Location data for genetic samples of nudibranch Glaucus atlanticus from global gyre systems (Neuston Phylogeny project)

Website: https://www.bco-dmo.org/dataset/502605
Version: 21 February 2014
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Project
» Community Phylogeny and Global Phylogeography of the Neuston (Neuston Phylogeny)

Contributors	Affiliation	Role
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Dataset Description

These samples are part of a study that suggests the premise that continents like Europe and the Americas cause barriers to gene flow for the nudibranchs found in the uppermost layer (neuston) of the ocean. The nudibranch *Glaucus atlanticus*, found in all oceans, was studied to assess the genetic differentiation of mulitiple specimens from a global sampling effort.

These data are published as Table S1 in Churchill (2013).

Methods & Sampling

Glaucus atlanticus specimens were collected between 2006 and 2012 either from the beach or in the open ocean from neuston tows. The specimens were then preserved in 95% ethanol and identified. Where possible, 15 - 20 individuals were chosen from each ocean gyre for genetic analysis. Genomic DNA was extracted and mitochondrial cytochrome oxidase I (COI) was amplified using the universal primers LCO1490 and HCO2198 using the general PCR protocol. Details of the extraction, amplification and analyses can be found in the methods section of the Churchill (2013).

Data Processing Description

See [reference?] for methodology.

Relevant References:

Celia K. C. Churchill, Ángel Valdés and Diarmaid Ó Foighil (2014) Afro-Eurasia and the Americas present barriers to gene flow for the cosmopolitan neustonic nudibranch Glaucus atlanticus. Marine Biology DOI 10.1007/s00227-014-2389-7.

Celia K. C. Churchill, Alvin Alejandrino, A´ngel Valde´s and Diarmaid O´ Foighil (2013) Parallel changes in genital morphology delineate cryptic diversification of planktonic nudibranchs. Proc R Soc B:280: 20131224. http://dx.doi.org/10.1098/rspb.2013.1224.

Celia K. C. Churchill, Ellen E. Strong and Diarmaid O´Foighil (2011) Hitchhiking juveniles in the rare neustonic gastropod Recluzia cf. jehennei (Janthinidae). Journal of Molluscan Studies (2011) 0: 1-4. doi:10.1093/mollus/eyr020

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Data Files

File
Glaucus_locations.csv (Comma Separated Values (.csv), 3.42 KB) MD5:63d255e77966af5e8e2d57e88c93d0e1 Primary data file for dataset ID 502605

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Parameters

Parameter	Description	Units
isolate	Genetic isolate code representing tissue from different individuals sampled from each gyre.	label
voucher	Museum voucher number	none
lat	latitude where specimen was collected. South is negative.	decimal degrees
lon	longitude where specimen was collected. West is negative.	decimal degrees
gyre_system	gyre system location on the Earth	none
accession_num	GenBank accession number	
species	species name	none

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Instruments

Dataset-specific Instrument Name	Neuston Net
Generic Instrument Name	Neuston Net
Generic Instrument Description	Neuston Nets are nets that collect zooplankton that live in the top few centimeters of the sea surface (the neuston layer). This specialized net has a rectangular mouth opening usually 2 or 3 times as wide as deep, i.e. 1 meter by 1/2 meter or 60 cm by 20 cm, with sometimes hollow piping construction to aid in flotation. They are generally towed half submerged at 1-2 kts from the side of the vessel on a boom to avoid the ship's wake.

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Deployments

OFoighil_2014

Website	https://www.bco-dmo.org/deployment/505320
Platform	OFoighil_2014
Description	Mollusc genetic analyses from globally collected samples.

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Project Information

Community Phylogeny and Global Phylogeography of the Neuston (Neuston Phylogeny)

Coverage: 5 subtropical gyre systems: North Atlantic, South Atlantic, North Pacific, South Pacific, Indian Ocean.

Abstract:

This project aims to construct the first marine community phylogeny. It is inspired by the integrative perspective that lies at the core of the modern concept of biodiversity. Empirical realization of this integration requires that study systems be simple enough to be tractable, yet (ideally) contain compelling ecological and evolutionary phenomena. The target marine community, the neuston, embodies these characteristics to an exceptional degree. It consists of a relatively small number of interacting species that drift at the water/atmosphere interface of the planet's subtropical gyres (40% of oceanic surface area) and play an important role in open-ocean epipelagic food webs. The ecological base of the neuston community is an endosymbiosis involving chondrophore cnidarian hosts (Porpitidae) and their dinoflagellate photosymbionts. Chondrophores are preyed upon by a variety of predators, chief among them two lineages of highly specialized gastropods (Janthinidae and Glaucinae). This prominent open ocean community has been poorly studied, apart from its resident insect genus Halobates. The investigator aims to complete a combined phylogeny/phylogeography of neuston taxa across three trophic levels (photosymbionts, chondrophore hosts, predatory gastropods) and all 5 subtropical gyre systems. The two main goals of the community phylogeny section are to determine the evolutionary origins of the photosymbiosis, and to establish the benthic sister lineages of both gastropod lineages in order to identify the synapomorphic changes associated with ancestral ecological transitions from benthos to neuston. The primary aims of the phylogeographic section are to establish the spatial scale of speciation for the target neustonic taxa, and to test three hypotheses of within-species genetic structuring: global panmixis; ocean basin panmixis; within gyre panmixis. The investigator has developed a multi-faceted sampling strategy that involves ichthyoplankton research colleagues in multiple gyres systems, the bi-coastal, ocean-going ships and students of the Woods Hole Semester at Sea program, national and international museum collections, and an informal network of colleagues worldwide that will sample

spontaneous neuston stranding event. He has also established collaborative relationships with colleagues expert in cnidarian, nudibranch, caenogastropod and epitoniid diversity, who will work closely with him on their respective groups within the neuston and, for gastropods, also within benthic sister lineages. To-date, preliminary samples from 3 of the 5 gyres have yielded results that not only demonstrate the feasibility of the primary project goals, but also provide exciting initial insights into the generality of the photosymbiotic association, the putative benthic sister lineages of neustonic gastropods, the likely presence of cryptic species complexes, and the divergent patterns of among-gyre and among-basin genetic structuring exhibited by sister taxa.

This project has an unusually extensive student outreach component in the form of the >100 Sea Education Association (SEA) undergraduates and high school students that will participate in multiple upcoming SSV Seamans & SSV Cramer cruises and who will collect neuston taxa. The investigator will provide detailed electronic feedback to the SEA courses, in the field, so that students will be able to connect the organisms they collect with the biogeographic and evolutionary hypotheses being testing, and to determine for themselves which hypotheses the available data reject, or corroborate. One graduate and three undergraduate UM students will receive in-depth training during this project. The graduate student, Celia Churchill, has participated in offshore neuston sampling, generated much of the preliminary data, and recently presented at her first scientific meeting. She will work/train with the P.I., and also with 4 expert collaborators, directly in their laboratories for 2 of them. One UM undergraduate student has already worked directly on this project and the investigator will recruit at least two more. Substantial international outreach and collaborative activities are planned across research specialties, especially involving ichthyoplankton colleagues working in different gyre systems, as well as international museum colleagues. This study promises to significantly enhance background knowledge of the vast subtropical gyre surface ecosystem, now heavily impacted, even in mid-ocean, by the incremental accumulation of non-biodegradable, plastic flotsam. This is a major new marine conservation issue that is just now entering public discourse, e.g., see recent descriptions of the North Pacific's Giant Garbage Patch in the popular press.

PUBLICATIONS PRODUCED AS A RESULT OF THIS RESEARCH

Ó Foighil, D; Lee, T; Slapcinsky, J. "Prehistoric anthropogenic introduction of partulid tree snails in Papua New Guinean archipelagos," JOURNAL OF BIOGEOGRAPHY, v.38, 2011, p. 1625. View record at Web of Science

Churchill, CKC; Ó Foighil, D; Strong, EE; Gittenberger, A. "Females floated first in bubble-rafting snails," CURRENT BIOLOGY, v.21, 2011, p. R802. View record at Web of Science

Churchill, CKC; Strong, EE; Ó Foighil, D. "Hitchhiking Juveniles in the Rare Neustonic Gastropod Recluzia Cf. Jehennei (Janthinidae)," Journal Of Molluscan Studies, v.77, 2011, p. 441. View record at Web of Science

Ó Foighil, D; Li, JC; Lee, T; Johnson, P; Evans, R; Burch, JB. "Conservation Genetics of a Critically Endangered Limpet Genus and Rediscovery of an Extinct Species," PLOS ONE, v.6, 2011. View record at Web of Science

Focal Publications

Churchill, C.K., Valdés, Á. Ó Foighil, D. 2014. Afro-Eurasia and the Americas present barriers to gene flow for the cosmopolitan neustonic nudibranch Glaucus atlanticus. Marine Biology, In Press.

Churchill, C.K., Valdés, Á. Ó Foighil, D. 2014. Molecular and morphological systematics of neustonic nudibranchs (Mollusca, Gastropoda, Glaucidae, Glaucus) with descriptions of three new cryptic species. In Press, Invertebrate Systematics.

Churchill, C.K., Alejandrino, A., Valdés, Á. Ó Foighil, D. 2013. Parallel changes in genital morphology delineate cryptic diversification of planktonic nudibranchs. Proceedings of the Royal Society B. 280:20131224. http://dx.doi.org/10.1098/rspb.2013.1224

Exemplar media coverage: www.earthtimes.org/nature/glaucus-twin/2394/

Churchill, C.K. and Ó Foighil, D. 2013. Bubble rafting snails. McGraw-Hill Yearbook of Science and Technology 2013, pp. 56-58.

Churchill, C.K., Ó Foighil, D., Strong, E.E. and Gittenberger, A. 2011. Females floated first in bubble-rafting snails. Current Biology. 21: R802-R803. Featured on the journal cover, in Science and in multiple online media outlets, e.g., http://www.msnbc.msn.com/id/44849146/ns/technology_and_science-science/#.UPMcgY5_dsR

Churchill C.K., Strong, E.E. and Ó Foighil, D. 2011. Hitchhiking juveniles in the rare neustonic gastropod Recluzia cf. jehennei (Janthinidae). Journal of Molluscan Studies. 77:441-444.

Non-Focal publications

Li, J., Ó Foighil, D. & Park, J.K. 2013. Triton's trident: cryptic Neogene divergences in a marine clam (Lasaea australis) correspond to Australia's three temperate biogeographic provinces Molecular Ecology 22:1933-1946.

http://onlinelibrary.wiley.com/doi/10.1111/mec.12220/full

Exemplar media: http://phys.org/news/2013-03-cryptic-clams-biologists-species-plain.html

Scott, P.V., Ó Foighil, D. & Li, J. 2013. Where's Waldo? A new commensal species, Waldo arthuri (Mollusca: Bivalvia: Galeommatidae), from the Northeastern Pacific Ocean. Zookeys, 316:67-80. www.pensoft.net/journals/zookeys/article/4256

Exemplar media coverage: http://www.sciencedaily.com/releases/2013/07/130716120022.htm

http://www.foxnews.com/science/2013/07/20/heres-waldo-strange-new-alien-like-clam-species-found/

Miura, O., Köhler, F., Lee, T., Li, J. & Ó Foighil, D. 2013. Rare, divergent Korean Semisulcospira spp. mitochondrial haplotypes have Japanese sister lineages. Journal of Molluscan Studies, 79:86-89. http://mollus.oxfordjournals.org/content/79/1/86.full.pdf+html

Li, J., Ó Foighil, D. & Middelfart, P. 2012. The evolutionary ecology of biotic association in a megadiverse bivalve superfamily: sponsorship required for permanent residency in sediment. PLoS ONE, 7(8): e42121. Featured in multiple online media outlets, e.g., http://www.sciencedaily.com/releases/2012/08/120809090308.htm

Li, J. and Ó Foighil, D. 2012. Host-specific morphologies but no host races in the commensal bivalve Neaeromya rugifera. Invertebrate Biology, 131:197-203.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0850625

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