

COMMENT

Estimating by-catch of loggerhead turtles in the Mediterranean: Comment on Álvarez de Quevedo et al. (2013)

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ABSTRACT: Álvarez de Quevedo et al. (2013; Mar Ecol Prog Ser 489:225–234) tagged 26 by-caught loggerhead sea turtles, released them with the hook and 40 cm of line, tracked them for 90 d, and concluded that the Spanish longline fleet in the southwestern Mediterranean Sea has an annual by-catch of 10 656 loggerhead turtles, resulting in 3421 to 4028 turtle deaths. We consider the methodology and results in Álvarez de Quevedo et al. (2013) to be correct overall, but based on the loggerhead CPUE (per 1000 hooks) in the 2006–2007 period, we estimate that only 6060 ind. (SE: $\pm 40\%$) are captured annually; this would lead to a lower estimate of turtle mortality of 1945 to 2290 ind. ($\pm 40\%$).

KEY WORDS: By-catch · Longline · Mediterranean · Sea turtle

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The Spanish Mediterranean longline fleet targets swordfish *Xiphias gladius*, bluefin tuna *Thunnus thynnus*, and albacore *T. alalunga*, employing a variety of gears (Table 1), which differ by fishing season, hook type, type of bait, and presence or absence of weights (see Camiñas et al. 2006, Báez et al. 2007a,b, 2010, 2011, 2013, Wallace et al. 2008, García Barcelona et al. 2010).

Báez et al. (2013) did not observe significant turtle by-catch in LLPB, mainly due to its deeper operational fishing depth; thus, only 3 of the longline gears capture sea turtles: LLJAP, LLHB, and LLALB, whereby LLHB has the lowest and LLALB has the highest by-catch per unit of effort. We estimate 6060 ± 2397 loggerheads captured annually in 2006–2007 (Table 2). This leads to an estimate of turtle mortality of 1945 to 2290 individuals, according to the mortality rates in Álvarez de Quevedo et al. (2013).

Finally, each by-catch event is customarily considered as affecting a different individual, even when there is evidence of released turtles being caught again on another longline nearby (e.g. Tomas et al. 2001). For this reason, our by-catch and mortality estimates represent hypothetical maximum values.

Table 1. Overview of Spanish Mediterranean longline fisheries

	Longline type	Description	Target
LLJAP	Japanese	Surface drifting	Bluefin tuna
LLPB	Stone and ball	Demersal	Swordfish
LLHB	Home-based	(also semipelagic)	Swordfish
LLALB	Albacore	Surface drifting	Albacore

Table 2. Effort, catches per unit effort (CPUE) and total bycatch estimates of loggerhead data per gear type of the Spanish Mediterranean longline fishery in 2006 and 2007. See Table 1 for abbreviations. The total effort data per gear were estimated by combining data on landings per trip of the Ministry of Agriculture, Food and Environment (MAGRAMA) and effort data of the observer program of the Spanish Institute of Oceanography (IEO). CPUE data were also from the IEO observer program on commercial vessels (Camiñas et al. 2006, Báez et al. 2007a,b, 2010, 2011, García Barcelona et al. 2010)

	Gear	Effort (10 ³ hooks)	CPUE (ind. × 10 ⁻³ hooks)	Catch (ind.)
2006	LLJAP	851	0.17	140
	LLPB	1142	0.092	105
	LLHB	5880	0.35	2073
	LLALB	5537	0.98	5436
	Total			7755
2007	LLJAP	620	0.304	189
	LLPB	1823	0	0
	LLHB	6720	0.15	1017
	LLALB	5987	0.53	3158
	Total			4364
Mean	LLJAP	736	0.23	165
	LLPB	1483	0.046	53
	LLHB	6300	0.25	1545
	LLALB	5762	0.76	4297
	Total			6060
SD	LLJAP	163	0.99	34
	LLPB	481	0.065	74
	LLHB	593	0.14	746
	LLALB	318	0.32	1610
	Total			2397

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