Chapter

9

Our environment - Our concern

Everyone is familiar with one's own surrounding. It plays an important role in the survival of all organisms. The sum of physical and biological factors along with their chemical interactions that affect an organism is called environment. The living organisms maintain a balance with each other and to its biotic and abiotic factors. All components of biosphere interact in an organized manner with the organisms. This interaction assures an organism to survive that may result in gradual evolution of the organisms in the biosphere. The physical factors refers to abiotic factors (land, air, water sun light etc) and biological factors to biotic factors. The place where an organisms lives is called biosphere. One organism cannot completely defy the balance to suit one's need. It would in some way or the other affect the balance in such a way that the survival of the organism affecting the damage would be at stake.

You have understood the relationships between organisms and their food in earlier classes with the help of food chains and food webs. Food chains are interconnected and when we try to observe these connections among a number of food chains then it becomes a food web. As you know a food chain shows who eats what in a particular habitat. The arrows between each organism in the chain always point from the food to the feeder.

fig-1: Food relationship

If we want to show a food chain consisting of grass, snake, rabbit and hawk then connect the given

organisms by putting arrows and make a food chain.

- *Name the producer and consumers in the above food chain.*
- *Try to guess what does the arrows marked by you indicate?*
- *Identify at least four other food chains in your surroundings. Name the producers and different levels of consumers in those food chains.*

While identifying different food chains in your surroundings you will find that most of the food chains are quite short and they rarely consists of not more than four steps. You will also notice that as we move from producer to consumers (primary, secondary & tertiary) in a food chain the numbers of organisms at each level decreases.

What type of relationships exist among the biotic components? In an ecosystem the energy rich food passes from producers to consumers stepwise, with respect to their (food) relationships.

Examples

Grass	grasshopper	frog	snake	Hawk
Grass	Rabbit	Fox	Wolf	
Grass	Goat	Man		

- *Why do most of the food chains consist of four steps?*
- *Why do the number of organisms get decreased as we move form producer to different level of consumers?*

To get answers for the above question we have to recall some of the things which have been discussed in the earlier classes. In chapter 7 "Different Ecosystems" of class 8th it was mentioned that all organisms in an ecosystem derive energy from food to live and sunlight is the main source of the energy. Food chain shows that how the energy is passed from one organism to another. At each transfer a large proportion (80 to 90 percent) of energy is dissipated as heat produced during the process of respiration and other ways. Thus above three steps in a food chain very little energy is still available for living organisms to use.

Within the biosphere there are a number of major ecosystems, the terrestrial ones being determined largely by the variations in climatic conditions between the Poles and Equator .In a similar way, if you climb a mountain such as Kilimanjaro in Equatorial Africa or Himalayan mountains in our country. You quickly go through a comparable system of ecosystems,

starting with tropical rain forest at the base and ending with perpetual snow and ice at the summit.

The main climatic influences which determine these ecosystems are rainfall, temperature and the availability of light from the sun. For instance, forests are usually associated with high rainfall, but the type is influenced by temperature and light; the same applies to deserts which occur in regions where rainfall is extremely low.

But these links are never as simple or rigid as the word 'chain' suggests. For example, aphids are eaten by many insectivorous birds in addition to warblers, and also ladybirds and other insects; hawks, on the other hand, prey upon a considerable variety of birds and small mammal-So the term food web is often a better one to use when being precise, as it suggests a far greater number of possible links and reflects the fact that the whole community is a complex inter-connected unit. Thus the original energy from the sun flows through the whole ecosystem from one tropic level to another.

Let us observe the diagram (fig-2) which shows some of the feeding relationships amongst organisms living in deciduous woodland. You will see from the diagram that animals fit into special positions within the food web; each is described as its niche. For instance, there is a niche for insects such as aphids which suck up the juices of leaves. Another niche for insects such as caterpillars which have strong jaws for biting off pieces of a leaf and a niche for relatively large animals such as deer which browse on the vegetation. All these animals feed on leaves but they differ both in size and in the manner in which they feed. So the term 'niche' denotes not only the animal's position in the food web and what it eats, but also its mode of life. Just as a habitat is the place where an animal lives, so a niche describes its occupation the way it 'goes about its business and earns its livings.

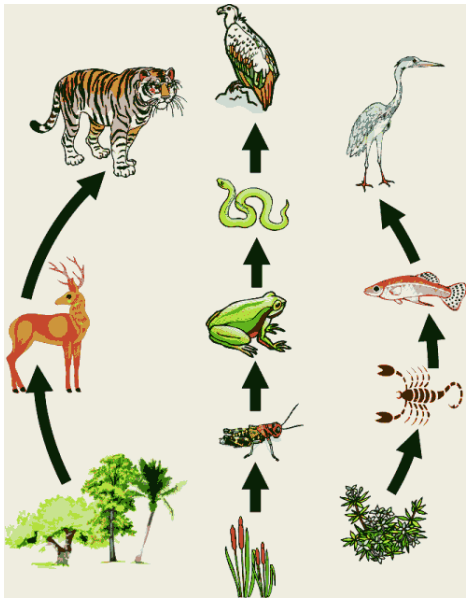


fig-2: Food relationships

Ecological pyramids

Apart from the food chains pyramids are another type of representations which show flow of energy from one organism to another. You may have heard about pyramids of Egypt. The ecologists also used this idea of pyramid to show relationship among organisms in an existing

fig-3: Pyramid of Egypt

food chain. In short we can say that graphic representation of the feeding level (tropic level) of an ecosystem by taking the shape of a pyramid is called "Ecological pyramid". It was first introduced by a British ecologist Charles Elton in 1927. In the ecological pyramid the producers (first trophic level) are represented at the base; and other successive trophic levels (primary, secondary and tertiary consumers) are represented one above the other with top carnivores at the tip. There are three types of pyramids; pyramid of biomass, pyramid of number, pyramid of energy. In this chapter we will try to discuss about the pyramid of number, biomass and energy.

Do you know?

A pyramid is a structure whose shape is roughly that of a pyramid in the geometric sense; that is, its outer surfaces are triangular and converge to a single point at the top. The base of a pyramid can be trilateral, quadrilateral or polygonal shape. The square pyramids, with square base and four triangular outer surfaces, is a common version.

Pyramid of numbers

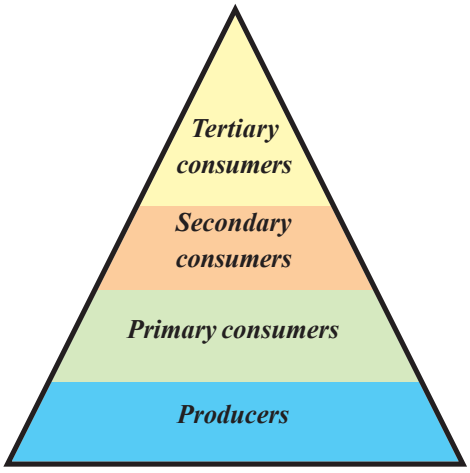


fig-4: Pyramid of numbers

Biologists are not only interested in studying the food relationships which exists between living things, but also in comparing the numbers of organisms at each link in the chain. Here is an example of food web to make estimates of the comparative numbers of organisms present at each stage of chain. The comparison needs to involve the use of such terms as most, many, several, few and scarce. Is there any relationship between the numbers?Is there any comparison that could be made about the sizes of the organisms involved at each stage.

The number of organisms in a food chain can be represented graphically in a pyramid. Each bar represents the number of individuals at each trophic level in the food chain. At each link in a food chain, from the first-order consumers to the large carnivores, there is

normally an increase in size, but decrease in number. Let us observe fig-5, for example in a forest, the aphids are very small and occur in astronomical numbers, the ladybirds which feed on them are distinctly larger and not so numerous, the insectivorous birds which feed on the ladybirds are larger still and are only present in small numbers, and there may only be a single pair of hawks of much larger size than the insectivorous birds on which they prey. This relationship is best shown as a pyramid, which is upright.

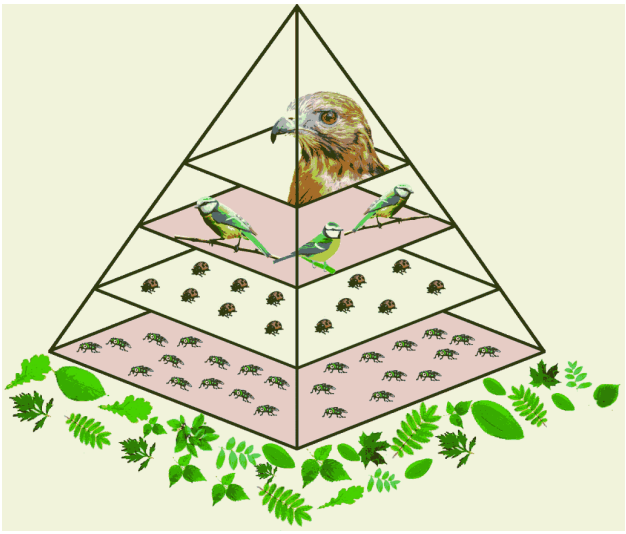


fig-5: Pyramid of numbers

- Draw the pyramid of number for the following food chains

  (i) Banyan → insects → Woodpecker

  (ii) Grass → rabbit → wolf

- *Are the pyramid of numbers having same structure in both of the above two cases as compare to the example given in the earlier paragraph?*
- *If there is a difference then what is it?*

Sometimes the pyramid of numbers does not look like a pyramid at all. This could happen if the producer is a large plant such as tree or if one of the organisms at any trophic level is very small. So keep one thing always in mind that whatever the situation, the producers still goes at the bottom of the pyramid.

Pyramid of Biomass

What is biomass?

Biomass is organic material of biological origin that is ultimately derived from the fixation of carbon dioxide by trapping solar energy during photosynthesis. This includes trees, shrubs, crops, grasses, algae, aquatic plants, agricultural and forest residues and all forms of human, animal and plant waste. Any type of plant or animal material that can be converted into energy is called biomass. When these materials are used for energy production. They are known as bio fuels.

The pyramid of biomass represents the relationships that exist between the quantity of living matter (biomass) at different trophic levels. In

terrestrial ecosystems, the biomass progressively decreases from producers to top carnivores.

- *Think why are the pyramids always upright?*

In an aquatic ecosystem, the biomass of phytoplankton is quite negligible as compared to that of the crustaceans and small herbivorous fish that feed on these producers. The biomass of large carnivorous fish living on small fishes is still greater. This makes the pyramid of biomass inverted. It is found that 10 - 20 % of the biomass is transferred from one tropic level to the next in a food chain.

A more accurate idea of food relationship may be obtained if the above pyramid of numbers is converted into a pyramid of biomass. This indicates the mass of plant matter which is used by the aphids to produce the mass of the of aphids population, the total mass of the ladybird population that could be supported by the aphids and so on through out the chain. In short we can say that biomass is food for the next trophic level in a food chain.

Do you know?

To reduce our dependence on fossil fuels (fuels formed by natural processes such as anaerobic decomposition of buried dead organisms, like coal, petrol etc.), and to help reduce air pollution, biomass can also be used as a source energy. Using biomass as fuel still puts carbon dioxide back into the atmosphere, but it is the same carbon dioxide taken from the air as the biomass was produced.

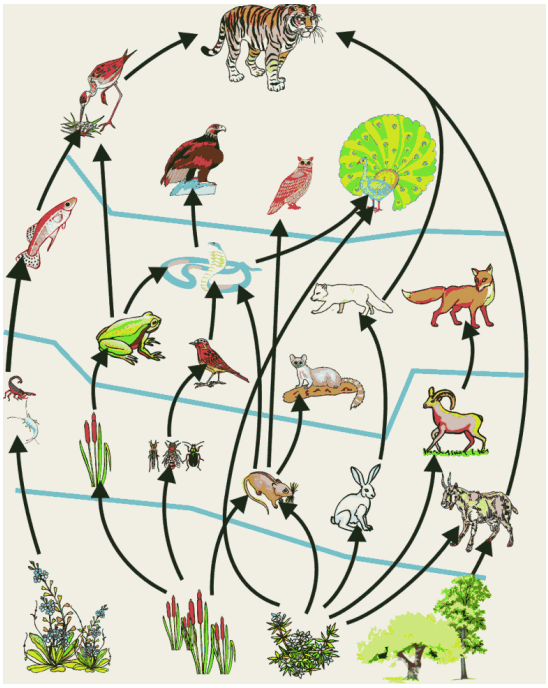
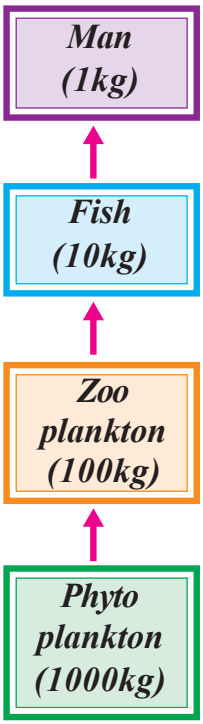


fig-6: Pyramid of biomass

The biomass in each trophic level is always less than the tropic level below. This is because biomass is a measure of the amount of food available. When animals eat, only a small proportion of their food is converted into new tissue, which inturn forms the food for the next trophic level. Most of the biomass that animals eat is either not digested, or used to provide the energy needed for staying alive.

The biomass pyramid shows that animals are relatively inefficient in converting food into body tissues, the remaining part of the food being undigested is passed out as waste, or broken down in respiration to supply energy for such activities as feeding. Many animals convert not more than 10% of their food into their body

tissues, some herbivores even less. Let us take an example of a food chain which has been worked out in some detail- one in which we are involved when we eat fish. In this chain the plant plankton on the surface of waters of sea are food producers. They trap energy from sunlight. The animal plankton feed on the microscopic plants and the fish in turn feed on the animal plankton; we are at the end of the chain when we eat the fish.



The pyramid of biomass for this particular food chain will be as follows. In this particular food chain roughly 90% of the food is lost at each step. So it allows that it would take 1000 kg of plant plankton to produce 100 kg of animal plankton to form 10 kg of fish to produce 1 kg of human tissues, with a corresponding loss of the original plant potential energy that came from the sun. Thus we can conclude that the nearer an animal species is to the original plant source in a food chain the greater the amount of energy is available to the population of that species. In other words, the fewer the steps in the food chain, the more energy will be for the species at the top.

Pyramid of Energy

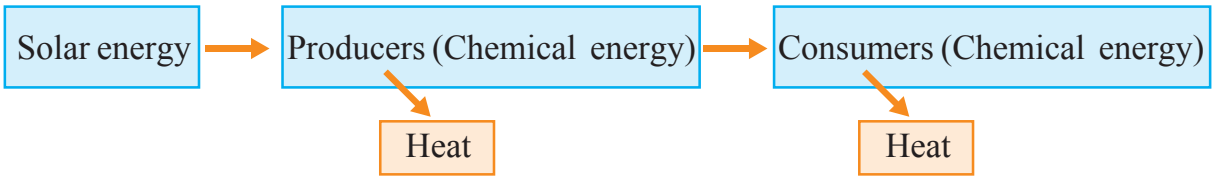
Food is the source of energy for organisms that are used in the growth and rebuilding of the parts of the body; that are constantly wearing out. The food by its nature is the chemical energy and by in its stored form, it is the potential energy. There are several mechanisms in organisms for continuous absorption of materials for the production of organic material, and for the release and conversion of organic material into inorganic form. Plants absorb the minerals from the soil. They are absorbed into the plant along with through roots.

Photosynthesis is an essential process for the life. The energy of sunlight, carbon dioxide, and the water, which ofcourse needed by all living things, belong to nonliving things. As a result of photosynthesis, these can be made available in a suitable form of energy the food to the world of living things the animals or consumers, only by the green plants the producers. The food chains and food webs help in the transfer of the food and energy from the producers to different consumers. Animals obtain the minerals from the plant or animal food or both. Thus the mineral matter is constantly being removed from the earth to become a part of the plant, which may become a part of animal body.

Curd that we eat is processed from milk, which comes from a cow, which in turn eats grass. The grass carries out photosynthesis and prepares food. In every case, the origin of food materials can be traced back to green plants.

Once the food is eaten, its energy follows a variety of pattern through the organisms. Not all the food can be fully digested and assimilated. Hair, feathers, insect exoskeletons, cartilage and bone in animal foods, cellulose and lignin in plant foods cannot be digested by most animals. These materials are either egected by defaecation or regurgitated in pellets of indigested remains.

Assimilated energy (that is not lost through respiration or excretion) is available for the synthesis of new biomass through growth and reproduction. Organisms lose some biomass by death, disease or annual leaf-drop, where they enter the detritus pathways of the food chain i.e., after the death and decomposition of organisms the materials flow back into the environment. The remaining biomass is eventually consumed by herbivores or predators and its energy there by enters the next higher trophic level in the ecosystem.



The materials keep on cycling i.e. entering the living beings and through death and decay returning to the soil and atmosphere Such a flow of materials between organisms and their environment is called Cycling of materials or mineral circulation or Biogeochemical cycles (You have learnt in class IX).

Energy enters the producers in the ecosystem from the sun in the form of solar energy or solar radiation. No other organisms except green plants and Photosynthetic bacteria due to the presence of chlorophyll are capable of absorbing solar energy and converting it into chemical energy.

From the producers, the chemical energy passes to the consumers from one tropic level to the next through food. At each tropic level, organisms use most of the food energy that they assimilate into their bodies to fulfill their metabolic requirements- performance of work, growth and reproduction. Because biological energy transformations are inefficient, a substantial proportion of metabolized food energy is lost, unused as heat.

Only a small fraction goes to the eater at next trophic level. Organisms are no different from man-made machines in this respect. Most of the energy in gasoline is lost as heat in a car's engine rather than being transformed into the energy of motion. In natural communities, energy

used to perform work or dissipated as heat cannot be consumed by other organism and is forever lost to the ecosystem.

The effects of human activities on ecosystems

In the earlier classes we have studied about different types of pollution as a result of human interventions in ecosystem. In this section we will try to understand that when we cut forest to grow food crops, how this activity brings harmful changes in ecosystem and affects organisms of each tropic level.

Let us study a pond ecosystem to understand the components of environment, their interactions and effects of human interventions in the following story.

Story of Kolleru Lake

Fresh water lakes provide the nutritional requirements of the world's poorest people. One such lake is Kolleru which is no ordinary wetland. It is one of the largest fresh water lakes in India, existing between West Godavari and Krishna districts of the state of Andhra Pradesh. The catchment of the lake extends up to 6121 km^2. The lake Kolleru discharges its excess water in to the Bay of Bengal through the twisty channel called Upputeru, which is about 65 km long. Nevertheless, the Kolleru wetland receives huge quantity of nutrient rich sediments from the flood plains of these rivers.

In November 1999, the Government of Andhra Pradesh had declared the lake as Bird Sanctuary. This lake is hosting 193 species of birds and a variety of flora and fauna, including medicinal plants. It attracts migratory birds from northern Asia and Eastern Europe between the months of October and March and it is estimated as 20,00,000 birds per year. The lake was also an important habitat for an estimated 20 million residents. This largest sweet water lake has not only shrunk in size but faced great threat due to pollution in the last three decades as revealed by satellite pictures. The decrease in water area and muddy ground in the lake resulted in flooding

fig-7: Kolleru Lake

Table-1

Classes	Area in 1967 (Km^2)	Area in 2004 (Km^2)
Lake –water spread area	70.70	62.65
Lake with sparse weed	0	47.45
Lake with dense weed	0	15.20
Lake-liable to flood in rainy season	100.97	0
Aquaculture ponds	0	99.74
Rice fields	8.40	16.62
Settlements	0.31	1.37
Total	**180.38**	**180.38**

problems in the lake area. Observe the data given in the following table.

- *In which year lake-water spread area is more? Why?*
- *How do you think weeds are more in the lake?*
- *What are the reasons for decrease in lake area?*
- *How do the above reasons lead to pollution?*
- *How was the threat to the lake due to pollution discovered?*
- *What could be the reason for the migration of birds to this lake?*

Being a profitable business, Aquaculture in Kolleru was started extensively in the eighties which later spread to other areas in the Krishna Godavari delta and attracted a large number of investors to the area. In 1996, almost entire lake was brought under cultivation and bunds were constructed to keep water out to protect the crops. This divertion affected the natural flow system of the lake. The water holding capacity of the lake is also found significantly reduced.

In due course of time activities such as agriculture and industries came along in ever growing intensity in the catchment area of the lake. Consequently, the drains and rivulets carry substantial quantity of various types of pollutants into the lake. The major sources of pollution are agricultural runoff containing residues of several agrochemicals, fertilizers, fish tank discharges industrial effluents containing chemical residues and different types of organic substances, municipal and domestic sewage. Excessive nutrient addition, especially from anthropogenic sources, led to explosive weed growth. Ex: Eichornia

As a result, the water of the lake turned more alkaline in nature, turbid, nutrient rich, low in dissolved oxygen (DO) and high in biochemical oxygen demand (BOD). Water borne diseases like diarrhoea, typhoid, amoebiasis and others are said to be common among the local inhabitants who are unaware of the state of pollution in the lake water. Vector borne diseases also increased. Prawn and fish have been found to be affected by diseases leading to some farms being abandoned. The lands thus abandoned are useless for agriculture too. Let us observe the following table showing different activities in the lake and their influence.

Table-2

Problem	Agricultural Practices	Aquaculture practices	Industrial activities	Human activities
Biological				
1. Decreased Migratory birds	-	+	-	-
2. Population loss of flora and fauna	-	+	-	-
3. Pathogens	-	-	-	+
Chemical				
1. Eutrophication	+	+	-	+
2. Toxic contamination	+	+	+	-
Physical				
1. Siltation	+	+	-	-
2. Flooding	+	+	-	+

Legend: (+) means has influence on the mentioned problem

(-) means has no influence on the mentioned problem

- *What are the factors that affected the number of migratory birds to decrease?*
- *Do you find any relationship between biological and physical problems?*
- *What are the reasons for chemical problems?*
- *What happens if the dissolved oxygen reduce in lake water?*
- *Is BOD of turbid and nutrient rich water high or low? What are it's consequences?*
- *People living in catchment area of Kolleru faced so many problems. Why?*

The Ministry of Environment and Forest (MoEF), Government of India (GoI) constituted a committee "Operation Kolleru" to protect the lake. The objective of the programe is to bring back the ecological balance of Kolleru Lake which is a Gift of nature.

Activity-1

Observe any water ecosystem in your surroundings and identify the different food chains and food web operating in this ecosystem. Write the following details in your notebook.

Work Sheet

1. Names of the students in a group: _____ Date: _____
2. Name of the ecosystem: _____
3. Topography: _____
4. Names / Number of plants (producers) identified: _____
5. Names / Number of animals identified: _____
6. Identify the different types consumers and name them & mention their number below:
   - Herbivores (Primary consumers): _____
   - Carnivores (Secondary consumers): _____
   - Top carnivores(Tertiary): _____
7. Food relationships among them: food habits / preferences: _____
8. Show / draw the different food chains: _____
9. Showcase the food web: _____
10. List out all abiotic factors existing in the ecosystem: _____
    (A check list can be given, and asked to tick)
11. Is there any threat to the ecosystem? Yes/No _____
    If yes, what? and how? _____
    Suggest few remedial measures _____

When a forest is cut down and a food crop is grown in its place, a natural established ecosystem with its vast number of species in a state of dynamic equilibrium is replaced by a monoculture i.e. an unnatural concentration of a single crop of various kinds grown in different fields to provide cereals or roots, others grass for domestic animals.

When we grow crops in large concentrations we also get food in abundant quantities. This situation is optimum for pest, parasites like fungi to grow on this food material. If the quantities of food are larger then

multiplication of pests and parasites is rapid and the resulting damage would be great. To avoid such happening we have tried to eliminate these competitors for the crops by using toxic chemicals (pesticides, herbicides, and fungicides). Many of them have been very effective, but their use has also created new problems.

The perfect pesticide is the one which destroys a particular pest and is completely harmless to each and every other form of life, no such pesticide exists or likely to be.

- *Name any two pesticides you have heard about?*
- *How are the food grains and cereals being stored in your house and how do you protected them from pests and fungus?*

Pesticides are often indiscriminate in their action and vast number of other animals may be destroyed. Some of these may be predators which naturally feed on these pests, others may be the prey for other animals. Thus causing unpredictable changes in food chains and upsetting the balance within the ecosystem.

A further danger is that some have a cumulative effect. Pesticides vary in their length of "life" as toxic substances. Some of the pesticides as well as herbicides are degradable. They are broken down into harmless substances in a comparatively short time, usually a year. Others are non degradable, and include those which contain mercury, arsenic or lead. These non degradable pesticides are potentially dangerous as they accumulate in the bodies of animals and pass right through food web. Being further concentrated at each step until animals at the top of pyramid may receive enough to do considerable harm. The process of entry of pollutants into a food chain is known as Bioaccumulation, whereas the tendency of pollutants to concentrate as they move from one trophic level to the next is known as Biomagnification.

Let us observe the following research study on the effects of bio accumulation on human health.

Seasonal Bioaccumulation of heavy metals in fish (cyprinus carpio) of Edulabad Water Reservoir (EBWR), Andhra Pradesh, India.

The aquatic bodies such as water reservoirs and rivers surrounding the urban areas in India, pose a serious risk for survival of aquatic organisms due to water quality deterioration through excessive nutrient inputs, acidification, heavy metal contamination and organic pollution.

The aquatic biota is being contaminated with heavy metals due to industrialization and anthropogenic activities.

fig-8: Edulabad Water Reservoir

Recently, fish are considered to be the bio indicators of metal contamination in environmental monitoring because fish species are strongly respond to stress conditions.

A study was undertaken to assess the enrichment of heavy metal such as Lead (Pb), Cadmium (Cd), Chromium (Cr), Manganese (Mn), Nickel (Ni) and Ferrum (Fe) contamination in Edulabad Water Reservoir (EBWR) which is located in urban areas of Rangareddy district of Andhra Pradesh, highly polluted with industrial and agricultural effluents. Cyprinus carpio (common scale carp) is a cheap and high proteinaceous fish used as food for human beings, living in polluted EBWR was chosen for the study. Heavy metals in water samples and its bioaccumulation in various tissues including liver, kidney and gill of the fish growing in the reservoir were analyzed along with glycogen and lipids contents. A parallel study was conducted in water samples and fishes collected from Bibi Nagar, Nalgonda district fresh water reservoir because it is less polluted, located 30 km near to EBWR in Andhra Pradesh. The results obtained in present study revealed that higher bioaccumulation and lower glycogen and lipid content in the fish of EBWR when compared to Bibi Nagar fresh water reservoir.

The water and fish samples were collected in three seasons namely pre-monsoon (February-May), monsoon (June-September) and post monsoon (October-January) in each year. Three water samples were collected in three station thrice in each season from each tank in cleaned polythene bottles and tightly stopped and used for heavy metal analysis from June 2005 to May 2007.

The metal concentrations in EBWR reservoir were found to be higher than Indian standard limits and exhibiting the following sequence,

Fe > Pb > Cr > Ni > Cd.

The heavy metals could find their way into the human food chain, we analyzed bioaccumulation of these metals in the fish tissues. The bioaccumulation of these metals in fish tissues were of the following trend,

Cd > Cr > Fe > Ni > Pb.

Higher bioaccumulation factors were found for Cd in liver, gill and kidney indicated the sensitivity of fish to this metal even at low concentrations.

It is found that the bioaccumulation was lesser in monsoon season than pre and post monsoon seasons.

The heavy metals could find their way into human beings through food chain. This bio accumulation cause various physiological disorders such as hypertension, sporadic fever, renal damage, nausea, etc.

It is concluded that unplanned urban settlements, combined with the proliferation of unorganized small-scale industries and the sewage lead to the contamination of the EBWR. Such increased bioaccumulation of heavy metals in fishes not only disturbs aquatic life but also increases health risk in human beings through food chain.

- *Where from pollutants enter to the water sources?*
- *How can you say fishes living in water having heavy metals in their bodies?*
- *Researchers found that pollution levels increase during monsoon season. Why they found so?*
- *Why did people also suffer from various diseases after consuming fishes living in local water reservoir?*

In many areas man has changed the natural ecosystems to a great extent by damming rivers, draining marshes, re-claiming land from the sea, cutting down forests, plough-ing up land and growing crops, and by building towns, cities, canals and motorways. These changes have greatly altered the communities of plants and animals living there.

Consider the development of a large town, for example. There will be three kinds of change:

a) Some plants and animal species will die out.

b) Some will adapt to the new conditions sufficiently to survive in reduced numbers.

c) Some will benefit by the new conditions and will increase in numbers.

Do you know?

Minamata disease was first discovered in Minamata city in Kumamoto prefecture, Japan, in 1956. It was caused by the release of methyl mercury in the industrial wastewater from the Chisso corporation's chemical factory, which continued from 1932 to 1968. This highly toxic chemical bioaccumulated in shellfish and fish in Minimata Bay and the Shiranui Sea, which, when eaten by the local populace, resulted in mercury poisoning. While cat, dog, pig and humans deaths continued for 36 years.

Let us read the following story to know how cruel the human actvities are against the nature.

Sparrow campaign

Any living organism can't avoid crises since they are a normal part of life. However, none have ever encountered a disaster on the level of that which fell upon the Chinese Sparrows in 1958. The environmental crisis in question was not a natural one rather, it was manmade. In the entire history of sparrows around the world, they have never been hunted down as they were in China in 1958.

fig-9: Sparrow in danger

A radical campaign to rapidly increase China's industrial output by mobilizing the country's vast rural peasantry took place at this time. It was set in motion by the government with the intention to achieve rapid increase in industrial production that China would catch up with the rest of the civilized world. China had an agrarian society then.

One of the most famous initiatives then was to form co-operatives or collectives up to 5,000 families and this initially yielded double the amount of crops grown. This initial success led to ambitious goals for the following year, but the weather didn't cooperate. Even though fewer crops were harvested, rural officials overstated the amount of grain for fear of not meeting their quotas. This over-reporting led to an imbalance between the demand and the supply. The sparrows were accused of pecking away at the supplies in warehouses at an officially estimated rate of four pounds of grain per sparrow per year. In the cities and the outskirts, almost half of the labour force was mobilized into the anti-sparrow army.

fig-10: Sparrow campaign

People started trapping, poisoning and killing sparrows in large numbers. Several free-fire zones were set up for shooting the sparrows. People would beat drums to scare the birds from landing, so the sparrows were forced to keep flying until they dropped dead from fatigue. Sparrow nests were torn down, eggs were broken, and nestlings were killed. Non-material rewards and recognition were offered to schools, work units and government agencies in accordance with the number of sparrows killed.

Later some scientists who cut open the digestive systems of dead sparrows found that three-fourth of the contents were of insects harmful for crops and only one-fourth contained grains. The scientific findings

showed that sparrows were basically a beneficial bird for humans. Rather than being increased, crop yields after the campaign were substantially decreased. Though the campaign against sparrows ended it was too late. With no sparrows to eat the locust populations, the country was soon swarmed. Locusts coupled with bad weather led to the Great Chinese Famine. Use of pesticides against locust population further degraded the land.

Instead of working in the fields, millions of farmers had to leave their villages to work for industries. Very small area was left under agriculture and food shortages became everyday occurrence.

- *What is the food chain that has been discussed in the above case?*
- *How did the campaign disturb the food chain in the fields?*
- *How did these disturbances affect the environment?*
- *Is it right to eradicate a living organism in an ecosystem ?How is it harmful?*
- *Were the sparrows really responsible? What was the reason for the fall in crop production?*
- *What was the impact of human activities on the environment?*
- *What do you suggest for such incidents not to occur?*
- *Read the poem "Manavi" in class VIII biology textbook and discuss in your class.*

Steps towards prevention

If we think about the ways through which we can prevent ourselves and other living beings from the harmful effects of the use of toxic material as pesticides, then the instanct reaction may be to Ban the pesticides. It is easy to say "Ban all pesticides" but the pests still have to be kept in check. After using pesticides then also we are having a significant amount of loss of food material because of pests. Now you can imagine if pesticides were totally banned what would happen to the diseases? Are they really controlling the pests that effect the crops we vitally need for our growing population?

The long term solution to this problem is to find other effective methods of controlling pests which have far less harmful effects and are based on sound biological principles.

Here are some of the important methods used.

Rotation of crops: Growing different crops on a particular piece of land in successive years reduces the occurance of pests and damage to the crops from year to year in that area.

Studying the life histories of the pests: When this is done it is sometimes possible to sow the crops at a time when least damage will be caused.

Biological control: Introducing natural predator or parasite of the pest.

Sterility : Rendering the males of a pest species sterile

Genetic strains: The development of genetic strains (genetically modified plants) which are resistant to certain pest.

Environmental ethics: This is concerned with morality of human activities as they affect the environment. People need to know besides laws regarding environment there are some basic ethics what is is right and what is wrong in view of environment.

So one should have awareness about our environment. Protect nature Protect yourselves.Read the poem "Or will the dreamer wake" given in unit-VI in your english reader of class-10.

Courtesy-1: Research paper on status of Kolleru Lake between 1967 and 2004 by Marappan et.al., 2006.
Courtesy-2: International Jornal of Life Sciences Biotechnology and Pharma Research. This research was done by Vidya Sagar Gummadavelli, Ravi Shankar Piska, Srinu Noothi and Pavan K. Manikonda.

Key words

Food chain, Food web, Niche, Ecological Pyramid, Biomass, Pesticides, Bioaccumulation, Biomagnification, Ecofriendly activities, Ecofriendly activities, Environmental ethics.

What we have learnt

- Food chain shows that how energy passed from one organism to another.
- The arrows between each item in the food chain always point from the food to feeder.
- Pyramid of numbers and pyramid of biomass are other ways to show food relationship and flow of energy among living things
- A pyramid is a structure whose shape is roughly that of a pyramid in geometric sense.
- Pyramid of number shows the population of organisms at each trophic level in a food chain.
- Pyramid of biomass represents the available food as a source of energy at each trophic level in the food chain.
- Biomass can also be used as a bio fuel.
- Toxic material used to prevent the pest, fungus and other disease away from the food crop and grains do harms in many ways to ecosystem.
- Bioaccumulation is the entering of pollutants in the food chain.
- The tendency of pollutants to concentrate as they move from one trophic level to the next is known as Biomagnification.

- There are several alternatives for pesticides through which we can get more yields with less damage like rotation of crops, biological control, development of genetic resistant strains etc.

Improve your learning

1. What happens to the amount of energy transferred from one step to the next in a food chain?(AS1)
2. What do pyramids and food chain indicate in an ecosystem?(AS1)
3. Write a short note on pyramid of number for any food chain? What can we conclude from this pyramid of numbers?(AS1)
   (i) tree (ii) insect (iii) woodpecker
4. What is biomass? Draw a pyramid of biomass for the given food chain- (AS1)
   (i) grass leaves (ii) herbivores (iii) predators (iv) hawk
5. How is using of toxic material affecting the ecosystem? Write a short note on bioaccumulation and biomagnifications.(AS1)
6. Should we use pesticides as they prevent our crop and food from pests or should we think of alternatives? Write your view about this issue and give sound reason for your answer.(AS1)
7. What is a trophic level? What does it represent in an ecological pyramid?(AS1)
8. If you want to know more about flow of energy in an ecosystem, what questions do you ask?(AS2)
9. What will happen if we remove predators from food web?(AS2)
10. Observe a plant in your kitchen garden, and write a note on producer- consumer relationship.(AS3)
11. What type of information do you require to explain pyramid of biomass? (AS4)
12. Draw a pyramid of numbers considering yourself as a top level consumer.(AS5)
13. Prepare slogans to promote awareness in your classmates about ecofriendly activities.(AS7)
14. Suggest any three programmes for prevention of soil pollution in view of avoiding pesticides.(AS7)

Choose the correct answer

1. What does a food chain always start with - ( )
   (a) The herbivore (b) The carnivore (c) The producer (d) none of them
2. Which of the following do plants not compete for? ( )
   (a) Water (b) Food (c) space (d) all above
3. Ban all pesticides, this means that ( )
   a) Control on usage of pesticides b) prevention of pesticides
   c) promote eco friendly agricultural practices d) stop bio chemical factories
4. According to Charles Elton ( )
   a) carnivores at the top of the pyramid b) energy trapping is high at the top of the pyramid
   c) No producers at the top of the pyramid d) a and c