to establish the key business plan elements of a much larger facility (1500-3000MT) that would benefit from such economies of scale.

This reporting period covers the first phase of the project - optimizing the system so that it functions at optimum efficiency - and this is almost complete. The focus of the next phase is to improve fish performance, which involves reducing early maturation, improving growth, and managing cataracts, which emerged as a factor in Cohort 3. Strategies are being implemented to address these issues, and these actions are expected to have a significant impact on profitability. The addition of a hatchery would also increase profitability, as this would optimize timing of smolt intake; smolt costs would be reduced; smolt quality could be improved, and smolts would be acclimated to Kuterra's water and growing conditions from the start. A hatchery as part of operations would expand the understanding of production and profits possible from an optimized RAS facility.

Production – Technical & Biological Performance

Cohort #1 (0313, Completed)

This information is from the Milestone #6 report and is included for continuity and ease of access. Some information has been reorganized and moved to the General Production Information section.

Summary of Cohort 0313 to week 76

Production		
FCRb	1.25	
FCRe	1.43	
TGC (lifecycle)	1.5	TGC of last fish. Avg is about 1.6
SGR (lifecycle)	0.71%	
Average Condition	1.23	12 samples
Current Biomass (mt)		
Total Production (mt)	58.3	harvested+ current- smolt biomass
Smolts stocked (#)	23,503	
Current Inventory (#)		
Current Size (kg live)		
Smolt Size (gm)	85	

Mortality & Fish Health	#	%	
			Percent of start number
Fungus	2,271	9.7%	
Other	1,448	6.2%	* See note below
Culls	767	3.3%	
NVM	912	3.9%	No Visible Marks
Adjust.	272	1.2%	Count adjustments
Total #	5,670	24.1%	
Total Losses	15.1%	8803 kg	Percent of total production
Treatments			Salt , formalin (no antibiotics)

Water Quality (daily)		Max	Min	Average	
Temperature	C	16.4	10.1	14.3	
TAN	mg/l	2.02	0.09	0.60	
Nitrite	mg/l	1.60	0.01	0.46	
Nitrate	mg/l	132	1	58	
Oxygen	mg/l	13	7	10	
CO2	mg/l	38	4	15	
Salinity	ppt	13	1	3	
Alkalinity mg/l	mg/l	175	2	29	
Hardness (Ca)	mg/l	36	4	17	Quarantine only
Density	kg/m3	67	8	38	
Water Velocity	cm/sec	47	33	38	No samples after Oct 2013
TSS	mg/l	40	5	13	
NTU		11.8	0.04	2.3	Gradual reduction during the cycle
ORP	mv				No Samples

Feed	Max	Min	Average
Skretting			
Pigment	80	70	80
Fat	31	20	28
Protein	50	41	45

Smolts	
Vaccines	Forte Micro, APEX IHN, Renogen
Genetics	None Specified (Mowi or Mowi x McConnell cross ?)

Harvest	kg live	kg HOG
Total	60,326	50,071
Average Size	3.3	2.7
% Complete	100%	

* Other mortalities includes everything that does not fit into the main mortality categories including, for example: Fish that have jumped out of the tank, fish sucked into the bottom drain, fish removed for tissue samples, inventory adjustments when a tank is emptied.

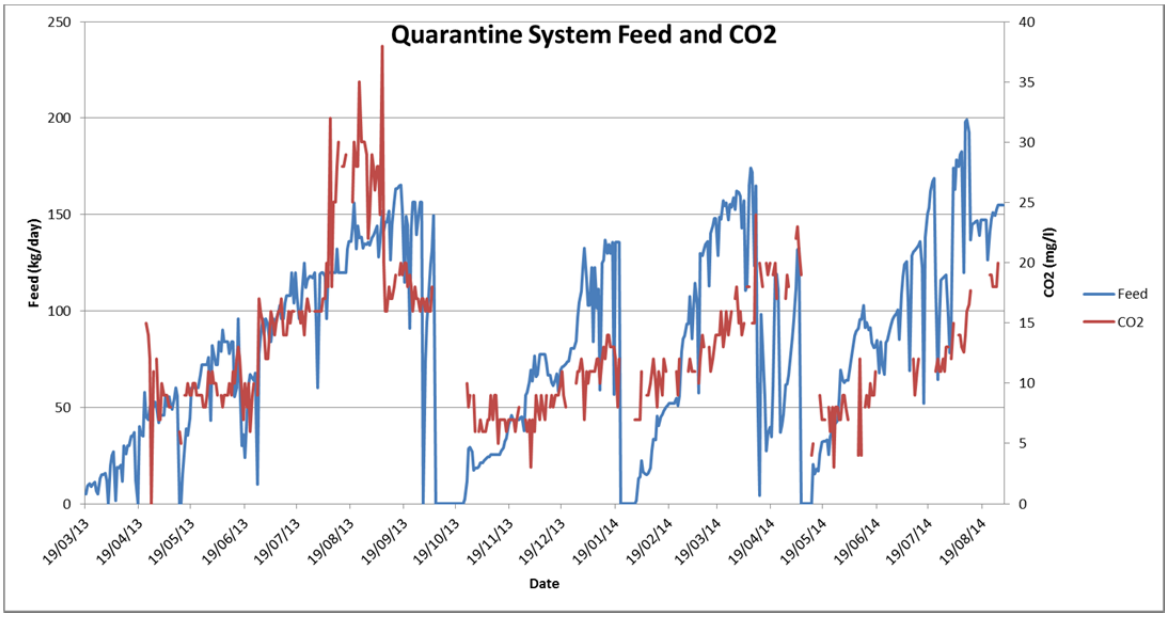
Note: Reported water quality (Min, Max and Mean) in the table above are weekly averages. Therefore, they do not represent the full range of metrics sampled. Weekly data for each cohort are presented in the Appendix.

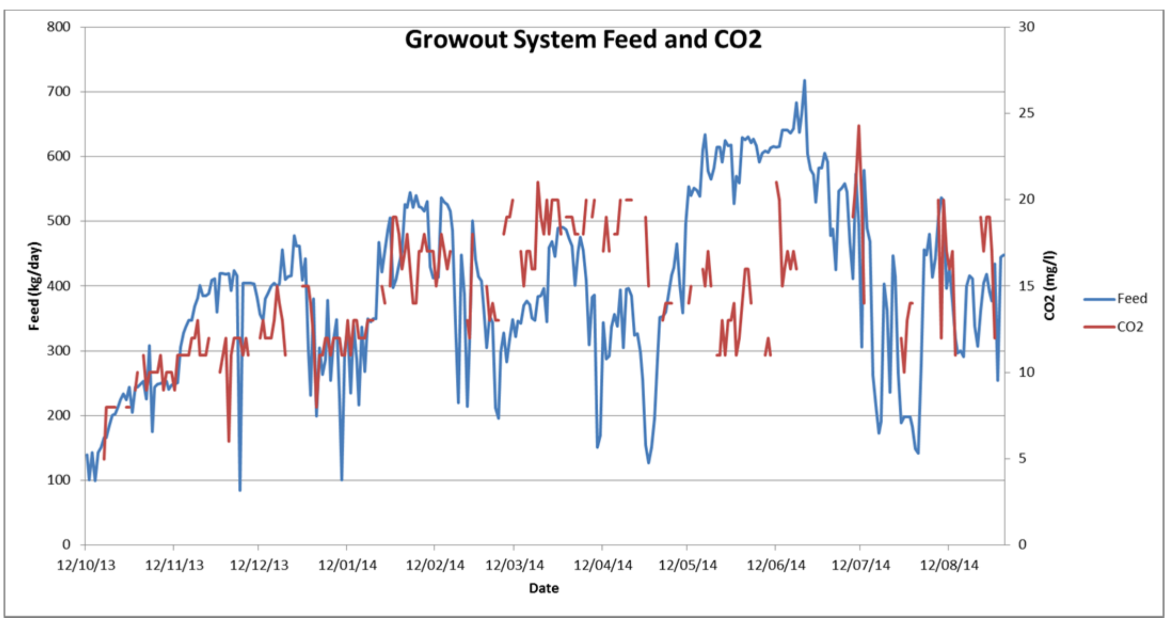
System Performance, Temperature, and Water Quality:

Concentrations of TAN, NO2-N, NO3-N, and dissolved oxygen averaged 0.6 mg/L, 0.46 mg/L, 58 mg/L, and 99% saturation, respectively, during culture of the first cohort within the Quarantine (Q1) and Growout (GO) systems. At most times, these levels were within the design specifications for the Q1 and GO systems. However, due to the low targeted biomass density for this first cohort, the maximum feed loadings were well below their design capacity for each system (255 kg/day at 75 kg/m3 and 1163 kg/day at 75kg/m3, respectively); feed loading only reached a maximum of approximately 170 kg/day in the quarantine system and 700 kg/day in the Growout system. In addition, alkalinity was supplemented to maintain a mean concentration of 65 mg/L (as CaCO3) using a pH controller feeding a 50% solution of sodium hydroxide to maintain a pH set-point of 7.2- 7.4 At times, total suspended solids (TSS) and turbidity were higher than desired (i.e., 40 mg/L and 9.7 NTU, respectively), largely due to commissioning issues that are described below. Many of these issues were resolved during the culture of this first cohort. Nevertheless, TSS and turbidity averaged 13 mg/L and 2.3 NTU over the production cycle of the first cohort.

Of greatest concern, the maximum dissolved carbon dioxide concentrations exceeded limits specified in the design (12 mg/L and 15 mg/L) for Q1 and GO systems, respectively, during much of the culture period of the first cohort. The reasons for this are explained in detail starting on page 52, in the System Performance section.

The daily feed load and corresponding CO2 concentration (measured in the heaviest fed culture tank in each system) during the culture of the first cohort in the Q1 (top graph) and GO systems (bottom graph) are shown in the following graphs.





Both graphs highlight how CO_2 concentrations improved (i.e., were reduced) at the same or even higher daily feed loading rates after several of the challenges listed below had been corrected. Several of these corrections also significantly improved water turbidity and clarity (not graphed) by the spring of 2014.

Additional changes were subsequently trialed and evaluated to prevent CO_2 from exceeding 20 mg/L when feed loading approaches maximum levels as fish biomass in the systems is increased. Potential improvements that were considered included:

a) Adding pump capacity (e.g. an additional centrifugal pump in the Quarantine system) to increase water flow through the culture tank but this was limited by the existing LHO and supply/return piping hydraulic capacity.
b) Adding structured packing under the cascade aeration column. This was installed in the Quarantine system and had no significant impact.
c) Adding diffused aeration or air-lift pumps at the culture tank, or just outside of the culture tanks. A PR Aqua based system and AgriMarine based system were trialed at the facility. An Inter-Aqua Advance system that has been used in other facilities was also evaluated.
d) Temporarily increasing water flow to the heaviest loaded tanks.

Several technical issues that were identified have been rectified during the commissioning of the systems during the culture of the first cohort. They were as follows:

- Inadequate water flow through the culture tanks at start up when all of the originally ordered water recirculating pumps for Q1 failed to meet their water flow performance specification. These pumps were rejected and replaced, which took time and left the system with less than design flow. The water recirculating pumps for the GO system were also rejected and commissioning of the GO system was delayed waiting for these new pumps to arrive. Thus, feed loading in the quarantine system was restricted until the new quarantine pumps were installed. In addition, fish were held in the quarantine system longer than desired until the new water recirculation pumps were installed in the GO system.

- Increased turbidity due to feed formulation.

- Bacteria suspended in the water column that were suspected of increasing TSS and turbidity, but that also likely consumed oxygen and produced CO_2 during much of the 1st year. Increased bacteria floc suspensions could have been attributed to the next four issues as follows:

- Accidental over-feeding by as much as 75 kg/day per tank by the automated feeding system. This created large amounts of waste feed. Waste feed accumulated in the microscreen drum filters, where it was eventually noticed. The drum filters appeared to have difficulty rotating the largest pellets (12 mm) up to the backwash trough, which left the feed to tumble and break-apart in the recirculating flow as the drums rotated. This likely placed a higher load of fine solids and dissolved organic matter in the recirculating water, which in turn would have contributed to higher TSS, turbidity, and bacteria respiration in the water column. The feeding glitch was corrected.

- Inadequate sand-bed fluidization at the corners and periphery of the biofilters; correcting this required passing more flow through the biofilters, which left the GO tanks with a 20% deficit

(9,000lpm average when it should have been 11,400lpm). More orifices were drilled through the distribution piping to improve bed expansion in the corners and this in turn allowed the total flow through the biofilters to be reduced. Largely as a result of these improvements the water quality in the system improved enormously (typically 0.3-0.4 NTU as opposed to a peak of 9.7 NTU). This in turn resulted in a proportional increase in CO2 levels in the GO and impacted tank cleaning.

- Installation of ducting to vent the outlet of the CO2 stripping fans directly out of the roof was delayed, but by spring of 2014, ventilation piping was installed to allow this high-humidity and high-CO2 air to be ventilated directly from the room, when desired. The CO2 stripping was maximized by operating the ventilation fans at full capacity and by ventilating this air directly out of the building.

- Installation of an ozone generator and ORP control system was delayed until August 2014, but its installation and commissioning is now complete.

In addition to these technical issues, a shortened photoperiod was sometimes used in an attempt to minimize grilse rates. However, this compressed the feeding into a smaller portion of the day, which created periods of higher fish metabolism, i.e. higher O2 consumption and CO2 production.

Water temperatures were often below the optimal 15^{o}C during the beginning and middle of the culture period. Heat pump installation was not completed until mid-way through the culture period. Water temperature in the quarantine and GO systems was decreased by increasing the makeup water flow or by directing the air ventilated out of the CO2 stripping unit directly out of the building and pulling air into the CO2 stripper from outside of the building. Water temperature in each system was increased by decreasing the air ventilated out of the building and decreasing the makeup water flow rate. In addition, a heat pump was used to increase or decrease water temperatures when necessary.

Accurate measurement of water flow to the culture tank(s) and biofilter(s) was also challenging because there were insufficient pipe lengths exposed to use a Doppler flow meter. Thus, culture tank flow rates were measured by blocking the flow outlet through the center drain and sidewall box using a stand-pipe and weir board, and then the change in water depth in the culture tank with time was recorded to estimate mean flow. Flow rates through the biofilters were estimated for specific valve set points at commissioning using water fill rates, pump speeds and pump volume curves. We have since, however, tested this method against a flow meter and found the results to be very similar which allows us to use this tool to measure flows. Both methods indicated a similar 20% flow deficit in the growout.

Growth:

These fish were delivered March 18, 2013 at an average weight that was smaller than that factored into our growth model (85g versus 100g) and they also showed a lot of size disparity. Early growth was much slower than anticipated. The primary reason for this was that the fish were grown at a lower temperature than modelled (15°C) – sometimes at only 9-11°C – in order to start harvesting later. The purpose of this was to fill a projected gap in supply between this cohort and the next to ensure consistency of supply to the market. Even when we changed this strategy later on in the production cycle, the heating system was not yet operational, which meant that this cohort of fish were grown at sub-optimal temperatures for the early part of their production cycle.

Another significant reason that these fish displayed slow growth was due to feed restrictions that were imposed upon them to manage through several months of restricted water flow caused by faulty recirculation pumps. These pumps eventually had to be replaced since they were underperforming by up to 30%.

We are confident too that if we had our own smolt supply/hatchery we would have much greater control over the fish we stock and we would be able to select for the fastest growers.

It can be seen from the "Growth Curve" on page 41 that Cohort #1 from 750g to 2.5kg average weight displayed excellent growth which was comparable to that of the growth model. But once the fish approached 3kg and signs of maturation became more evident, the growth tailed-off rapidly resulting in a TGC of 1.5 by the time they were completely harvested (versus 2.0 in the model).

Maturation:

The factor that most influenced the growth of Cohort #1, both directly and indirectly, was the onset and extent of maturation. These fish were manually graded between the 19th to the 21st of February 2014 when they were approximately 2.3kg. The estimated maturation rate at that time was 2.6% based on physical appearance. In the final three months prior to harvest, however, the rate of maturation appeared to increase significantly as seen in a much higher incidence of maturing fish in the harvested populations and based on paling observed during processing. Based on experience at the Fresh Water Institute (FWI), this was not entirely unexpected and we had, in fact, over-stocked by 20% in anticipation that this percentage could potentially be downgraded as a result of maturation. In the end, GSI testing showed that 100% of the fish matured and approximately 25% of the final product was downgraded due to paling of the flesh.

It should be noted that this first cohort has experienced very different conditions than subsequent cohorts largely because they were grown at different temperatures. So the grilse rate experienced with this cohort does not necessarily mean it will be the same with the others. It should also be pointed out that as evidenced from the Cohort Growth graph on page 41, between 750g – 2.5kg this Cohort exhibited a period of increased appetite and extremely good growth (similar to that of our growth model). It is possible that this increased level of feeding during this period may have contributed to the early onset of maturation. It has also been postulated that these fish may have actually been triggered to mature in the winter when the heating system came on line and the temperature was raised from 12°C to 15°C as it is after this period that obvious signs of maturation started to appear, the growth began to stall and the flesh colour (which was right where it should be up to that point) began to deteriorate. Neither of these anomalies is likely to be repeated in the future.

Another very important factor to consider is the prolonged production cycle of this group of fish. As mentioned above, these fish were slowed down initially in order to delay the start of harvesting in order to help to fill a projected gap in supply to the market. As a further measure to shrink this gap, the harvest volumes of Cohort #1 were reduced and the harvest schedule expanded as much as possible to minimize the extent of the break in supply. This meant that the harvest of this cohort was protracted over a period of 26 weeks during which time a clear trend of increased flesh paling was observed. In contrast, the harvest of Cohort #2 & #3 are scheduled to last only 10 weeks and 13 weeks respectively.

The impact of changing light regimes to reduce the incidence of maturing fish is an example of how maturation and strategies to deal with it were having indirect impacts on growth. This has proven to be a very significant factor in influencing growth on all cohorts. For example, the physical change itself from continuous lighting (LL) to a simulated natural photoperiod (SNP) or vice versa, resulted in fish going off their feed and consuming a reduced ration for several weeks after the change in light regime. Also, when the fish are on a continuous photoperiod, the ration can be gradually increased each day as the biomass increases. However, with the use of SNP regimes, the daily ration is compressed into shorter and shorter schedules as daylight hours contracted. So in complete contrast to fish on continuous light and fed over 24 hours, this compression of the feed schedule means that there is less time for delivery of the feed often resulting in less total feed given over time.

Another example of indirect negative impacts as a result of strategies to deal with maturation can be seen when fish were manually graded to remove mature individuals. The commissioning issues associated with that process subsequently had a big impact on their feeding levels for several weeks afterwards. Although the grading equipment has been modified and improved since commissioning, we are still finding that any manual handling of fish >2kg (e.g. even to take weight samples) significantly impacts feeding levels afterwards.

With the lessons learned from this Cohort a number of strategies have since been implemented with subsequent cohorts and so it is expected that the rate of maturation for Cohort #1 represents the worst case scenario and can only be improved upon.

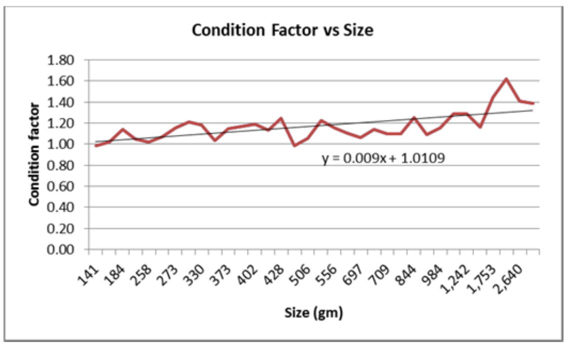
Other Factors Affecting Growth:

The above factors which slowed the growth considerably of Cohort #1 were compounded by a combination of fungal outbreaks, high CO2, poor water quality and poor water clarity (effecting light levels and visibility of the feed pellets).

It should also be noted that the predictive model assumes that the fish will feed a full ration the day after they are delivered to the site, which is not the case. The reality is that only a portion of the fish are eating in the beginning and the fish need approximately 6 -8 weeks to acclimatize to the new conditions and complete the smoltification process before the entire population is on the feed and eating a full ration. This has been the case with all of the cohorts with the length of time to full feeding being shorter at the warmer temperatures and when the incidence of fungal infection was low.

Also with regard to the model it is important to point out that fish that are maturing do not feed or grow at the same rate as those that are not maturing. This element was difficult to factor in to the growth model initially as the data simply did not exist for a Mowi strain grown under our conditions. However, the data provided by this and subsequent cohorts can be updated in the model to make it increasingly accurate with time.

Condition Factor: Condition Factor (K) is an indicator of the general state of health of a salmon. Salmon of good conformity have a K in the range of 1.1 – 1.6, depending on the weight of the salmon (age related; a smolt tends to be long and thin, older salmon are deeper). Salmon with a condition factor of less than 1 are often thin and possibly undernourished, runted or debilitated. Where K is greater than 1.6, it is regarded as excessive and may have too high levels of body and visceral fat. Measures of fish condition are also thought to be reliable indicators of the energetic condition or energy reserves of fish and K values can vary over the season because of spawning activities with the lowest K value found during the spawning period. The data collected for Cohort #1 seem to support this to some extent with the K value reducing between 525g and 1,800g when you would have expected it to increase which could be correlated with onset of maturation with individuals in the population. The large increase to 1.62 thereafter may reflect mature females full with eggs (as was observed during processing).



Feeds and Feeding:

The diet used is Skretting's standard Optiline diets which also contained binders to help coagulate the faeces and make it easier for the mechanical filters to remove the waste. The diet constituents are as in the following table below. Note that we switched from synthetic pigments in September 2014 (for Cohorts #2 onwards) to using Panaferd instead (a natural-source astaxanthin-rich bacterial pigment). Also, from March 2015 onwards we added an additional mineral supplement to the diet in an effort to reduce the level of cataracts. See the feed formulation table on page 48 in the General Production Information section.

Fish are fed multiple meals over the length of the daily photoperiod using a centralised feeding system. In February 2014 the software on the feeding system was brought online in order to automate feeding – the feeder will automatically increase the next days feed based on what had been fed the previous day (and hence the biomass increase). This allows much greater control over feeding regimes to maximise growth and feed conversion especially when feeding 24/7 but is dependent on getting accurate estimates of tank biomass, which is proving to be a challenge.

It has been difficult, however, to accurately measure or estimate the biomass of the larger fish. The Vaki scanner has proved to be inappropriate for our tank conditions since the fish either avoid the scanner frame or just hold station relative to it. In addition, manually sampling fish >2kg can negatively impact their feed rate for weeks afterward the sampling event. The result is that fish weights for fish bigger than this cannot be accurately estimated until the harvesting starts (2.6-2.8kg). Another example of how challenging it has been to establish the correct biomass, in particular with Cohort #1, was apparent when we experienced commissioning issues with the counting equipment during grading. At that time we experienced up to 10% discards (fish that are not counted) following the splitting of Cohort #1 into two tanks as a result of inappropriate shoot angles, water speeds, fish speeds, light pollution, splashing of the camera lens and other issues. These have since been largely resolved and 0-1% discards are now the norm but for Cohort #1 it meant there were major uncertainties over the number of fish in the tank and it is very difficult to feed the fish in a controlled way if you do not know the numbers in the tanks.

These difficulties establishing the appropriate feed level were considerably compounded by the impacts of many disruptions to feeding caused by changing light regimes, regular murky water conditions, fungal outbreaks and all the other system commissioning issues mentioned above. We are learning how best to feed these fish all the time and it certainly helps a lot to be able to see the fish in the tanks now that the water clarity is excellent.

There were also some commissioning issues with the feeding system software whereby instead of increasing the feed in increments of 3-4kg/day/tank, it randomly increased the ration in amounts of up to 75kg/day/tank which resulted in waste feed. The software also sometimes continued to feed tanks a full ration when they had been either taken offline or the ration was cut back. This took several weeks to rectify and will contribute to higher FCR's for all three cohorts.

While maturation certainly would have been a major contributor to the higher than projected FCR seen for Cohort #1 (1.24 versus 1.05), any changes to the feeding strategy that result in improvements in FCR has the potential to save thousands of dollars per annum. The feeding system software has a large array of tools which we are using to help us establish an appropriate feed rate for our fish. The feed program has a series of algorithms and tables and will use these to decide how much to increase the feed for the next day based on what it had fed the day before. We know that we can feed to satiation up until approximately 6-700g and still get excellent FCR's and have recently begun a trial using an appetite table that feeds a reduced ration (compared to standard tables designed for net pen sites) for fish larger than this in order to lower FCR's. This appetite table is designed for optimal feed utilisation – lowest possible feed conversion rate balanced against good production output. The results have been very positive and the plan is to tweak this table until ultimately we have tailored a table that is tuned to the conditions we grow our fish in.

Fish Health:

No antibiotic treatments have been used. The fish arrived with the majority showing fin erosion and with a significant fungal challenge. We have found that the fish are most susceptible to fungal infection during the first 4-6 weeks following introduction to the site due to the stress caused by transport and the stress caused by the physiological changes occurring during the smoltification process in particular. However, once maturation is well advanced we also experienced elevated mortalities in larger fish due to fungus.

Salt was used to treat a persistent fungal outbreak until a higher salinity well had been drilled. Approximately 10% of this cohort was lost largely due to this fungus infection. At the time of transfer our salinity was 0.5ppt which clearly was not enough to deal with the outbreak. The condition was controlled using salt treatments by artificially raising the salinity to as high as 10ppt for prolonged periods (this was increased in stages over 6 weeks to allow the bacteria in the biofilter to acclimatise). To further manage this issue with future cohorts we drilled a deeper, higher salinity well to give us salinity concentrations up to 6ppt. This proved successful in limiting fungal mortality with the subsequent cohort transferred to the site.

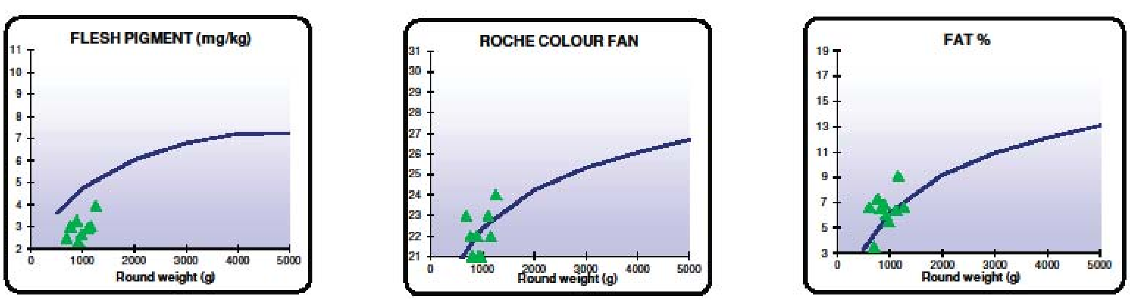
Total mortality for Cohort #1 was 24.1% and includes 3.3% culls. The majority of mortalities with the smaller fish (<1kg) were due to fungal issues and the mort removal system malfunctioning, which allowed thousands of smolts to enter the treatment system. The mort removal system was modified and has functioned well since then. The majority of mortalities with the larger fish (>1kg) are as a result of physical injury due to fish behaviour (leaping), commissioning of the harvesting and grading equipment (which has since been optimised and should not be repeated) and also due to maturation as fungus became a persistent problem in the final weeks of harvest.

Flesh Quality Analysis:

Fish from Cohort #1 were sampled on the 19th of August 2013 and again on the 10th of January 2014 (see tables below for individual results at different size ranges and the below graphs which show the progression of colour and fat content with time). Overall the results were appropriate for the size ranges sampled. The chemical pigments were as expected and the visualization of the pigments (Roche Score) was also good. One comment on the Roche score is that there does seem to be a reasonable amount of variation between fish, with some very high scores. Further samples were not taken as the colour was where it needed to be. However, as maturation progressed rapidly in the final months of growth so too did the absorption of pigment in the flesh. By the time harvest was complete, the degree of paling of the flesh (fish that are downgraded as they are <25 on the Roche scale) had increased from an estimated 8% in initial harvests to approximately 70% with the last of the fish processed. Overall, 25% of the Cohort 1 fish had pale flesh.

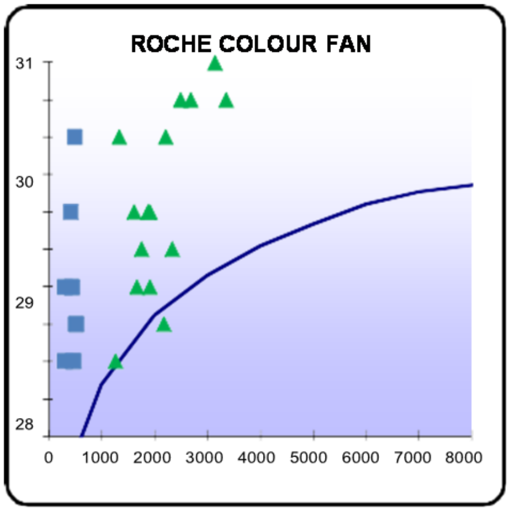
As a result of this problem and in conjunction with other efforts to moderate maturation, a new feeding strategy has been devised for the next cohort to improve Roche scores which involves an increase in pigment levels to the maximum 80ppm as well as an increase in Vitamin E and other anti-oxidants in the diet. Increasing the level of anti-oxidants in the diets should allow a higher proportion of pigment to be used for coloration rather than as anti-oxidants.

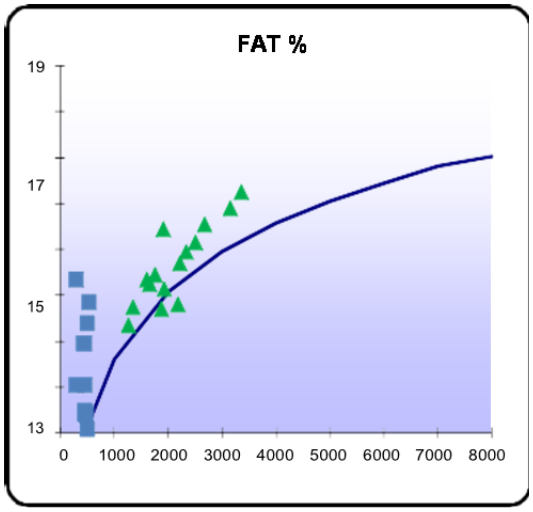
The fat levels were as expected.



Flesh pigment levels are compared to historical results when feeding a 75, 65, 50, 40, 30 pigment regime.

Fat and colour progression in fish from 300g to 3360g (Cohort #1)





Blue squares are from first sampling on the 19th of Aug 2013 and the green triangles are from sampling on the 10th of Jan 2014. The curves represent the projected results by Skretting Canada.

KUTERRA salmon being cleaned/gutted at Albion Fisheries' plant.

Colour & Fat Content of Fish Sampled Aug 19th 2013 (Cohort #1, 0313)

Fish no.	Round Weight (g)	Fish Length (cm)	Slaughter Loss %	Cond. factor (round)	Sex	Gonad Weight (g)	GSI %	Roche Colourfan score	Pigment NIR (NQC mg/kg)	EPA DHA (Total %)	Fat NIR (NQC %)
1	480	35.5		1.07				23.0	2.4	0.4	3.8
2	500	37.3		0.97				24.0	1.7	0.9	7.8
3	300	32.0		0.92				23.0	1.8	0.5	5.1
4	440	34.0		1.12				25.0	2.9	0.8	6.9
5	420	34.5		1.02				27.0	2.3	0.8	6.9
6	530	38.0		0.97				24.0	2.6	1.0	8.7
7	300	31.0		1.01				25.0	2.1	1.2	9.7
8	440	36.0		0.94				25.0	1.8	0.5	4.0
9	490	38.5		0.86				29.0	2.0	0.3	3.2
10	460	39.5		0.75				23.0	2.4	0.5	5.1

Average	**436.0**	**35.6**		**0.96**				**24.8**	**2.2**	**0.7**	**6.1**
St.dev.	78.6	2.8		0.11				1.9	0.4	0.3	2.2

Colour & Fat Content of Fish Sampled Jan 10th 2014 (Cohort #1, 0313)

Fish no.	Round Weight (g)	Fish Length (cm)	Slaughter Loss %	Cond. factor (round)	Sex	Gonad Weight (g)	GSI %	Roche Colourfan score	Pigment NIR (NQC mg/kg)	EPA DHA (Total %)	Fat NIR (NQC %)
1	3360	57.0		1.81				30.0	6.3	1.6	13.5
2	2500	56.0		1.42				30.0	6.0	1.3	11.3
3	1340	46.5		1.33				29.0	4.5	0.9	8.5
4	2330	55.0		1.40				26.0	3.2	1.3	10.9
5	2220	50.0		1.78				29.0	5.5	1.2	10.4
6	2680	57.5		1.41				30.0	6.4	1.3	12.1
7	1920	52.5		1.33				27.0	4.9	1.0	9.3
8	3150	59.5		1.50				31.0	6.4	1.4	12.8
9	1870	52.0		1.33				27.0	3.4	1.1	8.4
10	1660	48.0		1.50				25.0	4.0	1.1	9.5
11	1260	43.5		1.53				23.0	2.8	0.9	7.7
12	2180	57.5		1.15				24.0	4.3	1.0	8.6
13	1760	47.5		1.64				26.0	3.7	1.3	9.9
14	1610	49.5		1.33				27.0	3.7	1.1	9.7
15	1910	50.0		1.53				25.0	4.4	1.3	11.9
Average	**2116.7**	**52.1**		**1.47**				**27.3**	**4.6**	**1.19**	**10.3**
St.dev.	610.0	4.8		0.18				2.5	1.2	0.2	1.7

Freshly filleted KUTERRA salmon from Cohort #1 at Albion's processing plant.

Harvesting:

The first harvest occurred on the 4th of March 2014 (12 months after the introduction of the fish to the facility) when approximately 960kg (465 fish @ average of 1.7kg) were sent to market. These were fish considered to be of sub-optimal quality (e.g. grilse, humpback, etc.) which were graded out and harvested with the intention of testing the harvesting equipment as well as the logistics involved in organising delivery to the plant in Richmond.

The transfer and harvest procedures went very smoothly and the equipment (rigid crowder, 12" fish pump, harvest table, chutes and the stunning equipment) performed exceptionally well ensuring efficient removal and dispatch of the fish.

The first premium harvest was carried out on the 19th of April when 3856kg (2.9kg average) were removed. In total over 60T of fish were harvested from Cohort #1 at an average weight of 3.3kg which equated to 50T at 2.7kg average HOG. More details on the processing yields etc. are presented in later sections of this document. The final harvest was September 3, 2014.

Fish about to be stunned and bled.

Cohort #2 (1013, Completed)

Summary of Cohort 1013 to week 45

Production		
FCRb	1.12	
FCRe	1.17	
TGC (lifecycle)	1.5	
SGR (lifecycle)	0.73%	
Average Condition	1.18	five samples
Current Biomass (mt)	0.0	
Total Production (mt)	72.422	harvested+ current- smolt biomass
Smolts stocked (#)	33,723	
Current Inventory (#)	0	
Current Size (kg live)	complete	
Smolt Size (gm)	104	

Mortality & Fish Health			
	#	%	Percent of start number
Fungus	865	2.6%	
Other	370	1.1%	* See note below
Culls	1,016	3.0%	
NVM	1,042	3.1%	No Visible Marks
Prec.	8	0.0%	Precocial males or maturing female
Adjust.	966	2.9%	Count adjustments
Total #	4267	0.12653	
Total Losses		4741.54 kg	Percent of total production
Treatments			No antibiotics, salt

Water Quality (daily)					
		Max	Min	Average	
Temperature	C	16.4	8.9	13.9	
TAN	mg/l	2.02	0.04	0.69	
Nitrite	mg/l	1.30	0.01	0.26	
Nitrate	mg/l	266	3	115	
Oxygen	mg/l	12	7	9	
CO2	mg/l	24	3	14	
Salinity	ppt	7	2	4	
Alkalinity mg/l	mg/l	145	10	52	
Hardness (Ca)	mg/l				No samples
Density	kg/m3	69	14	32	
Water Velocity	cm/sec			1	One sample
TSS	mg/l	30	5	12	
NTU		9.6	0.03	1.9	Gradual reduction during the cycle
ORP	mv				No samples

Feed			
Skretting			
	Max	Min	Average
Pigment	80	80	80
Fat	31	20	26
Protein	50	41	47

Smolts	
Vaccines	Forte Micro, APEX IHN, Ermogen Vibrogen II
Genetics	Mowi

Harvest		
	kg live	kg HOG
Total	75,361	62,550
Average Size	2.5	2.1
% Complete	100%	

* Other mortalities includes everything that does not fit into the main mortality categories including, for example: Fish that have jumped out of the tank, fish sucked into the bottom drain, fish removed for tissue samples, inventory adjustments when a tank is emptied.

Growth:

These fish were sourced from a different site than the first cohort and were delivered October 24, 2013 at 104g average weight. They were more homogenous in size than either Cohort 0313 or Cohort 0114 (both of which came from the same site). They spent the first 13 weeks in the Quarantine at sub-optimal temperatures (average of 11.8°C) due to the fact that the heating system was not yet operational which would appear from the “Growth Curve” (under “General Production Information”) to have resulted in their growth trajectory being lower than all the other cohorts at that point in the production cycle. Despite being grown at 15C for the next 38 weeks before the overall system was dropped to 13C, they never seemed to recover and finished up with a TGC of 1.5 which was the same as the first cohort stocked. The main difference between Cohorts #1 & #2, however, is that the FCR dropped significantly from 1.25 down to 1.12 largely as a result of improved feeding practices introduced to help combat the problem of murky water conditions which made it difficult to both observe feeding behaviour and also made it difficult for the fish to see the feed. FCR was also helped by the fact that the rate of maturation was also lower largely because of new strategies developed in response to the high maturation rate observed in Cohort #1 and we did not see the same exponential increase that we saw in the final 3 months of Cohort #1.

Feeds and Feeding:

See also the feed information on page 12 and the feed formulation table on page 49 in the General Production Information section. Note that in September 2014 a switch from synthetic pigments to Panaferd (a natural-source astaxanthin rich bacterial pigment) was made.

A prototype in-tank aeration device was installed in August 2014 in a tank containing this cohort (G5) in order to test its efficiency at CO_2 removal. The unit developed a fault in Oct and was offline for several days. During the period that the unit was out of operation the feeding level crashed from 203kg/day before to an average of 153kg/day (25% less) for the next 9 days until the unit was brought back on line again. As soon as the unit was operational the feeding returned to 201kg/day and increased steadily beyond that thereafter. We have since noticed an increase in appetite in other tanks once the aeration devices were brought online. It has been postulated that, in addition to removing CO_2 from the tanks, the aeration units will enhance growth as a consequence of better mixing in the tank resulting in a more uniform tank environment and by creating more stable oxygen conditions across the tank.

Fish Health

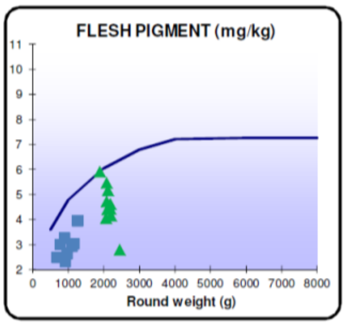
The fish arrived very clean in terms of fungus and showed excellent fin condition with little fin erosion. As a result of this, as well as the lessons learned from the first cohort in managing fungus, total mortalities for the entire period spent in the Quarantine were <1% (0.16% as a result of fungus). We did, however, have an outbreak of fungus in these fish while they were contained in the GO system (600g approx.) following an episode of extremely murky water conditions (9.61 NTU versus a "norm" of <0.2 NTU), density approaching 40kg/m3 and salinity dropping below 2.5ppt. It was not practical to use salt to treat fish in the GO system because of the large volumes required so formalin had to be used to control the outbreak (100ppm for three consecutive days). Approximately 2.4% of the population was lost as a direct result to this fungal episode. It should be noted that fungal mortalities dropped sharply following grading and splitting of these fish from one into two GO tanks which could suggest that density for this small size of fish (600g approx.) had a significant influence on the outbreak.

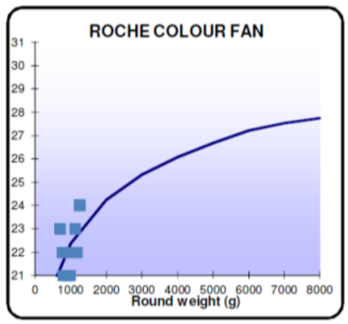
It should also be pointed out that approximately 1% of this cohort was lost as a result of an issue with the mort removal mechanism at the bottom of the tank when the fish ranged from 300-650g. The screen took too long to drop back down after actuation which resulted in live healthy fish entering the centre drain effluent pipe and eventually sticking to the side drain box screen. This issue has now been rectified in all of the GO tanks.

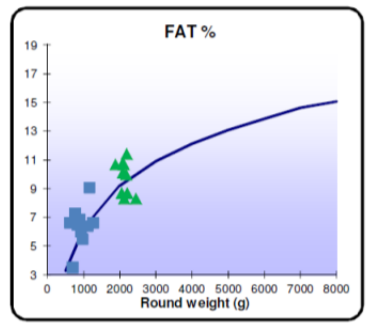
Flesh Quality Analysis

The results of NIR analysis are shown below. Overall the results were good and are within the expected range.

Fish no.	Round Weight (g)	Fish Length (cm)	Slaughter Loss %	Cond. factor (round)	Sex	Gonad Weight (g)	GSI %	Roche Colourfan score	Pigment NIR (NQC mg/kg)	EPA DHA (Total %)	Fat NIR (NQC %)
1	1890	54.0		1.20					5.9	1.2	10.7
2	2120	54.0		1.35					5.2	0.8	8.3
3	2080	55.0		1.25					5.5	1.1	10.1
4	2180	55.0		1.31					4.6	1.0	10.0
5	2210	57.0		1.19					4.2	0.9	8.7
6	2080	55.0		1.25					4.7	1.2	10.8
7	2060	53.0		1.38					4.1	0.9	8.7
8	2100	54.0		1.33					4.4	1.2	10.7
9	2450	59.0		1.19					2.8	1.0	8.3
10	2190	53.0		1.47					4.4	1.2	11.4
Average	**2136.0**	**54.9**		**1.29**					**4.6**	**1.05**	**9.8**
St.dev.	142.6	1.9		0.09					0.9	0.2	1.2







Flesh pigment levels are compared to historical results when feeding a 75, 65, 50, 40, 30 pigment regime.

Note: Blue squares are from first sampling on June 1st 2014. Green triangles are from second sampling on Aug 31st 2014.

Maturation

GSI (Gonad Size Index) testing carried out in these fish in September 2014 indicated that 36% of these fish were maturing. 31% were manually removed from the large grade and 10% from the small grade at the sizes indicated in the table below. Note that with the Mowi strains so far tested, the maturing fish tend to be smaller than the non-maturing fish. The GIS testing sampled 150 fish and the gonad size threshold was 0.1% for males and 0.2% for females. The average size of the fish sampled was 1.69kg.

Manual Grilse Grade (Visibly Maturing)				
	Date	**Size (grilse)**	**Size (total)**	**Removed**
Large Grade	9.10.14	1825	2240	31%
Small Grade	17.12.14	2210	2600	10%
Total Removed				

When the cohort was completely harvested, only 13.6% were downgraded due to paling of the flesh as opposed to 24% for Cohort #1 indicating that the strategies introduced to reduce maturation were having a positive effect. The final harvest was completed on January 26, 2015.

Cohort #3 (0114, Completed)

Summary of Cohort 0114 to week 68

Production		
FCRb	1.08	
FCRe	1.32	
TGC (lifecycle)	1.57	
SGR (lifecycle)	0.74%	
Average Condition	1.20	
Current Biomass (mt)	0.0	
Total Production (mt)	80.2	harvested+ current- smolt biomass
Smolts stocked (#)	40,210	
Current Inventory (#)	0	
Current Size (kg live)	0.0	
Smolt Size (gm)	100	

Mortality & Fish Health				
	#	%		Percent of start number
Fungus	7,452	18.5%		
Other	951	2.4%		* See note below
Culls	602	1.5%		
NVM	1,673	4.2%		No Visible Marks
Pre	22			
Adjust.	774	1.9%		Count adjustments
Total #	11,474	28.5%		
Biomass Loss		18.4%	14,744 kg	Percent of total production
Treatments				No antibiotics, salt, formalin

Water Quality (daily)		Max	Min	Average	
Temperature	C	16.4	11.1	14.0	
TAN	mg/l	3.00	0.04	0.77	
Nitrite	mg/l	1.47	0.01	0.24	
Nitrate	mg/l	266	3	119	
Oxygen	mg/l	12	7	9	
CO2	mg/l	28	6	16	
Salinity		8	1	4	
Alkalinity		145	10	56	
Hardness					No samples
Density (kg/m3)		94	16	47	peak daily was 22kg/m3
Water Velocity (cm/s)					No samples
TSS		20	5	9	
NTU		9.0	0.03	1.3	
ORP (mv)					No Samples

Feed			
Skretting			
	Max	Min	Average
Pigment	80	80	80
Fat	31	20	27
Protein	50	41	46

Smolts	
Vaccines	Forte Micro, APEX IHN, Ermogen Vibrogen II
Genetics	Mowi

Harvest	kg live	kg HOG
Total	84,170	69,861
Average Size	2.9	2.4
% Complete	100%	

* Other mortalities includes everything that does not fit into the main mortality categories including, for example: Fish that have jumped out of the tank, fish sucked into the bottom drain, fish removed for tissue samples, inventory adjustments when a tank is emptied.

Growth

Cohort #3 was delivered at 100g average weight on January 16, 2014. As can be seen from the "Growth Curve" (under "General Production Information"), unlike the first two cohorts transferred to the site, these fish had the benefit of near optimum temperatures being maintained for the majority of their time spent in quarantine (Q1). They were kept at a suboptimal temperature for the first 3 weeks (11-12°C - in order to help manage a fungus outbreak soon after transfer) which was undesirable and would have had some impact on growth. But essentially thereafter they were kept at 15°C for a total of 35 weeks at which point it was decided to drop the temperature of the entire GO system to 13C to test how this lower temperature might influence maturation. As a result, their growth up to that point had surpassed those of the previous two cohorts i.e. they were approximately 1,300g at week 33 when Cohort #1 and Cohort #2 were only 900g at the same period in their respective production cycles. Whereas Cohort 0313 displayed an apparent acceleration in growth (and maturation) when their temperature was increased from 12C up to 15C at about the same time in the production cycle, Cohort 0114 appeared to show a considerable downturn in growth soon after the drop in temperature. Feed conversion to 1300g had been excellent (FCRb of 0.88) and when the large grade had been fully harvested the FCR based on total volumes weighed at the processing plant finished at 1.08. The final harvest was completed on May 31, 2015.

With the large grade of this cohort we were able to exceed our 90kg/m3 target stocking density in the GO when we attained 94kg/m3 at the end of January, 2015. The average feed rate for this tank during the entire period spent in GO was 0.6%/day which was only a little lower than the rate recommended by the feed table (0.66%/day). A prototype aeration device was installed in the tank at the end of Oct which caused the feed level to crash. It took approximately 10 days for this size of fish (1,800g approx.) to acclimate to the device at which point feeding recovered and started to increase steadily again. For the 5 weeks prior to this, the fish on average matched the 0.7%/day feed rate recommended by the table despite periods of high CO_2 (exceeding 20ppm). Once they had adjusted to the aerator, they again matched the feed table until the density reached 70kg/m3. CO_2 at that point was >22ppm in that tank. From that point until the first harvest the feed rate was consistently lower than the table (0.5%/day versus 0.6%/day). During the harvest period the feed rate and fish appetite did not change significantly (0.4%/day versus 0.48%/day suggested by the table) as the biomass reduced suggesting that density was not the main factor limiting their feeding. CO_2 levels would have dropped sharply with each harvest and O_2 levels would have increased and stabilized so it would appear that they were not major factors either. Cataracts may also have played a role (see below) as could maturation. GSI testing of processed fish at the plant, while being much lower than previous cohorts, did indicate that the rate of maturation was increasing.

Feeds and Feeding

For a full description of the diet fed and methods used please see the appropriate section on page 12 and the feed formulation table on page 49 in the General Production Information section.

Fish Health

These fish were transferred from the same site as Cohort #1 and, similar to that batch of fish, they were already suffering from a significant fungal challenge. This resulted in elevated mortalities compared to Cohort #2, which had arrived from a different site and suffered very little fungus problems. During their time in Q1 10.5% of the population was lost, in large part attributed to fungus (9%).

Typically significant losses due to fungal mortalities have largely been confined to Q1 during that initial period when fish are still in the smoltification window and are stressed as a result of the morphological changes involved. We have seen fungal issues arise in GO in smaller fish (600g) as mentioned above with Cohort 1013. But this was when water quality conditions were poor and salinity was low (<3ppt) and we have seen it develop on the first cohort (0313) when maturation was well advanced. But generally speaking it has been relatively easy to manage with formalin treatments.

With the small grade of this cohort, however, a fungal outbreak occurred on large fish (>2.6kg) in March 2015 when the salinity of our incoming water dropped to as low as 1.2ppt and 7,500kg of fish were lost over a 4 week period as a result. The treatment regime developed from experience with previous outbreaks in GO was not as effective in this case and a new more aggressive regime had to be developed to bring the fungus under control. This involved three consecutive days of flush treatments with 80, 120 and 160ppm of formalin followed by 160ppm treatments on alternate days until the mortalities subsided. It was also necessary to give a higher dose of 200ppm to remove the last of the fungus.

These kinds of aggressive treatments pose quite a challenge in tanks of 500m3 of water since it can involve using up to 100l of formalin per treatment especially when dealing with outbreaks in more than one tank at the same time. The treatment itself has to be introduced in lower doses initially in order to acclimatize the bacteria in the biofilters and prevent biofilter disruption. Formalin also tends to kill bacteria and other microorganisms coating every surface of the system and so causes an increase in turbidity as a result.

The strategy used was ultimately successful and soon after the mortalities were declining, the salinity started to climb again which greatly enhanced controlling the outbreak. While we can expect to see a better response from treatments if we encounter this severe an outbreak again in the future due to the improved strategy developed, it clearly highlights the importance of salinity remaining high as possible to prevent fungal mortalities. For this tank the salinity had been falling for several weeks before the outbreak and had reached <2.4ppt when fungal mortalities started to appear. But ideally salinity should be no less than 4.5ppt as this is when the first sign of fungal issues tend to appear in the greater system particularly when fish are stressed e.g. during photoperiod changes or introduction of smolts.

For this reason, in April 2015 we plumbed in a dedicated line from our 6" well which tends to run at higher salinities than the main 8" and 12" production wells. Although there are limitations to how effective this well is in raising the salinity as it also varies seasonally in its salt content and it varies according to how much volume is pumped, having its own dedicated line will mean less dilution by mixing it with lower salinity water from the main production wells (especially when large volumes are required from the main wells to put to fish in the purge tank). Therefore, we will be able to direct the maximum salinity of this 6" well to where it is most needed at any particular moment in time which will give us better control over salinity and management of fungus in the future. In fact, this so far has proved very successful in GO where we have been able to maintain a temperature of 15C using higher exchange levels and yet maintain our salinity at ≥3ppt.

The higher salinity obviously directly influences the prevalence of fungus on the fish, but apart from that, there is also the suggestion that the low salinity in itself could be a stressor for the fish which could be a trigger or exacerbate the development of fungus. So this 6" well may be very effective going forward not only at helping to reduce the incidence of fungus, but it may also eliminate the need to increase the cooling capacity, since we may be able to use more exchange without going below the lower salinity threshold level.

The true cause of this fungal outbreak remains unknown. Water quality was determined to be good (TAN, Nitrite, CO_2, etc.,) and photoperiod can be ruled out as they were not subjected to any changes in lighting at the time. Mortalities started to appear at a density of about 65kg/m3 and reached a maximum of 67kg/m3. However, as indicated above the much higher densities (>94kg/m3) achieved with the large grade of this cohort did not appear to be a problem. There is the suggestion that the size of the fish when they hit higher stocking levels is an important factor and we do have some evidence to indicate that is the case with fish up to 6-700g. But in this case the fungal problem started in the small grade at 65kg/m3 when they were about 2.4kg average weight whereas the large grade had no such problems with fungus and they were only 1900g when they attained the same density. Dr. Steve Summerfelt has also indicated that he has reached densities of 100kg/m3 with 2.3-2.4kg fish with little negative impacts. So density does not look like being the main factor in this case.

Maturation may be an issue but we had graded out the majority of the maturing fish from that tank at that stage. Also, when the morts were examined very few were showing outward signs of maturation or contained egg sacs and in those that did contain signs of ova development the size of egg sacs was very small (<3”). In addition, with the first cohort of fish (which are the same strain as this cohort) almost all the fish matured to some degree and we had relatively minor fungus issues by comparison.

The grading process itself could have played a role. There were very few signs of fungus in either tank at the time of grading. Once we had removed the mature fish we very quickly saw fungus start to develop on the fish in the purge tank which suggests that it was brought on by the manual handling. The small grade was about 2.2kg when we manually graded them and while the setup worked very well in the past, it appeared to be stressful on this particular tank as we had 95 mortalities the day after (out of 15,000 fish or 33T in 2 days). As such, we modified the setup for the large tank (2.6kg average approx.) which resulted in only 22 mortalities (16,500 fish or 43T in 1 day). That said, the fungal mortalities only started to appear in the small grade 28 days following grading so it is difficult to establish how much of a role the grading process had. But it cannot be ruled out as a factor or perhaps as a trigger for the outbreak and it may be best to limit the size at which these fish are handled in the future, in particular when the salinity is low.

Also in the case of this cohort, almost 6% of the mortalities can be attributed to “shrinkage” or downward number adjustments when tanks are graded as the numbers delivered simply did not correspond with the numbers counted when the grading process was complete. Indeed, the numbers were up by 4.3% when the cohort was completely harvested. And as with other cohorts, the mort removal mechanism contributed to the mortalities as did self-inflicted damage caused by fish leaping behaviour, both of which were mitigated as the tanks were modified.

Cataracts

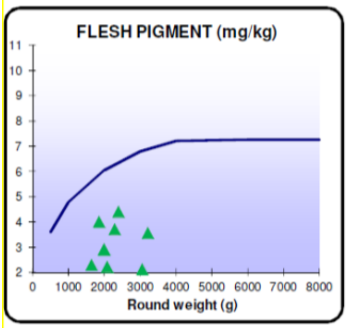
With this cohort cataracts started to emerge as an important factor influencing growth of the fish. A detailed description of the causes of cataracts is presented under the “General Production Information” heading as well as the strategy used to mitigate it. In weight samples carried out on these fish in February 2015, the small grade was observed to have 38.7% of the population with cataracts while the large grade was noted as having 12% with cataracts. In the tank with the small grade of fish, those with cataracts were 1920g versus 2227g in those without (14% smaller than the average) while in the tank with the large grade those with cataracts were 1859g versus 2739g in those without (32% smaller than the average). These tanks began harvest soon after so no further data was collected for this cohort. Data on cataracts up to this point is limited but now that it is surfacing as an issue with significant apparent impacts on growth, the prevalence and progression are being monitored more closely going forward in subsequent cohorts.

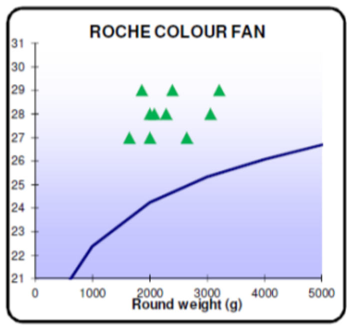
Flesh Quality Analysis

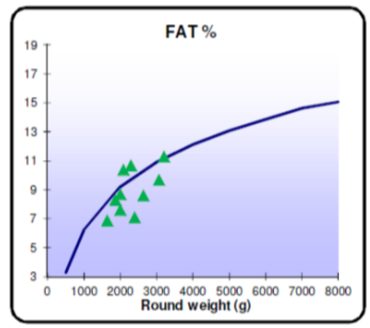
The results of NIR pigment analysis are shown below. Note that a switch from synthetic pigments to Panaferd (a natural-source astaxanthin-rich bacterial pigment) was made in Sept 2014.

Flesh Pigment Analysis

Fish no.	Round Weight (g)	Fish Length (cm)	Slaughter Loss %	Cond. factor (round)	Sex	Gonad Weight (g)	GSI %	Roche Colourfan score	Pigment NIR (NQC mg/kg)	EPA DHA (Total %)	Fat NIR (NQC %)
1	3210	61.5		1.38				29.0	3.6	1.4	11.3
2	2390	55.0		1.44				29.0	4.4	1.1	7.1
3	2640	58.0		1.35				27.0	1.1	1.3	8.6
4	1640	49.5		1.35				27.0	2.3	1.0	6.9
5	3060	61.0		1.35				28.0	2.1	1.4	9.7
6	2080	54.5		1.28				28.0	2.2	1.5	10.4
7	1860	56.0		1.06				29.0	4.0	1.2	8.3
8	2000	54.5		1.24				28.0	2.9	1.3	7.6
9	2290	56.0		1.30				28.0	3.7	1.4	10.7
10	2000	51.0		1.51				27.0	2.9	1.2	8.7
Average	**2317.0**	**55.7**		**1.33**				**28.0**	**2.9**	**1.28**	**8.9**
St.dev.	514.7	3.8		0.12				0.8	1.0	0.2	1.5







Flesh pigment levels are compared to historical results when feeding a 75, 65, 50, 40, 30 pigment regime.

Maturation

GSI testing in November 2014 indicated that the rate of maturation is increasing compared to the previous cohort (43% versus 36%). The GSI testing sampled 198 fish and the gonad size threshold was 0.1% for males and 0.2% for females. The average size of the fish that were sampled was 1.53kg live. But while Cohort #2 had 31% and 10% removed from the large and small grades respectively as being identifiable as maturing fish, the number identifiable for this cohort was only 9.5% for the large grade and 12.3% for the small grade. As with previous cohorts, it would appear that the maturing fish for the Mowi strain grown so far are smaller than the average population.

Manual Grilse Grade (Visibly Maturing)

	Date	Size (grilse)	Size (total)	Removed
Large Grade	31.1.15	1617	2600	9.5%
Small Grade	28.1.15	1617	2400	12.3%

Cohort #4 (0514)

Summary of Cohort 0514 to week 60

Production		
FCRb	1.02	
FCRe	1.11	
TGC (lifecycle)	1.61	
SGR (lifecycle)	0.76%	
Average Condition	1.25	
Current Biomass (mt)	64.5	
Total Production (mt)	91.5	harvested+ current- smolt biomass
Smolts stocked (#)	41,387	
Current Inventory (#)	21,891	
Current Size (kg live)	2.9	
Smolt Size (gm)	101	

Mortality & Fish Health	#	%		
				Percent of start number
Fungus	7,242	17.5%		
Other	523	1.3%		* See note below
Culls	494	1.2%		
NVM	751	1.8%		No Visible Marks
Adjust.	0	0.0%		Count adjustments
Pre	25	0.1%		Precocial
Total #	9,035	21.8%		
Total Losses		3.2%	2945 kg	Percent of total production
Treatments				No antibiotics, salt, formalin

Weekly Average Water Quality		Max	Min	Average	
Temperature	C	15.7	12.0	13.5	
TAN	mg/l	5.88	0.07	0.78	
Nitrite	mg/l	0.98	0.01	0.12	
Nitrate	mg/l	266	8	126	
Oxygen	mg/l	12	7	9	
CO2	mg/l	28	3	15	
Salinity		6.8	1.3	3.6	
Alkalinity		145	30	66	
Hardness					No samples
Density (kg/m3)		96	16	55	peak daily was 22kg/m3
Water Velocity (cm/s)					No samples
TSS					No samples
NTU		2.9	0.03	0.6	
ORP (mv)					No Samples

Feed	Max	Min	Average
Skretting			
Pigment	80	80	80
Fat	25	25	25
Protein	45	45	45

Smolts	
Vaccines	Forte Micro, APEX IHN, Ermogen Vibrogen II
Genetics	Mowi

Harvest	kg live	kg HOG	
Total	31,088	25,803	Harvesting not started
Average Size	3.0	2	
% Complete	32%		

* Other mortalities includes everything that does not fit into the main mortality categories including, for example: Fish that have jumped out of the tank, fish sucked into the bottom drain, fish removed for tissue samples, inventory adjustments when a tank is emptied.

Growth

Cohort #4 was delivered at 101g average weight on May 12, 2014 and was the first group to be grown at 13C (versus 15C) from the start in order to test the impact this would have on reducing maturation rates. It can be seen from the "Growth Curve" (under "General Production Information") that they have exhibited the best growth to >500g of all the cohorts stocked to date. This is despite being grown at lower temperatures from stocking. They had demonstrated a growth rate of 1.45%/day to 500g which is well ahead of all the others which grew in the range of 1.28-1.38%/day to a similar size. This enhanced growth reflects a gradual improvement in growing conditions as we have systematically resolved many of the commissioning problems, in particular, the murky water issue which was more recurrent in the quarantine (Q1) system than in the growout (GO). Conditions in the quarantine at this time were far better than in the past with an average for this group of 0.98 NTU (compared to 4.27 NTU for Cohort #3) while in Q1 and the fish remained for over 4 months in the system reaching a stocking density in excess of 80kg/m3.

Despite showing better growth than the other cohorts initially (to approximately 500g), it can also be seen from the growth graph that they did slow down thereafter. One possible explanation for this is density. The table below shows that once the fish were on a full ration, their appetite continued to increase and they exceeded the ration recommended by the table. Once densities approached 40kg/m3 the feed response started to slow down and the ration fed was gradually decreased and beyond 60kg/m3 the ration fed was consistently lower than that recommended by the table.

Feed Response

Days	Temp (C^o)	Ration (Actual)	Ration (Table @ 13C)	Max Density (kg/m3)	Max Feed Load (kg/d)	Average Feed Load
17	13.7	1.30%	1.30%	16	54.0	30
33	13.4	1.60%	1.30%	27	103.0	83
15	13.6	1.30%	1.19%	41	136.0	117
26	13.1	1.10%	1.08%	60	199.0	140
36	13.1	0.80%	1.00%	80	175.0	146
12	13.5	0.70%	0.96%	88	163.0	156

Another factor that reduced growth and caused this cohort to stray from their growth curve is the change in photoperiod. We have seen with all cohorts that soon after the light regime is changed the feed rate is adversely affected for a period afterwards. From what we have seen to date, the duration of the response seems to be fairly consistent, in that we see 3 weeks of much reduced rations with recovery starting in the 4th week and generally returning to 100% ration by the end of the 4th week or the start of the 5th week. The severity of the response, however, would appear to be size related with the associated feeding crash being more pronounced with smaller fish (2-300g) than with larger fish (1-1.5kg).

Cohort 0514 slowed down in Dec/Jan due to the change from SNP to LL on Dec 22nd which caused the ration to reduce and become erratic. If their feed rate had remained consistent during the time period taken to acclimatize to the change in photoperiod, the small grade would have been 1370g. Instead they were 1134g (a drop in TGC from 2.2 to 1.7). The large grade should have been 1836g but were instead 1561g (a drop in TGC from 2.1 to 1.9). Clearly the change of light regimes was having a substantial detrimental impact on growth and for some cohorts (Oct entry) the lights are changed twice during the production cycle. This led us to investigate strategies to mitigate this which are explained in more detail in the Early Maturation Strategy section of this document.

Despite these impacts on growth, the large grade of this cohort exceeded our previous maximum stocking density when they attained 96kg/m3 with no apparent negative impacts.

Feeds and Feeding

An important factor that appeared to improve growth early on with this cohort is the use of a transfer diet before and after entry to Q1. Following transfer to seawater there is always a critical period before the fish reach full appetite. The length of this period has a significant impact on the end result and typically varies from 8-15 weeks in the net pens. The transfer diet concept, Nutra Supreme and Spirit Supreme, are claimed to give seawater fish farms faster growing fish and more kilos of fish to harvest. Feeding salmon Nutra Supreme in the last five to six weeks before transferring the smolt to sea, and Spirit Supreme in the first five to six weeks in the sea is reported to help salmon reach full appetite much faster. In our case we have found that the time to full ration was only 17 days with this cohort whereas it was an average of 30 days with previous cohorts fed a standard diet and was as high as 28 days for Cohort 0114 grown at the same temperature (13.7C) but fed a standard diet.

For a full description of the diet fed and methods used please see the appropriate section on page 12 and the feed formulation table on page 49 in the General Production Information section.

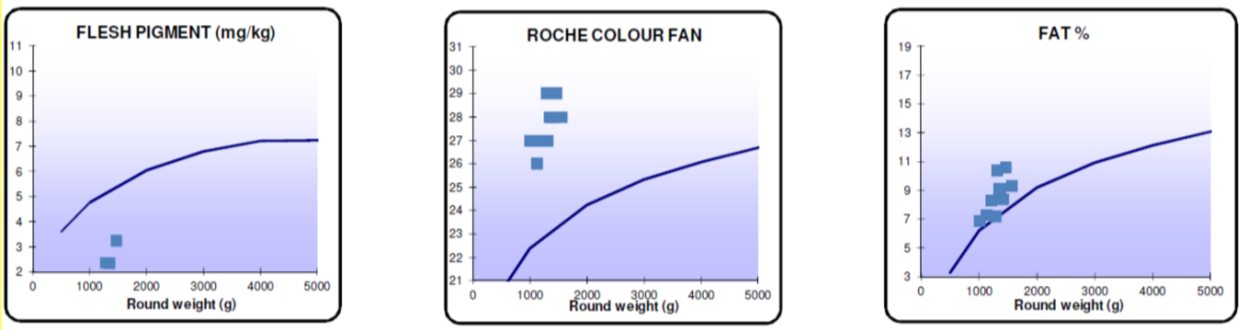
Fish Health
These fish were delivered from the same site that usually results in severe fungal outbreaks soon after transfer. In fact these fish were visibly suffering from a chronic fungal infection pre-delivery and the day following delivery we had >500 mortalities all due to fungus. The daily mortalities continued at this rate until treatments brought it under control three weeks later. By the time the outbreak had subsided we had lost 6835 fish (16.5%). Clearly, fungal related mortalities combined with low salinity (2ppt average) represent our greatest health threat and there appears to be enormous variability in the fungus challenge and response to treatment experienced with each cohort. A new strategy was developed based on lessons learnt with various treatment protocols to date and this was successfully trialed with subsequent cohorts. Thereafter with this cohort mortalities were relatively low and included culls, fish damaged from jumping and samples taken for GSI testing.

Cataracts
As noted earlier, data on cataracts up to this point is limited but now that it is emerging as an issue with significant apparent impacts on growth, the prevalence and progression are being monitored more closely going forward. The tank with the large grade (2437g) had 38.2% of the sample showing signs of cataracts and the average weight of the fish with cataracts was 18% smaller than the average weight of the fish without. In the final sample (2899g) before commencement of harvesting of the large grade the prevalence had increased to 59% and the average of those with cataracts was 20% smaller than those without. Harvesting of this tank began thereafter so no more data is available beyond this date for the large grade.

The tank with the small grade was sampled in April (2064g) and at that time 35.5% of the sample had cataracts and the average weight of the fish with cataracts was 11% smaller than the average weight of the fish without. The latest samples in July (2730g) recorded prevalence of 35% with the afflicted fish being 14.4% smaller than the average (20% smaller in the case of fish with cataracts in both eyes versus 10% smaller with cataracts in one eye only). This percentage is likely to increase as the fish continue to grow since the normal fish will continue to grow at a faster rate than those with cataracts as they are less efficient feeders. This has an obvious impact on growth and hence mitigating strategies have been implemented as outlined in the Cataracts section under General Production Information.

Flesh Quality Analysis
The results of NIR pigment analysis are shown below. Note that there is a consistent trend developing whereby the pigment NIR (NQC mg/kg) consistently reads lower than the historical results while the Roche score tends to be either as expected or reads high. This difference has become even more pronounced since switching to Panaferd in Sept 2014.

Fish no.	Round Weight (g)	Fish Length (cm)	Slaughter Loss %	Cond. factor (round)	Sex	Gonad Weight (g)	GSI %	Roche Colourfan score	Pigment NIR (NQC mg/kg)	EPA DHA (Total %)	Fat NIR (NQC %)
1*	1120	45.0		1.23				26.0	1.5	1.2	7.3
2	1280	49.5		1.06				29.0	2.4	1.0	7.2
3*	1560	50.5		1.21				28.0	1.6	1.4	9.3
4*	1000	45.0		1.10				27.0	1.3	1.0	6.9
5	1340	49.0		1.14				28.0	2.3	1.3	9.1
6	1460	50.0		1.17				29.0	3.3	1.5	10.6
7*	1360	47.5		1.27				28.0	1.5	1.4	9.1
8*	1210	48.5		1.06				27.0	1.6	1.3	8.3
9*	1410	47.0		1.36				28.0	1.7	1.3	8.4
10*	1310	47.5		1.22				27.0	1.4	1.6	10.4
Average	**1305.0**	**48.0**		**1.18**				**27.7**	**1.8**	**1.3**	**8.7**
St.dev.	163.7	1.9		0.10				0.9	0.6	0.2	1.3



Flesh pigment levels are compared to historical results when feeding a 75, 65, 50, 40, 30 pigment regime.

Note: * These fish read as outliers on the NIR

Maturation

GSI testing carried out on 248 fish in April 2015 indicated that 56% were maturing. At the time the samples were taken the validity of the GSI testing was being brought in to question since the results had been indicating that the rate of maturation was increasing with each cohort whereas evidence from observations in the tanks, grilse grading and downgrades at harvest have shown the opposite to be true. When the large and small grade were approximately 2200g and 1900g average weight respectively, visual inspection during sampling indicated that 2% and 9% were maturing whereas our previous best (Cohort #3) showed rates of 8% and 13% at the same size and this remained relatively stable right up to the grilse grade. So Cohort #4 appeared on course for exhibiting the lowest rate of maturation to date. Very soon afterwards, however, a rapid acceleration in the maturation rate was observed prompting a grilse grade at 2.9kg and 2.5kg. At that time approximately 20% of the large grade and 22% of the small grade were removed which supported, on this occasion, the increase indicated by the GSI testing.

In contrast to previous cohorts, the maturing fish for this cohort were larger than the average population indicating that there is likely to be variability in this outcome from one population stocked to the next.

Manual Grilse Grade (Visibly Maturing)				
	Date	Size (grilse)	Size (total)	Removed
Large Grade	1.6.15	3258	2931	20%
Small Grade	16.6.15	2640	2496	21.6%

Cohort #5 (1014)

Summary of Cohort 1014 to week 36

Production		
FCRb	0.84	
FCRe	1.08	
TGC (lifecycle)	1.56	
SGR (lifecycle)	0.89%	
Average Condition	1.21	
Current Biomass (mt)	48.9	
Total Production (mt)	44.5	harvested+ current- smolt biomass
Smolts stocked (#)	45,163	
Current Inventory (#)	42,686	
Current Size (kg live)	1.1	
Smolt Size (gm)	101	

Mortality & Fish Health				
	#	%		Percent of start number
Fungus	1,874	4.1%		
Other	102	0.2%		* See note below
Culls	101	0.2%		
NVM	402	0.9%		No Visible Marks
Adjust.	0	0.0%		Count adjustments
Total #	2,479	5.5%		
Total Losses		2.5%	1121 kg	Percent of total production
Treatments				No antibiotics, salt

Weekly Average Water Quality		Max	Min	Average	
Temperature	C	15.7	12.3	13.5	
TAN	mg/l	1.93	0.15	0.84	
Nitrite	mg/l	1.47	0.01	0.17	
Nitrate	mg/l	227	11	79	
Oxygen	mg/l	12	7	9	
CO2	mg/l	28	4	14	Peak daily was 10mg/l
Salinity		6.6	1.4	4.4	
Alkalinity		125	30	75	
Hardness					No samples
Density (kg/m3)		78	17	39	peak daily was 22kg/m3
Water Velocity (cm/s)					No samples
TSS					No samples
NTU		1.2	0.01	0.5	
ORP (mv)					No samples

Feed	Max	Min	Average
Skretting			
Pigment	80	80	80
Fat	25	25	25
Protein	45	45	45

Smolts	
Vaccines	Forte Micro, APEX IHN, Ermogen Vibrogen II
Genetics	Mowi

Harvest	kg live	kg HOG	
Total	0	0	Harvesting not started
Average Size			
% Complete	0%		

* Other mortalities includes everything that does not fit into the main mortality categories including, for example: Fish that have jumped out of the tank, fish sucked into the bottom drain, fish removed for tissue samples, inventory adjustments when a tank is emptied.

Growth

Cohort #5 was delivered at 98g average weight on October 27, 2014 from the same hatchery as Cohort #2. As experienced before with fish from this site, they tend to have excellent fin condition with few signs of fin erosion and low size disparity and this, when combined with the seasonal peak salinities in the source water at the time of entry (>6ppt), meant we had negligible mortalities (0.5%) for the entire period in quarantine (Q1).

This cohort has experienced less commissioning issues so far than all the previous cohorts but has not been able to avoid them entirely – the conditions experienced by this cohort in Q1 were the best of all the cohorts to date with an average turbidity in Q1 of 0.34 NTU but we did still have periods of murky water with turbidity elevated and peaking at 0.88 NTU. This was due to waste accumulating on the tank floor (confirmed by operating a remotely operated vehicle in the tank with a camera attached) and also in the sump in the centre of the tank. The impact of this was reduced in the short term by removing the centre drain standpipe and by vigorous agitation of the sump in the tank until it was clear using the air from the mort removal mechanism. The good overall conditions that these fish experienced in Q1 were also due to the short duration of their time in the system as they were delivered on October 27th but had to be removed again soon after to make way for the January entry.

They showed very good appetite and feed response in Q1 up until they reached a density of 40-50kg/m3 and a peak feed load of 170kg/day at which point feeding reduced and became more erratic. The change in the feeding behavior in Q1 was also around the time that the fish were put on to 24 hour lighting. As mentioned earlier, typically after the light regime is changed the feeding is impacted for 3-4 weeks afterwards. In the case of this cohort, the change in photoperiod seemed to have a more severe response than we had experienced before resulting in the ration dropping from a peak of 170kg/day to an average of 60kg/day for three weeks before rapidly picking up again. This, of course, will affect the growth curve for this cohort. This cohort was subjected to another photoperiod change from the 8th of June using a newly devised strategy explained in the Early Maturation Strategy section of this document. This strategy took approximately 4 weeks to complete and while the level of feeding actually increased throughout the implementation period, approximately two weeks after the changes were complete the feeding did reduce in both grades of this cohort. The severity of the change was greatest in the more heavily stocked large grade (65kg/m3) with the ration reducing to 40%. In the small grade (stocked at 50kg/m3) the reduction was much lower (only a 7% reduction in feeding). However, this may change in the coming days. This combined with the reduction resulting from the first photoperiod change will adversely impact the growth of this cohort.

Once they attained a density in excess of 35kg/m3 in a GO tank the rate of mortalities due to fungus accelerated which also coincided with falling salinities (fungus mortalities started to appear at ≤ 3.7ppt) which was exacerbated by a 3 week shut down of our higher salinity 6” well due to a mechanical failure. In fact, the majority of mortalities (2.3%) in this cohort to date occurred during this 8 week period during which time the fish were acclimatizing to a change in the photoperiod regime, the density increased beyond 45kg/m3 and the salinity dropped to as low as 1.4ppt. While the density cannot be ruled out as a stressor for this size of fish it is unlikely to be the main one since the appetite of the fish picked up significantly following treatments and an increase in salinity. It is likely that the change in photoperiod was the biggest stressor and if salinity could be maintained at >4.5ppt, then opportunistic fungal outbreaks would likely have not occurred to anywhere near the same extent.

A point to note is that this fungal outbreak occurred in this group of fish at the same time as an outbreak that occurred in the small grade of Cohort #3. Whereas the treatment regime used on both tanks was similar and both benefited from rising salinity levels, the mortalities reduced to very low numbers in Cohort #3 whereas they remained elevated in Cohort #5. A significant difference between the two tanks is that we had begun to harvest from Cohort #3 and so reduced the density from 67kg/m3 down to 45kg/m3 whereas the density for Cohort #5 continued to rise as mentioned above.

It was suggested in the last Metrics Report (#6) that density could be playing a role in both outbreaks. And as indicated earlier, we also experienced a similar fungal outbreak in Cohort #2 when they were at a similar size (5-600g), the density exceeded 40kg/m3 and the turbidity of the GO system was high (>9 NTU). While treatments were successful in bringing that mortality episode under control, the mortalities remained elevated until the fish were split and graded into two tanks. It was also noted in the last report that this again, could suggest that densities beyond 40kg/m3 could be an issue for fish in this size range.

However, while density cannot be ruled out as having a role to play it is quite likely that it was not the overriding factor or, at the very least, that the fish may have the ability to acclimatize to such conditions. This is because approximately two weeks after the higher salinity 6" well was brought on line the salinity had increased from 1.2 to 5.4ppt and within three weeks the mortalities declined to very low numbers and the appetite of the fish improved despite the densities continuing to increase and eventually reaching 80kg/m3 prior to grading.

Feeds and Feeding

These fish were fed a transfer diet before and after entry and they achieved 100% appetite in less than 19 days post-delivery. For a full description of the diet fed and methods used please see the appropriate section on page 12 and feed formulation table in General Production Information section on page 49.

Fish Health

As indicated above, the only significant losses to date were experienced over 8 weeks when falling salinities along with stressed fish allowed fungus to gain a foothold. To bring the outbreak under control, three consecutive treatments of formalin were required, ranging in dose rate from 80-120ppm. These were then followed up every second day with 120ppm until the mortalities had subsided. The efficacy of the treatments was greatly enhanced by rising salinity in the system at the time (1.2ppt at its lowest point and rising to about 5.6ppt).

Cataracts

Sampling of these fish in July indicated that 16.7% of the population in the large grade (1300g approx.) were recorded as having cataracts and these fish were 11% smaller than the average. Those with cataracts in both eyes (rather than just one eye) were 19% smaller than the average. The small grade (1080g approx.) had 13% with cataracts and they were 3% smaller than the average. Those with cataracts in both eyes were 14% smaller than the average.

Maturation

N/A – not yet large enough to sample.

Cohort #6 (0115)

Summary of Cohort 0115 to week 24

Production		
FCRb	0.86	
FCRe	0.90	
TGC (lifecycle)	1.78	
SGR (lifecycle)	1.08%	
Average Condition		no samples
Current Biomass (mt)	39.5	
Total Production (mt)	34.7	harvested+ current- smolt biomass
Smolts stocked (#)	45,340	
Current Inventory (#)	44,834	
Current Size (kg live)	0.88	
Smolt Size (gm)	106	

Mortality & Fish Health				
	#	%		Percent of start number
Fungus	136	0.3%		
Other	24	0.1%		* See note below
Culls	78	0.2%		
NVM	267	0.6%		No Visible Marks
Adjust.	0	0.0%		Count adjustments
Pre	1	0.0%		
Total #	506	1.1%		
Total Losses		0.4%	129 kg	Percent of total production
Treatments				No antibiotics, salt

Weekly Average Water Quality		Max	Min	Average	
Temperature	C	15.7	11.8	13.8	
TAN	mg/l	1.93	0.10	0.76	
Nitrite	mg/l	1.08	0.02	0.18	
Nitrate	mg/l	201	23	81	
Oxygen	mg/l	11	7	9	
CO2	mg/l	28	7	18	Peak daily was 10mg/l
Salinity		9.7	1.4	4.6	
Alkalinity		120	70	87	
Hardness					No samples
Density (kg/m3)		79	19	30	peak daily was 22kg/m3
Water Velocity (cm/s)					No samples
TSS					No samples
NTU		1.8	0.12	0.5	
ORP (mv)					No samples

Feed			
Skretting			
	Max	Min	Average
Pigment	80	80	80
Fat	25	25	25
Protein	45	45	45

Smolts	
Vaccines	Forte Micro, APEX IHN, Ermogen Vibrogen II
Genetics	Mowi

Harvest	kg live	kg HOG	
Total	0	0	Harvesting not started
Average Size			
% Complete	0%		

* Other mortalities includes everything that does not fit into the main mortality categories including, for example: Fish that have jumped out of the tank, fish sucked into the bottom drain, fish removed for tissue samples, inventory adjustments when a tank is emptied.

Growth

Cohort 0115 was transferred to the facility at 106g average weight on January 16, 2015. This cohort experienced generally good water quality conditions during their time in Q1. At the start, however, we were still experiencing problems with waste accumulation in the tank and in the tank sump which caused turbidity to rise at times peaking at 1.20 NTU. After approximately 5 weeks, we were largely able to eliminate the problem of waste collecting in the sump. This was achieved by increasing the flow to the tank, by diverting it from the biofilter, and by installing a modified inlet manifold in the tank that directed more flow towards the centre. These changes combined with ozone injection allowed us to maintain an average turbidity thereafter of about 0.25 NTU (for comparison, Cohort #3 experienced an average of 4.37 NTU during it's time spent in Q1). Note, however, that just like all the other cohorts in the Q1 system these fish also hit a wall where the feeding crashed, in this case at a density of 42kg/m3 and a feed load of 168kg feed/day.

The water quality started to deteriorate at about the same time as the reduction in feeding which was traced, at least in part, to insufficient fluidization in the biofilter. It was believed at the time that this was a result of the flow being diverted to the tank to improve its self-cleaning capacity. This tactic was reversed to some extent by returning the flow back to the biofilter and attempting to find a balance whereby waste does not accumulate in the tank sump as it did previously and at the same time the biofilter is sufficiently fluidized. This approach did not result in improved turbidity during the remainder of their time in Q1.

It should also be noted that we discovered a major problem with solid waste accumulation in the CO_2 stripper sump a few months back when we lowered it to do a repair. It was thereby felt that this particular issue may have been contributing to the murky water (e.g. a leachate or solids emanating from the CO_2 stripper sump at a certain feed load or bacterial proliferation as a result of the waste accumulation). As such, once this cohort was removed, the water in the sump was drained to carry out modifications to the manifolds in the base of the sump to try and prevent this waste from accumulating.

Another potential factor we considered is that there may be significant volumes of waste sitting on the floor of the tank despite increasing the flow and changing the inlet manifold. This would result in nutrients dissolving in to the water and can contribute to bacterial propagation. To minimize this risk the mort screen in the base of the tank was removed and additional holes drilled to facilitate movement of waste solids toward the sump and effluent. Subsequent filming with a submerged camera indicates that there is no buildup of solids on the floor of the quarantine tank.

Also, as pointed out earlier there is some evidence from previous cohorts which could indicate that density could be a factor for this small size of fish causing a slowdown in appetite (change of photoperiod regime cannot be implicated in this case as the fish remained on 24 hour lights following transfer from the hatchery where they would also have been exposed to 24 hour lights).

Whatever the cause of the reduction in appetite, it was becoming increasingly difficult to maintain the desired turbidity levels despite using increasing volumes of ozone and exchange and this would have undoubtedly impacted the growth to some extent.

Similar to Cohort #5, these fish were subjected to a photoperiod change from the 8th of June using a newly devised strategy explained in the Early Maturation Strategy section of this document. This strategy took approximately 4 weeks to complete and while the level of feeding actually increased throughout the implementation period, approximately two weeks after the changes were complete the feeding did crash in this tank. The severity of the change was greater in this tank than the others which could be correlated with the fact that the tank was more heavily stocked (>90kg/m3 versus 65 & 50kg/m3 in the others).

A final point to mention in relation to growth is that it took more than twice as long to get these fish on to a full ration (see notes below on “Feed and Feeding”) than previous cohorts. Any growth gains or losses with small fish are important as they tend to be maintained throughout the production cycle so taking longer to get to 100% ration will have some negative impact on their growth curve.

Feeds and Feeding

We have noticed that the prophylactic treatment used for this cohort to prevent fungal mortalities appeared to impact the time taken to get the smolts to 100% ration. For example, it can be seen from the table below that it took this cohort 40 days to reach 100% ration when operating in the range of 9.7ppt to 3.7ppt (average 7.5ppt & 13.1C) whereas with Cohort #5 they were on 100% ration in just 19 days when operating in the range of 6.6ppt to 5.8ppt (average 6.3ppt & 12.9C).

Time Taken to Reach 100% Ration Following Delivery to Site

Cohort	Days	Temp (C°)	Average Salinity (ppt)	Min Salinity (ppt)	Max Salinity (ppt)	Standard Deviation	Diet
0313	25	11.1	5	3.1	8.4	3.7	Standard
1013	38	11	3.8	2.9	4.9	1.4	Standard
0114	28	13.7	5.5	5	5.8	0.6	Standard
0514	17	13.7	2.2	2	2.4	0.3	Supreme
1014	19	12.9	6.3	5.8	6.6	0.6	Supreme
0115	40	13.1	7.5	3.7	9.7	4.2	Supreme

Both cohorts received the Skretting Supreme transfer diet before and after transfer and so it is speculated that the higher salinity at the start may have been the cause for the delay. There could also be a correlation with how stable the salinity is during this time period. So operating at a reduced salinity of 6ppt and maintaining that salinity as consistently as possible may both be important factors in influencing the time to 100% ration. As a result, we plan to operate Cohort #7 at a consistent 6ppt for 3-4 weeks to test this theory.

For a full description of the diet fed and methods used please see the appropriate section on page 12 and feed formulation table in the General Production Information section on page 49.

Fish Health

As indicated above, fungal outbreaks with fish from one supplier during the first 6-8 weeks in Q1 have resulted in heavy mortalities especially when the salinity levels in the production wells are low (<4.5ppt). For this cohort we implemented a new strategy whereby we raised the salinity of the Q1 system to 9.5ppt and allowed it to fall very gradually to 3.7ppt over 5 weeks (average of 7.5ppt over that period). We were also required to give formalin treatments over three consecutive days ranging from 120-160ppm. This prophylactic salt treatment along with the formalin treatments has proven extremely successful as instead of experiencing up to 17% mortalities in the first 6 weeks, the fish are now through the highest risk period and with just 1% total mortalities - 0.3% due to fungus.

Cataracts

These fish would have benefited from the introduction early in their production cycle of the preventative measures described in the Cataracts section in the General Production Information. So far they have not shown any incidence of cataracts with their current weight being >938g.

Maturation

N/A – not yet large enough to sample.

Cohort #7 (0415)

Summary of Cohort 0415 to week 11

Production			
FCRb	0.73		
FCRe	0.74		
TGC (lifecycle)	1.67		
SGR (lifecycle)	1.18%		
Average Condition			no samples
Current Biomass (mt)	16.8		
Total Production (mt)	11.8		harvested+ current- smolt biomass
Smolts stocked (#)	39,840		
Current Inventory (#)	38,756		
Current Size (kg live)	0.43		
Smolt Size (gm)	125		

Mortality & Fish Health				
	#	%		Percent of start number
Fungus	579	1.5%		
Other	35	0.1%		* See note below
Culls	72	0.2%		
NVM	442	1.1%		No Visible Marks
Adjust.	0	0.0%		Count adjustments
Pre	2	0.0%		
Total #	1,130	2.8%		
Total Losses		1.3%	149 kg	Percent of total production
Treatments				No antibiotics, salt

Weekly Average Water Quality		Max	Min	Average	
Temperature	C	15.7	12.0	14.6	
TAN	mg/l	7.34	0.26	1.44	
Nitrite	mg/l	1.22	0.04	0.40	
Nitrate	mg/l	202	1	44	
Oxygen	mg/l	11	8	9	
CO2	mg/l	10	8	9	Peak daily was 10mg/l
Salinity		6.8	2.8	5.2	
Alkalinity		145	120	134	
Hardness					No samples
Density (kg/m3)		66	19	40	
Water Velocity (cm/s)					No samples
TSS					No samples
NTU					
ORP (mv)					No samples

Feed			
Skretting			
	Max	Min	Average
Pigment	80	80	80
Fat	25	25	25
Protein	45	45	45

Smolts	
Vaccines	Forte Micro, APEX IHN, Renogen
Genetics	Mowi

Harvest			
	kg live	kg HOG	
Total	0	0	Harvesting not started
Average Size			
% Complete	0%		

* Other mortalities includes everything that does not fit into the main mortality categories including, for example: Fish that have jumped out of the tank, fish sucked into the bottom drain, fish removed for tissue samples, inventory adjustments when a tank is emptied.

Growth

Cohort 0415 was transferred to the facility from a new source on April 20, 2015 and was our largest smolt entry to date at 125g (25% larger than projected). Work had been carried out on the CO2 stripper sump in Q1 prior to the delivery in an attempt to reduce the accumulation of sludge previously observed in this part of the system. This involved strategically drilling holes in the pipe manifold at the bottom of the sump and required that the biofilter be taken off line (no fluidization) for approximately 8 hours. This was not the first time we had carried out this procedure but on this occasion we found that when we brought the biofilter back on line that biofloc persistently emanated from the biofilter for many weeks afterwards causing murky water conditions (max of 4.1NTU).

Upon inspection we found that there were a number of areas at the bottom of the biofilter where sand was not fluidized and was gathering in mounds approximately 2 feet deep. An examination of the flow rates on each of the biofilter laterals (all valves 100% open) using a flow meter found that the laterals where sand was most inclined to accumulate had an average flow rate of only 284lpm compared to an average of 475lpm for the others. Several attempts were made to correct this using the valves as well as by diverting flow from the tank to the biofilter to increase fluidization but there was a limit to how much could be diverted from the tank due to the accumulation of waste in the Q1 tank sump as previously noted.

Each time we made an adjustment or change like this we noticed that the quantity of biofloc leaving the biofilter increased, almost certainly due to the change in the flow dynamics of the fluidized sand created by the change in flow to the biofilter cell. Repeated failed attempts to prevent dead areas of sand using the flow from the tanks led to the decision to increase the overall flow to the system by bringing online a centrifugal pump that had been installed in the Q1 system when we had faulty pumps in operation (underperforming by up to 30%) while the first cohort occupied the system. We have also directed all our surplus heat from the mechanical room in to the Q1 unit and vented CO_2 stripped air inside the Q1 building in order to maximize the heat load such that the maximum possible water exchange could be used to alleviate the murky conditions without lowering the temperature below the 15C optimum (maximized feeding is also contributing to the heat load).

This in combination with the use of ozone has allowed us to stabilize the turbidity at about 1 – 1.5NTU despite introducing record feed loads. It is expected that with these tactics along with the use of increased flow capacity, the install of drop-down pipes to the remaining trouble areas in the biofilter (1" pipes directing flow toward the remaining areas of dead sand), a lengthening of the siphon pipe to improve removal efficiency of old biofloc, an increase in the depth of the Q1 tank to reduce waste accumulation in the tank sump and increased tank turnover will, over a period of weeks, contribute to further improvement in water quality and stabilization of the biofilter. If these measures are unsuccessful then we will take the biofilter offline at the earliest opportunity and empty it to allow a thorough assessment and potential reconfiguration of the pipe manifolds at the bottom.

Indeed, at the time of writing the water clarity had improved markedly (0.4NTU) while putting in 245kg of feed/day and the fish were showing no signs of a reduction in appetite despite being at a density of 80kg/m3 (previously 160-170kg feed/day was the max we could achieve in Q1 before a marked slowdown in performance). It was also decided not to change the lights with this cohort of fish and to instead trial them with LL regime right through the production period and this has also greatly contributed to the improved feeding levels observed by this cohort to date in Q1.

Feeds and Feeding

It can be seen from the table below that despite sub optimal water quality conditions it took this cohort 25 days to reach 100% ration when operating in a narrow salinity range (6.5 ± 0.6 ppt) and average temperature of 13.2C. This is not our best result to date (19 days) but is a vast improvement on Cohort #6 which took 40 days to get to 100% ration at the same temperature (and use of the transfer diet) but with a much greater salinity range (±4.2ppt). This would suggest that, along with the use of the transfer diet, maintaining stable salinity conditions during the first 3-4 weeks is a very important factor in reducing the time to 100% ration which, in turn, will impact the growth trajectory of that cohort thereafter.

As noted above, these fish were transferred from a new location and the husbandry conditions experienced by the fish were, in some respects, quite different to what they experience at Kuterra. For example, the lights used at Kuterra are submerged lights whereas the source hatchery used overhead lights. As well as this, the source hatchery used a stationary feeder that dropped the feed in one location of the tank whereas at Kuterra we use a spreader which can be observed by the fish spinning and spreading feed over the entire circumference of the tank. They are also coming from a tank where the fish are very much sheltered from surrounding activity by a canopy that completely encloses the tank, plus there is virtually no noise. In the Q1 system the fish are more exposed to activities outside the tank and noise levels than they are used to.

All of these are just some examples of conditions the fish need to acclimatize to when they are first delivered to the Kuterra site and thereby influence the time to 100% ration. It is also expected that operating at 15C with future cohorts in Q1 rather than 13C very soon after delivery of the smolts (while carefully monitoring fungus which is more prolific at higher temperatures) should significantly reduce this time and so maximize growth performance further. The ultimate solution would be to have an onsite hatchery linked to the smolt tank such that the smolts are exposed to the same conditions they have experienced all their lives while having the ability to gradually change key parameters in that tank as appropriate (e.g. salinity).

Time Taken to 100% Ration Following Delivery to the Site

Cohort	Days	Temp (C^{o})	Average Salinity (ppt)	Min Salinity (ppt)	Max Salinity (ppt)	Standard Deviation	Diet	Dates
0313	25	11.1	5	3.1	8.4	3.7	Standard	19/3/13-12/4/13
1013	38	11	3.8	2.9	4.9	1.4	Standard	24/10/13-30/11/13
0114	28	13.7	5.5	5	5.8	0.6	Standard	29/01/14-25/02/14
0514	17	13.7	2.2	2	2.4	0.3	Supreme	12/5/14-28/5/14
1014	19	12.9	6.3	5.8	6.6	0.6	Supreme	27/10/14-14/11/14
0115	40	13.1	7.5	3.7	9.7	4.2	Supreme	15/1/15-23/02/15
0415	25	13.2	6.5	5.9	6.8	0.6	Supreme	17/4/15-11/05/15

For a full description of the diet fed and methods used please see the appropriate section on page 11 and feed formulation table in the General Production Information section.

Fish Health

For this cohort we were again able to maintain salinity at a level that gave excellent control over fungal mortalities (1.3% fungal mortalities by the time they were through the high risk period – negligible mortalities thereafter). That said, however, the murky water conditions experienced at the start would have contributed to higher than normal mortalities and should mean even lower mortalities (similar to Cohort #6) once the problem is fully rectified.

On this occasion we were able to use well water from the higher salinity 6" well rather than continually adding industrial salt to artificially raise the salinity. This has obvious cost saving implications but, more importantly, raising the salinity in this way allows for an increase in key minerals and trace elements that play an important role in fish physiology (e.g. calcium) and which may be low under very low salinity conditions at the Kuterra site or not present to the same extent when using industrial salt. This could also be playing an important role allowing us to sustain a strong appetite in Q1 while feeding at record levels.

Cataracts

So far these fish have not shown any incidence of cataracts with their current weight being >480g.

Maturation

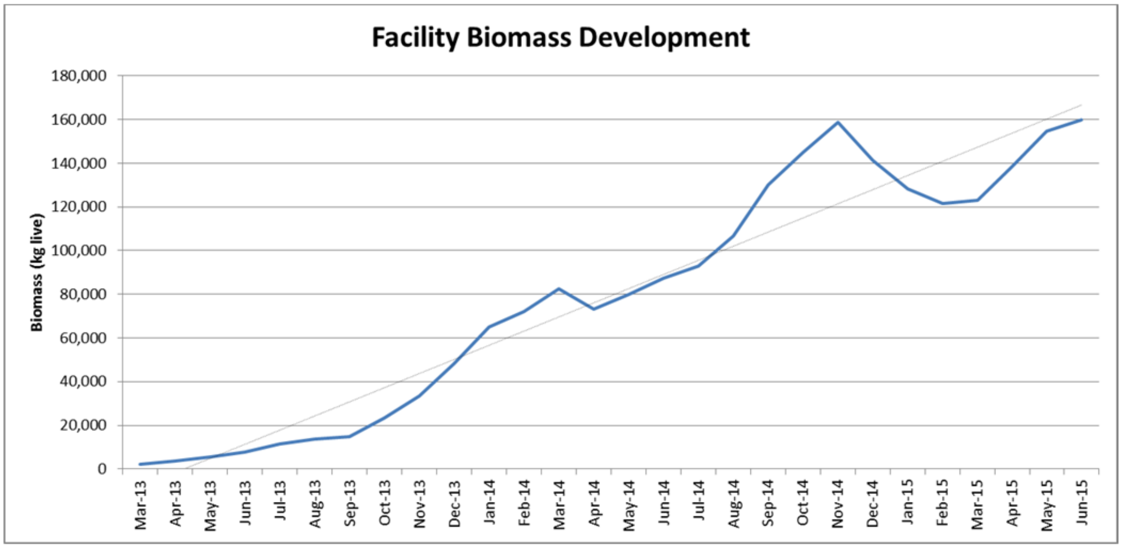
N/A – not yet large enough to sample.

General Production Information

Summary of Production Metrics for All Cohorts

Cohort (month/Year) =>	0313	1013	0114	0514	1014	0115	0415	Total/ Average	Budget
Production									
FCRb	1.25	1.12	1.08	1.02	0.84	0.86	0.73	0.99	1.05
FCRe	1.43	1.17	1.32	1.11	1.08	0.90	0.74	1.11	1.08
TGC (lifecycle)	1.5	1.5	1.6	1.6	1.6	1.8	1.7	1.59	2.50
SGR (lifecycle, %bw/d)	0.7%	0.7%	0.7%	0.8%	0.9%	1.1%	1.2%	0.9%	
Average Condition	1.23	1.18	1.20	1.25	1.21			1.21	
Current Biomass (mt live)	0	0	0	52	49	40	17	157	
Total Production (mt live)	58	72	80	92	44	35	12	394	
Smolts stocked (#)	23,503	33,723	40,210	41,387	45,163	45,340	39,840	38,452	
Current Inventory (#)	0	0	0	18,258	42,686	44,834	38,756	144,534	
Mortality & Fish Health (% of start number)									
Fungus	9.7%	2.6%	18.5%	17.5%	4.1%	0.3%	1.5%	7.7%	
Other	6.2%	1.1%	2.4%	1.3%	0.2%	0.1%	0.1%	1.6%	
Culls	3.3%	3.0%	1.5%	1.2%	0.2%	0.2%	0.2%	1.4%	
NVM	3.9%	3.1%	4.2%	1.8%	0.9%	0.6%	1.1%	2.2%	
Adjust.	1.2%	2.9%	1.9%	0.0%	0.0%	0.0%	0.0%	0.8%	
Total Number	24.1%	12.7%	28.5%	21.8%	5.5%	1.1%	2.8%	13.8%	7.0%
Mort Biomass (mt)	8.8	4.7	14.7	2.9	1.1	0.1	0.1	32.6	
(% of prod.)	15%	7%	18%	3%	3%	0%	1%	8%	3.0%
Early Maturation	100%	41%	*42%*						
Harvest									
Total (kg HOG)	50,071	62,550	69,861	36,324	0	0	0	218,806	400,000
Average Size (kg HOG)	2.7	2.1	*2.8*	3.1				2.7	3.7
Total Feed (kg)	83,305	84,650	105,777	101,823	48,160	31,328	8,767	463,809	
Water Quality									
Temperature	14.3	13.9	14.0	13.5	13.5	13.8	14.6	13.9	15.0
CO2 (mg/l average)	15	14	16	14	14	11	9	14	12 -15
Salinity (ppt average))	3	2	4	3.6	2.4	7.4	5.2	3.7	6 - 8
Total Ammonia -N (mg/l average)	0.6	0.69	0.75	0.79	0.72	0.39	1.44	0.7	2.6
Nitrate-N (mg/l average)	58	115	122	126	75	53	44	92	75
Nitrite-N (mg/l average)	0.46	0.26	0.21	0.11	0.03	0.06	0.40	0.2	0.3
Alkalinity (mg/l average)	29	52	54	64	79	85	134	61	120

Note: Only Cohorts #1, #2 & #3 have been completely harvested at the time of writing (July, 2015). All other cohorts are in production. The current (July, 2015) standing stock exceeds 158T (129T in the Growout, 17T in the Quarantine and 12T in Purge). The biomass will vary going forward due to the inconsistency in supply of smolts throughout the year (smolts available in October, January and April followed by a 6 month gap before they become available again in October).

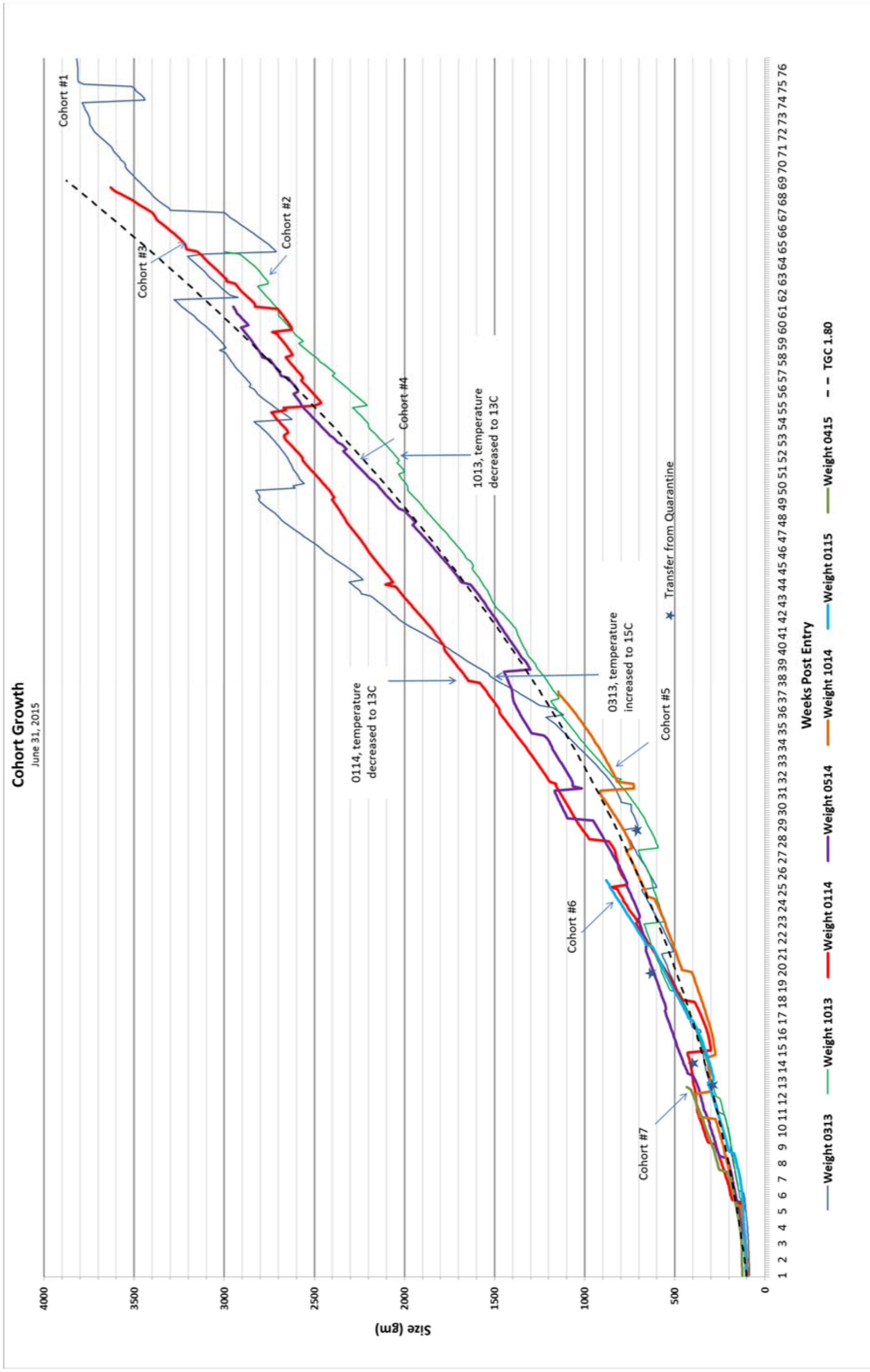


Accurate biomass estimations are critical for every facet of the business, not the least of which is to be able to measure performance as well as to monitor the progress of any changes made to improve growth. Establishing the average weight accurately, in particular for large fish, has proven to be challenging. It is not uncommon to take samples and have little confidence in certain results since one can tell that they are, for example, overstated because the FCR's are unrealistically low. Or conversely the FCR is so high we know that the weights are understated. This leads to large adjustments which can be clearly seen in the many spikes in the graph lines on the growth graph on the following page.

We trialed a Vaki system to measure fish weights in the tank. This was a camera based system enclosed in a square frame that uses pictures to size the fish and required that the fish swim through the frame. We found, however, that the fish either remained stationary inside the frame resulting in repeated observations of the same fish or the fish avoided the frame altogether. As a result the unit consistently under estimated the size of the fish. We also trialed an updated version of the Vicass system, which is also an underwater camera based system but does not require fish to swim through a frame. However, that unit also was inconsistent in its measurements, especially of the bigger fish. One of the drawbacks with this unit also is that a considerable amount of expertise and time is required to analyze the hundreds of pictures that are generated, which required the data to be assessed externally. We continue to test this unit and are currently collecting data on the length, height and weight of individual fish during manual samples in an effort to improve the accuracy of the software.

In the meantime, the measured average weight is assessed against those of both a FCR and a TGC model projection and adjusted accordingly based on the known growing conditions and a mathematical formula (adjust the manual sample weights by half the difference between the manual sample and the average of the two model projections. Using this method one can assume that the model weights and sample weights are equally accurate). This enables us to modulate outliers and gives more representative numbers to work with. Actual numbers are confirmed at the time of harvest completion.

Growth Curves

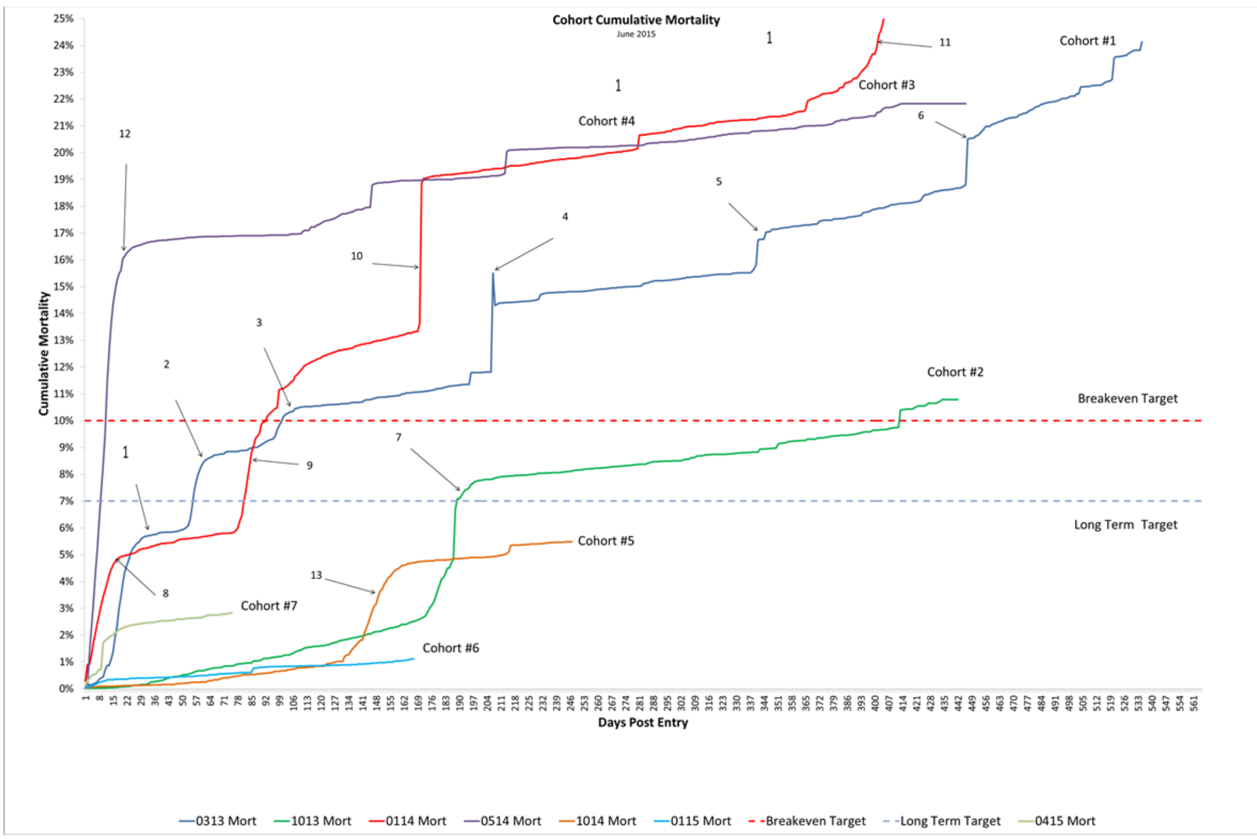


Also see the Appendix for growth and temperature curves for each cohort and detailed smolt stocking information.

Smolt Quality

There was considerable variation between smolts from different suppliers in terms of quality. For example, the fish from Cohort #2 and Cohort #5 (which were from a different site to the others) were much more homogenous in size (CV of <15%) than the other cohorts and showed very little signs of fin erosion or fungal presence. We experienced very few fungal related mortalities (<1%) with this cohort during the first 5-6 weeks during which the smoltification process is completed. The fish from Cohort #1, #3, and #4 (all from the same site) had considerable fin abrasion and higher size disparity (CV's of 22-28%) on transfer to the site and they experienced high mortalities during the same smoltification window (12-17%). The response to treatments also varied between cohorts with some responding well to discrete salt treatment while others required formalin treatment when the salt was found to be limited in impacting fungal mortalities. There was also significant variation in the size of smolts delivered to the site with smallest average being 15% lower than optimal (Cohort #1 – 85g) and the largest average being 25% bigger than optimal (Cohort #7 - 125g). This has a significant impact on the final weights achieved. An onsite hatchery would yield many benefits.

Mortalities



1-3 Cohort #1. These were three fungal outbreaks. Fish from this site are particularly prone to fungal infection due to a lot of fin erosion and large size disparity and they often come in already suffering from an outbreak (as in this case). As the fish are still going through smoltification they are stressed and so particularly susceptible to opportunistic fungal infections if you do not have the salinity to combat it (>4.5ppt). This particular cohort relapsed 3 x times. When fish are delivered to the site nowadays, we instigate a prophylactic treatment by artificially raising the salinity to 9.5ppt when the first arrive and maintaining it for several weeks. This has proved very successful as can be seen in the very low mortality in Cohorts #5 & #6. We will also be plumbing in a new higher salinity well in April to raise salinity levels.

4. Cohort #1. This is a straight upward line as they represent fish that were culled as well as downward number adjustments during grading. The % culled will vary from cohort to cohort but has been less with Cermaq fish as they come in with very low size disparity. We will be moving to entirely Cermaq supplied fish in Oct 2015. The adjustments in numbers are due to counting errors (by the electronic scanners) which are often corrected when the fish are entirely harvested (numbers up at harvest) and is directly related to size variation which is less with Cermaq fish.
5. Cohort #1. Grilse removal – this was our first attempt at pumping and manually grading large fish (2.5-3kg). The techniques and procedures for this have been refined and streamlined dramatically since then such that we see very little mortality nowadays as a result of manhandling the fish.
6. Cohort #1. Downward number adjustment when one tank was emptied as well as mortalities due to fungus developing on maturing fish. In fact, the gradual increase from 5 until the end of this curve is largely as a result of fungal mortalities caused by early maturation. We have since implemented a number of successful strategies to delay the onset of early maturation (lowering temperature from 15C down to 13C, additional lighting in the tanks to get the desired biological response and improving the water clarity to get much better light penetration).
7. Cohort #2. This spike represents a 2% cull during grading plus a fungal outbreak due to very murky water conditions (turbidity of up to 7.6 NTU) largely as a result of the biofilters not fluidizing properly. The biofilter issue has since been rectified and ozone installed to “polish” the water. As a result we now run at an average of 0.3-0.4 NTU.
8. Cohort #3. Same as 1 above – no longer an issue due to successful prophylactic strategy developed.
9. Cohort #3. Same as 1 above (fish relapsing) – no longer an issue due to successful prophylactic strategy developed. This accounts for the steepest part of this section of the curve. The tail end of this section was a steady mortality rate due to healthy fish getting trapped when the mort removal screen was lifted as it went down too slowly. The fix was very simple – drill a larger hole in the air vessel that caused the screen to lift so the air could bleed out faster but we could not do this until the tank was empty. This was an issue for all tanks and has since been corrected.
10. Cohort #3. This straight line represents fish that were culled (3.6% of the population) and shrinkage during grading (a 6% downward adjustment due to the numbers being less than expected).
11. Cohort #3. Fungal outbreak when the salinity of our incoming water fell below 1.2 ppt. We have now plumbed in a new dedicated line (for Cohort #7 onwards) to a well drilled to provide higher salinity which will mitigate against such fungal episodes in the future.
12. Cohort #4. Same as 1 above – no longer an issue due to successful prophylactic strategy developed.
13. Cohort #5. Same as 11 above.
14. Cohort #6. Same as 11 above except showing further improvements as a result of benefiting from the greater control offered by the higher salinity well.
15. Cohort #7. Use of the higher salinity well allowed more control over fungal mortalities although a problem with the biofilter lead to murky water conditions at the start which would have contributed to higher than normal mortalities.

Cataracts

Cataracts may be induced by a variety of factors of a nutritional, environmental, chemical or infectious nature. For example, some factors associated with cataract formation are rapid fluctuations in water temperature, rapid growth, fluctuations in the water salinity and strain of fish grown – none of which can be ruled out at Kuterra. The bright underwater lights in the tanks may also be a factor. Other potential culprits are triploid genetic constitution, UV radiation, cholinesterase inhibitors and electrolytic imbalance. It is also know that in salmonids, several nutritional causes have been proposed for the development of cataracts: zinc deficiency, riboflavin deficiency, tryptophan deficiency, thiamine deficiency, methionine deficiency, histidine deficiency or high levels of manganese.

Out of all the salmon growout trials at the FWI their Director of Aquatic Veterinary Research, Dr. Chris Good, has only seen cataracts to any real extent in one cohort, and that was the last Cascade group before their current SalmoBreed trial. They are still not sure what caused this to occur. The only major difference with that particular group, compared to the other cohorts, was that it was held up in their partial reuse system longer than expected while their main system was being harvested. According to Dr. Good, the resulting increased density and elevated CO_2 at that life stage (12-13mo post-hatch) probably contributed to the development of cataracts in those fish, although a definitive answer was not determined. He noted that they saw cataracts in varying degrees in about 25% of the population. Of interest, he also noted that he was concerned that these fish entering the growout system would have increased feed conversion as a result of not being able to see the feed, but their FCR was comparable in that group and, overall, they saw a decrease in cataract prevalence as they grew to market size. Dr. Good found that surprising but he indicated that apparently cataracts can resolve over time; although he was expecting the condition to be progressive.

One other suggestion relates to the diet the fish are fed in our system – the fish are being fed a saltwater diet but are being raised in a "soft" freshwater environment. There is the suggestion that the loss of some electrolytes may be different/greater in freshwater and that the diet may not be designed to compensate for this. Having discussed this with the feed manufacturer we have decided to supplement the diet going forward with a mineral mix that is typically used in the hatchery up to 100g. It contains a number of minerals but, in particular, it contains manganese, calcium and potassium, which tend to be more abundant in hard water.

Early Maturation Strategy

Photoperiod: The suppression of pre-harvest sexual maturation is a priority in the salmon on-growing industry. This is achieved by photoperiodic manipulation of the stock in the form of continuous artificial-light (LL) applied between the winter and summer solstice during the second year at sea in ambient S1 stock. This 6-month period LL-regime is recognized as the most efficient by providing a key environmental signal that phase advances the so-called 'spring decision window' such that a reduced proportion of the stock meets the developmental/energetic thresholds required to proceed through maturation. Of key importance is the specific timing of the LL application for the control of maturation and this will vary with each smolt intake depending on whether they are S1's or S0's.
Intensity Target: Optimally there should be an even distribution of light, with levels above a theoretical threshold of 0.012-0.016 W/m2 on the bottom of the tank (measured using a light meter under different water clarity conditions).

Spectrum & Actual Intensity: The lights in our tanks are full spectrum and have 40% royal blue LED's that emit light in the 425-485 nanometer wavelengths at approximately 100watts/tank (three per 500m3 tank and two per 250m3 tank). The measured light intensity in the Quarantine tank ranged from 0.0 to 0.12 watts/m2 across the tank bottom, 0.12- 0.60 watts/m2 at mid-depth. This was measured when the water turbidity was poor (>2 NTU), the density was 60kg/m3 and when it was an overcast day. The most recent readings (August 2014) taken at 72kg/m3 in GO measured 0.002 to 0.03 watts/m2.

The large variation in the readings was due to constantly changing water clarity, fish density, fish movement, probe location and whether overhead lights were on or off. Note: According to the Director of Research at the Institute of Aquaculture at University of Stirling, Professor Herve Migaud, research findings suggest that salmon will react to light levels as low as 0.02 watts/m2 based on measured suppression of melatonin levels in the blood. The readings taken at that time suggest that the levels deep in the tanks are marginal and we may not be getting the desired biological response as a result.

As well as this, providing that light levels are high enough to be perceived by salmon, it is now believed that lighting unit intensity per se would not be the main key issue explaining suboptimal biological efficiency but rather the generation of an even, diffuse lighting field throughout a cage or a tank allowing the fish to perceive the artificial light independently of their swimming position. Consequently, it is believed that the spread of the light throughout the rearing unit is a critical parameter and when this is coupled with the marginal light levels measured in the bottom of the tank, it is now believed that more lamps may be necessary in each tank to have the desired biological effect.

Considering the fact that our light readings are marginal in the bottom of the tanks, we engaged an expert, Tony Manning, Ph.D., Senior Scientist, RPC-Food Fisheries and Aquaculture Dept., to test melatonin levels in the fish under the light conditions experienced in our tanks. Photoperiod is perceived by pineal photoreceptors in the brain of the fish and transduced into rhythmic melatonin signals. These rhythms can be influenced by light intensity and spectral content and hence can be used to give us a more definitive evaluation of whether we need to install more lights in the tank or not. The results are indicated in the below table. The extrapolated values are presented as averages per time point in order to illustrate melatonin secretion patterns and indicate the following:

- A strong nocturnal melatonin secretion pattern is present in the fish population examined in Q1. A strong presence of melatonin, typical of nocturnal values is also seen in GO (2 hours post-dark).

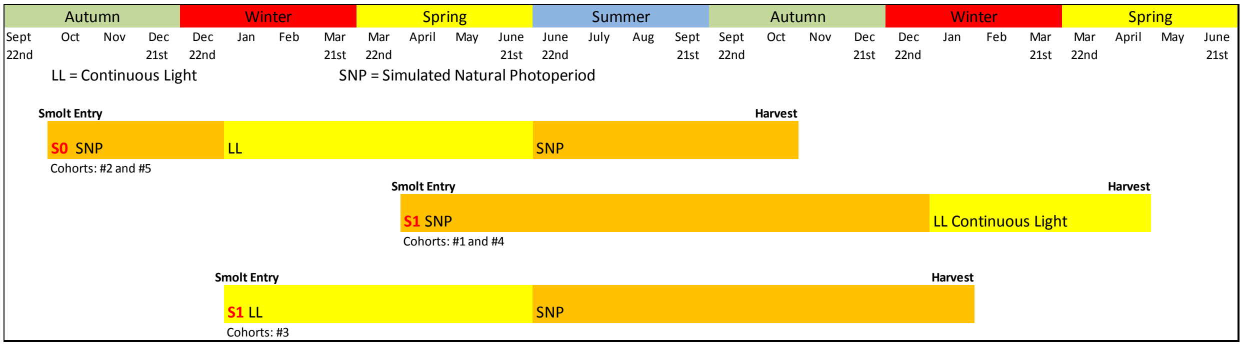
- A diurnal change in melatonin between the light and dark phases is indicated. The daylight samples, taken 2 hours prior and post the dark phase, did show elevated melatonin, but, as expected, at lower levels than during the dark phase. A melatonin response to light and dark is present

The presence of light should markedly reduce melatonin levels further than shown in the table. Literature sources indicate that <200 pg/ml or even significantly lower values can be expected during daylight hours. In contrast, the present data suggests that light levels, before and after the targeted or planned dark phase, are not entirely effective at suppressing melatonin secretion. Moreover, similar levels are seen in both pre- and post-night samples which may indicate that there is a chronic melatonin secretion over the day length period. Prolonged melatonin secretion in this study may indicate that the fish perceive a dark phase at least four hours longer than what was planned. The physiology of the fish will then be adapted to a shorter photoperiod than what may be needed to suppress maturation. Further experimentation with additional lights and its impact on night-day shifts in plasma melatonin was recommended.

Samples	Q1-7	Q8-14	Q15-21	Q22-28	Q29-35		G1-7
Time of sampl	2 hrs befor e	2 hrs post-dark	mid-nigh	2hrs pre-dawn	2 hrs post-daw		2 hrs post dark
Dilution in assay	1x	3x	3x	3x	1x		3x
Fish a	>350	>1050	>1050	>1050	>350		>1050
Fish b	>350	>1050	895	>1050	>350		619
Fish c	>350	>1050	>1050	>1050	>350		791
Fish d	>350	>1050	>1050	>1050	>350		852
Fish e	>350	>1050	>1050	>1050	>350		358
Fish f	>350	>1050	>1050	>1050	329		703
Fish g	328	>1050	>1050	>1050	>350		974
Estimated average based on extrapolated values							
	Q1-7	**Q8-14**	**Q15-21**	**Q22-28**	**Q29-35**		**G1-7**
Mean (*n* =7)	500	1406	1451	1474	448		856
Standard deviation	±109	±304	±328	±364	±64		±420

As such, additional lights were purchased increasing the intensity in the tank from approximately 6.3 watts/m2 to 12.5 watts/m2 in GO and from 7.2 watts/m2 to 18.5 watts/m2 in Q1. A new set of readings was taken in Q1 using the light meter and indicated an average intensity of 0.045 watts/m2 which is almost three times higher than the recommended threshold level. A similar set of readings should be taken from GO and Q1 once all the new lights have been installed and the new melatonin response tested. Unfortunately, however, each of the new lights have developed faults which has meant that they needed to be returned to the vendor as these faults became apparent. Further faults were detected in some of the lights following repair. This has caused a delay in their full implementation and therefore the benefit of the full biological response required. It would appear that the cause of the fault has now been corrected and it is expected that we will be able to operate with full intensity in all tanks by August, 2015.

Photoperiod Regime: Prof. Herve Migaud and Dr. John Taylor of Sterling University were consulted to provide knowledge on the best suited lighting protocols to optimise growth and minimise salmon early maturation in the Kuterra project. Their recommendations were based on both commercial and scientific backgrounds as well as the knowledge and expertise of both consultants and resulted in a number of light regimes specifically tailored to the time of entry of each cohort. The photoperiod regimen used for Cohorts #1 to #6 according to approximate month of entry is shown in the following figure. Variations on these regimes are being trialled on subsequent cohort's e.g. Cohort #7 is expected to be grown on LL light throughout their time at Kuterra while Cohort #8 may be grown at 16:8 without change. This is largely based on experience and knowledge gained at Kuterra and elsewhere as well as the suggestion that the change in photoperiod itself may be more important than the actual regime used.



The maturation rate with Cohort #2 and #3 when one looks at the numbers of identifiable grilse removed from each (21% and 11% respectively) would appear to suggest that the photoperiod and other mitigating strategies are having a positive impact, especially now that consistently good water clarity (0.2-0.3 NTU) has been achieved in the GO. That said, Cohort #4 showed an increase in the number removed (21%) and this is despite this cohort being grown at 13C for most of their time at Kuterra (versus 15C) in an attempt to further improve maturation rates. This has led to this tactic being questioned in light of the sacrificed growth as a result of operating at lower temperatures. While a decision has not been made on whether 13C should be the target temperature going forward, this trial is on hold for the moment due to high stocking levels combined with summer temperatures meaning that it is not currently possible to maintain the system temperature at 13C. The facility was designed to operate at 15C, and it is at 15C at time of writing (July, 2015).

As noted above, the change from one photoperiod to another results in a feeding crash which remains depressed for a period of 3-4 weeks which has a significant negative impact on growth. In order to counter this we tested a strategy whereby we aimed to change the photoperiod in 15 min increments over an extended period (1 month) i.e. when changing from LL to SNP we started by introducing 15 mins of darkness 2 weeks before the intended date and continued to add 15 mins each day for 2 weeks after that date. Also, instead of aiming for a SNP which follows natural daylight hours, we instead decided to test 16:8. During the implementation of this trial there was for the first time no crash in the feeding levels in any of the tanks tested and the appetite of the fish continued unabated.

Feed Formulation

Diet Name	Formulation								Cohort							Notes
	Size	Protein	Oil	Moisture	Pigment			Energy	0313	1030	0114	0514	1014	0115	0114	
					Synthetic		Natural									
					Ax.	Cantha.	Panaferd	Digestible								
	(mm)	%	%	%	ppm	ppm	ppm	mj/kg								
Optiline RC 50 MB	3	50	24	8.5	40	40		19.5	x	x	x	x				
Optiline RC 100 MB	4	50	25	8.5	40	40		19.7	x	x	x	x				
Optiline RC 400 MB	6	45	29	8.5	40	40		20.1	x	x	x	x				
Optiline RC 1000 MB	9	41	31	8.5	35	35		20.2	x	x	x	x				
Optiline RC 2000 MB	12	37	34	8.5	20	30		20.2	x	x	x	x				Finished use Sept/ 2014
Optiline RC 50 MB	3	50	24	8.5			80	19.5		x	x	x	x	x	x	Started use Sept/2014
Optiline RC 100 MB	4	50	25	8.5			80	19.7		x	x	x	x	x	x	
Optiline RC 400 MB	6	45	29	8.5			80	20.1		x	x	x	x	x	x	
Optiline RC 1000 MB	9	41	31	8.5			80	20.2		x	x	x	x	x	x	
Optiline RC 2000 MB	12	37	34	8.5			80	20.2		x	x	x	x	x	x	

Feed Quality

A total of 10 feed samples were taken for analysis at various times. Results confirmed that protein was within specifications and, in fact, was consistently higher than indicated on the label with inclusion levels being 1.0% to 10.1% higher in the samples analysed. Fat content, on the other hand, was consistently lower in the samples analysed with inclusion levels being 0.1% to 4% below that of the label (apart from one sample which had a 1% higher inclusion level compared to the label). Flesh quality analysis of the fish, however, has shown the fat content of the flesh to be as expected in the size ranges sampled (see Product Quality Results below).

Feed Sustainability

(Wild Fish consumed to Farm Fish produced ratio / FIFO)
As part of the BAP program, certified feed companies calculate a Marine Fish Feed Inclusion Factor (FFIF) for all products. This is an estimate of the combined fishmeal and fish oil concentration of the feed on a dry weight basis relative to wild fish. A FFIF of 2 signifies that the feed is twice as concentrated in marine protein and oil as wild fish. Meals or oils derived from fishery by-products such as trimmings, offal and their derivatives are excluded. The FIFO ratio for farmed fish production is calculated by FFIF x FCR. Currently the feed used to produce Kuterra products has a FFIF using the BAP method of 0.53 (Value supplied by Skretting Canada). The 1.08 FCRb achieved for cohort #3 translates to a FIFO ratio of 0.57, i.e. 0.57 kg of wild fish are required to produce 1 kg of Kuterra fish.

Harvesting

Harvest Results (Cohort 0114, Jan 28/15 -May/15)

Category	lbs R&B[1]	kg Live[2]	Kg HOG[3]	
Average wt	6.1	2.9	2.5	Total weights/ piece count
Range	3.3 7.5	3.6	1.6 3.6	
Total Biomass	174,428	84,170	71,545	Determined at processing plant when received (round bled product)
Total Number	28,747			Determined at harvest by electronic counter

1 = Stunned and bled product form

2= Live – estimated swimming weight (pre-starve)

3= Head on Gutted product form

Product Quality Sampling and Management

Taste

One set of tissue analysis for MIB and Geosmin was conducted prior to the start of the harvest of Cohort #1. For this sample, 19 fish were weighed, tagged and placed in a tote with flow through water from the Purge System. At 0, 5, 7 and 10 days, fish were removed, filleted and frozen. These samples were sent to a Dongliang (Eric) Ruan, Agriculture and Agri-Food Canada, Lacombe Research Centre, Lacombe, Alberta. The results were as follows:

	MIB (ng/Kg)		**GSM (ng/Kg)**	
	Range [a]	**Ave (± S.E.)** [b]	**Range** [a]	**Ave (± S.E.)** [b]
0-day	633-981	809 ± 130	523-679	604 ± 55
5-day	436-572	521 ± 46	368-456	411 ± 30
7-day	238-417	363 ± 66	156-292	245 ± 47
10-day	106-269	196 ± 57	118-217	169 ± 38

The lab stated that levels >200 could be detected/tasted by people with sensitive palettes.

We found during initial testing of small numbers of fish that after 5 x days of purge there was a very slight hint of off-flavour while 7 x days of purge gave a top quality product. The conditions experienced during actual operations, however, are quite different to those experienced during the initial trial where fish were kept in a small tote. For example, the biomass in the purge tank is many times greater than the initial testing and hence the loading of off-flavour compounds emanating from the fish is potentially a lot greater. Also the exchange rate in the purge tank is not as great as in the tote so the off-flavour compounds are not removed as quickly. These issues were compounded by poor water conditions in the growout system with very murky water at times (up to 9.7 NTU) and the fact that the protocols for purge cleaning were not well established for that system at that time.

As such, it was necessary to purge the fish for 12 days in the beginning to produce a premium tasting fish at harvest. Purge cleaning protocols were developed and the problem with murky water in the GO system was resolved. Therefore in March 2015 we reduced the time that fish were kept in the purge tank down to 9 days. Reports of off flavour began to surface, however, so the schedule was changed to eliminate this problem while at the same time allowing the primary processor the flexibility to supply the market each week despite only receiving Kuterra product biweekly. Shipping product every second Monday allows us to do that which results in a 13 day purge time.

M														M														M
Cl	0	1	2	3	4	5	6	7	8	9	10	11	12	13														
														Cl	0	1	2	3	4	5	6	7	8	9	10	11	12	13

Cl	CLEAN
13	HARVEST

Once the fish are harvested, the system is cleaned. This is a complete cleaning whereby the sumps, the LHO and the 250m3 tank are drained. All accessible areas are then power washed to remove biofilm and a coat of hydrogen peroxide is applied. The system is then brought back online and more fish are then transferred to the tank.

Prior to commencement of harvesting, an executive and quality control (QC) team at Albion and key personnel sample the product to try and tell if there is any noticeable Geosmin or MIB flavour and, to date, the above strategy has provided excellent results with minimal risk. This schedule also allows some leeway in case conditions in the GO change (which they can and have done due, for example, to equipment failures) and to provide a buffer for fish groups that are more heavily loaded in the purge tank. As a result, comments on the quality of the product are rarely anything but very positive.

Moreover a veteran sales and purchasing team at Albion composed of 15 people, many with over 30 years' experience in the seafood industry, carried out a blind taste test with our product versus a standard and a premium net pen product. 100% of the experts chose the KUTERRA salmon as having the best taste. The meat color on the fish they sampled was described as excellent.

In a 2015 international competition of the top chefs of all the Hyatt hotels globally, Kuterra's product came third which means the dish will advance to the finals in the fall.

The freshness of the fish, the firm texture, and the excellent taste has all been mentioned by consumers and top chefs such as Ned Bell.

Ned Bell - "I'm excited to congratulate KUTERRA on its first anniversary in the market. I love cooking with KUTERRA salmon. Its consistency, flavour and quality are second to none. Responsible aquaculture, with closed containment, land-based aquaculture is the future of feeding the planet with sustainable seafood."

Executive Chef Ned Bell, Four Seasons Hotel Vancouver and YEW seafood + bar and *Founder of Chefs for Oceans*

Residues

Persistent Organic Pollutants, Drug, Therapeutics Residues and Mercury: In March 2014 samples of fish were tested for 13 classes of contaminants (140 compounds). The results indicated extremely low or undetectable levels for all compounds tested (see previous Milestone reports) Albion's Quality Assurance Manager noted that this result is extremely good based on his many years of experience in reviewing similar test results for wild and farmed seafood. "Honestly I have never seen this type of result. Everything came "NOT DETECTED" under modern micro technology where detection limits are negligible 0.003~0.01 ug/g. Everything came out even under detection limits except mercury (detected 0.02 ug/g but regulation is $\leq$0.5 ug/g). ".

Processing & Sales Results

For the period (February 1/15 – June 30/15) the harvest and processing results were substantially represented by cohort # 3 (0114) which was harvested from Jan 26/15 to May 31/15.

Due to a slightly longer cycle time for this cohort (70 weeks vs 45 weeks), the average size and percent of size downgrades was improved over the previous cohort. In addition, probably due to a lower degree of maturation, the percent quality downgrades and yields were also improved over the previous cohort.

Since start up, the trend in processing and sale results has generally reflected changes in maturation status and size of harvested fish. For example, in Q3-2014, the maturation status of Cohort one was very high resulting in a high degree of quality downgrades and poor processing yields. In Q4-2014, the early harvesting of cohort two (short production cycle) resulted in a high degree of undersized downgrades. However, this group had the best processing yields.

Total Processing and Sales Summary

Calendar Years >>	**2014**				**2015**		**Total/**	**Budget**
	Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Average**	
Average Size (kg HOG)	**1.6**	**2.2**	**2.8**	**2.0**	**2.4**	**2.7**	**2.4**	**3.7**
Harvest Volume (kg HOG)	792	28,847	20,062	39,931	62,054	45,883	197,568	
Sales Volume (Kg HOG equiv.)		21,147	16,688	17,377	56,423	45,560	157,195	
Unsold Inventory (kg HOG equiv*)		7,847	13,889	28,985	35,940	37,270		
Quality (% Premium)		**85%**	**66%**	**77%**	**81%**	**85%**	**79%**	**90%**
Processing Yields								
Round to HOG		88%	87%	89%	90%	90%	89%	89%
HOG to Fillet (all trims)		65%	57%	64%	63%	64%	62%	65%
Round to Fillet		57%	51%	61%	57%	58%	57%	58%
Fillet to Portion (all sizes)					74%	59%	67%	
Live to Round (estimated)		94%	94%	94%	94%	94%	94%	93%

* Fresh and Frozen

< A KUTERRA salmon from the first cohort.

Engineering & Energy

Summary of Volume Use and Oxygen Metrics

Engineering Metrics					
Total production	152	mt	Biological production (Live weight, includes mortalities)		
Rearing volume use efficiency					
Total rearing volume	2750	m3			
Months of operation	5				
Volume Efficiency - current	135	kg/m3/year			
Volume Efficiency - previous	102	kg/m3/year	Sept /14 - Jan/15		
Quarantine	349	lpm average			
Growout	1552	lpm average			
Oxygen Use					
Total Generated	134,474	kg	Estimate based on generator hours.		
Total LOX used	48,087	kg			
Current	1.20	kg/kg prod.	1.22	kg/kg feed	
Previous	1.53	kg/kg prod.	1.23	kg/kg feed	Sept /14 - Jan/15

System Performance, Temperature, and Water Quality

CO2 Removal

Measurements have shown that the treatment systems are removing from 30 to 50% of the dissolved CO_2 in the system.

Time	Location	CO2	DO	Flow	CO2	DO	Mixed CO2 Conc	Mixed DO Conc	Net CO2 produced across tank		Net DO consumed across tank		Feed	CO2 production	O2 production	CO2 to O2
		mg/L	mg/L	lpm	mg/min	mg/min	mg/L	mg/L	mg/min	g/h	mg/min	g/h	kg/day	gCO2/kg	gO2/kg	
BASELINE																
15/08/2014	Inlet	9.5	14.2	9900	94050	140580								451.4	655.5	0.69
15/08/2014	Side Drain	13.4	8.6	6930	92862	59598	13.5	8.5	39204	2352	56925	3416	125			
15/08/2014	Bottom	13.6	8.1	2970	40392	24057										
16/08/2014	Inlet	9.2	13.1	9900	91080	129690								389.0	466.4	0.83
16/08/2014	Side Drain	12.8	9.3	6930	88704	64449	12.6	9.0	33858	2031	40590	2435	125			
16/08/2014	Bottom	12.2	8.3	2970	36234	24651										
17/08/2014	Inlet	9.3	13.8	9900	92070	136620								424.4	631.8	0.67
17/08/2014	Side Drain	12.9	8.8	6930	89397	60984	12.8	8.5	35046	2103	52173	3130	119			
17/08/2014	Bottom	12.7	7.9	2970	37719	23463										
18/08/2014	Inlet	9.4	12.1	9900	93060	119790								547.9	348.6	1.57
18/08/2014	Side Drain	14.3	9.2	6930	99099	63756	14.2	9.0	47916	2875	30492	1830	125.94			
18/08/2014	Bottom	14.1	8.6	2970	41877	25542										
20/08/2014	Inlet	9.4	12.9	9900	93060	127710								633.0	586.8	1.08
20/08/2014	Side Drain	15.2	7.6	6930	105336	52668	15.0	7.7	55638	3338	51579	3095	127			
20/08/2014	Bottom	14.6	7.9	2970	43362	23463										
													Average	489.2	537.8	0.91

Five CO_2 data points were measured from 15 August 2014 to 20 August 2014 from the GO. The average CO_2 production rate was 489.2 gCO_2/kg feed and the average O_2 consumption rate was 537.8 gO_2/kg feed. This provides a CO_2 to O_2 ratio of 0.91 to 1. The assumed O_2 rate used for the design of the strippers was 330gO_2/kg feed and a 1:1 conversion ratio. On this basis, the CO_2 production was underestimated by approximately 50%. A number of factors contributed to this:

1) Feeding only during daylight hours means that the peak levels are higher than when fish are fed over 24 hours. This was further compounded when using a simulated natural photoperiod when daylight hours were decreasing resulting in an increasing amount of feed (as the fish grow) being fed over reducing time intervals (as daylight hours decrease).

2) This was compounded by insufficient flow to the tanks – 20% lower than design spec with a corresponding 20% increase in CO2 levels in the tanks as a result. The flow deficit was because of insufficient fluidization in the biofilters which required more water than intended to keep them properly fluidized. This has now been corrected and the tanks are currently operating at design flow or greater.

3) Very murky water conditions (>9 NTU) likely contributed to high bacterial loads and accompanying metabolic loading leading to additional O2 consumption and CO2 production. Improving fluidization of the biofilters in combination with ozone installation has resulted in the water conditions improving immensely.

4) Water short circuiting on the stripper orifice plates which reduced efficiency – this has since been rectified.

5) Increase in the target stocking density from 75kg/m3 to 90kg/m3.

< Centralized CO2 stripper

Elevated CO2 concentrations are a serious issue that can reduce salmon growth and performance, particularly if they exceed 20 mg/L, as has often been the case at Kuterra. A substantial effort was made to verify the accuracy of the CO2 concentration measurement; this is still not completely resolved. The CO2 concentration was measured using three methods, i.e., using a CO2 probe (Oxyguard and/or Franatech), a standard methods titration technique, and a standard methods calculation of CO2 from the water's pH and alkalinity. The calculation method based on pH and alkalinity provided much lower estimates of CO2 than were estimated using the CO2 probe. Unfortunately, the small amount of salinity (typically 1-5 ppt) can create varied levels of interference with the two standard method techniques. Thus, all CO2 values reported here were measured using the CO2 probe. However, it should be noted that difficulties in estimating CO2 production were confounded by uncertainties in the accuracy of the measurements as evidenced by the large variability between instruments (even the same instruments - all recently calibrated, checked and located in the same place – see image below), between tanks and over time.

As a result of the high CO2 levels frequently experienced in the tanks, it was decided to install in-tank aeration devices in all of the tanks to supplement the CO2 strippers. Rather than maintaining the original CO2 target (12mg/l max), the targets were changed and are now as follows:

- Quarantine Module: ≤17 mg/L at 280 kg of feed per day.
- Growout Module: ≤20 mg/L with a system feed load of up to 1250 kg of feed per day and/or up to a maximum of 400kg/tank per day.

The solution consists of three components:
1. Central blower system with a water cooled heat exchanger.

2. Air distribution plumbing to all the culture tanks with throttling valves

3. Six diffused air aeration devices and a trapeze mounting device.

These have been designed and installed by PRA as part of the system warranty and have been in operation since the end of June. Photos of the units are shown below and show a swing arm (trapeze) which suspends the device from the overhead I-beam above each tank so that the units can be lowered or raised out of the tanks with ease.


In-tank aeration device

To date the units have been shown to be very effective at reducing the CO2 levels to approximately 15mg/l at design feed loads. Other observations include:

1) The units do not appear to interfere with circulation in the tanks – the same swim speeds and tank velocities were recorded in tanks with and without the units. In fact, the units appear to enhance the tank cleaning as seen in the appearance of old mortalities (held up by the oxygen diffusers on the floor of the tank) once the device is operational in a tank.
2) Concerns about an increase in turbidity have proven to be unfounded (at 1500kg/day of feed which is greater than the design load). Water clarity is as good or better (0.15-25 NTU) than when the devices were offline.
3) The added energy consumption of the blowers (45kW) is compensated to some extent by the addition of oxygen via aeration (as the units are located at a point in the tank where the oxygen saturation is lowest).
4) The units create more stable oxygen conditions across the tank (see next section below) and likely lead to a more stable environment for the fish to grow in through better tank mixing which has been reflected in an increase in appetite in heavily stocked tanks once the unit is introduced to the tank.
5) The water agitation has the effect of pushing feed pellets out to fish closer to the outside rim of the tank.
6) The install of a heat exchanger is important – this dropped the temperature of the blower air being bubbled up through the tank water column from 65C down to 19C. The ability to adjust the heat in this way is important to assist cooling of the system and for the addition of heat at other times (if required).

Oxygen

The oxygen consumption of the fish was measured at 537.8 gO2/kg feed. The assumed rate for the facility design was 330gO2/kg feed. Therefore the oxygen consumption is >60% higher than anticipated.

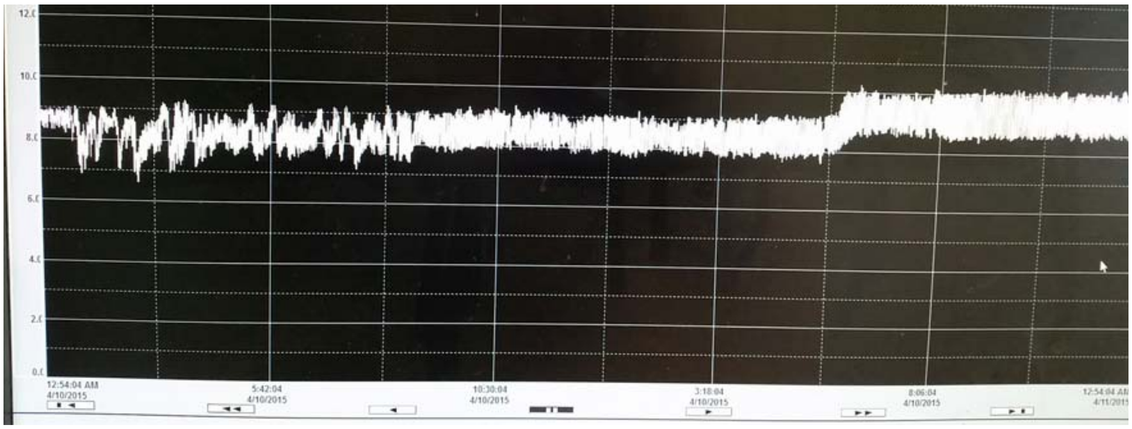
In addition, measurements were taken to estimate the oxygen transfer efficiency across each LHO. This data indicated that oxygen transfer across the LHO units was only 30-60%, which is much lower than expected (≥75%). Water coverage over the orifice plate was deemed to be adequate (at least 10-12”). The base of the LHO chambers, however, corresponds with the entry into the bottom-cone leading to the water flowing to the culture tank. Thus, bubbles entering this cone are more likely to be carried into the culture tank.

In addition, we discovered a serious flaw in the manufacture or assembly of the units – there was a ¼” gap between the orifice plates on top of the LHO and the chambers that it should sit on with a tight seal. This allowed oxygen entering the LHO at the first chamber to short-circuit through this gap directly to the last chamber and escape via the burp tube. Under warranty, all of the LHO’s were modified to close this gap and the efficiency has increased to the 75% design point. This represents a big improvement, and given the high hydraulic loading of these LHO’s (100gpm/ft^2) and structural limitations, we are not likely to increase the efficiency beyond this point without adding more LHO plan area.

Of note, the last report indicated that the mass of oxygen generated compared to the feed fed was found to be higher than originally expected i.e. 1.42 kg O2/kg feed (note that this refers to total O2 consumption including bacteria in the biofilters and elsewhere in the system). We believe that the higher than expected oxygen usage was due to reduced oxygen transfer efficiency at the LHO and possibly to increased oxygen consumption due to periods of very murky water when suspended biofloc in the water column created oxygen demand (before this problem was rectified and other system optimization changes were implemented). When those modifications had been made we saw the oxygen consumption drop to approximately 0.96kg O2/kg feed. Since then the CO2 blowers have been brought online in all the tanks (mid-June) and other parameters optimized resulting in a further reduction to an approximate low of 0.75kgO2/kg feed. Again, note that this is not just the O2 consumption of the fish but also includes oxygen demand elsewhere in the system.

Despite the improvements made to the LHO efficiency, the fact that the fish consume 60% more oxygen than originally anticipated means that the two existing oxygen generators are currently not able to provide all of the oxygen needed during normal operations or during a no-flow event and the deficit is being provided by a liquid oxygen (LOX) tank installed on site.

As can be seen from the image below, the aeration devices used to strip CO2 help to create more stable oxygen conditions across the tank. Also, because of the fact that they are located in the centre of the tank where the oxygen saturation is lowest, they have been shown to actually add oxygen via aeration which will compensate to some extent for the higher energy demand of these units once they are online.



Oxygen trend (mg/l) - approximately half way between 5.42pm and 10.30pm the aeration device is switched on creating more stable oxygen conditions.

Examples of conditions that need to be optimized to achieve maximum oxygen use:

1. Having the oxygen control meters on manual is much less efficient for O2 usage than when in auto especially if you are not using a LL photoperiod (we have had issues with the units developing faults and having to be operated in manual for considerable periods of time).
2. Set points used.
3. Feeding schedule – impacts peak demand.
4. Optical O2 probes need to be kept clean daily.
5. Temp of water.
6. Stocking density.
7. LHO efficiency.

Energy

Until December, 2013 the heating and cooling system was not fully operational so temperatures varied seasonally although some control was possible through building venting and control of supply water (cool water) additions. Since December 2013, the system was in heating mode and the target of 15C could be maintained. Through the spring of 2014, with increasing system biomass (internal heating loads) and outside temperatures, heating has gradually been reduced. Due to challenges with water quality (described earlier), relatively high volumes of supply water additions have been required which helped offset building heat loads. The addition of direct venting of the CO2 strippers has also allowed heat to be shed from the system. Switching the system consistently to cooling mode has only been required from spring of 2015 onwards as the standing stock has approached steady state and temperatures have started to climb. Note that the system was designed more so for heating than cooling and, as such, it is less efficient at removing the excess heat load. This issue is compounded by the reduction in the operating temperature of the system from 15C down to 13C (more heat to remove) and for this reason the Kuterra team is exploring methods of increasing the cooling capacity of the system.

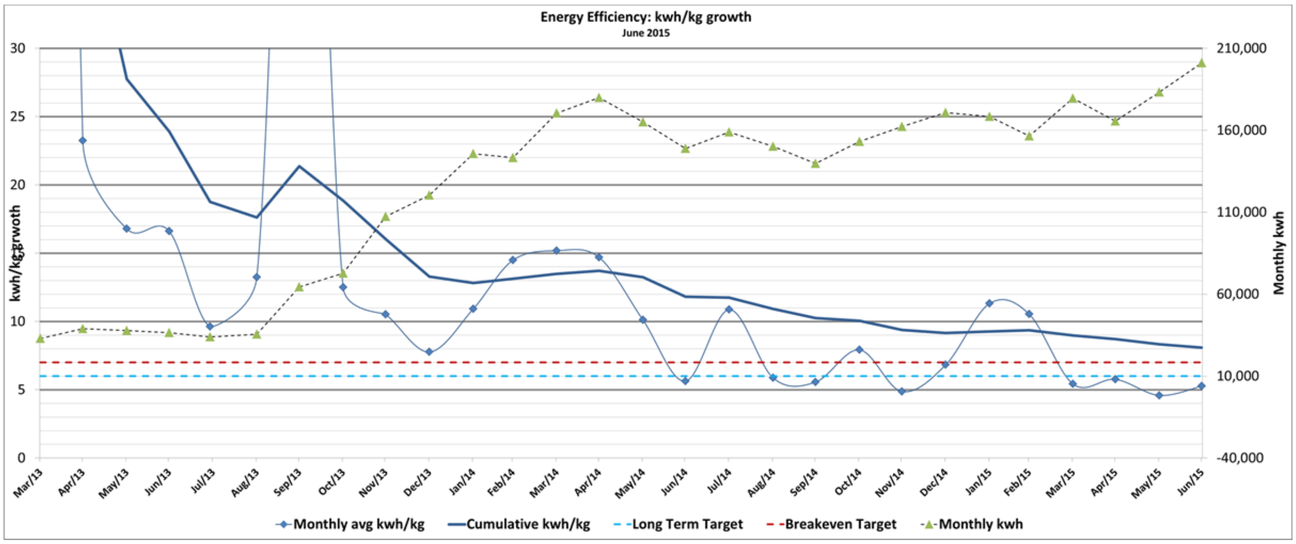
Note: During the design phase of the facility, to control costs it was decided not to include separate heating & cooling systems for the Q1 and GO facilities. This has presented a challenge at times when the GO system is in cooling mode but the Q1 requires heating e.g. when a small biomass of smolts have just been delivered in January when ambient outside temperatures are cold. We have managed to mitigate this quite effectively to date by restricting the volume of exchange to levels required to control nitrate levels and also by taking the heat generated in the mechanical room by the equipment and using a transfer fan to direct this in to Q1. This will likely be a useful strategy going forward although it could be more of a challenge in the autumn and winter of 2015/2016 depending on how cold the weather conditions are (the 2014/2015 winter was relatively mild).

Summary of Energy Metrics

Energy- Electricity							
Energy Cost:		**$0.073**	/kwh	Blended cost of all charges			
		%	kwh	kwh/kg	kwh/tfp	Cost/kg	kg= biological production (not net prod.)
Growout RAS		45%	399,680	2.6	2,635	$0.19	
Oxygen generation		13%	116,253	0.8	766	$0.06	
Quarantine RAS		9%	80,524	0.5	531	$0.04	
Heat/Cool		7%	61,533	0.4	406	$0.03	Includes geothermal wells
Purge		2%	22,096	0.1	146	$0.01	
Other		23%	205,994	1.4	1,358	$0.10	Supply wells, UV, feeders, general lighting, office heat
Total	Current	**100%**	**886,080**	**5.8**	**5,841**	**$0.43**	
	Previous		790,560	6.7	6,750	$0.49	Sept /14 - Jan/15
CO2 blowers added during this period							
Costs and total power based on BCHydro billing. Cost includes all charges excluding tax							
Energy- Diesel							
(back up generator, Bobcat)			litres	litres/kg	litres/tfp		
Total	Current		371	0.002	2		
	Previous			0.034	22		Sept /14 - Jan/15

Kuterra Energy Efficiency Graph. Note that the fluctuations in energy use per kg result from the biomass estimation variability. This will stabilize over time.

The Energy Efficiency graph shows how the power has fallen as the production at Kuterra has increased and as many of the operating parameters have been optimized. Average power consumption decreased from 6.7 kwh/kg last period to 5.8 kwh/kg this period and should continue to fall as maximum stocking is approached.



Environment

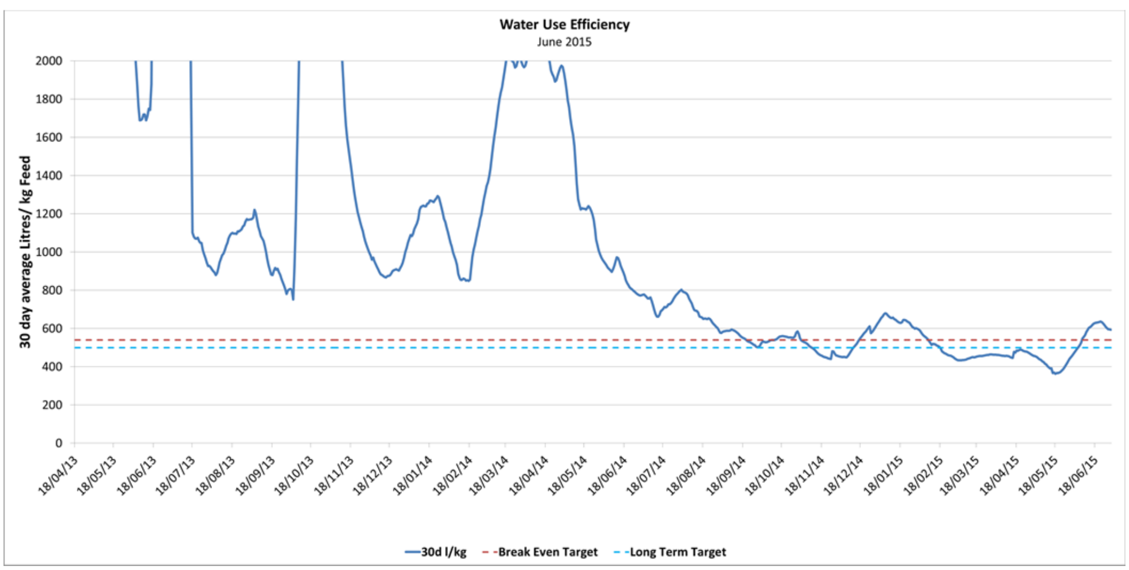
Summary of inlet/ outlet water quality

Environmental Metrics 1							
	Facility Inlet			Facility Outlet			Difference
Weekly Average Water Quality*	Max	Min	Average	Max	Min	Average	Average
Temp (C)	10.5	10.0	10.3	14.3	10.6	14.0	3.6
TAN-N (mg/l)	1.35	0.08	0.26	1.00	0.1	0.7	0.4
TKN (mg/l)	0.43	0.04	0.20	3.90	0.0	1.7	1.5
Nitrite-N (mg/l)	13.81	0.00	3.55	0.68	0.0	0.2	-3.4
Nitrate-N (mg/l)	3.4	0.0	0.9	127.8	18.2	51.6	50.7
CO2 (mg/l)	No samples						
Phos (mg/l)	0.15	0.00	0.04	1.57	0.83	1.35	1.30
BOD (mg/l)	No samples			13.0	0.0	7.3	
DO (mg/l)	10.3	6.5	8.5	8.4	8.4	8.4	-0.1
Salinity (ppt)	6.4	1.2	4.0	6.2	2.2	3.0	-1.0
PH	7.3	6.8	7.0	7.2	7.2	6.9	-0.1
Total Effluent Volume (lpm)				1217	484	821	
* "0"= lower than test detection limit							

Also see the Appendix for detailed and graphic water quality results for the quarantine and grow-out systems.

Summary of Other Environmental Metrics

Environmental Metrics 2					
	Max	**Min**	**Average**	**Total/pd**	
Water Treatments					Weekly total discharge volumes
NaOH consumption (kg/week)	2,678	1,558	2,077	41,100	50% solution (w:w)
Salt (kg/ week)			186	3,959	Used only in Q. facility
Calcium Chloride(kg /week)			0	0	Used for short period in Q. Facility
Sodium Bicarbonate(kg/week)			0	0	Used for short period in Q. Facility
Therapeutants used					
Salt (kg)				41,100	
Formalin (litres)				1,484	
Fish escapes				0	
Waste disposal					
Mortality (mt)				13	Disposed in local compost facility
Biosolids / sludge (m3)				320	Approximatley 10% solids
Water Use- Production Facility					
Total (m3/day)	1,790	327	1,293	192,682	Includes purge overflow
Total (lpm)	1,243	227	892	133,807	Includes purge overflow
Litres/kg feed- Production Only			488		Excludes purge overflow
Average/day (m3/day)- Production Only			488		Excludes purge overflow
Litres/kg feed- Purge Overflow Only			804		Excess of culture needs
Average/day (m3/day)- Purge Overflow Only			805		Excess of culture needs



Biosolids analysis

Date	Total Vol. Removed From Site (m3)	Specific Gravity	Total Wet Weight Removed From Site (Kg.)	% Total (Dry) Solids	Total Dry Solids Removed From Site (Kg)	Total Fixed Solids (%)	Weight of Fixed Solids Removed From Site (Kg)	Total Volatile Solids (%)	Weight of Volatile Solids Removed From Site (Kg)	Total Nitrogen (% of Dry Solids)	Total N Removed From Site (Kg)	Total Phosphorous as P (g/Kg)	Total P Removed from Site(Kg)
07/11/2013	16	*1.020*	*16320*	*3.50%*	*571*	*3.59%*	*20.51*	*6.98%*	*39.88*	*5.59%*	*31.95*	*0.029*	*0.016*
18/12/2013	8.5	*1.020*	*8670*	*4.50%*	*390*	*3.59%*	*14.01*	*6.98%*	*27.24*	*5.59%*	*21.81*	*0.029*	*0.011*
23/12/2013	32	1.027	32864	3.45%	1134	1.07%	12.13	2.38%	26.98	5.12%	58.05	0.028	0.032
03/03/2014	50	1.095	54750	18.50%	10129	7.24%	733.32	11.20%	1134.42	5.43%	549.99	0.045	0.456
11/04/2014	55	1.012	55660	4.67%	2599	0.83%	21.57	3.84%	99.81	6.61%	171.82	0.017	0.044
23/04/2014	30.25	1.025	31006	14.80%	4589	4.57%	209.71	10.20%	468.07	5.60%	256.98	0.028	0.128
28/05/2014	40	*1.020*	40800	11.50%	4692	4.24%	198.94	7.29%	342.05	5.21%	244.45	0.025	0.117
09/06/2014	45	*1.020*	*45900*	*8.70%*	*3995*	*3.59%*	*143.41*	*6.98%*	*278.90*	*5.59%*	*223.44*	*0.029*	*0.114*
26/06/2014	50	1.020	51000	3.66%	1867	0.89%	16.61	2.77%	51.70	4.05%	75.60	0.033	0.062
14/07/2014	30	*1.020*	30600	*6.03%*	1845	1.17%	21.59	*4.86%*	89.68	*2.10%*	38.75	*0.024*	0.044
30/07/2014	50	*1.020*	*51000*	*7.93%*	*4045*	*3.08%*	*124.50*	*6.35%*	*256.80*	*5.09%*	*205.88*	*0.029*	*0.116*
10/09/2014	30	*1.020*	*30600*	*7.93%*	*2427*	*3.08%*	*74.70*	*6.35%*	*154.08*	*5.09%*	*123.53*	*0.029*	*0.069*
25/09/2014	30	*1.020*	*30600*	*7.93%*	*2427*	*3.08%*	*74.70*	*6.35%*	*154.08*	*5.09%*	*123.53*	*0.029*	*0.069*
14/10/2014	30	1.020	30600	3.40%	1040	27.70%	288.19	72.30%	752.21	4.20%	43.70	0.034	0.035
29/10/2014	30	1.020	30600	54.70%	16738	88.80%	14863.52	11.20%	1874.68	0.90%	150.64	0.021	0.352
12/11/2014	30	1.020	30600	29.50%	9027	73.20%	6607.76	26.80%	2419.24	2.00%	180.54	0.032	0.289
25/11/2014	20	1.020	20400	5.60%	1142	37.10%	423.83	62.90%	718.57		0.00	0.044	0.050
10/12/2014	30	1.020	30600	18.20%	5569	44.40%	2472.72	55.60%	3096.48	3.20%	178.21	0.054	0.301
23/12/2014	30	*1.020*	*30600*	*11.92%*	*3647*	*17.29%*	*630.49*	*17.30%*	*630.73*	*4.50%*	*164.03*	*0.031*	*0.113*
10/01/2015	20	1.020	20400	11.70%	2387	58.50%	1396.28	41.50%	990.52	2.90%	69.22	0.028	0.067
24/01/2015	30	1.020	30600	22.10%	6763	66.60%	4503.89	32.70%	2211.37	2.40%	162.30	0.025	0.169
07/02/2015	*30*	*1.020*	*30600*	*15.24%*	*4663*	*62.55%*	*2916.79*	*37.10%*	*1730.02*	*2.65%*	*123.57*	*0.031*	*0.144*
18/02/2015	*30*	*1.020*	*30600*	*15.24%*	*4663*	*62.55%*	*2916.79*	*37.10%*	*1730.02*	*2.65%*	*123.57*	*0.030*	*0.127*
04/03/2015	*40*	*1.020*	*40800*	*15.24%*	*6218*	*62.55%*	*3889.06*	*37.10%*	*2306.70*	*2.65%*	*164.76*	*0.031*	*0.132*
18/03/2015	*30*	*1.020*	*30600*	*15.24%*	*4663*	*62.55%*	*2916.79*	*37.10%*	*1730.02*	*2.65%*	*123.57*	*0.031*	*0.132*
02/04/2015	*20*	*1.020*	*20400*	*15.24%*	*3109*	*62.55%*	*1944.53*	*37.10%*	*1153.35*	*2.65%*	*82.38*	*0.031*	*0.132*
15/04/2015	*40*	*1.020*	*40800*	*15.24%*	*6218*	*62.55%*	*3889.06*	*37.10%*	*2306.70*	*2.65%*	*164.76*	*0.031*	*0.133*
29/04/2015	*30*	*1.020*	*30600*	*15.24%*	*4663*	*62.55%*	*2916.79*	*37.10%*	*1730.02*	*2.65%*	*123.57*	*0.031*	*0.137*
14/05/2015	*20*	*1.020*	*20400*	*15.24%*	*3109*	*62.55%*	*1944.53*	*37.10%*	*1153.35*	*2.65%*	*82.38*	*0.032*	*0.143*
27/05/2015	*30*	*1.020*	*30600*	*15.24%*	*4663*	*62.55%*	*2916.79*	*37.10%*	*1730.02*	*2.65%*	*123.57*	*0.032*	*0.144*
Total/*Avg.* to Date	**956.75**	*1.024*	**704170**	*12.39%*	**87023**	*21.60%*	**32852.40**	*19.18%*	**15817.48**	*4.31%*	**3074.41**	*0.031*	**2.655**

Notes:

-Values in Yellow based on actual results from North Island Labs (Maxxam).

-Other values (*italics*) inferred from lab averages. March - May /15 sample results TBA when received from lab

Fish Health Treatments

To date all treatments have been in response to fungal outbreaks, which can be strongly correlated with stress induced during either smoltification, poor water quality conditions (7-9.7 NTU for extended periods), changes in photoperiod, manual handling, or lowered salinity.

Salt has been used to successfully treat fungus in the Q1 system. The max concentration has been 10ppt. This level was gradually attained over 6 weeks in order to allow the bacteria to acclimatize. The biofilters were populated with a combination of freshwater and saltwater nitrifying species in order to ensure a high tolerance to salt water. As a result, we did not experience any negative impacts on the biofilters during salinity increases from 0.5ppt to 10ppt.

Because of the much larger volumes in the GO system, treating with additional salt is very challenging due to the quantities required. Thus far we have used consecutive flush treatments of formalin ranging from 60 to 200 ppm followed by further treatments every other day. For more details of the fungal episodes experienced and specific treatments used please see the "Fish Health" section for each cohort.

The vast majority of our mortalities to date occur in the first few weeks in Q1 when the fish are still in the smoltification window. As explained earlier, these mortalities are no longer an issue due to a new strategy whereby we raised the salinity of the Q1 system and allowed it fall very gradually over 5 weeks. In those cases when smolts arrive with fungal challenges, they are also given formalin treatments over three consecutive days ranging from 120-160ppm. These prophylactic treatments have proven extremely successful in mitigating against the high mortalities typically experienced during this time. In order to reduce or eliminate the use of formalin:

- In February a higher salinity well was plumbed in. This allows better control of the salinity levels in the quarantine and growout tanks. Already the results are very positive. Additional salt was not required and mortalities were again extremely low for the latest cohort added to the system (Cohort #7).
- Smolts from future cohorts will be sourced from a supplier whose fish arrive in excellent condition, with no fungal challenges.
- Building our own hatchery so as to get the highest quality smolts that are used to our growing conditions and that experience reduced stress as a result, is a long-term solution that is being evaluated.

Fish Escapes: No fish escaped the system and because of the chlorine effluent treatment system and the infiltration basin it is impossible for them to do so.

Summary and Next Steps

Kuterra is the first RAS facility designed and built in North America to grow Atlantic salmon to market size at a commercial scale. The first smolts arrived in March 2013 and it has taken more than two years to identify and rectify most of the technical issues. This process of continual improvement has been mirrored by a steady improvement in fish performance. The positive trends documented in the preceding pages continue. As fish production increases and the biomass in the system grows, the costs per kg of production continue to fall. Now that target water quality is being achieved, the growout of cohorts 4-6 will more clearly show what the long-term, steady state operating parameters will be for this pilot scale facility. These parameters can then be extrapolated and modeled for a larger facility (1500MT-3000MT) that benefits from economies of scale.

Financial

The financial model and financial projections have been updated based on the information provided by the growout, harvest, and sale of Cohorts 1, 2 and 3. Given the poor performance of Cohort #1 (start-up challenges) and the facility operating at under capacity, net returns for fish sold in 2014 (first year of sale) were negative.

It is assumed that fish performance will continue to improve steadily towards levels that are already attained by open net-pen operators and by the Freshwater Institute in their trials. Given this trend, other improvements in production processes, and by operating at full capacity, the facility should be operating at full break even by March 2016.

Construction and Capital Improvement Costs

The facility was essentially completed by August 31/14. However there have been a number of capital improvements since that time including: The addition of a liquid oxygen (LOX) facility, harvest area expansion, and the addition of electrical load reactors to protect key equipment. There were also a number of improvements, made under warranty, to improve CO2 stripping (in –tank aeration units) and oxygen supplementation (LHO and emergency oxygen delivery systems modifications).

Looking Forward: Investments geared towards reducing early maturation (lighting, improved cooling capacity) are either planned or in the process of being made. Since slower than expected growth, high early maturation and increasing smolt survival (by reducing fungus outbreaks) are key challenges, there may be the need for further investments in these areas. The addition of a third oxygen generator has been put on hold pending the results from the oxygen system upgrades.

Liquid Oxygen Tank

Facility Construction	Cost		Comments
Costs to Aug 31, 2014			**Initial construction costs**
RAS Engineering & Services	579,266	7%	
RAS Equipment	2,452,243	28%	Third O2 generator and LOX facility to be added
RAS Installation	2,545,776	29%	
Civil Developments	2,290,454	26%	
Aquaculture Equipment	695,985	8%	
Other Equipment	89,034	1%	
Total Construction Capital	**8,652,758**	100%	
Unit Capital Costs*	$22 /kg		Based on 400mt/yr potential production
	$21,632 /tfp		
Costs from Aug 31/14 to June 30/15			**Capital improvements**
Liquid oxygen (LOX) facility	62,229		RAS equipment
Harvest area expansion	11,849		RAS equipment
Load Reactors	5,154		RAS equipment
Photperiod Lighting	35,960		RAS equipment
Plumbing from high salinity well	43,009		RAS equipment
Oxygen supply upgrades	6,813		RAS equipment
Misc	134,884		RAS equipment
Total	202,660		Excludes capitalized repairs
Total Construction cost	**8,855,418**		

<Biofilters and tanks during construction.

Interior of Kuterra facility>

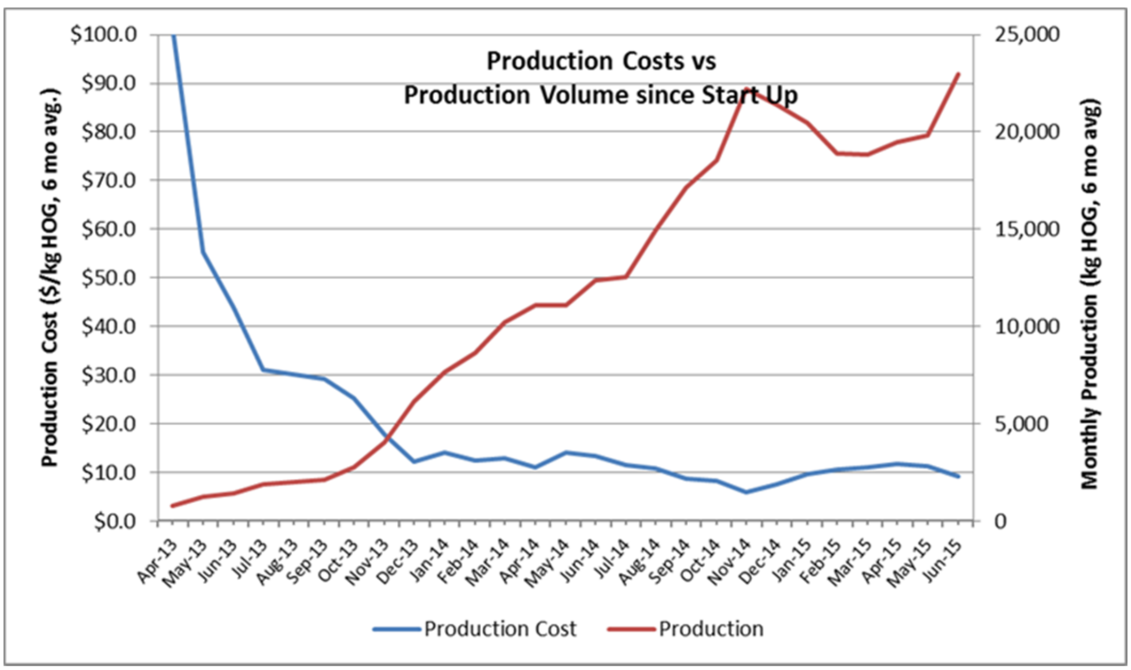
L. to R: Biofilter header tank, CO2 stripper, and drum filters.

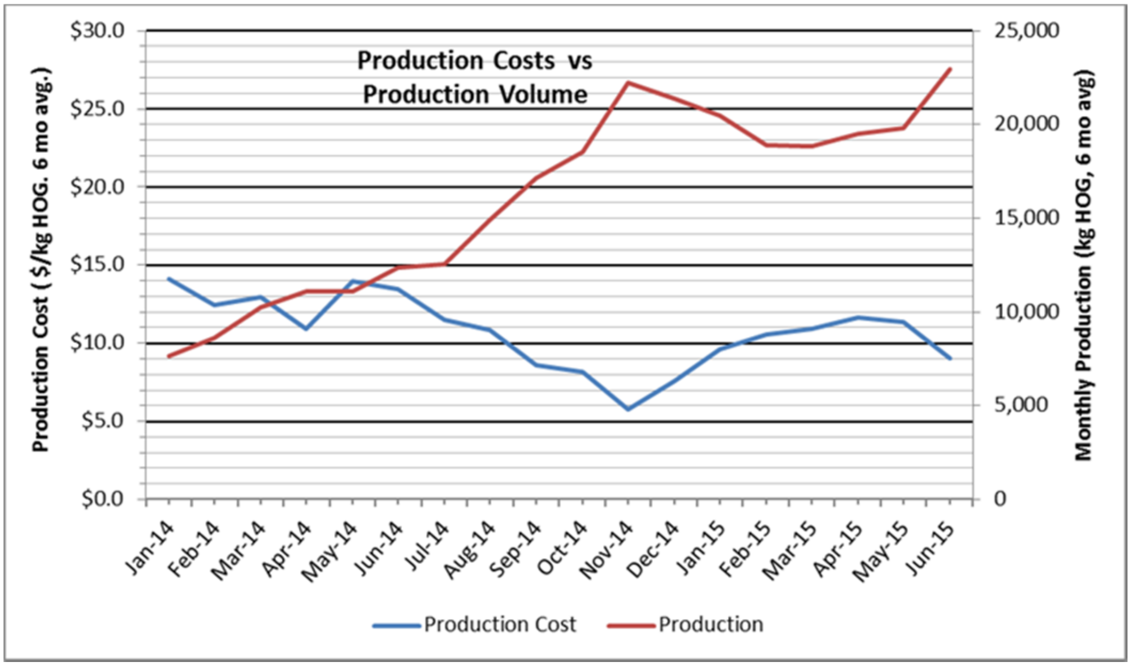
Production Costs

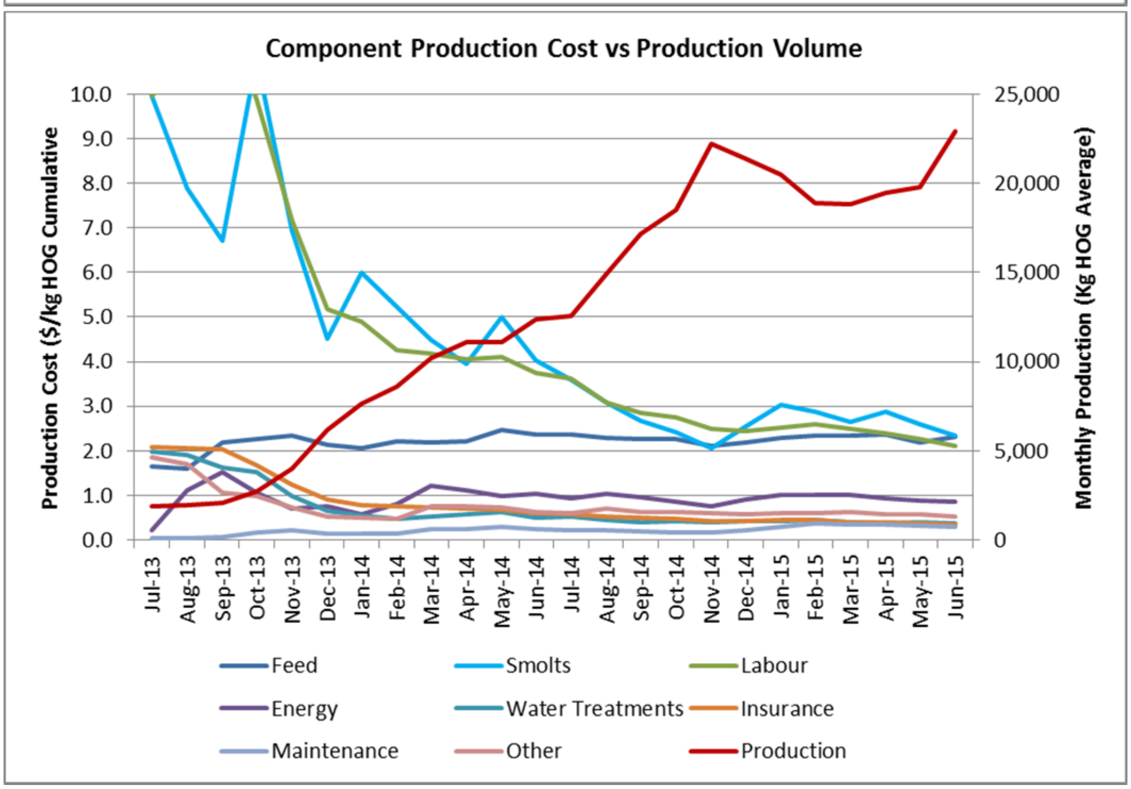
Since start up, monthly production volumes have gradually increased and, in concert, unit costs have decreased. Current unit production costs (cost of fish biomass added in Q2-2015), are currently about $7.68/kg HOG. (See below).

The main contributors to decreasing unit costs have been improvements in Smolt, Labour and Other costs (See category descriptions below). While this is understandable, from the perspective of biomass dilution of relatively fixed costs, it also reflects improvements in processes and cost control (see Production and Cohort naratives above).

Some of the variation in unit costs trends reflects the irregularity of certain costs. In particular, smolt costs involve very large and irregular descrete payments. The other major source of variation is the estimate of production (biomass gain) each month. This reflects the uncertainy around live fish sample weights. However, as each cohort is harvested, exact weights from fish delivered to the processing plant are used to correct inventory weights and total production. Therefore, the use of cumulative or six month averages are used to smooth the progression lines.




Production Costs vs
Production Volume
Production Cost ($/kg HOG. 6 mo avg.)
Monthly Production (kg HOG, 6 mo avg)
$30.0
$25.0
$20.0
$15.0
$10.0
$5.0
$0.0
25,000
20,000
15,000
10,000
5,000
0
Jan-14
Feb-14
Mar-14
Apr-14
May-14
Jun-14
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Production Cost
Production


Component Production Cost vs Production Volume
Production Cost ($/kg HOG Cumulative
Monthly Production (Kg HOG Average)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
25,000
20,000
15,000
10,000
5,000
0
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Dec-13
Jan-14
Feb-14
Mar-14
Apr-14
May-14
Jun-14
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Feed
Smolts
Labour
Energy
Water Treatments
Insurance
Maintenance
Other
Production

Production Cost Categories	
Feed	Feed, transport,
Smolts	Smolts, vaccinations, disease screening, transport
Labour	Manager and site technicians, Wages and benefits
Power	All electricity charges and fuels
Water Treatment and Fish health	Water amendments (NaOH, Salt, etc), Fish health treatments, Vet services.
Insurance	Fish, Liability and Property insurance
Maintenance	All maintenance costs (including capitalized costs)
Other	**Variable:** Oxygen, Waste disposal, Equipment rental, Chemicals and Cleaning agents, Supplies and Misc Consumables **Fixed**: Financial management and services, Communications and IT, Office supplies, Testing, Professional services, Tools and small equipment, Training, Vehicle expenses, Work clothing

Labour Cost

Labour could be considered a relatively fixed cost since it depends more, for example, on the number of tanks being managed rather than the biomass in each tank. Therefore, as production tonnage increased unit costs have decreased, as well as due to improvements in labour/ worker efficiency.

Current labour costs by position and by type of cost are presented below. While the time required to deal with start up activities has been decreasing (eg- Time required to deal with treatment system optimization), the time required for harvesting and other fish handling activies has increased (eg fish now undergo four transfers in a production cycle rather than three for the first cohort). The net effect is that labour demand (including management time) has stabilized at about 5.2 Full Time Equivalents (FTEs).

(See Report #5 for the distribution of labour by general task)

Labour Distribution by Position

April/15-June 15	**Hours**	**Staff**	**FTE**	**% hours**
Management	480	1	0.9	18%
Technical	2188	7	4.3	82%
Maint	0		0.0	0%
Admin	0		0.0	0%
Total	2668	7	**5.2**	**100%**
Total since start up	**24868**	9	**5.4**	

Labour Cost Summary

Total Wages	$715,332	Average Wage (all positions)	$28.8 /hr
Total Benefits	$97,173	Benefits as percent of labour	12%
Total Labour Cost	$812,505	Average Labour Costs (includes management)	$32.7 /hr
Unit Cost	$2,064 /tfp		
	$2.06 /kg Live		

Future Outlook: As methods to increase total production from the facility are found, unit labour costs will decrease. The eventual reduction in reporting requirements related to funding (eg Tides Canada Performance Metrics recording and reporting) will also decrease labour costs.

Energy Cost

While energy efficiency has improved since start up, the unit price of electricity ($/kWh) has increased. This is due to increasing total energy use (part of the pricing formula penalizes increasing energy use) and general energy cost increases. For example, hydro has increased from a low of $0.67/kwh in May 2014 to $0.076/kwh in January 2015. The net result has been relatively flat unit energy costs. Current costs are averaging $0.071/kwh.

Future Outlook: As energy use stabilizes the energy price penalties decrease, therefore unit energy cost should decrease. As improvements in the cooling system and treatments system are made, the reliance on new water to cool or improve water quality (pumping costs) should contribute to further lowering energy cost. However, BC Hydro forecasts a significant increase in rates (about 6%/yr) for the next few years.

Smolt Cost

The price for smolts ($/smolt) has been relatively stable from cohort to cohort. However fish survival has generally improved (see cohort narratives above). Therefore, the cost of smolts in biomass produced (cost of production) has been decreasing. However, it remains much higher compared to the original budget due to:

1. Smaller than budgeted harvest size: Production of smaller fish requires more smolts for a given production output.
2. Total mortality being substantially higher than originally forecast.
3. The use of an IHN vaccine (very expensive) to mitigate the risk of being located next to a major salmon stream.

Future Outlook: As methods to increase final harvest size (improve growth or allow fish to grow to a larger size) and reduce mortality are found, the number of smolts required (cost of production for smolts) will decrease.

Smolt Cost details

Cohort	1 0313	2 1013	3 0114	4 0514	5 1014	6 0115	7 0415	Total
Number Stocked	23,503	33,723	40,210	41,387	45,163	45,340	39,840	229,326
Cost								
Total	$84,082	$108,216	$138,605	$137,430	$152,760	$144,287	$132,571	$897,951
$/smolt	$3.58	$3.21	$3.45	$3.32	$3.38	$3.18	$3.33	$3.92
$/kg live*	$1.44	$1.49	$1.76					$1.47
$/tfp*	$1,442	$1,494	$1,759					$1,471

* $/kg net production for completed cohorts

Smolt costs includes disease screening and transport

Feed Cost

With improving feed conversions, the cost of feed in fish produced has decreased. Conversely, while the price of base feed formulation purchased hasn't changed substantially:

1. The production of smaller fish has meant a higher relative use of small fish diets which are more expensive than large fish diets. I.e. If larger fish could be produced, feed costs would decrease further.
2. The change to natural pigmentation and addition of some mineral packs to improve performance has added cost.

Future Outlook: As feeding efficiency continues to improve, feed costs will decrease. However, the limits for FCR improvement may depend on supplying more optimal water chemistry (eg O2, salinity, etc.), minimizing maturation processes, and/or supplying a feed optimized to the given water chemistry (freshwater). With the current feed energy level, the fish have a biological capacity to achieve significantly better feed conversion rates.

Feed Cost Details

Feed Cost Since Start Up (by Cohort)				
Cohort	Feed Use (kg)	Feed Cost		Production Cost- Feed*
		Total	Unit (Average $/kg)	Unit ($/kg live)
0313	83,304	$ 149,488	$ 1.79	$ 2.56
1030	95,231	$ 179,661	$ 1.89	$ 2.48
0114	101,148	$ 200,233	$ 1.98	$ 2.50
0514	95,378	$ 202,190	$ 2.12	$ 2.20
1014	43,432	$ 94,190	$ 2.17	$ 2.12
0115	29,355	$ 61,876	$ 2.11	$ 1.78
0415	7,438	$ 15,170	$ 2.04	$ 1.29
Total	**455,286**	**$ 902,807**	**$ 1.98**	**$ 2.29**
*Total Feed Fed/ Total production.				

Blended Average Feed Cost		
Period		$/kg
2013	Q1	$2.65
	Q2	$2.13
	Q3	$2.03
	Q4	$1.91
2014	Q1	$1.84
	Q2	$1.82
	Q3	$1.95
	Q4	$1.94
2015	Q1	$2.06
	Q2	$2.13

Water treatments and Fish health

The dominant cost in this category is sodium hydroxide that is used for alkalinity/ Ph adjustment. This cost, in turn, is directly related to the degree of water re-use. The addition of new water dilutes existing water, therefore triggering the addition of more sodium hydroxide. As water use efficiency has improved, the use (and cost) of water treatments has decreased.

Future Outlook: As water chemistry requirements and water quality is further optimized, there may be an opportunity to further reduce water exchange requirements.

Insurance Costs

The dominant cost in this category is fish insurance. The gradual decrease in unit cost since start-up was due to:

1. The gradual increase in average fish sizes as inventories built up to steady state (smaller fish have a higher $/kg insurance value/cost).
2. Gradually increasing production to dilute fixed insurance costs (Property and Liability).

Future Outlook: Given that fish insurance cost is dependent on the value of the fish insured, as production costs fall, so should insurance costs. Also, as the business and industry become more established and a record of performance (low risk) established, rates should decrease in concert.

Maintenance Costs

While the facility and equipment were relatively new and mostly under warranty, a number of non-warranty related repairs were required. Some of these were related to aspects of the facility that were not optimally constructed but have since been improved. For example: The addition of electrical load reactors to prevent motor damage from supply power oscillations.

Future Outlook: As the facility ages, maintenance costs will probably increase until a steady state is reached. This may take a few years. However, the improvements made to the system in response to early failures, and an ongoing preventative maintenance program, should help ensure the steady state costs are low.

Other Costs

This is a large group of relatively small variable and fixed costs that are dominated by: Financial Management (accounting and financial oversight), Liquid oxygen and tank rental, Waste disposal (sludge and mortalities), Water quality testing (environmental monitoring program) and Marketing fees and materials. Given that most of the costs are relatively fixed, unit Other production costs have fallen with increasing production. Fixed Other costs averaged about $198,000/year.

Future Outlook: As grant applications and grant reporting requirements are completed, and financial systems stabilized, several of the contributing costs should decrease. As overall production increases, all unit fixed costs should decrease.

Other Operating Costs			
	Variable	**Fixed**	
Liquid oxygen	13%		Tank rental and oxygen
Waste Disposal	5%		Sludge and mortality disposal
Water Quality Testing	5%		Part of environmental monitoring program
Supplies and Consumables	5%		
Chemicals and cleaning agents	3%		disinfectants
Bioscanner rent	2%		Fish size sampling service
Effluent Disinfection	2%		
Other Variable	1%		
Tools and small equipment		2%	
Financial Man. & Accounting		51%	Controller, accounting, audit
Meetings &Entertainment		2%	
legal		2%	
Communications		2%	
Travel Expense		2%	
Other Fixed		4%	
	35%	**65%**	

Revenue and Returns

As previously discussed, the unit cost of biomass produced each quarter continues to fall through 2015 based on improved production processes and dilution of relatively fixed costs. While in previous periods production costs were significantly higher than net sales revenues, the direct (variable) cost of fish produced in the second quarter of 2015 was less than the farm gate sales returns. (ie) Operations have produced a positive gross margin.

Future Outlook: Production and harvest volumes will continue to increase through 2015 until the fall since the largest smolt intake was in October 2014. Therefore, relatively fixed unit costs (eg labour) will continue to decrease as well as costs related to production improvement initiatives.

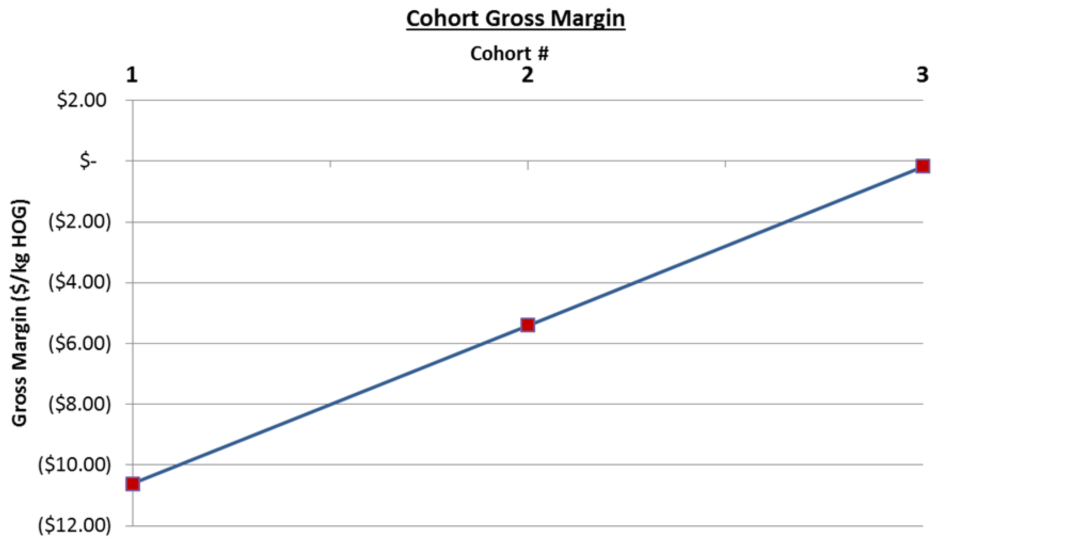
Production Costs and Returns								
	2014 Actual				2015 Actual		Totals / Avg.	ST Targets
	Q1	Q2	Q3	Q4	Q1	Q2		
Production (kg HOG)	26,681	36,446	51,065	58,165	38,000	79,116	289,472	292,000
Current Production Costs ($/kg HOG)								
(Marginal cost of biomass added *)								
Feed	$2.67	$3.13	$2.41	$2.36	$3.81	$2.59	$2.75	$2.69
Smolts	$5.22	$3.80	$0.00	$2.63	$3.80	$1.68	$2.44	$1.28
Labour	$3.35	$3.50	$1.32	$1.59	$3.28	$1.12	$2.04	$1.48
Power	$2.17	$0.83	$0.93	$0.94	$1.79	$0.42	$1.01	$0.45
Water Treatment	$0.38	$0.58	$0.21	$0.57	$0.26	$0.34	$0.39	$0.17
Insurance	$0.55	$0.46	$0.32	$0.29	$0.29	$0.22	$0.32	$0.09
Maintenance	$0.44	$0.26	$0.10	$0.37	$1.20	$0.22	$0.38	$0.27
Other- Variable	$1.27	$0.46	$0.72	$0.55	$0.95	$0.31	$0.63	$0.25
- Fixed	$2.36	$0.86	$1.34	$1.03	$1.38	$0.79	$1.17	$1.17
Total	$18.42	$13.88	$7.36	$10.34	$16.76	$7.68	**$11.12**	**$7.85**
Sales								
Harvest volume (kg HOG)	803	29,268	20,355	40,514	64,022	47,523	202,486	
Sales volume (kg HOG)	17	21,215	16,742	17,631	58,212	47,002	160,819	
Net back to farm revenue($/kg HOG)	-$1.94	$9.41	$6.69	$9.66	$8.87	$10.00	**$9.13**	**$8.59**
Gross Margins*								
On Current prod. costs	-$20.4	-$4.5	-$0.7	-$0.7	-$7.9	$2.3	**-$2.0**	**$0.7**
On Current variable prod. costs	-$18.0	-$3.6	$0.7	$0.4	-$6.5	$3.1	-$0.8	
Gross Margin on Volume Harvested*	$0.0	$6.8	$15.3	$4.2	$8.1	$9.9	$7.3	

*** Marginal Cost of Biomass Added :** Production expenses in a period divided by estimated growth for all fish in the period. This is the cost of adding biomass today and represents the what the future cost of fish harvested will be. It is not the cost of fish sold in a period. Given the trend of increasing production and biomass, the actual cost of fish sold in the current periods would be higher than the current marginal costs. (The fish sold today would carry costs accumulated when the facility was at less than full production). **Gross Margin** in this statement is the difference between the revenue generated by fish sold during the period and cost of biomass created during the period (biomass that will be sold in the future). Therefore, it represents potential future gross margins. **Gross Margin on Volume Harvested** is the net to farm revenue for each period divided by harvested volume in that period. Variation from "Gross Margin" is primarily due to changes in volumes of harvested fish that are inventoried rather than sold in a period.

Notes: Sales do not include the estimated return for frozen downgraded products. The negative net sales returns in first quarter were due to the combination of very small sales volumes and relatively large unit freight costs for the period.

Kuterra Cohort Margin Analysis

As of June 30 2015



Cohort	0313	1013	0114
	1	2	3
Production			
Size/ harvest size (kg HOG)	2.8	2.1	2.4
Harvest to date (kg HOG)	50,341	51,954	81,336
Total Projected Harvest (kg HOG)	50,341	51,954	81,336
Cost ($'000)			
Value of fish harvested	952.4	626.0	797.2
Total- All	952.4	626.0	797.2
Total- Fixed	106.5	76.7	85.2
Total- Variable (direct)	845.9	549.4	712.1
Revenue ($'000)			
Sales	311.5	268.6	698.7
Total	311.5	268.6	698.7
Margins ($'000)			
On Total Costs	(640.9)	(357.4)	(98.5)
On Variable Costs	(534.4)	(280.7)	(13.4)
Unit Returns ($/kg HOG)			
Total Cost	$ 18.92	$ 12.05	$ 9.80
Total Revenue	$ 6.19	$ 5.17	$ 8.59
Gross Margin on Total Cost	($ 12.73)	($ 6.88)	($ 1.21)
Margin on Variable Costs	($ 10.62)	($ 5.40)	($ 0.16)

Notes:

- Costs do not include: Interest, Depreciation or Corporate Overheads .
- Revenue does not include the value of harvested but unsold fish (eg frozen inventory).

- Costs were allocated to each cohort on the basis of relative biomass except for smolts which were allocated based on actual costs.

Key Financial Points

- Operating costs to date include the costs of applying for grant funding and for tracking data and reporting on the project's results. Those costs are estimated to be roughly 10% of the grant funding secured and need to be factored out when modeling a scaled up facility.

- Full biomass and steady state operations should be achieved by the fall of 2015. Therefore the operating and financial results from cohorts 4-6 will be much more representative of the facility's potential than cohorts 1-3.

- Kuterra's anticipated production of 400-470MT/year is a demonstration or pilot-sized production level. Significant improvements in operating costs and in production are anticipated with a scaled up facility (>1500MT/yr) that has its own hatchery.

Chef filleting a KUTERRA salmon.

Grants and Contributions to Date

Government Funding	
DFO - Aquaculture Innovation & Marketing Progran	800,000
Sustainable Development Technology Canada	3,735,000
Coast Sustainability Trust	113,111
Aboriginal Affairs Canada (AANDC)	497,575
BC Hydro PowerSmart Program	112,615
North Vancouver Island Aboriginal Training Society	27,300
New Relationship Trust	25,000
Total Government Funding	**5,310,601**
Financing from charitable organizations	
Tides Canada	2,940,000
Ritchie Brothers Foundation	154,745
Total Charitable Funding	3,094,745
Funding Received to June 30/2015	8,405,346

Capital Structure

As at June 30, 2015 Kuterra was financed as follows:

$8.4m - Grants as listed above

$2.25m - Long-term debt. Guaranteed by the 'Namgis First Nation

$1.0m - Equity invested by the 'Namgis First Nation

$1.0m - Line of credit guaranteed by the 'Namgis First Nation.

For the year ended March 31, 2015, interest charges totaled $148,577.

In-Kind Contributions

In-kind contributions from July 1, 2011 to June 30, 2015 total $1,078,718.

Social Impacts

Training: Approximately 3 hours a week are involved with training and training administration. This includes administering exams, developing educational materials including written operating procedures (SOP's) and partaking in courses (WHIMIS; Chemical Safety; Procedures for Working Alone; Emergency Procedures; Harassment in the Work Place).

Social impact of facility construction (to Aug. 31/14)

Regional Expenditures	Expenditures	Companies	Labour Hours
Vancouver Island	$6,645,065	69	40,777
BC (excluding Vancouver Island)	$1,526,113	16	3,456
Outside BC	$481,580	22	241
Total	$8,652,758	107	44,474

Note: Labour hours = on-site labour + directly contracted off-site labour (eg consulting).
Other companies assumed to supply goods or off-site services

Social impact of operations

Region			Vancouver Island	BC outside Vancouver Isl.	Total BC	Outside BC	Total
Construction							
Number of companies			69	16	85	22	107
Financial Impacts							
Direct Expenditures			$6,645,065	$1,526,113	$8,171,177	$481,580	$8,652,758
Social Impact of Operations							
Financial Impacts							
Production	727,518	lbs HOG estimated annual production (330mt/yr)					
Revenue (Farm Gate)	$ 4.14	/lb HOG includes downgrades			$ 3,012,900		
Annual expenditures					**$ 2,444,197**	include Corp. OH	
Total Output	1.91	Sector Multiplier (BC)			**$ 5,754,639**	(Revenue x Multiplier)	
Total GDP	0.66	Sector Multiplier (BC)			**$ 1,988,514**	(Revenue x Multiplier)	
Employment Impacts							
Direct Employment					5.20	FTE (Farm staff only)	
Indirect and induced employment	7.83	FTE /$1 million revenue			23.59	(Revenue x Multiplier/ M.)	
Total Employment					**28.79**		

Indirect and induced social impacts were calculated using the latest sector multipliers from BC Stats. http://www.bcstats.gov.bc.ca/StatisticsBySubject/BusinessIndustry/FisheriesAquacultureHuntingTrapping.aspx

Also see Report #5 for additional detail on social impacts during construction and direct labour impacts.

Facility and Equipment Overview

The main production system consists of five 500m3 fiberglass tanks serviced by a RAS treatment system that includes tank-side Low Head Oxygenators (LHO's) plus a centralized water treatment system including rotary drum filters, CO_2 stripper, fluidized sand bed biofilter, pump sump, and header tank. The main recirculating flow pumps (axial flow type) are used to supply a total flow of about 20,000 gal/min (90 m3/min) while maintaining the water level in the header tank, which supplies water by gravity to the LHO's and biofilters; flow exiting the LHO's enters the adjoining culture tank and flow exiting the biofilters enters the CO_2 stripping unit. Culture tank volumes are exchanged approximately once every (45) minutes. Supplemental oxygen is generated on site and is supplied to the LHO's (and emergency tank sparging system) based on individual tank oxygen levels. A backup liquid oxygen facility was added in September 2014. Alkalinity is maintained by an automatic sodium hydroxide dosing system based on water PH. A controls system monitors and regulates pump speed, drum filter backwash cycles, oxygen delivery, and sodium hydroxide dosing (for alkalinity control) based on pre-set and monitored conditions.

An ozone system was added in August 2014 to facilitate removal of fine suspended and dissolved solids.

A completely separate Quarantine system consisting of a single, 250m3 tank, is serviced by a similar RAS system but is sized to support a much smaller biomass.

A pre-harvest off flavour purge facility consists of a single 250m3 tank and is serviced by a partial reuse facility that includes a recirculating pump, sump header tank, LHO and CO_2 stripper. Controls are similar to the main system with the exception of alkalinity control.

All three systems are housed in a steel building 117'x 271'.

A single backup generator with automatic switching provides emergency power.

Effluents: Filtered solid wastes (drum filter backwash) flow into gravity thickening tanks. The thickened solids that collect at the base of these tanks are regularly pumped out to a main storage tank, which is emptied as required (pumped) to a transport truck. The supernatant from the settlement tanks and main effluent from the facility flows by gravity into a chlorination tank and then a de-chlorination tank and then into one of two infiltration basins and then to ground. Only one basin is used at a time so that regular fallowing can be used to maintain sediment permeability.

Heating and Cooling: Two heat pumps and heat exchangers are used to move heat to or from geothermal wells, culture tanks (tank base heating/cooling coils) and air heating/cooling units. Building ventilation is also used to control air heat retention, humidity (condensation) and CO_2 levels.

It appears that additional cooling capacity will need to be added in order to maintain the water temperature at 13^0C throughout the summer.

Harvesting and Off-flavour Depuration: Fish are held in the depuration tank (previously described) for a minimum of seven days prior to harvest. At harvest, fish are removed from the tank using a mechanical crowder and a 12” fish pump with de-watering at end. Fish are then directed through a Seafood Innovations stun and bleed machine (http://www.seafoodinnovations.com.au) into plastic totes with ice/water slurry for bleeding, chilling, and transport to the processing plant.

The complete basis of design narrative, process flow diagrams, site map and site layout were presented in the Appendix of the Milestone #4 report.

The Kuterra facility.

Summary of Problems Encountered & Lessons Learned (from inception)

Factors Contributing to Poor Water Quality (high turbidity, high CO_2 production and high O_2 consumption)

- Accidental overfeeding event due to feed system programing error.

- Changes in light regimes – fish went off feed resulting in wasted feed until the appropriate feed rate could be established.

- Use of 12mm feed pellet. The large pellets that were not eaten by the fish and were also not removed by drum filter since they were too big to cling to the filter screen. They simply rolled around inside the drum until they disintegrated.

- The biofilters not fluidizing properly required flow to be diverted from the tanks to the biofilters. This reduced tank flow reduced tank self-cleaning action.

- Diverting water from the tanks to the biofilters reduced tank flow by >20% with a proportional increase in CO_2 in the tanks as a result.

- This also reduced the rate at which oxygen could be supplied to the fish.

- Insufficient center drain flow. In the quarantine tank insufficient waste removal (solids collecting around the centre drain) necessitated shortening of the centre drain standpipe to increase bottom drain flow and solids movement to the center drain.

- Air entrainment in the side drain boxes probably resulted in some disintegration of fecal pellets rendering them unfilterable by the drum filter.

- Poor (soft, unconsolidated) fecal pellet quality. This was corrected by the feed supplier changing the feed formulation.

- Waste feed accumulating on the bottom and in suspension resulted in high bacterial loads and accompanying metabolic loading (O_2 consumption and CO_2 production)

- Water flow instabilities (caused by the use of automated flow control / constantly changing flow) caused the biofilter to expand and contract which in turn caused some bacteria and other particles to be sheared off.

- Automatic cycling of well pump use. Even with changing pump use every 24 hours there was frequent input of orange, iron rich water into the system for the first 20 minutes after each changeover.

- Low in-tank light placement. Fish tended to avoid the lights and therefore stratify higher in the water column. Feed therefore more easily sank past the fish and was wasted. In addition, tank cleaning was impaired since there was less fish activity (tail wash) close to the bottom to facilitate movement of settled solids towards the center drain. Light placement has since been optimised.

- The poor water clarity resulted in increased waste feed accumulating on the bottom and in the water, etc. This further increased the potential for feed wastage due to reduced visibility of feed by fish and staff could see very little of the fishes feeding behaviour).

- Insufficient center drain flow in the Quarantine tank resulting in insufficient waste removal (solids collecting around the sump area) which necessitated shortening of the centre drain standpipe

- The screen covering the tank sump in the Quarantine had no holes drilled in the outer perimeter and was not flush with the floor which contributed to solids collecting. In April 2015 the screen was removed and additional holes were drilled.

Lower Growth (potential factors)

- The first cohort of smolts was smaller than budgeted (85 vs 100gm).

- Faulty pumps – all of the primary recirc pumps had to be replaced as they were underperforming by as much as 30% which limited what we could feed the fish

- We are confident that if we had our own supply (hatchery) we would be able to select for the fastest growers.

- Feed restrictions were imposed to manage through several weeks of restricted water flow caused by faulty circulation pumps. These eventually had to be replaced since they were underperforming by up to 30%.

- Cohort #1 was grown at a lower temperature than budgeted. This was intentionally implemented to delay harvesting and to fill a gap in supply between cohorts. However, the program was lengthened more than planned by a delay in start-up of the heating system (nine months after stocking, in December 2013).

- The temperature of the overall systems was dropped from 15C down to 13C as a strategy to minimize maturation.

- Fungal outbreaks resulting in reduced feeding rates and general stress.

- Temporary impact of changing light regimes. For example, changing to continuous lighting from a natural photoperiod resulted in fish going off feed for several weeks.

- The use of natural photoperiod regimes meant there was less time for feeding and less total feed delivered than with longer photoperiods.

- Early Maturation: 100% of the first cohort matured. Once this process is fully underway, it is expected that growth will slow and eventually stop. The large investments in gamete development in combination with ceased or reduced feeding lead to a reduction in growth, increased mortality, a marked increase in FCR and the depletion of lipids, proteins and astaxanthin (red pigment) from the muscle tissue in sexually mature salmon. The fish also develop unattractive secondary sexual characteristics. The severity of these physical changes was even more pronounced with Cohort#1 since there harvest was extended over a prolonged period in order to shorten a gap in supply before the next cohort was big enough to harvest.

- High CO_2 levels in the tanks (e.g. >30ppm at times)

- Manually grading the fish had a big impact on their feeding levels for several weeks afterwards. We have modified and improved the grading equipment since commissioning but we are still finding that any manual handling of fish >1kg (e.g. even to take weight samples) significantly impacts feeding levels afterwards. We have streamlined the process such that we were able to manually grade >47T of large fish (2.6kg average) in one working day with minimal mortalities (22 fish out 16,600). But it does impact the feeding for several days afterwards so it is better to not have to touch the bigger fish unless absolutely necessary.

- The facility cannot operate as efficiently as it should because we are not able to stock smolts every 4 months as intended (smolts are only available in Oct/Jan/April followed by a 6 month gap until the following Oct).

- Cataracts is emerging as a significant problem with a prevalence as high as 60% in some tanks with the afflicted fish being up to 20% smaller than those without cataracts.

Higher FCR (potential factors)

- Establishing the appropriate feed rates based on fish behaviour was difficult due to the poor water clarity. Post March 31/14 we have systematically identified and resolved a number of the system issues and installed ozone in the system. As a result the water is the cleanest we have ever seen it (August 2014) with NTU's down to 0.1 when at one time we were up at 8.0 NTU.

- These difficulties were considerably compounded by impacts and disruptions caused by changing light regimes, fungal outbreaks and all the other commissioning issues previously mentioned.

- Early maturation: A high portion of the first cohort is maturing. Once the maturation process is fully underway, it is expected that FCR's will climb as more energy is put into gonad development and growth slows.

- Low Salinity: The physiological / energetic impact of rearing at low salinities may be another factor contributing to high FCR.

Other Issues

- Challenges with inventory control, which is essential for optimal feed management. It has been difficult to accurately measure or estimate the biomass of the larger fish. The Vaki scanner has proved to be inappropriate for our tank conditions since the fish either avoid the scanner frame or just hold station relative to it. In addition, manually sampling fish >1kg strongly impacts feed for weeks afterwards. The result is that fish weights cannot be accurately estimated until the harvesting starts (2.8-3kg). There were also significant uncertainties over fish counts due to commissioning issues with the counting equipment (which have since been resolved). Better fish biomass measurement options are being investigated.

- The growth projection model did not take maturation in to account. Fish that are maturing do not feed or grow at the same rate as those that are not maturing. The model is constantly being improved to reflect actual conditions experienced on site. In addition, newly introduced smolts do not eat full rations for the first 2 – 8 weeks and this factor is not accounted for in the predictive model.

- The commissioning process resulted in several equipment design improvements such as rectifying inadequate biofilter fluidization and modifying the smolt removal system.

- The poor efficiency of the CO2 stripper is ripe for innovation. Pumping costs would be dramatically reduced if the efficiency were doubled.

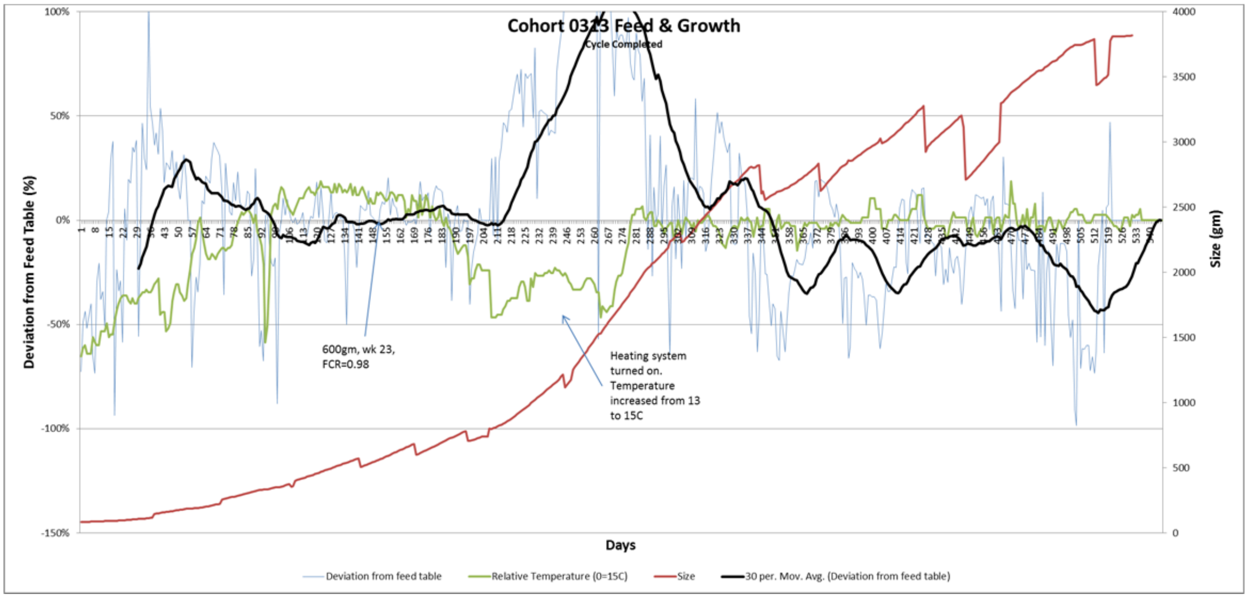
- The poor efficiency of the low head oxygenators. With improvements that have recently been identified, LHO efficiency is now close to design specification (75%). Oxygen costs would be significantly reduced if the LHOs were >95% efficient at all flow rates.

Appendix

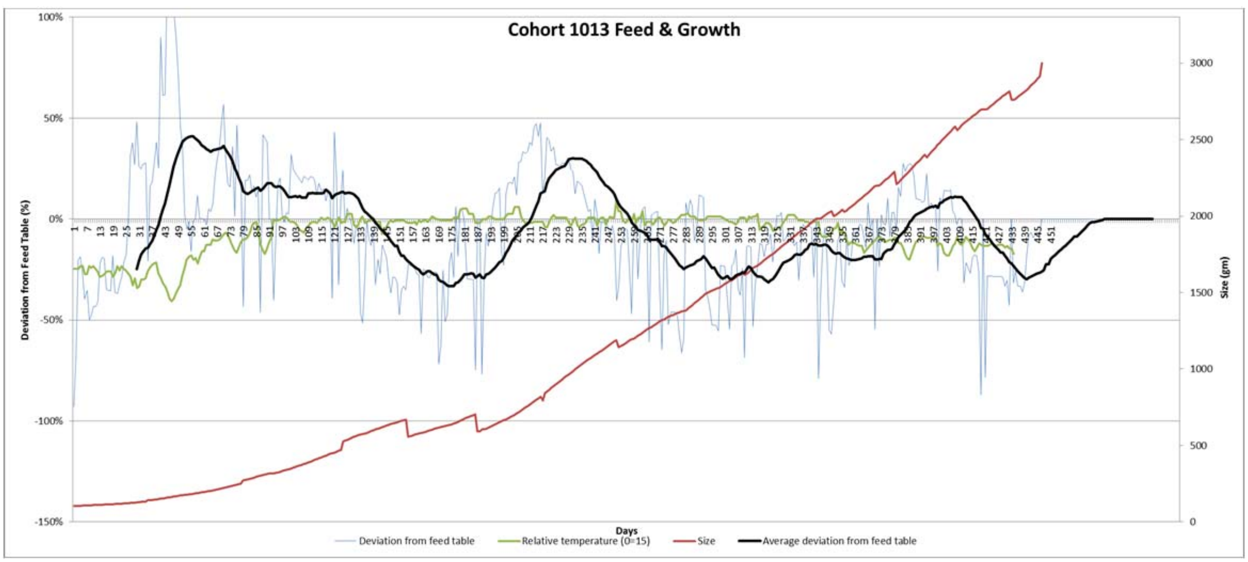
Original Facility Design Specifications and Operational Targets as of March 31/2013

Biological					
FCRb	1.05		Mortality	7%	% of start #
FCRe	1.08		Mortality	3%	% of prod.
TGC (lifecycle)	2.4		Maximum rearing density	Q-50, G-75	kg/m3
Production	470	mt live/yr			
Harvest Size	3700	gm live			
Smolt Size	100	gm live			
Water Quality					
TAN (Ammonia-N)	2.58	mg/l max	Oxygen	100%	minimum
Nitriite	0.3	mg/l max	CO2	Q-12, G-12	mg/l max
Nitrate	75	mg/l max	Temperature	15	C avg
Salinity	6 - 8	ppt avg	Alkalinity	120	mg/l min
TSS	10	mg/l max			
PH	7.2 - 7.4				
Engineering & Environment					
Water Use	540	l/kg feed	Recirc flows - Quarantine tanks avg	8,630	lpm
	454-680	lpm	Recirc flows - Growout tank avg	55,556	lpm
Tank water exchange rate	Q-30, G-45	minutes	Recirc flows - Purge tank avg	5,756	lpm
Feed rate- Grower RAS	1,163	kg/d max	Recirc flows - Quarantine system max	16,200	lpm
Feed rate- Quarantine RAS	255	kg/d max	Recirc flows - Growout system max	90,000	lpm
Power- Heating	3.2	kwh/kg prod	Recirc flows - Purge system max	34,000	lpm
Power- Non Heating	1.0	kwh/kg prod	O2 consumption	0.333	kg/kg feed
Power- Total	4.2	kwh/kg prod			
Financial					
Feed cost	$ 1.48	/kg	Sale price	$ 5.43	$/lb HOG
Staffing	4	FTE	Fish Insurance Rate	6%	of value
Smolt cost	$ 3.05	/smolt	Other Operating Costs	$ 155,802	/yr
Electricity cost	$ 0.08	/kwh	Water Treatments & Fish Health	$ 87,966	/yr
Maintenance	0.50%	of capital			
Total Production Cost	$ 5.63	/kg HOG			
Equipment					
Volumes	**Dia x Depth**		**Volume**		
Tank Sizes- Grower	(mxm, m3) 48'x 10.5'		5x500 = 2500m3		
Tank Sizes- Purge	(mxm ??) 36'x 9.5'		1x250= 259m3		
Tank Sizes- Quarantine	(mxm ??) 36'x 9.5'		1x250= 259m3		
System volume- Grower			3055 m3		
System volume- Purge			274 m3		
System volume- Quarantine			402 m3		
Drum Filter- Grower	80 micron		3 units		
Drum Filter- Quarantine	89 micron		1 unit		
Oxygen Generator	2 units x 0.5mt/day		2x 250 lpm, VSA technology		
Recirc Pumps - Grower	3x 30,355 lpm		3x 8018 gpm		
Recirc Pumps - Purge	1x 5678 lpm		1x 1500 gpm		
Recirc Pumps - Quarantine	2x 8585 lpm		2x 2268 gpm		
UV	2x 270gpm (1022lpm)		60 mj/cm2 dose @ 90% transmissivity		
Sludge thickening cones	3x 9' (2.74m) dia				
Sodium Hydroxide dosing	9092 litre tank				
Biofilter Sand	138m3				
Biofilter dimensions- Grower	4x 15'x15'x12' deep				
Biofilter dimensions- Quarantine	1x 15'x15'x12' deep				
CO2 stripper - Grower	700 m2				
CO2 stripper - Purge	150 m2				
CO2 stripper - Quarantine					

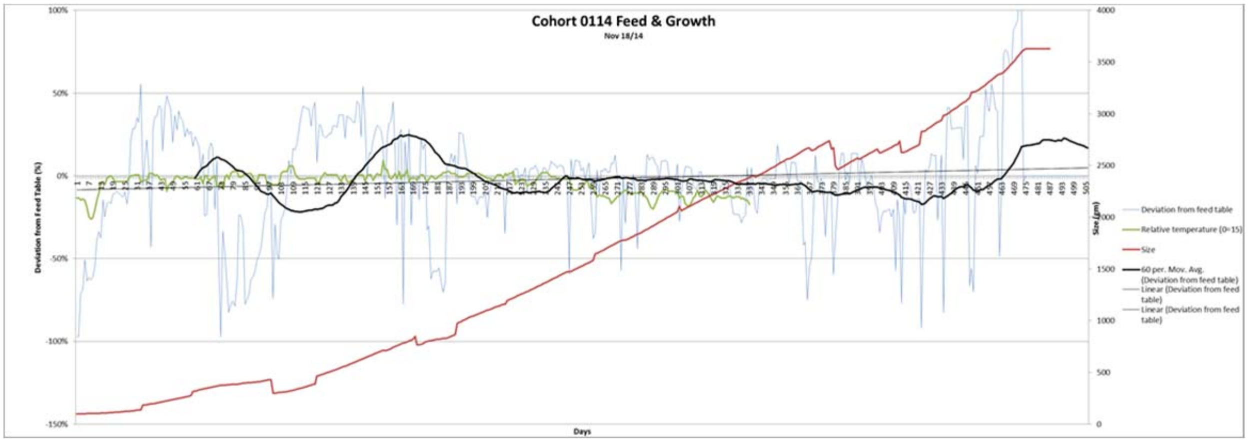
Cohort 0313 Feed and Growth



Cohort 1013 Feed and Growth

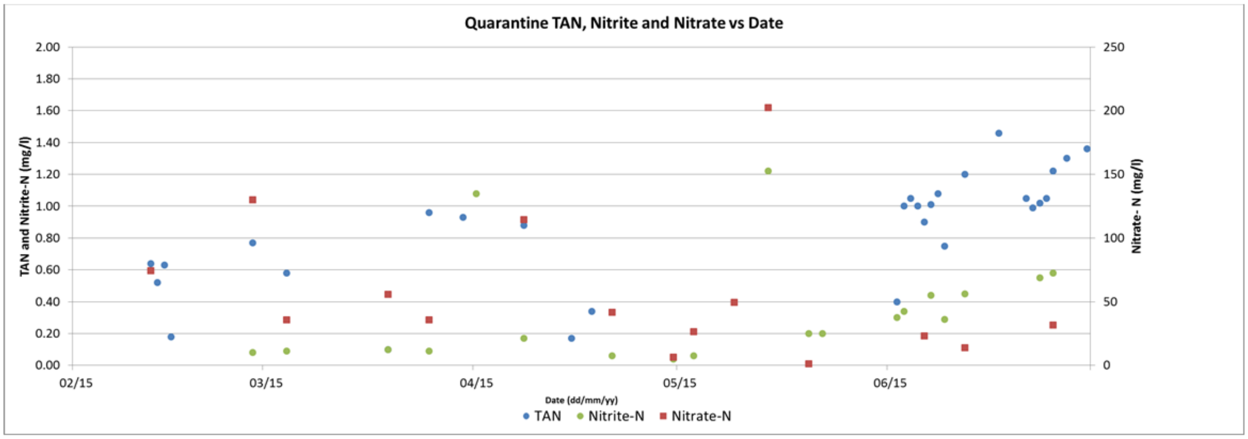


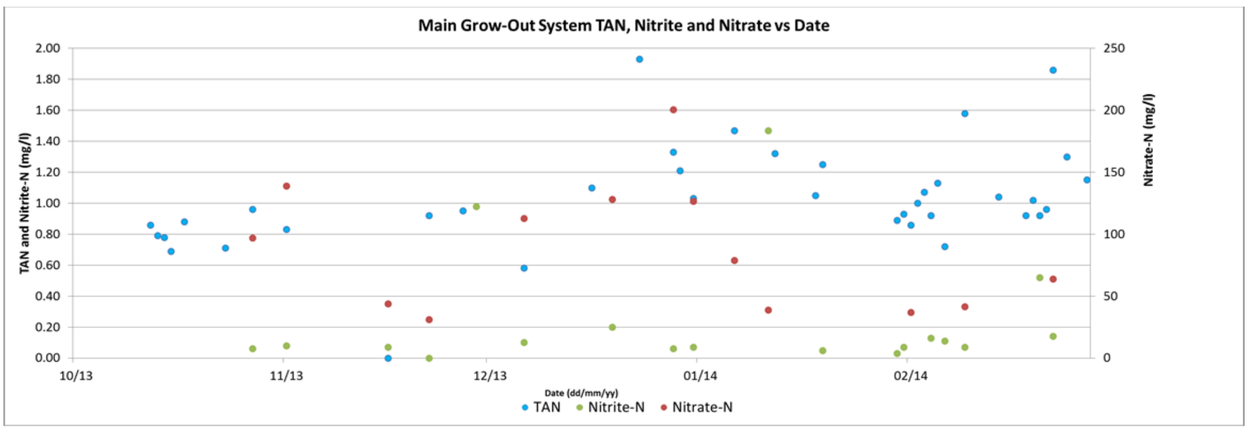
Cohort 0114 Feed and Growth



Water Quality - TAN, Nitrite, Nitrate

Period: Feb 1/15 – June 30/15





Weekly Data Summaries

Cohort #1 (0313)

Week	Size	SGR	TGC	Condition	Morts	Feed	Density	TAN	TSS	Nitrite	Nitrate	Ph	DO %	CO2	Salinity	Alkalinity	Hardness	Turbidity	TDS	Water Velocity	Biomass	Inventory	Photo-period
1	86	0.47%	0.7		62	61	8	0.4		0.4		7	98		3	42		1		33	2022	23477	
2	89	0.60%	0.8		194	76	8	0.5		0.5		7	104		3	43		0			2086	23354	
3	94	0.78%	1.0		773	131	8	0.7		1.1	40	7	105	4	5	56	19	1		33	2143	22831	
4	101	1.23%	1.6		255	198	9	0.6		1.5	18		104		7	86	15	1			2245	22306	
5	110	1.21%	1.6		67	218	10	0.3		1.0	90		104		7	88	28	2		33	2440	22177	
6	142	4.53%	6.2	1.02	21	345	12	0.4		0.9	66		104	13	5	83		2		33	3149	22147	
7	166	1.39%	2.2		18	342	14	0.3		0.4	110	7	104	9	2	35		2		33	3668	22134	
8	183	1.23%	1.9		348	271	16	0.2			25	7	105	8	4	40		2			4021	22015	
9	193	0.81%	1.1		280	284	16	0.4	8.0	0.5	45	7	106	8	7	55		2		33	4160	21567	
10	211	1.50%	2.2		39	463	18	0.4		0.5	18	7	105	9	2	42		2		35	4539	21466	14
11	260	3.11%	4.7		23	495	22	0.4	7.0	0.2	41	7	104	10	2	50	12	2		33	5583	21436	
12	291	1.40%	2.1		27	583	24	0.6		0.2	57	7	105	9	2	46	25	1		47	6237	21422	16
13	319	1.16%	1.7		45	476	27	0.4		0.1	48		104	11	2	43	22	4		33	6812	21386	14
14	337	0.69%	1.3		118	366	28	0.2		0.1	15	7	103	9	2	40		4			7189	21315	
15	358	0.98%	1.5		160	523	30	0.5		0.2	67		104	13	9	38		1		37	7568	21127	14
16	390	1.68%	2.7	1.07	43	646	32	0.7		0.3	57	7	103	14	5	50	4	1			8203	21051	
17	436	1.18%	1.9		7	723	36	0.6	5.5	0.2	94		99	15	2	43		2		37	9180	21037	14
18	474	1.14%	1.8		12	754	39	0.6		0.1	90	7	98	16	1	42		1	1061		9968	21024	
19	513	1.15%	1.9		8	826	42	0.4	7.0	0.1	60	7	97	16	1	85		2	1053	37	10780	21016	16
20	551	0.98%	1.7		13	728	45	0.4				7	92	16	1	105		1	1123		11579	21003	
21	529	-0.81%	-1.4	1.03	32	852	43	0.8	7.5	0.3			97	22	2			2	1354	37	11089	20980	16
22	561	1.12%	1.9		18	884	46	0.6		0.2	64	7	89	29	2	93		1		38	11758	20956	16
23	609	1.17%	2.1		23	985	50	1.1		0.1	11		92	29	3	126		1	3	47	12750	20942	16
24	657	1.04%	1.9		15	957	54	1.0	11.0	0.1	62		94	28	4	160		1			13744	20917	
25	627	-0.92%	-1.7		13	994	51	1.0		0.3	90		100	27	5	150		1		47	13107	20906	16
26	665	1.14%	2.2		25	1071	54	1.0		0.1	22		97	17	5	148		2			13885	20884	
27	719	0.99%	2.0		22	959	59	1.0	15.0	0.2	65		93	19	5	155		3		47	14989	20859	16
28	756	-0.62%	-1.3		112	912	62	0.9	40.0	0.1	76		93	17	4	148		3			15749	20830	
29	722	0.68%	1.5		3	679	59	0.8	20.0	0.1			93	17	3	95		4		47	14975	20739	15
30	777	1.30%	3.1		605	384	42	1.0					90	10	3						15816	20358	
31	841	0.94%	2.5		8	1111	17	0.8	20.0				100	7	3						16932	20126	12
32	912	1.27%	3.3		10	1550	18	0.7		1.0	38	7	96	8	3	55		2			18344	20118	0
33	997	1.29%	3.4		57	1700	20	0.6		0.8	8	7	94	9	3	40		1			20046	20099	12
34	1086	1.16%	3.0		18	1735	22	0.8		0.4	32		93	10	4	65		1			21765	20043	0
35	1166	-0.10%	-0.3		7	2165	23	0.8		0.3	26		93	10	4	35		1			23365	20035	11
36	1228	2.31%	6.4	1.17	3	2718	24	0.7		0.4	85		98	12	4	50		3			24589	20030	0
37	1398	1.55%	4.5		16	2844	28	0.6		0.3	25		108	11	4	50		4			27987	20021	11
38	1540	1.25%	3.9		11	2544	31	0.4		0.2	61			11	4	40		4			30802	20007	0
39	1677	1.19%	3.9		12	2659	33							12				4	6		33541	19995	11
40	1820	1.17%	3.4		7	2904	36			0.2	26	7		13	3	60		3			36366	19986	
41	1974	1.11%	3.0		41	2788	39			0.2				14	3			3			39405	19961	13
42	2094	0.72%	2.0		9	2067	42			0.1	1			12	3	40		3			41739	19935	
43	2220	0.89%	2.6		14	1865	44	0		0.1	31			12	3	20		3			44225	19926	17
44	2271	0.08%	0.2	1.44	19	2144	45	0		0.1	19			12	4	30		3			45201	19908	
45	2366	0.80%	2.4		10	2570	47	1						14	5			2			47077	19896	20
46	2487	0.67%	2.0		11	2296	49	1		0.2	49			17	5	55		2			49404	19863	
47	2613	0.71%	2.3		10	2437	52	0		0.4	94			16	6	55		2			51894	19857	22
48	2722	0.54%	1.7		3	2120	54	0		0.2	68			17	6	50		2	6		54033	19848	
49	2808	0.27%	0.9		293	1271	54							17	6			2			54577	19439	23
50	2589	-1.19%	-3.8	1.50	90	1493	49	0		0.2	53			14	5	60		4			49245	19022	
51	2628	0.27%	0.9		18	929	50	0		0.3				14	4	40		2			49906	18988	24
52	2686	0.37%	1.2		18	1371	51	1		0.2				18	3	63		5			50951	18971	
53	2764	0.44%	1.4		9	1717	52	1		1.0	61			18	3	42		6	6		52405	18959	
54	2709	-0.54%	-1.7	1.20	34	2357	51	0		0.1	7			19	3	45		7			51270	18923	
55	2767	0.60%	1.9		17	2023	52		21.0					19	3	3			11		52308	18907	24
56	2856	0.35%	1.1		22	1236	50	0.5		0.2	9			19	2	2					49032	17177	24
57	2928	0.37%	1.2		54	1194	50	0.3	10.0	0.4	51			18	2	2					47372	16179	24
58	2993	0.19%	0.6		23	974	52	0.9		0.1	109			20	3	3					45580	15233	24
59	3044	0.40%	1.3		30	1159	53	0.4	10.0	0.0	54			15	3	3					39527	12984	24
60	3142	0.46%	1.5		12	1347	55	0.5		0.0	94			14	3	3					40745	12969	24
61	3195	-1.22%	-3.9		68	1445	55	0.4		0.0				15	3	3					40945	12799	24
62	3012	0.62%	2.0		34	1039	38	0.4		0.1	50			14	2	2					31124	10335	24
63	3108	0.44%	1.4		20	957	39	0.5						13	2	2					32060	10315	24
64	3040	-2.08%	-6.6		435	905	41	0.4		0.3	104	7		15	2	2					29126	9516	24
65	2788	0.60%	1.9		82	994	44	0.3	5.0	0.0	96			15	2	2					22350	8017	24
66	2912	0.63%			59	1021	46	0.3				7		16	2	2					23095	7931	24
67	3232	1.78%	5.8		40	691	42	0.4				7		18	2	2					20898	6508	24
68	3415	0.39%	1.3		43	489	39	0.5		0.0	67			16	2	2					19395	5679	24
69	3504	0.36%	1.2		60	472	39	0.9						21	2	2					19699	5622	24
70	3573	0.26%	0.9		41	202	23	0.7		0.0				14	2	2					11392	3190	24
71	3648	0.32%	1.1		28	258	22	0.7	10.0	0.0	132			12	2	2					10875	2982	24
72	3731	0.22%	0.8		98	127	22	0.5		0.0	70			13	2	2					10952	2936	24
73	3764	0.14%	0.5	1.38	15	123	22	0.8	8.0					16	2	2					10784	2865	24
74	3513	-1.13%	-3.8		37	85	9	0.8			107			16	2	2					4671	1311	24
76	3815	0.03%			53	0	1														351	92	24

Cohort #2 (1013)

Week		Size	SGR	TGC	Condition	Morts	Feed	Density	TAN	TSS	Nitrite	Nitrate	Ph	DO %	CO2	Salinity	Alkalinity	Hardness	Turbidity	TDS	Water	Harvest	Biomass	Inventory	Pigment	Fat	Protein	Photo-
1		106				9	134	14			0.22		7.1	101	8	2.9	30.0		1.4		0.50		3569	33719	80	20	50	12
2		110	0.59%	0.8		5	150	15	0.12		0.30	11.6		100	6	4.2	55.0		2.9				3722	33712	80	20	50	12
3		116	0.68%	1.0		14	176	15	0.49					99	8	4.7	50.0		3.4				3894	33704	80	20	50	11
4		122	0.85%	1.3		20	253	16	0.38		0.60	3.2	7.1	100	7	3.8	50.0		2.8				4099	33686	80	20	50	11
5		132	1.70%	2.8		38	301	17	0.40					104	7	3.4			2.8				4428	33660	80	20	50	11
6		148	1.29%	2.0		40	453	20	0.34		0.42	21.4	7.2		6	3.6	57.5		3.3				4974	33619	80	21	49	11
7		163	1.42%	2.7		38	517	22							8	3.6			3.4				5485	33575	80	25	45	11
8		179	1.13%	1.9		48	450	23							9	3.5			2.5				5990	33536	80	25	45	11
9		194	1.19%	1.9		34	523	25	0.44						9	3.3			3				6481	33493	80	25	45	11
10		212	1.45%	2.1		22	732	28	0.70		0.73	35.1	7.1		10	3.1	70		2				7090	33463	80	25	45	11
11		236	1.51%	2.3		37	752	31	0.43		0.63	45.5			11	2.9	60		3				7904	33434	80	25	46	11
12		276	2.35%	3.7		22	823	36	0.46		1.30	45.9			12	3.7	75		3				9233	33406	80	25	50	11
13		306	1.28%	2.1		54	730	40	0.61						12	5.5			3				10219	33371	80	25	50	11
14		325	0.82%	1.3		22	718	23	0.70		0.17	48.8			16	5.3	55		2				11848	36481	80	25	50	12
15		354	1.31%	2.1		36	1059	24	0.47						16	5.6			2				11803	33304	80	25	50	
16		390	1.35%	2.3		76	1175	26			0.36	93.6			17	5.8	55		3				12958	33244	80	25	50	
17		428	1.32%	2.2		19	1250	28	0.43		0.24	67.9			17	5.7	50		2				14207	33197	80	25	50	
18		480	2.56%	4.5		41	1159	32	0.20		0.22	52.7			14	4.9	60		2				15921	33171	80	25	50	
19		555	1.03%	1.9		45	1191	37							14	4.3			3				18391	33121	80	25	50	
20		589	0.81%	1.5		39	1078	39	0.46		0.24				18	3.6	60		4				19501	33081	80	25	50	
21		625	0.78%	1.5		54	1066	41	0.63		1.00	108.6			16	2.8	43		5				20643	33038	80	25	50	
22		657	0.66%	1.3		43	961	43	0.31		0.12	10.5			19	2.6	45		8				21681	32990	80	25	50	
23		570	-1.99%	-4		54	928	38		12.00					19	2.5			8	372			18764	32943	80	25	50	
24		600	0.73%	1		45	1017	39		25.00	0	9			19	2			7			0	19720	32894	80	25	50	0
25		627	0.58%	1		163	806	41	0.35	10.00	0	51			18	2			5			0	20575	32805	80	25	50	0
26		663	0.95%	2		380	1374	43	0.25						20	3			3			0	21533	32493	80	25	49	24
27		653	-1.74%	-3		991	570	39	0.95	10.00	0	81			17	3	45		2			0	20898	31959	80	25	50	24
28		624	0.89%	2		185	1322	19	0.55	10.00	0	94			14	3			2			0	19478	31239	80	27	48	24
29		671	1.07%	2		60	1504	21	0.42						15	3			2			0	20884	31108	80	27	48	24
30		729	1.25%	2		27	1922	23	0.40	5.00	0	50			16	3	50		1			0	22651	31079	80	27	48	24
31		794	0.71%	1	1.16	15	2135	25	0.47						12	2			3			0	24647	31052	80	27	48	24
32		877	1.91%	4	1.06	13	2245	27	0.46		0	104			14	2	30		2			0	27208	31038	80	27	48	24
33		954	1.17%	3		24	2293	30	0.38	5.00	0	96			12	2			2	2400		0	29606	31023	80	27	48	24
34		1030	1.02%	2		8	2137	32	0.26						17	2	45		1			0	31935	31008	80	28	46	24
35		1101	0.90%	2		13	2033	34	0.34						17	2	34		0	2300		0	34119	30998	80	29	44	19
36		1162	0.16%	0	1.10	24	1839	36	0.39		0	23				2	30		1			0	35985	30977	80	30	44	16
37		1176	0.70%	2		17	1770	36	0.80		0	90	7		17	2	43		1			0	36411	30957	80	29	45	16
38		1238	0.79%	2		12	1827	38	0.92		0				20	2			2	2170		0	38321	30944	80	29	45	16
39		1301	0.62%	2		18	1796	40	0.70				7			2	28		4		0.50	0	40238	30927	80	30	44	16
40		1353	0.49%	1		16	1241	42	0.63	10.00	0	132			13	2			2			0	41817	30912	80	31	41	16
41		1399	0.63%	2		30	1979	43	0.56	8.00	0	70	7			2	13		1			0	43216	30892	80	30	42	15
42		1477	0.73%	2	1.29	14	2101	46	0.82			107			17	2	30		1			0	45581	30865	80	30	43	15
43		1533	0.46%	1		3	1532	47	0.83						11	2			0			0	47302	30858	80	30	43	14
44		1590	0.54%	1		39	1700	49	0.83				7		16	2	20		1			0	49033	30836	80	30	43	14
45		1640	0.45%	1	1.30	35	1759	50	0.89		0	103	7		15	3	40		0			0	50508	30794	80	30	43	14
46		1709	0.61%	2		6	2244	53	1.02		0	119	7		17	3	25		0			0	52607	30778	80	30	43	14
47		1788	0.65%	2		11	2374	55	1.08		0	126	7		18	3	25		0			0	55022	30771	80	30	43	13
48		1868	0.59%	2		16	2292	57	0.91						19	4			1			0	57443	30756	80	30	43	13
49		1947	0.60%	2		41	2105	60			0	85				4	100		0			0	59832	30736	80	30	43	13
50		2004	0.36%	1		11	1660	62	0.84							4			0			0	61538	30702	80	30	42	13
51		2023	0.04%	0	1.38	84	1807	53	0.85		0	50			22	5	95		0			8576	52454	25932	80	30	43	13
52		2083	0.57%	2		10	2126	55	1.13							5			0			0	53957	25909	80	30	43	13
53		2168	0.53%	2		34	1688	57	0.83		0	85			21	6	115		1			0	56128	25887	80	30	43	11
54		2236	0.47%	2		23	2198	59	0.76		0	183			21	6	145		0			0	57833	25863	80	30	43	11
55		2249	0.03%	0		10	2191	57	1.14		0	143			19	7	120		0			8509	51237	22769	80	30	43	11
56		2340	0.65%	2		30	2267	59	1.26			98				6			1			0	52101	22265	80	31	42	11
57		2422	0.48%	2	1.36	36	1910	62	1.38		1	217			20	6	100		0			9580	46585	19241	80	31	41	11
58		2525	0.59%	2		11	1940	65	1.10		0	172			20	5	115		0			0	47201	18692	80	31	41	11
59		2595	0.31%	1		244	1444	77	1.09		0	131			20	5			0			9138	41274	15904	80	31	41	11
60		2672	0.38%	1		26	866	78	0.73			145			15	5			0			13024	38796	14526	80	31	41	11
61		2726	0.32%	1		58	702	55	0.77			133	7		16	5			0			0	27729	10171	80	31	41	11
62		2784	-0.01%	0	1.51	46	563	49	0.66			206				5			1			13003	24279	8708	80	31	41	11
63		2802	0.40%	1		0	408	29														0	14350	5122	80	31	41	11

Cohort #3 (0114)

Week	Size	TGC wt	Condition	Morts	Feed	Density	TAN	TSS	Nitrite	Nitrate	Ph	CO2	Salinity	Alkalinity	Hardness	Turbidity	Harvest	Biomass	Inventory	Pigment	Fat	Protein
1	101	105.5		983	85	16	0.16					8	5.5	55.0		1.8	0	3993	39661	80	20	50
2	104	118.5		806	189	16	0.36		0.16	3.2		10	5.6	50.0		1.6	0	4033	38736	80	20	50
3	112	134.0		208	333	17	0.60		0.25			10	5.6	70.0		2.1	0	4275	38262	80	20	50
4	122	151.4		85	398	18	0.32		0.58	9.2		11	5.0	65.0		2.2	0	4660	38174	80	21	49
5	149	170.0	1.14	57	653	22						11	4.3			2.3	0	5668	38095	80	25	45
6	199	190.0		45	800	30	0.55		0.96	37.1		12	3.9	40.0		2.5	0	7561	38040	80	25	45
7	225	211.4		60	958	33	1		0.02	24.7		13	2.8	25.0		3.1	0	8537	38001	80	25	45
8	254	234.0		20	1066	38			0.69	31.7		14	2.7	75.0		5.2	0	9649	37956	80	25	45
9	311	258.2	1.21	31	1091	46						16	2.6			4.8	0	11785	37930	80	25	50
10	351	283.3		38	1015	52						16	2.5			5.7	0	13309	37894	80	25	50
11	376	309.7		38	497	56	0.42		0.45			19	2.3			5.3	0	14250	37868	80	25	50
12	388	338.5		980	521	57	0.52					19	7.5			7.1	0	14495	37382	80	25	50
13	403	369.2		654	393	58						18	5.8			6.1	0	14675	36419	80	25	50
14	420	401.1		210	558	59	1.90		0.21	49.1		21	3.1	100.0		4.6	0	15147	36072	80	25	50
15	306	433.6		389	516	25	0		0.08	57.1		15	2.8			2.0	0	10906	35676	80	25	50
16	329	469.9		250	1011	23			0.03			16	2.6			1.1	0	11658	35462	80	25	50
17	366	506.8		99	1355	26	0.44					12	2.3	50.0		2.7	0	12910	35299	80	25	50
18	467	543.1		88	1493	33	0.54					14	2.2			2.4	0	16453	35203	80	25	50
19	525	587.8		54	1734	37	0.38		0.25			12	2.1	30.0		2.1	0	18444	35132	80	25	50
20	577	630.8		67	1890	40	0.26		0.01	95.9		18	1.8	45.0		0.7	0	20224	35079	80	25	50
21	633	676.1		48	2013	44						17	1.8			0.5	0	22188	35025	80	25	50
22	690	726.6		44	2082	48	0.37		0.01	23.0			1.8	30.0		0.6	0	24124	34977	80	25	50
23	734	776.7	1.10	52	2010	51	1		0.01	89.7		16	1.8	43.3		0.8	0	25622	34927	80	25	50
24	790	821.2		54	1845	55						20	1.7			1.6	0	27546	34872	80	25	50
25	792	867.9		2318	1065	31	0.59						1.8	27.5		3.4	0	26337	33203	80	25	50
26	812	916.1		31	847	27	0.64		0.01	132.0		12	1.7			2.8	0	26389	32518	80	26	49
27	838	964.4		15	1346	28	0.50		0.01		7.1	14	1.8	12.5		0.7	0	27231	32498	80	25	50
28	979	1013.6		22	2171	32	0.89					17	1.9			0.7	0	31808	32477	80	25	50
29	1054	1064.4		40	1839	34						14	2.1			0.6	0	34201	32446			
30	1107	1117.0		19	1862	36	0.85				7.1	15	2.3	20.0		0.5	0	35875	32419			
31	1164	1172.9	1.27	42	1990	38	0.88		0.04	103.2		15	2.6	40.0		0.3	0	37702	32386			
32	1238	1228.4		16	2291	40	1.02		0.01	118.7	7.1	16	2.9	25.0		0.3	0	40076	32362	80	31	41
33	1301	1288.5		39	2408	42	1.09		0.10	125.8	7.2	18	3.3	25.0		0.3	0	42048	32328	80	31	41
34	1367	1348.6		27	2504	44	0.93					19	3.8			0.6	0	44152	32297	80	31	41
35	1435	1411.6		26	2534	46	#DIV/0!		0.13	85.2			4.3	100.0		0.2	0	46322	32273	80	31	41
36	1490	1477.0		26	1899	48	0.90						4.2			0.3	0	48060	32253	80	31	41
37	1554	1539.6		25	2317	50	0.79		0.03	50.2			4.7	95.0		0.2	0	50078	32222	80	31	41
38	1673	1601.8		33	2463	54	1.12					22	5.0			0.4	0	53863	32187	80	31	41
39	1744	1659.8		26	2417	56	0.85		0.04	85.2			6.1	115.0		0.4	0	56093	32164	80	31	41
40	1798	1720.5		34	2107	58	0.71		0.08	169.2		21	6.4	145.0		0.5	0	57783	32133	80	31	41
41	1864	1783.3		228	2622	60	1.05		0.10	139.6		20	6.6	120.0		0.4	0	59466	31900	80	31	41
42	1941	1843.7		22	2899	62	1.30			150.9			6.2			0.5	0	61874	31875	80	31	41
43	2018	1908.8		55	2795	64	1.44		0.54	235.5		20	5.9	100.0		0.2	0	64244	31832	80	31	41
44	2092	1974.8		33	2583	67	1.12		0.03	172.9		19	5.3	115.0		0.4	0	66495	31788	80	31	41
45	2156	2028.1		23	2677	69	1.15		0.45	131.1		21	5.2			0.2	0	68496	31767	80	31	41
46	2222	2075.7		43	2446	71	0.71			144.9		15	4.9			0.2	0	70504	31724	80	31	41
47	2289	2122.7		21	2615	73	0.80			119.9	7.2	16	5.0			0.1	0	72551	31699	80	31	41
48	2350	2170.5		9	2225	75	0.60			214.3			4.9			0.5	0	74472	31685	80	31	41
49	2399	2218.3	1.29	31	2616	76	0.64			154.8		18	4.9			0.4	0	75988	31669	80	31	41
50	2462	2268.6		21	2998	78				41.8							0	77897	31635	80	31	41
51	2540	2318.3		35	2622	81	0.54		0.04	119.2	7.1		4.5			0.3	0	80315	31617	80	31	41
52	2610	2367.2		39	2931	83	0.59		0.02	71.4	7.1	22	3.6	70.0		0.5	0	82387	31568	80	31	41
53	2660	2417.5		223	1840	74	0.28		0.02	86.1	7.0	18	3.3	70.0		0.7	12290	73616	27669	80	31	41
54	2705	2469.5		55	2350	69							3.0			0.6	0	69241	25601	80	31	41
55	2511	2522.0		153	1834	59	0.80						2.6			0.9	10363	57388	22819	80	31	41
56	2547	2574.0		112	2084	57	0.71				6.9		2.4			0.9	9577	53837	21140	80	31	41
57	2605	2625.9		324	1688	57	0.96		0.06	97.1	7.3					0.7	0	47271	18145	80	31	41
58	2642	2679.3		696	1208	58	0.83		0.08	138.8	7.0		1.7	90.0		0.5	7959	41866	15844	80	31	41
59	2684	2733.9		887	899	55							1.5			0.5	8351	36995	13774	80	31	41
60	2654	2787.4		870	885	57			0.07	44.0	7.1		2.1			0.3	0	28536	10753	80	31	41
61	2802	2842.2		319	775	49	0.94			31.2	7.1		4.1			0.3	5728	24573	8793	80	31	41
62	2922	2898.3		77	750	45			0.98		6.9	19	5.3			0.3	5889	22746	7790	80	31	41
63	3028	2952.8		13	707	37	0.58		0.10	112.8	7.0	23	5.3			0.4	0	18371	6067	80	31	41
64	3129	3008.5		12	581	36	1.10		0.20	128.2	7.1	19	4.6			0.3	6119	18079	5785	80	31	41
65	3241	3059.1		4	433	27	1.93						5.4			0.4	0	13430	4143	80	31	41
66	3343	3110.3		6	512	26	1.19		0.07	163.7	7.0		4.9			0.4	7257	12796	3831	80	31	41
67	3441	3163.7		2	341	14	1.47			79.0		12	5.4			0.3	0	6842	1988	80	31	41
68	3589	3229.5		-1005	296	11	1.32		1.47	38.8	7.1	10	4.2	82.5		0.3	10637	5659	1582	80	31	41
69	3629			8	0	0											0	175	48			

Cohort #4 (0514)

Week	Size	SGR	Condition	Morts	Feed	Density	TAN	TSS	Nitrite	Nitrate	Ph	CO2	Salinity	Alkalinity	Hardness	Turbidity	Harvest	Biomass	Inventory	Pigment	Fat	Protein	Photo-
1	102	0.5%		326	20	16	0.21					7	2.3			2		4117	40220	80	25	45	16
2	108	0.9%		474	35	16	0.37		0.04	18.5		7	2.1	70		2		3990	36826	80	25	45	16
3	118	1.5%		115	60	16	0.63					8	2.0			2		4132	34908	80	25	45	16
4	134	1.9%		17	84	18	0.46		0.09	59.2		8	2.0	70		2		4630	34567	80	25	45	16
5	155	2.0%		8	93	21						8	1.6			1		5331	34496	80	25	45	16
6	174	1.5%		4	77	24	0.39					10	1.6	38		1		5994	34463	80	25	45	16
7	192	1.5%		3	92	26	0.41		0.14				1.7	37		1		6617	34442				16
8	246	4.2%	1.1	3	110	33			0.07	13.9	7.1	13	1.6	43		1		8472	34419				16
9	284	1.4%		1	123	38						11	1.6			1		9787	34407				16
10	313	1.4%		0	135	42		7				8	1.7			1		10759	34403				16
11	343	1.1%		1	114	46	0.69		0.05	91.9		11	1.7			1		11811	34398	80	29	45	16
12	368	1.1%		0	129	50	0.54					13	1.8			0		12664	34393	80	29	45	15
13	417	2.2%	1.2	1	178	56	0.86					14	1.9			0		14344	34391	80	29	45	15
14	465	1.1%		1	144	63	0.72		0.05	81.6		16	2.1	85		0		15975	34385	80	29	45	14
15	497	0.9%		3	144	67	0.79					15	2.3			0		17085	34376	80	29	45	14
16	528	0.8%		8	154	71	0.80					19	2.6			0		18125	34342	80	29	45	14
17	552	0.47%	1.3	16	130	74	0.62		0	28	7.1	13	2.8	60		0		18894	34248	80	29	45	14
18	578	0.76%		11	151	77	2.45		0.14	63.4	7.1	22	3.4	80		1		19725	34151	80	29	45	13
19	609	0.76%		11	155	81	1.11	5				22	3.9			1		20738	34065	80	29	45	13
20	641	0.74%		8	161	85	0.95		0.07	48.7			4.5	95		1		21786	34001	80	29	45	13
21	662	0.32%		58	46	75	0.70						4.2			0		22380	33802	80	25	50	13
22	686	0.60%		3	138	46	0.79		0.03	50.2			4.6	95		0		23033	33569	80	25	50	13
23	705	0.37%	1.3	3	149	47	1.04					22	4.9			0		23643	33548	80	25	50	13
24	740	0.81%		1	204	50	0.94		0.04	85.2			6.0	115		0		24825	33540	80	25	50	12
25	775	0.58%		1	150	52	0.73		0	161		21	6.4	145		1		25974	33531	80	25	50	11
26	816	0.83%		1	235	55	0.97		0.10	131.2		20	6.6	120		0		27357	33523	80	25	50	11
27	866	0.82%		3	235	58	1.30			223			6.2			1		29028	33515	80	25	50	11
28	916	0.81%		2	252	61	1.51		0.54	153.4		21	5.9	100		0		30683	33499				11
29	1063	2.53%	1.3	2	246	71	1.09		0	182		19	5.4	115		0		35593	33485	80	31	41	11
30	1146	0.53%		3	219	77	1.23		0.45	140.3		20	5.3			0		38339	33465	80	31	41	11
31	1078	-1.00%		56	130	41	0.73			147		15	4.9			0		35811	33293	80	31	41	11
32	1115	0.69%		2	280	37	0.79			102.0	7.2	17	5.0			0		36847	33060	80	31	41	13
33	1169	0.62%		1	248	39	0.63			222		15	4.9			0		38638	33053	80	31	41	24
34	1249	1.39%	1.3	2	281	41	0.73			194.5		18	4.9			0		41277	33042	80	31	41	24
35	1342	0.57%		1	282	44	0.22	5		59			4.9			0		44316	33032	80	31	41	24
36	1388	0.39%		0	171	46	0.54		0.04	119.2	7.1		4.5			0		45840	33029	80	31	41	24
37	1411	0.24%		1	155	47	0.81	6	0	77	7.1	19	3.7	70		0		46607	33022	80	31	41	24
38	1384	-1.11%		1	263	46	0.22		0.02	76.0	7.0	23	3.3	70		1		45703	33017	80	31	41	24
39	1356	0.68%	1.1	2	310	45							3.0			1		44748	33006	80	31	41	24
40	1418	0.63%		1	332	47	0.78						2.6			1		46787	32999	80	31	41	24
41	1478	0.57%		5	325	49	0.80				7.0		2.4			1		48729	32974	80	31	41	24
42	1540	0.59%		2	342	51	0.96		0.06	97.1	7.0					1		50731	32951	80	31	41	24
43	1604	0.60%		2	361	53	0.83		0	139	7.0		1.7	90		1		52834	32939	80	31	41	24
44	1713	0.92%	1.3	3	368	56	1.07			159.8		21	2.5			0		56381	32916	80	31	41	24
45	1785	0.61%		5	423	59	1.09		0	131		20	5.2			0		58706	32884	80	31	41	24
46	1863	0.61%		5	442	61	0.73			145.0		15	4.9			0		61211	32853	80	31	41	24
47	1936	0.41%	1.2	3	450	64	0.77			133	7.2	16	5.0			0		63536	32822	80	31	41	24
48	2008	0.73%		3	458	66	0.66			206.1			4.9			1		65861	32807	80	31	41	24
49	2102	0.57%		3	444	69	0.60	5		127		18	4.8			0		68911	32776	80	31	41	24
50	2188	0.58%		3	521	72	0.45			125.8			4.7			0		71683	32765	80	31	41	24
51	2277	0.55%		3	500	75	0.63		0	116	7.1		4.5			0		74535	32741	80	31	41	24
52	2346	0.41%	1.3	6	439	77	0.59		0.02	71.4	7.1	22	3.6	70		1		76762	32715	80	31	41	24
53	2439	0.55%		1	534	80	0.28		0	86	7.0	18	3.1	70		1		79733	32694	80	31	41	24
54	2523	0.47%		5	469	83							3.0			1		82459	32678	80	31	41	24
55	2592	0.17%		7	334	83	0.80						2.6			1		83281	32135	80	31	41	24
56	2629	0.51%		5	317	77	0.71				7.0		2.4			1		76853	29238	80	31	41	24
57	2719	0.33%		4	326	79	0.90		0	118	7.0		1.8	90		1		79441	29213	80	31	41	24
58	2811	0.46%		19	260	72							1.7			1		72048	25627	80	31	41	24
59	2877	0.35%		8	301	74							1.5			0		73535	25562	80	31	41	24
60	2869	0.00%		1	343	64	0.92		0.07	37.6	7.1		2.3			0		63200	22027	80	31	41	14
61	2960	0.40%	1.3	2	319	66	0.95		1		6.9		4.4			0		65157	22015	80	31	41	0
62	2971	-0.04%		1	129	60	0.58		0.10	112.8	7.0	21	5.4			0		54154	18230	80	31	41	0
63	2982	0.00%		0	0	60						18	5.2			1		54366	18230				0
64	2982	0.00%		0	0	34	1.10				7.1	20	4.5			0		54366	18230				0
65	2982	0.00%		0	0	0												54366	18230				0

Cohort #5 (1014)

Week	Size	TGC	Condition	Morts	Feed	Density	TAN	TSS	Nitrite	Nitrate	Ph	CO2	Salinity	Alkalinity	Hardness	Turbidity	Harvest	Biomass	Inventory	Pigment	Fat	Protein
1	99	103		5	14	17	0.38				7		6.2	60		0.4		4450	45139	80	25	45
2	103	117		1	37	18	0.48		0.01	63		4	6.5	70		0.4		4655	45121	80	25	45
3	111	132		2	58	20	0.62		0.01	11			6.1	60		0.4		4992	45114	80	25	45
4	123	147		0	83	22	0.95		0.10	26			5.7	60		0.3		5530	45107	80	25	45
5	152	164	1.2	1	105	27	0.94		0.02	102		9	5.5	125		0.4		6863	45101	80	25	45
6	182	182		1	99	32	0.93		0.07	113		8	5.2	115		0.3		8186	45095			
7	198	202		2	109	35	0.88						4.9			0.5		8937	45084			
8	219	222		3	124	39	0.93			35		15	4.9			0.3		9846	45062			
9	241	244		3	141	43	0.92			61	7	11	4.9			0.2		10860	45048			
10	278	268	1.5	6	142	49	0.83			227			4.9			0.3		12513	45009			
11	374	293		5	127	66	0.34			67		15	4.9			0.3		16833	44969			
12	338	319		3	41	48	0.24		0.03	84	8		4.6			0.3		15183	44933	80	25	50
13	306	346		4	42	28	0.81	5.5	0.02	77	7	19	3.7	70		0.4		13761	44913	80	25	50
14	303	375		4	65	27	0.22		0.02	76	7	23	3.3	70		0.8		13604	44886	80	25	50
15	285	406	1.1	4	108	26							3.0			0.6		12767	44854	80	25	50
16	305	439		5	149	27	0.78	5.3					2.6			0.8		13654	44814	80	25	50
17	332	473		4	164	30	0.88						2.5			1.0		14867	44794	80	25	50
18	361	508		9	175	32	0.84		0.06	97			2.4			0.7		16169	44753	80	25	50
19	392	549		18	183	35	0.83		0.08	139			1.7	90		0.6		17524	44678	80	25	50
20	474	592		36	182	42							1.5			0.5		21066	44459	80	25	50
21	506	637		82	194	45			0.07	44			1.7			0.3		22297	44050	80	25	50
22	538	684		68	210	47	0.92			31			3.6			0.3		23411	43485			
23	574	734		30	231	50	0.95						5.1			0.3		24763	43169			
24	627	776		7	232	54	0.58			113		23	5.3			0.2		26988	43053			
25	685	813		4	253	59	1.10				7	19	4.8			0.4		29485	43015			
26	726	852		2	259	62	1.93			128			5.1			0.4		31228	42998			
27	753	892		3	239	65	1.19			164			5.0			0.4		32383	42981			
28	772	933		3	299	66	1.47			79			5.4			0.3		33177	42962			
29	824	979		1	346	71	1.32		1.47	39	7	10	4.5	83		0.3		35391	42950			
30	883	1025		4	342	76	1.15		0.05		7	11	3.8			0.6		37919	42934			
31	808	1075	1.2	25	139	37							3.7			0.6		34627	42852	80	31	41
32	853	1125		2	313	22	0.95		0.08				3.5			0.8		36437	42741	80	31	41
33	901	1182		2	353	24	1.14				7		3.6	30		0.7		38488	42725	80	31	41
34	957	1240		3	381	25	0.98					10	3.5			0.7		40868	42707	80	31	41
35	1019	1297		2	431	26	1.21		0.33	64			3.8	60		0.4		43506	42692	80	31	41
36	1088	1357		0	479	28	1.04		0.09	29			3.1			0.4		46440	42686	80	31	41
37	1168	1421	1.2	0	456	29												49850	42686	80	31	41
38	1237	1488		0	315	31												52799	42686			
39	1253	1556		0	0	31												53494	42686			

Cohort #6 (0115)

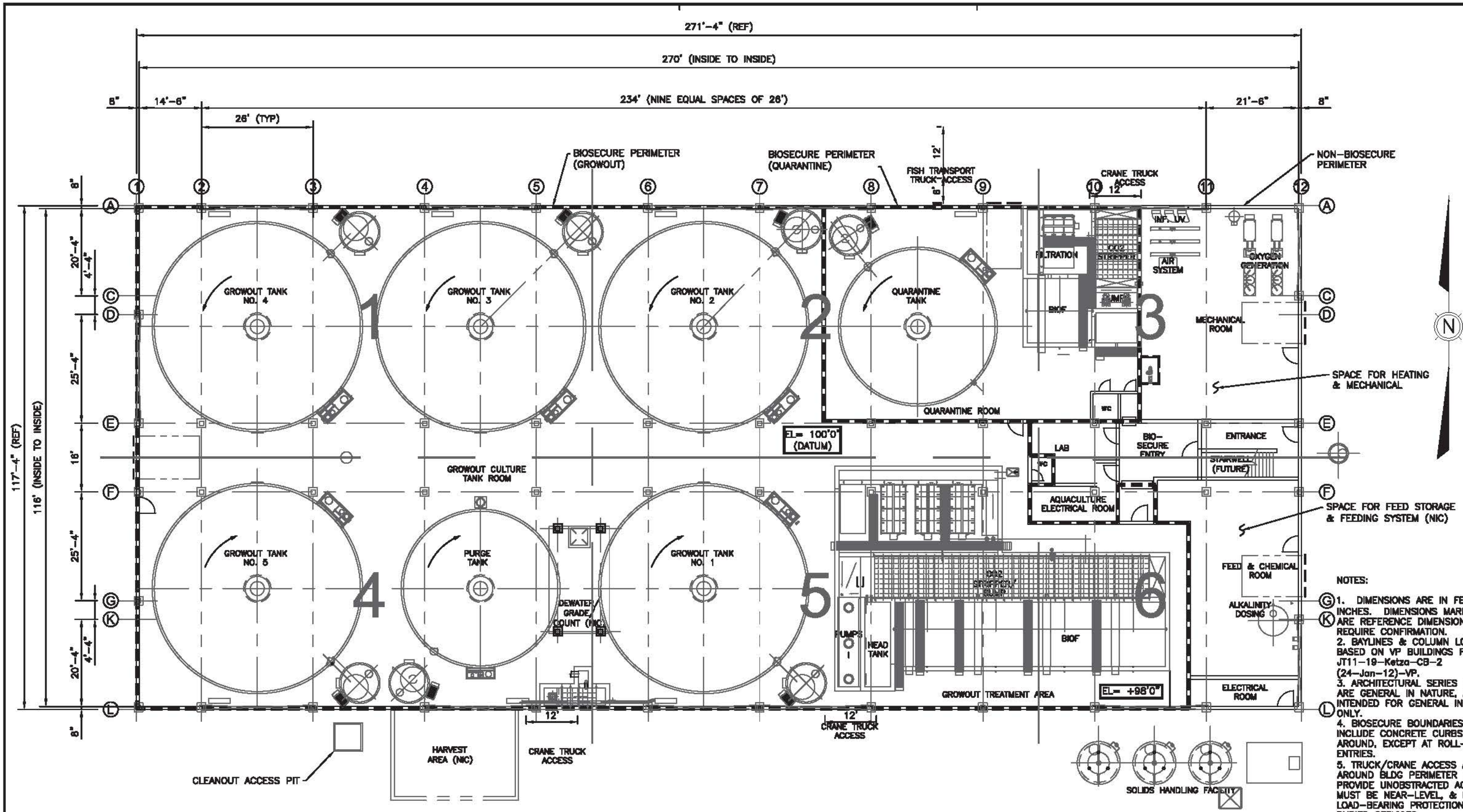
Week	Size	TGC	Morts	Feed	Density	TAN	TSS	Nitrite	Nitrate	Ph	CO2	Salinity	Alkalinity	Turbidity	Harvest	Biomass	Inventory	Pigment	Fat	Protein
1	107	111	13	12	19	0.22		0.03	50	8		8		0.5		4825	45290	80	25	45
2	109	125	9	18	19	0.23	5.0	0.11	30	7	14	9	75	0.9		4937	45204	80	25	45
3	113	141	1	25	20	0.29		0.04	81	7	7	9	95	0.5		5102	45178	80	25	45
4	118	158	3	30	21		7.5					8		0.6		5314	45164	80	25	45
5	122	177	0	37	22	0.49			74			6		0.5		5494	45156	80	25	45
6	130	196	1	74	23					7		4		0.2		5888	45149	80	25	45
7	146	216	2	110	26	0.68		0.09	83	7		3	120	0.3		6600	45141	80	25	45
8	174	238	1	127	31							2		0.2		7866	45130	80	25	45
9	216	262	3	144	38							2		0.2		9750	45117			
10	243	287	3	164	43	0.53	5.3	0.10	46	7	16	2		0.3		10961	45098			
11	271	314	2	161	48	0.93		1.08		7		5		0.4		12218	45082			
12	300	342	1	173	53							8		0.8		13501	45069			
13	295	370	13	107	30	0.81		0.02	77	7		4		0.4		13276	44994	80	25	50
14	315	401	2	160	28	0.22		0.02	76	7	23	3	70	0.8		14155	44967	80	25	50
15	345	433	1	199	31							3		0.6		15505	44961	80	25	50
16	382	467	1	237	34		5.3					3		0.8		17189	44956	80	25	50
17	442	502	0	258	40	0.88						2		1.0		19853	44950	80	25	50
18	489	542	1	294	44	0.84	5.3	0.06	97	7		2		0.7		21994	44945	80	25	50
19	537	585	1	291	48	0.83		0.08	139	7		2	90	0.6		24133	44939	80	25	50
20	579	629	2	269	52							2		0.5		26017	44929	80	25	50
21	637	671	2	293	57			0.07	44	7		2		0.3		28615	44914	80	25	50
22	705	712	3	365	63	0.92			31	7		4		0.3		31634	44897			
23	761	754	4	361	68	0.95		0.98		7	19	5		0.3		34168	44874			
24	818	797	4	380	73							5		0.2		36703	44845			
25	874	841	0	357	78	1.10				7		5		0.4		39205	44834			
26	933	890	0	369	84	1.93		0.20	128			5		0.4		41843	44834			
27	974	940	0	59	87	1.19		0.07	164	7		5		0.4		43668	44834			
28	975	992	0	0	87							5		0.3		43727	44834			

Cohort #7 (0415)

Week	Size	TGC	Morts	Feed	Density	TAN	Nitrite	Nitrate	Ph	CO2	Salinity	Alkalinity	Hardness	Turbidity	TDS	Water	Harvest	Biomass	Inventory	Pigment	Fat	Protein	Photo-
1	126	131	36	11	20	0.3	0.06	42	7.0		5.9			3.9				5012	39718	80	25	45	24
2	128	147	77	14	20		0.04	6	7.0		6.5			2.2				5029	39275	80	25	45	24
3	134	163	19	45	20		0.06	26	7.1	9	6.5			0.6				5216	39016	80	25	45	24
4	145	183	6	74	22		1.22	126	7.0		6.3	140		0.8				5646	38939	80	25	45	24
5	162	204	3	100	25		0.20	1	7.1	9	6.1	130		1.4				6318	38906	80	25	45	24
6	184	226	3	113	28		0.20		7.0		5.7			2.9				7136	38883				24
7	226	250	3	122	34	0.8	0.32			8	5.2			3.6				8764	38863				24
8	275	275	3	133	42	0.9	0.37	23			4.7			2.6				10670	38840				24
9	304	302	6	162	46	1.3	0.45	14	7.2	10	4.0	145		2.4				11801	38818				24
10	337	330	2	163	51	1.1	0.57	32			3.0	120		1.5				13073	38788				24
11	370	359	3	176	56	1.2	0.82	40			3.1			1.2				14357	38763				24
12	411	391	0	192	63													15947	38756				0
13	459	423	0	182	70													17771	38756				0
14	480	457	0	0	73													18613	38756				0

Smolt Stocking Information

Cohort		0313	1013	0114	0514	1014	0115	0415
Date		08/03/2014	24/10/2013	29/01/2014	12/05/2014	27/10/2014	16/01/2015	17/04/2015
Stock		"Mowi"	"Mowi"	"Mowi"	"Mowi"	"Mowi"	"Mowi"	"Mowi"
Photoperiod	hrs light/day	24	24	24	24	24	24	24
Average Wt	gm	85	104	100	101	98.19	105.98	125.18
Number		23,000	33,725	26,231	40,392	45,142	45,340	39,840
Vaccines	Type	Forte Micro	Forte Micro	Forte Micro	Forte Micro		Forte Micro	Forte Micro
		Apex IHN	Apex IHN	Apex IHN	Apex IHN		Apex IHN	Apex IHN
		Renogen	Ermogen	Ermogen			Renogen	Renogen
			Vibrogen 2	Vibrogen 2				
	Last vaccination	30/01/2013	11/09/2013	07/12/2013	21/03/2014		14/11/2014	13/02/2015
Transport Treatment		Vidalife		Vidalife	Vidalife		Vidalife	Vidalife
		Defoam		Defoam	Defoam		Defoam	Defoam



NOTES:

1. DIMENSIONS ARE IN FEET AND INCHES. DIMENSIONS MARKED "REF" ARE REFERENCE DIMENSIONS AND REQUIRE CONFIRMATION.
2. BAYLINES & COLUMN LOCATIONS BASED ON VP BUILDINGS FILENAME JT11-19-Ketza-CB-2 (24-Jan-12)-VP.
3. ARCHITECTURAL SERIES DRAWINGS ARE GENERAL IN NATURE, AND ARE INTENDED FOR GENERAL INFORMATION ONLY.
4. BIOSECURE BOUNDARIES TO INCLUDE CONCRETE CURBS ALL AROUND, EXCEPT AT ROLL-UP DOOR ENTRIES.
5. TRUCK/CRANE ACCESS AREAS AROUND BLDG PERIMETER MUST PROVIDE UNOBSTRACTED ACCESS, MUST BE NEAR-LEVEL, & MUST HAVE LOAD-BEARING PROTECTION FOR BURIED SERVICES.

BUILDING LAYOUT

SCALE: 3/64" = 1'-0"

PR Aqua — An In-Situ Inc. Company

FOR CONSTRUCTION

NO.	DATE:	REVISION
0	25MAY12	ISSUED FOR CONSTRUCTION
D	07MAR12	ISSUED FOR 95% SUBMITTAL
C	17JAN12	ISSUED FOR INFORMATION
B	18OCT11	ISSUED FOR INFORMATION
A	14OCT11	ISSUED FOR 60% SUBMITTAL

DRAWING IS ISSUED AS 11" x 17". IF LINE SHOWN ABOVE IS NOT 1" LONG, ACTUAL SCALE DIFFERS FROM STATED SCALE.

SEAL

PR Aqua Ltd.
1635 Harold Road
Nanaimo, BC, Canada
V9X 1T4
PH: (250)714-0141, FAX: (250)714-0171

'NAMGIS FIRST NATION

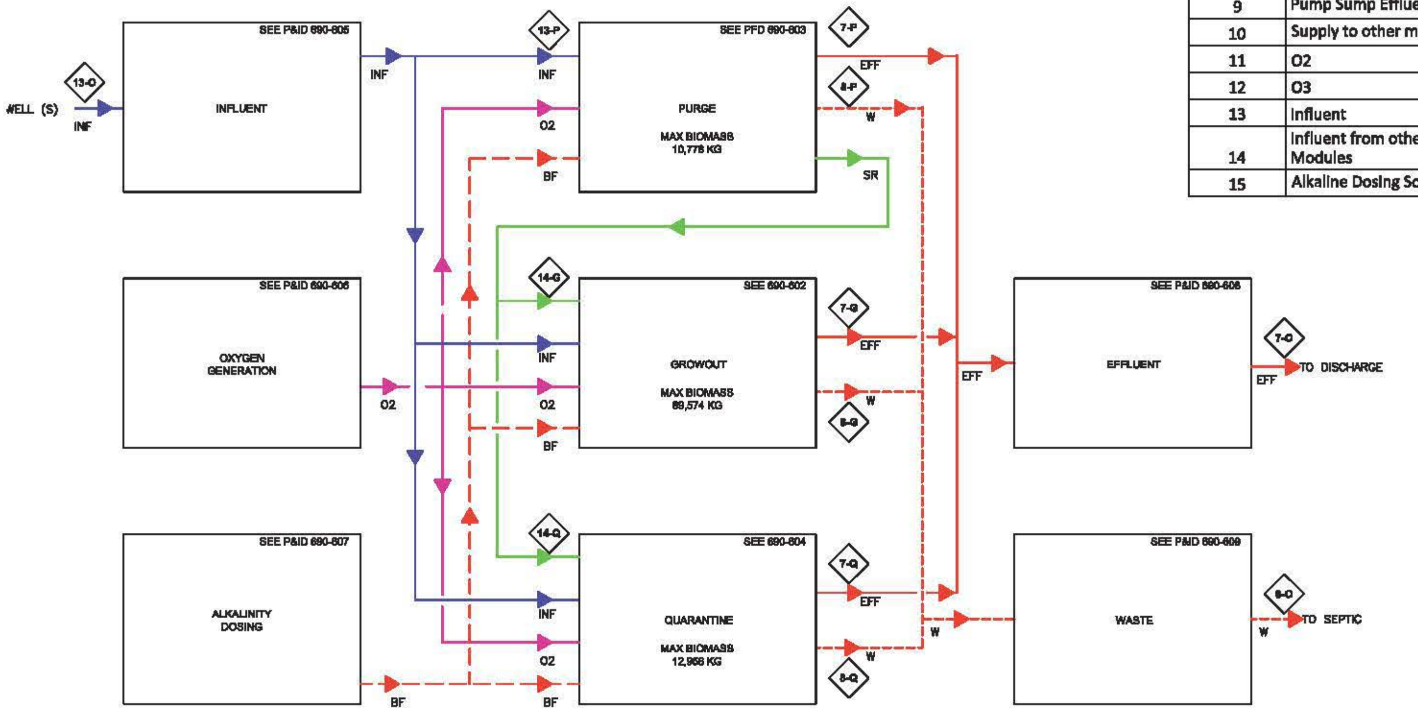
K'UDAS CLOSED CONTAINMENT PROJECT
LAND-BASED SALMON PILOT PROJECT
BUILDING LAYOUT

DESIGNED: SKP	DRAWN: KCG	CHECKED:
DATE: 10OCT11	SCALE: AS NOTED	APP'D:
DWG. NO. A690-101		REV: 0

Note: Ozone was not included at time of reporting

FLOW SCHEDULE

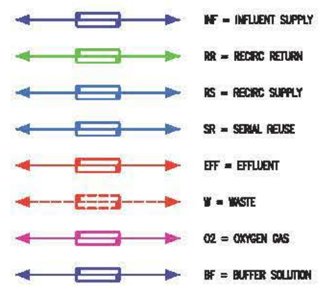
Pipe Section	Description	Units	Purge	Grow Out	Quarantine	Overall
1	Recirc Return	gpm	1,520	14,676	2,281	18,477
2	Filtered RR	gpm	1,395	14,584	2,271	18,250
3	Stripper	gpm	1,520	23,573	4,229	29,323
4	Recirc Supply	gpm	1,520	14,676	2,281	18,477
5	BioFilter Supply	gpm	NA	8,897	1,949	10,845
6	Biofilter Return	gpm	1,520	23,573	4,229	29,323
7	Tank Effluent	gpm	150	0	0	150
8	Drum Filter Waste	gpm	NA	92	10	102
9	Pump Sump Effluent	gpm	NA	0	0	0
10	Supply to other modules	gpm	125	0	0	125
11	O2	Lpm				0
12	O3	Lpm	NA			0
13	Influent	gpm	275	0	0	275
14	Influent from other Modules	gpm	0	100	25	125
15	Alkaline Dosing Solution	gpm	NA			0



PROCESS FLOW DIAGRAM

SCALE: NOT TO SCALE

FLOW STREAM LEGEND



FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

NO.	DATE:	REVISION
C	07MAR12	ISSUED FOR 95% SUBMITTAL
B	14OCT11	ISSUED FOR INFORMATION
A	21SEP11	ISSUED FOR INFORMATION

DRAWING IS ISSUED AS 11" x 17". IF LINE SHOWN ABOVE IS NOT 1" LONG, ACTUAL SCALE DIFFERS FROM STATED SCALE.

SEAL

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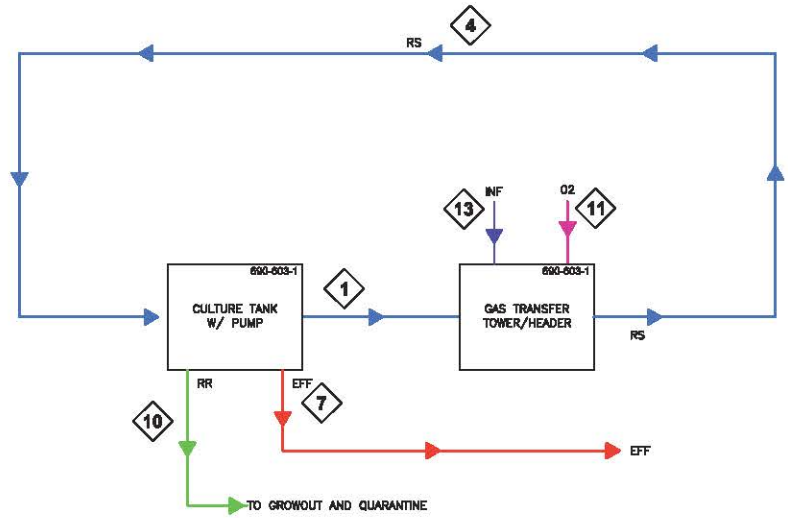
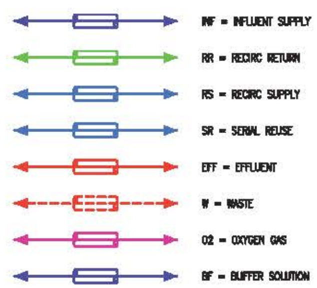
'NAMGIS FIRST NATION

K'UDAS CLOSED CONTAINMENT PROJECT
LAND-BASED SALMON PILOT PROJECT
PROCESS FLOW DIAGRAM: OVERALL

DESIGNED: SKP	DRAWN: KCG	CHECKED:
DATE: 09MAR11	SCALE: AS NOTED	APP'D:
DWG. NO. Q690-601-1		REV: C



FLOW STREAM LEGEND



PROCESS FLOW DIAGRAM

SCALE: NOT TO SCALE

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

NO.	DATE:	REVISION
C	07MAR12	ISSUED FOR 95% SUBMITTAL
B	14OCT11	ISSUED FOR INFORMATION
A	21SEP11	ISSUED FOR INFORMATION

DRAWING IS ISSUED AS 11" x 17". IF LINE SHOWN ABOVE IS NOT 1" LONG, ACTUAL SCALE DIFFERS FROM STATED SCALE.

SEAL

PR Aqua Ltd.
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V9X 1T4
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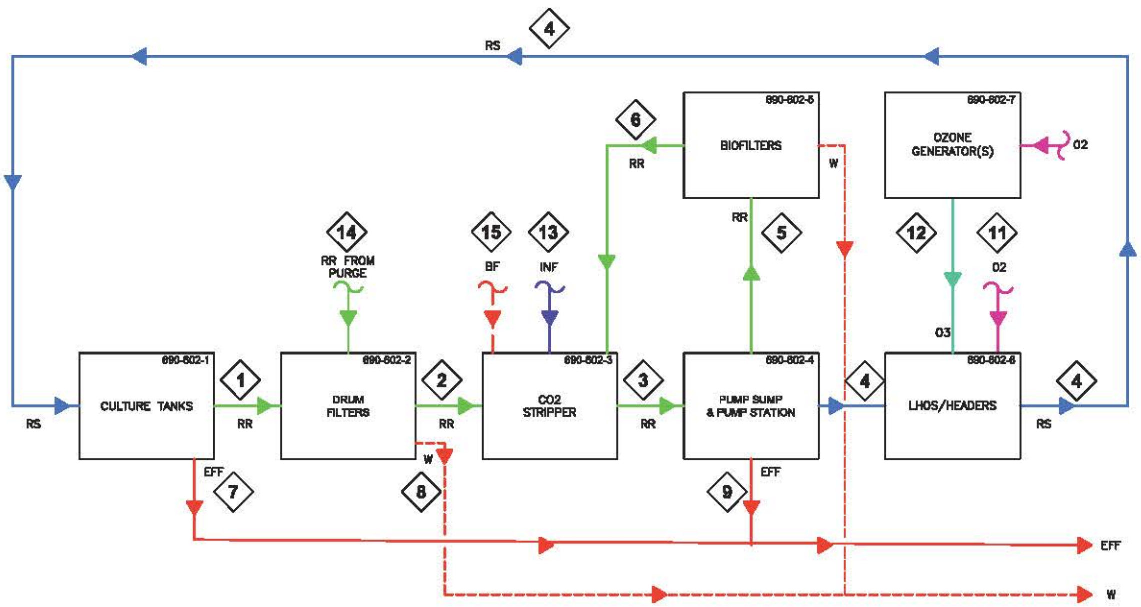
'NAMGIS FIRST NATION

K'UDAS CLOSED CONTAINMENT PROJECT
LAND-BASED SALMON PILOT PROJECT
PROCESS FLOW DIAGRAM: PURGE

DESIGNED:	DRAWN:	CHECKED:
SKP	KCG	
DATE: 09MAR11	SCALE: AS NOTED	APP'D:
DWG. NO. Q690-601-2		REV: C



FLOW STREAM LEGEND

- INF = INFLUENT SUPPLY
- RR = RECIRC RETURN
- RS = RECIRC SUPPLY
- SR = SERIAL REUSE
- EFF = EFFLUENT
- W = WASTE
- O2 = OXYGEN GAS
- BF = BUFFER SOLUTION

PROCESS FLOW DIAGRAM

SCALE: NOT TO SCALE

FOR INFORMATION ONLY
NOT FOR CONSTRUCTION

NO.	DATE:	REVISION
C	07MAR12	ISSUED FOR 95% SUBMITTAL
B	14OCT11	ISSUED FOR INFORMATION
A	21SEP11	ISSUED FOR INFORMATION

DRAWING IS ISSUED AS 11" x 17". IF LINE SHOWN ABOVE IS NOT 1" LONG, ACTUAL SCALE DIFFERS FROM STATED SCALE.

SEAL

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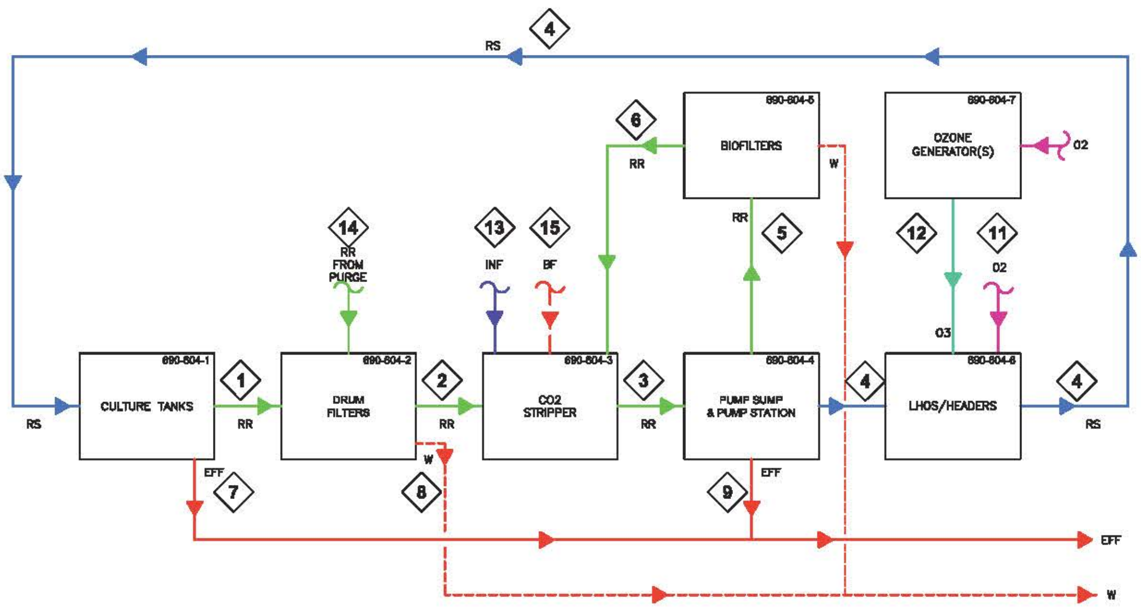
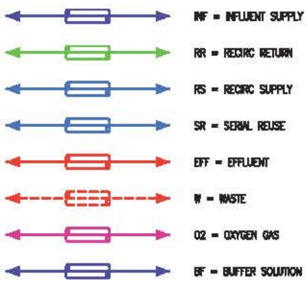
'NAMGIS FIRST NATION

K'UDAS CLOSED CONTAINMENT PROJECT
LAND-BASED SALMON PILOT PROJECT
PROCESS FLOW DIAGRAM: GROWOUT

DESIGNED: SKP	DRAWN: KCG	CHECKED:
DATE: 09MAR11	SCALE: AS NOTED	APP'D:
DWG. NO. Q690-601-3		REV: C



FLOW STREAM LEGEND



PROCESS FLOW DIAGRAM

SCALE: NOT TO SCALE

FOR INFORMATION ONLY
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NO.	DATE:	REVISION
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B	14OCT11	ISSUED FOR INFORMATION
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'NAMGIS FIRST NATION

K'UDAS CLOSED CONTAINMENT PROJECT
LAND-BASED SALMON PILOT PROJECT
PROCESS FLOW DIAGRAM: QUARANTINE

DESIGNED:	DRAWN:	CHECKED:
SKP	KCG	
DATE: 09MAR11	SCALE: AS NOTED	APP'D:
DWG. NO. Q690-601-4		REV: C

KUTERRA LIMITED PARTNERSHIP
FINANCIAL STATEMENTS
March 31, 2015

Cory McIntosh, CPA, CGA, CAFM, CFP *
Jason S. Moore, BA, CPA, CGA *
Michael K. Williams, CPA, CGA *

Jay R. Norton, CPA, FCGA, CAFM (retired)

*practising as a professional corporation

McINTOSH | NORTON | WILLIAMS
certified general accountants

"It's not what you earn, it's what you keep!"

INDEPENDENT AUDITORS' REPORT

To: The Partners of Kuterra Limited Partnership

We have audited the accompanying financial statements of Kuterra Limited Partnership which comprise the balance sheet as at March 31, 2015 and the statements of loss, comprehensive loss and partners' deficiency and cash flows for the year then ended, and a summary of significant accounting policies and other explanatory information.

Management's responsibility for the financial statements
Management is responsible for the preparation and fair presentation of these financial statements in accordance with International Financial Reporting Standards, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's responsibility
Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with Canadian Auditing Standards. Those standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion
In our opinion, the financial statements present fairly, in all material respects, the financial position of Kuterra Limited Partnership as at March 31, 2015, and its financial performance and its cash flows for the year then ended in accordance with International Financial Reporting Standards.

McIntosh Norton Williams

McINTOSH | NORTON | WILLIAMS
chartered professional accountants

Port Alberni, B.C.
August 31, 2015

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Kuterra Limited Partnership
Financial Statements
March 31, 2015

TABLE OF CONTENTS

Kuterra Limited Partnership
Statement of Loss, Comprehensive Loss and Partners' Deficiency
Year Ended March 31, 2015

	2015 Budget *(Unaudited)*	2015 Actual	2014 Actual
Income			
Fish sales	$ 1,493,149	$ 1,156,721	$ 10,775
Fair value adjustment on biological assets *(Note 5)*	-	537,272	181,234
	1,493,149	1,693,993	192,009
Cost of goods sold			
Feed	583,872	537,927	160,017
Smolt purchases	437,400	463,504	3,430
Wages and benefits	402,612	426,100	308,363
Repairs and maintenance	25,801	66,528	17,117
Energy for fish production	162,279	161,401	89,668
Other direct costs	97,174	128,894	61,999
Water Treatment & Fish Health	75,937	71,927	21,841
Insurance - fish	52,976	39,472	36,270
	1,838,051	1,895,753	698,705
Gross profit (loss)	(344,902)	(201,760)	(506,696)
Operating Expenses - *page 18*			
Fixed Costs	258,400	290,107	206,068
Corporate Overhead	127,369	166,822	166,822
Loss from operations before other items	(730,671)	(658,689)	(807,611)
Other income (expense)			
Other revenue	112,615	112,615	810
Interest income	-	15	656
Depreciation	-	(264,438)	(267,963)
Interest on long term debt	(137,865)	(133,626)	(129,570)
	(25,250)	(285,434)	(396,067)
Net loss and comprehensive loss	(755,921)	(944,123)	(1,203,678)
Partners' equity (deficiency), beginning of year		(284,305)	919,373
Partners' deficiency, end of year *(Note 13) - page 3*		$ (1,228,428)	$ (284,305)

The attached notes are an integral part of these financial statements.

Kuterra Limited Partnership
Statement of Cash Flows
Year Ended March 31, 2015

	2015	2014
Operating activities		
Loss	$ (944,123)	$ (1,203,678)
Items not involving cash		
Depreciation	1,753,052	1,519,411
Amortization of government funding	(1,488,614)	(1,251,448)
	(679,685)	(935,715)
Changes in non-cash working capital		
Accounts receivable	(405,404)	239,225
HST refundable	3,418	16,156
Due from Namgis First Nation	-	33,111
Inventory	(33,699)	(58,100)
Biological Assets	(508,900)	(424,624)
Prepaid expenses	401	11,490
Other Current Assets	-	130,217
Accounts payable and accrued liabilities	32,545	(453,146)
Accrued wages payable	(220)	8,277
Due to government agencies	(2,266)	(3,993)
Cash used	(1,593,810)	(1,437,102)
Investing activities		
Acquisition of capital assets	(470,998)	(1,848,185)
Government grants received	928,072	2,823,368
Cash (used) provided	457,074	975,183
Financing activities		
Increase in smolt deposits	(38,400)	-
Advances from (advances to) related parties	102,427	9,573
Proceeds from debt	-	923,563
Repayment of long-term debt	(39,191)	(2,628)
Cash provided	24,836	930,508
(Decrease) increase in cash	(1,111,900)	468,589
Cash (deficiency) - beginning of year	290,555	(178,034)
Cash (deficiency) - end of year	$ (821,345)	$ 290,555
Cash (deficiency) consists of:		
Cash	$ -	$ 290,555
Bank indebtedness	(821,345)	-
	$ (821,345)	$ 290,555

The attached notes are an integral part of these financial statements.

Kuterra Limited Partnership
Balance Sheet
As at March 31, 2015

	2015	2014
ASSETS		
Current		
Cash	$ -	$ 290,555
Accounts receivable	416,180	10,775
Goods and services tax refundable	11,053	14,471
Inventory *(Note 3.a)*	112,639	78,941
Biological assets *(Note 3.f, 4.a, 5)*	1,008,075	499,175
Prepaid expenses	8,358	8,759
	1,556,305	902,676
Property, plant and equipment *(Note 6)*	5,762,540	7,045,740
Smolt deposits *(Note 7)*	38,400	-
	$ 7,357,245	$ 7,948,416
LIABILITIES		
Current		
Bank indebtedness *(Note 8)*	$ 821,345	$ -
Accounts payable and accrued liabilities *(Note 9)*	192,356	162,297
Current portion of debt *(Note 10)*	1,380,106	582,544
	2,393,807	744,841
Debt *(Note 10)*	835,795	1,672,548
Deferred government funding *(Note 11)*	5,244,070	5,805,758
Due to related parties *(Note 12)*	112,000	9,573
	8,585,672	8,232,720
PARTNERS' DEFICIENCY		
Partners' deficit *(Note 13) - page 1*	(1,228,427)	(284,304)
	$ 7,357,245	$ 7,948,416

Economic Dependence *(Note 14)*

Commitments *(Note 15)*

Contingent liabilities *(Note 19)*

Approved by Kuterra General Partner Inc.
acting as the general partner of Kuterra Limited Partnership

______________________ Director

______________________ Director

The attached notes are an integral part of these financial statements.

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

1. Nature of Operations and Going Concern

These financial statements include only those assets, liabilities, revenues and expenses of the Limited Partnership and do not include any assets, liabilities, revenues or expenses of the partners or the liability of the partners for taxes on earnings of the Limited Partnership. No provision is included in the accounts for any remuneration, interest and other charges accruing to the partners.

The Partnership was formed by 'Namgis First Nation ("the Nation") and Kuterra General Partner Inc. on October 25, 2011 in accordance with the partnership laws of the Province of British Columbia. The principal business activity of the Partnership is to produce Atlantic salmon that are grown to an average harvest size of between two and four kilograms, in a land-based, biosecure, closed containment recirculating aquaculture system (RAS).

These financial statements have been prepared on a going concern basis, which presumes the Partnership will continue its business for the foreseeable future and will be able to realize its assets and discharge its liabilities and commitments in the ordinary course of business. Growing Atlantic salmon in an RAS facility on land is a new industry. There are many factors which will determine the ability of the Partnership to operate as a profitable entity including fish mortality, the rate of growth of the fish, the amount of early maturation, and the quantity of premium salmon that is produced. These financial statements do not give effect to any adjustment to the amounts or classification of assets and liabilities that might be necessary should the Partnership be unable to continue as a going concern. Such adjustments could be material.

2. Basis of Presentation

a) Statement of Compliance

The financial statements of the Partnership have been prepared in accordance with International Financial Reporting Standards (IFRS) as issued by the International Accounting Standards Board (IASB).

b) Basis of Measurement

The financial statements have been prepared on a historical cost basis.

The Partnership makes estimates and assumptions about the future that affect the reported amounts of assets and liabilities. Estimates and judgments are continually evaluated based on historical experience and other factors, including expectations of future events that are believed to be reasonable under the circumstances. In the future, actual experience may differ from these estimates and assumptions.

The effect of a change in accounting estimate is recognized prospectively by including it in comprehensive income in the period of change, if the change affects that period only, or in the period of the change and future periods, if the change affects both.

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

3. Significant Accounting Policies

a) Inventory

Inventory is comprised of fish feed and is measured at the lower of cost and net realizable value.

b) Comparative Figures

Comparative figures have been reclassified, where applicable, to conform to current presentation.

c) Impairment of Long-Lived Assets

The Partnership reviews its recirculating aquaculture system facility costs for impairment whenever events or changes in circumstances indicate that the carrying amount may not be fully recoverable. Recoverability is assessed by comparing the carrying amount to the estimated future net cash flows the assets are expected to generate. If the carrying amount exceeds the estimated future cash flows, the asset is written-down to its fair value.

d) Income Taxes

As a limited partnership, Kuterra Limited Partnership does not pay income taxes directly. Instead, the income taxes are paid by the entities that ultimately hold limited partnership interests in the Partnership. Accordingly, no tax liability is recognized in these financial statements.

e) Government Grants

Government grants related to property, plant and equipment are recognized as deferred income and are subsequently recognized in income on a systematic basis over the useful life of the corresponding asset.

Government grants that become receivable as compensation for expenses or losses already incurred or for the purpose of giving immediate financial support are recognized in income in the period in which they become receivable.

f) Biological Assets

The Partnership's biological assets consist of Atlantic salmon that are grown in large tanks on land in a recirculating aquaculture system. Live fish are measured at fair value less costs to sell. The fair value of salmon greater than 1kg in size is based on market prices less the estimated costs to sell the fish. For fish less than 1kg in size, the initial purchase cost, less impairment losses, if any, is used as an approximation of fair value. Costs of production are not capitalized.

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

3. Significant Accounting Policies (continued)

g) Property, Plant and Equipment

Property, plant and equipment are recorded at cost. The Partnership capitalizes costs which result in improvements to output or reductions in operating costs. Expenditures for maintenance and repairs are charged to income.

The costs capitalized for assets include borrowing costs incurred that are attributable to the qualifying asset. Straight-line depreciation is applied over the useful life of an asset, based on the asset's historical cost and estimated residual value at disposal. If a substantial part of an asset has an individual and different useful life this part is depreciated separately. The asset's residual value, useful life and depreciation method are evaluated annually and changes to estimated useful lives, residual values or depreciation methods resulting from such review are accounted for prospectively. Currently the Partnership is in the evaluation stage of this technology and has chosen to be conservative in its estimation of useful life. The significant classes of depreciable property and equipment and their estimated useful lives are as follows:

Aquaculture Equipment	5 years	straight-line
Buildings	5 years	straight-line
Site Development	5 years	straight-line
Equipment	5 years	straight-line
Recirculating aquaculture growout system	5 years	straight-line
Vehicles	30 %	diminishing balance

h) Financial Instruments - recognition and measurement

Financial instruments are initially recorded at historical cost. If subsequent circumstances indicate that a decline in fair value of a financial asset is other than temporary, the financial asset is written down to its fair value.

The Partnership has classified its financial assets and liabilities as follows:

Cash is classified as held for trading and is measured at fair value. Accounts receivable, harmonized sales tax receivable, and amounts due from 'Namgis First Nation are classified as loans receivable and are measured at amortized cost.

Bank indebtedness, accounts payable and accrued liabilities, and deferred government funding are classified as other financial liabilities and are measured at amortized cost.

i) Borrowing Costs

The Partnership capitalizes all borrowing costs directly attributable to the acquisition, construction or production of property, plant and equipment up until the asset is available for use. Other borrowing costs are recognized as an expense in the period in which they are incurred. Transaction costs for other liabilities are capitalized when they relate to capital assets.

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

3. Significant Accounting Policies (continued)

j) Future Accounting Pronouncements

The International Accounting Standards Board is currently updating a number of International Financial Reporting Standards which are expected to be published and enforced within the years ahead. At present, the Partnership believes these changes will not have a significant impact on its financial statements.

k) Revenue Recognition

Revenue is recognized to the extent that it is probable that the economic benefits will flow to the Partnership and the revenue can be reliably measured. Revenue is measured at the fair value of the consideration received or receivable for the sale of goods and services in the ordinary course of business. Revenue is net of returns, rebates, other price reductions, and taxes.

Revenue for the Partnership is related to sales of fish. The Partnership has an exclusive processing, distribution, and sales agreement with the distributor. Fish sales are recognized when the distributor's carrier picks up the fish at the farm site and ownership and risks have passed to the distributor. The Partnership invoices the distributor at a deemed cost per pound that will enable the Partnership to recoup it's operating costs. Once the distributor's and the Partnership's deemed costs have been covered by sales to third parties, any remaining profits are shared between the distributor and the Partnership on a quarterly basis. Revenue is only recognized to the extent that it is probable that amounts billed to the distributor will be received by the Partnership. Revenue from profit sharing is only recognized when the profits have been received by the Partnership. Amounts billed to the distributor for the year ended March 31, 2015 have been written down by $546,140 as sales to third parties were insufficient to cover the Partnership's deemed costs for these fish.

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

4. Significant Accounting Estimates and Judgments

The preparation of financial statements in accordance with IFRS requires management to make certain accounting judgments, estimates and assumptions that affect the reported amounts of assets, liabilities, income and expenses. The estimates and underlying assumptions are based on past experience and other factors perceived to be relevant and probable when the estimates were made. Estimates are reviewed on an ongoing basis and the changes to the accounting estimates are accounted for prospectively. Significant areas involving critical judgments in applying accounting policies, key assumptions and sources of estimation uncertainty that have the most significant effect on the amounts recognized in the financial statements are listed as follows:

(a) Biological Assets

The estimate of fair value of the biological assets relies on assumptions of the biomass volume and market prices.

The Partnership uses a fish growth model that is based on the actual growth rates to date of the fish in the facility. These inputs include feed conversion rates, growth rates, early maturation, etc. and are used to project the biomass volume for the whole life cycle of fish in each rearing tank. The Partnership measures the deviation in biomass volume by comparing the projections with periodic weight samples of the fish and with the actual results obtained when the tank is emptied or harvested out. The growth model is updated and revised every time the fish are sampled or harvested.

The market price less estimated selling costs is used to estimate the fair value of live fish over 1kg. For fish less than 1kg in size, no value adjustment is made. The initial purchase cost, less impairment losses, if any, is used as an approximation of fair value.

(b) Property, plant and equipment

A significant portion of the Partnership's property, plant and equipment is the tank rearing system. Using a closed-containment tank recirculating aquaculture system to farm Atlantic salmon is new in the fish farming industry. The Partnership, therefore, lacks industry benchmarks to reference in terms of estimating the useful lives and recoverable amounts of these assets. The Partnership uses the available information related to the tank's technical design and materials used to make its best estimates. Details of property, plant and equipment are disclosed in note 3(f) and 6.

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

5. Biological Assets

The Partnership's biological assets consist of Atlantic salmon that are grown in large tanks on land in a recirculating aquaculture system. Approximately every four months, smolts that are 100 grams in size are purchased and transferred into the facility. Over a four month period, generally starting after the twelfth month in the facility, the salmon are harvested. Their harvest weights average between two and four kilograms over the four month harvest period.

The unrealized fair value adjustment on biological assets only applies to those fish that are saleable, which are fish > 1kg in size. For fish less than 1kg in size, no value adjustment is made. The initial purchase cost, less impairment losses, if any, is used as an approximation of fair value. Costs of growing the fish are not capitalized.

(a) Biomass Status

At March 31, 2015 the Partnership valued its biological assets as follows:

Purchase Date	No. of Fish	Value	Size
January 30, 2014	8,126	$ 192,638	>1 kg
May 12, 2014	32,833	518,390	>1 kg
December 01, 2014	43,228	152,760	<1 kg
January 16, 2015	45,080	144,287	<1 kg
		$ 1,008,075	

(b) Reconciliation of Changes in Carrying Amount of Biological Assets at Fair Value

	2015	**2014**
Carrying amount at beginning of year	**$ 499,175**	$ 74,551
Increase due to smolt purchases	**435,132**	246,820
Unrealized fair value adjustment	**537,272**	181,234
Decrease due to harvest	**(463,504)**	(3,430)
	$ 1,008,075	$ 499,175

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

5. Biological Assets (continued)

(c) Mortalities

There is no strict standard for how to account for mortality in the books, and there is no unified industry standard. Three alternative approaches are as follows:

1. Charge all mortality to expense when it occurs.
2. Do nothing when it occurs, thereby effectively capitalizing all mortality. Because smolt purchases are capitalized, this approach has the effect of letting the surviving fish carry the cost of the dead fish, when the fish are harvested.
3. Only charge exceptional mortality to expense (as an impairment in value). Exceptional mortality is mortality that is higher than what is expected under normal circumstances.

As it is not considered possible to perform biological production without any mortality, the Partnership has adopted the second and third approaches. Under normal circumstances, by capitalizing the mortality cost, the cost of harvested fish will reflect the total cost for the biomass that can be harvested from each cohort.

The Partnership carries fish mortality insurance that provides coverage for a portion of the value of fish in the event significant mortality is experienced during the growout process. The coverage is based on a formula resulting in varying degrees of coverage as the biomass changes.

6. Property, Plant and Equipment

	Cost	Depreciation	2015 Net	2014 Net
Aquaculture equipment	$ 698,711	$ 200,357	$ **498,354**	$ 587,181
Buildings	1,331,051	517,849	**813,202**	1,073,105
Site development	1,075,620	385,034	**690,586**	773,308
Equipment	68,552	17,463	**51,089**	42,432
Recirculating aquaculture growout system	5,796,288	2,152,525	**3,643,763**	4,499,853
Vehicles	28,700	12,404	**16,296**	23,281
Hatchery - work in process	49,250	-	**49,250**	46,580
	$ 9,048,172	$ 3,285,632	$ **5,762,540**	$ 7,045,740

Land: Pursuant to conditions of funding agreements, 'Namgis First Nation is providing the land for use by the Partnership at no cost. The land is Cheslakee Indian Reserve Number Three and the area that the Partnership is utilizing was estimated in the year ended March 31, 2012, by an arms-length real estate appraiser, to have a market value of $430,000.

Depreciation is offset by the amount of deferred government funding pertaining to the purchase of property, plant and equipment and that has been amortized in the period. In 2015, $1,488,614 (2014 - $1,251,448) of deferred government funding has been amortized. See also Note 11.

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

7. Smolt Deposits

The Partnership entered into a smolt supply agreement with a fish farming company to supply seven groups of smolts beginning April 2015. The Partnership paid a deposit of $38,500 to the fish farming company. The deposit is only refundable if the company is unable to supply the smolts. The deposit will be applied against the final (seventh) smolt purchase, which is scheduled to occur in May 2017.

8. Bank Indebtedness

The bank indebtedness is an operating line of credit, $1,000,000 authorized limit, bearing interest at bank prime plus 1%, secured by an assignment of books debts, a personal property security agreement and guarantee of the partners.

9. Accounts Payable and Accrued Liabilities

	2015	2014
Accounts payable	$ **173,939**	$ 141,393
Accrued wages payable	**16,393**	16,614
Due to government agencies	**2,024**	4,290
	$ **192,356**	$ 162,297

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

10. Debt

	2015	2014
Greater Vancouver Community Assistance Foundation demand loan, repayable on demand at the end of the term, interest at prime plus 0%, secured by a promissory note, general security agreement, and Band Council Resolution from 'Namgis First Nation, due October, 2015.	$ 536,041	$ 521,000
Nuu-chah-nulth Economic Development Corporation (NEDC) loan, repayable at 7% interest per annum by way of 30 monthly "interest only" payments of total monthly interest accrued, with the first payment commencing 30 days after the first advance of funds hereunder, and thereafter monthly for 30 consecutive months, then the balance outstanding shall be paid in full with the interest only payment due in the 30th consecutive month, due September, 2015.	752,289	753,799
NEDC National Aboriginal Capital Corporations Association Enhanced Access Loan, repayable at 7% interest per annum by way of 18 monthly "interest only" payments of $1,490 commencing March, 2013 and 102 monthly payments of $3,270 blended principal and interest commencing September, 2014, due April, 2023.	238,057	251,263
NEDC First Citizen Fund loan repayable at 12% interest per annum by way of 12 monthly "interest only" payments of $760 commencing March, 2013 and 108 monthly payments of $1,160 blended principal and interest commencing March, 2014, due April, 2023. Up to 40% of the loan ($30,450) is eligible to be forgiven over the life of the loan.	70,453	75,704
NEDC National Aboriginal Capital Corporations Association Enhanced Access Loan, repayable at 7% interest per annum by way of 18 monthly "interest only" payments of $1,490 commencing March, 2013 and 102 monthly payments of $3,270 blended principal and interest commencing September, 2014, due April, 2023.	238,057	251,263
NEDC National Aboriginal Capital Corporations Association Enhanced Access Loan, repayable at 7% interest per annum calculated monthly, not in advance. Payments to comprise of 18 monthly " interest only" payments of $900 commence February 1, 2013 and 102 monthly instalments of $1,960 blended principal and interest commencing September 1, 2014.	142,860	150,768
NEDC National Aboriginal Capital Corporations Association Enhanced Access Loan, repayable at 7% interest per annum by way of 18 monthly "interest only" payments of $1,490 commencing March, 2013 and 102 monthly payments of $3,270 blended principal and interest commencing September, 2014, due April, 2023.	238,144	251,295
	2,215,901	2,255,092
Less: current portion	1,380,106	582,544
	$ 835,795	$ 1,672,548

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

9. Debt (continued)

Security for all NEDC debt:

- A general security agreement from Kuterra Limited Partnership;
- a promissory note in the amount of $1,726,125 from Kuterra Limited Partnership;
- a guarantee from 'Namgis First Nation; and
- the loan agreement with NEDC from Kuterra Limited Partnership.

The next five years principal payments are:

Year	
2016	$ 1,380,106
2017	99,280
2018	107,477
2019	116,449
2020	126,279
Balance	386,310
	2,215,901

11. Deferred Government Funding

	Received	Amortization	2015 Net	2014 Net
'Namgis First Nation	$ 3,032,856	$ 1,097,625	$ **1,935,231**	$ 2,450,514
Sustainable Development Technology Canada	3,735,000	1,234,966	**2,500,034**	2,493,116
Department of Fisheries and Oceans	800,000	292,249	**507,751**	656,860
Department of Indian Affairs and Northern Development Canada	425,000	123,946	**301,054**	205,268
	$ 7,992,856	$ 2,748,786	$ **5,244,070**	$ 5,805,758

Deferred government funding consists of amounts received to assist with the purchase and construction of certain property, plant and equipment. These grants are amortized at a rate that is equal to the proportion of the annual depreciation of the property, plant, and equipment that was paid for by these grants.

The balance from 'Namgis First Nation consists of amounts received by 'Namgis First Nation from various funders and transferred to the Partnership; it is comprised of:

	2015	2014
Deferred Funding - Tides Canada	$ **2,765,000**	$ 2,715,000
Deferred Funding - Ritchie Foundation	**154,745**	154,745
Deferred Funding - Coast Sustainability Trust	**113,111**	113,111
	$ **3,032,856**	$ 2,982,856

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

12. Due to Related Parties

	2015	2014
'Namgis First Nation	$ 12,000	$ 9,573
Atli Resources Limited Partnership	100,000	-
	$ 112,000	$ 9,573

The amounts due to related parties are unsecured, non-interest bearing and without specific repayment terms and has therefore been classified as a non-current liability. Atli Resources Limited Partnership is wholly-owned by 'Namgis First Nation.

13. Partners' Equity

	Kuterra General Partner Inc.	'Namgis First Nation	Total
Capital, beginning of year	$ (150)	$ (284,154)	$ **(284,304)**
Net loss	(94)	(944,029)	**(944,123)**
Capital, end of year	$ (244)	$ (1,228,183)	$ **(1,228,427)**

'Namgis First Nation is a limited partner owning 99.99%, while Kuterra General Partner Inc. is the general partner owning 0.01%. Kuterra General Partner Inc. is wholly owned by 'Namgis First Nation.

14. Economic Dependence

The Partnership derives the majority of its capital from funding agreements with various governmental and non-governmental agencies and organizations. Funding is released periodically subject to the Partnership achieving certain milestones, which differ between the various funders, over the next several years. The final funding payment is scheduled to be released in September 2015. The Partnership is dependent on its ability to continue to meet the required milestones, which include securing sufficient funding to build the facility and grow out three cohorts of Atlantic salmon smolts. These financial statements do not reflect adjustments to the carrying value of the assets which would be needed should the required milestones not be met and the funding not be received as planned.

See also *Note 15* (Commitments).

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

15. Commitments

The Partnership has entered into the following agreement and contracts:

- a feed supply agreement with a feed supply company to supply 100% of their feed requirements during the contract period. The term of this contract is from March 1, 2013 to February 29, 2016.
- a contract with a fish farming company for the supply of seven groups of smolts beginning April 2015. The final delivery date of smolts under this agreement is anticipated to be May 2017.

16. Fair Values of Financial Instruments

The fair values of cash approximates the carrying values since it bears interest that approximates market rates for similar instruments.

The fair values of bank indebtedness, accounts receivable, goods and services tax receivable, accounts payable and accrued liabilities and amounts due from 'Namgis First Nation approximate their carrying values given the short-term nature of these instruments.

Deferred government funding received to assist with the purchase and construction of certain property, plant and equipment approximates its carrying value as it is recognized in revenue at the rates that correspond with the applicable assets.

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

17. Financial instruments risks

a) Credit risk

The Partnership's exposure to credit risk is as indicated by the carrying amounts of its accounts receivable, in the event customers fail to fulfil their contractual commitments resulting in financial loss to the Partnership.

The Partnership manages this risk by having well established, conservative credit and due diligence policies, procedures and agreements in place to ensure the receivables are appropriately secured, monitored and realized on a timely basis. The Partnership's conservative credit policies also ensure there are no significant concentrations of risk.

b) Interest rate risk

The Partnership's cash and bank indebtedness bears interest at market rates.

At March 31, 2015, with all other variables held constant, a 1.0% change in interest rates would not have a significant effect on net earnings.

c) Foreign exchange risk

The Partnership's exposure to foreign exchange risk is not significant as it has nominal foreign currency transactions.

d) Liquidity risk

The Partnership manages its liquidity risk by maintaining contribution agreements with various levels of government and government agencies to finance the capital construction of the project which will form the largest investment for the partnership. The specialized nature and relatively new technology for this project increase the liquidity risk.

18. Capital Management

Capital is comprised of partners' equity. The Partnership's objectives in managing capital are to safeguard the Partnership's ability to continue as a going concern and to provide adequate returns to its partners commensurate with the level of risk. The Partnership does not have any externally imposed capital requirements.

19. Contingent Liabilities

The Partnership received a BC Hydro Powersmart Grant during the year ended March 31, 2015. Under the terms of the Power Smart Incentive Fund Agreement, the payment assumes that the Partnership will remain a BC Hydro customer over the next 10 years and the project installation will remain in operation over the next 10 years. In the event that either of these conditions are not fulfilled, the Partnership will be required to refund a prorated portion of the grant to BC Hydro.

Kuterra Limited Partnership
Notes to Financial Statements
March 31, 2015

20. Budget Figures

The financial statements include unaudited budget data from the Annual Budget as approved by the Board.

Kuterra Limited Partnership
Schedule of Operating Expenses
Year Ended March 31, 2015

	2015 Budget (Unaudited)	2015 Actual	2014 Actual
Operating Expenses			
Fixed costs			
Accounting services	$ 40,251	$ **40,597**	$ 36,849
Advertising	25,677	**27,629**	53,867
Audit fees	15,000	**14,460**	15,460
Bank charges and interest	957	**15,738**	14,885
Insurance - Property & Liability	20,621	**21,436**	17,319
Meetings	4,657	**5,611**	2,445
Office	11,936	**12,714**	11,889
Professional fees	120,086	**119,092**	40,492
Recruitment costs	-	**2,082**	-
Repairs and maintenance - Buildings	1,170	**10,385**	30
Repairs and maintenance - Site Infras. & Other	819	**7,309**	331
Supplies	1,264	**1,527**	1,971
Training	3,141	**382**	50
Travel - staff	8,505	**7,896**	7,352
Vehicle	4,316	**3,249**	3,128
	258,400	**290,107**	206,068
Corporate Overhead			
Board expenses	7,267	**7,584**	24
Community relations	25,706	**43,299**	38,734
Environmental analysis	3,535	**3,342**	13,420
Insurance - Directors & Officers	7,165	**7,724**	6,532
Project support	75,000	**86,271**	33,550
Travel - non farm staff	8,696	**18,602**	2,587
	127,369	**166,822**	94,847
Total - *page 1*	$ 385,769	$ **456,929**	$ 300,915

The attached notes are an integral part of these financial statements.