# Introduced Marine and Maritime Species of the Pacific Northwest: Historical Pathways and Current Patterns

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Introduced species are multiple ecosystem stressors, altering community structure and threatening native species worldwide. Documenting the history, patterns and status of introduced species is essential for identifying dominant pathways and prioritizing control efforts. In an extensive survey of the recent and historic literature we found >140 records of established introduced marine and maritime species in the Pacific Northwest, >50 cryptogenic species (i.e., of uncertain origin), and >20 records of transient non-native species. Most species are invertebrates from 11 phyla ( >100 introduced species, >40 cryptogenic, >20 transient); vascular plants (27 introduced, 2 cryptogenic), algae (4 introduced, 6 crytpogenic), fish (4 introduced), and protists (4 introduced, 3 cryptogenic) are also present. Most species have had few documented ecological and economic effects, but some have had notably dramatic impacts. Historically, the major pathways of introduction to this region were oyster shipments and ship hulls (invertebrates and algae) and intentional plantings (vascular plants). Currently, the major pathway is most likely ballast water transport in commercial vessels. As the number of introduced species increases in other North American coastal ports, the short-distance spread of invaders from these nearby hubs is likely to increase.

# Marine and Estuarine Non-indigenous Species in the Strait of Georgia, British Columbia

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## Abstract

The Strait of Georgia on the west coast of Canada is an important inland sea for seafood production, recreational activity, and maritime industry. In this paper we review the presence and role of non-indigenous species (NIS) in the ecosystem of the Strait. Based on the literature and authoritative personal communications, we estimate the following number of NIS have established populations in the Strait or along its shoreline: algae - 22; vascular plants - 22; invertebrates - 65; fish - 3; birds - 1; mammals - 1. Some of the species' records may only represent range extensions and other species may be cryptogenic. Because of the lack of ecological surveys and monitoring in the Strait, there is uncertainty about when most of the NIS arrived in the Strait, modes of introduction, and ecological impact. However, it is clear that numerous species arrived as hitchhikers with oysters (*Crassostrea gigas*), which were intentionally introduced. Other species may have arrived via ballast water, ship fouling, releases of live food organisms, the plant nursery and aquarium trade, and research and teaching activities. Because of the multiple pathways available for NIS to spread into the Strait, it is difficult to implement comprehensive effective control mechanisms to minimise or prevent any introductions. However there are programs in place such as quarantine procedures, ballast water control and management, and public education, which could be expanded to help reduce the risk.

**For the full report on which this abstract is based, see the reference below.**

Levings, C.D., Kieser, D., Jamieson, G.S., and S. Dudas, 2001. Non-indigenous species in the Strait of Georgia, BC. Chapter for book to be published by Natural Resources Canada (Ed Renata Claudi) on Alien Species in Canada 26 p + appendix table (in press)