

Cambios fisiológicos en salmones de cultivo con nefrocalcinosis

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- C. Klykken, L. Boissonnot, L. Lunde, S. Stensby-Skjærvik, Forekomst av nefrokalsinose hos oppdrettslaks i Midt-Norge (2020).
A. Tepeler, B. Turna, Stone analysis (2017). doi:10.1007/978-1-4471-4348-2-22.
H. M. Thomsen, Forekomst av nefrokalsinose hos atlantisk laks (*Salmo salar* L.) og regnbueørret (*Oncorhynchus mykiss*); et klinisk studie (2019).
F. Fazio, Fish hematology analysis as an important tool of aquaculture: A review, *Aquaculture* 500 (2019) 237–242. doi:10.1016/j.aquaculture.2018.10.030.
N. M. Wade, T. D. Clark, B. T. Maynard, S. Atherton, R. J. Wilkinson, R. P. Smullen, R. S. Taylor, Effects of an unprecedented summer heatwave on the growth performance, flesh colour and plasma biochemistry of marine cage-farmed atlantic salmon (*Salmo salar*), *Journal of Thermal Biology* 80 (2019) 64–74. doi:10.1016/j.jtherbio.2018.12.021.
S. Calabrese, T. Nilsen, J. Kolarevic, L. Ebbesson, C. Pedrosa, S. Fivelstad, C. Hosfeld, S. Stefansson, B. Terjesen, H. Takle, C. Martins, H. Sveier, F. Mathisen, A. Imsland, S. Handeland, Stocking density limits for post-smolt atlantic salmon (*Salmo salar* L.) with emphasis on production performance and welfare, *Aquaculture* 468 (2017) 363–370. doi:10.1016/j.aquaculture.2016.10.041.
M. H. Berntssen, G. Rosenlund, B. Garlito, H. Amlund, N. H. Sissener, A. Bernhard, M. Sanden, Sensitivity of atlantic salmon to the pesticide pirimiphos-methyl, present in plant-based feeds, *Aquaculture* 531 (2021) 735825. doi:10.1016/j.aquaculture.2020.735825.
M. B. Knoph, K. Thorud, Toxicity of ammonia to atlantic salmon (*Salmo salar* L.) in seawater - effects on plasma osmolality, ion, ammonia, urea and glucose levels and hematologic parameters, *Comparative Biochemistry and Physiology - A Physiology* 113 (1996) 375–381. doi:10.1016/0300-9629(95)02078-0.
C. Klykken, A. Reed, A. Dalum, R. Olsen, M. Moe, K. Attramadal, L. Boissonnot, Physiological changes observed in farmed atlantic salmon (*Salmo salar* L.) with nephrocalcinosis, *Aquaculture* 554 (2022) 738104. doi:10.1016/j.aquaculture.2022.738104.
K. Béland, E. Wong, J. St-Cyr, S. Lair, High occurrence rate of xanthomatosis and nephrocalcinosis in aquarium-housed Atlantic wolffish *Anarhichas lupus* and spotted wolffish *A. minor*, *Diseases of Aquatic Organisms* 139 (2020) 223–232. doi:10.3354/dao03477.
M. Olszynski, J. Prywer, A. Torzewska, Effect of size and shape of nanosilver particles on struvite and carbonate apatite precipitation, *Crystal Growth and Design* 15 (2015) 3307–3320. doi:10.1021/acs.cgd.5b00425.
P. K. Roy, S. P. Lall, Urinary phosphorus excretion in haddock, *Melanogrammus aeglefinus* (L.) and Atlantic salmon, *Salmo salar* (L.), *Aquaculture* 233 (2004) 369–382. doi:10.1016/j.aquaculture.2003.09.041.
K. R. Friedrichs, K. E. Harr, K. P. Freeman, B. Szladovits, R. M. Walton, K. F. Barnhart, J. Blanco-Chavez, Asvcp reference interval guidelines: determination of de novo reference intervals in veterinary species and other related topics, *Veterinary Clinical Pathology* 41 (2012) 441–453. doi:10.1111/vcp.12006.
K. Sandnes, O. Lie, R. Waagbo, Normal ranges of some blood chemistry parameters in adult farmed Atlantic salmon, *Salmo salar*, *Journal of Fish Biology* 32 (1988) 129–136. doi:10.1111/j.1095-8649.1988.tb05341.x.
M. A. Matsche, J. Arnold, E. Jenkins, H. Townsend, K. Rosemary, Determination of hematology and plasma chemistry reference intervals for 3 populations of captive Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), *Veterinary Clinical Pathology* 43 (2014) 387–396. doi:10.1111/vcp.12174.
H. Peres, B. Costas, A. Perez-Jimenez, I. Guerreiro, A. Oliva-Teles, Reference values for selected hematological and serum biochemical parameters of Senegalese sole (*Solea senegalensis* kaup, 1858) juveniles under intensive aquaculture conditions, *Journal of Applied Ichthyology* 31 (2015) 65–71. doi:10.1111/jai.12641.
J. Vielma, S. P. Lall, Control of phosphorus homeostasis of Atlantic salmon (*Salmo salar*) in fresh water, *Fish Physiology and Biochemistry* 19 (1998) 83–93. doi:10.1023/A:1007757321695.
M. Iversen, R. A. Eliassen, The effect of aqua-s® sedation on primary, secondary, and tertiary stress responses during salmon smolt, *Salmo salar* L., transport and transfer to sea, *Journal of the World Aquaculture Society* 40 (2009) 216–225. doi:10.1111/j.1749-7345.2009.00244.x.
M. J. Bijvelds, J. A. V. D. Velden, Z. I. Kolar, G. Flik, Magnesium transport in freshwater teleosts, *Journal of Experimental Biology* 201 (1998) 1981–1990.