

Correlation analysis between salmon farming and red tide distributions in inland sea of Chiloe Island, Chile mapped out by remote sensing

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Fish farming is one of the growing industry in Chile for several decades, nowadays occupying the second production of salmon in the world behind Norway. The red tide in coastal areas often accompanies the salmon fishkill resulting in ~20 % (100 million kg) of its production in 2016, which is the big issue to be solved.

Red tide is well-known to be triggered directly by marine phytoplankton blooming and indirectly by rising temperature on sea surface and eutrophication through human activities. In the report, Harmful Algal Blooms Assessing Chile's Historic HAB Events of 2016, Anderson and coworkers pointed out four possible sources of nutrient salt in the inland sea of Chiloe Island, Chile: salmon farming, living drainage from coastal cities, seafood factory effluent, and rivers lying downstream of a fiord. However, their contribution to red tide in the sea is still open questions.

To shed light on the questions we investigated the time/space distributions of red tide in Chiloe inland sea in 2013-2017 by satellite remote-sensing and analyzed the correlation between statistics above and these frequency/distributions.

Observed satellite images with Terra and Aqua map out monthly averaged concentrations of chlorophyll A after the post-processing on NASA worldview, the area or frequency above the threshold concentration identified as red tide. The adopted statistics is as followings: monthly yield of salmon from SalmonChile (The Salmon Industry Association A. G) and annual population of coastal cities found in National Statistics Institute of Chile, which is roughly proportional to living drainage without removal processing for nutrient salt.

The good correlation between monthly salmon production and frequency of red tide is exemplified (correlation factor 0.64). Both affect each other. Salmon fishkill is caused by hypoxia, lack of dissolved oxygen (DO), due to red tide, whereas eutrophication with much feed in salmon farm and discarded carcass in coastal areas leads to increase the frequency of red tide. Our result indicates the latter mechanism works predominantly than the former in Chiloe inland sea. The detail analysis and results will be displayed in the presentation.

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