Reconstructing long-term limnological trends in phytoplankton and toxin production using paleogenomics and next generation sequencing


INTRODUCTION

- Lake Diefenbaker (LD):
  - Large multi-purpose reservoir (225-km long), formed in 1967, located in southern Saskatchewan, Canada.
  - Provides water for 45% of Saskatchewan residences (WSA 2012).
  - Local reports and concerns regarding increasing frequency and abundance of algal blooms and their potential impacts on water quality and usability.
  - Moderately eutrophic1 up-reservoir to oligo-mesotrophic down-reservoir2.

- Buffalo Pound Lake (BPL):
  - Provides water for 25% of Saskatchewan residences (WSA 2014).
  - Hepato- and neurotoxins were observed in water samples collected in the summer of 2014.
  - Naturally rich in nutrients (e.g. phosphate and nitrogen and dissolved organic carbon) which encourage the growth of phytoplankton (City of Regina Annual Report 2012).
  - Eutrophic1.

Objectives:
- Reconstruct historical trends of the phytoplankton community in both reservoirs.
- Identify potential invasive and harmful cyanobacterial species.
- Identify toxin producing genes if known toxin-producers are present.

MATERIALS & METHODS

Sediment Collection and Sectioning – Sediment cores were collected from the Gardiner arm (red), and Qu’Appelle arm (yellow) from LD (summer of 2011) and BPL (green, fall of 2013) (Figure 1). Samples were sectioned at 1-cm increments.

Genomic DNA (gDNA) was extracted from 1-g of sediment (wet wt.) from each 1-cm increment using EZNA Soil DNA kits.

PCR amplification of the 23S rDNA was accomplished using modified primer pairs P23SrV_f1 and P23SrV_r1 with Illumina recommended overhangs.

Sequencing was completed using a MiSeq Desktop Sequencer.

Trimming and selection of high-quality sequences were performed using the Mothur software package (v 1.33.3). Only sequences between 440 and 460 bp in length with no ambiguous bases were retained. These sequences were then identified using Blast2GO (v 2.7.2) in the non-redundant database.

PRELIMINARY RESULTS AND DISCUSSION

GENOMIC DNA CONCENTRATION AND PURITY

- gDNA was successfully extracted throughout each sediment core.
- Increasing concentration of total extracted gDNA in more recent sediments.
- DNA purity was relatively conserved in all sediment increments with average 260/280 absorbances of:
  - BPL – 1.85
  - LD: Gardiner arm – 1.79
  - LD: Qu’Appelle arm – 1.65

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REFERENCES

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