

Down under the southeastern Pacific: marine non-indigenous species in Chile

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Abstract

This article presents the first compilation of marine non-indigenous species (NIS) of algae and macro-invertebrates invading Chilean waters. A total of 32 cosmopolitan and non-cosmopolitan species are reported. Among them there are six species considered as extending their southern range of distribution in connection with El Niño events. The article highlights negative and positive impacts caused by marine NIS invasions. Among the first are *Codium fragile* var. *tomentosoide*, considered as a pest in *Gracilaria chilensis* aquaculture facilities in northern Chile, and *Ciona intestinalis*, a pest in scallop aquaculture installations. Among the second are bio-engineers species, such as the ascidian *Pyura praeputialis* and the sea grass *Heterozostera tasmanica*, which have caused an increase in local biodiversity and enhancement of nursery grounds via the creation of new habitats. Further more, invaders such as the algae *Mastocarpus papillosus*, *Porphyra linearis* and *P. pseudolinearis* represent new exploitable resources, extracted by coastal food gatherers along the coast (*M. papillosus*) or potential species to develop aquaculture. Additional information is presented on the anemone *Anemonia alicemartinae*, which appears to be a native species (?), having shown in the past 40–50 years, a geographical southward range extension of approximately 1900 km. The number of NIS reported for Chile is compared with those published for the southwestern Atlantic, South Africa, North America (Atlantic and Pacific coasts) and New Zealand. It is suggested that probably the low number of Chilean NIS is due to the fact that the Chilean coasts are environmentally less stressed than other coasts in the world, due to the scarcity of estuaries, gulfs, enclosed bays, lagoons and low human populations. These kinds of sheltered areas have been suggested as centers for bio-invasions, due to the high rate of human-mediated transfer and increase of pollutants. Furthermore, none of NIS reported from Chile show a fast geographical expansion rate

(exception of *A. alicemartinae*), nor invading strategies such as those described for marine NIS in other latitudes, where notorious ecological unbalances following invasions have been observed. An alternative hypothesis is that the low number of marine NIS invading Chile is underestimated, since the modern list of species generated through specific taxonomically intensive port and harbor surveys is still lacking. Fifteen species (five invertebrate and 10 fish) have been deliberately imported to Chile for aquaculture. The invertebrates appear to be controlled within aquaculture facilities and have not established naturalized populations or caused direct ecological impacts on local communities. On the contrary, several millions of salmoniforms (and rainbow trout) have escaped from farming facilities in southern Chile and established naturalized populations. Studies on ecological impacts are lacking. These escapees are also playing a role in the enhancement of artisanal and sport fishery activities.