TOPIC 4

OCEAN ZONATION

Objectives

- By the end of this topic you should be able to:

1. Illustrate the various ocean zones on the basis of various parameters
2. Outline the characteristics of each of the zones
3. Describe the Exclusive Economic Zone

- https://www.youtube.com/watch?v=Z8xhciQWL-s

https://youtu.be/Z8xhciQWL-s

Main divisions of the marine environment

- The marine ecosystem is the largest aquatic system o n the planet (71%).
- Its size and complexity make it difficult to deal with it as a whole.
- As a result it is convenient to divide it into more manageable arbitrary subdivisions.
- There are broadly **two ways** in which organisms live in the sea.
  - They **float or swim in the water;(pelagic zone)**
  - Or they dwell on or within **the sea bottom**.(benthic zone)

- Hence there are two major divisions of the ocean environment;
  - **Pelagic division-** whole body of water forming the seas and the oceans/
    The entire area of the open water is the pelagic zone.
  - **Benthic division-** the entire sea bottom(sea bottom and sea shore)benthic zone

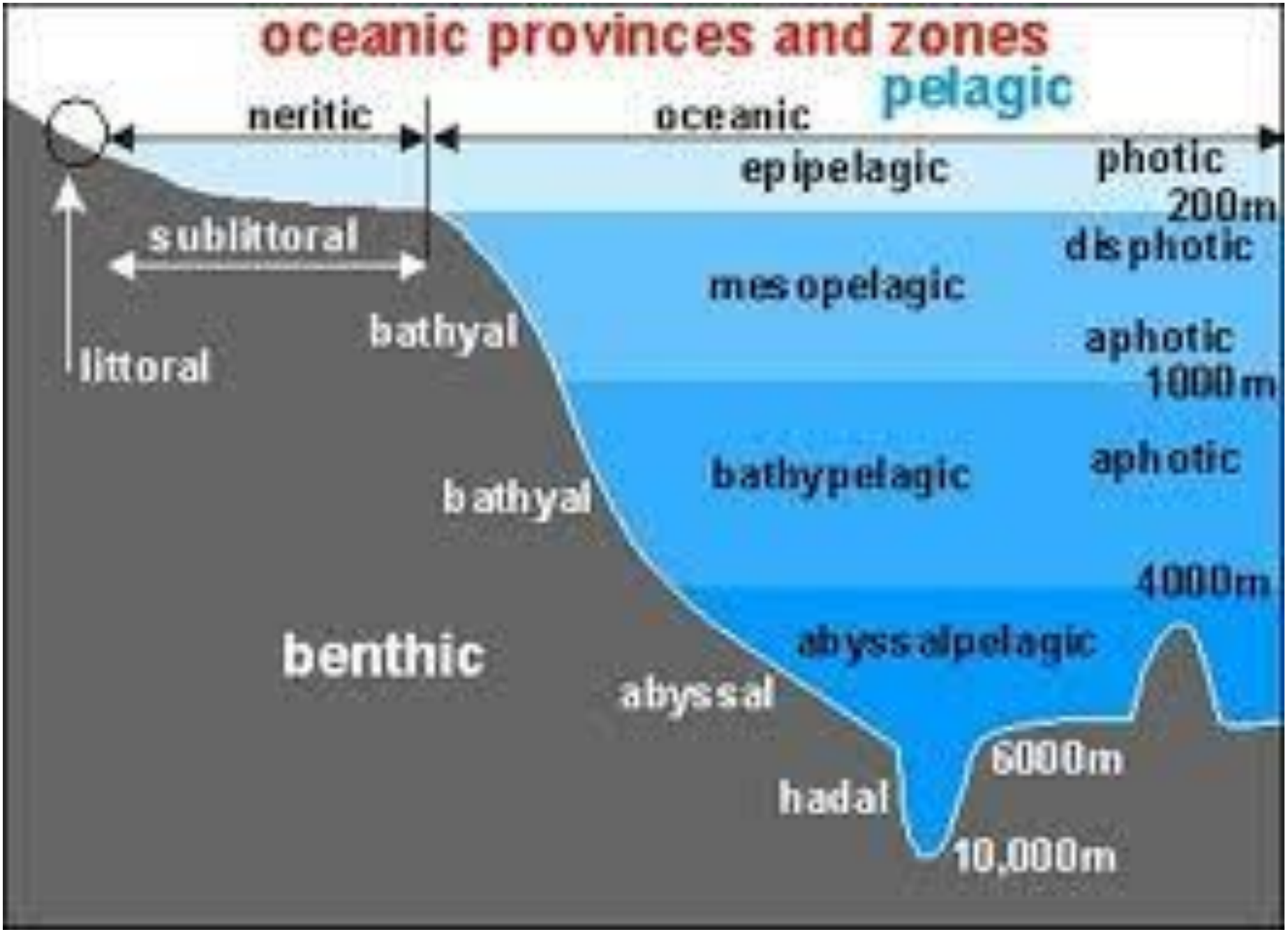
Pelagic division

- Refers to the ocean water zone
- The pelagic division can further be subdivided **vertically** and **horizontally**.

Horizontally there are two major divisions:

1. Neritic province (shallow water above the continental shelf).

2. Oceanic province (all other open waters (deep waters)


oceanic provinces and zones
pelagic
neritic
oceanic
epipelagic
photic
200m
dysphotic
sublittoral
mesopelagic
bathyal
aphotic
littoral
1000m
bathypelagic
aphotic
bathyal
4000m
abyssalpelagic
benthic
abyssal
6000m
hadal
10,000m

Vertically, the pelagic zone can further be subdivided **first on the basis of:**

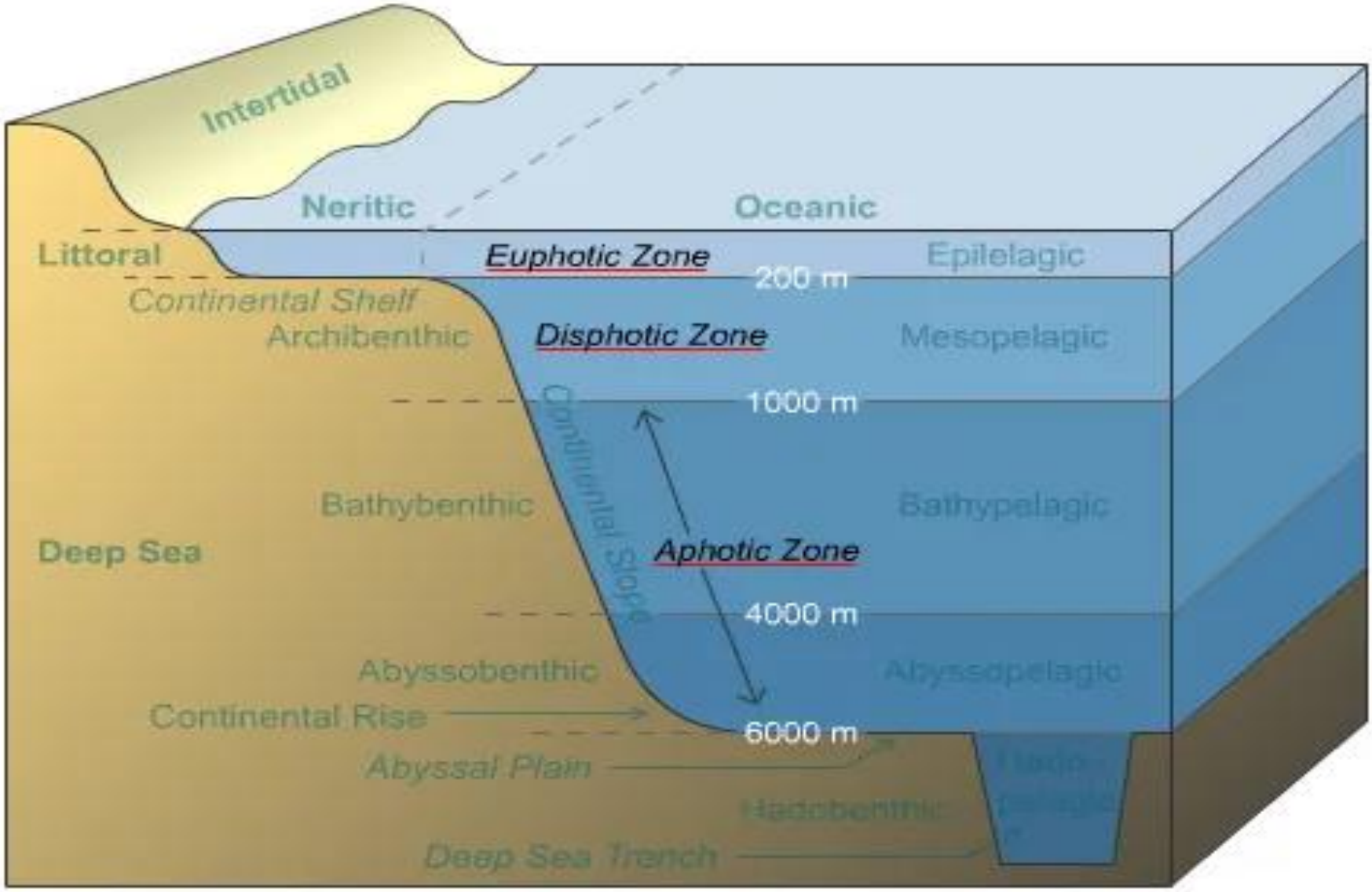
1. Light penetration

Photic/ euphotic zone -

- part of the pelagic zone that is lighted.
- Its lower boundary is the limit of light penetration and varies with **clarity of the water**.
- This is the region where photosynthesis occurs and therefore is the most biodiverse.

- The lower boundary is between **100 and 200m.**
- A synonym for this zone is the **epipelagic** zone, because it is the zone of **primary production** in the ocean and of major importance.

PROFILE OF THE PELAGIC AND BENTHIC ZONE



- **Disphotic zone-** a transition zone between the photic and aphotic zone

  This transition area has enough light for **vision** but not enough for photosynthesis .

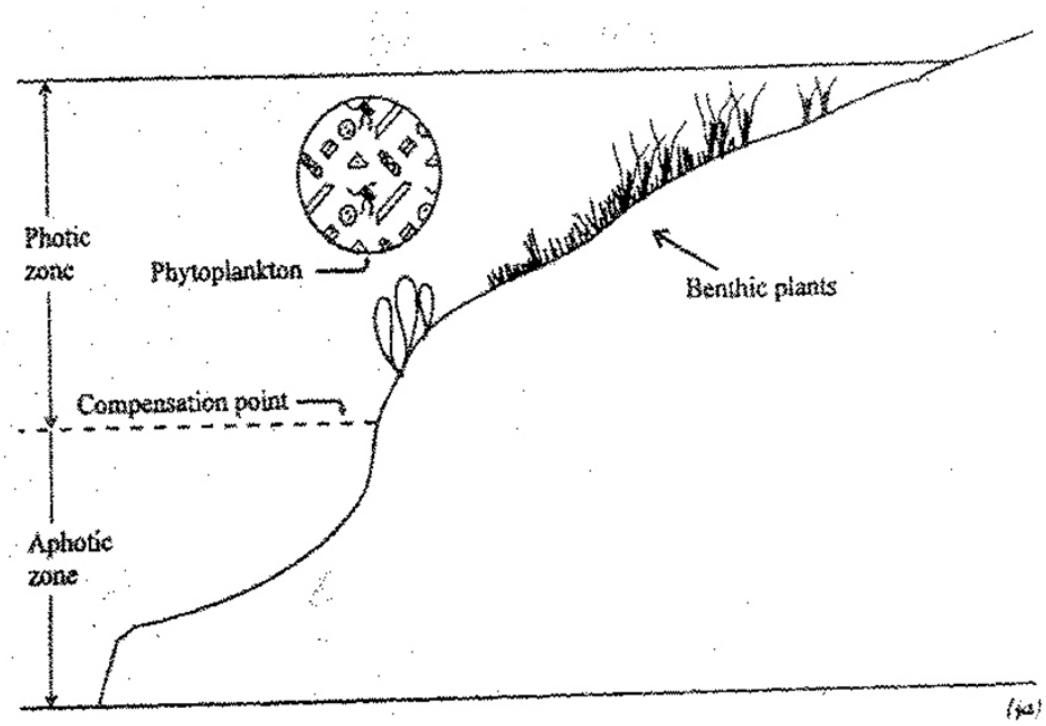
  It extends down to about 1000m

  –**Aphotic zone-** a permanently dark zone below the Disphotic zone(1000m -11000m)

Distribution of marine plants in relation to light penetration. Phytoplankton and benthic plants are limited to the photic zone

Photosynthesizing organisms include

- Cyanobacteria
- Phytoplanktons
- Seaweeds
- Seagrasses
- Salt marsh vegetation
- Mangroves
- Microbes that associate with corals



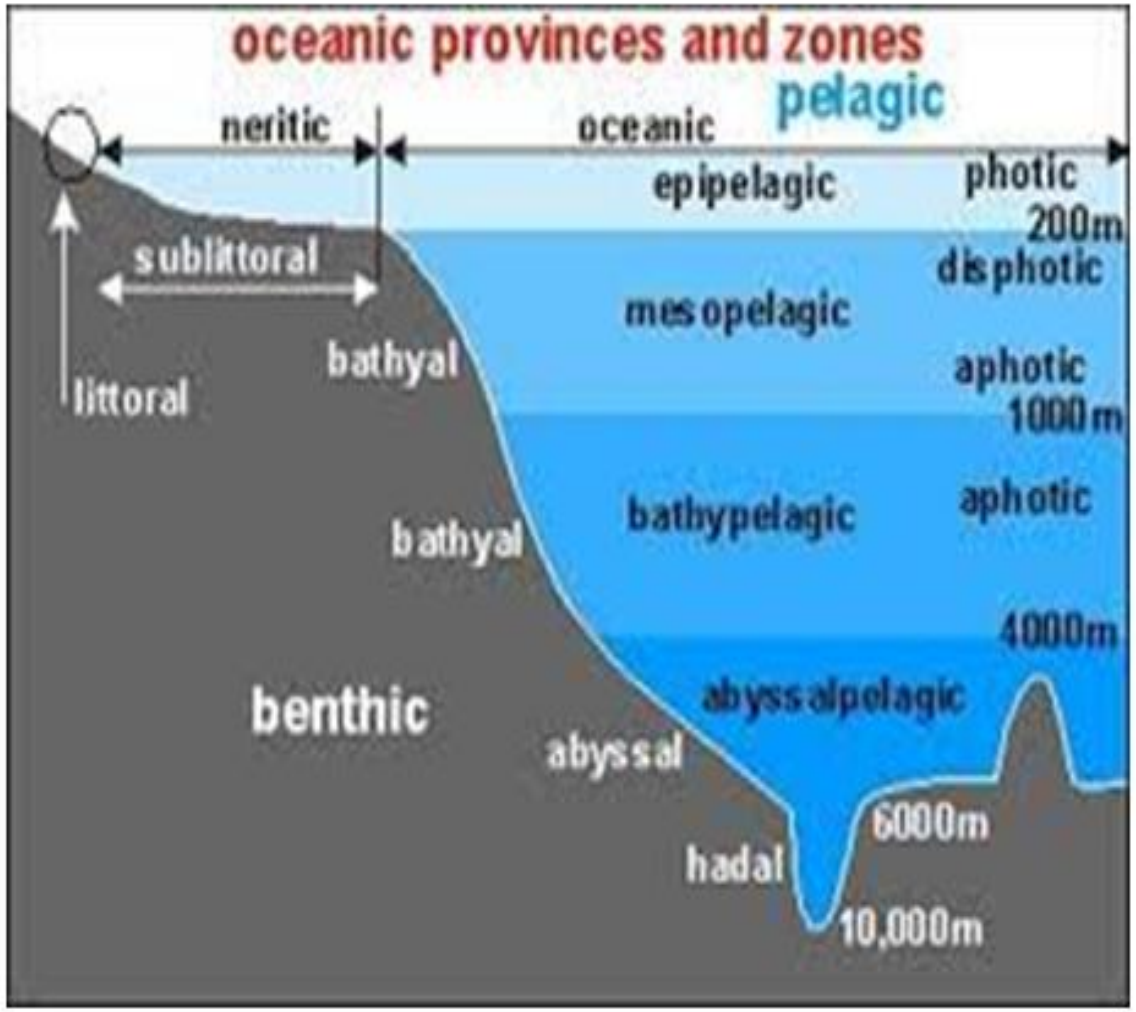
- However light penetrates only a short distance into the water.
- Marine plants must therefore be able to **float** to the surface or if attached to the bottom are limited to **shallow depths**
- In aquatic organisms there are several advantages in small size.
- A large surface area to volume ratio
  - retards sinking,
  - facilitates absorption of solutes at great dilution and;
  - favours light absorption

2. Depth

- The pelagic division can also be zoned in terms of depth (from sea surface to ocean bottom/floor)
- In deep water, conditions change with depth and it is useful to distinguish four zones.

1. The Epipelagic zone-

- From the surface to 200m depth.
- There are sharp gradients of illumination and often temperature, between the surface and the deeper levels.
- There are also **diurnal** and **seasonal** changes of light intensity and temperature.



2. Mesopelagic zone - 200 to 1000m

- Very little light penetrates.
- Temperature gradient is more **even** and gradual without much seasonal variation.
- An oxygen minimum layer
- Maximum concentrations of **nitrate and phosphate often occur within this zone.**

3. Bathypelagic zone; 1000 and 4000m

- Darkness is virtually complete except for bioluminescence (production of light by living organisms).
- Temperature is low and constant .
- Water pressure high.

4. **Abyssopelagic zone** 4000-6000m

- Dark,
- cold with greatest pressures and very little food

5. **Hadal pelagic- 6000-10000m**

The open water of the deep oceanic trenches It is the deepest oceanic zone.

Dark, cold with high pressure

High oxygen level(why?)

Organisms of the pelagic division

Comprise two broad categories:

- Plankton and nekton differing in their powers of locomotion.

- Planktons - consist of floating plants(phyto) and animals(zoo) which drift with the water and whose swimming powers, if any, serve mainly to keep them afloat and adjust their depth level rather than to carry them from place to place.

Planktons

- Plankton are drifting organisms that inhabit the water column of oceans and seas; they also occur in freshwater.
- They are important in the food webs of aquatic systems because they provide food for the biotic communities
- Organisms which spend their entire life cycle free floating as part of the plankton such as most algae, copepods, and jellyfish are ***holoplankton.***

- Those that are only plankton for part of their lives, usually the larval stage, and later move either to the nekton (free swimming) or a benthic (sea floor) life, are ***meroplankton***.
- *Fish, marine crustaceans, starfish, sea urchins* belong to this group.

- Plankton are small and are usually classified by size rather than by their taxonomic composition.
- Some plankton engulf others of about their size.
- The most abundant plankton are the smallest in size, while the largest in size are the fewest.

Planktons are classified according to size

– **Femtoplankton**- 0.02-0.2 micrometer
- **Picoplankton**: Smaller than 2 µm ; includes bacteria, prochlorophytes, and viruses
- **Nanoplankton**: 2 to 20 µm; includes diatoms, coccoliths, and silicoflagellates
- **Microplankton**: 20 to 200 µm; includes large diatoms, dinoflagellates, and small zooplankton, such as ciliates
- **Macroplankton**: 200 to 2,000 µm; includes large zooplankton, copepods, and invertebrate larvae
- **Megaplankton**: Larger than 2,000 µm; includes fish larvae and gelatinous zooplankton

NB: Free living bacterioplankton is in the range of picoplankton.

- Many bacteria are attached to plankton organisms

- Nekton comprises the more powerful swimming animals, vertebrates and cephalopods which are capable of travelling from one place to another independently of the flow of the water.

Major benthic divisions

- **Littoral / intertidal zone-** greater part of the sea shore together with the **wave-splashed region above high tide level**.
- It covers the region between **low** and **high tide** and represents the transitional area between marine and terrestrial conditions.
- It is also known as the intertidal zone because it is the area where tide level affects the conditions of the region.

Sublittoral zone (continental shelf)

- Zone from low tide to shelf break(continental edge.
- This is the coastal edge of shallow sea bottom and close to the land.
- The bottom shelves gradually from the shore to a depth of about 200m.
- About 8% of the total sea area lies above it.

- Its seaward margin is termed the continental edge; beyond which the waters and the gradient become much deeper.
- It is **illuminated** and is generally populated with an abundance of organisms constituting several different communities, including:
  - sea grass beds,
  - kelp forests(sea weeds) and
  - coral reefs.

- Many of the shelf areas are of special economic importance because:
  - geographically the major fisheries are concentrated here (reason?).
  - Shelf areas are also widely exploited as sources of oil and gas.

The deep sea zone- can be divide into:

- **Bathy benthic zone-** lies between the continental edge and a depth of about 2000m comprising mainly the continental slope
- **Abyssobenthic zone-** below 2000m(continental rise, abyssal plain and deeper parts of the sea floor).
- **Hadalbenthic zones-** are the deepest parts of the ocean floor within the trenches below some 6000 and 7000m.

Organisms of the benthic division

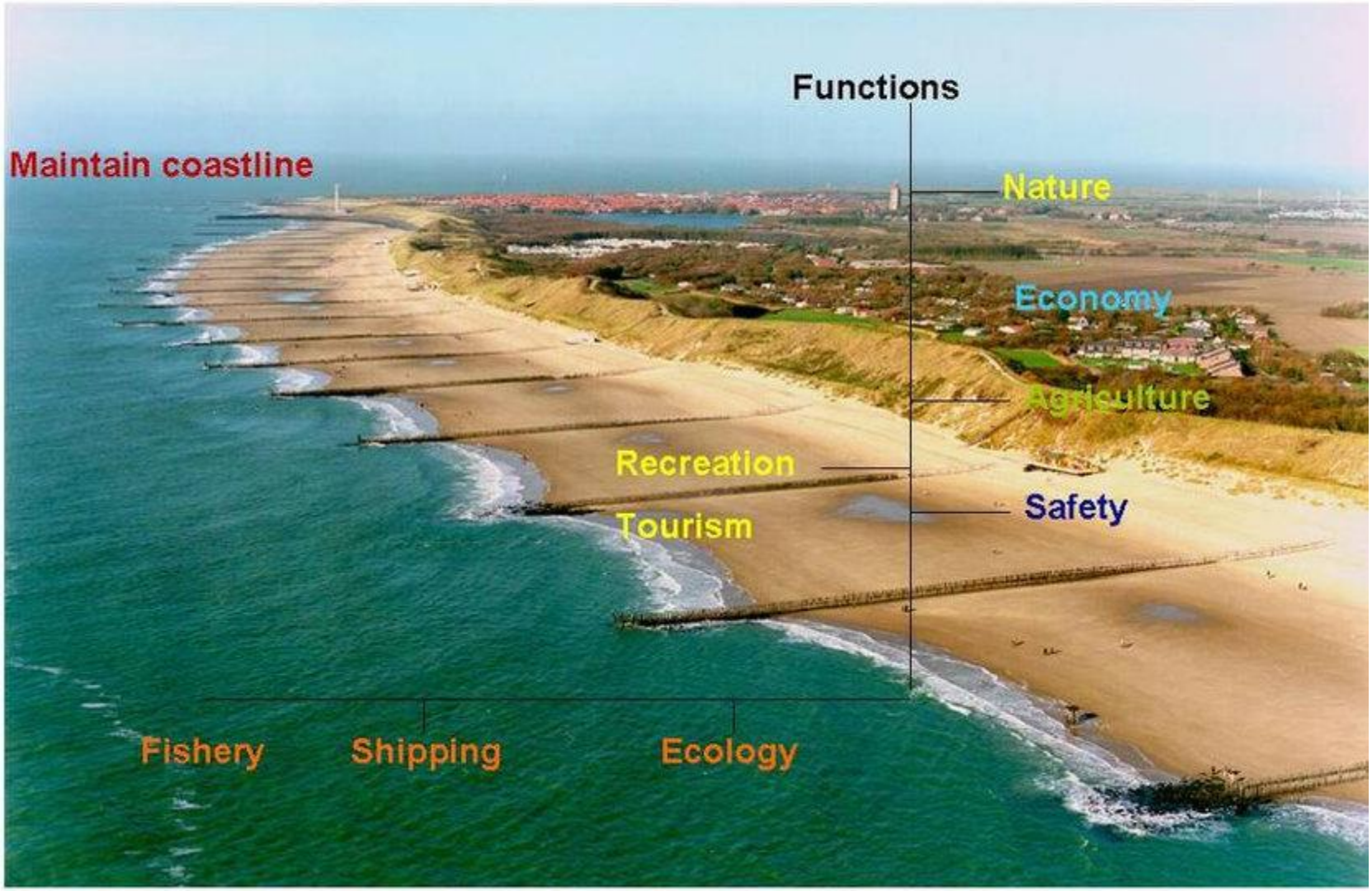
- They are collectively known as the *Benthos*.
- Include the sessile and attached plants and animals and all creeping and burrowing forms.
- *Benthopelagic*- refers to animals, mainly fish which live very close to but not actually resting on the bottom.
  - Hovering slightly above the sea floor, they are well placed for taking food from the bottom

Other zones

Coastal zone

- Interface between land and water (intertidal zone) words used interchangeably…..in this zone we have the rocky, muddy and sandy shores; mangrove forests, seagrass beds, estuaries, salt marshes
- Majority of the world's population inhabit such zones.
- This ecosystem is one of the most important for humans, because it produces the most fish, shellfish and seaweed.
- Additionally, coastal areas convert large amounts of CO_2 to O_2 because they house great amounts of phytoplankton.

Functions in the coastal zone



2. EXCLUSIVE ECONOMIC ZONE (EEZ)

Refers to **200 nautical miles(370km**) from the coastline of coastal nations.

How was EEZ developed? History

- The earliest use of the oceans by humans was probably for food.
- Human populations living along the oceans captured various fishes for consumption.
- However, today old ships and gear have been replaced by **larger and more powerful vessels**, and more **effective electronic devices** for detecting fish schools.

- This resulted in:
  - major significant reduction in many fish populations;
  - Disappearance or overexploitation of other fish species at a time when increasing human populations were demanding more food.
- Decline of many world fisheries due to **common access** and the **human pressure** have led to friction among fishing nations and various attempts have been made to regulate fishery resources.

09/10/2021

NTV Kenya @ntvkenya · 3h

Foreign fishing vessels have invaded Kenya's Indian Ocean waters after a French company terminated a surveillance contract with the government.

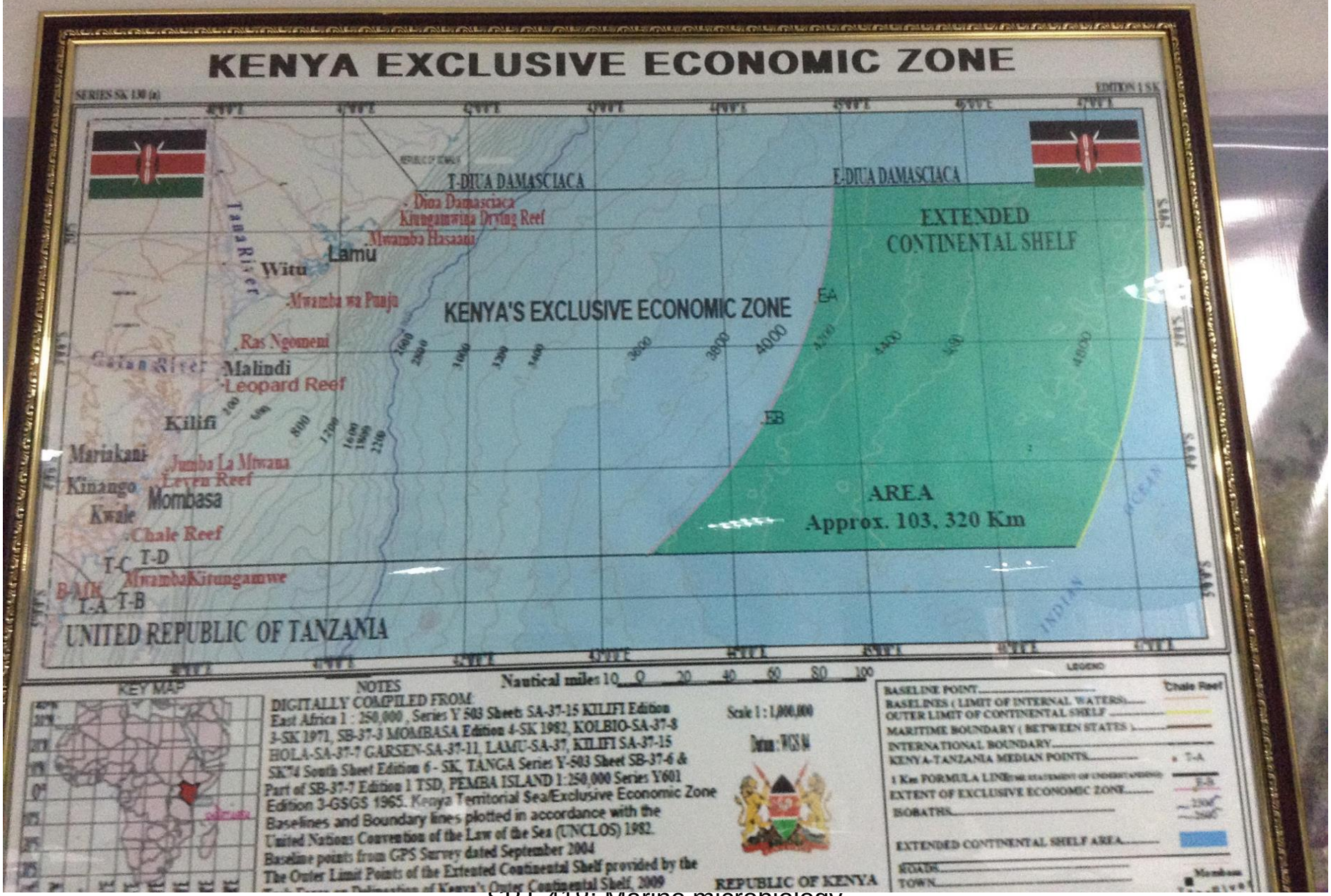
buff.ly/3mH6Pab

19 34 86

- Following the **Third United Nations Conference** during the **UN Convention on the Law of the Sea (1982),** a standard **200 nautical Miles (370km)** wide fishing areas from the base line called **Exclusive Economic Zone (EEZ)** was established for the waters of each coastal nations.

This means that:

- individual nations now have full control of all fishery activity within 200 nautical miles of their shores
- **they have sovereign rights over the resources** of their continental shelves that, in some case can extend even further.
  - Coastal countries have been allowed to apply for an extension of the EEZ


KENYA EXCLUSIVE ECONOMIC ZONE
T-DIUA DAMASCIACA
E-DIUA DAMASCIACA
Diua Damasciaca
Kitunganwina Drying Reef
Mwamba Hasaanu
Lamu
Witu
Tana River
Mwamba wa Punju
KENYA'S EXCLUSIVE ECONOMIC ZONE
EXTENDED
CONTINENTAL SHELF
EA
EB
Ras Ngomeni
Malindi
Leopard Reef
Kilifi
Mariakani
Jumba La Mtwana
Leven Reef
Kinango
Mombasa
Kwale
Chale Reef
T-C
T-D
MwambaKitungamwe
BANK
T-A
T-B
UNITED REPUBLIC OF TANZANIA
AREA
Approx. 103, 320 Km
INDIAN
OCEAN
KEY MAP
NOTES
Nautical miles 10 0 20 40 60 80 100
DIGITALLY COMPILED FROM:
East Africa 1 : 250,000 , Series Y 503 Sheets SA-37-15 KILIFI Edition
3-SK 1971, SB-37-3 MOMBASA Edition 4-SK 1982, KOLBIO-SA-37-8
HOLA-SA-37-7 GARSEN-SA-37-11, LAMU-SA-37, KILIFI SA-37-15
SK74 South Sheet Edition 6 - SK, TANGA Series Y-503 Sheet SB-37-6 &
Part of SB-37-7 Edition 1 TSD, PEMBA ISLAND 1:250,000 Series Y601
Edition 3-GSGS 1965. Kenya Territorial Sea/Exclusive Economic Zone
Baselines and Boundary lines plotted in accordance with the
United Nations Convention of the Law of the Sea (UNCLOS) 1982.
Baseline points from GPS Survey dated September 2004
The Outer Limit Points of the Extented Continental Shelf provided by the
Scale 1 : 1,000,000
Datum : WGS 84
REPUBLIC OF KENYA
LEGEND
BASELINE POINT
Chale Reef
BASELINES (LIMIT OF INTERNAL WATERS)
OUTER LIMIT OF CONTINENTAL SHELF
MARITIME BOUNDARY (BETWEEN STATES)
INTERNATIONAL BOUNDARY
KENYA-TANZANIA MEDIAN POINTS
T-A
1 Km FORMULA LINE
EXTENT OF EXCLUSIVE ECONOMIC ZONE
ISOBATHS
EXTENDED CONTINENTAL SHELF AREA
ROADS
TOWN
Mombasa

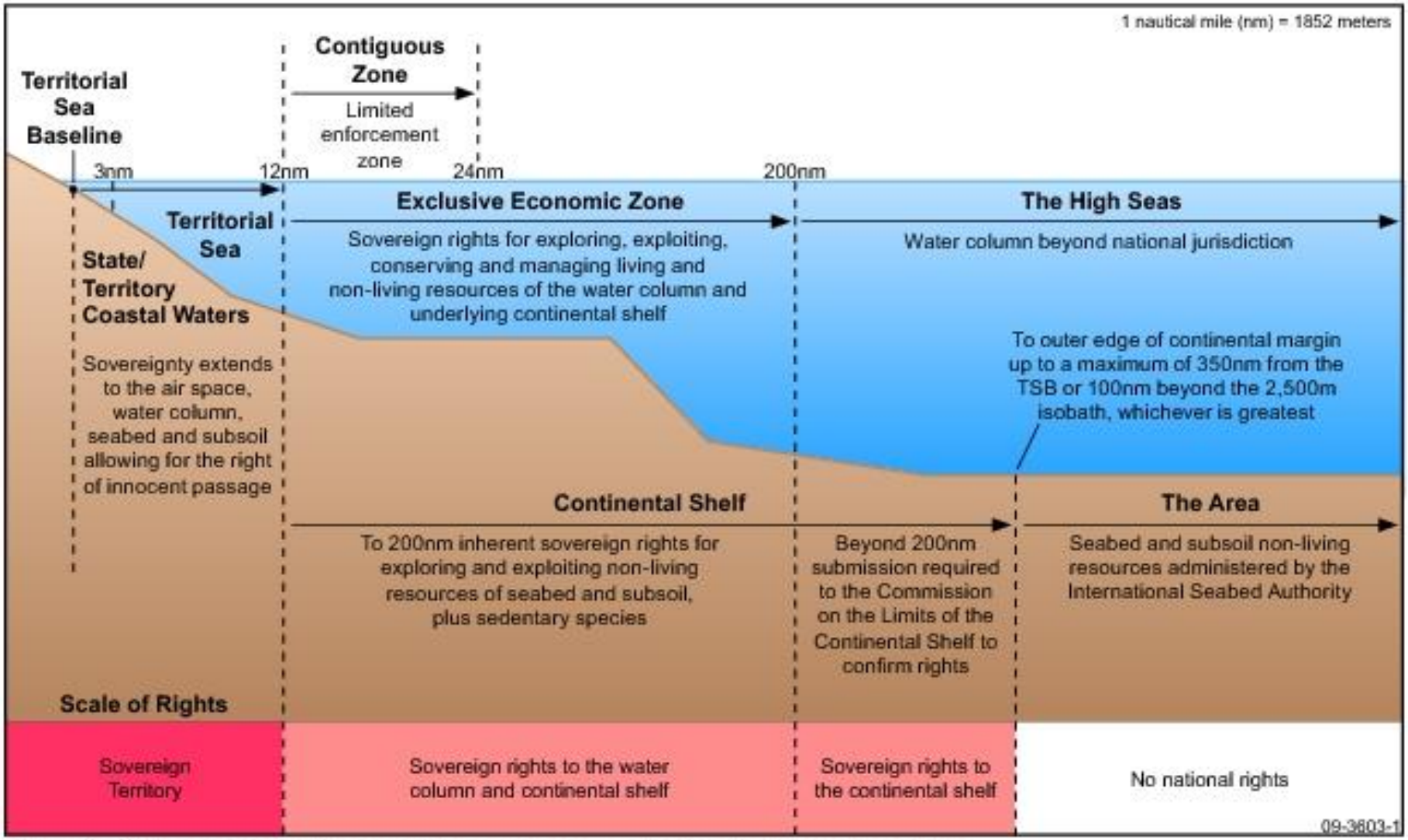
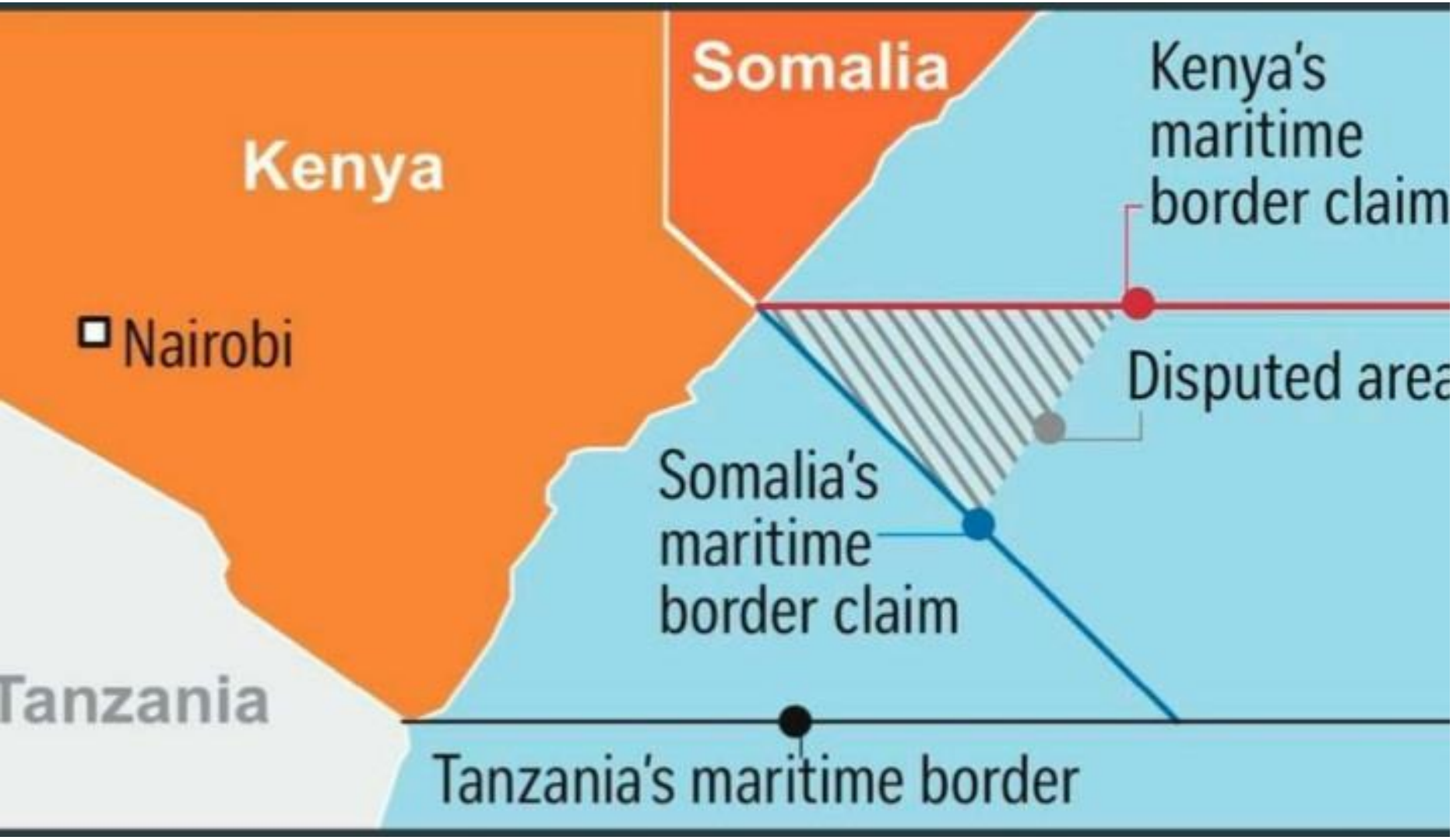


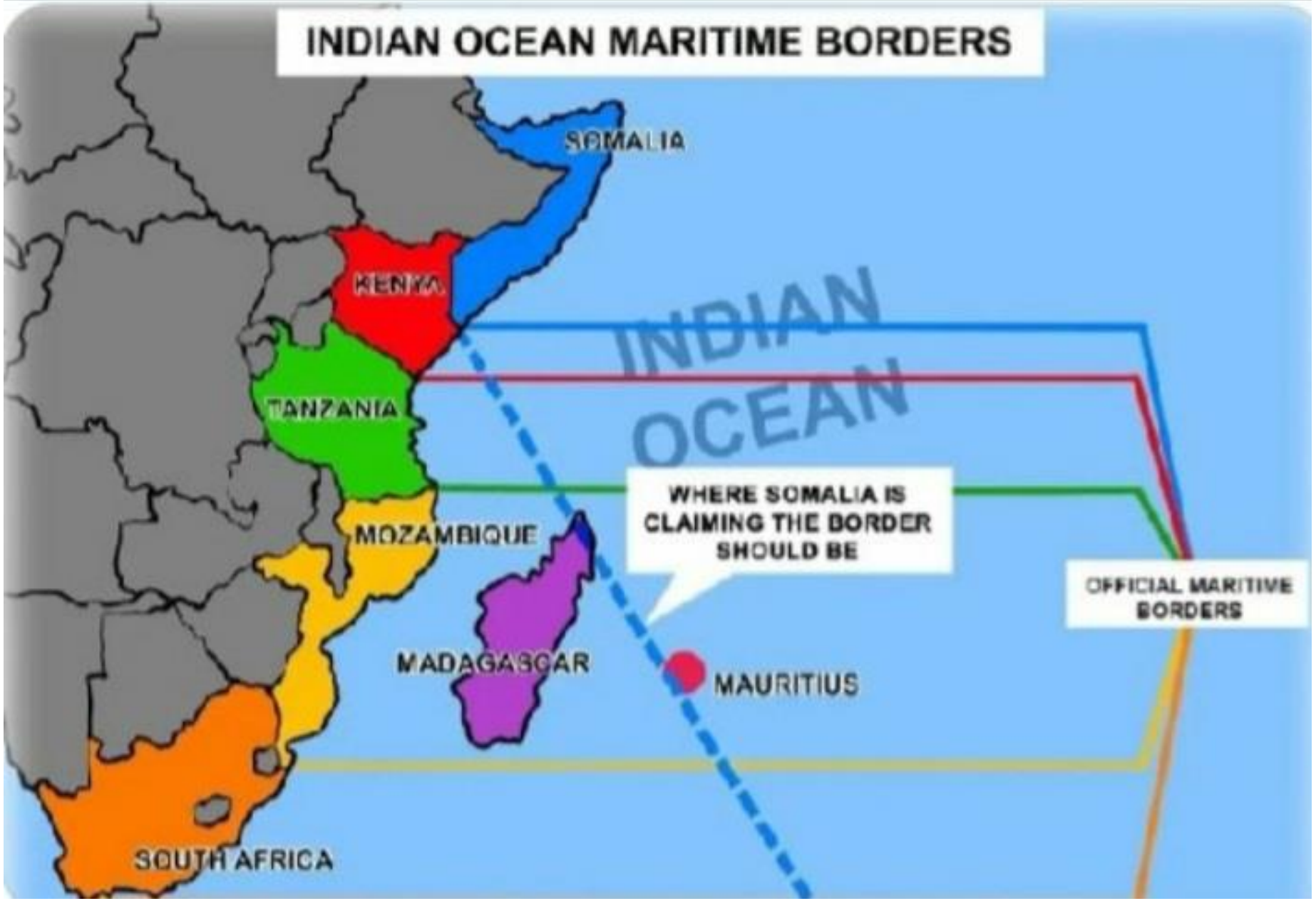
Figure 1: Offshore extent of the maritime zones recognized under international law

Assignment

Kenya /Somali maritime border conflict

- What is the matter(history?
- When did it start? were there any agreements?
- Who went to court and where?
- When and what was the Judgement?
- What is the Kenya's governments stand regarding this matter?


Somalia
Kenya
Kenya's
maritime
border claim
Nairobi
Disputed area
Somalia's
maritime
border claim
Tanzania
Tanzania's maritime border


INDIAN OCEAN MARITIME BORDERS
SOMALIA
KENYA
TANZANIA
MOZAMBIQUE
MADAGASCAR
MAURITIUS
SOUTH AFRICA
INDIAN OCEAN
WHERE SOMALIA IS CLAIMING THE BORDER SHOULD BE
OFFICIAL MARITIVE BORDERS

INTERNATIONAL MANAGEMENT REGIMES FOR MARINE ENVIRONNENT

Objective:

- To address the complexity of management regimes, by developing appropriate **methodology** and by **collecting the information** required for the systematic **valuation of ocean assets and services.**

1. Law of the Sea

- The **United Nations Convention on the Law of the Sea** (**UNCLOS**), also called:
  - the **Law of the Sea Convention** or
  - the **Law of the Sea treaty**,
- Is the international agreement that resulted from **the third United Nations Conference on the Law of the Sea (UNCLOS III),** which took place between 1973 and 1982.
- This is at the global level: the **central regime** for ocean governance.
- The Law of the Sea Convention defines:
  - the rights and responsibilities of nations in the use of the world's oceans,
  - establishing guidelines for businesses, the environment, and the management of marine natural resources.

Other most important sub-regimes

2. Food and Agricultural Organization (FAO): part of the United Nations; focus is on the sustainable management of marine living resources.

3. International Maritime Organization (IMO);

– focus; Shipping and marine pollution control.

4. United Nations Environment Programme (UNEP);

– **focus;** marine environment, regional seas agreements and action plans;

(good place to look for internships and job opportunities)

6.Intergovernmental Oceanographic Commission of UNESCO (IOC);

Focus; Marine scientific research and associated ocean services and management.

7. International Sea Bed Authority (ISBA).

Focus; Deep sea bed mineral development,

The recommendations set by these organizations are essentially directed at governments in recognition of the key role they must play in shaping more effective systems of **ocean governance**.