

**Supplementary Table 1.** Supporting references for Table 1. Example interpretations of potential effects of altered traits of GH transgenic coho salmon compared to wild type on survival, reproduction, and ecosystem consequences, based on data available to date. Evidence for stability of phenotypes among environments are also indicated where known. Summed individual phenotypic effects within columns (Net Effect) indicated by a question mark simply reflect the difficulty in summarizing individual traits into a single overall influence. This summary table is intended to provide an example process towards determining potential effects of the pleiotropic influences of a transgene on phenotype that may result in ecological consequences. A formal risk assessment would require a fulsome analysis by an expert panel to reach consensus regarding effects and associated uncertainty for each altered trait.

Trait	Survival	Reproduction	Ecosystem Consequence	Stable among environments	References
<b>Life history effects</b>					
Early hatching	+/-	N	P	No	[9, 34, 55]
Early smolting	+/-	+	P	No	[4, 8, 9, 59]
Maturation age and season	+	+	P	No	[1, 5, 9, 32]
Diurnal effects	-	n/a	n/a	n/a	[25, 59]
Higher fecundity, smaller egg size	-	+/-	NE/P	No	[1]
Seasonally uncoupled growth.	+/-	N	P	No	[4, 9, 33, 38]
<b>Genetics/cell biology</b>					
Altered gene expression	n/a	n/a	n/a	No	[11, 14, 20, 22, 25, 36, 37, 40, 44, 47, 48]
Pituitary function/structure altered	+/-	+/-	P	No	[36]
Altered growth pathway endocrinology	+/-	N	?	No	[8, 11, 15, 19, 23, 36, 44, 45]
Transgene structure stability	+/-	+/-	NE/P	n/a	[35, 42, 46, 62]
<b>Physiology/morphology</b>					
Plastic growth rate	+	n/a	n/a	No	[10, 34, 51, 57-59]
Acromegaly and altered allometry	-	-	n/a	No	[5, 6, 13, 20, 22, 26, 31, 32, 34, 39, 49, 50]
Altered aerobic scope/osmoregulation	+/-	n/a	P	n/a	[8, 27, 28, 61]
Poorer swimming	-	-	P	n/a	[16, 27]
Reduced innate immune function	-	-	P	n/a	[21]
Acquired immune function normal	N	N	NE	n/a	[21, 24]
Altered stress response	+/-	n/a	n/a	n/a	[3, 21, 29, 51]
Sperm function	N	N	NE	n/a	[1, 17]
Effects of triploidy	-	-	NE/P	n/a	[9, 12, 14]
Enhanced feed-conversion efficiency	+	n/a	P	No	[9, 19, 38, 43]

Altered metabolic pathways	+/-	N	n/a	No	[2, 15, 29, 30, 41]
Altered response to nutrition/dietary carbohydrate	+/-	n/a	n/a	No	[18, 19, 38, 43]
Altered body colouration	-	-	n/a	No	[1, 6, 31]
<b>Behaviour</b>					
Enhanced feeding behaviour	+	n/a	P	No	[7, 10, 34, 35, 51, 52, 53, 58]
Predator susceptibility	N/-	n/a	P	No	[51, 52, 54, 55, 63]
Altered spawning behaviour	N	-	P	No	[1, 17, 32]
Increased juvenile aggression	+	n/a	P	No	[10]
Decreased mature adult aggression	N	-	NE	No	[1, 32]
Altered dispersal/migration	+	+	P	No	[51, 55, 56, 59]
Broader prey type selection	+	N	P	n/a	[53]
Reduced schooling/shoaling	-	-	NE/P	n/a	[56]
Enhanced cannibalistic behaviour	-	N	P	No	[10]
Invasion impacts	+	n/a	NE/P	n/a	[57, 58, 60]
<b>Net effect</b>	?	?	?	?	

Symbols: +, increased/higher survival or reproduction due to trait relative to wild type; -, reduced/lower survival or reproduction due to trait relative to wild type; N, neutral or no effect on survival, reproduction, or ecosystem consequences due to trait; n/a; unknown or no data available; P, probable ecological consequence; NE, not expected ecological consequence.

## References

1. Bessey C, Devlin RH, Liley NR, Biagi CA. 2004. Reproductive performance of growth-enhanced transgenic coho salmon. *Transactions of the American Fisheries Society* 133: 1205-1220.
2. Blier PU, Lemieux H, Devlin RH. 2002. Is the growth rate of fish set by digestive enzymes or metabolic capacity of the tissues? Insight from transgenic coho salmon. *Aquaculture* 209: 379-384.
3. Carney Almroth B, Johnsson JI, Devlin RH, Sturve J. 2012. Oxidative stress in growth hormone transgenic coho salmon with compressed life span - a model for addressing aging. *Free Radical Research* 46: 1183-1189.
4. Devlin RH, Yesaki TY, Biagi CA, Donaldson EM, Swanson P, Chan W-K. 1994. Extraordinary salmon growth. *Nature* 371: 209-210.
5. Devlin RH, Yesaki TY, Donaldson EM, Du SJ, Hew CL. 1995. Production of germline transgenic Pacific salmonids with dramatically increased growth performance. *Canadian Journal of Fisheries and Aquatic Sciences* 52: 1376-1384.
6. Devlin RH, Yesaki TY, Donaldson EM, Hew CL. 1995. Transmission and phenotypic effects of an antifreeze/GH gene construct in coho salmon (*Oncorhynchus kisutch*). *Aquaculture* 137: 161-169.
7. Devlin RH, Johnsson JI, Smailus DE, Biagi CA, Jönsson E, Björnsson BT. 1999. Increased ability to compete for food by growth hormone-transgenic coho salmon, *Oncorhynchus kisutch* (Walbaum). *Aquaculture Research* 30: 479-482.
8. Devlin RH, Swanson P, Clarke WC, Plisetskaya E, Dickhoff W, Moriyama S, Yesaki TY, Hew CL. 2000. Seawater adaptability and hormone levels in growth-enhanced transgenic coho salmon, *Oncorhynchus kisutch*. *Aquaculture* 191: 367-385.

9. Devlin RH, Biagi CA, Yesaki TY. 2004. Growth, viability and genetic characteristics of GH transgenic coho salmon strains. *Aquaculture* 236: 607-632.
10. Devlin RH, D'Andrade M, Uh M, Biagi CA. 2004. Population effects of growth hormone transgenic coho salmon depend on food availability and genotype by environment interactions. *Proceedings of the National Academy of Sciences of the United States of America* 101: 9303-9308.
11. Devlin RH, Sakhrani D, Tymchuk WE, Rise ML, Goh B. 2009. Domestication and growth hormone transgenesis cause similar changes in gene expression in coho salmon (*Oncorhynchus kisutch*). *Proceedings of the National Academy of Sciences of the United States of America* 106: 3047-3052.
12. Devlin RH, Sakhrani D, Biagi CA, Eom K-W. 2010. Occurrence of incomplete paternal-chromosome retention in GH-transgenic coho salmon being assessed for reproductive containment by pressure-shock-induced triploidy. *Aquaculture* 304: 66-78.
13. Devlin RH, Vandersteen WE, Uh M, Stevens ED. 2012. Genetically modified growth affects allometry of eye and brain in salmonids. *Canadian Journal of Zoology* 90: 193-202.
14. Devlin RH, Sakhrani D, Biagi CA, Smith JL, Fujimoto T, Beckman B. 2014. Growth and endocrine effect of growth hormone transgene dosage in diploid and triploid coho salmon. *General and Comparative Endocrinology* 196: 112-122.
15. Eales JG, Devlin R, Higgs DA, McLeese JM, Oakes JD, Plohman J. 2004. Thyroid function in growth-hormone-transgenic coho salmon (*Oncorhynchus kisutch*). *Canadian Journal of Zoology* 82: 1225-1229.
16. Farrell AP, Bennett W, Devlin RH. 1997. Growth-enhanced transgenic salmon can be inferior swimmers. *Canadian Journal of Zoology* 75: 335-337.
17. Fitzpatrick JL, Akbarashandiz H, Sakhrani D, Biagi CA, Pitcher TE, Devlin RH. 2011. Cultured growth hormone transgenic salmon are reproductively out-competed by wild-reared salmon in semi-natural mating arenas. *Aquaculture* 312: 185-191.
18. Friesen EN, Higgs DA, Devlin RH. 2015. Flesh nutritional content of growth hormone transgenic and non-transgenic coho salmon compared to various species of farmed and wild salmon. *Aquaculture* 437: 318-326.
19. Higgs DA, Sutton JN, Kim H, Oakes JD, Smith J, Biagi C, Rowshandeli M, Devlin RH. 2009. Influence of dietary concentrations of protein, lipid and carbohydrate on growth, protein and energy utilization, body composition, and plasma titres of growth hormone and insulin-like growth factor-1 in non-transgenic and growth hormone transgenic coho salmon, *Oncorhynchus kisutch* (Walbaum). *Aquaculture* 286: 127-137.
20. Hill JA, Kiessling A, Devlin RH. 2000. Coho salmon (*Oncorhynchus kisutch*) transgenic for a growth hormone gene construct exhibit increased rates of muscle hyperplasia and detectable levels of differential gene expression. *Canadian Journal of Fisheries and Aquatic Sciences* 57: 939-950.
21. Jhingan E, Devlin RH, Iwama GK. 2003. Disease resistance, stress response and effects of triploidy in growth hormone transgenic coho salmon. *Journal of Fish Biology* 63: 806-823.
22. Johnston IA, Garcia de la serrana D, Devlin RH. 2014. Muscle fibre size optimisation provides flexibility for energy budgeting in calorie-restricted coho salmon transgenic for growth hormone. *Journal of Experimental Biology* 217: 3392-3395.
23. Kang DY, Devlin RH. 2004. Effects of 3,5,3'-triiodo-L-thyronine (T3) and 6-n-propyl-2-thiouracil (PTU) on growth of GH-transgenic coho salmon, *Oncorhynchus kisutch*. *Fish Physiology and Biochemistry* 29: 77-85.
24. Kim J-H, Balfry S, Devlin RH. 2013. Disease resistance and health parameters of growth-hormone transgenic and wild-type coho salmon, *Oncorhynchus kisutch*. *Fish & Shellfish Immunology* 34: 1553-1559.
25. Kim J-H, White, SL, Devlin, RH. 2014. Interaction of growth hormone overexpression and nutritional status on pituitary gland clock gene expression in coho salmon, *Oncorhynchus kisutch*. *Chronobiology International* 32: 113-127.
26. Kotrschal A, Sundström LF, Brelin D, Devlin RH, Kolm N. 2012. Inside the heads of David and Goliath: environmental effects on brain morphology among wild and growth-enhanced salmon. *Journal of Fish Biology* 81: 987-1002.

27. Lee CG, Devlin RH, Farrell AP. 2003. Swimming performance, oxygen consumption and excess post-exercise oxygen consumption in adult transgenic and ocean-ranched coho salmon. *Journal of Fish Biology* 62: 753-766.
28. Leggatt RA, Devlin RH, Farrell AP, Randall DJ. 2003. Oxygen uptake of growth hormone transgenic coho salmon during starvation and feeding. *Journal of Fish Biology* 62: 1053-1066.
29. Leggatt RA, Brauner CJ, Iwama GK, Devlin RH. 2007. The glutathione antioxidant system is enhanced in growth hormone transgenic coho salmon (*Oncorhynchus kisutch*). *Journal of Comparative Physiology B* 177: 413-422.
30. Leggatt RA, Raven PA, Mommsen TP, Sakhrani D, Higgs D, Devlin RH. 2009. Growth hormone transgenesis influences carbohydrate, lipid and protein metabolism capacity for energy production in coho salmon (*Oncorhynchus kisutch*). *Comparative Biochemistry and Physiology B* 154: 121-133.
31. Leggatt RA, Biagi CA, Smith JL, Devlin RH. 2012. Growth of growth hormone transgenic coho salmon *Oncorhynchus kisutch* is influenced by construct promoter type and family line. *Aquaculture* 356: 193-199.
32. Leggatt RA, Hollo T, Vandersteen WE, McFarlane K, Goh B, Prevost J, Devlin RH. 2014. Rearing in seawater mesocosms improves the spawning performance of growth hormone transgenic and wild-type coho salmon. *PloS One* 9: e105377
33. Löhmus M, Raven PA, Sundström LF, Devlin RH. 2008. Disruption of seasonality in growth hormone-transgenic coho salmon (*Oncorhynchus kisutch*) and the role of cholecystokinin in seasonal feeding behavior. *Hormones and Behavior* 54: 506-513.
34. Löhmus M, Sundström LF, Björklund M, Devlin RH. 2010. Genotype-temperature interaction in the regulation of development, growth, and morphometrics in wild-type, and growth-hormone transgenic coho salmon. *PloS One* 5: e9980.
35. Masri S, Rast H, Ripley T, James D, Green M, Jia X, Devlin RH. 2002. Detection of genetically modified coho salmon using polymerase chain reaction (PCR) amplification. *Journal of Agricultural and Food Chemistry* 50: 3161-3164.
36. Mori T, Devlin RH. 1999. Transgene and host growth hormone gene expression in pituitary and nonpituitary tissues of normal and growth hormone transgenic salmon. *Molecular and Cellular Endocrinology*. 149: 129-139.
37. Nakano T, Shoji Y, Shirakawa H, Suda Y, Yamaguchi T, Sato M, Devlin RH. 2011. Daily expression patterns of growth-related genes in growth hormone transgenic coho salmon, *Oncorhynchus kisutch*. *La mer* 49: 111-117.
38. Oakes JD, Higgs DA, Eales JG, Devlin RH. 2007. Influence of ration level on the growth performance and body composition of non-transgenic and growth-hormone-transgenic coho salmon (*Oncorhynchus kisutch*). *Aquaculture* 265: 309-324.
39. Ostefeld TH, McLean E, Devlin RH. 1998. Transgenesis changes body and head shape in Pacific salmon. *Journal of Fish Biology* 52: 850-854.
40. Overturf K, Sakhrani D, Devlin RH. 2010. Expression profile for metabolic and growth-related genes in domesticated and transgenic coho salmon (*Oncorhynchus kisutch*) modified for increased growth hormone production. *Aquaculture* 307: 111-122.
41. Panserat S, Kamalam BS, Fournier J, Plagnes-Juan E, Woodward K, Devlin RH. 2014. Glucose metabolic gene expression in growth hormone transgenic coho salmon. *Comparative Biochemistry and Physiology A* 170: 38-45.
42. Phillips RB, Devlin RH. Integration of growth hormone gene constructs in transgenic strains of coho salmon (*Oncorhynchus kisutch*) at centromeric or telomeric sites. *Genome* 53: 79-82.
43. Raven PA, Devlin RH, Higgs DA. 2006. Influence of dietary digestible energy content on growth, protein and energy utilization and body composition of growth hormone transgenic and non-transgenic coho salmon (*Oncorhynchus kisutch*). *Aquaculture* 254: 730-747.
44. Raven PA, Uh M, Sakhrani D, Beckman BR, Cooper K, Pinter J, Leder EH, Silverstein J, Devlin RH. 2008. Endocrine effects of growth hormone overexpression in transgenic coho salmon. *General and Comparative Endocrinology* 159: 26-37.
45. Raven PA, Sakhrani D, Beckman B, Neregård L, Sundström LF, Björnsson BT, Devlin RH. 2012. Growth and endocrine effects of recombinant bovine growth hormone treatment in non-transgenic and growth hormone transgenic coho salmon. *General and Comparative Endocrinology* 177: 143-152.

46. Rehbein H, Devlin RH, Rüggeberg H. 2002. Detection of a genetic alteration and species identification of coho salmon (*Oncorhynchus kisutch*): a collaborative study. *European Food Research and Technology* 214: 352-355.
47. Rise ML, Douglas SE, Sakhrani D, Williams J, Ewart KV, Rise M, Davidson WS, Koop BF, Devlin RH. 2006. Multiple microarray platforms utilized for hepatic gene expression profiling of GH transgenic coho salmon with and without ration restriction. *Journal of Molecular Endocrinology* 37: 259-282.
48. Roberts SB, McCauley LAR, Devlin RH, Goetz FW. 2004. Transgenic salmon overexpressing growth hormone exhibit decreased myostatin transcript and protein expression. *Journal of Experimental Biology* 207: 3741-3748.
49. Stevens ED, Devlin RH. 2000. Intestinal morphology in growth hormone transgenic coho salmon. *Journal of Fish Biology* 56: 191-195.
50. Stevens ED, Devlin RH. 2005. Gut size in GH-transgenic coho salmon is enhanced by both the GHtransgene and increased food intake. *Journal of Fish Biology* 66: 1633-1648.
51. Sundström LF, Devlin RH. 2011. Increased intrinsic growth rate is advantageous even under ecologically stressful conditions in coho salmon (*Oncorhynchus kisutch*). *Evolutionary Ecology* 25: 447-460.
52. Sundström LF, Devlin RH, Johnsson JI, Biagi CA. 2003. Vertical position reflects increased feeding motivation in growth hormone transgenic coho salmon (*Oncorhynchus kisutch*). *Ethology* 109: 701-712.
53. Sundström LF, Löhmus M, Devlin RH, Johnsson JI, Biagi CA, Bohlin T. 2004. Feeding on profitable and unprofitable prey: Comparing behaviour of growth-enhanced transgenic and normal coho salmon (*Oncorhynchus kisutch*). *Ethology* 110: 381-396.
54. Sundström LF, Löhmus M, Johnsson JI, Devlin RH. 2004. Growth hormone transgenic salmon pay for growth potential with increased predation mortality. *Proceedings of the Royal Society B: Biological Sciences* 271: S350-S352.
55. Sundström LF, Löhmus M, Devlin RH. 2005. Selection on increased intrinsic growth rates in coho salmon, *Oncorhynchus kisutch*. *Evolution* 59: 1560-1569.
56. Sundström LF, Löhmus M, Johnsson JI, Devlin RH. 2007. Dispersal potential is affected by growth-hormone transgenesis in coho salmon (*Oncorhynchus kisutch*). *Ethology* 113: 403-410.
57. Sundström LF, Löhmus M, Tymchuk WE, Devlin RH. 2007. Gene-environment interactions influence ecological consequences of transgenic animals. *Proceedings of the National Academy of Sciences of the United States of America* 104: 3889-3894.
58. Sundström LF, Tymchuk WE, Löhmus M, Devlin RH. 2009. Sustained predation effects of hatchery-reared transgenic coho salmon *Oncorhynchus kisutch* in semi-natural environments. *Journal of Applied Ecology* 46: 762-769.
59. Sundström LF, Löhmus M, Devlin RH. 2010. Migration and growth potential of coho salmon smolts: implications for ecological impacts from growth-enhanced fish. *Ecological Applications* 20: 1372-1383.
60. Sundström LF, Vandersteen WE, Löhmus M, Devlin RH. 2014. Growth-enhanced coho salmon invading other salmon species populations: effects on early survival and growth. *Journal of Applied Ecology* 51: 82-89.
61. Sundt-Hansen L, Sundström LF, Einum S, Hindar K, Fleming IA, Devlin RH. 2007. Genetically enhanced growth causes increased mortality in hypoxic environments. *Biology Letters* 3: 165-168.
62. Uh M, Khattra J, Devlin RH. 2006. Transgene constructs in coho salmon (*Oncorhynchus kisutchx*) are repeated in a head-to-tail fashion and can be integrated adjacent to horizontally-transmitted parasite DNA. *Transgenic Research* 15: 711-727.
63. Vandersteen Tymchuk WE, Abrahams MV, Devlin RH. 2005. Competitive ability and mortality of growth-enhanced transgenic coho salmon fry and parr when foraging for food. *Transactions of the American Fisheries Society* 134: 381-389.