

Sistemas de mitigación de microalgas tóxicas en el sur de Chile: una tarea pendiente

J. Mardones¹, A. Flores-Leñero¹, M. Pinto¹, M. Vergara¹, P. Leal² y J. Paredes-Mella¹

¹ Centro de Estudios de Algas Nocivas (CREAN), Departamento de Medio Ambiente, División de Investigación en Acuicultura Instituto de Fomento Pesquero (IFOP), Puerto Montt, Chile.

² Laboratorio para el Estudio de Ambientes y Recursos Marinos (ARMLab), Departamento de Repoblación y Cultivo, División de Investigación en Acuicultura, Instituto de Fomento Pesquero (IFOP), Puerto Montt, Chile.

* jorge.mardones@ifop.cl

- Chopin, T., A.H. Buschmann, C. Halling, M. Troell, N. Kautsky, A. Neori, G.P. Kraemer, J.A. Zertuche-Gonzalez, C. Yarish, and C. Neefus. 2001. Integrating seaweeds into marine aquaculture systems: a key toward sustainability. *J. Phycol.* 37, 975–986.
- Chorus, I. and J. Bartram (eds.) 1999. Toxic cyanobacteria in water: A guide to their public health consequences, monitoring and management. London: E&FN Spon, 1999.
- Gregg, M., Rigby, G., Hallegraef, G.M., 2009. Review of two decades of progress in the development of management options for reducing or eradicating phytoplankton, zooplankton and bacteria in ship's ballast water. *Aquat. Invasions* 4 (3) 521–565.
- Guardiola, F.A., A. Cuesta, J. Meseguer, and M.A. Esteban. 2012. Risks of using antifouling biocides in aquaculture. *I. J. Mol. Sci.* 13, 1541–1560.
- Mardones, J.I., Dorantes-Aranda, J.J., Seger, A., Nichols, P., Hallegraef, G.M., 2016. Avances en el estudio de ictiotoxinas asociadas con floraciones algales nocivas (FANs). *Salmonexpert* 38(6), 38-44.
- Mardones, J.I., Paredes, J., Godoy, M., Suarez, R., Norambuena, L., Vargas, V., Fuenzalida, G., Pinilla, E., Artal, O., Rojas, X., Dorantes-Aranda, J.J., Lee, K.J., Anderson, D.M., Hallegraef, G.M. 2020. Disentangling the environmental processes responsible for the world's largest farmed fish-killing harmful algal bloom: Chile, 2016. *Sci. Total Env.* 766, 144383.
- Mardones, J.I., Paredes-Mella, J., Flores-Leñero, A., Yarimizu, K., Godoy, M., Artal, O., Corredor-Acosta, A., Marcus, L., Cascales, E., Espinoza, J.P., Norambuena, L., Garraud, R.D., Gonzalez, H.E., Iriarte, J.L., 2022. Extreme harmful algal blooms, climate change, and potential risk of eutrophication in Patagonian fjords: Insights from an exceptional *Heterosigma akashiwo* fish-killing event. *Prog. Oceanogr.* 210, 102921.
- Mardones, J.I., Flores-Leñero, A., Pinto-Torres, M., Paredes-Mella, J., Fuentes-Alburquenque, S., 2023. Mitigation of marine dinoflagellates using hydrogen peroxide (H2O2) increases toxicity towards epithelial gill cells. *Microorganisms* 11, 83.
- Park, S.-C., J.-K. Lee, S.W. Kim, and Y. Park. 2011. Selective algicidal action of peptides against harmful algal bloom species. *PLoS ONE* 6(10), 1–10.
- Seger, A., Park, T-G., Hallegraef, G., 2017. Assessment of the efficacy of clay flocculation in Korean fish farm waters: Cochlodinium cell removal and mitigation of ichthyotoxicity. *Harmful Algae* 61, 46-55.
- Seguel, M., Varela, D., Paredes, J., Aguilera, A., Alarcón, R., Martínez, C., Díaz, M., Zúñiga, A., 2018a. Effect of different algicidal on the viability of *Alexandrium catenella* at laboratory conditions. International Conference on Harmful Algae ICHA 2018, Nantes, Francia.
- Seguel, M., Varela, D., Paredes, J., Aguilera, A., Kossmann, H., Vogel, J., Martínez, C., 2018b. Algicidal effects of Bioionix's electro-chemical technology on *Alexandrium catenella*: laboratory and field experiments. International Conference on Harmful Algae ICHA 2018, Nantes, Francia.
- Turner, J.T. 2006. Harmful algae interactions with marine planktonic grazers. In: *Ecology of Harmful Algae*.
- Uddin, M.R., S.K. Min, J.D. Kim, S.U. Park, and J.Y. Pyon. 2012. Sorgoleone, a sorghum root exudate: algicidal activity and acute toxicity to the ricefish *Oryzias latipes*. *Aquat. Bot.* 98, 40–44.
- Wu, X., E.M. Joyce, and T.J. Mason. 2011. The effects of ultrasound on cyanobacteria. *Harmful Algae* 10, 738–743.
- Yang, Z., W. Jiang, Y. Zhang, and T.M. Lim. 2015. Inactivation of dinoflagellate *Scripsiella trochoidea* in synthetic ballast water by advanced oxidation processes. *Environ. Tech.*, 36, 750–759.
- Zerrifi, S.E.A., Khalloufi, F.E., Oudra, B., Vasconcelos, V., 2018. Seaweed bioactive compounds against pathogens and microalgae: Potential uses on pharmacology and harmful algae bloom control. *Mar. Drugs* 16, 55, doi: 10.3390/md16020055.
- Zhou, L.H., T.L. Zheng, X.H. Chen, X. Wang, S.B. Chen, Y. Tian, and H.S. Hong. 2008. The inhibitory effects of garlic (*Allium sativum*) and diallyl trisulfide on *Alexandrium tamarense* and other harmful algal species. *J. Appl. Phycol.* 20, 349–358.