



References

References

- Abd El-Rhman AM, Khattab YAE, Shalaby AME (2009) *Micrococcus luteus* and *Pseudomonas* species as probiotics for promoting the growth performance and health of Nile tilapia, *Oreochromis niloticus*. Fish Shellfish Immunol 27(2):175-180.
- Abdelhamid AM, Mehrim AI, El-Barbary MI, Ibrahim SM, Abd El-Wahab AI (2009) Evaluation of a new Egyptian probiotic by African catfish fingerlings. Environ Sci Technol 2(3):133-145.
- Abo-Esa JFK (2008) Study on some ectoparasitic diseases of catfish, *Clarias gariepinus* with their control by ginger, *Zingiber officiale*. Mediterr Aquac J 1(1):1-9.
- Abraham TJ, Mallick PK, Adikesavalu H, Banerjee S (2015) Pathology of *Edwardsiella tarda* infection in African catfish, *Clarias gariepinus* (Burchell 1822), fingerlings. Arch Pol Fish 23:141-148.
- Abraham TJ, Surendra Babu CH, Banerjee T (2007) Influence of a fish gut bacterium *Lactobacillus* sp. on the production of swordtail *Xiphophorus helleri* (Heckel 1848). Bangladesh Fish Res 11(1):65-74.
- Aderolu AZ, Ogun A, Sanni RA, Oguntoyinbo FA (2013) Growth response of juvenile catfish (*Clarias gariepinus*) fed diets supplemented with *Lactobacillus* sp. inclusion into feeds and cultured water. Nig Vet J 34(1):684-690.
- Adewole AM (2014) Effects of Roselle as dietary additive on growth performance and production economy of *Clarias gariepinus*. J Emerg Trends Eng Appl Sci 5(7):1-8.
- Adeyemo OK (2007) Haematological profile of *Clarias gariepinus* (Burchell, 1822) exposed to lead. Turk J Fish Aquat Sci 7:163-169.

- Adeyeye EI, Akinyugha NJ, Fesobi ME, Tenabe VO (1996) Determination of some metals in *Clarias gariepinus* (Cuvier and Vallenciennes), *Cyprinus carpio* (L.) and *Oreochromis niloticus* (L.) fishes in a polyculture fresh water pond and their environments. *Aquaculture* 147:205-214.
- Afrilasari W, Widanarni W, Meryandini A (2017) Effect of probiotic *Bacillus megaterium* PTB 1.4 on the population of intestinal microflora, digestive enzyme activity and the growth of catfish (*Clarias* sp.). *Hayati J Biosci* 24:1-5.
- Ahmad U, Parveen S, Abdel Mola HR, Ganai AH (2012) Zooplankton population in relation to physico-chemical parameters of Lal Diggi pond in Aligarh, India. *J Environ Biol* 33:1015-1019.
- Ahmed I, Yokota A, Yamazoe A, Fujiwara T (2007) Proposal of *Lysinibacillus boronitolerans* gen. nov. sp. nov., and transfer of *Bacillus fusiformis* to *Lysinibacillus fusiformis* comb. nov. and *Bacillus sphaericus* to *Lysinibacillus sphaericus* comb. nov. *Int J Syst Evol Microbiol* 57:1117-1125.
- Ahmed R, Pandey RB, Arif SH, Nabi N, Jabeen M, Hasnain A (2012) Polymorphic β and γ lens crystalline demonstrate latitudinal distribution of threatened walking catfish *Clarias batrachus* (Linn.) populations in North-Western India. *J Biol Sci* 12:98-104.
- Alcaide E, Blasco MD, Esteve C (2005) Occurrence of drug-resistant bacteria in two European eel farms. *Appl Environ Microbiol* 71(6):3348-3350.
- Al-Deghayem WA, Al-Balawi HF, Kandeal SA, Suliman EAM (2017) Gonadosomatic index and some hematological parameters in African catfish *Clarias gariepinus* (Burchell, 1822) as affected by feed type and temperature level. *Braz Arch Biol Technol* 60:e17160157. <http://dx.doi.org/10.1590/1678-4324-2017160157>

- Al-Dohail MA, Hasim R, Aliyu-Paiko M (2011) Evaluating the use of *Lactobacillus acidophilus* as a biocontrol agent against common pathogenic bacteria and the effects on the haematology parameters and histopathology in African catfish *Clarias gariepinus* juveniles. Aquac Res 42(2):196-209.
- Al-Dohail MA, Hasim R, Aliyu-Paiko M (2009) Effects of the probiotic, *Lactobacillus acidophilus*, on the growth performance, haematology parameters and immunoglobulin concentration in African Catfish (*Clarias gariepinus*, Burchell 1822) fingerling. Aquac Res 40(14):1642-1652.
- Al-Harbi AH, Uddin N (2003) Quantitative and qualitative studies on bacterial flora of hybrid tilapia (*Oreochromis niloticus* × *O. aureus*) cultured in earthen ponds in Saudi Arabia. Aquac res 34(1):43-48.
- Al-Harbi AH, Uddin N (2005) Bacterial diversity of tilapia (*Oreochromis niloticus*) cultured in brackish water in Saudi Arabia. Aquaculture 250:566-572.
- Aly SM, Abdel-Galil Ahmed Y, Abdel-Aziz Ghareeb A, Mohamed MF (2008) Studies on *Bacillus subtilis* and *Lactobacillus acidophilus*, as potential probiotics, on the immune response and resistance of Tilapia nilotica (*Oreochromis niloticus*) to challenge infections. Fish Shellfish Immunol 25(1-2):128-136.
- Anonymous data (2016) “Natural Resource” retrieved 14th January, 2016
www.bankura.org.
- APHA (2008) Standard methods for the examination of water and wastewater, 20th edition; American Public Health Association, Washington, DC.
- Apiratikul R, Pavasant P (2008) Batch and column studies of biosorption of heavy metals by *Caulerpa lentillifera*. Bioresour Technol 99(8):2766-2777.

- Atawodi JC, Yola IA, Kowo AH, Abdullahi BA (2017) Fungi associated with African mudfish (*Clarias gariepinus*, Burchell 1822) in selected fish farms and dams in Zaria and its environs, Kaduna state, Nigeria. *Bayero J Pure Appl Sci* 10(1):642-646.
- Ayo Olalusi CI, Mojekwu T, Adeleke TA, Bernard E, Adejonwo MO, Adeyemi YB (2014) Digestive enzymes assay and haematological profile of *Clarias gariepinus* juveniles fed with probiotics supplemented diets. *Adv Plants Agric Res* 1(4):1-5.
- Ayoola SO, Ajani EK, Fashae OF (2013) Effect of probiotics (*Lactobacillus* and *Bifidobacterium*) on growth performance and hematological profile of *Clarias gariepinus* juveniles. *World J Fish Mar Sci* 5(1):01-08.
- Azam F, Fenchel T, Field JG, Gray JS, Meyerr-Reil LA, Thingstad F (1983) The ecological role of water column microbes in the sea. *Mar Ecol Prog Ser* 10:257-263.
- Bairagi A, Ghosh KS, Sen SK, Ray AK (2002) Enzyme producing bacterial flora isolated from fish digestive tracts. *Aquac Int* 10:109-121.
- Balakrishna A (2013) *In vitro* evaluation of adhesion and aggregation abilities of four potential probiotic strains isolated from guppy (*Poecilia reticulata*). *Braz Arch Biol Technol* 56(5):793-800.
- Balcazar JL, Blas ID, Ruiz-Zarzuela I, Cunningham D, Vendrell D, M'uzquiz JL (2006) The role of probiotics in aquaculture. *Vet Microbiol* 114(3-4):173-186.
- Balogun O, Solomon JR (2015) Prevalence of endoparasitic infection of *Clarias gariepinus* fed chicken droppings. *Afr J Environ Pollut Health* 11:26-33.
- Bandyopadhyay P, Das Mohapatra PK (2009) Effect of probiotic bacterium *Bacillus circulans* PB7 in the formulated diets: on growth, nutritional quality and immunity of *Catla catla* (Ham.). *Fish Physiol Biochem* 35:467-478.

- Banerjee A, Jana A, Pati BR, Mondal KC, Das Mohapatra PK (2012) Characterization of tannase protein sequences of bacteria and fungi: an *in silico* study. Protein J 31(4):306-327.
- Banerjee A, Sahoo DK, Thatoi HN, Pati BR, Mondal KC, Sen A, Das Mohapatra PK (2014) Structural characterization and active site prediction of bacterial keratinase through molecular docking. J Bioinformatics 1(4):67-82.
- Banerjee G, Dan SK, Nandi A, Ghosh P, Ray AK (2015) Autochthonous gut bacteria in two Indian air-breathing fish, climbing perch (*Anabas testudineus*) and walking catfish (*Clarias batrachus*): mode of association, identification and enzyme producing ability. Pol J Microbiol 64(4):361-368.
- Barman, P, Banerjee A, Bandyopadhyay P, Mondal KC, Das Mohapatra PK (2011) Isolation, identification and molecular characterization of potential probiotic bacterium, *Bacillus subtilis* PPP 13 from *Penaeus monodon*. Biotechnology, Bioinformatics and Bioengineering 1(4):473-482.
- Barman P, Raut S, Sen SK, Shaikh U, Bandyopadhyay P, Das Mohapatra PK (2017) Effect of a three-component bacterial consortium in white shrimp farming for growth, survival and water quality management. Acta Biol Szeged 61(1):35-44.
- Battish SK (1992) Freshwater Zooplankton of India. Oxford and IBH publishing Co., New Delhi.
- Bauer AW, Kirby WMM, Sherris JC, Turck M (1966) Antibiotic susceptibility testing by a standardized disk method. Am J Clin Pathol 45:493-496.
- Bäumler AJ, Sperandio V (2016) Interactions between the microbiota and pathogenic bacteria in the gut. Nature 535:85-93.

- Begley M, Hill C, Gahan CGM (2006) Bile salt hydrolase activity in probiotics. *Appl Environ Microbiol* 72(3):1729-1738.
- Behera BC, Yadav H, Singh SK, Mishra RR, Sethi BK, Dutta SK, Thatoi HN (2017) Phosphate solubilization and acid phosphatase activity of *Serratia* sp. isolated from mangrove soil of Mahanadi river delta, Odisha, India. *J Genet Eng Biotechnol* 15:169-178.
- Beveridge MCM, McAndrew B (2000) Tilapias: biology and exploitation. Springer Science and Business Media, Netherland.
- Bhatnagar A, Devi P (2013) Water quality guidelines for the management of pond fish culture. *Int J Env Sci* 3(6):1980-2009.
- Bhatnagar A, Garg SK (2000) Causative factors of fish mortality in still water fish ponds under sub-tropical conditions. *Aquaculture* 1(2):91-96.
- Bisht A, Singh UP, Pandey NN (2014) Comparative study of seasonal variation in bacterial flora concomitant with farm raised fingerlings of *Cyprinus carpio* at Tarai region of Uttarakhand. *J Environ Biol* 35:363-367.
- Boon JH, Huisman EA (1996) Viral, bacterial and fungal diseases of Siluroidei, cultured for human consumption. *Aquat Living Resour* 9:153-164.
- Borghi C, Rosei EA, Bardin T, Dawson J, Dominiczak A, Kielstein JT, Manolis AJ, Perez-Ruiz F, Mancia G (2015) Serum uric acid and the risk of cardiovascular and renal disease. *J Hypertens* 33(9):1729-1741.
- Boyd CE (1982) Water quality management for pond fish culture. Elsevier Scientific Publishing Co. New York.

- Boyd CE, Scarsbrook E (1974) Effects of agricultural limestone on phytoplankton communities of fish ponds. *Arch Hydrobiol* 74:336-349.
- Butprom S, Phumkhachorn P, Rattanachaikunsopon P (2013) Effect of *Lactobacillus plantarum* C014 on innate immune response and disease resistance against *Aeromonas hydrophila* in hybrid catfish. *Scientific World J* 2013:1-6.
- Cai Y, Yuan W, Wang S, Guo W, Li A, Wu Y, Chen X, Ren Z, Zhou Y (2019) *In vitro* screening of putative probiotics and their dual beneficial effects: To white shrimp (*Litopenaeus vannamei*) postlarvae and to the rearing water. *Aquaculture* 498:61-71.
- Chakrabarti R, Jana BB (1998) Effects on growth and water quality of feeding exogenous plankton compared to use of manure in the culture of Mrigal, *Cirrhinus mrigala*, and Rohu, *Labeo rohita*, fry in tanks. *J Appl Aquacult* 8(2):87-95.
- Chen K, Wang CQ, Fan YQ, Xie YS, Yin ZF, Xu ZJ, Zhang HL, Cao JT, Wang Y (2015) Application of chrysophanol in zebrafish to reduce dietary introduced lipid and its possible mechanism. *Int J Clin Exp Med* 8(7):10558-10567.
- Chiba S, Batten S, Martin CS, Ivory S, Miloslavich P, Weatherdon LV (2018) Zooplankton monitoring to contribute towards addressing global biodiversity conservation challenges. *J Plankton Res* 40(5):509-518.
- Chowdhury MBR, Uddin MN, Begum A (1994) Bacterial flora in catfish, *Clarias batrachus* pond. *Bangladesh J Aquacult* 16:39-42.
- Chun SJ, Cui Y, Ahn CY, Oh HM (2018) Improving water quality using settleable microalga *Ettlia* sp. and the bacterial community in freshwater recirculating aquaculture system of *Danio rerio*. *Water Res* 135:112-121.

- Coello-Camba A, Agustí S, Holding J, Arrieta JM, Duarte CM (2014) Interactive effect of temperature and CO₂ increase in Arctic phytoplankton. *Front Mar Sci* doi: 10.3389/fmars.2014.00049.
- Courtenay WR, Sahlman HF, Miley WW, Herrema DJ (1974) Exotic fishes in fresh and brackish waters of Florida. *Biol Conserv* 6:292-302.
- Crab R, Avnimelech Y, Defoirdt T, Bossier P, Verstraete W (2007) Nitrogen removal techniques in aquaculture for a sustainable production. *Aquaculture* 270:1-14.
- Crab R, Chielens B, Wille M, Bossier P, Verstraete W (2010) The effect of different carbon sources on the nutritional value of bioflocs, a feed for *Macrobrachium rosenbergii* post larvae. *Aquac Res* 41(4):559-567.
- Dahiya T, Gahlawat SK, Sihag RC (2012a) Elimination of pathogenic bacterium (*Micrococcus sp.*) by the use of probiotics. *Turk J Fish Aquat Sci* 12:185-187.
- Dahiya T, Verma RK, Singh G, Sihag RC (2012b) Elimination of pathogenic bacterium, *Aeromonas hydrophila* by the use of probiotics. *J FisheriesSciences.com* 6(3):209-214.
- Dahiya T, Sihag RC, Gahlawat SK (2012c) Effect of probiotics on the haematological parameters of Indian magur (*Clarias batrachus* L.). *J Fish Aquat Sci* 7(4):279-290.
- Dalmin G, Kathiresan K, Purushothaman A (2001) Effect of probiotics on bacterial population and health status of shrimp in culture pond ecosystem. *Indian J Exp Biol* 39:939-942.
- Datta Munshi JS (1961) The accessory respiratory organs of *Clarias batrachus* (Linn.). *J Morphol* 109(2):115-139.

- Dawah AM, Gomaah SA (2005) Phytoplankton dynamics in earthen ponds stocked with African catfish (*Clarias gariepinus*) feeding with different diets. Egyptian J Phycol 6:1-15.
- De Almeida FA, Pinto UM, Dantas Vanetti MC (2016) Novel insights from molecular docking of SdiA from *Salmonella enteritidis* and *Escherichia coli* with quorum sensing and quorum quenching molecules. Microb Pathog 99:178-190.
- De BC, Meena DK, Behera BK, Das P, Das Mohapatra PK, Sharma AP (2014) Probiotics in fish and shellfish culture: immunomodulatory and ecophysiological responses. Fish Physiol Biochem 40(3): 921-971.
- Dean M, Cervellati C, Casanova E, Squerzanti M, Lanzara V, Medici A, Polverino de Laureto P, Bergamini CM (2002) Characterization of cholylglycine hydrolase from a bile-adapted strain of *Xanthomonas maltophilia* and its application for quantitative hydrolysis of conjugated bile salts. Appl Environ Microbiol 68:3126-3128.
- Defoirdt T, Boon N, Bossier P, Verstraete W (2004) Disruption of bacterial quorum sensing: an unexplored strategy to fight infections in aquaculture. Aquaculture 240(1-4):69-88.
- Dennis EU, Uchenna OJ (2016) Use of probiotics as first feed of larval African catfish *Clarias gariepinus* (Burchell 1822). Annu Res Rev Biol 9(2):1-9.
- Devaraja T, Banerjee S, Yusoff F, Sariff M, Khatoon H (2013) A holistic approach for selection of *Bacillus* sp. as a bioremediator for shrimp post larvae culture. Turk J Biol 37:92-100.

- Dey A, Ghosh K, Hazra N (2016a) Evaluation of extracellular enzyme-producing autochthonous gut bacteria in walking catfish, *Clarias batrachus* (L.). J Fish 4(1):345-352.
- Dey A, Ghosh K, Hazra N (2016b) Evaluation of preference of dry feed, bio-encapsulated and non-bio-encapsulated live feed and survival of the walking catfish, *Clarias batrachus* (L.) juveniles. Int J Fish Aquat Stud 4(5):545-549.
- Dey A, Ghosh K, Hazra N (2017) Improvement of growth and survival of the juvenile walking catfish, *Clarias batrachus* (L.) (Siluriformes: Clariidae) fed on probiotics encapsulated and ascorbic acid enriched chironomid larvae (Diptera: Chironomidae). Proc Zool Soc doi:10.1007/s12595-017-0236-9.
- Dhanasekaran D, Saha S, Thajuddin N, Panneerselvam A (2008) Probiotic effect of *Lactobacillus* isolates against bacterial pathogens in *Clarias orientalis*. Facta Univ 15(3):97-102.
- Dhawale MR, Wilson JJ, Khachatourians GG, Mikeingledew W (1982) Improved method for detection of starch hydrolysis. Appl Environ Microbiol 44(3):747-750.
- Dhilon SS, Gupta AK (1983) A clinical approach to study the pollutants intoxication in a freshwater teleost *Clarias batrachus*. Water Air Soil Pollut 20:63-68.
- Dryer RL, Tammes AR, Routh JI (1957) The determination of phosphorus and phosphatase with *N*-Phenyl-*p*-Phenylenediamine. J Biol Chem 225:177-184.
- DuBois M, Gilles K, Hamilton J, Rebers P, Smith F (1956) Colorimetric method for determination of sugars and related substances. Anal Chem 28(3):350-356.
- Duhovny D, Nussinov R, Wolfson HJ (2002) Efficient unbound docking of rigid molecules. In Gusfield et al., Ed. Proceedings of the 2'nd Workshop on Algorithms in

- Bioinformatics (WABI) Rome, Italy, Lecture Notes in Computer Science 2452, pp. 185-200, Springer Verlag,
- Dutta TK, Patra BC (2013) Biodiversity and seasonal abundance of zooplankton and its relation to physico-chemical parameters of Jamunabundh, Bishnupur, India. Int J Sci Res 3:76-82.
- Elavarasi K, Ranjini S, Rajagopal T, Rameshkumar G, Ponmanickam P (2013) Bactericidal proteins of skin mucus and skin extracts from fresh water fishes, *Clarias batrachus* and *Tilapia mossambicus*. Thai J Pharm Sci 37:194-200.
- El-Feky MMM (2017) Effect of zooplankton and environmental parameters on African catfish *Clarias gariepinus* (Burchell, 1822) in Egypt. J Aquac Res Development 8:4. doi:10.4172/2155-9546.1000487
- El-Haroun ER (2007) Improved growth rate and feed utilization in farmed African catfish *Clarias gariepinus* (Burchell 1822) through a growth promoter Biogen supplementation. J Fish Aquat Sci 2:319-327.
- El-Haroun ER, Goda AMA, Kabir Chowdhury MA (2006) Effect of dietary probiotic Biogen® supplementation as a growth promoter on growth performance and feed utilization of Nile tilapia *Oreochromis niloticus* (L.). Aquac Res 37:1473-1480.
- Ellis MM (1937) Detection and measurement of stream pollution. U. S. Department of commerce, Bureau of Fisheries; volume XLVIII, Bulletin No. 22, USA.
- El-Tantawy SAM, El-Sherbiny HAE (2010) Ectoparasitic Trichodinians Infecting catfish *Clarias gariepinus* inhabiting Nile Delta Water of the River Nile, Dakahlia Province, Egypt. J Am Sci 6(9):656-668.

- Essa MA, Mabrouk HA, Mohamed RA, Michael FR (2011) Evaluating different additive levels of yeast, *Saccharomyces cerevisiae*, on the growth and production performances of a hybrid of two populations of Egyptian African catfish, *Clarias gariepinus*. Aquaculture 320(1-2):137-141.
- Fagbenro OA (2005) Soybean meal substitution with Roselle (*Hibiscus sabdariffa* L.) seed meal in dry practical diets for fingerlings of the African catfish, *Clarias gariepinus* (Burchell 1822). J Anim Vet Adv 4(4):473-477.
- Falaye A, Emikpe B, Ogundipe E (2016) Influence of *Lactobacillus plantarum* supplemented diet on growth response, gut morphometry and microbial profile in gut of *Clarias gariepinus* fingerlings. J Coast Life Med 4(8):597-602.
- FAO (2018) <http://www.fao.org/3/i9540en/I9540EN.pdf>
- FAO/OIE/WHO (2006) Antimicrobial use in aquaculture and antimicrobial resistance. Report of a Joint. Expert Consultation on Antimicrobial Use in Aquaculture and Antimicrobial Resistance.
- Fazio F, Marafioti S, Arfuso F, Piccione G, Faggio C (2013) Comparative study of the biochemical and haematological parameters of four wild Tyrrhenian fish species. Vet Med 58(11):576-581.
- Feliatra F, Elizal E, Lukistyowati I, Melina D, Ramadhani M (2018) Effectiveness of immersion with probiotic in improving the health of Nile Tilapia (*Oreochromis niloticus*) Asian J Anim Vet Adv 13:43-51.
- FishBase (2016) <http://www.fishbase.org/search.php>.
- Fisher EA, Feig JE, Hewing B, Hazen SL, Smith JD (2012) HDL function, dysfunction, and reverse cholesterol transport. Arterioscler Thromb Vasc Biol 32(12):2813-2820.

- Forbes B, Sahm DF, Weissfeld AS (2002) Bailey & Scott's diagnostic microbiology, 11th ed. Mosby, St. Louis, MO. ISBN 0-323-01678-2.
- Fuller R (1989) Probiotics in man and animals. J Appl Bacteriol 66(5):365-378.
- Gado MSM, Mahfouz NB, Moustafa EMM, Lolo EEE (2017) Prevalence of some ectoparasitic diseases in African catfish (*Clarias gariepinus*) at Kafr El-Sheikh governorate. Int J Fish Aquat Stud 5(3):576-583.
- Gatesoupe FJ (1993) *Bacillus* sp. spores as food additive for the rotifer *Brachionus plicatilis*: improvement of their bacterial environment and their dietary value for larval turbot, *Scophthalmus maximus* L. In: Kaushik, S.J., Luquet, P. Eds., Fish Nutrition in Practice. Paris, France, Les Colloques, Vol. 61, pp. 561-568.
- Gatesoupe FJ (1994) Lactic acid bacteria increase the resistance of turbot larvae, *Scophthalmus maximus*, against pathogenic *Vibrio*. Aquat Living Resour 7:277-282
- Gatesoupe FJ (1999) The use of probiotics in aquaculture. Aquaculture 180:147-165.
- Ghoneim WM, Khalil RH, Saad TT, Tanekhy M, Abdel-Latif HMR (2015) Ectoparasite fauna of cultured African catfish, *Clarias gariepinus* (Burchell, 1822), El-Behera Province, Egypt. Int J Fish Aquat Stud 3(1):19-22.
- Ghosh K, Sen SK, Ray AK (2004) Growth and survival of Rohu *Labeo rohita* (Hamilton) spawn fed diets fermented with intestinal bacterium, *Bacillus circulans*. Acta Ichthyol Piscat 34(2):155-165.
- Ghosh S, Sinha A, Sahu C (2007) Isolation of putative probiotics from the intestines of Indian major carps. Isr J Aquacult Bamidgeh 59(3):127-132.
- Gilliland SE, Staley TE, Bush LJ (1984) Importance of bile tolerance of *Lactobacillus acidophilus* used as a dietary adjunct. J Dairy Sci 67:3045-3051.

- Giri SS, Sen SS, Sukumaran V (2012) Effects of dietary supplementation of potential probiotic *Pseudomonas aeruginosa* VSG-2 on the innate immunity and disease resistance of tropical freshwater fish, *Labeo rohita*. Fish Shellfish Immunol 32:1135-1140.
- Gismondo MR, Drago L, Lombardi A (1999) Review of probiotics available to modify gastrointestinal flora. Int J Antimicrob Agents 12:287-292.
- GFSI (2018) <https://foodsecurityindex.eiu.com>
- Gomaa EZ (2013) Optimization and characterization of alkaline protease and carboxymethyl-cellulase produced by *Bacillus pumillus* grown on *Ficus nitida* wastes. Braz J Microbiol 44(2):529-537.
- Gomes LC, Brinn RP, Marcon JL, Dantas LA, Brandao FR, Sampaio de Abreu J, Lemos PEM, McComb DM, Baldisserotto B (2009) Benefits of using the probiotic Efinol®L during transportation of cardinal tetra, *Paracheirodon axelrodi* (Schultz), in the Amazon. Aquac Res 40:157-165.
- Goodsell DS, Olson AJ (1990) Automated docking of substrates to proteins by simulated annealing. Proteins: Struct Funct Genet 8:195-202.
- Gram L, Melchiorsen J, Spanggaard B, Huber I, Nielsen T (1999) Inhibition of *Vibrio anguillarum* by *Pseudomonas fluorescens* strain AH2, a possible probiotic treatment of fish. Appl Environ Microbiol 65(3):969-973.
- Hai NV, Fotedar R, Buller N (2007) Selection of probiotics by various inhibition test methods for use in the culture of western king shrimps, *Penaeus latisulcatus* (Kishinouye). Aquaculture 272:231-239.

- Hamon E, Horvatovich P, Marchioni E, Aoude-Werner D, Ennahar S (2014) Investigation of potential markers of acid resistance in *Lactobacillus plantarum* by comparative proteomics. J Appl Microbiol 116:134-144.
- Hapsari F (2016) The effect of fermented and non fermented biofloc inoculated with bacterium *Bacillus cereus* for catfish (*Clarias gariepinus*) juveniles. AACL Bioflux 9(2):334-339.
- Hargreaves JA (1998) Nitrogen biogeochemistry of aquaculture ponds. Aquaculture 166:181-212.
- Hargreaves JA, Brunson MW (1996) Carbon dioxide in fish ponds. Southern Regional Aquaculture Center, SRAC Publication 468, Starkville, Mississippi.
- Harmon SM, Specht WL, Chandler GT (2003) A comparison of the Daphnids *Ceriodaphnia dubia* and *Daphnia ambigua* for their utilization in routine toxicity testing in the southeastern United States. Arch Environ Contam Toxicol 45:79-85.
- Heine W, Radke M, Wutzke KD (1995) The significance of tryptophan in human nutrition. Amino acids 9:191-205.
- Hjelm M, Bergh Ø, Riaza A, Nielsen J, Melchiorsen J, Jensen S, Duncan H, Ahrens P, Birkbeck H, Gram L (2004) Selection and identification of autochthonous potential probiotic bacteria from turbot larvae (*Scophthalmus maximus*) rearing units. Syst Appl Microbiol 27(3):360-371.
- Holt JG, Krieg NR, Sneath PHA, Staley JT, Williams ST (1994) Bergey's Manual of Determinative Bacteriology, 9th edn. Baltimore: Williams & Wilkins.
- Hossain MA, Afsana K, Azad Shah AKM (1999) Nutritional value of some small indigenous fish species (SIS) of Bangladesh. Bangladesh J Fish Res 3(1):77-85.

- Huson DH, Richter DC, Rausch C, Dezulian T, Franz M, Rupp R (2007) Dendroscope: An interactive viewer for large Phylogenetic trees. BMC Bioinformatics 8:460-464.
- Hutchinson GE (1957) A treatise on Limnology. Vol-I. Chapman Hall, London. pp 1015.
- Ibrahem MD (2015) Evolution of probiotics in aquatic world: Potential effects, the current status in Egypt and recent prospective. J Adv Res 6:765-791.
- ICAR-CIFA (2016-17) Annual report, Kausalyaganga, Bhubaneswar-751002, Odisha, India.
- Ige BA (2013) Probiotics use in intensive fish farming. Afr J Microbiol Res 7(22):2701-2711.
- Ikpi G, Offem B (2011) Bacterial infection of mudfish *Clarias gariepinus* (Siluriformes: Clariidae) fingerlings in tropical nursery ponds. Rev Biol Trop 59(2):751-759.
- Irianto A, Austin B (2002) Use of probiotics to control furunculosis in rainbow trout, *Oncorhynchus mykiss* (Walbaum). J Fish Dis 25:333-342.
- Jahan T, Ayub Ali M, Rahman T (2016) Investigation on the growth performances of selected probiotic supplemented tilapia (*Oreochromis niloticus*) and walking catfish (*Clarias batrachus*) fingerlings. Fundam Appl Agric 1(2):75-81.
- James ME (2000) Water quality and recalculating aquaculture systems. Aquaculture Systems Technologies, LLC. New Orleans, LA. 16-17p, 28p.
- Jayaram KC (1981) The Freshwater Fishes of India, Pakistan, Bangladesh, Burma, and Sri Lanka. Handbook of Zoological Survey of India, Volume- 2, Calcutta. 475 p.
<https://trove.nla.gov.au/version/21770737>
- Jhingran VG (1982) Fish and Fisheries of India. Hindustan Publishing Corp. (India) Delhi.

- Jimoh WA, Oladele-Bukola MO, Adebayo MD, Yusuff AA, Azeez FA, Salam OO (2014) Microbial flora of the gastro-intestinal tract of *Clarias gariepinus* caught from river Dandaru Ibadan, Nigeria. Sokoto J Vet Sci 12(2):19-24.
- Jin LJ, Ho YW, Abdullah N, Jalaludin S (1998) Acid and bile tolerance of *Lactobacillus* isolated from chicken intestine. Lett Appl Microbiol 27:183-185.
- Kasana RC, Salwan R, Dhar H, Dutt S, Gulati A (2008) A rapid and easy method for the detection of microbial cellulases on agar plates using Gram's iodine. Curr Microbiol 57(5):503-507.
- Kasornchandra J, Rogers WA, Plumb JA (1987) *Edwardsiella ictaluri* from walking catfish, *Clarias batrachus* L., in Thailand. J Fish Dis 10:137-138.
- Kato CD, Kabarozi R, Majalija S, Tamale A, Musisi NL, Sengooba A (2016) Isolation and identification of potential probiotic bacteria on surfaces of *Oreochromis niloticus* and *Clarias gariepinus* from around Kampala, Uganda. Afr J Microbiol Res 10(36):1524-1530.
- Kavitha M, Raja M, Perumal P (2018) Evaluation of probiotic potential of *Bacillus* spp. isolated from the digestive tract of freshwater fish *Labeo calbasu* (Hamilton, 1822). Aquaculture Reports 11:59-69.
- Kavya KS, Jadesh M, Kulkarni RS (2016) Hematology and serum biochemical changes in response to change in saline concentration in fresh water fish *Notopterus notopterus*. World Scientific News 32:49-60.
- Keysami MA, Mohammadpour M (2013) Effect of *Bacillus subtilis* on *Aeromonas hydrophila* infection resistance in juvenile freshwater prawn, *Macrobrachium rosenbergii* (de Man). Aquac Int 21(3):553-562.

- Khedkar GD, Tiknaik AD, Shinde RN, Kalyankar AD, Ron TB, Haymer D (2015) High rates of substitution of the native catfish *Clarias batrachus* by *Clarias gariepinus* in India. Mitochondrial DNA. <https://doi.org/10.3109/19401736.2014.905863>
- Kim DH, Austin B (2006) Innate immune responses in rainbow trout (*Oncorhynchus mykiss*, Walbaum) induced by probiotics. Fish Shellfish Immunol 21(5):513-524.
- Knud-Hansen CF, Batterson TR, McNabb CD, Hadiroseyan Y, Dana D, Eidman HM (1990) Hatchery techniques for egg and fry production of *Clarias batrachus* (Linnaeus). Aquaculture 89:9-19.
- Kozasa M (1986) Toyocerin (*Bacillus toyoi*) as growth promoter for animal feeding. Microbiologie Aliments Nutrition 4:121-135.
- Krasowska A, Sigler K (2014) How microorganisms use hydrophobicity and what does this mean for human needs? Front Cell Infect Microbiol 4:1-7.
- Kumar R, Banerjee TK (2016) Arsenic induced hematological and biochemical responses in nutritionally important catfish *Clarias batrachus* (L.). Toxicol Rep 3:148-152.
- Kumar R, Mukherjee SC, Prasad KP, Pal AK (2006) Evaluation of *Bacillus subtilis* as a probiotic to Indian major carp *Labeo rohita* (Ham.). Aquac Res 37:1215-1221.
- Laboni NN, Chandra KJ, Chhanda MS (2012) Effects of caryophyllaeid cestode infestations on *Clarias batrachus* (Linn.). J Asiat Soc Bangladesh, Sci 38(2):135-144.
- Lambertsen G (1977) Fatty acid compositions of fish fats. Comparisons based on eight fatty acids. Fisk Dir Skr Ser Ernering 1(4):105-116.
- Lara-Flores M, Olvera-Novoa MA, Guzman-Mendez BE, Lopez-Madrid W (2003) Use of the bacteria *Streptococcus faecium* and *Lactobacillus acidophilus*, and the yeast

- Saccharomyces cerevisiae* as growth promoters in Nile tilapia (*Oreochromis niloticus*). Aquaculture 216(1-4):193-201.
- Larkin MA, Blackshields G, Brown NP, Chenna R, McGettigan PA, William HM, Valentin F, Wallace IM, Wilm A, Lopez R, Thompson JD, Gibson TJ, Higgins DG (2007) Clustal Wand Clustal X version 2.0. Bioinformatics 23:2947-2948.
- Larsen T, Thilsted SH, Kongsbak K, Hansen M (2000) Whole small fish as a rich calcium source. Br J Nutr 83(2):191-196.
- Leaf A, Kang JX (1996) Prevention of cardiac sudden death by N-3 fatty acids: a review of the evidence. J Intern Med 240:5-12.
- Lepercq P, Relano P, Cayuela C, Juste C (2004) *Bifidobacterium animalis* strain DN-173 010 hydrolyses bile salts in the gastrointestinal tract of pigs. Scand J Gastroenterol 39(12):1266-1271.
- Li M, Huang Y, Xiao Y (2008) Effects of external interactions on protein sequence-structure relations of beta-trefoil fold. Proteins 72:1161-1170.
- Lightner DV (1996) A hand book of shrimp pathology and diagnostic procedures for disease of culture Penaeid shrimp. World Aquaculture Society, Baton Rouge, Louisiana.
- Lin J, Negga R, Zeng X, Smith K (2014) Effect of bile salt hydrolase inhibitors on a bile salt hydrolase from *Lactobacillus acidophilus*. Pathogens 3:947-956.
- Lin T, Liu X, Xiao D, Zhang D, Cai Y, Zhu X (2019) *Lactobacillus* spp. as probiotics for prevention and treatment of enteritis in the lined seahorse (*Hippocampus erectus*) juveniles. Aquaculture 503:16-25.

- Lisboa V, Barcarolli IF, Sampaio LA, Bianchini A (2015) Effect of salinity on survival, growth and biochemical parameters in juvenile Lebranch mullet *Mugil liza* (Perciformes: Mugilidae). *Neotrop ichthyol* 13(2):447-452.
- Liu W, Ren P, He S, Xu L, Yang Y, Gu Z, Zhou Z (2013) Comparison of adhesive gut bacteria composition, immunity, and disease resistance in juvenile hybrid tilapia fed two different *Lactobacillus* strains. *Fish Shellfish Immunol* 35(1):54-62.
- Llobrera AT, Gacutan RQ (1987) *Aeromonas hydrophila* associated with ulcerative disease epizootic in Laguna de Bay, Philippines. *Aquaculture* 67:273-276.
- Luo S, Wu B, Xiong X, Wang J (2016) Effects of total hardness and Calcium: Magnesium ratio of water during early stages of rare minnows (*Gobiocypris rarus*). *Comp Med* 66(3):181-187.
- Mackowiak PA (2013) Recycling Metchnikoff: probiotics, the intestinal microbiome and the quest for long life. *Front public health*. doi:10.3389/fpubh.2013.00052.
- Magdy IH, El-Hady MA, Ahmed HA, Elmeadawy SA, Kenwy AM (2014) A contribution on *Pseudomonas aeruginosa* infection in African Catfish (*Clarias gariepinus*). *Res J Pharm Biol Chem Sci* 5(5):575-588.
- Majed R, Faille C, Kallassy M, Gohar M (2016) *Bacillus cereus* biofilms same, only different. *Front Microbiol* 7:1054. doi:10.3389/fmicb.2016.01054
- Malde MK, Graff IE, Siljander-Rasi H, Venalainen E, Julshamn K, Pedersen JI, Valaja J (2010) Fish bones-a highly available calcium source for growing pigs. *J Anim Physiol Anim Nutr* 94(5):e66-76.

- Mandal A (2015) Study of distribution of xylanase producing microbes in soil: a case study in Midnapore town, Paschim Medinipur, West Bengal, India. Asian J Sci Technol 6(8):1712-1718.
- Mao X, Zeng X, Qiao S, Wu G, Li D (2011) Specific roles of threonine in intestinal mucosal integrity and barrier function. Front Biosci E3:1192-1200.
- Maurer LM, Yohannes E, Bondurant SS, Radmacher M, Slonczewski JL (2005) pH regulates genes for flagellar motility, catabolism, and oxidative stress in *Escherichia coli* K-12. J Bacteriol 187:304-319.
- Melaku H, Lakew M, Alemayehu E, Wubie A, Chane M (2017) Isolation and identification of pathogenic fungus from African catfish (*Clarias gariepinus*) eggs and adults in National Fishery and Aquatic Life Research Center Hatchery, Ethiopia. Fish Aqua J 8:3
- Mohanty B, Mahanty A, Ganguly S, Sankar TV, Chakraborty K, Rangasamy A, Paul B, Sarma D, Mathew S, Asha KK, Behera BK, Aftabuddin M, Debnath D, Vijayagopal P, Sridhar N, Akhtar MS, Sahi N, Mitra T, Banerjee S, Paria P, Das D, Das P, Vijayan KK, Laxmanan PT, Sharma AP (2014) Amino acid compositions of 27 food fishes and their importance in clinical nutrition. J Amino Acids. <http://dx.doi.org/10.1155/2014/269797>
- Mohanty BP, Pati MK, Bhattacharjee S, Hajra A, Sharma AP (2013) Small indigenous fishes and their importance in human health. Adv Fish Res 5:257-278.
- Mollah MFA, Nurullah M (1988) Effects of feeding frequency on the growth and survival of catfish (*Clarias batrachus* L.) larvae. Bangladesh J Fish 11(2):9-14.

- Monte MJ, Marin JJG, Antelo A, Vazquez-Tato J (2009) Bile acids: chemistry, physiology, and pathophysiology. *World J Gastroenterol* 15(7):804-816.
- Montgomery HAC, Thom NS, Cockburn A (1964) Determination of dissolved oxygen by the Winkler method and the solubility of oxygen in pure water and sea water. *J Appl Chcm* 14(7):280-296.
- Msangi S, Batka M (2015) The rise of aquaculture: The role of fish in global food security. *Glob Food Policy Rep.*, Washington D.C.: International Food Policy Research Institute (IFPRI); p. 61-72.
- Mukhopadhyay PK (1977) Studies on the enzymatic activities related to varied pattern of diets in the air-breathing cat fish, *Clarias batrachus* (Linn.). *Hydrobiologia* 52(2-3):235-237.
- Muylaert K, Van der Gucht K, Vloemans N, Meester LD, Gills M, Vyverman W (2002) Relationship between bacterial community composition and bottom-up versus top-down variables in four eutrophic shallow lakes. *Appl Environ Microbiol* 68(10):4740-4750.
- Nandi A, Banerjee G, Dan SK, Ghosh K, Ray AK (2017) Probiotic efficiency of *Bacillus* sp. in *Labeo rohita* challenged by *Aeromonas hydrophila*: assessment of stress profile, haemato-biochemical parameters and immune responses. *Aquac Res* 48:1-12.
- NBFGR (2010) <http://www.nbfgr.res.in/PDF/ThreatenedFreshwaterFishes.pdf>
- Needham JG, Needham PR (1978) *A Guide to the Study of Freshwater Biology*. Holden Day. Inc. Publishing San Francisco, pp108.

- Newaj-Fyzul A, Adesiyun AA, Mutani A, Ramsubhag A, Brunt J, Austin B (2007) *Bacillus subtilis* AB1 controls *Aeromonas* infection in rainbow trout (*Oncorhynchus mykiss*, Walbaum). *J Appl Microbiol* 103(5):1699-1706.
- Ng HH, Kottelat M (2008) The identity of *Clarias batrachus* (Linnaeus, 1758), with the designation of a neotype (Teleostei: Clariidae). *Zool J Linn Soc* 153:725-732.
- Nikoskelainen S, Ouwehand AC, Bylund G, Salminen S, Lilius EM (2003) Immune enhancement in rainbow trout (*Oncorhynchus mykiss*) by potential probiotic bacteria (*Lactobacillus rhamnosus*). *Fish Shellfish Immunol* 15(5):443-452.
- Noriega L, Cuevas I, Margolles A, de los Reyes-Gavilan CG (2006) Deconjugation and bile salts hydrolase activity by *Bifidobacterium* strains with acquired resistance to bile. *Int Dairy J* 16:850-855.
- Novita H, Rusmana I, Yuhana M, Pasaribu FH (2015) Potential of *Bacillus* sp., as a producer of AHL lactonase and its application as a probiotic for the prevention of *Mycobacterium* in catfish (*Clarias gariepinus*). *J Fish Aquat Sci* 10(6):464-476.
- Nwabueze AA (2012) Disease status of *Clarias gariepinus* (Burchell, 1822) and some fish ponds in Asaba, Nigeria. *Int J Agric Rural Dev* 15(3):1216-1222
- Nwanna LC, Tope-Jegede H (2016) Effects of dietary *Lactobacillus plantarum* on the growth, carcass quality, and immune response of African catfish (*Clarias gariepinus*) challenged with *Salmonella typhi*. *J Appl Aquacult* 29(1):62-80.
- Ogunshe AAO, Olabode OP (2009) Antimicrobial potentials of indigenous *Lactobacillus* strains on gram-negative indicator bacterial species from *Clarias gariepinus* (Burchell.) microbial inhibition of fish-borne pathogens. *Afr J Microbiol Res* 3(12):870-876.

- Olayinka AS, Afolabi OO (2013) Evaluation of the effects of *Lactobacillus acidophilus* on the haematological parameters of *Clarias gariepinus*. Int J Res Fish Aquac 3(2):38-41.
- Omenwa VC, Mbakwem-Aniebo C, Ibiene AA (2015) Effects of selected probiotics on the growth and survival of fry-fingerlings of *Clarias gariepinus*. IOSR J Pharm Biol Sci 10(5):89-93.
- Osman H, Suriah AR, Law EC (2001) Fatty acid composition and cholesterol content of selected marine fish in Malaysian waters. Food Chem 73:55-60.
- Paiva-Maia ED, Alves-Modesto G, Otavio-Brito L, Olivera A, Vasconcelos-Gesteira TC (2013) Effect of a commercial probiotic on bacterial and phytoplankton concentration in intensive shrimp farming (*Litopenaeus vannamei*) recirculation systems. Lat Am J Aquat Res 41(1):126-137.
- Panigrahi A, Kiron V, Puangkaew J, Kobayashi T, Satoh S, Sugita H (2005) The viability of probiotic bacteria as a factor influencing the immune response in rainbow trout (*Oncorhynchus mykiss*). Aquaculture 243(1-4):241-254.
- Papadimitriou K, Zoumpopoulou G, Foligné B, Alexandraki V, Kazou M, Pot B, Tsakalidou E (2015) Discovering probiotic microorganisms: *in vitro*, *in vivo*, genetic and omics approaches. Front Microbiol 6:1-28.
- Paul BN, Chanda S, Sridhar N, Saha GS, Giri SS (2016) Fatty acid, Amino acid and vitamin composition of Indian catfish, magur (*Clarias batrachus*) and singhi (*Heteropneustes fossilis*). SAARC J Agri 14(2):189-199.
- Paul P, Adikesavalu H, Banerjee S, Abraham TJ (2015) Antibiotic resistant motile Aeromonads induced septicemia in Philippine catfish *Clarias batrachus* (Linnaeus, 1758) fingerlings. Croat J Fish 73:170-175.

- Pedersen O, Colmer TD, Sand-Jensen K (2013) Underwater photosynthesis of submerged plants-recent advances and methods. *Front plant sci.* doi:10.3389/fpls.2013.00140
- Prabhulkar S, Tian H, Wang X, Zhu JJ, Li CZ (2012) Engineered Proteins: Redox properties and their applications. *Antioxid Redox Signal* 17(12):1796-1822.
- Prabhurajeshwar C, Chandrakanth K (2018) Evaluation of antimicrobial properties and their substances against pathogenic bacteria in-vitro by probiotic Lactobacilli strains isolated from commercial yoghurt. *Clin Nutr Exp*. <https://doi.org/10.1016/j.yclnex.2018.10.001>.
- Pradhan A, Bhaumik P, Das S Chaudhuri SR (2008) Phytoplankton diversity as indicator of water quality for fish cultivation. *Am J Environ Sci* 4(4):406-411.
- Příkrylová I, Blažek R, Vanhove MPM (2012) An overview of the Gyrodactylus (Monogenea: Gyrodactylidae) species parasitizing African catfishes, and their morphological and molecular diversity. *Parasitol Res* 110(3):1185-1200.
- Prosser JI, Tough AJ (1991) Growth mechanisms and growth kinetics of filamentous microorganisms. *Crit Rev Biotechnol* 10(4):253-274.
- Putra I, Rusliadi R, Fauzi M, Tang UM, Muchlisin ZA (2017) Growth performance and feed utilization of African catfish *Clarias gariepinus* fed a commercial diet and reared in the biofloc system enhanced with probiotic. *F1000Research* 6:1545.
- Queiroz J, Boyd CE (1998) Effects of a Bacterial Inoculum in Channel Catfish Ponds. *J World Aquacult Soc* 29(1):67-73.
- Radhakrishnan KV, Lan ZJ, Zhao J, Qing N, Huang XL (2011) Invasion of the African sharp-tooth catfish *Clarias gariepinus* (Burchell, 1822) in South China. *Biol Invasions* 13:1723-1727.

- Rahman MM, Chowdhury MBR (1999) Incidence of ulcer disease in African catfish (*Clarias gariepinus* Burchell) and trial for its chemotherapy. *Bangladesh J Fish Res* 3(2):193-200.
- Rajikkannu M, Natarajan N, Santhanam P, Deivasigamani B, Ilamathi J, Janani S (2015) Effect of probiotics on the haematological parameters of Indian major carp (*Labeo rohita*). *Int J Fish Aquat Stud* 2(5):105-109.
- Ramakrishnan CM, Haniffa MA, Manohar M, Dhanaraj M, Arockiaraj AJ, Seetharaman S, Arunsingh SV (2008) Effects of probiotics and Spirulina on survival and growth of juvenile common carp (*Cyprinus carpio*). *Isr J Aquacult Bamidgeh* 60(2):128-133.
- Ramesh D, Vinothkanna A, Rai AK, Vignesh VS (2015) Isolation of potential probiotic *Bacillus* spp. and assessment of their subcellular components to induce immune responses in *Labeo rohita* against *Aeromonas hydrophila*. *Fish Shellfish Immunol* 45:268-276.
- Ran C, Carrias A, Williams MA, Capps N, Dan BC, Newton JC, Kloepper JW, Ooi EL, Browdy CL, Terhune JS, Liles MR (2012) Identification of *Bacillus* strains for biological control of catfish pathogens. *PLoS ONE* 7(9):e45793. doi: 10.1371/journal.pone.0045793
- Ren P, Xu L, Yang Y, He S, Liu W, Ringø E, Zhou Z (2013) *Lactobacillus planarum* subsp. *planarum* JCM 1149 vs. *Aeromonas hydrophila* NJ-1 in the anterior intestine and posterior intestine of hybrid tilapia *Oreochromis niloticus* ♀ × *Oreochromis aureus* ♂: An *ex vivo* study. *Fish Shellfish Immunol* 35:146-153.
- Reneshwary C, Rajalakshmi M, Marimuthu K, Xavier R (2011) Dietary administration of *Bacillus thuringiensis* on the cellular innate immune response of African catfish

- (*Clarias gariepinus*) against *Aeromonas hydrophila*. Eur Rev Med Pharmacol Sci 15(1):53-60.
- Rengipat S, Phianphak W, Piyatiratitivorakul S, Menasveta P (1998) Effects of a probiotic bacterium on black tiger shrimp *Penaeus monodon* survival and growth. Aquaculture 167(3-4):301-313.
- Ringo E, Salinas I, Olsen RE, Nyhaug A, Myklebust R, Mayhew TM (2007) Histological changes in intestine of Atlantic salmon (*Salmo salar* L.) following *in vitro* exposure to pathogenic and probiotic bacterial strains. Cell Tissue Res 328:109-116.
- Robertson PAW, O'Dowd C, Burrells C, Williams P, Austin B (2000) Use of *Carnobacterium* sp. as a probiotics for Atlantic salmon (*Salmo salar* L.) and rainbow trout (*Oncorhynchus mykiss*, Walbaum). Aquaculture 185(3-4):235-243.
- Rodríguez J, Gallampois CMJ, Timonen S, Andersson A, Sinkko H, Haglund P, Berglund AMM, Ripszam M, Figueroa D, Tysklind Mats, Rowe O (2018) Effects of organic pollutants on bacterial communities under future climate change scenarios. Front Microbiol. doi:10.3389/fmicb.2018.02926.
- Roos N, Islam MM, Thilsted SH (2003) Small fish is an important dietary source of vitamin A and calcium in Bangladesh. J Nutr 133:4021S-4026S.
- Roy C, Vass KK, Patra BC, Sanyal AK (2013) Fish diversity in two south-western districts of West Bengal- Bankura and Purulia. Rec Zool Surv India 113:167-179.
- Roy PR, Barat S (2011) Influence of water quality on the bacterial contamination of resident loach, *Lepidocephalichthys guntea* (Hamilton Buchanan) and on a Terai River Lotchka of Darjeeling District, West Bengal, India. Arch Environ Sci 5:116-123.

- Sahu MK, Swarnakumar NS, Sivakumar K, Thangaradjou T, Kannan L (2008) Probiotics in aquaculture: importance and future perspectives. Indian J Microbiol 48(3):299-308.
- Sakata T, Nakaji M, Kakimoto D (1978) Microflora in the digestive tract of marine fish I. General characterization of the isolates from yellow tail. Mem Fac Fish Kagoshima Univ 27:65-71.
- Salinas I, Abelli L, Bertoni F, Picchietti S, Roque A, Furones D, Cuesta A, Meseguer J, Esteban MA (2008) Monospecies and multispecies probiotic formulations produce different systemic and local immunostimulatory effects in the gilthead seabream (*Sparus aurata L.*). Fish Shellfish Immunol 25(1-2):114-123.
- Sarkar AK, Roy S, Pal A, Pakrashi S, Mahra PK, Sahoo S, Deb A, Mishra M, Sen SK, Thakur AR, Chaudhuri SR (2008) Microbial biodiversity screening for metal accumulators from mineral ore rich site in Andhra Pradesh, India. OnLine J Biol Sci 8(2):32-40.
- Sarma K, Prabakaran K, Krishnan P, Grinson G, Anand Kumar A (2012) Response of a freshwater air-breathing fish, *Clarias batrachus* to salinity stress: an experimental case for their farming in brackishwater areas in Andaman, India. Aquacult Int 21:183-196.
- Savage DC (1992) Growth phase cellular hydrophobicity and adhesion *in vitro* of lactobacilli colonizing the keratinizing gastric epithelium in the mouse. Appl Environ Microbiol 58(6):1992-1995.
- Schaeffer AB, Fulton MD (1933) A simplified method of staining endospores. Science 77(1990):194. doi:10.1126/science.77.1990.194

- Schneidman-Duhovny D, Inbar Y, Nussinov R, Wolfson HJ (2005) PatchDock and SymmDock: servers for rigid and symmetric docking. *Nucl Acids Res* 33:W363-367.
- Sedláček I, Staňková E, Švec P (2016) Composition of cultivable enteric bacteria from the intestine of Antarctic fish (family Nototheniidae). *Czech J Anim Sci* 61(3):127-132.
- Shankar N, Baghdayan AS, MS Gilmore (2002) Modulation of virulence within a pathogenicity island in vancomycin-resistant *Enterococcus faecalis*. *Nature* 417:746-750.
- Shashikanth M, Vijay Kumar K (2009) Ecology and abundance of zooplankton in Karanja river, Karnataka. *Environ Monit Assess* 152(1-4):451-458.
- Sheeba BD, Narayanan R, Ebanasar J (2003) Digestibility of hydrophytes and survival of grasscarp *Ctenopharyngodon idella* exposed to microbial probiotic *Lactobacillus*. *Indian J Comp Anim Physiol* 21:5-10.
- Shehata MG, El Sohaimy SA, El-Sahn MA, Youssef MM (2016) Screening of isolated potential probiotic lactic acid bacteria for cholesterol lowering property and bile salt hydrolase activity. *Ann Agric Sci* 61(1):65-75.
- Shewan JM, Hobbs G (1967) The bacteriology of fish spoilage and preservation. *Prog Ind Microbiol* 6:169-208.
- Shiddamallayya N, Pratima M (2008) Impact of domestic sewage on fresh water body. *J Environ Biol* 29(3):303-308.
- Sissons JW (1989) Potential of probiotic organisms to prevent diarrhoea and promote digestion in farm animals-a review. *J Sci Food Agric* 49:1-13.

- Sivakami S, Ayyapan S, Rahman MF, Govind BV (1986) Biochemical composition of *Cyprinus carpio* (Linn.) cultured in cage in relation to maturity. Indian J Fish 33(2):180-187.
- Suanyuk N, Rogge M, Thune R, Watthanaphiromsakul M, Champhat N, Wiangkum W (2014) Mortality and pathology of hybrid catfish, *Clarias macrocephalus* (Günter) × *Clarias gariepinus* (Burchell), associated with *Edwardsiella ictaluri* infection in southern Thailand. J Fish Dis 37:385-395.
- Sudheesh PS, Al-Ghabshi A, Al-Mazrooei N, Al-Habsi S (2012) Comparative pathogenomics of bacteria causing infectious diseases in fish. Int J Evolution Biol. doi:10.1155/2012/457264.
- Sugiura M, Oikawa T, Hirano K, Maeda H, Yoshimura H, Sugiyama M, Kuratsu T (1977) A simple colorimetric method for determination of serum triglycerides with lipoprotein lipase and glycerol dehydrogenase. Clinica Chimica Acta 81:125-130.
- Sun YZ, Yang HL, Ma RL, Lin WY (2010) Probiotic applications of two dominant gut *Bacillus* strains with antagonistic activity improved the growth performance and immune responses of grouper *Epinephelus coioides*. Fish Shellfish Immunol 29(5):803-809.
- Tacon AGJ, Metian M (2015) Feed matters: Satisfying the feed demand of aquaculture. Rev Fish Sci Aquac 23:1-10.
- Tallapragada P, Rayavarapu B, Rao PP, Ranganath NN, Veerabhadrappa PP (2018) Screening of potential probiotic lactic acid bacteria and production of amylase and its partial purification. J Genet Eng Biotechnol 16:357-362.

- Talwar PK, Jhingran AG (1991) Inland fishes of India and adjacent countries. Volume- 1. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India. 541.
- Thomas J, Madan N, Nambi KSN, Majeed SA, Basha AN, Hameed ASS (2013) Studies on ulcerative disease caused by *Aeromonas caviae*-like bacterium in Indian catfish, *Clarias batrachus* (Linn). Aquaculture 376-379:146-150.
- Thurlow CM, Williams MA, Carrias A, Ran C, Newman M, Tweedie J, Allison E, Jescovitch LN, Wilson AE, Terhune JS, Liles MR (2018) *Bacillus velezensis* AP193 exerts probiotic effects in channel catfish (*Ictalurus punctatus*) and reduces aquaculture pond eutrophication. Aquaculture. doi: <https://doi.org/10.1016/j.aquaculture.2018.11.051>
- Toutou MM, Soliman AAA, Farrag MMS, Abouelwafa AE (2016) Effect of probiotic and synbiotic food supplementation on growth performance and healthy status of Grass carp, *Ctenopharyngodon idella* (Valenciennes, 1844). Int J Ecotoxicol Ecobiol 1(3):111-117.
- Tovar D, Zambonino J, Cahu C, Gatesoupe FJ, Vazquez-Juarez R, Lesel R (2002) Effect of live yeast incorporation in compound diet on digestive enzyme activity in sea bass (*Dicentrarchus labrax*) larvae. Aquaculture 204(1-2):113-123.
- Tripathi SD (1996) Present status of breeding and culture of catfishes in South Asia. Aquat Living Resour 9:219-228.
- Tripathy PP, Suar M, Das JK, Saini MR (2014) Probiotic and functional characteristics of an indigenous *Lactobacillus* species isolated from traditional fermented product (Dahi-Chenna) of rural Odisha. Int J Curr Microbiol App Sci 3(11):82-95.

- Tucker CS, Lloyd SW, Busch RL (1984) Relationship between un-ionized ammonia in channel catfish ponds. *Hydrobiologia* 111:75-79.
- Tuimala J (1989) A primer to phylogenetic analysis using PHYLIP package. *Cladistics* 5:164-166.
- Utang PB, Akpan HE (2012) Water quality impediments to sustainable aquaculture development along selected segments of the new Calabar River, Niger delta, Nigeria. *Res J Environ Earth Sci* 4(1):34-40.
- VanDuinen AJ, Winchell KR, Keithly ME, Cook PD (2015) X-ray crystallographic structure of bshC, a unique enzyme involved in Bacillithiol biosynthesis. *Biochemistry* 54(2):100-103.
- Verschuere L, Rombaut G, Sorgeloos P, Verstraete W (2000) Probiotic bacteria as biological control agents in aquaculture. *Microbiol Mol Biol Rev* 64:655-671.
- Vignolo GM, Suriani F, Holdago APR, Oliver G (1993) Antibacterial activity of *Lactobacillus* strains isolated from dry fermented sausages. *J Appl Microbiol* 75:344-349.
- Vlamakis H, Chai Y, Beauregard P, Losick R, Kolter R (2013) Sticking together: building a biofilm the *Bacillus subtilis* way. *Nat Rev Microbiol* 11:157-168.
- Vyamzal J (1995) Algae and element cycling in wetlands. CRC press, Florida.
- Wang AR, Ran C, Ringø E, Zhou ZG (2017) Progress in fish gastrointestinal microbiota research. *Rev Aquacult.* doi:10.1111/raq.12191
- Wang H, Liu F, Yang L, Zu Y, Wang H, Qu S, Zhang Y (2011) Oxidative stability of fish oil supplemented with carnosic acid compared with synthetic antioxidants during long-term storage. *Food Chem* 128:93-99.

- Wang W, Wu Z, Dai Z, Yang Y, Wang J, Wu G (2013) Glycine metabolism in animals and humans: implications for nutrition and health. *Amino Acids* 45(3):463-477.
- Wang YB, Xu ZR, Xia MS (2005) The effectiveness of commercial probiotics in northern white shrimp (*Penaeus vannamei*) ponds. *Fish Sci* 71:1036-1041.
- Wimalasena S, Jayasuriya MNS (1996) Nutrient analysis of some fresh water fish. *J Natn Sci Coun Sri Lanka* 24(1):21-26.
- Wu G (2016) Dietary protein intake and human health. *Food Funct* 7(3):1251-1265.
- WWF (2016) <https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF>
- Xu H, Jeong HS, Lee HY, Ahn J (2009) Assessment of cell surface properties and adhesion potential of selected probiotic strains. *Lett Appl Microbiol* 49(4):434-442.
- Yakubu AF, Olaji ED, Adams TE (2016) Effect of probiotic (Biogut) on the growth and survival of *Clarias gariepinus* Burchell, 1822 fry in glass aquaria tanks. *Eur J Appl Sci* 8(6):326-329.
- Zhao J, Ling Y, Zhang R, Ke C, Hong G (2018) Effects of dietary supplementation of probiotics on growth, immune responses, and gut microbiome of the abalone *Haliotis diversicolor*. *Aquaculture*. doi:10.1016/j.aquaculture.2018.05.011
- Zhao X, Kuipers OP (2016) Identification and classification of known and putative antimicrobial compounds produced by a wide variety of *Bacillales* species. *BMC Genomics* 17(1):882. doi:10.1186/s12864-016-3224-y
- Zhong Y, Shahidi F (2011) Lipophilized epigallocatechin gallate (EGCG) derivatives as novel antioxidants. *J Agric Food Chem* 59:6526-6533.

References

- Zorriehzahra MJ, Delshad ST, Adel M, Tiwari R, Karthik K, Dhama K, Lazado CC (2016) Probiotics as beneficial microbes in aquaculture: an update on their multiple modes of action: a review. *Vet Q* 36(4):228-241.