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Stable isotopes in the fin whale *Balaenoptera physalus* from the Mediterranean Sea: implications for management and conservation

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Introduction. The fin whale *Balaenoptera physalus* is the most common large whale species in the Mediterranean Sea, found mostly over deep, offshore waters of the western and central portions of the region (Notarbartolo-Di-Sciara et al. 2003). In order to effectively conserve fin whale in the Mediterranean Sea, their diet and isotopic niche must be identified. Recently, it was proposed that stable isotope patterns can be used to quantify the width of the ecological niche of animals, keeping in mind potential effects of habitat use on these isotopic patterns (*e.g.* Newsome et al. 2007; Flaherty and Ben David 2010). We provide here (1) $\delta^{13}C$ and $\delta^{15}N$ values analysed in skin biopsies of fin whales sampled in the North western Mediterranean Sea and (2) a preliminary- SIBER Stable Isotope Bayesian Ellipses(Jackson et al. 2011) to compare isotopic niches of males and females.

Methodology. $\delta^{13}C$ and $\delta^{15}N$ values were analysed by IR-MS (Isoprime 100) coupled to an N-C-S elemental analyser (Vario MICRO Cube, Elementar) in 113 skin biopsies from Mediterranean fin whales sampled in 2010 and 2011 during WWF campaign at sea (NW Mediterranean Sea, Figure 1). A lipid normalization equation was applied (adapted from Post al. 2007). Isotopic niches of male and female fin whales were compared using SIBER metrics. The SIBER framework was used to draw standard ellipses and convex hulls from individual normalized $\delta^{13}C$ and $\delta^{15}N$ values, to compute associated parameters (SEAc, TA) and to compare them across groups. All calculations were realized using the SIAR 4.1.3 package in the R 2.15 statistical environment.

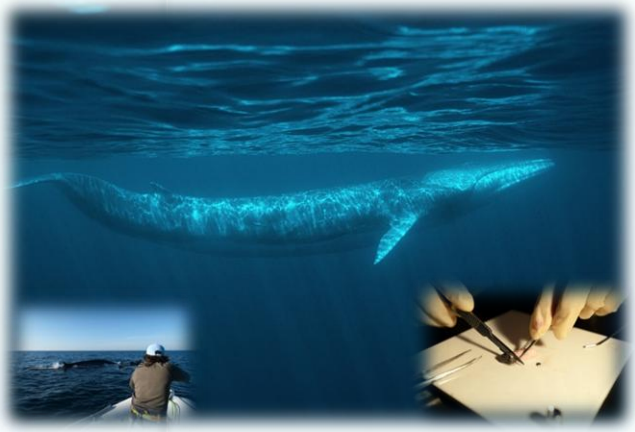

Figure 1: The fin whale *Balaenoptera physalus* and its sampling in the Mediterranean Sea (Picture credit: WWF-France, F. Bassemayousse)

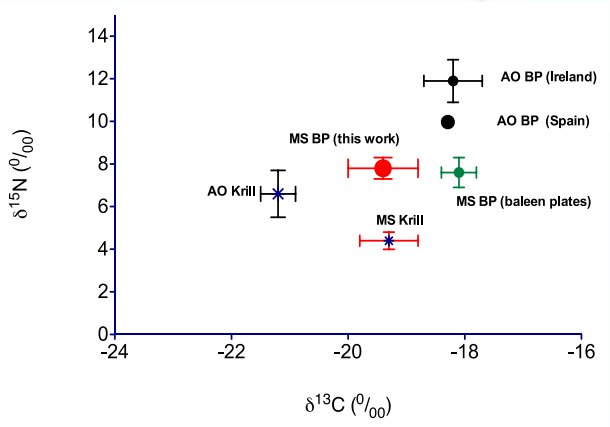

Figure 2: $\delta^{13}C$ and $\delta^{15}N$ values in skin of Mediterranean (MS) fin whales *Balaenoptera physalus* (BP, this work), baleen plates of Mediterranean fin whales (Bentaleb *et al.* 2011), skin of Atlantic (AO) fin whales sampled near Ireland (AO BP, Ryan *et al.* 2012) and near Spain (AO BP, Borrell *et al*. 2012), and krill *Meganyctiphanes norvegica* from the Mediterranean Sea (MS) and the Atlantic Ocean (AO) (Bentaleb *et al.* 2011).

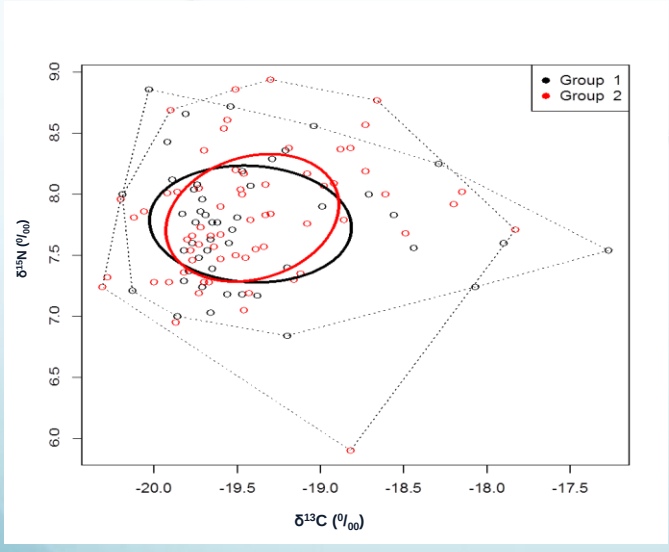

Figure 3: Data sampled according to SIBER for females (group 1, black dots) and males (group 2, red dots). Dotted lines standard ellipses, dotted line : convex hulls

Results and discussion. Normalized $\delta^{13}C$ and $\delta^{15}N$ values ranged from -20.3 to -17.3 ‰ and from 5.9 to 8.9 ‰, respectively, in good agreement with those collected previously on baleen plates from Mediterranean fin whales (Bentaleb et al., 2011) (Figure 2). These preliminary data confirm the importance of krill as a major food source for the Mediterranean fin whale.

Our observed $\delta^{13}C$ and $\delta^{15}N$ values are lower than that described for fin whales from the Atlantic Ocean (Ryan et al. 2012, Borrell et al. 2012). The Mediterranean fin whale is known to feed mainly on krill in contrast to its Atlantic counterpart, displaying a more diversified diet including schooling fishes such as capelin and herring (Aguilar 2002; Notarbartolo-Di-Sciara et al. 2003).

Isotopic niches did not differ between males and females (Figure 3). We expect narrower width of the isotopic niche of the Mediterranean fin whale (evaluated by SIBER) compared to the Atlantic fin whale (see also Ryan et al. 2013, present ECS conference). SIBER provides useful tool to discuss ecological *versus* isotopic niches of fin whales. One could expect that species displaying narrow niches would be more susceptible to ecosystem fragmentation and global changes.

How will these global changes affect the Mediterranean krill and fin whale is currently unknown and deserves urgent investigation.

References: **Bentaleb**, I., et al. 2011. Mar Ecol Prog Ser 438, 285-302. **Borrell** et al. (2012). Rapid Commun. Mass Spectrom. 2012. 26: 1596-1602. **Jackson** et al. (2011). Journal of Applied Ecology 80: 595-602. **Flaherty and Ben-David** (2010). Oikos. **Notarbartolo-Di-Sciara** et al. (2003). Mammal Review 33: 105-150. **Ryan** et al. (2012). Rapid Commun. Mass Spectrom 26: 2745-2754

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