SCIENCE - Science Understanding - *Biological sciences*

Years 1 AC9S1U01 identify the basic needs of plants and animals, including air, water, food or shelter, and describe how the places they live meet those needs
Coral Reefs: • Explore the basic needs of coral polyps, such as sunlight, clean water, and a stable substrate. • Discuss how coral reefs provide shelter and food for a diverse array of marine animals.
Seagrass Meadows: • Identify the needs of seagrass plants, including sunlight, clear water, and nutrient-rich sediments. • Describe how seagrass meadows serve as habitats for various marine species like dugongs, turtles, and fish, offering food and shelter.
Mangrove Forests: • Examine the basic needs of mangrove trees, such as brackish water, tidal zones, and nutrient-rich mud. • Discuss how mangroves provide shelter and breeding grounds for marine animals, such as crabs, fish, and birds.
Rocky Shores: • Investigate the needs of intertidal organisms, such as barnacles, mussels, and sea anemones, including their need for air during low tide and water during high tide. • Describe how rocky shores offer shelter and food sources through tidal pools and crevices.
Open Ocean: • Study the needs of pelagic fish, such as tuna and mackerel, including their need for open water to swim and abundant prey. • Explore how the open ocean provides vast spaces and migration routes for these fish
Deep-Sea Hydrothermal Vents: • Identify the basic needs of organisms living near hydrothermal vents, such as chemosynthetic bacteria, which require hydrogen sulfide and other chemicals from the vents. • Discuss how the extreme environment of hydrothermal vents supports unique communities of organisms that rely on chemical energy.
Kelp Forests: • Examine the needs of kelp, including cold, nutrient-rich water and sunlight for photosynthesis. • Describe how kelp forests provide habitat, food, and shelter for marine animals like sea otters, fish, and invertebrates.
Estuaries: • Investigate the needs of estuarine species, such as oysters, crabs, and fish, including their need for brackish water and nutrient-rich sediments. • Discuss how estuaries serve as nurseries for many marine species, offering shelter and abundant food resources.

Year 3
AC9S3U01
compare characteristics of living and non-living things and examine the differences between the life cycles of plants and animals

Coral Reefs:

- **Living vs. Non-Living**: Compare the living coral polyps with the non-living coral skeletons that they build.
- **Life Cycles**: Explore the life cycle of corals, including their reproductive methods (spawning and budding).

Marine Plants:

- **Seagrasses and Algae**: Identify the basic characteristics of living marine plants like seagrasses and algae and compare them with non-living elements like rocks and sand.
- **Life Cycles**: Examine the life cycle of seagrasses and algae, including their growth, reproduction, and dispersal methods.

Marine Animals:

- **Fish vs. Shells**: Compare living fish with non-living shells they leave behind after death.
- **Life Cycles**: Study the life cycle of a common marine fish, such as the clownfish or blue manna crab, from eggs to adulthood.

Marine Invertebrates:

- **Starfish and Urchins**: Identify the characteristics of living marine invertebrates like starfish and sea urchins and compare them with non-living parts of their environment.
- **Life Cycles**: Investigate the life cycle of starfish, including their unique ability to regenerate limbs.

Plankton:

- **Phytoplankton and Zooplankton**: Discuss the characteristics of living phytoplankton (plant-like plankton) and zooplankton (animal-like plankton) and their role in the marine food web.
- **Life Cycles**: Explore the life cycles of different types of plankton, including their growth and reproduction.

Jellyfish:

- **Living Organisms: Discuss the characteristics of living jellyfish and how they differ from non-living elements in their habitat.**
- **Life Cycles: Study the complex life cycle of jellyfish, including their polyp and medusa stages.**

Tide Pools:

- **Living vs. Non-Living: Compare the living organisms found in tide pools (e.g., crabs, anemones, seaweeds) with non-living components (e.g., rocks, water, sand).**
- **Life Cycles: Examine the life cycles of tide pool inhabitants, such as crabs or sea anemones.**

Mangrove Ecosystems:

- **Mangrove Trees: Identify the basic characteristics of living mangrove trees and compare them with non-living elements like soil and water.**
- **Life Cycles: Explore the life cycle of mangroves, including seed germination and growth in the intertidal zone.**

Year 4
AC9S4U01
explain the roles and interactions of consumers, producers, and decomposers within a habitat and how food chains represent feeding relationships

Coral Reef Ecosystems:

- **Producers**: Corals, algae, and seagrasses.
- **Consumers**: Herbivorous fish (e.g., parrotfish), carnivorous fish (e.g., barracuda), and omnivores (e.g., clownfish).
- **Decomposers**: Bacteria and fungi that break down dead organic matter.
- **Food Chains**: Explore the food chains within a coral reef, starting with algae and ending with top predators like sharks.

Kelp Forests:

- **Producers**: Kelp and other seaweeds.
- **Consumers**: Herbivores (e.g., sea urchins), carnivores (e.g., sea otters), and omnivores (e.g., crabs).
- **Decomposers**: Bacteria and detritivores that break down dead kelp and other organic material.
- **Food Chains**: Discuss the food chains in a kelp forest, highlighting the role of sea otters in controlling sea urchin populations.

Mangrove Ecosystems:

- **Producers**: Mangrove trees and algae.
- **Consumers**: Herbivores (e.g., manatees), carnivores (e.g., fish), and omnivores (e.g., crabs).
- **Decomposers**: Bacteria and fungi that decompose fallen leaves and other organic matter.
- **Food Chains**: Examine the food chains in mangrove forests, starting with detritus (dead organic material) and ending with predators like birds and fish.

Open Ocean:

- **Producers**: Phytoplankton.
- **Consumers**: Zooplankton, small fish (e.g., anchovies), larger fish (e.g., tuna), and top predators (e.g., sharks, whales).
- **Decomposers**: Marine bacteria that break down dead organisms.
- **Food Chains**: Explore the food chains in the open ocean, from phytoplankton to apex predators

Rocky Shorelines:

- **Producers**: Algae and seaweeds.
- **Consumers**: Herbivores (e.g., limpets), carnivores (e.g., sea stars), and omnivores (e.g., crabs).
- **Decomposers**: Bacteria and detritivores that break down organic matter.
- **Food Chains**: Discuss the food chains on rocky shores, highlighting the interactions between different species.

Seagrass Meadows:

- **Producers: Seagrasses.**
- **Consumers: Herbivores (e.g., sea turtles), carnivores (e.g., fish), and omnivores (e.g., sea cucumbers).**
- **Decomposers: Bacteria and detritivores that decompose dead seagrass.**
- **Food Chains: Examine the food chains in seagrass meadows, starting with seagrass and ending with top predators like large fish and birds.**

Year 5
AC9S5U01
examine how particular structural features and behaviours of living things enable their survival in specific habitats

Adaptations of Marine Mammals:
- Study the structural features of marine mammals like dolphins, whales, and seals, such as blubber, streamlined bodies, and flippers.
- Explore their behaviours, such as echolocation in dolphins and deep diving in whales, and how these adaptations help them survive in the ocean.

Camouflage in Marine Animals:
- Investigate how marine animals like octopuses, cuttlefish, and decorator crabs use camouflage to blend into their surroundings and avoid predators.
- Discuss their structural features, like chromatophores in octopuses, and behavioural adaptations, like mimicry.

Reef-Building Corals:
- Examine the structural features of corals, such as calcium carbonate skeletons, and their symbiotic relationship with zooxanthellae.
- Explore how their behaviours, like forming colonies and reproducing through spawning, enable them to build and maintain coral reefs.

Life in the Deep Sea:
- Study the unique adaptations of deep-sea creatures, such as bioluminescence in anglerfish and the ability to withstand high pressure in deep-sea squids.
- Discuss how these adaptations enable them to survive in the harsh environment of the deep ocean.

Mangrove Ecosystems:
- Explore the structural features of mangrove trees, such as stilt roots and salt-excreting leaves.
- Investigate how these trees' behaviours, like seed dispersal through water, enable them to thrive in intertidal zones.

Seahorses and Sea Dragons:
- Examine the structural features of seahorses and sea dragons, such as prehensile tails and leaf-like appendages for camouflage.
- Discuss their behaviours, like males carrying eggs in brood pouches, and how these adaptations help them survive in their habitats.

Sharks and Rays:
- Study the structural features of sharks and rays, such as cartilage skeletons, gills, and electroreceptors.
- Explore their behaviours, like hunting strategies and migratory patterns, and how these adaptations enable them to be successful predators

Marine Invertebrates:
- Investigate the structural features of marine invertebrates like sea stars, sea urchins, and jellyfish.
- Discuss their behaviours, like regeneration in sea stars and drifting in jellyfish, and how these adaptations help them survive in various marine environments.

Tide Pool Adaptations:
- Study the structural features of tide pool organisms, such as the hard shells of barnacles and the tube feet of sea stars.
- Explore their behaviours, like closing shells to retain moisture and hiding in crevices, and how these adaptations help them survive the changing conditions of tide pools.

Fish Adaptations:
- **Examine the structural features of various fish species, such as gills, fins, and scales.**
- **Discuss their behaviours, like schooling for protection and migration for breeding, and how these adaptations enable them to thrive in different marine habitats.**

Year 6

AC9S6U01

investigate the physical conditions of a habitat and analyse how the growth and survival of living things is affected by changing physical conditions

Coral Bleaching:

- **Physical Conditions**: Investigate the impact of rising sea temperatures on coral reefs.
- **Effects on Growth and Survival**: Analyze how increased temperatures cause coral bleaching, leading to the loss of symbiotic algae and affecting the survival of corals and reef-dependent species.

Ocean Acidification:

- **Physical Conditions**: Explore the increase in ocean acidity due to the absorption of excess atmospheric CO2.
- **Effects on Growth and Survival**: Examine how acidification affects marine organisms, particularly those with calcium carbonate shells or skeletons, such as corals, mollusks, and certain plankton species.

Mangrove Ecosystems:

- **Physical Conditions**: Study the role of tidal fluctuations, salinity levels, and sediment composition in mangrove habitats.
- **Effects on Growth and Survival**: Analyze how changes in these physical conditions, such as coastal development or pollution, impact the growth and survival of mangrove trees and the species that depend on them.

Seagrass Meadows:

- **Physical Conditions**: Investigate the importance of water quality, light availability, and nutrient levels for seagrass growth.
- **Effects on Growth and Survival**: Discuss how factors like eutrophication, sedimentation, and water pollution affect the health of seagrass meadows and the marine life that relies on them.

Kelp Forests:

- **Physical Conditions**: Explore the effects of water temperature, nutrient availability, and wave action on kelp forests.
- **Effects on Growth and Survival**: Analyze how changing ocean temperatures, nutrient levels, and storm frequency impact the growth of kelp and the biodiversity of these underwater forests.

Tide Pools:

- **Physical Conditions**: Study the influence of tidal cycles, temperature fluctuations, and salinity changes on tide pool habitats.
- **Effects on Growth and Survival:** Examine how these varying physical conditions affect the organisms living in tide pools, such as anemones, crabs, and sea stars.

Polar Marine Ecosystems:

- **Physical Conditions:** Explore the impact of sea ice cover, water temperature, and salinity on polar marine habitats.
- **Effects on Growth and Survival:** Analyze how changes in these conditions, due to climate change, affect the growth and survival of polar species like krill, seals, and penguins.

Estuarine Ecosystems:

- **Physical Conditions:** Study the role of salinity gradients, tidal influences, and nutrient levels in estuaries.
- **Effects on Growth and Survival:** Examine how changes in these physical conditions, such as freshwater inflows and pollution, impact the growth and survival of estuarine species.

Marine Pollution:

- **Physical Conditions**: Investigate the types and sources of marine pollution, including plastic waste, oil spills, and chemical contaminants.
- **Effects on Growth and Survival:** Discuss how pollution affects the health and survival of marine organisms and ecosystems, and the long-term implications for biodiversity and human health.

Year 7
AC9S7U01
investigate the role of classification in ordering and organising the diversity of life on Earth and use and develop classification tools including dichotomous keys

Marine Invertebrates:
- **Diversity**: Explore the vast diversity of marine invertebrates, such as mollusks, crustaceans, and echinoderms.
- **Classification Tools**: Use dichotomous keys to identify and classify different marine invertebrates based on their physical characteristics.

Fish Classification:
- **Diversity**: Study the variety of fish species, from cartilaginous fish like sharks and rays to bony fish like clownfish and tuna.
- **Classification Tools**: Develop and use dichotomous keys to classify fish based on features such as fin shape, scale type, and body structure.

Coral Species:
- **Diversity**: Investigate the different species of corals, including hard corals (stony corals) and soft corals.
- **Classification Tools**: Use classification tools to identify coral species based on their skeletal structure and growth forms.

Marine Mammals:
- **Diversity**: Examine the diversity of marine mammals, including cetaceans (whales, dolphins), pinnipeds (seals, sea lions), and sirenians (manatees, dugongs).
- **Classification Tools**: Create classification keys to differentiate marine mammals based on their anatomical features and behaviours.

Marine Algae:
- **Diversity**: Explore the various types of marine algae, including green, brown, and red algae.
- **Classification Tools**: Use dichotomous keys to classify marine algae based on their color, structure, and habitat.

Plankton:
- **Diversity**: Study the diversity of plankton, including phytoplankton (plant-like) and zooplankton (animal-like).
- **Classification Tools:** Develop and use classification keys to identify different types of plankton based on their microscopic features.

Sea Turtles:
- **Diversity:** Investigate the different species of sea turtles, such as the green turtle, loggerhead turtle, and leatherback turtle.
- **Classification Tools:** Use classification keys to identify sea turtle species based on their shell shape, size, and coloration.

Seabirds:
- **Diversity**: Examine the diversity of seabirds, including gulls, albatrosses, and puffins.
- **Classification Tools:** Create and use dichotomous keys to classify seabirds based on their beak shape, plumage, and feeding habits.

Marine Plants:
- **Diversity:** Explore the diversity of marine plants, such as seagrasses and saltmarsh plants.
- **Classification Tools:** Use dichotomous keys to classify marine plants based on their leaf structure, growth form, and habitat.

Cnidarians:
- **Diversity**: Study the diversity of cnidarians, including jellyfish, sea anemones, and hydroids.
- **Classification Tools:** Develop and use classification keys to identify different cnidarian species based on their tentacle arrangement, body form, and stinging cells.

Year 8 AC9S8U01
recognise cells as the basic units of living things, compare plant and animal cells, and describe the functions of specialised cell structures and organelles

Marine Phytoplankton Cells:
- **Cell Structures**: Study the cell structures of marine phytoplankton, such as chloroplasts for photosynthesis, cell walls, and flagella for movement.
- **Functions**: Describe how these structures enable phytoplankton to convert sunlight into energy and survive in marine environments.

Seaweed Cells:
- **Comparison**: Compare the cells of different types of seaweed (e.g., green, brown, and red algae) with terrestrial plant cells.
- **Specialized Structures**: Examine specialized structures like chloroplasts, pyrenoids (starch storage centers), and holdfast cells for anchoring.

Coral Polyp Cells:
- **Cell Types**: Investigate the different cell types in coral polyps, including gastrodermal cells (for digestion) and epidermal cells (for protection).
- **Symbiosis**: Describe the symbiotic relationship between coral polyp cells and zooxanthellae (photosynthetic algae) and how it benefits both organisms.

Sponge Cells:
- **Cell Functions**: Study the specialized cells in sponges, such as choanocytes (collar cells) for filter feeding, and archaeocytes for digestion and reproduction.
- **Organization**: Describe how sponge cells are organized into a simple, yet efficient, multicellular organism.

Fish Muscle Cells:
- **Cell Comparison**: Compare the muscle cells of fish with those of mammals, focusing on structures like myofibrils and mitochondria.
- **Functions**: Discuss how these specialized cells enable fish to swim efficiently and maintain high energy levels.

Jellyfish Cells:
- **Cell Types**: Investigate the different cell types in jellyfish, including cnidocytes (stinging cells) and nerve cells.
- **Specialized Functions:** Describe how these specialized cells help jellyfish capture prey and respond to environmental stimuli.

Sea Urchin Embryonic Cells:
- **Cell Division:** Study the process of cell division and differentiation in sea urchin embryos.
- **Functions:** Explain how specialized embryonic cells develop into various tissues and structures in adult sea urchins.

Marine Bacteria:
- **Cell Structure:** Compare the cell structures of marine bacteria with those of eukaryotic marine organisms.
- **Functions:** Describe the roles of marine bacteria in nutrient cycling, decomposition, and symbiotic relationships.

Starfish Regenerative Cells:
- **Regeneration:** Investigate the specialized cells involved in the regeneration of starfish limbs.
- **Functions**: Describe how these cells enable starfish to regrow lost limbs and the biological processes involved.

Mangrove Plant Cells:
- **Comparison**: Compare the cells of mangrove plants with those of terrestrial plants, focusing on adaptations like salt-excreting cells.
- **Specialized Structures**: Discuss how these specialized cell structures enable mangroves to thrive in saline environments.