

# A simple NPZD model for Llanquihue Lake

You

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## Abstract

In the present study, a mathematical model (NPZD) based on the four compartments Nutrient (N), Phytoplankton (P), Zooplankton (Z) and Detritus (D), is proposed for understanding the ecology of shallow coastal lagoons. Model is simulated for the two cases of detritus link with the system: i) through remineralization and ii) through remineralization and palatability of detritus to zooplankton.

## 1 Introduction

Un modelo biogeoquímico es una representación simplificada y matemática de los procesos biológicos, geológicos y químicos que ocurren en los ecosistemas. Estos modelos se utilizan para comprender y simular los flujos de energía, nutrientes y elementos químicos a través de los sistemas naturales, como los océanos, bosques, suelos y cuerpos de agua. Los modelos biogeoquímicos integran información sobre los ciclos biogeoquímicos, que incluyen procesos como la fotosíntesis, la descomposición, la respiración, la fijación de nitrógeno, la lixiviación de nutrientes y la deposición atmosférica. Estos modelos tienen en cuenta las interacciones entre los diferentes componentes del sistema, como las plantas, los animales, los microorganismos, los suelos y la atmósfera. Los modelos biogeoquímicos son herramientas poderosas para predecir los efectos del cambio ambiental, como el cambio climático, la contaminación y la deforestación, en los ciclos biogeoquímicos y en la salud de los ecosistemas. También se utilizan para evaluar la eficacia de las estrategias de gestión y conservación, y para informar la toma de decisiones en la gestión de recursos naturales.

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## 2 Formulacion del modelo

### 2.1 Modelos NPDZ

El modelo NPZ captura los procesos fundamentales que rigen el crecimiento y las interacciones entre estos compartimentos clave. Considera variables como la disponibilidad de nutrientes, la presión de pastoreo y las tasas de crecimiento del fitoplancton, brindando una representación simplificada pero valiosa de la dinámica de los ecosistemas pelágicos. Este modelo ha sido adaptado y aplicado en diversos entornos marinos, proporcionando información crucial sobre el funcionamiento de las comunidades planctónicas y sus respuestas a los cambios ambientales.

Simply use the section and subsection commands, as in this example document! With Overleaf, all the formatting and numbering is handled automatically according to the template you've chosen. If you're using Rich Text mode, you can also create new section and subsections via the buttons in the editor toolbar.

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First you have to upload the image file from your computer using the upload link in the file-tree menu. Then use the `includegraphics` command to include it in your document. Use the figure environment



Figure 1: This frog was uploaded via the file-tree menu.

Region	Lagos Quantity
Decima	5
Undecima	7

Table 1: Numero de lagos por region.

and the caption command to add a number and a caption to your figure. See the code for Figure 1 in this section for an example.

Note that your figure will automatically be placed in the most appropriate place for it, given the surrounding text and taking into account other figures or tables that may be close by. You can find out more about adding images to your documents in this help article on [including images on Overleaf](#).

## 2.3 How to add Tables

Use the table and tabular environments for basic tables — see Table 1, for example. For more information, please see this help article on [tables](#).

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## 2.5 How to add Lists

You can make lists with automatic numbering ...

1. Like this,
2. and like this.

... or bullet points ...

- Like this,
- and like this.

## 2.6 How to write Mathematics

L<sup>A</sup>T<sub>E</sub>X is great at typesetting mathematics. Let  $X_1, X_2, \dots, X_n$  be a sequence of independent and identically distributed random variables with  $E[X_i] = \mu$  and  $\text{Var}[X_i] = \sigma^2 < \infty$ , and let

$$S_n = \frac{X_1 + X_2 + \dots + X_n}{n} = \frac{1}{n} \sum_i^n X_i$$

denote their mean. Then as  $n$  approaches infinity, the random variables  $\sqrt{n}(S_n - \mu)$  converge in distribution to a normal  $\mathcal{N}(0, \sigma^2)$ .

## 2.7 How to change the margins and paper size

Usually the template you're using will have the page margins and paper size set correctly for that use-case. For example, if you're using a journal article template provided by the journal publisher, that template will be formatted according to their requirements. In these cases, it's best not to alter the margins directly.

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## 2.8 How to change the document language and spell check settings

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## 2.9 How to add Citations and a References List

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## 2.10 Good luck!

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