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Numerical and experimental hydrodynamic analysis of suction cup bio-logging tag designs for marine mammals MARK MURRAY, United States Naval Academy, ALEX SHORTER, Woods Hole Oceanographic Institution, LAURENS HOWLE, Duke University, MARK JOHNSON, University of St Andrews, MICHAEL MOORE, Woods Hole Oceanographic Institution — The improvement and miniaturization of sensing technologies has made bio-logging tags, utilized for the study of marine mammal behavior, more practical. These sophisticated sensing packages require a housing which protects the electronics from the environment and provides a means of attachment to the animal. The hydrodynamic forces on these housings can inadvertently remove the tag or adversely affect the behavior or energetics of the animal. A modification to the original design of a suction cup bio-logging tag housing was desired to minimize the adverse forces. In this work, hydrodynamic loading of two suction cup tag designs, original and modified designs, were analyzed using computational fluid dynamics (CFD) models and validated experimentally. Overall, the simulation and experimental results demonstrated that a tag housing that minimized geometric disruptions to the flow reduced drag forces, and that a tag housing with a small frontal cross-sectional area close to the attachment surface reduced lift forces. Preliminary results from experimental work with a common dolphin cadaver indicates that the suction cups used to attach the tags to the animal provide sufficient attachment force to resist failure at predicted drag and lift forces in 10 m/s flow.

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