UNIVERSITY OF PORT HARCOURT

SEARCHING THE SOUL OF THE ENVIRONMENT, WHO DARE? TERRITORIANS OR SUBDUERS?

An Inaugural Lecture

By

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CONTENTS

SEARCHING THE SOUL OF THE ENVIRONMENT, WHO DARE? TERRITORIANS OR SUBDUERS?

INTRODUCTION

Animals, Humans and the Environment

In Science, the Environment is defined as all of the **biotic** and **abiotic** factors that act on an organism, population or ecological community and influence, its survival and development. Biotic factors include the organisms themselves, their food, and their interactions. Abiotic factors include such items as sunlight, soil, (land), air, water, climate, and pollution. Organisms respond to changes in their environment by evolutionary adaptations in form and behavior.

The Environment consists of four components:

i)	Micro environment	-	the immediate local surrounding of an organism
ii)	Macro environment	-	the large scale and long term physical and biotic conditions that surround the organism externally
iii)	Physical environment	-	all abiotic factors or conditions like temperature, light, rainfall soil, minerals, etc, consisting of the **atmosphere, hydrosphere** and **lithosphere.**
iv)	Biotic environment	-	includes all biotic factors or living forms like plants, animals, and micro organisms.

The perception in the world today is that all people now see the environment as a topic for discussion on the print and electronic media. Global summits are held frequently. The importance of the environment has manifested in the last hundred years, as biologists, sociologists,

anthropologists, geographers, technologists engineers, etc now have mutual relationship with the environment.

The planet earth, sustains all natural resources. However, there is evidence that people are consuming far more natural resources than what the planet can sustainably provide.

Lives of animals and plants are interconnected in a complex pattern and following the phylogenetic tree of life of the animal kingdom, it is clear that animals occur at different levels of organisation with mammals and humans as part of the apex (fig 1). It is difficult to imagine how many species of plants, animals and other creatures there are, on the planet, earth.

The focus of this text is on animal and human activities in search of the soul of the environment in which they live. Animals adapt to the environment to survive, while humans subdue the animals and the environment to exploit the environment to their benefit and sometimes to their own detriment. God created humans to subdue the earth as in Genesis 1:27-31 (text below). However this authority has been abused by humans who most times do not seem to know their limits. Animals are stressed due to the activities of humans. The physical environment is also stressed due to human activities.

Edward Wilson, a foremost entomologist in Harvard University who wrote a landmark text, titled, 'The Crisis of Biological Diversity', in 1985, was not convinced that humans really should be given the authority to subdue the earth because they were going about it wrongly, and those who gave the instruction were not environmentally knowledgeable. He wrote:

> "By and large, religious leaders also lack a record in environmental stewardship of which they can be proud; Even though the fate of the creation itself is at stake, very few are committed conservationists seen from a historical perspective, however, the hesitancy of the majority is understandable. The sacred texts of the Abrahamic religions contain few instructions

about the rest of the living world. The Iron Age, scribes who wrote them knew war. They knew love, and compassion. They knew purity of spirit, but they did not know Ecology."

Give an inch to humans and they take a mile. Humans, after creating problems, turn around to solve the very problems they have created, Indeed sometimes, the problems are irreversible and cannot be solved. An example is the degradation of the environment, through human activities which will be discussed later in the text. The planet's bio-capacity, which is the Earth's ability to produce natural resources, provide land to build on, farmland for agriculture, and absorb waste like carbon dioxide emissions, is saturated, because of the pressure put on it by an increasing population with its attendant increase in demands. This year, the theme for World Environment Day has asked all to consume with care. We are informed by the United Nations Environment Programme (UNEP) that we will require 3 planets by 2050 to sustain the living and current consumption pattern. Yet, humans, apart from the high consumption, are degrading the environment through deforestation, pollution, overexploitation of land, and over fishing of the oceans etc. Human activities have not produced resources that can ensure production exceeds consumption.

Animals protect their immediate environment (territories) with all they have, and will not tolerate an intruder, no matter how friendly the intruder may seem. This is the reason for referring to them as **territorians**. On the other hand, humans exploit their immediate environment to their benefit (so they think), not minding the results on the environment or themselves. They are said to be **subduers** in the text. Humans could positively subdue or negatively subdue the environment. Humans bring the environment and all in it under their control, and by so doing their activities threaten biodiversity, pollute the environment and destroy the habitat of plants, animals and microorganisms. The importance of the preservation of biodiversity, made the United Nations earmark the year 2010 as 'The International Year of Biodiversity', aiming to bring the effects of climate change, pollution, land exploitation and loss of natural habitat through **human actions** on Biodiversity. More importantly, people need to be educated

on biodiversity and know how it supports everyday life. Global species estimates range from 2 million to 100 million and approximately 1.4 million species have been identified (Corker, 2003). The importance of preserving the biodiversity on planet, earth, cannot be ignored and any activity reducing their number must be avoided.

Edward Wilson, has coined an acronym, 'HIPPO', representing, 'Habitat destruction, Invasive Species, Pollution, Population (over), Overharvesting (by hunting and fishing).

The thrust of this text is the relationship of the animals, humans and the environment. It is not aimed at elucidating the chemical nature of the toxins in animals, neither has it attempted to discuss the mechanisms. That will be the subject of another lecture.

Let us examine the process **for searching the soul of the environment by territorians (animals) and subduers (humans)**, and their effects on the environment.

SOME OBVIOUS AND NON-OBVIOUS ITEMS MADE FROM ANIMAL PRODUCTS.

Animals are useful to humans in diverse ways. They are used for food (meat), clothing (winter coats, shoes, bags, belts, hats) furniture, (leather puffs and chairs). These are the obvious items made from animal products. However, there are non-obvious items that are made from animal products which are revealing (Table 1).

Earlier inaugural lectures had show-cased items made from plants and chemicals, and I thought it may be necessary to inform us about some non-obvious items from animal products, which are not easily recognisable.

Table 1 SOME NON-OBVIOUS ITEMS MADE FROM ANIMAL PRODUCTS.

Item	Description
Guinness Beer	Contains isinglass, a chemical found in fish bladders which gathers stray yeast cells during the fermenting process and solidifies them into a mass which settles on the bottom of the barrel for removal.
Perfume	Scents that smell like vanilla, has cartereum as an ingredient which comes from beavers castor sacs, a gland located between the animals pelvis and the base of the tail.
Plastic Bags	"Slip agents" contained in commercial plastic bags are derived from the stearic acid in animal fat. Some bicycle tyres also contain these elements, prevents the polymers from sticking to metals.
Sugar	Bone char used in the refining process for both white and brown sugar is made using a granular material from animal ashes. Gives sugar its white colour.
Condoms	Casein (milk protein) is added to material for production of condoms as a lubricant.
Nail Polish	Cosmetics like nail polish or lipstick contain guanine (one of four bases of RNA and DNA obtained from fish (herring) scales.
Crayons	Crayons are made including animal fat.
Cake mixes	Beef fat added to cup cakes.
Red candy	Red cochineal beetles, dried and crushed, produce a powder called carmine, used as dye in red foods e.g yogurt, ice cream, candy, etc.

Some brands of orange juice	Omega-3-fatty acids, found in fish used as ingredient to increase consumer health.
Bagels	L-cysteine used in bread products made from bird feathers with some human and hog hair mixed in.
Biofuels	May include animal fats
Downy	Contains horse and sheep ingredient (fabric softener)
Tooth paste	Glycerin in toothpaste may be plant or animal based.
Cat gut	Absorbable tough thin cord made from treated and stretched intestine of certain animals especially sheep, used for surgical ligatures.

Obvious items made from Animal products are shoes, bags, etc


Leather gloves


Leather shoes


Leather strapped watch


Leather belt


Leather jacket


Leather sofa


Leather bag


Leather puff

Non obvious items made from Animal products.


Perfume

Condom

Guiness beer


Crayons


Bagel


Nail polish


Sugar

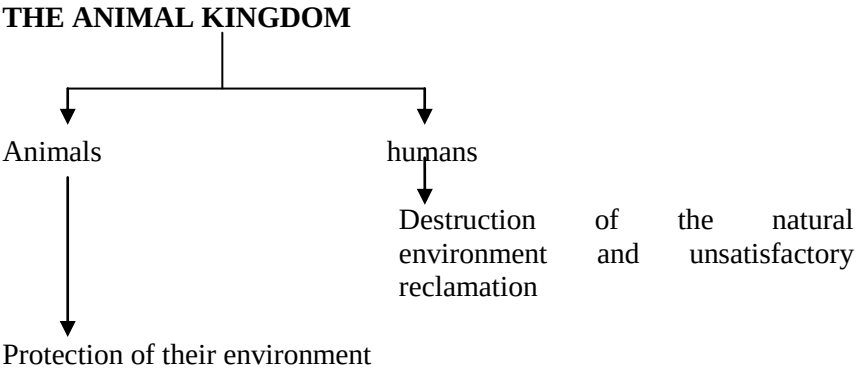

Downy fabric softener

Biofuel with animal fat

Cake mix


Red candy


Animal based glycerine toothpaste



Flow chart of Environmental role of animals and humans

King James Translation

27 So God created man in his own image, in the image of God created he him; male and female created he them.
28 And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth.
29 And God said, Behold, I have given you every herb bearing seed, which is upon the face of all the earth, and every tree, in which is the fruit of a tree yielding seed; to you it shall be for meat.
30 And to every beast of the earth, and to every fowl of the air, and to everything that creepeth upon the earth, wherein there is life, I have given every green herb for meat: and it was so.
31 And God saw everything that he had made, and behold, it was very good, And the evening and the morning were the sixth day.

New International Translation

27 So God created man in his own image, in the image of God he created him; male and female he created them.
28 God blessed them and said to them. "Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish of the sea and the birds of the air and over every living creature that moves on the ground"
29 Then God said, "I give you every seed-bearing plant on the face of the whole earth and every tree that has fruit with seed in it. They will be yours for food.
30 And to all the beasts of the earth and all the birds of the air and all the creatures that move on the ground – everything that has the breath of life in it – I give every green plant for food." And it was so.
31 God saw all that he had made, and it was very good. And there was evening, and there was morning-the sixth day.

Genesis 1: 27-31

A. BIOTIC ENVIRONMENT

This includes all biotic factors or living forms like plants, animals and microorganisms.

SEARCH FOR THE SOUL OF THE BIOTIC ENVIRONMENT BY TERRITORIANS

TERRITORIANS AND THEIR ADAPTATIONS

Animals have a relationship with their environment. The environment in which an animal lives is its **habitat**. Human activities, can eliminate habitat of animals either by clearing of forests for agriculture or urbanization (cows in areas with grass, etc) or by polluting the sea (eg. crabs in rocks in the sea) Definition of the environment has been earlier stated in this text. Abiotic components of an animal's environment include a huge range of characteristics-temperature, humidity, oxygen, wind, soil composition, day length and elevation.

The biotic components of an animal environment include: plant matter, predators, competitors, parasites, individuals of the same species, and individuals of different species.

Animals require energy to support the processes of life; movement, foraging, digestion, reproduction, growth and work. Animals are either **autotrophs** (obtain energy from sunlight or inorganic compounds), or **heterotrophs** (obtain energy from organic materials).

When animals perceive harsh environmental conditions, they devise ways to survive such conditions which include:
Torpor - when they decrease their metabolism and reduce their temperature in daily activities

Hibernation - when they decrease their metabolism and reduce temperature

Aestivation - when they are inactive to sustain extended periods of drying.

Diapause - when development is suspended and physiological activity is diminished as in some insects.

The range of an environmental characteristic to which an animal is adapted is known as **tolerance range for that characteristic.** Within an animal's tolerance range is an optimal range of values at which the animal is most successful. In response to prolonged change in environmental characteristic, animals' physiology adjusts to accommodate the change in its environment, shifting its tolerance range. This shift is known as **acclimation** or **acclimatization**.

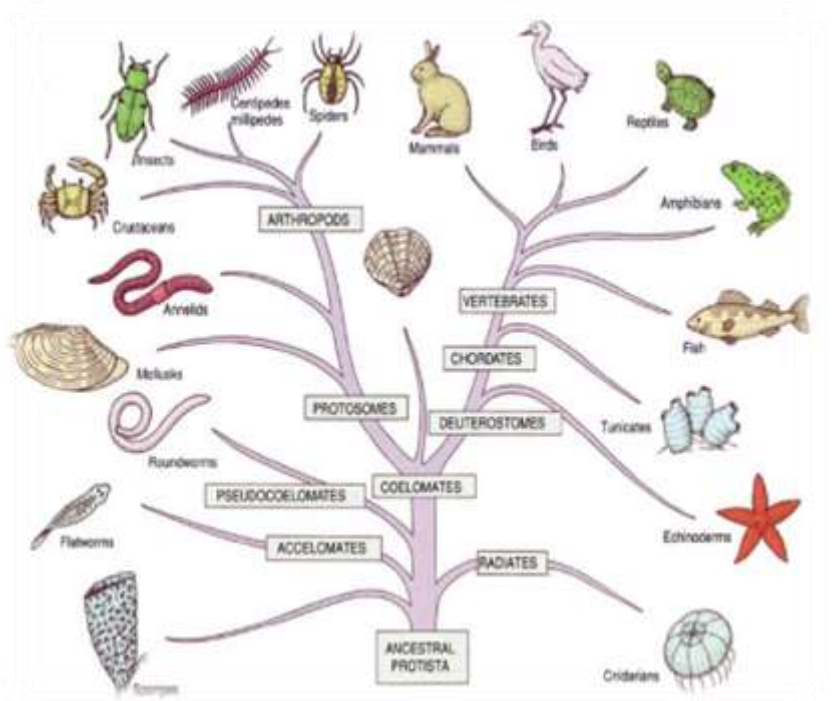


Fig. 1: Tree of life

MAIN GROUPS OF ANIMALS

They are amphibians, birds, fishes, invertebrates, mammals and reptiles. A modest grouping of these animals are shown below:

Arthropods (arthropoda) (insects, crustaceans, arachnids);

Chordates (chordata) (vertebrates, tunicates and caphalochordates);

Cnidarians (cnidaria) 9,000 species (jelly fish, sea anemones, corals and hydras);

Echinoderms (echinodermata) 6,000 species (starfish, sea lilies, sea urchins, sea cucumbers, etc);

Molluscs (mollsusca) 100,000 species, (bivalves, gastropoda, chephalopods, etc);

Annelids (annelida) 12,000 species, (segmented worms, earthworms ragworms, leeches);

Flatworms (platyhelminthes) 20,000 species, (tapeworms, flukes);

Sponges (porifera) 10,000 species, (Calcarious sponges, demosponges, glass sponges);

The positions of some of these animals are in the phylogenetic tree of life (Fig. 1).

There are many more less well known animal groups.

With the exceptions of sponges, animals have bodies that are differentiated into tissues that serve a specific function. These tissues are in turn organized into organ systems.

Cells → tissues → organs → organisms (Animals)

GENERAL CHARACTERISTICS

Animals are heterotrophs

Animals do not possess the rigid cell walls that are characteristic of plants

Animals move because have motile structures

The heads of animals point in the direction they move, while the rest of the body follows

Most animals reproduce sexually by means of different eggs and sperms

Animals range in size from microscopic animals called plankton that drift on the ocean's currents to the massive blue whale.

Animals inhabit every habitat on the planet from the poles to the tropics and from the tops of mountains to the deep, dark waters of the open ocean.

Animals have adapted themselves to several hazardous conditions; one may be tempted to assume that they have conquered the environment.

FOUR SENSES ANIMALS HAVE, THAT HUMANS DO NOT.

Echolation

Allows animals to emit tiny high-pitched sounds and gain information about the world around them from the echoes that return to their ears. Humans cannot do this but animals like bats use this process. Bats use echolation to locate their prey at night.

Electric eels do not emit sounds, but emit electrical impulses from their bodies and use the reverberations to identify their surroundings.

Electromagnetism:

Insects (bees and butterflies) see ultraviolet rays which assist them in pollination. Humans can only see a small percentage of low frequency radiation to gamma rays.

Pigeons can discriminate between almost identical shades of the same colour-some with wavelength differences of a billionth of a metre. Humans on the other hand are trichromates - having only three colours – variations of red, blue and green at one time. Humans are actually missing out on a portion of the colours and patterns in the world.

Pheromones:
Ants emit scents called pheromones that communicate with other ants, telling other ants to pay attention, direct their direction, attack or step aside. Some mammals also do this, and cnidarians.

Magnetocaption
This is the *"sixth sense"* of animals that allows them to detect the magnetic fields of the Earth to perceive, altitude, direction and location. Birds migrate and they use magnetocaption to follow migration routes. Salmon use it to navigate the ocean and find their way back to their original spawning ground.

All these attributes are for searching the soul of the environment; finding out how to adapt to their immediate environment to maximize their well-being.

COLOURATION OF SKIN AS AN ADAPTATION TO THE ENVIRONMENT

The Zebra:
The zebra is a black and white striped animal and the stripes are unique to each animal, just as the fingerprints of humans are unique to each individual. No two patterns are the same even within same subspecies (Plate 1).

They use their stripes as **camouflage** to colour blind predators e.g colour blind lions cannot detect the presence of the zebras as they blend in close proximity to one another.

Zebras actually have been found to be black with white stripes, using embryological data instead of the reverse.

They communicate with each other by barking, snorting or whining. They also use body language to express their feelings – the ear stands if feeling calm, but pushed down if feeling tense or frightened. Zebra circle round any zebra that may be in trouble with a predator to ward off the predator – a perfect adaptation.

Tim Caro and his team at the University of California analysed all the hypotheses as reasons for the stripes of the zebra, and concluded that camouflage, yes, but most tenable reason is to keep away flies from biting the zebras. Most scientists, however, are skeptical.

Plate 1: The Zebra

THE SEA DRAGON:

The sea dragon is camouflaged to keep safe from predators. They resemble twigs of plants (Plate. 2) – no wonder, also known as leafy sea dragon.

Plate 2: The Sea Dragon

ADAPTATION OF LIZARDS

Metachromatism

Lizards can adjust their colour due to temperature fluctuations in a process known as **metachromatism.** They rely on their environment to keep their temperature in the correct (poikilothermy) range because they cannot internally regulate their temperature (homeothermy).

When the desert, is cool, lizards turn darker as heat absorption increases with dark colours. When temperature is high, their colours become lighter, reflecting the heat, keeping the lizard cool.

Orientation of their bodies may also be used to thermoregulate. It can turn its body to the sun's angle if it needs to increase its temperature. If it needs to cool off, it turns away from the sun.

Some burrow into underground holes (plate 3), while others move fast across sand, not leaving a trace for their own protection, **still in search of the soul of the environment**

Plate 3: Lizard in a Hole

AMPHIBIANS

Amphibians have devised ways of overcoming their environmental problems. Pollution, infectious diseases, habitat loss, invasive species, climate change and over-harvesting for pet and food trades have increasingly declined the population of amphibians which has resulted in irreversible consequences to the earth's ecosystem and humans**.**

Humans of course are the central actors in all above circumstances leading to the decline of their population.

Amphibians are bio-indicators, integral part of the food web and important in medical research that benefits humans. Humans therefore must carefully exploit them if there is need e.g frogs eat mosquitoes which are vectors of malaria parasites in humans, and their tadpoles filter our drinking water. Tadpoles of frogs keep waterways clean by feeding on algae.

Frogs

Frogs require adaptations that can enable them live both on land and in water as amphibians. They start lives as tadpoles with gills to breathe. Their skins are covered by a layer of slime that dissolves oxygen from air and water, with numerous blood vessels, to absorb oxygen. Dryness of the skin is avoided by producing mucous to keep it moist.

Their large and round eyes are located on top of the head. The eyes so positioned allow the frog to look round even under water for predators and preys.

Generally, frogs have long and powerful legs for jumping on land and webbed feet for swimming in water (plate 4).

Plate 4: A frog showing the adaptations

The animals are armed to survive in their physical environment, protecting their territories making them real territorians.
Frogs adapt even with their colours. The green frog in plate 5 has camouflaged with its immediate environment – the green leaf – perfect blending which will not allow a predator recognise that an animal is on the leaf. Who dare say this frog has not searched the soul of its environment?

Plate 5: Perfect Blending of frog colour with the immediate environment, leaf

Phyllobates terribilis is the most toxic species found in the Amazonian rainforest. Adults are more brightly coloured than the young.

They are used to poison hunting darts by humans (subduers). Their poisons are thought could be developed into muscle relaxants, anesthetics, and heart stimulants. Their toxicity decreases with captivity for a period. **They are not aggressive to humans.** Deforestation has decreased their population. These animals would rather be left alone by subduers.

"Chorus" of frogs.

When a frog forces air from its lungs, the vocal cords vibrate and give off sound. Many species have a vocal sac which fills with air and swells

like a balloon producing a much louder call (plate 6). Male frogs sing. After a rain, you may hear frog "Chorus". Frogs sing to attract a mate; **to mark their territory** and also because the weather is going to change-all in search of the soul of the environment.

Plate 6: The vocals of the frog

Toads

Toads have warty skins. They show enlarged *"parotid glands"* behind their eyes, true toxin batteries ready for their defence, eg. The American toad (*Anaxyrus americanus*) (plate 7).

***Anaxyrus americanus*:**

Skin colour is a shade of brown, red sometimes in other species. The bellies are white or yellow. Colour changes depend on temperature, humidity, and stress. The colour change ranges from yellow to brown to black – colouration is mainly an adaptation to the environment and to camouflage from predators which include hawks, herons, hognose snakes, garter snakes, etc. The toads feed on insects and play a role in the ecosystem control of such insect populations.

Their skins produce toxins for protection. They can also inflate their bodies with air to make themselves more difficult to be swallowed by a snake. They are mainly active at night to make it difficult for predators.

Plate 7: The American toad *(Anaxyrus americanus)*

Plate 8: The Fire-bellied toad

Source: animals.nationalgeographic.com

The fire-bellied toad when bothered, exhibits an unken reflex (*unken* is the German word for toad; unken reflex refers to a defensive or anti-predatory posture). It will arch its back and limbs to expose the bright

belly, and may turn over on its back, warning its predators. The skin toxins are distasteful. The dull colouring on fire-bellied backs helps camouflage them while the bright colours on their undersides send a warning.

TOXINS IN ANIMALS AS ADAPTATIONS

Toxinology is the study of toxins in natural products (plants, animals, microorganisms) as opposed to **toxicology** which is the study of the adverse effects of chemical substances.

The words, **venomous** and **poisonous,** are often used synonymously, but it is important that the words are used appropriately.

Venomous animals are those creatures with a gland or group of highly specialized secretory cells, a venom duct (not in all cases) and a structure for delivering the venom. The venom apparatus may comprise the duct, and the structures for delivering the venom in the form of stings, fangs, spines, jaws, teeth, the nematocyst as in the case of cnidarians (Fig. 2).

Poisonous animals have no such apparatus, thus poisoning usually takes place through ingestion. A poison is a substance, which in relatively small amounts, kills or seriously impairs the function of an organ on tissue. **Generally, all venomous animals are poisonous but not all poisonous animals are venomous.**

Poisonous or venomous animals are found in every phylum. Birds were earlier described as non-poisonous, but recently, it has been revealed that there are some toxic birds. **The hooded *Pitohui* (*Pitohui kirhocephalus, P.dichrous and P. ferrugineus*)** have a neurotoxin, homobatrachotoxin, a steroidal alkaloid, found in their skins and feathers which causes numbness and tingling sensation on contact with the birds, and they are also poisonous.

These toxins are used to defend the bird from predators, hence protecting its territory from intruders, (Jack Dumbacher 1989). It is the first scientifically confirmed poisonous bird. Indeed, locals in New

Guinea call them *"rubbish birds"* due to their unpleasant odours, but never imagined they were poisonous.

Jack Dumbacher (1989) wrote,

> *"Within a minute, your tongue tingles,*
> *then it burns, and your mouth can go numb*
> *for several hours. It's a lot like tasting hot*
> *chili peppers or touching a 9-volt battery…"*

At that time, poisonous birds were unknown. Investigations into the claim, confirmed that poisonous birds actually existed, (Dumbacher, 1989). These **territorians** use toxins as chemical defence. In New Guinea, there is another genus, *Ifrita*, which has only one species, kowaldi, known as *"bitter bird"*.

Table 2: EFFECTS OF TOXINS ON HUMANS AND OTHER ANIMALS

VENOM	EFFECT
A. Mammals Water shrew venom	Paralyse their prey with venom in saliva
Duck-billed platypus eg. *Ornithorhynchus anatinus* (Australian)	Spurs on front limbs that jab painfully into an attacker, injecting venom.
B. Reptiles 3,000 snake spp. in the world.	10% of total numbers are venomous. A more recent study (2011) estimates that over 314,000 bites, 7,300 deaths and nearly 6,000 amputations occur from snake bites annually in Sub-Saharan Africa. (Chippaux J.P. 2011).
Four types a) Non venomous (aglyphous) 2,000 spp.	
b) Rear-fanged (opistoglyphous)	Poison fangs at **rear** of mouth. Holds prey in mouth for a long time to have effect. Not very dangerous to man. Most venomous is the Boomslang, *Dispholidus* typus.
c) Front-fanged (proteroglyphous cobras) and relatives of the family Elipidae	Fangs like hypodermic syringe needle through which they inject venom. Some spit venom at eyes of predator or humans-known as **spitting cobras,** *Haemachatus haemachatus.* Deadly and a threat to humans. Venom causes pain in the eyes of victim. Can cause blindness.

	The Elipidae family (cobras, kraits, corals, mambas, tiger snakes, death adders, black snakes) have venoms specific on acetylcholine receptors.
d) Solenoglyphous snakes front-fanged vipers.	When a venomous snake locates its prey and within a range, it strikes. Vipers strike more quickly than other snakes. A viper will give a quick bite and wait for the venom to take effect. When animal has succumbed, the snake will set off in pursuit.
General	Snakes prefer to swallow animals. Snakes ingest animals from the head end and can swallow animals several times larger than their own head. All snakes are carnivorous. The Asian cobra is 40 times as toxic as Sodium cyanide. It is 7 times as toxic as the poison of the *Fly agaric* toadstool.
LIZARDS 3,000 species in the world. Only two are venomous – members of *Holoderma genus*, found in USA and Mexico. eg. the Gila Monster, *Heladerma* suspectum and the *Beaded* lizard, *Heladerma horridum*,	Grab and chew victim with grooved teeth to allow venom to flow from the glands at the base of the mouth to the damaged tissue of the unfortunate victim. Venom not usually fatal to humans, but bite is painful. Only eight known cases have been reported to have died of their bites. One of the cases was a fairground Barker who was a drug addict who wanted to show the Gila monster was not that harmful afterall. After taking a considerable amount of whisky, left his finger in its mouth and Gila chewed him to death!

AMPHIBIANS – FROGS, NEWTS AND TOADS

Amphibians do not inject venom into humans but can release toxic compound through ducts in their skins if handled roughly.

Frog poisons are used as arrow-poison in South America. They are usually beautifully coloured and very small. Most are mild to humans. It however deters predators from eating the amphibians (defensive).

A few amphibians secrete toxins powerful enough to cause a reaction on a person's skin.

Table 3: Amphibian venoms and their effects

AMPHIBIAN VENOM	EFFECT
Pickerel frog of North America *Rana palustris*	Secretion effective enough to kill other frogs in the tank.
Kaloula pulchra hainana Californian Newt,*Taricha torosa*	Found in China. Skin secretions induce enythrocyres lysis. Secretion through its skin is venomous to humans. Causes a local reaction in humans. Tetrodotoxin, a membrane stabilizer blocks sodium channel. Toxin is found in the skin, muscle and blood of newts in North America.

Some frog venoms are used as arrow poisons for hunting. All arrow-poison frogs live in the rainforest where there is sufficient water for laying of eggs (table 4).

Table 4: Arrow-poison frogs, toads, fish

Name	Description
i) Flat – spined Atelopus, *Atelopus planispina*	Gold and green with white spots and black markings. Comes from mountains of Ecuador
ii) Zetek's frog *Atelopus zateki*	Gold all over, male has black blotches. Found in the Panama
iii) Yellow – spotted Arrow-poison frog. *Dendrobates flavopictus*	Black species with bright yellow spots and lines. Found in the uplands of Central Brazil
iv) Boulenger's Arrow-poison frog. *Atelopus boulengeri*	Black with cream spots and lives on the mountains of Peru and Ecuador.
v) Three-striped Arrow – poison frog. *Dendrobates trivittatus*	Black and yellow striped species from Northern part of South America.
vi) Two-toned Arrow – poison frog. *Phyllobates bicolor*	Red with black markings comes from Northern South America.
vii) Gold Arrow-poison frog. *Dendrobates auratus*	Little gold and green from Nicaragua thro Panama to Columbia.
viii) *Phyllobates aurotaenia* arrow-poison frog.	Secretes a membrane labilizer which depolarizes nerve and muscle fibre membranes by opening the sodium channel. Secretion is through the skin. The membrane labilizer is known as Batrachotoxin.

TOADS Genus Bufo	Secrete venom in the parotid glands behind the eyes. When stressed, the toad produces a white – a chemical cocktail which contains compounds, bufonin, bufogin and bufotalin. Works like digitalis increasing the tonicity of the heart to the point of stopping it. Cause weak breathing, muscular paralysis and nausea. Symptoms seen in small animals. Some cause rashes on the hands of handlers eg. *Hyla vasta* and African frog, *Phrynomerus bifasciatus.*
FISH	Sea water fishes are more venomous than fresh water fishes.
Weavers eg. *Trachina vipera*	Greatest threat to humans. Found in British Isles and Europe also Morocco. Lives in deep water (50m) (160ft) and shallow waters (6m) (20ft). Swimmers are reported to be injured by weavers. First aid is usually by applying urine to the site, it is believed. Medical attention is required as the fish injects venom through the spines on the gill covers and the first dorsal fin. Stings are painful. Does not usually result in death.
Lion fish *Pterois volitans* or *Zebrafish, Dendrochorus* zebra	Very poisonous. Has 18 dorsal venomous spines. Stings are very painful. Spine may break up in the wound and may lead to secondary infection or gangrene. Death is rare. Not aggressive. Drifts round coral reefs.
Scorpion fish *Scorpaenopsis diabolus*	Spines on head and dorsal fins are venomous. Found in Hawaii and Idolo-Pacific region.
Siganidae known as Rabbit fish	Have sharp spines on their fins which are responsible for painful stings.
Stone fish *Synanceia horida*_ and Devilfish, *Synanceia-verrucosa*	Have erectile venomous spines in the dorsal fins. Cause much pain and distress to humans. Can cause death.
Rays of families *Dasyatididae* and *Myliobatididae*	Venomous. Rays of family Dasyatididae are commonly known as **stingrays**. Have long whip-like tails equipped with one or more venomous spines near the base. Usually attacks if disturbed when they are lying camouflaged at the bottom of the sea.

	A famous Naturalist Steve Irwin nicknamed "the crocodile hunter" 44, was killed on 4th September 2006 after being pierced on the chest by a stingray. Can attack boats with their venom spines.
Puffer Fish	Several cases of puffer fish poisoning reported in Japan. It is a delicacy in Japan where it is called *fugu*. A source of tetrodotoxin, toxic to humans. Earliest poisoning reported by Captain James Cook's journal in 1774. He described what he called eating a *"blowfish"* in New Caledonia. *"We found ourselves seized with an extraordinary weakness and numbness all over our limbs, I had almost lost the sense of feeling, nor could I distinguish between light and heavy bodies of such as I had strength to move; a quart pot full of water and a feather being the same in my hand"*. Symptoms of poisoning include numbness, and tingling of the lips, tongue and mouth, weakness and then paralysis of the limb and chest muscles, vomiting, low blood pressure and death through respiratory paralysis, lethal dose of tetrodotoxin in mice is 5µg/kg body wt.
Freshwater cat fish *Pangasius sanitwongsae*	Caused injuries of many in Thailand. Capable of inflicting wounds with their venomous spines.

More than 20 enzymes have been detected in snake venoms and 12 are found in the majority of venoms. Hyaluronidase is present in all snake venoms.

Elapids account for several deaths worldwide, particularly as a result of toxins that act at the neuromuscular junction. Action may be at presynaptic, postsynaptic or at both sites.

Among the most toxic components in elapid and Hydrophidae venoms, is a neurotoxin which binds to the nicotinic acetylcholine receptor in the postsynaptic membranes of skeletal muscles, thus preventing binding of acetylcholine.

COELENTERATES (CNIDARIANS)

There are 9,000 known species, 70 are reported to be injurious to man **in search of the soul of the environment.**

The stinging apparatus is the **nematocyst** located in the marginal tentacles which are highly contractile, hollow, thick and strong. The nematocysts are found in specialized cells called **cnidocysts**. A nematocyst is a capsule covered by a lid and containing a coiled tube. The nematocysts are discharged from the cnidocysts which main functions are prey capture, dispersal or anchorage.

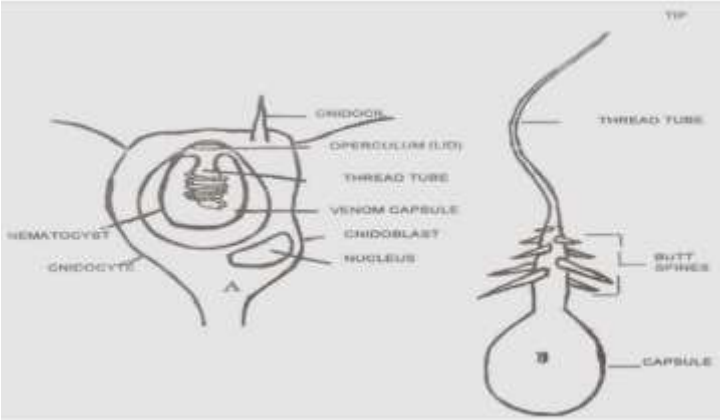


Fig 2: Principal morphological features of the A. Undischarged nematocyst in Cnidocyte, B. Discharged nematocyst.

Plate 9: The Sea Anemone: *Tealia felina*

Table 5: The Effects of Coelenterates

Types of Coelenterates	The Effects
SEA ANEMONES	Not very known by ordinary Nigerians but known by some fishermen. Causes itching on contact with skin, with burning sensation, skin flares red or pink-reactions close to Triple-Response of histamine. Histamine has 2 types of receptors H, and H_2. H_2 found in the stomach and involved in increase in acid pepsin secretion. Can be blocked by cimetidine, metiamide and burimamide. H_1 found in the skin, which produces the **triple response.** a flush – blue red area a flare – reddening near area a wheal – oedema (Bowman and Rand (1980) Sea anemones paralyse their preys by entangling in their tentacles. Less toxic stings than those of jellyfishes.
Condylactis gigantea	Venom is neurotoxic LD_{50} lµg/kg on crayfish
Stoichactis helianthus	Toxic LD_{50} 0.25mg/kg
Tealia felina	Antihistaminic in guinea pig ileum. Causes tremor of limbs of mice within mins. Causes haemolysis of human blood (Konya, 1984; Konya and Davies, 1990).
Bunodosoma cavernata	Found in Bonny Island. Antihistaminic (Eno *et al* 1998)
Rhodactis howesii	Found in Samoa where it is known as Matamulu, **most toxic sea anemone.** Toxic effect from eating it raw rather than stinging. Causes respiratory failure resulting in death. If cooked, doesn't kill. (Martin 1960).

Radianthus paumotensis	Poisonous whether raw or cooked. Reported by Farber and Lerke (1963)
Palythoa **species**	A zoanthid known as limu-make-Ohana. Has a toxin – **palytoxin,** isolated from it. LD_{50} of 0.15µg/kg. 10 times more lethal than tetrodotoxin. Palytoxin is a vasoconstrictor, found in puffer fish. Tetrodotoxin is also found in puffer fish. (Moore and schere 1971) Palythoa zoanthid is generally known as the Hawaiian seaweed. The seaweed is also used on spears for fishing.
Palythoa tuberculosa	Species responsible for deaths after eating puffer fish. Non-preteinaceous so cooking has no effect on it.
JELLYFISHES **Box Jellyfish** *Chrironex fleckeri* **(sea wasp)**	Funny!!! The only protection against the stings of these animals is the wearing of women's tight which the stings cannot penetrate. Dangerous and fatal to man. Causes death 3 – to 10mins after a sting preceded by sweating, convulsions, blindness, and respiratory paralysis. Causes deaths in Australia in less than 3 mins. (Barnes 1967). Fatality spans through guinea pigs, rats, rabbits, sheep, to monkeys and man.
Portuguese Man O'War *Physalia Physalis*	Dangerous to bathers. Rubbing meat tenderiser on affected part is said to alleviate pain and the discomfort of the sting. Dangling tentacles are the dangerous parts of the animal. (stein *et al* (1989) kills within five minutes of sting.

In Genesis 1:31a, the Bible states, "God saw everything that He has made, and behold, it was very good" (KJV). Even animals with toxins

were good in God's eyes after creation and they would rather be left alone to exist, unperturbed!

Plate 10: A man stung by a jellyfish, *Chiropsalmus quadrumanus*

Plate 11: Coelenterate Envenomation on the legs.

Courtesy of the Department of Dermatology, Naval Medical Center, Portsmouth, VA.

Generally, of all these animals with toxins, the purpose for the toxins in animals is defensive. These animals would rather be left alone to get on with their lives in their **territories**, than perturbing them. Their responses to these perturbations are defensive. Animals may possess stinging or biting apparatus, but they do not really go out to attack humans. That one receives a bite from an opponent in a fierce misunderstanding does not really indicate that the human teeth are for biting flesh. Venomous animals are defensive. The harsh environment must be repelled with any means available to these animals.

Plate 12: Jellyfish *Chiropsalmus quadrumanus*

As animals, they are absolutely fascinating. Many have developed beautiful, ornate forms, many are brightly coloured and even in superficial look at them can convert someone with a hatred of all creepy crawlies to become an interested observer. They have all evolved with venom apparatus as a means of capturing food or defense or both. In a world full of competitors, each animal has to surmount its own environmental problems, as efficiently as possible – ***searching the soul of the environment*** – so that, while the giraffe, has developed a means of reaching the parts of a tree that others cannot reach, others have developed a method of protecting themselves from being attacked, using venoms. Most countries in the world have legislation to stop the exploitation of animals, but there is too much money at stake to take much notice and indeed even the Government departments that are supposed to prevent this destruction, end up being involved in it.

THREATS TO ANIMALS

Many animals have become extinct. Prominent among them is the dinosaur. The process occurs over a very long period-billions of years. Extinction is a natural process, but the activities of humans continue to threaten the lives of animals at different levels. The table below (Table 6) shows the animals that have become extinct within the last 400 years.

Recorded number of Extinction among animal groups.

Table 6: IUCN red list of threatened species

Animals	Extinct	Extinct in the wild	Total
Mammals	86	3	89
Birds	104	4	108
Reptiles	20	1	21
Amphibians	5	0	5
Fishes	81	11	92
Molluscs	230	9	239
Crustaceans	9	1	10
Insects	72	1	73
Other invertebrates	4	0	4

Source: 1996 IUCN Red list of threatened species.

The International Union for the Conservation of Nature (IUCN) continues to publish data on animal facing threats and being endangered, in its red list (tables 7 and 8).

Data released by IUCN shows that birds and mammals are the most endangered. One does not need a soothsayer to tell us that human activities have a role to play in these threats. For example some birds become endangered because of the use of DDT which caused the thinning of egg shells and failure to reproduce. The blue whale, the gray whale, the elephant seal that were hunted to near extinction has recovered due to awareness of non-hunting of these animals by humans.

Table 7: Worldwide Status of Endangered and Threatened Animals

Animal Group	Critically Endangered	Endangered	Threatened
Mammals	180	340	610
Birds	182	321	680
Reptiles	56	79	161
Amphibians	25	38	83
Fish	152	126	431
Crustaceans	56	72	280
Insects	45	118	392
Mollusks	170	209	181

Source: Adapted from IUCN (World Conservation Union) Red list 2000.

Table 8: The IUCN Red Book of Threatened Animals have reported further as follows:

Animals	% Risk of Extinction
Mammals	25% of all known species
Birds	11%
Reptiles	20%
Amphibians	25%
Fish	34% (fresh water)

According to the United States Federal Endangered Species Act of 1973, the definitions are as follows:-

Endangered Species- any species which is in danger of extinction throughout all or a significant portion of its range other than Class Insect is determined by the Secretary to constitute a pest where protection under the provisions of this Act would present an overwhelming and overriding risk to humans.

Threatened Species - any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

It is interesting to note that disease causing bacteria or other microorganisms are not mentioned, only insect pests are excluded in this definition-possibly AN OMISSION!

The IUCN year has also published that:

- One bird out of eight
- One mammal out of four
- One conifer out of four
- One amphibian out of three
- Six marine turtles out seven

ARE ALL THREATENED WITH EXTINCTION.

In addition they report that:

- 75% of genetic diversity of agricultural Crops has been lost
- 75% of the world's fisheries are fully or over exploited
- Up to 70% of the world's known species risk extinction of global temperature rise more than $3.5^{O}C$
- One third of reef-building corals around the world are threatened with extinction and every second, a parcel of rainforest, the size of a football field disappears.

BIOTIC POSITIVE SUBDUING

Therapeutic agents from animals

Humans have subdued some animals (biotic agents) in the environment and have succeeded in extracting useful therapeutic agents from them to their benefit. Some are cited below.

Of more than 2,000 species tested by the United States, National Cancer Institute, about 40% of active species belongs to the Cnidarian phylum. Corals especially are known to yield pure cytotoxic compounds, notably crassin acetate.

Toxins from the Caribbean Sea anemone *Bunodeopsis globulifera* are known to increase cisplatin – induced cytotoxicity of human lung adenocarcinoma cells (Hiedi I. Monroy-Estrada *et al* (2013).

Puffer fish earlier discussed in this text is known to have tetrodotoxin which can be used at low doses as a local anaesthetic. A substance known as **azidorthymidine (AZT), a powerful antiviral ingredient** has been discovered in herring sperm. AZT was discovered around 1985 as the first and only effective weapon to control AIDS virus. It is now synthesized in the laboratory. It inhibits the enzyme that HIV uses to synthesise DNA, and consequently prevents viral DNA from forming. AZT is marked under the brand name, **Retrovir**, and it is the first US Government approved treatment for HIV.

A compound known as Ziconotide is found in the venom of a sea snail ***Conus magus*.** It is a non-opiod and non-NSAID (Non-Steroidal Anti-inflammatory/analgesic agent. Its effect is to ameliorate severe and chronic pain.

***Luffariella variabilis*,** is a sponge from the Palau Islands (North Pacific), known to contain steroids with anti-inflammatory and analgesic properties. (Vilret, 2004)

Derivatives of cembrene found only in cnidarians (sea fans and soft corals) have been shown to have anti-tumour properties.

Cytarabine or cytosine arabinoside, an anti-tumour agent has been discovered in a Carribean sponge, ***Cryptotethya crypta,*** used in the chemotherapy of acute leukemia, by killing cancer cells through interfering with DNA synthesis. (Vilret 2004).

Palytoxin from Hawaiin zoanthid **Palythoa** has general anti-tumour activity against Ehrlich ascites tumour in mice.(Quinn *et al* 1974) Also, crude extracts of jelly fishes, ***Cephea conifera*** and ***Aurelia labiata*** from Hawaii and the sea anemone from Tahiti,**Stoichantis** spp. and a soft coral from Australia, ***Nepthya*** spp. have been found to completely inhibit the growth of Ehrlich ascistes tumour in 100% of treated Swiss Webster female mice. (Tabrah *et al* 1972).

Aequorin, from the jellyfish, ***Aequoria forskalea*** is used to detect Ca^{2t} in tissues, as it glows with a blue light when it combines with Ca^{2t} ions. (Shimomura *et al* 1962).

A hormone-like prostaglandin isolated from soft and horny corals, is useful as a **contraceptive**, **one of the morning after** type. An eight-step synthetic procedure has converted the prostaglandin into physiologically active form. Several varieties of the soft marine coral ***Plexaura humomalla*** are used to produce contraceptive drugs (Weinheimer *et al* 1969).

Horseshoe crabs are used to test for bacterial contamination. Bonegrafts are obtained from coral skeletons; paid relievers are obtained from sea snail venom and infection-fighting agents are obtained from shark skin.

Marine natural compounds comprise either classical cytotoxic moieties targeting non specific molecules in the form of cancer cells, and also normal proliferating cells (e.g DNA, enzymes, microtubules) or new compounds targeting macromolecules specifically expressed on cancer cells (e.g oncogenic signal transduction pathways).

They may also be applied to cancer cells in the field of chemoprevention, since they are involved in the inhibition of specific processes of cancernogenesis.

Terrestrial animals also have therapeutic agents.

The Houston toad secretes chemicals through the skin for self protection, but the chemicals contain serotonin and alkaloids that are medically potent for treatment of heart and nervous diseases in humans.

Gila monster (a lizard), produces saliva that apparently controls blood sugar in type-2 diabetes (plate 13). An excellent review o the biology of the Gila monster has been published by Brown and Carmony (1991).

Plate 13: Lizard - *Gila monster*

A Lizard saliva that produces a drug for diabetes

B. ABIOTIC ENVIRONMENT

This includes such items as sunlight, soil, air, water, climate, and pollution.

ABIOTIC NEGATIVE SUBDUING

Negative and positive subduing are of the habitat

Subduing can be negative or positive. The Oxford Dictionary has one definition of the word *"Subdue"* as to bring somebody/something under control, especially by using force.

This definition is relevant to this text. The *"something"* is the natural environment and all in it.

It is important that humans help to take good care of the environment to protect themselves and animals, as destruction of a habitat can lead to the extinction of some animals.

Solid Waste Generation and management

Mankind is producing more refuse than ever before, creating unprecedented problems for the Environment. People in both developed and developing countries throw away tons of trash. In 2002, it was estimated that the residents of New York City alone produced enough garbage each year to bury the city's huge Central Park (covers an area of 341 hectares) under four meters of refuse! Germany was also reported to produce garbage annually that could fill a freight train extending from the capital, Berlin, to the coast of Africa, some 1,800kms away. Britain, during the same period was estimated that the average family of four discarded six trees' worth of paper in a year.

It is estimated that a glass bottle thrown into the sea will take 1,000 years to decompose. In contrast, paper tissues will decompose in only 3 months. A cigarette butt pollutes the sea for up to 5 years; plastic bags, 10 to 20 years; nylon articles, 30 to 40 years; cans, 500 years, and polystyrene, 1,000 years. The flow of such refuse has increased tremendously. Those who wish to move away from a throwaway economy would have to be willing to use the goods they purchase for as long as possible, throwing them away only when they are beyond repair.

Commodities like food for example should not be wasted by throwing away, part of it. The Bible informs us that Jesus carefully avoided wasting food – even when it was miraculously produced. John 6:11-13 (KJV)

"And Jesus took the loaves; and when he had
given thanks, he distributed to the disciples,
And the disciples to them that were sat down;
And likewise of the fishes as much as they would.
when they were filled, he said unto his disciples,
gather up the fragments that remain , that nothing
be lost.Therefore they gathered them together, and
filled twelve baskets with the fragments
of the five barley loaves, which remained
over and above unto them that had eaten."

Humans, who seem to be proud **subduers** of the Environment, continue to generate waste, (plate 14) causing health problems to themselves and animals and then turning round to find solution, after creating the problems. The solution however is in the Reduce, Reuse and Recycle (the 3RS), paradigm.

Plate 14: Heaps of garbage

Waste destroys the environment for humans and animals; it causes pollution of the environment. As a pollutant, waste demands controls.

Integrated waste management policies give primacy to waste minimization, recycling and composting, but inevitably solve the *"disposal problem"* through incinerator-reliant packages. The incinerator element commits us to a future in which increasing levels of pollutants such as dioxins, a known carcinogen will be generated and dispersed into the air and on land. Meanwhile, substantial recyclable material will be lost to disposal along with most of the energy contained therein opportunities for jobs and community participation would likewise be bypassed. Sanitary Landfills are part of the modern disposal methods. Unfortunately, pollutants from a solid waste disposal site can enter the environment by many paths:

1. Gases like methane, hydrogen sulphide, and nitrogen produced from compounds in the soil and the waste can enter the atmosphere.
2. Soluble materials, e.g chloride, nitrate, and sulphide can readily percolate through the waste and soil to the groundwater.
3. Runoff over soil can pick up leachate and transport it into streams and Local River, polluting it. **Leachate** is noxious,

polluted liquid produced when water infiltrates through organic and other waste material.

4. Heavy metals, e.g lead, chromium, iron, and mercury can enter into the environment via ash from coal, and concentration of cadmium taken into the plant from disposal sites. This results in a higher concentration of cadmium in plants. Hence as the cadmium moves through the food chain, it becomes more and more concentrated. When plants are eaten by animals and humans incorporating cadmium in the tissues, its concentration becomes 50-60 times higher than the concentration in original coal. This is the process of biomagnifications or bioaccumulation.
5. Toxic and hazardous materials can be transported to areas other than the landfill by wind.

These are great disadvantages to the environment caused by human activities – **the subduers**.

In Nigeria, the Environment spirit was awakened when toxic waste was dumped in Koko in 1987. The Federal Government subsequently promulgated the Harmful Waste Decree 42 of 1988, which facilitated the establishment of the Federal Environmental Protection Agency (FEPA) through Decrees 58 of 1988 and 59 of 1992.

Solid waste in Nigeria is disposed of in **open dumps**, where the refuse is piled up without being covered or protected. Burrow pits excavated for laterite in road construction are transformed into dumps for wastes. They are usually located in undeveloped areas, which soon become built-up and dangerous to human life. The refuse is periodically leveled and compacted without regard to whether they are hazardous or not, and whether they are degradable or not. This practice has persisted despite recycling possibilities available. Leachate from the waste is expected to be prevented from percolating into the layers beneath at the bottom of the pit with waterproof covering. However, most times, this may not be done, making the dump worse, as aquifers below the dump are polluted causing diseases in drinking water from boreholes.

Lead poisoning in Nigeria

In the Nation Newspaper of Friday 24th April 2015, there was a follow-up story of metal poisoning in Nigeria. It was reported that several communities where lucrative gold caused problems in Bagega community in Zamfara State, have deteriorated further even after 5 years of first identification of the poisoning. The community was described as the *"World's worst lead-poisoning disaster".* Children play out constantly and as lead is released into the air, its particles cling to clothing, domestic materials, buildings and run off into stream causing diseases of the brain, liver, kidney, abdomen, etc. Even the workers who tried to remediate the soil, got contaminated and needed treatment.

The Federal Government has not done much about the contamination in the area as only 8 out of 38 affected villages have been remediated, and only the residential axis, not the farmlands were remediated. Equipment that will not generate dust in the mining process is required to forestall this disaster.

The situation in Zamfara State is so pathetic that the women, children, etc have resigned to fate; because the artisanal gold mining activities still persist and no one knows when this will end.

Twenty Seven children were confirmed dead from fresh outbreak of lead poisoning from illegal mining in Nigeria. This was published in the punch newspaper of Thursday, May 14 2015. The then Minister of State for Health, Fidelis Nwankwo, broke the news when he also informed the public of 63 cases of the outbreak and death of many animals (cows, goats and chickens) in the Communities. The Communities affected were Shikira, Magiro Ward and Kawo, in Rafi Local Government Area. This outbreak was said to be deadly. In Zamfara State, 400 people were killed by lead poisoning in 2011.

Federal Government consequently has ordered the end of mining activities. Time will tell if this directive will be obeyed.

Persistent organic pollutants (POPs) in Nigeria

The Stockholm Convention on POPs in 2001 played a big role in the phasing out of POPs in the world. Persistent Organic Pollutions or POPs are a group of 12 chemicals, based on UNEP Governing Council decision of February 1997 as chemicals internationally recognized that need immediate global action. The substances are Aldrin, Chlordane, DDT, Dieldrin, Heptachlor, Mirex, Tozaphene, Lexachloronobenzene, Polychlorinated Biphenyls (PCBs), Dioxins, Furans and Endrin. POPs were introduced into Nigeria in the 1940s for use in the production, of commercial crops (cocoa, rubber, cotton) and forest products. All pesticides, including POPs used in Nigeria are imported from Europe, America, Japan, etc.

A few production plants owned by multinational oil companies were established in the 1980s and 1990s in Lagos, Port Harcourt and Kaduna, Gladly, in response to International concern on the adverse health and environmental effects, all the POPs and, these formulation plants were closed down in the 1990s, although that of the Chemical and Allied Products Limited(CAPL) persisted till 2004.

POPs (e.g. Aldrin, and Dieldrin) were used as insecticides in food crops protection. Heptachlor, chlordane and Dieldrin have been used for termite control in Nigeria. DDT was used for tsetse fly and mosquito eradication in the Northern part of the country. Osibanjo (2002) reported that Nigeria is estimated to have 22 tons of obsolete stocks of 40 assorted pesticides at 55 different contaminated sites.

The electricity generating industry is the major source of PCB (Polychlorinated Biphenyls) release into the environment. PCBs are additives in transformer oils. In some cases leaked transformer oil containing PCB seeps into the soil, contaminating ground water.

Domestic refuse with hazardous industrial waste including POPs wastes in Nigeria is a main source of these chemicals.

Contaminated foods are major sources of POP in humans in Nigeria. Meat, cereals have DDTs at high levels. Roasting of cow skin and

whole goat carcass with burnt vehicle tyres in market abattoirs, is a significant source of dioxin and furan.

The POPs are persistent, transported over long distances from point of origin in the environment, bioaccumulate in humans and other organisms through food chains and food webs. They have adverse effects on humans and wildlife.

Mobile phones

Discovery of mobile phones dates back to the 1940s although it only became widely available in the mid 1980s amongst industrialized countries. Nigeria only began to enjoy the benefits of mobile phone technology in 2001. This brought a new lease of life in communication as humans continue to search the soul of the environment.

However, research has continuously revealed that use of mobile phones has negative effects on users. Some scientists disagree. The following are some studies carried out by some researchers.

A 20 year study of servicemen in Poland established the strongest link yet between mobile phones and cancer. The results of the study showed a high cancer death rate among soldiers exposed to microwave radiation – at levels comparable to that emitted by mobile phones when in use. The scientists checked the medical records of servicemen who were exposed to the radiation between 1970 and 1990. They then compared their medical histories and death rates to a group of soldiers who were not exposed. The results found those exposed through using military equipment with similar radiation as in mobile phones, were more prone to some cancers, 10 years earlier than those not exposed. The cancer ranged from those of the skin, brain, blood, digestive system and lymphatic system.

In another study, a world – renowned laboratory at the University of Zurich has also published a paper in the Neuro Report, which suggests that use of mobile phones just before going to sleep can disturb the normal sleeping EEG patterns. Volunteers were exposed to digital mobile phone radiation for 30 minutes while awake and discovered that

their EEG activity after they fall asleep was significantly altered, compared to unexposed controls.

On December 8, 2000, the German Academy of pediatrics issued a statement advising parents to restrict their children's use of mobiles. It advised that all mobile phone users should keep conversation "as brief as possible", but that additional precautions are appropriate for children in view of "special health risks" associated with their growing bodies.

Phone Masts

In 2008, there were protests in Britain against phone masts. A study in Warwickshire by Dr. John Walker, showed a cluster of 31 cancers around a single street when he compiled the cluster studies with the help of local campaigners. A quarter of the 30 workers at a special school within sight of the 90ft high mast developed tumours since 2000, while another quarter had significant health problems. The evidence was presented to the operator, O2, by protesters and the masts were pulled down. (Washington Andrew 2008)

Andrew Washington, in Maidstone, Kent, UK, once said: *"In two weeks my life has turned upside down, I've recently started having all the main symptoms of Electro Hypersensitivity and believe my immune system has stopped defending me against a mobile phone mast 150m*

from my work space. I find it almost impossible to feel normal…" …. culled from The Guardian, Wednesday, January 9, 2008 pg 9.

Several studies confirm that electromagnetic radiation, especially radio and radar signals,

- Alters brain activity, including EEG and reaction times, memory loss, headaches, fatigues and concentration problems. Gordon 1966, Moscovict *et al* 1974, Frey 1998; Krause *et al* 2000
- disturbs sleep (Bordely *et al*1999)
- increases the suicide Risk (Van Wijngaarden at al 2000).
- Reduces sperm counts. (Wegandt *et al* 1996)
- Increases neurodegenerative disease including Alzheimer's disease. (Savitz *et al* 1998 a, b).

Cell phone radiation causes the following;

- Disturbs sleep. (Bordely *et al* 1999)
- Causes memory loss, concentration difficulties (Mild *et al* 1998 and Hocking 1998)
- Weakens the blood brain barrier. (Salford, Land Brun 1997)
- Increases tumour necrosis factor (TNK) (Fesenko *et al* 1999)
- Increases blood pressure.(Braune *et al* 1998)
- Decreases sperm counts and smaller tube development in testes, (Dasdag *et al* 1999)
- and more.

However, in order to **subdue** the earth, humans have solved communication problems, but created health problems for themselves as enumerated above. Humans are restless and in the process, produce both positive and negative results that sometimes are irreversible.

ABIOTIC POSITIVE SUBDUING-STILL SEARCHING THE SOUL OF THE ENVIRONMENT

To subdue can be positive or negative. I have earlier surveyed some of the negative subduing process. **Subduers** also, have positively subdued the environment. In a bid to search the soul of the environment, humans (subduers) try to find solutions to the problems they have created.

Energy from burning coal, energy from fossil oil, energy from nuclear energy, energy from incineration of waste, etc all involve processes that introduce toxic materials into the atmosphere.

However, **Clean Energy** as alternatives to above have also been explored and harnessed by **Humans. Renewable energy** does not deplete natural resources or cause environmental harm. It includes bioenergy, wind, hydroelectricity, solar energy, geothermal energy, and nuclear energy.

Bioenergy is produced from living things such as plants, crops like soybeans, corn are used to produce energy in forming biofuel. Waste can also be converted to produce biogas.

Wind turbines convert kinetic energy to mechanical energy which is converted to electricity. No emission, no solid waste except occasional noise.

Hydroelectricity is electricity produced by the gravitational force of falling or flowing water. Could be generated through dams or natural water falls.

Solar power is energy produced from the heat of the sun, harnessed using a range of ever-evolving technologies such as solar heating, solar photovoltaics, solar thermal energy, solar architecture and artificial photosynthesis.

Geothermal energy is the naturally occurring thermal energy produced by the earth's molten inner core.

Nuclear Energy is the use of sustained nuclear fission to generate heat and electricity. Nuclear power uses nuclear reactors to release nuclear energy. Nuclear Energy is said to save about 2.4 billion tonnes of carbon dioxide emissions per year that would otherwise be caused by coal-fired generation.

These are alternatives to the detrimental soul searching of the environment by humans, subduers.

DESIGNATED DAYS TO CELEBRATE THE ENVIRONMENT

Still in the search of the soul of both the biotic and abiotic components of the environment, humans have recognized designated days to remind themselves of aspects of the environment that require attention.

1. **WORLD EARTH DAY**

The 22nd April every year is the World Earth Day. Rachel Carson's book, New York Times best seller "Silent Spring" in 1962 raised public awareness and concern for living organisms, the environment and

public health. Anti-War protests raged in 1970, and students in America formed a movement which eventually had the Environment as its focus.

Gayton Nelson, a US Senator, after witnessing the negative effect of the 1969 massive oil spill in Santa Barbara, California, initiated the process that culminated in the founding of the Earth Day, having been inspired by the student's movement. He believed the movement could force environmental protection into the national political agenda. He co-opted some colleagues, Peter McCloskey, a conservationist and Denis Hayes as national coordinators of the "national teach-in on the environment" programme.

Consequently, on the 22nd of April 1970, 20million Americans took to the streets, parks and auditoriums to demonstrate for a healthy, sustainable environment in massive coast-to-coast rallies. He involved thousands of students, while already existing groups against pollution in different dimensions joined in the protests. The first Earth Day led to the creation of the United States Environment Protection Agency, and the passage of the Clean air, Clean water, and Endangered Species Acts.

Earth Day went global in 1990 when 200 million people in 141 countries lifted environment issues onto the World stage. Bill Clinton US President, in 1995, awarded Senator Nelson, the Earth Day founder, the Presidential Medal of Freedom, the highest honour given to civilians in the US.

In 2010, Earth Day focused mainly on Climate Change. Every year over a billion people in 190 countries get involved; they plant trees, clean up, contact elected officials and more, all to improve the environment.

The 2015 Earth Day theme was "*Its our turn to lead".*

2. WORLD ENVIRONMENT DAY (WED)

This is the biggest day celebrated in the field of Environment. It is the United Nations important vehicle to create awareness and action for the environment. It is celebrated by stakeholders in over 100 countries. It is

run by the United Nations Environment Programme (UNEP). United Nations Secretary-General, Ban Ki-moon, at the 2014 International Year of small Islands and Developing States, advised. "Planet Earth is our shared Island; let us join forces to protect it."

WED gives the opportunity for everyone to realize not only the responsibility to care for the Earth, but also to become agents of change (table 9).

WED was established by the United Nations General Assembly in 1972 to mark the opening of the Stockholm Conference on the Human environment. The creation of UNEP was also adopted in the same General Assembly, the same day. WED can be celebrated in many ways, including street rallies, lectures, concerts, essay and poster competitions in schools, tree planting, recycling efforts, clean-up campaigns and much more.

The observance also provides an opportunity to sign or ratify international environmental conventions.

The purposes of WED are:

a) Give a human face to environmental issues
b) **Empower** people to become active agents of sustainable and equitable development
c) Promote an understanding that communities are pivotal to changing attitudes towards environmental issues.
d) Advocate partnership which will ensure all nations and peoples enjoy a safer and more prosperous future.

WED now has an Anthem. It is an Earth Anthem by poet-diplomat Abhay K. which was launched in June, 2013 on the occasion of WED, at a function organized by the Indian Council of Cultural Relations in New Delhi. It is in eight languages; Arabic, Chinese, English, French, Russian, Spanish, Hindi and Nepali.

Table 9: World Environment Day, 2005 to 2015

Year	Theme
2005	**Theme**: "Green Cities" **Slogan:** Plan for the Planet **Explanation**: A high percentage of the World's population lives in urban cities. Mayors of cities were the focus for this celebration. They served as models to all sections of society and they are able to respond quickly to environmental issues and are accountable to the citizens.
2006	**Theme:** "Deserts and Desertification" **Slogan:** Don't desert dry lands **Explanation:** Dry lands which covers more than 40% of the planet's surface, are expected to be protected Main celebration was held in Algeria for obvious reasons.
2007 2008	Theme: "Melting ice – a Hot Topic" This was designated the International Polar year. Explanation: The effect that climate change had on polar ecosystems and communities was the focus for this celebration. Main celebration was in the city of Tromso, Norway for obvious reasons. **Slogan:** "Kick the Habit! Towards a low Carbon Economy" **Explanation:** This celebration found forest management as a tool for reducing greenhouse gases. The WED highlighted resources and initiatives that promote low carbon economics and life-styles, such as improved energy efficiency, alternative energy sources, forest conservation and eco-friendly consumption. The main international celebration was held in New Zealand.
2009	**Theme:** "Your Planet Needs You - Unite to Combat Climate Change" **Explanation:** It reflected on the urgency for nations to agree on a new deal at the climate convention that held in Copenhagen in that year. Major celebration was in Mexico.
2010	**Theme**: "Many species. One Planet. One Future" **Explanation**: Calls for conservation of the biodiversity of life on our planet. Millions of people and millions of species, plants, animals, humans are all connected to the planet. We should carefully address our actions towards one another.
2011	**Theme**: "Forests; Nature at your Service" **Explanation:** Explains the variety of life – sustaining services that forests provide and calls on all to protect these resources and move towards green economy.

2012	**Theme**: "Green Economy: Does it include You?" **Explanation**: Green Economy results in improved human well being and social equity whilst significantly reducing environmental risks and ecological scarcities. Green economy is where growth income is driven by low carbon emission. Green Economy is expected to have low carbon.
2013	**Theme**: "Think, Eat, Save" **Explanation**: Encourages one to become more aware of the environmental impact of the food choices one makes and empowers one to make informed decision. If food is wasted, it means that all the resources and inputs used in the production of all the food are also lost. Meanwhile, there are many without food in the world. We are expected to think before we eat and help save our environment. It is the single driver of biodiversity loss and land-use change.
2014	**Theme:** "Raise your voice, not the sea level" **Explanation:** International year of Small Island Developing States to celebrate the contributions that this group of countries/territories has made to the world.
2015	**Theme:** "Seven billion Dreams, One Planet, Consume with care" **Explanation**: The well being of humanity, the environment, and the functioning of the economy, ultimately depend upon the responsible management of the planet's natural resources. Yet evidence is building that people are consuming far more natural resources than what the planet can sustainably provide. We are informed that with a rising population we will need three planets by 2050 to sustain our ways of living and consumption if current consumption and production patterns remain the same.

WORLD OCEANS DAY

World Oceans Day is celebrated on the 8th of June every year. It is the United Nations-recognized day for attention on oceans. The main focus is to support action to protect the ocean. It was officially recognized by the United Nations (UN) in 2008, even though it was unofficially celebrated in 1992 by Canada.

The theme for 2015, World Oceans Day is:
"Healthy Oceans, healthy planet". Particular attention was given to plastic container pollution.

The ocean is the heart of the planet. It connects people across the earth. The ocean regulates the climates, feeds millions of people yearly, produces oxygen, home to magnificent variety of wildlife, source for

important medicines etc. It is therefore imperative that we take care of oceans. Intense search of the soul of the environment has led humans to over exploitation, illegal, unregulated and destructive fishing, marine pollution, habitat destruction, alien species, climate change and ocean acidification take a negative toll on oceans and seas.

Reasons for celebrating World Oceans Day

1. To remind everyone of the major part the ocean has in everyday life. They are the *"lungs"* of the planet, providing most (80%) of the oxygen we breathe.
2. To inform the public on the impact of human actions on the ocean.
3. To develop a worldwide movement of citizens, towards protecting the ocean.
4. To mobilize and unite the world's population on a project for the sustainable management of the World Ocean. The oceans are a major source of food and medicines and a critical part of the biosphere.
5. To celebrate together the beauty, the wealth and the promise of the Ocean.

The Secretary-General of UN this year said, *"The oceans are vast-but their capacity to withstand human damage is limited. In this potentially pivotal year, we must commit to using the gifts of the oceans peacefully, equitably and sustainably for generations to come."*

The ocean is absorbing the heat that would have gone into land, and it is paying for it. It is the responsibility of all.

WORLD REFUSE DAY

Alias
"GARBAGE MAN DAY"

Garbage handling is an old phenomenon.

In 500BC, Athens, Greece developed new law claiming garbage must be dumped at least a mile from the city. In 2000BC China developed methods of composting/recycling and recycling bronze for later use. In 3000BC, the first landfill was developed when Knossos, Crete, dug large holes for refuse. Garbage was dumped and filled at various levels. The Garbage Man Day is June 17th. This is a day to appreciate garbage collection providers.

The Black Plague killed 25 million people in 5years, about 1350. Consequently anything that could be re-used was not wasted. at about the same time Britain introduced their first garbage men. They were called "rakers" – they raked up the trash, put it in carts and removed.

And between 1200 – 1700, efforts were made in different parts of the world to introduce organized garbage handling. During the period 1990 – 2005, the New Garbage Truck was introduced, realizing the dangers of hazardous waste, and the benefits of recycling. The question then was how to collect waste faster, cheaper, and safer. The 1990's became the age of the refuse truck. The trucks have been modernized over the years.

Refuse or garbage is seen cursorily as useless, and must be removed and disposed of adequately. The reason is that if not removed, will cause diseases (eg diarrhea, cholera etc) who will actually like to be referred to as garbage? This is confirmed in the Bible portion, 1 Corinthians 4;13 which states:

> We appeal gently when evil things are said about us. Yet we are treated like the world's garbage, like everybody's trash-right up to the present moment

New Living Version

Or

When slandered, we retreat. We have become, and are still, like the scum of the world, the refuse of all things.
English Standard Version

The word *"garbage"* and *"refuse"* are used interchangeably in these Bible versions. Of course when slandered, we are turned into garbage or refuse, something useless. Such is the value or non-value of waste on cursory outlook.

Refuse collectors are at high risk of fatal accidents. In 1998, the United States Bureau of Labour Statistics recorded 48.8 fatalities per 100,000 workers. The Bureau also reported that refuse collecting was the 7th riskiest occupation in the USA. A detailed study at a single Danish Company in 1993 revealed that 114 employees out of 667 of the Company's employees experienced an injury. Coincidentally, this was the year that the Danish legislative approved a regulation specifying requirements for equipment, collection methods and accessibility to the collection sites. Forbes has listed 10 deadliest jobs with logging workers as the deadliest, refuse and recycling material collectors as the 6th deadliest (Forbes.com).

Generally, noise limit during the collection usually exceeds the normal limit of 60 dB, (60 decibels).

Plate 15: Garbage man day logo

The redesigned logo as shown in plate 15 recognizes both men and women who take part in waste management industry. The name "Garbage Man Day" does not exclude women.

CLIMATE CHANGE

Climate Change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e. decades to millions of years), regardless of cause (Wikipedia).

Climate Change may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions i.e. more or fewer **extreme weather** events). Climate change is caused by factors such as **biotic processes, variations in solar radiation** received by Earth, ***plate tectonics,*** and ***volcanic eruptions.*** Certain human activities have also been identified as significant causes of recent climate change, often referred to as ***"global warming".*** (America's Climate choices…….(2010).

Information from the above source informs us that there is a strong, credible evidence, based on multiple lines of research, documenting that climate is changing and that these changes are in large part ***caused by human activities***. The fact that the earth system is warming and that much of this warming is very likely due to human activities is no longer in doubt as there abounds credible evidence as a result of scientific research.

As humans subdue the environment in search of its soul, more negative results surface, which are revealed unexpectedly and recognised, surely but slowly.

Factors that shape climate are known as **climate forcing or forcing mechanisms**. Within scientific communications, global warming refers to surface temperature increases, while climate change includes global warming and everything else that increases **green house gases** (Fig. 3).

Indicators that reflect climate are **vegetation, ice cores, dendrochronology, sea level change** and **glacial geology**. ***Glaciers*** are

considered among the most sensitive indicators of climate change as their size is determined by a mass balance between snow input and melt output. As temperatures warm, glaciers retreat unless there is an increase in snow precipitation. Glaciers leave behind ***moraines*** that contain materials that include organic matter, quartz, and potassium that may be dated, used to know when a glacier advanced and retreated. By a technique known as **tephrochronologics**, the lack of glacier cover, can be identified by the presence of soil or volcanic **tephra** horizons whose date of deposit may be ascertained.

Use of tree ring growth patterns known as **dendroclimatology** can be used to determine past climate variations. Wide and thick rings indicate fertile, well-watered growing period, whilst thin, narrow rings indicate a period of drought, and unsatisfactory conditions of growth.

Beetles (whose genetic makeup has not altered over the millennia), have been used in the past to determine Climate change. Remains of beetles are commonly found in freshwater and land sediments. The age of the sediments in which remains are found, can be used to infer past climatic conditions.

A change in type and distribution of **vegetation** can occur during climate change. Cold will cause plant bio-cycles to lag while a gradual increase in warmth can lead to earlier flowering and fruiting.

Another obvious indication of climate change is an increase in sea level. In the past, **tide gauge** measurements over long periods was used but recently **altimeter measurements** are used in combination with the determination of satellite orbits.

Prince Charles, heir to the British throne has advised recently in the British Guardian newspaper. “Rewire the global economy to stop climate change,” recognising that climate change is caused in the greater part by human activities **in their search for the soul of the environment.**

The Prince argued that ending taxpayer subsidies enjoyed by coal, oil and gas companies could reduce the carbon emissions driving climate change by an estimated 13%.

Climate change has effects on the economy.
Environmental disasters such as floods, forest fires and hurricanes indirectly or directly caused by human activities, all have dire economic consequences for the regions afflicted. Erosion and desertification often as a result of deforestation reduce the ability of people to grow crops and feed themselves apart from reducing the carbon sink.

How human activities contribute to climate change.
Changes in Earth's atmosphere are caused by human activities with the production of amounts of greenhouse gases, aerosols and cloudiness. The largest known contribution comes from fossil fuels, which release carbon dioxide to the atmosphere.

Greenhouse gases and aerosols affect climate by altering incoming solar radiation and outgoing infrared (thermal) radiation that are part of energy of the Earth. The effect of changes in natural processes, like solar change and volcanic eruptions are far less than the human impact on climate change. The industrial era of 1750 witnessed a warming effect of human activities on the climate and since then there has been an increase.

Climate Change is already taking a toll on the Nigerian climate in diverse ways. Rainy and dry seasons are no longer arriving in the usual months. Sunshine when out is so severe and hot that it is intolerable on human skin etc.

Greenhouse Gases
Four prominent greenhouse gases resulting from human activities are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and halocarbons (gases containing fluorine, chlorine and bromine). These gases have increased with increase in human activities. Carbon dioxide has increased from fossil fuel, deforestation, and decay of plant matter.

Methane has increased with human activities in agricultural, natural gas distribution and landfills, and also from wetlands. Nitrous oxide is emitted from fertilizer use, and fossil fuel burning.

Halocarbon gas concentrations have increased due to human activities. The main halocarbons include the chlorofluorocarbons used as refrigerating agents and other industrial processes. Their presence in the atmosphere causes stratospheric **ozone depletion.** International regulation has been put in place to protect the ozone layer.

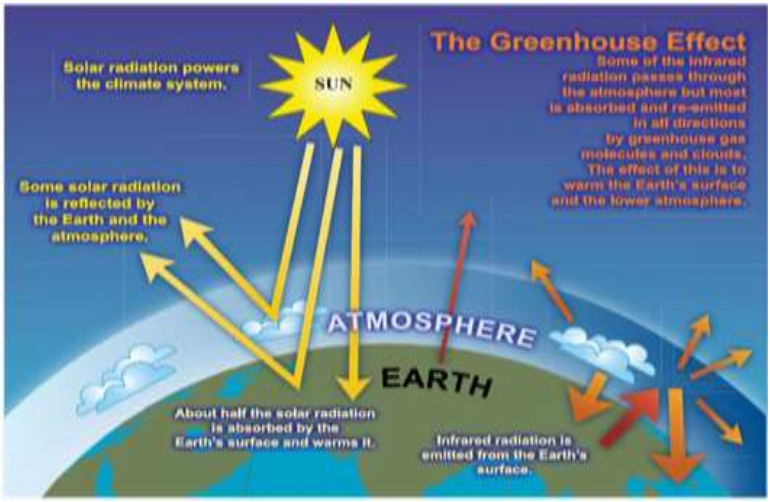


Fig. 3: The Greenhouse Effect

Halocarbons released by human activities have caused the ozone hole over the Antarctica. Water vapour is the most abundant. Humans do not have the direct effect on the amount of water vapour, but they indirectly influence it by changing the climate. Aerosols-small particles in the atmosphere with varying sizes and concentrations, also affect climate change, by interacting both directly and indirectly with the Earth radiation budget and climate. Aerosols scatter sunlight directly into space. Indirectly they modify the size of cloud particles changing how clouds reflect and absorb light.

Ozone Layer and Depletion.

Ozone as stated earlier is found in the troposphere as a pollutant, but present in the stratosphere as a shield, screening out the sun's harmful ultra-violet radiation (with short wavelength) from reaching the earth's surface. The ozone blanket absorbs the genetic material of DNA (de-oxyribonucleic Acid). This could result in skin cancer. The U.V radiation also causes problems in the human body's defence system as well as affecting other forms of life (plant etc). The maintenance of the ozone layer is therefore important and must not be depleted (Konya *et al* (editors) 2005). Human activities, such as surface mining and industrial processes have increased dust in the atmosphere increasing natural aerosols. These activities are all for **the search of the soul of the environment by humans (subduers) (**table 10).

Table 10: The Greenhouse Gases and the activities that cause their production.

Type of Gas	**The relevant activities**
Carbon Dioxide ($C0_2$)	Released during the burning of fossil fuels (Industry, automobiles, etc.) wood and wood products, and solid waste.
Methane (CH_4)	Emitted during the extraction and production of fossil fuels, the decomposition of organic wastes from herding and farming, and the decomposition of municipal landfills.
Nitrous oxide (N_20)	Emitted during agricultural and industrial activities, as well as during the combustion of fossil fuels and solid waste.
Chlorofluorocarbons (CFCs)	Released during the production of foams and as a by-product from refrigeration and air-conditioning appliances

The Kyoto Protocol

The Framework Convention on Climate Change,

"The Earth Summit" was held in Rio de Janeiro, Brazil in 1992 to set out objectives of stabilizing greenhouse gas emissions, to reduce the threat of global warming. To follow up, the conference in Kyoto, Japan,

held in 1997. Till date 192 countries have signed and ratified the Kyoto Protocol. The only nations that haven't are, Afghanistan, Sudan and U.S.A; Andora and the Vatican City are considered "observers" of the process, and were not asked to sign.

Agreement was aimed at holding carbon dioxide, methane, and nitrous oxide emissions to 5% below 1990 levels by 2012. The protocol has 28 articles with two annexures. Other greenhouse gases already listed above were also to be reduced. The Protocol came into force on February 16, 2005. Russia was one of first to sign it. USA one of the highest polluters in the world has refused to sign it.

Humans **in the search of the soul of the environment,** pollute the environment and subsequently try to remedy it. USA is no pretender, as it has blatantly refused to sign the protocol, despite its enormous pollution, degradation and very high carbon footprint.

Why the name Greenhouse gas? Simply means that the effect of these gases is analogous to a similar effect produced by the glass panes in a greenhouse although the processes are different. The heating of the Earth caused by the atmosphere is the Greenhouse effect.

Kyoto Protocol and Nigeria

In 2005, professional environmentalists were assembled to discuss "Minimizing Greenhouse Gas Emissions in Rivers State and the analysis was very educative. This workshop was organized by Rivers State Ministry of Environment while I was Hon Commissioner of Environment.

The environmentalists were S.C Teme (RSUST) Ethelbert Bekwele Dede, (the then National President of Nigerian Environmental Society) B.L.Nyanayo (UNIPORT) Akuro E. Gobo (RSUST); Ini U. Ubong, (RSUST); Eze C.L (RSUST; Eze, Evelyn, M (RSUST). The papers presented yielded an informative book. It was concluded that Nigeria, though not industrialised, is already experiencing climate change and since it was one of the early countries to sign the Protocol, she should endeavour to reduce Greenhouse gases, and more importantly, the flares

in the Niger Delta must stop (table 11). In this table, Nigeria was flaring the highest percentage of gross production of gas in 1991.

Table 11: Flaring of Natural Gas in major oil producing countries Country (% of gross production in 1991)

USA	0.6
Holland	0.0
Britain	4.3
Ex-USSR	1.5
Mexico	5.0
OPEC Countries	
Nigeria	76.0
Libya	21.0
Saudi Arabia	20.0
Iran	19.0
Algeria	4.0
OPEC Total	18.0
World Total	4.8

Source: Escravos Staff Appraisal Report, 1993.
Production of associated and non-associated gas

Nigeria occupies the 43rd position in the world's list of emitters as her annual carbon footprint is 100 million metric tones-**top on Black Economy list**! Nigeria has not been able to harness her natural God-given resources (sun, wind, water (hydroelectric power) to power the Green Economy. The consequences are poverty, disease and lack of economic growth. However, the amount of gas flared in Nigeria has decreased in recent years. It is difficult to get accurate figures.

POLLUTION

The Physiological Response of Animals to Toxic Materials

Pollution which is the introduction of contaminants into the environment has been a menace in Nigeria as oil exploration and pipeline vandalization have continued to cause pollution of our environment. Pollution can also be described as the human alteration of chemical or physical characteristics of the environment to a degree that is harmful to living organisms.

Contaminants can have adverse effects on the entire ecosystems, making life difficult for plants, animals and humans, eg. Sea turtles can confuse plastic bags for jelly fish and choke to death with it. Fish can be killed by oil spills into rivers or oceans, when oxygen is denied them as oil covers the surface of the water. Wild life population suffers losses or even extinction due to pollution. Birds get coated with oil and lose their feathers.

The toxicity of hydrocarbons is indirectly proportional to the viscosity of the agents. Products with high viscosity, for example: greases and oils have limited toxicity. The toxic effect of pollution on animals varies depending on the route of entry. It could be through the respiratory surfaces (lungs, gills, trachea etc); through ingestion (food, water etc) or through the general body surface (skin). Toxicants through the respiratory system results in a higher toxicity. Absorption through the body surface is slower as terrestrial and aquatic animals often have external body surfaces which are impervious to most toxicants. Toxicants through ingestion must pass through the alimentary canal before absorption and the chemical nature of the pollutant may be altered during the process.

Elimination of toxicants may be achieved through excretion, transformation into other less toxic forms in a process known as **sequestration** in metabolically non active tissues. The elimination rate has to be higher than the uptake rate to achieve no net accumulation in a biological system. Sequestration is a protective mechanism involving the storage of toxicants, in inert tissues such as fat, teeth, hair and horns to remove the toxicants from the general circulation.

Toxicants may include biological responses at different levels of biological organization. At the **molecular level**, toxicants may bind to DNA, alter its structure and initiate a cascade of effects including cancer development. At the **biochemical level**, toxicants may directly induce or suppress enzymes activities, alter essential behavioural pathways and impair normal metabolism by competing with metabolites for active binding sites. When molecular and biochemical level responses cannot be compensated, molecular and biochemical changes

may progress to **physiological changes** (e.g. changes in heart beat, hormone levels, respiration, osmoregulation etc). Major physiological disturbances by toxicants may result in behavioural changes (e.g. Feeding, locomotion, response to light and other environmental factors).

Pollution in Nigeria

Contamination of the environment in Nigeria is caused by mainly human activities. Fortunately, natural disasters are minimal in Nigeria except for rain storms which may damage systems, causing gully erosions in areas susceptible to it.

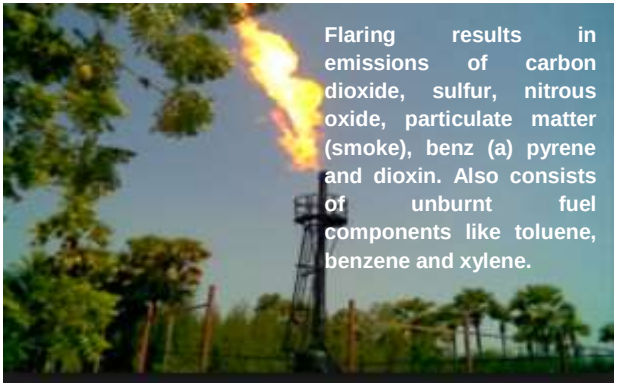


Plate 16: Gas flaring at a flow station in Nigeria

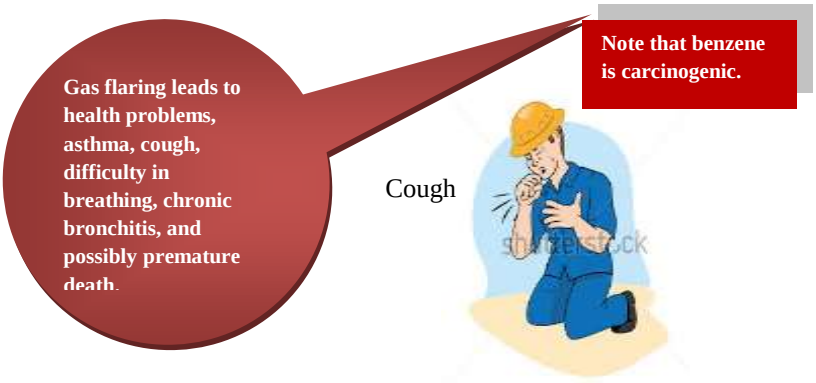


Figure 4: Health problems resulting from Gas flaring.

There are four major types of environmental pollution: Air Pollution, Land Pollution, Water Pollution and Noise Pollution. Their effects are detrimental to health (table 12)

Table 12: Types of pollution, sources, effects and control.

TYPE OF POLLUTION	SOURCE	EFFECT	CONTROL
Air Pollution (Pollution that affects air around us)	- Burning from vehicle exhaust -Coal mining and cement factory -Industrial processes e.g. Electric plants that use radioactive substances - Burning of fuel cars, other combustion engines and some industrial processes. - Gas flaring by oil and Gas companies.	- Causes suffocation - Causes irritation of eyes - Irritates respiratory System - Reduces visibility	-Chemical waste to be discharged into air through fume chambers -Industries should not be near residential areas -Controlled complete combustion of fuel is required possibly in internal combustion engines. - Drive electric cars if possible.
Land Pollution (Pollution that affects land)	- Refuse from homes, offices, industries and markets. - Sewage - Chemical waste from industries - Oil drilling (oil spillage)	- Causes offensive odour when decayed - Can cause respiratory disorder. - Destroys plants and animals - Prevents proper use of land	-Proper disposal of refuse required. -Sewage should be treated before disposal - MSW should be disposed of properly.
Water Pollution (Pollution that affects water)	- Sewage from these Sewage city system; - Chemical wastes from Industries - Human and Animal wastes (excreta etc); - Oil spillage - Pesticide washed by rain water from farms	- Makes water unfit for drinking; - Destroys aquatic plants and animals; - Produces unpleasant odours - Serves as medium to grow pathogens eg. Diaorrhea, cholera, hepatitis, typhoid disease etc.	-Proper sewage disposal system; - Avoiding of dumping of refuse into rivers; -Industrial waste must be monitored; -Industries should not be sited near residential areas.
Noise Pollution	- Noise from factories - Noise from thunder (120dB) - Aeroplane	- Causes loss of hearing or deafness - Normal range of intensity of sound is 60dB – above is	- Reduction of noise from loudspeaker; - Railway and aircraft should be sited away from

	and car noise - Generator noise - Rock music concert (110dB) - Jet aircraft take off (125 dB) - Chain saw noise (80dB) - Rocket engine noise (180 dB)*Key dB = decibel	uncomfortable; -Can cause emotional disorder; - Can cause high blood pressure.	residential areas; - Soundproof generators should be used and - Installation of sound proof machines in industries.

Adapted from ngenvirons.blogspot.com

Pollution definitely is caused in Nigeria by human activities and these activities can be controlled by humans themselves (subduers) in a bid to make the environment conducive for living organisms (plants, animals and humans).

Gas Flaring:
This is the burning of natural gas that is associated with crude oil when it is pumped up from the ground. (plate 16) It is a main source of air pollution in Nigeria. Nigeria flares 17.2 billion m^3 of natural gas per year in conjunction with the exploration of crude oil in the Niger Delta. Gas flaring contributes the main green house gas, carbon dioxide. Legislative bureaucracy has not allowed the passing into Law of the Petroleum Industry Bill (PIB) which would have stopped flaring by 31st December, 2012. We are now in 2015. Gas flaring leads to health problems, like asthma, cough, difficulty in breathing, chronic bronchitis and possibly premature death. (Fig. 4)

Oil Spillage:
Oil spillage is a menace in areas of exploration of oil. There are majorly two causes of spillages: Operational and Induced causes.

Operational spillages include **equipment failure** and **human error**.

Plate 17: UNEP experts during a reconnaissance exercise (**Source:** UNEP report on Ogoniland)

Equipment Failure:
Equipment failure can be addressed if there is sustainable maintenance culture of the pipelines and overall equipment.

Equipment failure could include tanker accidents, accidental spillage from well blowouts and pipeline leakage. Failure of control systems also causes spillages. Human Error may include lack or wrong interpretation of pressure tests in the system. If leaks are not spotted early and valves and bolts not properly set on the pipeline and well heads, they may cause large spills with time. Large spills of course means extensive pollution (Plates 17 and 18). Lateral pollution is easier to handle, but vertical pollution is more difficult to control as it percolates into the soil, polluting the aquifer.

NNPC trunk line spill (K-Dere, Gokana LGA)

Plate 18: NNPC trunk line spill (**Source:** UNEP report on Ogoniland)

Induced Spillage:

Artisanal refining bunkering, sabotage and encroachment on right of way e.g., building on pipeline pathways have become common. Artisanal crude refining (plate 19) in the Niger Delta has caused serious problems which include environmental, land and water pollution with financial implications. Last year, 2014, Nigeria was said to lose $35 million daily from oil theft. It is on record that about 7% of Nigerian Crude oil is stolen daily, quantified to about 150,000 barrels a day. Sabotage has been common, whereby pipes are opened or bolts loosened to siphon oil from the pipes for illegal refining if it is crude, and outright sale, if refined product. Interestingly, the market seems to be available all the year round encouraging the illegal acts.

Fire outbreaks on sites of bunkering are common and sometimes cause death of perpetrators. An example of fire outbreak on oil facilities took place on SPDC facility at Afam well 16, well head on the 17th of May 2004 following an oil bunkering operation by unknown persons while I was Hon. Commissioner of Environment. The fire was put out on the 5th of June 2004. The ugly incident claimed the lives of 37 youths from Oyigbo and neighbouring communities suspected to be crude oil

bunkerers. More than 100 square meters of adjoining land/vegetation were negatively impacted by the fire. Combined efforts of local fire fighters from SPDC, NAOC, EPNL and Rivers State Government fire service could not put out the fire. An International well control /fire experts (Boots & Coots) were flown from Texas (USA) to extinguish the fire. The major impacts experienced by the communities included, but not limited to, intense heat, vibration, hydrocarbon smoke /soot (containing polycyclic aromatic hydrocarbon), destruction of vegetation, human and animal lives, etc. The hazards of oil bunkering are enormous and must not be indulged in. Humans (subduers) continue to degrade the environment out of greed. An example of such fire is in plate 20.

Plate 19: Remnants of the artisanal refinery
(**Source:** UNEP report on Ogoniland)

Plate 20: Fire on a pipeline right of way
(**Source:** UNEP report on Ogoniland)

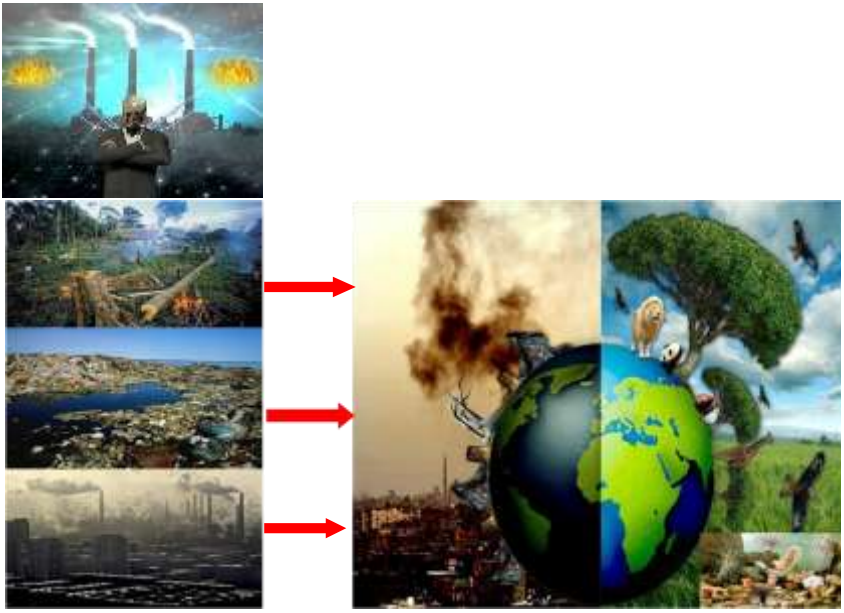


Figure 5: Negative subduing of the environment by humans

Observe the contrast of the effects of pollution, deforestation and immense generation of waste on the planet, earth, and the green condition with animals and plants thriving on the part of the planet not so polluted (Fig. 5).

STUDIES ON THE BIOTIC ENVIRONMENT

BACKGROUND

Toxinology is the study of toxins in natural products (plants, animals, microorganisms), as opposed to toxicology, the study of adverse effects of chemical substances. Toxinology has also been defined as the science of toxic substances produced by or accumulated in living organisms, their properties and their biological significance for the organisms involved (Meier and White 1995).

This second definition is very relevant to this text for the fact that the biological significance of the toxins in the organisms is paramount. The

question is; what is the importance of the toxic ingredient in the toxin for the animal or plant?

Poisoning by plants and animals and envenomation by animals have become tools in clinical management of poisons and venoms. The investigations in the field have led to production of anti-venoms to these toxins (positive subduing), and cure for diseases (eg some have anti-cancer agents), (positive subduing).

It is unfortunate that apart from the fact that toxic plants and animals use the toxins in them to ward off intruders, protecting their territories as territorians, some humans have over the years, used them for deliberate self-harm (Fonseka *et al* 2002). These organisms would rather be left alone as already discussed. They try their best to adapt to their environment, but animals would spontaneously react if their immediate environment (territory) is perturbed.

In food poisons, and a few venoms, the component toxins are not produced by the plant or animal, but are synthesized by microorganisms and concentrated and used by the organism. Tetrodotoxin is an example, used by many poisonous animals and a few venomous animals. (see earlier text on definitions of venoms and poisons).

There have been several reviews and investigations on cnidarians (konya 1998), showing that some cnidarians can be both toxic and therapeutic, while others are toxic only, but in all, these organisms would prefer to be left alone. Predators attempting to molest or eat a poisonous animal or plant, will suffer adverse effects from toxins in the poison, varying from mild discomfort (eg tingling sensation of the lips) to sudden death in a few minutes. Venomous animals immediately inject their venoms through specialized apparatus as soon as they are perturbed. Death of the pertuber could ensue in minutes. Barnes (1967) reported that death occurred in less than 3 minutes following the stings of *Chironex flecker*i, the box jellyfish among sea bathers in Australia. A prominent example was the death of a celebrated naturalist, Steve Irwin the "crocodile hunter", who was killed by a Stingray.

Some sea anemones, *Tealia felina*, *Diadumene kameruniensis*, *Bunodosoma cavernata*, some plants from euphorbia family (*Elaephorbia drupifera* and *Euphorbia kamerunica* and the plant *Carica papaya*, were studied).

A. **THE SEA ANEMONE, *TEALIA FELINA***

Purification of *Tealia felina*

The Sea anemone, ***Tealia felina*** collected from the shores of Scotland, was studied in detail after step by step purification to produce a partially purified extract (Elliott *et al* 1986). Agarose gel was used in the purification of the crude to Extract I, and, Sephadex G100 used to obtain Extract II.

Blue B Affinity dye was used (a kit) for the purification to the next level producing Extract III. This resultant fraction was passed through Carboxymethyl ion exchange column to produce Extract IV which changed in physical state (Fig. 6).

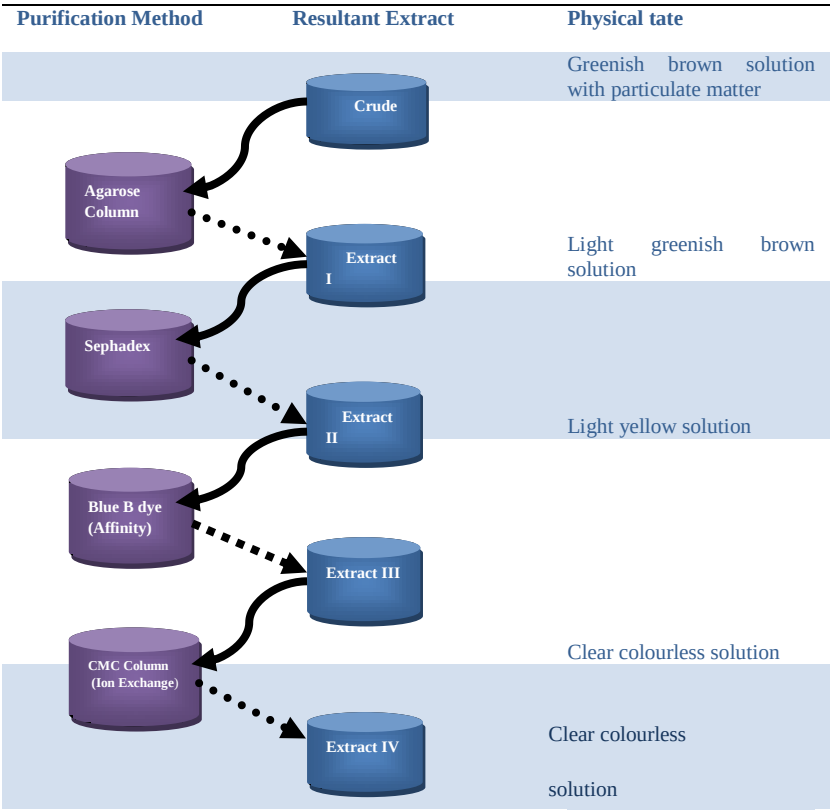


Fig. 6: Changes in physical state of Tealia felina extract during purification. Konya (1984)

Extract IV was designated, Tealiatoxin, which had a molecular weight of 7,800 with a pI of 9.

Activities

Tealiatoxin blocked histamine-induced contractions of the guinea pig ileum, which was the standard assay method used in the process of the purification. (Aldeen *et al* (1981) (Fig. 7) to identify the active fraction.

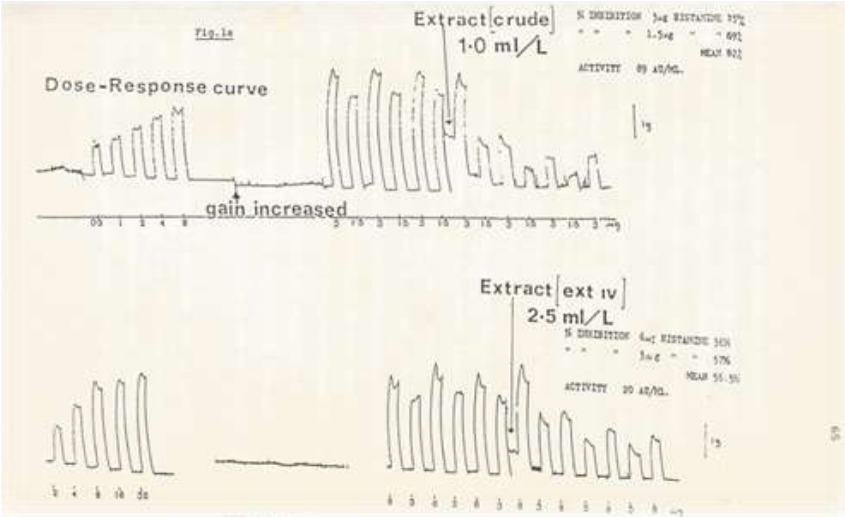


Fig. 7: Typical tracing of the response of *Tealia felina* extract on histamine induced contraction of the guinea pig ileum. (Konya 1984)

Haemolysis of human blood; also cardiotoxic actions (Elliott and Konya 1984a), vasoconstriction, haemolysis (Elliott and Konya (1984b) and cardiotoxicity were common features of several sea anemone toxins (Beress *et al* 1975; Mebs *et al* 1983; Konya and Davies 1990). Most cnidarian toxins are thermolabile. It is therefore not surprising that their haemolytic activities are pH and temperature – dependent.

Occurrence of haemolysis in the bloodsteam of mammals and humans (biotic environment) is obviously disastrous. When haemolysis of erythrocytes occurs in the blood stream, the haemoglobin liberated into the plasma forms a complex with haptoglobin, an α2-globulin. The haptoglobin – haemoglobin complex is taken up slowly in the liver, probably by the reticuloendothelial cells. If the haemolysis is severe and the haptoglobin becomes saturated, haemoglobin is excreted into the urine.

A second consequence of haemolysis in the blood stream is that the erythocyle debris after haemolysis has weak thromboplastic activity

and may promote formation of emboli, which result in the depletion of platelets, thereby causing a haemorrhagic diathesis.

The third consequence of haemolysis is the inducement of hyperbilirubinaemia and jaundice in the victim, when the rate of production of bilirubin from the protoporphyrin moiety of haemoglobin exceeds the rate at which it can be metabolized, by the liver.

Other consequences include excess K^+ in the blood stream. This problem is however, ameliorated by the redistribution of the K^+ into the cells and excretion by the kidney. The mechanism of haemolysis by cnidarian toxins is still not very clear. However one cannot exclude an interaction with the red cell membrane disrupting its integrity. It is possible that the toxin-induced haemolysis involves the formation of stable holes in the red cell membrane as opposed to the transient holes formed during osmotic haemolysis. Further Research will unravel this.

Palytoxin completely inhibited the growth of Ehrlich Ascites tumour in100% of mice treated with very low doses, Quinn *et al* (1974). However *Tealia felina* did not (Konya, 1987). ***Tealia felina*** (Extract IV) was found to produce marked bradycardia and arrhythmias in the rat in vivo. In the Langendoff rat heart preparation perfused at constant pressure, extract IV reduced the force of contraction. When the preparation was perfused at constant flow rate, the extract increased the coronary circulation resistance (Konya and Elliott 1996).

It was concluded that the bradycardia produced in vivo, and in preparations perfused in vitro, at constant pressure was probably secondary to the coronary vasospasm produced, which could contribute to the cardiotoxcity of the extract.

The various attempts to reverse the vasoconstriction with vasodilator drugs failed. This is a possible consequence of the anatomy of the coronary circulation in which there are parallel circuits. Intense vasoconstriction in the endocardial vessels could cause flow to be shunted through a parallel epicardial circuit and thus prolonged washing

or antagonist would not be effective because they would not reach the vasoconstrictor segment.

It was concluded that ***Tealia felina*** had negative inotropic (depth of heart beat) and chronotropic (rate of heart beat) effects on the heart of the rat in vitro and substantially increased the resistance to perfusion. Coronary vasoconstriction is suggested as the main factor that account for the cardiotoxicity of the toxin in vivo.

Partially purified extract (extract iv) of ***Tealia felina*** had a vasoconstrictor effect on the mesenteric vessels of rat (Fig. 8)

The potent constriction by the extract was closely related. The response on the mesenteric vessels was slow and long-lasting, in contrast to the brief and short-lasting response of nor adrenaline. Known blockers had no effect on the extract iv-induced vasoconstrictor responses. Indomethacin (60µg/ml) blocked the responses to the extract. However, Indomethacin is not a specific blocker.

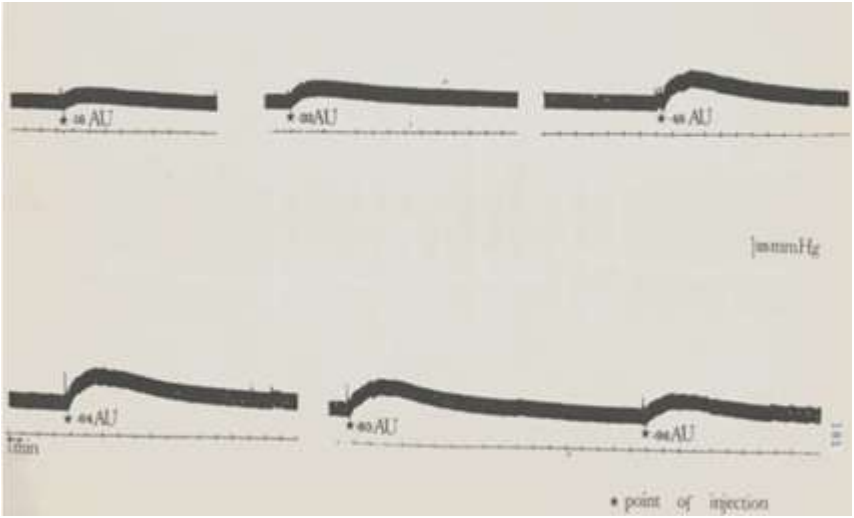


Fig. 8: Tracings of *Tealia felina* responses on the mesenteric vessels of rats (dose-responsiveness)

The vasoconstrictor action of the extract was more likely to be implicated in the rise in the blood pressure of rats caused by the extract and its toxicity in the heart of guinea pigs (Konya and Elliott, 1996). The vasoconstrictor action of the extract on the mesenteric Vessels was found to be reversible. Earlier work on the extract showed that its molecular weight was 7,800 (Konya 1984; Elliott *et al* 1986). Its size therefore may afford it move freely in and out of the mesenteric tissue, if there is no limitation.

Extract iv from the sea anemone ***Tealia felina*** caused a transient fall in blood pressure followed by concentration of the active extract to 44.93AU/kg! The rise in arterial pressure following injection of Extract iv was accompanied by marked decrease in pulse pressure.

The rise was not accompanied by a rise in heart rate. The rise preceded arrhythmia and bradycardia. Extract iv also disrupted the respiration of the rats but death of the rats was not due to either the pressor effect or the effect on respiration, Cardiotoxcicity or constriction of the coronary vessels was more likely the cause of death of the animal as arrhythmia always preceded death. Paralysis of the respiratory muscles was an unlikely cause of death, since the amplitude of the contraction of the gastrocnemius muscle evoked by stimulation of the sciatic nerve did not disappear as soon as the animal died. All above properties are for defense of its territory if perturbed.

THE SEA ANEMONE*, DIADUMENE KAMERUNIENSIS*

The sea anemone, ***Diadumene kameruniensis*** obtained from twigs of Avicenia (White mangrove) of Eagle Island, Port Harcourt, induced haemolysis in human erythrocytes. The percentage of haemolysis increased with concentration (protein content).

The study also showed that the crude extract was themolabile beyond 60^{o}c, and completely denatured at 100^{o}c (Konya and Davies 1990), indicating it is proteinaceous and activity is connected with the protein content.

This sea anemone was observed to cause irritations which left dermonecrotic scars on human skin. The scars disappeared after a few days. Whether this irritant was the same as the substance causing haemolysis was not certain. The ability of the extract to haemolyse human erythrocytes might be significant to the anemones as defensive chemicals although humans are not the natural preys of sea anemones. This is a warning that our seashores are not always safe for humans – the irritant may be protecting the territory of the anemone. (territorian)

THE SEA ANEMONE – *BUNODOSOMA CAVERNATA*

Crude extract was prepared from the sea anemone, ***Bunodosoma cavernata,*** collected from the creeks of Opuaduakiri, fishing port close to Bonny town, about 5km from the Atlantic ocean.

The crude extract showed a dose-mortality relationship which was sigmoidal. The extract dose-dependently inhibited histamine – induced contraction of the ileum.

The extract also haemolysed blood, and the response was both temperature and pH - dependent to a peak of 60^{o}c. The crude extract definitely was shown to be highly toxic and very unstable in storage. (Eno *et al*,1998). Those toxic properties are for the protection of the territories of the sea anemone and also for prey capture.

The crude extract was shown to haemolyse blood. Low doses of the extract did not produce any behavioural changes in the animals whereas high doses (50-65 µg protein/kg) produced some noticeable pathological conditions such as severe lethargy, ataxia, laboured respiration and convulsive spasms in some animals, about 30min post injection. In vivo time-dependent haemolysis was observed in the mice. In vitro tests also showed the extract haemolysed enythrocytes. These actions were pH and temperature – dependent. A haemolytic factor definitely is contained in the extract which it possibly used to protect its territory (Eno *et al* 1999).

The crude extract antagonized histamine-induced contractions of the ileum in a dose-related fashion, and shifted the histamine dose-response

curve to the right. Doubling the dose of histamine failed to surmount the antagonism. It was concluded that the extract contained an antihistaminic substance (Eno *et al*, 2001).

Intradermal (id) injection (injection under the skin) of the sea anemone ***Bunodosoma cavernata*** extract caused dermonecrosis in the guinea pigs, rats and rabbits. In each case, a tumour up to 1.5cm emerged at the site of injection which burst resulting in lesions. A wheal appeared around the site of injection before emergence of the tumour. Signs of paralysis appeared in the animals which eventually died; 100% death was caused by high doses (2.5mg and 5mg protein).

The formation of tumours and eventual lesions on the skin occurred in those animals that survived the day of injection. A central action of the extract were most likely; twitching and paralysis in the animals were observed with oozing of gelatinous substance from the eyes of the guinea pigs.

In humans, cnidarians' sting give rise to whealing with a fringing flare of erythema. Onset of symptoms was marked by intense pain followed in some cases by weakness, nausea, headache, pain in the large muscle masses, increased perspiration, vertigo, respiratory distress and cyanosis. Collapse, if it occurred might have been sudden or preceded by violent twitching. Death ensued within minutes. The animals succeed in killing intruders in their environment. If perturbed by stinging them; using their natural apparatus the nematocysts. They are indeed territorians.

The effects of the extract on haematogenous cells both in vivo and in vitro were studied. A low dose, 120µg protein/kg of the extract was injected into rats at zero time, and blood samples collected at 30min intervals for 2 hours and at 12 hours. (Eno *et al*, 2000). Human blood was used for the in vitro experiments and the % haemolysis assessed.

Results showed that ***Bunodosoma cavernata*** extract which contained 0.52mg protein/ml. had an LD_{50} of about 40µg protein/kg mice i.p. (intraperitoneally) High doses (50-65µg protein/kg) produced noticeable pathological conditions. Severe lethargy, ataxic, laboured

respiration and convulsive spasms were observed in some animals, 30 minutes post-injection. Significant reduction in erythrocytes count was revealed.

The crude extract also antagonized histamine-induced contractions of the ileum in a dose-related fashion. The antagonism was not surmounted even when the histamine was doubled. (Eno *et al*,2001). The crude when injected into the rat, caused only transient hypotension with higher doses of the extract (10-20µg protein/kg iv). The transient hypotension was accompanied by a dose-dependent increase in blood pressure. Doses of the extract about 20µg protein/kg iv produced a decrease in pulse rate and an increase in pulse pressure (Eno *et al*, 2001). With the hypotension caused by the extract, contact with it or sting will cause harm to the victim which could result in death. I have pleasure to announce that my collections of the Sea anemones, *Diadumene kameruniensis* from Eagle Island Port Harcourt and *Bunodosoma cavernata* from Bonny Island are part of items displayed at the zoology department of the Natural History Museum London since the 1980s till date. This obviously has brought to the limelight the research and species of cnidarians available in Rivers state, Nigeria to the international community.

SOME PLANTS WERE ALSO STUDIED

Both in vitro and in vivo studies revealed *Elaeophorbia drupifera* had a haemolytic factor as it caused haemolysis in rat. It was suggested that ingestion of the extract for medicinal purposes might afford the extract fast metabolism of the haemolytic factor in vivo.

Humans searching the soul of the environment use this plant in Africa for medicinal purposes. However, the purpose of the negative factors in the plant could be suggested to be beneficial to the plants. (Eno *et al* 1999)

A crude ethanol extract of unripened fruit of ***Carica papaya*** (paw-paw) showed a dose-mortality relationship in mice administered intraperitoneally. In male albino Wistar rats, the extract produced a significant depression of mean arterial blood pressure. It was concluded that the fruit juice probably contained antihypertensive agents(s). Still

searching the soul of the environment, this ordinary pawpaw has medicinal properties which humans can actually benefit from. Many are now aware of this property of paw paw as herbal medicine thrives in Nigeria.

The effect of *Euphorbia kamerunica* latex on the blood of albino rat (*Rattus Novergicus*) was observed. Results showed that there was a decline in all the blood parameters in the blood sample with latex as compared with blood without the latex as follows:

Table 13: Effect of E.kamerunica latex an blood parameters.

Blood Component	Without Latex	With Latex
Packed Cell Volume (PCV) (%)	17.0	9.0
Haemoglobin (g/dl)	5.10	3.2
Red Blood Cell (RBC)	3.70×10^{12}	2.1×10^{9}
White Blood Cells	4.20×10^{9}	3.2×10^{7}
Neutrophils	20.0	15.0

It was concluded that *E. kamerunica* had disruptive toxic effects on blood parameters. (table 13) It is reported widely that plants of the *Euphorbia* genus also have therapeutic properties. It is therefore necessary to handle the latex carefully because it also had detrimental effects, the dose would determine the effect.
(Konya *et al*. 2013)

STUDIES ON THE ABIOTIC ENVIRONMENT

WASTE TO WEALTH

Two Waste to Wealth projects were established in Rivers State while I was at the Ministry of Environment as Hon. Commissioner. One was a Waste to Compost project, and the other was a Scrap to Wealth.

WASTE TO COMPOST

A Company known as CAMBI BONO Nigeria Limited with its foreign counterparts (partner) called Masions "Masias Recycling S.L. of Spain made available their expertise. The technology produces organic Fertilizers and Biogas, Methane and Carbon dioxide in large quantities

(Anaerobic Digestion). Within two digestors, the substrate is fermented sequentially by microorganisms which convert the organics within the waste to mainly biogas and carbon dioxide.

The raw materials needed are different classes of refuse/compost generated in Port Harcourt metropolis. Forty thousand tons of organic materials are expected to be converted, annually.

The Foundation stone of the project was laid by the then Governor of Rivers State Sir Dr Peter Odili at Mgbabo-Esawu Rumu-Wogozo in Rumuokwurusi, Obio/Akpor Local Government Area. The project was established in recognition of the fact that globally, WHAT IS WASTE IN ONE SECTOR IS RAW MATERIAL IN ANOTHER.

Benefits of the Project
Production of compost (manure) for the improvement of the fertility and quality of soil in Agriculture.

Remediation of polluted sites
Production of biogas as bye-product which would be used to provide energy for treatment plants.

Scrap to Wealth
This project was approved under my watch when I was Hon. Commissioner for Environment in 2007. It was a project between the Rivers State Government and SERAM UK LTD and their Nigerian partner, DELIGHT NIGERIA LTD.

It was conceived by the fact that the Nigerian National Petroleum Corporation was desirous of the establishment of a local steel pipe manufacturing facility to meet the growing demand for the commodity. NNPC had stated in The Punch of 10th April 2007, that there was then no local capacity to meet the demand of 1.15 million tones of steel pipes required by the oil and gas industry. The NNPC News, an in-house publication of the organization, quoted the Group Managing Director, that "Steel pipes and cement, represented a major component of the $25bn that was to be spent on procurement by NNPC.

We decided to buy into it, and made efforts to establish this Scrap to Wealth project in Rivers State. The project was subsequently sited at Kira in Tai Local Government Area.

CHARACTERIZATION OF WASTES AND THEIR RECYCLING POTENTIALS: A CASE STUDY OF EAST-WEST ROAD, PORT HARCOURT.

Eight receptacles of wastes along the Port Harcourt axis of East-West Road were characterized and their recycling potentials investigated. Common waste discovered at these receptacles were cartons, papers, animal bones, plastics, aluminum plates, nylon bags, ceramic materials, vegetables, medical wastes, old and damaged electronics, old computers and photocopying machines etc. Numerous scavengers found on the sites were interviewed to determine the preferred wastes in Port Harcourt and to indicate the destination of sorted items. Indeed Aba seemed to be the ultimate destination since almost all items could be recycled and reused there. Waste recycling involves a process of characterization, sorting, grading, reduction and re-use (Bonnie 2006). Experienced scavengers are skilled, to sort items in demand.

Plastic recycling suffers poor patronage because it is cheaper to produce a new plastic product than to recycle used ones while glass aluminum, and paper recycling have comparative advantage over the production of fresh ones. Aluminum and glass can be recycled indefinitely producing economic and environmental resources. Heavy bags of sorted aluminum were seen being carried by scavengers from the receptacles. In a publication in the May 7, 2012 of the Economist, it was reported that recycling of aluminum requires only 5% of the energy used to make new aluminum products and can be recycled indefinitely.

It was concluded that wastes at receptacles from Choba bridge to Rumukwurushi Market had great recycling potentials which should be tapped. Waste sorting was recommended in Rivers State at all levels, from households to receptacles as is done in developed countries. Poverty will consequently be reduced if recycling is taken seriously.

USE OF PERSONAL PROTECTIVE EQUIPMENT (PPE)

Occupational hazards are imminent in the business of refuse management. The use of Personal Protective Equipment (PPE) is therefore mandatory in refuse collection and disposal. The study sought to evaluate the compliance level in the use of PPE among

workers of five refuse disposal companies in Port Harcourt Metropolis, Nigeria. Two sets of workers were randomly selected; the senior staff and field workers of the five companies. Three senior staff members from each of the companies were selected and a survey using questionnaire was conducted among them for a period of one week to evaluate their knowledge and opinion on PPE. Field workers were monitored on a daily basis to see their compliance on the use of PPE for a period of four weeks. Refuse collectors are at high risk of fatal accidents, confirmed by USA Bureau of Labour statistics as earlier enumerated under the world refuse day section.

Only 28% compliance by staff was observed and 72% non-compliance (Konya *et al* 2013). This means that the workers were not wearing personal personal protective equipment (PPE) which is very important in the waste industry. Accidents abound among workers frequently and wearing PPE averts these. Moreover, Refuse Collection disposal is one of the riskiest/deadliest jobs. (See earlier text).

ASSESSMENT OF E-WASTE STATUS IN PORT HARCOURT CITY IN RIVER STATE AND ITS ENVIRONS.

Waste Electrical and Electronic Equipment (WEEE) popularly known as e-waste has fast become one of the major sources of contamination in the environment that adversely affect humans. The WEEE typically consists of discarded TV sets, refrigerators, microwave ovens, mobile phones, computers and accessories, recordable electronics such as DVDs, VCRs, tape recorder, radio and other audios visual equipment.

Table 14: Typical WEEE items

Item	Weight(kg)	Typical lifespan (Yrs.)
Computers	25	3
Facsimile machine	3	5
High-fidelity system	10	10
Mobile telephone	0.1	2
Electronic games	3	5
Photocopier	60	8
Radio	2	10
Television	30	5
Video recorder and DVD player	5	5
Electricals		
Air conditioning unit	55	12
Dish washer	50	10
Electric cooker	60	10
Electric heaters	5	20
Food mixer	1	5
Freezer	35	10
Hair dryer	1	10
Iron	1	10
Kettle	1	3
Microwave	15	7
Refrigerator	35	10
Telephone	1	5
Toaster	1	5
Tumble dryer	35	10
Vacuum cleaner	10	10
Washing machine	60	10

Source: (Betts, 2008; Cobbing, 2008; Li *et al*., 2009)

Discarded electrical and electronic goods contain a range of toxic materials such as furans, dioxins, polycyclic aromatic hydrocarbons (PAHs), polyhalogenated aromatic hydrocarbons (PHAHs), hydrogen chloride and heavy metals (see table 15). These toxic materials require special handling prior to disposal and are difficult to recycle safely with profit.

The current status of e-waste in Port Harcourt City and its environs was assessed with a view to providing scientific data necessary for an integrated and sustainable e-waste management in the catchment area.

Table 15: Typical contaminats in e-waste and their concentrations in mg/Kg

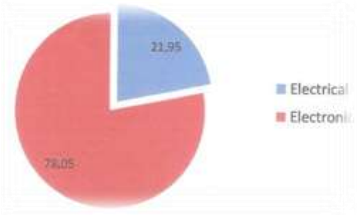
Contaminant	Relationship with e-waste	Typical e-waste concentration (mg/kg)
Polybrominated diphenyl ethers (PBDEs)	Flame retardants	
Polybrominated diphenyls (PBBs)		
Tetrabromobisphenol-A (YBBPA)		
Polychlorinated biphenyls (PCB)	Condensers, transformers	14, 280
Chlorofluorocarbon (CFC)	Cooling units, insulation foam	
Polycyclic aromatic hydrocarbons (PAHs)	Product of combustion	
Polyhalogenated aromatic hydrocarbons (PHAHs)	Product of low-temperature combustion	
Polychlorinated dibenzo-p-dioxins (PCDDs)	Product of low-temperature combustion of PVCs and other plastics	
Polychlorinated dibenzofurans (PCDFs)		
Americium (Am)	Smoke detectors	
Antimony	Flame retardants, plastics (Ernst *et al*.,) 2003	1, 700
Arsenic (As)	Doping material for Si	
Barium (Ba)	Getters in cathode ray tubes (CRTs)	
Beryllium (Be)	Silicon-controlled rectifiers	
Cadmium (Cd)	Batteries, tonners, plastics	180
Chromium (Cr)	Data tapes and floppy disks	9,900
Copper (Cu)	Wiring	41,000
Gallium (Ga)	semiconductors	
Indium (In)	Solder, LCD displays	
Lead (Pb)	CRTs, batteries (Kang and Schoenung, (2005))	29,000
Lithium (Li)	batteries	
Mercury (Hg)	Fluorescent lamps, batteries, switches	0.68
Nickel (Ni)	Batteries	10,300
Selenium (Se)	Rectifiers	
Silver (Ag)	Wiring. Switches	
Tin (Sn)	Solder, LCD screens (Kang and Schoenung, 2005)	2,400
Zinc (Zn) Rare Earth metals	CRT screens	5,100

Adapted from (e-waste, 2009)

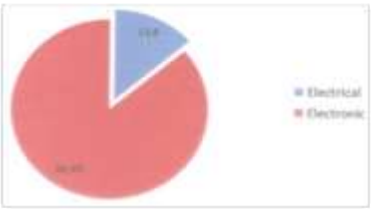
Table outlays contaminants in e-waste and their concentrations.

In the study two Local Government Areas, Port Harcourt and Obio/Akpor were selected because of the socio-economic activities, that thrive in them.

Fig. 9: Rivers State showing all the LGAs with the study sites in red circles



Percentage composition of the two major categories of WEEE in Obio/Akpor LGA



Percentage composition of the two major categories of WEEE in Obio/Akpor LGA

Fig. 10: Assessment of e-waste status in Port Harcourt city and its environs

A summary of % composition of the Electrical and Electronic (two main categories of WEEE) in the two LGAs were plotted as shown in the pie charts (see Fig. 9). Indeed Obio/Akpor recorded more electrical

WEEE (21.95%) than Port Harcourt LGA (13.5%). The reverse is the case for electronics. Electronic equipment dominated all the sampling locations ranging from 71.4% at Rumuokoro in Obio/Akpor LGA to 91.5% at Diobu in Port Harcourt LGA.

For dumpsite locations, Rumuokoro, Trans Amadi, Eneka, Wimpey were selected in Obio/Akpor LGA and Elekahia, GRA, Diobu, Main township for Port Harcourt LGA.

In Obio/Akpor LGA

Wimpey	Mean % composition Electrical devices	Mean % Composition of Electronic devices
Trans Amadi	25.4	85.7%
Eneka	28.7%	73.1%
Rumuokoro	19.2%	80.1%

Eneka and Trans Amadi are industrial areas with high probability of discarding electrical equipment, (welding machines electrical lamps, soldering gun, fridges, freezers, fans, and general garage waste, hence the result obtained. Wimpey is a residential settlement and more likely to dispose of electronic gadgets (DVDs, VCR, radios, Televisions, cameras. Rumuokoro had a fairly larger ICTC commerce than Wimpey. More computers were recorded at its sampling site.

In Port Harcourt LGA

Mean % composition Electrical devices		Mean % Composition of Electronic devices
Diobu	8.8%	91.2%
Elekahia	12.5%	85.0%
Port Harcourt Main	18.5%	82.5%
GRA	13.0%	80.5%

Diobu has a dedicated dumpsite at Iloabuchi for Electronic gadgets (TV sets, Circuit Boards, DVDs, VCR, Radio and audio usual devices. This

is why Diobu obviously had more discarded Electronic devices than Elekahia. GRA and Main Township.

Generally, more electrical devices were found on dumpsites of Industrial areas, Eneka and Trans Amadi in Obio/Akpor LGA. In Port Harcourt LGA, Port Harcourt main recorded the highest % of electrical, possibly because of its transformation from mainly old colonial households to renovated ones. Moreover, welding and mechanic shops predominate in this area.

Organic waste, polyethylene and paper are the leading municipal solid waste components in the two LGAs. E-waste require proper disposal as these items have components that pollute the environment (Table 15).

CONCLUSION

Vice Chancellor Sir, I wish to conclude by informing us that the sea anemone studies show survival strategies of territorians which are for defense, predation and territoriality. The waste management studies investigated components of the environment that require attention. Human neglect of the environment is pathetic from the results obtained. The work is my humble response to human's short-sightedness, lack of appreciation of nature's beauty, and lack of good attitude to environmental matters.

Many animals are venomous. Some are poisonous. We must also know that some are neither venomous nor poisonous. Of those that are, only a comparatively small number of species are of any danger to humans. Those that are dangerous to humans are reluctant to bite or sting unless they are disturbed or their immediate environment interfered with, as they would far rather get on with living without humans. We must also note that most victims of venomous animals survive; only a few deaths are caused due to the fact that an attack is almost always very fast and the animal does not have time to inject an appreciable amount of venom. The response of the victim is dependent upon the nature of the toxin and the actual dose received by the victim. This dose and corresponding response equation has been known over centuries and the

basis for the quotation from the works of the 16th century physician, Paracelsus (1493-1541) (Plate 21):

> "What is there that is not a poison? All things are poison and nothing (is) without poison. Solely the dose determines that a thing is not a poison."

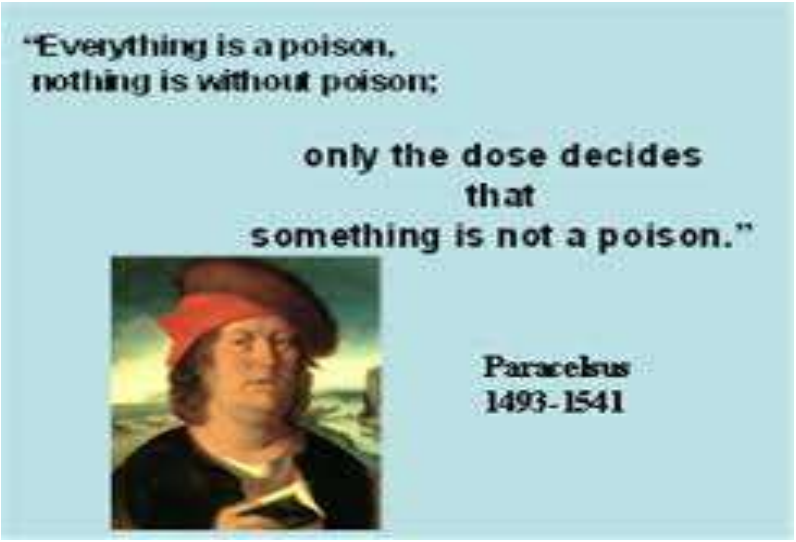


Plate 21: Paracelsus (1493-1541)

The dose of the toxin is also important for poisonous animals. A venom may have one or several functions in an animal's armament. It may play a role in offence, as in the capture and digestion of food, or may contribute to the animal's defense as in protection against predators or aggressors. It may also serve both functions. Most venoms used in an offensive posture are associated with the oral pole of the animal, obviously the most functional place for their delivery. Defensively designed venoms usually are associated with the aboral pole, as in stingrays, or with dermal tissues as in scorpion fishes and certain other fishes (Russel, 1965; Halstead, 1965) or the sea anemone (e.g. *Bunodosoma cavernata*). In poisonous animals, the poison or toxin may not play much role in the animal's offensive or defensive activities. The poison may be a product or by-product of metabolism or a product

passed along in the food chain. These are all mechanisms used to search the soul of the environment.''

Cleanliness is next to Godliness. A clean environment is one that guarantees a healthy workforce for optimal productivity. Conservation of the nation's health for development purposes is mandatory and treating ailments with the wealth meant for such development programmes must be discouraged.

Nigeria needs all the economic indices of a nation at this stage of the economic cycle to be properly harnessed through an institutional framework suitable for such development process.

Ecosystem management is an invitation to restorative action that promises a healthy future for the entire biotic enterprise. We need to narrow the gap between humans and nature for the latter to be protected. For example, tree felling is so rampant that there is hardly any rainforest in the Niger Delta area that has not been devastated in the search of the soul of the environment. We all know that trees play important roles even as "homes" for many animals and other plants. Lack of ecosystem management has threatened a number of animal species rendering them endangered. Developed countries are at the level of evaluating success, in their ecosystem management, and protection of biodiversity. At what level is Nigeria?

NESREA (National Environmental Standards and Regulations Enforcement Agency) has brought out National Guidelines for Environmental Audit in Nigeria which should be used to determine compliers and non-compliers of environmental laws. How many Nigerians are aware of these guidelines?

Humans have stressed the environment by using 25% more natural resources than the planet, earth, can sustain, resulting in pressure of direct threats on species and species habitats, depleting local species communities. The search for the soul of the environment by humans should not propel them to degrade the environment and perturb the peace of animals in their niches.

RECOMMENDATIONS

Vice Chancellor Sir, I have a few recommendations to make.

- Humans must learn to relate to animals reasonably, to avoid, provocation and eventual harm caused by the animals. They will prefer to be left alone. The toxins in them are mainly defensive and for capturing their prey, and humans are not their natural preys. Animals in their habitat need a place to hide, rest, move about, and mate. Humans feed on some animals, but those that are not for food for humans, should be allowed to perform above "rituals" unperturbed to forestall extinction. Even the animals that are for human food should be harvested selectively to avoid drastic reduction in their species population.

- Enlightenment and good sanitation education should be encouraged from kindergarten level through to primary and secondary levels in Nigeria such that cleanliness becomes a habit. For example environmental authorities should facilitate and enforce the sorting of waste at source. The use of different coloured bins is a measure that has facilitated effective waste management in industrialized countries.

- When children and adults alike can relate different colours to certain types of waste and are trained to dispose of waste according to its classification, the task of waste management will only be made that much easier. At present any efforts to segregate waste in Nigeria is largely administered at the dumpsite through the tedious efforts of 'scavengers'. Such a system is not only inefficient, it exposes the environment to unnecessary damage, not to mention the health of the scavengers. Furthermore, the sorting of waste at the source will not only add meaningful value to waste management institutions, it will also provide scope for comprehensive recycling measures and renewable energy technology in the future. **Environmental laws will not clean our environment, but good environmental habits, will. There must be attitudinal change.**

- An integrated multifaceted Waste Management Complex is required in Rivers State which will involve handling from haulage to

treatment and final disposal. Automated belt conveyors should be an integral part of the complex to minimize contact for health reasons.

- Nigeria is well documented as being the most populous black nation in the world with an estimated population of one hundred and seventy million. Rivers State alone is documented to have a population of approximately five million. It is therefore obvious that the population will come with large generation of waste.

- Recycling should be encouraged to avoid overtaxing of natural resources for fresh raw materials.

- The Federal Government should enforce its directive to oil and Gas Companies to stop flaring gas into the atmosphere. The goal post has been shifted many times as deadline for gas flaring which is a source of greenhouse gases. We understand Government and the companies are considering the cost. But is the cost more problematic than the negative impact it has on the citizens?

- Nigeria should **generate green jobs**, also known as green-collar jobs to help protect the ecosystems pointedly by Government (MDAs) and the Private sector.

- Green politics – a political ideology that aims for the creation of an ecologically sustainable society rooted in environmentalism, social liberalism, and grassroots democracy should be adopted in Nigeria. Politicians need to understand greenism to enable them implement when in positions of authority. The campaigns for the last election did not see politicians at any level discuss climate change as an issue that requires attention. There are varieties of Green parties in Europe. No such considerations and attention are found in Nigeria and yet subduing of the environment by humans is recklessly pursued.

- In agreement with the call for a Climate Change Commission in Nigeria, there is an urgent need to prioritize climate change in any

agenda being administered by the environment sector. Such a commission will attract skilled professionals thereby facilitating invaluable synergies between Nigeria and the rest of the world on environmental matters. Nigeria is already experiencing climate change.

- Phone masts should no longer be installed near living areas in view of the radiation emitted from it, and the consequent health hazards. Economic considerations have lured land and house owners to give up space to mobile phone service providers for installation of masts, due to lack of knowledge of health hazards associated with it.

- Diversification of the sources of energy in Nigeria should be embarked upon to reduce pollution and consequently reduce biodiversity loss. This should start with Government. Solar and wind power would suffice; without polluting the environment.

- A Centre for Toxicology and Waste Management should be established in the University of Port Harcourt as these aspects of environmental studies are currently on the front burner.

Thank you and God bless.

Professor (Mrs) Roseline S. Konya JP KJW
Professor of Animal and Environmental Biology
The Inaugural Lecturer
13th August, 2015

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CITATION ON

PROFESSOR (MRS) ROSELINE S. KONYA JP KJW
BSc (CNAA); MSc (LOUGHBOROUGH); PhD (BRUNEL)

Professor Roseline Sonayee Konya was born in Buan, Khana Local Government Area to the family of Mary and Gordon Duudee. Her father retired as a Chief Chemist from Bulk Oil Plant (BOP) Nig. Ltd, a division of United African Company (UAC). When her father named her, Sonayee, meaning "it is never too late", because his first marriage did not produce any child, he knew she was a special gift.

Professor S. Konya was married to an erudite Chartered Accountant/Banker, Barido Ababeenwi Konya of blessed memory who hailed from Kaani Babbe in the same Khana Local Government Area.

She attended Primary School in the then St Arthur's Anglican Primary School, Buan, from where she proceeded to Mercy Secondary School, Okigwe but was disrupted by the Nigerian Civil War. She continued her secondary education through 1968 to 1969 in Holy Rosary Secondary School, Port Harcourt, while the war was still on.

She then proceeded to St. Anne's School, Ibadan from 1970 to 1971 for A'Levels. While at St. Anne's School, she did not only win the

John F. Kennedy Essay Contest in 1971, but she obtained the best A'Level result in Geography. She was also the Netball Captain of the School. She then proceeded to the United Kingdom where she obtained a CNAA, U.K. B.Sc. Degree in Science in 1976, and continued at Loughborough University for a Masters Degree in 1977.

She returned to Nigeria in December 1977 and started her NYSC, which she completed in 1978. She was employed in 1979 as an Assistant Lecturer in the University of Port Harcourt. She went on a Staff Development Programme in 1981 for a PhD programme in Brunel University, Uxbridge, Middlesex U.K. She completed the programme in record time and returned to the University of Port Harcourt in April 1984. Since then, Prof. Konya has taught several courses and worked in several committees in the University, which space will not permit to enumerate. Some of the University committees she worked in, include; Faculty of Science Timetable Committee 1979/1980; Zoology Department Library Coordinator; Departmental Exam officer 1988/1989; University congregation representative on the University Demonstration Primary School Board of Governors 1985-1987; Member, University Endowment Fund Committee; Chairman, Protocol Subcommittee of Convocation Committee 1990; University Coordinator for SIWES, 1991; Member of Senate (representing Faculty of Science) 2001-2002; Member NUGA 2004; Member, UNIPORT Silver Jubilee Committee 2003; Member, New Faculties and Programmes Committee 2010; Member, Academic Advisory Board, Institute of Petroleum Studies (IPS); Member, Board of the Centre for Logistics and Transport Studies (CELTRAS) 2014 till date and more.

A gold fish can never hide. Prof Roseline Konya was fished out to head the then School of Graduate Studies as Dean, and later Pioneer Provost of the College when it was restructured and transformed into a College. Since then revenue generation in the University through the College has been astronomical. Two outstanding innovations which have left indelible marks in the college, are the Overstay Policy, which resulted in the graduation of 450 PhD graduates at the last Convocation, and the "No fee, No admission letter" Policy. Prof Konya is a workaholic. She informs those who care to listen, that performance speaks louder than lobbying. It is in the construct of her great performance at duty posts in

Government and in the University, that she is usually **invited** to take up positions.

She was the University orator for many years, spanning from 2001 to 2011. She was Head of Animal and Environmental Biology Department, from November, 2001 to November, 2003. During this period she led her Department on a courtesy visit to the then Deputy Governor of Bayelsa State, Dr Goodluck Jonathan who responded by equipping the Head of Department's office with all necessary items ranging from a computer required by the department to a photocopying machine. She has a plethora of scientific publications and is the author of three standard books, one of which is a best seller among Animal and Environmental Biology Students. That book exposes the careers available to them on completion of their programmes.

She rose through the ranks and was promoted to the position of Professor of Animal and Environmental Biology with effect from 2003.

Samples of sea anemones from the Niger Delta Region which she worked on, are part of items displayed in the zoology department of the Natural History Museum London since the 1980s till date, bringing to the International Community the species of cnidarians available in Rivers State, Nigeria.

She is the first female to become a Professor in Ogoniland.

MEMBERSHIP OF PROFESSIONAL BODIES

- Member – International Society on Toxinology. First Nigerian member in 1989.
- Member, Physiological Society of Nigeria
- Member, Science Association of Nigeria (SAN) Represented Zoology discipline in the Council - November 2001 to 2005.
- Associate Member, The Chartered Institution of Waste Management, U.K
- Member, West African Toxicological Society

SCIENTIFIC CONFERENCES ATTENDED

Professor Konya has attended several International Conferences and presented papers in some. They are: British Pharmacological Society

Conference (1983). Cambridge University, U.K. April 7, 1983. British Pharmacological Society Conference London, U.K. 4th to 6th January 1984. International Union of Pharmacology (IUPHAR), 9th Congress London, U.K. 30th July – 3rd August, 1984. Annual Conference and Exhibition, Chartered Institution of Waste Management Paignton, Torbay, U.K. 15th – 18th June, 2004. Workshop/Presentation on the Amenam Kpono Oil and Gas Export Environmental Impact Assessment (EIA) organized by TOTAL/ELF PETROLEUM NIG LTD in Paris, France, 21st to 25th September, 2004. Represented Nigeria at the United Nations Commission on Sustainable Development (CSD-13) UN Headquarters, New York, USA. - 11th to 22nd April, 2005. OFFSHORE EUROPE: Oil and Gas Conference and Exhibition, Aberdeen, Scotland, U.K., 4th to 7th September, 2007. Venoms 2013 – Making sense of Venoms in Health and Disease – St Hildas College, Oxford University, U.K., 24th to 26th September, 2013. She is due to attend the 2015 International Society on Toxinology (IST) Conference again in Oxford University towards the end of the year.

The local conferences are not listed here due to limited space allowed, but she has attended myriad of local conferences

PUBLIC APPOINTMENTS

Vice Chancellor Sir, She is a person of many parts. She was appointed by Rivers State Government as follows: Director, Delta Rubber Company; Rivers State (1991 – 1993); Commissioner, Civil Service Commission (1991-1996). She was elevated to the position of Chairman, Civil Service Commission from January 1997 to August 1999. It was **indeed the first time a female was so appointed to that position in Rivers State.** Prominent among her achievements in the Commission was the reinstatement of over two hundred civil servants wrongly dismissed under the military in 1995 – a feat difficult to perform during a military regime. They were reinstated in 1999 still under a Military Government. Professor Konya was Chairman, Ogoni Negotiation Committee (ONC) in 1997 till 1998. This was a Committee of Ogoni Prominent persons, which negotiated with SPDC and Government. The Committee was facilitated by the National Reconciliation Committee (NRC) headed by Chief Alex Akinyele. Major SPDC projects (Electricity and Roads, Potable Water) sited in

Ogoniland today are the results of that negotiation. She became Hon. Commissioner of Environment, Rivers State from the 28th of November, 2003 to May, 2007 Prof Konya cannot hide. In the Ministry of Environment, she reinstated monthly sanitation in Rivers State which had ceased years before she assumed duty. During her tenure, a Waste-to-Wealth (Compost) project and a Scrap-to-Wealth project were approved by the State Executive Council. She represented Rivers State on the Federal Government Niger Delta Security Committee. She subsequently became a member of the Sub-committee on Holistic Development of the Niger Delta with Dr. Goodluck Jonathan, the then Deputy Governor of Bayelsa State as Chairman. Government had not finished with Prof Konya. In 2006, she was appointed, member of the Presidential Implementation Committee (PIC) on the Environmental Assessment of Ogoniland by the United Nations Environment Programme (UNEP). The Report was presented to the then President of the Federal Republic of Nigeria, Dr. Goodluck Jonathan on 4th August, 2011.

A hard worker cannot be skipped, Vice Chancellor. At the end of her tenure as Hon. Commissioner of Environment, she was again appointed Hon. Commissioner of Commerce and Industry in July 2007. Methodist Church saw her as a shining light and appointed her into the Governing Council of Wesley University of Science and Technology (WUSTO), Ondo, from August 24, 2007 to 2012.

In continuation of her role in the Environmental restoration of Ogoniland, Prof. Roseline S. Konya was appointed by the Federal Government through the Ministry of Petroleum Resources as a Multi-Stakeholder Consultative Committee member, on the Environmental Restoration of Ogoniland, which was inaugurated at Abuja on the 23rd of October, 2014.

WOMEN EDUCATION

Prof Roseline Konya is an advocate for the Education of Women, and non-discrimination against women. This conviction made her join the National Council of Women's Societies (NCWS) in the 80s and was part of the campaign in Schools and Communities in the old Rivers State. She was elected 1st Vice President in Rivers State in 1989, and

also Vice President, Nigerian Association of Women in Science, Technology and Mathematics (NAWSTEM) in the same year. She attended some National and International Conferences. Notable among them are the fifth African Regional Conference on Women in Dakar, Senegal, 16th to 23rd November 1994; and the famous United Nations 4th World Conference on Women, Beijing, China from the 4th-15th September 1995, where she represented Rivers State, and contributed immensely.

AWARDS

Vice Chancellor Sir, Professor Konya has received 60 Awards and below are some of them. (space cannot take all): She selects the Awards to accept.

She won Certificates of Merit for School Recitations Public Speeches in Festival of Arts Competitions in 1965 and 1966.- a training ground for public speaking. She was appointed a Justice of the Peace by the Rivers State Government in 1995. The Distinguished Leadership Award in Environmental Technology by the British Society of Commerce in recognition of meritorious achievements and leadership prominence in 2004. In 2004, a Merit Award of Excellence by Nigerian Environmental Society (NES). An Award as one of Nigeria's best six performing Commissioners was given her by Tell Magazine, a foremost magazine in Nigeria in 2006, published in the July 24 edition. Animal and Environmental Biology Students Association gave her a Merit Award as MOST OUTSTANDING LECTURER on the 23rd of September 2010. An award by the Committee of Deans and Provosts of Post Graduate School (CDPGS) in Nigeria was given her in appreciation of her contributions on the 4th of December, 2012. In the Church, she has received several Awards, which have culminated in her being investitured as a Methodist Knight of John Wesley in 2009, **the first female to be so appointed in Rivers and Bayelsa States**. Indeed, she is currently the pioneer chairman of the Knights Council in the Archdiocese of Port Harcourt. She was cited in the WHO IS WHO for Excellence in Management Intelligence Special Merit Award in October 2008. She has received several Awards from Ogoniland on different aspects of activities.

On 1st September 2012, Prof. Konya received a Gold Star Award by Association of Rivers Communities, United Kingdom in recognition of her meritorious services and valuable contributions to the development of Rivers State.

Space and time will not allow us read out **all the sixty awards** that Prof. Roseline S. Konya has received for hard work. Indeed, with the assistance of her children and family friends, she built a Methodist Church in Kaani Babbe which she started in 2006 after her husband's demise and was commissioned by the then Prelate of Methodist Church Nigeria, His Eminence, Dr. Sunday Makinde on 17th August, 2013. The Church was subsequently named by Methodist Church Nigeria after her late husband. It is now known as BARIDO KONYA MEMORIAL METHODIST CHURCH, KAANI BABBE. Prof. Roseline Konya has three children who are now adults, Dr Kaanakia Konya (son); Barr. Dumyii Konya (daughter) and Mrs Letura Suanu-Nwinia (daughter) and three active joyous grandchildren, Isaiah (grandson), Muele (granddaughter) and Kekale (grandson).

Vice Chancellor Sir, Principal officers, Emeriti Professors, here present
Respected Professors, Colleagues
Unique Students of Uniport

I present to you,
A leader in her own right, 1st female Professor in Ogoniland, A recipient of sixty deserving Awards, A renowned Environmental Scientist, A foremost Toxinologist,

A gold fish without a hiding place, A performer with legacy trails, Even her Sea Anemone samples have to be placed in the Natural History Museum, London.

1st female Methodist Knight in Rivers State and Bayelsa State, The orator of orators, The pioneer Provost, College of Graduate Studies,
Prof Roseline Sonayee Konya to give her inaugural lecture.

Prof. A. A. Uwakwe
University Orator