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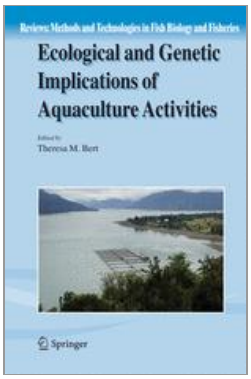
Using Natural Ecosystem Services to Diminish Salmon-Farming Footprints in Southern Chile

Through field observations and a compilation of several manipulative and mensurative experiments carried out in freshwater and marine ecosystems in southern Chile, we here provide alternatives for using natural ecosystem services to diminish salmonfarming ecological footprints. In freshwater lakes, where early stages of salmon growth are completed, the high filter-feeding rate of the native bivalve, Diplodon chilensis, can significantly reduce the effect of salmon farming by maintaining oligotrophic conditions. The constant movements of D. chilensis on the bottom sediment substrate generate enough bioturbation to reduce the impact of nutrient accumulation (nitrogen and phosphorus) due to salmon farming. We documented a similar mitigating effect in marine mussel (Aulacomya ater) beds, on rocky substrates in the channels and fjords where salmon are grown in pens. There is an additional benefit in such cases because A. ater is a valuable commercial resource. Artificial reefs, both in lakes and the inner sea, provide refuges for crustaceans and fish. In particular, these artificial structures enhance juvenile recruitment of invertebrates and fish. In freshwater ecosystems, native endemic crustaceans (crabs [Aegla sp.] and crayfish [Samastacus spinifrons]) are capable of processing excess food deposited on the bottom from salmon pens. Marine crabs (Cancer edwardsi) perform a similar ecological role under salmon pens in the inner sea. In summary, artificial reefs provide a way to link salmon farming with bottom heterogeneity and thus reduce the impacts of the salmon farms by facilitating the incorporation of organic matter into benthic productivity. Excess food is utilized around salmon-farm pens by both native fish and escaped salmon. These fishes, in turn, are prime targets for sport fishing, which, if managed in an appropriate way, could become an effective way to remove assimilated nutrients and organic matter via the removal of fish, which are at the top of the food web. This practice would have the additional benefit of removing salmon that have escaped from culture pens, particularly if the fishery was conducted around the pens.



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