



Stable isotope analyses reveal anthropogenically driven spatial and trophic changes to Indo-Pacific humpback dolphins in the Pearl River Estuary, China

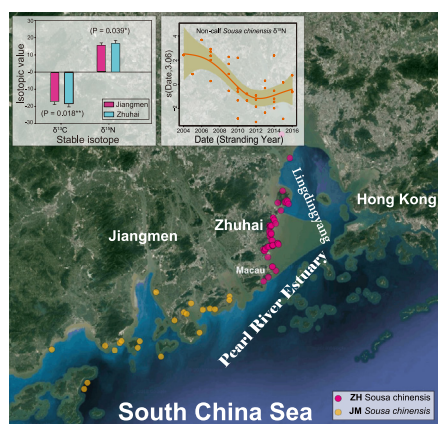
Xiyang Zhang^{a,1}, Ri-Qing Yu^{b,1}, Wenzhi Lin^{a,1}, Duan Gui^a, Xian Sun^a, Xinjian Yu^a, Lang Guo^a, Yuanxiong Cheng^c, Haobin Ren^a, Yuping Wu^{a,*}

^a Zhuhai Key Laboratory of Marine Bioresources and Environment, Guangdong Provincial Key Laboratory of Marine Resources and Coastal Engineering, School of Marine Sciences, Sun Yat-Sen University, Guangzhou 510275, China

^b Department of Biology, University of Texas at Tyler, Tyler, TX 75799, USA

^c The Third Affiliated Hospital of Southern Medical University, Guangzhou 510275, China

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

Received 19 June 2018

Received in revised form 19 September 2018

Accepted 20 September 2018

Available online 21 September 2018

Editor: Mae Sexauer Gustin

Keywords:

Carbon

Nitrogen

Sousa chinensis

ABSTRACT

As long-lived apex predators in the Pearl River Estuary (PRE) of China, Indo-Pacific humpback dolphins (*Sousa chinensis*) are particularly vulnerable to anthropogenic impact and may undergo considerable ecological trait changes. The variability of traits, however, is often difficult to trace back in nature. Here, we analyzed stable isotope ratios of carbon and nitrogen in muscle samples of 88 *S. chinensis* stranded in the PRE from 2004 to 2016 to investigate the ecological changes occurring in the dolphins. Stable isotope analysis revealed the existence of two sub-aggregations of *S. chinensis* in the PRE. Generalized additive models showed significant decreasing trends in both carbon and nitrogen isotopic signatures over time, indicating the habitat changes and dietary shifts, possibly due to the influence of increased coastal developments and fishing activities in the PRE. Diet modeling suggests that the proportional contribution of higher trophic-level prey decreased in the *S. chinensis* diet over time, while increased consumption of lower trophic-level prey was observed. This shift was related to depletion of higher trophic-level prey caused by overfishing. Although *S. chinensis* could temporarily compensate for the lost energy

* Corresponding author at: Zhuhai Key Laboratory of Marine Bioresources and Environment, Guangdong Provincial Key Laboratory of Marine Resources and Coastal Engineering, School of Marine Sciences, Sun Yat-Sen University, Guangzhou 510275, China.

E-mail address: exwyp@mail.sysu.edu.cn (Y. Wu).

¹ Equal contribution.

Coastal development
Overfishing
Habitat change
Feeding plasticity

supply through feeding plasticity (revealed by the negligible differences of isotope niche width among different stranding periods), long-term depletion in prey availability may cause long-lasting negative effects on this dolphin population. This study highlights the crucial relationships between fishery management and dolphin conservation, providing scientific evidence for the long-term protection of this threatened species in the PRE region.

© 2018 Elsevier B.V. All rights reserved.

1. Introduction

Centuries of overexploitation, habitat destruction, and anthropogenic pollution have greatly impacted the marine ecosystems around the world (Halpern et al., 2008). As long-life top predators, marine mammals are likely to experience most severe impacts from these anthropogenic stressors (Bowen, 1997). For example, overfishing by commercial fisheries can significantly affect the feeding success of marine mammals and decrease the fitness of a population over time by reducing their prey availability and quality (Bearzi et al., 2006; Bearzi et al., 2008). However, it is often difficult to track these impacts on marine mammals in nature. This is especially true for cetaceans, which spend most of their time underwater, and which are elusive in nature.

The Pearl River Estuary (PRE), located between Guangdong Province and Hong Kong, has been a traditional fish nursery ground providing abundant fishery resources for the southern China provinces (Fig. 1). The PRE is also a typical coastal ecosystem experiencing rapid industrialization and urbanization in the South China Sea. Since the 1980s, the coastal PRE ecosystem has experienced high pressure from over-utilized fisheries, leading to being the first major human-disturbed coastal area (Jackson et al., 2001). Moreover, large-scale construction projects around the PRE have permanently undermined the stabilities of natural coastal

habitats, altered the ecological balance, and influenced the survival of aquatic life directly and indirectly (Karczmarski et al., 2016).

The Indo-Pacific humpback dolphin (*Sousa chinensis*), locally known as the Chinese white dolphin, is a small delphinid species discontinuously distributed along the coastal and inshore waters from the Indian to western Pacific oceans (Jefferson and Karczmarski, 2001). This species has been classified as a “Vulnerable” mammal in the Red List of the International Union for Conservation of Nature and Natural Resources (IUCN) since 2017 (Jefferson et al., 2017). In China, this species mainly occurs in the estuarine waters of the southeastern coastal areas and has been listed as a National Key Protected Animal (Grade I) by the State Council since 1988. Among the five known *S. chinensis* populations in coastal Chinese waters, the PRE population, comprised of approximately 2637 individuals, was generally believed to be the largest known population of this mammal (Jefferson and Smith, 2016). Although the population size may appear to be robust enough to withstand stochastic events, their persistence is at particular risk owing to severe anthropogenic impacts resulting from coastal construction projects, vessel traffic, anthropogenic noise, chemical pollution, and prey depletion (Jefferson, 2000; Gui et al., 2017; Or, 2016). Among these threats, prey depletion due to heavy fishing and habitat degradation from coastal development may cause long-lasting effects on the

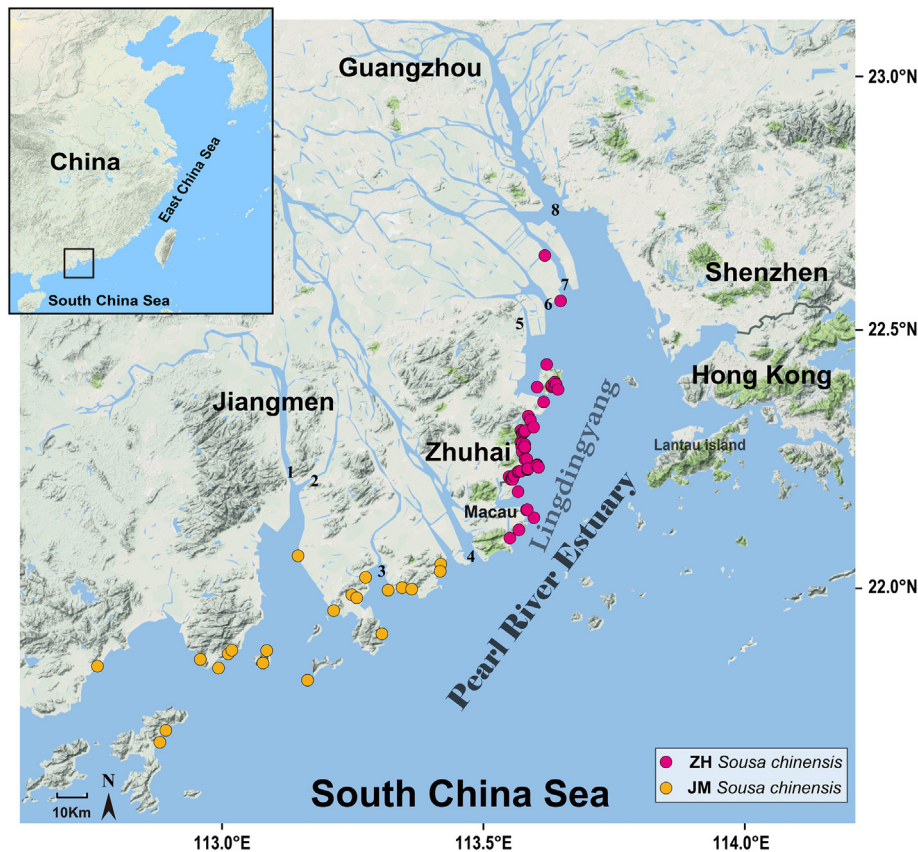


Fig. 1. Sampling locations of stranded *S. chinensis* in the Pearl River Estuary, China. The numbers refer to the eight main outlets where the Pearl River flows into the South China Sea, including Yamen (1), Hutiaomen (2), Jitimen (3), Modaomen (4), Hengmen (5), Hongqimen (6), Jiaomen (7), and Humen (8).

Download English Version:

<https://daneshyari.com/en/article/10223567>

Download Persian Version:

<https://daneshyari.com/article/10223567>

[Daneshyari.com](https://daneshyari.com)