

## Stress in bottlenose dolphins linked to boat type

Cetaceans living in urbanized coastal areas are susceptible to a range of human induced stress. The ability to assess and quantify stressors is critical for effective conservation and management. An analysis of dive duration patterns, derived from the field of statistical physics has identified a non-invasive method of assessing stress in bottlenose dolphins (*Tursiops truncatus*), revealing the complexity of their responses and its relationship to boat type.



An adult bottlenose dolphin about to reach the surface in the Adelaide Dolphin Sanctuary (Photo courtesy of N.Cribb)

Disturbances introduced in the oceans through anthropogenic activities may interfere with cetaceans, and affect their physiology, behavior, and ultimately their fitness and population dynamics. This issue is particularly relevant for cetaceans inhabiting coastal areas that are increasingly exposed to a variety of potential human disturbances, such as the Adelaide Dolphin Sanctuary.

Researchers Prof. Laurent Seuront (SARDI / Flinders University / CNRS) and Nardi Cribb (Flinders University), non-intrusively investigated the level of stress experienced by bottlenose dolphins from the distribution patterns of their dive durations, which have previously been shown to increase under boat traffic conditions, and is considered as a typical avoidance behavior.

Dive durations were opportunistically recorded from land-based stations in the absence of boat traffic, and in the presence of kayaks, inflatable motor boats, powerboats and fishing boats.

Subsequent analyses were based on nearly 6000 behavioral observations.

No significant differences in dive durations were found between control observations (i.e. absence of boats) and boat interferences, which could have incorrectly led to conclude that boat traffic did not induce any stress in bottlenose dolphins. However, more elaborate analyses derived from the field of statistical physics and based on the fractal complexity of behavioral display which decreases under stressful conditions show:

- (i) that the presence of boats affected the complexity of dive duration patterns; and
- (ii) that stress levels were related to boat type.

Specifically, the complex dive duration patterns were not observed in the presence of kayaks. A significant increase in behavioral stress was, however, induced by the presence of fishing boats, motorized inflatable boats and powerboats.

This work demonstrates that traditional approaches based on the analysis of averaged behavioral metrics may not be sensitive enough to detect changes in the distribution pattern of behavioral sequences, hence underestimating the potential consequences, such as chronic exposure to low levels of stress. This is critical for dolphin welfare as reports on the persistent exposure of bottlenose dolphins to boat traffic did not imply the absence of stress and hence may be thought as a pernicious threat.

Fractal analyses of behavioral variables, as demonstrated in this study, may provide a non-invasive, objective and quantitative framework that can be used to assess the changes in stress response, and subsequently evaluate the welfare status of organisms under various conditions of abiotic and/or biotic stress.

## Key Points

The impact of anthropogenic activities, including boat traffic, on bottlenose dolphins is still difficult to assess.

Non-intrusive assessment of dolphin stress levels is critically needed for their conservation and management.

A recently published study demonstrates that bottlenose dolphin stress increases in the presence of boats and that levels were a function of boat type.

## References

Seuront L and Cribb N (2011) Fractal analysis reveals pernicious stress levels related to boat presence and type in the Indo-Pacific bottlenose dolphin, *Tursiops truncatus*. *Physica A*, 390, 2333-2339.

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