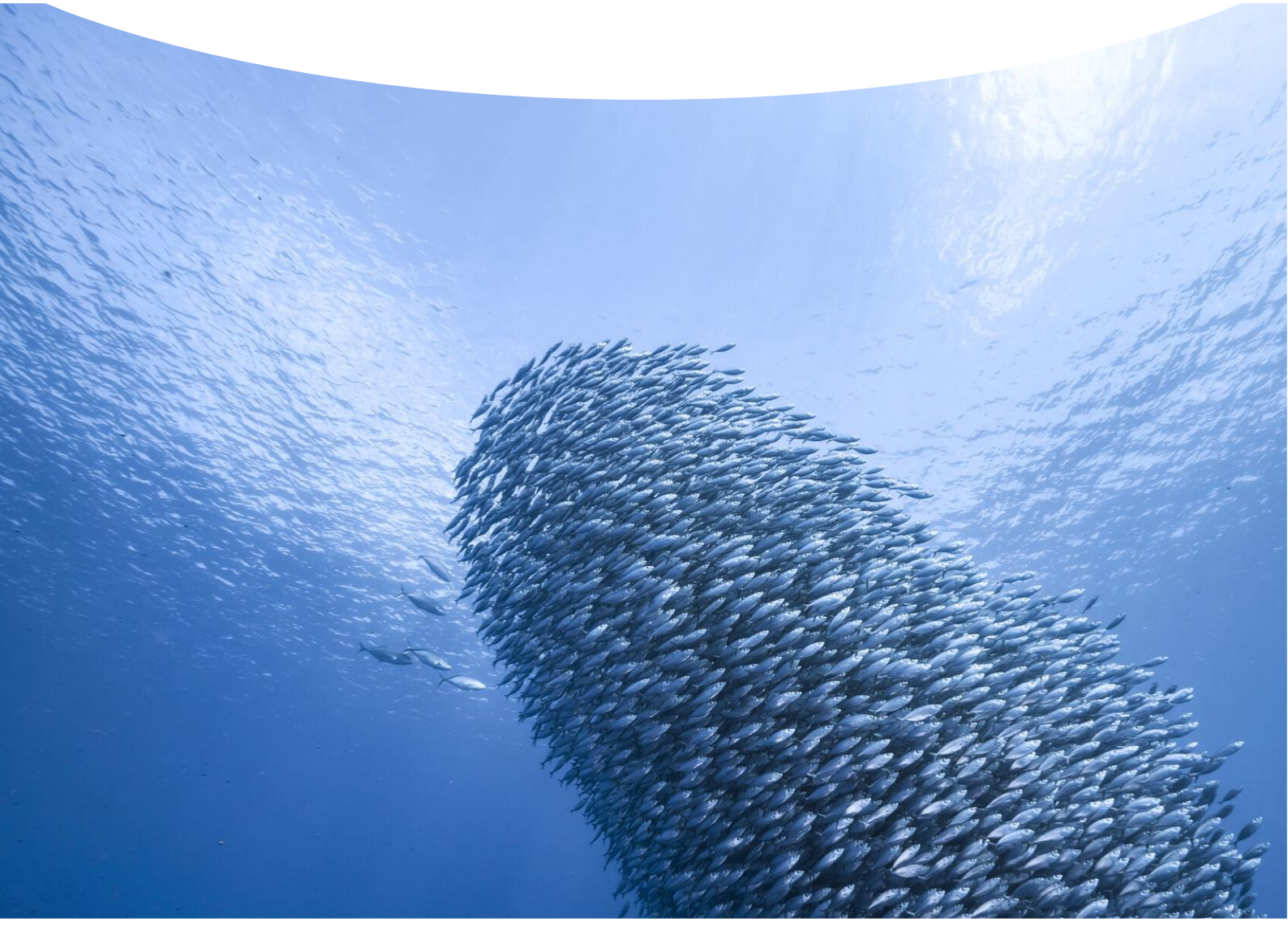
Marine Stewardship Council

ALBACORE TUNA: NZ SUSTAINABLE FISHERY CASE STUDY

TEACHER LESSON PLANS



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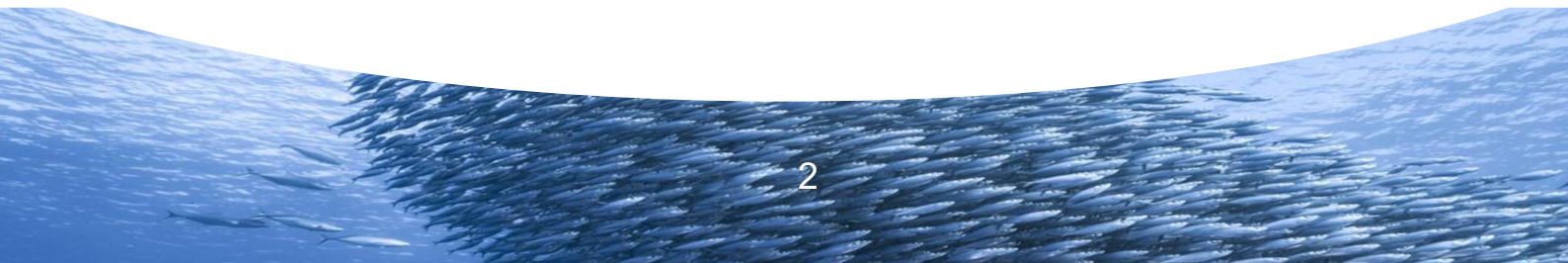
BACKGROUND

These lesson plans and teacher resources were developed to support learning around a sustainable fishery case study (New Zealand's West Coast Albacore Tuna Fishery) and to accompany the short (9 minute) educational film about this fishery.



ACTIVITY #1 : OPEN OCEAN HABITAT

CURRICULUM LINKS

ECOSYSTEMS AND HABITATS

SCIENCE (YR 1, 2, 3) / Biological / Ecosystems / Habitats (Yr 2)

Knowledge

- Habitats are places where organisms interact with other organisms and can find the resources they need for survival (e.g. Maui dolphins live in coastal waters where they can catch small fish).
- Animals and plants vary across habitats (e.g. beach, ocean, rainforest).

Practices

- Identifying and explaining how the structural features and behaviours of organisms support their survival in their habitats (e.g. pāua have a large, muscular foot to stick to rocks)

ECOSYSTEMS AND FOOD WEBS

SCIENCE PHASE 2: Ecosystems YEAR 5

KNOWLEDGE: Relationships in an ecosystem

- An ecosystem is a community of organisms interacting with each other and with their habitat (e.g. water, land, air).
- Organisms in an ecosystem are interdependent and have roles that cycle matter through the system.

PRACTICES

- Representing relationships in ecosystems using food webs.

STUDENT ACTIVITY: OPEN OCEAN HABITAT

(**Teachers**: See teacher background information to expand your knowledge)

1. Discuss key differences between marine habitats.
2. Talk about the open ocean habitat.
3. What it would be like living in the open ocean like Albacore tuna do?
4. What would you see? (e.g. lots of blue!)
5. What other creatures would live there? (e.g. planktonic creatures, large and fast creatures sometimes in schools)
6. How might the different creatures of this habitat interact? (intro to the idea of interdependence and interactions through food webs)
7. How might it feel in the open ocean? (e.g. open, empty, clean, light, rough sometimes and calm other times)
8. What would you need to do and be to survive there? (e.g. swim fast, have eyes that can look around, find food to eat, avoid being eaten)
9. What are some threats to this ocean habitat and what can we do to protect ocean ecosystems like this one?
10. **Use ideas and learning from this activity to create a labelled picture or diagram illustrating the open ocean habitat**

EXTENSION ACTIVITIES:

- Complete the above activity again for other ocean habitats such as sandy beach, rocky shore, deep water… and compare with the pelagic habitat. What are some key differences.
- Use this free teacher resource to explore characteristics of marine habitats and meet some sea creatures that live in each habitat.
- Use these simple scientific keys to explore the body shapes of fishes (includes simple scientific keys for understanding fish body shapes and characteristics in relation to habitat).

ACTIVITY #2 : FISH CHARACTERISTICS: CASE STUDY ALBACORE TUNA

CURRICULUM LINKS

ECOSYSTEMS AND HABITATS

SCIENCE (YR 1, 2, 3) / Biological / Ecosystems / Habitats (Yr 2)

Knowledge

- Habitats are places where organisms interact with other organisms and can find the resources they need for survival (e.g. Maui dolphins live in coastal waters where they can catch small fish).
- Animals and plants vary across habitats (vary across habitats (e.g. beach, ocean, rainforest).

Practices

- Identifying and explaining how the structural features and behaviours of organisms support their survival in their habitats (e.g. pāua have a large, muscular foot to stick to rocks)

ECOSYSTEMS AND FOOD CHAINS

SCIENCE (YR 1, 2, 3) / Biological / Ecosystems / Food Chains (Yr 3)

Knowledge

- Nutrition is transferred from one organism to another when organisms eat other organisms.

Practices

- Identifying and explaining how the structural features and behaviours of organisms support their survival in their habitats (e.g. pāua have a large, muscular foot to stick to rocks)

ECOSYSTEMS AND FOOD WEBS

SCIENCE PHASE 2: Ecosystems YEAR 5

KNOWLEDGE: Relationships in an ecosystem

- An ecosystem is a community of organisms interacting with each other and with their habitat (e.g. water, land, air).
- Organisms in an ecosystem are interdependent and have roles that cycle matter through the system.

PRACTICES

- Representing relationships in ecosystems using food webs.

DIVERSITY AND FOOD WEBS

PHASE 1 SCIENCE (YR 1, 2, 3) / Biological / Organism Diversity / How organisms meet their needs (Yr 3)

Knowledge

- Animals gain nutrition by digesting other organisms.
- Different types of animals have varied diets, with some eating plants (herbivores), some eating other animals (carnivores), and some eating a variety of foods (omnivores).
- Animals have body structures adapted for their diets (e.g. teeth, jaw size, snout/beak length, tongue shape).
- The teeth of carnivores and herbivores look different, related to their different functions.

Practices

- Comparing the diets of different types of animals (herbivores, carnivores, omnivores) and explaining how their body structures (e.g. teeth, jaw size, snout/beak length, tongue shape) relate to the food types they consume
- Predicting the type of diet an animal eats based on the size and shape of its teeth

STUDENT ACTIVITY: FISH CHARACTERISTICS: CASE STUDY ALBACORE TUNA

(**Teachers**: See teacher background information to expand your knowledge)

1. Talk about the fact that open water / pelagic fish (like tuna) need to be able to swim fast and live mostly in the upper more well lit part of the open ocean (e.g. they are not bottom dwellers like flounder or deep water creatures like angler fish).

2. Discuss the fact that where a fish lives and how it lives affects how it looks and explore the idea that fish have evolved to suit their habitat. (e.g. pelagic fish like tuna generally have smaller eyes than the deep water fish, sleek bodies and powerful tails to swim fast, often darker upper body and silver or white under body (camouflage). Look at the shape of different fish.

3. Use the pictures provided and ask learners to sort the fish pictures into two piles – ones they think are similar in body type and suited to the open ocean and ones that are different.

4. Discuss the body shapes and characteristics of each fish (see notes below)

    - Orange roughy (red spikey fish)– has eyes either side of it's head so swims above the bottom. Has big eyes – suggesting low light environment. Lives in 400m – 1800m depth.

    - Eel – oceanic eels mostly hide in holes or rocky caves and crevices.

    - Tuna species – forked tail indicates very fast swimmer. Body shape indicates open ocean swimming above the bottom. Eyes on the side of the head indicate open / mid water swimming.

    - Butterfly fish (yellow) – tall and slim so can move amongst corals and rocks, pointy mouth helps it dig out prey from crevices

    - Swordfish – very fast swimmer (forked tail); lives above the bottom (eyes on either side of its head) in open water. Kills prey by stunning first with its sword!

    - Flounder (flat fish) – lives on the sandy seafloor (eyes on top of one side), mouth on underside so feeds on bottom.

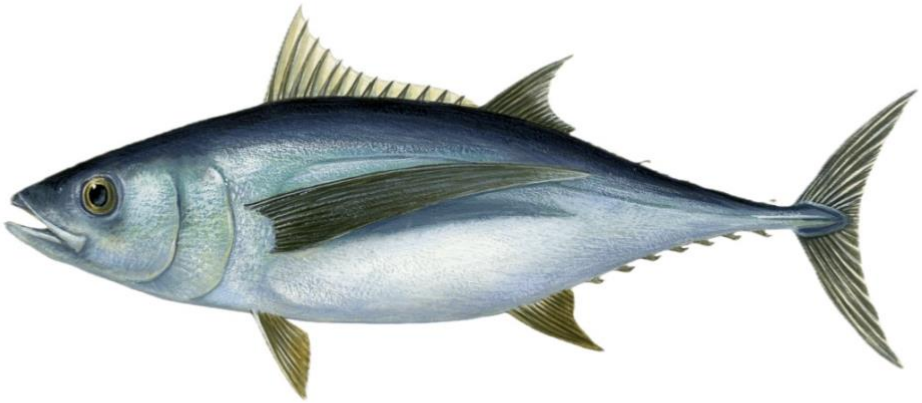
5. Extend this learning by asking students what they can tell about where and how a fish might live from the fishes body characteristics. Then use a simple set of scientific keys to help expand understanding of the relationship between habitat and life style with body characteristics.

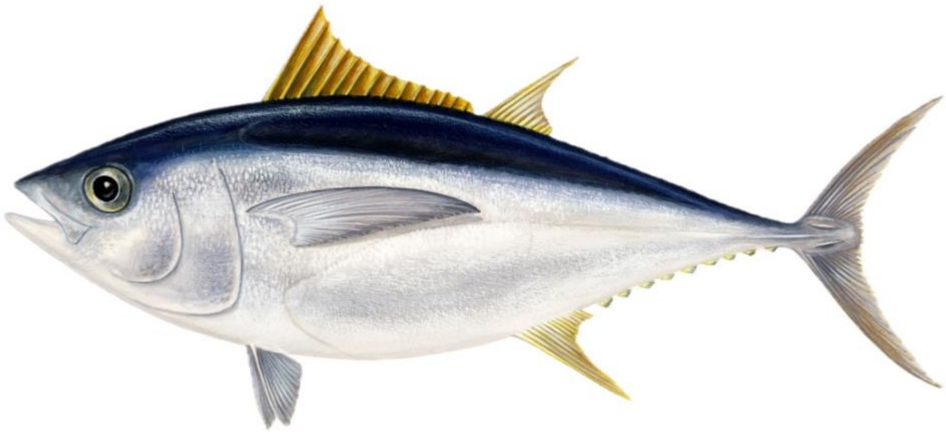
6. Use ideas and learning from this activity to create an imaginary fish and describe the habitat where the fish lives (imaginary or real). Fish body characteristics should correspond to the habitat in which it lives.

EXTENSION ACTIVITIES:

- Use Ngā ika moana o Aotearoa (New Zealand fishes) cards to learn more about some of the fish species living in Aotearoa New Zealand.
- Use the simple set of scientific keys to work out where and how some of these fish might live.

PRINTABLE RESOURCE FOR FISH CHARACTERISTICS ACTIVITY



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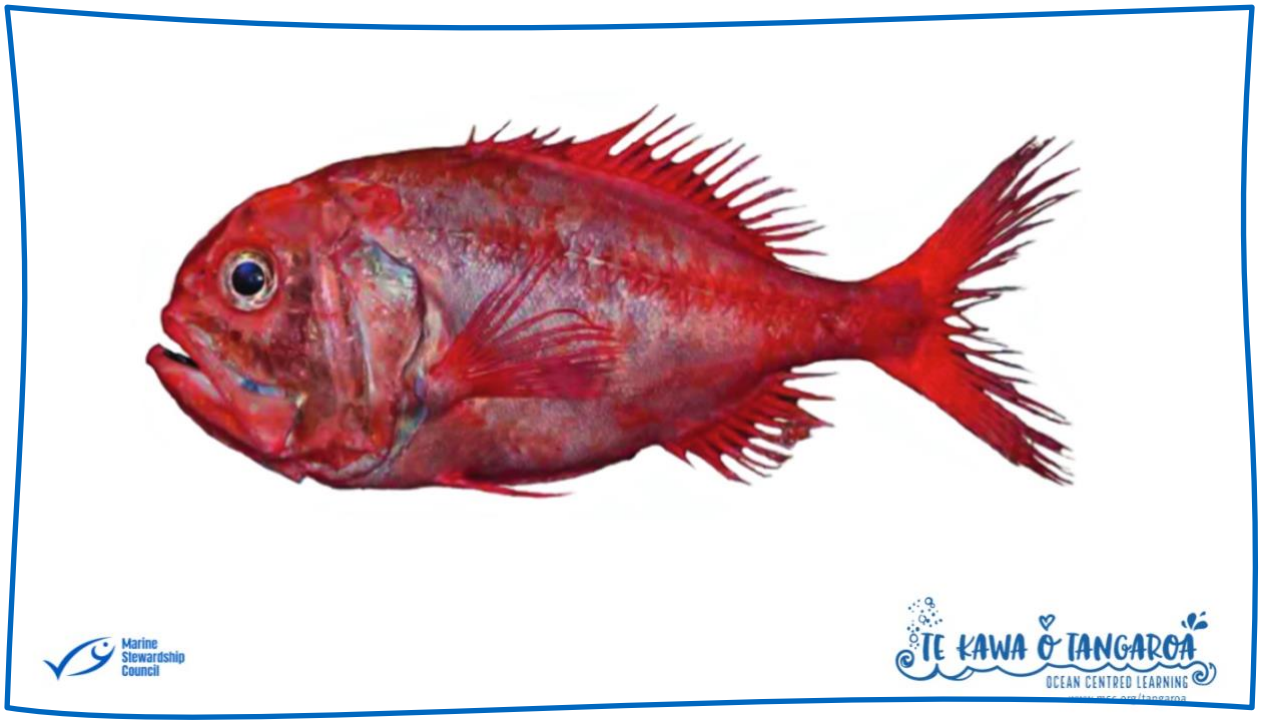
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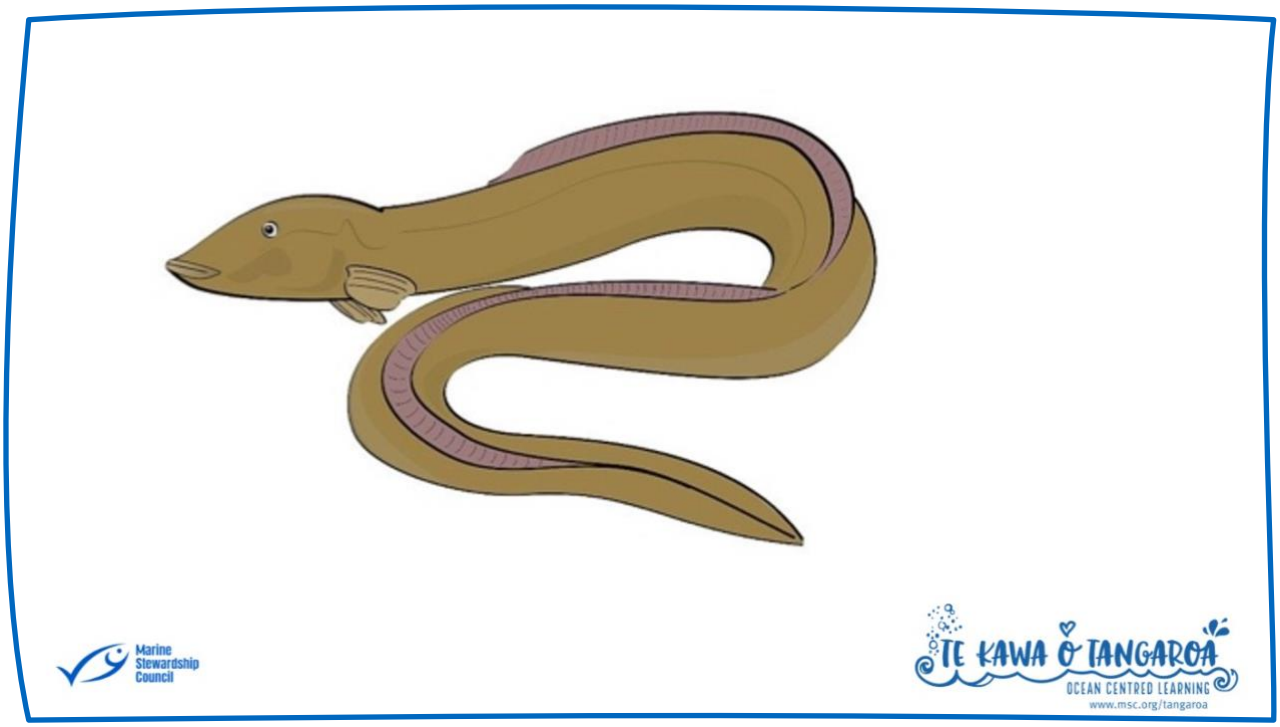
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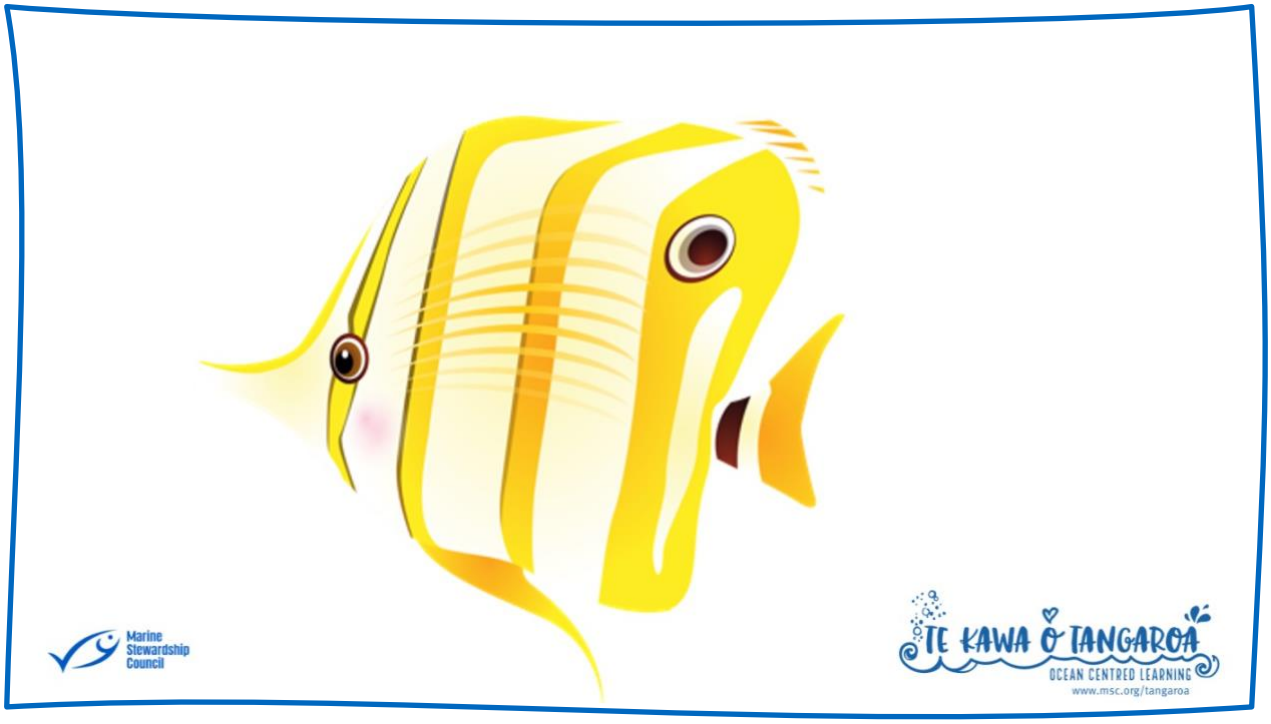
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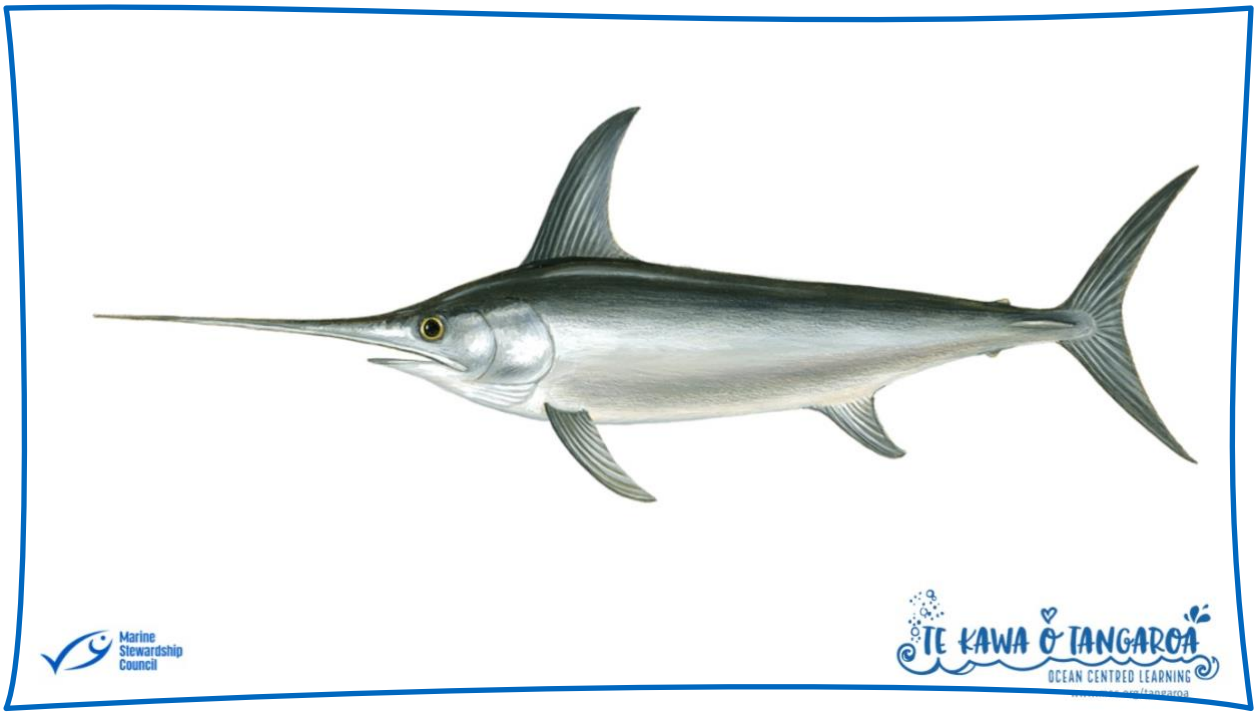
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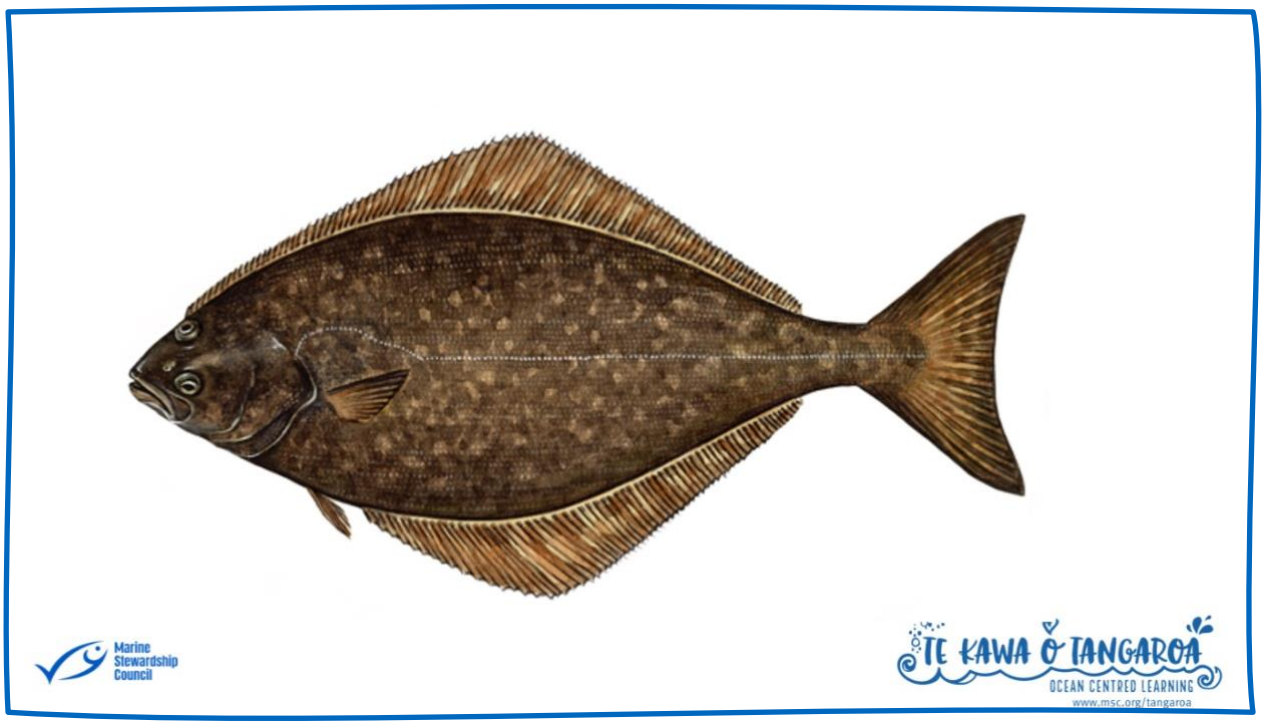
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ACTIVITY#3 : OCEAN FOOD CHAIN

CURRICULUM LINKS

DIVERSITY AND FOOD WEBS

PHASE 1 SCIENCE (YR 1, 2, 3) / Biological / Organism Diversity / How organisms meet their needs (Yr 3)

Knowledge

- Animals gain nutrition by digesting other organisms.
- Different types of animals have varied diets, with some eating plants (herbivores), some eating other animals (carnivores), and some eating a variety of foods (omnivores).
- Animals have body structures adapted for their diets (e.g. teeth, jaw size, snout/beak length, tongue shape).
- The teeth of carnivores and herbivores look different, related to their different functions.

Practices

- Comparing the diets of different types of animals (herbivores, carnivores, omnivores) and explaining how their body structures (e.g. teeth, jaw size, snout/beak length, tongue shape) relate to the food types they consume
- Predicting the type of diet an animal eats based on the size and shape of its teeth

ECOSYSTEMS AND FOOD CHAINS

SCIENCE (YR 1, 2, 3) / Biological / Ecosystems / Food Chains (Yr 3)

Knowledge

- Nutrition is transferred from one organism to another when organisms eat other organisms.

Practices

- Identifying and explaining how the structural features and behaviours of organisms support their survival in their habitats (e.g. pāua have a large, muscular foot to stick to rocks)

ECOSYSTEMS AND FOOD WEBS

SCIENCE PHASE 2: Ecosystems YEAR 5

KNOWLEDGE: Relationships in an ecosystem

- An ecosystem is a community of organisms interacting with each other and with their habitat (e.g. water, land, air).
- Organisms in an ecosystem are interdependent and have roles that cycle matter through the system.

PRACTICES

- Representing relationships in ecosystems using food webs.

STUDENT ACTIVITY: OCEAN FOOD CHAIN

(**Teachers**: See teacher background information to expand your knowledge)

PART ONE: FOOD CHAIN

1. Discuss the idea that sea creatures eat one another to survive.
2. Explore the nutritional relationships between sea creatures using a simple food chain.
3. Print out the pages provided and have learners place pages in the correct order to illustrate a simple food chain.
4. Discuss
   - How in ocean ecosystems everything is connected to everything else?
   - What happens if one creature in a food chain or food web disappears?
   - What happens if one creature in the food chain or food web declines in numbers (e.g. other creatures have less to eat or get eaten less)?
   - What happens if a species in the food chain dramatically increases in numbers (e.g. other creatures have more to eat or get eaten more)?
5. What would happen if we caught too many of our favourite fish?
6. Explore the idea of sustainable fishing and discuss the following:
   - How does sustainable fishing differ to unsustainable fishing (and overfishing)?
   - How these two approaches yield different outcomes for the health of ocean ecosystems?

7. Use ideas and learning from this activity to create a food chain for a marine creature of your own choice that illustrates at least two of produce, consumer, decomposer, carnivore, omnivore, herbivore
    - Catch fish the sustainable way

PART TWO: FISH MOUTH CHARACTERISTICS AND EATING

8. Explore the different mouths of fish and relate these to different feeding strategies. For example, a mouth on the bottom of the fish body suggests it's a bottom feeder. Sharp teeth indicate it eats larger or tougher prey. Short square teeth are better for grinding or grazing. Some sea creatures eat very small organisms filtering their food from the seawater. A long pointy mouth might indicate that a creature finds food in crevices, caves or tunnels.

9. Use the fish pictures provided to compare different mouth characteristics of fishes and discuss what the different mouth characteristics might tell us about how and where a fish lives and feeds.

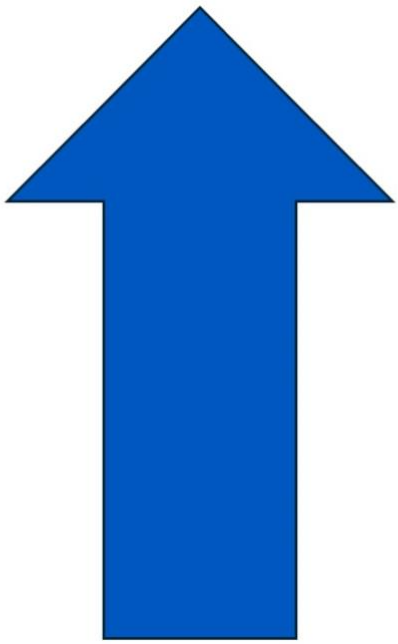
EXTENSION ACTIVITIES:

- Use Ngā ika moana o Aotearoa (New Zealand fishes) cards to explore mouth characteristics and discuss what this might tell us about the feeding strategies of some fish species living in Aotearoa New Zealand.

PRINTABLE RESOURCE 1 FOR OCEAN FOOD CHAIN ACTIVITY

SIMPLE OCEAN FOOD CHAIN (FOR ALBACORE TUNA)

PHYTOPLANKTON



JELLY FISH

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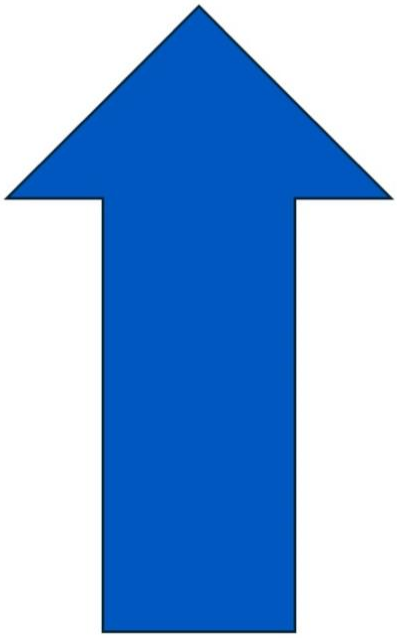

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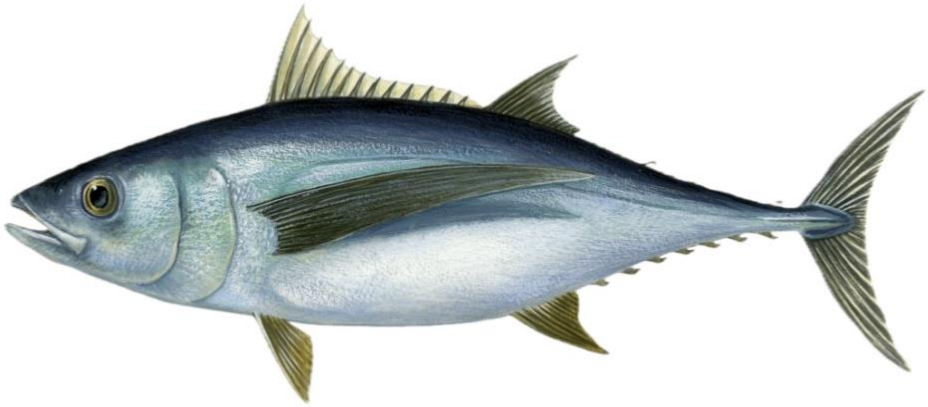
ALBACORE TUNA



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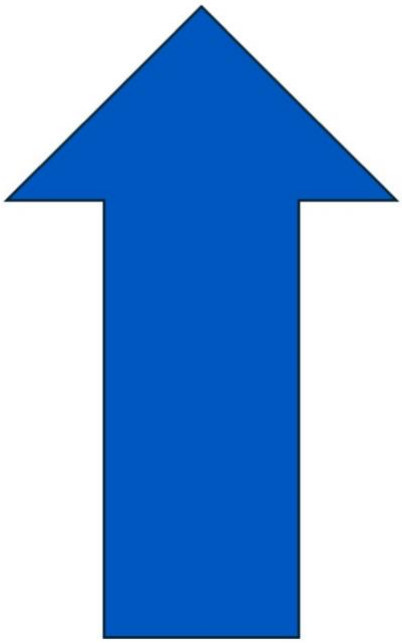

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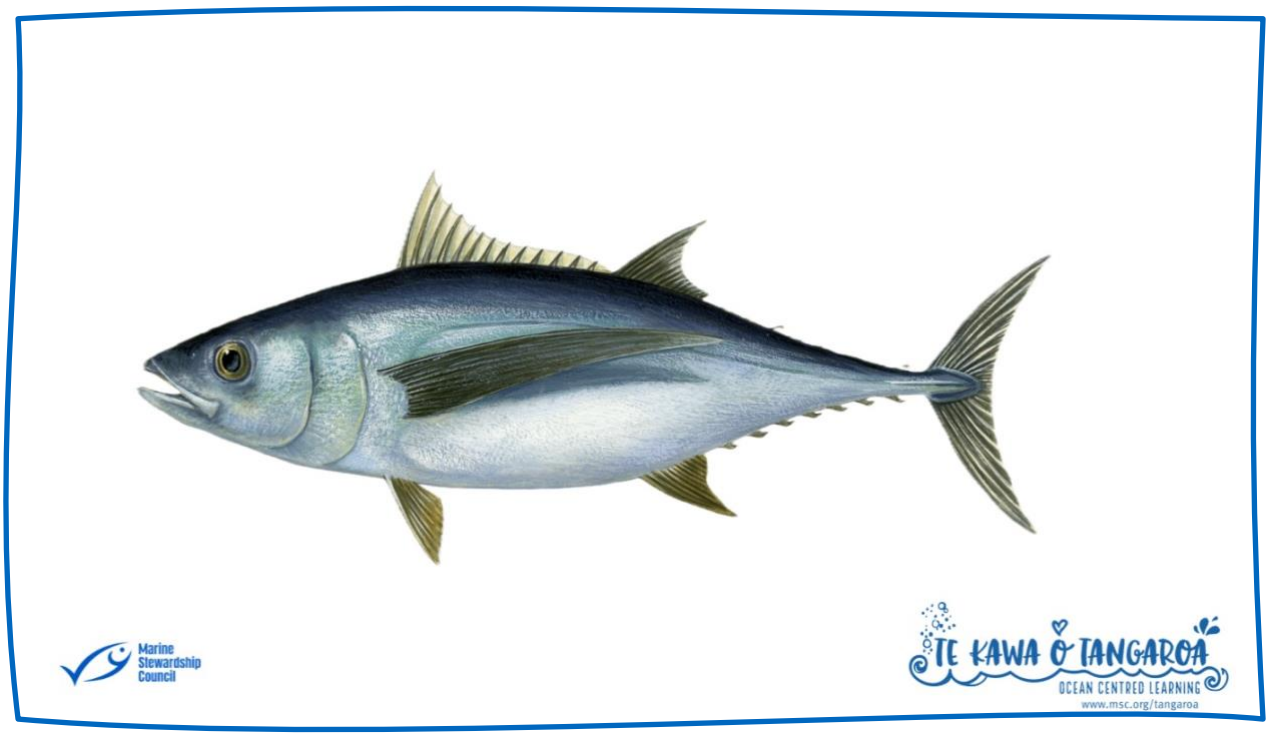
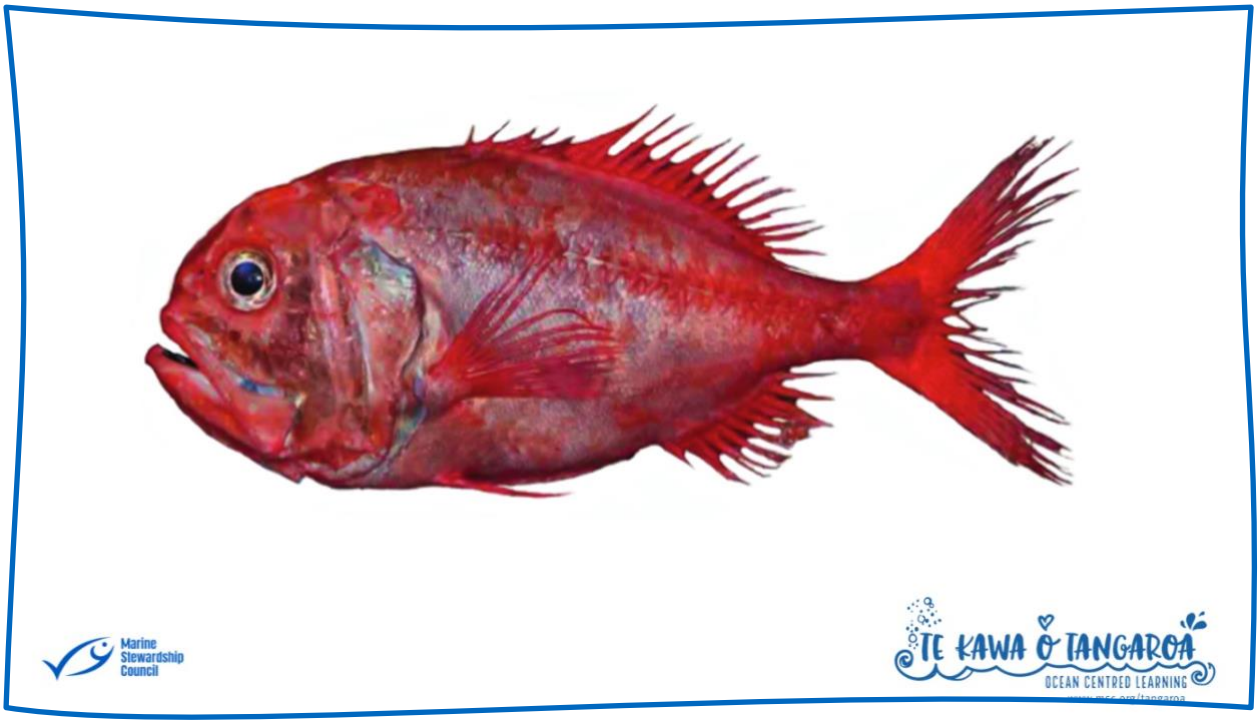
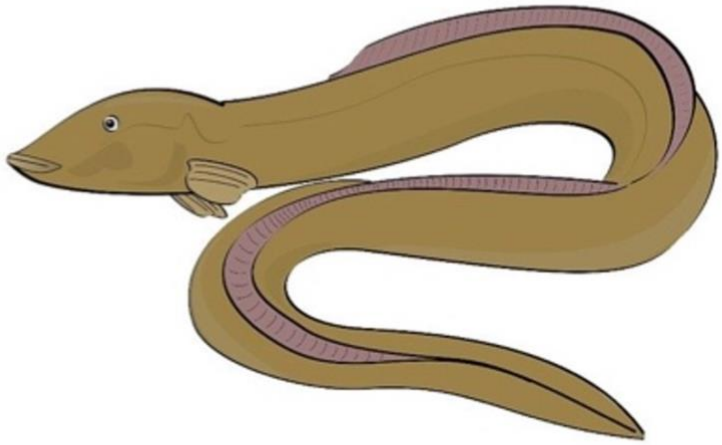
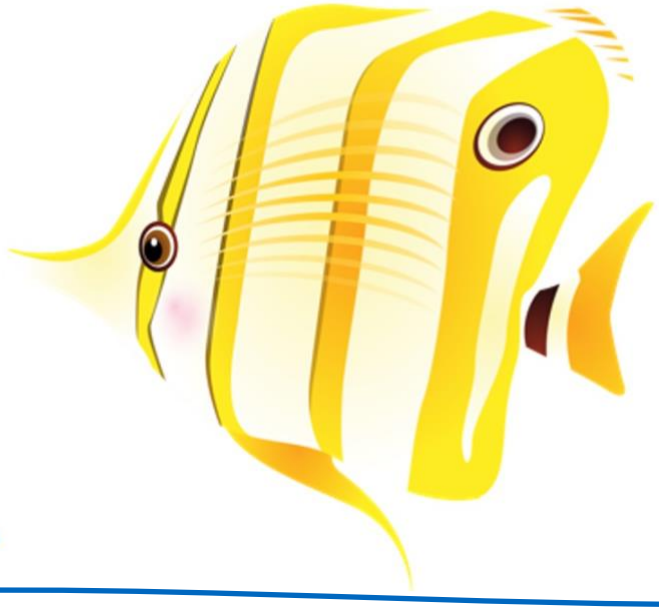
SHARK

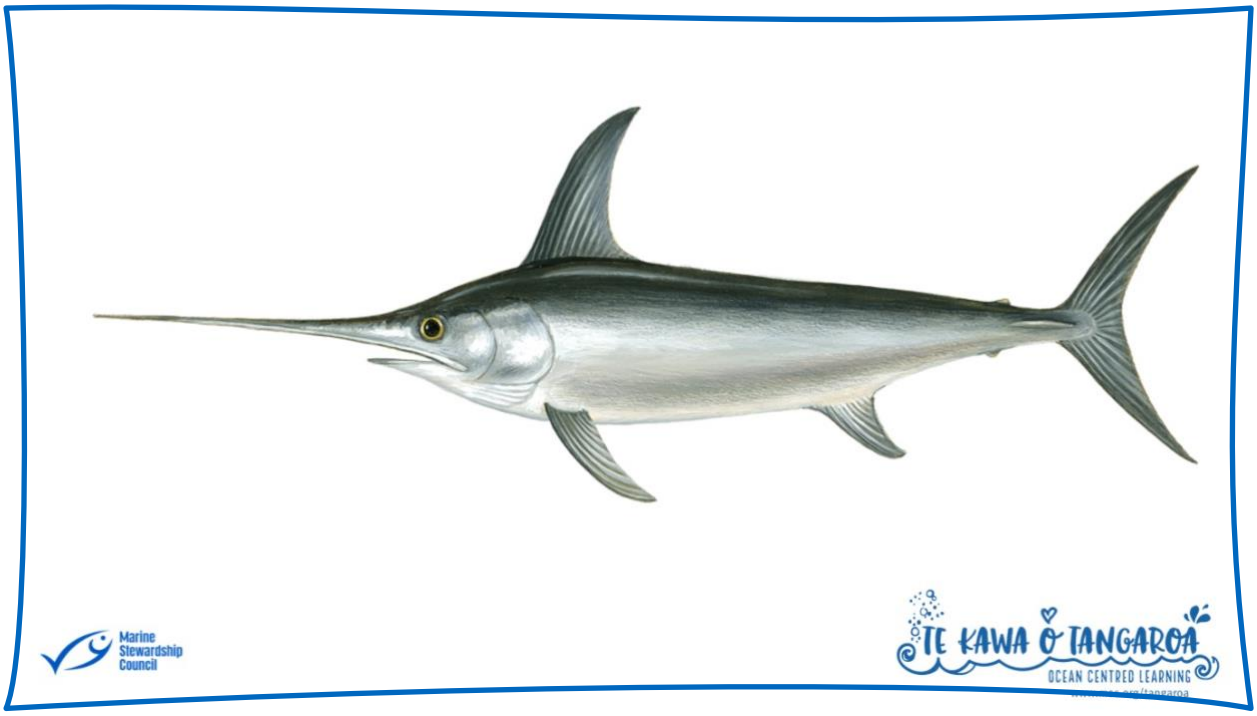
PRINTABLE RESOURCE 2 FOR OCEAN FOOD CHAIN ACTIVITY







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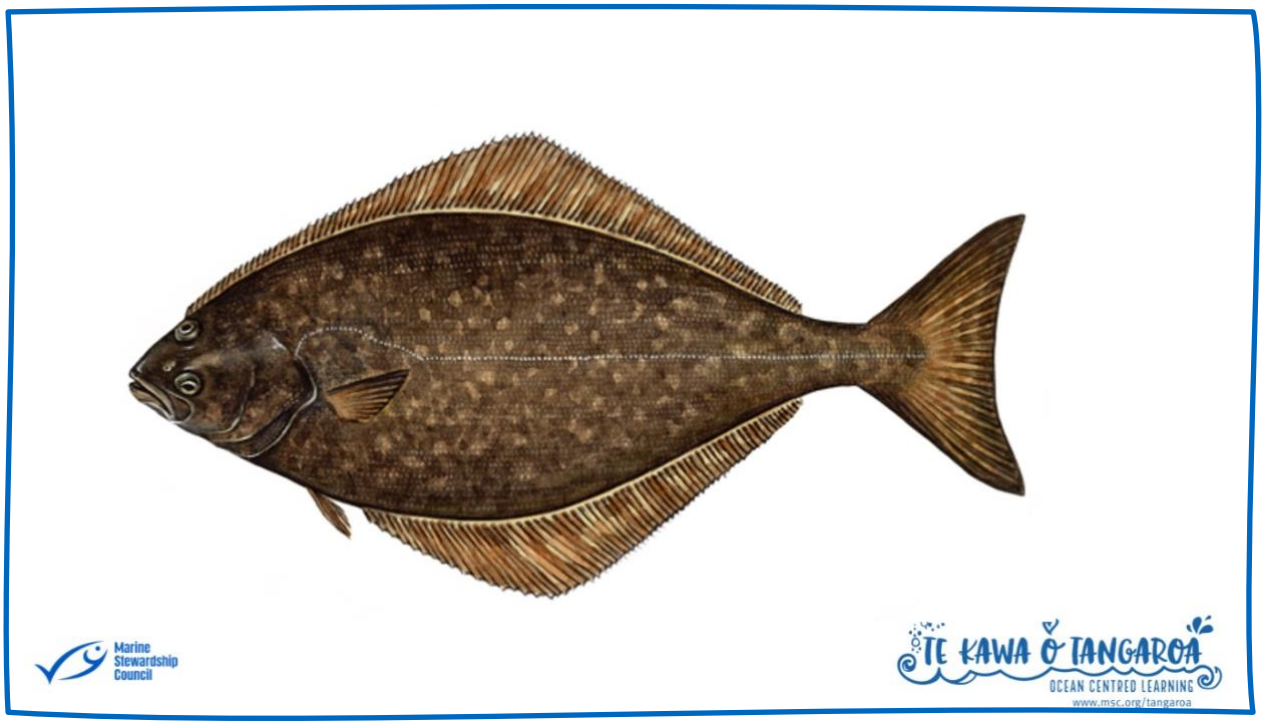
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ACTIVITY #4 : SUSTAINABLE FISHING

CURRICULUM LINKS

HUMANS AND ECOSYSTEMS

SCIENCE PHASE 3: Ecosystems YEAR 7

KNOWLEDGE: Ecosystem interactions

- Human activity and technology impact the environment.
- Humans benefit from managing other species to produce material.
- Humans are part of ecosystems and can change them through their actions.
- Humans can support the health of the environment.

PRACTICES

- Explaining how humans benefit from other organisms and natural resources and evaluating the importance of biodiversity in daily life.
- Evaluating ways humans can positively impact ecosystems and communicating actions that support kaitiakitanga.

ENVIRONMENTAL IMPACTS OF HUMAN ACTIVITY

SCIENCE PHASE 4: Ecosystems YEAR 10

KNOWLEDGE: Environmental impacts of human activity

- Human activity can cause habitat destruction, pollution, and climate change, which threaten ecosystem stability and biodiversity.
- Human activity can alter environments faster than some species can adapt, leading to biodiversity loss.
- Some human activities, such as agriculture, can reduce or offset environmental impacts through sustainable methods and practices.
- Individually, in communities, or as nations, humans can help protect and restore ecosystems through sustainable practices, including conserving resources, supporting regeneration, and developing alternate methods for resource use.

PRACTICES

- Analysing the effects of human activities (e.g. deforestation, pollution) on ecosystems and large Earth systems (e.g. climate, oceans) using scientific models and concepts.
- Researching interventions that address specific ecosystem disruptions, using case studies or local examples to explore the practicalities and outcomes of different solutions (e.g. conservation strategies, sustainable technologies).

STUDENT ACTIVITY: SUSTAINABLE FISHING

(**Teachers**: See teacher background information to expand your knowledge)

1. Explore the idea that we too are part of ocean food chains and food webs.
2. Brainstorm what can happen in the ocean if (1) we catch too many fish or (2) we fish in a way that damages the ocean?
3. Discuss the idea of sustainable fishing? You could include the three principles of the MSC sustainable fishing standard:
    i. Sustainable fish stocks
    ii. Minimising environmental impacts
    iii. Effective fisheries management
4. Explore some different fishing methods.
5. Brainstorm different harvest controls that might be used to manage fishing so that it is sustainable (e.g. limits imposed on method, equipment, time of day, location etc).
6. Watch the short (9 minute) film about New Zealand's West Coast Albacore Tuna Fishery.
7. Brainstorm key features of the Albacore Tuna Fishery that help to make this fishery sustainable.
8. Discuss the role of science in helping us to ensure we are catching fish sustainably? Your discussion could include:
    a. Importance of understanding the fish population (to know how many we can catch)
    b. Value of understanding the fish life and reproductive cycle (to understand whether for example they are slow or fast growing, slow or fast reproducing)
    c. Importance of fisheries scientists who are monitoring fish populations over time
    d. The role of science and technology in fishery improvements (e.g. understanding implications for bycatch of mesh size, hook type, fishing method etc)
    e. Recent examples of science and research in sustainable fishing

9. Use ideas and learning from this activity to create a presentation, poster or short report addressing the question:
    - How do science and research support and enable sustainable fishing?

10. Create a written piece or a presentation to present your personal viewpoints and research findings on one or more of the following:
    - How humans benefit from the harvest of fish from the sea (economic, social, cultural and environmental)?
    - How can humans positively impact ocean ecosystems (for example ensuring fishing is sustainable)?
    - How overfishing can impact habitats, ecosystem stability and biodiversity.
    - What happens when too many fish are caught and a population of fish cannot replenish itself?
    - How does overfishing impact biodiversity?
    - How does sustainable fishing reduce and offset the impact of overfishing?

EXTENSION ACTIVITIES:

- Read the article https://www.stuff.co.nz/environment/360633029/beyond-catch-untold-story-kiwi-fishers. Write a short report outlining how this fishery reduces or offsets environmental impacts through sustainable methods and practices?

- Use the Kaitiakitanga Worksheet to explore kaitiakitanga in the context of sustainable fishing and ocean protection.

ACTIVITY#5: OCEAN TO PLATE JOURNEY

CURRICULUM LINKS

SUPPLY CHAIN AND JOBS

SOCIAL SCIENCE PHASE 2: Economic Activity YEAR 5

KNOWLEDGE: Financial education

- People do different kinds of work to help others and/or to earn money. Work can include producing goods or providing services that help people in the community and can be influenced by people's values (e.g. sustainability, providing employment, providing for family).

PRACTICES

- Comparing different kinds of work people do to help others or earn money, including making goods or providing services
- Identifying reasons that influence the type of work people do

PEOPLE AND OCEAN ENVIRONMENTS

SOCIAL SCIENCE PHASE 1: Geography YEAR 3

OCEANIA AND OCEAN ENVIRONMENTS / Locations and environments

Knowledge

- The sea is an important part of life for many people in Oceania.

Practices

- Using flow maps to communicate how goods are exchanged around Oceania

STUDENT ACTIVITY: OCEAN TO PLATE JOURNEY

(**Teachers**: See teacher background information to expand your knowledge)

1. Talk about the different parts of the ocean to our plate journey. These might include:
    a. catching the fish
    b. processing the fish
    c. transporting the fish
    d. selling the fish at market
    e. sale of fish in retail stores and supermarkets
    f. preparation of fish in homes and restaurants
2. Watch the short (9 minute) film about New Zealand's West Coast Albacore Tuna Fishery.
3. Brainstorm a list of the different parts of the journey of a fish from the ocean to a plate.
4. List some different jobs that people might do in the ocean to plate journey.
5. If you owned a shop or restaurant that was selling seafood what could you do to ensure New Zealand's fisheries continue to thrive? Brainstorm and create a class list.
6. Create your own flow map showing the journey of a fish from the ocean to a plate.

EXTENSION:

- Discuss responsible processes that can be applied at each step to improve the overall sustainability of the process.
- Compare the flow map you created with this one from FishWise. Make any additions to your flow map if needed.
- Use value statement cards to help learners explore their own values in relation to ocean protection. Then discuss what can influence why and how some people do ocean and seafood related jobs. What makes one person more sustainably inclined than another? How might personal values affect our conduct when fishing?
- Learn more from the people who work key roles in the Seafood Industry.

ACTIVITY #6 : REDUCING ENVIRONMENTAL IMPACTS

CURRICULUM LINKS

ENVIRONMENTAL IMPACTS OF HUMAN ACTIVITY

SCIENCE PHASE 4: Ecosystems YEAR 10

KNOWLEDGE: Environmental impacts of human activity

- Human activity can cause habitat destruction, pollution, and climate change, which threaten ecosystem stability and biodiversity.
- Human activity can alter environments faster than some species can adapt, leading to biodiversity loss.
- Some human activities, such as agriculture, can reduce or offset environmental impacts through sustainable methods and practices.
- Individually, in communities, or as nations, humans can help protect and restore ecosystems through sustainable practices, including conserving resources, supporting regeneration, and developing alternate methods for resource use.
- Ecosystems can usually regenerate naturally, and humans can support this through conservation and restoration.

PRACTICES

- Analysing the effects of human activities (e.g. deforestation, pollution) on ecosystems and large Earth systems (e.g. climate, oceans) using scientific models and concepts
- Researching interventions that address specific ecosystem disruptions, using case studies or local examples to explore the practicalities and outcomes of different solutions (e.g. conservation strategies, sustainable technologies)

HUMANS AND ECOSYSTEMS

SCIENCE PHASE 3: Ecosystems YEAR 7

KNOWLEDGE: Ecosystem interactions

- Human activity and technology impact the environment.
- Humans benefit from managing other species to produce material.
- Humans are part of ecosystems and can change them through their actions.
- Humans can support the health of the environment.

PRACTICES

- Explaining how humans benefit from other organisms and natural resources and evaluating the importance of biodiversity in daily life.
- Evaluating ways humans can positively impact ecosystems and communicating actions that support kaitiakitanga.

ACTIVITY: REDUCING ENVIRONMENTAL IMPACTS

(**Teachers**: See teacher background information to expand your knowledge)

1. Brainstorm some key differences between unsustainable fishing (including overfishing) and sustainable fishing.
2. Watch a short (9 minute) film about New Zealand's West Coast Albacore Tuna Fishery.
3. Explore some different fishing methods.
4. Play the 'bycatch in a bucket game' to experience hands on how different fishing methods can influence the amount of bycatch.
5. Individually or with a partner, find evidence to support and answer one or more of the research questions below.
6. Present findings either in a report or a poster and/or as part of a Minecraft World (see next action (5)).

7. Create a MINECRAFT world that helps New Zealand's fisheries thrive with a focus on one of the following:
   - Protect fishing habitats or
   - Catch fish the sustainable way or
   - Responsibly process and transport seafood or
   - Use science and research to support sustainable fishing practices or
   - Serve it up in a restaurant or shop

RESEARCH QUESTIONS:

QUESTION ONE: How does unsustainable fishing and overfishing impact ocean habitats and threaten ecosystem stability and biodiversity?

USEFUL RESOURCES:

- Understanding what is a fishery
- Overfishing: A summary of facts
- Overfishing impacts marine biodiversity
- United Nations Report on the State of the World's Fishing and Aquaculture 2024
- Key stats about the ocean's fisheries and what we need to do to improve ocean health

QUESTION TWO: How can overfishing alter the marine environment faster than some species can adapt leading to biodiversity loss?

USEFUL RESOURCES:

- Overfishing impacts marine biodiversity
- Overfishing: A summary of facts
- United Nations Report on the State of the World's Fishing and Aquaculture 2024

QUESTION THREE: How does sustainable fishing (using sustainable methods and practices) reduce or offset the environmental impact of overfishing?

USEFUL RESOURCES:

- Sustainable fishing offsets environmental impacts
- Eliminating bycatch to support ecosystem recovery and marine biodiversity
- Fisheries can be encouraged to make improvements to help ensure they are fishing in a sustainable way
- How this tuna fishery reduces or offsets environmental impacts through sustainable methods and practices

QUESTION FOUR: How can we individually, in communities, and as nations, promote the use of sustainable fishing practices to protect and restore ocean ecosystems?

USEFUL RESOURCES:

- Examples of sustainable fishing in practice from around New Zealand and Australia
- How does the MSC help
- A tuna fishery that worked to reduce bycatch
- Examples of fisheries from around the world that have improved their fishing practice to fish sustainably
- Orange roughy as a case study of fishery recovery
- Key stats about the ocean's fisheries and what we need to do to improve ocean health
- How this tuna fishery reduces or offsets environmental impacts through sustainable methods and practices

QUESTION FIVE: What evidence is there that ocean ecosystems can regenerate naturally, and how can we support regeneration to occur?

USEFUL RESOURCES:

- Recovery from overharvest - blue whales of the Southern Ocean (their numbers were decimated by whaling during industrial whaling prior to 1965)
- New Zealand fur seal on a track for recovery having been overharvested in the 19th Century
- Orange roughy - a case study of fishery recovery
- Key stats about the ocean's fisheries and what we need to do to improve ocean health

EXTENSION ACTIVITIES:

- Take action using the structure of Whakapuāwai: A Collaborative Action Project.

TEACHER BACKGROUND READING

Albacore tuna – ocean to plate sustainability case study

- Watch this 9 minute educational film showcasing New Zealand's West Coast Albacore Tuna Fishery.

Taxonomy

- Albacore Tuna are also known as *Thunnus alalunga.* Albacore belong to the fish family Scombridae family (that comprises mackerels, tunas).
- Like other tuna, albacore tuna have sleek torpedo shaped bodies with powerful tails that are common to fast swimming pelagic (open ocean) fish.

Characteristics

- New Zealand albacore tuna typically live for 10 to 12 years. They don't usually reproduce until they reach around 5-6 years old.
- Albacore tuna have a fast initial growth rate, but their growth slows down as they age.
- They are normally 50–70cm in length. Albacore can weigh anywhere from 3–10kg, right up to 55kg (that's the same weight as a small human!
- Albacore tuna are a migratory fish primarily found on the west coasts of both the North and South Islands in New Zealand during the summer months when the waters are warm. These fish are pelagic and live in the mid and upper (better lit) levels of the open ocean.

Food chain

- Care is needed to ensure we don't catch too many albacore tuna. They are an important part of the ocean's delicately balanced food web.
- Animals gain nutrition by digesting other organisms and there are producers and consumers, carnivores, herbivores and omnivores. Albacore tuna are top carnivores, preying on jelly like sea creatures and sea creatures that like to school (like sardine, anchovy, and squid.
- Albacore tuna eat an enormous amount of food to fuel their high metabolism, sometimes consuming as much as 25 percent of their own weight every day.
- We aren't the only species on the planet that like to eat albacore tuna. Some larger species of billfish, tuna, and sharks like to eat albacore too.

Habitats

- Sandy beaches are a buffer zone between land and sea. They are subject to wave action and most commonly soft substrates (sand, silt or mud). Commonly there are many small animals that live there. These habitats can be less diverse than rocky reef communities.
- Rocky reefs have good light. They provide a firm place for seaweeds / algae to grow. There can be good diversity in these habitats. And in the intertidal zone there can be great variety according to different tidal zonation.
- Deep water trenches are dark and cold with extreme pressure. Unusual life forms are common. There is less known of these habitats as they are hard to get to!

- Pelagic open water habitats are home to many large and fast sea creatures. Many of these creatures live in schools. Pelagic habitats are also home to planktonic (small) creatures. This habitat is high above the seafloor, can be subject to changing wave action, ocean currents. The upper part of the ocean in the pelagic habitat is well lit.
- For pelagic creatures that live in the open ocean they often stay near the surface or in the water column a long way above the seafloor. These fish have no caves or crevices to hide in so have to be able to swim fast and camouflage themselves. Their bodies reflect this lifestyle (see next activity).

Body characteristics and habitats

- Pelagic fish living in the upper open ocean need to be able to swim fast.
- Where fish live can affect how they look! Which means you can tell a bit about where a fish lives from its body features. Pelagic fish for example have smaller eyes than the deep-water fish as there is more light.
- They also have eyes located on the side of their head so they can look around (different for example to a bottom dwelling fish that might have eyes that look upward on the top of their body).
- Pelagic fish have sleek bodies with powerful tails. They have to swim fast to survive.
- They have camouflage features to help hide them against a backdrop of open ocean - often a darker upper body and silver or white under body (camouflage).
- Look at the shape of different fish. Use the pictures provided and ask learners to sort the fish pictures into two piles – ones that they think are all similar in body type (tuna) and ones that are different.

Sustainable fishing

- Sustainable fishing means fishing in a responsible way that prevents overfishing, minimises bycatch and maintains marine biodiversity.
- Harvest controls are tools used to manage fishing so that it is more sustainable.
- Without harvest controls fishing would be uncontrolled (both in how it is done and how much it is done!).
- There are many historical examples (including the Grand Banks and Southern Ocean whales) that demonstrate how populations can collapse when harvested uncontrollably.
- Examples of fishing harvest controls might include:
    - Limiting the size or number of fish caught
    - Limiting the time of day that fishing occurs (nighttime can reduce bycatch of birds for example)
    - Limiting the method by which fishing can occur (e.g. Only line fishing)
    - Limiting the equipment that is used to catch fish (for example, the number of hooks on a line or the size of the net mesh).

Science

- Science and scientists play a key role in sustainable fishing. Scientists help us understand life cycles of fishes (including how long they live, when the reproduce etc). This knowledge enables us to work out how many fish we can catch whilst still enabling the fishery to replenish itself.
- Science informs our understanding of each fishery.