

## **Dr. Santosh P. Lall**

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### **EDUCATION**

B. Sc. (Agr.), Allahabad University, India  
M. Sc., Ph.D. (Nutrition), University of Guelph, Ontario, Canada

### **PROFESSIONAL EXPERIENCE**

*Principal Research Officer* (July 2000-to present), *Group Leader*, Aquatic Animal Health & Nutrition (June 2005-to present), *Group Leader*, Aquaculture Biotechnology (Dec.1998- March 2001) & *Senior Research Officer* (Sept.1996- June 2001), Institute for Marine Biosciences, National Research Council of Canada, Halifax.

*Head, Fish Health & Nutrition Section* (1994-96) & Research Scientist (1974-96), Aquaculture Division, Department of Fisheries and Oceans, Halifax, Nova Scotia.

#### ***Adjunct Professor***

- Biology Department (July1990 – present), Dalhousie University, Halifax, N. S.
- Food Science Department (1993- present), Technical University of Nova Scotia/Daltech, Halifax, N. S.
- Animal Science Department (July1993 -present), Nova Scotia Agriculture College, Truro, N. S.
- Atlantic Veterinary College (April 1989 – present), University of Prince Edward Island, Charlottetown, P.E.I.
- Honorary Research Associate, School of Graduate Studies, (November 2001 to present), University of New Brunswick, Fredericton, N.B.

### **ACHIEVEMENTS**

I have undertaken and directed research in support of aquaculture and fish nutrition since 1974, with emphasis on salmonids and marine fish. I have worked closely with Aquaculture industry in Canada and abroad. A major research effort has been also directed in characterization of nutritional deficiency diseases under laboratory and field conditions. Developed diets for more than 10 fish species. I have also served on several region, national and international review and advisory committees in the past two decades.

## **Awards**

- Research Award of Excellence (2000) – Aquaculture Association of Canada.
- Merit Award for Technology Transfer (1993) – Minister's award, Department of Fisheries and Oceans.

## **PROFESSIONAL AFFILIATIONS**

### **Membership**

- Canadian Society for Nutritional Sciences & Canadian Federation of Biological Societies
- Comparative Nutrition Society
- World Aquaculture Society
- Aquaculture Association of Canada
- Nova Scotia Institute of Science

### **Committees**

- Chairman, Fish nutrition subcommittee (2001- present), formerly Int'l Union of Nutritional Sciences.
- Advisory Committee, Aquaculture Protein Center, Ås, Norway (2007-)
- Expert Reviewer, European Union, Brussels, Belgium (2007-)
- Committee on Minerals and Toxic Substances in Diets and Waters for Animals (2003-2005), National Research Council, National Academy of Sciences, Washington D.C.
- *Ad hoc* subcommittee on the use of fish in research, teaching and testing (1997-2005), Canadian Council on Animal Care.
- International Review Committee (1996-97), Norwegian Research Council's Aquaculture Programs (PAL, AQUAFORSK), Oslo, Norway.
- Int'l Program and Res Rev Committees (several from 1990-present)

### **Editorial Board**

Aquaculture Nutrition, Blackwell Science, UK

Area Editor, Encyclopedia of Farm Animal Nutrition, CABI Publishing, UK

Suisanzoshoku, Japan Aquaculture Society, Japan

## **RECENT PUBLICATIONS**

### ***Invited chapters in books***

- Lall, S.P. 2007. Metabolic and Nutritionally-Related Disorders. *In*: J.F. Leatherland and P.T.K. Woo (eds.), Fish Diseases and Disorders, 2<sup>nd</sup> ed., CABI International, Wallingford, Oxon, U.K. (submitted).
- Lall S. P. 2007. Comparative mineral nutrition of fish sources and requirements. Pp 387-391. *In*: Nutritional Biotechnology in the Feed and Food Industries, proceedings of Alltech's 23<sup>rd</sup> symposium, Nottingham University Press, Nottingham, U.K.
- Lall, S.P. 2002. Mineral Nutrition. Pp 260-308. *In*: J.E. Halver and R.W. Hardy (eds.), Fish Nutrition, 3<sup>rd</sup> ed., Academic Press, San Diego, USA.
- Ackman, R.G., Parazo, M.P. and Lall, S.P. 1998. Impact of dietary peroxides and tocopherols on fillet flavor of farmed Atlantic salmon. Pp 148-165. *In* Flavors and Lipid Chemistry of

Seafoods, F. Shahidi and K. R. Cadwallader (eds.), American Chemical Society, Washington, D. C.

Lall, S.P. 1994. Minerals in fish and shellfish. Pp. 187-213. *In* A. Ruiter (ed.), Fish and Fishery Products. CAB International, Wallingford, Oxon, U. K.

Lall, S.P. and Parazo, M.P. 1994. Vitamins in fish and shellfish. p. 157-186. *In* A. Ruiter (ed.), Fish and Fishery Products. CAB International, Wallingford, Oxon, U. K.

#### **Refereed journals** (last 7 years)

Lall, S.P. and Lewis-McCrea, L.M. 2007. Role of nutrients in skeletal development in fish – An overview. *Aquaculture* 267: 3-19.

Lewis-McCrea, L. M. and Lall, S. P. 2007. Effects of moderately oxidized dietary lipid and the role of vitamin E on the development of skeletal abnormalities in juvenile Atlantic halibut (*Hippoglossus hippoglossus*). *Aquaculture* 262: 142-155.

Martins, D. A., Valente, L. M. P., and Lall, S.P. 2007. Effects of dietary lipid level on growth and lipid utilization by juvenile halibut (*Hippoglossus hippoglossus*, L.). *Aquaculture* 263: 150-158.

Roy P. K. and Lall S, P. 2007. Vitamin K deficiency inhibits mineralisation and enhances deformity in vertebrae of haddock (*Melanogrammus aeglefinus* L.) *Comp. Biochem. Physiol.* 148: 174-183.

Roy, P. K. and Lall, S. P. 2007. Mineral nutrition of haddock *Melanogrammus aeglefinus* (L.): a comparison of wild and cultured stock. *J. Fish Biol.* 68: 160-1472.

Kim, J-D., Tibbetts, S.M., Milley, J.E., and Lall, S.P. 2007. Effect of the incorporation level of dehulled soybean meal into test diet on apparent digestibility coefficients for protein and energy by juvenile haddock, *Melanogrammus aeglefinus* L. *Aquaculture*, 267:308-314.

Kim, J-D., Tibbetts, S.M., Milley, J.E., and Lall, S.P. 2006. Effect of the incorporation level of herring meal into test diet on apparent digestibility coefficients for protein and energy by juvenile haddock, *Melanogrammus aeglefinus* L. *Aquaculture* 258: 479-486

Lewis, L. M. and Lall, S. P. 2006. Development of axial skeleton and skeletal abnormalities of Atlantic halibut (*Hippoglossus hippoglossus*) from first feeding through metamorphosis. *Aquaculture* 257: 124-135.

Matthews, S.J., Ross, N.W., Lall, S.P., and Gill, T.A. Gill. 2006. Astaxanthin binding protein in Atlantic salmon. *Comparative Biochemistry and Physiology*, 144B: 206–214.

Nanton D.A., Lall S.P. and McNiven M.A., 2006. Serum lipoproteins in juvenile haddock, *Melanogrammus aeglefinus*. *Aquaculture Nutrition* 12: 363–371

Roy, P. K. and Lall, S. P. 2006. Mineral nutrition of haddock *Melanogrammus aeglefinus* (L.): a comparison of wild and cultured stock. *J. Fish Biol.* 68: 160-1472.

Saha, M.R., Lall, S.P., Ross, N.W., and Lall, S.P. 2006. Astaxanthin binding to solubilized muscle proteins of Atlantic salmon (*Salmo salar* L.), haddock (*Melanogrammus aeglefinus* L.) and Atlantic halibut (*Hippoglossus hippoglossus* L.). *Comparative Biochemistry and Physiology* 144B: 488-495.

Tibbetts, S.M., Milley, J. E., and Lall, S.P. 2006. Apparent protein and energy digestibility of common and alternative feed ingredients by Atlantic cod, *Gadus morhua* (Linnaeus, 1758). *Aquaculture* 261:1314-1327.

- Jordal, A-E. O., Torstensen, B. E., Tsoi, S., Tocher, D. R., Lall, S. P. and Douglas, S. E. 2005. Dietary Rapeseed Oil Affects the Expression of Genes Involved in Hepatic Lipid Metabolism in Atlantic Salmon (*Salmo salar* L.). *J. Nutrition* 135: 2355-2361.
- Olsen, R. E., Kiessling, A., Milley, J. E., Ross, N. W. and Lall, S. P. 2005. Lipid source, not bile acids, affects absorption of astaxanthin in Atlantic salmon, *Salmo salar*. *Aquaculture* 250: 804-812.
- Saha, M.R., Ross, N.W., Gill, T. A., Olsen, R.E. and Lall, S.P. 2005. Development of a method to assess binding of astaxanthin to Atlantic salmon *Salmo salar* L. muscle proteins. *Aquaculture Research* 36: 336-343.
- Lewis, L. M., Lall, S. P. and Witten, P. E. 2004. Morphological descriptions of the early stages of spine and vertebral development in hatchery-reared larval juvenile Atlantic halibut (*Hippoglossus hippoglossus*). *Aquaculture* 242: 47-59.
- Roy, P. K. and Lall, S. P. 2004. Urinary phosphorus excretion in haddock, *Melanogrammus aeglefinus* (L.) and Atlantic salmon, *Salmo salar* (L.). *Aquaculture* 233:369-382
- Roy, P. K., Lall, S. P. and Harvey-Clarke, C. 2004. A cannulation technique for urine collection from haddock, *Melanogrammus aeglefinus* L. *Aquaculture Research* 35: 87-92.
- Wagner, G. N. and S. K. Balfry, D. A. Higgs, S. P. Lall, A. P. Farrell. 2004. Dietary fatty acid composition affects the repeat swimming performance of Atlantic salmon in seawater. *Comp. Biochem and Physiol.* 137 A: 567-576.
- Roy, P. K., Witten, P. E., Hall, B. K. and Lall, S. P. 2002. Effect of dietary phosphorus on bone growth and mineralization of vertebrae in haddock (*Melanogrammus agelfinus* L). *Fish Physiol. Biochem.* 27:35-48. (Published in 2004).
- Tibbetts, S. M. Lall, S. P. and Milley, J. E. 2004. Apparent digestibility of common feed ingredients by juvenile haddock, *Melanogrammus aeglefinus* L. *Aquaculture Research* 35, 643-651.
- Kim, J. D. and Lall S. P. 2003. Dietary lysine requirement of juvenile yellowtail flounder *Pleuronectes ferrugineus*. *Asian-Aust. J. Anim. Sci.* 16:1777-1781.
- Nanton D.A., Lall S.P., Ross N.W. and McNiven M.A., 2003. Effect of dietary lipid level on fatty acid  $\beta$ -oxidation and lipid composition in various tissues of haddock, *Melanogrammus aeglefinus* L. *Comp. Biochem and Physiol B* 135:95-108.
- Lee, S., Kim, K. and Lall S. P. 2003 Utilization of glucose, maltose, dextrin and cellulose by juvenile flounder (*Paralichthys olivaceus*. *Aquaculture*. 221:427-438.
- Roy, P. K. and Lall, S. P. 2003. Phosphorus requirement of haddock (*Melanogrammus agelfinus*). *Aquaculture*. 221:451-468.
- Kim, J-D., Lall, S.P. and Milley, J.E. 2001. Protein requirement of juvenile haddock (*Melanogrammus agelfinus*). *Aquac. Res.* 32s: 1-7.
- Kim, J.-D. and Lall, S.P., 2001. Effects of dietary protein level on growth and utilization of protein and energy by juvenile haddock (*Melanogrammus agelfinus*). *Aquaculture* 195, 311-319.
- Nanton, D.A., Lall, S.P. and McNiven, M.A. 2001. Effects of dietary lipid on fatty liver condition in juvenile haddock, *Melanogrammus aeglefinus*. *Aquac. Res.* 32s:225-234.
- Tibbetts, S.M., Lall, S.P. and Anderson, D.M., 2001. Optimum dietary ratio of digestible protein and energy for juvenile American eel (*Anguilla rostrata*) fed practical diets. *Aquaculture Nutrition* 7, 213-220.

- Kim, J-D. and Lall, S.P., 2000. Amino acid composition of whole body tissue of Atlantic halibut (*Hippoglossus hippoglossus*), yellowtail flounder (*Pleuronectes ferruginea*) and Japanese flounder (*Paralichthys olivaceus*). *Aquaculture* 187, 367-373.
- Tibbetts, S.M., Lall, S.P. and Anderson, D.M., 2000. Dietary protein requirement of juvenile American eel (*Anguilla rostrata*) fed practical diets. *Aquaculture* 186, 145-155.
- Pustowka, C., McNiven, M.A., Richardson, G.F., Lall, S.P. 2000. Source of dietary lipid affects sperm plasma membrane integrity and fertility in rainbow trout *Oncorhynchus mykiss* (Walbaum) after cryopreservation. *Aquaculture Research* 31, 297-305.
- Vielma, J., Lall, S.P., Koskela, J. and Mattila, P. 1999. Influence of low dietary cholecalciferol intake on phosphorus and trace element metabolism by rainbow trout (*Oncorhynchus mykiss*, Walbaum). *Comp. Biochem. Physiol.* 122:119-128.
- Vielma, J., Ruohonen, K. and Lall, S.P. 1999. Supplemental citric acid and particle size of fish bone meal influence availability of minerals in rainbow trout, *Oncorhynchus mykiss* (Walbaum). *Aquaculture Nutrition*, 5: 65-71.

### **Reviews in Conference Proceedings or technical journals/bulletins**

- Walbourne, C.W. and S.P. Lall. 2006. Effect of Dietary Lipid on Prevalence of Fatty Liver Condition in Juvenile Haddock, *Melanogrammus aeglefinus* L. *AAC Spec. Publ.* 9: 94-96.
- Zhong, Y., S. P. Lall and F. Shahidi. 2006. Effect of oxidized dietary lipid on growth. Muscle and liver quality of Atlantic cod, and the protective role of vitamin E. *AAC Spec. Publ.* 10: 38-39
- Lall, S. P. and Anderson, S. 2005. Amino acid nutrition of salmonids: Dietary requirements and bioavailability. *Proc. Med. Fish Nutrition, Cahiers Options Med.* 63: 73-90.
- Lall, S. P., Nanton, D.A., Tibbetts, S. M., Roy, P. K. and Milley, J. E. 2003. Nutrient requirements and feeding of haddock. *Bull. Aquac. Assoc. Canada Special Publ. No. 7*, pp. 79-86.
- Lall, S.P. and Kaushik, S.J. 2003. Current Issues in Fish and Shellfish Nutrition. *Forum of Nutrition (formerly Bib. Nutr. Diet., Karger, Basel)*, 56: 340-343.
- Lall, S. P. and Nanton, D.A. 2002. Nutrition of Atlantic cod. *Bull. Aquac. Assoc. Canada*, 102-1:23-26.
- Lall, S.P. 2001. Dietary lipids, immune function and pathogenesis of diseases in fish. Pp. 150-158. *Proc. Eastern Nutr. Conf., Feed Industry Association, Ottawa.*
- Hardy, R.W., Higgs, D. A. and Lall, S.P., Tacon, A.J. 2001. Alternative dietary protein and lipid sources for sustainable production of salmonids. *Fisken og Havet Nr. 8 – 2001, Bergen Norway.*
- Lall, S.P., 2001. Phosphorus in Fish Nutrition. *International Aqua Feed*, 2001 (1), 26-29.
- Lall, S.P. 2000. Nutrition and health of fish. In: Cruz-Suárez, L.E., Ricque-Marie, D., Tapia-Salazar, M., Olvera-Novoa, M.A., Civera-Cerecedo, R. (Eds.). *Avances en Nutrición Acuícola V. Memorias del V Simposium Internacional de Nutrición Acuícola.* 19-22 Noviembre, 2000. Mérida, Yucatán, Mexico, 13-23.
- Lall, S.P., 2000. Role of Nutrition in Fish Health. *International Aqua Feed Issue* 2000 (2), 10-14.

### **Other Scientific Publications**

National Research Council 2005. Mineral Tolerance of Animals. Washington, DC, National Academy Press. 496p (*Committee publication*).

Canadian Council of Animal Care. 2005. Guidelines on: The care and use of fish in research teaching and testing. CCAC, Ottawa, Canada.86 p (*Committee publication*).