

Baseline status of the Indo-Pacific humpback dolphin, *Sousa chinensis*, in the Gulf of Thailand: What do we know and what will we need?

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My journey



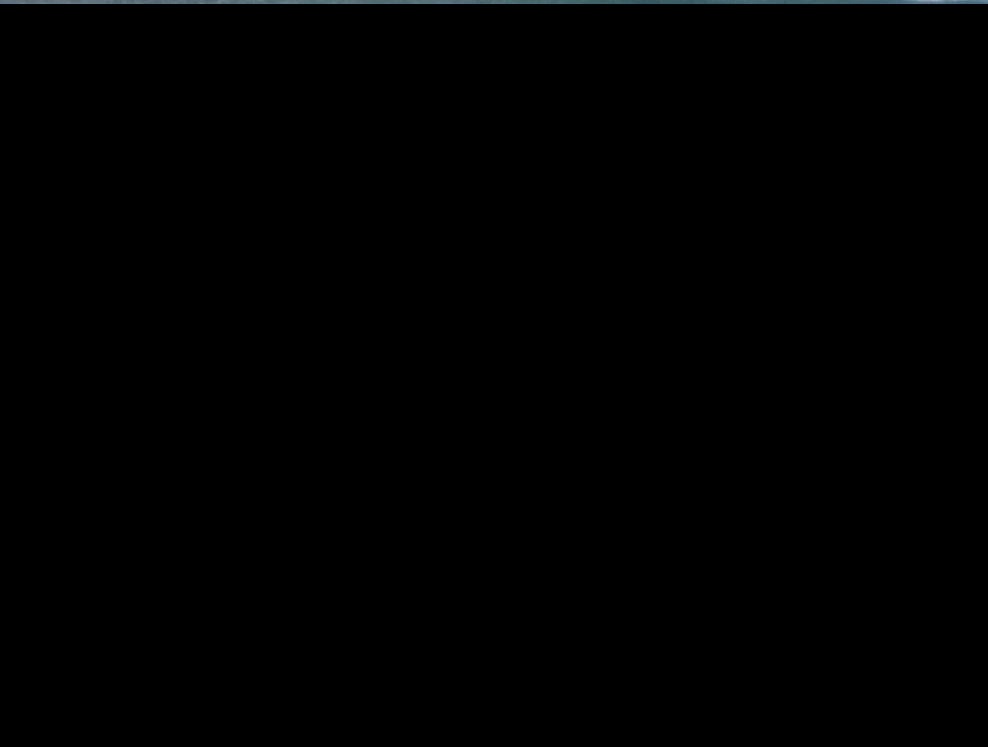
This is what we expect



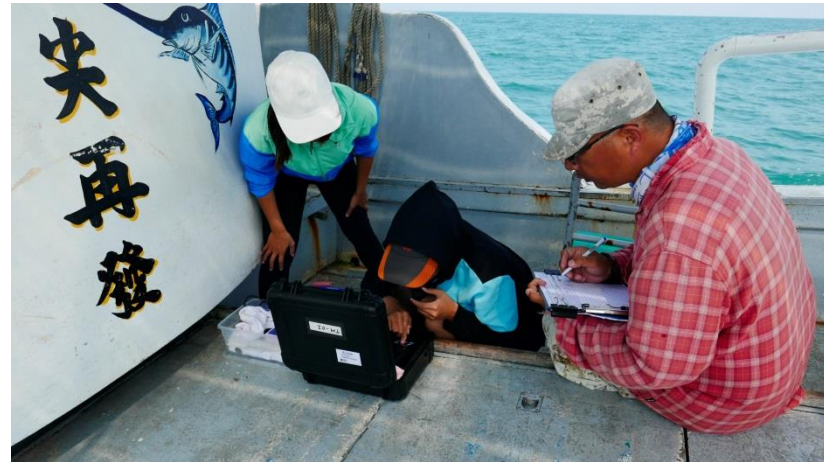
Qinzhou University



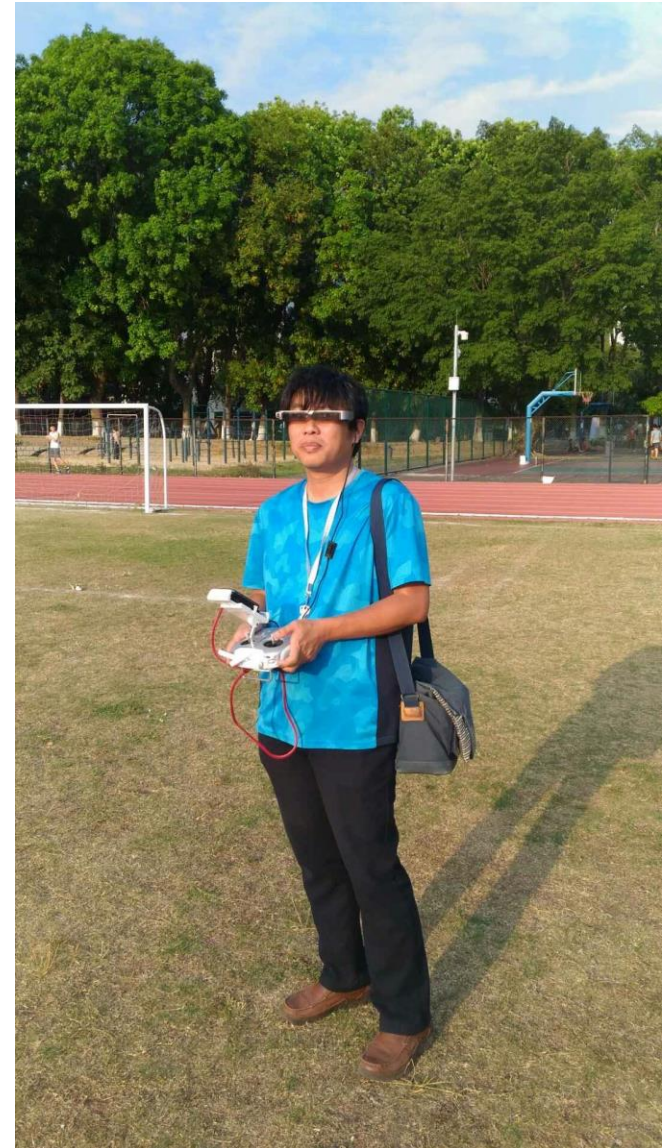
This is what we frequently met



Field works



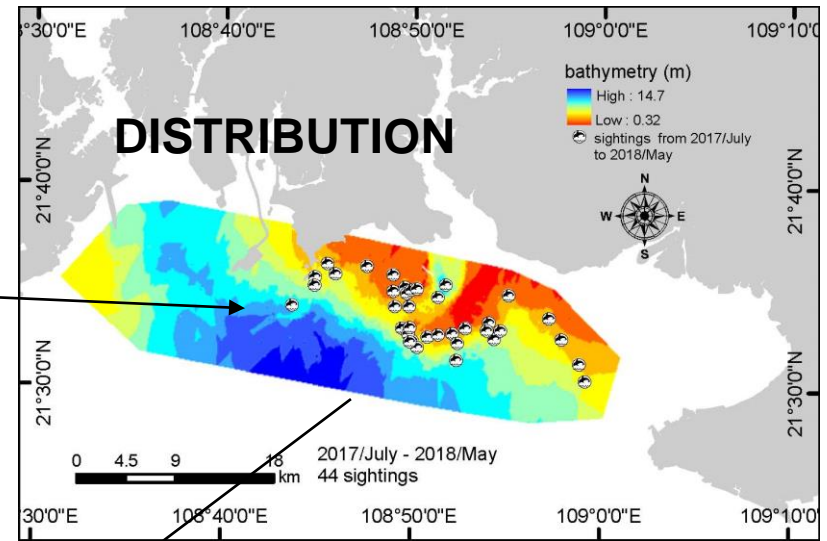
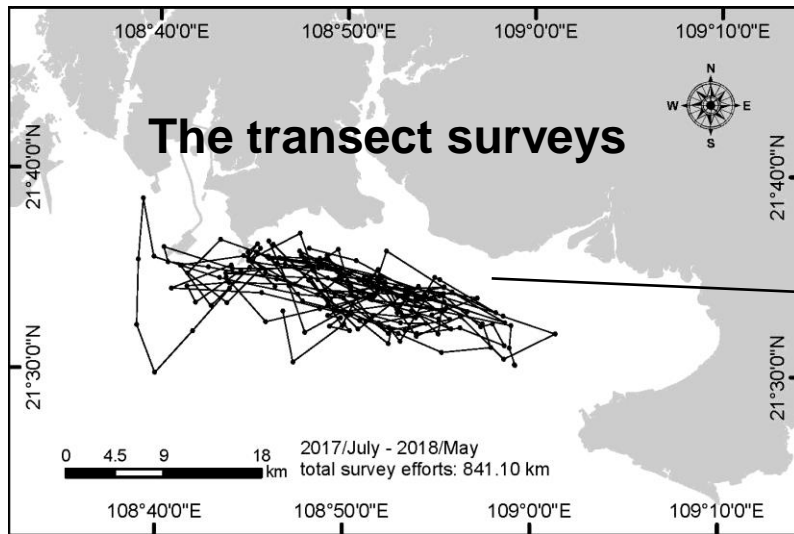
Some new techs



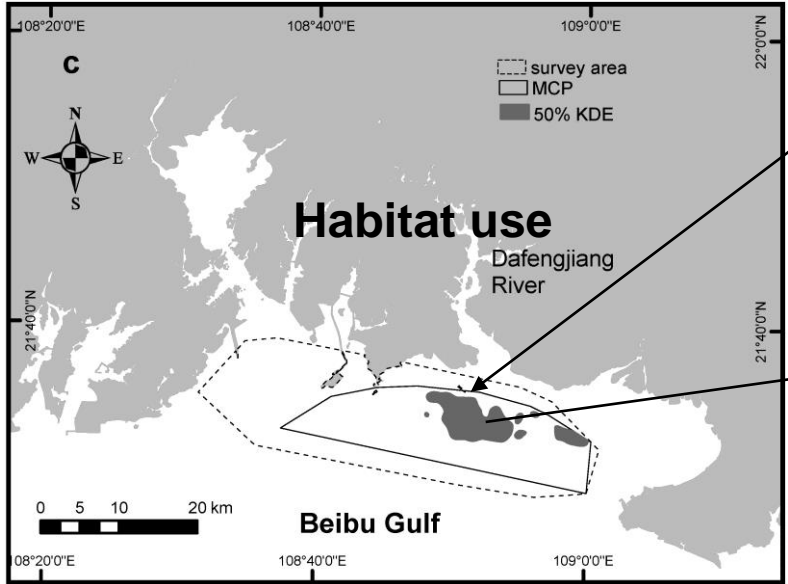
Videos by drone



For what we did these surveys?



Wu et al 2017

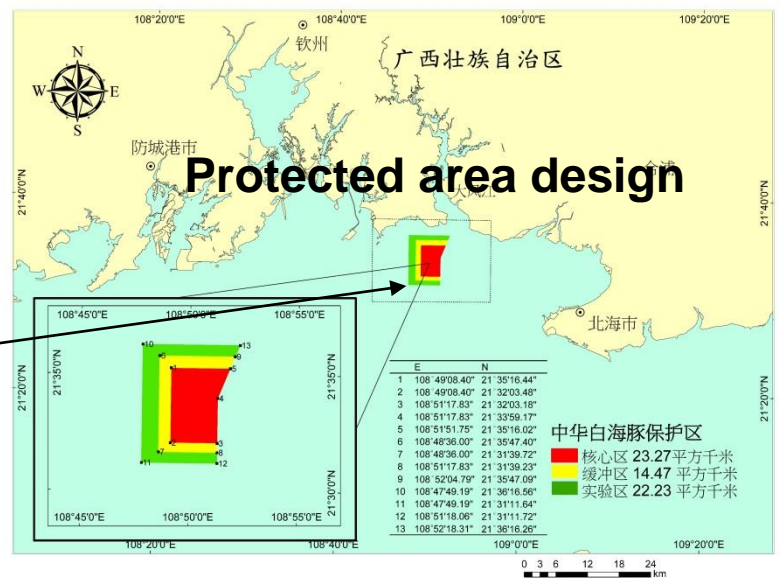


Population Size and Habitat Characteristics of the Indo-Pacific Humpback Dolphin (*Sousa thomasi*) Off Dongxi, Surat Thani, Thailand

Sawat Kongsam, Shing-Lin Huang, Sungsai Li, Mingli Liu, Kongkai Kietkietnong, and Sotepan Peadar

Abstract
Investigation on the distribution, population size, and habitat characteristics of Indo-Pacific humpback dolphins (*Sousa thomasi*) was conducted in a region located in the Beibu Gulf, Thailand. A total of 44 sightings were recorded from July 2017 to May 2018. The population size was estimated using capture-recapture and habitat characteristics were analyzed using kernel density estimates. The distribution and habitat characteristics of Indo-Pacific humpback dolphins were compared with those of the Pacific humpback dolphins (*Sousa pacifica*) in the same region. The population size of Indo-Pacific humpback dolphins was estimated to be 100-150 individuals. The distribution and habitat characteristics of Indo-Pacific humpback dolphins were similar to those of Pacific humpback dolphins. The population size of Indo-Pacific humpback dolphins was smaller than that of Pacific humpback dolphins. The distribution and habitat characteristics of Indo-Pacific humpback dolphins were similar to those of Pacific humpback dolphins. The population size of Indo-Pacific humpback dolphins was smaller than that of Pacific humpback dolphins.

Key Words: Indo-Pacific humpback dolphin, population size, habitat characteristics, kernel density estimate, capture-recapture



Why do we photo?



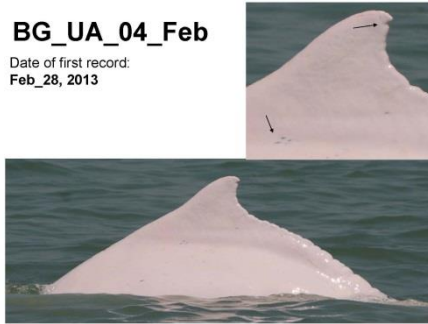
BG_UA_01_Aug

Date of first record:
Jul_25, 2014
female



BG_UA_04_Feb

Date of first record:
Feb_28, 2013



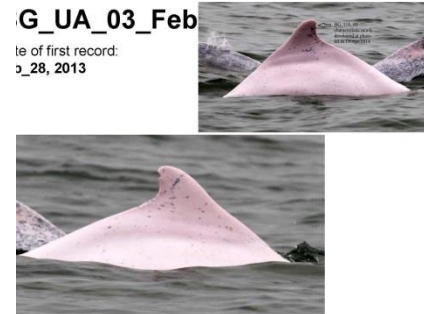
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Date of first record:
may_12, 2013



G_UA_03_Feb

Date of first record:
Feb_28, 2013



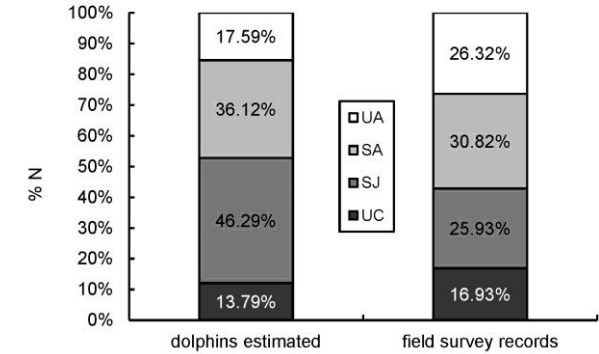
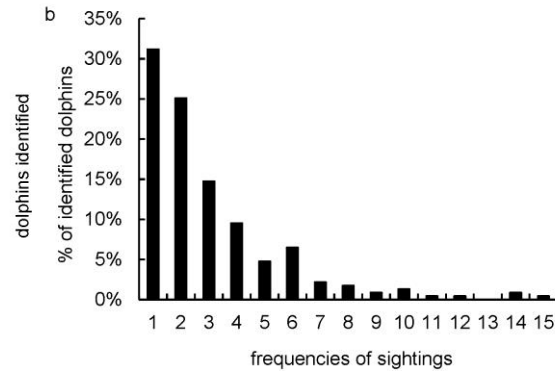
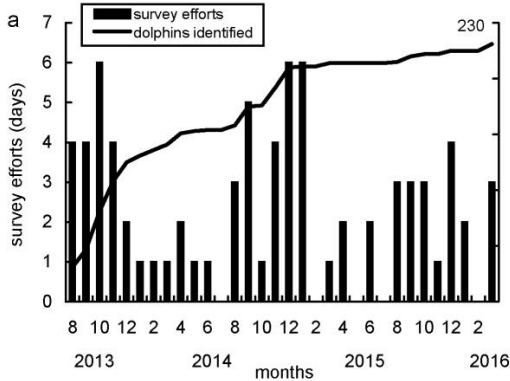
三娘湾中华白海豚照相识别个体库



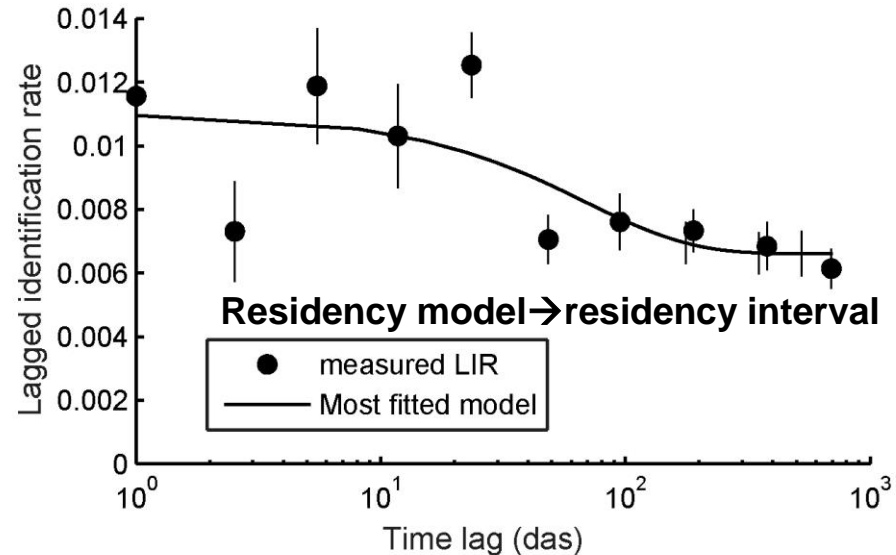
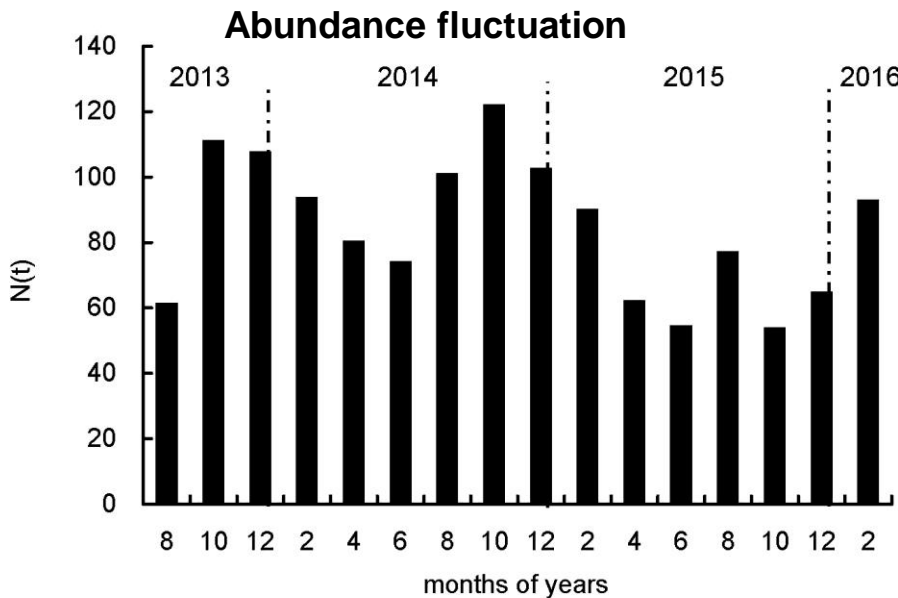
Dr. Haiping Wu, unpublished data

What can photo-ID surveys tell us?

Dr. Haiping Wu & Chongwei Peng,
unpublished data



Age structure → demography





Biological conservation

- **Species protection:** endangered, threatened, endemic, rare, precious
- **Biodiversity conservation:** species diversity, indicator species, umbrella species, key habitats
- **Ecosystem integrity:** functions, integrity

RESEARCH ARTICLE

Long-term changes in the distribution and core habitat use of a coastal delphinid in response to anthropogenic coastal alterations

Xianyan Wang¹, Fuxing Wu¹, Qian Zhu², Shiang-Lin Huang³

¹ Institute of Oceanography, National Central University, Chungli, Taiwan; ² Institute of Oceanography, National Central University, Chungli, Taiwan; ³ Institute of Oceanography, National Central University, Chungli, Taiwan

Abstract

The influence of anthropogenic habitat loss on animal distribution and core habitat use can be quantified using maximum entropy models. We investigated the distribution and core habitat use of a coastal delphinid species, the Indo-Pacific humpback dolphin (*Sousa chinensis*), in response to anthropogenic coastal alterations. We used a maximum entropy model to predict the distribution and core habitat use of the species in 1970 and 2012. The distribution of the species in 2012 was significantly different from that in 1970, indicating a significant shift in the species' distribution. The core habitat use of the species in 2012 was also significantly different from that in 1970, indicating a significant shift in the species' core habitat use. Our results suggest that anthropogenic coastal alterations have significantly affected the distribution and core habitat use of the Indo-Pacific humpback dolphin. We recommend that coastal management should take into account the distribution and core habitat use of the species when planning coastal development.

Keywords: Indo-Pacific humpback dolphin, maximum entropy model, coastal alteration, core habitat use, distribution, long-term changes

Contents lists available at ScienceDirect
Estuarine, Coastal and Shelf Science
 journal homepage: www.elsevier.com/locate/ecss

Impact of long-term habitat loss on the Japanese eel *Anguilla japonica*

Jan-Ze Chen¹, Shiang-Lin Huang³, Yu-San Hsu^{4,*}

Abstract

The impact of long-term habitat loss on the Japanese eel (*Anguilla japonica*) was investigated using a maximum entropy model. We used a maximum entropy model to predict the distribution and core habitat use of the species in 1970 and 2012. The distribution of the species in 2012 was significantly different from that in 1970, indicating a significant shift in the species' distribution. The core habitat use of the species in 2012 was also significantly different from that in 1970, indicating a significant shift in the species' core habitat use. Our results suggest that long-term habitat loss has significantly affected the distribution and core habitat use of the Japanese eel. We recommend that coastal management should take into account the distribution and core habitat use of the species when planning coastal development.

Keywords: Japanese eel, maximum entropy model, habitat loss, distribution, core habitat use, long-term changes

Contents lists available at ScienceDirect
Biological Conservation
 journal homepage: www.elsevier.com/locate/bioco

Demography and population trends of the largest population of Indo-Pacific humpback dolphins

Shiang-Lin Huang³, Janek Karczmarski¹, Jialin Chen⁵, Ruitian Zhou¹, Wenzhi Lin¹, Huifei Zhang¹, Haiyan Li¹, Yajun Wu^{1,*}

Abstract

The demography and population trends of the largest population of Indo-Pacific humpback dolphins (*Sousa chinensis*) were investigated using a capture-mark-recapture model. We used a capture-mark-recapture model to estimate the survival, recruitment, and emigration rates of the species. Our results suggest that the population of the species is stable and that the survival rate is high. We recommend that coastal management should take into account the demography and population trends of the species when planning coastal development.

Keywords: Indo-Pacific humpback dolphin, capture-mark-recapture model, demography, population trends, survival, recruitment, emigration

Contents lists available at ScienceDirect
Biological Conservation
 journal homepage: www.elsevier.com/locate/bioco

Population trends and vulnerability of humpback dolphins *Sousa chinensis* off the west coast of Taiwan

Shiang-Lin Huang, Wei-Lin Chang, Janek Karczmarski¹

Abstract

The population trends and vulnerability of humpback dolphins (*Sousa chinensis*) off the west coast of Taiwan were investigated using a capture-mark-recapture model. We used a capture-mark-recapture model to estimate the survival, recruitment, and emigration rates of the species. Our results suggest that the population of the species is declining and that the species is vulnerable to extinction. We recommend that coastal management should take into account the population trends and vulnerability of the species when planning coastal development.

Keywords: Humpback dolphin, capture-mark-recapture model, population trends, vulnerability, extinction

Contents lists available at ScienceDirect
Biological Conservation
 journal homepage: www.elsevier.com/locate/bioco

Saving the Yangtze finless porpoise: Time is rapidly running out

Shiang-Lin Huang¹, Zhigang Mei¹, Yujang Hao, Jinsong Zheng, Xekong Wang, Ding Wang²

Abstract

The Yangtze finless porpoise (*Neomeris phocaenoides*) is the world's only finless porpoise and is endemic to the Yangtze River. However, it is now critically endangered, with its population estimated to be less than 1000 individuals. We used a maximum entropy model to predict the distribution and core habitat use of the species in 1970 and 2012. The distribution of the species in 2012 was significantly different from that in 1970, indicating a significant shift in the species' distribution. The core habitat use of the species in 2012 was also significantly different from that in 1970, indicating a significant shift in the species' core habitat use. Our results suggest that the Yangtze finless porpoise is facing a high risk of extinction. We recommend that coastal management should take into account the distribution and core habitat use of the species when planning coastal development.

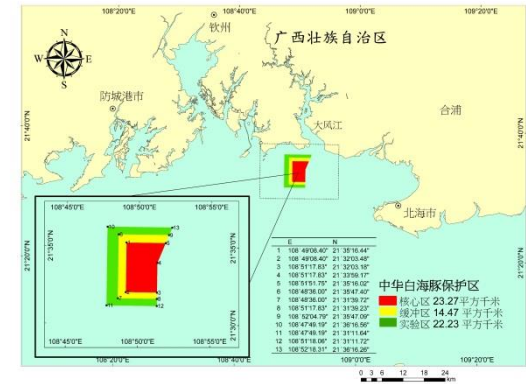
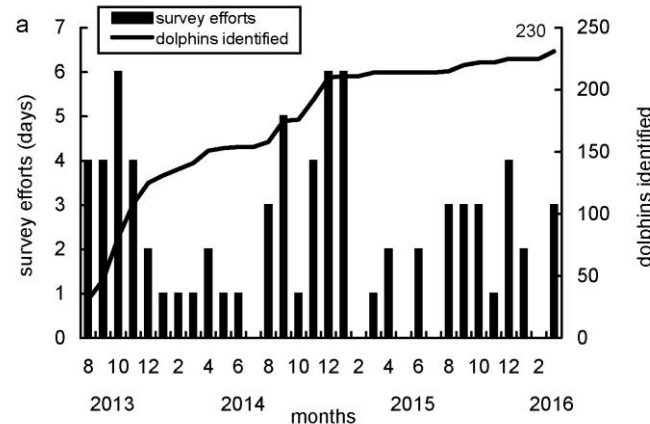
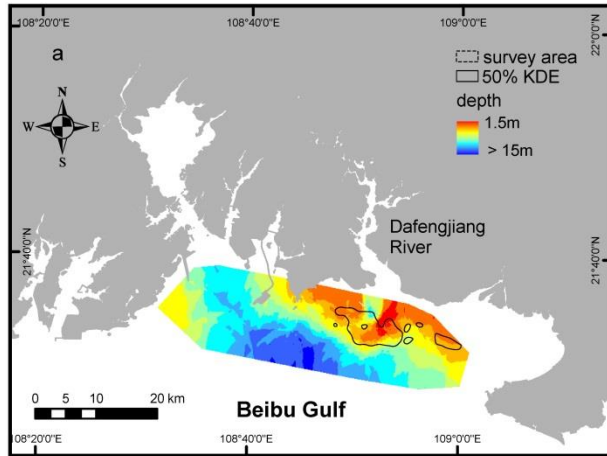
Keywords: Yangtze finless porpoise, maximum entropy model, distribution, core habitat use, extinction



STEPS

- **S**ites, **s**pecies and **s**urrogates to be protected—oceanographic characteristics of key habitats
- **T**hreat identification (extent, frequency, intensity)-intense coastal alterations, climate changes
- **E**valuation: **s**tatus, impact and risks, functions and values
 1. economic values (fisheries, mining, energy...)
 2. species diversity, endangered animals
 3. CO₂ fixation, nutrition functions, biomass production, carrying capacity
- **P**: **P**lanning (HPA, SCP)
- **S**: social conscious and stakeholder attitudes

Researches for conservation



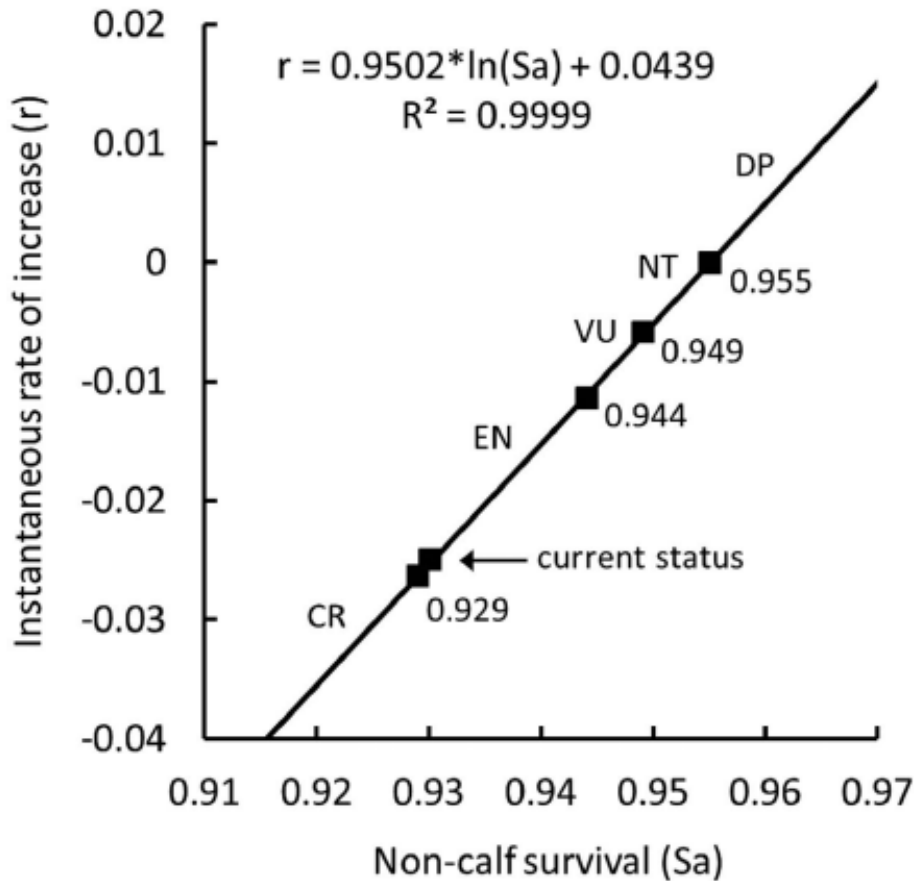
- **(S) baselines:** N, m, q, distribution, critical habitats
- **(T) Long-term trends:** dN/dt , habitat changes
- **(E) assessments:** PE, TE (PVA, RA, ...)
- **(P) policies:** status, PA design, long-term monitoring, management and community collaboration
- **(S) stakeholder baselines:** questionnaires



Why is above information needed?

IUCN Red List Categories and
Criteria (IUCN, 2001)

IUCN Red List Categories and Criteria (IUCN, 2001)



- Five criteria (A, B, C, D, E)
- Population size (C, D)
- Distribution (B)
- Rate of decline, demography (A, C)
- Viability (D, E)

SCIENTIFIC REPORTS

OPEN Threshold of long-term survival of a coastal delphinid in anthropogenically degraded environment: Indo-Pacific humpback dolphins in Pearl River Delta

Received: 23 June 2021
Accepted: 17 January 2022
Published: 24 February 2022

Leiwei Kang¹, Shiang Li¹, Huang B. Stephen C.Y. Chan¹
Defining demographic and ecological threshold of population persistence can assist in informing conservation management. We conducted such analyses for the Indo-Pacific humpback dolphin (Coryphaena hippurus) in the Pearl River Delta (PRD) region, southeast China. We use adult survival estimates to assess the population status and survival state of change. Our analyses indicate that, given a stationary population structure and constant vital rates, 2000 individuals (minimum viable population) in steady state, MPM, can maintain the population persistence over 40 generations. However, under the current population trend (LJPM demographic), the population is fast approaching a viability threshold and may soon face the effects of demographic stochasticity. The population demographic trajectory and the minimum area of critical habitat (MACH) that could prevent stochastic extinction are both highly sensitive to fluctuations and crucial for a targeted stationary population. MACH should approximate 8000 km². However, the estimate increases four fold with a 10% increase of adult mortality and exceeds the size of PRD area allocated for the conservation status. On the other hand, conserving all current MPMs within PRD fails to secure the minimum habitat requirements for a stationary population. Our findings indicate that the PRD population is deemed to become extinct unless effective conservation measures can rapidly reverse the current population trend.

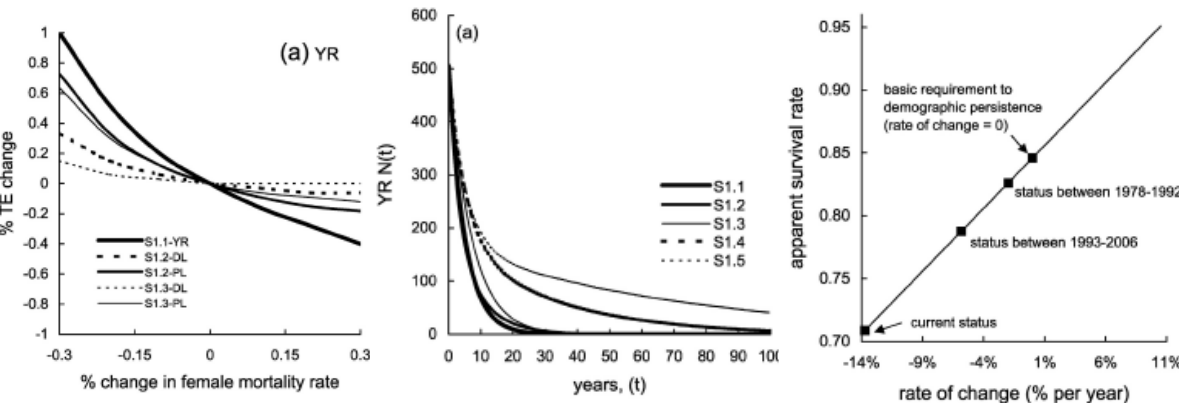
In conservation status, a thorough status assessment of a population should ideally consider all life cycle vital rates, including the rate of change in vital rates. Individuals are highly mobile, and their vital rates are subject to variation over time and space. However, such a thorough assessment is often infeasible due to the difficulty of tracking all individuals. The Chao's Estimator (CE) is a particularly useful tool for estimating population size and population viability analysis (PVA) are used to assess the viability of the population. However, the current population viability analysis (PVA) are based on stationary vital rates and stationary population structure, which may not be realistic. In this study, we use the life table method to investigate the population viability analysis (PVA) under non-stationary vital rates and stationary population structure. Such a life table method may have more implications for the survival of species and populations.

Under Criterion A of the IUCN Red List Categories and Criteria Version 3.1, the population status, under the current population trend (LJPM demographic) is deemed to be "Critically Endangered" and "Extinct in the Wild" unless the three generations adult survival rates, along with the density and fecundity, are improved to a level that allows a stationary population to persist over a long time period.

The Pearl River Institute of Marine Science and School of Biological Science, Faculty of Science, The University of Hong Kong, Sha Tin, Hong Kong. Correspondence and requests for materials should be addressed to L.K. (email: leiwk@hkust.edu.hk)

Viability (Criteria D, E)

- A measure of risk to location extinction,
- probability of extinction (PE)
- **PE = f(population size, survival rate, reproductive rate, threats-strength and frequency)**
- Population viability analysis (PVA)



Conservation Biology

Journal of Conservation Biology

Saving the Yangtze finless porpoise: Time is rapidly running out
 Shuang-Qin Huang¹, Zhigang Mei¹, Yigang Han, Jin-wang Zhang, Xianrong Wang, Ding Wang^{*}
¹Key Laboratory of Conservation and Utilization of Biological Resources, Institute of Zoology, Chinese Academy of Sciences, Beijing 100080, China

ARTICLE INFO ABSTRACT

Introduction
 The Yangtze finless porpoise (*Neomeris phocaenoides*) is a critically endangered species. It is the only member of the genus *Neomeris* in the world. The population has declined rapidly since the 1950s, and is now estimated to be around 100 individuals. The population is fragmented and isolated, and the genetic diversity is low. The population viability analysis (PVA) is a useful tool to assess the extinction risk of a species. In this study, we conducted a PVA for the Yangtze finless porpoise. We used a stochastic matrix model to estimate the population growth rate and the probability of extinction. We found that the population is at a high risk of extinction, and the time to extinction is estimated to be around 100 years. We also found that the population is highly sensitive to changes in survival and reproduction. Our results suggest that urgent conservation actions are needed to prevent the extinction of this species.

Keywords: Yangtze finless porpoise, population viability analysis, extinction risk, stochastic matrix model.

Correspondence: Ding Wang, Institute of Zoology, Chinese Academy of Sciences, Beijing 100080, China. Email: wangding@ibp.cas.ac.cn

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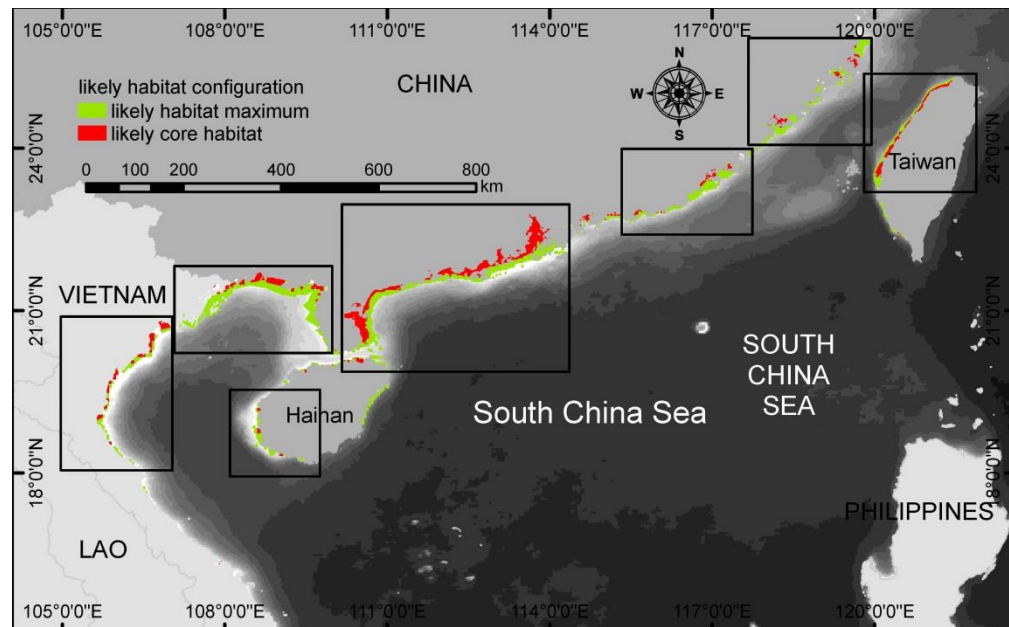
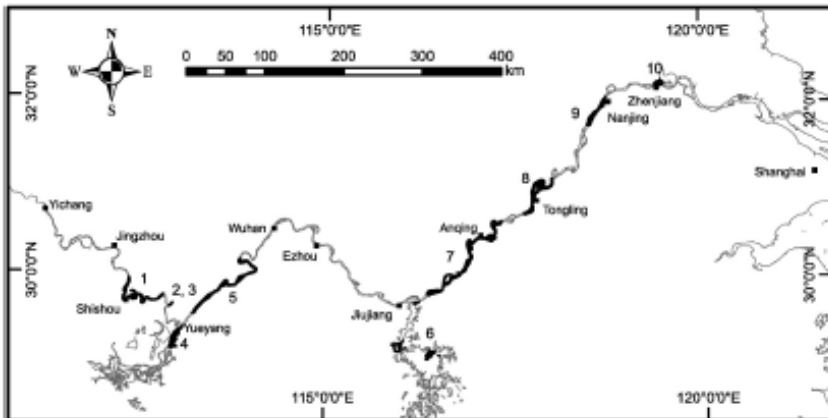
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Population size (Criteria C, D)

- Number of **adults** (adult females)
- Transect, photo-ID (CMR) analyses
- Demographic unit: number, connectivity →
- distribution

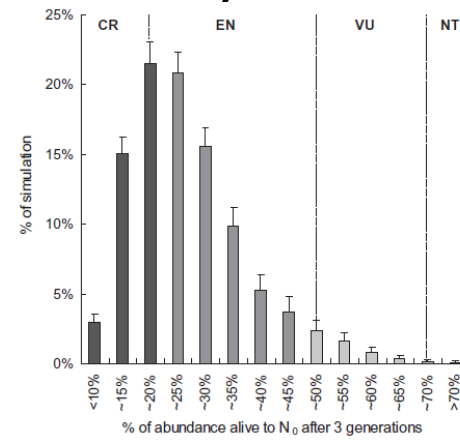
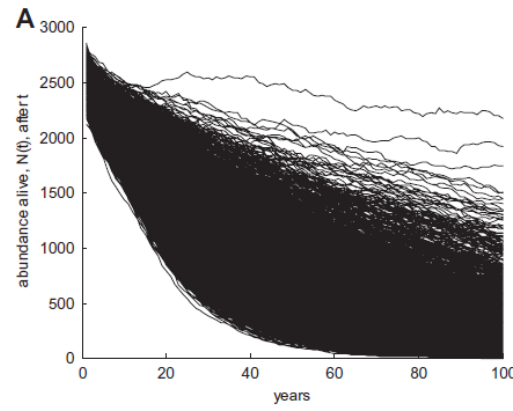
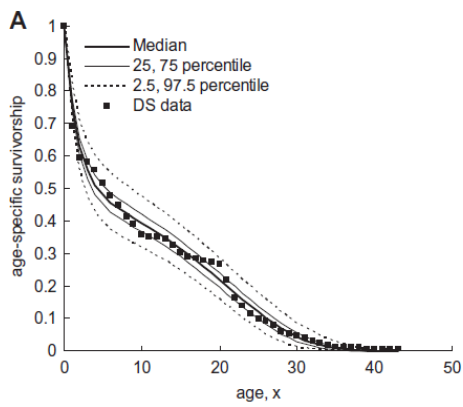
Distribution (Criterion B)

- Extent of occurrence (B1a): measured by MCP (minimum convex polygon)
- Extent of occupancy (B1b): associated with 50% (or 25%) KDE (kernel density estimate)
- Demographic unit



Rate of decline (Criteria A, C)

- **Generation length** (humpback dolphin = 20-22 years): 1, 2, 3 generations, or 100 years
- Change of N , demographic and trend analysis
- f (survival rates, reproductive interval, reproductive span, brood size)



Check for updates at <https://doi.org/10.1016/j.bcon.2019.04.001>

Biological Conservation

Demography and population trends of the largest population of Indo-Pacific humpback dolphins

Shuang Liu Huang^{a,*}, Jiequn Karczmarski^a, Jialin Chen^a, Naikun Zhou^a, Wenzhi Liu^{a,b}, Hailin Zhang^a, Hailin Li^a, Tingting Wang^a

^aSouth China Sea Marine Mammal Research Station, Chinese Academy of Sciences, Xiamen 361021, China; ^bDepartment of Oceanography, Southern University of Science and Technology, Shenzhen 518055, China

ARTICLE INFO

ABSTRACT

Demography and population trends of the largest population of Indo-Pacific humpback dolphins were investigated using a population viability analysis (PVA) to provide baseline metrics for the management of species and populations. Using 1000 simulations, we estimated the extinction risk of the population under different scenarios. The results show that the population is at a high risk of extinction, with a median time to extinction of 100 years. The population is most vulnerable to changes in survival rates, followed by changes in fecundity and then changes in dispersal. The results suggest that the population is at a high risk of extinction, and the results suggest that the population is at a high risk of extinction.

1. Introduction

Demographic parameters, including population size, age structure, sex ratio, and reproductive rates, are key factors in determining the viability of a population. Understanding these parameters is essential for the management of species and populations. In this study, we used a population viability analysis (PVA) to estimate the extinction risk of the population under different scenarios. The results show that the population is at a high risk of extinction, with a median time to extinction of 100 years. The population is most vulnerable to changes in survival rates, followed by changes in fecundity and then changes in dispersal. The results suggest that the population is at a high risk of extinction, and the results suggest that the population is at a high risk of extinction.

IUCN Red List Categories and Criteria (IUCN, 2001)

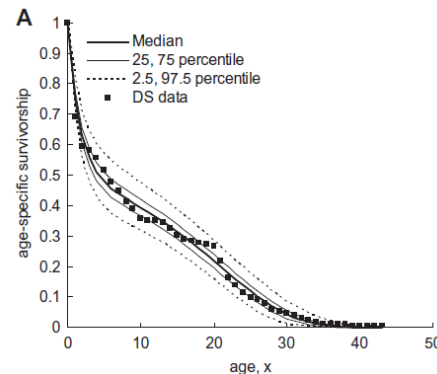
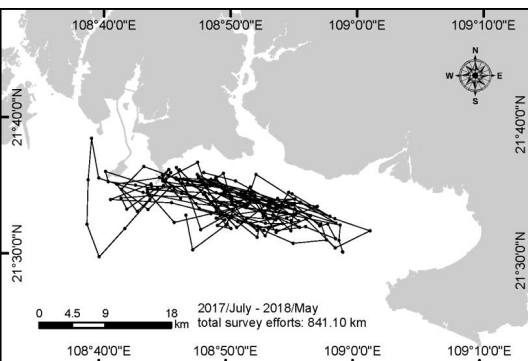


Criteria and baselines

- Population size (C, D)
- Distribution (B)
- Rate of decline (A, C)
- Viability (E)

Baselines and surveys

- Photo-ID \rightarrow N
- Transect \rightarrow MCP, KDE
- Photo-ID, life table \rightarrow s, r
- Demography analysis, PVA \rightarrow PE

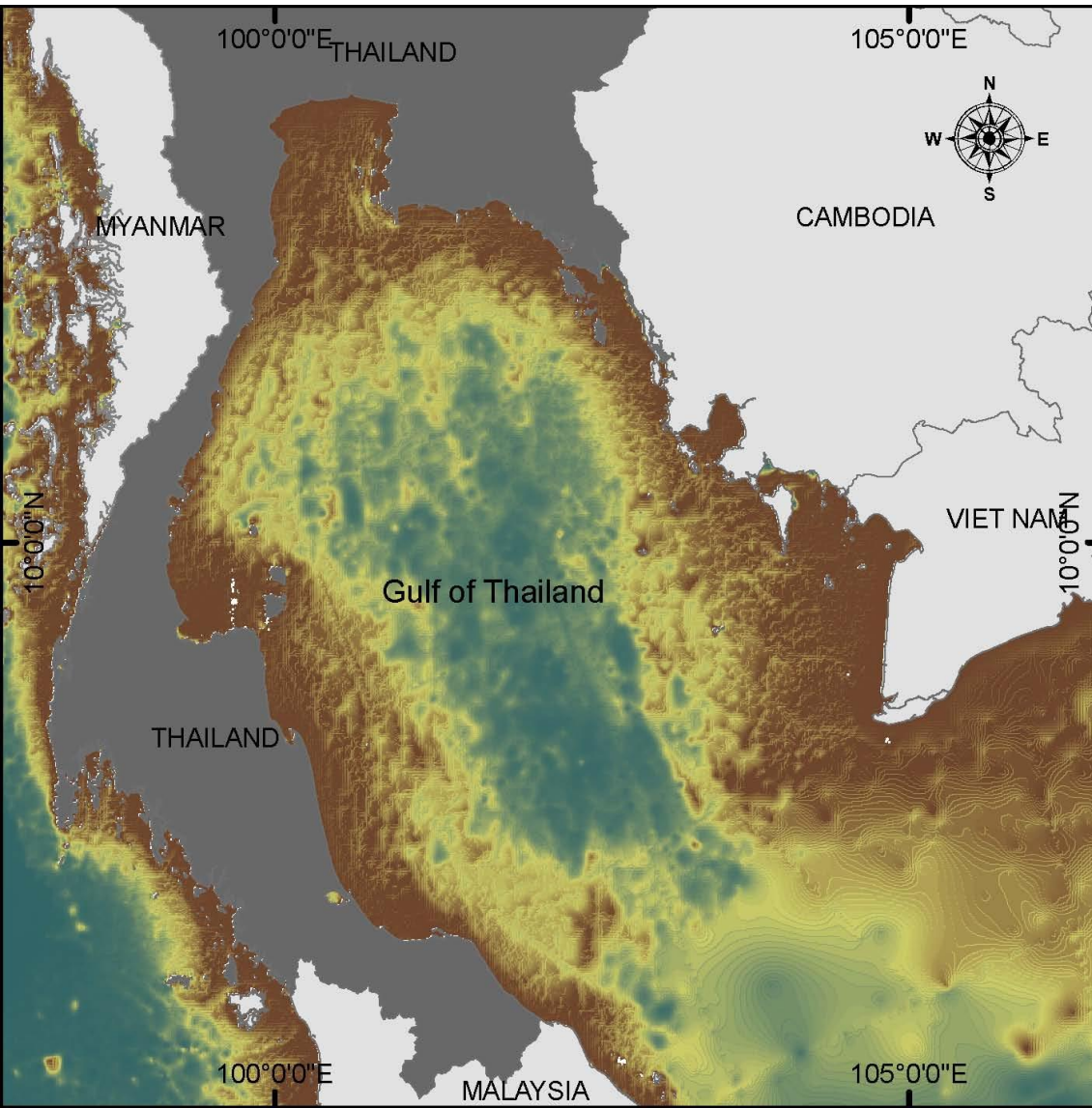


Dr. Haiping Wu, unpublished data

Let's go back to Gulf of
Thailand

**What's the humpback dolphin's
current status?**

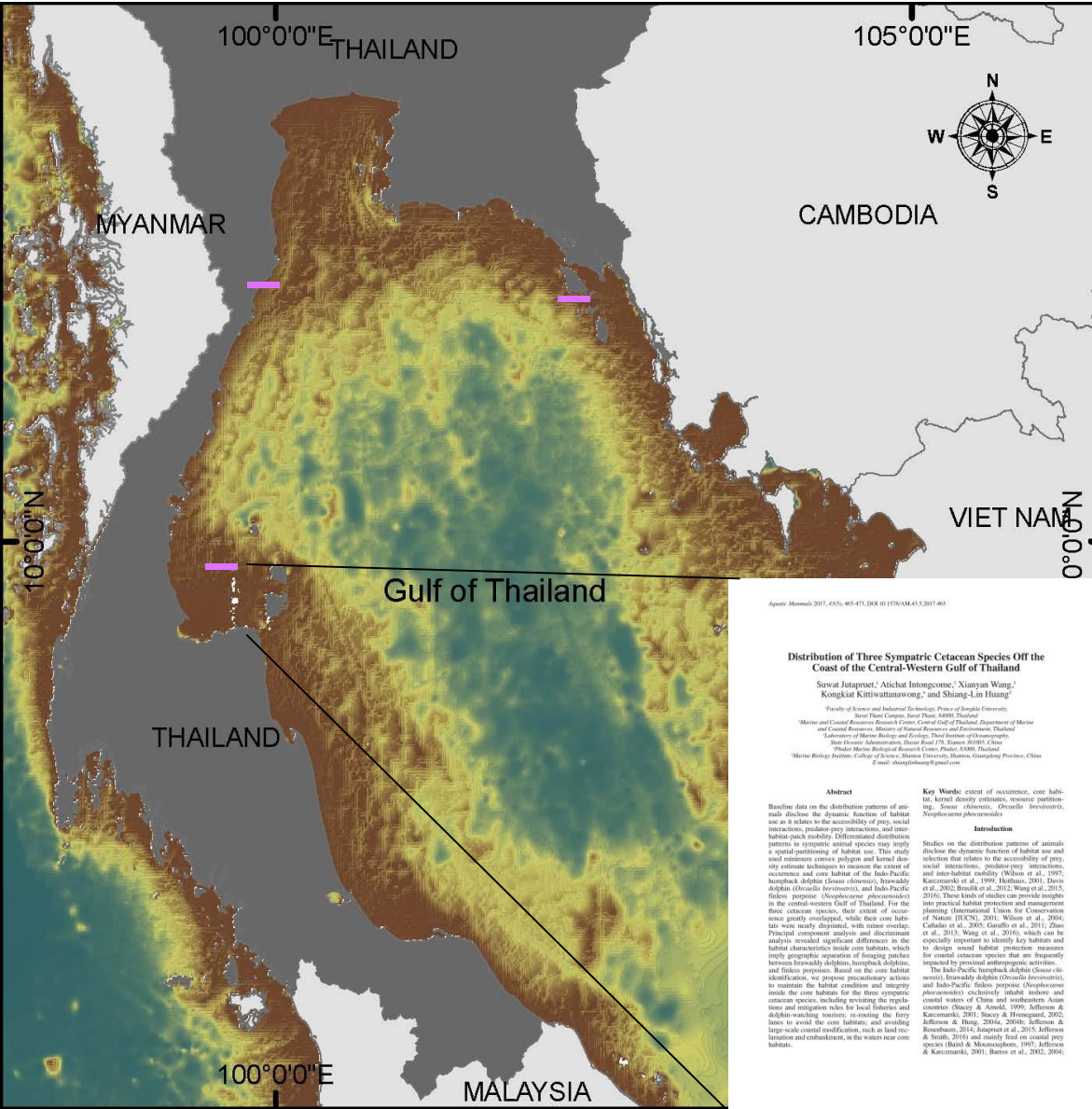
Scale problem



- Spatial: **Gulf of Thailand**
- **Demographical: ??**
(connectivity, occurrence sites)
- → **great information gaps in population structure (connectivity) and occurrence sites**

Humpback dolphin status in Thailand

— Distribution



- Criterion B1a
- MCP, KDE: Surat Thani (Jutapruet et al. 2017)
- Others: no data
- → **DD** (Data Deficient)
- → information gaps: **likely distribution ranges, regional MCP and KDE**

Aquatic Mammals 2017, 43(5), 465-473, DOI 10.1578/MAM.43.5.2017.465

Distribution of Three Sympatric Cetacean Species Off the Coast of the Central-Western Gulf of Thailand

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²Marine and Coastal Sciences Research Center, Central Staff of Education, Department of Marine and Coastal Resources, Ministry of Natural Resources and Environmental Conservation, Thailand
³Laboratory of Marine Biology and Ecology, Thai Institute of Oceanography, State Oceanic Administration, Dalian Road 179, Xianyan 311005, China
⁴State Marine Biological Research Center, Pacific Ocean Institute, Marine Biology Institute, College of Science, Shantou University, Shantou, Guangdong Province, China
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Abstract

Baseline data on the distribution patterns of animals disclose the dynamic function of habitat use as a relation to the accessibility of prey, social interactions, predator-prey interactions, and inter-habitat reach mobility. Differentiated distribution patterns in sympatric animal species may imply a spatial partitioning of habitat use. This study and minimum convex polygon and kernel density estimate techniques to measure the extent of occurrence and core habitat of the Indo-Pacific humpback dolphin (*Grampus griseus*), Irrawaddy dolphin (*Orcaella brevirostris*), and Indo-Pacific finless porpoise (*Neophocaena phocaenoides*) in the central-western Gulf of Thailand. For the three cetacean species, their extent of occurrence greatly overlapped, while their core habitats were nearly disjointed, with minor overlap. Principal component analysis and discriminant analysis revealed significant differences in the habitat characteristics inside core habitats, which imply geographic separation of foraging patches between Irrawaddy dolphins, humpback dolphins, and finless porpoises. Based on the core habitat identification, we propose precautionary actions to maintain the habitat conditions and integrity inside the core habitats for the three sympatric cetacean species, including revising the regulations and mitigation rules for local fisheries and dolphin-watching tourism, re-routing the ferry lanes to avoid the core habitats, and avoiding large-scale coastal modification, such as land reclamation and embankment, in the waters near core habitats.

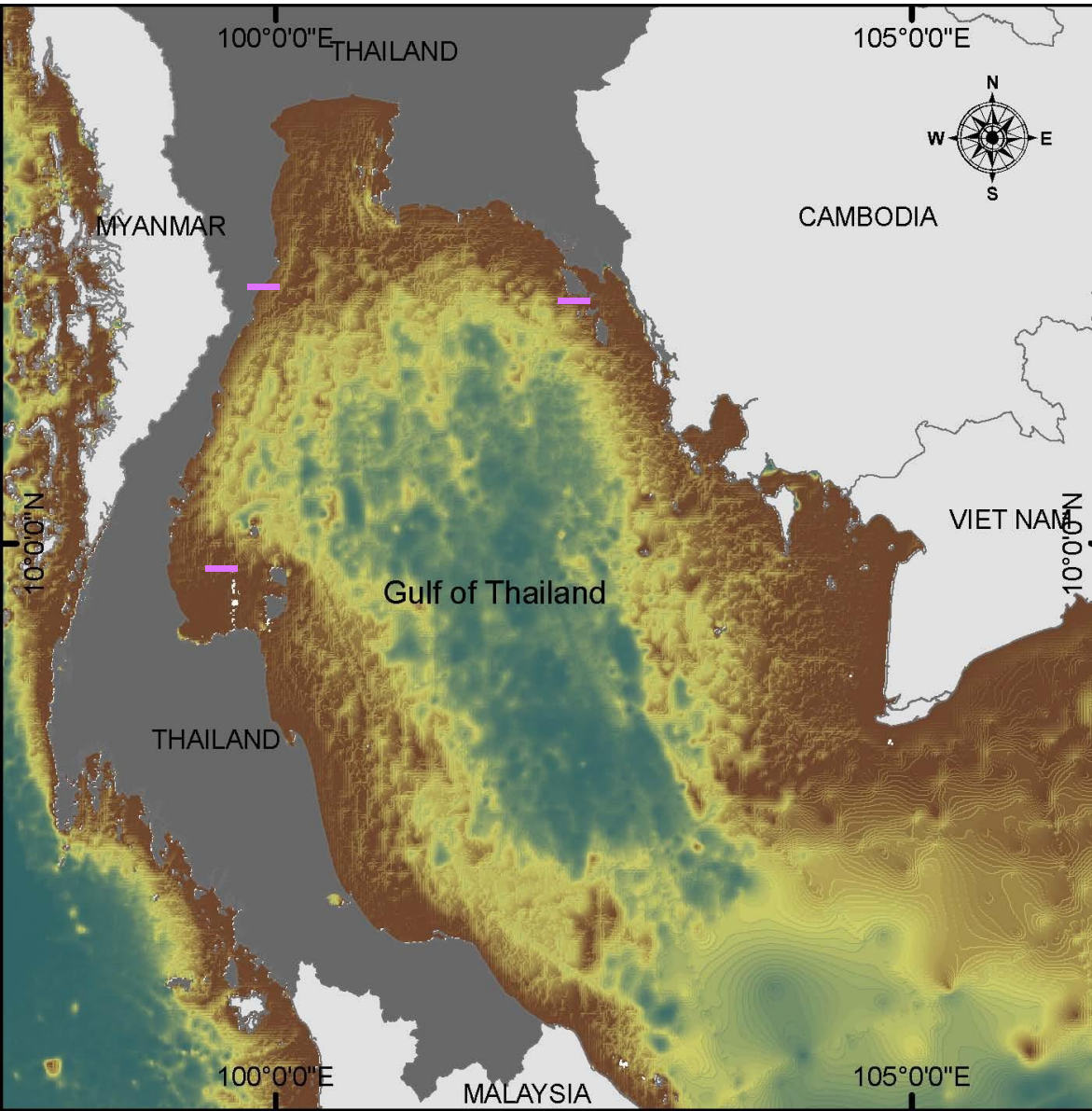
Key Words: extent of occurrence, core habitat, kernel density estimates, resource partitioning, *Grampus griseus*, *Orcaella brevirostris*, *Neophocaena phocaenoides*

Introduction

Studies on the distribution patterns of animals disclose the dynamic function of habitat use and selection that relates to the accessibility of prey, social interactions, predator-prey interactions, and inter-habitat mobility (Wilson et al. 1997; Karczmarski et al. 1999; Heithaus, 2001; Davila et al. 2002; Brandt et al. 2012; Wang et al. 2015, 2016). These kinds of studies can provide insights into practical habitat protection and management planning. International Union for Conservation of Nature (IUCN), 2001; Wilson et al., 2004; Cahalot et al., 2005; Gendron et al., 2011; Zhao et al., 2013; Wang et al., 2016), which can be especially important to identify key habitats and to design sound habitat protection measures for coastal cetacean species that are frequently impacted by proximal anthropogenic activities. The Indo-Pacific humpback dolphins (*Grampus griseus*), Irrawaddy dolphins (*Orcaella brevirostris*), and Indo-Pacific finless porpoises (*Neophocaena phocaenoides*) exclusively inhabit inshore and coastal waters of China and southeastern Asian countries (Stacey & Amiel, 1996; Jefferson & Karczmarski, 2001; Stacey & Hovgaard, 2002; Jefferson & Hung, 2004a, 2004b; Jefferson & Rosenbaum, 2010; Inoué et al., 2015; Jefferson & Smith, 2016) and mainly feed on coastal prey species (Band & Mousongkorn, 1997; Jefferson & Karczmarski, 2001; Barros et al., 2002, 2004;

Humpback dolphin status in Thailand

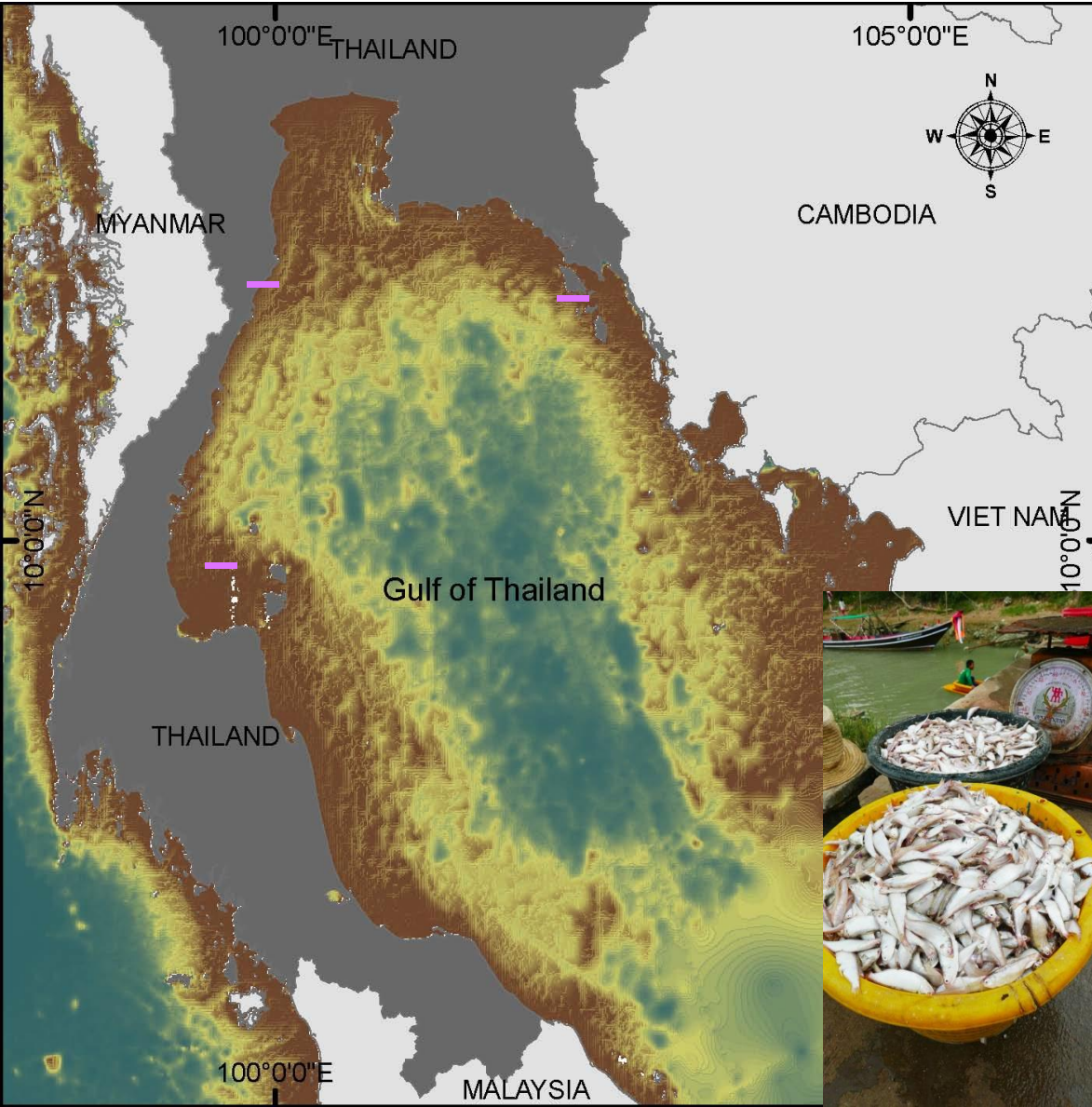
— rate of decline, viability



- Criterion A, C, E
- Baselines: survival rates, reproductive rates, population demography
- NO DATA
- → **DD** (Data Deficient)
- → information gaps: **survival rate, reproductive rate, life history estimates**

Humpback dolphin status in Thailand

— Likely Threats



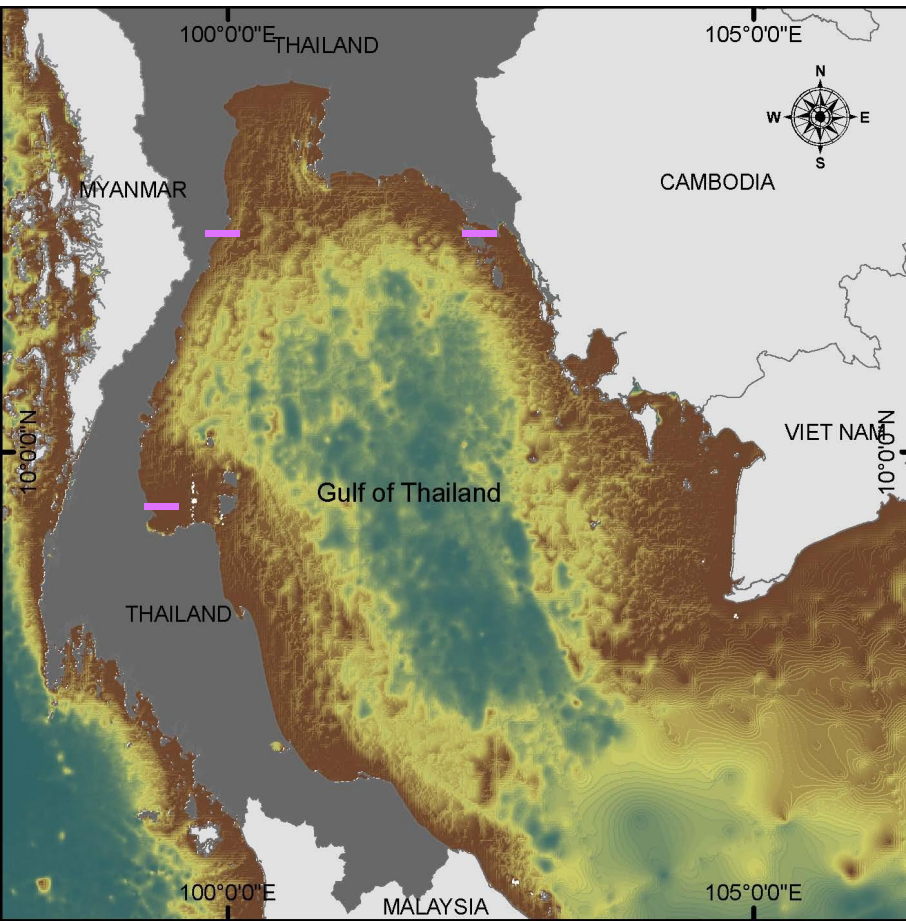
- Fishery (bycatch, prey depletion)??
- Pollution??
- **Dolphin watching??**
- **Coastal alteration: likely insignificant**
- **→ great information gaps → DD**



Humpback dolphin status in Thailand

— Summary

- Status: DD (Data Deficient) over Criteria A-E
- information gaps in
 1. likely distribution ranges
 2. population structure and connectivity
 3. regional abundance estimates
 4. regional MCP/KDE
 5. threats identification

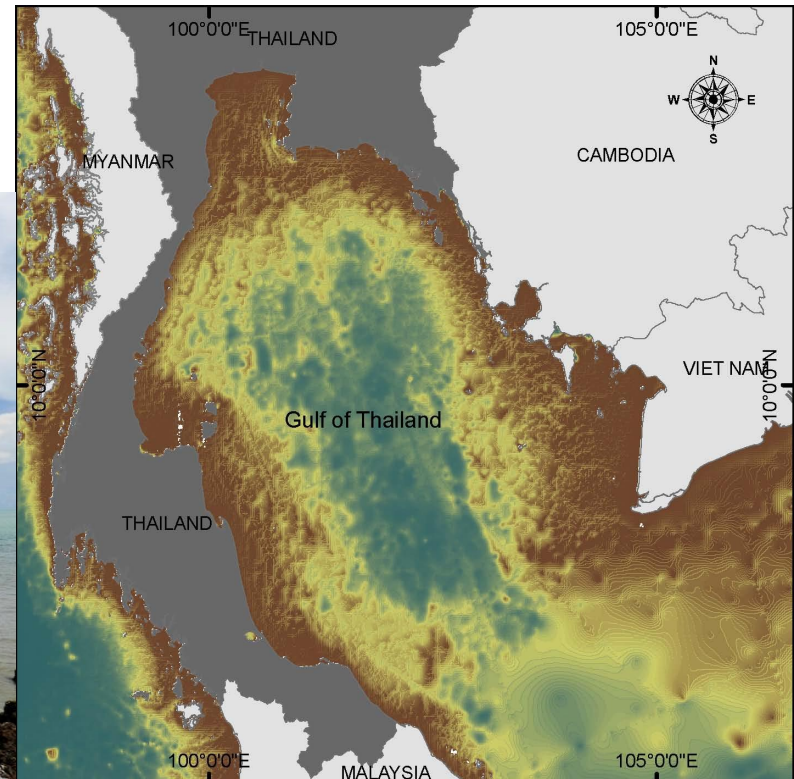


What should we do to bridge information gaps?

Researches enriching baselines

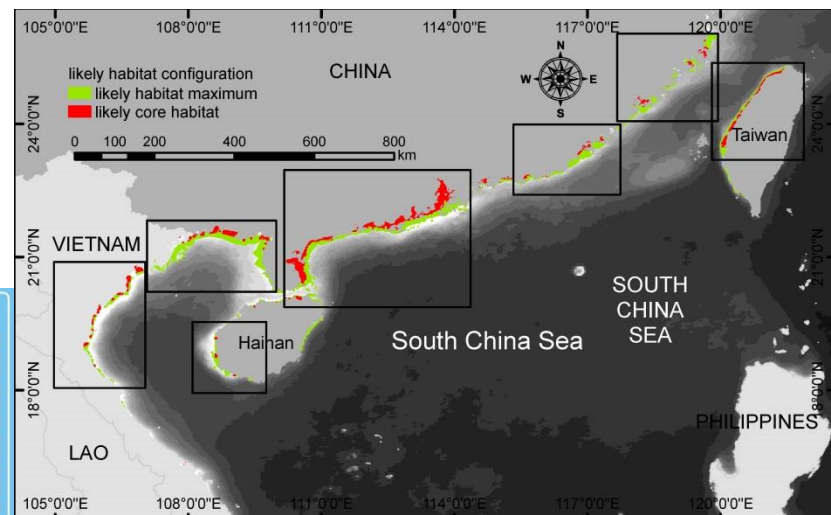
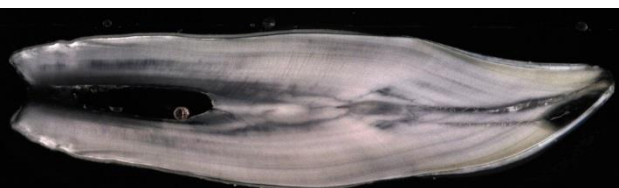
Information gaps

- likely distribution ranges
- population structure and connectivity
- regional abundance estimates
- regional MCP/KDE
- threats identification



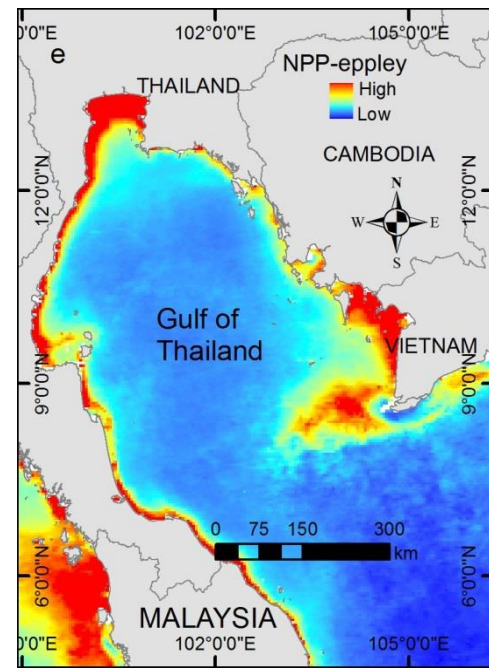
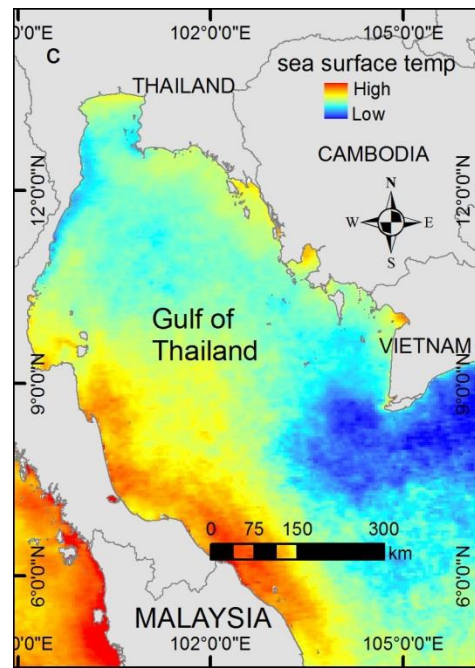
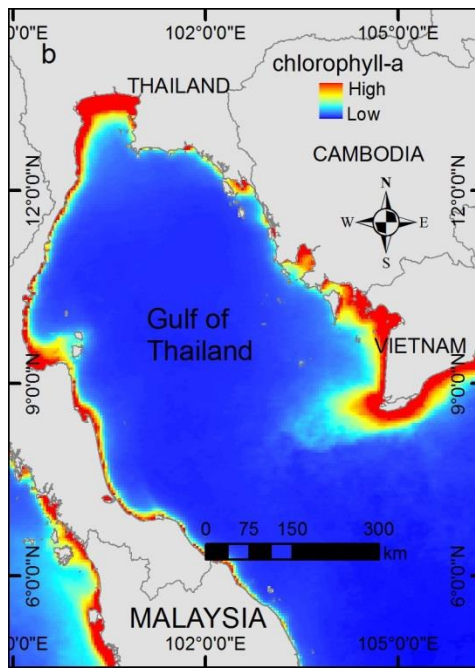
Researches needed

- **SDM** → extrapolate likely habitats (e.g. Huang et al., 2018) (ongoing now)
- **Stranded carcasses collection** → age, reproductive status → life history, demography (e.g. Huang et al., 2012); DNA specimen → population structure
- **Transect + photo-ID surveys**: estimating N (e.g. Jutapruet et al., 2015), mapping MCP, KDE (Jutapruet et al., 2017); verifying SDM predictions
- **Fishery statistics: monitoring bycatch**



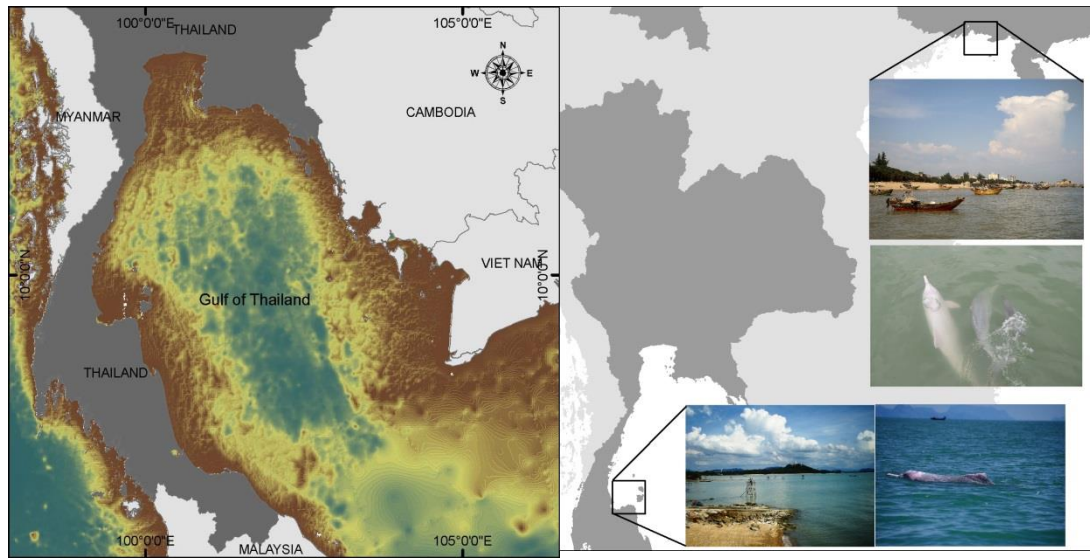
New techniques

- Satellite remote sensing: coastline, ocean color
- Drones: real-time (or quasi-real-time) large scale monitoring, number counting



International collaborations

- Population baselines across national boundaries (connectivity, distribution, abundance)
- Protection measures: protected area networks, stakeholder participations



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