Sperm whale (*Physter macrocephalus*):

Summary of review of AquaMaps predictions for WCR undertaken by Kristin Kaschner & Randall Reeves, December 2011-12-06

Revision of AquaMaps predictions based on available regional data (KK)

Using the 427 sperm whale occurrence records available through OBIS for the study area, I computed relative encounter rates by calculating the proportion of total sighting events of this species in each of the 122 half degree "presence cells". An analysis of mean depth values associated with cells in which relative encounter rates were high showed the depth usage of the species in the WCR was more coastal than the original global depth envelopes, which was also supported by information provided in the literature about regional habitat usage (Mullin et al. 1994, Davis et al. 1998, Baumgartner et al. 2001, Maze-Foley & Mullin 2006) and I therefore adjusted said envelope accordingly. Available literature about habitat usage of the species in this region did not suggest regional temperature or other environmental ranges divergent from the global mean envelopes, so these were not changed. Final input parameter settings can be seen in Table 1 and resulting gradient predictions, generated using the AquaMaps model (Kaschner et al. 2008), are shown in Figure 1. To show the most likely representation of known and probable occurrence of the species in the WCR I applied a presence threshold of 0.6 supported by recent validations for global predictions (Kaschner et al. 2011) (Figure 2).

Mapping parameters for Physeter macrocephalus (sperm whale)

FAOAreas: 18 | 21 | 27 | 31 | 34 | 37 | 41 | 47 | 48 | 51 | 57 | 58 | 61 | 67 | 71 | 77 | 81 | 87 | 88				
Pelagic: True				
Bounding Box (NSWE):	90	-90	-180	180
	Min	Pref Min (10th)	Pref Max (90th)	Max
Depth (m)	0	300	3000	8000
SST (°C)	-1.78	0	26.77	30.97
Salinity (psu)	29.75	32.86	35.64	40
Primary Production	93	177	969	2959

Table 1: AquaMaps input parameter settings for revised map generation

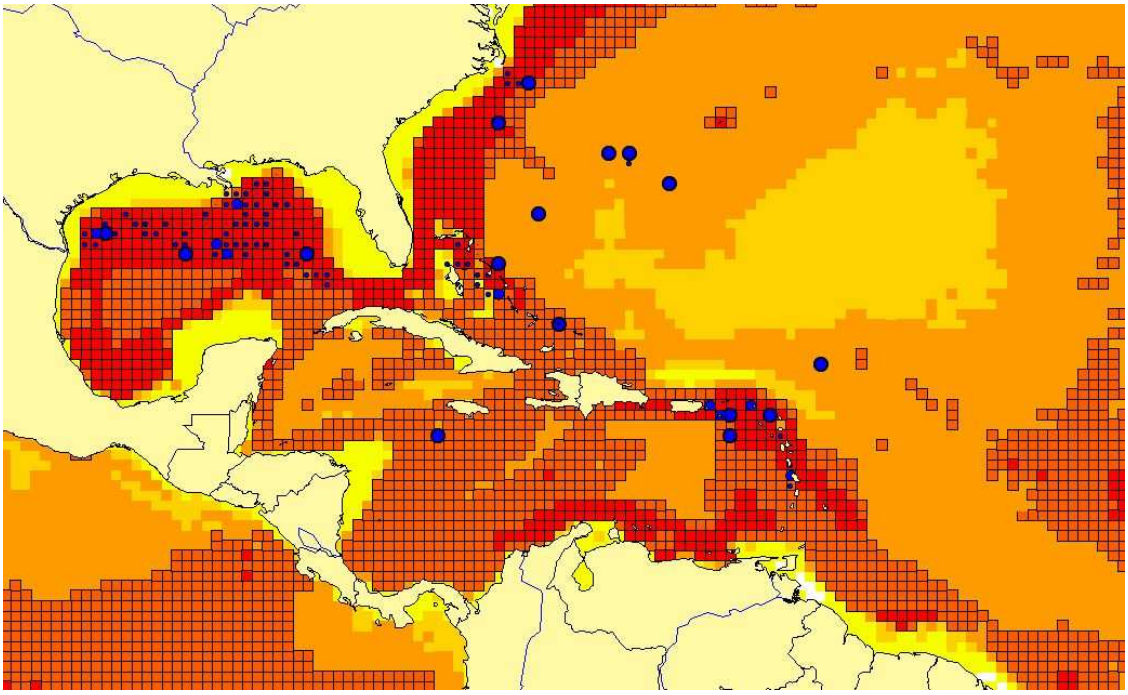

Fig 1. Predicted relative habitat suitability based on envelope settings in Table 1 and calculated relative encounter rates based on available sightings from OBIS (blue). Cells with probability values above the selected threshold are shown with boundaries. *Note that not all occurrences are available/accessible through online data repositories, such as OBIS (www.iobis.org), and records shown on the map do not necessarily represent the whole extent of documented species occurrence!

Review of outputs by independent experts (Randall Reeves et al.)

The experts consulted in Tampa – Keith Mullin, Shane Gero and Bruce Mate – found the KK map of sperm whale distribution to be a good and reasonable representation of what is known and what would be predicted based on likely suitable habitat outside well-surveyed areas. The environmental envelope determined by KK was judged to be sensible. Mullin emphasized that the highest densities observed in the northern Gulf of Mexico are directly off the Mississippi River delta, beginning in waters 500 m deep (Maze-Foley & Mullin 2006). Two other areas with exceptionally high densities are off Brownsville (Texas) and the Dry Tortugas (due west of the Florida Keys) – but primarily in shelf edge and slope waters, not on the shelf per se. Historical whaling data (Reeves et al. 2011) show that the Gulf of Campeche (along the edge of the Campeche Bank), as well as the Mississippi delta and eastern Gulf along and seaward of the 1000 m isobath, provide significant habitat for sperm whales (as also shown on the KK map). An important point to bear in mind is that the sperm whale population in the Gulf of Mexico (females at least) is genetically differentiated from those outside the Gulf, and the Gulf whales are consistently smaller than those in the Atlantic. Males apparently roam more widely than the females: one adult male tagged by Mate moved outside the Gulf into the Atlantic (via Straits of Florida, I think). Gero, who is heavily invested in sperm whale monitoring in Dominica (for his PhD under H. Whitehead at Dalhousie University), said that he regards the sperm whales there as part of a “Lesser Antilles” population that is at least semi-resident off the lee shores from Dominica to Grenada (Gero et al. 2007). He believes the Grenada Basin plays a role in determining sperm whale occurrence in this region.

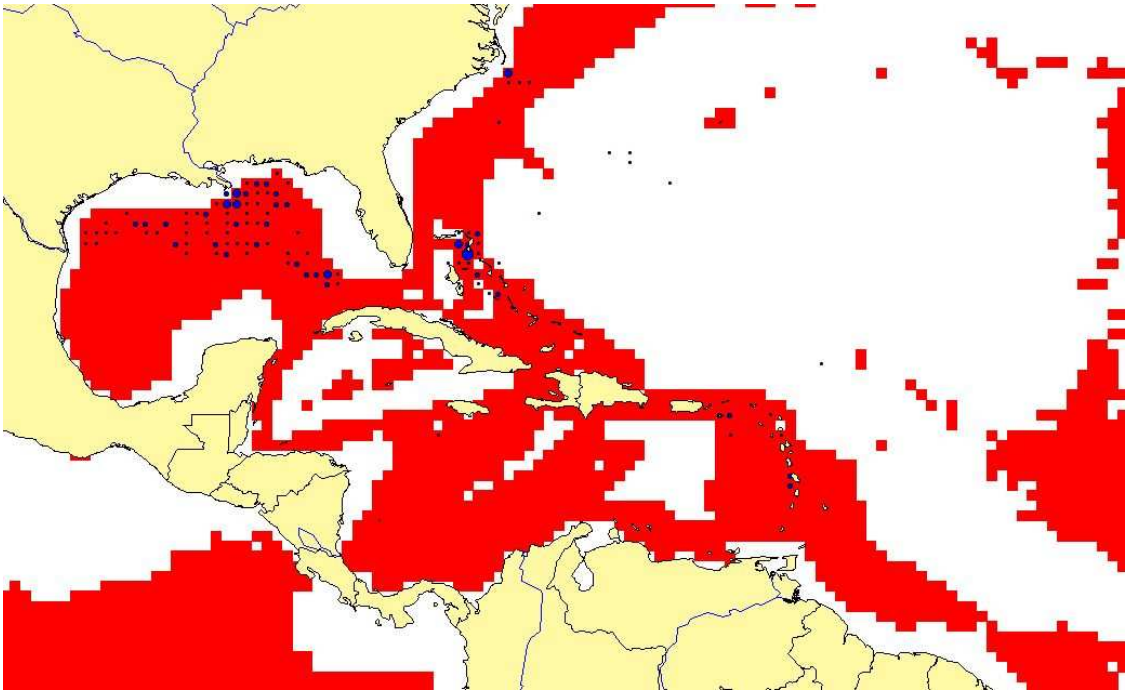

Fig 2: Consensus map of known and probable occurrence of species in WCR plus sightings available through OBIS shown in blue. *Note that not all occurrences are available/accessible through online data repositories, such as OBIS (www.iobis.org), and records shown on the map do not necessarily represent the whole extent of documented species occurrence!

Quality of outputs: ★★★

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