



DAFTAR PUSTAKA

- Abidin, M. (2009). Pengoperasian Alat Tangkap Tangkul Untuk Menangkap Benih Ikan Jelawat (*Leptobarbus hoeveni* Blkr) DI Perairan Batanghari Jambi. *Buletin Teknik Litkayasa Sumber Daya Dan Penangkapan*, 7(1), 7. <https://doi.org/10.15578/btl.7.1.2009.7-9>
- Abinawanto, A., Yimastria, S., & Pertiwi, P. (2018). Sperm analysis of Lukas fish (*Puntius bramoides*): Motility, viability and abnormalities. *AIP Conference Proceedings*, 2023(October 2018). <https://doi.org/10.1063/1.5064130>
- Abinawanto, Abi, Nurman, K., & Lestari, R. (2012). The effect if sucrose on sperm quality of *Osphronemus goramy* two days postcryopreservation. *International Journal of Aquatic Science*, 3(1). [http://aquaticscience.e-journalsdirect.com/2012\(1\)/Abinawanto et al. \(2012\).pdf](http://aquaticscience.e-journalsdirect.com/2012(1)/Abinawanto%20et%20al.%20(2012).pdf)
- Abinawanto, Rahayu, S., & Lestari, R. (2013). Cryopreservation of java barb (*barbonymus gonionotus*) using egg yolk as a cryoprotectant. *Global Veterinaria*, 10(3), 318–321. <https://doi.org/10.5829/idosi.gv.2013.10.3.72150>
- Adipu, Y., Sinjal, H. J., & Watung, J. (2011). Ratio Pengenceran Sperma Terhadap Motilitas Spermatozoa, Fertilitas dan Daya Tetas Ikan Lele (*Clarias sp.*). *Jurnal Perikanan Dan Kelautan Tropis*, 7(1), 48. <https://doi.org/10.35800/jpkt.7.1.2011.16>
- Affandi, R., & Tang, U. M. (2017). *Fisiologi Hewan Air*. INTIMEDIA.
- Agarwal, A., Gupta, S., & Sharma, R. (2016). Eosin-Nigrosin Staining Procedure. *Andrological Evaluation of Male Infertility*, 73–77. https://doi.org/10.1007/978-3-319-26797-5_8.
- Agarwal, N. K. (2011). *Cryopreservation of fish Gametes.pdf*. 104–127.
- Aitken, R. J., & Drevet, J. R. (2020). The Importance of Oxidative Stress in Determining the Functionality of Mammalian Spermatozoa: A Two-Edged Sword. *Antioxidants*, 9, 111. <https://doi.org/10.3390/antiox9020111>.
- Aksoy, E., Aktan, T. M., Duman, S., & Cuce, G. (2012). Assessment of Spermatozoa Morphology under Light Microscopy with Different Histologic Stains and Comparison of Morphometric Measurements. *International Journal of Morphology*, 30(4), 1544–1550. <https://doi.org/10.4067/s0717-95022012000400045>.
- Alahmar, A. (2019). Role of oxidative stress in male infertility: An updated review. *Journal of Human Reproductive Sciences*, 12(1), 4–18. https://doi.org/10.4103/jhrs.JHRS_150_18.
- Alavi, S. M. H., & Cosson, J. (2006). Sperm motility in fishes. (II) Effects of ions and osmolality: A review. *Cell Biology International*, 30(1), 1–14. <https://doi.org/10.1016/j.cellbi.2005.06.004>.
- Alonzo, S. H., Stiver, K. A., Kindsvater, H. K., Marsh-Rollo, S. E., Nugent, B., &



- Kazancıoğlu, E. (2021). Ejaculate allocation and sperm characteristics differ among alternative male types in a species of fish with cooperation and competition among unrelated males. *Cells*, 10(10), 19–23. <https://doi.org/10.3390/cells10102612>.
- Andini, A., Prayekti, E., Triasmoro, F., & Kamaliyah, I. N. (2021). Pengaruh Penggunaan Jenis Pelarut dalam Uji Sitotoksistas Metode Brine Shrimp Lethality Test (BSLT) pada Wound Dressing Kolagen-Kitosan. *Al-Kimiya*, 8(1), 15–20. <https://doi.org/10.15575/ak.v8i1.10277>.
- Anindita, I. (2010). *Pengaruh Pemberian Berbagai Konsentrasi Susu Skim Terhadap Kualitas Spermatozoa Ikan Gurami (*Osphronemus goramy*, Lacepede 1801) Dua Hari Pascakriopreservasi*. Universitas Indonesia.
- Aoki, K., Okamoto, M., Tatsumi, K., & Ishikawa, Y. (1997). Cryopreservation of Medaka Spermatozoa. *Zoological Science*, 14(4), 641–644. <https://doi.org/10.2108/zsj.14.641>.
- Aryani, N. (2018). *Teknologi Tepat Guna Budidaya Ikan Jelawat* (D. I. N. Aryani (ed.); Cetakan Pe). Bung Hatta University Press.
- Ax, R. L., Dally, M., Didion, B. A., Lenz, R. W., Love, C. C., Varner, D. D., Hafez, B., & Bellin, M. E. (2008). Semen Evaluation. In E. S. . H. B. Hafez (Ed.), *Assisted Reproductive Technology* (7th Editio, pp. 365–375). Wiley. [https://doi.org/10.1016/S1322-7696\(08\)60200-0](https://doi.org/10.1016/S1322-7696(08)60200-0).
- Babiak, I., Marschhäuser, V., Ottesen, O., Rudolfsen, G., Eggen, B., & Babiak, J. (2012). Effects of extender, storage and sperm-to-egg ratio on cryopreservation success of Atlantic cod (*Gadus morhua* L.) sperm. *Journal of Applied Ichthyology*, 28(6), 941–947. <https://doi.org/10.1111/JAI.12063>.
- Babin, P. J., Oliana, C., Lubzens, E., & Schneider, W. J. (2007). Molecular Aspects Of Oocyte Vitellogenesis In Fish. In *Oocyte Vitellogenesis in Fish* (pp. 39–76).
- Bai, C., Wang, X., Lu, G., Wei, L., Liu, K., Gao, H., Huang, C., & Dong, Q. (2013). Cooling rate optimization for zebrafish sperm cryopreservation using a cryomicroscope coupled with SYBR14/PI dual staining. *Cryobiology*, 67(2), 117–123. <https://doi.org/10.1016/J.CRYOBIOL.2013.05.011>.
- Balitbang, K. (2017). *Preservasi, Perpanjang Daya Hidup Spermatozoa Pada Sapi Potong - Info Teknologi - Badan Litbang Pertanian*. <https://www.litbang.pertanian.go.id/info-teknologi/2997/>.
- Balitbangtan, S. (2018). *Penyimpanan pembawa materi generik ternak dengan teknik kriopreservasi*. <https://sulsel.litbang.pertanian.go.id/ind/index.php/publikasi/buletin/48-buletin-volume-i-nomor-i-tahun-2005/185-penyimpanan-pembawa-materi-generik-ternak-dengan-teknik-kriopreservasi>.
- Basavaraja, N., & Hegde, S. N. (2005). Some characteristics and short-term preservation of spermatozoa of Deccan mahseer, *Tor khudree* (Sykes). *Aquaculture Research*,



- 36(5), 422–430. <https://doi.org/10.1111/J.1365-2109.2004.01194.X>.
- Betsy, J., & Kumar, S. (2020). Cryopreservation of Fish Gametes. In J. Betsy & S. Kumar (Eds.), *Springer Nature Singapore*. Springer. https://doi.org/10.1007/978-981-15-4025-7_3.
- Billard, R., & Cosson, M. P. (1992). Some problems related to the assessment of sperm motility in freshwater fish. *Journal of Experimental Zoology*, 261(2), 122–131. <https://doi.org/10.1002/jez.1402610203>.
- Bobé, J., Jalabert, B., & Fostier, A. (2008). Oogenesis: Post-vitellogenic Events Leading to a Fertilizable Oocyte. *Fish Reproduction*, 15–50. <https://doi.org/10.1201/B10747-2>.
- Borella, M. I., Chehade, C., Costa, F. G., De Jesus, L. W. O., Cassel, M., & Batlouni, S. R. (2019). The brain-pituitary-gonad axis and the gametogenesis. *Biology and Physiology of Freshwater Neotropical Fish*, 315–341. <https://doi.org/10.1016/B978-0-12-815872-2.00014-2>.
- Cabrita, E., Robles, V., Rebordinos, L., Sarasquete, C., & Herráez, M. P. (2005). Evaluation of DNA damage in rainbow trout (*Oncorhynchus mykiss*) and gilthead sea bream (*Sparus aurata*) cryopreserved sperm. *Cryobiology*, 50(2), 144–153. <https://doi.org/10.1016/j.cryobiol.2004.12.003>.
- Cabrita, E., Sarasquete, C., Martínez-Páramo, S., Robles, V., Beirão, J., Pérez-Cerezales, S., & Herráez, M. P. (2010). Cryopreservation of fish sperm: Applications and perspectives. In *Journal of Applied Ichthyology* (Vol. 26, Issue 5, pp. 623–635). John Wiley & Sons, Ltd. <https://doi.org/10.1111/j.1439-0426.2010.01556.x>.
- Cejko, B. I., Sarosiek, B., Krejszef, S., & Kowalski, R. K. (2018). Multiple collections of common carp *Cyprinus carpio* L. semen during the reproductive period and its effects on sperm quality. *Animal Reproduction Science*, 188, 178–188. <https://doi.org/10.1016/J.ANIREPROSCI.2017.12.002>.
- Chang, T., & Zhao, G. (2021). Ice Inhibition for Cryopreservation: Materials, Strategies, and Challenges. *Advanced Science*, 8(6), 1–34. <https://doi.org/10.1002/advs.202002425>.
- Chen, J., Zhou, A., Xie, S., Wang, C., Lv, Z., & Zou, J. (2016). *Comparative Proteomic Identification of Mature and Immature Sperm in the Catfish *Cranoglanis boudierus**. <https://doi.org/10.1371/journal.pone.0151254>.
- Chew, P. C., & Zulkafli, A. R. (2012). Sperm Cryopreservation of Some Freshwater Fish Species in Malaysia. *Current Frontiers in Cryopreservation*, 13. <http://dx.doi.org/10.1039/C7RA00172J><https://www.intechopen.com/books/advanced-biometric-technologies/liveness-detection-in-biometrics><http://dx.doi.org/10.1016/j.colsurfa.2011.12.014>.
- Chong, G., Tsai, S., Wang, L.-H., Huang, C.-Y., & Lin, C. (2016). Cryopreservation of the gorgonian endosymbiont *Symbiodinium* OPEN. *Nature Publishing Group*.



<https://doi.org/10.1038/srep18816>.

Consuegra, C., Crespo, F., Bottrel, M., Ortiz, I., Dorado, J., Diaz-Jimenez, M., Pereira, B., & Hidalgo, M. (2018). Stallion sperm freezing with sucrose extenders: A strategy to avoid permeable cryoprotectants. *Animal Reproduction Science*, 191, 85–91. <https://doi.org/10.1016/J.ANIREPROSCI.2018.02.013>.

Contreras, P., Ulloa, P., Merino, O., Valdebenito, I., Figueroa, E., Farías, J., & Risopatrón, J. (2017). Effect of short-term storage on sperm function in Patagonian blenny (*Eleginops maclovinus*) sperm. *Aquaculture*, 481, 58–63. <https://doi.org/10.1016/j.aquaculture.2017.08.022>.

Cosson, J, Groison, A., Suquet, M., Fauvel, C., Dreanno, C., & Billard, R. (2008). *Review Article Studying sperm motility in marine fish : an overview on the state of the art*. 24, 460–486. <https://doi.org/10.1111/j.1439-0426.2008.01151.x>.

Cosson, Jacky. (2019). Fish Sperm Physiology: Structure, Factors Regulating Motility, and Motility Evaluation. In *Biological Research in Aquatic Science*. <https://doi.org/10.5772/intechopen.85139>.

Craig, S., & Louis, H. (2017). Understanding Fish Nutrition, Feeds and Feeding. *Virginia Cooperative Extension*, 420–256, 1–6.

Cuevas-Urbe, R., Chesney, E. J., Daly, J., & Tiersch, T. R. (2015). *Vitrification of Sperm from Marine Fishes: Effect on Motility and Membrane Integrity*. 1(46(7)), : 1770–1784. <https://doi.org/10.1111/are.12337>.

Darwisito, S., Jr., M. Z., Sjafei, D. S., Manalu, W., & Sudrajat, A. O. (2008). Pemberian Pakan Mengandung Vitamin E Dan Minyak Ikan Pada Induk Memperbaiki Kualitas Telur dan Larva Ikan Nila (*Oreochromis niloticus*). *Jurnal Akuakultur Indonesia*, 7(1): 1–10 (2008), 7(1), 165–175.

Dewantoro, E., Yudhiswara, R., & . F. (2017). Pengaruh Penyuntikan Hormon Ovaprim Terhadap Kinerja Pemijahan Ikan Tengadak (*Barbonymus Schwanenfeldii*). *Jurnal Ruaya*, 5(2), 1–9. <https://doi.org/10.29406/rya.v5i2.715>.

Diskan, K. (2022). *Danau Keliling Desa Tembang Sudah Bisa Panen Ikan Jelawat Hasil Restocking*. <https://diskan.kapuashulukab.go.id/2022/03/26/danau-keliling-desa-tembang-sudah-bisa-panen-ikan-jelawat-hasil-restocking/>.

Dislautkan, P. (2020). *Rencana Strategis (Renstra) Tahun 2018-2023 Dinas Kelautan dan Perikanan Provinsi Kalimantan Barat*. https://dislautkan.kalbarprov.go.id/wp-content/uploads/2020/08/Renstra_dkp.pdf.

Doğu, Z. (2012). Cryopreservation of semen in shabout (*Barbus grypus* Heckel, 1843): Sperm motility and fertilization rates. *Journal of Applied Ichthyology*, 28(6), 952–955. <https://doi.org/10.1111/jai.12072>.

Dupesh, S., Rasappan, P., Shila, S., & Gunasekaran, K. (2018). Human Sperm Freezing: Mini Update. *Advances in Reproductive Sciences*, 06(03), 59–69.



<https://doi.org/10.4236/arsci.2018.63006>.

- Effendie, M. I. (2002). *Biologi Perikanan* (2nd ed.). Yayasan Pustaka Nusantara.
- Fard, E. R., Kamarudin, M. S., & Harmin, S. A. (2013). Endocrine Control of Oogenesis in Teleosts. *Asian Journal of Animal and Veterinary*, 8(2), 205–215.
- Firman, M. S., & Budiarsa, A. A. (2017). Analisis Kebiasaan Makan Ikan Jelawat (*Leptobarbus hoevenii*) di Rawa Banjiran Perairan Mahakam Tengah Kecamatan Muara Wis Kabupaten Kutai Kartanegara. *Tfs*, 23(1), 18–25.
- Frommel, A. Y., Stiebens, V., Clemmesen, C., & Havenhand, J. (2010). Effect of ocean acidification on marine fish sperm (Baltic cod: *Gadus morhua*). *Biogeosciences*, 7(12), 3915–3919. <https://doi.org/10.5194/bg-7-3915-2010>.
- Fujaya, I. Y. (2005). *Genetika dan Perkembangbiakan Ikan*. Universitas Hassanudin.
- Gazali, M., & Tambing, S. N. (2002). Ulasan Kriopreservasi Sel Spermatozoa Cryopreservation of Sperm. *Hayati*, 9(1), 27–32.
- Hadi, R. S. (2011). Apoptosis Pada Sperma Sebagai Petanda Adanya Gangguan Kesuburan Pria. *Majalah Kesehatan Pharma Medika*, 3(2), 282–285.
- Hajirezaee, S., Amiri, B. M., & Mirvaghefi, A. (2010). Fish milt quality and major factors influencing the milt quality parameters: A review. *African Journal of Biotechnology*, 9(54), 9148–9154. <https://doi.org/10.4314/ajb.v9i54>.
- Handoyo, B., Setiowibowo, C., & Yustiran, Y. (2010). *Cara Mudah Budi Daya dan Peluang Bisnis Ikan Baung dan Jelawat*. PT. Penerbit IPB Press. http://perpustakaan.kkp.go.id/knowledgerepository/index.php?p=show_detail&id=1073985&keywords=.
- Harper, C. V., Cummerson, J. A., White, M. R. H., Publicover, S. J., & Johnson, P. M. (2008). Dynamic resolution of acrosomal exocytosis in human sperm. *Journal of Cell Science*, 121(13), 2130–2135. <https://doi.org/10.1242/JCS.030379>.
- Hasanah, U., Abinawanto, Alimuddin, A., & Boediono, A. (2020). Optimization of spermatozoa cryopreservation of Albino *pangasius catfish*: Cryoprotectants with various concentrations and different equilibration times. *IOP Conference Series: Earth and Environmental Science*, 441(1). <https://doi.org/10.1088/1755-1315/441/1/012088>.
- Hasrah, Tarno, S., Shilman, M. I., Setiawan, A., Juanda, E., Nofembrianti, Kurniawan, A., Nasir, M., & Muhammad, A. (2021). Peningkatan Keberlangsungan Perikanan Lokal Dengan Restocking Ikan Jelawat (*Leptobarbus hoevenii*) Di Danau Keliling Desa Tembang Kabupaten Kapuas Hulu. *Jurnal Publikasi Pengabdian Pada Masyarakat Unit Penelitian Dan Pengabdian Pada Masyarakat (UPPM) POLNEP, Volume 1*(2-Juni 2021), 114–118.
- Hezavehei, M., Sharafi, M., Kouchesfahani, H. M., Henkel, R., Agarwal, A., Esmaeili, V.,



- & Shahverdi, A. (2018). Sperm cryopreservation: A review on current molecular cryobiology and advanced approaches. *Reproductive BioMedicine Online*, 37(3), 327–339. <https://doi.org/10.1016/j.rbmo.2018.05.012>.
- Hidayaturrahmah. (2007). Waktu Motilitas Dan Viabilitas Spermatozoa Ikan Mas (*Cyprinus carpio* L) Pada Beberapa Konsentrasi Larutan Fruktosa. *Bioscientiae*, 4, 9–18.
- Hill, J. E., Kilgore, K. H., Pouder, D. B., Powell, J. F. F., Watson, C. A., & Yanong, R. P. E. (2009). Survey of Ovaprim Use as a Spawning Aid in Ornamental Fishes in the United States as Administered through the University of Florida Tropical Aquaculture Laboratory. *North American Journal of Aquaculture*, 71(3), 206–209. <https://doi.org/10.1577/a08-020.1>.
- Horváth, Á., Miskolczi, E., & Urbányi, B. (2003). Cryopreservation of common carp sperm. *Aquatic Living Resources*, 16(5), 457–460. [https://doi.org/10.1016/S0990-7440\(03\)00084-6](https://doi.org/10.1016/S0990-7440(03)00084-6).
- Huang, C., Dong, Q., & Tiersch, T. R. (2004). Sperm cryopreservation of a live-bearing fish, the platyfish *Xiphophorus couchianus*. HHS Public Access. *Theriogenology*, 62(6), 971–989. <https://doi.org/10.1016/j.theriogenology.2003.12.022>.
- Iqbal, M. F., Liew, H. J., & Rahmah, S. (2021). Dietary protein level influenced reproductive development of hoven's carp *Leptobarbus hoevenii* female broodstock. *Animal Feed Science and Technology*, 281, 115112. <https://doi.org/10.1016/J.ANIFEEDSCI.2021.115112>.
- Irawan, H. (2014). Pengaruh pH Pada Ekstender Terhadap Daya Simpan dan Motilitas Sel Sperma Ikan Mas (*Cyprinus carpio*). *Dinamika Maritim*, 3(2), 30–39.
- Islam, M. S., & Akhter, T. (2012). Tale of Fish Sperm and Factors Affecting Sperm Motility: A Review. *Advances in Life Sciences*, 1(1), 11–19. <https://doi.org/10.5923/j.als.20110101.03>.
- ITIS. (2020). *ITIS - Report: Leptobarbus hoevenii*. https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=689377#null.
- Iwamatsu, T. (1983). A new technique for dechoriation and observations on the development of the naked egg in *Oryzias latipes*. *Journal of Experimental Zoology*, 228(1), 83–89. <https://doi.org/10.1002/JEZ.1402280109>.
- Izquierdo, M. S., Fernández-Palacios, H., & Tacon, A. G. J. (2001). Effect of broodstock nutrition on reproductive performance of fish. *Aquaculture*, 197(1–4), 25–42. [https://doi.org/10.1016/S0044-8486\(01\)00581-6](https://doi.org/10.1016/S0044-8486(01)00581-6).
- Jang, T. H. (2017). Cryopreservation and its clinical applications | Elsevier Enhanced Reader. *Integrative Medicine Research*, 6(1), 12–18. <https://doi.org/10.1016/j.imr.2016.12.001>.



- Jang, T. H., Park, S. C., Yang, J. H., Kim, J. Y., Seok, J. H., Park, S., Choi, C. W., Lee, S. R., & Han, J. (2017). Cryopreservation and its clinical applications. *Integrative Medicine Research*, 6(7), 12–18. <https://doi.org/10.1016/j.imr.2016.12.001>.
- Junaedi, J., Arifiantini, R., Sumantri, C., & Gunawan, A. (2016). Penggunaan Dimethyl Sulfoxide Sebagai Krioprotektan dalam Pembekuan Semen Ayam Kampung. *Jurnal Veteriner*, 17(2), 300–308. <https://doi.org/10.19087/jveteriner.2016.17.2.300>.
- Kamarudin, A., Khairul, M., Idris, M., & Toriman, M. E. (2013). Analysis of *Leptobarbus hoevenii* in control environment at natural lakes. *American Journal of Agricultural and Biological Science*, 8(2), 142–148. <https://doi.org/10.3844/ajabssp.2013.142.148>.
- Khodadadi, M., Arab, A., & Jaferian, A. (2016). A Preliminary Study on Sperm Morphology, Motility and Composition of Seminal Plasma of Shirbot, *Barbus grypus* Mojan. *Turkish Journal of Fisheries and Aquatic Sciences*, 16(4), 953–959. <https://doi.org/10.4194/1303-2712-v16>.
- Kholodnyy, V., Gadelha, H., Cosson, J., & Boryshpolets, S. (2019). How do freshwater fish sperm find the egg? The physicochemical factors guiding the gamete encounters of externally fertilizing freshwater fish. *Reviews in Aquaculture*, 1–28. <https://doi.org/10.1111/raq.12378>.
- Krisdahasti, L. M., Hardaningsih, I., & Wahyu Kartika Sari, D. (2019). DMSO and sucrose combination as a cryoprotectant of Najawa carp (*Cyprinus carpio* L.) sperm cryopreservation. *E3S Web of Conferences* 147, 01014 (2019) 3rd ISMFR. <https://doi.org/10.1051/e3sconf/202014701014>.
- Kristanto, A. H., Ningrum, S., Endang, W., Atmadja, H., Sunarno, T. J., & Fatuchri, S. (1992). *Penelitian pengembangan teknologi budidaya ikan jelawat (Leptobarbushoeveni) di Kalimantan Barat*.
- Kumar, M., Gupta, G., Vikas, & Sanjeev, S. (2018). Role of broodstock nutrition on fish reproductive performance. *Aqua Star*, APRIL.
- Kurniawan, I. Y., Basuki, F., & Susilowati, T. (2013). Penambahan Air Kelapa Dan Gliserol Pada Penyimpanan Sperma Terhadap Motilitas Dan Fertilitas Spermatozoa Ikan Mas (*Cyprinus carpio* L.). *Journal of Aquaculture Management and Technology*, 2(1), 51–65. <https://doi.org/10.2/JQUERY.MIN.JS>.
- Kusmini, I., & Rudy, I. M. G. dan. (2011). Karakterisasi Genetik Ikan Kelabau (*Osteochilus kelabau*) Dari Berbagai Lokasi Di Kalimantan Barat Menggunakan Metode RAPD (Random Amplified Polymorphism DNA). *BERITA BIOLOGI*, 10(4), 449–454. <https://doi.org/10.14203/BERITABIOLOGI.V10I4.762>.
- Lal, K. K., Barman, A. S., Punia, P., Khare, P., Mohindra, V., Lal, B., Gopalakrishnan, A., Sah, R. S., & Lakra, W. S. (2009). Effect of extender composition on sperm cryopreservation of Asian catfish *Heteropneustes fossilis* (Bloch) and *Clarias batrachus* (Linnaeus). *Philippines Asian Fisheries Science*, 22, 137–142. <https://doi.org/10.33997/j.afs.2009.22.1.013>.



- Law, A. T. (1984). Nutritional study of jelawat, *Leptobarbus hoevenii* (Bleeker), fed on pelleted feed. *Aquaculture*, 41, 227–233.
- Leray, C., Nonnotte, G., Roubaud, P., & Leger, C. (1985). Incidence of (n-3) essential fatty acid deficiency on trout reproductive processes. *Reproduction Nutrition Developpement*, 25(3), 567–581. <https://doi.org/10.1051/rnd:19850409>.
- Linhart, O., Rodina, M., & Cosson, J. (2000). Cryopreservation of sperm in common carp *Cyprinus carpio*: Sperm motility and hatching success of embryos. *Cryobiology*, 41(3), 241–250. <https://doi.org/10.1006/cryo.2000.2284>.
- Lubzens, E., Young, G., Bobe, J., & Cerdà, J. (2010). Oogenesis in teleosts: How fish eggs are formed. *General and Comparative Endocrinology*, 165(3), 367–389. <https://doi.org/10.1016/j.ygcen.2009.05.022>.
- Mangkunegara, A. A. A., Dwinanti, S. H., & Syaifudin, M. (2019). The utilization of honey as extender for stripped snakehead (*Channa striata*) sperm cryopreservation. *Jurnal Akuakultur Rawa Indonesia*, 7(2), 123–134. <https://ejournal.unsri.ac.id/index.php/jari/article/view/9916>.
- Marinović, Z., Šćekić, I., Lujčić, J., Urbányi, B., & Horváth, Á. (2021). The effects of cryopreservation and cold storage on sperm subpopulation structure of common carp (*Cyprinus carpio* L.). *Cryobiology*, 99(January), 88–94. <https://doi.org/10.1016/j.cryobiol.2021.01.007>.
- Maulana, F., Alimuddin, & Junior, M. Z. (2014). Morphology , physiology , preservation of climbing perch *Anabas testudineus* Bloch 1792 sperm and the endurance to electric shock. *Jurnal Iktiologi Indonesia*, 14(3), 211–223.
- McMaster, M. E., Portt, C. B., Munkittrick, K. R., & Dixon, D. G. (1992). Milt characteristics, reproductive performance, and larval survival and development of white sucker exposed to bleached kraft mill effluent. *Ecotoxicology and Environmental Safety*, 23(1), 103–117. [https://doi.org/10.1016/0147-6513\(92\)90025-X](https://doi.org/10.1016/0147-6513(92)90025-X).
- Meitasari, P. (2020). *Viabilitas Dan Ketahanan Sperma Ikan Mas Najawa (Cyprinus carpio L.) Pada Kriopreservasi Dengan Kombinasi Krioprotektan DMSO Dan Sakarida*. UGM.
- Merino, O., Dumorné, K., Leidy, S. V., Figueroa, E., Valdebenito, I., Farías, J. G., & Risopatrón, J. (2020). Short-term storage sperm of coho salmon (*Oncorhynchus kisutch*) at 4 °C: Effect of sperm: Extender dilution ratios and antioxidant butylhydroxytoluene (BHT) on sperm function. *Cryobiology*, 95, 44–50. <https://doi.org/10.1016/J.CRYOBIOL.2020.06.007>.
- Meryman, H. T. (2007). Cryopreservation of living cells: principles and practice. *Transfusion*, 47(5), 935–945. <https://doi.org/10.1111/J.1537-2995.2007.01212.X>.
- Miura, C., Higashino, T., & Miura, T. (2007). A progestin and an estrogen regulate early stages of oogenesis in fish. *Biology of Reproduction*, 77(5), 822–828.



<https://doi.org/10.1095/biolreprod.107.061408>.

- Muchlisin, Z. A. (1970). REVIEW: Current Status of Extenders and Cryoprotectants on Fish Spermatozoa Cryopreservation. *Biodiversitas Journal of Biological Diversity*, 6(1), 66–69. <https://doi.org/10.13057/biodiv/d060114>.
- Muchlisin, Z. A., Sarah, P. I., Aldila, D. F., Eriani, K., Hasri, I., Batubara, A. S., Nur, F. M., Mustaqim, M., Ruhul, C., Abinawanto, M., & Martin, A. (2020). Effect of Dimethyl sulfoxide (DMSO) and egg yolk on sperm motility , fertility and hatching rates of depik *Rasbora tawarensis* (*Pisces: Cyprinidae*) eggs after short-term cryopreservation. *December 2019*, 1–6. <https://doi.org/10.1111/are.14516>.
- Mulyadi, N. P. (2017). Kriopreservasi Semen Ikan Mas *Cyprinus carpio* dalam Pengencer Ringer Laktat-Susu Skim. *Undefined*.
- Muthmainnah, C. R., Muchlisin, Z. A., Eriani, K., Hasri, I., Fadli, N., & Muhammadar, A. A. (2019). Kriopreservasi sperma ikan kawan *Poropontius tawarensis* menggunakan Dimetil sulfoxida (DMSO). *Depik*, 8(3), 158–166. <https://doi.org/10.13170/depik.8.3.15072>.
- Nainggolan, M., Napitupulu, H., Sipayung, K., & Sukendi, D. (2018). The Effect of Ovaprim Injections Combination With Oxytocin on Ovulation Stimulation and The Quality of Egg Hoven's Carp (*Leptobarbus Hoevenii* Blkr). *International Journal of Applied Environmental Sciences*, 13(7), 621–632. <http://www.ripublication.com>.
- Nannou, T. K., Jouhara, H., Trembley, J., & Herrmann, J. (2016). Cryopreservation: Methods, equipment and critical concerns. *Refrigeration Science and Technology*, 22-25-June, 247–258. <https://doi.org/10.18462/IIR.ICCRT.2016.0020>.
- Napitu, R., Santoso, L., & Sparmono. (2013). Pengaruh Penambahan Vitamin E Pada Pakan Berbasis Tepung Ikan Rucuh Terhadap Kematangan Gonad. *E-Jurnal Rekrayasa Dan Teknologi Budidaya Perairan*, 1(2), 109–116.
- Nevo, A. C., Plge, C., & Frederick, G. (1969). Aerobic And Anaerobic Metabolism Of Boar Spermatozoa In Relation To Their Motility. *Journal Reproduction Fert*, 22, 109–118.
- Nóbrega, R. H., Batlouni, S. R., & França, L. R. (2009). An overview of functional and stereological evaluation of spermatogenesis and germ cell transplantation in fish. *Fish Physiology and Biochemistry*, 35(1), 197–206. <https://doi.org/10.1007/s10695-008-9252-z>.
- Nugroho, E., Sundari, S., & Rachman, N. N. (2010). Variasi Genetik Ikan Jelawat Hasil Budidaya dan Tangkapan Alam Di Pontianak Dengan Menggunakan Marker DNA-RAPD (Random Amplified Polymorphism DNA). *Media Akuakultur*, 5(2), 115–117. <https://doi.org/10.15578/MA.5.2.2010.115-117>.
- Omitogun, O. G., Olaniyan, O. F., Oyeleye, O. O., Ojiokpota, C., Aladele, S. E., & Odofin, W. T. (2010). Potentials of short term and long term cryopreserved sperm of the african giant catfish (*Clarias gariepinus* burchell, 1822) for aquaculture. *African*



- Journal of Biotechnology*, 9(41), 6973–6982. <https://doi.org/10.5897/AJB09.1680>.
- Omoniyi, A.-D., & Ovie, I. A. (2018). Vitamin C: An Important Nutritional Factor in Fish Diets. *Journal of Agriculture and Ecology Research International*, 16(2), 1–7. <https://doi.org/10.9734/jaeri/2018/15528>.
- Parwata, I. M. O. A. (2015). Bahan Ajar Uji Bioaktivitas : Antioksidan. In *Universitas Udayana* (Issue April).
- Pathmasothy, S. (1985). The effect of three diets with variable protein levels on ovary development and fecundity in *Leptobarbus hoevenii*. *Finfish Nutrition in Asia: Methodological Approaches to Research and Development*, 107–112.
- Perez, L. M. (2020). Fish Sperm Maturation, Capacitation, and Motility Activation. In *Reproduction in Aquatic Animals: From Basic Biology to Aquaculture Technology* (pp. 293–320). https://doi.org/10.1007/978-981-15-2290-1_15.
- Pontoh, J. (2019). Penentuan Kandungan Sukrosa Pada Gula Aren Dengan Metode Enzimatik. *CHEMISTRY PROGRESS*, 6(1). <https://doi.org/10.35799/CP.6.1.2013.2068>.
- Pradana, D. F., Hardaningsih, I., & Sari, D. W. K. (2020). Viability of Najawa carp (*Cyprinus carpio* L.) sperm at 4°C temperature storage. *E3S Web of Conferences*, 147, 0–3. <https://doi.org/10.1051/e3sconf/202014701015>.
- Prakoso, A. A. (2018). *Kriopreservasi sperma ikan mas punten (Cyprinus carpio Linn) menggunakan sukrosa dan dimetil sulfoksida*. Universitas Gadjah Mada.
- Pusat Penelitian dan Pengembangan Perikanan. (1992). *Teknologi Pembenihan Ikan Jelawat (Leptobarbus hoevenii) Secara Terkontrol*. Pusat Penelitian dan Pengembangan Perikanan.
- Rahardhianto, A., Abdulgani, N., & Trisyani, N. (2012). Pengaruh Konsentrasi Larutan Madu dalam NaCl Fisiologis terhadap Viabilitas dan Motilitas Masa Penyimpanan. *Jurnal Sains Dan Seni ITS*, 1(1), 58–63.
- Ranjan, V., Vikram, U., Raju, R., Dewry, K., Kumar, G., Raval, K., & Patoliya, P. (2021). *Implications of cryopreservation on structural and functional attributes of bovine spermatozoa : An overview*. May, 1–16. <https://doi.org/10.1111/and.14154>.
- Reading, B. J., Sullivan, C. V., & Carolina, N. (2011). Vitellogenesis in Fishes. In *Encyclopedia of Fish Physiology: From Genome to Environment* (Vol. 1). Elsevier Inc. <https://doi.org/10.1016/B978-0-12-374553-8.00257-4>.
- Rizzo, E., & Bazzoli, N. (2019). Reproduction and embryogenesis. In *Biology and Physiology of Freshwater Neotropical Fish*. Elsevier Inc. <https://doi.org/10.1016/B978-0-12-815872-2.00013-0>.
- Robles, V., Valcarce, D. G., & Riesco, M. F. (2019). The use of antifreeze proteins in the cryopreservation of gametes and embryos. *Biomolecules*, 9(5).



<https://doi.org/10.3390/BIOM9050181>.

- Roostika, I., Dan, D., Megia, R., Besar, B., Dan, P., Bioteknologi, P., Sumberdaya, D., & Pertanian, G. (2007). Kriopreservasi Tanaman Purwoceng (*Pimpinella pruatjan Molk.*) Dengan Teknik Vitrifikasi. *Berita Biologi*, 8(6)..
- Saborido-Rey, F. (2019). Fish reproduction. In *Encyclopedia of Ocean Sciences* (Issue January). Elsevier Inc. <https://doi.org/10.1016/B978-0-12-409548-9.09708-6>.
- Sadeghi, S., Carles, J. N., & Silvestre, S. M. A. (2017). Effect of the Activation Media with Different Osmolality and Cool Storage on Spermatozoa Motility Parameters Over Time in Zebrafish, *Danio rerio*. *Turkish Journal of Fisheries and Aquatic Sciences*, 17(1), 111–120. https://doi.org/10.4194/1303-2712-V17_1_13.
- Said, A., Sunarno, M. T. D., & Nurdawati, S. (1992). Budidaya Pemebesaran Ikan Jelawat (*Leptobarbus hoevenii*) Dalam Keramba Jaring Terapung Di Danau Teluk Jambi. *Seminar Hasil Penelitian Air Tawar 1991/1992*, 235–238.
- Salamon, S., & Maxwell, W. M. C. (2000). Storage of ram semen. *Animal Reproduction Science*, 62(1–3), 77–111. [https://doi.org/10.1016/S0378-4320\(00\)00155-X](https://doi.org/10.1016/S0378-4320(00)00155-X).
- Salisbury, G. W., & Lodge, J. R. (1962). Metabolism of spermatozoa. *Advances in Enzymology - and Related Areas of Molecular Biology*, 24.
- Sandblom, E., & Gräns, A. (2017). Form, Function and Control of the Vasculature. In *Fish Physiology* (Vol. 36, Issue PartA, pp. 369–433). <https://doi.org/10.1016/bs.fp.2017.06.001>.
- Saputra, Y. H., Syahrir, M. R., Aditya, A., Ilmu, J., Tropis, P., No, V., Issn, A., Saputra, Y. H., Syahrir, M. R., & Aditya, A. (2016). Biologi Reproduksi Ikan Jelawat (*Leptobarbus hoevenii*, Bleeker 1851) Di Rawa Banjiran Sungai Mahakam Kecamatan Muarawis Kabupaten Kutai Kartanegara Provinsi Kalimantan Timur. *Jurnal Ilmu Perikanan Tropis*, 21(2), 48–54.
- Sarosiek, B., Cejko, B. I., Glogowski, J., Targońska, K., Zarski, D., Kowalski, R. K., & Kucharczyk, D. (2012). Spermatozoa motility and short-term sperm storage of colourful orfe (*Leuciscus idus aberr orfus*). *Italian Journal of Animal Science*, 11(3). <https://doi.org/10.4081/ijas.2012.e50>.
- Schulz, R. W., & Nóbrega, R. H. (2011). The reproductive organs and processes | Regulation of Spermatogenesis. In *Encyclopedia of Fish Physiology* (Vol. 1, pp. 627–634). <https://doi.org/10.1016/B978-0-12-374553-8.00269-0>.
- Schulz, Rüdiger W., de França, L. R., Lareyre, J. J., LeGac, F., Chiarini-Garcia, H., Nobrega, R. H., & Miura, T. (2009). Spermatogenesis in fish. *General and Comparative Endocrinology*, 165(3), 390–411. <https://doi.org/10.1016/j.ygcen.2009.02.013>.
- Selman, K., Wallace, R. A., Sarka, A., & Qi, X. (1993). Stages of oocyte development in the zebrafish, *Brachydanio rerio*. *Journal of Morphology*, 218(2), 203–224.



<https://doi.org/10.1002/jmor.1052180209>.

- Septiani, D., Effendi, E. M., & Moerfiah, -. (2017). Penyimpanan Spermatozoa Pada Suhu Preservasi Dan Berbagai Pengencer Semen Terhadap Daya Tahan Hidup Spermatozoa. *EKOLOGIA*, 17(2), 18–23. <https://journal.unpak.ac.id/index.php/ekologia/article/view/763>.
- Sieme, H., Oldenhof, H., & Wolkers, W. F. (2016). Mode of action of cryoprotectants for sperm preservation. *Animal Reproduction Science*, 169, 2–5. <https://doi.org/10.1016/J.ANIREPROSCI.2016.02.004>.
- Sinjal, H. (2014). Pengaruh vitamin C terhadap perkembangan gonad, daya tetas telur dan sintasan larva ikan lele dumbo (*Clarias sp*). *E-Journal BUDIDAYA PERAIRAN*, 2(1), 22–29. <https://doi.org/10.35800/bdp.2.1.2014.3789>.
- Srithongthum, S., Au, H., Amornsakun, T., Chesoh, S., Jantararat, S., Suzuki, N., Takeuchi, Y., Hassan, A., Kawamura, G., & Lim, L. (2020). *Yolk-sac absorption , mouth size development , and first exogenous feeding of Sultan fish , Leptobarbus hoevenii*. 13(3), 1320–1327.
- Sudarmono, S. (Sudarmono), Tarsim, T. (Tarsim), & Hudaidah, S. (Siti). (2013). Pengaruh Vitamin C dan E terhadap Kandungan Asam Lemak Bebas Telur Ikan Baung (*Mystus nemurus*). *E-Jurnal Rekayasa Dan Teknologi Budidaya Perairan*, 2(1), 185–190. <https://www.neliti.com/id/publications/233596/>.
- Suharman, H. (2017). Kualitas Semen Beku domba garut (*Ovis aries*) Pada Penambahan Sukrosa Dalam Pengencer Semen Tris Kuning Telur. *Berita Biologi*, 16(1).
- Sukmawati, E., Arifiantini, R. I., & Purwantara, B. (2014). Daya Tahan Spermatozoa terhadap Proses Pembekuan pada Berbagai Jenis Sapi Pejantan Unggul. *Undefined*, 19(3). <https://doi.org/10.14334/JITV.V19I3.1079>.
- Sunarma, A., Hastuti, D. W. B., Saleh, D. M., & Sistina, Y. (2008). Kombinasi Efektif Ekstender dan Krioprotektan Pada Kriopreservasi Sperma Ikan Nilem (*Osteochilus hasseltii* Valenciennes, 1842). *Jurnal Perikanan Universitas Gadjah Mada*, 10(1), 76–84. <https://doi.org/10.22146/JFS.8931>.
- Sunarno, M. T. . (1991). *Pengembangan domestikasi ikan jelawat (Leptobarbus hoeveni Blkr.) di Kalimantan Barat*.
- Sunarno, M. T. D., Saputra, A., & Syamsunarno, M. B. (2019). Feeding appropriate formulated diet for improving gonad maturation and spawning of brooder of some native fishes of indonesia. *IOP Conference Series: Earth and Environmental Science*, 383(1). <https://doi.org/10.1088/1755-1315/383/1/012031>.
- Suquet, M., Dreanno, C., Fauvel, C., Cosson, J., & Billard, R. (2000). Cryopreservation of sperm in marine fish. *Aquaculture Research*, 31(3), 231–243. <https://doi.org/10.1046/J.1365-2109.2000.00445.X>.



- Susilawati, T. (2011). Spermatologi. In *Universitas Brawijaya Press* (Cetakan Pe). Universitas Brawijaya Press (UB Press).
- Sutarjo, G. A. (2014). Pengaruh konsentrasi sukrosa dengan krioprotektan dimethyl sulfoxide terhadap kualitas telur ikan mas (. *Jurnal Gamma, ISSN 0216-9037, 9(2)*, 20–30. <http://ejournal.umm.ac.id/index.php/gamma/article/view/2500/2705>.
- Tanaka, S., Zhang, H., Horie, N., Yamada, Y., Okamura, A., Utoh, T., Mikawa, N., Oka, H. P., & Kurokura, H. (2002). Long-term cryopreservation of sperm of Japanese eel. *Journal of Fish Biology, 60(1)*, 139–146. <https://doi.org/10.1111/J.1095-8649.2002.TB02393.X>.
- Tarigan, N., Supriatna, I., Setiadi, M. A., & Affandi, R. (2017). Pengaruh Vitamin E dalam Pakan terhadap Pematangan Gonad Ikan Nilem (*Ostheochilus hasselti* , CV). *Perikanan Universitas Gadjah Mada, 19(1)*, 1–9.
- Thalathiah Binte, S., Ahmad, A. B. O., & Sulaiman, M. Z. Bin. (1988). Induced spawning techniques practised at Batu Berendam, Melaka, Malaysia. *Aquaculture, 74(1–2)*, 23–33. [https://doi.org/10.1016/0044-8486\(88\)90082-8](https://doi.org/10.1016/0044-8486(88)90082-8).
- Triastuti, J., Kintani, D., Luqman, E. M., & Pujiastuti1, D. Y. (2017). The motility and motion duration of jatimbulan tilapia (*Oreochromis niloticus*) spermatozoa in different salinity. *ASEAN-FEN INTERNATIONAL FISHERIES SYMPOSIUM, IOP Conf. Series: Earth and Environmental Science 137 (2018) 012023 doi*. <https://doi.org/doi:10.1088/1755-1315/137/1/012023>.
- Trummer, H., Tucker, K., Young, C., Kaula, N., & Meacham, R. B. (1998). Effect of storage temperature on sperm cryopreservation. *Fertility and Sterility, 70(6)*, 1162–1164. [https://doi.org/10.1016/S0015-0282\(98\)00349-5](https://doi.org/10.1016/S0015-0282(98)00349-5).
- Tsai, S., & Lin, C. (2012). Advantages and Applications of Cryopreservation in Fisheries Science. *Brazilian Archives of Biology and Technology, 55(3)*, 425–434. <https://doi.org/10.1590/S1516-89132012000300014>.
- Tsai, Sujune, Spikings, E., Hwang, C.-C., & Lin, C. (2010). Effects of the slow cooling during cryopreservation on the survival and morphology of Taiwan shoveljaw carp (*Varicorhinus barbatulus*) spermatozoa. *Aquat. Living Resour, 23*, 119–124. <https://doi.org/10.1051/alr/2009055>.
- Ubilla, A., Fornari, D., Figueroa, E., Effer, B., & Valdebenito, I. (2015). Short-term cold storage of the semen of rainbow trout *Oncorhynchus mykiss* (Walbaum, 1792) incorporating DMSO in the sperm diluent. Effects on motility and fertilizing capacity. *Aquaculture Research, 46(S1)*, 37–44. <https://doi.org/10.1111/ARE.12458>.
- Untsa, A. T., Sutarjo, G. A., & Hakim, R. R. (2019). *Simple storage of sperm cells using a combination of coconut water and glycerol against the motility and viability of Koi Fish sperm (Cyprinus carpio)*. 2(1), 25–32.
- Utomo, N. B. P. (2009). *Peningkatan mutu reproduksi ikan hias melalui pemberian kombinasi asam lemak esensial dan vitamin E dalam pakan ikan zebra (Danio rerio)*.



Institut Pertanian Bogor.

- Varela Junior, A. S., Goularte, K. L., Alves, J. P., Pereira, F. A., Silva, E. F., Cardoso, T. F., Jardim, R. D., Streit, D. P., & Corcini, C. D. (2015). Methods of cryopreservation of Tambaqui semen, *Colossoma macropomum*. *Animal Reproduction Science*, 157, 71–77. <https://doi.org/10.1016/j.anireprosci.2015.03.017>.
- Vitt, L. J., & Caldwell, J. P. (2009). Reproduction and Life Histories. *Herpetology*, 113–146. <https://doi.org/10.1016/b978-0-12-374346-6.00004-3>.
- Viveiros, A. T. M., Taffarel, T. R., & Leal, M. C. (2014). Osmolality and composition of the extender during the cold storage of *Prochilodus lineatus* (Characiformes: Prochilodontidae) sperm. *Neotropical Ichthyology*, 12(3), 643–648. <https://doi.org/10.1590/1982-0224-20130207>.
- Wayman, W., & Tiersch, T. R. (2000). Research methods for cryopreservation of sperm : Cryopreservation in Aquatic Species. *World Aquaculture Society, Baton Rouge, Louisiana*, 264–275.
- Whaley, D., Damyar, K., Witek, R. P., Mendoza, A., Alexander, M., & Lakey, J. R. (2021). Cryopreservation: An Overview of Principles and Cell-Specific Considerations. *Cell Transplantation*, 30, 1–12. <https://doi.org/10.1177/0963689721999617>.
- Wijayanti, G. E., & Simanjuntak, S. B. I. (2006). Viabilitas Sperma Ikan Nilem (*Osteochilus hasselti* C.V.) Setelah Penyimpanan Jangka Pendek dalam Larutan Ringer. *Journal of Fisheries Sciences*, 8(2), 207–214.
- Yamashita, M. (2000). Toward modeling of a general mechanism of MPF formation during oocyte maturation in vertebrates. *Zoological Science*, 17(7), 841–851. <https://doi.org/10.2108/zsj.17.841>.
- Zairin Jr, M., Handayani, S., & Supriatna, I. (2005). Kualitas Sperma Ikan Batak (*Torosoro*) Hasil Kriopreservasi Semen Menggunakan Dimetilsulfoksida (DMSO) Dan Gliserol 5, 10 Dan 15%. *Jurnal Akuakultur Indonesia*, 4(2), 145–151. <http://jurnalakuakulturindonesia.ipb.ac.id>