

A Tribute to Dr. Ronald Hardy for his Contribution to Aquaculture Nutrition

L. Elizabeth Cruz Suárez and Denis Ricque

Universidad Autónoma de Nuevo León

Facultad de Ciencias Biológicas/Departamento de Ecología- Programa Maricultura

Av. Universidad S/N, Cd. Universitaria San Nicolás de los Garza, N.L.

C.P. 66450 Tel.fax: 8183 526380 E-mail: lucia.cruzs@uanl.edu.mx

Abstract

Ronald William Hardy was born in 1947 in Vancouver, Canada. He comes from a very academically able Canadian/Scottish family. His grandparents came from Scotland and moved to Vancouver in 1909. In his father's family there were doctors, nurses and also missionaries in Canada near Alaska. Ron's father worked in agriculture communities around Seattle (an expert in poultry science), and used to take his 6 years old son salmon fishing, that was Ron's first connection with salmon and trout. His mother came from a family of Scottish farmers, and then scientists; she was a Microbiologist and worked on tuberculosis. Ron took pre-medicine curriculum for 4 years, receiving his BS in Zoology in 1969 at the University of Washington. He took many jobs, including on farms and railroads, to pay for his college education. In 1970 he married Elizabeth the future mother of his daughters (Anna and Clare). Then in 1973, he obtained a M.S. in Animal Sciences/Nutrition at Washington State University; his thesis subject was "Studies on factors in rye which cause growth depression in chicks". One day at the University Library he found the book of Dr. Halver on fish nutrition and, discovering the important gap in this area with respect to poultry, porcine and bovine nutrition, realized the huge potential of this new activity. Halver's book was his second inspiration... It was at this time that he commenced his life's work on the nutrition of fish, graduating with a PhD in Fisheries at the University of Washington, Seattle (1978). Hardy's PhD dissertation subject was "Effects of dietary protein and pyridoxine levels on growth and disease resistance of chinook salmon", having as mentors Dr. Halver (biochemistry and nutrition) and Dr. Brannon (salmon biology).

Prior to coming to the University of Idaho in 1996, he was a member of the research faculty (assistant to full professor) in the School of Fisheries, University of Washington and concurrently a research scientist for the Northwest Fisheries Science Center, NOAA Fisheries, in Seattle, from 1984 to 1996.

Ron Hardy was appointed Director of the University of Idaho Fish Culture Experiment Station, Hagerman in 1996 (a purpose-built facility in Hagerman, ID, with all the facilities for detailed and accurate nutritional

studies, and with a sufficient water supply to support adequate numbers of test animals and replicates) and a Professor in the Department of Animal and Veterinary Sciences. In 2002 Ron became Director of the Aquaculture Research Institute when Ernie Brannon retired. Ron's laboratory has hosted visiting scientists and students from several countries including; Korea, Germany, China, Norway, Taiwan, U.K., India, Chile, México etc. Dr. Ernie Brannon: "I have always been very impressed with Dr. Hardy. He was an outstanding graduate student, and outstanding nutrition expert at NOAA in Seattle, and he is an outstanding Director of the Hagerman Fish Culture Experiment Station. When the University of Idaho acquired the Hagerman laboratory, Ron was the first person that was sought as head of the Station. When I retired from Director of the Aquaculture Research Institute at the University, there was no question who should take over the Institute responsibilities. Dr. Hardy has taken the program to a new level, and one that only he could have achieved, with world recognition. He has been and is an outstanding asset to the faculty and the University program."

Dr. Hardy is an expert on aquaculture, fish nutrition and feed production technology, authoring over 250 scientific publications, book chapters and popular articles on these topics. He is recognized for his leadership role in fish nutrition research, NRC committees, editorial boards, many societies (e.g. World Aquaculture Society) and other organizations as well as for his role in addressing key nutritional problems of the aquaculture industry.

He is co-author of *Fish Nutrition, 3rd Edition*, one of the leading texts on the topic worldwide. Dr Halver published the 1st Edition in 1972, and then asked Ron to write a chapter for the 2nd edition. This book is the standard text on the subject and has become an essential resource for everyone involved in fish feed formulation, manufacture or research.

He is editor-in-chief of *Aquaculture Research* and serves on the editorial boards of *Aquaculture*, *Aquaculture Nutrition*, *Reviews in Fisheries Sciences* and *Fisheries and Aquatic Sciences*.

Not content to do research, teach, mentor, and supervise, Ron has been a major figure in international science, and he has been honored accordingly. He was elected Secretary and Vice-President of the World Aquaculture Society (WAS) from 1997 to 2001 and 2001-2002, respectively. He was chair of the WAS annual meeting in Seattle in 2009. He served on the Committee on Animal Nutrition, National Research Council, National Academy of Sciences, and more recently was chair of the National Research Council's committee that revised the NRC Bulletin "Nutrient Requirements of Fish and Shrimp." He served a term on the National Agricultural Research, Extension, Education and Economics Advisory Board of the US Department of Agriculture. He is currently chair of the International Scientific Committee on Fish Nutrition and Feeding, which organizes and oversees a bi-annual international symposium (Qingdao, China in 2010, Norway in 2012), and chair of the Western Regional Aquaculture Center board. He received an award in

2011 from the University of Idaho for “Innovations Impacting Society” related to having patented a process to concentrate protein in grains.

Dr. Hardy leads a multi-disciplinary research team involving collaborative partnerships with the USDA/ARS and the Columbia River Inter-Tribal Fish Commission; both of which have scientists located in the University of Idaho’s Hagerman Fish Culture Experiment Station. He is good for negotiations and for getting funds for research. Stickney: “Ron has found the resources to build what was a quality facility into one of the best fish nutrition labs in the United States”. He is very active in his encouragement of staff to aim for high achievement. He is a very dynamic person who inspires others. He has been always a major contributor to University activities. Dr. Santosh Lall: “Ron has certainly demonstrated vision, initiative and commitment in working to develop a successful fish nutrition program at the University of Idaho and Hagerman Fish Culture Experiment Station. He always has a great sense of humor during both good and difficult times”.

His primary interest is in applied research, going to basic research when necessary to solve a specific question; his interests include developing sustainable feed sources for the global aquaculture industry and expanding the use of genomics in fish nutrition research. He has worked extensively on salmon and steelhead hatchery and recovery issues in the Pacific Northwest with state and federal agencies, and Native American Tribes. Although he made contributions to nutrition and feed technology for a wide spectrum of fish species, Hardy’s particular research interest has been in rainbow trout as a model. Dr. John Halver: “His pioneering work on the role of specific nutrients in disease has been extended to cataloging nutrient deficiency signs for vitamin, amino acid, and fatty acid imbalances in fish diets. More recently he has been involved in the ecological problem of imbalance and excess of mineral components of practical diets, and has led research endeavors to minimize these problems”. Dr. I. Forster: “He's well known for his work on developing alternative ingredients, including fisheries byproducts and plant proteins for salmonid feeds”. There is almost nothing in protein alternatives in trout nutrition that Ron didn’t evaluate first. He showed that trout could be fed with whole plant protein feeds without detrimental effects on performance. Concurrently he has focused on trout mineral imbalances, mainly phosphorus, working hard on the solution of problems that were crucial for the regional trout farming industry survival; this led to refine requirements, and gave to him an early conscience that fish nutrition really had to involve physiology, genetics and genomics.

But probably just as important as his research achievements has been his deep commitment to mentoring new researchers. He has supervised numerous PhD students and postdoctoral fellows, who agree that they had an exceptional guide. Ron Hardy has been the mentor of several of the best fish nutritionists in the world. He is admired for his abilities as a scientist and his friendly and helpful approach to his students. Dr. Jacques Gabaudan: “Dr. Hardy has been a mentor and a good friend ever since I met him at the University of Washington where I was a novice MS student trying to cope with the complex world of American

Cruz-Suárez, L. y D. Rique. 2011. Homenaje al Dr. Ronald Hardy por su Contribución en Nutrición Acuícola. En: Cruz-Suárez, L.E., Rique-Marie, D., Tapia-Salazar, M., Nieto-López, M.G., Villarreal-Cavazos, D. A., Gamboa-Delgado, J., Hernández-Hernández, L. (Eds), Avances en Nutrición Acuícola XI - Memorias del Décimo Primer Simposio Internacional de Nutrición Acuícola, 23-25 de Noviembre, San Nicolás de los Garza, N. L., México. ISBN 978-607-433-775-4. Universidad Autónoma de Nuevo León, Monterrey, México, pp. 172-199.

graduate schools. I sought his advice and he generously provided it. Later on I repeatedly went back to him for more help. He always makes time to help, with a smile, a joke and much solid science. I know I owe him a lot so I am happy to have this opportunity to say: thanks Ron!.....”, Dr. Ian Forster: “what I have always admired about Ron as much as his abilities as a scientist, is his friendly and helpful approach to his students and others. I remember more than one student, myself included, who, when things got rough with research or finding our way through the graduate school system, was helped to see a path to success by Ron. I learned from Ron that in addition to taking research seriously, it's important to treat people in a friendly and sincere way”, Dr. Madisson Powell: “Ron has been a great mentor to me back when I began at the University of Idaho as an Assistant Professor. He not only takes the time to help students but really supports and encourages junior colleagues as well”, Dr. Shozo Sugiura: “I was Dr. Hardy's student for five years. --- Probably, the longest one. And, I was Dr. Hardy's most difficult and unmanageable student. --- Probably, the worst one. Now, I guess it is fair to say that Dr. Hardy has outstanding patience, mentorship and diplomatic capability. He is not just a distinguished researcher of fish nutrition, but the finest leader I have ever known”. Dr. Jurij Wacyk: “Thank you for feeding my curiosity and helping me with the tools to explore it...”, Dr. Scott Snyder: “I was a Ph.D. student in his program from 2004-2011, Ron once joked about me being the first graduate student in history to go for tenure due to the amount of time I took to graduate. I was not typical of today's graduate student; I finished my BS in 1991, my MS in 2001 and my PhD in 2011; with aquaculture careers in between each degree. I was a catfish farmer after the BS; and then went to work for the USDA-ARS while working towards both the MS and PhD. So at the ripe old age of 41 and after 20 years of continuously working in the aquaculture industry I graduated with my PhD. I entered Ron's program thinking a little too highly of myself. To make a long story short, Ron quickly demonstrated that I really didn't know nearly as much as I thought, but instead of just knocking me down a few notches, Ron and his fellow staff took it upon themselves to make sure I put the right rungs back in my ladder and helped pull me back up. Anyone can knock you down, but it takes a dedicated advocate and true mentor to pick someone up. If it were not for Ron and his staff I would not be where I am today.”

Ron has travelled extensively consulting, giving lectures and working on behalf of international organizations, including the Food and Agriculture Organization. He has contributed to the development of aquaculture in other countries: in Chile, he was involved in the development of the first salmon feeds, manufactured by Mainstream Fisheries. Ltd, which would be purchased later by Ewos in 1996; in Thailand, he was required in the 1990's by FAO and the government to develop quality standards of feeds and local analytical capacity, and formulate feeds for new species; in China, where most aquaculture was extensive at that time, he was asked by the government to give training seminars to develop feeds for freshwater carnivorous species, and to help the transition from natural food to pelleted feeds; in Mexico, he has collaborated with staff of Silver Cup Feeds company and Alimentos el Pedregal for over 10 years, with Dr. Crisantema Hernández, Ciudad, Mazatlan, and Dr. Cruz and Dr. Ricque, Programa Maricultura UANL, Monterrey; in Scotland, he contributed to the salmon broodstock diets development.

Ron is also someone who has vision, initiative, creates interest in the things that are important to him and he is deeply committed to everything he undertakes. One of his most recent important works has been to be the scientific and administrative leader in the National Academy of Sciences National Research Council program to revise and update the **Nutrient Requirements of Fish and Shrimp**, which is now being used as the standard reference source for fish and shrimp dietary formulations. Dr. John Halver: “Merging together the opinions of recognized nutritionists from seven countries into the final recommendations of requirements, and then nutrient research needs for the future, is a reflection of his mature and effective ability to identify the problem to be solved, and then organize and supervise the input from needed sources to accomplish this task”. Dr. Delbert Gatlin: “Ron served as Chair and I was Vice-Chair of the National Research Council committee which produced the bulletin on Nutrient Requirements of Fish and Shrimp. During that 2-year appointment, I came to truly appreciate Ron’s leadership in overseeing the committee of 10 scientists from several different countries. He was quite skillful in mediating differences in opinion among the committee members and keeping us on task”.

Dr. Ronald Roberts: “Ron’s career has not been always easy. His first wife died of a brain tumor and he has had other serious problems to deal with and yet always retains his cheerfulness and great sense of humor. Ron Hardy has two hobbies apart from fish nutrition. They are old cars and salmon fishing. He has achieved the greatest success in both...”. In 2008, Ron married Barb, who has been Ron’s constant companion since then: “To be married to Ron Hardy makes life an incredible adventure. This soft-spoken, brilliant scientist has passion not only for his fish projects, but it extends to the people he works with in all areas of education and science. It is a true joy to be part of his life and his work”.

As much as his 250 papers, NRC book and scientific insight, it is his sympathy, generosity and good sense of humor, his mentor qualities, friendship and guidance, for which he will be remembered. Lets conclude on the words of fish pathologist Dr. Ronald Roberts, his Scottish fellow: “Dr. Hardy is a very good scientist and also extremely good man”.

L. Elizabeth Cruz-Suárez, Denis Ricque

CURRICULUM VITAE

Ronald W. Hardy, Ph.D.

224 Oak Creek Circle
Twin Falls, Idaho 83301

208/733-4665 (hm)
208/837-9096, ext. 1105 (wk)
email: rhardy@uidaho.edu

October, 2011

Education:

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| 1969 | B.S. | University of Washington (Zoology) Seattle, Washington. |
| 1973 | M.S. | Washington State University (Nutrition) Pullman, Washington. |
- Thesis: Studies on Factors in Rye Which Cause Growth Depression in Chicks.
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| 1978 | Ph.D. | University of Washington (Fisheries) Seattle, Washington. |
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- Dissertation: Effects of Dietary Protein and Pyridoxine Levels on Growth and Disease Resistance of Chinook Salmon.

Employment:

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| 1978 | Liaison Officer, United Nations Development Program, FAO/UNDO Training Course in Fish Nutrition and Fishfeed Technology, Seattle, Washington. |
| 1979-1984 | Research Assistant Professor, School of Fisheries, University of Washington, Seattle, Washington. |
| 1984 | Research Associate Professor, School of Fisheries, University of Washington, Seattle, Washington. |
| 1981 | Staff Consultant, Board of Agricultural and Renewable Resources, National Academy of Science, Washington, DC. |
| 1984-1996 | Supervisory Research Chemist, Northwest Fisheries Science Center, National Marine Fisheries Service, Seattle, Washington. |

1994-1995 Acting Deputy Director, UR Division, Northwest Fisheries Science Center, National Marine Fisheries Service, Seattle, Washington.

1992-1995 Scientific Editor for the National Marine Fisheries Service, Editor, Fishery Bulletin and NOAA Technical Reports.

1984-1992 Affiliate Associate Professor, School of Fisheries, University of Washington, Seattle, Washington.

1992 to 2007 Affiliate Professor, School of Fisheries, University of Washington, Seattle, Washington.

1996 to present Director, Hagerman Fish Culture Experiment Station Hagerman, Idaho, Professor, Department of Animal and Veterinary Sciences, and Director, Aquaculture Research Institute, University of Idaho, Moscow, Idaho (since 2002).

2000 onward Editor, Aquaculture Research, Blackwell Science, Oxford, UK.

Professional service:

A. Membership in Professional Societies

American Institute of Nutrition

World Aquaculture Society (Secretary, 1997-2001, Vice President, 2001-2002)

B. Committees and Boards

Subcommittee on Warmwater Fish Nutrition, National Research Council, National Academy of Science. 1981-1984.

Committee on Impacts of Emerging Agricultural Trends on Fish and Wildlife Habitats, National Academy of Science. (Advisory Consultant). 1981.

Planning Committee, 9th Annual Fish Feed and Nutrition Workshop, Seattle, Washington. 1980.

Representative to the International Network of Feed Information Centers (INFIC), London, U.K. 1981.

Planning Committee, 11th Annual Fish Feed and Nutrition Workshop, Vancouver, B.C. 1983.

Planning Committee and Session Chairman, Salmonid Reproduction, An International Symposium, Bellevue, Washington. 1983.

Technical Committee, Research Subcommittee, Western Regional Aquaculture Consortium, USDA, 1987 to 2001. (Chair, Research Subcommittee, 1990 to 1995).

Scientific Advisory Board, Redfish Lake Sockeye Salmon Restoration Project, Eagle, Idaho. 1991 to present.

Scientific Advisor, Salmon Pigmentation Implementation Committee, Seattle, Washington, 1992 to 1995.

Member, Editorial Advisory Board, AQUACULTURE, Elsevier Publications, 1991-Present, and REVIEWS IN FISHERIES SCIENCE, CRC Press, 1992-present, AQUACULTURE NUTRITION, 1994-present, AQUANOTICES, 1992-present, FISHERY BULLETIN, 1995-present.

Steering and Planning Committees, Sixth International Symposium on Feeding and Nutrition in Fish, College Station, Texas, August, 1996; World Aquaculture Society Annual Meeting, Seattle, Feb., 1997; Eighth International Symposium on Feeding and Nutrition in Fish, Kyushu, Japan, May, 2000; Ninth International Symposium on Feeding and Nutrition in Fish, Rhodes, Greece, May, 2002; and 2nd International Seafood By-products Conference, Anchorage, Alaska, November 10-12, 2002, XII and XIII International Symposium on Fish Nutrition and Feeding, Biarritz France (2006) and Florianopolis, Brazil (2008).

Committee on Animal Nutrition, National Research Council, National Academy of Science. 2000-2005.
Western Regional Aquaculture Center, Board of Directors, 2002 to present (Chair 2004-2009).

National Agricultural Research, Extension, Education and Economics Advisory Board (USDA), 2002-2005 (Advisory Board to Secretary of Agriculture, USDA).

Organic Aquaculture Working Group (for National Organics Standard Board, USDA), 2005-present.

Scientific Committee, International Symposium on Fish Nutrition and Feeding, 2004 to present (Chair, 2008-present).

Chair, Committee to revise "Nutrient Requirements of Fish and Shellfish," National Research Council, National Academy of Science. 2008-2010.

Honors and awards

Outstanding Performance Certificate, NMFS, 1992-1996

Special Recognition Award as Scientific Editor of NMFS, 1995

"Innovation Impacting Society" award, University of Idaho, 2010

Visiting scientists

Dr. Ole J. Torrissen, Institute of Marine Research, Matre, Norway, 1987-88.

Dr. Torbjorn Asgard, Aquaforst, Sundlesora, Norway, 1989-90.

Dr. George Kissil, Israeli Center for Mariculture, Elat, Israel, 1995-96.

Prof. Hans Jorgen Fhyn, University of Bergen, Bergen, Norway, 1996.

Dr. candidate Umberto Luzzana, University of Milan, Milan, Italy, 1997.

Professor Kyeong-Jue Lee, JeJu University, Korea, 2009-2010.

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Professor Elizabeth Cruz, University of Nuevo Leon, Monterey, Mexico, 2011-2012.

Professor Denis Rique, University of Nuevo Leon, Monterey, Mexico, 2011-2012.

Dr. candidate Sung-Sam Lee, Jeju University, Korea, 2011.

Dr. candidate Ming-Chun Ren, Ocean University of China, 2010-2011.

Dr. candidate Fredrick Follesdal, Norwegian Veterinary College, Oslo, Norway.

Teaching experience:

A. Courses Taught (University of Washington)

1978, 83, 89 Fish Nutrition and Fishfeed Technology, a three-month intensive short course for professionals from underdeveloped nations.

1979 Fish Nutrition, an upper division course for seniors and graduate students (Fish 452). Course evaluation information available.

1979-1984 Fish Feeds and Feeding, an upper division course for seniors and graduate students (Fish 462). Course evaluation information available.

1984, 1985 Graduate Seminar in Fish Nutrition (Fish 521).

1984-present Numerous guest lectures.

B. Courses Taught (other universities)

1990, 91 Fish Nutrition, Kasetsart University, Bangkok, Thailand (short course).

1994, 96, 98-01 Practical Short Course on Aquaculture Nutrition and Feed Management, Texas A & M University.

C. Graduate Faculty, University of Washington, 1980 to 2007, University of Idaho, 1996 to present.

D. Graduate Student Committees

MS Committees: 58 since 1979

Ph.D. Committees: 31 since 1980

Ph.D. Examining Committee: Rune Christiansen, University of Bergen, Bergen, Norway, April, 1996.

International activities:

Delegate, International Network of Feed Information Centers Annual Meeting, London, UK, August, 1980.

Invited Speaker, Biological Assessment of Nutrient Requirements and Availability in Fish, XIII International Congress of Nutrition, Brighton, U.K., August 23-25, 1985

Visiting Scientist, Hubei Fisheries Science Research Institute, Wuhan, Peoples Republic of China. June, 1986

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- Invited Speaker, International Symposium on Feeding and Nutrition in Fish, Bergen, Norway, August 21-14, 1987.
- Invited Speaker and Moderator, Aquaculture International Congress, Vancouver, B.C., 1988.
- Invited Speaker, Recent Developments in Salmonid Aquaculture, Santiago, Chile, October 3-8, 1988.
- Session Chairman, Third International Symposium on Feeding and Nutrition in Fish, Toba, Japan, 1989.
- Consultant (Fish Nutrition Expert), Food and Agriculture Organization of the United Nations, United Nations Development Program, Bangkok, Thailand. October-December, 1990 and 1991.
- Invited Speaker, Fish Health Management Workshop, Pusan, Korea, October, 1990.
- Invited Speaker, Symposium on New Developments in Aquaculture, Bangkok, Thailand, November, 1990.
- Invited Speaker, Micro-ingredient Opportunities in Aquaculture Diets, Tokyo, Japan, November, 1990.
- Invited Speaker, IV International Symposium on Feeding and Nutrition in Fish, Biarritz, France, June, 1991.
- Featured Expert, American Soybean Association Tour of Aquaculture in Italy, Several Seminars and private meetings with government and industry, Venice to Rome, Italy, July, 1991.
- Invited Speaker, Aquaculture Feed Processing and Nutrition Workshops, Bangkok, Thailand, and Jakarta, Indonesia (Sponsored by the American Soybean Association), September, 1991.
- Invited Speaker, V International Symposium on Feeding and Nutrition in Fish, Santiago, Chile, September, 1992.
- Invited Speaker, "Feed Ingredient Asia, '95", Singapore, September, 1995.
- Invited Speaker, "Feed Ingredient Asia, '97", Singapore, March, 1997.
- Invited Speaker, "Roche Nutrition Conference, Bangkok, Thailand, March, 1998.
- Invited Speaker, VII International Symposium on Feeding and Nutrition in Fish, Los Palmos, Grand Canaria, May, 1998.
- Invited Keynote Speaker, Rank Prize Funds Mini-Symposium on Global Feed Needs for Aquaculture, England, November, 1999.
- VI Simposio Internacional de Nutricion Acuicola, Cancun, Mexico. Presentation: "Diets and feeding methods for environmentally-friendly aquaculture," September 2-5, 2002.
- VIII Simposio Internacional de Nutricion Acuicola, Mazatlan, Mexico. Presentation: "Alternate proteins for use in aquafeeds," November 22-24, 2006.
- Invited Speaker, "DMS Nutrition Conference, Bangkok, Thailand, November, 2008.
- XIII International Symposium on Fish Nutrition and Feeding, 1-5 June, 2008, Florianopolis Brazil. "Changing paradigms for alternate proteins for aquafeeds."
- European Aquaculture Association, Special session on Aquaculture Sustainability, 16-17 September, 2008, Krakow, Poland. "Sustainable Aquaculture: Effects of global demand and supplies of grains and oilseeds."
- The VII Symposium of World's Chinese Scientists on Nutrition and Feeding of Finfish and Shellfish, Beijing, PRC, 21-23, September, 2008. "Aquafeed protein sources.: Effects of global demand and supplies of grains and oilseeds."

International Workshop on Shrimp Nutrition, Brunei Darussalam, 4 November, 2008. "Challenges facing aquafeed producers."

IX International Symposium on Aquaculture Nutrition, Ensenada, Mexico, 23-27 November, 2008. "Utilization of plant proteins in fish diets: effects of global demand and supply of grains and oilseeds."

Publications:

A. Book Chapters

Hardy, R. W. 1980. Fish Feed Formulation. *In* Fish Feed Technology. ACDP/REP/80/11, pp. 233-239. FAO, Rome.

Hardy, R. W. 1980. Experimental Design in Diet Studies. *In* Fish Feed Technology. ACDP/REP/80/11, pp. 363-366. FAO, Rome.

Hardy, R. W. 1989. Practical Feeding - Salmon and Trout. *In* Nutrition and Feeding of Fish, pp. 185-203. R. T. Lovell (ed). Avi Publishing Co., Inc., Westport, CN.

Hardy, R. W. 1989. Diet Preparation. *In* Fish Nutrition, 2nd Edition, pp. 473-546. J. E. Halver (ed). Academic Press, NY.

Hardy, R. W. 1991. Nutrient Requirements of Pacific Salmon. *In* Nutrient Requirements of Fish, pp 105-121. R. P. Wilson (ed) CRC Press, Inc., Boca Raton, FL.

Hardy, R. W. 1992. Fisheries Processing By-products and their Reclamation. *In* Inedible Meat, Poultry, and Fishery Products (Advances in Meat Research, Volume 8), pp 199-216. A. M. Pearson (ed) Elsevier Science Publishers Ltd. Essex, England.

Hardy, R. W. 1995. Current Issues in Salmonid Nutrition. *In* Nutrition and Utilization Technology in Aquaculture, C. E. Lim and D. J. Sessa (eds). AOCS Press, Champaign, Illinois, pp. 26-35.

Pike, I. H. and R. W. Hardy. 1997. Standards for Assessing Quality of Feed Ingredients. *In* Crustacea Nutrition, pp 473-492. L.R. D'Abramo, D. E. Conklin, and D. M. Akiyama (eds). World Aquaculture Society, Baton Rouge, LA.

Hardy, R. W. 1998. Feeding Salmon and Trout. Pp. 175-197 *In* Nutrition and Feeding of Fish, 2nd Edition, R. T. Lovell (ed). Kluwer Academic Press, Dordrecht, The Netherlands.

Gabaudan, J. and Hardy, R.W., 2000. Vitamin Requirements of Fish. In: *Encyclopedia of Aquaculture*, R.R. Stickney, editor. John Wiley & Sons, Inc., New York, NY. Pp. 957-961

Forster, I.P. and Hardy, R.W., 2000. Dietary energy. In: *Encyclopedia of Aquaculture*, R.R. Stickney, editor. John Wiley & Sons, Inc., New York, NY. Pp. 292-298

Barrows, F.T. and Hardy, R.W., 2000. Feed Manufacturing Technology. In: *Encyclopedia of Aquaculture*, R.R. Stickney, editor. John Wiley & Sons, Inc., New York, NY. Pp. 354-359

Barrows, F.T. and Hardy, R.W., 2000. Feed additives. In: *Encyclopedia of Aquaculture*, R.R. Stickney, editor. John Wiley & Sons, Inc., New York, NY. Pp. 335-340

Cruz-Suárez, L. y D. Ricque. 2011. Homenaje al Dr. Ronald Hardy por su Contribución en Nutrición Acuícola. En: Cruz-Suárez, L.E., Ricque-Marie, D., Tapia-Salazar, M., Nieto-López, M.G., Villarreal-Cavazos, D. A., Gamboa-Delgado, J., Hernández-Hernández, L. (Eds), Avances en Nutrición Acuícola XI - Memorias del Décimo Primer Simposio Internacional de Nutrición Acuícola, 23-25 de Noviembre, San Nicolás de los Garza, N. L., México. ISBN 978-607-433-775-4. Universidad Autónoma de Nuevo León, Monterrey, México, pp. 172-199.

- Dong, F.M. and Hardy, R.W., 2000. Feed Evaluation, Chemical. In: *Encyclopedia of Aquaculture*, R.R. Stickney, editor. John Wiley & Sons, Inc., New York, NY. Pp. 340-349
- Dong, F.M. Hardy, R.W., and Higgs, D.A., 2000. Antinutritional Factors. In: *Encyclopedia of Aquaculture*, R.R. Stickney, editor. John Wiley & Sons, Inc., New York, NY. Pp. 45-50
- Hardy, R.W., Fornshell, C.G., and Brannon, E.L., 2000. Rainbow Trout Culture. In: *Encyclopedia of Aquaculture*, R.R. Stickney, editor. John Wiley & Sons, Inc., New York, NY. Pp. 716-722
- Roberts, R.R. and Hardy, R.W., 2000. Salmon Farming. In: *Encyclopedia of Aquaculture*, R.R. Stickney, editor. John Wiley & Sons, Inc., New York, NY. Pp. 773-778
- Li, M.H., Hardy, R.W., and Robinson, E.H., 2000. Dietary Protein Requirements. In: *Encyclopedia of Aquaculture*, R.R. Stickney, editor. John Wiley & Sons, Inc., New York, NY. Pp. 202-209
- Li, M.H., Hardy, R.W., and Robinson, E.H., 2000. Protein Sources for Feeds. In: *Encyclopedia of Aquaculture*, R.R. Stickney, editor. John Wiley & Sons, Inc., New York, NY. Pp. 688-695
- Hardy, R.W. and Roley, D.D., 2000. Lipid Oxidation and Antioxidants. In: *Encyclopedia of Aquaculture*, R.R. Stickney, editor. John Wiley & Sons, Inc., New York, NY. Pp. 470-476
- Sugiura, S.H. and Hardy, R.W., 2000. Environmentally friendly feeds. In: *Encyclopedia of Aquaculture*, R.R. Stickney, editor. John Wiley & Sons, Inc., New York, NY. Pp. 299-310.
- Hardy, R.W., 2001. The Nutritional Pathology of Teleosts. In: *Fish Pathology, Third Edition*, R.J. Roberts (editor). W.B.Saunders, London. Pp. 347-366.
- Hardy, R.W., 2001. Nutritional deficiencies in commercial aquaculture: likelihood, onset, and identification. In: *Nutrition and Fish Health*, Chhorn Lim and Carl D. Webster (editors). Food Products Press, New York. Pp. 131-147.
- Hardy, R.W., 2002. Rainbow Trout, *Oncorhynchus mykiss*. In: *Nutrient Requirements and Feeding of Finfish for Aquaculture*, Carl D. Webster and Chhorn Lim (editors). Food Products Press, New York.
- Hardy, R.W. and Barrows, F.T., 2002. Diet Formulation and Manufacturing. In: *Fish Nutrition, 3rd Edition*, J.E. Halver and R.W.Hardy (editors). Academic Press Inc., New York, NY.
- Halver, J.E. and Hardy, R.W. 2002. Nutrient Flow and Retention. Pp. 755-770 in: *Fish Nutrition, 3rd Edition*, J.E. Halver and R.W. Hardy (editors). Academic Press Inc., New York.
- Barrows, F.T. and Hardy, R.W., 2002. Nutrition and Feeding. Pp. 483-558 in: *Fish Hatchery Management, Second Edition*, G. Wedemeyer, editor. American Fisheries Society, Bethesda.
- Gatlin, D.M.III and Hardy, R.W. 2002. Manipulations of diets and feeding to reduce losses of nutrients in intensive aquaculture. Pp. 155-165 in: *Aquaculture and the Environment in the United States*, J.R. Tomasso, editor. U.S. Aquaculture Society, Baton Rouge, LA.
- Hardy, R.W. 2002. Rainbow trout, *Oncorhynchus mykiss*. Pp. 184-202 in: *Nutrient Requirements and Feeding of Finfish for Aquaculture*, C.D. Webster and C.E. Lin, editors. CABI Publishing, New York, NY.

- Hardy, R.W. 2008. Farmed fish diet requirements for the next decade and implications for global availability of nutrients. Pp. 1-16 *in*: Alternate Protein Sources in Aquaculture Diets, C Lim, C.D. Webster and C-S. Lee, editors. The Haworth Press, New York.
- Hardy, R.W. 2008. Alternative marine sources of fish feed and farmed fish quality. Pp. 328-342 *in*: Improving farmed fish quality and safety, Ø. Lie, editor. CRC Press, Woodhead Publishing Limited, New York.
- Hardy, R.W. 2009. Aquaculture feeds and ingredients: an overview. Pp. 370-386 *in*: New Technologies in Aquaculture, G. Burnell and G. Allan, editors. CRC Press, Woodhead Publishing Limited, New York.
- Hardy, R.W. 2009. Protein sources for marine shrimp aquafeeds: Perspectives and problems. In: Craig L. Browdy and Darryl E. Jory, Editors, *The Rising Tide, Proceedings of the Special Session on Sustainable Shrimp Farming*, World Aquaculture 2009. The World Aquaculture Society, Baton Rouge, Louisiana, USA. pp. 115-125.

B.Articles in Peer-Reviewed Journals

- Cardenas, D. D., W. C. Stolov, and R. W. Hardy. 1977. Muscle fiber number in immobilization atrophy. *Arch Phys. Med. and Rehab.* 58: 423-426.
- Mugrditchian, D. S., R. W. Hardy, and W. T. Iwaoka. 1981. Linseed oil and animal fat as alternative lipid sources in dry diets in chinook salmon (*O. tshawytscha*). *Aquaculture* 25: 161-172.
- Hardy, R. W., D. S. Mugrditchian, and W. T. Iwaoka. 1983. Storage stability of a dry salmonid diet. *Aquaculture* 34: 239-246.
- Hardy, R. W. and C. V. Sullivan. 1983. Canola meal in rainbow trout (*Salmo gairdneri*) production diets. *Can. J. Fish. Aquat. Sci.* 40: 281-286.
- Hardy, R. W., K. D. Shearer, F. E. Stone, and D. H. Wieg. 1983. Fish silage in aquaculture diets. *J. World Maricul. Soc.* 14: 695-703.
- Stone, F. E., R. W. Hardy, and J. Spinelli. 1984. Autolysis of phytic acid and protein in canola meal (*Brassica* sp.), wheat bran (*Triticum*), and fish silage blends. *J. Sci. Food and Agric.* 35: 513-519.
- Ridelman, J. M., R. W. Hardy, and E. L. Brannon. 1984. The effect of short-term starvation on ovarian development and egg viability in rainbow trout (*Salmo gairdneri*). *Aquaculture* 37: 133-140.
- Hardy, R. W., K. D. Shearer, and J. Spinelli. 1984. The nutritional properties of co-dried fish silage in rainbow trout (*Salmo gairdneri*) dry diets. *Aquaculture* 38: 35-44.
- Opstvedt, J., R. Miller, R. W. Hardy, and J. Spinelli. 1984. Heat-induced changes in sulfhydryl groups and disulfide bonds in fish protein and their effect on protein and amino acid digestibility in rainbow trout (*Salmo gairdneri*). *J. Agric. Food Chem.* 32: 929-935.
- Chen, Hwei-Mei, S. P. Meyers, R. W. Hardy, and S. L. Biede. 1984. Color stability of astaxanthin pigmented rainbow trout under various packaging conditions. *J. Food Sci.* 49: 1337-1340.

- Hardy, R. W., K. D. Shearer, and I. B. King. 1984. Proximate and elemental composition of developing eggs of pen-reared coho salmon (*Oncorhynchus kisutch*) fed production and trace elemental fortified diets. *Aquaculture* 43: 147-165.
- Hardy, R. W. and K. D. Shearer. 1985. Effect of dietary calcium phosphate and zinc supplementation on whole body zinc concentration of rainbow trout (*Salmo gairdneri*). *Can. J. Fish Aquat. Sci.* 42:181-184.
- Boggio, S. M., R. W. Hardy, J. K. Babbitt, and E. L. Brannon. 1985. The influence of dietary lipid source and alpha-tocopheryl acetate level on product quality of rainbow trout (*Salmo gairdneri*). *Aquaculture* 51: 13-24.
- Stone, F. E. and R. W. Hardy. 1986. Nutritional value of acid stabilized silage and liquefied fish protein. *J. Sci. Food Agric.* 37:797-803.
- Hardy, R. W., E. Casillas, and T. Masumoto. 1987. Determination of vitamin B₆ deficiency in rainbow trout (*Salmo gairdneri*) by liver enzyme and HPLC analysis. *Can. J. Fish. Aquat. Sci.* 44: 219-222.
- Hardy, R. W., C. V. Sullivan, and A. M. Koziol. 1987. Assessment of absorption, body distribution, and excretion of dietary zinc by rainbow trout (*Salmo gairdneri*). *Fish Physiol. Biochem.* 2: 133-143.
- Shearer, K. D. and R. W. Hardy. 1987. Phosphorus deficiency in rainbow trout (*Salmo gairdneri*) fed a diet containing deboned fillet scrap. *Prog. Fish-Cult.* 49: 192-197.
- Hardy, R. W., T. M. Scott, and L. W. Harrell. 1987. Replacement of herring oil with menhaden oil, soybean oil, or tallow in the diets of Atlantic salmon raised in marine net-pens. *Aquaculture* 62: 267-277.
- Masumoto, T., R. W. Hardy, and E. Casillas. 1987. Comparison of transketolase activity and thiamin pyrophosphate levels in erythrocytes and liver of rainbow trout (*Salmo gairdneri*) as indicators of thiamin status. *J. Nutr.* 117: 1422-1426.
- Borghetti, J. R., R. N. Iwamoto, R. W. Hardy, and S. Sower. 1988. The effects of naturally occurring androgens in practical diets fed to normal-sired and jack-sired progeny of coho salmon. *Aquaculture* 77: 51-60.
- Wu, Zun-Li and R. W. Hardy. 1988. A preliminary analysis on feeding behavior of the young fish of *Simperca chautsi*. *Freshwater Fisheries* 5: 18-20.
- Torrissen, O. J., R. W. Hardy, and K. D. Shearer. 1989. Pigmentation of salmonids - Carotenoid deposition and metabolism. *Rev. in Aquat. Sci.* 1(2): 209-225.
- Stickney, R. R. and R. W. Hardy. 1988. Lipid requirements of some warmwater species. *Aquaculture* 79: 145-156.
- Stone, F. E., R. W. Hardy, K. D. Shearer, and T. M. Scott. 1989. Utilization of fish silage by rainbow trout (*Salmo gairdneri*). *Aquaculture* 76: 109-118.
- Hardy, R. W., O. J. Torrissen, and T. M. Scott. 1990. Absorption and distribution of ¹⁴C-labeled canthaxanthin in rainbow trout (*Oncorhynchus mykiss*). *Aquaculture* 87: 331-340.

- Torrissen, O. J., R. W. Hardy, K. D. Shearer, T. M. Scott, and F. E. Stone. 1990. Effects of dietary canthaxanthin level and lipid level on apparent digestibility coefficients for canthaxanthin in rainbow trout (*Oncorhynchus mykiss*). *Aquaculture* 88: 351-362.
- Plisetskaya, E., L. I. Buchelli-Narvaez, R. W. Hardy, and W. W. Dickhoff. 1991. Effects of injected and dietary arginine on plasma insulin levels and growth of Pacific salmon and rainbow trout. *Comp. Bioc. Physiol.* 98A: 165-170.
- Smith, B. E., R. W. Hardy, and O. J. Torrissen. 1991. Synthetic astaxanthin deposition in coho salmon (*Oncorhynchus kisutch*) *Aquaculture*. 104: 105-119.
- Dong, F. M., R. W. Hardy, N. F. Haard, F. T. Barrows, B. A. Rasco, W. T. Fairgrieve, and I. P. Forster. 1993. Chemical composition and protein digestibility of poultry by-product meals for salmonid diets. *Aquaculture*. 116: 149-158.
- Rust, M. B., R. W. Hardy, and R. R. Stickney. 1993. A new method for force-feeding larval fish. *Aquaculture*. 116: 341-352.
- Masumoto, T., R. W. Hardy, and R. R. Stickney. 1994. Pantothenic acid deficiency detection in rainbow trout (*Oncorhynchus mykiss*). *J. Nutr.* 124: 430-435.
- Dimes, L.E., N.F. Haard, F.M. Dong, B.A. Rasco, I.P. Forster, W.T. Fairgrieve, R. Arndt, R.W. Hardy, F.T. Barrows, and D.A. Higgs. 1994. Estimation of protein digestibility - II. *In vitro* assay of protein in salmonid feeds. *Comp. Biochem. Physiol.*, 108: 363-370.
- Hardy, R. W. and E. Castro C. 1994. Characteristics of the Chilean salmon feed industry. *Aquaculture*, 124: 307-320.
- Halver, J. E. and R. W. Hardy. 1994. L-ascorbyl-2-sulfate alleviates Atlantic salmon scurvy. *Proc. Soc. Exp. Biol. Med.*, 206: 421-424.
- Scott, T., R. W. Hardy, and B. A. Rasco. 1994. Stability of krill meal, astaxanthin, and canthaxanthin color in cultured rainbow trout (*Oncorhynchus mykiss*) fillets during frozen storage and cooking. *J. Aquat. Food Product Tech.*, 3: 53-63.
- Fairgrieve, W. T., M. S. Myers, R. W. Hardy, and F. M. Dong. 1994. Gastric abnormalities in rainbow trout (*Oncorhynchus mykiss*) fed amine-supplemented diets or chicken gizzard-erosion-positive fish meal. *Aquaculture*, 127: 219-232.
- Thorarinsson, R., Landolt, M., Elliott, D. G., Pascho, R. J., and Hardy, R. W. 1994. Effect of dietary vitamin E and selenium on growth, survival and the prevalence of *Renibacterium salmoninarum* infection in chinook salmon (*Oncorhynchus tshawytscha*). *Aquaculture*, 121: 343-358.
- Teskeredzic, A., Higgs, D. A., Dosanjh, B. S., McBride, J. R. Hardy, R. W., Beames, R. M., Jones, J. D., Simell, M., Vaara, T., and Bridges, R. B. 1995. Assessment of undephtinized and dephtinized rapeseed protein concentrate as sources of dietary protein for juvenile rainbow trout (*Oncorhynchus mykiss*). *Aquaculture*, 131: 261-277.
- Hardy, R. W., Scott, T. M., Hatfield, C. L., Barnett, H. J., Gauglitz, E. J. Jr., Wekell, J. C., and Eklund, M. W. 1995. Domoic acid in rainbow trout (*Oncorhynchus mykiss*) feeds. *Aquaculture*, 131: 253-260.

- Massee, K.C., Rust, M.B., Hardy, R.W., and Stickney, R.R., 1995. The effectiveness of tricaine, quinaldine sulfate and metomidate as anesthetics for larval fish. *Aquaculture*, 134: 351-359.
- Stickney, R.R., Hardy, R.W., Koch, K., Harrold, R., Seawright, D., and Massee, K.C., 1996. The effects of substituting selected oilseed protein concentrates for fish meal in rainbow trout diets. *J. World Aqua. Soc.*, 27: 57-63.
- Hardy, R.W., 1996. Alternate protein sources for salmon and trout diets. *Animal Feed Science Technology*, 59: 71-80.
- Kim, J., Massee, K.C. and Hardy, R.W., 1996. Adult *Artemia* as food for first feeding coho salmon (*Oncorhynchus kisutch*). *Aquaculture*, 144: 217-226.
- Skonberg, D. I., Yogev, L., Hardy, R. W. and Dong, F. M., 1997. Metabolic response to dietary phosphorus intake in rainbow trout (*Oncorhynchus mykiss*). *Aquaculture*, 157: 11-24.
- Kissil, G. Wm., Lupatsch, I., Higgs, D. A., and Hardy, R. W., 1997. Preliminary evaluation of rapeseed protein concentrate as an alternative to fish meal in diets for gilthead seabream (*Sparus aurata*). *Israeli J. Aqua.- Bamidgeh*, 49: 135-143.
- Skonberg, D. I., Hardy, R. W., Barrows, F. T. and Dong, F. M., 1998. Color and flavor analyses of fillet from farm-raised rainbow trout (*Oncorhynchus mykiss*) fed low-phosphorus feeds containing corn or wheat gluten. *Aquaculture*, 166: 269-277.
- Sugiura, S. H., Dong, F. M., Rathbone, C. K. and Hardy, R. W., 1998. Apparent protein digestibility and mineral availabilities in various feed ingredients for salmonid feeds. *Aquaculture*, 159: 177-202.
- Sugiura, S. H., Dong, F. M. and Hardy, R. W., 1998. Effects of dietary supplements on the availability of minerals in fish meal; preliminary observations. *Aquaculture*, 160: 283-303.
- Satoh, S., Higgs, D.A., Dosanjh, B.S., Hardy, R.W., Eales, J.G. and Deacon, G., 1998. Effect of extrusion processing on the nutritive value of canola meal for chinook salmon (*Oncorhynchus tshawytscha*) in seawater. *Aqua. Nutr.*, 4: 115-122.
- Luzzana, U., Hardy, R.W. and Halver, J.E., 1998. Dietary arginine requirement of fingerling coho salmon (*Oncorhynchus kisutch*). *Aquaculture*, 163: 137-150.
- Sugiura, S. H., Dong, F. M. and Hardy, R. W., 1999. Availability of phosphorus and trace elements in low-phytate varieties of barley and corn for rainbow trout (*Oncorhynchus mykiss*). *Aquaculture*, 170: 285-296.
- Hardy, R. W., 1999. Collaborative opportunities between fish nutrition and other disciplines in aquaculture: an overview. *Aquaculture*, 177: 217-230.
- Arndt, R. E., Hardy, R. W., Sugiura, S. H., and Dong, F. M., 1999. Effects of heat treatment and substitution level on palatability and nutritional value of soy defatted flour in feeds for coho salmon (*Oncorhynchus kisutch*). *Aquaculture*, 180: 129-145.
- Majack, T. J., Rust, M. B., Massee, K. C., Kissil, G. Wm., Hardy, R. W. and Peterson, M. E., 2000. Bioencapsulation of erythromycin using adult brine shrimp, *Artemia franciscana* (LATREILLE, 1817). *J. Fish Diseases*, 23: 1-6.

- Kissil, G. Wm., Lupatsch, I., Higgs, D. A., and Hardy, R. W., 2000. Dietary substitution of soy and rapeseed protein concentrates for fish meal, and their effects on growth and nutrient utilization in gilthead seabream *Sparus aurata* L. *Aquaculture Res.* 31(7): 585-601.
- Sugiura, S.H., Dong, F.M., and Hardy, R.W., 2000. A new approach to estimating the minimum dietary requirement of phosphorus for large rainbow trout based on nonfecal excretions of phosphorus and nitrogen. *J. Nutrition*, 130: 865-872.
- Sugiura, S.H., Babbitt, J.K., Dong, F.M., Hardy, R.W., 2000. Utilization of fish and animal by-product meals in low-pollution feeds for rainbow trout, *Oncorhynchus mykiss* (Walbaum). *Aquaculture Res.* 31(7): 585-593.
- Scolari, M., Luzzana, U., Stefani, L., Mentasti, T., Moretti, V.M., Valfre, F., Lopez, C. and Hardy, R.W. 2000. Quantification of cholesterol oxidation products in commercial fish meals and their formation during storage. *Aquaculture Res.* 31 (10): 785-791.
- Sugiura, S.H., Dong, F.M., and Hardy, R.W., 2000. Primary responses of rainbow trout to dietary phosphorus concentrations. *Aquaculture Nutrition*, 6: 235-245.
- Rathbone, C.K., Babbitt, J.K., Dong, F.M. and Hardy, R.W. 2001. Performance of juvenile coho salmon *Oncorhynchus kisutch* fed diets containing meals from fish wastes, deboned fish wastes, or skin-and-bone by-product as the protein ingredient. *J. World Aqua. Soc.*, 32(1): 21-29.
- Overturf, K. and Hardy, R.W. 2001. Myosin expression in trout muscle: a new method for monitoring specific growth rates for rainbow trout *Oncorhynchus mykiss* Walbaum on varied planes of nutrition. *Aquaculture Research*, 32(4): 315-322.
- Sugiura, S.H., Gabaudan, J., Dong, F.M. and Hardy, R.W. 2001. Dietary microbial phytase supplementation and the utilization of phosphorus, trace minerals and protein by rainbow trout [*Oncorhynchus mykiss* (Walbaum)] fed soybean meal-based diets. *Aquaculture Research*, 32(7): 583-592.
- Weerasinghe, V., Hardy, R.W. and Haard, N.F., 2001. An *in vitro* method for phosphorus digestibility of trout (*Oncorhynchus mykiss*) feed. *Aquaculture Nutrition*, 7(1): 1-9.
- Roberts, R.J., Hardy, R.W. and Sugiura, S. 2001. Screamer disease in Atlantic salmon, *Salmo salar* L., in Chile. *J. Fish Diseases*, 24: 543-549.
- Cheng, Z.J. and Hardy, R.W. 2002. Effect of microbial phytase on apparent nutrient digestibility of barley, canola meal, wheat and wheat middlings, measured *in vivo* using rainbow trout (*Oncorhynchus mykiss*). *Aquaculture Nutrition* 8(4): 271-278.
- Green, J.A., R.W. Hardy and E.L. Brannon. 2002. Effects of dietary phosphorus and lipid levels on utilization and excretion of phosphorus and nitrogen by rainbow trout (*Oncorhynchus mykiss*). 1. Laboratory-scale study. *Aquaculture Nutrition* 8(4): 279-290.
- Green, J.A., R.W. Hardy and E.L. Brannon. 2002. Effects of dietary phosphorus and lipid levels on utilization and excretion of phosphorus and nitrogen by rainbow trout (*Oncorhynchus mykiss*). 2. Production-scale study. *Aquaculture Nutrition* 8(4): 291-298.

- Cheng, Z.J. and Hardy, R.W. 2002. Apparent digestibility coefficients of nutrients and nutritional value of poultry by-product meals for rainbow trout *Oncorhynchus mykiss* measured *in vivo* using settlement. *J. World Aquaculture Society* 33(4): 458-465.
- Thorgaard, G.H., G.S. Bailey, D. Williams, D.R. Buhler, S.L. Kaattari, S.S. Ristow, J.D. Hansen, J.R. Winton, J.L. Bartholomew, J.J. Nagler, P.J. Walsh, M.M. Vijayan, R.H. Devlin, R.W. Hardy, K.E. Overturf, W.P. Young, B.D. Robison, C. Rexroad III, Y. Palti, 2002. Status and opportunities for genomics research with rainbow trout. *Comp. Biochem. Physiol. B.*, 133: 609-646.
- Cheng, Z.J. and R.W. Hardy. 2003. Effects of extrusion and expelling processing, and microbial phytase supplementation on apparent digestibility coefficients of nutrients in full-fat soybeans for rainbow trout (*Oncorhynchus mykiss*). *Aquaculture*, 218: 501-514.
- Cheng, Z.J., Hardy, R.W. and Usry, J.L. 2003. Plant protein ingredients with lysine supplementation reduce dietary protein level in rainbow trout (*Oncorhynchus mykiss*) diets, and reduce ammonia nitrogen and soluble phosphorus excretion. *Aquaculture*, 218: 553-565.
- Chaiyapechara, S., Casten, M.T., Hardy, R.W. and Dong, F.M. 2003. Fish performance, fillet characteristics, and health assessment index of rainbow trout (*Oncorhynchus mykiss*) fed diets containing adequate and high concentrations of lipid and vitamin E. *Aquaculture*, 219: 715-738.
- Cheng, Z.J. and R.W. Hardy. 2003. Effects of extrusion processing of feed ingredients on apparent digestibility coefficients of nutrients for rainbow trout (*Oncorhynchus mykiss*). *Aquaculture Nutrition*, 9:77-83.
- Overturf, K., Casten, M.T., LaPatra, S. L., Rexroad III, C., and Hardy, R.W. 2003. Comparison of growth performance, immunological response and genetic diversity of five strains of rainbow trout (*Oncorhynchus mykiss*). *Aquaculture* 217: 93-106.
- Cheng, Z.J., Hardy, R.W. and Usry, J.L. 2003. Effect of lysine supplementation in a plant protein-based diets on the performance of rainbow trout (*Oncorhynchus mykiss*) and apparent digestibility coefficients of nutrients. *Aquaculture* 215: 255-265.
- Lellis, W. A., Barrows, F. T. and Hardy, R. W., 2004. Effects of phase-feeding dietary phosphorus on survival, growth, and processing characteristics of rainbow trout (*Oncorhynchus mykiss*). *Aquaculture*, 242:607-616.
- Green, J.A. and Hardy, R.W. 2004. The optimum dietary essential amino acid pattern for rainbow trout (*Oncorhynchus mykiss*), to maximize nitrogen retention and minimize nitrogen excretion. *Fish Physiology and Biochemistry* 27: 97-108.
- Green, J.A., Hardy, R.W. and Brannon, E.L. 2004. The optimum dietary essential: nonessential amino acid ratio for rainbow trout (*Oncorhynchus mykiss*), which maximizes nitrogen retention and minimizes nitrogen excretion. *Fish Physiology and Biochemistry* 27: 109-115.
- Sugiura, S., Hardy, R.W. and Roberts, R.J. 2004. The pathology of phosphorus deficiency in fish – a review. *Journal of Fish Diseases*, 27: 255-265.

- Cheng, Z.J., Hardy, R.W. and Huige, N.J. 2004. Apparent digestibility coefficients of nutrients in brewer's and rendered animal by-products for rainbow trout *Oncorhynchus mykiss* (Walbaum). *Aquaculture Research*, 35: 1-9.
- Li, P., Wang, X., Hardy, R.W. and Gatlin III, D.M. 2004. Nutritional value of fisheries by-catch and by-product meal in the diet of red drum (*Sciaenops ocellatus*). *Aquaculture*, 236: 485-496.
- Cheng, Z.J. and R.W. Hardy. 2004. Nutritional value of diets containing distiller's dried grain with solubles for rainbow trout, *Oncorhynchus mykiss*. *Journal of Applied Aquaculture*, 15(3/4): 101-113.
- Cheng, Z.J. and R.W. Hardy. 2004. Effects of microbial phytase supplementation in corn distiller's dried grain with solubles on nutrient digestibility and growth performance of rainbow trout, *Oncorhynchus mykiss*. *Journal of Applied Aquaculture*, 15(3/4): 83-100.
- Overturf, K., Bullock, D., LaPatra, S., and Hardy, R. 2004. Genetic selection and molecular analysis of domesticated rainbow trout for enhanced growth on alternative diet sources. *Environmental Biology of Fishes* 69: 409-418.
- Biga, P.R., Cain, K.D., Hardy, R.W., Schelling, G.T., Overturf, K., Roberts, S.B., Goetz, F.W. and Ott, T.L. 2004. Growth hormone differentially regulates muscle myostatin 1 and -2 and increases circulating cortisol in rainbow trout (*Oncorhynchus mykiss*). *Gen. Comp. Endocrinology*, 138: 32-41.
- Cheng, Z.J. and Hardy, R.W. 2004. Protein and lipid sources affect cholesterol concentrations of juvenile Pacific white shrimp, *Litopenaeus vannamei* (Boone). *Journal of Animal Science* 82: 1136-1145.
- Cheng, Z.J., Hardy, R.W., Verlhac, V., and Gabaudan, J. 2004. Effects of microbial phytase supplementation and dosage on apparent digestibility coefficients of nutrients and dry matter in soybean product-based diets for rainbow trout *Oncorhynchus mykiss*. *Journal the World Aquaculture Society*, 35(1): 1-15.
- Liu, K.K.M., Barrows, F.T., Hardy, R.W. and Dong, F.M. 2004. Body composition, growth performance and product quality of rainbow trout, *Oncorhynchus mykiss* fed diets containing poultry fat, soybean/corn lecithin, or menhaden oil. *Aquaculture* 238, 309-328.
- Hardy, R.W., Sealy, W.M. and Gatlin, D.M. III. 2005. Fisheries by-catch and by-product meals as protein sources for rainbow trout *Oncorhynchus mykiss*. *Journal the World Aquaculture Society*, 36(3): 393-400.
- Stone, D.A.J., Hardy, R.W., Barrows, F.T. and Cheng, X.J. 2005. Effects of extrusion on nutritional value of diets containing corn gluten meal and corn distiller's dried grain for rainbow trout, *Oncorhynchus mykiss*. *Journal of Applied Aquaculture*, 17(3): 1-20.
- Biga, P.R., Peterson, B.C., Schelling G.T., Hardy, R.W. Cain K.D., Overturf K., and Ott T.L. (2005) Bovine growth hormone treatment increased IGF-I in circulation and induced the production of a specific immune response in rainbow trout (*Oncorhynchus mykiss*) *Aquaculture*, 246(1-4): 437-445.
- Sullivan, M., Reid, J.W.J., Ternent, H. Manchester, N.J., Roberts, R.J., Stone, D.A.J & Hardy, R.W. (2007) The aetiology of spinal deformation in Atlantic salmon, *Salmo salar* L.: influence of different
- Cruz-Suárez, L. y D. Ricque. 2011. Homenaje al Dr. Ronald Hardy por su Contribución en Nutrición Acuícola. En: Cruz-Suárez, L.E., Ricque-Marie, D., Tapia-Salazar, M., Nieto-López, M.G., Villarreal-Cavazos, D. A., Gamboa-Delgado, J., Hernández-Hernández, L. (Eds), *Avances en Nutrición Acuícola XI - Memorias del Décimo Primer Simposio Internacional de Nutrición Acuícola*, 23-25 de Noviembre, San Nicolás de los Garza, N. L., México. ISBN 978-607-433-775-4. Universidad Autónoma de Nuevo León, Monterrey, México, pp. 172-199.

- commercial diets on the incidence and severity of the preclinical condition in salmon parr under two contrasting husbandry regimes. *Journal of Fish Diseases* 30: 759-767.
- Papasani, M.R., Robison, B.D., Hardy, R.W. & Hill, R. (2007). Early developmental expression of two zebrafish insulin genes. *Physiological Genomics*, 27:79-85.
- Barrows, F.T., D.A.J. Stone, R.W. Hardy. 2007 The effects of extrusion conditions on the nutritional value of soybean meal for rainbow trout (*Oncorhynchus mykiss*) *Aquaculture* 265:244-252
- Gatlin, D.M. III, Barrows, F. T., Bellis, D., Brown, P., Campen, J., Dabrowski, K., Gaylord, T.G., Hardy, R. W., Herman, E., Hu, G., Krogdahl, Á., Nelson, R., Overturf, K., Rust, M., Sealey, W., Skonberg, D., Souza, E., Stone, D., Wilson, R. and Wurtele, E. (2007). Expanding the Utilization of Sustainable Plant Products in Aquafeeds – A Review. *Aquaculture Research* 38(6): 551-579.
- St-Hilaire, S., Sheppard, C., Tomberlin, J.K., Irving, S., Newton, L., McGuire, M.A., Mosley, E.E., Hardy, R.W. and Sealey, W. (2007) Fly prepupae as a feedstuff for rainbow trout, *Oncorhynchus mykiss*. *Journal of the World Aquaculture Society* 38(1): 59-67.
- Sealey, W., Barrows, F., Johansen, K., Overturf, K., LaPatra, S. and Hardy, R. 2007. Evaluation of the ability of partially autolyzed yeast and Grobiotic™-A to improve disease resistance of rainbow trout *Oncorhynchus mykiss*. *North American Journal of Aquaculture* 69(4): 400-406.
- Massee, K.C., Kim, J., Berejikian, B.A. and Hardy, R. W. (2007) Prey selection and efficiency of naïve and experienced juvenile sockeye salmon. *Journal of Fish Biology* 70(4): 1213-1223.
- Robison, B.D., Drew, R.E., Murdoch, G.K., Powell, M., Rodnick, K.J., Settles, M., Stone, D., Churchill, E., Hill, R.A., Papasani, M.R., Lewis, S.S., Hardy, R.W. (2008). Sexual dimorphism in hepatic gene expression and the response to dietary carbohydrate manipulation in the zebrafish (*Danio rerio*). *Comp Biochem Physiol Part D Genomics and Proteomics* 3, 141-154.
- Sealey, W.M., Barrows, F.T., Hang, A., Johansen, K.A., Overturf, K., LaPatra, S.E. & Hardy, R.W. (2008). Evaluation of the ability of barley varieties containing different amounts of β -glucan to alter growth and disease resistance of rainbow trout *Oncorhynchus mykiss*. *Animal Feed Science and Technology*, 141: 115-128.
- Drew, R.E., Rodnick, K.J., Settles, M., Wacyk, J., Churchill, E., Powell, M., Hardy, R.W., Murdoch, G.K., Hill, R.A. and Robison, B.D. (2008). Effect of starvation on transcriptomes of brain and liver in female zebrafish (*Danio rerio*). *Physiol. Genomics* 35, 283-295.
- Green, J.A. and Hardy, R.W. (2008). The effects of dietary protein/energy ratio and amino acid pattern on nitrogen utilization and excretion of rainbow trout *Oncorhynchus mykiss* (Walbaum). *Journal of Fish Biology* 73, 663-682.
- Plante, S., Smiley, S., Oliveira, A.C.M., Stone, D.A.J., Hardy, R.W. and Bechtel, P.J. (2008). Chemical characterization of testes meals made from Alaska's seafood processing byproducts. *J. Aquatic Food Product Tech.* 17(2), 195-211.
- Chapalamadugu, K.C. Robison, B.D., Drew, R.E., Powell, M.S., Hill, R.A., Amberg, J.J., Rodnick, K.J., Hardy, R.W., Hill, M.L., and Murdoch, G.K. (2009) Dietary carbohydrate level affects transcription factor expression that regulates skeletal muscle myogenesis in rainbow trout.
- Cruz-Suárez, L. y D. Ricque. 2011. Homenaje al Dr. Ronald Hardy por su Contribución en Nutrición Acuicola. En: Cruz-Suárez, L.E., Ricque-Marie, D., Tapia-Salazar, M., Nieto-López, M.G., Villarreal-Cavazos, D. A., Gamboa-Delgado, J., Hernández-Hernández, L. (Eds), *Avances en Nutrición Acuicola XI - Memorias del Décimo Primer Simposio Internacional de Nutrición Acuicola*, 23-25 de Noviembre, San Nicolás de los Garza, N. L., México. ISBN 978-607-433-775-4. Universidad Autónoma de Nuevo León, Monterrey, México, pp. 172-199.

- Comparative Biochemistry and Physiology, Part B: Biochemistry and Molecular Biology 153, 66-72.
- Sealey, W.M., Barrows, F.T., Casten, M. and Hardy, R.W. (2009) Dietary protein source and level affects growth in neon tetras. *North American Journal of Aquaculture* 71, 320-324.
- Naylor, R., Hardy, R., Bureau, D., Chiu, A., Elliott, M., Farrell, A., Forster, I., Gatlin, D., Goldberg, R., Hua, K., and Nichols, P. 2009. Feeding aquaculture in an era of finite resources. *Proceedings of the National Academy of Sciences*, 106(36): 15103-15110.
- Hernandez, C., Olvera-Novoa, M.A., Hardy, R.W., Hermosillo, A. and Gonzalez, B. Complete replacement of fish meal by porcine and poultry by-product meals in practical diets for Nile tilapia *Oreochromis niloticus*: digestibility and growth performance. *Aquaculture Nutrition* 16, 44-53.
- Wolters, W.R., Barrows, F.T., Burr, G.S. & Hardy, R.W. 2009. Growth parameters of wild and selected strains of Atlantic salmon, *Salmo salar*, on two experimental diets. *Aquaculture* 297, 136-140.
- Hardy, R.W. & Wacyk, J. 2009. Research thrusts in nutritional genomics of rainbow trout. *Bulletin of the Aquaculture Association of Canada* 107-3: 11-20.
- Hardy, R.W., Moller, G. and Oram, L. 2010. Effects of dietary selenomethionine on cutthroat trout (*Oncorhynchus clarki bouvieri*) growth and reproductive performance over a life-cycle. *Archives of Environmental Contamination and Toxicology*, 58: 237-245.
- Hardy, R.W. 2010. Utilization of plant proteins in fish diets: effects of global demand and supplies of fishmeal. *Aquaculture Research* 41, 770-776.
- Lee, K-J., Powell, M. S., Barrows, F.T., Smiley, S., Bechtel, P. and Hardy, R.W. 2010. Evaluation of supplemental fish bone meal made from Alaska seafood processing byproducts and dicalcium phosphate in plant protein based diets for rainbow trout (*Oncorhynchus mykiss*). *Aquaculture* [doi:10.1016/j.aquaculture.2010.02.034](https://doi.org/10.1016/j.aquaculture.2010.02.034)
- Powell, M.S., Hardy, R.W., Flagg, T.A. and Kline, P.A. 2010. Proximate composition and fatty acid differences in hatchery-reared and wild Snake River sockeye salmon overwintering in nursery lakes. *North American Journal of Fisheries Management* 39, 530-537.
- Benner, M.J., Drew, R.E., Hardy, R.W. and Robison, B.D. 2010. Zebrafish (*Danio rerio*) vary by strain and sex in their behavioral and transcriptional responses to selenium supplementation. *Comparative Biochemistry and Physiology – Part A: Molecular & Integrative Physiology, Part A*, 157: 310-318. [doi:10.1016/j.cbpa.2010.07.016](https://doi.org/10.1016/j.cbpa.2010.07.016)
- Stone, D.A.J., Oliveira, A.C.M., Plante, S., Smiley, S., Bechtel, P. and Hardy, R.W. 2010. Enhancing highly unsaturated w-3 fatty acids in phase-fed rainbow trout (*Oncorhynchus mykiss*) using Alaskan fish oils. *Aquaculture Nutrition* (published on-line 14, Sep 2010, DOI: 10.1111/j.1365-2095.2010.00790.x)
- Stone, D.A.J., Oliveira, A.C.M., Ross, C.F., Plante, S., Smiley, S., Bechtel, P. and Hardy, R.W. 2010. The effects of phase-feeding rainbow trout (*Oncorhynchus mykiss*) with canola oil and Alaskan pollock oil on fillet fatty acid composition and sensory attributes. *Aquaculture Nutrition* (published on-line 14, Sep 2010, DOI: 10.1111/j.1365-2095.2010.00792.x)
- Cruz-Suárez, L. y D. Ricque. 2011. Homenaje al Dr. Ronald Hardy por su Contribución en Nutrición Acuícola. En: Cruz-Suárez, L.E., Ricque-Marie, D., Tapia-Salazar, M., Nieto-López, M.G., Villarreal-Cavazos, D. A., Gamboa-Delgado, J., Hernández-Hernández, L. (Eds), *Avances en Nutrición Acuícola XI - Memorias del Décimo Primer Simposio Internacional de Nutrición Acuícola*, 23-25 de Noviembre, San Nicolás de los Garza, N. L., México. ISBN 978-607-433-775-4. Universidad Autónoma de Nuevo León, Monterrey, México, pp. 172-199.

- Torrissen, O., Olson, R.E., Toresen, R., Hemre, G.I., Tacon, A.G.J., Asche, F., Hardy, R.W. and Lall, S. 2011. Atlantic salmon (*Salmo salar*): The “super-chicken” of the sea? *Reviews in Fisheries Science*, 19:3, 257-278.
- Sealey, W.M., Hardy, R.W., Barrows, F.T., Pan, Q. and Stone, D.A.J. 2011. Evaluation of 100% fish meal substitutes with chicken concentrate, poultry protein by-product blend, and chicken and egg concentrate on growth and disease resistance of juvenile rainbow trout *Oncorhynchus mykiss* fed plant-based diets. *Journal of the World Aquaculture Society* 42: 46-55.
- Thlusty, M.F., Hardy, R. and Cross, S.F. 2011. Limiting size of fish fillets at the center of the plate improves the sustainability of aquaculture production. *Sustainability* 3:957-964.

C. Proceedings, Technical Reports, and Magazine Articles, and Abstracts.

- Stolov, W. C. and R. W. Hardy. 1975. Relative length of muscle fiber and origin and insertion aponeurosis in immobilization contracture of rat soleus. *Arch Phys. Med. and Rehab.* 56: 562 (Abst.)
- Stolov, W. C. and R. W. Hardy. 1976. Muscle contracture. Growth and immobilization atrophy. *Arch Phys. Med. and Rehab.* 56: 562 (Abst.)
- Hardy, R. W., E. L. Brannon, and W. T. Iwaoka. 1979. A new dry diet with alternative oil sources for Pacific salmon. *Proc. World Maricul. Soc.* 10: 728-734.
- Hardy, R. W., J. E. Halver, and E. L. Brannon. 1979. Effect of dietary protein level on the pyridoxine requirement and disease resistance of chinook salmon (*Oncorhynchus tshawytscha*). *Proc. World Symp. on Finfish Nutrition and Feed Technology*, Vol. 1. Hamburg, 20-23 June, 1978, pp. 253-260.
- Hardy, R. W. 1981. Nutrition and broodstock, A summary. *In: Salmonid Broodstock Maturation*, T. Noshio (ed). Washington Sea Grant, Seattle, WA. 92 pp.
- Hardy, R. W. 1983. Nutrient Requirements of Warmwater Aquatic Animals (with R. R. Stickney, J. D. Castell, H. G. Ketola, and R. P. Wilson). National Research Council, National Academy of Science, Washington, DC. 102 pp.
- Hardy, R. W. (with E. O. Salo). 1983. Salmon species plan. *In: National Aquaculture Development Plan*, Vol. II. Prepared by Joint Subcommittee on Aquaculture, Washington, DC, pp. 99-123.
- Hardy, R. W. 1983. Effects of dietary oil source on carcass and membrane fatty acid composition, smoltification, and seawater adaptation in hatchery-reared coho salmon (Columbia Basin stock). Final Report for National Marine Fisheries Serviced. 28 pp.
- Hardy, R. W. 1985. Salmonid broodstock nutrition. *In: Salmonid Reproduction*, R. N. Iwamoto and S. Sower (eds). Washington Sea Grant, Seattle, WA, pp. 98-108.
- Hardy, R. W. 1986. Nutritional considerations for salmon farming in North America. *Aquaculture Magazine* 12(3): 44-46.
- Hardy, R. W. 1987. Fish silage and liquefied fish products. *Aquaculture Magazine* 13(2): 48-50.

- Scott, T. M. and R. W. Hardy. 1987. Effect of silica-based absorbant on oil absorption/retention and durability of Abernathy dry salmon diet. NOAA Tech. Memo. NOAA Technical Memorandum. NMFS F/NWC-114.
- Hardy, R. W. 1988. Carotenoid pigmentation of salmonids. *Tecnicas de Cultivo Y Manejo del Salmon: Desarrollos Recientes*, Fundacion Chile, 19-20 October, 1988. Santiago, Chile.
- Hardy, R. W. 1988. Nutritional requirements of farmed fish. *In: Proc. Fourth Alaska Aquaculture Conference*, S. Keller (ed). Alaska Sea Grant Report No. 8804, University of Alaska, Fairbanks, AK, pp 121-129.
- Hardy, R. W. 1988. Utilization of fish silage. *Tecnicas de Cultivo Y Manejo del Salmon: Desarrollos Recientes*. Fundacion Chile, 19-20 October, 1988, Santiago, Chile.
- Stone, F. E. and R. W. Hardy. 1989. Plasma amino acid changes in rainbow trout (*Salmo gairdneri*) fed freeze-dried fish silage, liquefied fish, and fish meal. *In: Proc. Aquaculture International Congress*, Vancouver, BC, Canada, 6-9 Sept., 1988, pp. 419-426.
- Hardy, R. W. and I. B. King. 1989. Variation in n-3 fatty acid content of fresh and frozen salmon. *Omega 3 News*, IV(4): 1-4.
- Hardy, R. W., T. Masumoto, W. T. Fairgrieve, and R. R. Stickney. 1990. The effects of dietary lipid source on muscle and egg fatty acid composition and reproductive performance of coho salmon (*Oncorhynchus kisutch*). *In: Proc. Third Int. Symp. on Feeding and Nutri. in Fish*, Aug. 28-Sept 1, Toba, Japan, pp 347-355.
- Hardy, R. W., and T. Masumoto. 1990. Specifications for marine by-products for aquaculture. *In: Proc. Internat. Conf. on Fish By-Products*, S. Keller (ed). Alaska Sea Grant College Program, 1990 Report No. 90-07, pp 109-120.
- Hardy, R. W. 1991. Fish Health Management and Nutrition in the Asia-Pacific Region. *In ADB/NACA, 1991, Fish Health Management in Asia-Pacific. Report on a Regional Study and Workshop on Fish Disease and Fish Health Management*. ADB Agriculture Department Report Series No. 1. Network of Aquaculture Centres in Asia-Pacific. Bangkok, Thailand, pp 425-434.
- Hardy, R. W., W. T. Fairgrieve, and T. M. Scott. 1991. Periodic feeding of low-phosphorus diet and phosphorus retention in rainbow trout (*Oncorhynchus mykiss*). *In Fish Nutrition in Practice*, S. J. Kaushik and P. Luquet (eds). INRA, Paris, 1993 (Les Colloques, #61), pp 403-412.
- Masumoto, T., R. W. Hardy, and R. R. Stickney. 1991. Gill lipid metabolism in pantothenic acid-deficient rainbow trout (*Oncorhynchus mykiss*). *In Fish Nutrition in Practice*, S. J. Kaushik and P. Luquet (eds). INRA, Paris, 1993 (Les Colloques, #61), pp 247-256.
- Higgs, D., R. W. Hardy, Z. Teskeredzic, B. Dosanjh, I. Forster, J. McBride, J. Jones, and R. Beames. 1991. Nutritive value of rapeseed protein concentrate for rainbow trout (*Oncorhynchus mykiss*). *Proc. Eighth International Rapeseed Congress*, 5: 1612-1617.
- Hardy, R. W. 1992. Fish hydrolysates: Production and use in aquaculture feeds. *In Proc. Aqua. Feed Processing and Nutrition Workshop*, D. M. Akiyama and R. K. H. Tan (eds). American Soybean Association, Singapore, pp 109-115.
- Cruz-Suárez, L. y D. Ricque. 2011. Homenaje al Dr. Ronald Hardy por su Contribución en Nutrición Acuícola. En: Cruz-Suárez, L.E., Ricque-Marie, D., Tapia-Salazar, M., Nieto-López, M.G., Villarreal-Cavazos, D. A., Gamboa-Delgado, J., Hernández-Hernández, L. (Eds), *Avances en Nutrición Acuícola XI - Memorias del Décimo Primer Simposio Internacional de Nutrición Acuícola*, 23-25 de Noviembre, San Nicolás de los Garza, N. L., México. ISBN 978-607-433-775-4. Universidad Autónoma de Nuevo León, Monterrey, México, pp. 172-199.

- Hardy, R. W. 1992. Application of hazard analysis and critical control point principles to feed manufacturing. *In Proc. Aqua. Feed Processing and Nutrition Workshop*, D. M. Akiyama and R. K. H. Tan (eds). American Soybean Association, Singapore, pp 121-128.
- Dong, F. M., F. T. Barrows, J. D. Erickson, W. T. Fairgrieve, I. P. Forster, N. F. Haard, R. W. Hardy, D. A. Higgs, B. A. Rasco, J. S. Rohovec, and C. E. Smith. 1993. The nutritive value of alternate protein sources in the diets of cultured salmonids. *In Proc. Twentieth U.S.-Japan Symp. on Aqua. Nutr.*, M. R. Collie and J. P. McVey (eds). Hatfield Marine Science Center, Newport, Oregon, 28-30 October, 1991. USDC/Sea Grant, pp 29-34.
- Stickney, R. R. and R. W. Hardy. 1993. Feeding practices as related to aquaculture nutrition studies. *In Proc. Twentieth U.S.-Japan Symp. on Aqua. Nutr.*, M. R. Collie and J. P. McVey (eds). Hatfield Marine Science Center, Newport, Oregon, 28-30 October, 1991. USDC/Sea Grant, pp 61-72.
- Forster, I. P. and Hardy, R.W., 1995. Captive salmon broodstock nutrition literature review. Pp. 4-1 to 4-38 *In An Assessment of the Status of Captive Broodstock Technology for Pacific Salmon*, T.A.Flagg and C.V.M.Mahnken (eds). Final Report, U.S. Department of Energy, Bonneville Power Administration, Division of Fish & Wildlife, Portland, Oregon, Project No. 93-56.
- Higgs, D. A., B. S. Dosanjh, A. F. Prendergast, R. M. Beames, R. W. Hardy, W. Riley and G. Deacon. 1995. Use of rapeseed/canola protein products in finfish diets. *In Nutrition and Utilization Technology in Aquaculture*, C. E. Lim and D. J. Sessa (eds). AOCS Press, Champaign, Illinois, pp. 130-156.
- Hardy, R. W. and Kissil, G. Wm., 1996. Trends in world aquaculture production: issues limiting increased production. *In Biotechnology in the Feed Industry, Proceedings of Alltech's Twelfth Annual Symposium*, T. P. Lyons and K. A. Jacques (eds). Nottingham University Press, Nottingham, UK, pp 107-120.
- Hardy, R. W. and Dong, F. M., 1997. Salmonid nutrition: constraints and quality standards. *Proc. Feed Ingredient Asia '97*, Singapore.
- Hardy, R. W., 1997. Sustainable aquaculture. *Aquaculture Magazine*, 23(2): 72-77.
- Hardy, R. W., 1997. Understanding and using apparent digestibility coefficients in fish nutrition. *Aquaculture Magazine*, 23(3): 84-89.
- Hardy, R. W., 1997. Do's and don'ts in fish nutrition research. *Aquaculture Magazine*, 23(4): 72-77.
- Hardy, R. W., 1997. How fish nutrition and feeding supports research and production; lessons from chickens. *Aquaculture Magazine*, 23(5): 88-92.
- Hardy, R.W. and Roberts, R.R., 1998. Atlantic salmon species profile: Nutrition and Feeding. *International Aqua Feed*, July-August, 1998.
- Hardy, R. W., 1998. Nutritional benefits of farmed fish. *Aquaculture Magazine*, 24(1): 68-71.
- Hardy, R. W., 1998. Back to the future. *Aquaculture Magazine*, 24(2): 78-81.
- Hardy, R. W., 1998. Pelleting technology for fish feeds. *Aquaculture Magazine*, 24(3): 86-90.
- Hardy, R. W., 1998. Oxidation of fish oil. *Aquaculture Magazine*, 24(4): 78-81.
- Hardy, R. W., 1998. Prevention and detection of fish oil oxidation. *Aquaculture Magazine*, 24(5): 93-98.
- Cruz-Suárez, L. y D. Ricque. 2011. Homenaje al Dr. Ronald Hardy por su Contribución en Nutrición Acuícola. En: Cruz-Suárez, L.E., Ricque-Marie, D., Tapia-Salazar, M., Nieto-López, M.G., Villarreal-Cavazos, D. A., Gamboa-Delgado, J., Hernández-Hernández, L. (Eds), *Avances en Nutrición Acuícola XI - Memorias del Décimo Primer Simposio Internacional de Nutrición Acuícola*, 23-25 de Noviembre, San Nicolás de los Garza, N. L., México. ISBN 978-607-433-775-4. Universidad Autónoma de Nuevo León, Monterrey, México, pp. 172-199.

- Hardy, R. W., 1998. Phytate. *Aquaculture Magazine*, 24(6): 77-80.
- Hardy, R.W., 1999. Aquaculture's rapid growth requirements for alternate protein sources. *Feed Management*, 50(1): 25-28.
- Hardy, R. W., 1999. IV International Symposium on Aquatic Nutrition. *Aquaculture Magazine*, 25(1): 74-77.
- Hardy, R.W., 1999. Evolution of shrimp feeds. *Aquaculture Magazine*, 25(3): 97-100.
- Hardy, R.W., 1999. Problems and opportunities in fish feed formulation. *Aquaculture Magazine*, 25(4): 56-60.
- Hardy, R.W., 1999. Which is better? *Aquaculture Magazine*, 25 (5): 75-79.
- Hardy, R.W., 1999. Grains and their by-products. *Aquaculture Magazine*, 25 (6): 54-58.
- Hardy, R.W., 1999. Aquaculture's rapid growth requirements for alternate protein sources. *Feed Management*, 50(1): 25-28.
- Hardy, R.W. and Green, J.A., 1999. How much feed does the world need? *Aquaculture Asia*, IV (1): 4-8.
- Hardy, R. W., 2000. Feeds and Nutrition in the New Millennium. *Aquaculture Magazine*, 26(1): 85-89
- Hardy, R.W., 2000. Advances in Hybrid Striped Bass Nutrition. *Aquaculture Magazine*, 26 (2): 88-92.
- Hardy, R.W., 2000. Committee on Animal Nutrition. *Aquaculture Magazine*, 26 (4): 62-66.
- Hardy, R.W., 2000. Fish Protein Hydrolysates as Components in Feeds. *Aquaculture Magazine*, 26 (5): 62-66.
- Hardy, R.W., 2000. Urban Legends. *Aquaculture Magazine*, 26 (6): 47-50.
- Hardy, R.W., 2000. World's largest feed company. *World Aquaculture*, 31(3): 12-14.
- Hardy, R.W., 2001. The Fifth International Symposium on Aquatic Nutrition. *Aquaculture Magazine*, 27 (1): 54-58.
- Hardy, R.W., 2001. Urban Legends and Fish Nutrition, Part 2. *Aquaculture Magazine*, 27 (2): 57-62.
- Hardy, R.W., 2001. Feed development for Asian aquaculture. *Aquaculture Magazine*, 27 (3): 51-54.
- Hardy, R.W., 2001. Alternatives to fish oil. *Aquaculture Magazine*, 27 (4): 49-54.
- Hardy, R.W., 2001. One size doesn't fit all. *Aquaculture Magazine*, 27 (5): 51-54.
- Forster, J. and Hardy, R.W., 2001. Measuring efficiency in intensive aquaculture. *World Aquaculture*, 32(2): 41-45.
- Hardy, R.W., 2001. *Urban Legend: Are we one? Aquaculture Magazine*, 27 (6): 52-56.
- Hardy, R.W., Higgs, D.A., Lall, S.P. and Tacon, A.G.J. 2001. Alternative dietary protein and lipid sources for sustainable production of salmonids. *Fisken og Havet* Nr. 8-2001. Institute of Marine Research (Havforskningsinstituttet), Bergen, Norway.
- Hardy, R.W., 2002. How to stifle innovation while "protecting" the environment. *Aquaculture Magazine*, 21 (1): 56-59.
- Hardy, R.W., 2002. Salmon pigmentation. *Aquaculture Magazine*, 21 (2): 48-53.
- Hardy, R.W., 2002. Salmon pigments: what's Natural? *Aquaculture Magazine*, 21 (3): 51-54.
- Hardy, R.W., 2002. Phytase. *Aquaculture Magazine*, 21 (4): 41-45.

- Hardy, R.W., 2002. Approval process for fish feed supplements and medications. *Aquaculture Magazine*, 21 (5): 52-55.
- Hardy, R.W., 2002. Organic Farmed Fish. *Aquaculture Magazine*, 21 (6): 60-63.
- Cheng, Z.J. and R.W. Hardy. 2003. Dietary lysine in plant protein diets improves rainbow trout performance, water quality. *Global Aquaculture Advocate*, 6(2): 56-57.
- Hardy, R.W. 2003. Phosphorus as an essential nutrient. *Aqua Feed International*, 6(2): 27-29.
- Hardy, R.W. 2003. Seafood Processing By-product Conference. *Aquaculture Magazine* 22(1): 59-62.
- Hardy, R.W. 2003. Farmed fish & omega-3 fatty acids. *Aquaculture Magazine* 22(2): 63-65.
- Hardy, R.W. 2003. Carbohydrate utilization: Omnivorous v. carnivorous fish. *Aquaculture Magazine* 22(3): 58-63.
- Hardy, R.W. 2003. Fish meal to farmed fish conversions. *Aquaculture Magazine* 22(4): 36-40.
- Hardy, R.W. 2003. Soybeans: the time is now. *Aquaculture Magazine* 22(5): 36-62.
- Hardy, R.W. 2003. Conflict ahead; can we reduce fish oil use. *Aquaculture Magazine* 22(6): 44-48
- Hardy, R.W. 2004. New approach to fish disease diagnosis. *Aquaculture Magazine* 30(1): 14-18.
- Hardy, R.W. 2004. Fatty acids: washed out or diluted following dietary change? *Aquaculture Magazine* 30(1): 63-66.
- Hardy, R.W. 2004. Contaminants in fish feed ingredients. *Aquaculture Magazine* 30(2): 59-61.
- Hardy, R.W. 2004. New developments in alternative proteins. *Aquaculture Magazine* 30(3): 56-59.
- Hardy, R.W. 2004. High tech hatcheries cannot overcome poor feeding practices. *Aquaculture Magazine* 30(4): 30-34.
- Hardy, R.W. 2004. How to influence people. *Aquaculture Magazine* 30(5): 56-57.
- Hardy, R.W. 2004. Best management practices for salmon feeds, feeding. *Global Aquaculture Advocate* (April), 44-45.
- Hardy, R.W. 2004. Problems and opportunities in fish feeds – fisheries processing by-products. *International Aqua Feed* (March-April): 33.
- Cheng, Zongjia and Hardy, R.W. 2004. MHA supplementation in soy-based diets improves performance of rainbow trout. *Global Aquaculture Advocate* (August), 72-73.
- Hardy, R.W. 2004 Fish oil quality. *International Aqua Feeds*, 7(3), 10-11.
- Hardy, R.W. 2005. “Color Added” labeling and carotenoid pigments in salmon feed. *Aquaculture Magazine* 30(1): 25-30.
- Hardy, R.W. 2005. Contaminants in salmon: a follow-up. *Aquaculture Magazine* 31(2): 43-45.
- Hardy, R.W. 2005. Fish meal myths concerning omnivorous farmed fish. *Aquaculture Magazine* 31(3): 53-58.
- Hardy, R.W. 2005. Fundamentals of fish nutrition studies. *Aquaculture Magazine* 31(4): 39-42.
- Hardy, R.W. 2005. Fish nutrition in the molecular age. *Aquaculture Magazine* 31(5): 39-42.
- Hardy, R.W. 2006. Removing “persistent organic pollutants” from fish meal and oil. *Aquaculture Magazine* 32(1): 43-45.

- Hardy, R.W. 2006. Fish nutrition basics, or how not to look like a fool when giving a presentation. *Aquaculture Magazine* 32(2): 55-58.
- Hardy, R.W. 2006. XII International Symposium on Fish Nutrition and Feeding. *Aquaculture Magazine* 32(3): 48-51.
- Hardy, R.W. 2006. Fish meal prices drive changes in fish feed formulation.. *Aquaculture Magazine* 32(4): 29-31.
- Hardy, R.W. 2006. Fish oil replacements shift fatty acid content of farmed fish. *Global Aquaculture Advocate*, 9(6), 48-49.
- Hardy, R.W. (2006) Worldwide fish meal production Outlook and the use of alternative protein meals for aquaculture. *Avances en Nutrición Acuícola VIII*, 410-419.
http://www.uanl.mx/utilerias/nutricion_acuicola/VIII/archivos/25Hardy.pdf
- Hardy, R.W. 2007. Phytase. *Aquaculture Magazine* 33(1): 49-50.
- Hardy, R.W. 2007. Marine protein and oil prices driving innovation in aquafeed ingredients. *Aquaculture Magazine* 33(2): 49-50.
- Hardy, R.W. 2007. XII Benefits and risks of global feed ingredient trade. *Aquaculture Magazine* 33(3): 43-45.
- Hardy, R.W. 2007. Zebrafish as a model fish in nutrition research.. *Aquaculture Magazine* 33(4): 81-83.
- Hardy, R.W. 2007. The issue of POP contamination of farmed salmon should be closed. *Aquaculture Magazine* 33(4): 33-36.
- Sealey, W.M., Hardy, R.W., Barrows, F.T., Johansen, K.A., Overturf, K., Hang, A. and LaPatra, S. (2007). Beta-glucans in barley increase immune response, disease resistance in rainbow trout study. *Global Aquaculture Advocate* 10(3): 70-73.
- Hardy, R.W. (2007) Increased ethanol production shifts feed industry grain use. *Global Aquaculture Advocate* 10(3): 68-70.
- Oliveira, A.C.M., Stone, D.A.J., Plante, S., Smiley S., Bechtel, P.J. and Hardy, R.W. (2008) Fish oils from Alaska seafood processing by-products: an un-exploited sustainable resource for aquaculture. *World Aquaculture* 51: 50:51, 69.
- Hardy, R.W. (2008) Seafood Processing Waste and By-Catch: Underutilized Resource or Lost Cause? *Aquaculture Magazine* 33 (1): 37-40.
- Hardy, R.W. (2008) USDA ARS/CSREES Aquaculture Stakeholder Workshop. *Aquaculture Magazine* 33 (2): 37-40.
- Hardy, R.W. (2008) The changing nature of fish nutrition research. *Aquaculture Magazine* 33 (3): 35-38.
- Hardy, R.W. (2008) Utilization of plant proteins in fish diets; effect of global demand and supplies of grains and oilseeds. *Avances en Nutrición Acuícola IX*, 6-12.
http://www.uanl.mx/utilerias/nutricion_acuicola/IX/archivos/2-Hardy.pdf
- Hardy, R.W. and Shepherd, J. (2009) Sustainable marine resources for organic feeds. *World Aquaculture* 40(2), 59-64.

- Hardy, R.W. 2010. Making a change in feeds. *Aquaculture Asia Pacific Magazine*, September/October, pp. 16-17.
- Sealey, W.M., Barrows, F.T., Smith, C.E. and Hardy, R.W. (2010) Dietary supplementation strategies to improve performance of rainbow trout *Oncorhynchus mykiss* fed plant-based diets. Proceedings of the 37th United States Japan Natural Resource (UJNR) annual conference, Kagoshima, Japan. *Bulletin of Fisheries Research Agency*, 31: 15-23.
- Hardy, R.W. and Cheng-Sheng Lee (2010) Aquaculture feed and seafood quality. Proceedings of the 37th United States Japan Natural Resource (UJNR) annual conference, Kagoshima, Japan. *Bulletin of Fisheries Research Agency*, 31: 43-50.