

# Occurrence and ecological niche modeling of blue whales (*Balaenoptera musculus*) within Skjálfandi Bay, NE Iceland

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## Introduction

Blue whales (*Balaenoptera musculus*) are known to occur in Icelandic waters (Sigurjónsson & Gunnlaugsson 1990). In the last four years, 2004-2008, it has been observed an increase in sighting frequency of this species in Skjálfandi Bay, NE Iceland. Investigations with respect to environmental variables (EVs) were made in order to get insight of any potential significant correlations. Further predictions on habitat suitability were considered for conservation purposes.

## Materials and methods

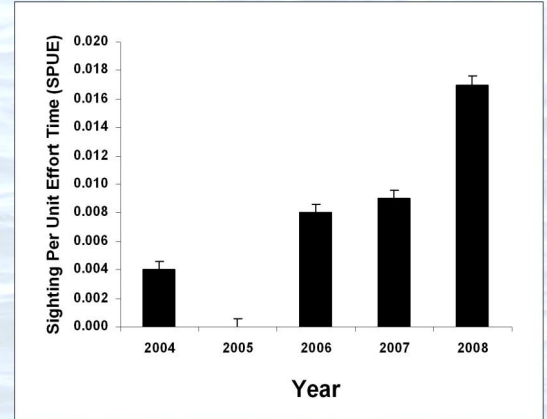
Data was collected during the period 2004-2008 utilising whale watching vessels as platform of opportunity within Skjálfandi Bay. GIS and remote sensing techniques were employed to determine associations between blue whales observed and co-occurring environmental variables. Lastly a maximum entropy approach (after Philips *et al.*, 2006) was used to spatial map and predict potential habitat within Skjálfandi Bay.

## Results

Across the period sightings per unit effort (SPUE, Fig.1) was observed to increase (0.004 – 0.018). Results showed that blue whale observations predominantly occurred within areas (Fig.2) of high depth (mean = 139.472 ± 54.180), low temperature (mean = 7.643 ± 0.181) and high concentrations of chlorophyll-a (mean = 1.890 ± 0.595). Habitat suitability (Fig.3) was predicted to occur most frequently within the central, deepest, part of the bay, with a decreasing trend outside.

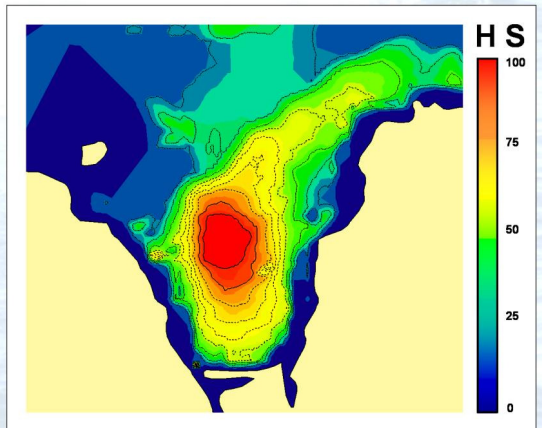
**Table 2.** EVs values in relation to blue whales observations within the study area

	Depth (metres)	Depth Gradient (percent rise)	SST (°C)	SST Gradient (percent rise)	CHL (µg l <sup>-1</sup> )	CHL Gradient (percent rise)	Salinity (ppm)
Maximum	212.817	63.114	7.700	2.050	3.299	1.130	34.620
Minimum	16.469	4.040	6.769	0.000	1.259	0.000	34.597
Range	196.348	59.074	0.931	2.050	2.040	1.130	0.022
Mean	139.472	35.400	7.643	0.100	1.890	0.300	34.605
Standard Deviation	54.181	2.087	0.181	0.040	0.595	0.034	0.004

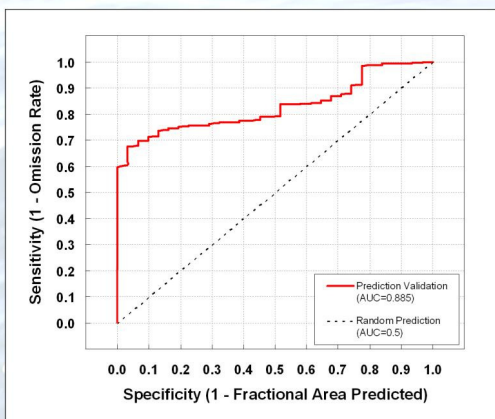


**Fig 1.** Blue whales sightings per unit effort for the period 2004-2008 within Skjálfandi Bay, NE Iceland.

Predictions were validated using a random seed process of 20 : 80 percent Training : Testing, results of which gave a prediction area under the curve (AUC) of 0.885 (Fig.4).



**Fig 3.** Map of habitat suitability for blue whales within Skjálfandi Bay, NE Iceland, using MAXENT ENM technique



**Fig 4.** ROC validation AUC of modelled blue whale distribution

## Discussion

Concerning the increase of sighting frequency of blue whales within north eastern Icelandic waters, temperature change is considered to be prime factor in the habitat variation for this species. Skjálfandi Bay represents an increasing critical area of habitat and hence conservation measures are thought important to be considered regarding future ecosystem changes.

## References

1. Sigurjónsson J. and Gunnlaugsson Th., 1990. Recent trends in abundance of blue (*Balaenoptera musculus*).....*Report of the International Whaling Commission* 40:537-551.
2. Phillips S.J., Anderson, P.S. and Schapire R.E., 2006. Maximum entropy modelling of species geographic distributions. *Ecological Modelling* 190:231-259.

## Acknowledgements

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