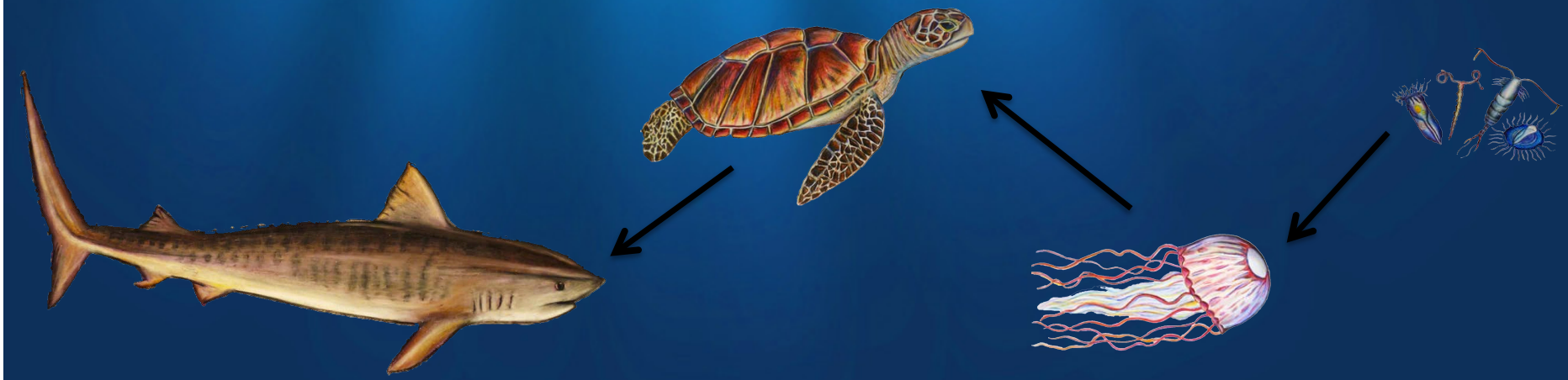
Presents:

Marine Food Chains and Webs



Vocabulary

Abiotic - The non-living parts of an ecosystem (sunlight, soil, air, water).

Apex Predator - top predator of an ecosystem, no natural predators.

Autorotroph - organisms that produce their own food from the environment (sunlight or chemicals).

Bioaccumulate - toxins accumulating in organisms as they move up trophic levels.

Biomagnification - refers to pollutants concentrating as they move from one trophic level to the next.

Biodiversity - The variety of different species within an ecosystem.

Biomass - living organisms and the energy contained within them.

Biome - regions of the world with similar climate, animals and plants.

Biotic - living parts of an ecosystem.

Consumer - organisms that depend on producers or other consumers as a food source.

Decomposer - organisms that break down organic matter.

Ecosystem - Animals, plants and nonliving things that make up an environment and impact one another.

Energy - the ability to do work.

Energy Pyramid - shows the biomass at each trophic level in an ecosystem.

Food Chain - group of organisms linked in order of the food they eat.

Food web - The whole group of interacting food chains in an ecosystem.

Heterotroph - organisms that can't produce their own energy and rely on consuming other organisms.

Photosynthesis - the process by which sunlight, carbon dioxide and water are converted into simple sugars and oxygen.

Population - All of the individuals of the same species living within a given area.

Producer - living things that make their own food through photosynthesis.

Predator - an animal that hunts and eats other animals.

Prey - an animal that is hunted and eaten by other animals.

Primary Consumer - organisms that eat plants or other autotrophs.

Secondary Consumer - organisms that eats meat.

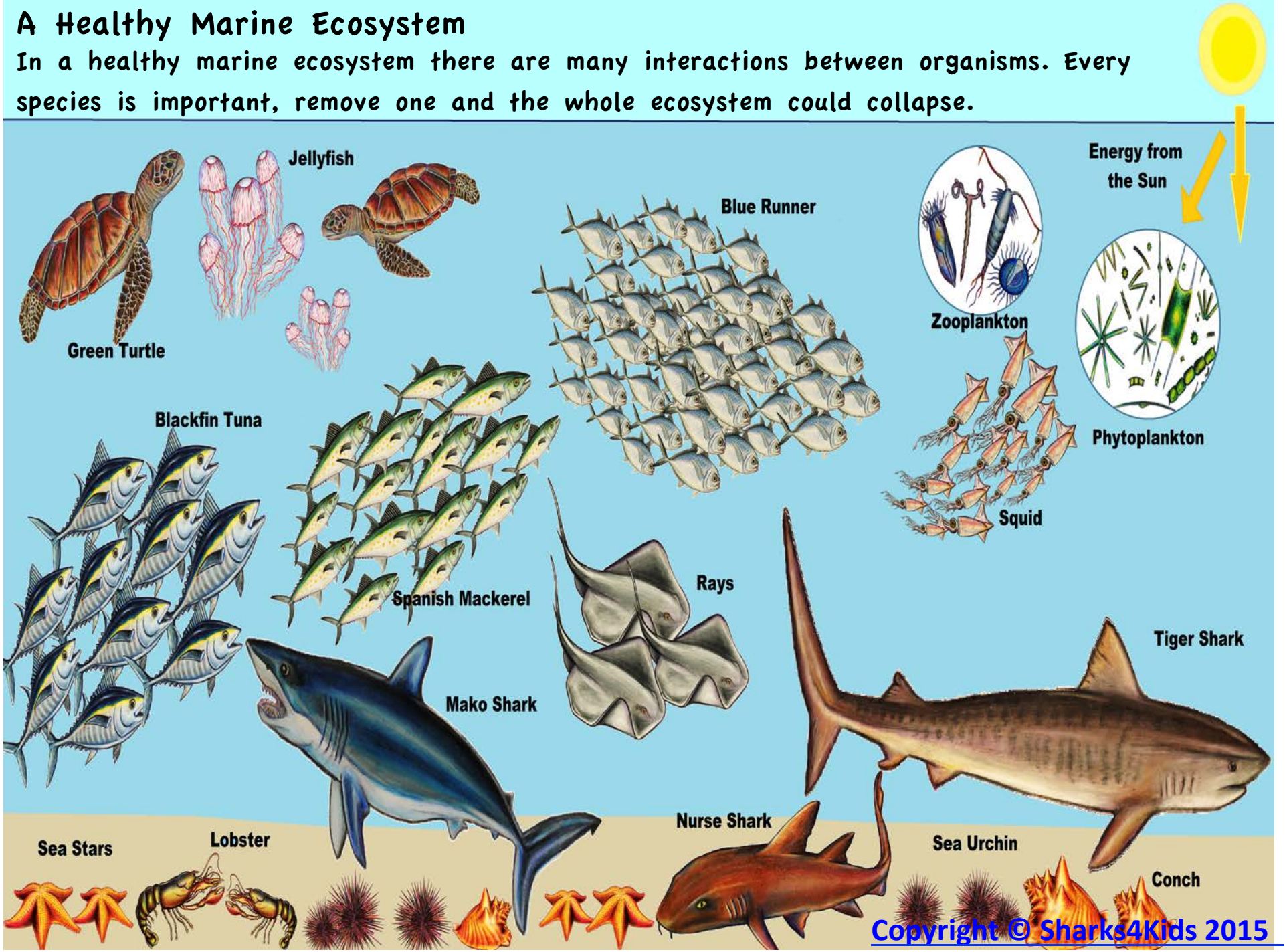
Tertiary Consumer - carnivore that mostly eats other carnivores.

Trophic Cascade - The loss of a top predator that leads to a series of population increases and crashes, cascading down the trophic levels of an ecosystem.

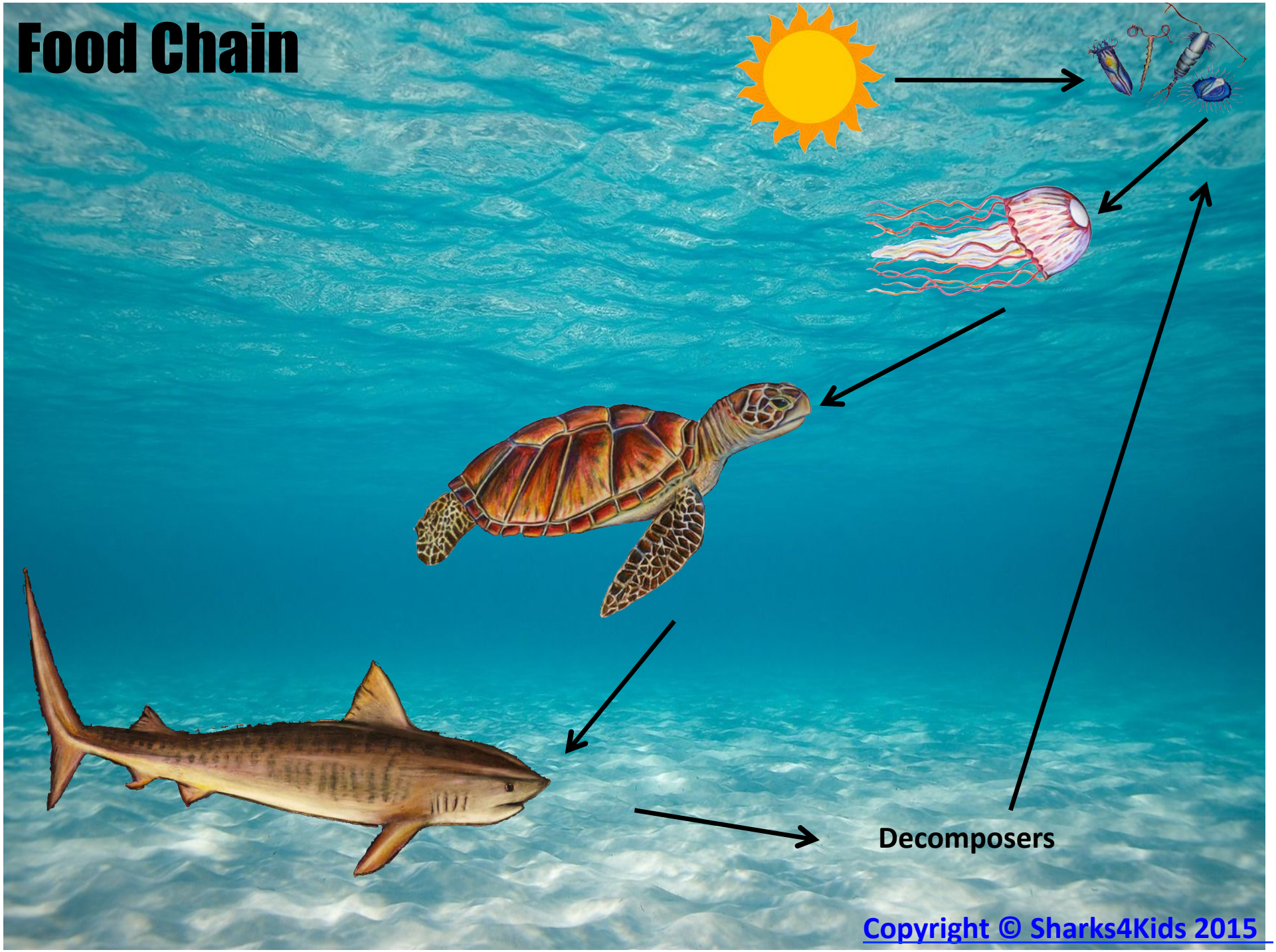
Trophic Level - one of three positions on the food chain: autotrophs (first), herbivores (second), and carnivores and omnivores (third).

A Healthy Marine Ecosystem

In a healthy marine ecosystem there are many interactions between organisms. Every species is important, remove one and the whole ecosystem could collapse.



Food Chain



Food Chain

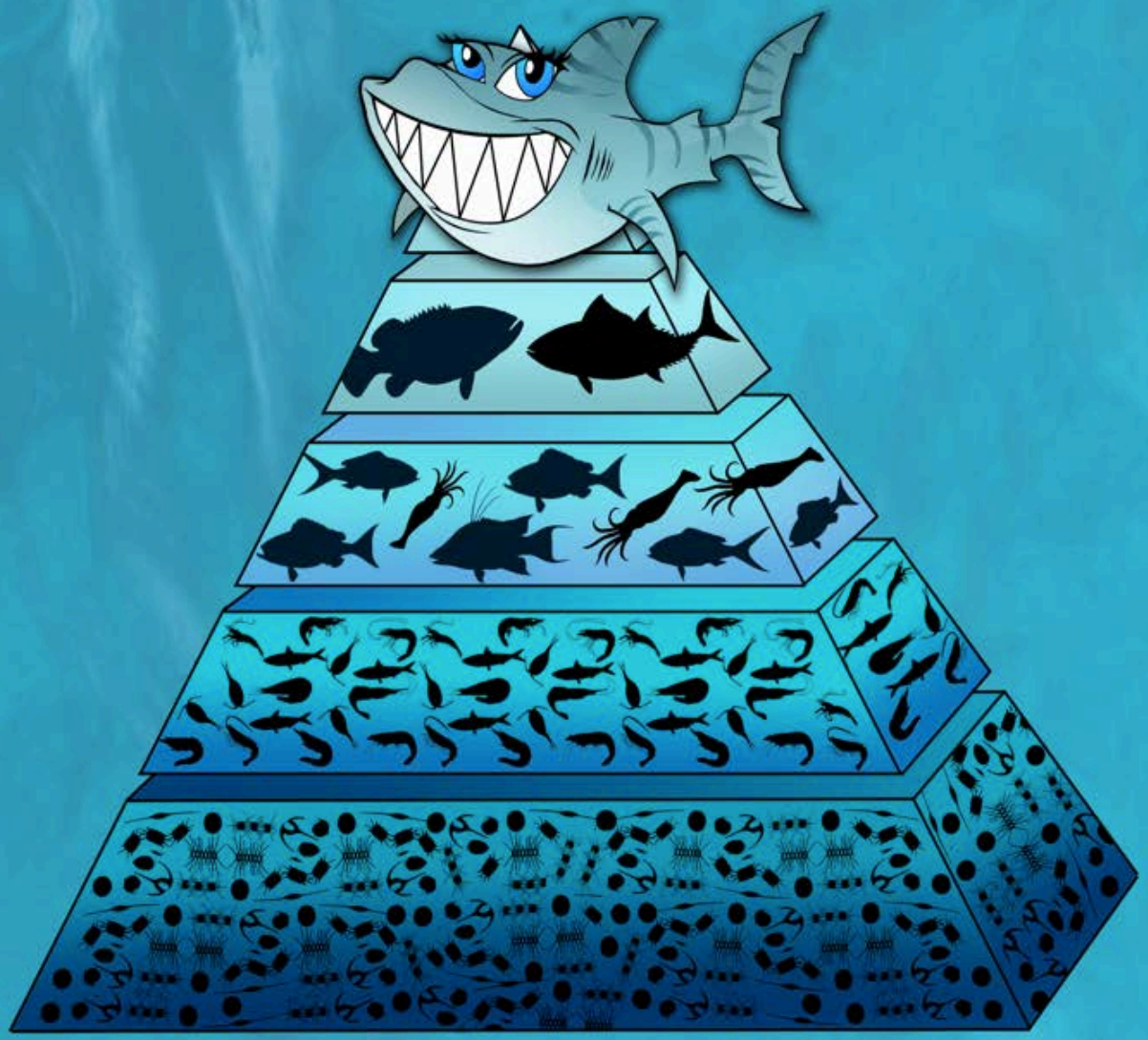
• FOOD CHAINS are a possible path that ENERGY and nutrients may take as they move through the ECOSYSTEM. Food chains can be long and complicated, or very short.

• Phytoplankton are the main PRODUCERS in marine ecosystems. Tiny creatures called zooplankton are PRIMARY CONSUMERS, feeding on the the plankton. Jellyfish are opportunistic, happily feeding on phytoplankton as well as zooplankton and are SECONDARY CONSUMERS. Juvenile green sea turtles feed on jellyfish as TERTIARY CONSUMERS. Tiger sharks are APEX PREDATORS, feeding on green sea turtles. When the tiger sharks die, their bodies sink to the seafloor and DECOMPOSERS such as worms break down the material. The nutrients released by the decaying flesh provide chemicals for phytoplankton to start a new series of food chains.

Biomass

BIOMASS is the energy in living organisms. AUTOTROPHS, the producers in a food web, convert the suns energy into biomass. Biomass decreases with each TROPHIC LEVEL, there is always more autotrophs than HETEROTROPHS (consumers) in a healthy ecosystem. Smaller animals are more numerous than larger ones. Tiger sharks and jelleyfish are both CONSUMERS, however, it takes much more biomass to support a tiger shark population than a jellyfish population. As the number of plants and other autotrophs is reduced, the rest of the food web is forced to adapt or die.

FOOD PYRAMID



Food Pyramid

• In a balanced ecosystem, the FOOD PYRAMID shows the POPULATION of organisms on each trophic level.

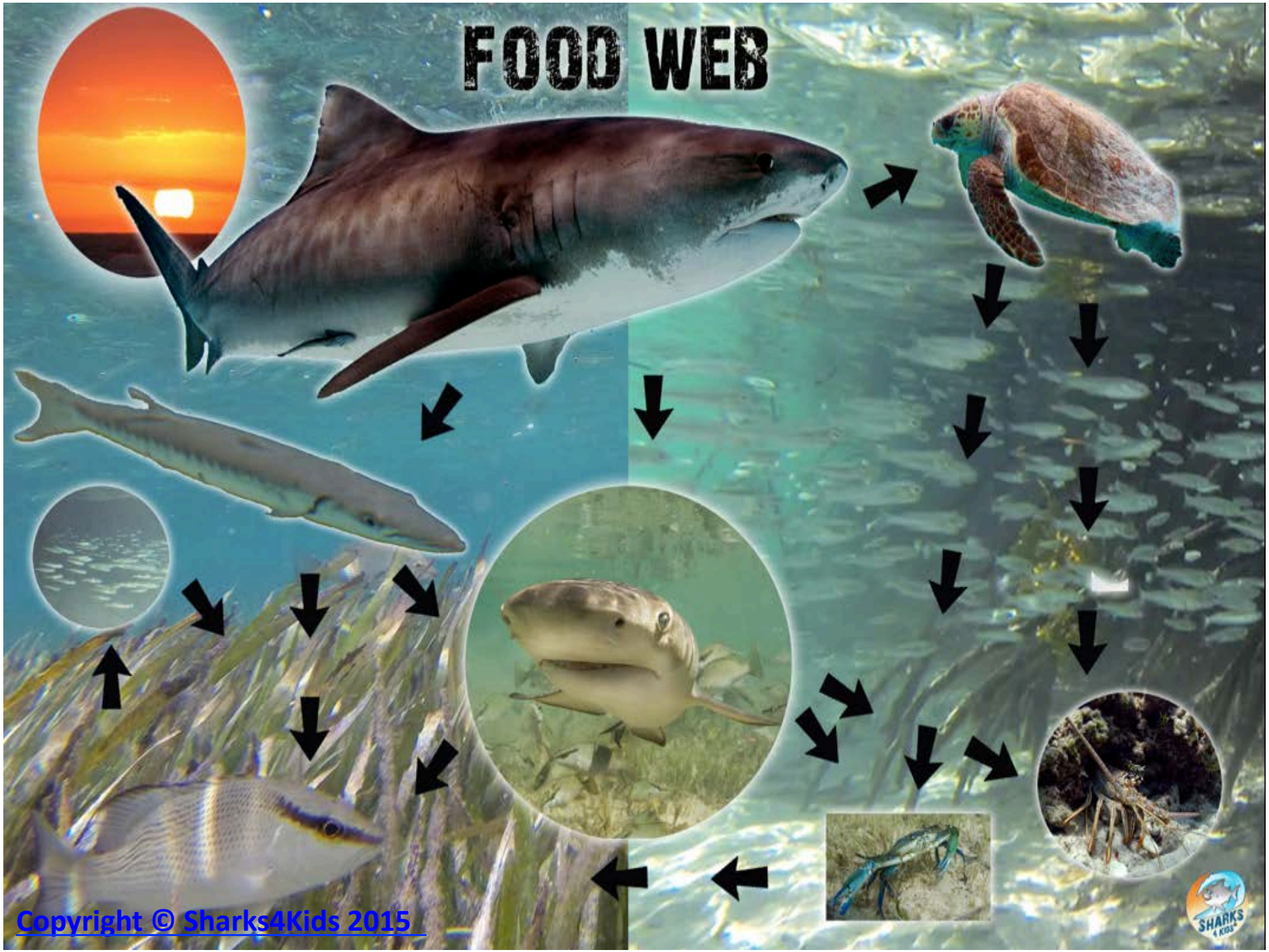
• There are more producers (base) than there are consumers (upper levels). It is estimated that if there are a million producers, there may only be 10,000 primary consumers, supporting 100 secondary consumers. All these organisms support only one tertiary consumer.

• In the ocean, phytoplankton are at the base of the pyramid. They make their own food using energy from the sun through PHOTOSYNTHESIS.

• Shark species are at the top of the food pyramid in almost every part of the world's oceans. This means sharks play a critical role in the largest BIOME on the planet, the marine biome, which covers 71% of the Earth's surface.

• As apex predators, scientists believe sharks are critical for maintaining ocean BIODIVERSITY and the health of ecosystems. They eat old, sick, dead or dying fish and keep the population of fish beneath them on the food chain from overpopulating.

• Without sharks, fish species below them on the food chain swell in population and can overeat their food source. These fish will die off and the next level has a swell in population and so on. This can cause a TROPHIC CASCADE, impacting all levels of the food pyramid.


FOOD WEB
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Food Web

• FOOD WEBS consist of all the food chains in a single ecosystem, a more accurate way to display interactions because each living thing in an ecosystem is part of multiple food chains. A food chain is only one possible path of many that energy and nutrients may take as they move through the ecosystem.

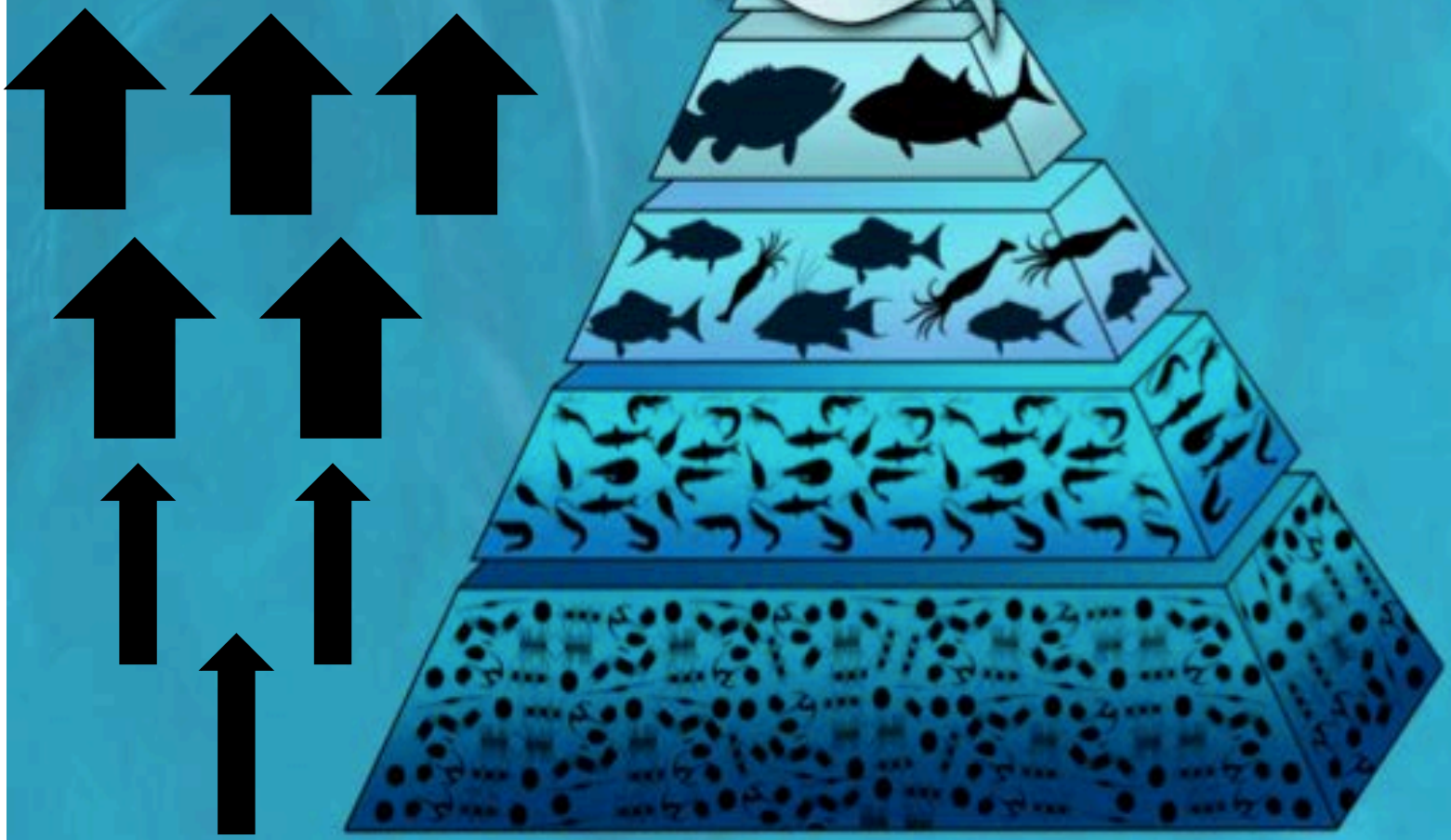
• Organisms in food webs are grouped into categories called trophic levels. These are divided into producers (first trophic level), consumers, and decomposers (last trophic level).

A Food Web in the Bahamas

• The sun is an ABIOTIC element, providing energy for the BIOTIC elements of the ecosystem. The seagrass and mangroves are producers, making their own food through photosynthesis. The silversides and small crustaceans that feed on the producers are primary consumers. The mangrove snapper that eat the silversides and small crustaceans are secondary consumers. The loggerhead turtles, small sharks, and barracudas are tertiary consumers. The tiger shark, which feeds on turtles, barracudas and small sharks is the apex predator of the ecosystem.

• The above is a simplified food web with only a few species from the Bahamas, but food webs can be incredibly complex. A study (Link 2002) looking at the food web of the northwest Atlantic shelf ecosystem. He found that there were 1562 links between 81 species. Food webs can be extremely complex and only goes to show how many different organisms can be impacted when one group (like sharks) is removed from the ecosystem.

Bioaccumulation And Biomagnification



Toxins

Bioaccumulation and Biomagnification

BIOACCUMULATION is the gradual build up over time of a chemical in a living organism. Many chemicals can't be broken down by the body so they build up in the organism's tissues.

BIOMAGNIFICATION refers to the tendency of pollutants to concentrate as they move from one trophic level to the next when eaten by higher level consumers.

When a toxic pollutant is in the water, it quickly enters the food chain:

- Phytoplankton absorbs the pollutants from the water, but because there is so little pollutant in each phytoplankton it doesn't cause much damage at this level of the food web.

- When zooplankton consumes ten phytoplankton, it now has ten times the level of the pollutant in its body.

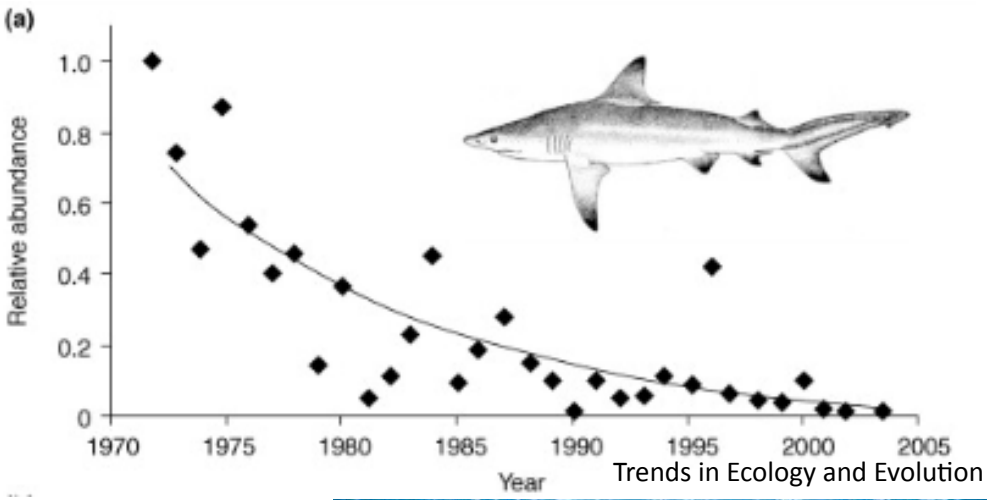
- A small fish eating ten zooplankton will have 100 times the level of toxic pollutant as a single phytoplankton.

- This multiplication continues throughout the food web until it reaches the apex predator.

This bioaccumulation of toxins is what makes eating shark flesh so dangerous. By eating the top predator from an ecosystem, humans get a dangerous dose of toxins like mercury and various pesticides.

Case Study: US Eastern Seaboard Shellfish Collapse

The Decline of Sharks Along the Eastern Seaboard of the United States



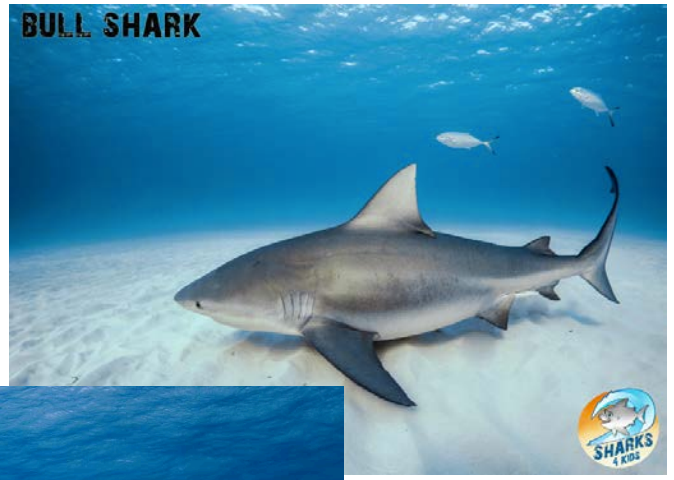
Trends in Ecology and Evolution

• Researchers in Canada and the US have studied 17 marine surveys carried out along the eastern coast of the US between 1970 and 2005.

• They discovered that populations of scalloped hammerheads and tiger sharks have fallen by more than 97% and populations of bull, dusky and smooth hammerhead sharks have fallen by more than 99%.

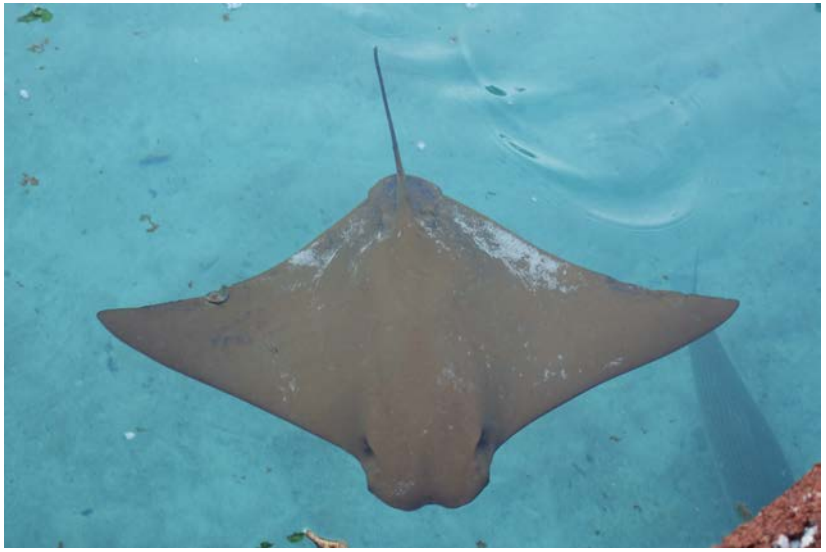
• This decline can be traced back to demand for shark fins as well as bycatch from fisheries.

• The overall size of these shark speices has decreased as well during this period as many individuals don't survive long enough to reach their full potential.



Case Study: US Eastern Seaboard Shellfish Collapse

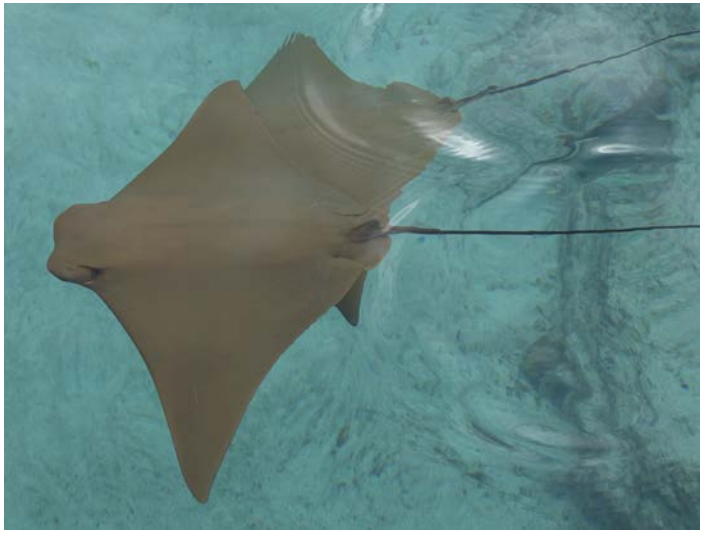
The Rise of the Secondary Consumers: Cownose Rays

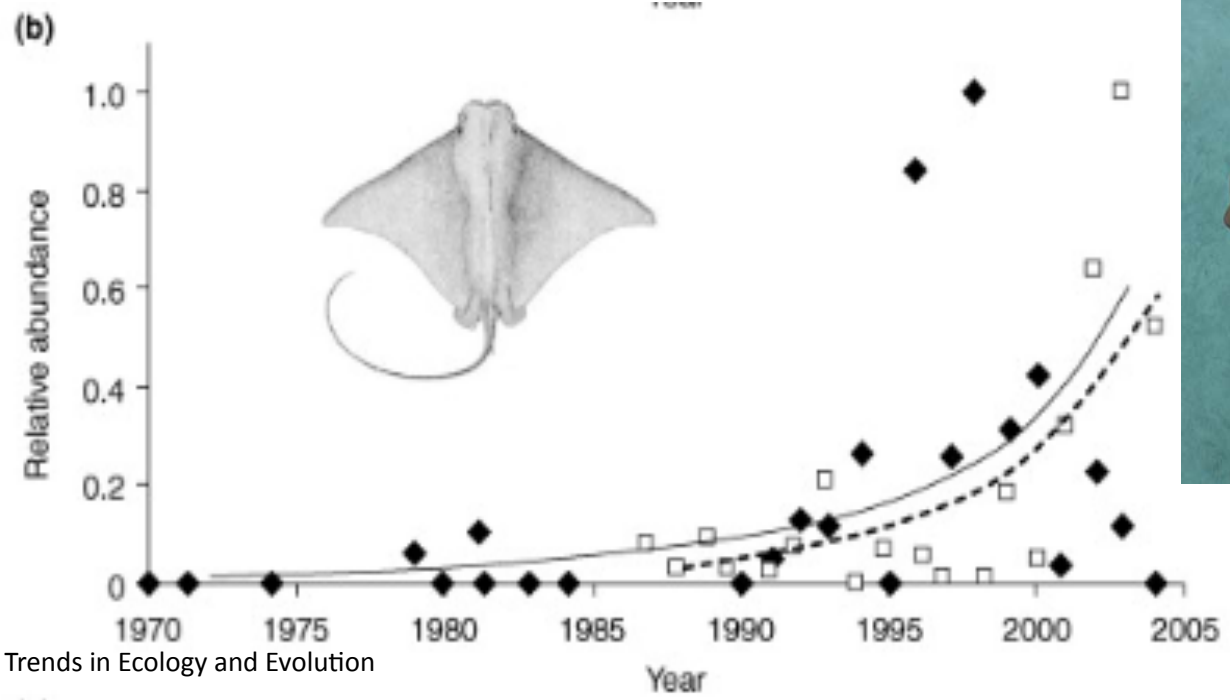


• On the flipside, small sharks, rays and skates populations have soared. All are prey for large sharks.

•The cownose ray benefited most with their numbers increasing tenfold.

•Cownose rays eat a variety of molluscs, including scallops, oysters and clams.





Trends in Ecology and Evolution

Case Study: US Eastern Seaboard Shellfish Collapse

A Trophic Cascade and the Demise of the US Shellfish Industry

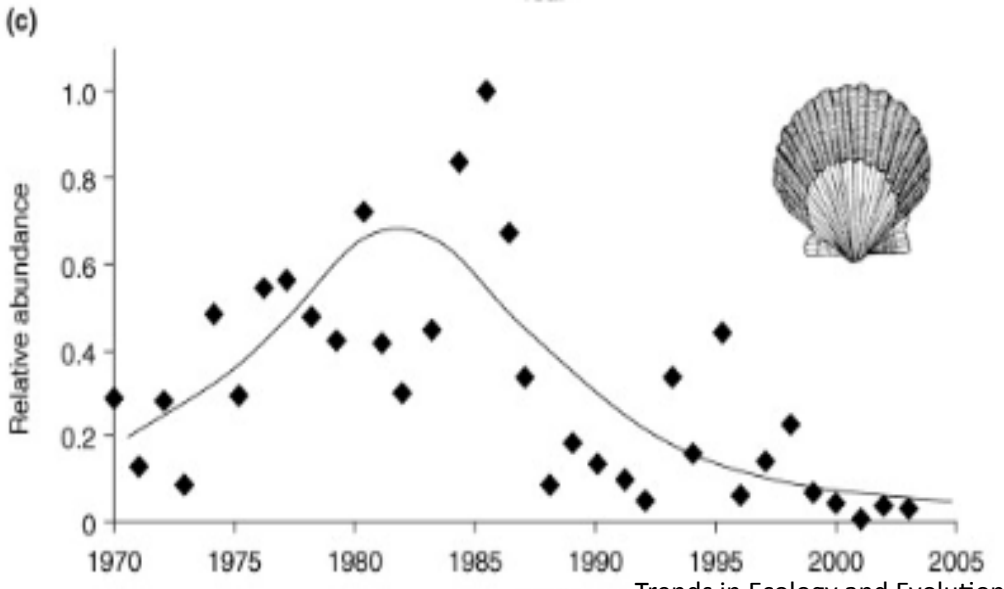
- During their yearly migration through areas like Chesapeake Bay and the sounds of North Carolina, 40 million cownose rays devour over 840,000 tonnes of mollusc.

- The century old scallop fishery in North Carolina was shutdown in 2004 due to a collapse of scallop populations.

- By reducing populations of large sharks, humans may have indirectly threatened or wiped out their own shellfish fishing industries.

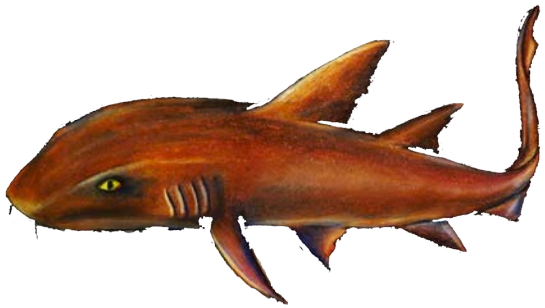
- Large and small animals are linked in ecosystems. If we don't preserve our largest and most powerful sharks, these types of trophic cascades could continue to occur across many marine ecosystem.

Bay Shellfish Co./Marine Photobank



Trends in Ecology and Evolution

Food Chains and Webs Word Search



Pick out the hidden words by looking across, up, down, diagonally and even backwards to find the hidden words.

ABIOTIC

BIOMASS

BIOTIC

CONSUMER

ECOSYSTEM

ENERGY

FOOD CHAIN

FOOD WEB

PRODUCER

TROPHIC LEVEL

M X B S Z G F J N T E H A P L
Y N Q A W O X I Z O A P A R E
I Z E E O N A B I U U B G O V
C L Q D E H S S A M O I B D E
W O W V C C K V F H Y C D U L
C E N D E C O S Y S T E M C C
B I O S I T A N G F T W Y E I
H O T T U Q A H R Y W W B R H
F Y O O E M I A E I O X E I P
F I A Z I A E E N J S T J V O
B I D B M B F R E D K U O M R
F C U J Z O A E G M Y V B Y T
B Z M I E H U Y W R O F Y G U
W U K O C U L I K H D C A I T
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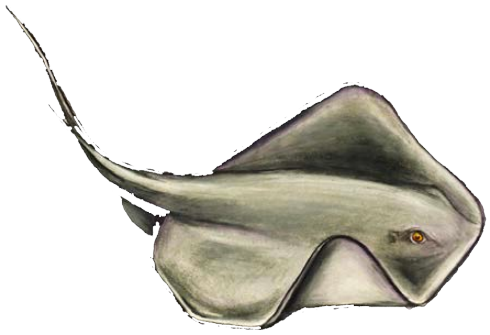
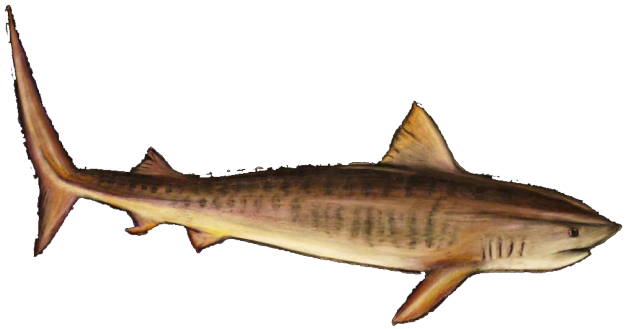


Create Your Own Marine Food Web Challenge!

Complete a food web of your own around the tiger shark, an apex predator. Draw or write the names of the organisms you include. Be sure to include these elements:

- 2 producers
- 2 primary consumers
- 2 secondary consumers
- 2 tertiary consumers
- 1 decomposer
- 3 extra marine creatures of you choice!

* Remember that the arrow points to who is doing the eating!

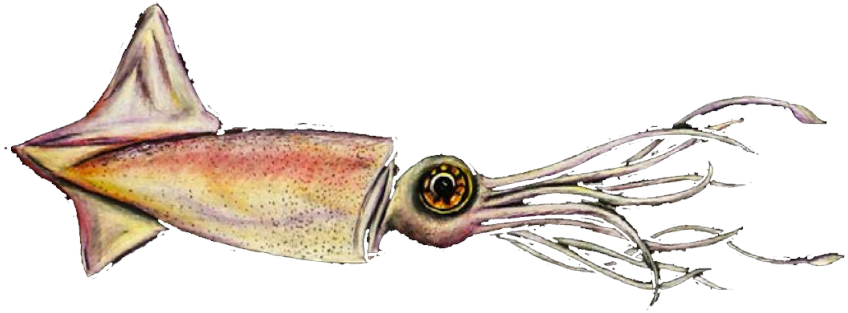


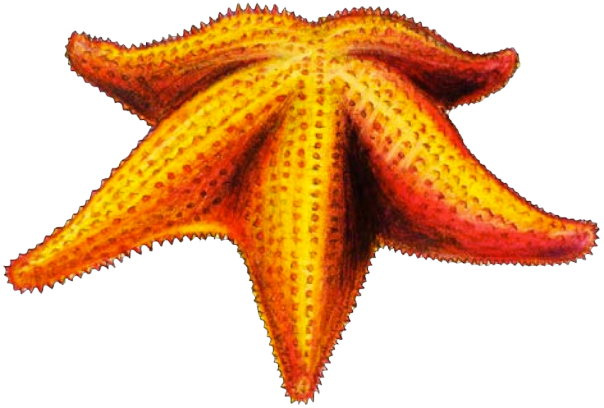
Food Web Bulletin Board

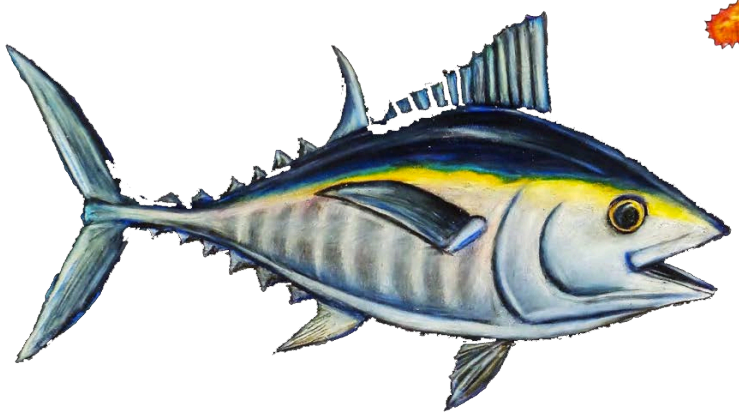
Work as a class to research the marine species depicted on the illustrated posters and create a food web on your classroom bulletin board.

Print the slides to build your bulletin board. Create multiple copies of the arrow slide and remember, the arrow points to who is doing the eating!

1) Phytoplankton
2) Zooplankton
3) Conch
4) Sea Urchin
5) Sea Star
6) Lobster
7) Jellyfish
8) Squid
9) Blue Runner
10) Spanish Mackerel
11) Blackfin Tuna
12) Stingray
13) Green Sea Turtle
14) Nurse Shark
15) Mako Shark
16) Tiger Shark





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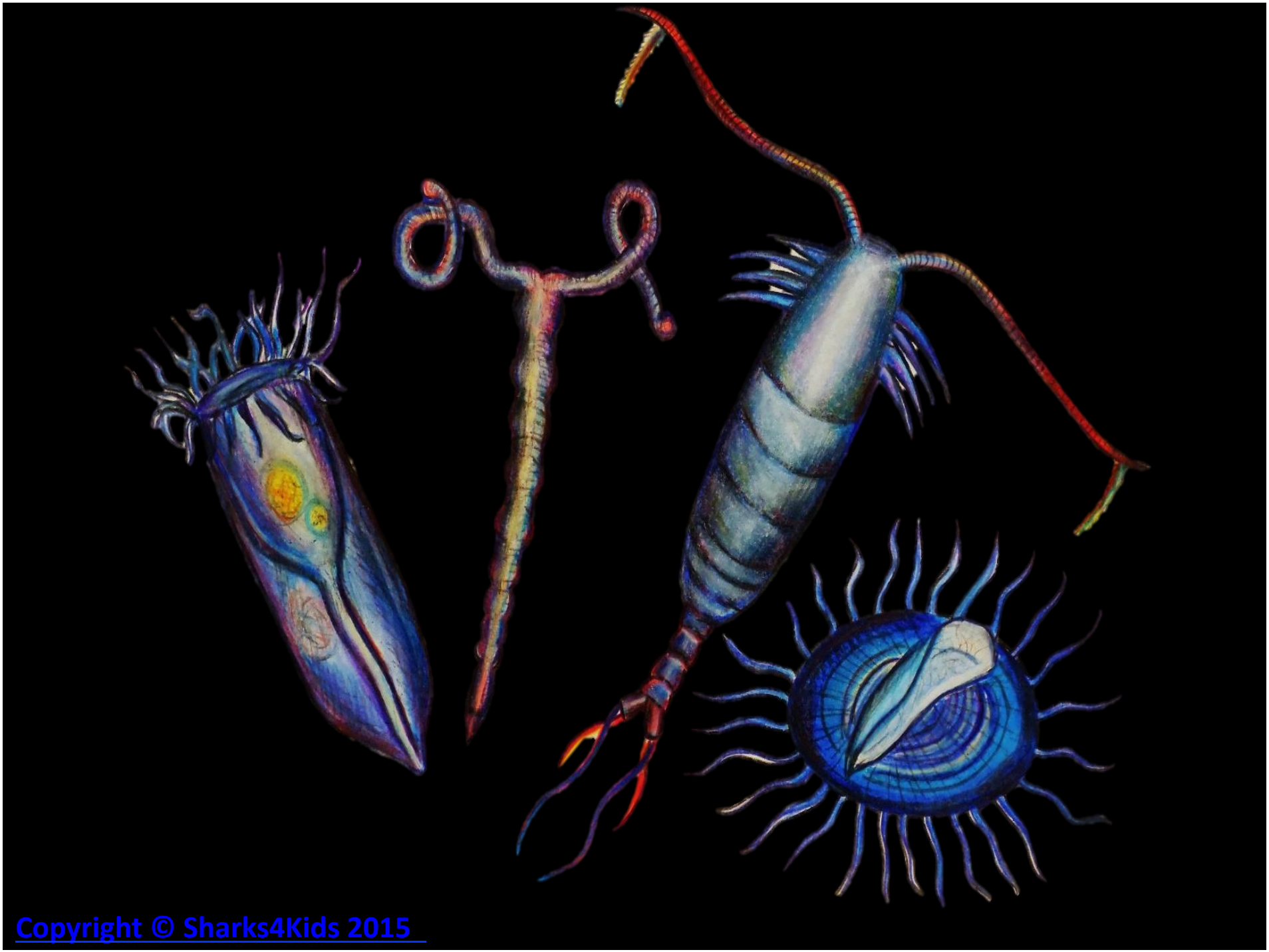


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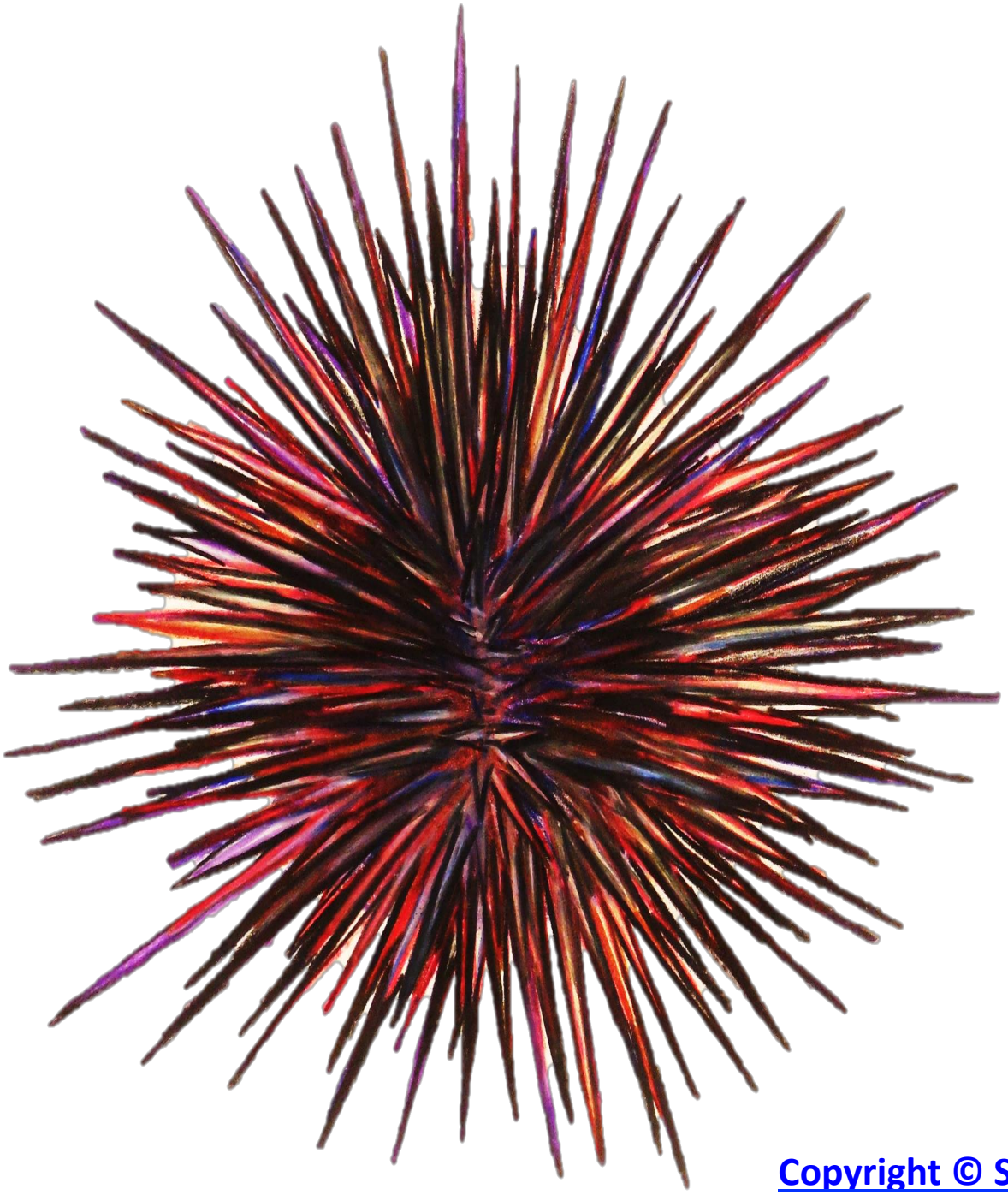

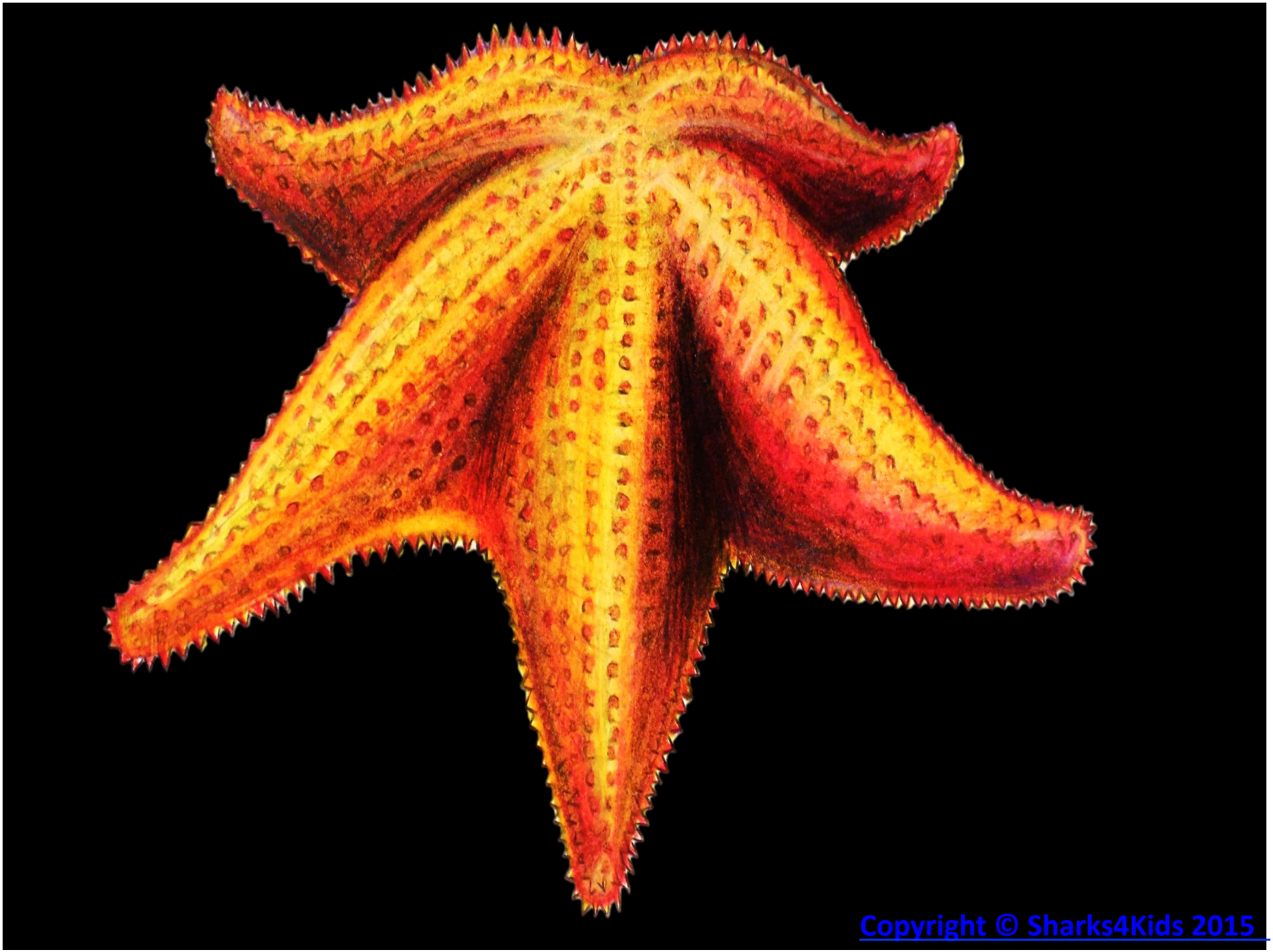

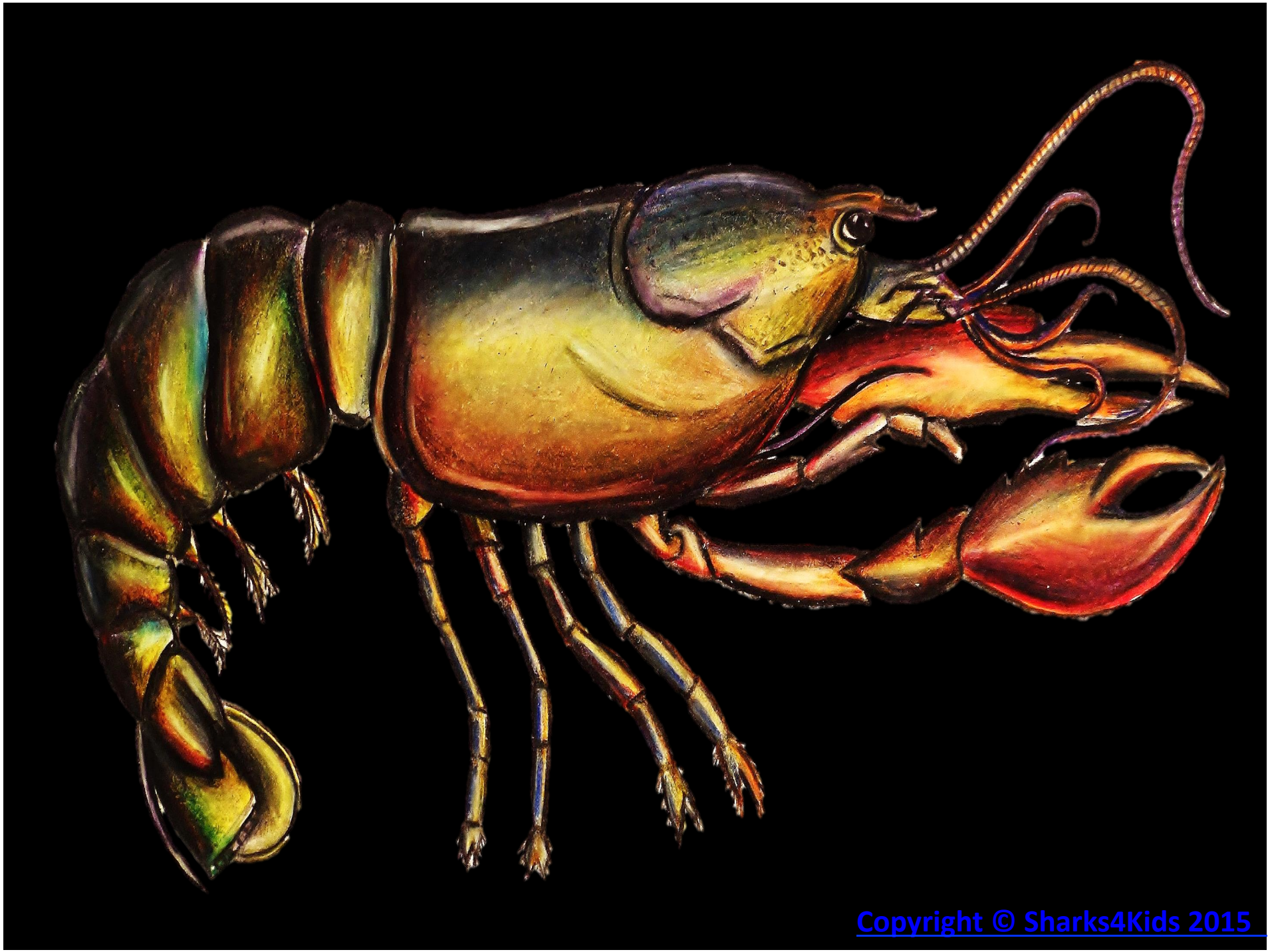
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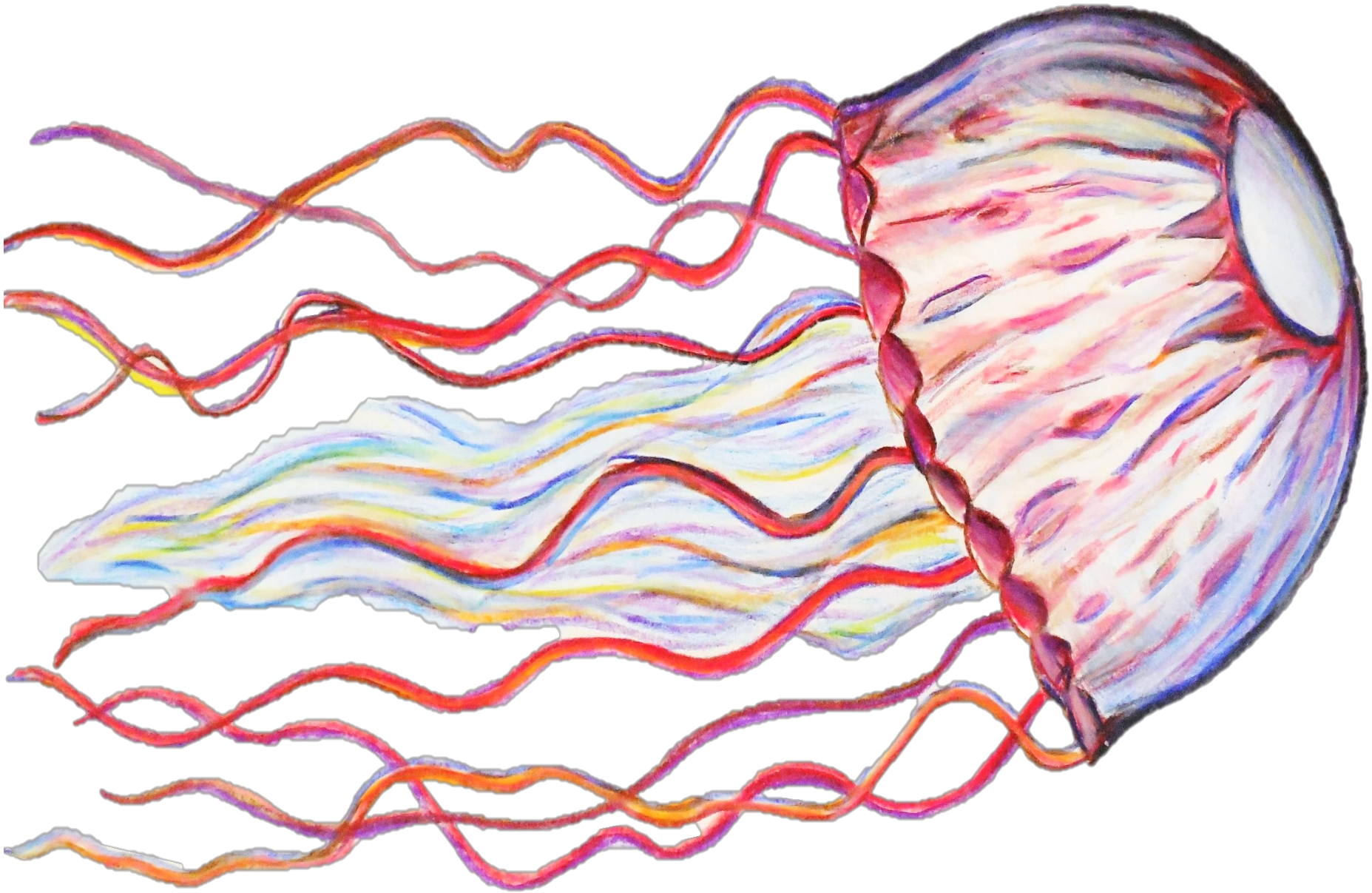

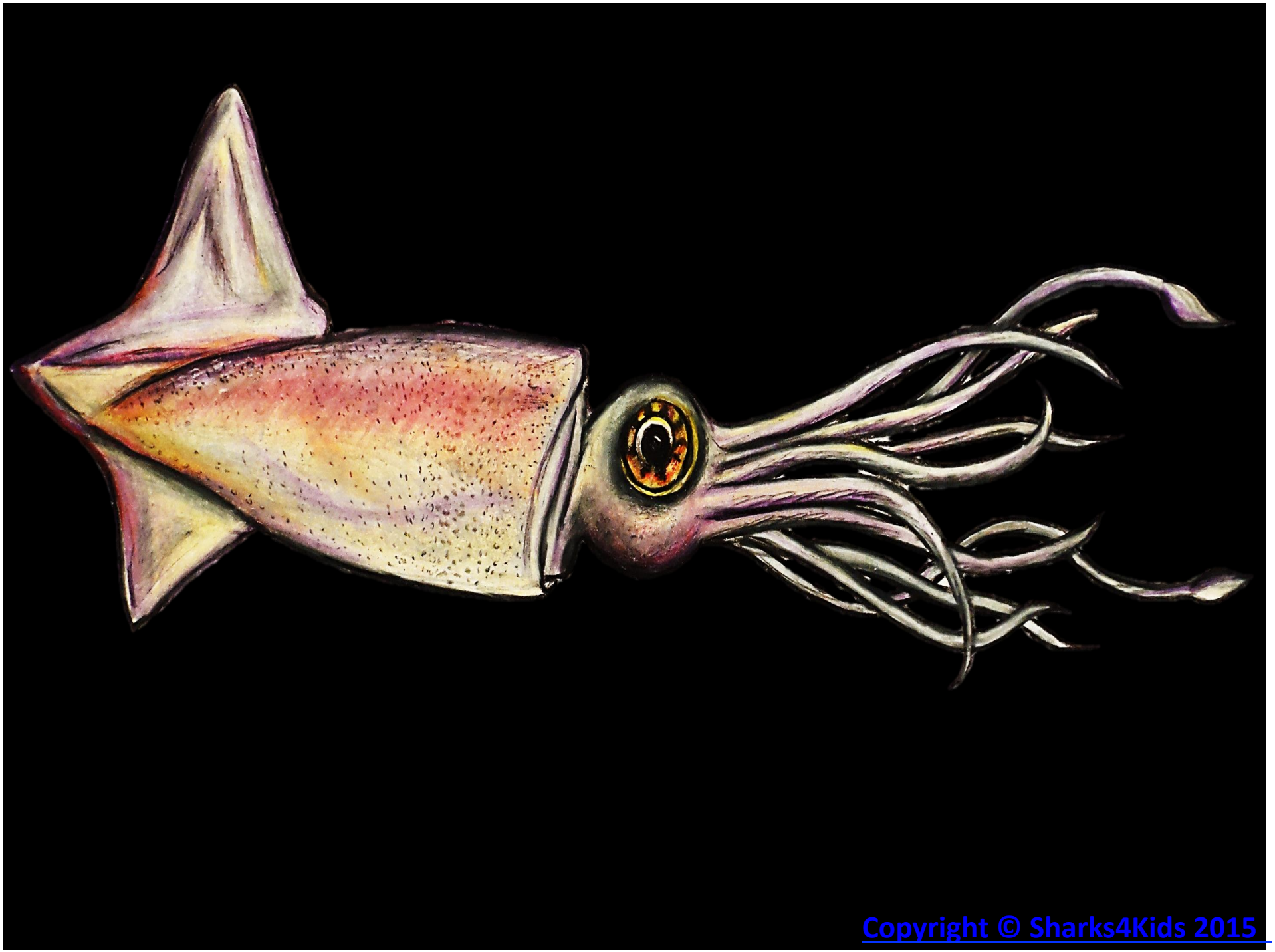

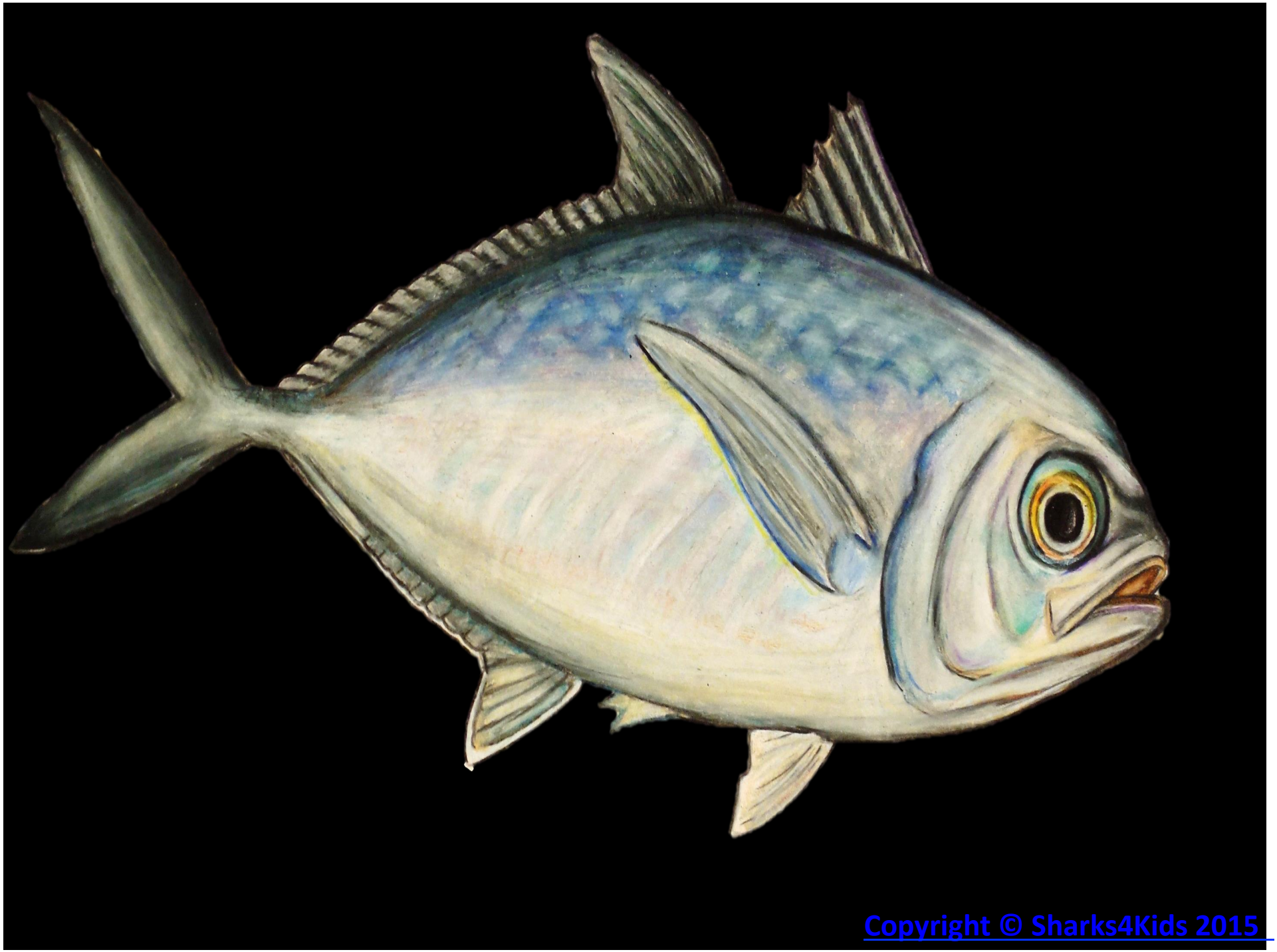
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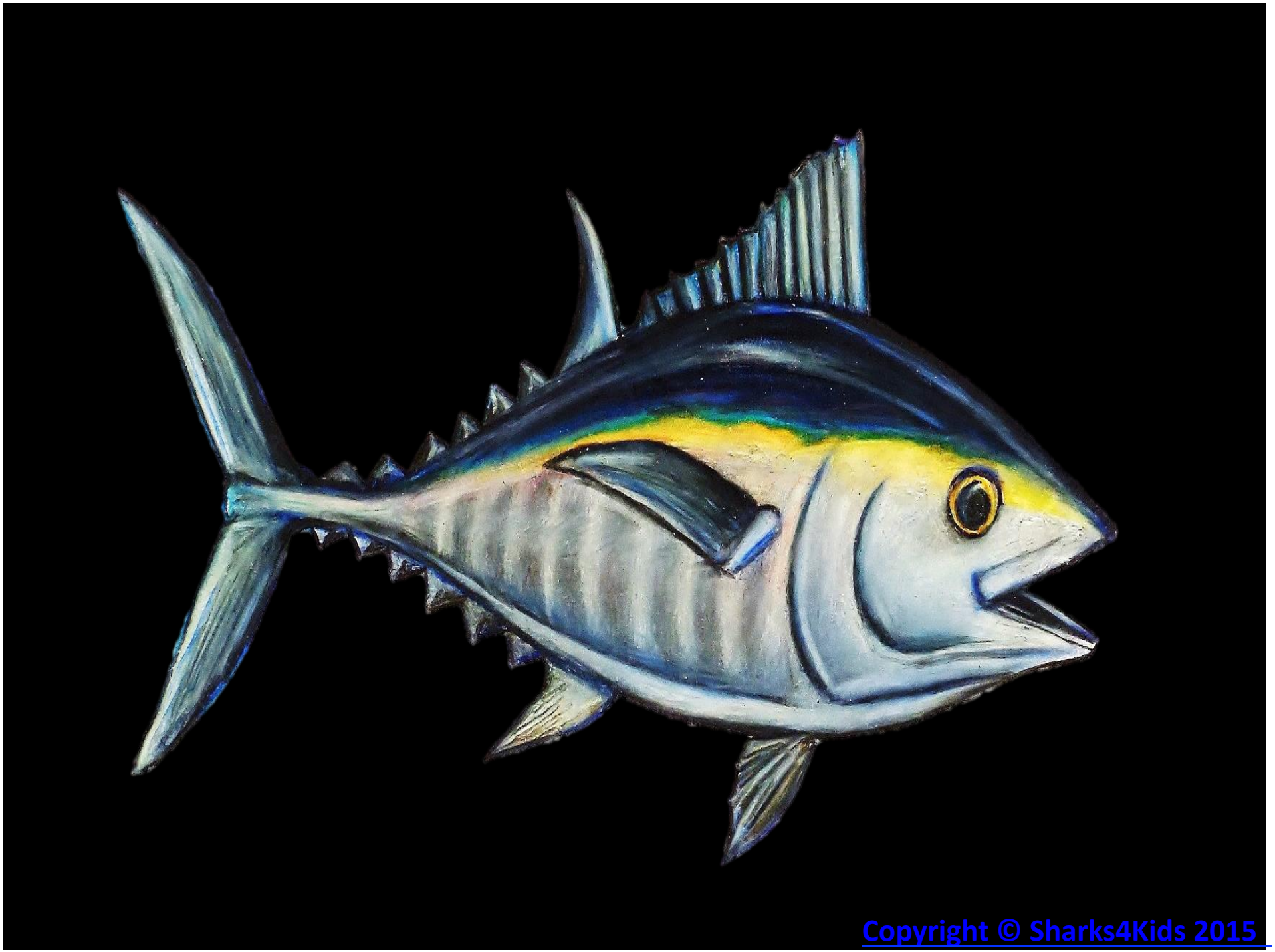

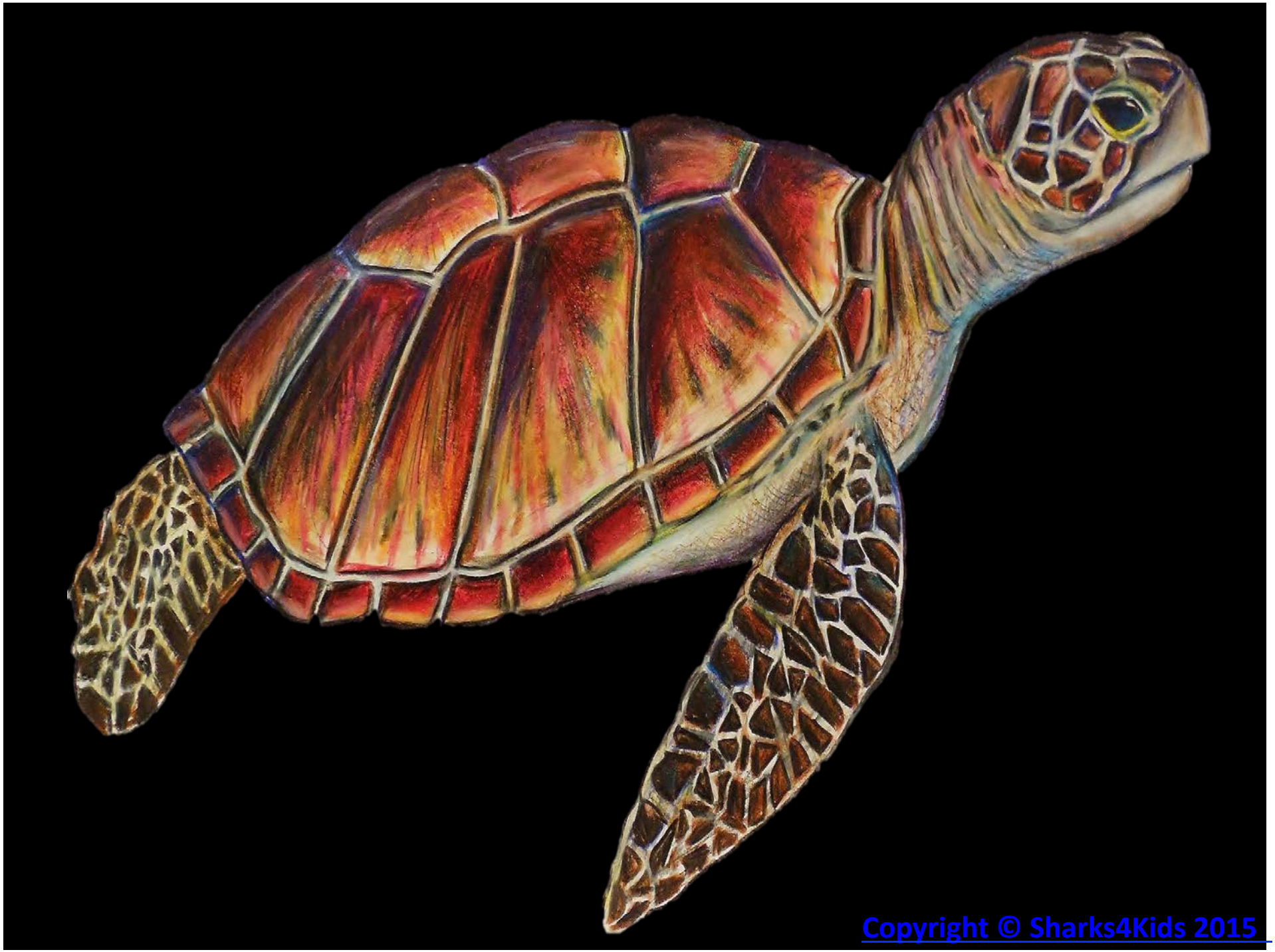
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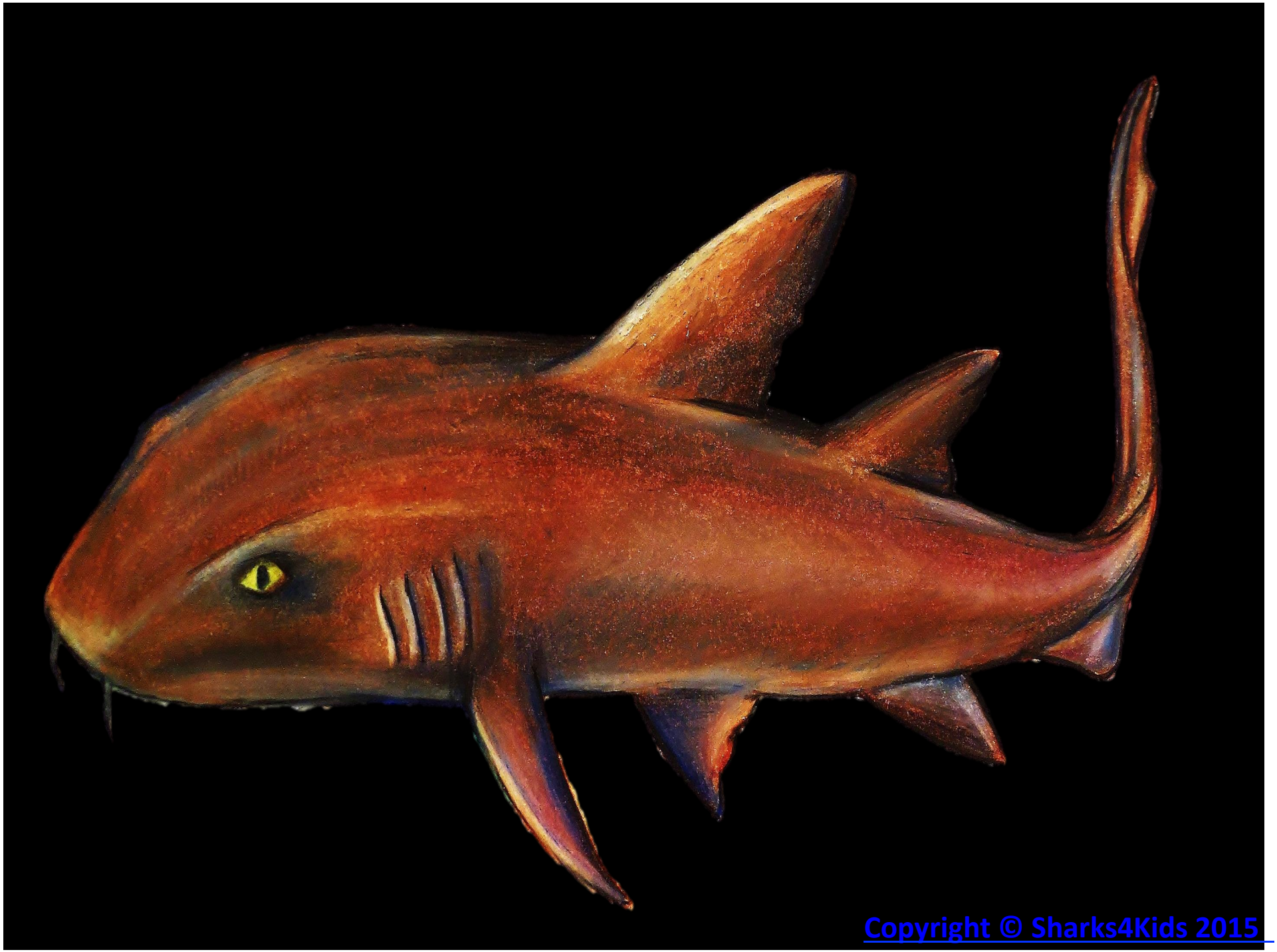
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