Interconnectivity of Coastal Ecosystems

(Mangrove Forest, Seagrass beds and Coral Reefs)

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Bio 243 (Marine Biology)
Outline of the topic

- Mangrove
- Seagrass
- Coral Reef
- Connectivity between coastal areas
Marine ecosystems are among the largest ecosystems of Earth’s aquatic ecosystem. These type of ecosystems mostly in areas with high salinity or the salty areas (Kennedy, 2016).
### Types of marine ecosystems

<table>
<thead>
<tr>
<th>Salt marsh</th>
<th>Intertidals</th>
<th>ocean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagoons</td>
<td><strong>Coral reefs</strong></td>
<td>kelp</td>
</tr>
<tr>
<td><strong>Seagrass beds</strong></td>
<td><strong>Mangrove</strong></td>
<td>estuaries</td>
</tr>
</tbody>
</table>

- are dominant features of tropical coastlines because for their high productivity, rich biodiversity and various ecosystem services it provides (Nagelkerken, 2009).
Mangrove Forest

- Mangrove forest is also known as the “rainforest of the sea”.
- It derived from a Malay word “manggi-manggi” for a mangrove plant Avicennia and combined with the Arab word “el-grum” to become “mang-gurm”.
- Basically the place is called mangal where the community of organisms inhabit the mangrove and the trees that flourish in salty ecosystem or found in mangal are called mangrove.
• Tropical evergreen trees restricted to intertidal and adjacent communities (brackish and marine waters)
• Restricted to the tropical and subtropical regions of the world (between 25°N and 25°S latitude)
• Occupy all but the most exposed or rockiest shorelines in tropical regions (up to 75% of the coastline in many areas)
Table 1. Areal distribution of mangrove forest.

<table>
<thead>
<tr>
<th>Region</th>
<th>Area (km²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>South and Southeast Asia</td>
<td>75,170</td>
<td>41.4</td>
</tr>
<tr>
<td>America</td>
<td>49,096</td>
<td>27.1</td>
</tr>
<tr>
<td>West Africa</td>
<td>27,995</td>
<td>15.4</td>
</tr>
<tr>
<td>Australasia</td>
<td>18,788</td>
<td>10.4</td>
</tr>
<tr>
<td>East Africa and Middle East</td>
<td>10,348</td>
<td>5.7</td>
</tr>
</tbody>
</table>
The Philippines as part of the Southeast Asian country ranked 15 in most mangrove-rich in the world (Long and Giri, 2011).

Historically Garcia et al. (2014) noted that the Philippines used to be covered by 400,000 – 500,000 ha of mangrove in 1920 but it declined to 120,000 ha in 1994 due to overexploitation.

(Long et al., 2010)
Types of mangrove plants in Philippines:

Primavera (2009) mentioned at least 19 genus of plants from different families found in the mangrove forest.

PIAPI (BUNGALON)  
*Avicennia marina*

PAGATPAT  
*Sonneratia alba*

BAKHAW  
*Rhizophora species*
Mangrove Forest
Ecological Services

- Habitat for birds, bees, monkeys and other wildlife
- Microbial decomposers & herbivores
- Leaf Litter/Detritus: Protection from storm waves and erosion
- Detritus: Traps sediments and stabilizes coastal areas
- Detritivores
- Small carnivores
- Commercial and subsistence fisheries
- Large carnivores
- Benefits to humans:
  - Clean water
  - Fish, shellfish, mollusks, etc.
  - Medicine
  - Tannin
  - Wood (fuel and construction)
  - Honey
  - Alcohol
  - Shoreline protection
  - Research data
  - Education
  - Recreation/tourism
  - Biodiversity

Nursery ground
Juveniles for aquaculture
What is seagrass?
What is seagrass?

- True flowering plant (angiosperms)
  - Monocots (lily, corn, rice)
  - Not a true grass
- Wholly submerged in salt or brackish water
- Can reproduce sexually and asexually
  - developed a submarine pollination mechanism
  - can produce large, old clones (600 m² and >1,000 years old)
Factors affecting distribution

Physiology
- Temperature
- Salinity
- Waves
- Currents
- Depth
- Substrate
- Day length

Photosynthesis
- Light
- Nutrients
- Epiphytes
- Disease
Geographical distribution, and the shades of color represents the number of species observed (Short et al, 2007).
Ecological services of seagrass beds

- The seagrass community played a vital role in marine ecosystems like:
  - a) stabilizing the sea bottom;
  - b) provide food and shelter for other marine life;
  - c) maintaining water quality and
  - d) supporting local economies of marine life

(Jakson et al, 2001)
Stabilizing sea bottom and a refuge for microorganism (that helps in nutrient cycle)
b) provide food and shelter for other marine life;
Coral Reefs

- Diverse assemblages of sclerectinian hermatypic (stony) corals, algae and numerous other organisms
- Corals are made up of tiny organisms (animals) called polyps (phylum Coelenterata)
- The polyps secrete the calcium carbonate that creates the reef
- Photosynthesis in reefs is carried out by single-celled algae (zooxanthellae) that live in symbiotic association with the coral polyps
- This symbiotic relationship supports all life on the reefs
- Coral reefs rival rainforests in their productivity
Coral Reefs

- Restricted primarily to tropical waters in the Indo-Pacific and Caribbean regions
- Require sea temperatures generally between $20^\circ C$ and $33^\circ C$
- Tolerate salinity ranging somewhere from 30 to 40 parts per thousand
- Very sensitive to increased turbidity and nutrient runoff from coastal regions
- Very sensitive to other sources of pollution as well
World Coral Reef Distribution

Species richness is highest in the Indo-Pacific region
Coral Reef services:

- Coral ecosystems are the main source of food for millions;
- protect coastlines from storms and erosion;
- provide habitat, spawning and nursery grounds for economically important fish species;
- provide jobs and income to local economies from fishing, recreation and tourism;
- possible a good source of medicine and
- hotspots of marine biodiversity
Coastal Ecosystems Connectivity
5 Major interactions between the ecosystems

Mangrove
- Prevents erosion
- Absorbs nutrients*
- Interrupts freshwater discharge
- Export of fish and crustaceans

Sea Grass Bed
- Binds sediment
- Absorbs nutrients*
- Export of maturing fish

Coral Reef
- Buffering of waves and currents
- Export of fish and invertebrate larvae
- Migration of adult fish and invertebrates (influencing productivity of sea grass bed through grazing and nutrient export)
- Export of organic material, and nutrients supporting the pelagic food web

*Mangroves and sea grass beds sometimes export nutrients (especially organic nutrients).
The nursery hypothesis illustrated by ontogenetic migrations of coral reef fish species between mangroves, seagrass beds and the coral reefs. Adult fish live on the coral reefs where reproduction takes place.

(1). During their larval life phase, fish can be transported over large distances by ocean currents (2). After this pelagic larval life phase, fish settle in seagrass beds and/or mangroves where they spend their juvenile life phase (3). During their juvenile life phase, fish may interchange habitats and migrate between mangroves and seagrass beds or vice versa (4a). Finally, when nearing maturity, subadult fish migrate back to the coral reefs (4b). (Source: Dorenbosch 2006).
Ecosystem services:
- High biomass seagrass meadows trap sediments and nutrients.
- Seagrass meadows provide a nursery for finfish and shellfish.
- Seagrass and associated algae have high primary production.
- Seagrass promote trophic transfers and cross-habitat utilization.
- Tropical seagrasses provide food for dugongs, manatees and turtles.

Tropical seagrass loss:
- Coastal salinity changes because of altered water flow for irrigation.
- Pulsed turbidity exacerbated by erosion due to poor land management.
- Large urchin grazing events.
- Eutrophication resulting in phytoplankton blooms, reducing light.
- Dredging and boating effects.


• Kathiresan, K. 2005. Distribution of Mangroves. UNU-INWEH-UNESCO


Thank you for listening 😊