Killer whale (*Orcinus orca*):

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

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

Mean depth of sightings from line transect surveys in the northern Gulf of Mexico indicated the species occurs mostly on the lower slope and beyond (Maze-Foley & Mullin 2006). This is supported by the analysis of mean depth values of cells associated with high encounter rates of this species (41 available occurrence records from OBIS in 28 cells) and by patterns in observed annual mean densities from line transect surveys conducted in the northern Gulf of Mexico (Hansen et al. 1995, Davis & Fargion 1996, Davis et al. 2002, Fulling et al. 2003, Mullin & Fulling 2004). Taking all available information into account, I adjusted the depth envelope to the values summarized in Table 1. I also extended the preferred temperature range into slightly warmer waters to reflect occurrence records from the central coast of Venezuela. 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 known and probable occurrence of the species in the WCR I applied a presence threshold of 0.6 as suggested by recent validation analyses (Kaschner et al. 2011) (Figure 2). It should be noted, however, that this species is mostly observed, at least in the northern Gulf of Mexico, during the spring and is rarely seen during the remainder of the year (Davis & Fargion 1996). Therefore predicted occurrence is probably most representative of the spring distribution of the species, but likely overstates the occurrence of this species during any other time of the year.

Mapping parameters for Orcinus orca (killer whale)_2
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	500	3000	5000
SST (°C)	-2	-1.64	27	30.02
Salinity (psu)	28.7	31.9	35.21	40
Primary Production	0	194	1563	3160
Sea Ice Conc.	-0.83	0	0.6	1.5
Distance to Land (km)				

Table 1: AquaMaps input parameter settings for revised map generation

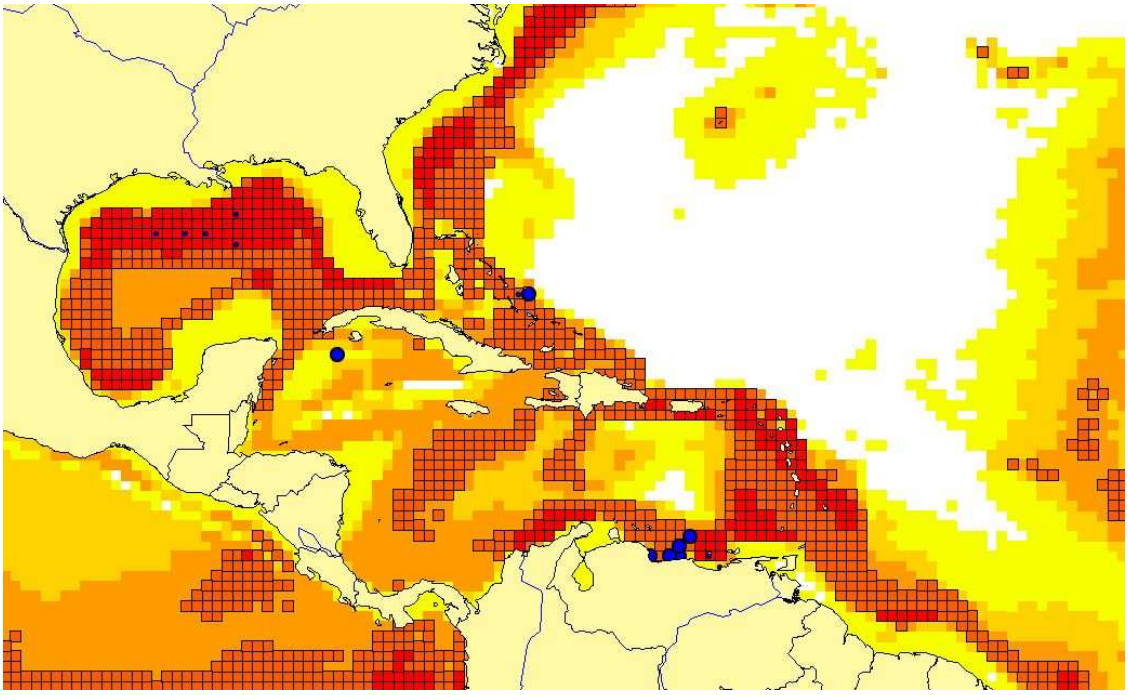

Fig 1. Predicted relative habitat suitability based on envelope settings in Table 1 and calculated relative encounter rates based on available sightings from OBIS (blue). Cells with probability values above the selected threshold are shown with boundaries. *Note that not all occurrences are available/accessible 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 expert (Randall Reeves)

The predicted occurrence in the Gulf of Mexico matches reasonably well the few 19th century whaling records reported by Reeves et al. (2011) and the sightings reported by O'Sullivan and Mullin (1997). The latter authors suggested that killer whales in this region occur mainly in oceanic waters, and rarely on the continental shelf. Also, a disproportionate number of sightings (with effort taken into account) have been made in the warmer months from May to September, so occurrence could well be seasonal (O'Sullivan and Mullin 1997).

Distribution in the Caribbean is less easily characterized from the literature, as virtually all records there are from opportunistic observations and probably strongly biased towards coastal areas where both sighting effort (and hunting in some cases – e.g. St. Vincent and St. Lucia; see Caldwell and Caldwell 1975, Reeves 1988) and reporting have been non-systematic. The only part of the region where opportunistic records have been comprehensively compiled and published is Venezuela, where 18 observations along the coast in waters 10-1,500 m deep were reported from 1982 to 2008 (Bolaños-Jiménez et al. 2009). The authors of that compilation suggested a possible association of killer whales with tuna and billfish movements.

Jaime Bolaños-Jiménez has taken the lead in attempting to compile killer whale records for the entire Caribbean and these come from both the Greater and Lesser Antilles, Cuba, Venezuela, Trinidad, La Blanquilla, and Bonaire. It is clear that although they may occur over a very broad range, killer whales are not abundant in the region and tend to occur only in small groups, usually no more than about ten individuals. Attacks on whales and sea turtles have been reported.

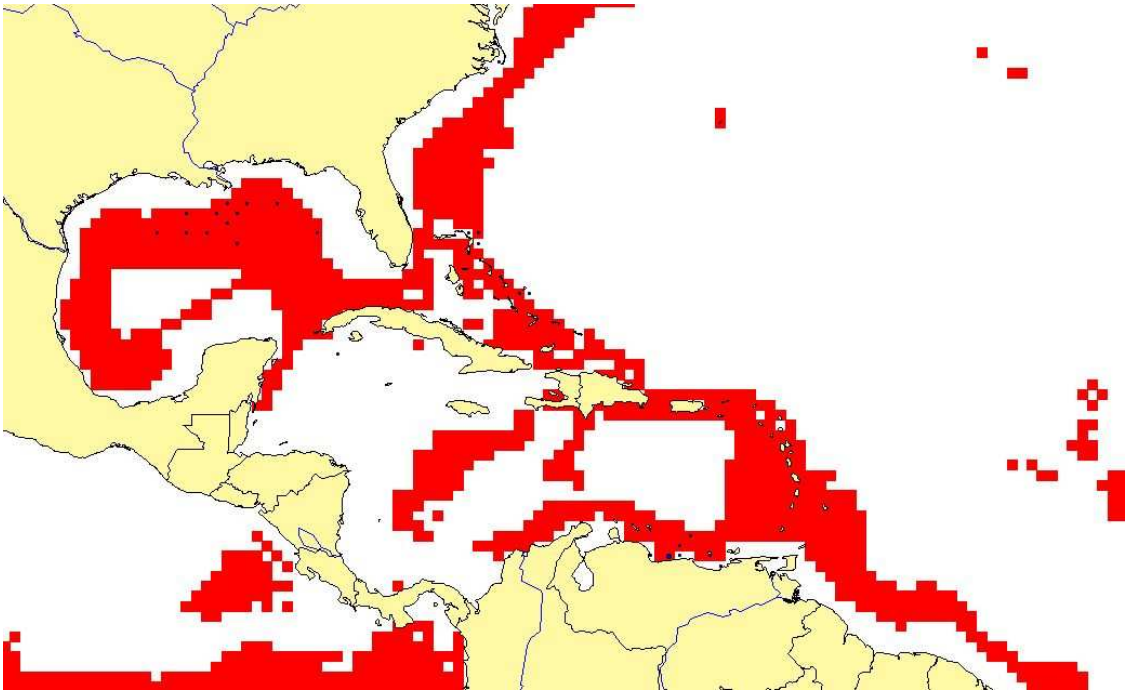

Fig 2. Consensus map of known and probable occurrence of species in WCR plus sightings available through OBIS shown in blue. *Note that not all occurrences are available/accessible through online data repositories, such as OBIS (www.iobis.org), and records shown on the map do not necessarily represent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

Quality of outputs: ★★

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