

Accepted Manuscript

Research paper

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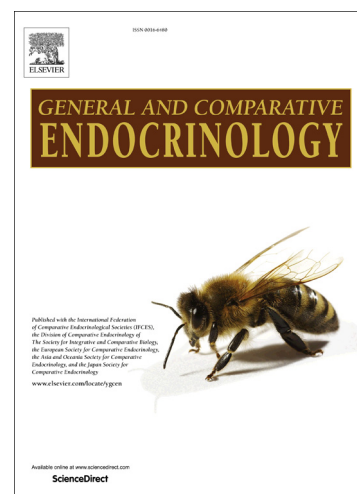
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PII: S0016-6480(17)30427-6
DOI: <https://doi.org/10.1016/j.ygcen.2018.02.015>
Reference: YGCEN 12872

To appear in: *General and Comparative Endocrinology*

Please cite this article as: Valenzuela-Molina, M., Atkinson, S., Mashburn, K., Gendron, D., Brownell, R.L. Jr., Fecal steroid hormones reveal reproductive state in female blue whales sampled in the Gulf of California, Mexico, *General and Comparative Endocrinology* (2018), doi: <https://doi.org/10.1016/j.ygcen.2018.02.015>

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Fecal steroid hormones reveal reproductive state in female blue whales sampled in the Gulf of California, Mexico

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1. Introduction

2 The study of steroid hormones in many aquatic mammals has been in-
3 creasingly undertaken through non-invasive techniques that avoid potential
4 impacts caused by capture, handling or other disturbances ([Amaral, 2010](#);
5 [Atkinson et al., 2015](#)). Non-invasive or minimally invasive techniques are
6 also the only non-lethal sampling alternatives in live mysticetes due to the
7 logistical difficulties of sample collection, such as large size, diving behavior
8 and the environment they inhabit ([Hunt et al., 2013](#); [Rolland et al., 2005](#)).
9 Feces are one type of useful non-invasive sample because fecal concentrations
10 of steroid metabolites represent an average of hormone levels that reflect a
11 similar pattern that occurs in the bloodstream ([Palme et al., 1996](#)), but they
12 have a lag time, which depends upon the species and transit time factors
13 ([Palme et al., 1996](#); [Schwarzenberger et al., 1996](#)). Fecal samples represent

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