

## Mitochondrial DNA Part B Resources

ISSN: (Print) 2380-2359 (Online) Journal homepage: <https://www.tandfonline.com/loi/tmdn20>

# The complete mitochondrial genome of the blue skate *Dipturus batis*

Aurélien Delaval, Tanja Schwanck, Martina Elisabeth Luise Kopp, Galice Hoarau, Catherine S Jones & Leslie R Noble

To cite this article: Aurélien Delaval, Tanja Schwanck, Martina Elisabeth Luise Kopp, Galice Hoarau, Catherine S Jones & Leslie R Noble (2020) The complete mitochondrial genome of the blue skate *Dipturus batis*, Mitochondrial DNA Part B, 5:3, 2488-2489, DOI: [10.1080/23802359.2020.1778572](https://doi.org/10.1080/23802359.2020.1778572)

To link to this article: <https://doi.org/10.1080/23802359.2020.1778572>



© 2020 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



Published online: 17 Jun 2020.



Submit your article to this journal [↗](#)



Article views: 85



View related articles [↗](#)



View Crossmark data [↗](#)

## The complete mitochondrial genome of the blue skate *Dipturus batis*

Aurélien Delaval<sup>a</sup>, Tanja Schwanck<sup>b</sup>, Martina Elisabeth Luise Kopp<sup>a</sup>, Galice Hoarau<sup>a</sup>, Catherine S Jones<sup>b</sup> and Leslie R Noble<sup>a,b</sup>

<sup>a</sup>Faculty of Biosciences and Aquaculture, Nord University, Bodø, Norway; <sup>b</sup>School of Biological Sciences, University of Aberdeen, Aberdeen, UK

### ABSTRACT

The complete mitochondrial genome of the blue skate *Dipturus batis* is described from shotgun sequencing on an Illumina next-generation sequencing platform. We report a 16,911 bp long sequence similar in size to other members of the genus, containing 13 protein-coding regions, 22 *tRNA* genes, 2 *rRNA* genes, and 2 non-coding areas. Phylogenetic analysis was performed using the complete mitochondrial genomes of 17 related species, placing *D. batis* within the Rajini tribe of the Rajidae family, consistent with current taxonomy. The new resource adds to a growing database of rajid mitogenomes which will help resolve phylogenetic relationships within the family.

### ARTICLE HISTORY

Received 26 May 2020  
Accepted 30 May 2020

### KEYWORDS

*Dipturus batis*;  
mitogenome; Rajidae



The blue skate *Dipturus batis* (Family Rajidae, previously *Dipturus cf. flossada*) occurs on the continental shelf of the north-east Atlantic, primarily around the British Isles. *D. batis* has only recently received species status, after morphological and genetic investigations distinguished it from other large skates, particularly *D. intermedius* (Griffiths et al. 2010; Iglésias et al. 2010). Taxonomic confusion remains an issue among large skates, many of which are of conservation concern, and could benefit from additional tools.

We report the complete mitochondrial genome of *D. batis* from the fin clip (Natural History Museum London accession NHMUK014391967) of a male collected from the Rockall plateau (57°09'6"N, 14°19'3W) on 10 September 2012 during a Marine Scotland Science survey. The individual was identified based on morphology including size of mature specimen, eye color, and dorsal patterning (Iglésias et al. 2010), and genetically (M. Frost pers comm). DNA was extracted using a DNeasy<sup>®</sup> Blood & Tissue Kit (QIAGEN, Hilden, Germany) and shotgun sequenced on an Illumina<sup>®</sup> NextSeq<sup>®</sup> 500 using paired-end sequencing after library preparation using the NEBNext<sup>®</sup> Ultra<sup>™</sup> II DNA Library Prep Kit for Illumina (New England Biolabs<sup>®</sup>, Ipswich, MA, USA). The 32,180,856 raw reads generated were trimmed with BBDuk (30,920,799 reads remained) and mapped against the mitogenome of *D. oxyrinchus* (NC\_037967) in Geneious version R9.1 (Biomatters Ltd., Auckland, New Zealand). A total of 9077 reads mapped to the reference with 100% coverage (mean coverage depth 75.8), and produced a consensus sequence of 16,911 bp. To validate the consensus sequence we also performed a *de-novo* assembly using MINIA (kmer length 71), after trimming raw reads with TrimGalore and quality checking using

FastQC, and BLASTed this assembly against the reference-mapped consensus sequence from Geneious.

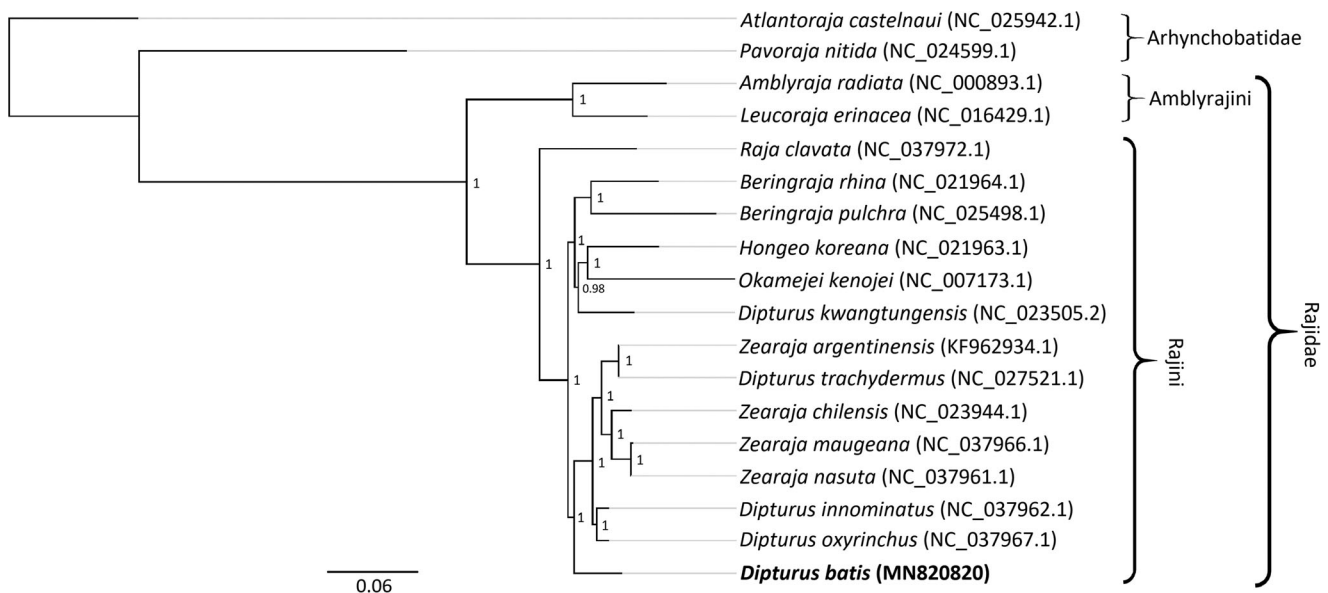
The 16,911 bp consensus mitogenome (GenBank accession number MN820820) we report is similar in size to other members of the genus (16,907–16,913). The consensus was annotated using MitoAnnotator (Iwasaki et al. 2013) and MITOS (Bernt et al. 2013). Gene order and structure was typical of vertebrate mitogenomes and to that of *Dipturus* relatives, containing 13 protein-coding regions, 22 *tRNA* genes, 2 *rRNA* genes, and two non-coding areas (control region and the origin of L-strand replication). Nucleotide frequencies were: 30.1% A, 26.8% C, 14.3% G, 28.8% T (A + T composition of 58.9%). This is comparable to that reported for other *Dipturus* species (Vargas-Caro et al. 2016).

We performed a phylogenetic analysis in Geneious using the full mitochondrial genome sequences of 17 related species. Sequences were aligned using MAFFT and the phylogenetic tree was constructed using Bayesian inference, as implemented in the MrBayes (Huelsenbeck and Ronquist 2001) plugin, using the GTR substitution model for 500,000 iterations, sampling every 500th iteration after a burn-in of 100,000. *Atlantoraja castelnaui* (NC\_025942.1) was used as the out-group. The phylogenetic tree places *D. batis* within the monophyletic clade of hardnosed skates (Rajidae), and within the tribe Rajini, consistent with current taxonomy (Last et al. 2016) (Figure 1). Rajidae currently includes 159 validated species (Fricke et al. 2019) within which re-assignments of genera are likely to occur (Last et al. 2016). The mitogenome of *D. batis* adds to a growing database that can be used to resolve phylogenetic relationships in the future.

**CONTACT** Leslie R. Noble  [leslie.r.noble@nord.no](mailto:leslie.r.noble@nord.no)  Faculty of Biosciences and Aquaculture, Nord University, Bodø, Norway

© 2020 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



**Figure 1.** Phylogenetic tree of *Dipturus batis* (in bold) and 17 other species inferred from their complete mitogenomes. Scale bar shows the number of substitutions per site (thick black line), and posterior probabilities are shown for each node. Species names following Last et al. (2016) and GenBank accession numbers are given.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

This work was supported by Nord University.

## Data availability statement

The data that support the findings of this study are openly available in Genbank at <https://www.ncbi.nlm.nih.gov/search/all/?term=MN820820>, accession number MN820820.

## Acknowledgments

We thank Michelle Frost for genetic identification of the species, and Irina Smolina and Joanna Babiak for assistance in the lab.

## References

Bernt M, Donath A, Jühling F, Externbrink F, Florentz C, Fritsch G, Pütz J, Middendorf M, Stadler PF. 2013. MITOS: improved de novo metazoan mitochondrial genome annotation. *Mol Phylogenet Evol.* 69(2):313–319.

Fricke R, Eschmeyer WN, Van der Laan R, editors. 2019. Eschmeyer's catalog of fishes: genera, species, references. [accessed 2020 March 10] <http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>.

Griffiths A, Sims D, Cotterell S, Nagar A, Ellis J, Lynghammar A, McHugh M, Neat F, Pade N, Queiroz N, et al. 2010. Molecular markers reveal spatially segregated cryptic species in a critically endangered fish, the common skate (*Dipturus batis*). *Proc Biol Sci.* 277(1687):1497–1503.

Huelsenbeck JP, Ronquist F. 2001. MRBAYES: bayesian inference of phylogenetic trees. *Bioinformatics.* 17(8):754–755.

Iglésias S, Toulhoat L, Sellos D. 2010. Taxonomic confusion and market mislabelling of threatened skates: important consequences for their conservation status. *Aquatic Conserv Mar Freshw Ecosyst.* 20(3): 319–333.

Iwasaki W, Fukunaga T, Isagozawa R, Yamada K, Maeda Y, Satoh TP, Sado T, Mabuchi K, Takeshima H, Miya M, et al. 2013. MitoFish and MitoAnnotator: a mitochondrial genome database of fish with an accurate and automatic annotation pipeline. *Mol Biol Evol.* 30(11): 2531–2540.

Last PR, White WT, de Carvalho MR, Séret B, Stehmann MFW, Naylor GJP. 2016. Rays of the world. Clayton South, Australia: CSIRO Publishing.

Vargas-Caro C, Bustamante C, Lamilla J, Bennett MB, Ovenden JR. 2016. The phylogenetic position of the roughskin skate *Dipturus trachyderma* (Krefft & Stehmann, 1975) (Rajiformes, Rajidae) inferred from the mitochondrial genome. *Mitochondr DNA A DNA Mapp Seq Anal.* 27(4):2965–2966.