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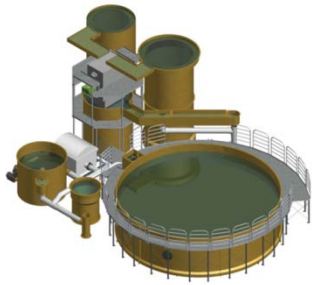

Assessing photoperiod regimes for freshwater-reared post-smolts

Christopher Good, Steven Summerfelt, Travis May, Curtis Crouse, Lars Ebbesen, Sigurd Stefansson, Sigurd Handeland, Sven Martin Jorgensen, Frode Mathisen, and Bendik Fyhn Terjesen

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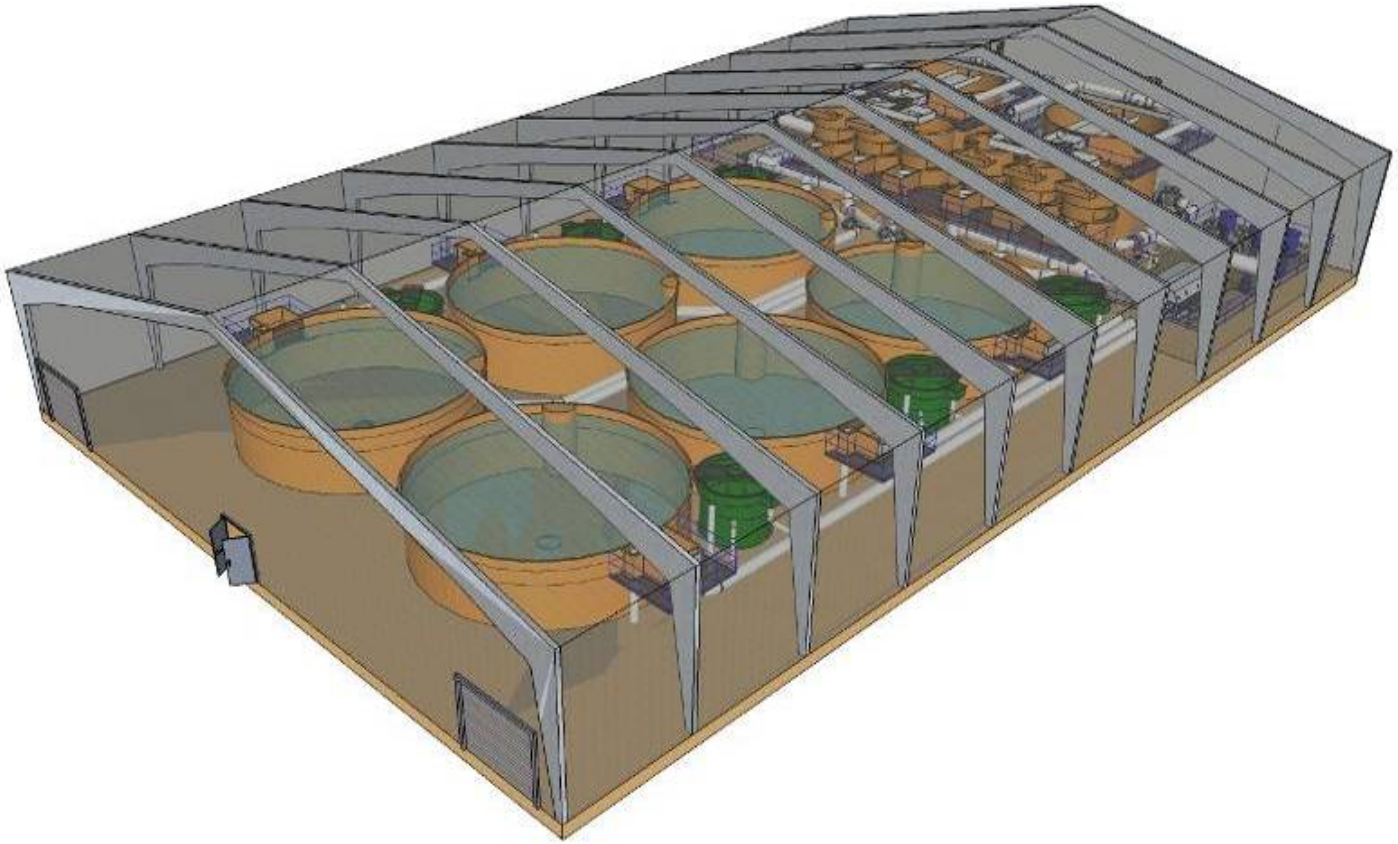
Land-Based Closed Containment RAS Facilities for Atlantic Salmon Growout



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Atlantic salmon growout trials

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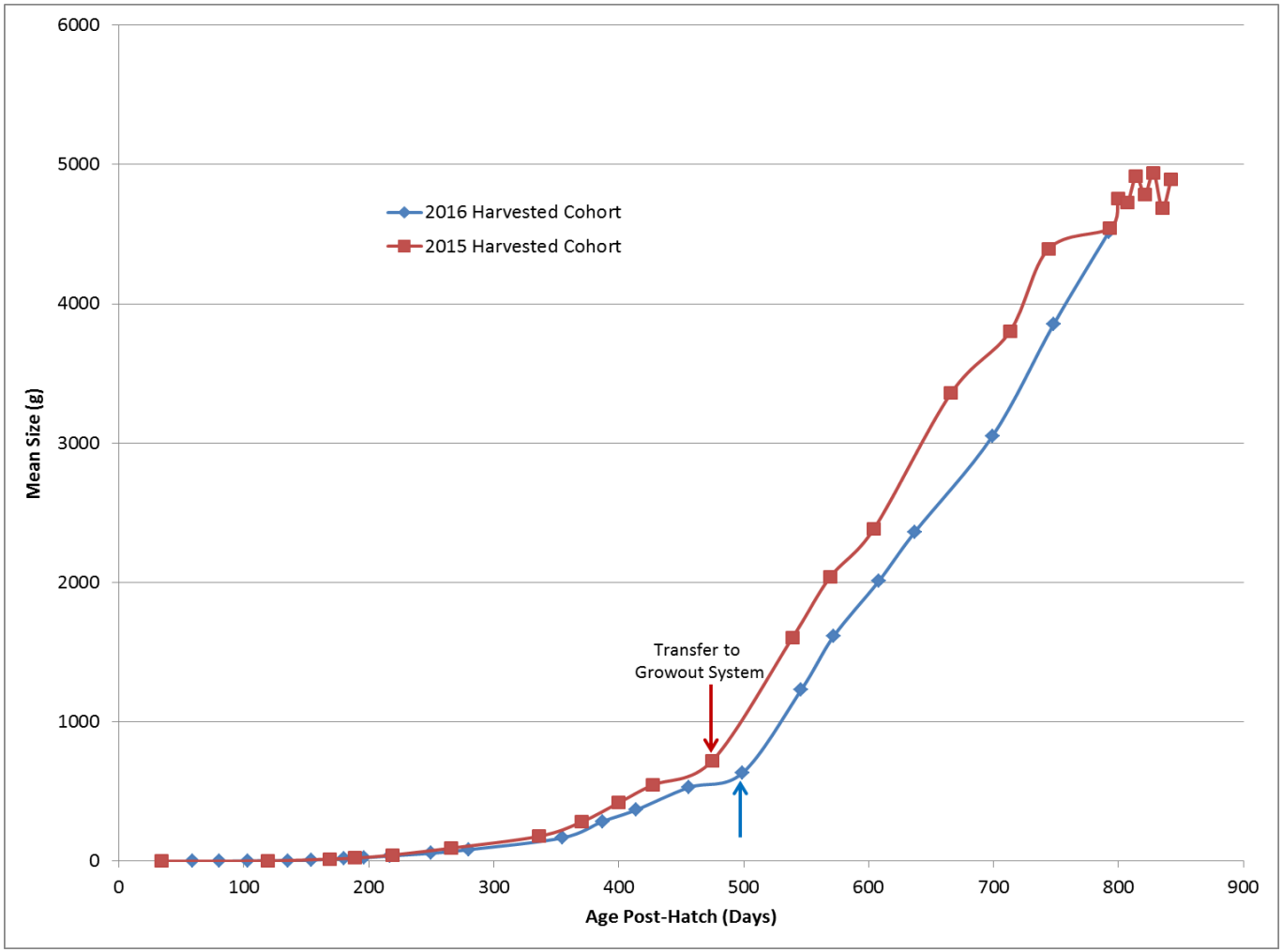
Atlantic salmon growout trials



Precocious male maturation

Up to 80% of male salmon mature early

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Negative consequences of maturation

- Decreased growth and feed conversion
- Reduced product quality
- Increased susceptibility to opportunistic infections

All-female salmon now being piloted

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Early Rearing Conditions

- Impact on growout performance
- Producing a robust post-smolt in freshwater?

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PHOTO – determining photoperiod regimes for optimal smoltification, decreased maturation, and improved health / robustness

- There is significant industry interest in raising larger smolts (up to 1kg) in land-based freshwater RAS
- This new variation on smolt production is largely untested, and optimum environmental conditions need to be established to ensure salmon quality prior to sea cage transfer

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- **Description of work (2016)**
  - **Task 1.** Apply three photoperiod regimes to first-year Atlantic salmon raised in replicated freshwater reuse systems up to 500g and 1,000g
    - **LD24:0 (constant photoperiod)**
    - **LD12:12**
    - **LDN (natural photoperiod)**
  - **Task 2.** Assess light quality and intensity at various water depths and fish densities through the study period
  - **Task 3.** Assess fish osmoregulation, maturation, immunocompetence, growth, survival, and feed conversion

- **Current activities (January - August, 2016)**
  - Commencement of “pre-study”; physiological and performance data collection on post-smolts under experimental conditions in replicated freshwater RAS; received eggs (SalmoBreed) for main study

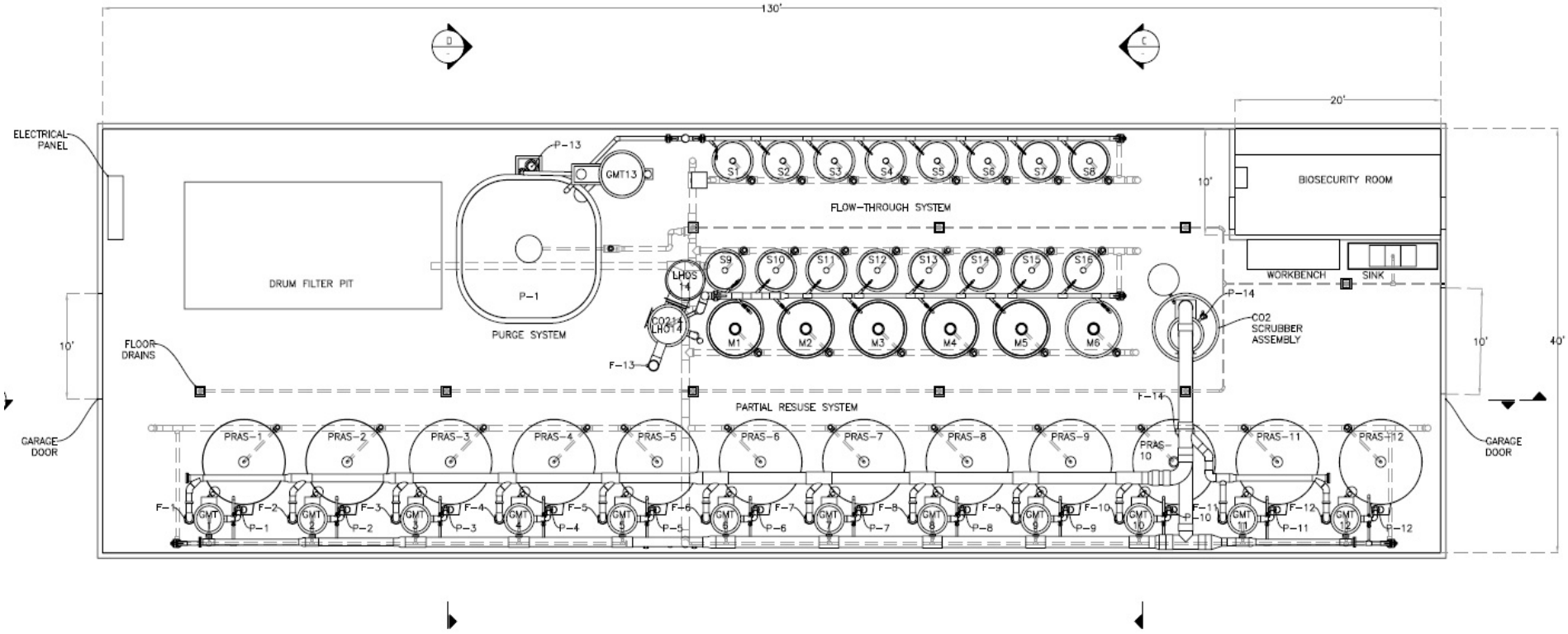
130'
20'
ELECTRICAL PANEL
P-13
GMT13
S1
S2
S3
S4
S5
S6
S7
S8
FLOW-THROUGH SYSTEM
10'
BIOSECURITY ROOM
WORKBENCH
SINK
DRUM FILTER PIT
P-1
PURGE SYSTEM
LHDS 14
S9
S10
S11
S12
S13
S14
S15
S16
CO2 LHDS14
M1
M2
M3
M4
M5
M6
P-14
CO2 SCRUBBER ASSEMBLY
F-13
F-14
10'
FLOOR DRAINS
10'
40'
PARTIAL RESUSE SYSTEM
GARAGE DOOR
PRAS-1
PRAS-2
PRAS-3
PRAS-4
PRAS-5
PRAS-6
PRAS-7
PRAS-8
PRAS-9
PRAS 10
PRAS-11
PRAS-12
GARAGE DOOR
F-1
F-2
F-3
F-4
F-5
F-6
F-7
F-8
F-9
F-10
F-11
F-12
GMT 1
GMT 2
GMT 3
GMT 4
GMT 5
GMT 6
GMT 7
GMT 8
GMT 9
GMT 10
GMT 11
GMT 12
P-1
P-2
P-3
P-4
P-5
P-6
P-7
P-8
P-9
P-10
P-11
P-12

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PHOTO: Treatment summary

Initial Treatment Group	Early Rearing Fry system (12-13C)			Transfer to partial reuse @ ~13C	Either:	A) **remain** in partial reuse under original photoperiod regime, then transfer at 1000g B) **transfer** to growout RAS w/ LD24:0 @ ~15C	Growout RAS under LD24:0 @ ~15C		Final Treatment Group
	40g			~100g	500g		1000g	4-6kg	
1	LD24:0	LD12:12	LD24:0		A				1A
					B				1B
2	LD24:0	LD12:12	LD24:0	LD12:12	A				2A
					B				2B
3	LD24:0	LD12:12	LD24:0	LDN	A				3A
					B				3B
4	LD24:0				A				4A
					B				4B

Physiological Outcomes – Main Study

1. Smoltification

- Gill ATPase
- Seawater challenges
- Plasma chloride/osmolality
- Gill gene expression (NKAα1a and 1b, NKCC, DIO2a)
- Brain DIO2b mRNA
- Endocrine parameters (cortisol and thyroxine)
- Pituitary gene expression in ROBUST

2. Maturation

- Plasma 11-KT
- Precocious parr and grilse identification
- Gonadosomatic indices

3. Immunocompetence

- Transcriptome analysis – SIQ microarray and bioinformatics platform

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PHOTO: “Pre-Study”

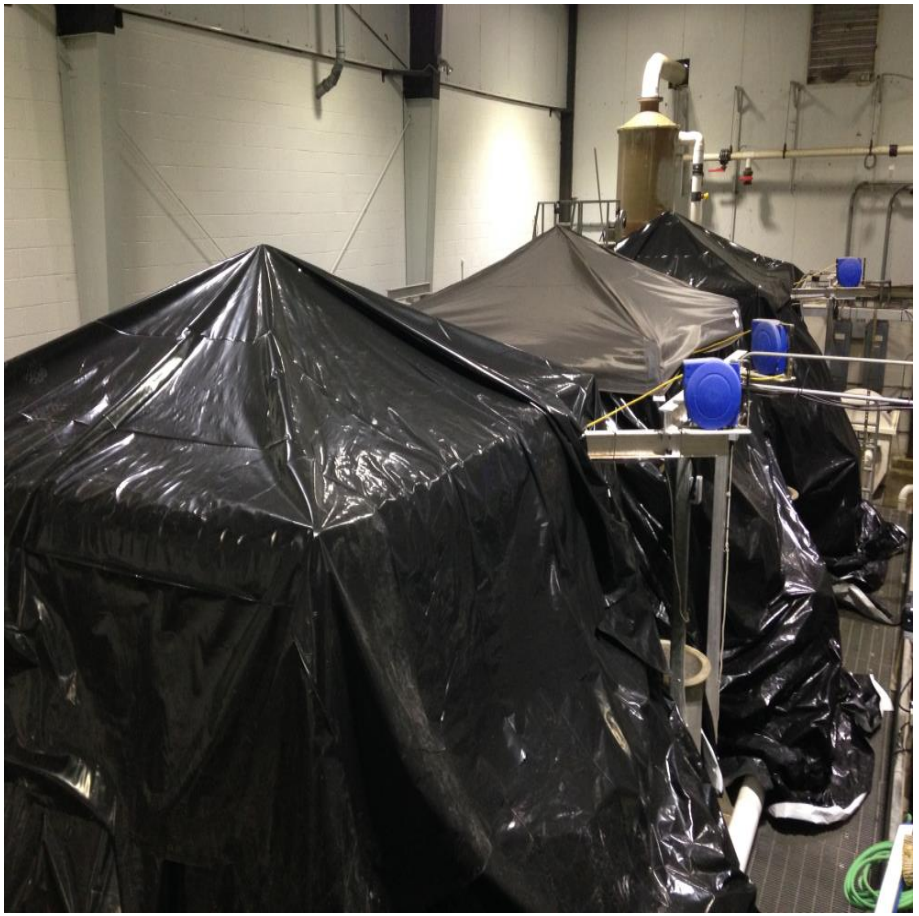

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PHOTO: Pre-Study Treatment Summary

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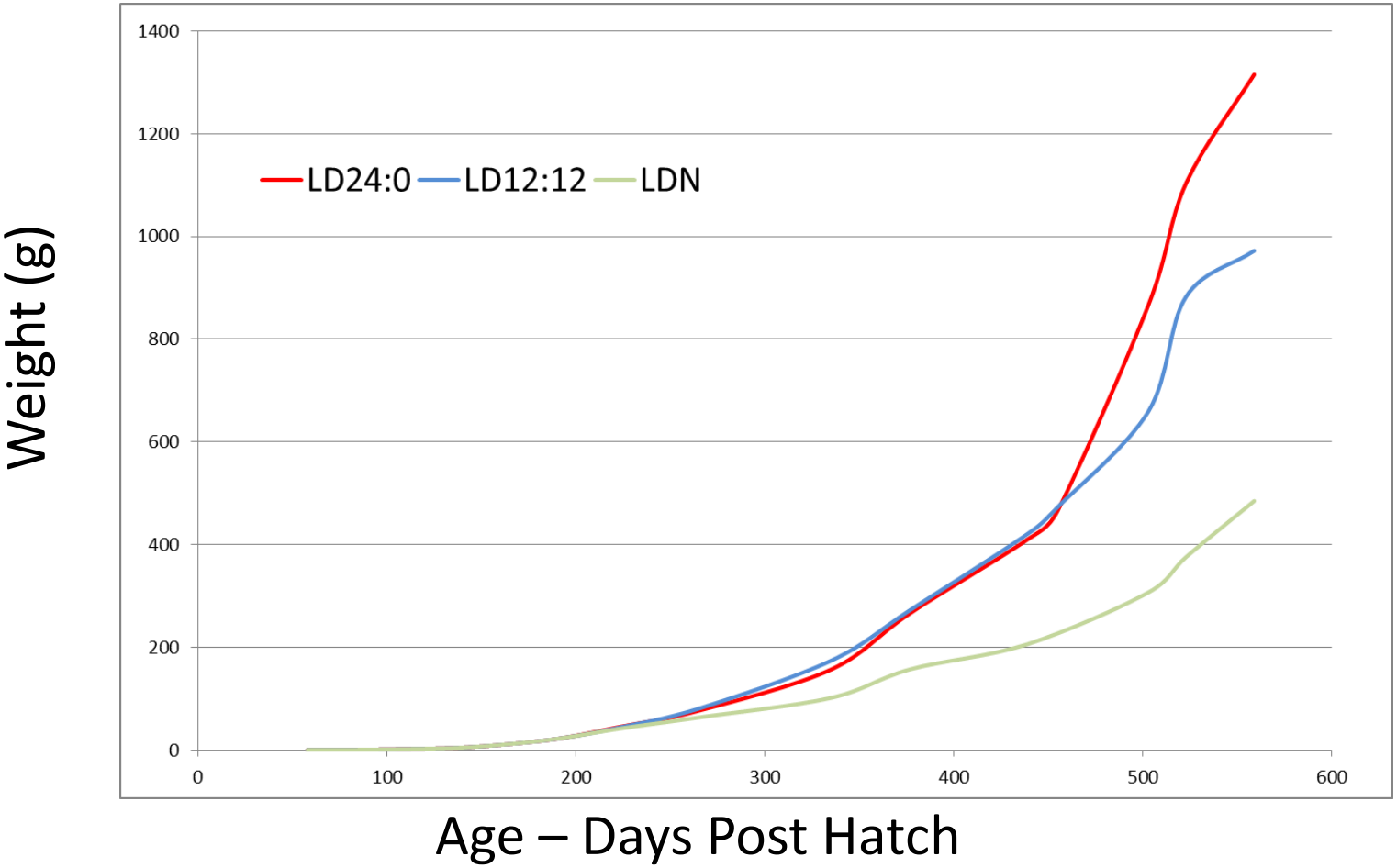
					B				1B
2	LD24:0			LD12:12	A				2A
					B				2B
3	LDN				A				3A
					B				3B

Results So Far – Pre-Study



Results So Far – Pre-Study

	LD24:0	LD12:12	LDN
Weight (g)	1315 ± 36	971.6 ± 36	485.3 ± 14
# Fish	508	538	2286
Density (kg/m3)	61.9	47.5	85.9
SGR	1.16	1.39	0.96
TGC	0.277	0.307	0.161
FCR	0.981	0.926	1.12
% Mature males	97.8	68.6	46.2

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Next Steps…

1. Post-Roanoke meeting with partners to develop sampling regime beginning Fall, 2016

2. Continue with pre-study; analysis of tissue samples