ETHNOMEDICINE

Subject Code: 18UZOEC61

Semester: VI ECC:2 Credits: 2

Course coordinator: Dr.R. Azhagu Raj

Objective:

To provide basic information on the therapeutic species and their uses in traditional medicine and conservation.

Course Outcomes: At the end of the course the students will be able to

1. understand the basics of Ethnotaxonomy.
2. learn the importance of therapeutic animals in traditional medicine
3. understand the role of animals in ecological diversity
4. learn about the Ethnozoological practices in tribes.
5. understand the importance and conservation of animals

ETHNOMEDICINE

CONTENT

6.0. Ethnomedicine

6.1.Foot crack

6.2.Indigestion and diarrhea

7.0. Conservation Of Traditional Knowledge And Systems

7.1. Animals In A Magico-Religious Sphere

7.2.**Animals in omen indication, and weather forecast**

7.3.Consulting a Local Healer

7.4.Visiting a Spirit-medium ('Bhopa'):

7.5.Taboos

7.6. Human influence on Animal biodiversity

7.7. The role of Ethnozoology in Animal conservation

8.0.Traditional Knowledge

9.0. Ethno-veterinary practices

10.0 .Ethnobiology - Quantitative Analysis

10.1. Relative Frequency Citation (RFC)

10.2. Use value

10.3. Relative Importance.

10.4. Model question

ETHNOMEDICINE

1.0. Introduction

Since ancient times animals and products derived from different organs of their bodies have constituted part of the inventory of medicinal substances used in many cultures, and such uses still exist in ethnic folk medicine. Archives, papyruses, and other early written historical sources dealing with medicine, testify how old is the practice of using animals and their products as medicine (Lev, 2003).

Traditional human populations have got a broad natural pharmacopoeia obtained from plants and animals. The interest on this knowledge has increased, partly because the empirical basis developed throughout centuries may be corroborated, in many cases, through scientific evidences (Anyinam, 1995), but above all, for its historical, economical, sociological, anthropological, and environmental importance (Lev, 2003 ;Alvels *et al* .2006).

1.1. Ethnobiology

Studies dealing with the relationship between plants, animals and humans and are placed in the field of science called Ethnobiology. Khajoei Nasab and Khosravi (2014) reported that ethnobiology surveys include interviewing local people, use of the available data in the literature, and the folklore of each region. The goal of ethno biology is to protect and to pass the valuable and useful traditional knowledge to future generations. Uncontrolled harvest of medicinal plants by people has increased the risk of extinction of many species and subsequently the loss of local knowledge as how to use them.

India is the second largest country in the world with over one billion people with diverse socio-cultural backgrounds. It accounts for sixteen percentage of the world's population and

holds twenty one percent of the world's, global burden of diseases. The impact of traditional systems of medicine in the public healthcare system of India is substantially high and medicine is intimately interwoven with religiosity and ethnicity (Broom et al., 2009).

The first written Siddha medical text ‘Thirumanthiram’ dates back around 6th–7th century A. D. and the Siddha medicine as it now exists both in theory and practice, began in Tamil Nadu around the16th century, but elements of healing practices which became part of Siddha medicine including those they hold in common with Ayurveda, came from an earlier period as evidenced by the concepts for good health in Thirukural, collection of Tamil poems that dates around 450–550 A.D. (Zysk, 2008).

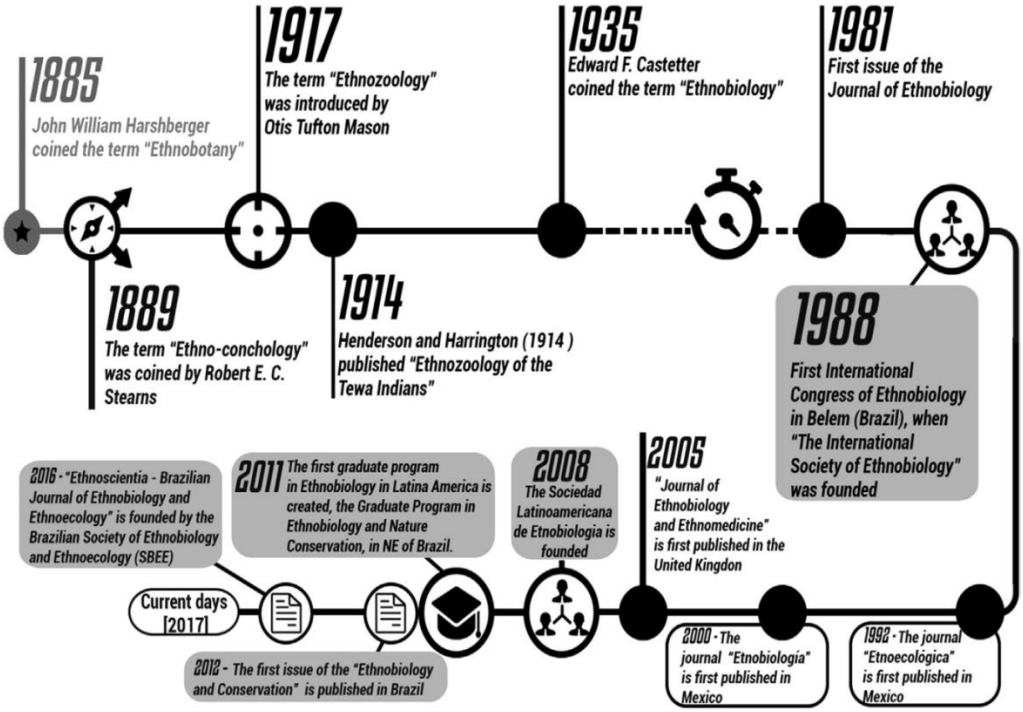

Figure.1. History of Ethno zoology courtesy (Alvels, 2018)

2.0.Ethnobiology

Ethnobiology must have been the first knowledge, which the early man had acquired by sheer necessity, intuition, observation and experimentation. Factors like geographical isolation,

uniqueness of the habitat, genetic differences etc. affect a particular human population of an area in acquiring skills, developing concepts, techniques for earning subsistence, etc., which lays base stone in the ethnoecology. The knowledge gained by the local people of a particular area is generally acquired through generations by direct interaction with nature. Hence this orally transmitted information of a particular community is not rigid but renewed continuously by time.

2.1. Ethnobiological knowledge

Ethnobiological knowledge is very ancient in India. Ethnobiology describes how people of a particular culture and region make use of indigenous plants and animals. Ethnobiological knowledge accumulated over generations help people protect their nutrition and health and manage their habitats (Laird, 2002). The possibility that traditional knowledge may be rapidly and widely lost in response to globalization has become a major concern of scholars and policy-makers (Agrawal, 2002).

This concern emerges from the presumed link between traditional knowledge and conservation and development. For example, researchers have said that ethnobiological knowledge related to the habitat or traditional ecological knowledge, contributes to ecological adaptation and might help to design policies for conservation. The loss of traditional ecological knowledge concerns policy-makers because it represents the irreversible loss of information about different ways to manage natural resources.

2.2. Traditional ecological knowledge

Traditional ecological knowledge and ethnobiological studies have attracted researcher's interest since the beginning of the nineteenth century. The initial interest focused in documenting how native people classified their environment. By the mid- 1980s, the international recognition of the potential value of traditional knowledge generated increasing interest in the topic (WCED,

1987). At that point researchers shifted their interest from documenting how people classified their environment to study how traditional knowledge contributed to human adaptation.

Traditional knowledge resembling scientific knowledge developed through inductive methods and it contribute to the conservation of biological diversity, agriculture, health, nutrition and the management of natural resources. Despite the growing interest in the topic, there has been little and fragmented quantitative research about the causes and rate of loss of traditional knowledge. Although some researchers have linked the loss of traditional knowledge to the expansion of the market economy (Victoria Reyes-García *et. al*., 2005a), others have found persistence in traditional knowledge despite large socioeconomic changes (Zarger and Stepp, 2004). Ethnoecology deals with the study of local people's interaction with the natural environment including sub disciplines such as ethnobiology, ethnobotany, ethnoentomology and ethnozoology.

The use of cultural consensus to analyze data on traditional ecological knowledge has been used by several authors and is becoming a recognized method to measure variation in individual's traditional ecological knowledge. We also used another measure of traditional ecological knowledge that focuses on empirical, rather than on theoretical knowledge: self-reported ethnobiological skills. We use this new variable because skills capture the practical dimension of ethnobiological knowledge.

The loss of traditional ecological knowledge might affect ethnozoological skills before affecting theoretical ethnozoological knowledge. Integration to the market economy is recent in many traditional societies. If economic development erodes ethnobiological knowledge by enabling people to gain access to substitutes for plant and animal products, then we would expect

to see economic development producing an effect on the skills to manufacture products from animals before producing an effect on theoretical knowledge.

Wildlife has always been used by the human society for its survival. The use has been for edible and non-edible products, other than as a source of recreation. The Wildlife, in all its forms, from the mammals to the invertebrates, have also been used for its various end uses like food (e.g. bats, rats, deer, wild boar, etc.), medicine (e.g. civet, cat, bats, nilgiri langur) for the trade in parts or whole (e.g. civet, lion tailed macaque, mongoose, shrews, etc.) and for non-edible purposes like ornaments, clothing, tools and in religious functions also. These associations have to be evaluated in terms of the cultural, aesthetic, medicinal, economic and on social values.

The biodiversity in the universe is said to be declining due to various reasons like loss/fragmentation of habitats, population pressure, shortening resource base, increasing demand, etc. Many species of animals and animal products/derivatives are declining gradually and many species are categorized as endangered or threatened.

Human beings have been using animal resources for therapeutic purposes since ancient times (Weiss, 1947; Rosner, 1992; Unnikrishnan, 1998), where folk remedies were elaborated from parts of the animal body, from products of its metabolism, such as corporal secretions and excrements, or from non-animal materials such as nests and cocoons. This ethnozoological interaction has been recorded both in indigenous and western societies throughout the world (Gudger, 1925; Branch and Silva, 1983; Conconi and Pino, 1988; Begossi and Braga, 1992; Antonio, 1994; van Huis, 1996).

Both wild and domesticated animals are useful for therapeutic purposes. The latter are used especially through pet therapies, such as the employment of dogs, cats, and horses for the treatment and improvement of different kinds of pathological conditions, as for example mental

deficiencies. The ample geographical distribution of zootherapy has been such that all human cultures show a developed medical system that will utilize animals as medicines. Such a statement forms the basis of what he has called ‘zootherapeutic universality hypothesis’.

For example angiotensin I, an antihypertensive derived from the Brazilian arrowhead viper *Bothrops jararaca*, brings the Squibb Company US $1.3 billion a year in sales and contributes to the well-being and longevity of millions of peoples (Lovejoy, 1997). Today from 252 essential chemicals that have been selected by the World Health Organization, 11.1% have plant origins, while 8.7% come from animals (Marques, 1996). In Brazil, animal species have been medicinally used by indigenous society for millennia and by descendants of the European settlers for the last four centuries. An amazing number of about 300 species have been recorded and these can be easily found as commercial items sold by herbalists and healers in marketplaces all over the country (Marques, personal communication, 1996).

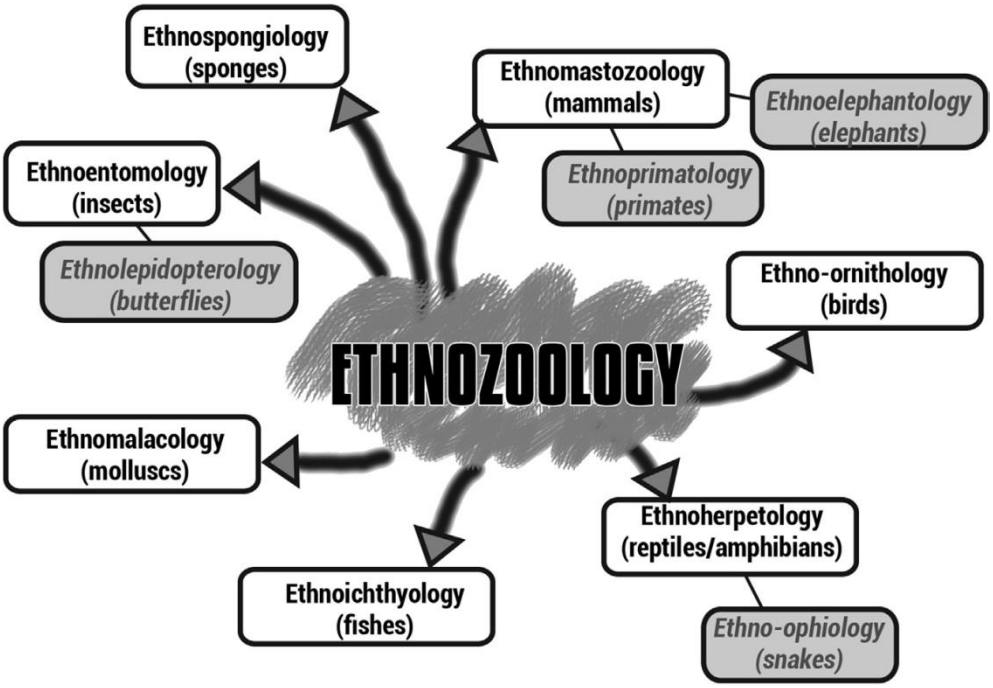

Figure.2. Ethnozoology branches (courtesy Alvels, 2018)

3.0.Zootherapeutics

3.1.Insects as food

In India, the insects are the staple food of the tribal's. Among them, beetles, bugs, cockroaches, locust, grasshoppers and crickets, moth butterflies and their larval and pupal stages, ants, bees and wasps are consumed as food. Other animals like rats and snakes, lizards, toads, frogs and snails are used in some other form as food. The crunchy little ants (*Oecophylla smaragdina*) and also some beetles have medicinal value (Mishra *et. al*., 1999). Costa-Neto (1996) has recorded the use of 22 species in the area of the Chapada Diamantina National Park, 49 species in the county of Glória, 16 species in the city of Feira de Santana (1999b), and 55 species in the county of Conde.

Costa-Neto and Melo (1998) have recorded the use of 16 insect folk species in the county of Matinha dos Pretos. Informants have also cited the use of living animals, such as tortoise (*Geochelone* cf. c*arbonaria*). This reptile is reared as a pet. Although considered by many as superstition, the pertinence of traditional medicine based on animals cannot be denied since they have been methodically tested by pharmaceutical companies as sources of drugs to the modern medical science. As Kunin and Lawton (1996) argue, According to McGirk (1998), Brazilian scientists are studying a type of frog that is used to cure intestinal illnesses by members of the Yawanawa Indian tribes on the banks of the Rio Grande. Indeed, amphibians have provided compounds capable of being turned to therapeutic advantage.

Peptides extracted from the scraped secretions of *Phyllomedusa bicolor*, for instance, are used in the treatment of depression, stroke, seizures and cognitive loss in ailments such as Alzheimer's disease (Amato, 1992). Some of these compounds are important tools for

biochemical research or as new leads for the development of anticancer or antiviral drugs (Lazarus and Attila, 1993).

3.2.Animal-derived metabolites

Several other animal-derived compounds of proven efficacy have also been found as observed by Zhang, Guo and Wang (1992), who have studied therapeutic uses of earthworms and found that these animals possess antipyretic, antispasmodic, diuretic, detoxic, antiasthmatic, antihypertensive, and antiallergenic effects. From the plasma of the European hedgehog, Mebs *et. al*. (1996) have isolated erinacin, which is an antihaemorrhagic factor. In addition to this, Oldfield (1989) records that about 4% of the extracts evaluated in the 1970s from 800 species of terrestrial arthropods (insects, crustaceans, spiders, millipedes, and centipedes) showed some anticancer activity.

Even lethal, natural substances can become medicines. The study of viperid, crotalid and elapid venoms has shown the presence of analgesic activity, which, in the case of serpent venoms, is stronger than morphine and therefore, of use in cases of terminal cancer (Bisset, 1991). A more recent development is the introduction of captopril and related substances in the treatment of hypertension. Regarding fish, several compounds have been extracted and these are employed as remedies in the official medicines (Hamada and Nagai, 1995). Oily fish, like cod, herring, salmon, and turbot have a great medicinal value due to presense of polyunsaturated compound known as OMEGA-3. This substance helps the prevention of arthritis.

The presence of an anticoagulant system in the plasma of Atlantic salmon (*Salmo salar* L.) and rainbow trout (*Oncorhynchus mykiss* Walbaun) has been confirmed, what supports similarities with the protein C anticoagulant system in mammals (Salte *et. al*., 1996). Tetrodotoxin (TTX), a water-soluble guanidinium derivative, is an example of a bioactive

compound produced by marine organisms such as puffer fish “that resembles procaine in its ability to inhibit transmission of nerve cells” (Colwell, 1997). When diluted it acts as an extraordinary narcotic and analgesic (Bisset, 1991).

Zoo-therapeutic is such a body of indigenous knowledge system built up by a group of people through generations, by living in close contact with nature and using traditional drugs of animal origin in the local environment so that it is specifically adapted to the local people and conditions. This plays a significant role in the healing practices, magic rituals and religions of both indigenous and western societies all over the world (Rosner, 1992).

Although integration of indigenous people with larger societies, growth of national and international markets, imposition of educational and religious systems and various developmental processes lead to the homogenization of world cultures, the contemporary society may benefit from such experience in its fight against disease and sufferings and the established. It is thus, essential to document the various zootherapeutic uses and formulate conservation strategies for animals before these indigenous beliefs, values, customs, know-how and practices are altered and rendered unsuitable, making the knowledge base incomplete. Although quite a relevant contribution in the ethnozoological drugs of vertebrate origin has been made by Joseph(1984) no authentic report is available from Nagaland except for the Chakhesang tribe (Kakati *et. al*., 2006).

4.0. Zootherapy

The healthful use of animals and their product for the advantage of humans is termed Zootherapy. The Zootherapy (therapy attended or facilited by animals) is a therapeutic device that is based on the interaction between animals and the human being (Bradbury, 2001; Costa Neto, 2005). Many ethnic communities have utilized various substances derived

from domestic animals like milk, urine, and honey in curing various ailments over the years. In ancient china, substances of animal origin were used by many people for treatment of various diseases (Kremers and Urdang, 1976).
In India, nearly 15-20 percent of the Ayurvedic medicines are based on animal derived substances and out of these animals most are domestic (Unnikrisnhan, 1998).

The Hindus, in Asian country use mixing of 5 product (milk, dung, curd, urine and ghee) of cow for purification. Among the 252 essential chemicals that have been selected by the WHO, 8.7% come from animals (Marques, 1997). Mahawar and Jaroli carried out a study among Saharia people of Rajasthan, India and identified 9 domestic animals out of 15 studied used in traditional therapeutic practices (Mahawar and Jaroli, 2007). Barboza carried out a survey in the district of Cubati, Brazil and described 5 domestic animals out of 15 total studied, 62.5% informant provided information about medicinal use of sheep and thirty seven.5% provided info concerning cattle's for therapeutic practices (Barboza,2007).

5.0. ETHNOZOOLOGICAL RECORDS FROM INDIA

5.1. INSECTS

5.1.1. Order: Hymenoptera

Family: Apidae

Species: *Apis cerana indica* (Fabricius, 1793)

Common name: Indian bee

Notes: This species is domesticated. Head is darker, flattened and triangular in shape. It is protected by chitinous plates called sclerites. Abdomen is formed of nine segments. They also have prominent abdominal stripes. They form smaller colonies.

Usage: Honey is effective for cough, stomach pain and urinary disorder. It is also fed to women after delivery.

5.1.2. Order: Hymenoptera

Family: Apidae

Species: *Apis dorsata* (Fabricius, 1793)

Common name: Rock bee

Notes: In the southern states of India including Kerala, extraction of honey from *Apis dorsata* colonies has been significant and about 60 percent of honey extracted in Kerala come from this species. The size of a single open-air comb, depending upon the season and stage of development of a colony measures 1.5 to 2m breadth wise and 0.6 to 1.2 m lengthwise. The comb is suspended from rocks, ceilings of neglected and uninhabited houses and branches of tall trees. Honey yield per colony varies from 5-20 kg. Their sting is probably the most painful of any honeybee species.

Usage: Honey is used in diarrhoea and vomiting.

5.1.3. Order: Hymenoptera

Family: Apidae

Species: *Apis florea* (Fabricius, 1787)

Common name: Little honeybee

Notes: This is an inoffensive little insect, reluctant to use its sting. A single colony consists of a single comb, the size of the palm of a man's hand. This dwarf honeybee isthe smallest species of honeybee. A nest of *A. florea* consists of a single comb, whose upper part expands to form a crest that surrounds the branch or other object from which the comb is suspended.

Usage: Honey is used in snakebite, general head ache, cures eye diseases and imparts fair complexion also in the treatment of mental diseases.

5.1.4. Order: Lepidoptera

Family: Bombicidae

Species: *Bombyx mori* (Linnaeus, 1758)

Common name: Silk worm

Notes: Commercially most important species and is the major producer of silk. The silk worm is naked and has a short anal horn. Adults in this family have heavy, rounded, furry bodies and cannot feed. The forewing has a hooked tip, characteristic in this family, however it is flightless. Wings and body are usually white, but may vary to shades of light brown. The larva is an elongated caterpillar commonly called a silkworm. Larvae are monophagous and feed only on mulberry plants.

Usage: Its ash is used in digestive problems and in eye diseases.

5.1.5. Order: Hymenoptera

Family: Formicidae

Species: *Oecophylla smaragdina* (Fabricius, 1775)

Common name: Red ant

Notes: Large reddish ants with a fierce bite. Is a species of arboreal ant always nesting in trees or shrubs. They make nests in trees made of leaves stitched together using the silk produced by their larvae. Foraging takes place both on vegetation and on the ground, and they are predacious.

Usage: A paste made of ants is eaten as a remedy for myopia.

5.1.6. Order: Orthoptera

Family: Acrididae

Species: *Patanga succincta* (Johansson, 1763)

Common name: Grasshopper

Notes: Live among grass and herbage on the ground. They are variously colored and are protected as long as they keep still by blending with their surroundings. They are active by day and if disturbed jump suddenly and powerfully, using their greatly enlarged hindlegs. Can also crawl slowly by means of the other two pairs of legs. It Is short-horned. They are mainly ground living insects.

Usage: Fried and eaten as a delicious food.

5.1.7. Order: Dictyoptera

Family: Blattidae

Species: *Periplanata americana* (Linnaeus, 1758)

Common name: Cockroach

Notes: It is the chief house-living cockroach. They come out at night. The adult cockroach is reddish brown in appearance with a pale-brown or yellow band around the edge of the pronotum. The males are longer than the females because their wings extend 4 to 8 mm beyond the tip of the abdomen. Males and females have a pair of slender, jointed cerci at the tip of the abdomen. The male cockroaches have cerci with 18 to 19 segments while the female has 13 to 14 segments. The male American cockroaches have a pair of styles between the cerci while the females do not.

Usage: Ash is used with honey for dysponea, urinary obstruction and uterine colic infection.

5.1.8. Order: Diptera

Family: Muscidae

Species: *Musca domestica* (Linnaeus)

Common name: Housefly

Notes: Stoutly built and in both sexes abdomen is yellowish or buff. The adults are 5-8 mm long. Their thorax is grey, with four dark longitudinal lines on the back. The underside of the abdomen is yellow. The whole body is covered with hair. They have red compound eyes. The females are slightly larger than the males and have a much larger space between the eyes. have only one pair of wings; the hind pair is reduced to small halteres that aid in flight stability. Characteristically, the medial vein shows a sharp upward bend.

Usage: Whole paste is applied to treat furuncles.

5.1.9. Order: Hymnoptera

Family: Apidae

Species: *Trigona*

Common name: Stingless bee

Notes: They make large colonies in hollow logs and similar places and they are domesticated for their honey. The bees are small in size and do not sting. They are black in colour with hairy, extended hind legs for carrying nectar and pollens.

Usage: Used to treat glaucoma.

5.1.10. Order: Hymnoptera

Family: Apidae

Species: *Melipona*

Common name: Stingless bee

Notes: They make large colonies in hollow logs and similar places and they are domesticated for their honey. The bees are small in size and do not sting. They are black in colour with hairy,

extended hind legs for carrying nectar and pollens. A few grams of honey alone are available from a single comb.

Usage: Used to treat glaucoma.

5.2. ANNELIDS

Order: Rhyncobdellida

Family: Hirudidae

Species: *Hirundo medicinalis* (Lamarck, 1818)

Common name: Leech

Notes: It is a viscous animal, greenish with longitudinal red stripes. It has a pattern of irregular markings over its body. It is a jawed leech, and has strong teeth, which make Y-shaped cut in the skin of its prey, through which it sucks blood.

Usage: Tribes boil leeches in sesame oil to produce a sexual stimulant for male sex organ. Dried and pulverized leeches are given with honey in pharyngitis; with oil in piles.

Order: Prospora

Family: Lumbricidae

Species: *Pheretima posthuma* (Kinberg)

Common name: Earthworm

Notes: Body is divided into segments. Meronephric. Has tufted pharyngeal nephridia on segments 4-6. There are 200-250 small, closed integumentary exonephridia on segments 7-15 and open holonephric enteronephridia.

Usage: Dried worms are beneficial in healing wounds, chronic boils, piles, sore, chronic cough, and diphtheria and in jaundice. Oil from worms is used in hemiplegia, paralysis and muscular pains.

5.3. MOLLUSC

Order: Gastropoda

Family: Ampullariidae

Species: *Pila globosa* (Swainson, 1821)

Common name: Apple snail

Notes: The shell is globose with an oval opening. *Pila globosa* has a large and deep umbilicus. The colour varies from olive green to grey green with a tinge of red. The interior of the shell is dull reddish with very faint spiral bands visible, white at the columella.

Usage: Flesh is edible, shell is used to scrapping.

5.4. ARTHROPODA

Order: Decapoda

Family: Paguridae

Species: *Cancer pagurus* (Linnaeus, 1758)

Common name: Crab

Notes: During summer small individuals, seldom large enough for eating may be found beneath rocks and in crevices around the low tide mark. As the weather becomes colder there is a migration to deep water, where spawning takes place during winter. The eggs hatch the following summer in shallow coastal waters.

Usage: Flesh boiled and taken in, to relieve cough. Fat used for burns and flesh and eggs are used to increase lactation. Fat is placed in the decaying teeth. Fried crab is used to treat whooping cough.

5.5. ARACHNIDS

Order: Orthognatha

Family: Theraphosidae

Species: *Theraphosa* (Thorell, 1870)

Common name: Bird eating spider

Notes: This is the largest among the living spiders. Body and legs are hairy and the hairs have an irritant effect on the human skin. This is a deep burrowing species that flicks clouds of urticating hairs at any perceived threat.

Usage: Hairs used in magic rituals.

Order: Labidognatha

Family: Scorpionidae

Species: *Palamnaeus swammerdami*

Common name: Scorpion

Notes: Notorious for their stings and the venom is fatal to man. Body is segmented and bears a pair of chelicerae or pincer like claws. Thorax has four segments with a pair of walking legs on the under surface and the abdomen has six segments tapering to a single sharp sting at the end with a small opening supplied by two relatively large venom glands.

Usage: The whole body is boiled in gingiley oil and used for massaging to treat rheumatic pains.

5.6.PISCES

Order: Osteoglossiformes

Family: Notopteridae

Species: *Notopterus notopterus* (Pallas)

Common name: Bronze featherback fish (Plate 3b.)

Notes: Body oblong and strongly compressed. Head compressed. Pre orbital is serrated. Mouth moderate, maxilla extends upto middle of the orbit. Dorsal fin inserted nearer to the caudal fin base than the tip of the snout. Ventral fin is rudimentary. Anal fin is confluent with the caudal fin. Scales minute, larger in the opercular region than the scales in the body. Color is silvery white with numerous fine grey spots in the body and head.

Usage: Fish is taken as food.

Order: Cypriniformis

Family: Cyprinidae

Species: *Cyprinus carpio communis* (Linnaeus)

Common name: Katla

Notes: Body robust and laterally compressed. Head is small. Snout is bluntly rounded. Eyes are large. Inter orbital region is convex. Barbels two pairs, maxillaries and rostral and the former are longer than latter. Dorsal fin inserted distinctly nearer to the base of the caudal peduncle than the tip of the snout. Its large unbranched ray is osseous, strong and finely serrated. Anal fin is with a strong and osseous serrated spine. Caudal fin is short and stout. Scales large and cycloid. Lateral line is complete with 32 scales. Color in golden yellowish without any markings.

Usage: Fish is edible.

Order: Cypriniformis

Family: Cyprinidae

Species: *Hypselobarbus kolus* (Sykes)

Common name: Kolus

Notes: Body is fairly deep. Eyes are large and not visible from ventral side. Mouth subterminal. One or two pairs of barbels well developed. Dorsal fins inserted anterior to the pelvic fins. Its

last unbranched ray is osseous, weak or strong. Scales are medium to large size and the lateral line complete.

Usage: Fish is edible.

Order: Cypriniformis

Family: Cyprinidae

Species: *Hypselobarbus dubius* (Day)

Common name: Nilgiris barb

Notes: Inhabits in deeper portion of large streams and rivers below the ghats. Migrates upstreams during floods and spawns in the upper reaches of streams. Omnivorous; feeds on allochthonous plant materials, seeds, terrestrial insects, *Chironomous* larvae and small benthic molluscs.

Usage: Fish is taken as food.

Order: Cypriniformis

Family: Cyprinidae

Species: *Neolissochilus wynaadensis* (Day)

Common name: Pachilavetti vella

Notes: Body elongate and slightly compressed. Head is broad. Mouth smoothly rounded and lips are fleshy. Lower labial groove is interrupted in the middle. Snout is conical. Interorbital region is nearly convex. Barbels two pairs, maxillaries and rostral; former is longer reaching upto the orbit. Snout is with or without pores. Dorsal fin inserted distinctly nearer to the tip of the snout than the base of the caudal peduncle. Its last unbranched ray is slightly osseous. Ventral fin inserted behind the dorsal. Caudal peduncle is long and narrow. Scales are long and medium

sized. Color is leaden along the back. Yellowish tinge on the flanks. A dark lateral band is running along the lateral line from eye to the middle of the caudal fin base. Fins are grayish.

Usage: Fish is edible.

Order: Cypriniformis

Family: Cyprinidae

Species: *Neolissochilus anamalaiensis* sp. nov.

Common name: Pachilavetti karuppu

Usage: Fish is taken as food

Order: Cypriniformis

Family: Cyprinidae

Subfamily: Cyprininae

Species: *Cirrhinus mirgala* (Hamilton-Buchanan)

Common name: Mirgala

Notes: Body streamlined, its depth about equal to length of head. Snout blunt, often with pores. Mouth broad; upperlip entire, lower lip most indistinct. Barbels, a single short pair of rostrals only. Pharyngeal teeth are in three rows. Dorsal fin present as high as body. Pectoral fins shorter than head. Gill rakers 40 to 49 on first arch. Caudal fin deeply forked. Lateral line with 40 - 45 scales. Dark grey along back often with a coppery tinge, flanks silvery with a yellowish tinge and belly silvery white. Eyes are golden color.

Usage: Fish is edible.

Order: Cypriniformis

Family: Cyprinidae

Species: *Labeo calbasu* (Hamilton-Buchanan)

Common name: Major carp (Plate 3a.)

Notes: Scales of moderate or small size. Dorsal fin without osseous ray with more than nine branched rays, commencing somewhat in advance of the ventrals. Snout obtusely rounded, the skin of maxillary region being more or less thickened forming a projection beyond the mouth. Mouth transverse, inferior, with the lips thickened, each or one of them being provided with an inner transverse fold, which is covered with a deciduous horny substance forming a sharp edge which however does not rest upon the bone as base, but is soft and movable.

Usage: Fish is edible.

Order: Cypriniformis

Family: Cyprinidae

Species: *Labeo rohita* (Hamilton-Buchanan)

Common name: Rohu (Plate 3c.)

Notes: Body deep, stout, with broad snout. Mouth wide with skin covering lower lip. Length approximately 198cm, snout blunt, gill rackers nine in number. Lateral line system is complete. Dorsal fins are with four unbranched and eight branched rays. Pectorals below the lateral line and body bluish along the back, becoming silvery on the flanks and beneath. Eyes are reddish.

Usage: Fish is edible.

Labeo calbasu b. *Notopterus notopterus* c. Labeo rohita

Figure.3. Trap from bamboo stakes used for large ungulates, and trap for small rodents, Zambia.

(*Photos: Anthony B. Cunningham courtesy; Alvels, 2018)*

6.0. Ethnomedicine

6.1.Foot crack

Powdered shell (100g) of the peal oyster, *Pinctada vulgaris* is thoroughly blended with the fruit juice (100ml) of *Emblica officinalis* and ground well with the seed oil (50ml) of *Ricinus communis* to make an ointment. This prescription is externally applied over the foot crack twice a day.

6.2.Indigestion and diarrhea

The seed of *Cyminum cuminum* (10g) and sugar crystals (10g) are roasted with the gastric mucosa of the hen, *Gallus domesticus.* This medicinal mixture is ground well with the cow's ghee and given to children for consumption twice a day for 3 consecutive days.

7.0. CONSERVATION OF TRADITIONAL KNOWLEDGE AND SYSTEMS

7.1. ANIMALS IN A MAGICO-RELIGIOUS SPHERE

Animal parts and products such as bones and claws of the wall lizard (*Hemidactylus* spp.) and serpent eagle (*Spilornis cheela*), bones, claws and whiskers of tiger (*Panthera tigris*), and musk of musk deer (*Moschus* spp.), are used in making charms and tied round the neck and arm to ward off perceived "evil and disease causing elements". Faith healers use the tail of Himalayan cow- Yak (Bos spp.) and horns of deer (*Cervus unicolor*) in their faith healing therapy. Tiger milk (*Panthera tigris*) is believed to prevent further propagation of fire in the village.

7.2.**Animals in omen indication, and weather forecast**

Crossing of the road by snakes and cats of any species indicates a bad omen. Similarly, flying of *Gyps fulvus* above the house predicts death of one of the members of the house.

Unusual sounds like “hoon-hoon“ of *Bubo bubo* and the laughing sound of fish owl (*Ketupa* spp.) and howling of fox (*Vulpes vulpes*) and Dog predict bad news for the family of the vicinity.

The villagers believe that such a sound could even lead to the death of a close relative of the family. Domestic animals such as cats and dogs indicate omens which could be good or bad depending upon their particular activity at different times. When the Serpent eagle (*Spilornis cheela*) makes a shrill sound instead of its usual sound, it indicates rainfall in the near future. Similar reports of weather forecasting by birds and insects are available from India and abroad.

7.3.Local Healer

Practically in every village, there are individuals who are regarded as especially knowledgeable or skilled in the treatment of human/animal diseases. Sometimes their reputation extends only to their own village and they will be consulted only occasionally. Others draw clients from great distances and operate very much like a ethno medicinal practitioner. Their degree of specialization varies. A few are generalized and treat humans as well as animals. Some of them are specialized in certain types of afflictions (such as fractures or birthing problems), types of treatment (e.g. firing or massage).

7.4.Visiting a Spirit-medium (‘Bhopa’):

Another option in the case of human animal disease is a visit to the *bhopa.* The *bhopa is* a spirit-medium, i.e., a person in whom a god (devta) becomes manifest after he has aroused himself into a state of trance. In this condition the *bhopa* is endowed with supernatural powers and can provide help and give advice in important matters. Frequently, the *bhopa* also belong to the pastoral castes.

7.5..Taboo

A taboo is a strong social prohibition (or ban) relating to any area of human activity or social custom that is sacred and or forbidden based on moral judgment religious beliefs and or scientific consensus. Breaking the taboo is typically thought-about objectionable or obscene by society. The term comes from the Tongan word 'tabu', meaning set apart or forbidden, and appears in many cultures. In many cultures, a taboo often has specific religious associations.

The word itself (taboo) is employed in additional than one content. Some taboo activities or customs are prohibited underneath law and transgressions might result in severe penalties. On the opposite hand taboos lead to embarrassment, shame, and rudeness. Although critics may oppose taboos, they are put into place to avoid disrespect to any given authority, be it legal, moral or religious, but sometimes it may be a boon for example for conserving biodiversity there are many taboos and sacred beliefs which help in conserving biodiversity. In the same way sacred sacramental beliefs are also helping in some or the other way for conserving the biodiversity. (Shah and Gohil, 2011).

Taboos example

It is believed that if someone kills the swallow (*Hirundo rustica*), the killer is sure to suffer from leprosy. Similar kinds of taboos are reported from other parts of Nepal.

7.6. Human influence on Animal biodiversity

The global biodiversity crisis, caused mainly by anthropogenic activities, makes it abundantly clear that *ethnobiology* can contribute considerably to *conservation biology*, especially considering that these disciplines share many similarities. As pointed out by Soule (1985), conservation biology was originally conceptualized as a "crisis" discipline, with the goal of providing the principles and tools for preserving biodiversity. Newing (2010) noted that, like

ethnobiology, conservation biology has a long history as a concept, but it emerged as an academic discipline in the 1980s, largely in response to the increasingly urgent need to address the perceived biodiversity crisis (Noss, 1999).

The mission to preserve biodiversity is clearly value driven and implies urgency, yet the techniques of conservation biology are scientific, with research questions and methods being derived from a broad range of pure and applied fields (Saunders, 2003). Indeed, many early conservation biologists were field biologists whose study sites faced an immediate threat of destruction from the impact of human activities; yet, their professional training in ecology left them ill-equipped to deal with these threats. Conservation biology was then, from the beginning, an overtly mission-oriented discipline (Meine et al., 2006; Noss, 1999).

It aimed to develop new, applied, and interdisciplinary perspectives and to produce a generation of professionals who were better equipped to address the "human dimensions" of biodiversity conservation in a changing global context (Buscher and Wolmer, 2007). Most of the disciplines contributing to conservation biology have been related to the natural sciences, but conservation biologists had long acknowledged that biological knowledge alone is not sufficient for solving conservation problems (Mascia et al., 2003). In fact, Lidicker et al. (1998) emphasized that "conservation needs conservation biologists for sure, but it also needs conservation sociologists, conservation political scientists, conservation chemists, conservation economists, conservation psychologists, and conservation humanitarians." We add to this list conservation ethnobiologists, as they fit perfectly within this context.

7.7. The role of ethnozoology in Animal conservation

Embedded within the scenario described above, the human species is a key element of the environment, and possesses an unequaled ability to interfere in the most diverse of ecological

functions, which often results in modifications of an entire ecosystem (Boivin et al., 2016). Therefore, it can be assumed that for animal conservation, understanding human complexity is equally as important as understanding ecosystems; even conservation biologists recognize that biological knowledge alone is not sufficient to solve conservation problems (Mascia et al., 2003). However, many conservation studies have understood that the actions of humans are as important in predicting environmental change (Effiom et al., 2014; Galetti et al., 2013), studies regarding sociocultural dynamics, although fundamental, are still relatively rare (see Dickman, 2010).

7.8.The role of ethnozoology in animal conservation

Since humans are the source of conservation problems, as well as the hope for their solutions (Saunders, 2003), we cannot talk about biodiversity conservation without incorporating human dimensions. In this way, ethnozoological surveys can generate support for conservation efforts. In the case of fauna, a number of examples can be cited that illustrate the application of ethnozoological research to assisting animal conservation strategies. One such example is the application of ethnozoology to solving problems regarding wildlife–human conflict, which is a widespread conservation issue and of increasing concern to conservationists

. Ethnozoological studies that investigate human perception of species involved in conflicts can provide information crucial for making conservation efforts more effective. As pointed out by Dickman (2010), social factors can play an extremely important role in wildlife–human conflicts, yet they are rarely considered. Animals play important roles in the folklore of almost all cultures, which can substantially influence attitudes toward particular species. For instance, mythology regarding vampirism has been shown to be related to negative attitudes toward bats (Prokop et al., 2009), while beliefs that the aye-aye, *Daubentonia madagascariensis*,

is a harbinger of doom has often lead to it being killed on sight, with some people believing that an entire village should be burned down and abandoned if an aye-aye is seen nearby (Glaw et al., 2008). These perceptions of certain species as innately evil or harmful mean that even if wildlife damage is entirely mitigated, residual fear and antagonism can still lead to continued persecution (Dickman, 2010).

Another interesting example is found in the research carried out by Ceríaco et al. (2011) on the subject of folklore and traditional ecological knowledge of geckos in southern Portugal, where it is recorded that local populations possess misconceptions about geckos being poisonous or carriers of dermatological diseases. The persistence of these ideas has led to continued fear and aversion of geckos by the population, resulting in their direct persecution and one of the major conservation problems facing these animals.

Education can help lessen hostility, but such deep-seated preconceptions tend to be hard to overcome and must be taken into account in studies of wildlife–human conflicts (Dickman, 2010). Ceríaco (2010) points out that it is essential, from both a scientific and conservationist perspective, to understand the knowledge and perceptions that people have of animals, since only then may hitherto unrecognized pertinent information and conservation problems be detected and resolved. It is important to emphasize that, in some circumstances, folk beliefs, religious doctrines, and species-specific taboos can be important in the conservation of declining or threatened species, and therefore such practices should be stimulated (Alves et al., 2010). Primates exemplify this situation (Alves et al., 2010; Shepherd et al., 2004)

8.0.Traditional Ecological Knowledge

The traditional ecological knowledge on the technologies of farming, forestry, hunting, trapping and the intimate relationship with environmental system as a whole has

immense value in conservation. This traditional knowledge would also help in the sustainable utilization of the natural resources. Apart from the beliefs, there are many cases, which prove that the traditional methods of hunting and harvesting are not sustainable.

Daniels and Vencatesan (1995) have discussed the relevance of TEK – Traditional Ecological Knowledge in the context of recent developments in biodiversity conservation. They have also cited examples to support and contradict the sustainability value of traditional ecological knowledge. They have also stressed the need to collect and analyse the data with a scientific scrutiny and interpretation. They conclude by quoting Kenneth Ruddle, from his writing for UNESCO "The romantic and uncritical espousal of traditional knowledge and management is as extreme as unfortunate as that of dismissing it".

9.0. Ethno-veterinary practices

Ethno veterinary practices concern to animal healthcare is as old as the domestication of various livestock species. They comprise belief, knowledge, practices and skills pertaining to healthcare and management of livestock. The Indian subcontinent has rich ethno veterinary health traditions that are the products of decades of experiences. The traditional medicines that are usually used for animal tending will weigh down prices significantly. The key challenges are to search out out the effectiveness and up to date connectedness of those practices. Before the introduction of western drugs, all placental mammal keepers relied on these ancient practices.

10.0 .Ethnobiology - Quantitative Analysis

10.1. Relative Frequency Citation (RFC)

This index used here is the relative frequency of citation (RFC). This index is obtained by dividing the number of informants mentioning a useful species (FC or frequency of citation), by

the total number of informants in the survey (N). RFC value varies from 0 (when nobody refers to a plant/animal as a useful one) to 1 (when all the informants mentioning it as useful) (Tardio and Pardo-de Santayana, 2008).

10.2. Use value (UV)

The use value (UV) demonstrates the relative importance of plants/animals known locally. It was calculated using the following formula (Gazzaneo et al., 2005): where Ui is the number of uses mentioned by each informant for a given species and N is the total number of informants.

10.3. Relative Importance

The relative importance (RI) of plant/animal species cited by the informants is calculated as follows (Kadir et al., 2012): RI = PP + AC, where PP = the number of pharmacological properties (reported specific ailments) attributed to a species divided by the maximum number of properties attributed to the most resourceful species (species with the highest number of properties). AC = the number of ailment categories treated by a given species divided by the maximum number of ailment categories treated by the most resourceful species. A value of 2 is the highest possible value for relative importance (RI) indicating the most versatile species with the greatest number of medicinal properties (Oliveira et al., 2010).

MODEL QUESTION

SUBJECT : ETHNOMEDICINE

SUB.CODE:18UZOEC61 Max. Marks: 100 TIMES: 3hrs

PART – A 10 X 1 = 10 marks

Each question carries equal marks; Choose the correct answer:

1. Growing of pets helps in
a) Reducing stress b) Promotes cardiovascular health c) Both a and b d) None of the above

2. The blood of horse shoe crab is
a) Green b) Blue c) Red d) colorless

3. ----------can be defined as restriction or prohibition of something.
a) Taboos b) Thandaphobia c) Religious Ethics d) none of them

4. The Word "Sacred "referred as
a) Holy b) Evil c) Death d) None

5. The World Health Organization (WHO) estimates that more than ____of are met through traditional health care practices.
a) 60 % b) 50% c) 80% d) 40%

6. Rattle snake fat is used to treat
a) Rheumatism b) bone fracture c) stomach pain d) Anemia.

7. The _____ whole body is boiled in gingiley oil and used for massaging to treat rheumatic pains.
a) Fishes b) Snakes c) Scorpion d) Crab.

8._____an antihypertensive derived from the Brazilian arrowhead viper *Bothrops jararaca*
a) angiotensin I b) . angiotensin III c) . angiotensin Q d) all of these

9. In India nearly 15–20 percent of the ____medicine is based on animal-derived substances
a) Ayurvedic medicine b) Allopathic c) Siddha d) Naturopathy

10. The _____technologies of farming, forestry, hunting, trapping and the intimate relationship with environmental system.
a) Traditional ecological knowledge b)Ethnozoology c) Traditional knowledge d) Ethno biology

PART – B

Answer ALL the Questions choosing either (a) or (b) (5 X 5= 25 Marks)

11. a) Write any five ethnozoological records in India. (Or)

b).Comment on "Leech therapy ".

12. a) Write short notes on "Zootherapy ". (Or)
    b).Write in detail about the medical importance of Honey in ethno medicine.
13. a) How you will cure the Asthma? Explain?(Or)
    b) What are the uses of Oils, Milk, Horn, Urine and Feathers in zootherapy?
14. a) Write short notes on thandaphobia. (Or)
    b) Give detail account on the major nutrients for life.
15. a) Define Ethano biology and comment on folk medicine.(Or)
    b) Discuss some benefits of earthworms.

PART – C

Answer ALL questions, choosing either (a) or (b) (5 X 8= 40 marks)

16. a). Elucidate the role of animals in Ethnomedicine. **Or**
    b) Discuss the methods of collection and utilization of animal resources.
17. a) List out the animals used for the treatments for burns and wounds, vomiting, diarrhea, pimples and sterility. (Or**)**

    b) Discuss about the Zootherapeutic fishes and birds species in India.
18. a) Explain in detail about the Ethno zoological practices in India. **(**Or)
    b) Discuss in detail about zootherapetic insects, frogs, snakes and birds.
19. a) Briefly discuss about sacred grove animals and plants. (**Or)**
    b) Write short notes on "Taboos" practiced among the peoples in the world.
20. a) Discuss about the zoo therapeutic species of India. (**Or)**
    b). Give an account on relationship between fauna and people.

REFERENCE

1. Ethnobiology in India, A Status Report. 2014. AICRPE. Ministry of Environment and Forests, Govt. of India, New Delhi.
2. Balakrishnan, M.2010. Mammalian resources In: The Natural Resources of Kerala, Thampi, B.K., N.M. Nayar and C.S. Nair (eds.) WWF, Kerala.
3. Wilson,D.E. and E. O. Wilson (eds.), *Biodiversity II: Understanding and Protecting our Biological Resources*.
4. Jamir, N. S. and Lal P. 2005. Ethnozoological practices among Naga tribes, *Indian J. of Traditional Knowledge*. 4(1), 100-104.
5. Radhakrishnan, K. and Pandurangan, A.G. The Role of Tribal medicine in local health care with reference to Kerala. In: Proceedings of the Twelfth Kerala Science Congress, Kumily, Kerala.
6. Ranjit Daniels, R.J and Jayashree Vencatesan. 1995. Traditional ecological knowledge and sustainable use of natural resources. *Current Science*. 69. 569-570.
7. Alves, R.R.N, Rosa, IL., 2007. Biodiversity, traditional medicine and public health: where do they meet? J Ethnobiol Ethnomed.
8. Agrawal, A. 1995. Indigenous and scientific knowledge: Some critical comments. *Indigenous Knowledge and Development Monitor*. 3(3), 1-10.
9. Agarwal, A. 2002. Indegenous knowledge and the politics of classification. *International Social Science Journal*. 54, 287-97.
10. Amato, I. 1992. From 'hunter magic,' a pharmacopoeia? *Scienc*e. 258, 1306.
11. Anonymous, 1993. Ethnobiology in India: A Status Report. AICRPE. Ministry of Environment and Forests, Govt. of India, New Delhi.
12. Antonio, T. M. F. 1994. Insects as remedies for illnesses in Zaire. *The FoodInsects*
13. *Newsletter*. 7 (3), 4-5.
14. Atran, S., D. Medin. 1997. Knowledge and action: Cultural models of nature and resource management in Mesoamerica. In M.Bazerman, D. Messick, A. Tinbrunsel, K. Wayde Benzoni (Editors), *Environment, Ethics and Behaviour*. San Fraansisco: New Lexington Press. 171-108.
15. Balakrishnan, M 1997. Mammalian resources In: The Natural Resources of Kerala,Thampi, B.K., N.M. Nayar and C.S. Nair (eds.) WWF, Kerala. 494-506.
16. Begossi, A. and F. M. S. Braga. 1992. Food taboos and folk medicine among fishermen from the Tocantins River. *Amazoniana* 12, 101-118.
17. Benz, B.F., J. Cevallos, F. Santana, J. Rosales, S. Graf. 2000. Losing knowledge about plant use in the sierra de Manantlan Biosphere Reserve, Mexico. *Economic Botany*. 54(2): 183-91.
18. Bisset, N. G. 1991. One man's poison, another man's medicine. *Journal of Ethnopharmacology* 32, 71-81.
19. Blakeney, M. 1999. What is Traditional Knowledge? Why should it be protected? Who should protect it? For whom? Understanding the Value Chain. UNESCOWIPO/ IPTK/RT/99/3 (October 6, 1999).
20. Branch, L. C. and M. F. Silva. 1983. Folk medicine in Alter do Chão, Pará, Brazil. *Acta*
21. *Amazonica* 13, 737-797.
22. Buchdahl, J. M. and D. Raper. 1998. Environmental ethics and sustainable development. *Sustainable Development* 6(2), 92-98.

23. But, P. P. H., Y. K. Tam, and L. C. Lung. 1991. Ethnopharmacology of rhinoceroshorn. II: Antipyretic effects of prescriptions containing rhinoceros horn and water buffalo horn. *Journal of Ethnopharmacology* 33, 45-50.
24. Chandra Prakash Kala. 2005. Ethnomedicinal botany of the Apatani in Eastern Himalayan region of India. *Jnl. of Ethnobiology and Ethnomedicine*. 1:11.
25. Chen, Y. and R. D. Akre. 1994. Ants used as food and medicine in China.*The Food Insects Newsletter* 7(2), 1, 8-11.
26. Colwell, R. R. 1997. Microbial biodiversity and biotechnology. In M. L. Reaka-Kudla, D. E. Wilson and E. O. Wilson (eds.), *Biodiversity II: Understanding and Protecting our Biological Resources*, 77-78.
27. Costa-Neto, E. M. 1996. Faunistic resources used as medicines by an Afro-Brazilian community from Chapada Diamantina National Park, State of Bahia, Brazil.*Sitientibus* 15, 211-219.
28. Costa-Neto, E. M. 1999b. Healing with animals in Feira de Santana city, Bahia, Brazil. *Journal of Ethnopharmacology* 65, 225-230.
29. Costa-Neto, E. M. and M. N. Melo. 1998. Entomotherapy in the county of Matinha dosPretos, state of Bahia, northeastern Brazil. *The Food Insects Newsletter* 11 (2),1-3.
30. Costa-Neto, E.M. and Maria Vanilda M. Oliveira. 2000. Cockroach is good for Asthma: Zootherapeutic Practices in Northern Brazil. *Human Ecology Review*, 7 (2). 41-51.
31. Costanza, R. and H. E. Daly. 1995. Natural capital and sustainable development. In D. Ehrenfeld (ed.), *Readings from Conservation Biology*, 152-161. Oxford:Blackwell Science. Cunningham, A.B. 2001. Applied ethnobotany: people, wild plant use and conservation. Earthscan, London, UK.
32. Easa, P.S. James Zacharias and Padmanabhan, P. 2001. Survey of Small Mammals in Kerala with Special Reference to endangered species. Kerala Forest Research Institute Research Report No. 207, Kerala Forest Research Institute, Peechi.
33. Ehrlich, P. R. and A. H. Ehrlich. 1992. The value of biodiversity. *Ambio* 21(3), 219- 226.
34. Glowka, L., F. Burherme-Guilmin and H. Synge. 1994. *A Guide to the Convention on Biological Diversity*. Gland: IUCN.144
35. Guest, G. 2002. Market integration and the distribution of ecological knowledge within an Ecuadorian fishing community. *Journal of Ecological Anthropology*. 6, 38-49.
36. Gudger, E. W. 1925. Stitching wounds with the mandibles of ants and beetles. *Journal of the American Medical Association* 84, 1862-1864.
37. Hamada, M. and T. Nagai. 1995. Inorganic components of bones of fish and their advanced utilization. *Journal of Shimonoseki University of Fisheries*. 43(4),185-194.
38. Jamir, N. S. and Lal P. 2005. Ethnozoological practices among Naga tribes, *Indian J. of Traditional Knowledge*. 4(1), 100-104.
39. Johannes, R. E. 1993. Integrating traditional ecological knowledge and management with environmental impact assessment. In J. T. Inglis (ed.), *Traditional Ecological Knowledge: Concepts and Cases*, 33-39. Ottawa: International Program on Traditional Ecological Knowledge and International Development Research Centre.
40. Joseph, A. N. T. 1982. Use of drugs in certain tribals of Madhya Pradesh, *J. Pharmacol*. 2. 229.
41. Kader, P. B. A. 1998-1999. Some observations on the fish and fisheries of inland waters of Trichur District. Ph.D thesis submitted to University of Calicut, Kozhikode.

42. Kakati, L.N., Bendang Ao and Duolo, V (2006). Indegenous Knowledge of zootherapeutic use of vertebrate origin by the ao tribe of Nagaland. *J. of Hum.Ecol*. 19(3): 163-167.
43. Kunin, W. E. and J. H. Lawton. 1996. Does biodiversity matter? Evaluating the case for conserving species. In K. J. Gaston (ed.), *Biodiversity: A biology of Numbers and Difference*, 283-308. Oxford: Blackwell Science.
44. Laird, D. 2002. Biodiversity and Traditional Ecological Knowledge: Equitable partnerships in price. London: Earthscan. Lazarus, L. H. and M. Attila. 1993. The toad, ugly and venomous, wears yet a precious jewel in his skin. *Progress in Neurobiology* 41, 473-507.
45. Lovejoy, T. E. 1997. Biodiversity, what is it? In M. L. Reaka-Kudla, D. E.Wilson and E. O. Wilson (eds.), *Biodiversity II: Understanding and Protecting our Biological Resources*. 7-14. Washington, D.C.: Joseph Henry Press.
46. Mebs, D., T. Omori-Satoh, Y. Yamakawa and Y. Nagaoka. 1996. Erinacin, an antihaemorrhagic factor from the European hedgehog, *Erinaceus europaeus. Toxicon*. 34(11/12), 1313-1316. Mishra, R.M., H.R.Khan and R.K Mishra. 1999. Unconventional food from animalia. *Ind. Jnl. of Forestry*. Vol. 18(3): 192-195.
47. Morin-Labatut, G. and S. Akhtar. 1992. Traditional environmental knowledge: Aresource to manage and share. *Development*. 4, 24-30.
48. Oksanen, M. 1997. The moral value of biodiversity. *Ambio*. 26(8), 541-545.
49. Oldfield, M. L. 1989. *The Value of Conserving Genetic Resources.* Washington, D. C.:National Park Service.
50. Olsson, P., C. Folke, F.Berkes. 2004. Adaptive co-management for building resiliecnce in social-ecological systems. Environemtal Management. 34 (1): 75-90.
51. Orlove, B., S.B.Brush. 1996. Anthropology and the conservation of Biodiversity. *Annual review of Anthropolgy*. 25. 329 – 352.
52. Padmanabhan, P. 1998. Conservation of Endemic and Endangered mammals of Western Ghats In: Proceedings of the Seminar on endemic and endangered Animal and Plant Species of Western and Eastern Ghats, Tamil Nadu Forest Department, Chennai.
53. Radhakrishnan, K and Pandurangan, A.G. 2000. The Role of Tribal medicine in local health care with reference to Kerala. In: Proceedings of the Twelfth Kerala Science Congress, Kumily, Kerala. 864-866.
54. Ranjit Daniels, R.J and Jayashree Vencatesan. 1995. Traditional ecological knowledge and sustainable use of natural resources. *Current Science*. 69. 569-570.
55. Redford, K., C. Padoch. 1992. Conservation of Neotropical Forests. Working from Traditional Resource Use. New York: Columbia University Press.
56. Rodrígues, E. and J. E. West. 1995. International research on biomedicines from the neotropical rain forest. *Interciencia*. 20(3), 140-143.
57. Rosner, F. 1992. Pigeons as a remedy (*segulah*) for jaundice. *New York State Journal of Medicine*. 92(5), 189-192.
58. Salte, R., K. Norberg and O. R. Odegaard. 1996. Evidence of a protein c-like anticoagulant system in bony fishes. *Thrombosis Research*. 83(5), 389-397.
59. Silva, G. A. and J. G. W. Marques. 1996. Mamíferos ameaçados deextinção utilizados na medicina popular do Estado de Alagoas. Paper presented at the 21st annual meeting of the Brazilian Society of Zoology in Porto Alegre, Rio Grande do Sul (February).
60. Unnikrishnan, P. M. 1998. Animals in Ayurveda. *Amruth*. 1(3), 1-23.

61. van Huis, A. 1996. The traditional use of arthropods in Subsaharan Africa. *Proceedings of Experimental and Applied Entomology, N. E. V. Amsterdam*. 7, 3-20.
62. Victoria Reyes-Grecia/a/, Vincentvadeza/a/, Tomas Huanca/a/, William, R. Leonardo/b/, Thomas Mc Dade/b/ 2005. Economic development and traditional knowledge: a deadlock? Data from an American Society. 1-29.
63. Warren, D.M., L.J. Silkkerveer, D. Brokensha. 1995. The Cultural Dimension of Development: Indegenous Knowledge System. London: Intermediate Technology Publications.
64. Conconi, J. E. and J. M. M. Pino. 1988. The utilization of insects in the empirical medicine of ancient Mexicans. *Journal of Ethnobiology*. 8(1), 195-202.
65. WCED, Our common future. Oxford: Oxford University Press. 1987.
66. Weiss, H. B. 1947. Entomological medicaments of the past. *Journal of the New York Entomological Society*. 55, 155-168.
67. Werner, D. 1970. Healing in the Sierra Madre. *Natural History*. 79(9), 61- 66.
68. Zarger, R., J.R. Stepp. 2004. Persistence of botanical knowledge among Tzeltal Maya children. *Current Anthropology*. 45. 413-16.