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Micronecton & Tourbillons

By:

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About the author

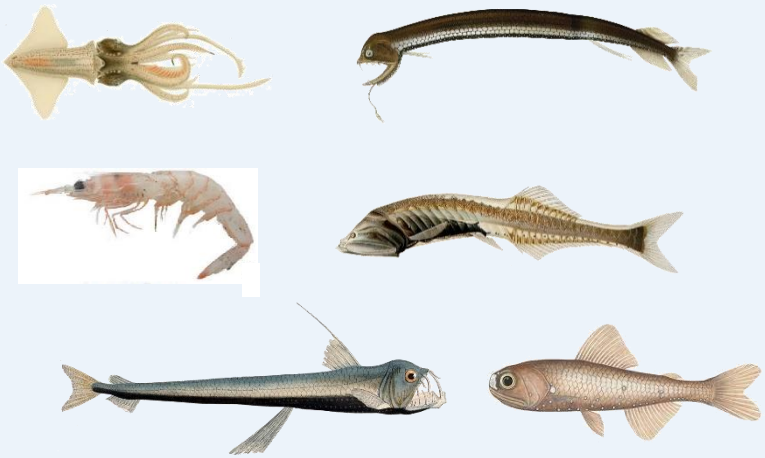
Angelee Pavanee Annasawmy

Dr Annasawmy is a biological oceanographer. She studies the physical mechanisms influencing biological processes in deep-sea ecosystems using a wide range of methods and techniques including active acoustics, stable isotopes, trace metals, and eDNA. She is an expert in micronekton ecology. She created the "Micronecton & Tourbillons" board game to highlight her MSCA postdoctoral project entitled "FINZWI0": Fine-scale zooplankton distribution within sub-mesoscale features of the south-west Indian Ocean. FINZWI0 investigates the influence of mesoscale and sub-mesoscale eddies on the distribution and migration patterns of micronekton.

"Micronecton & Tourbillons" is analogous to a Snakes and Ladder board game that can be played by 8-year-old children and adults. The game introduces organisms called micronekton that inhabit the deep ocean, their role, migration patterns and ecology.

What is micronekton?

Micronekton is a diverse group of organisms of 2-20 cm in size consisting of squids, crustaceans and fishes inhabiting the mesopelagic depths. Some micronekton organisms migrate from the deep ocean (below 400 meter, i.e., 1312 feet) to the sea surface (above 200 meter, i.e., 656 feet) at sunset and inversely at sunrise.

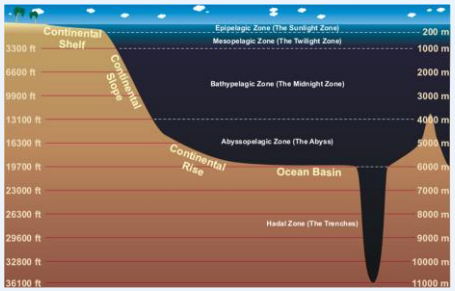


Players can use the following table to record their progress in the game.

Round number	Number on dice (Step 1)	Player name	Micronekton organism	Maximum depth reached
5	1			
	2			
	3			
	4			
	5			
	6			
6	1			
	2			
	3			
	4			
	5			
	6			

Micronekton habitat

Micronekton lives in the mesopelagic and bathypelagic zones, between approximately 200 to 4,000 meters below the sea surface.



Micronekton predators

Tunas, swordfish and squids feed on micronekton. Yellowfin tunas preferentially feed on micronekton within the first 100 meter of the water column. Big-eye tunas are deeper divers, being able to dive between 200 and 300 m to feed on micronekton. Swordfish may feed on micronekton at depths of 600 m. Larger-sized squids are deep divers that can feed at deeper depths in the ocean.

Role of micronekton

Micronekton plays an important role in the deep ocean by transporting organic carbon from the surface to deeper parts of the ocean, and can thus help us fight climate change!

Players can use the following table to record their progress in the game.

Round number	Number on dice (Step 1)	Player name	Micronekton organism	Maximum depth reached
3	1			
	2			
	3			
	4			
	5			
	6			
4	1			
	2			
	3			
	4			
	5			
	6			

Migration patterns of micronekton

Micronekton show varied migration patterns with some organisms migrating from the deep ocean (below 400 m) to the sea surface (above 200 m) at sunset and inversely at sunrise during a process called diel vertical migration.

Diel vertical migration is believed to result from a compromise between the need to feed and to avoid predation. It is considered to be the largest animal migration on the planet.

Some micronekton species are non-migrating or weakly migrating and thus stay at 400-m depth below the sea surface at sunset. Other micronekton species migrate from the deep ocean to approximately 200-m depth at sunset and back to below 400 m during sunrise.

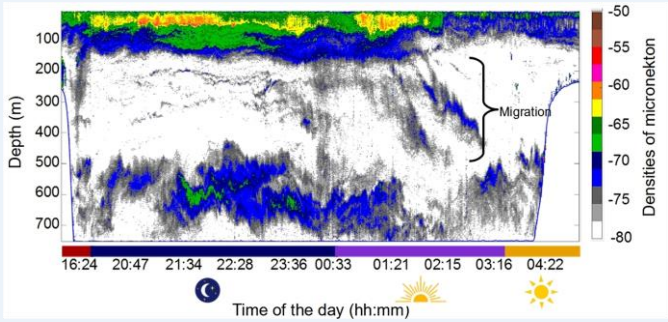


Diagram showing the distribution of micronekton (blue through red colors) between the sea surface to 800-m depth during nighttime, sunrise and daytime (rectangular bars). Micronekton migration is shown during sunrise from the sea surface to below 400-m depth.

Players can use the following table to record their progress in the game.

Round number	Number on dice (Step 1)	Player name	Micronekton organism	Maximum depth reached
1	1			
	2			
	3			
	4			
	5			
	6			
2	1			
	2			
	3			
	4			
	5			
	6			

Influence of physical oceanographic features in the ocean (such as mesoscale eddies) on the distribution and migration of micronekton

Eddies are water movements in the ocean interior caused by the combined action of the wind and the rotation of the earth. Cyclonic eddies cause micronekton to move up in the water column. Anti-cyclonic eddies cause micronekton to move deeper in the water column. Predators like to feed at the edges or center of eddies where micronekton are concentrated.

Cyclonic eddy

Anticyclonic eddy

Fact sheet to be used with the board game. Each player will be assigned one micronekton organism as shown below. Micronekton organisms are called by their Latin names.

"THE DEEP OCEAN" Fact Sheet

Number on dice	Micronekton organism	Ecology of each micronekton organism	Drawings of micronekton organisms
1	*Diaphus perspicillatus*	Lives in the deep ocean (between 400-1500 m) during the day. Migrates to the surface (above 200 m) at sunset. Player starts playing at 1500 m depth.	
2	*Chauliodus sloani*	Lives in the deep ocean (between 400-4000 m) during the day. Migrates to the surface (above 200 m) at sunset. Player starts playing at 4000 m depth.	
3	*Cyclothone atraria*	Is a deep-water species because it lives in the deep ocean (between 400-5000 m). Will not migrate above 400 m. Player starts playing at 5000 m depth and ends playing at 400 m. If this player arrives to the targeted depth of 400 m before the other players, then this player wins the game.	
4	*Funchalia taaningi*	Lives in the deep ocean (between 400-1500 m) during the day. Migrates to the surface (above 200 m) at sunset. Player starts playing at 1500 m depth.	
5	*Stomias longibarbatus*	Lives in the deep ocean (between 400-1500 m) during the day. Migrates to the surface (above 200 m) at sunset. Player starts playing at 1500 m depth.	
6	*Abraliopsis morisii*	Lives in the deep ocean (between 400-4000 m) during the day. Migrates to the surface (above 200 m) at sunset. Player starts playing at 4000 m depth.	

How to play "Micronecton & Tourbillons"?

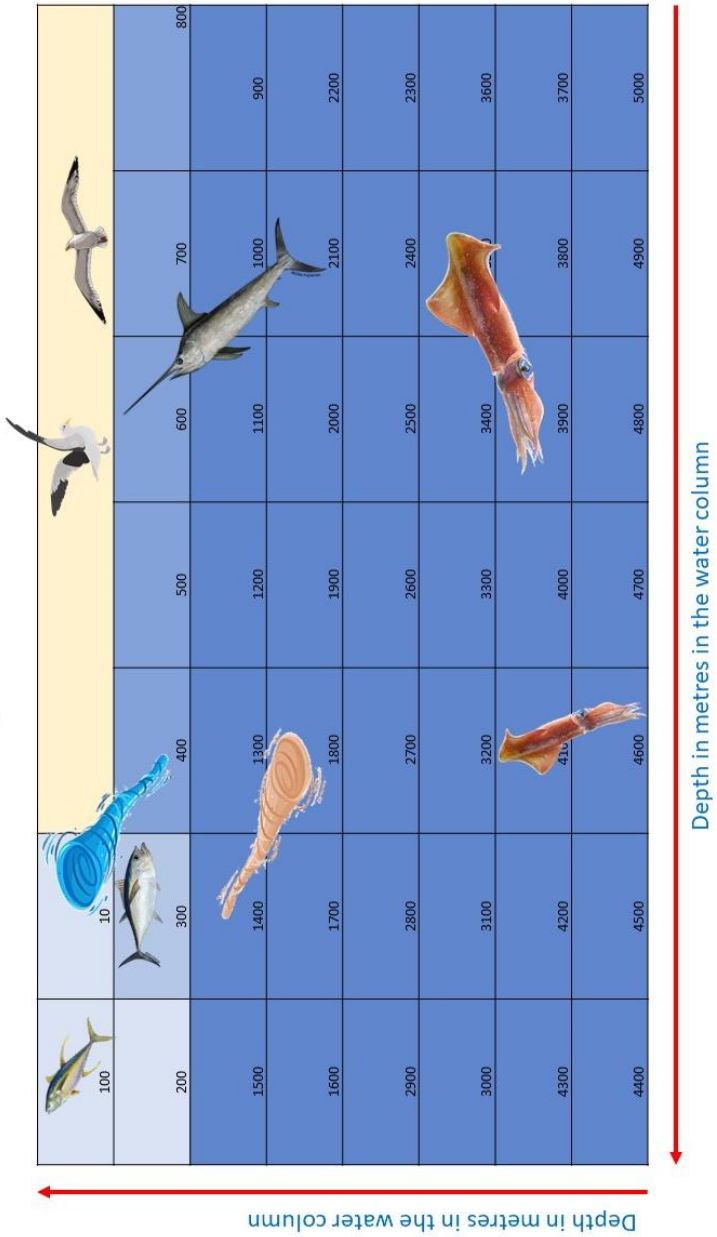
Use:

- a six-sided dice
- the board game "Micronecton & Tourbillons"
- the fact sheet
- micronekton organisms

By playing this game, you become a micronekton organism for a brief moment!

Aim:

For each micronekton (each player) to move from anywhere between 5000 m to the sea surface (10 m) depending on the migration pattern of his/her micronekton organism. If a micronekton falls on the square where there is the mouth of a predator, it is eaten up and hence disqualified from the game.



Board game. Micronekton predators (yellowfin and big-eye tunas, swordfish and the squid *O. bartrami*) are shown. The cyclonic eddy is shown as a blue whirlpool and the anti-cyclonic eddy as a red whirlpool.

How to play "Micronecton & Tourbillons" continued…

Start of each game:

Step 1: One of the six players rolls a six-sided dice. Each player will be assigned one micronekton organism based on the number on the dice (please see fact sheet). The number on the dice also reflects the order of players. Each micronekton organism will have a different migration pattern and a different starting depth (please see fact sheet). If a player falls on the same dice number as a previous player, he/she will roll the dice again to fall on a new organism. A total of 6 people can play at a time and will be assigned one micronekton organism.

How to play "Micronecton & Tourbillons" continued…

Step 2: Micronekton organism 1 rolls the dice again to determine by how many meters in the water column he/she can move on the board game.

For example, Player 1 is called a *Diaphus perspicillatus* and starts playing at 1500 m depth. If he obtains the number 3 when rolling the dice during this step, then he moves from 1500m to 1200 m.

Number on dice	*By how many meters the player can move in the water column*
1	Player moves by 100 m
2	Player moves by 200 m
3	Player moves by 300 m
4	Player moves by 400 m
5	Player moves by 500 m
6	Player moves by 600 m

How to play "Micronecton & Tourbillons" continued…

Key: Micronekton predators

Giant squid

Swordfish

Big-eye tuna

Yellowfin tuna

Seabirds

If a player falls on squares labelled "4600", "3900", "600", "300" and "100", he/she is disqualified.

How to play "Micronecton & Tourbillons" continued…

Step 3: Then Micronekton organism 2 can play by rolling the dice to determine by how many meters he/she can move in the water column. Micronekton organisms 3, 4, 5 and 6 will play successively by rolling the dice and moving up in the water column.

The player which first reaches the targeted depth wins the game (i.e., the sea surface - 10 m - for players 1, 2, 4, 5, 6 OR 400 m for player 3). The animals on the board game represent micronekton predators, i.e., organisms that will feed on micronekton and disqualify the player. Players are disqualified if they fall on the squares labelled "4600", "3900", "600", "300", and "100". In the event that all players are disqualified before reaching the targeted depth, the player which has moved closer to the targeted depth wins the game.

Step 4: Record progress in booklet on Pages 14 and 15.

How to play "Micronecton & Tourbillons" continued…

Key: Eddies

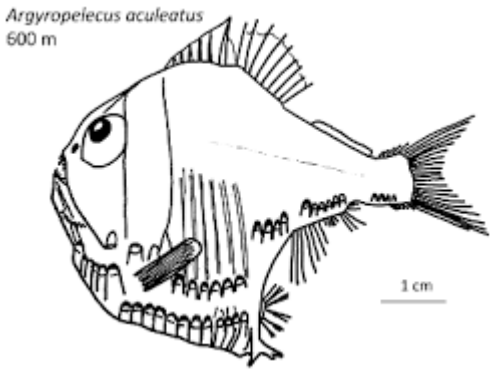
Anticyclonic eddy

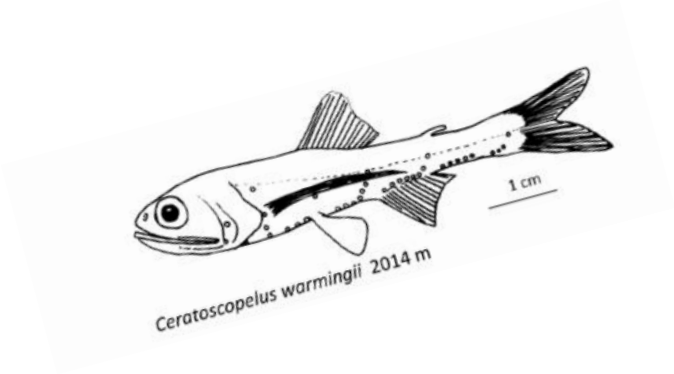
Cyclonic eddy

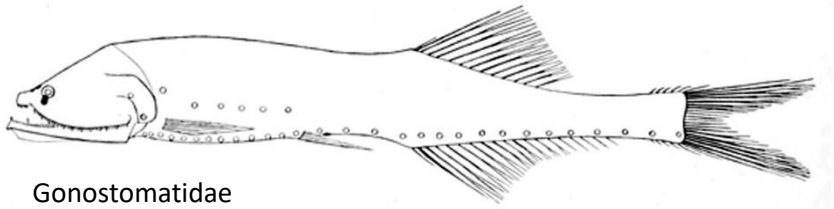
If a player falls on the square labelled "1400", he/she will have to move down in the water column to the square labelled "1800". The player will hence be delayed in his vertical migration to the sea surface.

If a player falls on the square labelled "400", he can move up in the water column to the square labelled "10", and hence win the game.

COLORING ACTIVITY







Gonostomatidae