NWFCC 2016 – Feeding 101 - Presentation

Today

- Feed
  - Fish Feed Basics
    - The Old way and Now the New Way
    - How feed is made, packaged and shipped
    - Raw materials, Asta, Insect meal
- Feeding
  - How to feed, FCR specifics
  - Pellet numbers per pound
  - Feed Management- Charts, Satiation, Maintenance, Growth programs (BOGRO)
  - CV'S

The Old Way

Early Fish Feed Production ca. 1947

Meat Received from

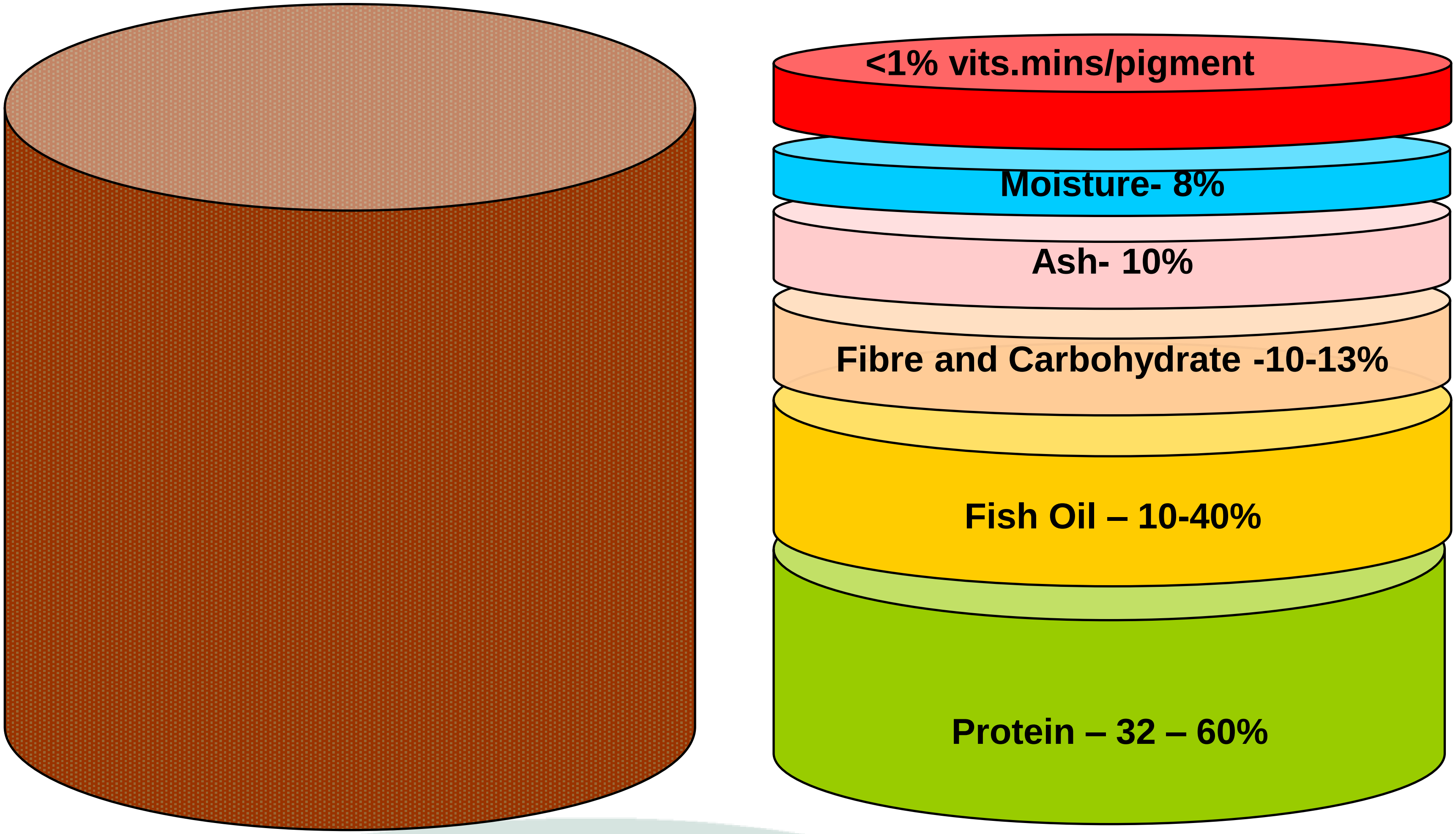
	Day of Month	Number Females Found Dead	Number Green Females Killed	Number Males Dead or Killed	Number Salmon Released Above Rack	Number Females Spawned	Number Eggs Taken	Number Eggs Lost	Number Fry Hatched	Number Fry Lost	Eggs—Fry Received Shipped From—To	Number Fry Turned From Hatchery Into Ponds	Number Fry Turned From Ponds Into Streams	Number Fry Turned From Hatchery Into Streams	Ma

Day	Date	Entry
Sunday		
Monday		
Tuesday		
Wednesday	1/29/47	up to date – 5 adult Mutton from Art Fenton – Vouchers sent for
Thursday	1/31	100 salmon 400 liver 400 viscera from cold storage in Seattle
Friday	2/5	29¾ lungs – 4¾ spleen 12½ liver from Flimbough
Saturday	2/11	2 spleens 7 lung 18 tripe – Fenton
Total	2/13	14 lungs 7 spleens from Flymbough
Total on hand	2/17	375 salmon viscera 975 salmon 450 liver – cold storage
Sunday	2/19	3 spleens 55 lungs 101 tripe ~~Flymbough~~ Firnboh
Monday	2/21	1 spleen 8 lung 42 tripe Fenton
Tuesday	2/24	30# Mutton Fenton
Wednesday		150 anchovies 450 viscera 1125 Salmon – Cold Storage
Thursday		114 tripe 30 lungs 3 spleen Fynbok –
Friday	2/28	282 Cow Meat Tachell
Saturday	3/1	4# spleen 27 lungs 70 tripe Flynbok
Total	3/1	1016 tripe Fenton
Total on hand		
Sunday		
Monday		
Tuesday		
Wednesday		
Thursday		


WARNING TO OPERATOR
DO NOT-FOR ANY REASON
PLACE HANDS IN HOPPER.
USE WOOD MASHER PROVIDED
FOR ANY SUCH NECESSITY.

The New Way

Fish Feed Composition




Anchovies


Fish Meal


Wheat
Fish Meal
Fish Oil
Wheat Flour
Corn Gluten

What makes a Salmon **Red** ?

Astaxanthin

(and other carotenoids, AKA Pigment)

Astaxanthin

- Found in nature:
  - algae
  - krill
  - shrimp
  - crayfish
  - crustaceans
  - Salmon & trout
  - Feathers of some birds
  - Yeast
  - Bacteria

- It protects cells from damage and enhances immune system functions.
- Astaxanthin's health benefits include: an ability to fight inflammatory diseases, boost the immune system, improve cognitive function, enhance blood lipids and possibly fight cancer.

Something New --- Insect Meal

- Uses a hatchery technology and a local beneficial insect.
- Recovers nutrients from grocery stores, markets, food distributors and food processors.
- Includes fruits, vegetables, fish and grains, that previously when to landfills.
- The insect does not feed as an adult and, as a result, is not considered a pest or carrier of disease.
- The larval stage of the insect life-cycle is rich in natural protein and oils that can be used to feed fish, livestock and pets.


Black Soldier Fly
Meet Nature's nutrient renewal experts
www.enterrafeed.com

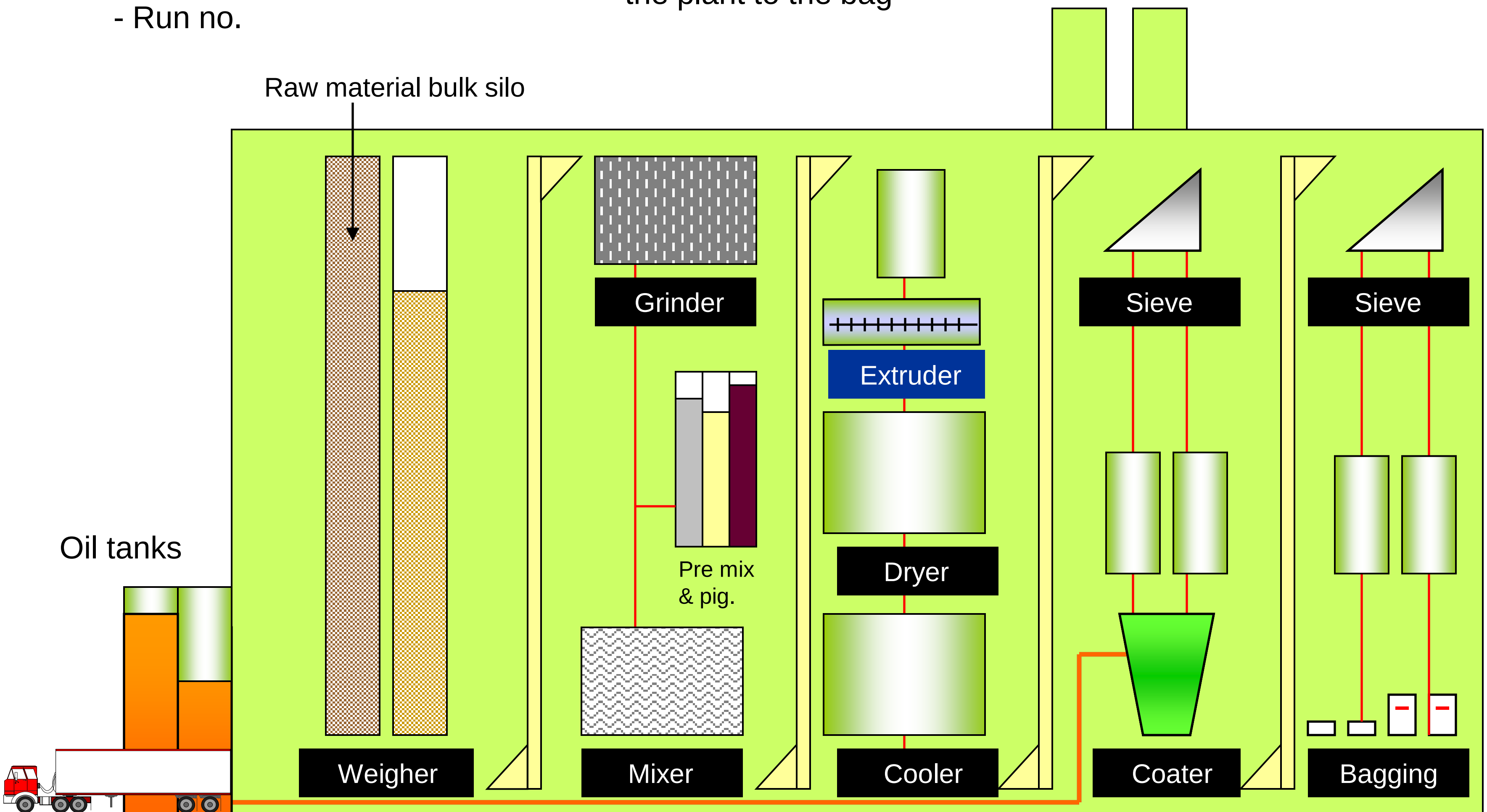

Natural Insect-Rearing Process
Hatchery
eggs
Larvae Rearing
4 hours
Organic
Fertilizer
Feedstock
Larvae
www.enterrafeed.com
9

Fly larvae and resulting meal

Fish feed production today

- Product code
- Formulation
- Run no.

Follows the mixture through the plant to the bag



Raw material intake

Lab: Raw materials database
Supplier, tonnage, test results

- Bag number

The Extruder cooks the ingredients under high heat and pressure.


E3
6.0 MM
4.7 mm hole 28% exp.
F3
4.7 mm hole 28% exp.


RIGHT


Product of Canada
BioVita Fry
2.0 MM
Product of Canada
BioVita Fry
2.0 MM
Product of Canada
Bio-Oregon

Feed is shipped via Truck or Barge

Arrives at your site

Delivered to You

…So what about feed and feeding?

Importance of Efficient Feeding

- Efficient Feeding will provide the greatest growth potential and the lowest FCR.
- Over feeding wastes feed and can negatively impact water quality.
- Underfeeding can result in lost growth and fish size variation.
- Both under feeding and over feeding increase the FCR.
- It is both HOW MUCH you feed, and HOW you feed.
- Fish feeding is an important job !!!

Feed Conversion Ratio   FCR

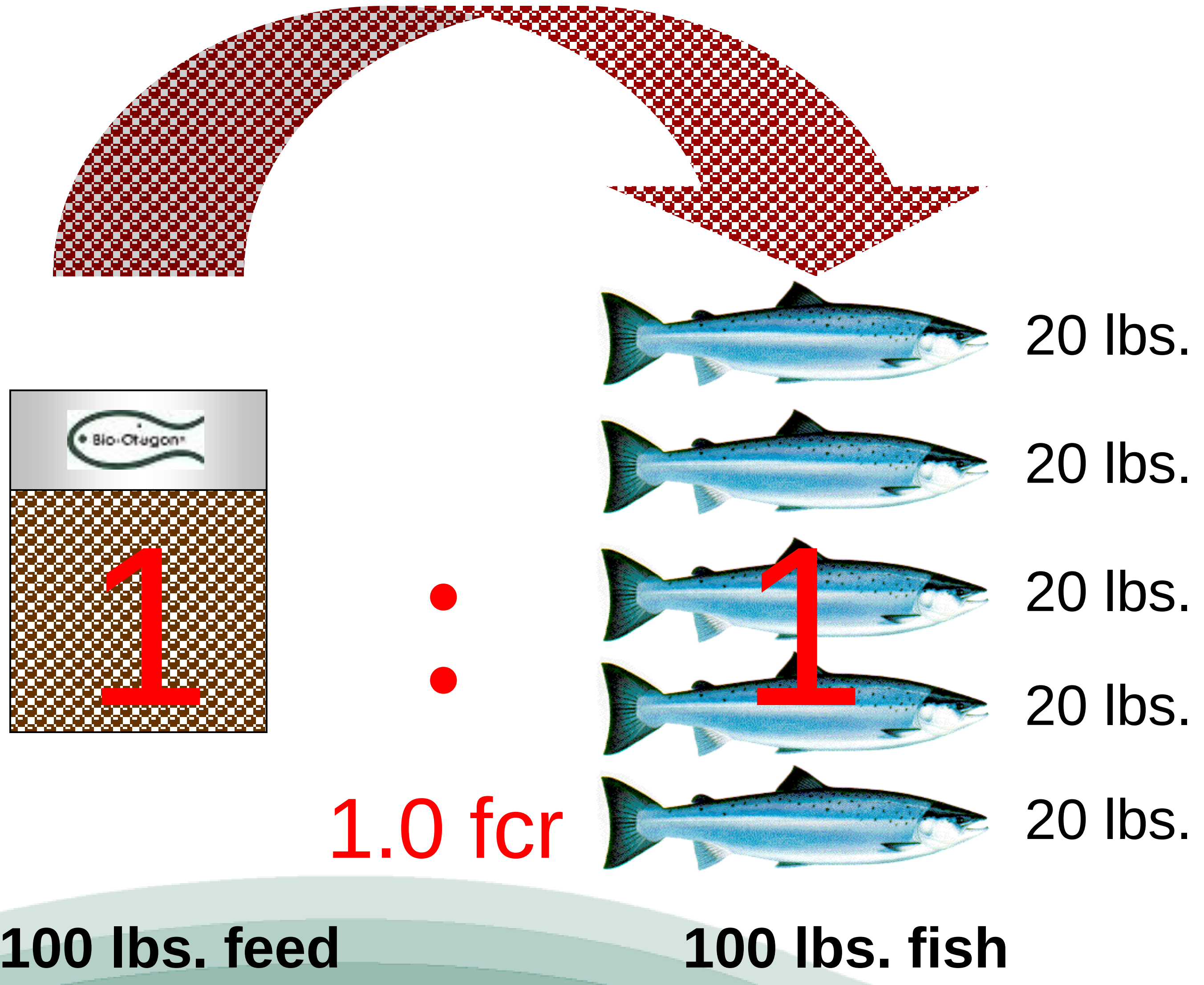
- **FCR** = Weight of Feed Fed / Weight Gain

- Examples:

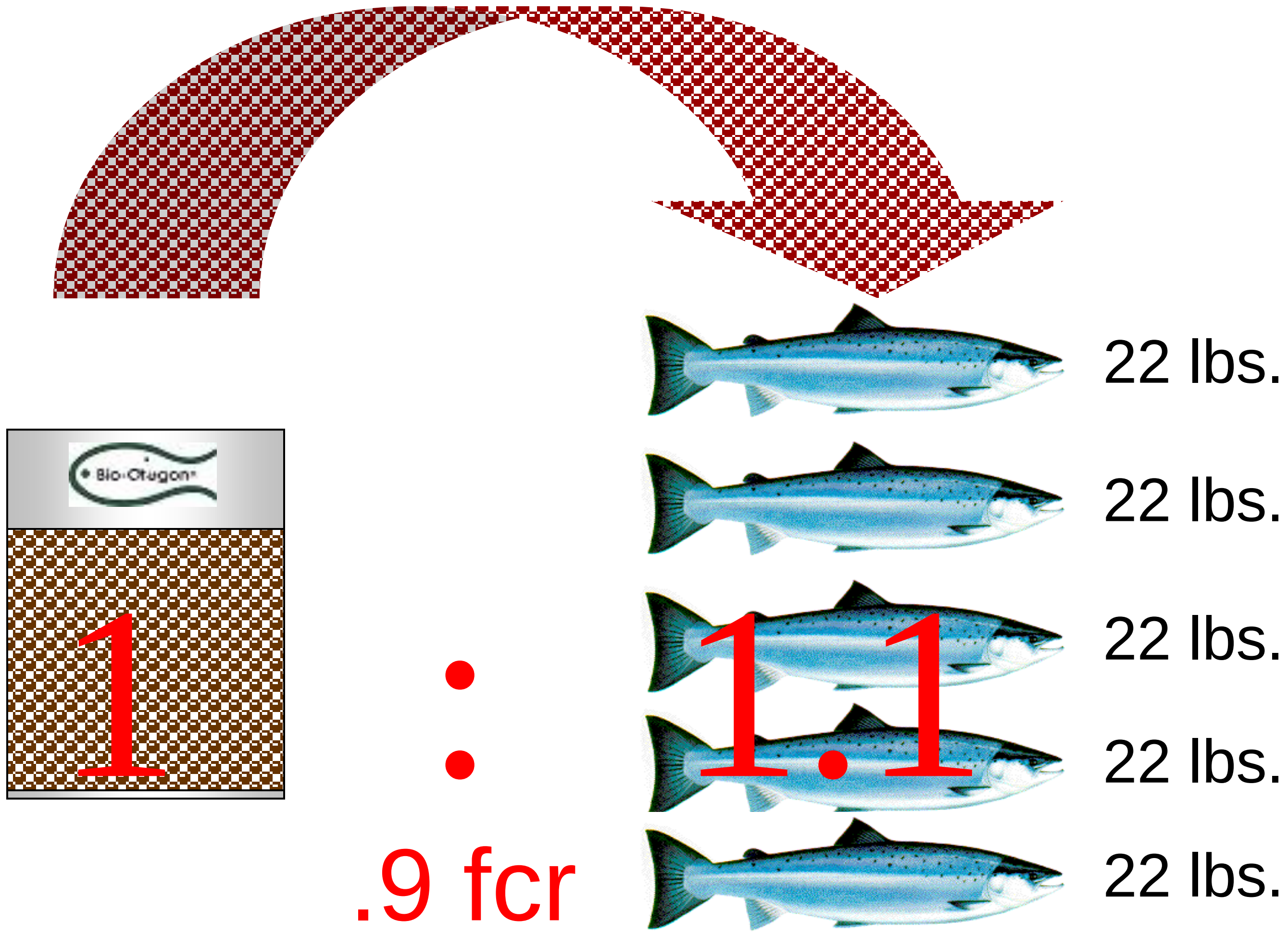
- **If you feed 100 lbs of feed and the fish weight gain equals 100 lbs.   FCR = 100 / 100 = 1**

- **If you feed 100 lbs of feed and the fish weight gain equals 110 lbs.   FCR = 100 / 110 = .909**

Feed Conversion Ratio - the basics



Feed Conversion Ratio - the basics



100 lbs. feed **110 lbs. fish**

Major Factors Influencing Growth and FCR

Fish	Environment	Feed	Operation	Feeding	Personnel
Age	Temp.	Energy content	Fish numbers	Feed type	Motivation
Sex	Light	Protein/energy balance	Fish biomass	Spread	Knowledge
Maturation		Amino acid profile	Density	Intensity	Training
Life stage	Site	Technical quality	Grading	Time of day	Ownership
Fish weight	Season	Storage	Handling	Feed amount	
Disease	Weather			Equipment	
Genetics	Current			Feed management	

(after Giskegjerde and Tvening, 1996)

Feeding for: Maximum Growth

Some things to consider:

- Feed Meals to satiation, as often as possible
- Feed until all fish have been satiated and have stopped feeding.
- Make sure all fish have access to the feed
- Water Temps will determine number of meals per day.
- Distribute feed widely and at a rate that discourages competition.
- Use a feed table or feed program as a guide to make sure you are feeding the correct amounts for maximum growth.
- But make sure to watch the fish to insure satiation.
- Feed a Moderate to High Energy Feed

Feeding for: Controlled Growth

- Use a growth program to determine % body weight per day to reach target goals.
- Take the reduced feed amount and feed it in less feedings so that the fish get more feed per feeding.
- Feed in a way that allows meals to satiation.
- Ensure a good spread and access to feed by all fish
- Feed at a rate that allows all feed to be eaten
- Consider feeding a smaller pellet size to provide more pellets
- Consider an enhanced Vitamin Pack
- Feed a Low to Moderate Energy Feed

Click on text in the boxes below to get instructions and information.

DATA ENTRY FORM

Pond Number:	
Species:	Coho
Starting Date:	8/19/01
Ending Date:	4/15/02
Species Number:	4
Starting Wt. (# Fish/Lb):	38
Target End Wt. (#Fish/Lb):	17
Feed Conversion:	1.0
Number of Fish:	141,441

BoGro ODFW.xls

For more information, contact:
Jean Paul Lagasse
Nutritional Services
Oregon Department of Fish & Wildlife
17330 SE Evelyn Street
Clackamas, OR 97015-9514
Tel: (503) 657-2000 ext. 238
FAX: (503) 657-2049
Email: jean.p.lagasse@state.or.us

Change value of %AGR to change the value of Fish/Lb. The worksheet recalculates automatically. Note that the ending Fish/Lb. is in cell L1 (above the #/LB heading). The sum of Feed (Lb. in red font) is at top of the column N.

Press the button below to perform needed action:

Print 7 Day Feed Schedule

OR

Print Daily Feed Schedule

Read Instructions

Read general information

Close File

%AGR	DATE	TEMP	17.00 #/LB	%BODWT	4638.2 FEED	FEED FOR 7 DAYS	NUMBER FISH	FEED CONV
72.58	10/01/16	50.0	38.00	0.927	34.52	236.079	141441	1.0
72.58	10/02/16	49.8	37.65	0.912	34.27		141441	1.0
72.58	10/03/16	49.5	37.31	0.897	34.01		141441	1.0
72.58	10/04/16	49.3	36.98	0.882	33.74		141441	1.0
72.58	10/05/16	49.0	36.65	0.867	33.47		141441	1.0
72.58	10/06/16	48.8	36.34	0.852	33.18		141441	1.0
72.58	10/07/16	48.6	36.03	0.838	32.89		141441	1.0
72.58	10/08/16	48.3	35.73	0.823	32.59	221.473	141441	1.0
72.58	10/09/16	48.1	35.43	0.809	32.29		141441	1.0
72.58	10/10/16	47.8	35.15	0.795	31.97		141441	1.0
72.58	10/11/16	47.6	34.87	0.780	31.65		141441	1.0
72.58	10/12/16	47.3	34.60	0.766	31.33		141441	1.0
72.58	10/13/16	47.1	34.34	0.752	30.99		141441	1.0
72.58	10/14/16	46.9	34.08	0.738	30.65		141441	1.0
72.58	10/15/16	46.6	33.83	0.725	30.30	204.381	141441	1.0
72.58	10/16/16	46.4	33.59	0.711	29.94		141441	1.0
72.58	10/17/16	46.1	33.35	0.697	29.58		141441	1.0
72.58	10/18/16	45.9	33.12	0.684	29.21		141441	1.0
72.58	10/19/16	45.7	32.89	0.671	28.83		141441	1.0
72.58	10/20/16	45.4	32.67	0.657	28.45		141441	1.0
72.58	10/21/16	45.2	32.46	0.644	28.06		141441	1.0
72.58	10/22/16	44.9	32.25	0.631	27.67	185.003	141441	1.0
72.58	10/23/16	44.7	32.05	0.618	27.26		141441	1.0
72.58	10/24/16	44.4	31.85	0.605	26.86		141441	1.0
72.58	10/25/16	44.2	31.66	0.592	26.44		141441	1.0
72.58	10/26/16	44.0	31.47	0.579	26.02		141441	1.0
72.58	10/27/16	43.7	31.29	0.566	25.59		141441	1.0
72.58	10/28/16	43.5	31.11	0.554	25.16		141441	1.0
72.58	10/29/16	43.2	30.94	0.541	24.72	170.222	141441	1.0
72.58	10/30/16	43.0	30.78	0.528	24.28		141441	1.0
72.58	10/31/16	42.8	30.61	0.516	23.83		141441	1.0
72.58	11/01/16	43.0	30.46	0.526	24.45		141441	1.0
72.58	11/02/16	42.9	30.30	0.522	24.38		141441	1.0
72.58	11/03/16	42.9	30.14	0.518	24.31		141441	1.0
72.58	11/04/16	42.8	29.98	0.514	24.24		141441	1.0
72.58	11/05/16	42.7	29.83	0.510	24.17	167.586	141441	1.0
72.58	11/06/16	42.7	29.68	0.506	24.10		141441	1.0
72.58	11/07/16	42.6	29.53	0.501	24.02		141441	1.0
72.58	11/08/16	42.5	29.38	0.497	23.94		141441	1.0
72.58	11/09/16	42.4	29.23	0.493	23.87		141441	1.0

All about CV’s

- Used to determine if fish are ready to switch to the next feed size
- Used to see how uniform in size your fish are
- Used to monitor Growth and Development – KD in fry
- Sample at least 100-300 fish per sample CV. More is better for accuracy
- Same for all Species
- A CV of 5-6 is Very Good – very tight
- A CV of 7-8 is Good –Average tight
- A CV of 9-10 is on the edge – not so tight
- A CV of higher than 10 is out of size.
- These are WDFW guidelines

ENTER DATA IN RED BOXES ONLY

RETRIEVE RESULTS FROM "RESULTS" PAGE

DATE:	7/25/2012
LOT AND SPECIES:	W. Stlhd.
POND #:	Big Fish Hatchery
WEIGHT (LBS):	1.16
LENGTH OF SMALLEST FISH:	62
LENGTH OF LONGEST FISH:	95
# OF BAD CLIPS FOR QC:	

Make sure to delete old data -------------------->
before entering new data.

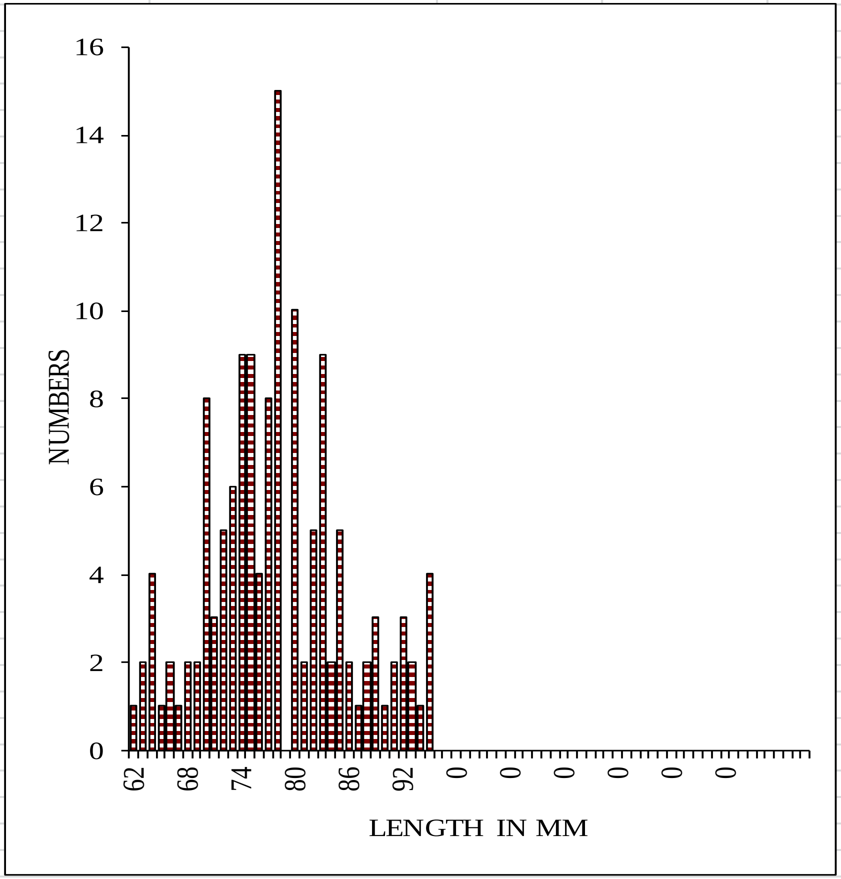
ENTER # OF FISH PER MEASURMENT	LENGTH IN MM
1	62
2	63
4	64
1	65
2	66
1	67
2	68
2	69
8	70
3	71
5	72
6	73
9	74
9	75
4	76
8	77
15	78
	79
10	80
2	81
5	82
9	83
2	84
5	85
2	86
1	87
2	88
3	89
1	90
2	91
3	92
2	93
1	94
4	95

LENGTH FREQUENCY

DO NOT ENTER DATA ON THIS PAGE

DATE	7/25/2012
SPECIES	W. Stlhd.
POND #	Big Fish Hatchery
LBS	1.16
FISH/LB	117.24
NUMBER	136
MEAN	77.985
STD	7.723
CV	9.903
C	2.947E-04
K	0.816
BAD CLIP%:	
Hatchery	Big Fish hatchery

NUMBER	LENGTH	FISH/LB
1	62	233.3
2	63	222.4
4	64	212.1
1	65	202.5
2	66	193.4
1	67	184.9
2	68	176.8
2	69	169.3
8	70	162.1
3	71	155.4
5	72	149.0
6	73	142.9
9	74	137.2
9	75	131.8
4	76	126.7
8	77	121.8
15	78	117.2
	79	
10	80	108.6
2	81	104.6
5	82	100.9
9	83	97.2
2	84	93.8
5	85	90.5
2	86	87.4
1	87	84.4
2	88	81.6
3	89	78.9
1	90	76.3
2	91	73.8
3	92	71.4
2	93	69.1
1	94	66.9
4	95	64.9

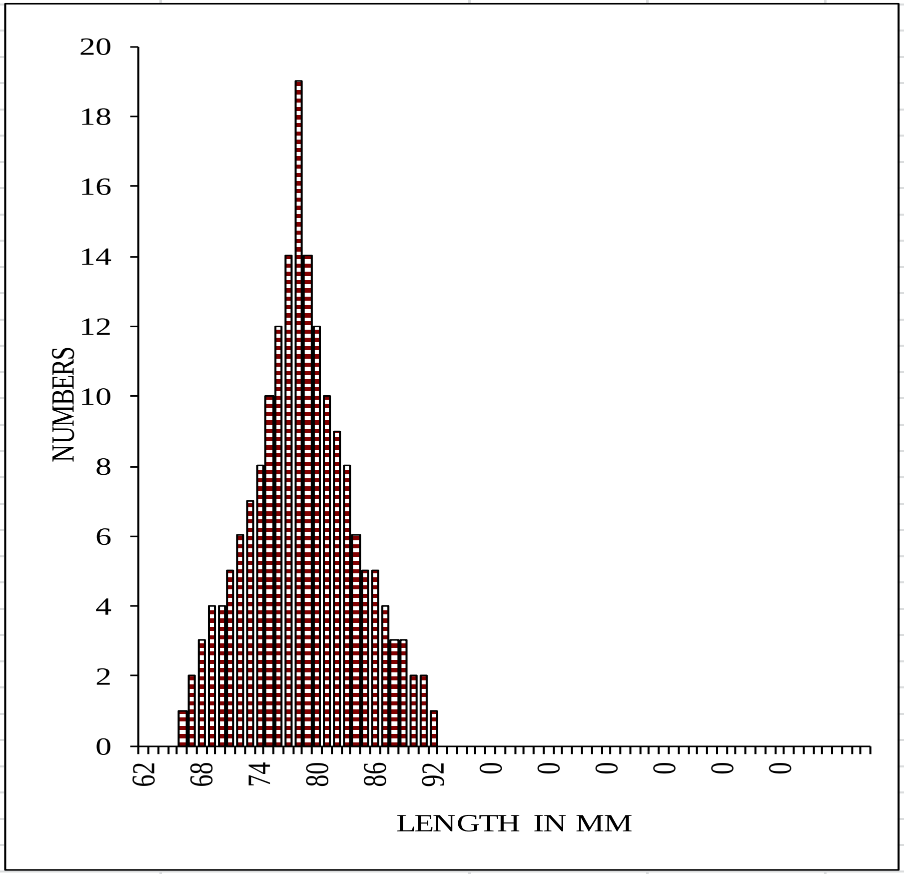


LENGTH FREQUENCY

DO NOT ENTER DATA ON THIS PAGE

DATE	7/25/2012
SPECIES	W. Stlhd.
POND #	Big Fish Hatchery
LBS	1.16
FISH/LB	154.31
NUMBER	179
MEAN	78.447
STD	5.422
CV	6.911
C	2.200E-04
K	0.609
BAD CLIP%:	
Hatchery	Big Fish Hatchery

NUMBER	LENGTH	FISH/LB
	62	
	63	
	64	
	65	
1	66	259.1
2	67	247.7
3	68	236.9
4	69	226.8
4	70	217.2
5	71	208.1
6	72	199.6
7	73	191.5
8	74	183.8
10	75	176.6
12	76	169.7
14	77	163.2
19	78	157.0
14	79	151.1
12	80	145.5
10	81	140.2
9	82	135.1
8	83	130.3
6	84	125.7
5	85	121.3
5	86	117.1
4	87	113.1
3	88	109.3
3	89	105.7
2	90	102.2
2	91	98.9
1	92	95.7
	93	
	94	
	95	



You want to be able to feed the best feed for your money.

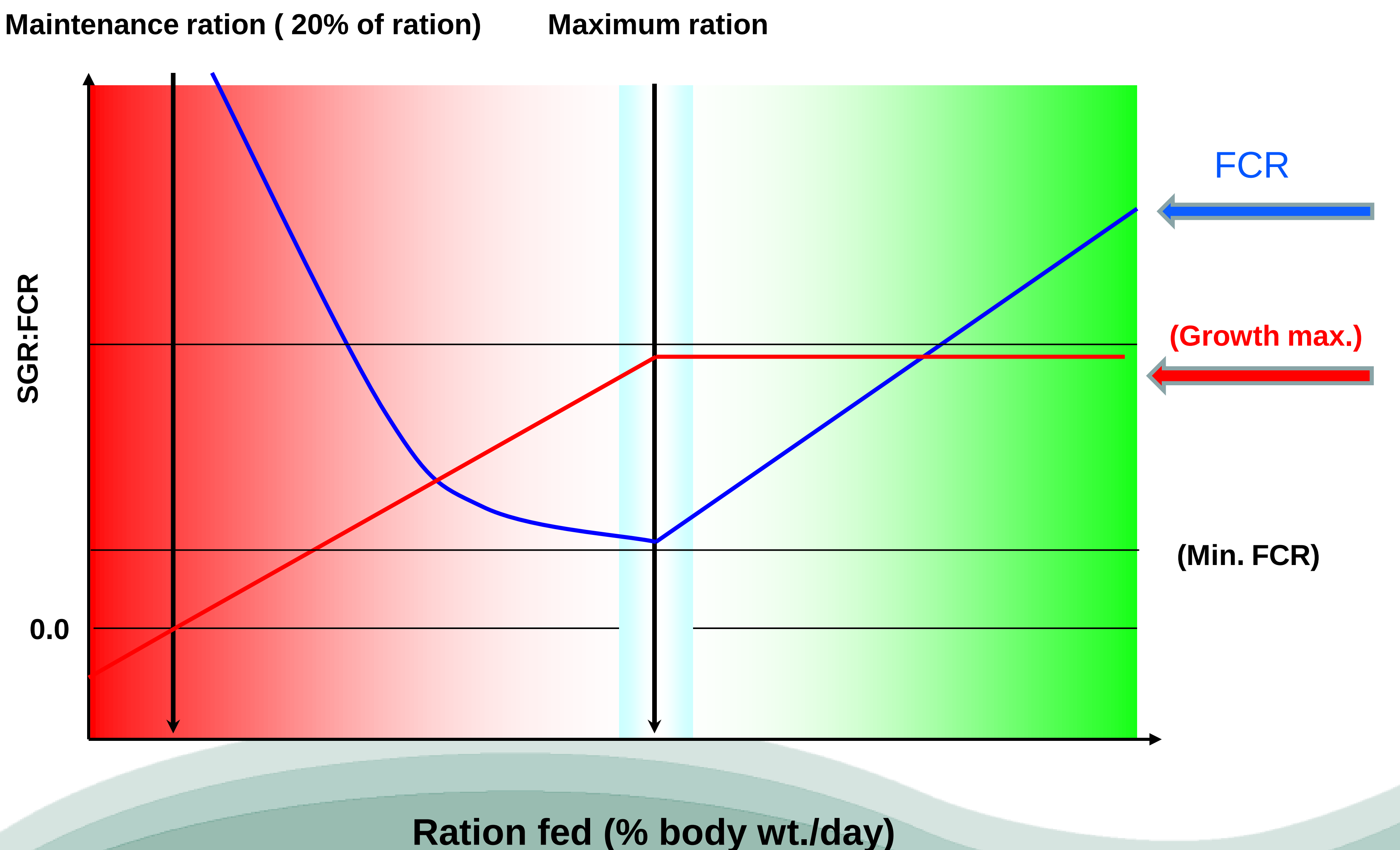
Poor feeding practices can mean not being able to get the most from the feed! And you want to get the most bang for your buck!

- Feed on the bottom?
- Feeding all the fish?
- Spending enough time?
- Feeding fish is an art, it takes time to develop!
- Or are you in a hurry to get back to that project?
- If it weren't for the fish you would not be doing that project!!!!
- How do the fish look? You could end up with….


Pinheads….


When you want this…

Growth / Ration relationships in fish



How much does it cost?

- 1,000,000 fish grown to 17 fpp.

- **Group A**: Has an FCR of .9
- Feed Cost $1.00 /lb. overall average
- 58,823 pounds of fish x .9 x $1.00 = $52,941

- **Group B**: Has an FCR of 1.1
- Feed Cost $1.00 /lb. overall average
- 58,823 pounds of fish x 1.1 x $1.00 = $64,705

- $11,764 extra dollars needed (nearly 20% more)

Pellet sizes and numbers / lb.

Diam. mm	Pellets per lb	Sinking Rate sec / foot
# 0	13,620,000	30.0
3.0	16,344	6.0

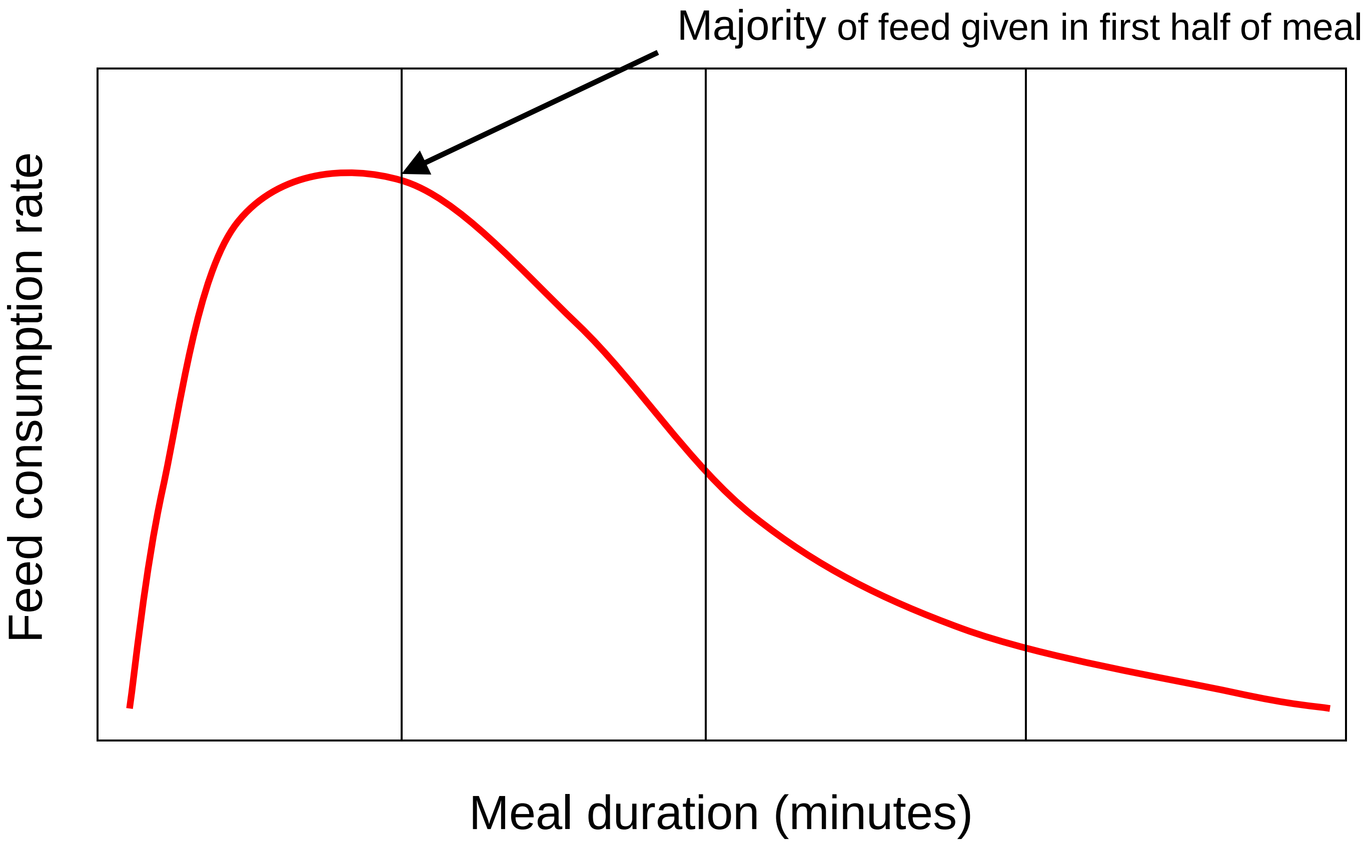
- Remember the importance of feeding speed
- Number of pellets per fish per minute ?
- (2-3) C. Talbot 1993 (In Fish Farming Technology pp. 19-26) Some biological and physical constraints to the design of feeding regimes for salmonids in intensive cultivation.
- You should spend a proportionately equal amount of time feeding each raceway- even if there are less fish or less feed to be fed out.

Pellet sizes and numbers / pound

		Sinking Time	Sinking Time	Avg. Number of Particles	Avg. Number of Particles
Feed Size	Particle Size (mm)	Seconds Per Foot	Seconds Per Meter(3.3 ft)	Per 1/4 pound (4oz.)	Per Pound
#0	**0.3-0.6**	**20 - 38 sec**	**66-124 sec**	**3,405,000**	**13,620,000**
#1	**0.4-1.0**	**12 - 24 sec**	**40-78 sec**	**1,816,000**	**7,264,000**
#2	**0.8-1.4**	**6 - 15 sec**	**21-50 sec**	**454,000**	**1,816,000**
#3	**1.1-2.3**	**5.5 - 11 sec**	**18-35 sec**	**60,155**	**240,620**
1.2	**1.2**	**7 - 9.5 sec**	**22-31 sec**	**73,775**	**295,100**
1.5	**1.5**	**4.5 - 7 sec**	**15-22 sec**	**24,970**	**99,880**
2.0	**2.0**	**3.5 - 6 sec**	**12-20 sec**	**11,350**	**45,400**
2.5	**2.5**	**4 - 8 sec**	**13-27 sec**	**7,377**	**29,510**
3.0	**3.0**	**3.5 - 8 sec**	**12-26 sec**	**4,086**	**16,344**
Sink rates tested in freshwater at 54 F					

One pellet at a time

Meal Shape



- Feed input should match ingestion rate
- Fast at beginning / slow towards the end

Gut Evacuation Time

Meal Size and Frequency

Number of Meals
Per Day

Temperature F.	C.	Gut Evacuation time in (hours)	Meals per day
36	2	36	Every 2nd day
41	5	24	1
50	10	12	2
59	15	6	3

Go Pro video provided by Ron Wong, USFWS


The End


Bio-Oregon®
inches
cm
Thank You