

Estimation of fork length using cranial measurements of sablefish (*Anoplopoma fimbria*).

Kathryn x. Temple, Lisa C. Lacko and Brendan M. Conners

Pacific Biological Station
Fisheries and Oceans Canada, 3190 Hammond Bay Road
Nanaimo, British Columbia, V9T 6N7, Canada

2020

**Canadian Technical Report of
Fisheries and Aquatic Sciences nnn**



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Canada 

Canadian Technical Report of Fisheries and Aquatic Sciences

Technical reports contain scientific and technical information that contributes to existing knowledge but which is not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of Fisheries and Oceans Canada, namely, fisheries and aquatic sciences.

Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in the data base *Aquatic Sciences and Fisheries Abstracts*.

Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Numbers 1–456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457–714 were issued as Department of the Environment, Fisheries and Marine Service, Research and Development Directorate Technical Reports. Numbers 715–924 were issued as Department of Fisheries and Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925.

Rapport technique canadien des sciences halieutiques et aquatiques

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques de Pêches et Océans Canada, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports techniques peuvent être cités comme des publications à part entière. Le titre exact figure au-dessus du résumé de chaque rapport. Les rapports techniques sont résumés dans la base de données *Résumés des sciences aquatiques et halieutiques*.

Les rapports techniques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par les agents commerciaux.

Les numéros 1 à 456 de cette série ont été publiés à titre de Rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de Rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de Rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925.

Canadian Technical Report of
Fisheries and Aquatic Sciences nnn

2020

ESTIMATION OF FORK LENGTH USING CRANIAL MEASUREMENTS OF SABLEFISH
(*ANOPLOPOMA FIMBRIA*).

by

Kathryn x. Temple, Lisa C. Lacko and Brendan M. Conners

Pacific Biological Station
Fisheries and Oceans Canada, 3190 Hammond Bay Road
Nanaimo, British Columbia, V9T 6N7, Canada

© Her Majesty the Queen in Right of Canada, 2020
Cat. No. Fs97-6/nnn E-PDF ISBN ISSN 1488-5379

Correct citation for this publication:

Kathryn x. Temple and Lacko, L.C. and Connors, B.M. 2020. Estimation of fork length using cranial measurements of sablefish (*Anoplopoma fimbria*).. Can. Tech. Rep. Fish. Aquat. Sci. nnn: v + 9 p.

CONTENTS

ABSTRACT	iv
RÉSUMÉ	v
1 Introduction	1
2 Methods	1
2.1 Sample collection and evaluation	1
2.2 Genetic test development	1
2.3 Model evaluation	2
3 Discussion	2
4 Results	3
5 Figures	3
6 Discussion	9
7 Acknowledgments	9

ABSTRACT

Kathryn x. Temple and Lacko, L.C. and Connors, B.M. 2020. Estimation of fork length using cranial measurements of sablefish (*Anoplopoma fimbria*).. Can. Tech. Rep. Fish. Aquat. Sci. nnn: v + 9 p.

This document describes sampling activities and summarizes results

RÉSUMÉ

Kathryn x. Temple and Lacko, L.C. and Connors, B.M. 2020. Estimation of fork length using cranial measurements of sablefish (*Anoplopoma fimbria*).. Can. Tech. Rep. Fish. Aquat. Sci. nnn: v + 9 p.

1 Introduction

Sablefish (*Anoplopoma fimbria*) stock indices are derived from commercial and survey trap catch rates and estimates of trap vulnerable biomass determined from tag-recovery data. The tag and release study has been conducted annually since 1991. Whole tagged fish are recovered mainly in the commercial fishery (trap, trawl, hook and line) and processed at the point of landing through the Dockside Monitoring Program (DMP) currently operated by Archipelago Marine Research (AMR). In order to eliminate whole fish samples, we assessed whether sablefish fork length and weight could be predicted from 6 different head dimension measurements. Simple linear regression models were calculated from 438 sablefish (240-1080 mm) collected on 2 biennial DFO Groundfish Synoptic Bottom Trawl surveys in 2016 and one salmon survey (details).

2 Methods

2.1 Sample collection and evaluation

Measurements of fork length (FL), round weight (RW), upper jaw length (UJ), eye diameter (ED), interorbital distance (ID), snout length (SL), post orbital to preoperculum distance (PP), and post orbital head length (PH) were obtained from 212 sablefish caught during the 2016 West Coast Vancouver Island (WCVI) survey (Williams et al. 2018) and 219 sablefish caught during the 2016 West Coast Haida Gwaii (WCHG) survey (Nottingham et al. 2018) (Figure 1). Seven small sablefish were collected during the 201? (Kathryn) salmon survey. In addition, sagittal otoliths and operculum clips (DNA) were collected. Fish sex and maturity were recorded at sea (Table ??).

The six cranial dimensions were considered as possible candidates for estimating fork length. Post orbital head lengths (PH) were abandoned after 130 fish due to measurement difficulties (Table ??). Each of the 6 head dimensions were measured by Mitutoyo absolute 500-??? (Kathryn) digital calipers and ranked in terms of ease of use and repeatability. (Table ??).

Later, a pilot study was conducted with the commercial sector returning sablefish heads, rather than the entire fish. In 2017, 360 heads were collected from J-cut sablefish on a trip to the Bowie Seamount. Each operculum was marked with either one knife cut (male) or two knife cuts (female) (Figure x) The first 99 heads of the pilot study were measured by 3 technicians for IO, SN, UJ and PP.

2.2 Genetic test development

DNA multiplex polymerase chain reactions (PCRs) were conducted using fluorescently labelled forward primers. X-insert and Y-insert specific primers developed by Rondeau et al. (2013) were used, but the X-insert forward and Y-nested reverse were redesigned to produce slightly smaller PCR products.

2.3 Model evaluation

3 Discussion

Routine biological sampling procedures have been modified so that commercial fisheries are now only returning heads, rather than entire fish

4 Results

The mean values of the predictor and response variables (Table ??).

Given the ease of measurement, we suggest that Interorbital distance be used to predict sablefish fork lengths and weights (Table ??).

We found evidence of relationships between upper jaw length and fork length ($p = 9.358 \times 10^{-278}$) ; eye diameter and fork length ($p = 5.34 \times 10^{-203}$); interorbital distance and fork length ($p = 5.539 \times 10^{-272}$); upper snout length and fork length ($p = 4.593 \times 10^{-292}$); postorbital to preoperculum length and fork length ($p = 2.024 \times 10^{-247}$); and postorbital head length and fork length ($p = 0$).

The estimated slope is 7.695 (SE 0.088) units of fork length per unit of upper jaw length; the estimated slope is 21.994 (SE 0.389) units of fork length per unit of eye diameter; the estimated slope is 11.622 (SE 0.138) units of fork length per unit of interorbital distance; the estimated slope is 11.182 (SE 0.118) units of fork length per unit of snout length; the estimated slope is 14.373 (SE 0.191) units of fork length per unit of postorbital to preoperculum length; and the estimated slope is 6.83 (SE 0.185) units of fork length per unit of postorbital head length.

5 Figures

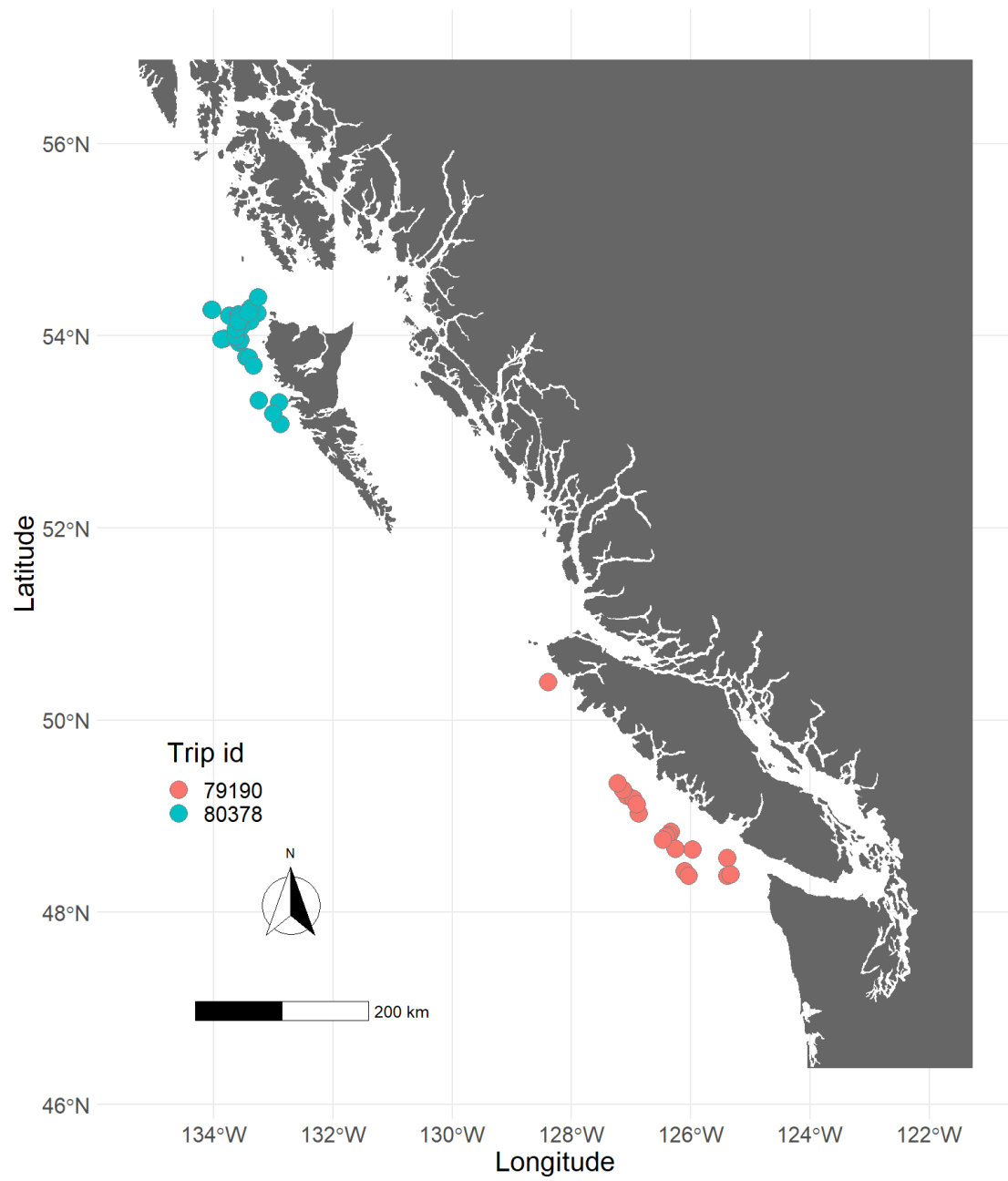


Figure 1. Sample locations.

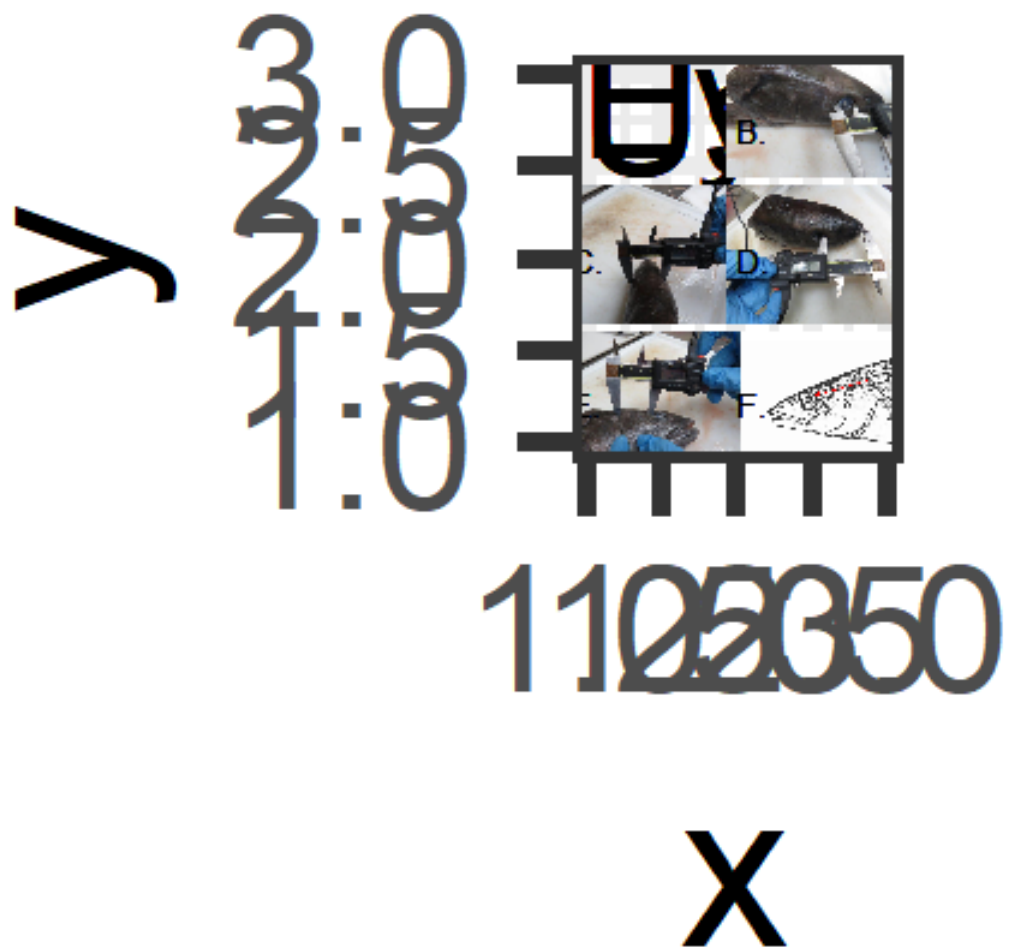


Figure 2. A. Upper jaw measurement; B. Eye diameter measurement; C. Interorbital distance; D. Snout length; E. Post orbital to preoperculum length measurement; F. Post orbital head length.

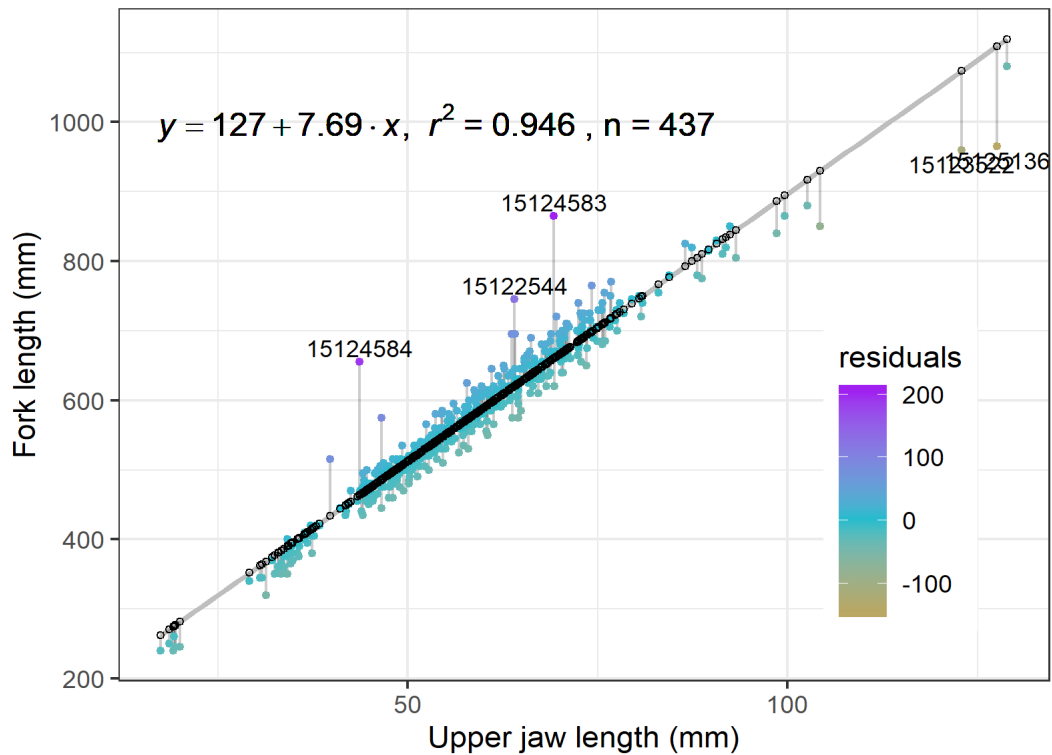


Figure 3. Scatterplot upper jaw vs fork length, measurements in millimeters.

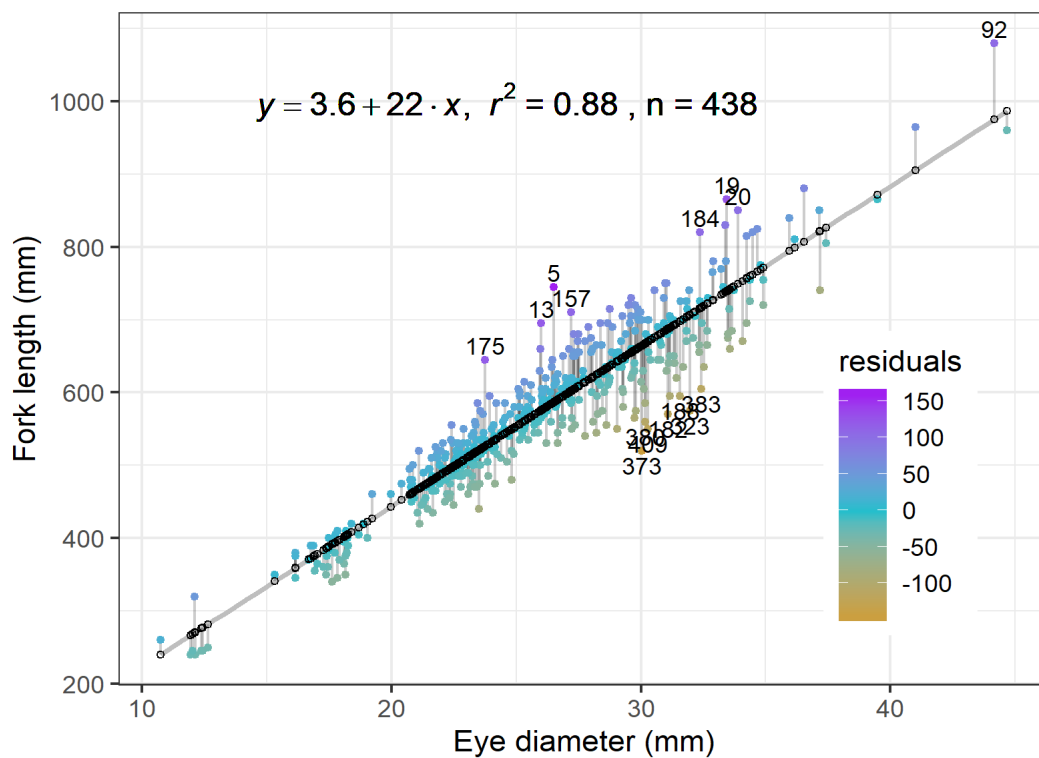


Figure 4. Scatterplot eye diameter vs fork length, measurements in millimeters.

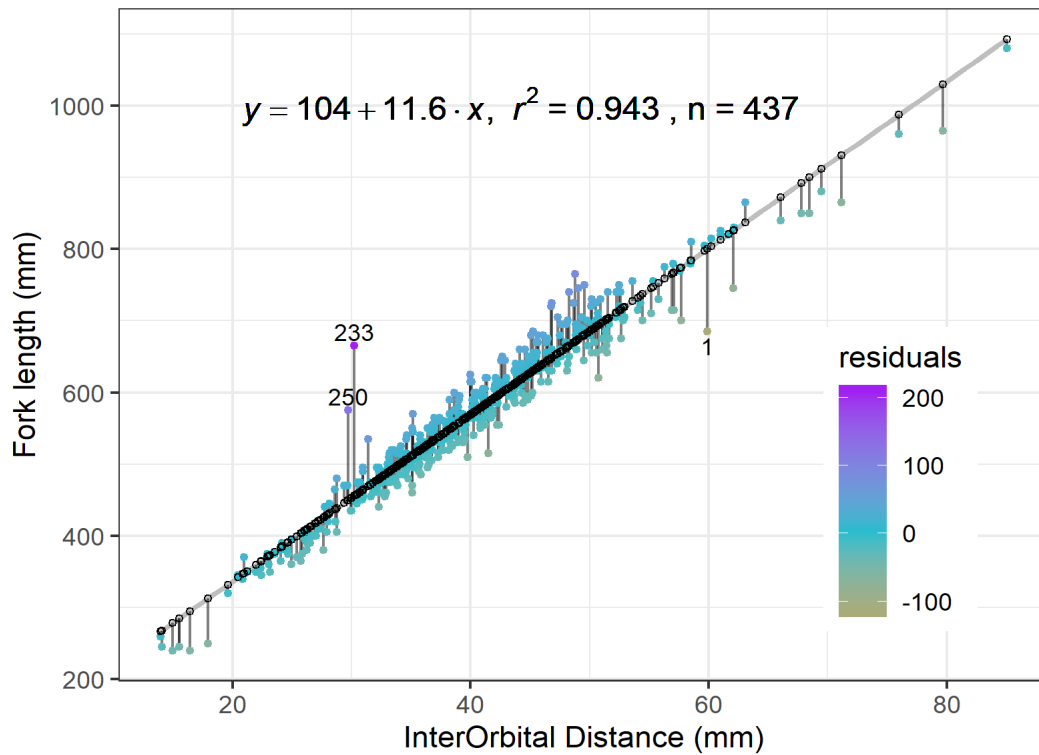


Figure 5. Scatterplot interorbital vs fork length.

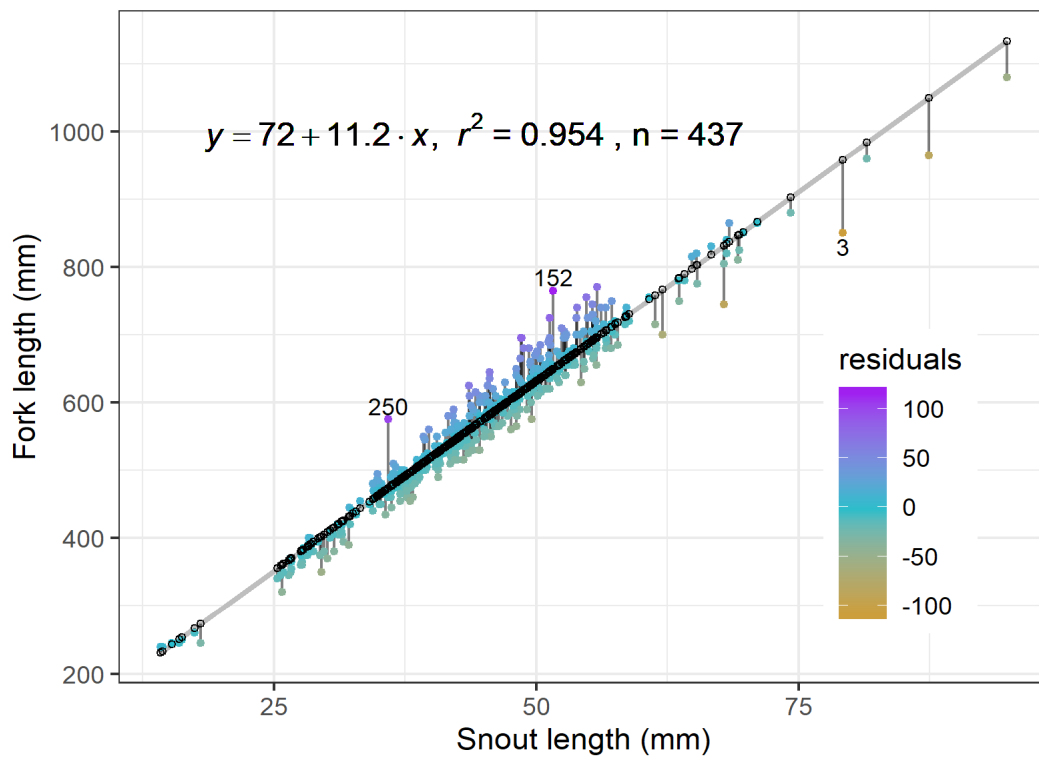


Figure 6. Scatterplot snout length vs fork length.

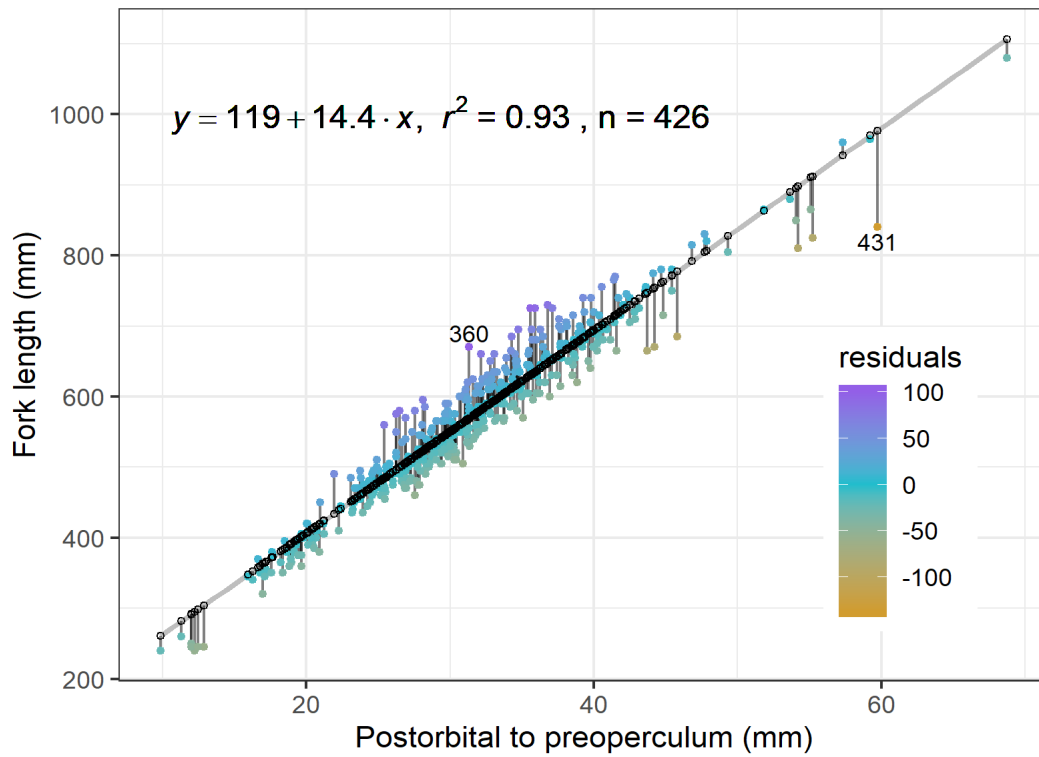


Figure 7. Scatterplot post orbital to preoperculum length vs fork length.

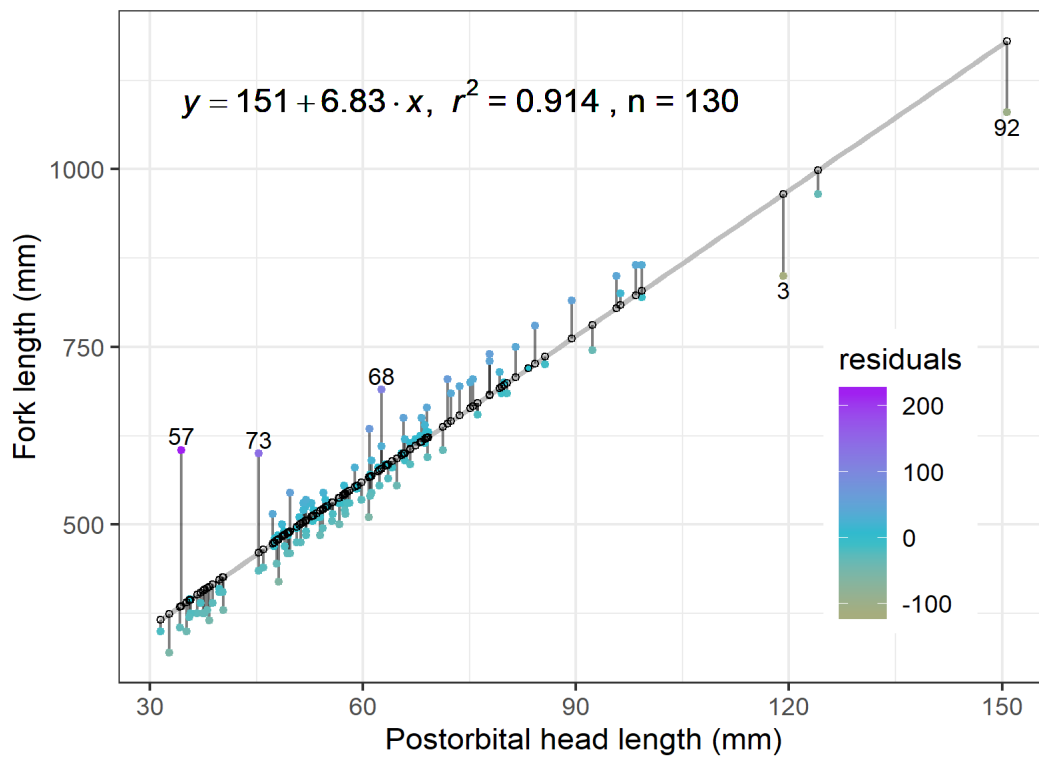


Figure 8. Scatterplot of post orbital length vs fork length.

6 Discussion

Interorbial head length (IO) proved to be a good predictor of fork length for sablefish.

7 Acknowledgments

We thank . . .

Nottingham, M.K., Williams, D.C., Wyeth, M.R., and Olsen, N. 2018. Summary of the west coast haida gwaii synoptic bottom trawl survey, august 25 - september 26, 2016. Can. Manuscr. Rep. Fish. Aquat. Sci. 3151: viii: 51 p.

Rondeau, E.B., Messmer, A.M., Sanderson, D.S., Jantzen, S.G., Schalburg, K.R. von, Minkley, D.R., Leong, J.S., Macdonald, G.M., Davidsen, A.E., Parker, W.A., Mazzola, R.S.A., Campbell, B., and Koop, B.F. 2013. Genomics of sablefish (*Anoplopoma fimbria*): Expressed genes, mitochondrial phylogeny, linkage map and identification of a putative sex gene. BMC Genomics 14(1): 452. Journal Article.

Williams, D.C., Nottingham, M.K., Olsen, N., and Wyeth, M.R. 2018. Summary of the west coast vancouver island synoptic bottom trawl survey, may 24 - june 15, 2016. Can. Manuscr. Rep. Fish. Aquat. Sci. 3137: viii: 54 p.