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STRIPED DOLPHIN COASTAL POPULATION AND BOAT TRAFFIC OFF ANTIBES: A CONSERVATION CHALLENGE

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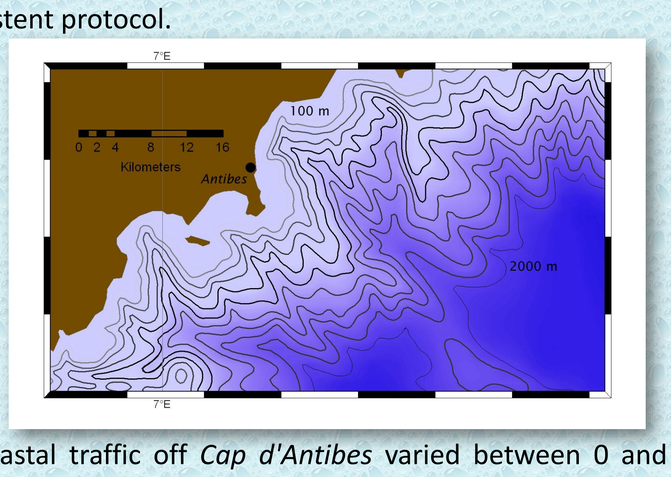
Abstract

While striped dolphins (*Stenella coeruleoalba*) are known as oceanic delphinids, they commonly occur in coastal waters of the western Mediterranean Sea, in particular off Riviera.

Since the eighties, recreational boat traffic has seen a tremendous increase off Antibes, and striped dolphin local preferred habitat is now boat-crowded about 7 months per year. Boat traffic was monitored for eight months in 2017-2018 (five consecutive days per month, seven hours per day) from a shore location in *Cap d'Antibes*; boat types were recorded in six basic categories ranging from sailboat to motorboat over 30 meters long. Boat direction (NE-SW or SW-NE) was also recorded. Dolphin presence was documented using survey sightings obtained by GREC in a recent period (2000-2016): time, location, school structure, and activity pattern data were collected with a consistent protocol.



Coastal traffic off *Cap d'Antibes* varied between 0 and 125 boats per hour, with a total amount of 553 in May 2017, 1283 in June, 1933 in July, 2476 in August, 668 in September, 849 in October, 105 in January and 90 in February 2018, on a 35 survey-hours per month basis. Sampling design enabled to show that week-ends were more crowded than average, and that weather had a significant effect on traffic (thus explaining the observed trend in September and October). Two daily peaks were evidenced, whatever the season, the first one late in the morning and the second one in the middle of the afternoon. Archived dolphin data included 610 sightings. In average, dolphin schools were significantly closer from shore before 10h00 (5.4 km in average, SD= 3.1) compared with their distance in the afternoon (9.4 km average, SD= 3.6). Dolphins were shown to move back towards coastal waters later in the evening. This study showed a strong co-occurrence of boat and dolphin presence, hence questioning the future existence of wild dolphins in such a touristic area.

Acknowledgements

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Figure 1: The striped dolphin is among the two species encountered close to shore off Antibes and the central French Riviera. A local community has been identified since thirty years ago and documented, through continuous presence and daily inshore/offshore movements (Gannier, 1999), and via a focused research project (Meissner *et al.*, 2008).

Figure 2: This local population is formally protected by at least four paper layers: French marine mammals protection act, *PELAGOS Sanctuary* international agreement, *ACCOBAMS* agreement and EC *Natura 2000* areas framework. Striped dolphins are nevertheless under pressure due to continuously growing maritime tourism activities.

Boat type / Month	Sailboat	Out-board < 7 m	In-board < 7 m	Motorboat 7-12 m	Motorboat 12-30 m	Motorboat > 30 m	5-days total
May 2017	162	116	132	88	45	10	553
June 2017	314	340	426	136	46	21	1283
July 2017	363	514	628	270	128	30	1933
August 2017	384	695	748	441	174	34	2476
September 2017	194	131	115	123	88	17	668
October 2017	307	221	173	84	54	10	849
January 2018	35	39	15	12	2	2	105
February 2018	41	25	9	10	4	1	90
TOTAL	1800	2081	2246	1164	541	125	7957

Table: The first aspect of this study was to determine the maritime traffic off *Cap d'Antibes*, an essential transit point for coastal boating all year long. Eight five-days sessions were programmed from May 2017 to February 2018 resulting in 291 hours of look-out survey. A total of 7957 boats was counted. Boat traffic was highly seasonal (over 50% in July and August), weather-dependent, with an obvious 'week-end effect'. More than 75% of boat traffic transited within 1 km from shore and more than 75% were motorized.

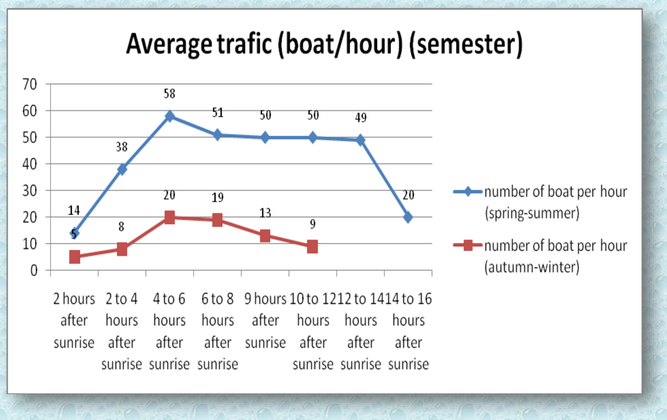

Figure 3: Boat count was highly variable during both seasonal periods: steadily increasing from sunrise to 4-6 hours after sunrise in spring/summer, remaining at over 50 boats per hour in average (max. measured value 125 boats/hour) for most of the day before decreasing in the afternoon. In autumn/winter, a similar trend was observed although the traffic peaked around midday, at about 20 boats per hour in average.

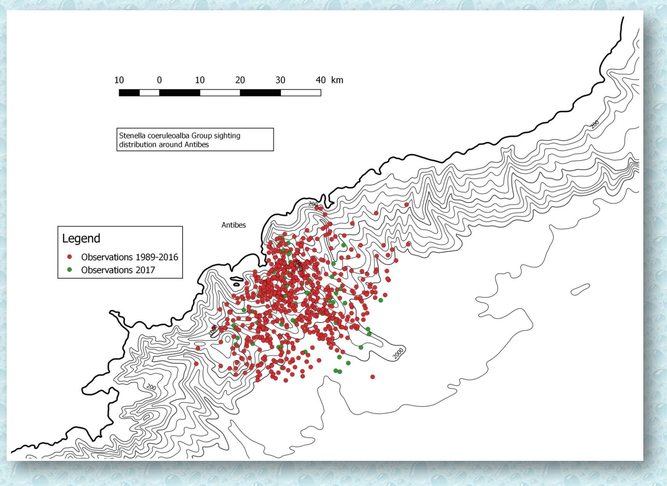

Figure 4: Dolphin sightings collected within 15 nautical miles from Antibes harbour were assigned to the local community and processed with QGIS: 1989 to 2016 sightings (n= 610) were called historic data set, and 2017 sightings (n= 66) were used as a control data set. Historic and contemporary data were not significantly different (T-test $p > 0.05$) in terms of average school size, whichever the season. Observed school sizes in 2017 were between 14.5 (summer, n= 20) and 18.0 (autumn, n= 12) individuals.

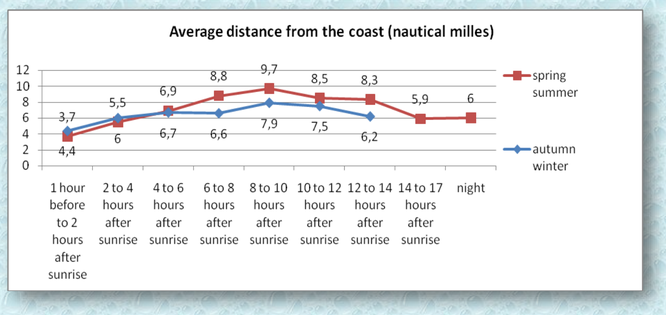

Figure 5: In average, dolphins were observed 7.5 nautical miles from shore, but this distance varied significantly between early in the morning and mid-afternoon, respectively 3.7 and 9.7 nautical miles during spring/summer season. The trend was similar in autumn/winter, although of lesser amplitude.

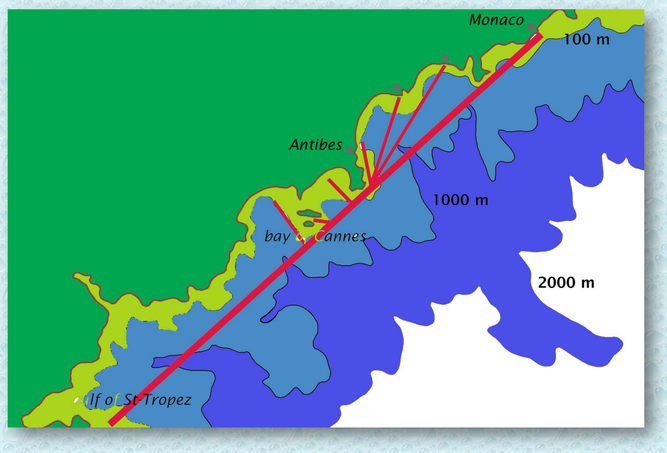

Figure 6: Main maritime recreational traffic patterns and coastal striped dolphins habitat are highly coincident off *Cap d'Antibes;* our boat counts and dolphin sighting maps are therefore good clues to evaluate a potential traffic-related disturbance caused to dolphins.

Conclusions

Striped dolphin community off Antibes is certainly the most vulnerable cetacean population in French national waters due to the coincidence of their coastal habitat and a very intense touristic boat traffic. Disturbance linked to dolphin-watch and swim-with tours comes in addition to this documented incidental effects and accounts for additional losses in dolphin energy budget (Cecchetti *et al.*, 2017).

Positive management actions are needed to favour their conservation for future generations, including increased boater awareness, area-focused speed regulation or local dolphin-watch exclusion zones, both actions being possible within *Natura 2000* framework.

References

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