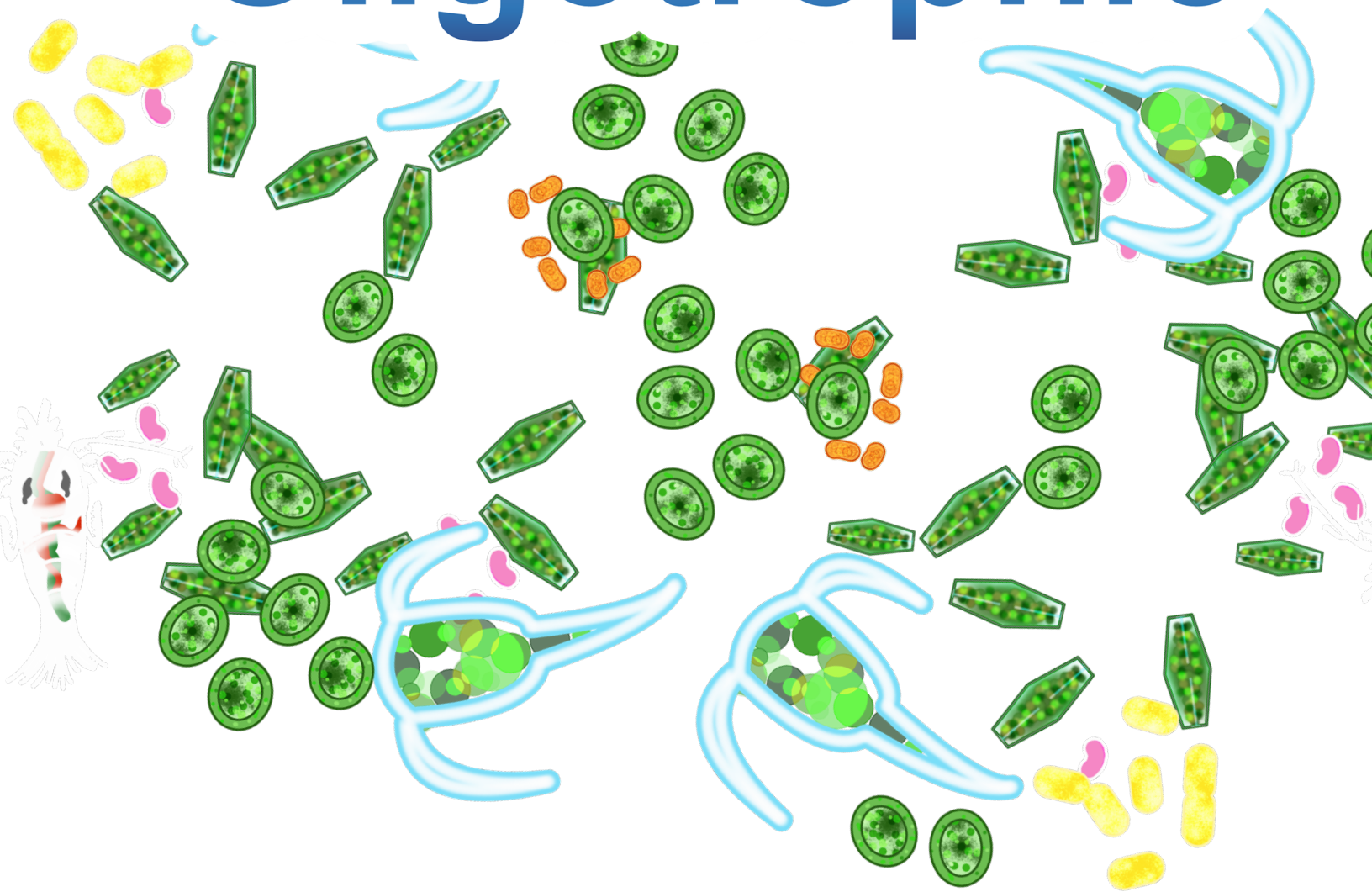
Supplemental - 8 -Game and Rules.pdf

This supplemental file contains the files needed to play *Oligotrophic*. A print friendly (low ink) version is available on the websites linked in the paper.

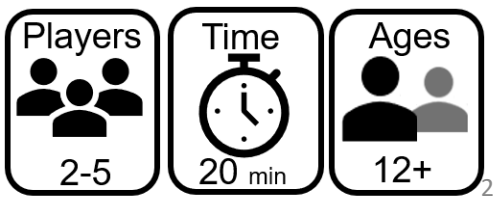
A second version of *Oligotrophic*, called *Tiny Oligotrophic* is also available and can be found in Supplemental 9. *Tiny Oligotrophic* is a simplified version of the game that is easier to learn and play.

Page	Contents
1	Description & Table of Contents
2-13	Oligotrophic Rulebook
14-21	Oligotrophic Cards
22	Oligotrophic Card Backs (optional)

Oligotrophic



Oligotrophic: an adjective used to describe bodies on water that are low in nutrients. Many of the organisms in this game are based of those found in the oligotrophic Sargasso Sea.



Goal to win: Start your turn with 5 or less of your 20 biomass cubes off of the board.

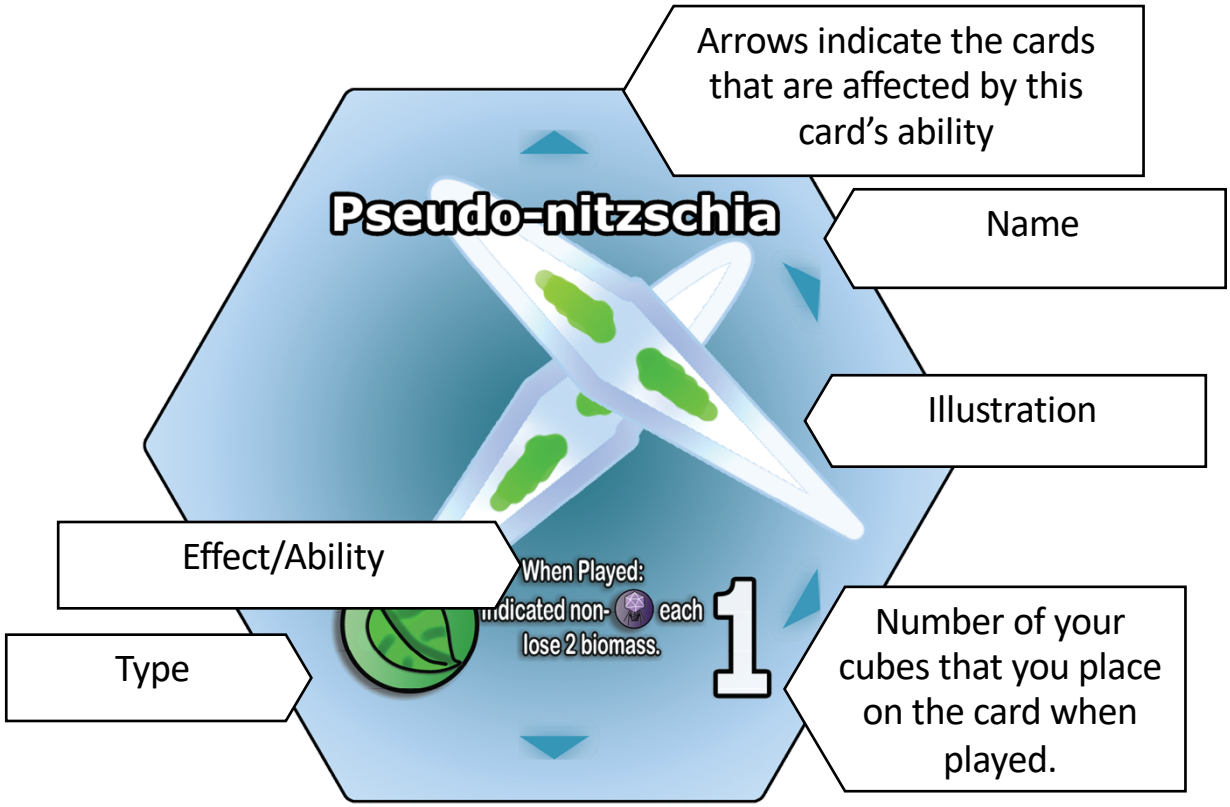
Table of Contents:

1 – Intro
2 – This page!
3 – Card intro
4-5 – Set up
6-8 – Example of play
9 – Turn breakdown
10 – FAQ
11 – Card type review
12 – Acknowledgments

Contents:

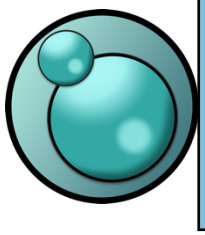
100 cubes (20 of 5 different colors)
48 Hexagonal Cards
1 Instruction book

Cards:

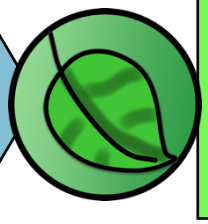


When Played:
Blue arrows only matter at the time that card is played

Ongoing:
Red arrows may affect other cards when they are played and while they are in play.



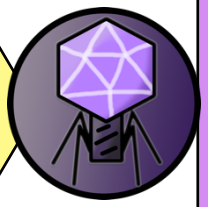
Abiotic
These are chemicals and processes that can be turned into biomass.



Phototrophs
These are organisms that use photosynthesis to turn atmospheric carbon into their biomass.



Heterotrophs
These are organisms that get energy by consuming biomass, either from debris or other organisms



Viruses
These are non-living entities that use living organisms to make more copies of themselves.

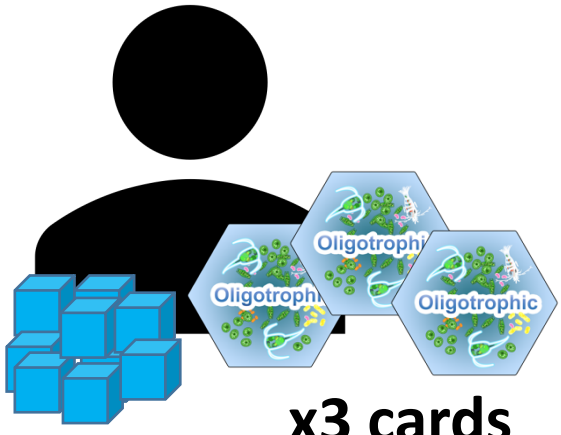
How to win the game:

Star your turn 5 or less biomass (cubes). The others being on the board.

Game Setup:

- Give each player 20 cubes in a color of their choice.
- Shuffle all of the cards and place them face down, forming a deck.
- Set the top card of the deck face up next to the deck, that can be played by any player on their turn
- Deal each player 3 cards.

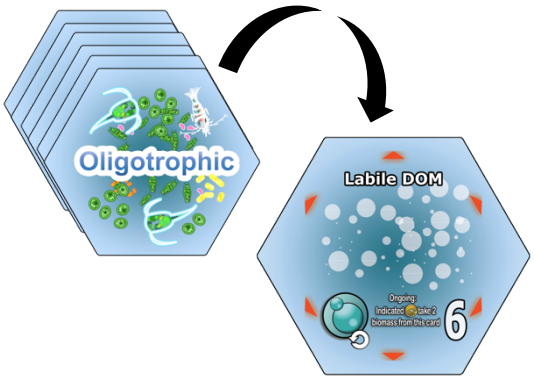
Each player:



x20 cubes

x3 cards

To the side of the play area:

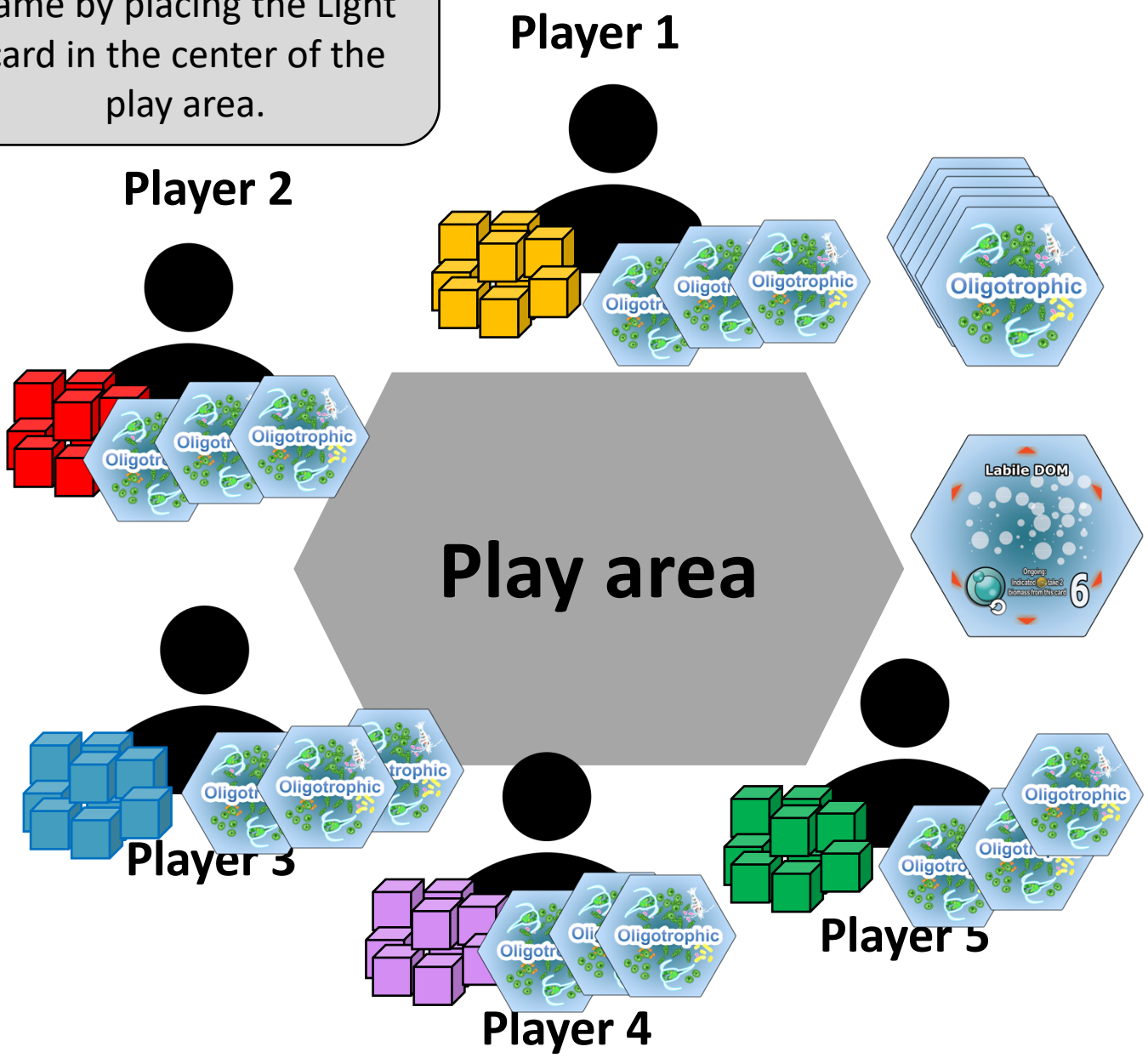


Then choose a starting player! You can do this randomly, or you can start with the last person who has done something related to microbes or visited the ocean.

Set up the play area:

- Each player has:
    - 3 cards
    - 20 “biomass cubes” of your color
- Extra cards are shuffled and face down in a deck
- One “communal card” drawn from the deck and turned face up.

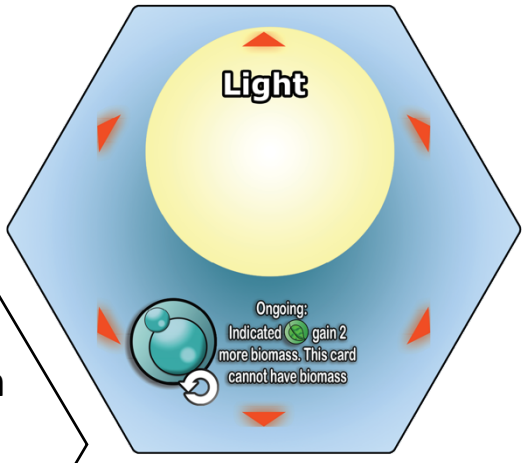
Optional Rule: Start the game by placing the Light card in the center of the play area.



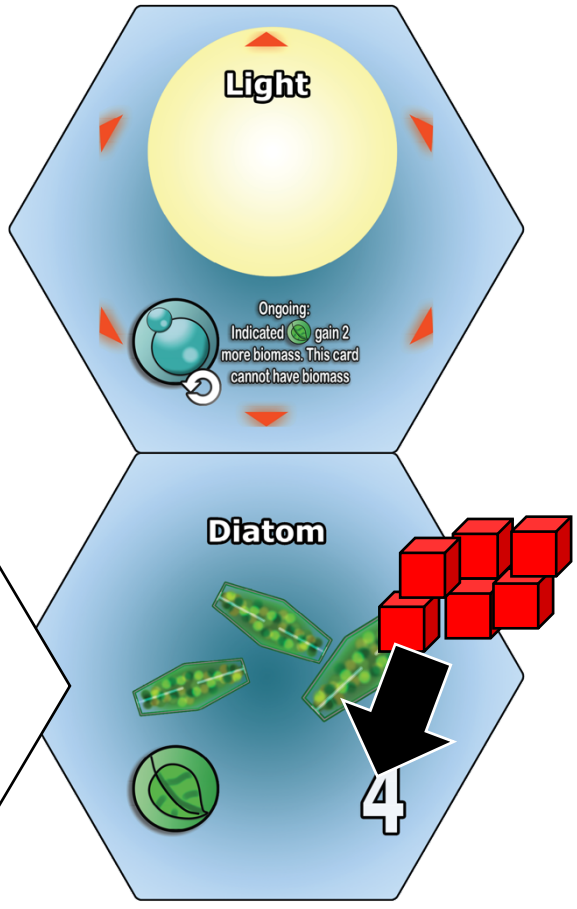
- Take turns going clock-wise.
- On your turn, choose to play a card from your hand or the face up card. Immediately replace it with the top card from the deck.

Example of how to play:

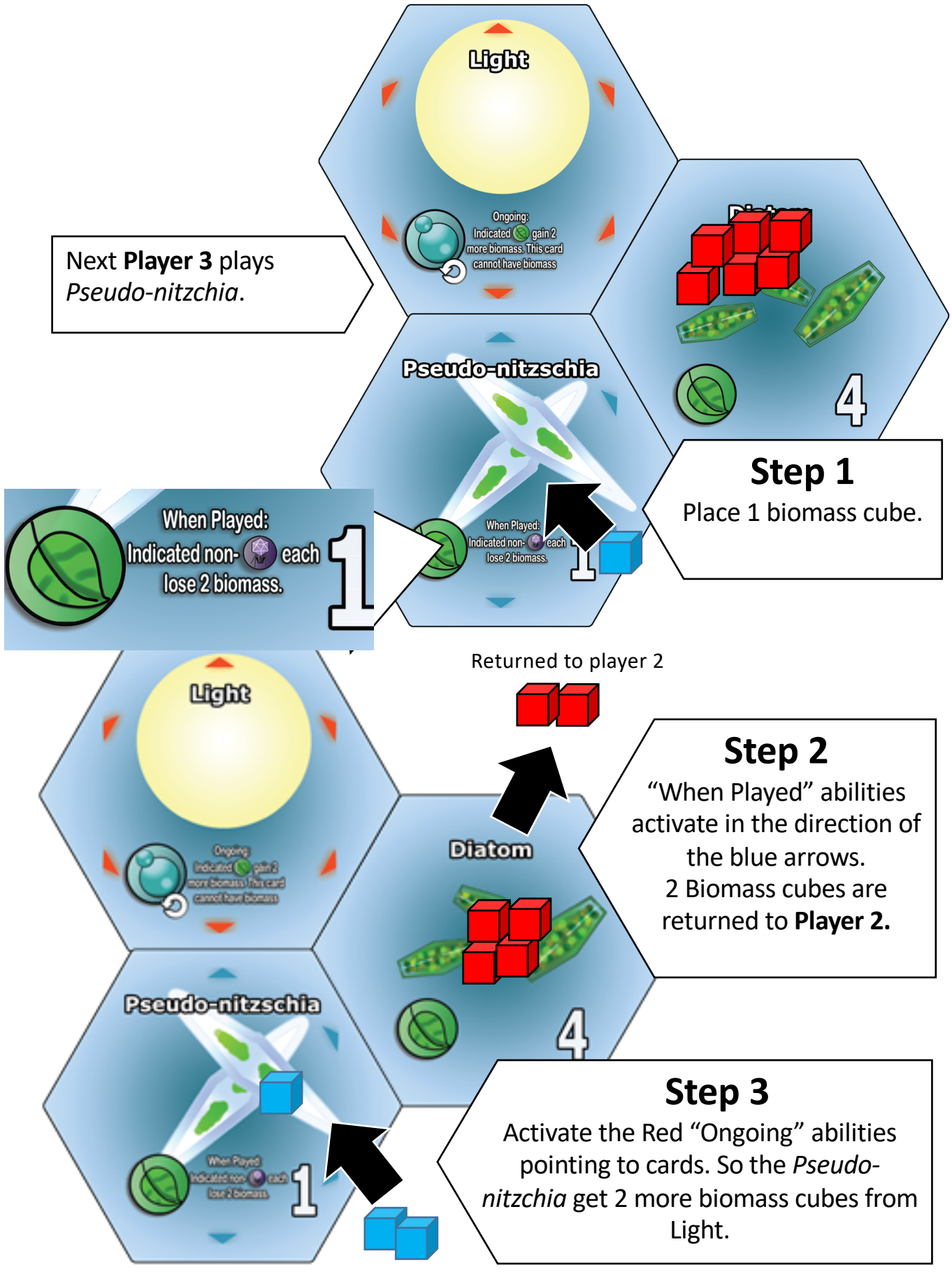
Player 1 plays light. It has no biomass so they do not place any of their biomass cubes.

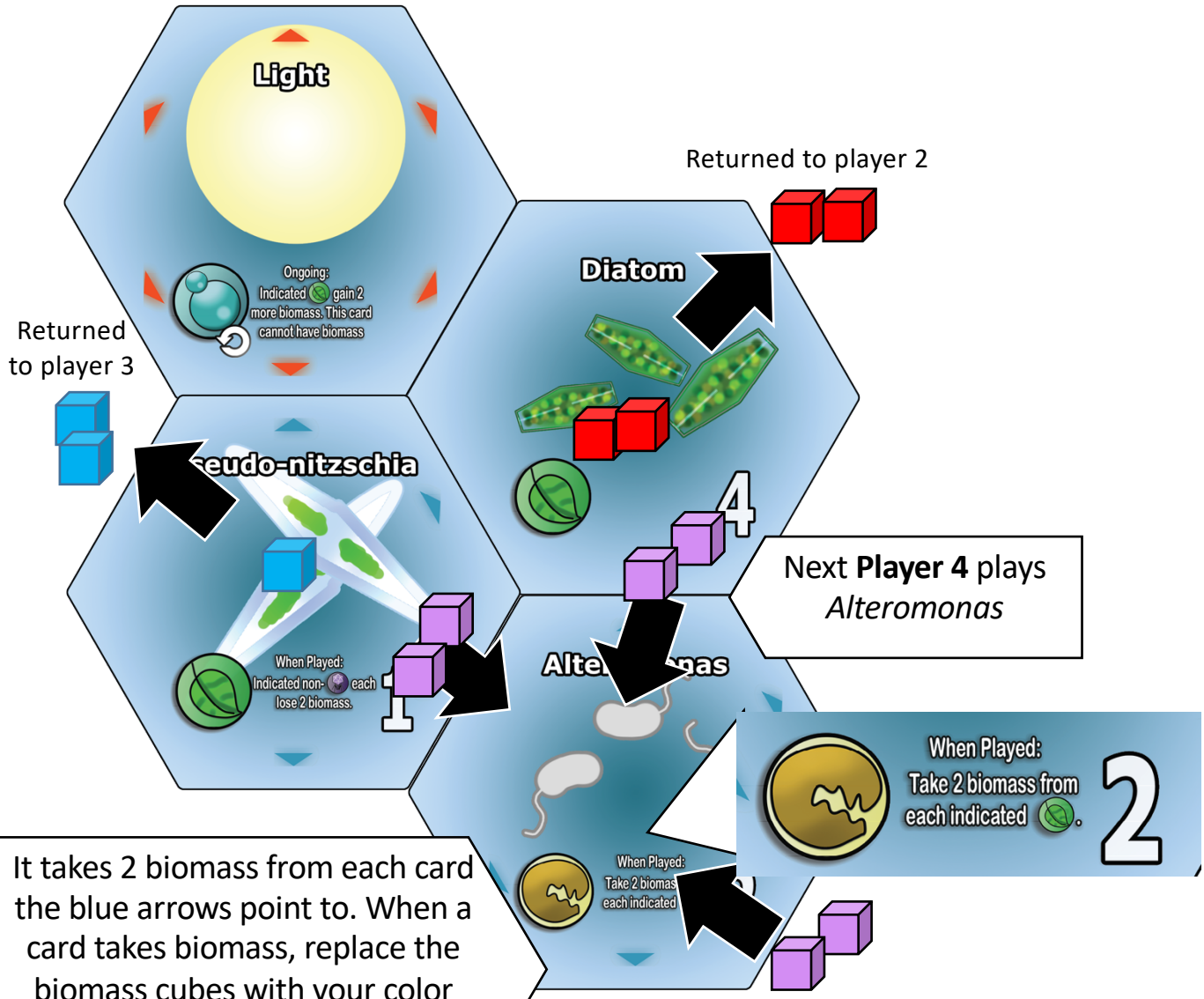


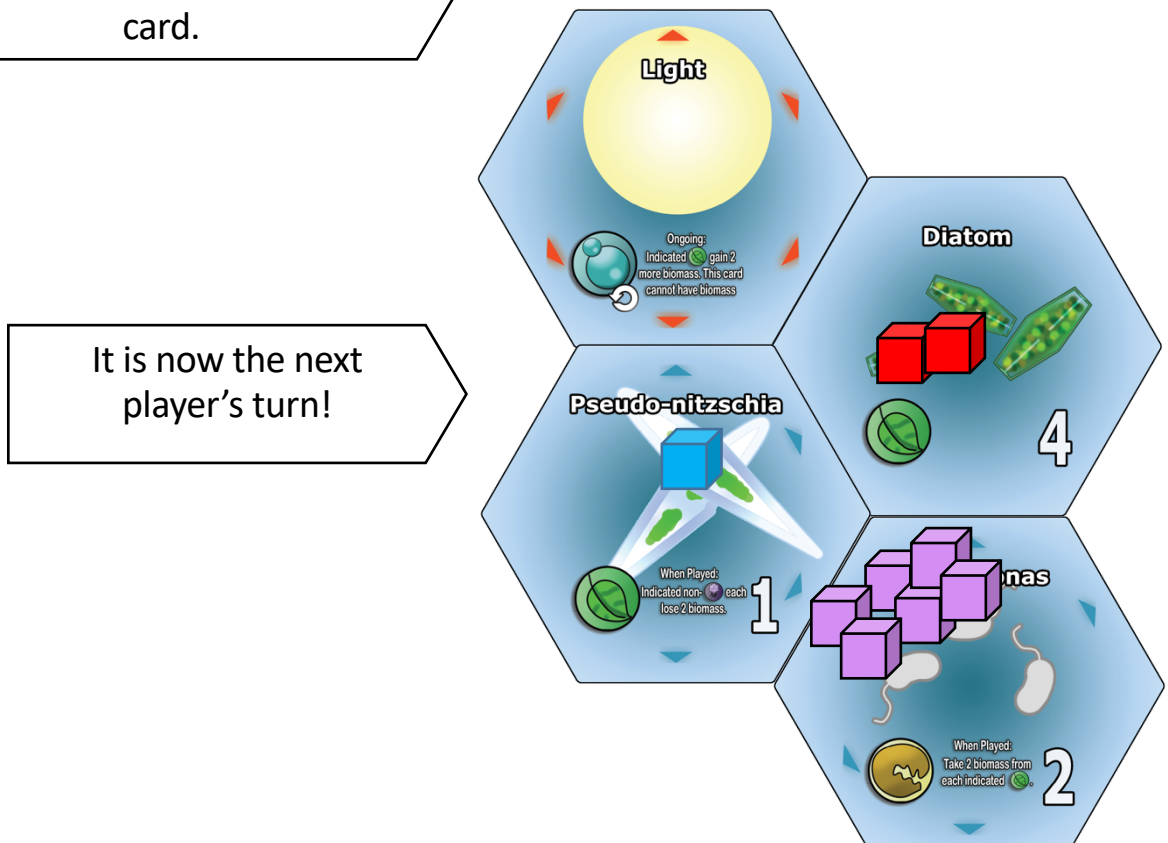
Optional Rule: You can start the game with the Light card already in play. This demonstrates that in the ocean light is central to all biological processes.



Next, **Player 2** plays Diatoms. They place 4 biomass on the Diatoms card and then add 2 more because of the ongoing effect of sunlight (indicated by the red arrows). They then draw a card to replace the card they just played.


Light
Ongoing:
Indicated gain 2
more biomass. This card
cannot have biomass
Pseudo-nitzschia
When Played:
Indicated non- each
lose 2 biomass.
1
4
Next **Player 3** plays *Pseudo-nitzchia*.
Step 1
Place 1 biomass cube.
Returned to player 2
Step 2
"When Played" abilities activate in the direction of the blue arrows.
2 Biomass cubes are returned to **Player 2.**
Diatom
Step 3
Activate the Red "Ongoing" abilities pointing to cards. So the *Pseudo-nitzchia* get 2 more biomass cubes from Light.


Light
Ongoing:
Indicated gain 2 more biomass. This card cannot have biomass
Returned to player 2
Diatom
4
Returned to player 3
eudo-nitzschia
When Played:
Indicated non- each lose 2 biomass.
Next **Player 4** plays *Alteromonas*
When Played:
Take 2 biomass from each indicated
2
It takes 2 biomass from each card the blue arrows point to. When a card takes biomass, replace the biomass cubes with your color before you move them to your card.


Light
Ongoing:
Indicated gain 2 more biomass. This card cannot have biomass
Diatom
4
It is now the next player's turn!
Pseudo-nitzschia
When Played:
Indicated non- each lose 2 biomass.
1
When Played:
Take 2 biomass from each indicated
2

Here's what you do on your turn:

Check to see if you have 5 or less biomass cubes in front of you, if you do you win!

1. Play one card from your hand or the face up card to the side of the play area.
2. Place the card so at least one of its edges is touching another card that is in play. (Ignore this rule if it is first card to be played).
3. Place cubes on the card equal to its starting biomass.
4. Blue arrows indicate which adjacent cards are effected by "When Played effects" .
    - These take effect only when the card is first played.
    - When a player takes biomass, they exchange the cube they take with their own
5. Red arrows indicate which adjacent cards are effected by "Ongoing."
    - These take effect anytime and adjacent card it is pointing to gains any biomass.
    - This may result in a chain of ongoing abilities activating.
6. Your turn is over, draw a new card from the deck. The next player takes their turn.

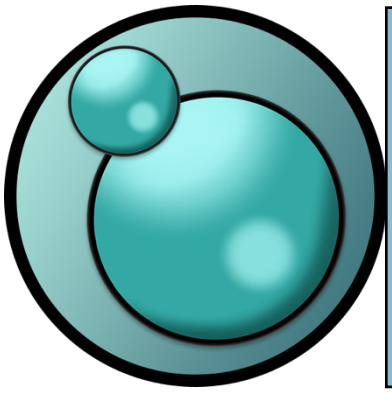
FAQ:

Q: What happens if a card that was in play gains biomass cubes, but has no biomass cubes currently, who puts cubes on it?

A: In this case the players whose cubes move to it first uses cubes of their color.

Q: If there are multiple Ongoing effects that take effect, what order do they occur in?

A: Start with abilities that give biomass, then lose biomass, then take biomass. If there is more than one of these that would occur the player whose turn it is decides the order to resolve the effects.



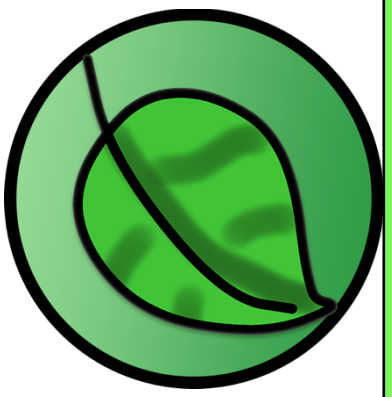
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These are organisms that use photosynthesis to turn atmospheric carbon into their biomass.



Viruses

These are non-living entities that use living organisms to make more copies of themselves.

Note:

While the authors made an attempt to keep the game as accurate as possible to interactions known to occur in nature, there are some discrepancies in the interactions of certain cards. This was done to allow for greater biodiversity in the cards than would have been otherwise possible, and to improve gameplay. The authors encourage the players to research each of the organisms represented in this game to gain a greater understand of each of their roles in the marine ecosystem.

Designer: Quinn Washburn
Art & Layout: Quinn Washburn
Editors: Chris Suffridge, Sarah Wolf, & Stephen Noell
Lesson Plan Development: Chris Suffridge, Sarah Wolf, Stephen Noell, Chih-Ping Lee, Luis Bolaños, Jay Well, and Stephen Giovannoni.

This project was created with the intent for use for both public outreach and for OSU Science and Math Investigative Learning Experiences (SMILE) Program. The Giovannoni Lab supports SMILE through National Science Foundation (NSF) grants used to fund the development of educational content as well as funding teachers' attendance to workshops to help support teacher in using the educational content. Support was provided through the following NSF grants to Steve Giovannoni: Dissolved Organic Carbon Cycling by SAR11 Marine Bacteria, OCE-1436865, and Dimensions Collaborative Research: Unraveling thiamin cycling complexity and impacts on microbial networks DEB 1639033.

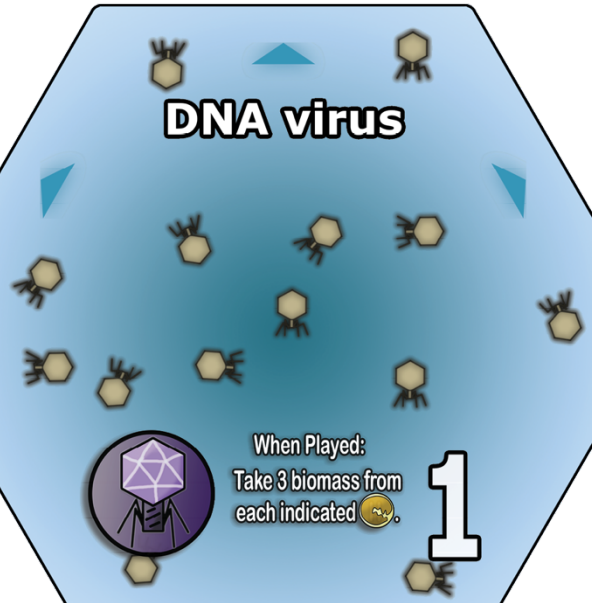
Abundant virus



When Played:
Take 3 biomass from each indicated .

1

DNA virus



When Played:
Take 3 biomass from each indicated .

1

Erythrobacter



Ongoing:
Gain 1 extra biomass for each indicated .

2

Dinoflagellate



When Played:
Take 1 biomass from each indicated & .

3

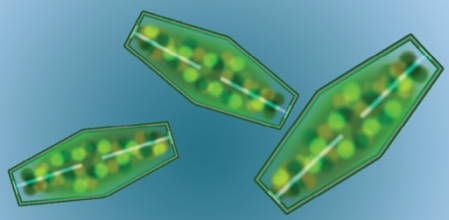
Emiliania huxleyi



Ongoing:
Ignore all effects (both good & bad) from indicated cards.

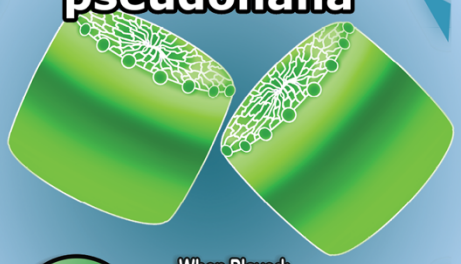
3

Diatom



4

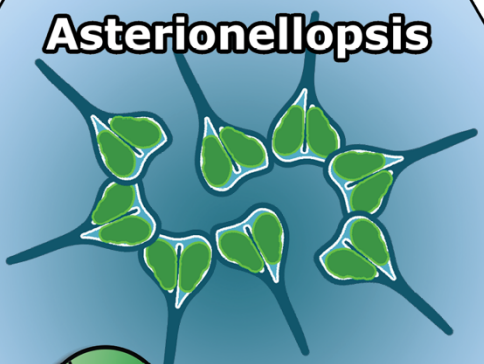
Thalassiosira pseudonana



When Played:
Gain 1 more biomass for each indicated .

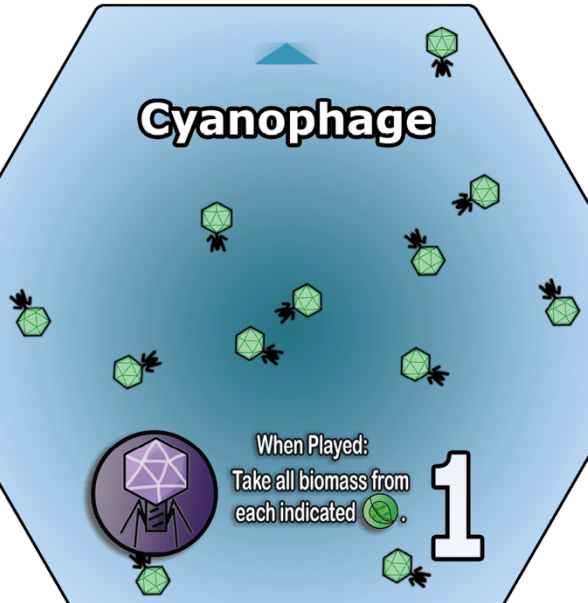
2

Asterionellopsis



4

Cyanophage



When Played:
Take all biomass from each indicated .

1

Arsenic

As

Ongoing:
Indicated & each lose 1 biomass.

3

Choanoflagellate



When Played:
Take all biomass from each indicated .

1

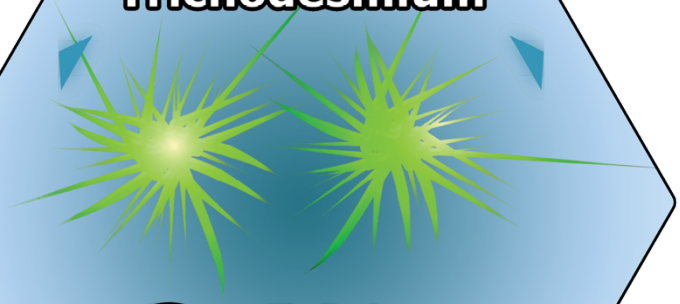
Alteromonas



When Played:
Take 2 biomass from each indicated .

2

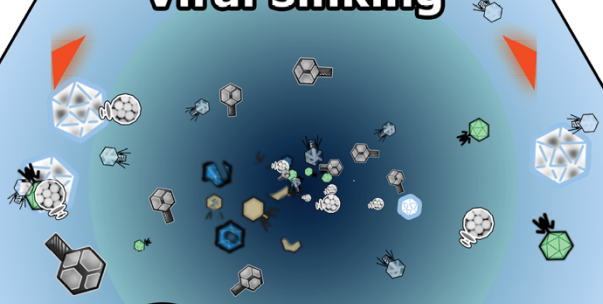
Trichodesmium



When Played:
Indicated non- gain 2 more biomass.

1

Viral sinking



Ongoing:
Take all biomass from each indicated .

0

Viral degradation



Ongoing:
Take all biomass from the indicated .

0

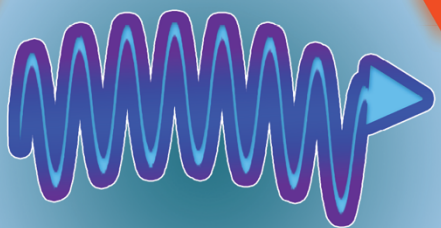
Vibrio



When Played:
Take 1 biomass from each indicated & .

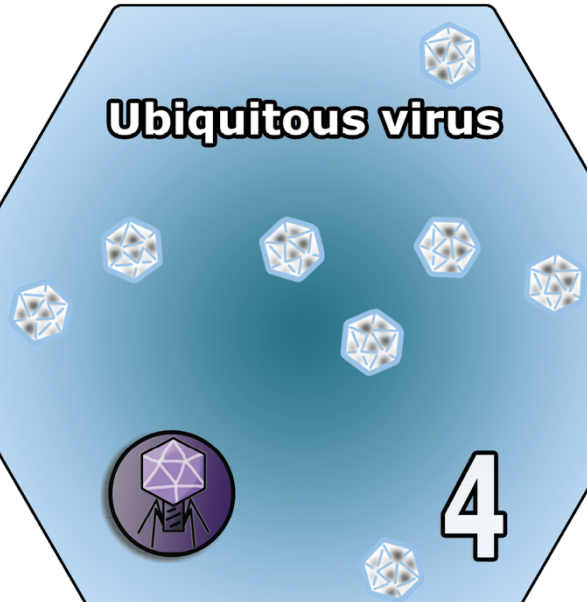
0

UV light



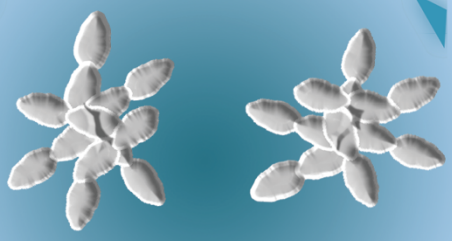
Ongoing:
Move 3 biomass from each indicated to any indicated or . This card cannot have biomass.

Ubiquitous virus



4

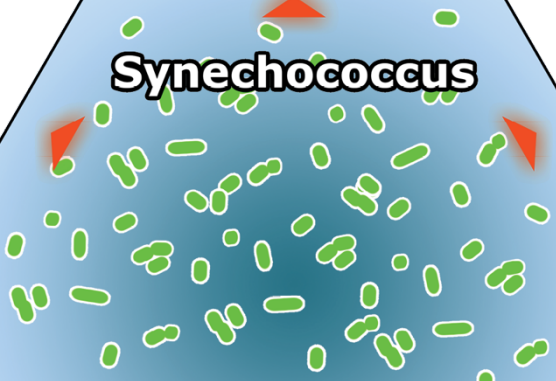
Roseobacter



When Played:
Gain 1 extra biomass for each indicated .

3

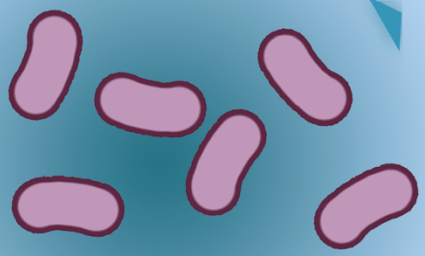
Synechococcus



Ongoing:
When biomass would be gained by this card, gain 1 extra biomass.

3

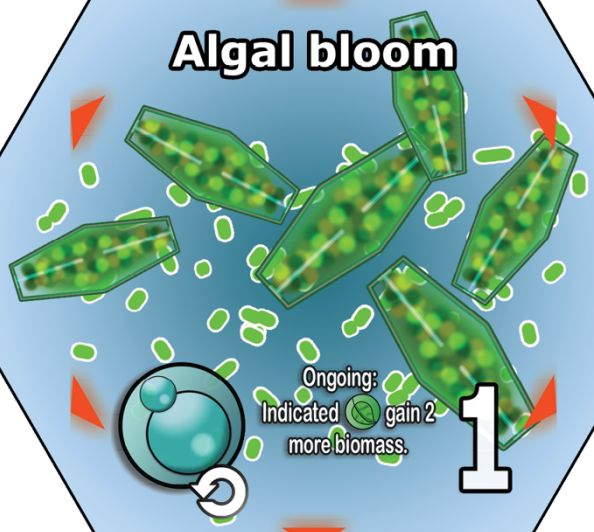
SAR86



When Played:
Take 1 biomass from each indicated .

2

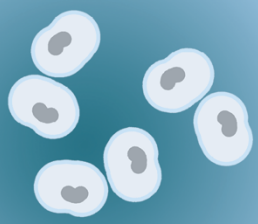
Algal bloom



Ongoing:
Indicated gain 2 more biomass.

1

SAR202



When Played:
Take all biomass from each indicated .

2

SAR11



Ongoing:
Gain 1 extra biomass for each indicated .

4

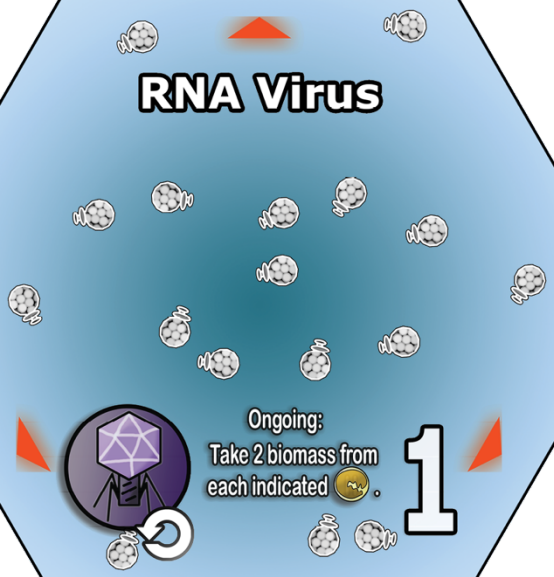
Phosphorus

P

Ongoing:
Indicated take 1 biomass from this card.

4

RNA Virus



Ongoing:
Take 2 biomass from each indicated .

1

Recalcitrant DOM

Ongoing:
Indicated take 1 biomass from this card.

5

Pseudo-alteromonas



When Played:
Each indicated lose 1 biomass.

3

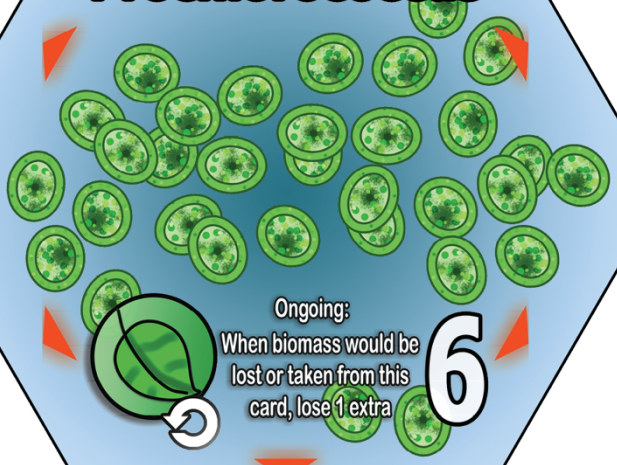
Pseudo-nitzschia



When Played:
Indicated non- each lose 2 biomass.

1

Prochlorococcus



Ongoing:
When biomass would be lost or taken from this card, lose 1 extra

6

Multi-host virus



When Played:
Take all biomass from each indicated .

1

Phosphorus

P

Ongoing:
Indicated take 1 biomass from this card.

4

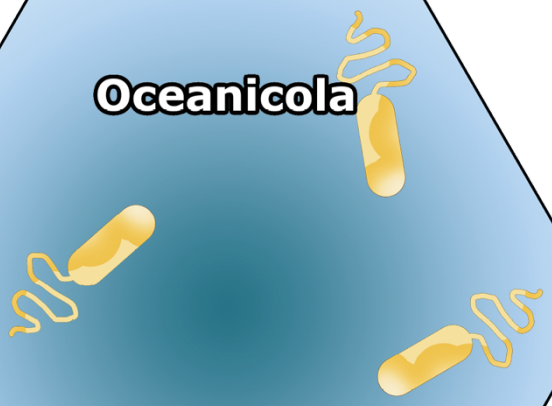
Alcanivorax



When Played:
Take 3 biomass from each indicated .

1

Oceanicola



4

Nitrogen

N

Ongoing:
Indicated take 2 biomass from this card

6

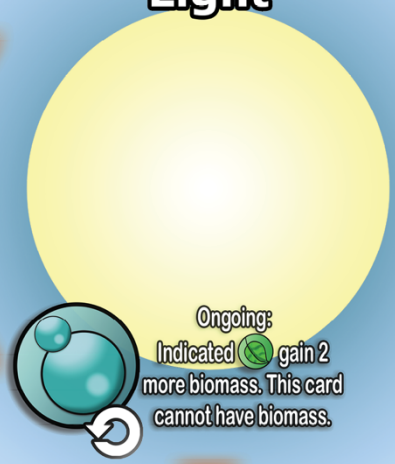
Nitrogen

N

Ongoing:
Indicated take 2 biomass from this card.

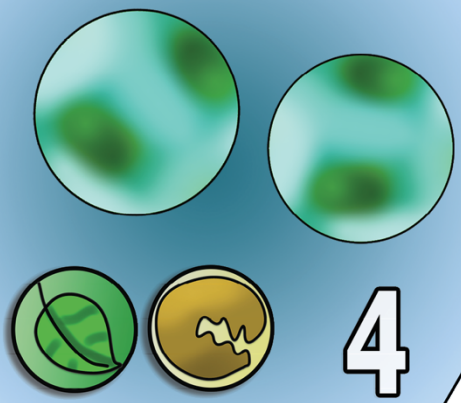
6

Light



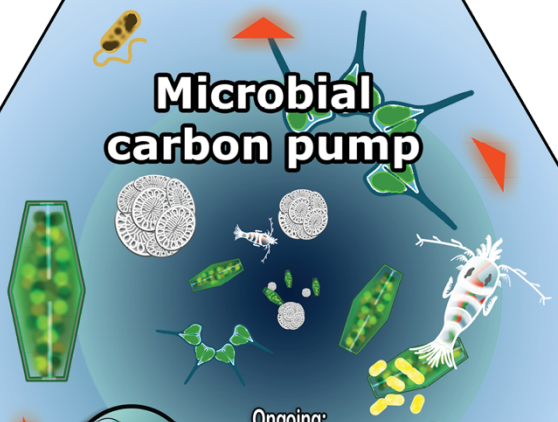
Ongoing:
Indicated gain 2 more biomass. This card cannot have biomass.

Mixotroph



4

Microbial carbon pump



Ongoing:
Take all, but 1, biomass from each indicated & .

0

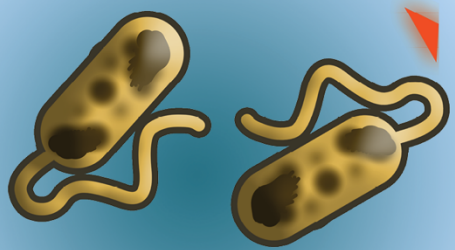
Membraned virus



Ongoing:
Take 1 biomass from each indicated & .

1

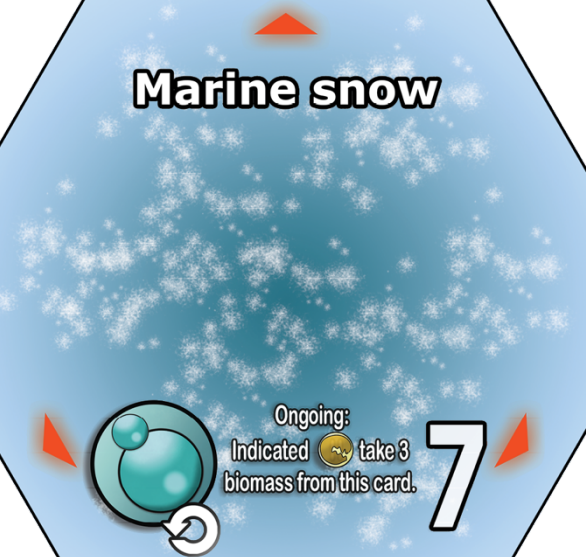
Marinobacter



Ongoing:
Take 1 biomass from each indicated card.

2

Marine snow



Ongoing:
Indicated take 3 biomass from this card.

7

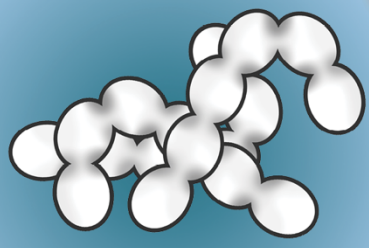
Flavobacteria



When Played:
Take 2 biomass from each indicated card.

2

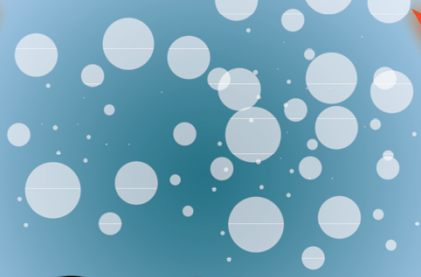
Actinobacteria



Ongoing:
When biomass would be lost or taken from this card, reduce it by 1.

3

Labile DOM



Ongoing:
Indicated take 2 biomass from this card.

6

Iron

Fe

When Played:
Indicated gain 3 more biomass.

2

Host-specific virus



When Played:
Take all biomass, but 1, from each indicated .

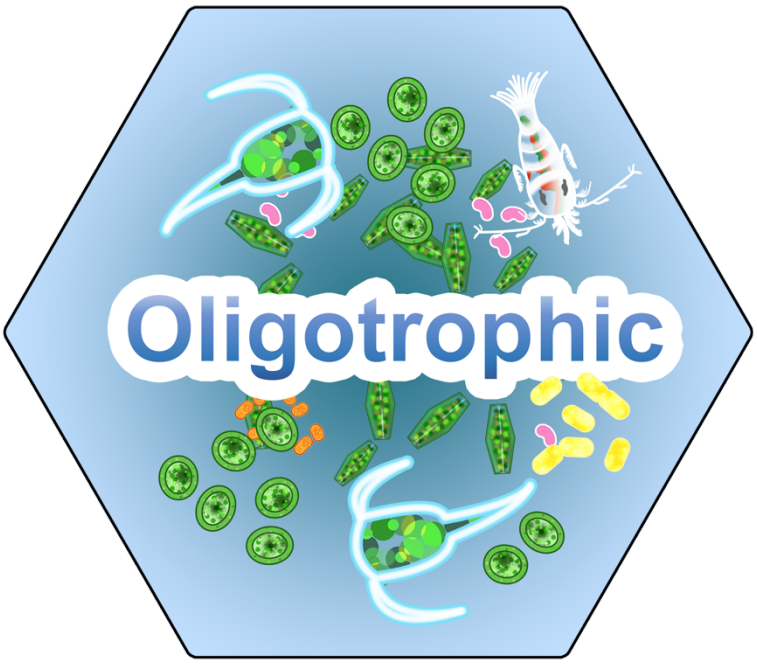
1

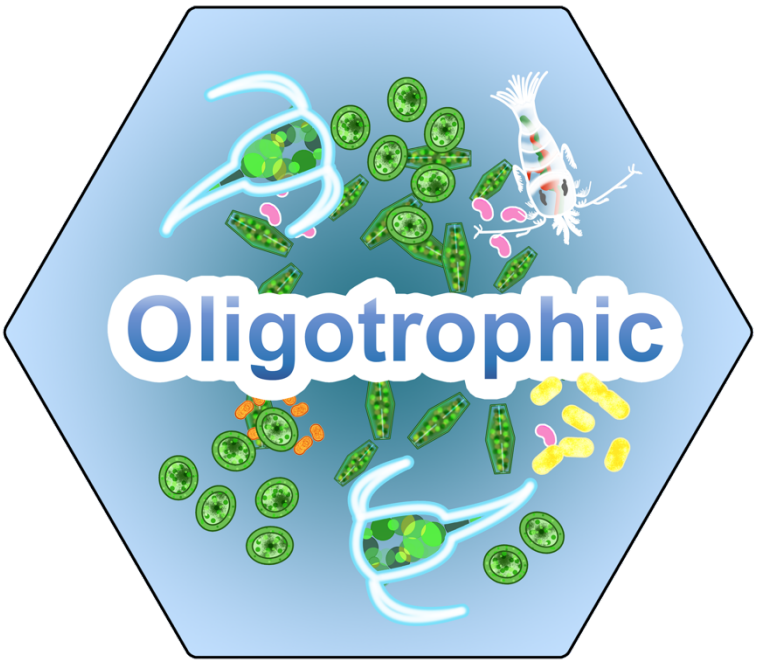
Herbivorous copepod

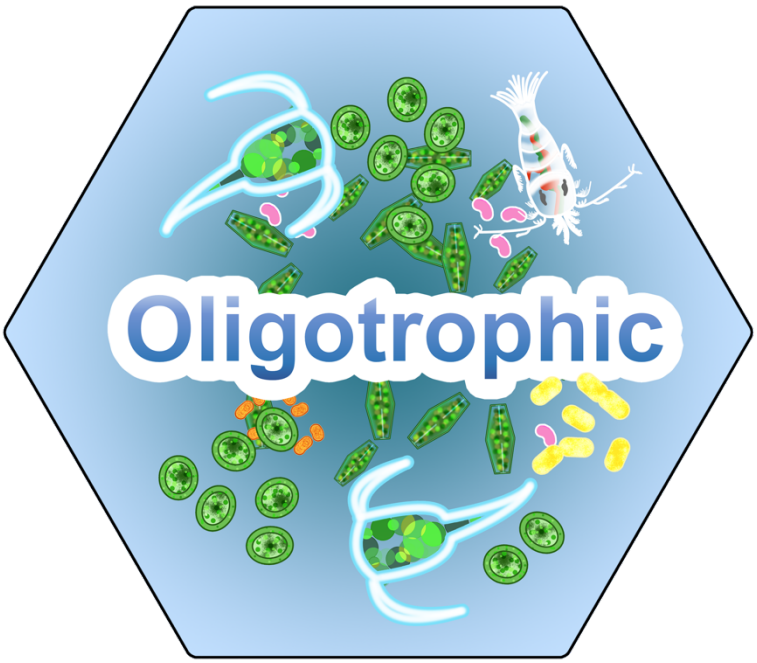


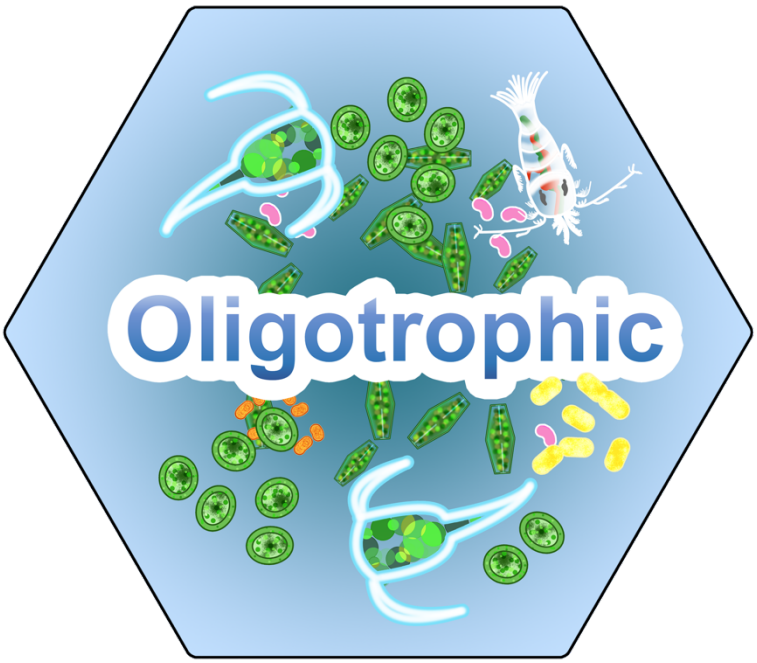
When Played:
Take all biomass from each indicated .

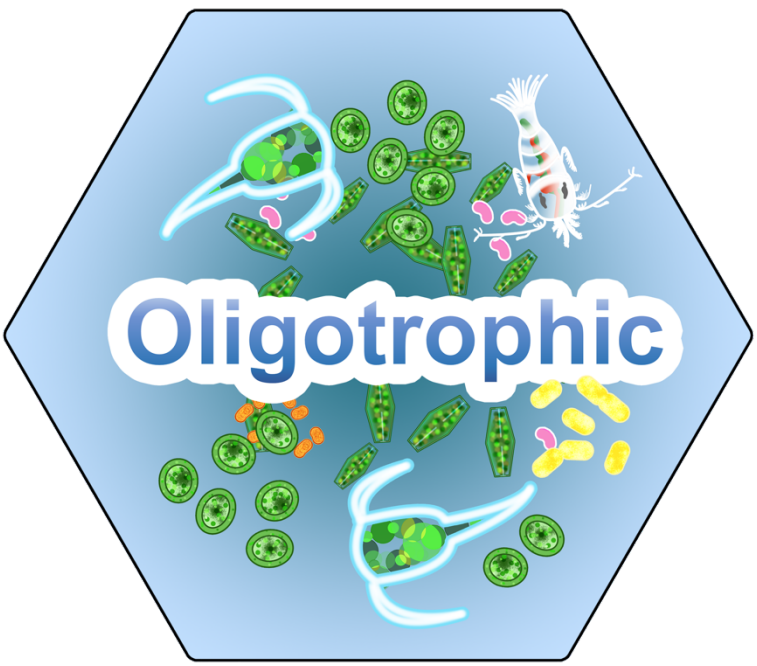
1

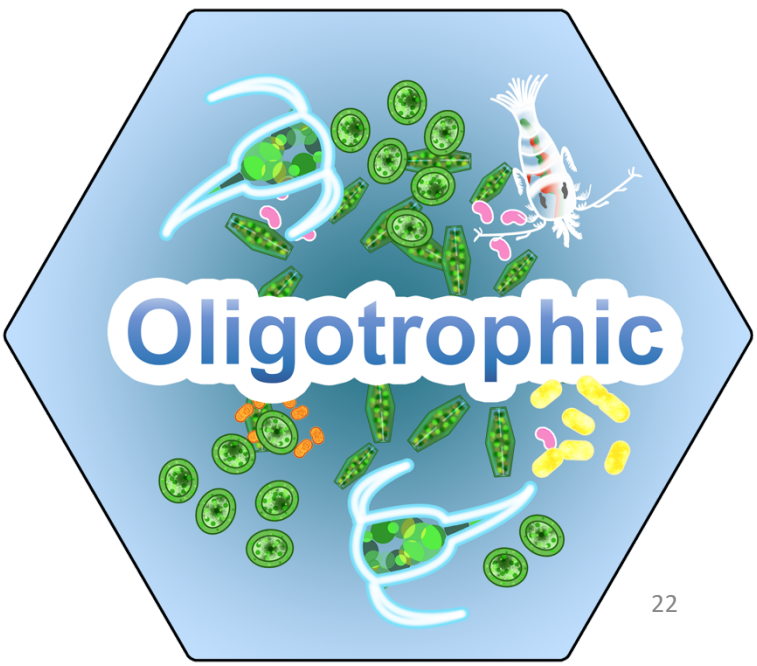

Oligotrophic


Oligotrophic


Oligotrophic


Oligotrophic


Oligotrophic


Oligotrophic