Biogeography

The aim of this study is to identify factors influencing the distribution of marine habitats and to develop a food web that demonstrates the flow of nutrients between reefs and nearby systems. You will compare maps showing the global distribution of mangroves, coral and seagrass diversity and explore current research programs to better understand the issues involved in determining and managing biodiversity and areas of essential habitat.

Time Three hours

Seagrass meadow.

Coral reef.

Mangrove.

Tools

- Computer
- Internet access
- A3 sheet of paper
- Pens or pencils
- Coloured pencils

Background

There are places on our planet where life just seems to explode. At the equator, the currents of the northern and southern hemispheres diverge, moving back towards the temperate and polar seas. They form a long thin ribbon of life, as a constant stream of nutrients is brought towards the surface to be bathed in the tropical sun.

On reefs and adjacent mangrove and seagrass beds you can find more species than you would in tropical rainforests. These productive areas form essential habitats supporting complex food webs from the smallest phytoplankton to some of the world's largest marine predators.

Maintaining and conserving these biological hotspots ensures that the greatest number of species survive into the long term future. Constant monitoring from scientists and volunteers helps to determine how these important areas are changing over time and assists researchers, managers and users to make informed decisions on the best ways to protect them and our future.
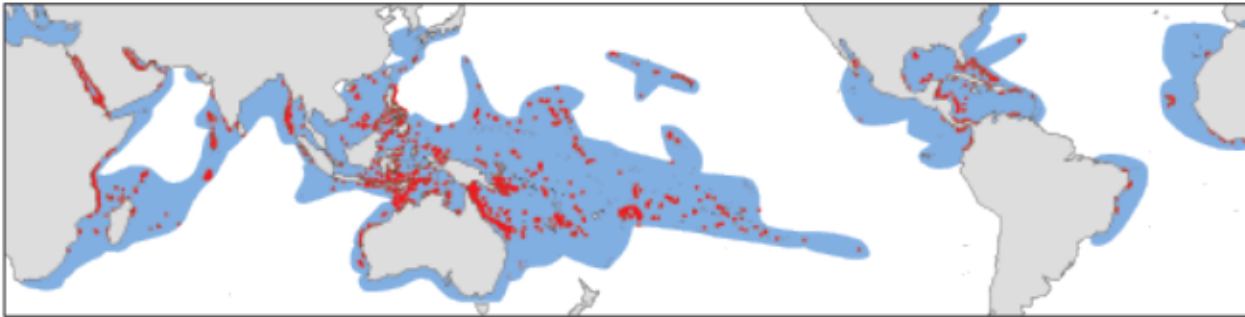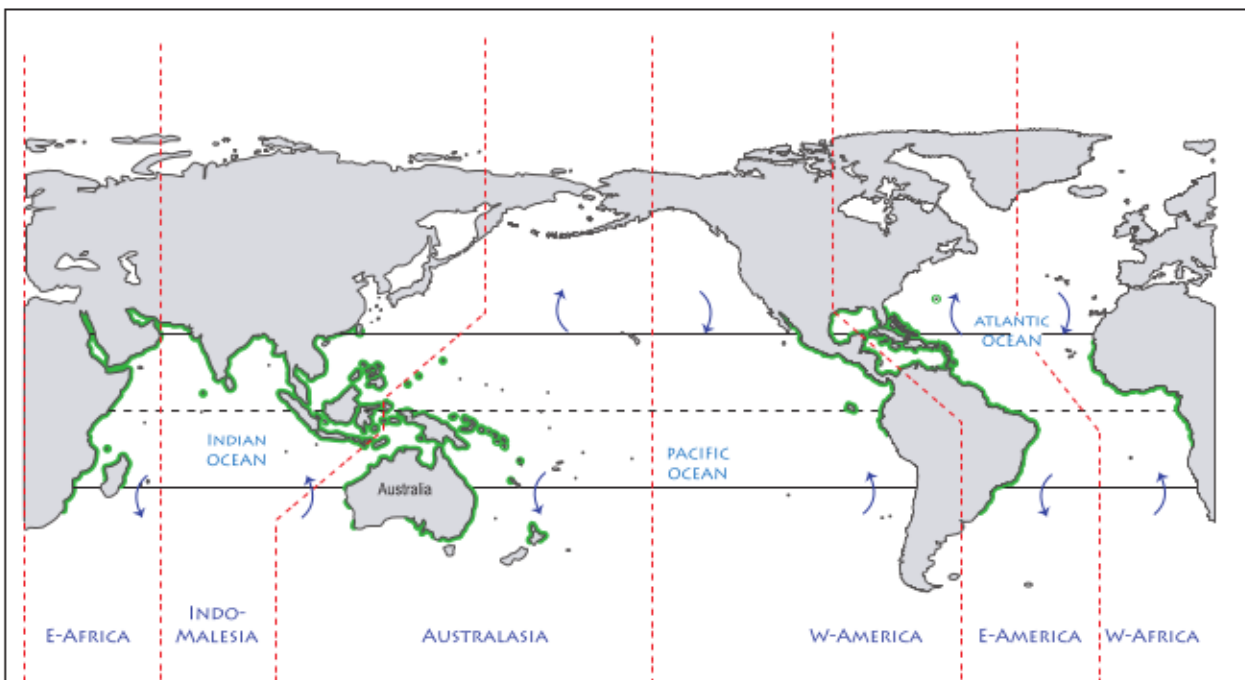
Coral distribution. source Veron 2000
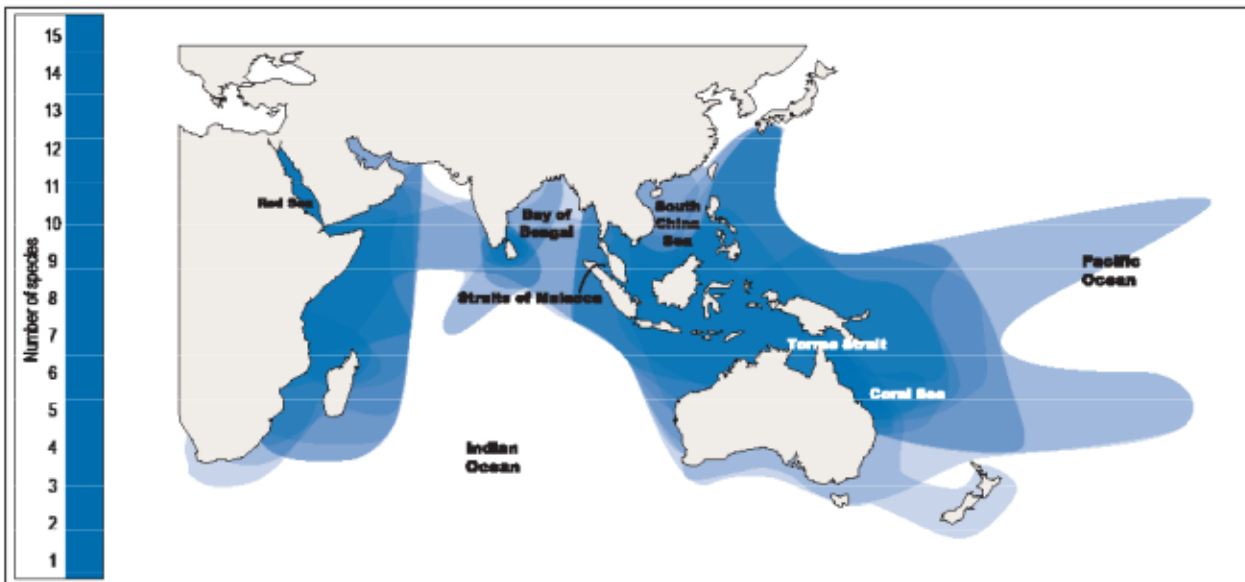
Seagrass distribution. source Waycott et al 2004

Mangrove distribution. source Duke 1996

Classroom activity

1. Research the three monitoring programs:
   a. CoralWatch
   b. Mangrove Watch
   c. Seagrass Watch
2. Draw up three columns on a page and answer the following:
   a. what is the program trying to achieve (e.g. quantify amounts of habitat, assess condition or impacts of disturbance)?
   b. what methods do they use to monitor the environment (e.g. transects, satellite images)?
   c. what kind of people are doing the monitoring (e.g. students, scientists, tourists)?
   d. how long have they been monitoring?
3. Find the closest site near you containing data and answer the following:
   a. what is the name of the site?
   b. what does the data collected tell you about that site?
   c. describe how that site has changed over time.
4. Create a five minute presentation on the benefits and challenges of your chosen monitoring program. Use some of the real data they provide in your report to give reasons for your answers.
5. List five other environmental 'Watch' programs that are monitoring important habitats. You can search for these online.

Teacher Hint

If you are short for time, split the group into three, each researching a separate monitoring program.

Classroom activity

1. List all the organisms you have found or have heard of associated with coastal marine ecosystems and enter them into the 'reef ecosystem table' as either a producer or consumer.
2. For the consumers, list the order these fall into; 1st, 2nd, 3rd or 4th. First-order consumers eat producers, second-order consumers eat first-order consumers and so on.
3. Draw a food web including these organisms in the space provided or on blank pages.
4. Using coloured pencils, show which direction energy and nutrients are flowing between organisms as well as into and out of the system.

OPEN OCEAN   CORAL REEFS   MANGROVE / SEAGRASS

CoralWatch
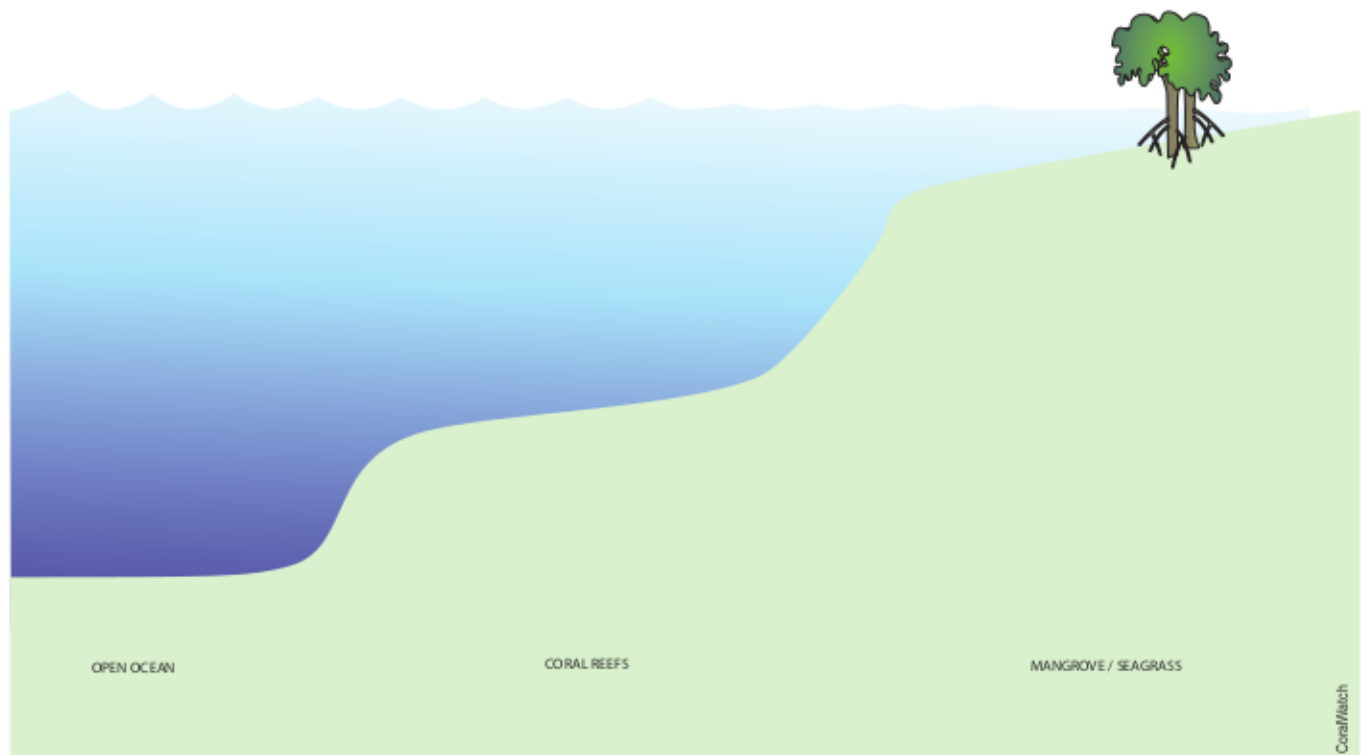
Field activity

During this activity you will estimate the amount of plant material being eaten by select grazers on the reef.

1. Choose an herbivorous fish, such as a parrotfish or rabbitfish, or a crab to observe (it is easy to find crabs feeding on top of coral colonies on a reef flat at low tide if you stand still and it is not too windy).
2. Wait until the animal is no longer disturbed by your presence and tally the number of bites or claw scrapes it takes in the space of one minute.
3. Repeat this three more times to calculate average bites per minute.
4. Assuming it eats at the same rate for the whole day, calculate the total number of bites the organism would take in 12 hours.

Ecosystem table

		Consumer (tick the appropriate box)			
Common name	Producer	1st order	2nd order	3rd order	4th order

Questions

1. Identify and name the main areas of land and ocean on the map that have high and moderate diversity of:

   a. corals

   b. mangroves

   c. seagrass

2. What correlation (if any) exists between these three ecosystems?

3. Describe the reasons why we see shifts in diversity of corals, mangroves and seagrasses the further we move north and south from the equator.

4. Describe how you could monitor or quantify these changes?

5. How could scientists and conservation managers use monitoring data and information to help protect areas of high diversity?

6. Coral bleaching is one of the most visible indicators of climate change. Using the food web, nutrient cycles and energy flows that you have drawn, explain how a coral bleaching event affects this reef ecosystem.

7. What are the implications of removing the 4th order consumers?

8. Why are herbivores so important to the reef?

9. Discuss the reasons why coral reefs are so sensitive to land based pollution.

Research projects

1. How do land use patterns affect the ecologies of these three ecosystems?

2. What are the potential effects on seagrasses and mangrove ecosystems if the coral reefs become heavily degraded as a result of climate change?

3. What is the relationship between the diversity of these ecosystems and pelagic fish population densities?

4. How will changes in the three ecosystems impact the people living?

5. Explain why seagrass beds and mangroves act as nurseries for young reef fish.

References

Reid et al. (2009) Coral Reefs and Climate Change: The guide for education and awareness. CoralWatch, The University of Queensland, Brisbane (See Productive Seas page 56 and Connectivity page 118)

Duke N (2006) Australia's Mangroves. The University of Queensland, Brisbane

Waycott et al. (2004) A Guide to Tropical Seagrasses of the Indo-West Pacific. James Cook University, Townsville

Veron JEN (2000) Corals of the World. Australian Institute of Marine Science and CRR QLD Pty Ltd, Townsville

Allen GR and Steene R (1994) Indo-Pacific Coral Reef Field Guide. Tropical Reef Research, Singapore

Gosliner TM, Behrens DW and Williams GC (1996) Coral Reef Animals of the Indo-Pacific. Sea Challengers, Monterey CA

CoralWatch; www.coralwatch.org

Mangrove Watch; www.marine.uq.edu.au/marbot/

Seagrass Watch; www.seagrasswatch.org