

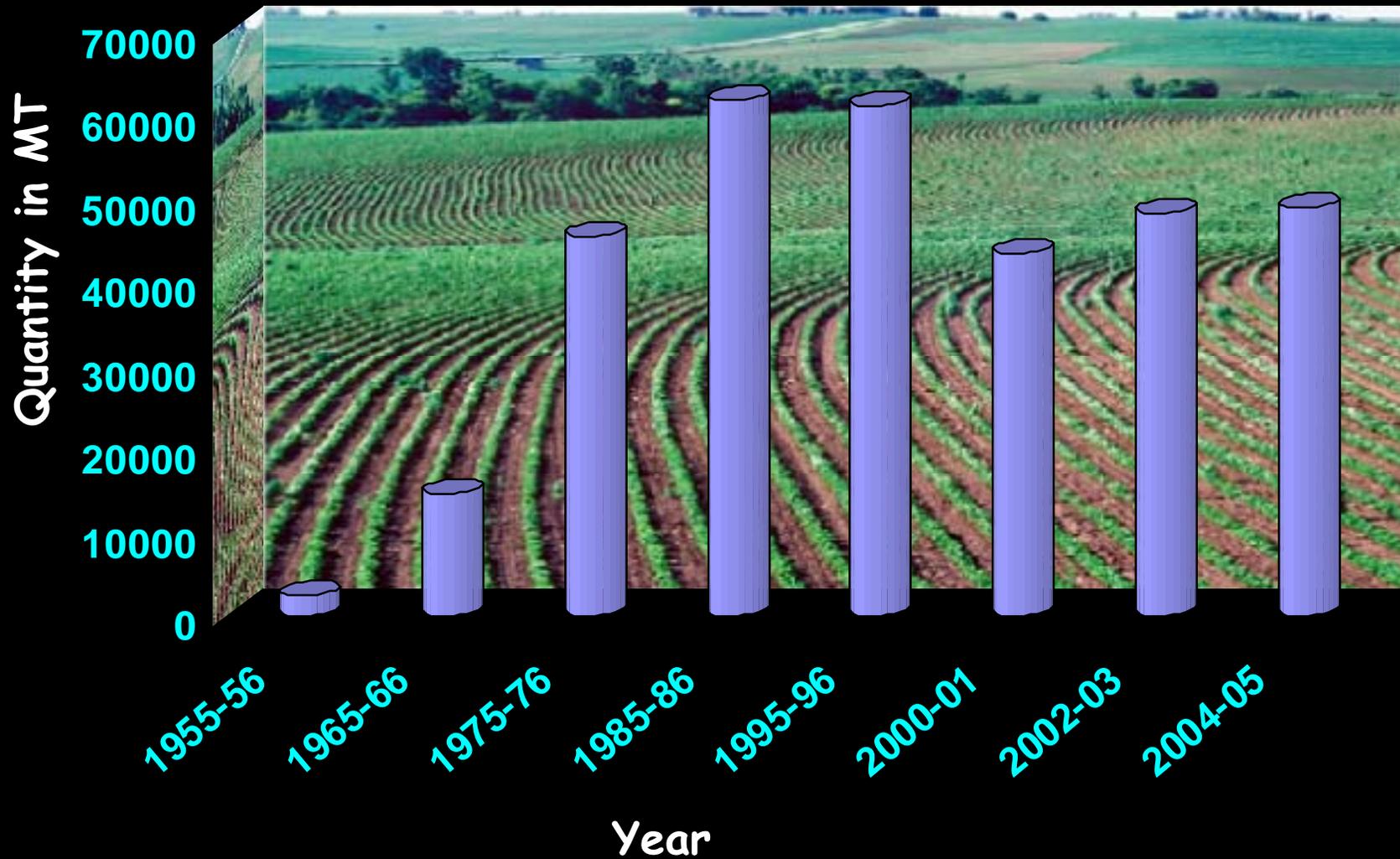
A photograph of three white swans in a shallow pond. The swan on the left is facing right with its head down. The middle swan is facing left with its head down. The swan on the right is facing left with its head down. The water is clear and reflects the sky. There is some green vegetation in the foreground and background.

**IMPACT OF ENVIRONMENTAL CONTAMINANTS
ON INDIAN AVIFAUNA - A Status Report and
Conservations Needs**

Dr. Subramanian Muralidharan

**Sálim Ali Centre for Ornithology & Natural History
Coimbatore - 641 108, INDIA**

Pesticide Consumption in India (1955-2005)



A few Facts

- **In India DDT has been in use for malaria control since 1946.**
- **Annual consumption of DDT is around 7500 MT.**
- **Even though Malathion (25%) and Pyrethroids (5%) are being currently used, DDT has not been dispersed with.**
- **HCH has been phased out of the programme in 1997.**
- **Dieldrin is still being used for locust control in arid zone**
- **Indian diet contains 0.27 mg of DDT.**
- **Studies reveal Indians have one of the highest body DDT concentration**

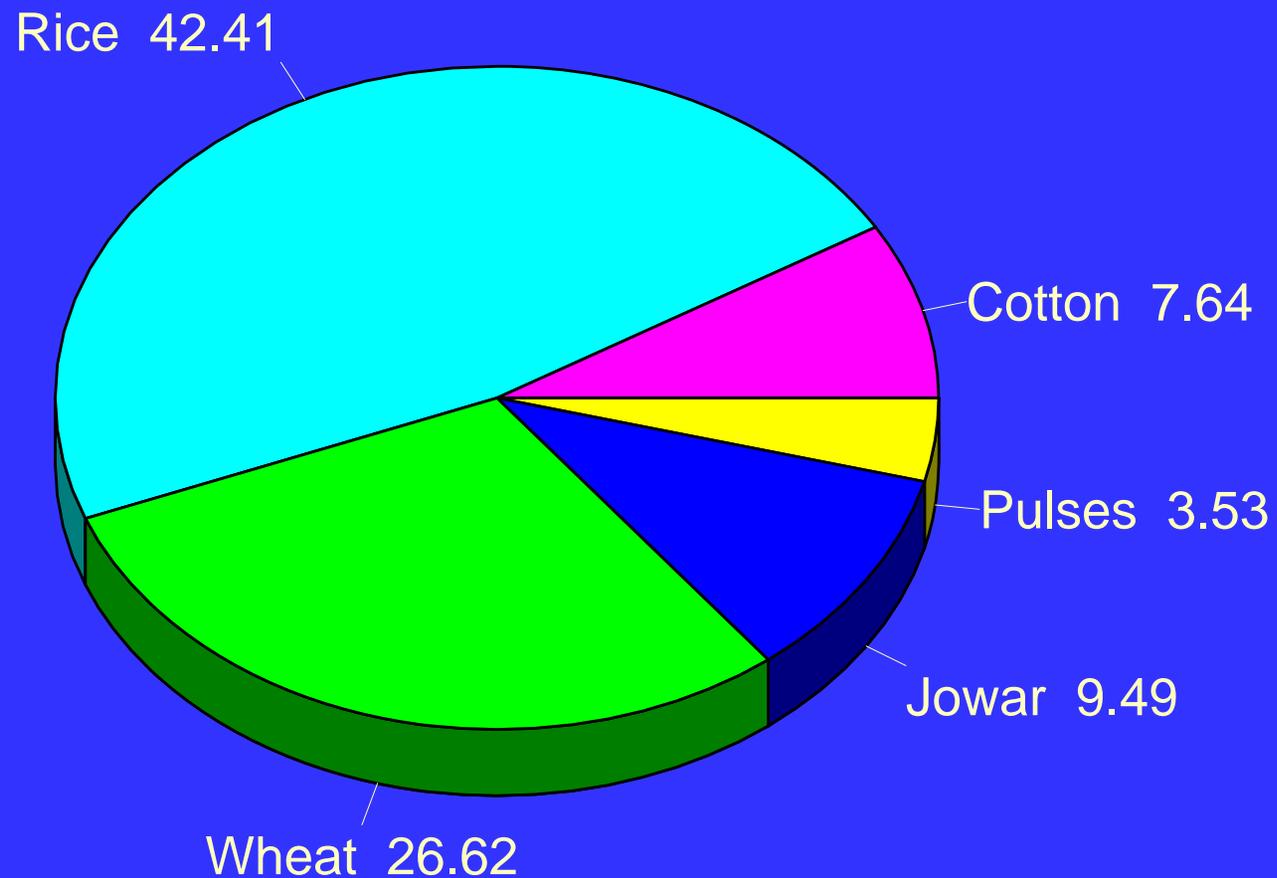
- ❖ **Total number of pesticide molecules registered in India is 144.**
- ❖ **The per hectare consumption in India is 570 g/ha against 2500 g/ha in USA. 3000 g./ha in Europe and 12000 g/ha in Japan.**
- ❖ **It is an industry estimate that the market value of spurious product is estimated at Rs. 500 crores per annum whereas the Industry turnover is around Rs. 2500 - 3000 crores.**

On 23rd May 2001 India signed the convention banning the use of 12 most dangerous persistent Organic Pollutants (POPs).

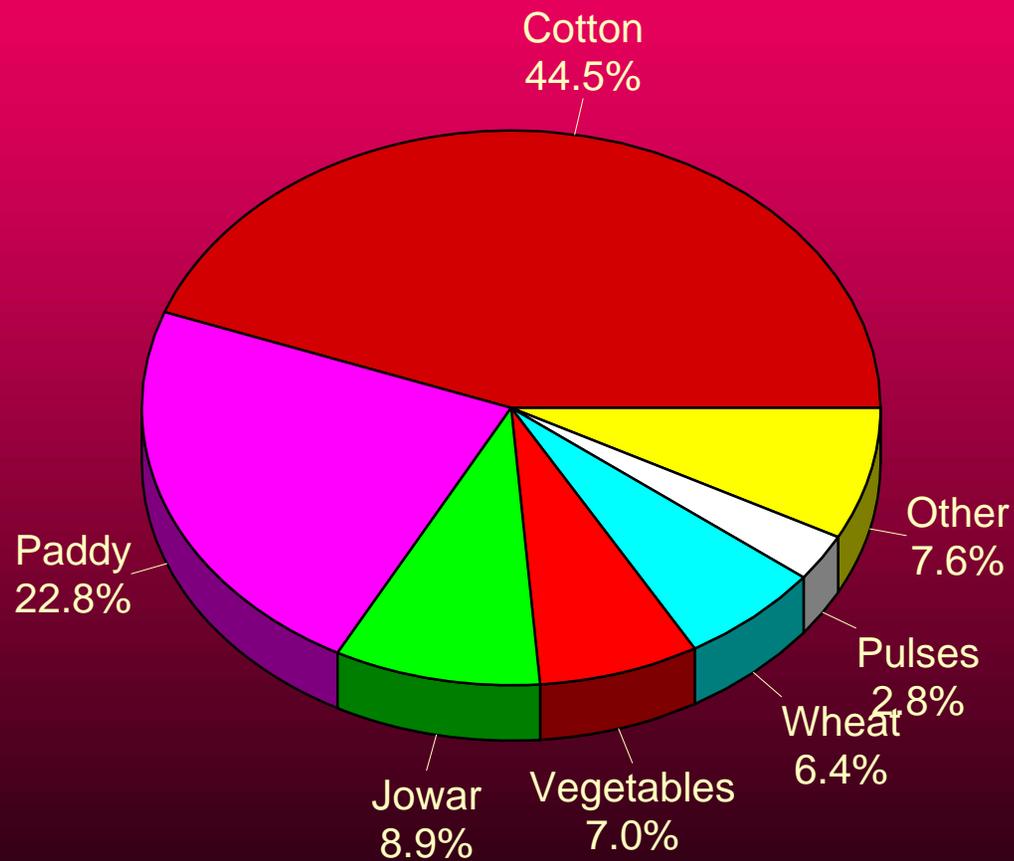
- **Currently, 70 % of all insecticides used in India are DDT and HCH, and their use is increasing at a rate of 6 % for every year.**

Source: *Health & environment newsletter.May-June 2002.*

Area under cultivation - major crops (Million ha)



Crop-wise Consumption of Pesticide in India



Major Areas of Pesticide Usage

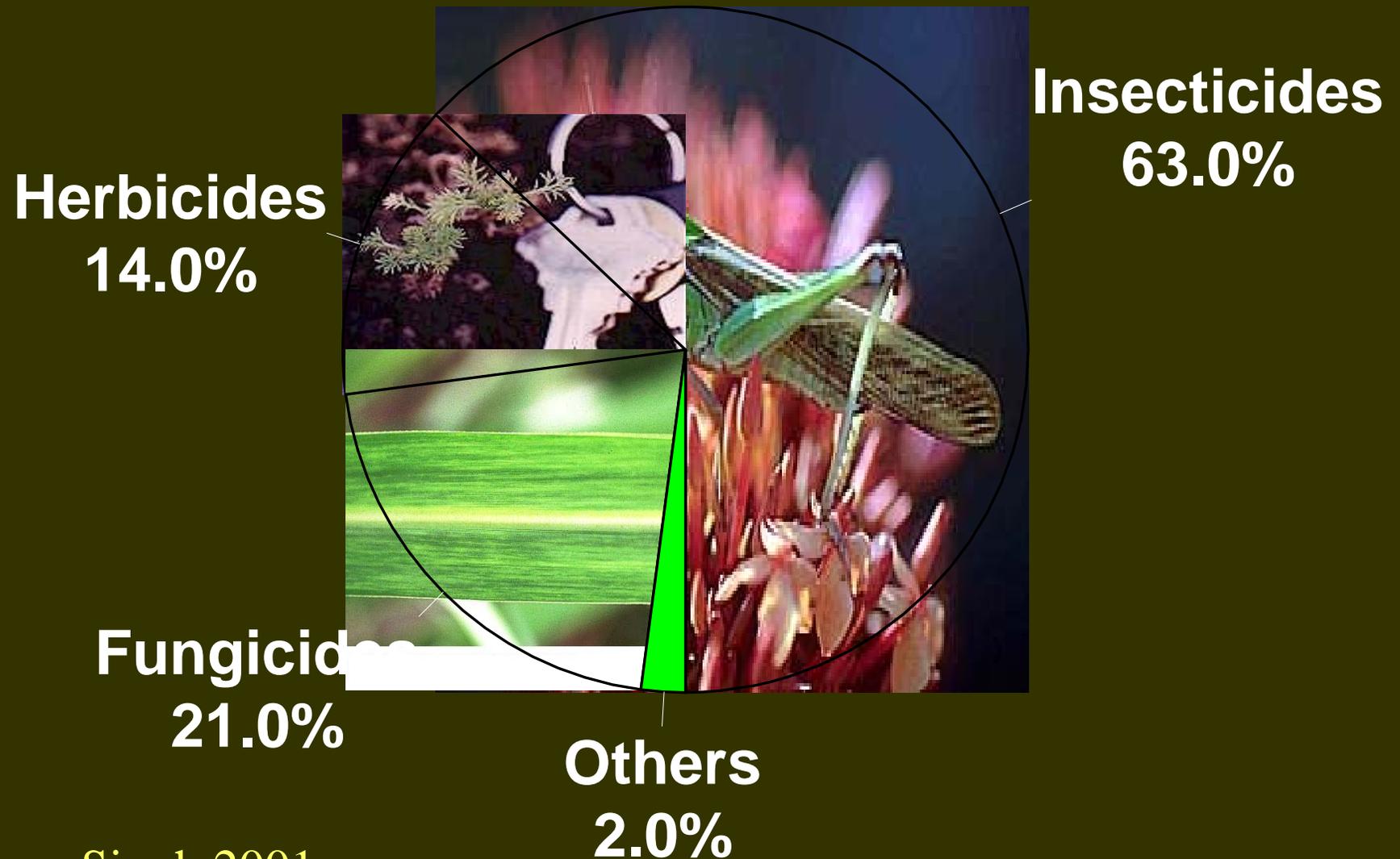
Agriculture
69.4%



Public health
30.6%

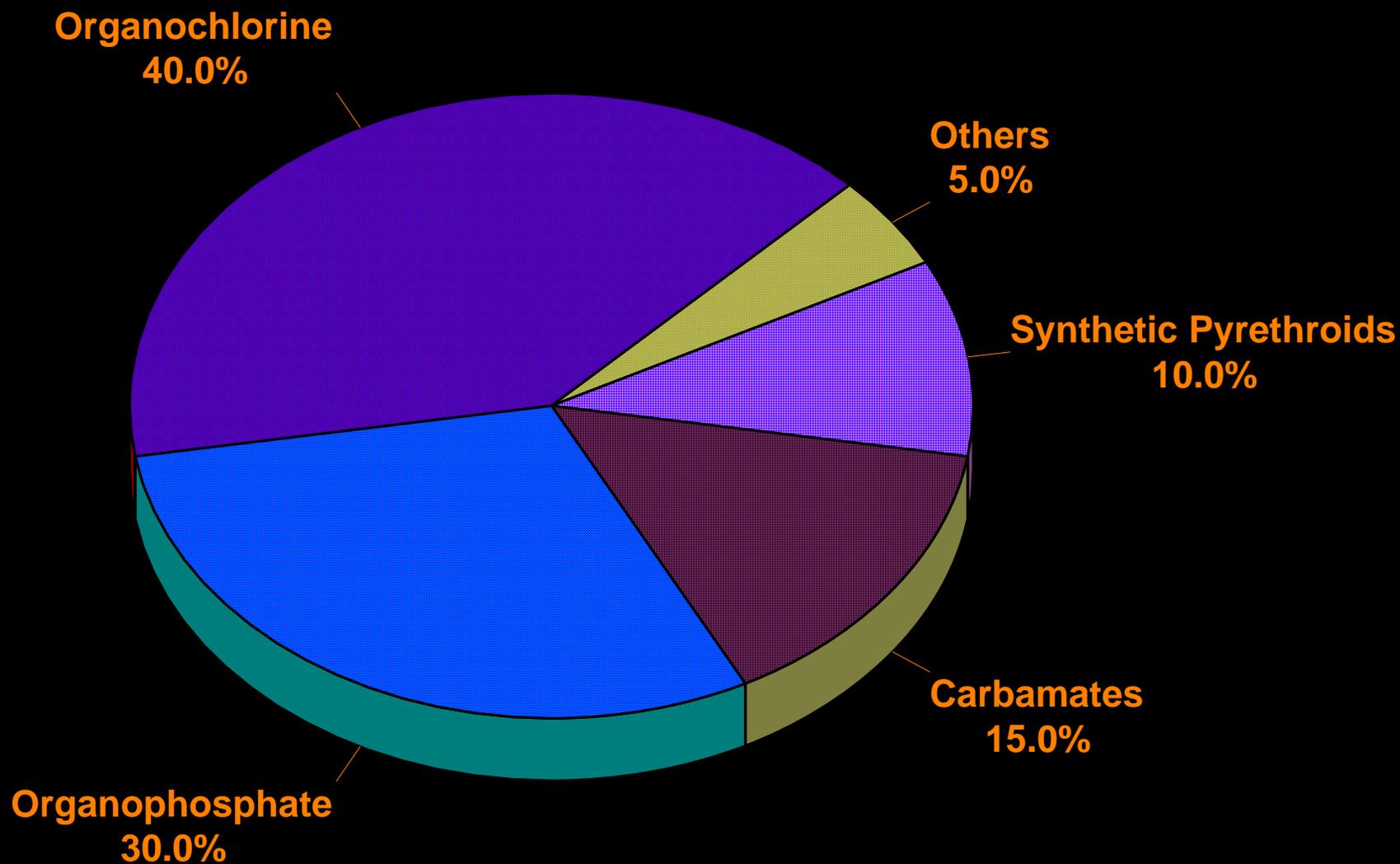
[Source: www.hinduonnet.com](http://www.hinduonnet.com)

Pesticide Consumption – target groups



Source: Singh 2001

Pesticide consumption – Chemical groups



Source: Kavitha Kuruganti- Green Peace India

Pesticides which have been Banned/ Severely restricted in Some Countries of the World but are still being used in India

Aluminium Phosphide	Methomyl	Endosulfan
Benomyl	Methoxy Chloride	Ethyl Mercury
Captan	Methyl Parathion	Fenarimol
Carbaryl	Monocrotophos	Fenpropathrin
Carbofuran	Oxyfluorfen	Lindane
Carbosulfan	Paraquat Dichloride	Linuron
Dicofol	Phorate	Malathion
DDT	Phosphamidon	Triazophos
Dimethoate	Pertilachlor	Tridemorph
Diuron	Sodium Cyanide	Thiomethon
Zinc Phosphide	Ziram	Thiram

Source: Lok Sabha Unstarred Q. No. 2291, dated 18. 03. 2002

Known instances of population decline/poisoning in birds in India

Spotbilled Pelican

Gradual population decline over the last two decades

Sarus Crane & Peacock

During the recent years many instances of poisoning have been reported in many parts of western India

Himalayan Greyheaded Fishing Eagle

Unsuccessful breeding at Corbett National Park, UP

Vultures

80-90% of population deduction has been recorded in the known ranges of distribution

Water fowl

Mass mortality of waterfowl in Nalabana Bird Sanctuary-Orissa





- **Population has plummeted from 2000 to 330 within a span of 30 years in Kokkarabelleru, Karnataka.**
- **In spite of local villagers' support towards conserving this species, there appears to be less improvement.**







Mortality of birds – A continuous phenomenon since 1987 in Keoladeo National Park, Bharatpur

Year	1987-1990	2000	2001	2002	2004
Number dead	1	3	5	3	15

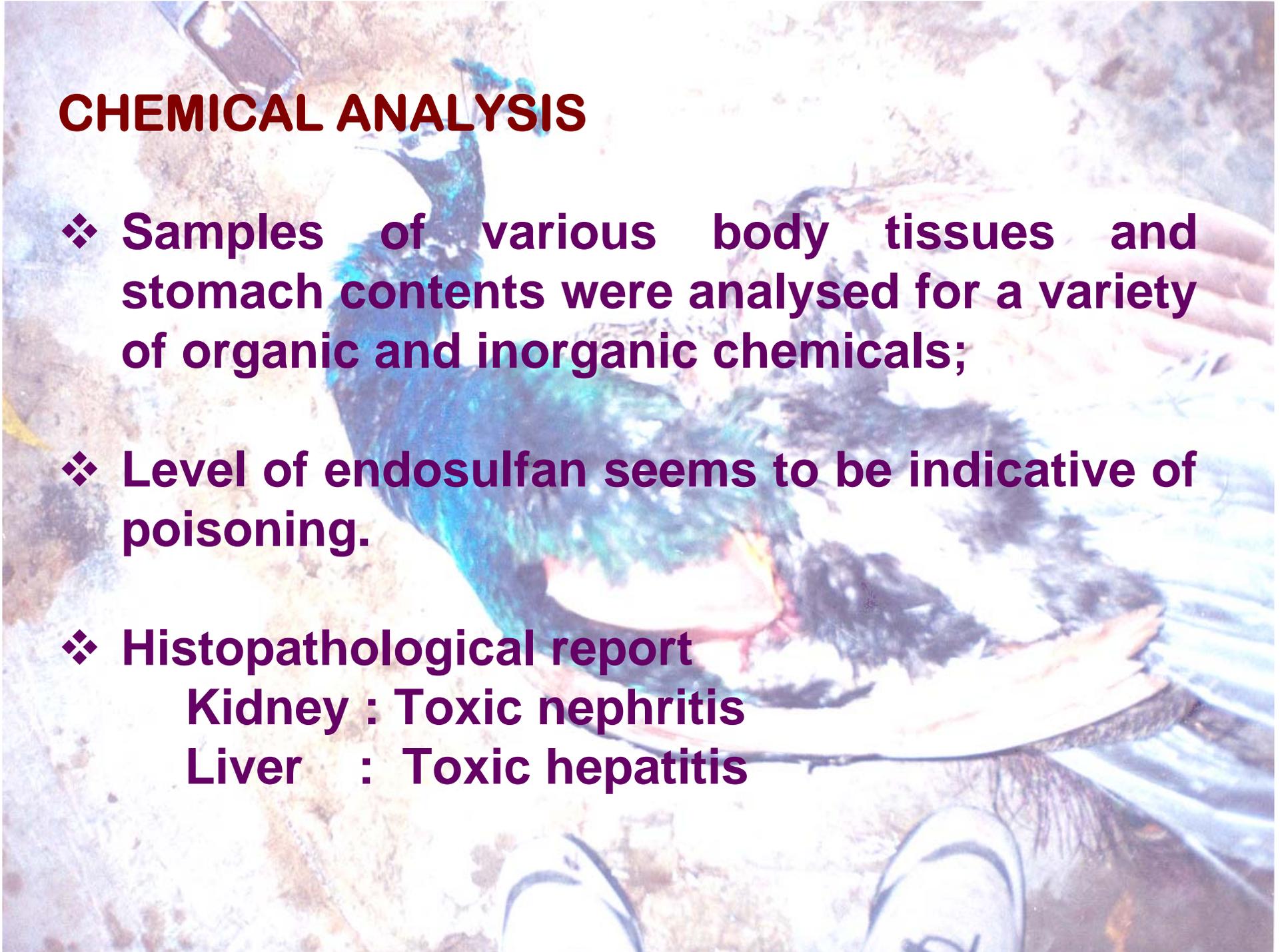
Chemicals Responsible: Aldrin, Chlorphyripos, Endosulfan & Monocrotophos

In addition to Sarus, Demoiselle Crane, Common Crane, Greylag Geese, Barheaded Geese, Collared Dove, Blue Rock Pigeon also fell victim to pesticides.



CHEMICAL ANALYSIS

- ❖ **Samples of various body tissues and stomach contents were analysed for a variety of organic and inorganic chemicals;**
- ❖ **Level of endosulfan seems to be indicative of poisoning.**
- ❖ **Histopathological report**
 - Kidney : Toxic nephritis**
 - Liver : Toxic hepatitis**

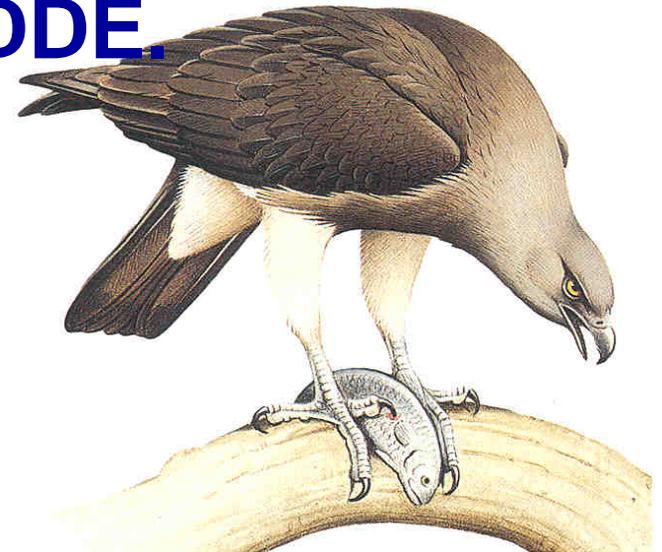


Himalayan Greyheaded Fishing Eagle



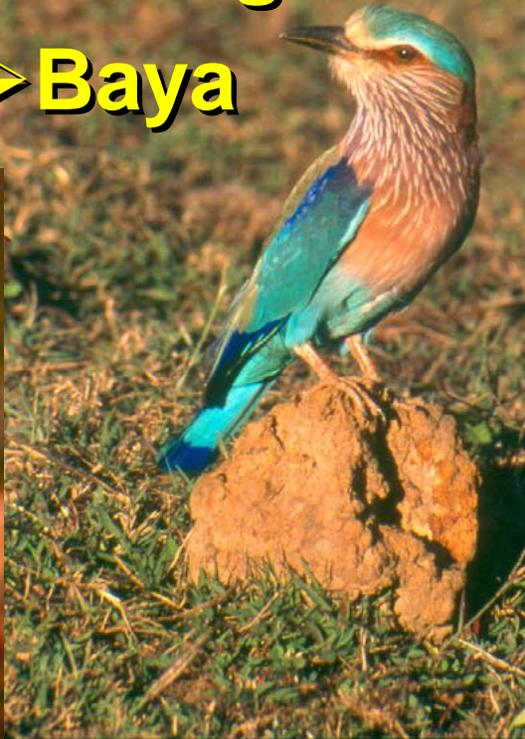
Has been breeding unsuccessfully for the last several years

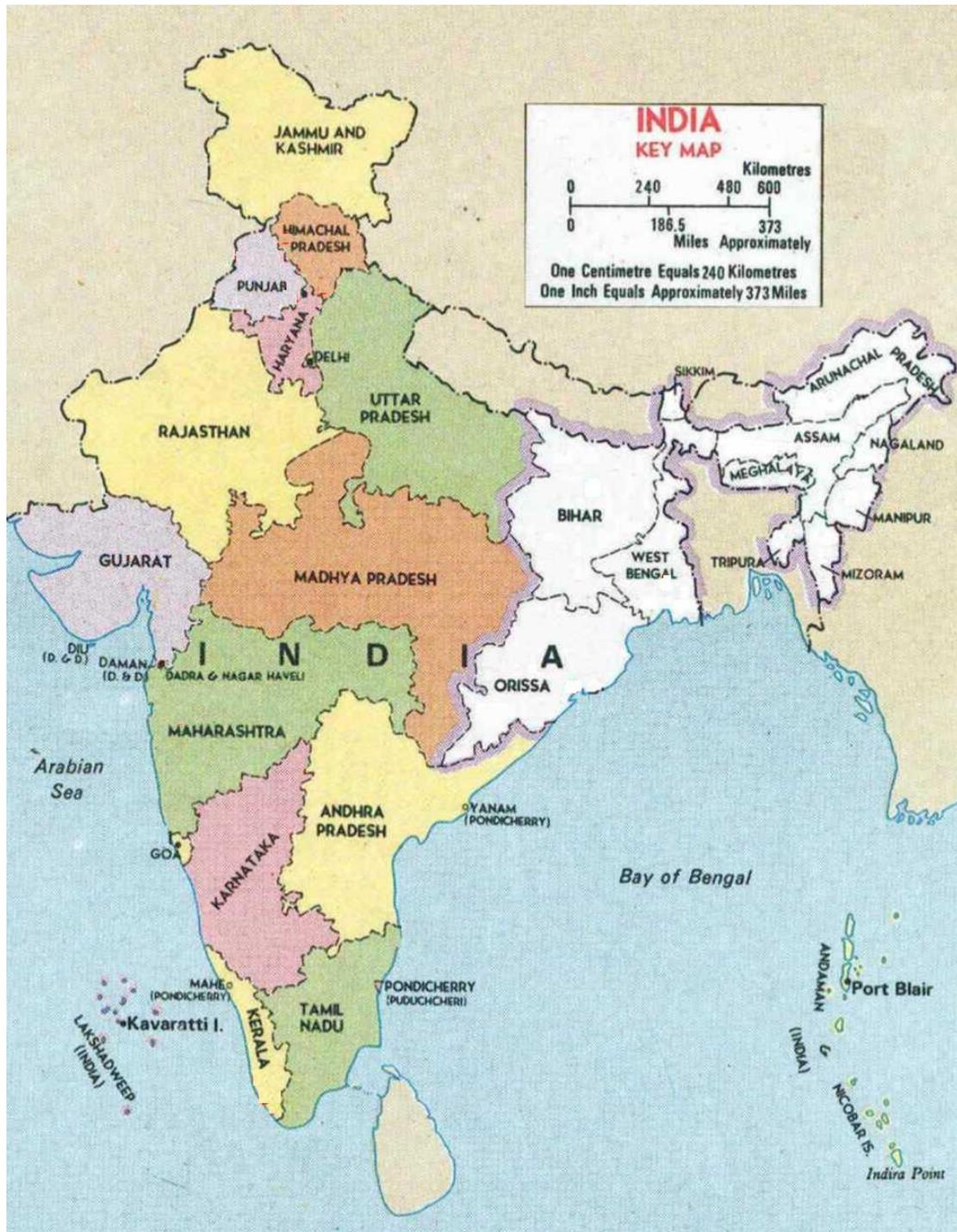
Chemical analysis in eggs revealed presence of 1973 ppm of DDE.





- House Sparrow
- Common Bee-eater
- Indian Roller
- Drongo
- Baya





Monitoring of Environmental Contaminants in Indian Avifauna

Total No. of Individuals received during 1999-2007

300

Species : 105

250

Individuals : 945

200

150

100

50

0

1999

2000

2001

2002

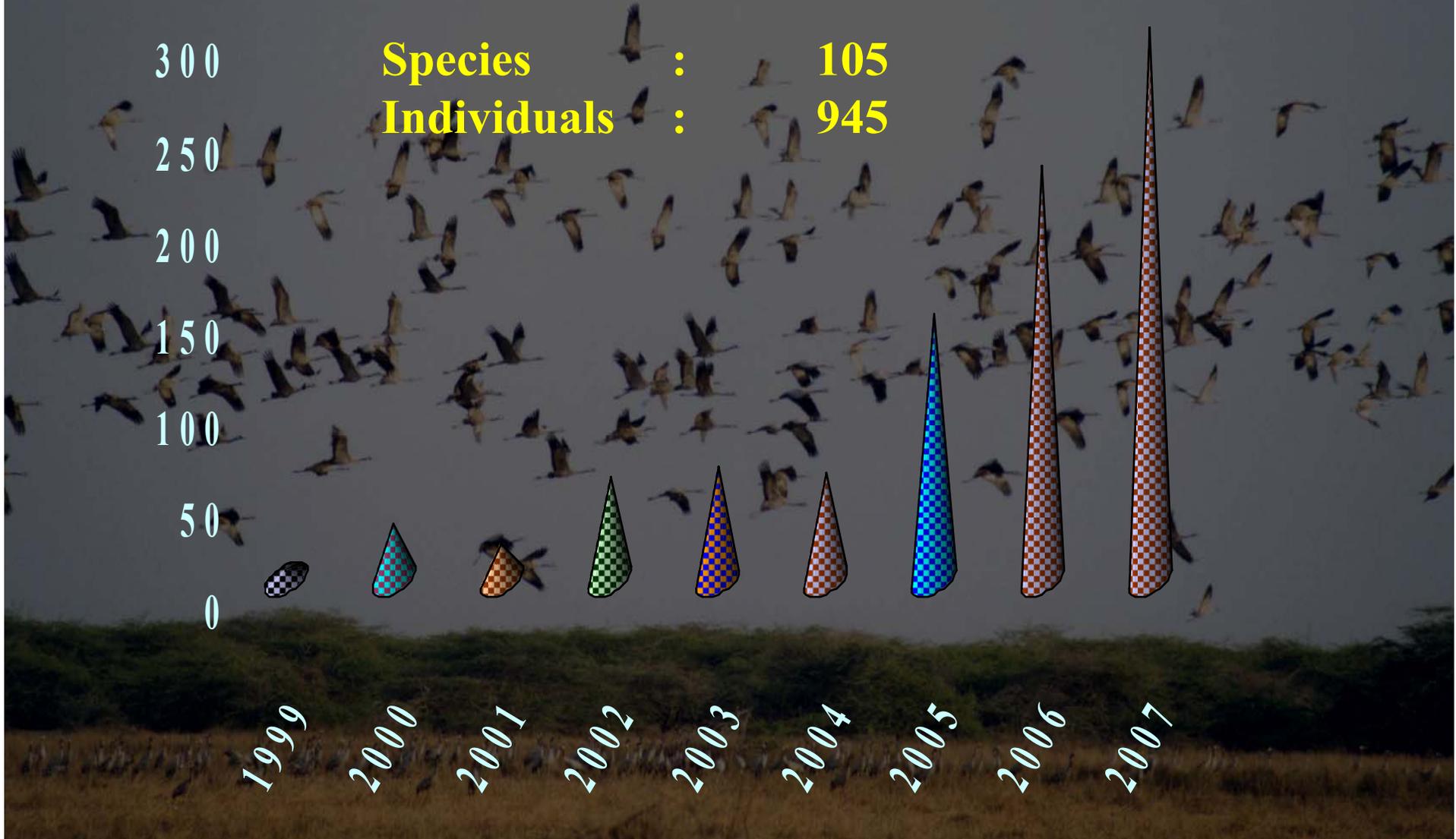
2003

2004

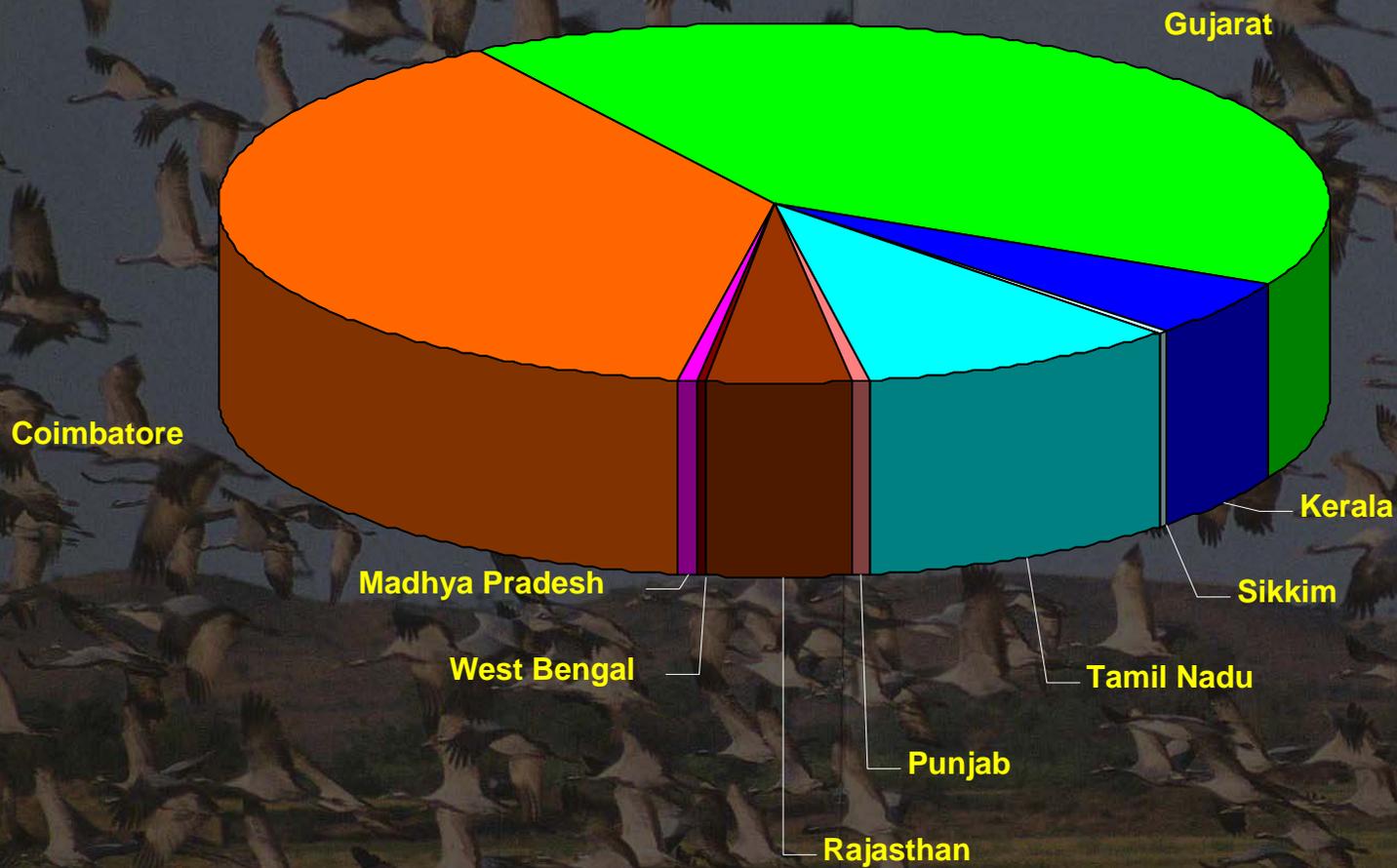
2005

2006

2007



Birds received from various places in India



Composition of dead birds based on food habits



16 peacocks found dead; farmer held

TIMES NEWS NETWORK

Ahmedabad: Sixteen peacocks were found dead in a farmland in Mausampur in Dehgam taluka of Gandhinagar district on Saturday. Forest officials said that the peacocks died after consuming some maize grains, which had been sprayed with pesticide.

The farmer, Valji Patel (65), in whose agricultural land the dead peacocks were found was arrested by the police. He was booked under various sections of the Wildlife Protection Act, 1972.

police reached the spot along with forest officials and forensic experts in tow.

Two other peacocks that are also suffering from pesticide effects, were under treatment at a local veterinary hospital. Forest officer (Dehgam taluka) K V Thakore said: "The farmer had sprinkled pesticide on maize plants that were sown amidst cotton crop. Preliminary investigations revealed that the peacocks had some of these grains. The peacocks were later buried."

Samples collected from the peacock carcasses have been sent to the Directorate of Forensic Science, Gandhinagar for detailed analysis of death.

List of mass mortality of birds in India during 2003-2004

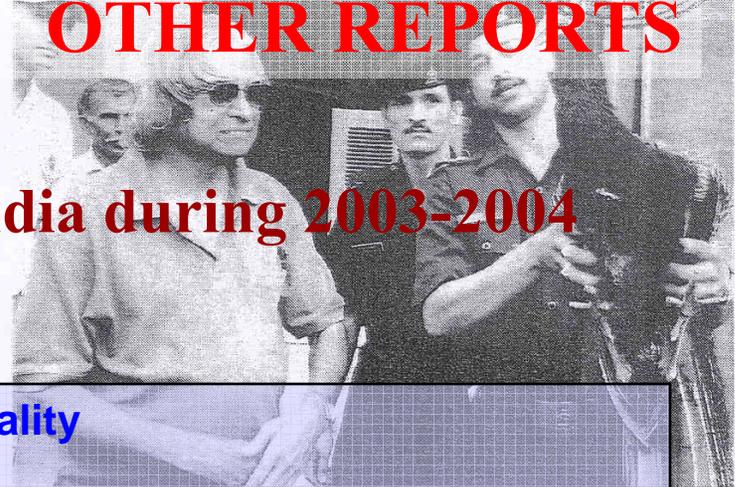
Place	Period	Mortality
Calicut, Kerala	November 24, 2003	139 Herons & egrets
Salem, Tamil Nadu	July 12, 2004	30 Crows
Coimbatore, Tamil Nadu	September 24, 2004	Around eight
Chennai, Tamil Nadu	December 20, 2004	25 Cattle Egrets and 19 Pond Herons

President saves a peacock

By Anjali Dhal Samanta

NEW DELHI, JUNE 9. It is a rather unusual story. The country's First Citizen has saved the life of a special resident of Rashtrapati Bhavan — a peacock, the National Bird. Suffering from cancer, the poor little peacock would in all likelihood have died had the President not spotted it on time. And the lady has a tough thing to say.

About a week ago, while taking his daily morning walk through the majestic Mughal Gardens of Rashtrapati Bhavan, the President noticed this bird with a growth around the right eye. Concerned at what he saw, Mr. Kalam asked the



OTHER REPORTS

Veterinary Surgeon of Rashtrapati Bhavan, Anandheer Kumar, to examine. The examination revealed that the peacock was suffering from a tumour near the base of its right eyeball. The tumour was already very big and growing. It was pressing the eyeball to one side and obliterating the peacock's vision. The tumour had also entered the buckle cavity of the mouth and the bird was un-

OTHER REPORTS

139 Herons & egrets

The President A.P.J. Abdul Kalam, with the peacock he saved, on June 9. The peacock was returned to its natural habitat as soon as it showed signs of recovery. Keeping that in mind, the veterinary staff had also

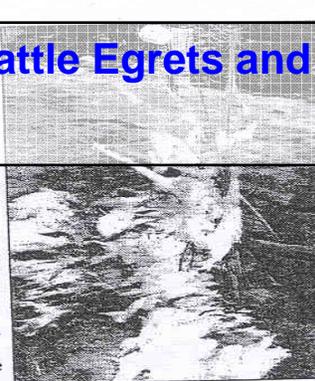
just to be on the safer side, though finding the bird was a difficult task. According to officials at Rashtrapati Bhavan, whenever

Trigger-happy tribal kills 45 wild birds

By VANI DORAIYAN
The news that a tribal in the City, a Narikorava, gunned down 45 wild birds feeding on the Pallikaranai marsh on Sunday. Though he was arrested by wildlife officials, such crimes are becoming all too common in various parts of the City, conservationists say.

Of the 45 birds shot down, 25 were cattle egrets, one was a little egret and 19 were pond herons, all of them protected under Schedule IV of the Wildlife Act. They had been shot down by the narikorava - identified as Thulukkanam from Kotturpuram - carrying an unlicensed country gun. When he was hunting for birds on the marsh, he was rounded up by wildlife personnel and was later remanded. This is the first time so many wild birds have been shot dead in a single day on the marsh, considered a fertile avian feeding ground, officials said. Though only one person has been arrested, there could be a bigger gang behind Sunday's massacre, given the large number of casualties, it is suspected.

"The narikorava was found using a dummy to snare the egrets and then shoot them. Egret meat is often consumed by narikoravas themselves or sold for Rs 5-10 per bird. It is often a poor man's substitute for chicken meat. In Pallikaranai, since egrets feed in larger numbers, the casualties are also on the higher side," said K S Sathya-murthy, Forest Range Officer, Velachery Wildlife Division, under whose jurisdiction the offence was committed. Though egrets are of little ecological value compared with migratory



The carcass of the egrets that were gunned down by a tribal kept at the Velachery Forest Office in Chennai on Sunday - Express

birds, conservationists say when shots are fired into the air, very often stray bullets end up hitting migratory birds like curlews, which also are fired up. With the birding season in full flow in Vedanthangal, migratory birds bound there also make a short stop in marshes like Pallikaranai and fall prey to bullets, conservationists say. Such acts have become common place not just at Pallikaranai but at various other waterbodies and marshes surrounding the city. With a fairly good monsoon ensuring plenty of fish, the Chembarambakkam and Red Hills reservoirs have also turned into watery graves for the birds which come there to feed.

In just one place, the lake at Korattur Agraharam off Red Hills, such shooting incidents have been taking place regularly for the past fortnight, residents say. They often go unreported as there is a healthy local market for the meat.

"I have seen a narikorava bring down five to six birds within a minute's time," said Vijayan, a resident. The hunting is normally done by narikoravas, traditional hunters, who not only gun down the birds but also protect animals like mongooses for profit. The tribals are spread in small pockets all over the City and are constantly on the move and hence it is difficult to keep track of their movements.

List of mass mortality of birds in India during 2005-2006

Place	Period	Mortality
Ahmadabad, Gujarat	January, 2005	Total No. of Individuals – 130* No. of Species – 17
Bhavnagar, Gujarat Patan, Gujarat	May, 2005	19 Vultures 100 Pigeons
Indore, Madhya Pradesh	June, 2005	Peacock (number not known)
Siliguri, Jalpaikuri, Malda, Dargiling	October 2005	Around 1000 waterfowl
Ahmadabad, Gujarat	January, 2006	Total no. of individuals 115* No. of species 22
Chilika, Nalabana bird Sanctuary	February 2006	1700 - Waterfowl*
Sikkim, West Bengal	February 2006	33 vultures, 10 kites
Aurangabad	February 2006	Around 200 waterfowl
Coimbatore	March 2006	9 Peacock

Birds received to our laboratory

were gunned down by a tribal kept at the Velachery Forest Office in Chennai on Sunday - Express
and are constantly on the move and hence it is difficult to keep track of their movements.

Environmental contaminant analyses

Pesticides

Alpha HCH
Beta HCH
Gamma HCH
Delta HCH
Heptachlor
Heptachlor epoxide
Endosulfan 1
Endosulfan 2
Endosulfan sulfate
p,p'- DDE
p,p'- DDT
p,p'- DDD
Dieldrin



Organophosphates
Synthetic Pyrethroids &
Carbamates

PCBs

(IUPAC Nos.)
8, 28, 52, 49,
44, 37, 74, 67,
60, 66, 101, 99,
87, 77, 82,
118/114, 153,
179/105, 138,
126/158, 166,
183, 128, 156,
180, 169, 170
and 189)

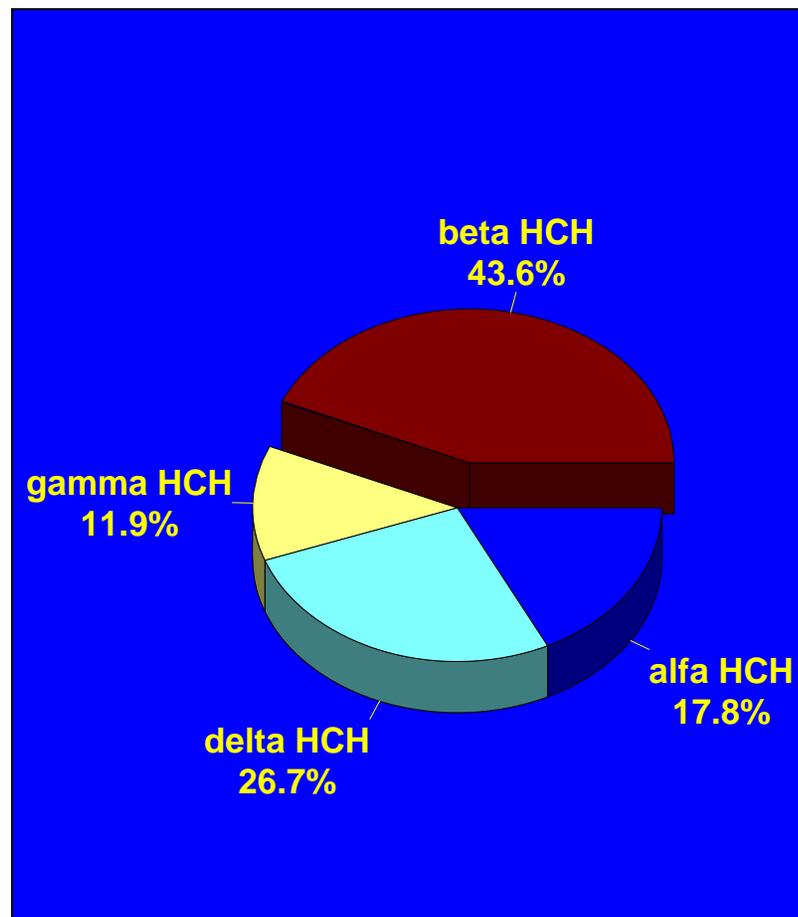
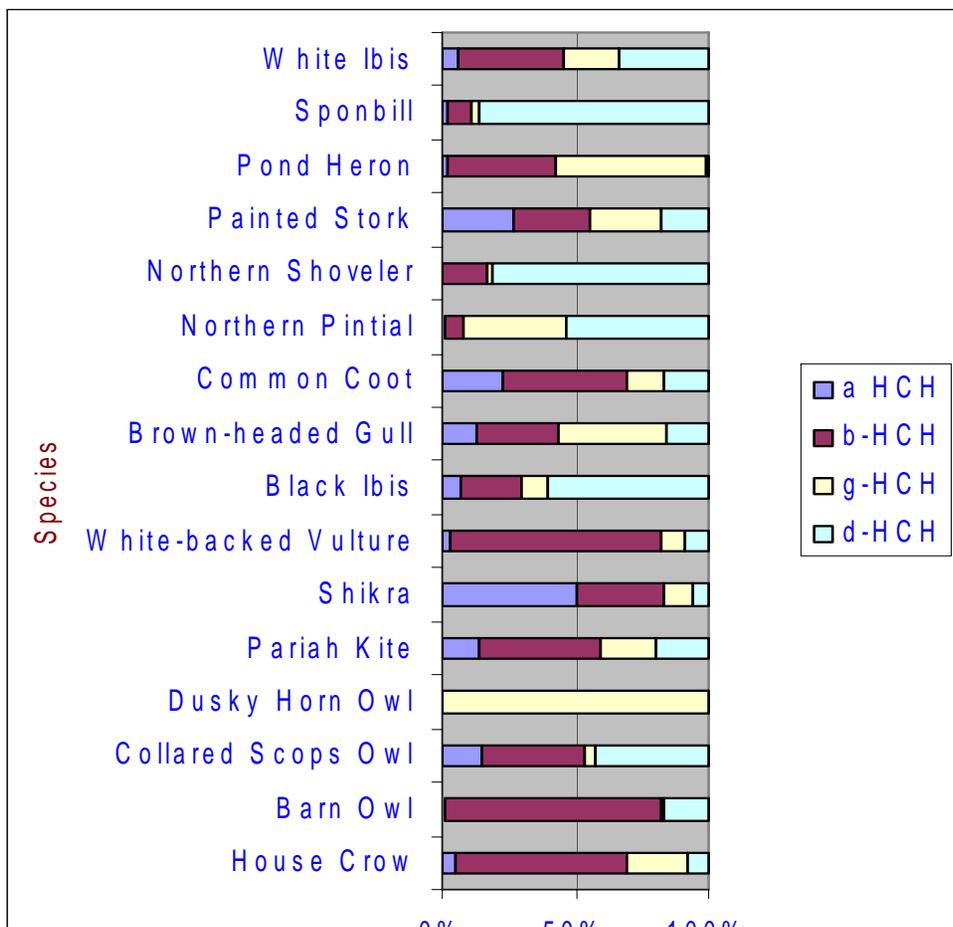
AChE

Brain and
Plasma

Heavy metals

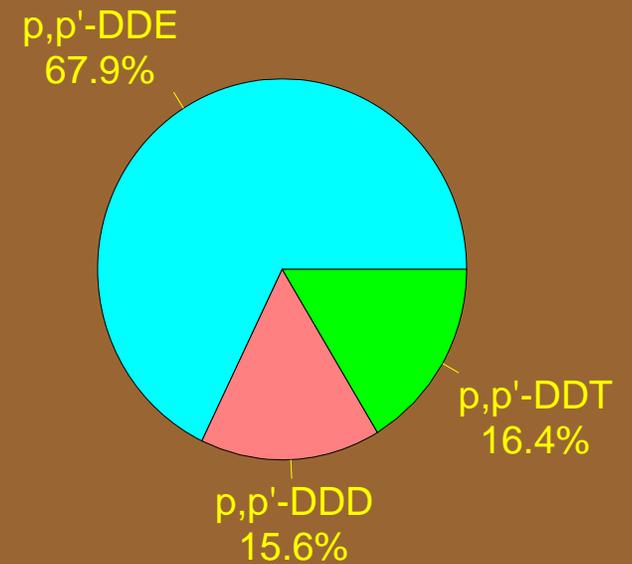
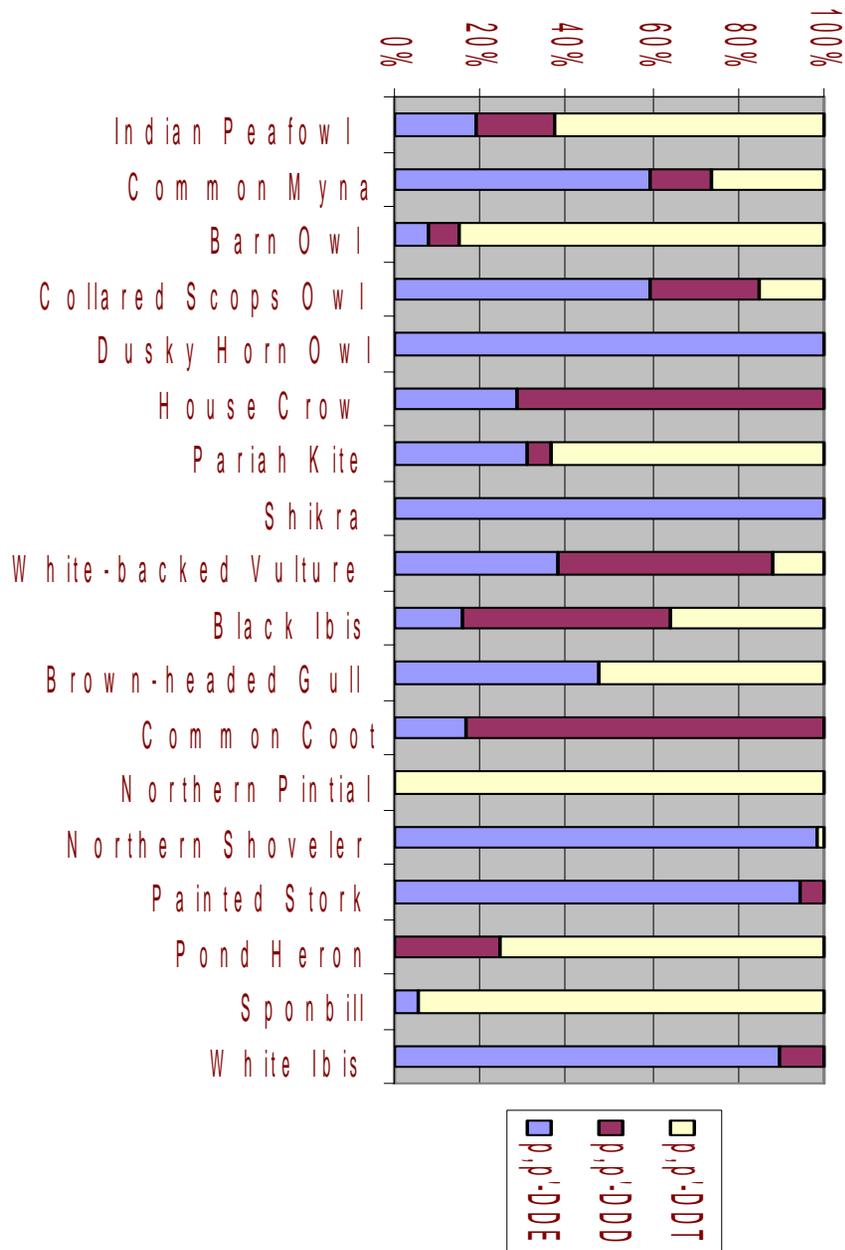
Lead
Copper
Chromium
Zinc
Chromium

Accumulation pattern of HCH isomers among select species of birds



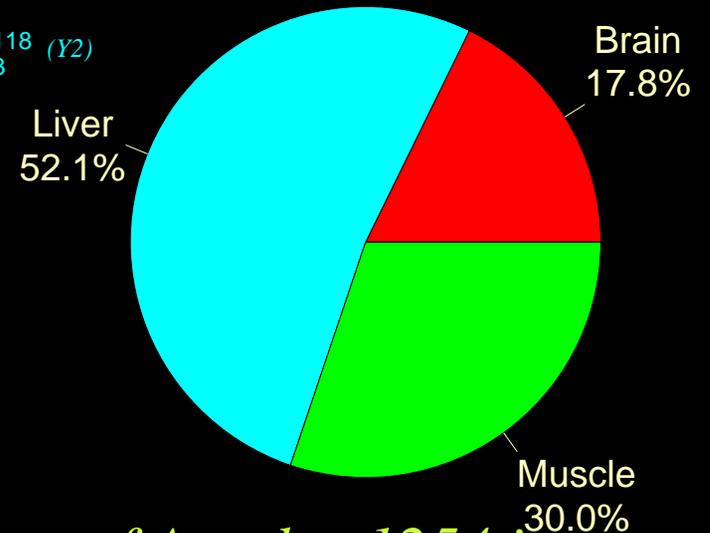
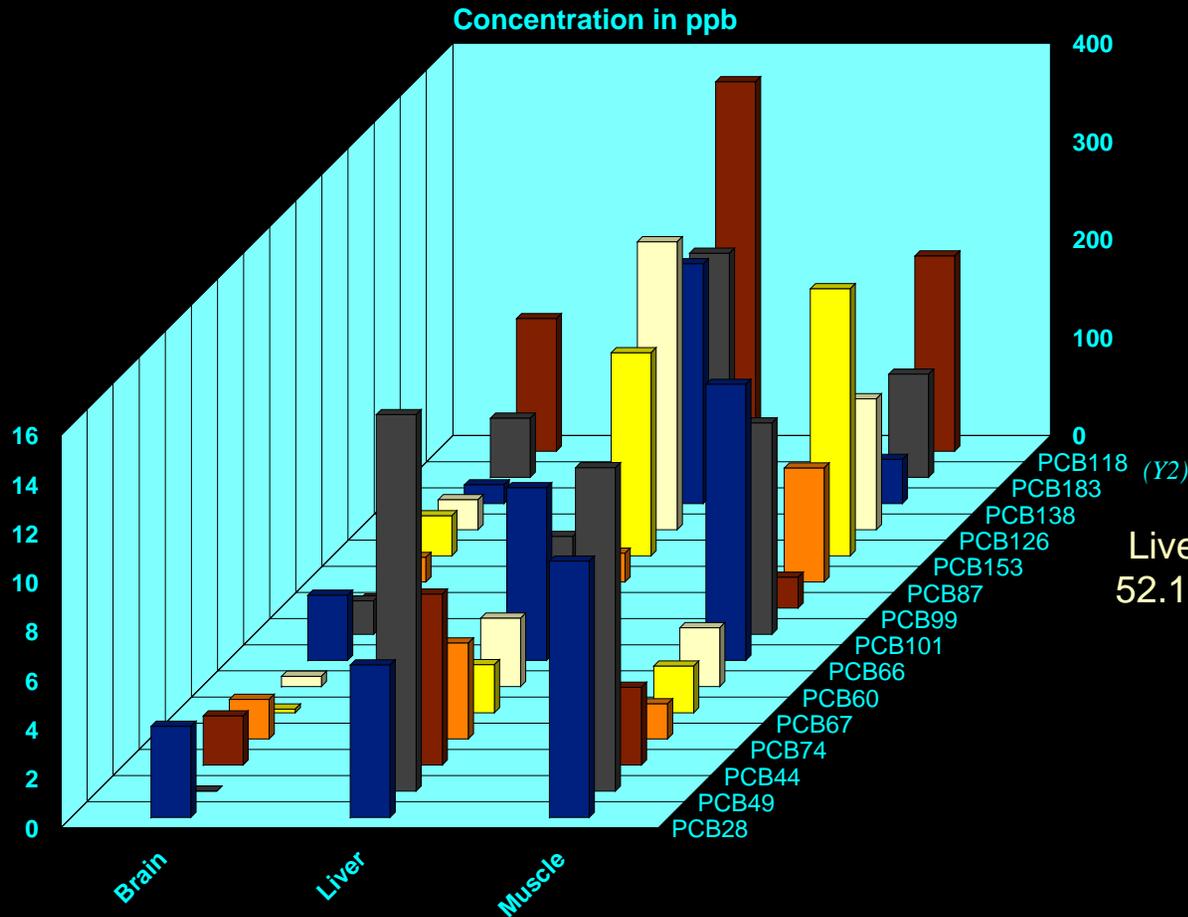
Although there is no data to compare the toxic levels, presences of beta HCH and gamme HCH shows its persistent nature and its recent usage in agricultural activity respectively.

DDT and its metabolites among select species of birds



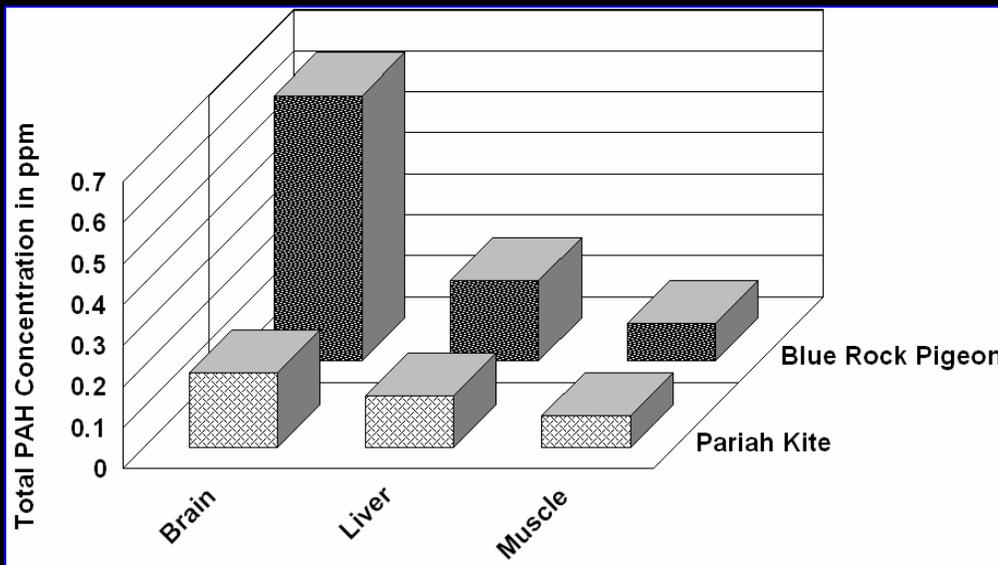
- *Presence of parent DDT shows the recent usage in the country*
- *p,p'-DDE, the most persistent metabolite accumulated the maximum in the tissue of birds*

Accumulation pattern of PCBs (ppb wet wt) among Pariah Kite – Gujarat



- *High conc. of PCB 118 shows recent usage of Aroclor 1254 in these area*
- *Suspected to affect embryo development*

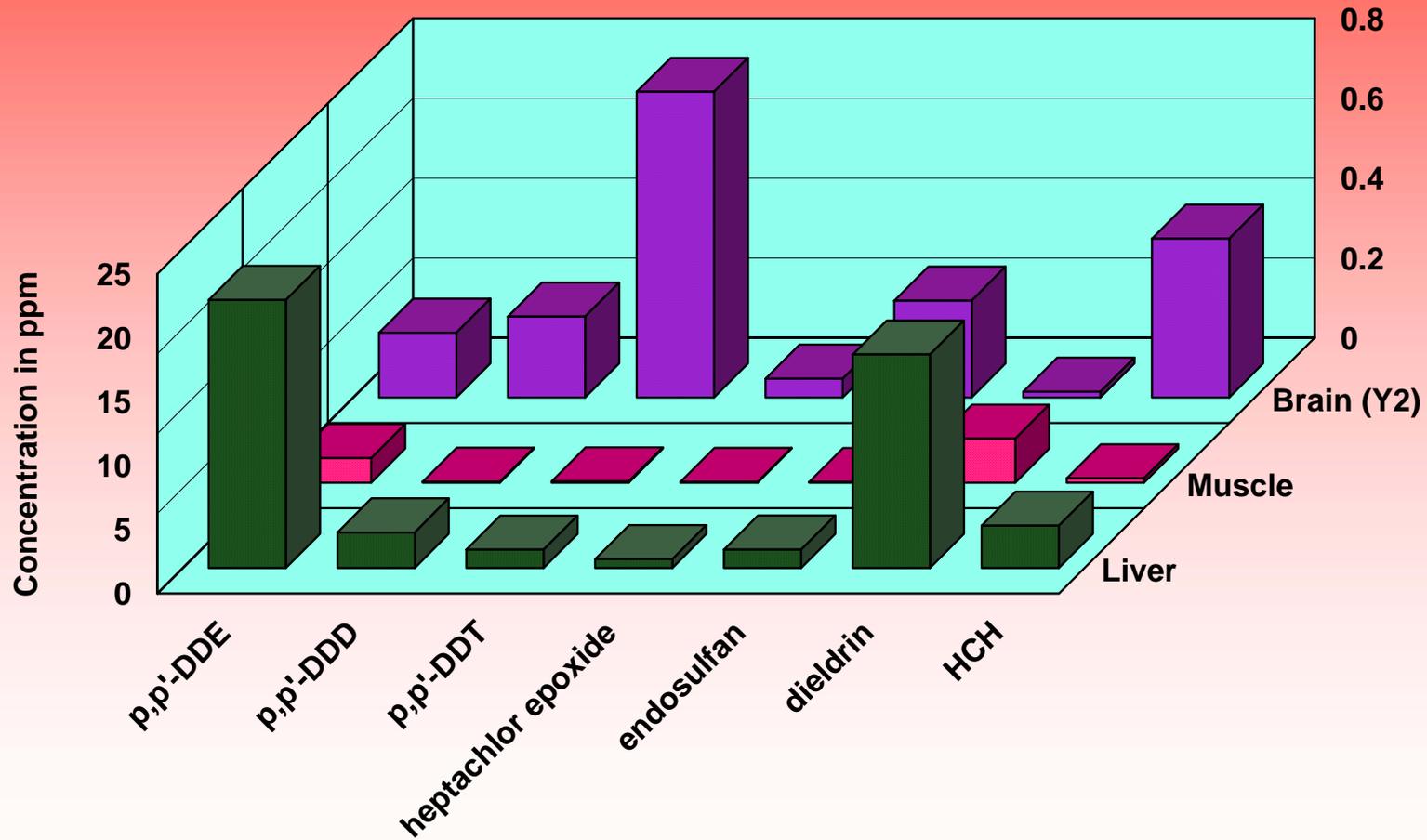
Total PAH
concentration (ppm)
among various
tissues of Blue
Rock Pigeon and
Pariah Kite



*Detected concentrations
can cause*

- *Reduced growth*
- *Increase in lesions in embryos*
- *Hormonal imbalance,*
- *Impaired reproduction etc.,*

Shikra



Pesticide	Concentration (ppm)	Toxicity	Species	Source
DDT	10 ppm equivalent 15 ppm in Brain	Lethal limits Cause for death	American Robin	Stickel <i>et al.</i> , 1970 Wurster <i>et al.</i> , 1965
DDD	65 ppm in Brain	Poisoning		Stickel <i>et al.</i> , 1970
DDE	20 -25 in Brain 35 - 39 in Brain 10-50 ppm in muscle	Lethal Cause for death Death	Passerines California condors	Stickel <i>et al.</i> , 1970 Haegele & Hudson 1974
Dieldrin	1 ppm in Brain 3 – 4 ppm 3.56 – 43.46 – Brain	Hazardous Lethal Dead birds	Sarus Crane Collared dove	Heinz & Johnson, 1981 Linder <i>et al.</i> , 1920 Muralidharan, 1993

Present study species

DDE	21 ppm	- Liver	- Shikra	Ahmedabad *
	3 ppm	- brain	- House Crow	Ahmedabad *
Dieldrin	16.9 ppm	- Liver	- Shikra	Ahmedabad *
HCH	9.6 ppm	- Brain	- Shikra	Ahmedabad

- **About 96 % of samples tested showed organochlorine contamination**
- **Metabolites of *p,p'*-DDT (81 %) and isomers of HCH (89 %) are the most commonly detected pesticides.**

Indian Peafowl – Pallapatti – Brain – 2.74 ppm **Dieldrin***

White-headed Babbler-Cuddalore – Brain 7.74 ppm **Heptachlor epoxide**

House Crow – Aravakurichi –Food content – 5 ppm of *p,p'*- **DDT**

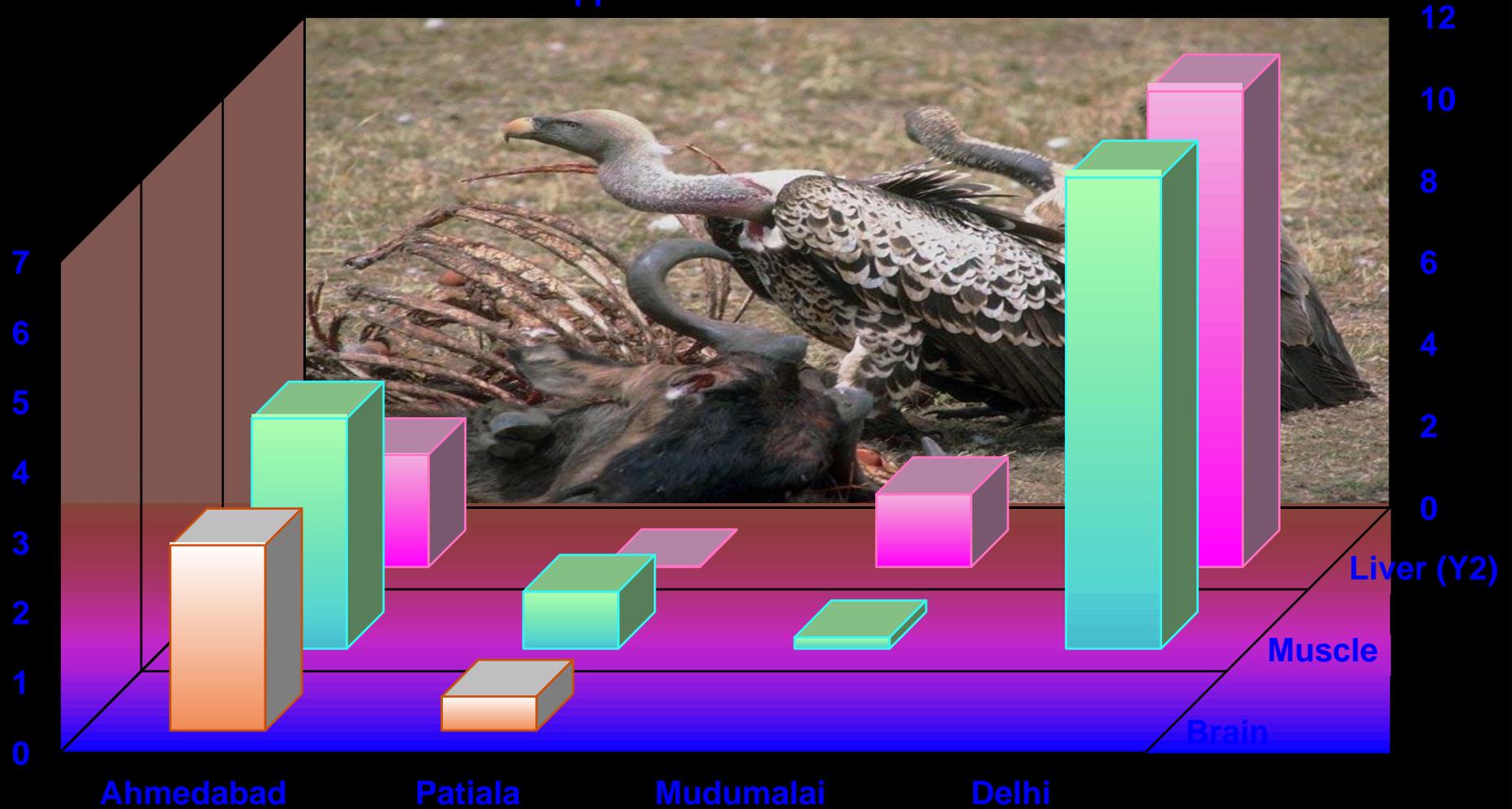
Shikra - Coimbatore – Liver – 21 ppm - **DDE***

Shikra - Coimbatore - Liver 16.9 ppm - **Dieldrin***

*** Indicative of toxic level**

Total organochlorine residues in the tissues of Indian White-backed Vulture collected from various places

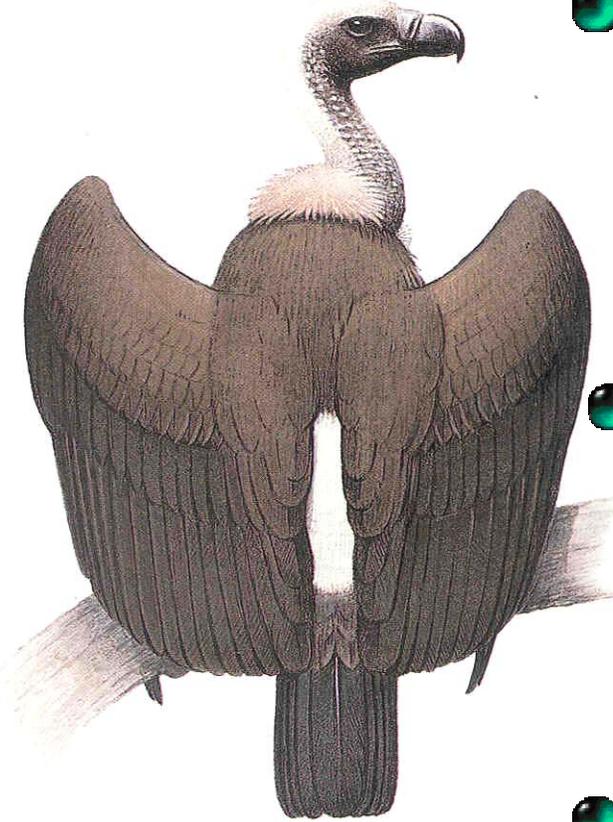
Concentration in ppm



Comparison of available information

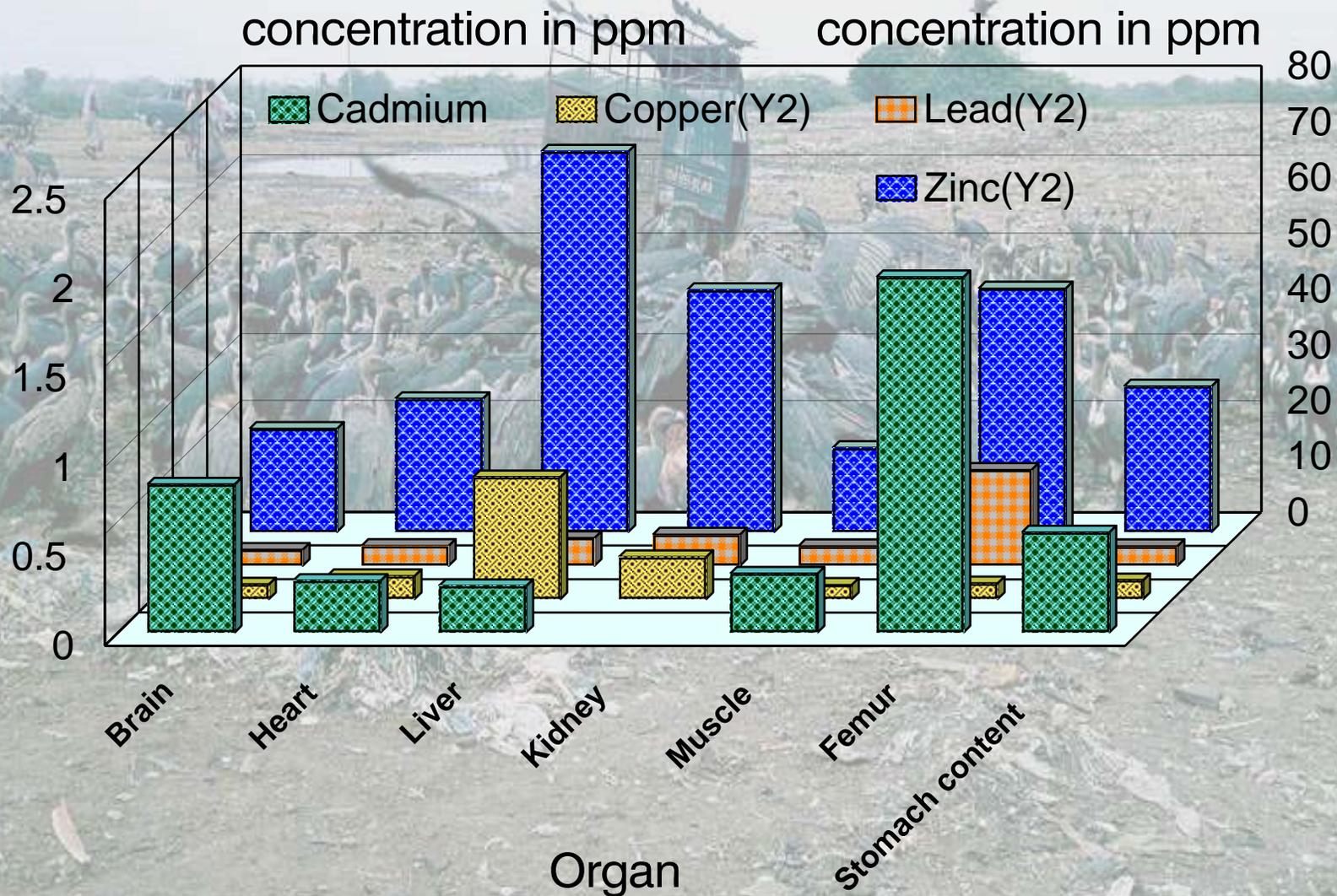
Pesticide (ppm)	Organ	Indian <i>White-backed Vulture (ppm)</i>	South African <i>White -backed Vulture (ppm) Wyk et al (2001)</i>
p,p' DDE	Liver	0.19 -9.30	0.002-0.009
	Muscle	0.32 -6.50	0.002-0.004
	Kidney	0.01- 0.06	0.004-0.008
p,p' DDD	Liver	0.47-5.80	0.001-0.005
	Muscle	0.12-4.40	nd- 0.002
	Kidney	0.12	0.004-0.004
p,p' DDT	Liver	0.15 -0.53	0.002-0.006
	Muscle	0.01-0.42	0.001-0.003
	Kidney	0.003-0.04	0.002-0.006
HCH	Liver	0.46-1.08	0.181-0.507
	Muscle	0.15-1.14	0.122-0.367
	Kidney	1.05	0.121-0.328
Dieldrin	Liver	0.04-0.08	0.002-0.318
	Muscle	0.02-0.06	0.030-0.048
	Kidney	0.03	0.055-0.126

What do the residue values mean?



- *In India, historical data on the levels of organochlorines are not available*
- *The values are exclusively compared with South African White-backed Vultures.*
- *Current data although do not indicate any problem, could serve as guideline values for future research on vultures.*

Heavy metal contamination in Indian White-backed Vulture collected during the year 1999-2003



What do we infer from these values?

Femur recorded high concentrations of lead in all the individuals indicative of chronic exposure

The level of lead recorded (18 ppm) in liver of White-backed Vulture (Ahmedabad) is indicative of lead toxicosis*.

**Reported toxic levels of Lead
(Franson *et al.*, 1996)**

2-6 ppm - sub clinical exposure

3-6 ppm - toxic

5-20 ppm - fatal*

Nalabana Bird Sanctuary, Chilika Lake, Orissa

Species	Northern Shoveler		Brown-headed Gull			Northern Pintail		Spoonbill	
	Brian	Liver	Brian	Liver	Intestine	Brain	Liver	Liver	Intestine
Σ HCH	130.48	20.52	465.96	1.05	8.69	140.91	46.53	BDL	9.76
heptachlor	BDL	2.35	5.91	3.22	0.79	BDL	0.25	BDL	0.49
HE	18.56	0.4	42.18	1.81	1.31	13.44	1.74	0.32	6.37
Σ endosulfan	12.88	BDL	43.43	0.81	6.13	10.4	0.56	BDL	2.12
<i>p,p'</i> -DDE	29.54	4.38	230.48	19.42	259.01	9.69	7.72	157.85	132.94
<i>p,p'</i> -DDT	BDL	1.76	76.77	2.21	3.87	BDL	1.43	BDL	2.3
dieldrin	6.52	BDL	4.86	2.68	1.1	20	0.53	0.45	0.77
Σ PCBs	53.4	18.22	525.13	61.61	231.54	24.84	BDL	107.22	BDL

Also tested for Organophosphate and carbamate pesticide

- a) Pesticides
 - organochlorine
 - organophosphate
- b) Polychlorinated biphenyls



Concentration reported in these species are less than the levels which are expected to create mortality.

- c) New Castle Disease (NDV)
- d) Aflatoxins

Negative

Organochlorine residues in eggs of birds

Percentage of occurrence

HCH	95
<i>p,p'</i> -DDE	87
DDT	83
Dieldrin	63
<i>p,p'</i> -DDD	46

p,p'-DDE concentration exceeded the

Threshold value of 0.5 ppm in

Purple Sunbird

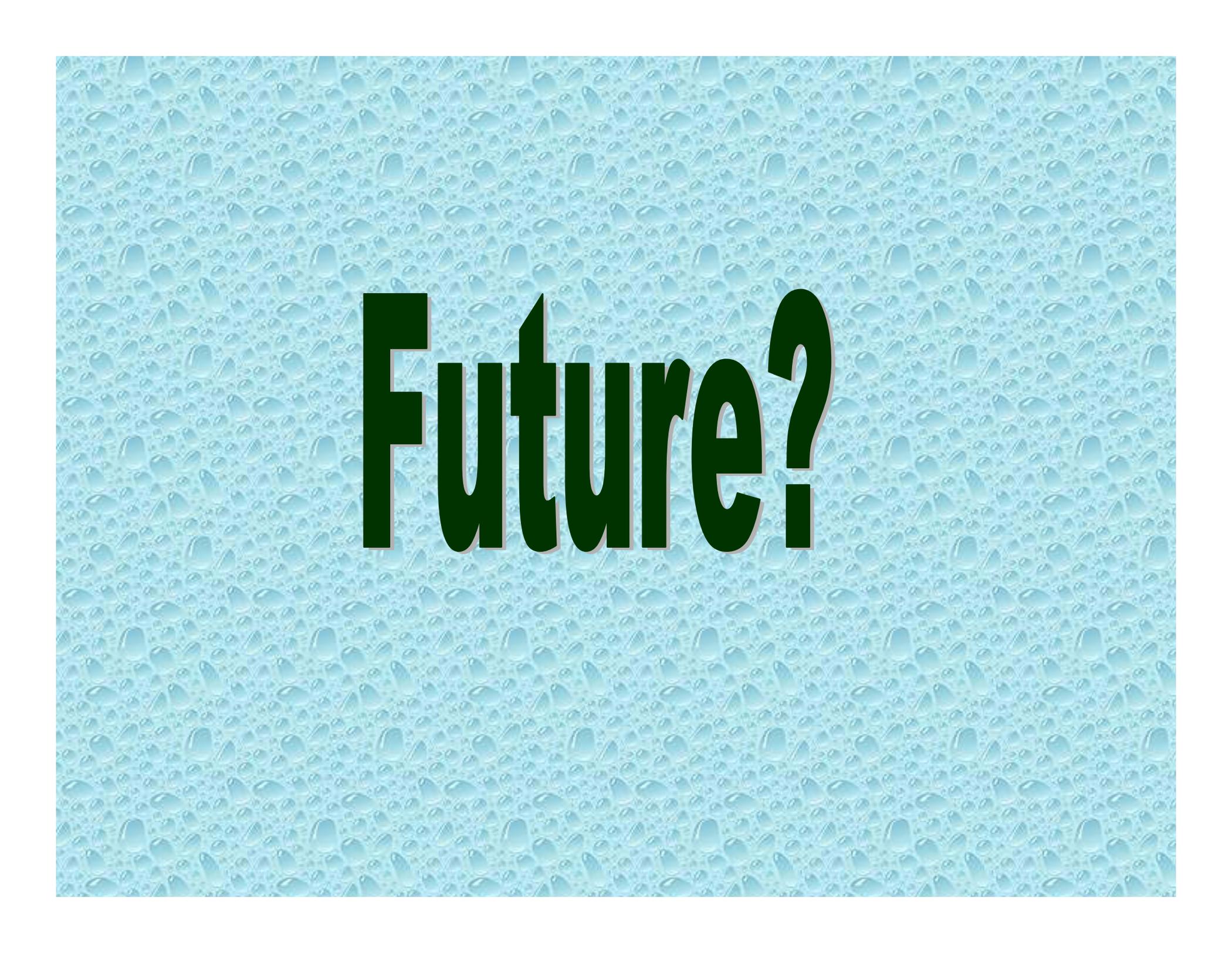
▶ House Sparrow

▶ White-backed Vulture

▶ Purple Sunbird

▶ Grey Partridge





Future?

CONSERVATION NEEDS

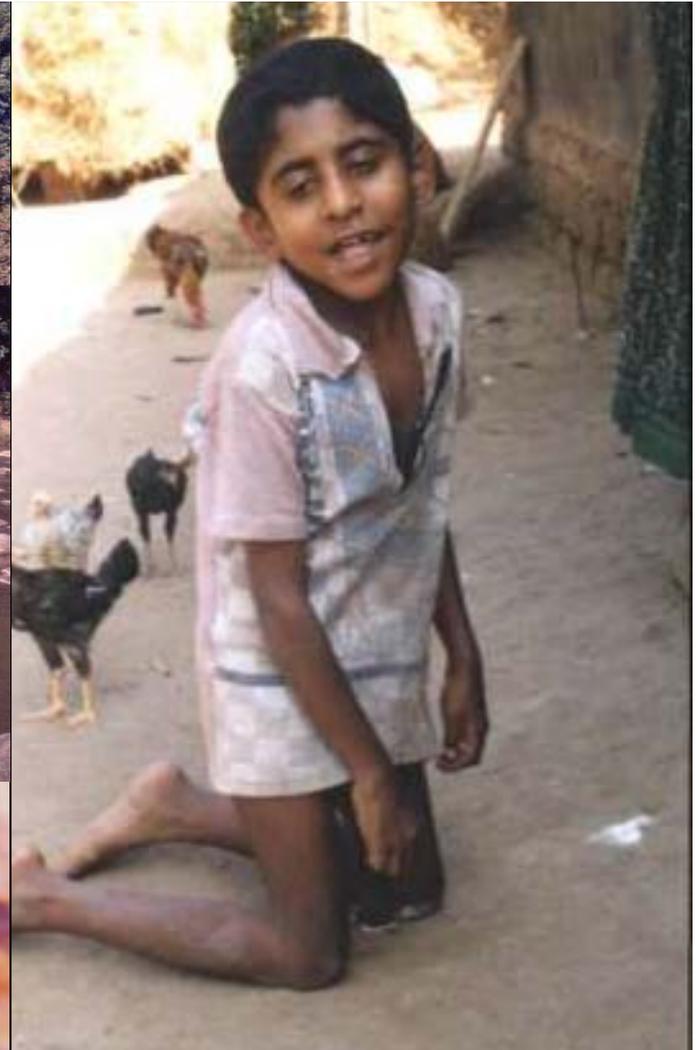
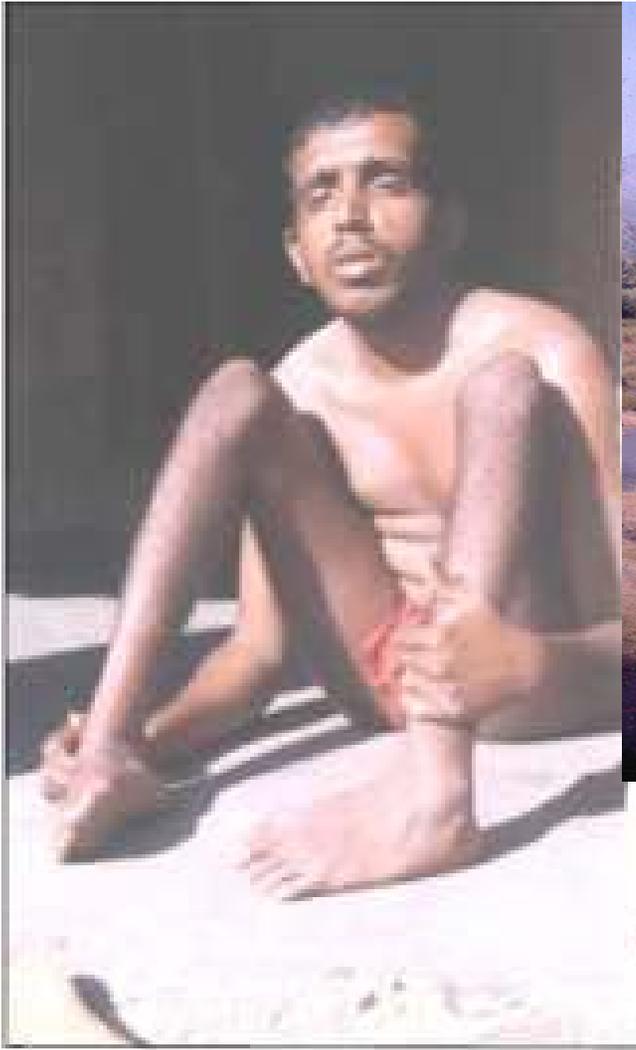
- Development of database on environmental residue levels of problem chemicals
- Formulate mechanism to monitor the residue levels of potentially harmful chemicals in select biological components in different ecosystems – Wetlands, Forests and Coastal zones
- Development of specific biomarkers to keep track of impact of specific chemicals on select ecological components
- Identify indicators for assessing impact of specific chemicals in problem areas

CONSERVATION NEEDS

- Invite collaborative ventures from countries like the US which has enormous expertise to address contaminants issue.
- Human health risk assessment is an area which requires attention.
- Creation of awareness among public on the potential threats due to contamination on human health
- Wildlife disease is another area which has to be strengthened to address issues which fall outside the purview of contamination

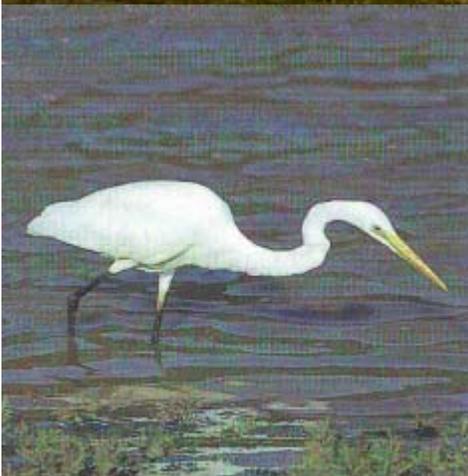
Impact of agricultural practices on the population status and breeding success of select species of fish-eating birds in India





Surveillance and monitoring of the impact of Endosulfan on certain species of birds associated with cashew plantations in and around Kasargode, Kerala and Cuddalore, Tamil Nadu.

Contamination profile of Inland Wetlands of India



**Surveillance of
waterfowl at Nalabana
Bird Sanctuary, Chilika
Lake, Orissa
consequent to the mass
mortality during 2005-
2007.**



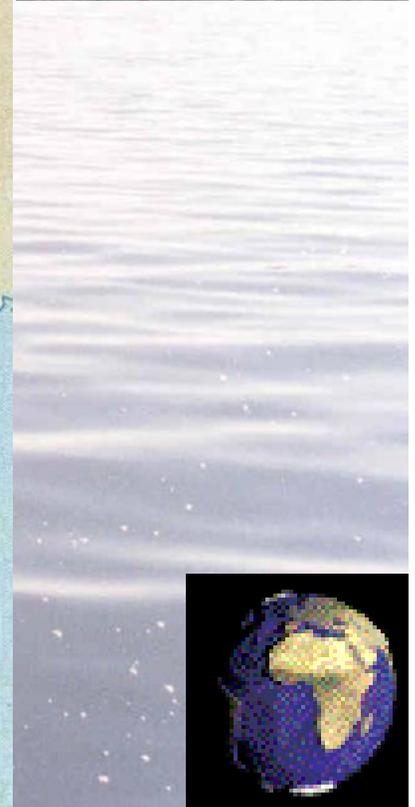
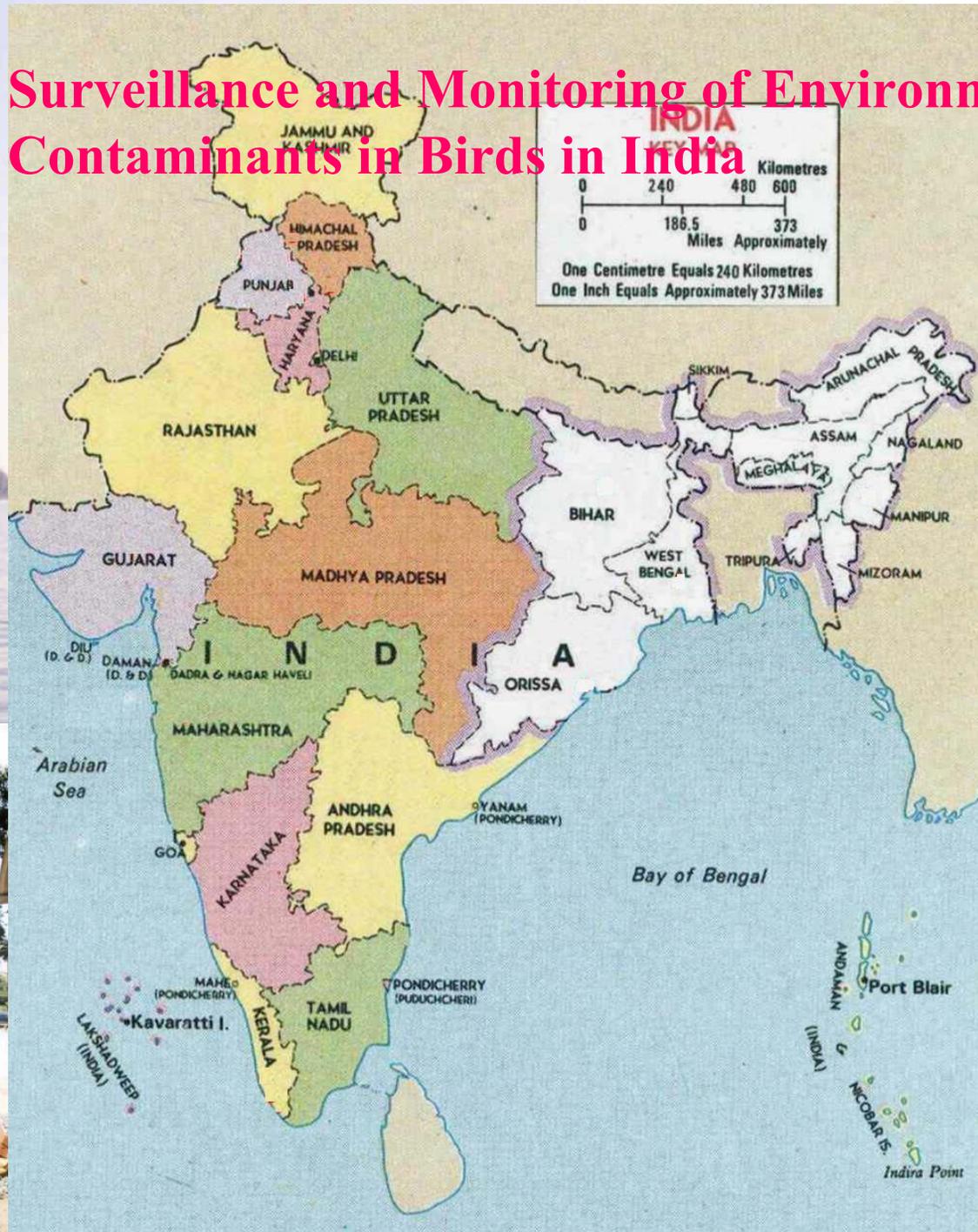
**Feathers as tool to
assess Heavy metal
contamination in
birds**





Organic contaminants and their
impact on select raptors

Surveillance and Monitoring of Environmental Contaminants in Birds in India



Chemical inputs in tea cultivation and their impact on avifauna and amphibians



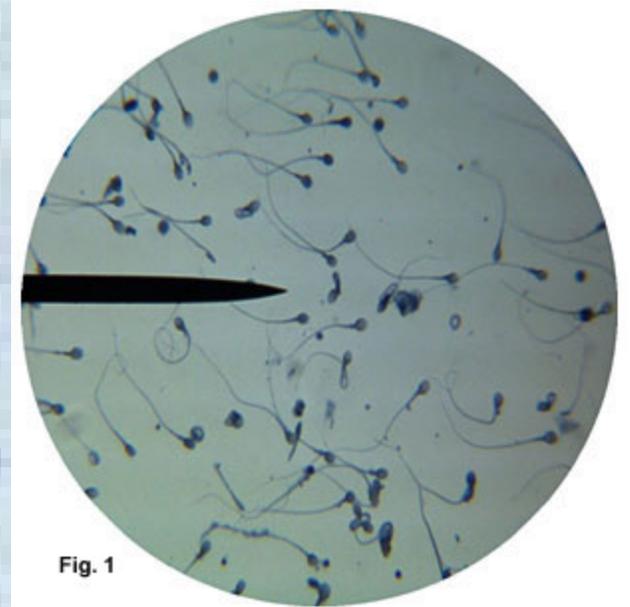


Fig. 1

A Study on the role of Environmental Estrogens on Infertility Among Men in and Around Coimbatore



Use of biomarkers in evaluation of heavy metal contaminants in marine fishes



THANKS



Salim Ali Centre for Ornithology & Natural History