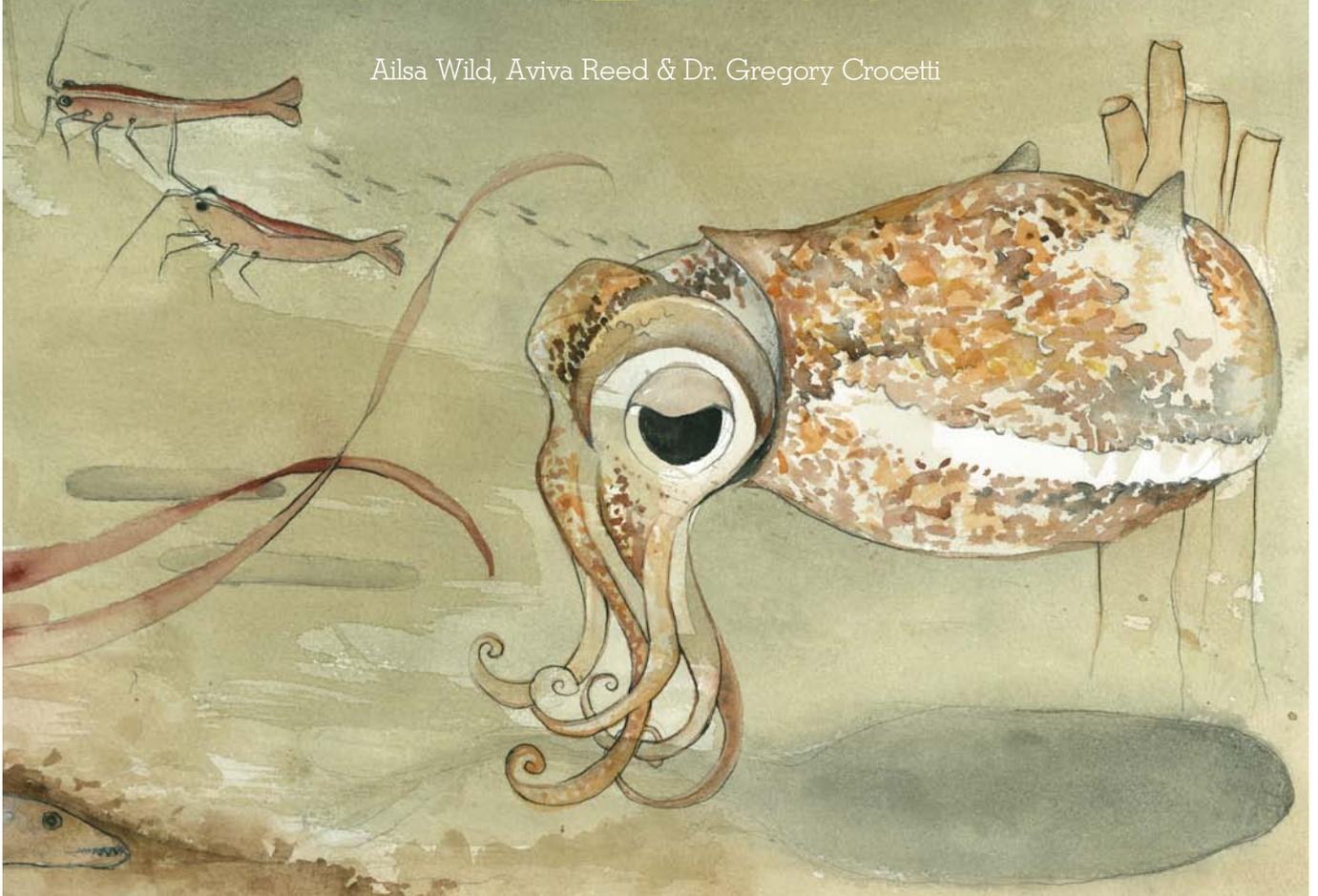


THE SQUID, THE VIBRIO & THE MOON

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PARTNER-PREDATOR-PREY A FOOD WEB ROLE-PLAYING CARD GAME

PARTNER-PREDATOR-PREY

A FOOD WEB GAME BASED ON THE SQUID, THE VIBRIO & THE MOON

WHAT IS A FOOD WEB?

All creatures – big and small – need energy to survive. All plants and some types of bacteria can transform light energy from the sun into chemical energy (these creatures are called primary producers). Most other creatures need to eat other (usually smaller) creatures to gain their energy (these creatures are called consumers or predators). A food web is a diagram illustrating the feeding relationships between many of the creatures within a community or ecosystem – or a map of who eats whom.

All food webs also require the important role of recycling – where dead creatures are decomposed by fungi and bacteria back into nutrients which are then re-used by primary producers to create food at the base of the web.

ABOUT THIS GAME

Partner-Predator-Prey explores the roles different living creatures play within the shallow waters of Hawaii. The game is based on the characters in the book, *The Squid, the Vibrio & the Moon* – with a couple of top predators (Shark and Human) added to test what affects they have on the food web.

This version of the game currently does not include any primary producers (such as Plants or Cyanobacteria), however does have the added feature of the symbiotic partnership between the Bobtail Squid and the bioluminescent Bacteria, *Vibrio fischeri*. And though it is not mentioned in the book, *Vibrio fischeri*, like most Bacteria, can play a role in the decomposition of other larger life forms – and can be included in the game as a source of food for any *Vibrio* before they have formed a symbiosis with a squid.

The game was originally designed for groups of 20 or more players. However, the game can also be played as a simple tabletop game for a single player or small numbers of players – using paperclips to hold any eaten creatures to the back of their predator or *Vibrio* to the back of their partner squid.

By changing the starting conditions and running multiple games with different combinations of creatures and different rules, this game allows for first-hand data to be collected by students for analysis and evaluation. This invites comparison and contrast between the roles of top predators on the entire food web, the role of cooperation (symbiosis with *Vibrio fischeri*) in enhancing the survival of the Bobtail Squid, the flow of energy within an ecosystem, etc.

PARTNER-PREDATOR-PREY INSTRUCTIONS

TO PREPARE

- Read *The Squid, the Vibrio & the Moon* to the group.
- Print and cut out the sheets of cards.
(Colour printing & laminating is an added bonus, or print directly onto a heavy paper stock.)

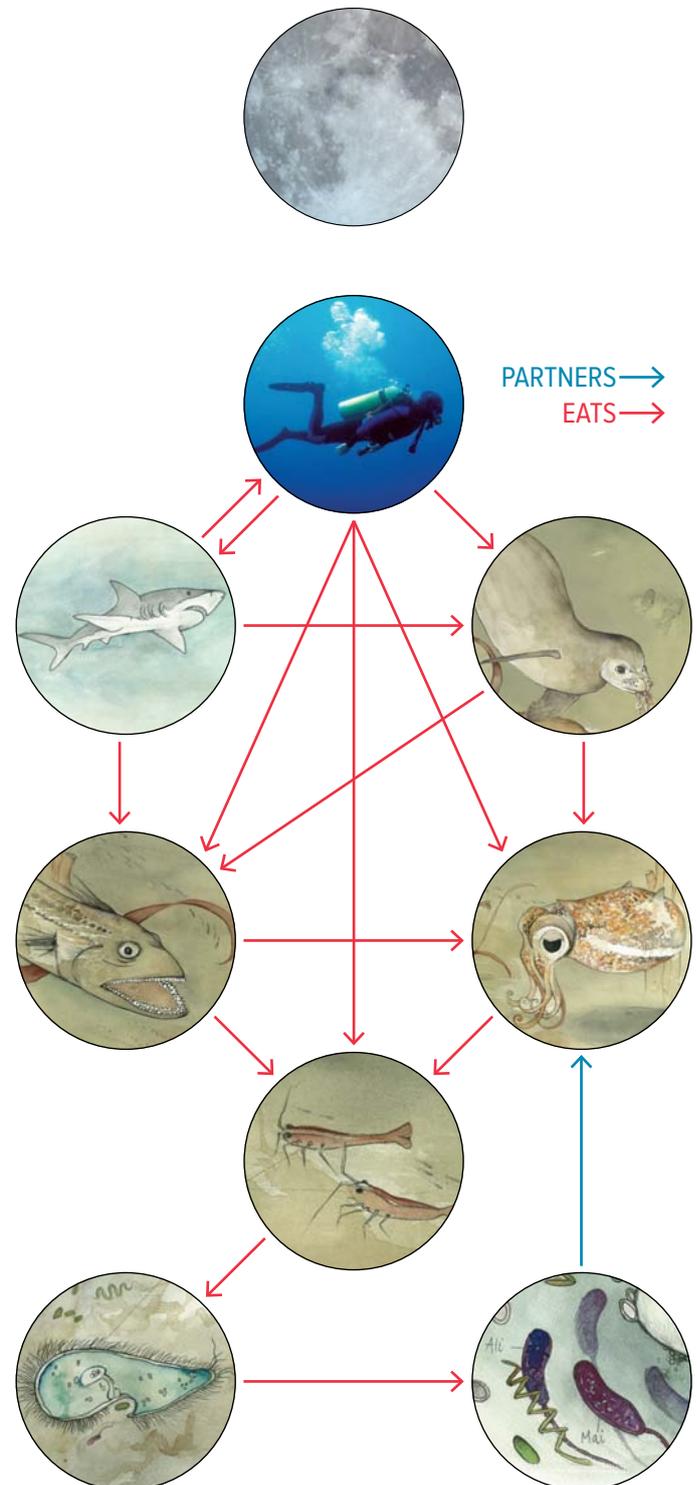
OBJECT OF THE GAME

- The aim of the game is to stay alive for as long as possible.
- During the game, every creature should eat as many other creatures as possible.

MAIN RULES OF THE GAME

- You must keep your creature identity secret!
- The game ends after a set number of rounds (10 works well). A game with large groups could run for extra rounds.
- Each round, creatures must **MEET** and form a random new pair with the nearest available creature.
- Each new pair should reveal and **COMPARE** their creature cards with each other.
- If one creature can **EAT** the other creature in their pair (a Predator meets its Prey), the Predator receives the creature card of their Prey and places this new card behind their own creature card.
- If a Bobtail Squid meets *Vibrio fischeri*, they can secretly **PARTNER** together:
 - The *Vibrio* card is placed behind the Squid creature card.
 - This symbiotic partnership makes them protected from all predators for the remainder of the game.
- Between rounds, creatures should randomly move and **REMIX** to create new pairs.

PARTNER-PREDATOR-PREY RELATIONSHIP CHART



PARTNER-PREDATOR-PREY

INSTRUCTIONS

SUGGESTED RULES FOR CLASS GROUPS (15—50 PLAYERS)

- Choose how many of each type of creature to include in the game. (See guide table below.)
- **MIX** the deck of creature cards and randomly hand a card out to each player. *Each player must keep their card and creature identity secret!*
- Between each round of a game, all creatures randomly move around the space (walking), using music as a cue.
- Each time the music stops, all players must **MEET** and form a new pair with the nearest available player.
- Each new pair should reveal their cards to each other and **COMPARE** their cards.
- If one player's creature can **EAT** the other in their pair, the **PREY** must immediately give their card to the **PREDATOR**.
- The **PREDATOR** should place the new creature card at the back of their other cards.
- All recently deceased **PREY** creatures should join *The Queue of the Dead*.
- If a Squid meets a Vibrio, they can secretly **PARTNER** together:
 - This symbiotic partnership makes them protected from all predators!
 - To protect the identity of this secret partnership – the Vibrio partner immediately hands their creature card to the Squid and joins the line of dead creatures** so that they do not reveal the identity of the squid. (No High Fives!)
 - The Squid partner holds the Vibrio card until the end of the game and must show this card to any potential (Lizardfish or Monk Seal) predators to avoid being eaten.
- **Vibrio players – rest assured your contribution counts! Your symbiotic partnership can be counted in any collected data.
- Restart the music to begin the next round and allow creatures to form new pairs. **REMIX**.
- The game ends when the agreed number of rounds is complete.
- Remember to collect data about remaining creatures at the end of the game – to compare with other game results (with different starting creatures and rule variations).

SUGGESTED RULES FOR PLAYING THE TABLETOP GAME (1—4 PLAYERS)

- Choose how many of each type of creature to include in the game.
- **MIX** the deck of creature cards and randomly place them all face down on the table.
- Each round, create a random pair from nearby creatures on the table. **MEET**.
- Reveal and **COMPARE** one pair at a time
- Use paperclips to hold any:
 - **EATEN PREY** creatures to the back of their **PREDATOR**, or
 - Vibrio fischeri to the back of their **PARTNER** Bobtail Squid.
- Before each new round, move the cards randomly around the table. **REMIX**.
- The game ends when the agreed number of rounds is complete.
- Remember to collect data about remaining creatures at the end of the game.



PARTNER-PREDATOR-PREY TABLES

GUIDE NUMBERS

Table providing some examples of starting numbers of creatures (following a pyramid shape).

CREATURES	Different combinations of numbers & creatures (following pyramid shape)				
Human					1
Shark				1	2
Monk Seal	1	1	2	2	2
Lizardfish	2	2	3	4	4
Bobtail Squid	3	4	5	5	6
Shrimp	4	5	6	6	7
Protozoa	4	6	6	8	8
Vibrio fischeri	6	7	8	9	10
TOTAL	20	25	30	35	40

COLLECTING DATA

- Running new games with the different starting creature numbers or different rules allows for simple experimental data to be tested, inviting comparison and analysis.
- Repeating several games with the same starting creature numbers and rules allows for experimental replicates to be collected, creating averages and better quality data.
- Other game rules or parameters can also be number (e.g. 50), making babies, different creatures, etc.

Table demonstrating data from different games.

CREATURES	GAME 1 Original Pyramid with <i>Making Babies</i> rule		GAME 2 Original Pyramid with <i>Making Babies</i> rule		GAME 3 Original Pyramid with <i>Shark & Eat or Die</i> rule		GAME 4 Even Spread of Creatures with <i>Making Babies</i> rule		GAME 5	
	START	END	START	END	START	END	START	END	START	END
Human							2	2		
Shark					1		4	1		
Monk Seal	2	2	2	1	2	1	4			
Lizardfish	2	1	2	1	2	1	4			
Bobtail Squid	4	1	5	3	5	2	4			
Shrimp	5		6	1	6		4			
Protozoa	6	2	7		6		4			
Vibrio fischeri#	7	0/1	8	0/11	8	0/7	4	2/0		
TOTAL	26		30		30		30			

The FIRST number represents the free-swimming Vibrio fischeri remaining at the end, The SECOND number is the Vibrio fischeri remaining in symbiosis with the surviving squid.

PARTNER-PREDATOR-PREY

GAME DATA TABLES

	GAME 1		GAME 2		GAME 3		GAME 4		GAME 5	
CREATURES	START	END								
Human										
Shark										
Monk Seal										
Lizardfish										
Bobtail Squid										
Shrimp										
Protozoa										
Vibrio fischeri										
TOTAL										

	GAME 1		GAME 2		GAME 3		GAME 4		GAME 5	
CREATURES	START	END								
Human										
Shark										
Monk Seal										
Lizardfish										
Bobtail Squid										
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Protozoa										
Vibrio fischeri										
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CREATURES	START	END								
Human										
Shark										
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Bobtail Squid										
Shrimp										
Protozoa										
Vibrio fischeri										
TOTAL										

PARTNER-PREDATOR-PREY

RULE VARIATIONS (OPTIONAL)

Before every new game, consider using different combinations of creature cards or changing other rules (See additional rules on the next page) – to see what affect this change has on the food web.

1. The Moon

- The Moon card can be used in the game to identify the Game Master. (This could simply be the teacher.)
- The responsibilities of the Moon include:
 - Starting and stopping the music between rounds.
 - Handing out new creature cards when any new babies are made.
 - Collecting any creature cards*, for any creatures which haven't eaten after 5 rounds of play (see the *Eat or Die* rule below).
**This can work by honesty with the Moon asking for any creatures with only one card to sit down... or the Moon can check all remaining player's cards to see if they have eaten a meal.*
 - Collecting all creature cards at the end of the game.
 - Mixing all cards together (including the Moon) and handing out creature cards to start the next game.

2. Making Babies

- In any round, if you pair with an identical creature, you can choose to make a baby!
- In group mode – any pair making a baby should both raise their hands and show their cards to the Game Master (The Moon or teacher) to provide a new card for that creature (remember to speak quietly to keep your identity secret!). Then, the Game Master should resurrect a player who has previously died to rejoin the game as the new (baby) creature from the front of the line of dead creatures (*Queue of the Dead*).
- As an optional extra rule, the group can decide whether new babies can potentially make babies with parents in future rounds. While somewhat complicated – this extra rule can prevent populations explosions from taking over the food web.

3. The Shark and the Human

- The Shark and Human cards can also be introduced to demonstrate the impact of super-predators at the top of the food web.
- As an optional extra, the Shark could sometimes also eat the human, with the survivor decided by a coin toss or a single game of rock/paper/scissors.
- Humans have hunted Monk Seals to near extinction. However, given that Monk Seals are now a protected species, you might want to make Monk Seals protected from humans as a predator.

4. Eat or Die

- After 5 rounds, any creatures** who have not eaten a meal (that is, do not hold the card of another creature), starve to death and immediately die. (Card collected by the Game Master.)
- *Variation 4A:* ***Vibrio fischeri* is immune to starvation due to its role as a decomposer.
- *Variation 4B:* (Decomposer). Before it succeeds in forming a symbiosis with a Bobtail Squid, *Vibrio fischeri* can still eat by stealing any spare dead creature cards from any other living creature they encounter in a new pair to create food by decomposing. If a creature only has one dead creature card, they do not have to give it away to the *Vibrio fischeri*.
- *Variation 4C:* If a Bobtail Squid starves as a result of the *Eat or Die* rule, any *Vibrio fischeri* partners (sitting in the *Queue of the Dead*) can immediately resume the game, due to their ability to potentially decompose the dead squid and return to the seawater.

5. 50:50 Escape Rule

- During each round, if a Predator/Prey pair is formed, the prey can escape being eaten by winning a single game of rock/paper/scissors and continue playing the game.

PARTNER-PREDATOR-PREY

QUESTIONS TO REFLECT ON AFTER THE GAME

Q: Did any particular type of creatures survive the game?

*A: Usually top level predators (Sharks or Humans)
This is where the energy moves to in a food web – also represented as a pyramid.*

Q: If using the *Making Babies* rule, was there an explosion of any population? What caused this explosion?

A: Knock on Effects, such as:

- A chain reaction of new babies making even more babies
- The early removal of predators

Q: Do Humans and Sharks affect the balance of the ecosystem? How?

Q: Did any Bobtail Squid survive until the end of the game? How many? How did they survive?

*A: Through cooperation (symbiosis) – by combining with *Vibrio fischeri*.
Also through competition – by eating the shrimp.*

Q: In the story, which life forms are competing?

A: All creatures which eat or are eaten by each other are directly in competition. However, the entire food web is interconnected and so all parts of a food web are dependent on each other in order to exist...

Q: What would happen to the shrimp if there were no predators (such as Lizardfish or Monk Seals) to eat most of the Bobtail Squids?

A: With no predators to eat the Bobtail Squid, most shrimp should get eaten – with shrimp numbers declining and collapsing! Eventually there may be so few shrimp that Bobtail Squid would have to find other food to eat or else they will begin starving to death!

Q: What important part of the food web is missing from this game?

A: Primary Producers – photosynthetic creatures such as seaweed, algae, and cyanobacteria.

Q: What role do Primary Producers play in an ecosystem?

A: They harvest energy from the sun to create sugars and proteins, which feed the zooplankton (such as protozoa and shrimp), which in turn provide energy for higher parts of the food web.

Q: What can we learn from this game about the bigger picture of food webs and life on Earth?