



RESEARCH NOTE

**REVISED** First visual record of rare purple-colored dogwhelks (*Nucella lapillus*) on the Atlantic coast of Nova Scotia, Canada [version 2; referees: 3 approved]

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**v2** First published: 04 Oct 2016, 5:2435 (doi: 10.12688/f1000research.9707.1)  
 Latest published: 23 Aug 2017, 5:2435 (doi: 10.12688/f1000research.9707.2)

**Abstract**

The dogwhelk *Nucella lapillus* is a rocky intertidal gastropod of the North Atlantic coast. Individual shell color varies. Common colors range between white and brown, with darker dogwhelks being more affected by heat stress than lighter-colored conspecifics. Other reported shell colors are purple, black, mauve, pink, yellow, and orange from UK coasts, red and gray from the Bay of Fundy coast of New Brunswick and Nova Scotia (Canada), and purple, black, gray, yellow, and orange from the coasts of Maine and Massachusetts (USA), with purple being considered as a rare color. On the Atlantic coast of Nova Scotia, dogwhelks are active from April until November, but information on dogwhelk shell color is missing for this coast. On 16 June 2016, we found two purple-colored dogwhelks in the mid-to-high intertidal zone of a moderately wave-exposed rocky shore near Duncans Cove, on the Atlantic coast of Nova Scotia while collecting dogwhelks (n= 1000) during low tide for manipulative field experiments. All other dogwhelks collected on that day were of common white and brown colors. During earlier dogwhelk collections in Atlantic Nova Scotia (between 2011-2013) and field surveys in Duncans Cove (between 2014-2016), we did not find any purple-colored dogwhelks, indicating the rareness of this color in that region. Apparently, our observations provide the first visual record of rare purple-colored dogwhelks on the Atlantic coast of Nova Scotia, Canada.

**Open Peer Review**

Referee Status:

	Invited Referees		
	1	2	3
<b>REVISED</b>			
<b>version 2</b>	report	report	report
published			
23 Aug 2017			
<b>version 1</b>	?	?	?
published	report	report	report
04 Oct 2016			

- Simon C. Courtenay**, University of Waterloo, Canada
- Jeff C. Clements** , Aquaculture and Coastal Ecosystems, Fisheries and Oceans Canada, Canada
- Mathieu Cusson**, Université du Québec à Chicoutimi (UQAC), Canada

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Comments (0)

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**Author roles:** **Ehlers SM:** Conceptualization, Formal Analysis, Investigation, Methodology, Writing – Review & Editing; **Ellrich JA:** Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Supervision, Writing – Original Draft Preparation, Writing – Review & Editing

**Competing interests:** No competing interests were disclosed.

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**Grant information:** The field surveys were funded by a Discovery Grant (#311624) awarded to Ricardo A. Scrosati by the Natural Sciences and Engineering Research Council of Canada (NSERC).

*The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.*

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**REVISED Amendments from Version 1**

From version 2 of our article "First visual record of rare purple-colored dogwhelks (*Nucella lapillus*) on the Atlantic coast of Nova Scotia, Canada", we removed the datasets that described the intertidal temperature for the days on which we surveyed the Atlantic coast near Duncans Cove (Nova Scotia, Canada) for purple-colored dogwhelks. Instead, we included information on permanent environmental conditions (i.e. the wave exposure degree, the presence of mussel patches, and the presence of seaweed canopies) observed during regular field surveys on that coast. We did that, because a previous study from the Atlantic coast of Massachusetts, USA (Etter, 1988) found that rare purple-colored dogwhelks occur in wave exposed habitats where wave splash, damp mussel patches and seaweed canopies cool and moisten such dogwhelks during low tide, thereby enabling their persistence on the coast. As these permanent conditions were similar in Massachusetts and Duncans Cove, they explain the occurrence of purple-colored dogwhelks in Duncans Cove more conclusively than the temperature data from our survey days.

See referee reports

## Introduction

The dogwhelk *Nucella lapillus* (L. 1758) is a common predatory gastropod in the rocky intertidal of the North Atlantic that feeds on barnacles and mussels (Crothers, 1985; Etter, 2007). Individuals vary in shell color. White and brown are common colors (Berry & Crothers, 1974; Crothers, 1983; Crothers, 1985; Etter, 1988). Other shell colors reported are purple, black, gray, mauve, pink, yellow, and orange on UK coasts (Berry & Crothers, 1968; Berry & Crothers, 1974; Castle & Emery, 1981; Cooke, 1915; Moore, 1936), red and gray from the Bay of Fundy coast of New Brunswick and Nova Scotia (Canada) (Colton, 1922; Crothers, 1983), and black, purple, gray, yellow, and orange from the coasts of Maine (Colton, 1916; Colton, 1922; Crothers, 1983) and Massachusetts (USA) (Etter, 1988). Purple is considered to be a rare color in dogwhelks (Berry & Crothers, 1968; Colton, 1922; Etter, 1988). As shell color in the closely related dogwhelk *Nucella emarginata* is inherited (Palmer, 1984; Palmer, 1985), a genetic control of the shell color has been suggested for *N. lapillus* (Etter, 1988). Variation in shell color may protect the dogwhelks from visual predators (Colton, 1916; Colton, 1922; Etter, 1988). Moreover, the occurrence of colored dogwhelks along the shore is influenced by physiological stress from heat and desiccation during tidal emersion periods, because darker-colored dogwhelks suffer more from desiccation than lighter-colored conspecifics as they show a higher energy intake from sunlight (Etter, 1988; Harris & Jones, 1995). On the Atlantic coast of Nova Scotia, dogwhelks are active from April until November (Hughes, 1972; Hunt & Scheibling, 1998), but information on dogwhelk shell colors is missing for this coast.

## Methods

On 16 June 2016, we collected 1000 dogwhelks along a 300 meter transect located in the mid-to-high intertidal of a moderately wave-exposed rocky coast with dense mussel (*Mytilus* spp.) patches and seaweed (*Fucus vesiculosus*) canopies near Duncans

Cove (44°29'41.22"N, 63° 31'26.66"W), Halifax on the Atlantic coast of Nova Scotia. We collected the dogwhelks during low tide for manipulative field experiments to examine nonconsumptive effects (NCEs) of these predators on their prey. Equal dogwhelk quantities were collected by one of us (JAE) for related research projects on dogwhelk NCEs (e.g. Ellrich *et al.*, 2015; Ellrich *et al.*, 2016) in several locations, with similar levels of intertidal elevation and wave exposure, along the Atlantic coast of Nova Scotia: in Glasgow Head (45°19'12.61"N, 60°17'34.15"W) in May and June 2011, in Deming Island (45°12'44.31"N, 61°10'25.99"W) in May 2012, and in Deming Island, Halfway Cove (45°20'58.98"N, 61°21'46.58"W), and Half Island Cove (45°21'19.77"N, 61°11'23.73"W) in May and June 2013.

During field surveys for another research project near our dogwhelk collection site in Duncans Cove, dogwhelk colors were observed regularly during low tides (on 12 August 2014, 1 September 2015, and 21 August 2016). To observe dogwhelk colors, 30 quadrats (25 cm × 25 cm) along a 150 m transect parallel to the coastline were sampled at random on each survey date.

## Results & discussion

During our collection of dogwhelks near Duncans Cove on 16 June 2016 (n= 1000 dogwhelks in total), we found two dogwhelks of purple shell color. Our results provide the first visual record of purple-colored dogwhelks on the Atlantic coast of Nova Scotia (Figure 1). The other dogwhelks collected on that day were of common brown and white shell colors. We did not find any other purple-colored dogwhelk during any of our five collections of equal dogwhelk quantities along the Atlantic Coast of Nova Scotia (n= 5000 dogwhelks of brown and white shell color in total) or three field surveys near Duncans Cove (n= 82 dogwhelks of brown and white shell color in total) indicating that purple-colored dogwhelks are rare in that region.



**Figure 1.** A purple-colored dogwhelk, *Nucella lapillus* (L. 1758). Picture taken near Duncans Cove (44°29'41.22"N, 63° 31'26.66"W), Halifax on the Atlantic coast of Nova Scotia, Canada on 16 June 2016 (picture credit: Julius A. Ellrich).

Previous observations along Massachusetts (USA) coasts found that darker-colored dogwhelks, including a small fraction of purple-colored individuals, occur mainly in wave-exposed habitats, presumably as occasional wave splash cools and moistens these organisms during low tide and, thereby, enables their persistence in such habitats (Etter, 1988). Our study supports that notion, as the two purple-colored dogwhelks were found on a moderately wave-exposed coast. In addition, we found the two purple-colored dogwhelks next to dense mussel patches and seaweed canopies that retain moisture during low tide and, thereby, limit physiological stress from desiccation for intertidal organisms (Beermann *et al.*, 2013; Etter, 1988). Hence, the occurrence of wave splash as well as the presence of mussel patches and seaweed canopies probably enhanced the chance of finding the rare purple-colored dogwhelks.

Future research could examine if dogwhelk behavioral responses to physiological stress from high temperatures vary with shell color. For example, purple-colored dogwhelks may find it less thermally stressful to venture out of crevices and macroalgal cover under relatively cool temperatures. Darker dogwhelks show stronger responses to heat, such as faster desiccation, than lighter-colored

conspecifics (Etter, 1988; Harris & Jones, 1995). Future experiments could, thus, examine if dogwhelk behavioral responses to temperature are related to shell color, which may contribute to the rareness in the observed purple-colored dogwhelks.

### Author contributions

SME and JAE conducted the field work and wrote the manuscript.

### Competing interests

No competing interests were disclosed.

### Grant information

The field surveys were funded by a Discovery Grant (#311624) awarded to Ricardo A. Scrosati by the Natural Sciences and Engineering Research Council of Canada (NSERC).

*The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.*

### Acknowledgements

We thank Simon C. Courtenay, Jeff C. Clements and Mathieu Cusson for their helpful comments that improved our article.

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# Open Peer Review

Current Referee Status:   

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## Version 2

Referee Report 18 September 2017

doi:[10.5256/f1000research.13449.r25322](https://doi.org/10.5256/f1000research.13449.r25322)



**Mathieu Cusson**

Département des sciences fondamentales, Université du Québec à Chicoutimi (UQAC), Chicoutimi, QC, Canada

The authors have addressed all comments and adjusted the paper accordingly. I recommend the acceptance of the revised paper. Nice piece of short communication!

**Competing Interests:** No competing interests were disclosed.

**I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

Referee Report 07 September 2017

doi:[10.5256/f1000research.13449.r25320](https://doi.org/10.5256/f1000research.13449.r25320)



**Jeff C. Clements** 

Aquaculture and Coastal Ecosystems, Fisheries and Oceans Canada, Moncton, NB, Canada

The authors have done a great job with addressing my comments and I suggest that the paper be accepted for indexing. Nice work!

**Competing Interests:** No competing interests were disclosed.

**I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

Referee Report 29 August 2017

doi:[10.5256/f1000research.13449.r25321](https://doi.org/10.5256/f1000research.13449.r25321)



**Simon C. Courtenay**

School of Environment, Resources and Sustainability (SERS), Canadian Water Network (CWN), University of Waterloo, Waterloo, ON, Canada

The authors have adequately addressed my suggestions and I recommend that the paper now be accepted.

**Competing Interests:** No competing interests were disclosed.

**I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

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**Version 1**

Referee Report 01 December 2016

doi:10.5256/f1000research.10463.r16799

**Mathieu Cusson**

Département des sciences fondamentales, Université du Québec à Chicoutimi (UQAC), Chicoutimi, QC, Canada

The authors report on a sighting of purple dogwhelks in Nova Scotia. During a sampling of over 1000 dogwhelks, they observed two purple-shelled individuals.

Ehlers and Ellrich indicate that there may be a link between intertidal (air/water?) temperatures and the observation of the purple dogwhelks. A purple colouring is less thermally stressful in colder settings and due to the lower temperatures, the whelks may venture out from crevices and macroalgal cover.

I work in the St. Lawrence Estuary where we have found dogwhelks in the intertidal zone although at lower quantities than those reported for Nova Scotia. Water and air temperatures are commonly under 12°C in this portion of the estuary, yet my team and I have never observed purple individuals - the typical colours for dogwhelks in this sector being white-beige to dark grey.

The findings of Ehlers and Ellrich are of interest and it is worthwhile to pursue the subject with additional observations or experimental manipulations to understand the factors that affect shell colour variability. However, their linking of the purple colour to a single, cold day (lower water temperatures in the intertidal zone) as reported in this manuscript is rather anecdotic. Rather, the authors should list potential factors (both physiological and environmental) that could potentially affect shell coloration instead of linking this observation to a single day and the possible behaviour of two rare individuals. The potential link to behaviour - lower temperatures favouring an active movement of purple-shelled individuals out from shelter - is not convincing. Mauve coloration has been seen along European coasts. As this colour is very similar to purple, in which environmental conditions were these latter observations made? Similarly, if purple has also been reported from Maine, how would these observations from Maine confirm a link to colder temperatures? I suspect that the purple colour may simply be a rare phenotypic trait that may not be at all related to environmental factors (purple shells may be the albino individuals in dogwhelk populations?).

Nevertheless, I do salute the authors for this valuable natural history observation that must be recorded. Thank you as well to F1000 for allowing the publication of such observations.

Other comments:

Datasets: I do not understand why the data were separated into four distinct data sets, one for each date. I suggest a graph presenting all average temperatures coupled with the occurrence of white/brown and purple coloration. In the references, the authors list separate temperature data sets (one for each day). These data sources should be combined (not be separate) so as to avoid artificially increasing the number of publications.

The observation date of June 16, the day on which the cool temperatures (12.3°C, n = 96) were recorded, is not presented in the companion data sets. Rather, I would prefer including a graph showing the recorded temperature for each relevant date.

**Competing Interests:** No competing interests were disclosed.

**I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Author Response 14 Aug 2017

**Julius Ellrich**, St. Francis Xavier University, Canada

*The authors report on a sighting of purple dogwhelks in Nova Scotia. During a sampling of over 1000 dogwhelks, they observed two purple-shelled individuals.*

*Ehlers and Ellrich indicate that there may be a link between intertidal (air/water?) temperatures and the observation of the purple dogwhelks. A purple colouring is less thermally stressful in colder settings and due to the lower temperatures, the whelks may venture out from crevices and macroalgal cover.*

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*The findings of Ehlers and Ellrich are of interest and it is worthwhile to pursue the subject with additional observations or experimental manipulations to understand the factors that affect shell colour variability. However, their linking of the purple colour to a single, cold day (lower water temperatures in the intertidal zone) as reported in this manuscript is rather anecdotic. Rather, the authors should list potential factors (both physiological and environmental) that could potentially affect shell coloration instead of linking this observation to a single day and the possible behaviour of two rare individuals. The potential link to behaviour - lower temperatures favouring an active movement of purple-shelled individuals out from shelter - is not convincing. Mauve coloration has been seen along European coasts. As this colour is very similar to purple, in which environmental conditions were these latter observations made? Similarly, if purple has also been reported from Maine, how would these observations from Maine confirm a link to colder temperatures? I suspect that the purple colour may simply be a rare phenotypic trait that may not be at all related to environmental factors (purple shells may be the albino individuals in dogwhelk populations?).*

*Nevertheless, I do salute the authors for this valuable natural history observation that must be recorded. Thank you as well to F1000 for allowing the publication of such observations.*

We appreciate the overall positive feedback on our manuscript and express our gratitude in the Acknowledgements. In the revised manuscript, we included the information that shell coloration in the dogwhelk *Nucella lapillus* is presumably inheritable. We agree that purple colored dogwhelks are rare. In addition, we discuss that their occurrence is likely favoured by the habitat characteristics (i.e. wave splash, presence of dense blue mussel beds and seaweed canopies) of the moderately wave-exposed coastline in Duncans Cove, Nova Scotia, which aligns closely with previous findings of rare purple colored dogwhelks along wave-exposed coasts in Massachusetts, USA (Etter 1988). Also, these habitat characteristics likely enhance the probability of finding rare purple colored dogwhelks.

Etter, R. 1988. Physiological stress and color polymorphism in the intertidal snail *Nucella lapillus*. *Evolution*. 4(2): 660-680.

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*Other comments:*

*Datasets: I do not understand why the data were separated into four distinct data sets, one for each date. I suggest a graph presenting all average temperatures coupled with the occurrence of white/brown and purple coloration. In the references, the authors list separate temperature data sets (one for each day). These data sources should be combined (not be separate) so as to avoid artificially increasing the number of publications.*

In the revised manuscript, we removed the information on temperature in favor of information on wave-exposure as well as mussel bed and seaweed canopy presence. We did so, because we think that this information explains our findings of the two purple colored dogwhelks more conclusively.

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*The observation date of June 16, the day on which the cool temperatures (12.3°C, n = 96) were recorded, is not presented in the companion data sets. Rather, I would prefer including a graph showing the recorded temperature for each relevant date.*

The correct temperature data for 16 June 2016 was actually included, but unfortunately labeled wrong (i.e. 12 June 2016) in the companion data set. We apologize for the confusion. For the reasons discussed above, we removed the information on temperature from the revised manuscript.

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**Competing Interests:** No competing interests were disclosed.

Referee Report 01 November 2016

doi:10.5256/f1000research.10463.r16798



**Jeff C. Clements** 

Aquaculture and Coastal Ecosystems, Fisheries and Oceans Canada, Moncton, NB, Canada



The article by Ehlers & Ellrich qualitatively documents the first record of the *Nucella lapillus* purple morph on the east coast of Canada. The authors also relate the observations of this colour morph to temperature, suggesting that cooler temperatures may allow this colour morph to become more active outside of rock crevasses.

I very much like this article. From my perspective, there are not enough outlets for basic biological observations such as this, which can serve as the basis for novel and important hypotheses. It is comforting to see F1000Research promoting observational records!

I recommend that this observation be indexed once minor revisions are made to the article, which I highlight below:

1. The authors state that temperatures on the date of observation (16 June 2016) were cool relative to 3 other sampling dates. However, temperature data is not presented for 16 June (but is presented for 12 June). I would suspect that the temperature data for 12 June is not an accurate representation of those on 16 June. This can be rectified by including HOBO logger data for 16 June (if the authors have it) or by utilizing historical sea surface temperatures from online databases (e.g. DFO, NOAA, GoSL, etc.).
2. Aside from mentioning that some colour morphs are more sensitive to temperatures than others, the authors do not provide much in the way of context for why this species exhibits such tremendous variation in shell colour. What is the ecological and evolutionary benefit (or hindrance) of having such variation in shell colour? A brief mention of this in the introduction and/or discussion would be useful.
3. Although temperature means and their errors are reported in the abstract, I'm not a fan of downloading 4 separate Excel files of temperature data. I would suggest including a single graph of 24 h temperature recordings (or a bar chart of temperature means  $\pm$  SE) for each sampling date. This will help the reader visualize the differences in temperature between the date when purple morphs were observed and the dates they were not.
4. I think the authors can add some more discussion points to the Results and Discussion section. Some specific suggestions are highlighted below:
  - Some mention of the origin of purple morphs in eastern Canada would be nice. Do you think purple morphs have existed in eastern Canada for some time and were simply not observed until now? Or do you think this might be a consequence of ocean warming, with purple morphs moving to more northerly latitudes to avoid high temperatures? This is especially relevant given that the authors suggest that purple colour morphs do not fare well in higher temperatures.
  - Some additional suggestions for future research are also warranted. For example, targeted sampling over a given time period in which temperatures vary might give a more quantitative understanding of *N. lapillus* colour morphs on the shores of Nova Scotia. Such a project would not only provide a quantitative description of *N. lapillus* colour morphs in eastern Canada (which is currently lacking), but could also inform on spatial and temporal overlaps in *N. lapillus* colour morphs and lend field evidence for behavioural responses to temperature (which would complement the authors' suggestion of lab experiments well). Genetic testing could also provide evidence for the origin of these animals, advocating for or against a potential northward displacement in response to warming temperatures.

**Competing Interests:** No competing interests were disclosed.

**I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Author Response 14 Aug 2017

**Julius Ellrich**, St. Francis Xavier University, Canada

*The article by Ehlers & Ellrich qualitatively documents the first record of the Nucella lapillus purple morph on the east coast of Canada. The authors also relate the observations of this colour morph to temperature, suggesting that cooler temperatures may allow this color morph to become more active outside of rock crevasses.*

*I very much like this article. From my perspective, there are not enough outlets for basic biological observations such as this, which can serve as the basis for novel and important hypotheses. It is comforting to see F1000Research promoting observational records!*

*I recommend that this observation be published once minor revisions are made to the article, which I highlight below:*

We are pleased about the thoughtful assessment of our article and express our gratefulness in the Acknowledgements of our revised article. Below, we address the comments.

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*1. The authors state that temperatures on the date of observation (16 June 2016) were cool relative to 3 other sampling dates. However, temperature data is not presented for 16 June (but is presented for 12 June). I would suspect that the temperature data for 12 June is not an accurate representation of those on 16 June. This can be rectified by including HOBO logger data for 16 June (if the authors have it) or by utilizing historical sea surface temperatures from online databases (e.g. DFO, NOAA, GoSL, etc.).*

The temperature data recorded by our HOBO loggers were actually from the dogwhelk collection day (i.e. 16 June 2016), but not from the 12 June 2016. When compiling the temperature data for the supplementary material of the manuscript, we accidentally labeled these data wrong. We are apologizing for the confusion. However, we excluded the temperature information from our revised manuscript in favor of information (i.e. wave-exposure, presence of mussel patches and seaweed canopies) that explains the finding of the two purple colored dogwhelks more conclusively.

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*Aside from mentioning that some colour morphs are more sensitive to temperatures than others, the authors do not provide much in the way of context for why this species exhibits such tremendous variation in shell colour. What is the ecological and evolutionary benefit (or hindrance) of having such variation in shell color? A brief mention of this in the introduction and/or discussion would be useful.*

We included a brief statement on the consequences of shell color variation in the Introduction of the revised manuscript.

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*3. Although temperature means and their errors are reported in the abstract, I'm not a fan of downloading 4 separate Excel files of temperature data. I would suggest including a single graph of*

*24 h temperature recordings (or a bar chart of temperature means  $\pm$  SE) for each sampling date. This will help the reader visualize the differences in temperature between the date when purple morphs were observed and the dates they were not.*

In the revised manuscript, we replaced the temperature information by other environmental information as outlined above.

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*4. I think the authors can add some more discussion points to the Results and Discussion section. Some specific suggestions are highlighted below:*

*i. Some mention of the origin of purple morphs in eastern Canada would be nice. Do you think purple morphs have existed in eastern Canada for some time and were simply not observed until now? Or do you think this might be a consequence of ocean warming, with purple morphs moving to more northerly latitudes to avoid high temperatures? This is especially relevant given that the authors suggest that purple color morphs do not fare well in higher temperatures.*

We think that purple colored dogwhelks have simply not been reported for the Atlantic coast of Nova Scotia yet, because they are relatively rare compared to the large quantities of the brown and white colored individuals commonly found on this coast. Purple colored individuals having moved to more northerly latitudes in response to ocean warming appears unlikely, because dogwhelks have a restricted activity range (which lies within tens of meters), and lack pelagic larval dispersal (Crothers 1985).

To add another discussion point to Results & Discussion in the revised manuscript, we included a paragraph that discusses the environmental influences (i.e. wave-exposure, presence of mussel patches and seaweed canopies) that may favor the occurrence of the rare purple colored dogwhelks on the coast.

Crothers, J. H. 1985. Dog-Whelks: an introduction to the biology of *Nucella lapillus* (L.). *Field Studies*. 6: 299-360.

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*ii. Some additional suggestions for future research are also warranted. For example, targeted sampling over a given time period in which temperatures vary might give a more quantitative understanding of *N. lapillus* colour morphs on the shores of Nova Scotia. Such a project would not only provide a quantitative description of *n. lapillus* colour morphs in eastern Canada (which is currently lacking), but could also inform on spatial and temporal overlaps in *N. lapillus* colour morphs and lend field evidence for behavioural responses to temperature (which would complement the authors' suggestion of lab experiments well). Genetic testing could also provide evidence for the origin of these animals, advocating for or against a potential northward displacement in response to warming temperatures.*

We suggested future research examining dogwhelk activity patterns in relation to shell color and temperature in the Results & Discussion of the revised manuscript. As discussed above, we deem that northward movement of dogwhelks in response to warming temperatures is unlikely.

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**Competing Interests:** No competing interests were disclosed.

Referee Report 14 October 2016

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**Simon C. Courtenay**

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This note reports, for the first time, the presence of a rare colour morph (purple) of the dogwhelk (*Nucella lapillus*) near Halifax, Nova Scotia, Canada. This is an interesting observation which will be strengthened by two minor revisions to the presentation.

First, it would be helpful in the Abstract and Methods to indicate that dogwhelks were (presumably) sampled during low tide when they were exposed to the air rather than in water.

Secondly, temperature records are provided which would benefit from clarification. Judging from the range of temperatures, the temperature loggers were exposed to water during some of the tidal cycle and to air the rest of the time (i.e. they were placed in the intertidal). It would be helpful to know at what point in this temperature record the whelks were sampled. It might be that there are better measures of temperature to report than the daily average (and why do you report the sample size for temperatures recorded on one of your sample days (n=96) but not the other days? Should we assume the same n?). Also, the whelks were sampled on June 16, 2016 but the nearest temperature record is June 12, 2016. Yet the abstract talks about the temperature on the day of whelk sampling. Did I miss something?

Finally, it would be useful to report whether you archived these unusual specimens, and perhaps some of the more usual colour morphs, in case a future researcher wants to look at them for possible morphological differences from the more common colour morphs. You note that there are physiological differences. With that said, I am delighted that there is a place that basic biological observations like these can still be reported. Well done F1000Research!

**Competing Interests:** No competing interests were disclosed.

**I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Author Response 14 Aug 2017

**Julius Ellrich**, St. Francis Xavier University, Canada

*This note reports, for the first time, the presence of a rare colour morph (purple) of the dogwhelk (Nucella lapillus) near Halifax, Nova Scotia, Canada. This is an interesting observation which will be strengthened by two minor revisions to the presentation.*

We appreciate the positive feedback on our report and express our gratitude in the Acknowledgements. We address each comment below.

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*First, it would be helpful in the Abstract and Methods to indicate that dogwhelks were (presumably)*

*sampled during low tide when they were exposed to the air rather than in water.*

We added the information that dogwhelk collections and observations were done during low tide in the Abstract and Methods of the revised manuscript.

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*Secondly, temperature records are provided which would benefit from clarification. Judging from the range of temperatures, the temperature loggers were exposed to water during some of the tidal cycle and to air the rest of the time (i.e. they were placed in the intertidal). It would be helpful to know at what point in this temperature record the whelks were sampled. It might be that there are better measures of temperature to report than the daily average (and why do you report the sample size for temperatures recorded on one of your sample days (n=96) but not the other days? Should we assume the same n?).*

*Also, the whelks were sampled on June 16, 2016 but the nearest temperature record is June 12, 2016. Yet the abstract talks about the temperature on the day of whelk sampling. Did I miss something?*

As noted correctly by the reviewer, the temperature loggers recorded seawater temperature (while submerged) and air temperature (while emerged). The dogwhelks were collected/sampled within two hours around each low tide. The sample size of temperature recordings was identical for all days (n= 96 temperature recordings). The temperature recordings reported for the dogwhelk collection day were actually recorded by our temperature loggers on that day (i.e. 16 June 2016). Unfortunately, we labeled them wrong (i.e. 12 June 2016) when preparing the supplementary material for the manuscript. We apologize for the confusion. However, for the revised manuscript, we chose to replace the temperature information with other environmental information (i.e. wave-exposure and presence of dense mussel patches and seaweed canopies in Duncans Cove), as this information explains our findings of the purple colored dogwhelks more conclusively.

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*Finally, it would be useful to report whether you archived these unusual specimens, and perhaps some of the more usual colour morphs, in case a future researcher wants to look at them for possible morphological differences from the more common colour morphs. You note that there are physiological differences. With that said, I am delighted that there is a place that basic biological observations like these can still be reported. Well done F1000Research!*

Having collected thousands of dogwhelks in Nova Scotia over the years for manipulative experiments, we were very surprised when we discovered the two purple dogwhelks. We, thus, considered them as rare, and decided not to collect them. Instead, we took the picture (Fig. 1) to document our findings. However, we agree that archiving a collection of dogwhelk color morphs including purple individuals could be useful for future comparative studies. As we will continue our research on nonconsumptive predator effects using dogwhelks, we will take this opportunity to deposit a collection of dogwhelk color morphs in a zoological collection.

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**Competing Interests:** No competing interests were disclosed.