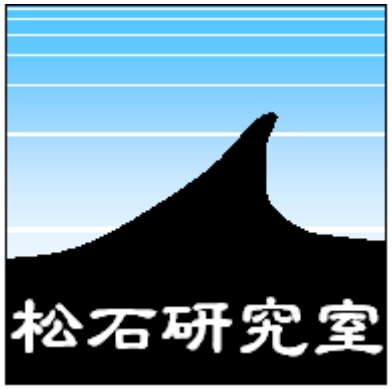


松石研究室

研究のコンセプト

美味い刺身が喰いたい

- 乱獲防止の科学　水産資源学
- いつまでも，美味い刺身を食べ続けたい。
- そのためには，水産資源(さかな)を絶やさないように，上手に利用し続ける。
- 松石研究室では，乱獲防止の研究をする「水産資源学」を研究。

数える

- さかなの数を知ることが乱獲防止の第一歩。
- 漁業統計から，資源量を推定する方法を研究。
- コホート解析：魚の年齢を一尾ずつ調べる「国勢調査」を行い，今後の数の変化を予測
- 体長や体重を用いて，もっと簡単にさかなの数を調べる方法も開発
- 鯨類を含め，様々なさかなの資源量を推定

調べる

- さかなにはいろいろな種類があり，特徴も様々
- 親が多ければ子が多くなるとは限らない。
- 親の量と子供の生残の関係（再生産関係）を調べ，適切な間引きを行う
- さかなの年齢や成長を調べることも資源の特徴を知るために重要。
- 漁獲に影響を与える鯨類や，一緒に漁獲される混獲に関する研究も。

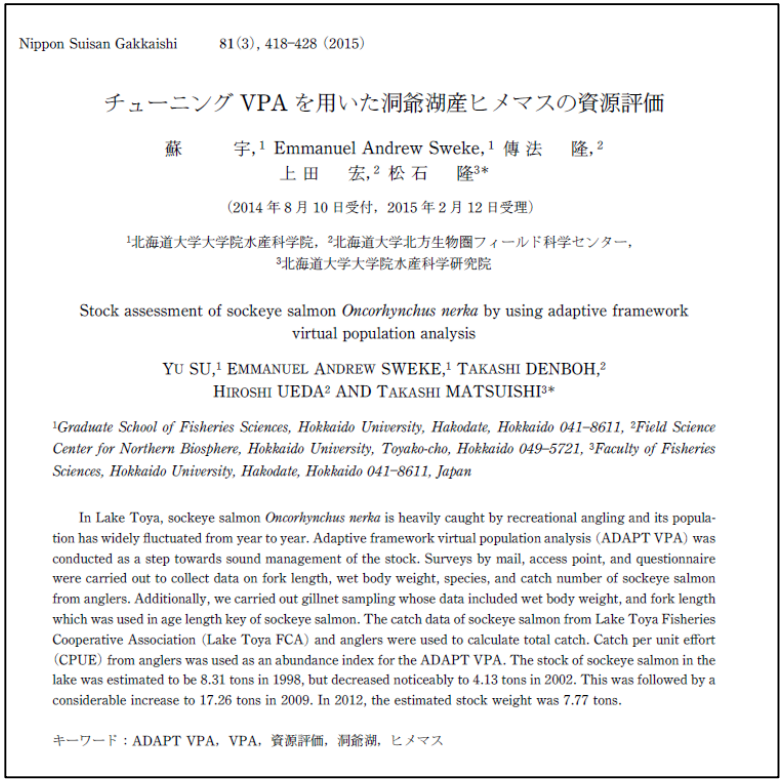
獲る

- 禁漁しては，美味しい刺身を食べられない。
- なるべく禁漁をせず，獲り続けながら資源を守る方法を検討。
- どのようなさかなの獲り方をしたら，将来に乱獲が起こりにくいのかを予測することが必要。
- さかなの増減は，環境によっても左右され，正確な予測は難しい。
- コンピュータ上でさまざまな環境が起こる場合を想定して計算し，資源管理を行い漁獲方法や漁獲量を変えた場合に乱獲が起こる確率を計算。
- 研究成果は，資源管理の現場に生かされています。

現在行っている研究

- 我が国周辺主要資源の資源管理方策に関する研究
- 内水面遊漁に関する研究
- イルカ類の混獲防止および環境認知に関する研究
- 漂着鯨類に関する研究
- 東南アジアにおける資源管理
- 学生提案研究テーマ

湖沼の遊漁管理



Nippon Suisan Gakkaishi　81(3), 418–428 (2015)

チューニング VPA を用いた洞爺湖産ヒメマスの資源評価

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上 田　宏,[2] 松 石　隆[3]*

(2014 年 8 月 10 日受付，2015 年 2 月 12 日受理)

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Stock assessment of sockeye salmon *Oncorhynchus nerka* by using adaptive framework virtual population analysis

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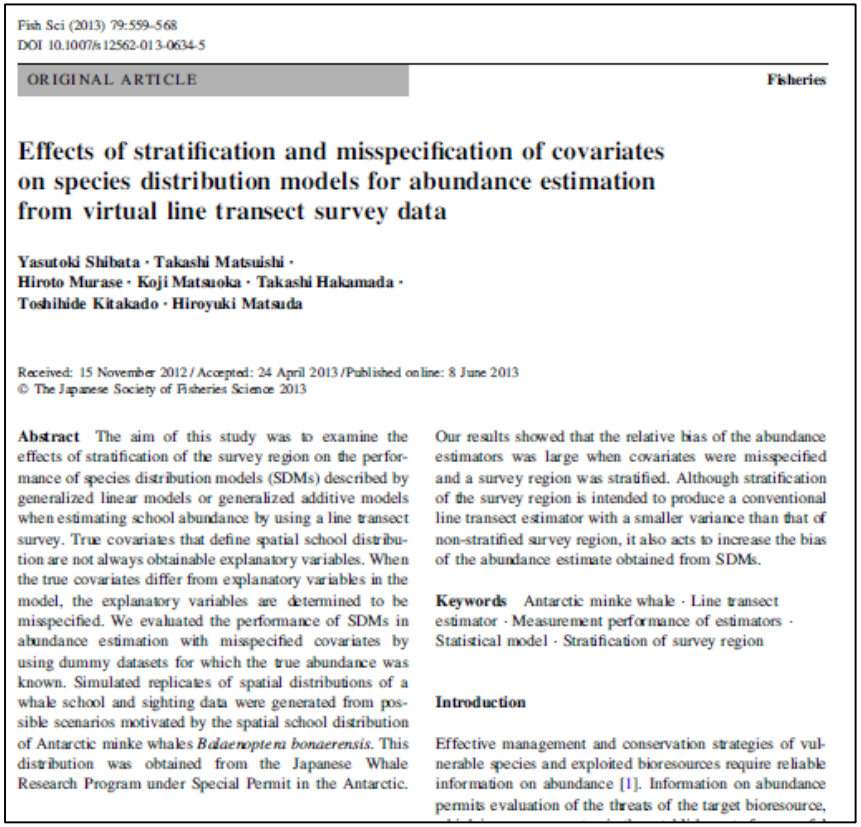
In Lake Toya, sockeye salmon *Oncorhynchus nerka* is heavily caught by recreational angling and its population has widely fluctuated from year to year. Adaptive framework virtual population analysis (ADAPT VPA) was conducted as a step towards sound management of the stock. Surveys by mail, access point, and questionnaire were carried out to collect data on fork length, wet body weight, species, and catch number of sockeye salmon from anglers. Additionally, we carried out gillnet sampling whose data included wet body weight, and fork length which was used in age length key of sockeye salmon. The catch data of sockeye salmon from Lake Toya Fisheries Cooperative Association (Lake Toya FCA) and anglers were used to calculate total catch. Catch per unit effort (CPUE) from anglers was used as an abundance index for the ADAPT VPA. The stock of sockeye salmon in the lake was estimated to be 8.31 tons in 1998, but decreased noticeably to 4.13 tons in 2002. This was followed by a considerable increase to 17.26 tons in 2009. In 2012, the estimated stock weight was 7.77 tons.

キーワード：ADAPT VPA，VPA，資源評価，洞爺湖，ヒメマス

- VPAを用いて洞爺湖のヒメマスの資源評価を実施
- 遊漁の影響を推定
- 遊漁者への聞き取り調査などによって、データを自ら入手
- 洞爺湖の漁業管理・遊漁管理に貢献
- 最新の資源量推定法を湖沼に適用

洞爺湖釣獲量調査

鯨類の資源量推定法の改善



Fish Sci (2013) 79:559–568
DOI 10.1007/s12562-013-0634-5

ORIGINAL ARTICLE

Fisheries

Effects of stratification and misspecification of covariates on species distribution models for abundance estimation from virtual line transect survey data

Yasutoki Shibata · Takashi Matsuishi · Hiroto Murase · Koji Matsuoka · Takashi Hakamada · Toshihide Kitakado · Hiroyuki Matsuda

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Abstract The aim of this study was to examine the effects of stratification of the survey region on the performance of species distribution models (SDMs) described by generalized linear models or generalized additive models when estimating school abundance by using a line transect survey. True covariates that define spatial school distribution are not always obtainable explanatory variables. When the true covariates differ from explanatory variables in the model, the explanatory variables are determined to be misspecified. We evaluated the performance of SDMs in abundance estimation with misspecified covariates by using dummy datasets for which the true abundance was known. Simulated replicates of spatial distributions of a whale school and sighting data were generated from possible scenarios motivated by the spatial school distribution of Antarctic minke whales *Balaenoptera bonaerensis*. This distribution was obtained from the Japanese Whale Research Program under Special Permit in the Antarctic. Our results showed that the relative bias of the abundance estimators was large when covariates were misspecified and a survey region was stratified. Although stratification of the survey region is intended to produce a conventional line transect estimator with a smaller variance than that of non-stratified survey region, it also acts to increase the bias of the abundance estimate obtained from SDMs.

Keywords Antarctic minke whale · Line transect estimator · Measurement performance of estimators · Statistical model · Stratification of survey region

Introduction

Effective management and conservation strategies of vulnerable species and exploited bioresources require reliable information on abundance [1]. Information on abundance permits evaluation of the threats of the target bioresource,

- ラインとランセクト法における天候等の効果を考慮した資源量推定法の改善
- 数理展開とシミュレーションによる妥当性の検討
- 日本水産学会論文賞受賞

ネズミイルカ混獲調査

鯨類研究会と共同調査

ネズミイルカのエコロケーション

Tissue physical property of the harbor porpoise *Phocoena phocoena* for investigation of the sound emission process

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The process by which sound is propagated in the head of a toothed whale is still a subject of discussion. Investigating the distribution of acoustic impedance calculated by density and Young's modulus is effective for quantitative comprehension because acoustic impedance determines the reflection coefficient of a sound wave. However, the sound propagation process of the toothed whale has been mainly examined by either anatomical techniques or the measurement of density or sound velocity. In the current study, the acoustic impedance of head tissue of harbor porpoise was measured. Results of this study should be a helpful information for further discussion about the relationship between the structure of sound-producing organ and clicks property.

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[WWA] Pages: 1451–1456

I. INTRODUCTION

The harbor porpoise (*Phocoena phocoena*) is a kind of small toothed whale widely distributed in the northern hemisphere (Read *et al.*, 1997). As with other toothed whales, the harbor porpoise recognizes surrounding environment using the echo of high frequency ultrasonic pulses called clicks. The production and propagation process of clicks in the forehead is highly complicated, involving various types of organs and tissues (McKenna *et al.*, 2012).

Elucidation of the sound propagation process of the toothed whale could contribute to the improvement of an acoustic detecting device, for example, a fish-finder. The principle of how dolphins search for prey using clicks with perfect control had been focused on to improve the fish-finder. The improvement of a fish-finder that uses ultrasonic waves resembling dolphin clicks has been promoted to obtain more detailed information about fish, for example, fish species and size (Akamatsu *et al.*, 2012; Imaizumi *et al.*, 2008). Clarification of the clicks emission mechanism should give helpful information for the development of a "dolphin sonar" from a biomimetic standpoint.

It has been confirmed that clicks are produced at the phonic lips, which consist of two pairs of balsae (Cranford *et al.*, 1996; Aroyan *et al.*, 1992) and are propagated to the melon. The clicks' beam is progressively focused by the melon, air sacs, skull, and collagenous connective tissues located in the forehead region (Cranford *et al.*, 1996; Huggenberger *et al.*, 2009) until they are finally emitted into the seawater. Matching of the acoustic impedance to coordinate the soft tissues must be important for efficient sound emission into the seawater, and mechanisms for this have been suggested (Norris and Harvey, 1974). A considerable amount of research as mentioned above has attempted to elucidate the clicks' emission process of toothed whales; however, quantitative information about soft tissue in the head is much less than anatomical information. Because of the lack of a quantitative understanding, the process by which sound is propagated in the head of the toothed whale remains the subject of debate. For one of the few studies providing a quantitative understanding, Soldevilla *et al.* (2005) measured sound velocity using sliced head tissue from a neonatal Cuvier's beaked whale (*Ziphius cavirostris*). This pioneering study focused on the differences in the physical properties of the head tissue of the Cuvier's beaked whale and tried to measure the elasticity of the soft tissue.

Thus, it is necessary to understand how the acoustic impedance is distributed and matched among the soft tissues in order to reveal how sound is propagated in the head of the harbor porpoise. To our knowledge, no conventional studies have directly measured the acoustic impedance in the head of toothed whales.

In the current study, we developed a procedure to measure the acoustic impedance of the soft tissues of the head, determined the distribution of acoustic impedance in the head, and investigated quantitative information about the

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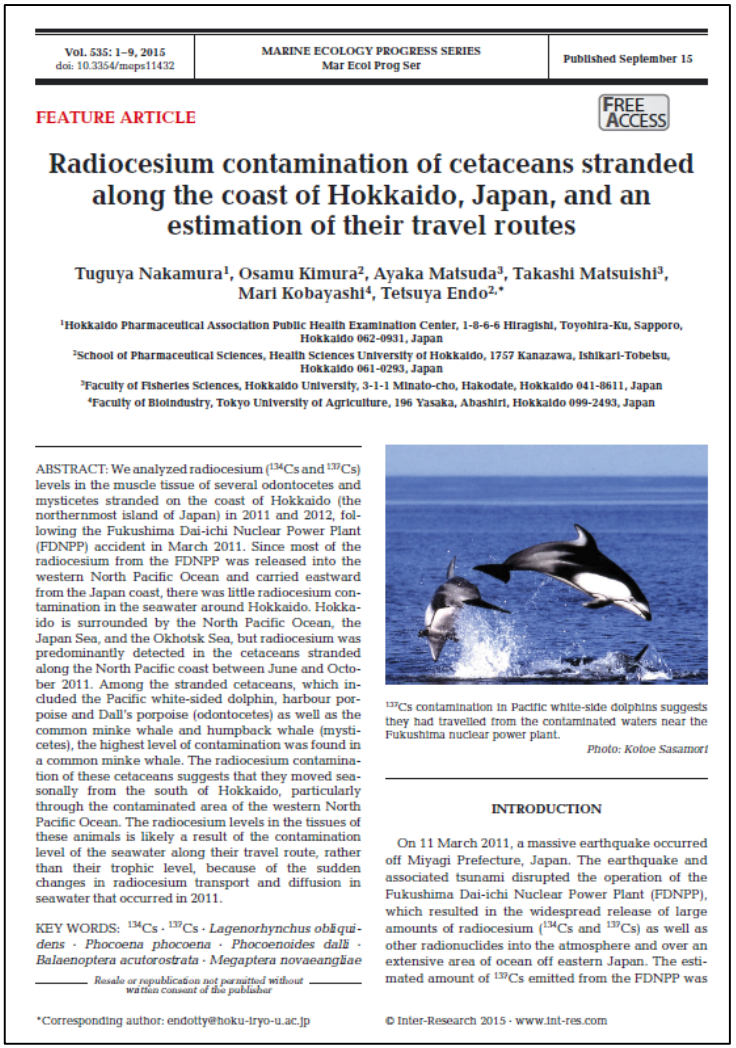
- ネズミイルカ頭部組織の物性を測定し、エコロケーション音の発出機構を明らかにした。
- 音響学、鯨類学のコラボレーション
- 国際一流誌JASAに掲載

座礁鯨類調査

漂着鯨類の放射性セシウム汚染



Vol. 535: 1–9, 2015
doi: 10.3354/meps11432

MARINE ECOLOGY PROGRESS SERIES
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Published September 15

FEATURE ARTICLE

FREE ACCESS

Radiocesium contamination of cetaceans stranded along the coast of Hokkaido, Japan, and an estimation of their travel routes

Tuguya Nakamura[1], Osamu Kimura[2], Ayaka Matsuda[3], Takashi Matsuishi[3], Mari Kobayashi[4], Tetsuya Endo[2,*]

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ABSTRACT: We analyzed radiocesium (^{134}Cs and ^{137}Cs) levels in the muscle tissue of several odontocetes and mysticetes stranded on the coast of Hokkaido (the northernmost island of Japan) in 2011 and 2012, following the Fukushima Dai-ichi Nuclear Power Plant (FDNPP) accident in March 2011. Since most of the radiocesium from the FDNPP was released into the western North Pacific Ocean and carried eastward from the Japan coast, there was little radiocesium contamination in the seawater around Hokkaido. Hokkaido is surrounded by the North Pacific Ocean, the Japan Sea, and the Okhotsk Sea, but radiocesium was predominantly detected in the cetaceans stranded along the North Pacific coast between June and October 2011. Among the stranded cetaceans, which included the Pacific white-sided dolphin, harbour porpoise and Dall's porpoise (odontocetes) as well as the common minke whale and humpback whale (mysticetes), the highest level of contamination was found in a common minke whale. The radiocesium contamination of these cetaceans suggests that they moved seasonally from the south of Hokkaido, particularly through the contaminated area of the western North Pacific Ocean. The radiocesium levels in the tissues of these animals is likely a result of the contamination level of the seawater along their travel route, rather than their trophic level, because of the sudden changes in radiocesium transport and diffusion in seawater that occurred in 2011.

KEY WORDS: ^{134}Cs · ^{137}Cs · *Lagenorhynchus obliquidens* · *Phocoena phocoena* · *Phocoenoides dalli* · *Balaenoptera acutorostrata* · *Megaptera novaeangliae*

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^{137}Cs contamination in Pacific white-side dolphins suggests they had travelled from the contaminated waters near the Fukushima nuclear power plant.
Photo: Kotoe Sasamori

INTRODUCTION

On 11 March 2011, a massive earthquake occurred off Miyagi Prefecture, Japan. The earthquake and associated tsunami disrupted the operation of the Fukushima Dai-ichi Nuclear Power Plant (FDNPP), which resulted in the widespread release of large amounts of radiocesium (^{134}Cs and ^{137}Cs) as well as other radionuclides into the atmosphere and over an extensive area of ocean off eastern Japan. The estimated amount of ^{137}Cs emitted from the FDNPP was

- 北海道に漂着した鯨類標本の放射性セシウムを測定
- いくつかの鯨種の回遊経路を証明した
- 国際一流誌MEPSに掲載

2016年度学生とテーマ

- D3 松田：　鯨類食性
- D2 黒田：　イルカ発音機構
- D2 芳山：　然別湖・朱鞠内湖遊漁管理
- D1 Hang(Vietnam) ：　Shrimp Aquaculture
- D1 Ledhyane(Indonesia)：　Fishery Management in Malaysia
- D1 Dong(Vietnam)：　Shrimp Traceability
- M2 呉(中国)：　複数種資源管理シミュレーション
- M1 松井：　ネズミイルカの生活史
- 4年 前田：　ネズミイルカの混獲メカニズム

研究室の選び方

- 一に院生　　お世話になるのは院生
- 二、三がなくて
- 四に先生　　先生の方針・人柄
- 五に内容　　研究内容の詳細は入ってから

- 作業的か創造的か
- ラボかフィールドか
- 最先端か伝統的か

松石研究室の基本理念

- 第１　創造的自由主義
- 第２　ＣＰＵＥの最適化
- 第３　自ら調べ自ら考える
- 第４　ジェネラリスト養成

研究室訪問

- 志望する方は（第三希望でも），必ず松石と面談をしてください。（アポ必須）
- 院生の話も，是非聞いてください。
- 鯨類に関する卒論は，鯨類研究会メンバー限定です。
  資源学に関する卒論は，限定はありません。