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The spatial distribution of spiny dogfish (*Squalus acanthias*) in the Gulf of Alaska: the use of fishery-dependent data, fishery-independent data, and generalized modelling for the spatial management of catch and bycatch

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The spiny dogfish (*Squalus acanthias*) is a common bycatch species in commercial longline fisheries in the Gulf of Alaska. This small shark is widely considered as a nuisance and most dogfish bycatch is discarded. Their spatial distribution in the Gulf of Alaska is poorly understood. A better understanding of areas of high bycatch would provide critical information to fishery managers, whether they seek to convert discards into valuable fishery landings or whether they seek to reduce fishing mortality on this long-lived species. We analysed the spatial distribution of spiny dogfish from fishery and survey data collected between 1996 and 2008 using generalized additive and generalized linear modelling techniques. Poisson, negative binomial, and quasi-Poisson error structures were investigated using goodness-of-fit statistics. The quasi-Poisson generalized additive model provided the best fit for predicting counts of dogfish and accommodating overdispersion caused by areas with low dogfish counts. The results revealed catches of spiny dogfish were concentrated east of Kodiak Island, Alaska, with a general shift in the distribution of dogfish to the west of Kodiak Island between 1996 and 2008. Greater bottom depth and fishing effort led to a non-linear decrease in dogfish catch over the period examined. In contrast to common perception among the Alaskan fishing industry, results do not suggest a large increase in the dogfish population in the Gulf of Alaska in recent years. Furthermore, modelling results reveal areas of high dogfish density that indicate core areas that are important to future stock assessments and management of harvest and bycatch.

Keywords: Alaska, GAM, spiny dogfish, *Squalus acanthias*.

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