Andfjord Production Model

Assumptions:	
FCR:	1.1
TGC:	3
Final weight (gram)	4200
Start weight (gram)	300
Day degrees (implicit from TGC):	3147
#of days (30 per month):	360
Average temperature:	8.7
Day degrees (monthly)/1000:	0.262
# smolts per generation:	944,822
# generations:	6
Production cycle (months):	12
Mortality (growout):	5%
Mortality (monthly)	0.24%
Yearly production (tonnes HOG)	19,000
Weight loss when gutting:	16%
Yearly production (live weight)	22,619
Average harvest weight (kg)	4.2
# of salmon:	5,385,488
# of smolts:	5,668,934

Cost of feed (kg):	12.75

Average price of feed pr. kg.	12.55

↑ Data from FD

$$TGC = \frac{(Final\ weight^{\frac{1}{3}} - Start\ weight^{\frac{1}{3}}) * 1000}{Day\ degrees}$$

$$Final\ weight = (Start\ weight^{\frac{1}{3}} + TGC * \frac{Day\ degrees}{1000})^3$$

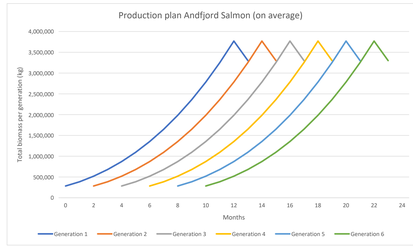
These formulas are retrived from Solheim and Trovatn (2019).

Production plan Andfjord Salmon

	Month beginning:	Weight per fish in grams (W_t)	Weight increase (grams): (W_{t+1} - W_t)	Survival (%)	Number of fish, given survival rate (N):	Biomass increase in kg included mortality ($(W_{t+1} - W_t)*N_t$)/1000	Standing biomass in kg beginning of month: B_t = (N_t*W_t)/1000	FCR:	Feed quantity in kg (Biomass increase * FCR)	Feed cost NOK per month:
Smolt into growout -->		0	300	119	97.50%	944,822	112,127	283,447	1.1	123,340	1,572,587
		1	419	146	99.76%	921,202	134,913	385,685	1.1	148,404	1,892,149
		2	565	177	99.76%	919,029	162,807	519,369	1.1	179,087	2,283,365
		3	742	211	99.76%	916,861	193,247	680,567	1.1	212,571	2,710,286
		4	953	247	99.76%	914,699	226,214	871,753	1.1	248,835	3,172,651
		5	1200	287	99.76%	912,541	261,690	1,095,377	1.1	287,859	3,670,202
		6	1487	329	99.76%	910,389	299,657	1,353,866	1.1	329,622	4,202,684
		7	1816	374	99.76%	908,242	340,096	1,649,623	1.1	374,105	4,769,840
		8	2191	423	99.76%	906,100	382,989	1,985,026	1.1	421,288	5,371,417
		9	2613	474	99.76%	903,962	428,318	2,362,429	1.1	471,150	6,007,160
		10	3087	528	99.76%	901,830	476,066	2,784,165	1.1	523,672	6,676,819
		11	3615	585	99.76%	899,703	526,213	3,252,541	1.1	578,835	7,380,142
Harvest -->		12	4200			897,581		3,769,841			

Feed calculation:	
Live weight (kg) at harvest:	3,769,841
HOG weight (kg) at harvest:	3,166,667
Yearly production (kg)	19,000,000
Total feed cost:	49,709,301
Feed per kg HOG:	15.70
Economic FCR:	1.12
Total biomass:	3,486,395
Total feed:	3,898,769

	Generation 1	Generation 2	Generation 3	Generation 4	Generation 5	Generation 6
0	283447					
1	385685					
2	519369	283447				
3	680567	385685				
4	871753	519369	283447			
5	1095377	680567	385685			
6	1353866	871753	519369	283447		
7	1649623	1095377	680567	385685		
8	1985026	1353866	871753	519369	283447	
9	2362429	1649623	1095377	680567	385685	
10	2784165	1985026	1353866	871753	519369	283447
11	3252541	2362429	1649623	1095377	680567	385685
12	3769841	2784165	1985026	1353866	871753	519369
13	3300000	3252541	2362429	1649623	1095377	680567
14		3769841	2784165	1985026	1353866	871753
15		3300000	3252541	2362429	1649623	1095377
16			3769841	2784165	1985026	1353866
17			3300000	3252541	2362429	1649623
18				3769841	2784165	1985026
19				3300000	3252541	2362429
20					3769841	2784165
21					3300000	3252541
22						3769841
23						3300000
24						



Proximar Production Model

Assumptions (hatchery):	
TGC (hatchery)	2.0
Final weight (gram)	100
Start weight (gram)	0.2
Day degrees (implicit from TGC):	2028
#of days (30 per month):	240
Average temperature:	8.5
Day degrees (monthly)/1000:	0.254
#number off eggs	156000
#number of generations	12
Production cycle smolt (months):	8
Mortality (culling)	36%
Mortality (culling monthly)	5.4%

Assumptions (growout):		
FCR:	1.1	
TGC (grow-out):	3	0.33
Weight loss when purging	7%	
Final weight (gram)	5376	
Start weight (gram)	100	
Day degrees (implicit from TGC):	4292	
#of days (30 per month):	330	
Average temperature:	13.0	
Day degrees (monthly)/1000:	0.390	
# smolts per generation:	100072	
# generations:	12	
Production cycle growout (months):	11	
Mortality (growout):	3%	
Mortality (growout monthly)	0.1%	
Yearly production (tonnes HOG)	5300	
Weight loss when gutting:	9%	
Yearly production (live weight)	5824	
Average harvest weight (kg)	5	
# of salmon:	1,164,835	
# of smolts:	1,200,861	

Cost of feed (kg):	12.8

Average price of feed pr. kg.	12.55

↑
Data from FD

$$TGC = \frac{(Final\ weight^{\frac{1}{3}} - Start\ weight^{\frac{1}{3}}) * 1000}{Day\ degrees}$$

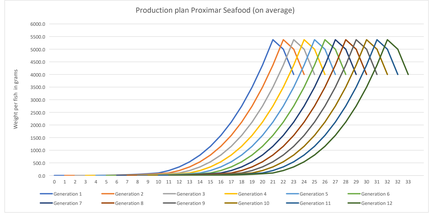
$$Final\ weight = (Start\ weight^{\frac{1}{3}} + TGC * \frac{Day\ degrees}{1000})^3$$

These formulas are retrived from Solheim and Trovatn (2019).

Production plan Proximar Seafood

	Month beginning:	Weight per fish in grams (Wk)	Weight increase (grams): (W_{k+1} - W_k)	Survival (%)	Number of fish, given survival rate (N_k):	Biomass increase in kg included mortality ($(W_{k+1}$ - $W_k)*N_k)/1000$	Standing biomass in kg beginning of month: B_k = $(N_k*W_k)/1000$	FCR:	Feed quantity in kg (Biomass increase * FCR)	Feed cost NOK per month:
Introduction of eggs -->	2	0.20	1	94.60%	156,000	172	31	1.1	189	2,420
	3	1.30	3	94.60%	147,578	411	192	1.1	452	5,790
	4	4.09	5	94.60%	139,612	733	571	1.1	807	10,327
	5	9.34	9	94.60%	132,075	1,123	1,234	1.1	1,235	15,812
	6	17.84	13	94.60%	124,945	1,566	2,230	1.1	1,723	22,052
	7	30.38	17	94.60%	118,200	2,051	3,591	1.1	2,256	28,873
	8	47.73	23	94.60%	111,819	2,566	5,337	1.1	2,822	36,126
	9	70.68	29	94.60%	105,782	3,102	7,476	1.1	3,412	43,677
Transfer from hatchery to grow-out -->	10	100.00	96	98.50%	100,072	9,642	10,007	1.1	10,606	135,754
	11	196.35	144	99.86%	98,571	14,208	19,354	1.1	15,628	200,043
	12	340.48	202	99.86%	98,433	19,839	33,515	1.1	21,823	279,336
	13	542.03	269	99.86%	98,296	26,401	53,280	1.1	29,041	371,729
	14	810.62	345	99.86%	98,159	33,890	79,570	1.1	37,279	477,167
	15	1155.88	432	99.86%	98,022	42,301	113,301	1.1	46,531	595,594
	16	1587.42	527	99.86%	97,886	51,630	155,385	1.1	56,793	726,955
	17	2114.87	633	99.86%	97,749	61,875	206,727	1.1	68,062	871,196
	18	2747.87	748	99.86%	97,613	73,030	268,227	1.1	80,333	1,028,262
	19	3496.03	873	99.86%	97,477	85,092	340,782	1.1	93,601	1,198,099
	20	4368.98	1007	99.86%	97,341	98,058	425,280	1.1	107,863	1,380,651
	21	5376.34	-376	99.86%	97,205	(36,583)	522,608			
Harvest -->	22	5000.00			97,070		485,348			

Feed calculation:	
Live weight (kg) at harvest:	485,348
HOG weight (kg) at harvest:	441,667
Yearly production (kg)	5,300,000
Total feed cost:	7,429,866
Feed per kg HOG:	16.82
Economic FCR:	1.1
Total biomass:	522,577
Total feed:	580,458



Biomass development plan

	Generation 1	Generation 2	Generation 3	Generation 4	Generation 5	Generation 6	Generation 7	Generation 8	Generation 9	Generation 10	Generation 11	Generation 12
0	0.0											
1	0.1	0.0										
2	0.2	0.1	0.0									
3	1.3	0.2	0.1	0.0								
4	4.1	1.3	0.2	0.1	0.0							
5	9.3	4.1	1.3	0.2	0.1	0.0						
6	17.8	9.3	4.1	1.3	0.2	0.1	0.0					
7	30.4	17.8	9.3	4.1	1.3	0.2	0.1	0.0				
8	47.7	30.4	17.8	9.3	4.1	1.3	0.2	0.1	0.0			
9	70.7	47.7	30.4	17.8	9.3	4.1	1.3	0.2	0.1	0.0		
10	100.0	70.7	47.7	30.4	17.8	9.3	4.1	1.3	0.2	0.1	0.0	
11	196.3	100.0	70.7	47.7	30.4	17.8	9.3	4.1	1.3	0.2	0.1	0.0
12	340.5	196.3	100.0	70.7	47.7	30.4	17.8	9.3	4.1	1.3	0.2	0.1
13	542.0	340.5	196.3	100.0	70.7	47.7	30.4	17.8	9.3	4.1	1.3	0.2
14	810.6	542.0	340.5	196.3	100.0	70.7	47.7	30.4	17.8	9.3	4.1	1.3
15	1155.9	810.6	542.0	340.5	196.3	100.0	70.7	47.7	30.4	17.8	9.3	4.1
16	1587.4	1155.9	810.6	542.0	340.5	196.3	100.0	70.7	47.7	30.4	17.8	9.3
17	2114.9	1587.4	1155.9	810.6	542.0	340.5	196.3	100.0	70.7	47.7	30.4	17.8
18	2747.9	2114.9	1587.4	1155.9	810.6	542.0	340.5	196.3	100.0	70.7	47.7	30.4
19	3496.0	2747.9	2114.9	1587.4	1155.9	810.6	542.0	340.5	196.3	100.0	70.7	47.7
20	4369.0	3496.0	2747.9	2114.9	1587.4	1155.9	810.6	542.0	340.5	196.3	100.0	70.7
21	5376.3	4369.0	3496.0	2747.9	2114.9	1587.4	1155.9	810.6	542.0	340.5	196.3	100.0
22	5000.0	5376.3	4369.0	3496.0	2747.9	2114.9	1587.4	1155.9	810.6	542.0	340.5	196.3
23	4000.0	5000.0	5376.3	4369.0	3496.0	2747.9	2114.9	1587.4	1155.9	810.6	542.0	340.5
24		4000.0	5000.0	5376.3	4369.0	3496.0	2747.9	2114.9	1587.4	1155.9	810.6	542.0
25			4000.0	5000.0	5376.3	4369.0	3496.0	2747.9	2114.9	1587.4	1155.9	810.6
26				4000.0	5000.0	5376.3	4369.0	3496.0	2747.9	2114.9	1587.4	1155.9
27					4000.0	5000.0	5376.3	4369.0	3496.0	2747.9	2114.9	1587.4
28						4000.0	5000.0	5376.3	4369.0	3496.0	2747.9	2114.9
29							4000.0	5000.0	5376.3	4369.0	3496.0	2747.9
30								4000.0	5000.0	5376.3	4369.0	3496.0
31									4000.0	5000.0	5376.3	4369.0
32										4000.0	5000.0	5376.3
33											4000.0	5000.0
												4000.0

Salmon Evolution Production Model

Assumptions:	
FCR:	1.05
TGC:	6
Final weight (gram)	5893
Start weight (gram)	130
Day degrees (implicit from TGC):	4332
#of days (30 per month):	330
Average temperature (implicit):	13.1
Day degrees (monthly)/1000:	0.394
# smolts per generation:	280,000
# generations:	6
Production cycle (months):	11
Mortality (growout):	5%
Mortality (monthly)	0.26%
Yearly production (tonnes HOG)	7,900
Weight loss when gutting:	16%
Yearly production (live weight)	9,405
Average harvest weight (kg)	5,893
# of salmon:	1,596,000
# of smolts:	1,680,000
Cost of feed (kg):	14.56

$$TGC = \frac{(Final\ weight^{\frac{1}{3}} - Start\ weight^{\frac{1}{3}}) * 1000}{Day\ degrees}$$

$$Final\ weight = (Start\ weight^{\frac{1}{3}} + TGC * \frac{Day\ degrees}{1000})^3$$

These formulas are retrived from Solheim and Trovatn (2019).

Production plan Salmon Evolution

	Month beginning:	Weight per fish in grams (W_t)	Weight increase (grams): (W_{t+1} - W_t)	Survival (%)	Number of fish, given survival rate (N_t):	Biomass increase in kg included mortality ($(W_{t+1} - W_t)*N_t)/1000$	Standing biomass in kg beginning of month: $B_t = (N_t*W_t)/1000$	FCR:	Feed quantity in kg (Biomass increase * FCR)	Feed cost NOK per month:
Smolt into growout -->	0	130	114	97.50%	280,000	31,871	36,400	1.05	33,464	487,237
	1	244	166	99.74%	273,000	45,358	66,564	1.05	47,626	693,440
	2	410	228	99.74%	272,292	62,183	111,632	1.05	65,292	950,652
	3	638	300	99.74%	271,585	81,607	173,364	1.05	85,688	1,247,612
	4	939	382	99.74%	270,881	103,611	254,310	1.05	108,792	1,584,005
	5	1321	474	99.74%	270,178	128,174	356,992	1.05	134,582	1,959,518
	6	1796	576	99.74%	269,477	155,275	483,907	1.05	163,038	2,373,840
	7	2372	688	99.74%	268,778	184,894	637,524	1.05	194,139	2,826,662
	8	3060	810	99.74%	268,081	217,012	820,284	1.05	227,862	3,317,676
	9	3869	941	99.74%	267,385	251,607	1,034,605	1.05	264,188	3,846,574
	10	4810	1082	99.74%	266,692	288,661	1,282,876	1.05	303,094	4,413,052
Harvest -->	11	5893			266,000		1,567,460	1.05		

Feed calculation:

Live weight (kg) at harvest:	1,567,460
Control: HOG weight (kg) at harvest:	1,316,667
Yearly production (kg)	7,900,000
Total feed cost:	23,700,268
Feed per kg HOG:	18.00
Economic FCR:	1.06
Total biomass:	1,531,060
Total feed:	1,627,766

	Generation 1	Generation 2	Generation 3	Generation 4	Generation 5	Generation 6	Generation 7
0	36400						
1	66564						
2	111632	36400					
3	173364	66564					
4	254310	111632	36400				
5	356992	173364	66564				
6	483907	254310	111632	36400			
7	637524	356992	173364	66564			
8	820284	483907	254310	111632	36400		
9	1034605	637524	356992	173364	66564		
10	1282876	820284	483907	254310	111632	36400	
11	1567460	1034605	637524	356992	173364	66564	
12	1300000	1282876	820284	483907	254310	111632	36400
13		1567460	1034605	637524	356992	173364	66564
14		1300000	1282876	820284	483907	254310	111632
15			1567460	1034605	637524	356992	173364
16			1300000	1282876	820284	483907	254310
17				1567460	1034605	637524	356992
18				1300000	1282876	820284	483907
19					1567460	1034605	637524
20					1300000	1282876	820284
21						1567460	1034605
22						1300000	1282876
23							1567460
24							1300000