

WILDLIFE DISEASE SURVEILLANCE AND MONITORING



***SEEK AND YE SHALL FIND – SO
SAYETH THE LORD***

**FOR EVERY MISTAKE YOU MAKE FOR NOT
KNOWING, YOU WILL MAKE A HUNDRED FOR NOT
LOOKING**

KAISER VAN DER WALT 1969

Disease surveillance in wildlife is generally less well structured than in livestock because free-ranging wildlife populations are not visited and visualized on a regular basis, frequently do not have owners, and are not easily manipulated for “hands on “ examination or specimen collection (Bengis *et al.*, 2002).

IT IS NOW WIDELY RECOGNISED THAT COUNTRIES THAT CONDUCT DISEASE SURVEILLANCE IN THEIR WILD ANIMAL POPULATIONS HAVE A BETTER UNDERSTANDING OF THE EPIDEMIOLOGY OF ANIMAL AND ZONOTIC INFECTIONS, AND ARE BETTER PREPARED TO PROTECT WILDLIFE, LIVESTOCK AND HUMAN POPULATIONS

TORSTEN MÖRNER et al 2002

REMEMBER !! IN FREE-RANGING MULTI-SPECIES SYSTEMS ALTHOUGH THE INDIVIDUAL ANIMAL IS PROBABLY UNIMPORTANT IN THE GREATER SCHEME OF THINGS, THEY MAY BE IMPORTANT INDICATORS OR SENTINELS OF DISEASE EVENTS

IMPORTANT LINKAGES IN WILDLIFE DISEASE SURVEILLANCE CHAIN

- 1) TRAINING OF PERSONNEL (LOW – MEDIUM TECHNOLOGY)**
- 2) FIELD INVESTIGATIONS, OBSERVATIONS AND GROUND TRUTHING (LOW TECH – HIGH HUMAN INPUT) : USE ALL SENSES INCLUDING “COMMON SENSE”**
- 3) COLLECTION OF UTILISABLE SAMPLES / SPECIMENS COLLECTION + COLD CHAIN (WHEN NECESSARY) LOW – MEDIUM TECHNOLOGY**
- 4) LABORATORY DIAGNOSTICS (LOW, MEDIUM OR HIGH TECH)**

DISEASE SURVEILLANCE IN THE KRUGER NATIONAL PARK

- THE KNP HAS ONE OF THE BEST WILDLIFE DISEASE SURVEILLANCE SYSTEMS IN AFRICA**
- THE KNP CURRENTLY HAS A ROBUST VETERINARY TECHNICAL STAFF COMPONENT**
- MULTI-DISCIPLINARY TRAINING HAS RESULTED IN BROAD-BASED REPORTING OF EVENTS, AND PARTICIPATION IN DISEASE MONITORING – INCLUDING FIELD RANGERS.**
- THE KNP HAS AN EXCELLENT NETWORK OF ROADS.**
- THERE ARE FREQUENT AERIAL FLY-OVERS BY SENSITISED PILOTS AND BIOLOGISTS.**

SOME **KNP ILLUSTRATIVE CASE HISTORIES WHERE INVESTIGATIONS AND OBSERVATIONS DETECTED INFECTIONS IN WILDLIFE AND OR DEMONSTRATED IMPORTANT EPIDEMIOLOGICAL RELATIONSHIPS.**

- FMD
- ANTHRAX
- BOVINE TB
- ENCEPHALOMYOCARDITIS
- CYANOBACTERIAL BIO-INTOXICATION
- SARCOPTIC MANGE
- CROCODILE PANSTEATITIS

EXAMPLE # 1 -FOOT AND MOUTH DISEASE

- **SUB-CLINICAL AND UBIQUITOUS IN MOST AFRICAN BUFFALO POPULATIONS.**
- **VIRUS TRANSMISSION TO OTHER SPECIES CAUSING CLINICAL DISEASE HAS ONLY BEEN REPORTED FROM SOUTH AFRICA AND ZIMBABWE.**

OUTBREAKS OF WILDLIFE CLINICAL DISEASE RECORDED

- **MOST OTHER SUB-SAHARAN AFRICAN COUNTRIES THAT HAVE INFECTED BUFFALO POPULATIONS DO NOT REPORT FMD OUTBREAKS IN SYMPATRIC CLOVEN HOOFED WILDLIFE**
- **IN THE KNP, 28 OUTBREAKS OF FMD IN MAINLY IMPALA, BUT ALSO KUDU, NYALA, WARTHOGS AND GIRAFFE HAVE BEEN DETECTED SINCE 1967 . QUITE A FEW OUTBREAKS HAVE ALSO PROBABLY BEEN MISSED.**
- **THIS HIGH SUCCESS RATE OF FMD DETECTION IN THE KNP IS PROBABLY DUE TO TRAINING FOR THIS TYPE OF TARGETED SURVEILLANCE, AND SECTION RANGERS AND GAME SCOUTS HAVE ALSO BEEN SENSITIZED TO REPORT ANIMALS SHOWING CLINICAL SIGNS.**

CLINICAL SIGNS ARE CRYPTIC AND EASILY MISSED

- **PILO-ERECTION (FEBRILE)**
- **“WALKING ON EGGS”**
- **VARYING DEGREES OF OVERT LAMENESS.**
- **SHAKING OF HOOVES**
- **EXCHANGING WEIGHT ON PAINFUL LIMBS**
- **LAGGING BEHIND HERD.**
- **LYING DOWN.**

SALIVATION IS RARELY EVER SEEN.



Shaking and licking of hooves



FMD LESIONS IN IMPALA



OTHER SPECIES IN WHICH FMD HAS BEEN RECORDED



EXAMPLE # 2 : ANTHRAX

- ANTHRAX IS A HIGHLY VISIBLE DISEASE
- ACUTE DEATHS OF ANIMALS IN GOOD CONDITION
- ANTHRAX IS A MULTI-SPECIES DISEASE
- ANTHRAX OUTBREAKS IN WILDLIFE ARE REGULARLY REPORTED FROM MANY SUB-SAHARAN AFRICAN COUNTRIES.
- NUMBER OF MORTALITIES CAN BE QUITE SPECTACULAR

ANTHRAX IN THE KNP

- NINE OUTBREAKS OF ANTHRAX HAVE BEEN DETECTED IN THE KNP OVER THE PAST 5 DECADES.

CARCASSES FREQUENTLY SHOW OPISTHOTONUS + EXTENSOR RIGIDITY OF FOR LIMBS.



**BLEEDING FROM BODY ORIFICES MAY BE SEEN –
DARK TARRY BLOOD THAT DOES NOT CLOT**



Bleeding from body orifices



**ECCHYMOSES OFTEN SEEN IN THE UNPIGMENTED
OR HAIRLESS AREAS OF THE SKIN**



**SWOLLEN FACES, LIPS AND TONGUES IN
PREDATORS**





DOMINANT EPIDEMIOLOGICAL ROLE PLAYERS VARY IN DIFFERENT HABITATS AND ECOSYSTEMS

- ZIMBABWE AND SOUTH AFRICAN EASTERN LOWVELD SAVANNAH : TRAGELAPHS, BUFFALO, WATERBUCK AND ROAN ANTELOPE.
- NAMIBIA AND BOTSWANA ARID SAVANNAHS : ELEPHANTS, ZEBRAS, WILDEBEEST AND SPRINGBOK.
- ZAMBIAN LUANGWA RIVERINE SYSTEM AND UGANDAN GREAT LAKES : HIPPOS AND BUFFALO
- KENYAN NORTHERN ARID ZONE : GREVI'S ZEBRA
- TANZANIAS LAKE MANYARA AREA : IMPALA
- ETHIOPIA'S ARID OMO NATIONAL PARK : LESSER KUDU

COLLECTION OF DIAGNOSTIC SPECIMENS

With fresh or partially putrefied carcasses:

- COLLECT A PERIPHERAL BLOOD SMEARS – FROM EARS, TAIL OR ANY SUPERFICIAL VEIN. THE DEPENDENT (LOWER) EAR IS GENERALLY MORE ENGORGED AND GIVES A BETTER SAMPLE.

In moderate to severely putrefied carcasses, or carcasses that have been heavily utilised :

- THE CORONARY BAND, INTERDIGITAL SPACE OR HOOF LAMELLAE GIVE THE BEST QUALITY SPECIMEN WITH LESS PUTREFACTION

SINCE 1959, 8 LARGE OUTBREAKS AND 1 SMALL OUTBREAK OF ANTHRAX HAVE BEEN DETECTED IN THE KNP



PERIPHERAL BLOOD SMEARS COLLECTION



SOMETIMES VERY LITTLE OF THE CARCASS IS LEFT TO SAMPLE



**COLLECTION OF BLOOD SMEARS FROM OLD
PUTREFIED CARCASSES OR CARCASSES THAT
HAVE BEEN HEAVILY UTILISED**



**COLLECTION OF BLOOD SMEARS FROM OLD
PUTREFIED OR HEAVILY UTILISED CARCASSES**



**COLLECTION OF SAMPLES FROM OLD SUSPECT
CARCASSES THAT ARE DRIED OUT OR MUMMIFIED**



COLLECTING A RIB SPECIMEN



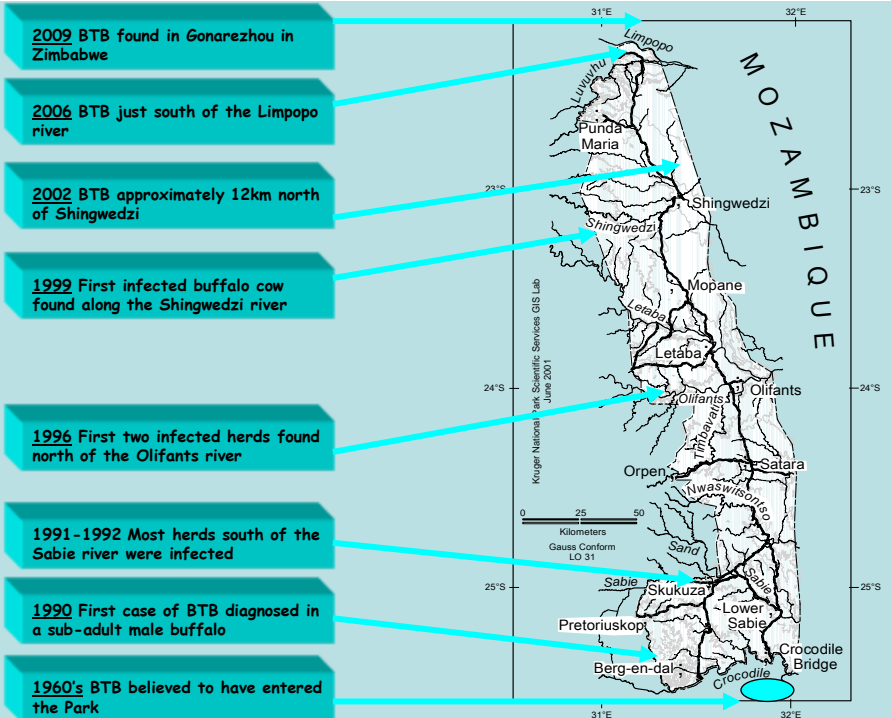
EXAMPLE # 3 : BOVINE TUBERCULOSIS

- LATE ONE FRIDAY AFTERNOON IN JULY 1990, THE RANGER AT STOLTZNEK REPORTED A DOWNER BUFFALO CLOSE TO THE WESTERN BOUNDARY FENCE AT MAQILI.
- THE INCIDENT WAS IMMEDIATELY INVESTIGATED, AND THE ANIMAL WAS NECROPSIED WITH THE ASSISTANCE OF VEHICLE HEADLIGHTS
- TYPICAL LARGE PYOGRANULOMATOUS LESIONS WERE FOUND IN THE LUNGS AND THORACIC NODES
- INFECTION WITH *Mycobacterium bovis* WAS CONFIRMED.
- THIS WAS THE FIRST CONFIRMED CASE OF BOVINE TUBERCULOSIS IN THE KNP
- FOLLOW UP MONITORING OF NEARBY BUFFALO HERDS SHOWED THAT SEVERAL HERDS SOUTH OF THE SABI RIVER WERE INFECTED, BUT NO INFECTION COULD BE DETECTED NORTH OF THE SABI RIVER.

BOVINE TUBERCULOSIS



BTB – SPREAD TO OTHER SPECIES



EXAMPLE # 4 : ENCEPHALOMYOCARDITIS IN AFRICAN ELEPHANTS IN THE KNP



BACKGROUND

- From the summer of 1993 and extending well into 1994, significant elephant mortalities occurred in the Kruger National Park.
- This was a novel event, and carcass counts far exceeded the normal sporadic elephant mortalities that are reported annually in rangers reports.

**THE MOST COMMON CAUSES OF SPORADIC
ELEPHANT MORTALITIES INCLUDE :**

- **OLD AGE (DENTAL ATTRITION)**
- **INTRA-SPECIFIC FIGHTING (BULLS)**
- **ANTHRAX**
- **POACHING**

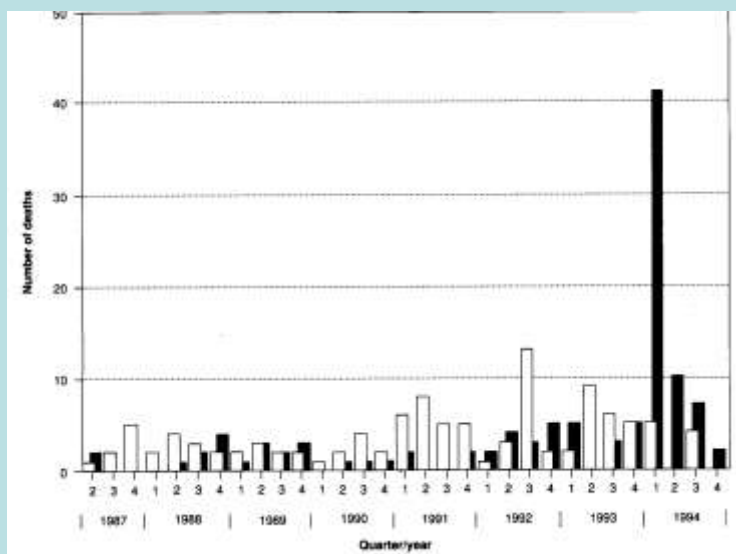
**BLOOD SMEARS WERE NEGATIVE FOR
ANTHRAX**



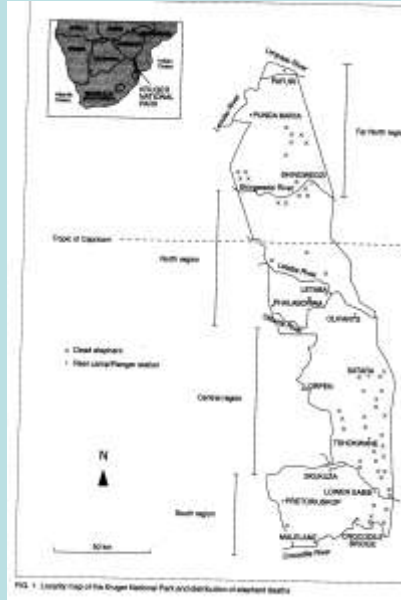
SOME EPIDEMIOLOGICAL DETERMINANTS

- MORTALITIES WERE TEMPORALLY CLUSTERED
- MORTALITIES WERE SPATIALLY CLUSTERED
- 83% OF ALL CARCASSES FOUND WERE ADULT BULLS
- THESE ELEPHANT MORTALITY EVENTS TOOK PLACE DURING A MAJOR RODENT POPULATION EXPLOSION IN THE KNP.

MORTALITIES WERE TEMPORALLY CLUSTERED



MORTALITIES WERE SPATIALLY CLUSTERED



THE MAIN RODENT SPECIES INVOLVED WAS *Mastomys natalensis*, THE MULTIMAMMATE MOUSE



BIOLOGY OF THE MULTI-MAMMATE MOUSE

- **FEMALES HAVE 8 – 12 PAIRS OF MAMMAE**
- **ARE EXCEPTIONALLY FECUND (6 – 22 YOUNG HAVE BEEN RECORDED)**
- **GESTATION PERIOD IS 23 DAYS.**
- **LITTER INTERVAL IS 35 DAYS**
- **YOUNG FEMALES REACH PUBERTY AT 10 WEEKS**
- **A SINGLE PAIR CAN THUS THEORETICALLY HAVE 1000 DESCENDANTS IN A YEAR.**
- **HUGE POPULATION EXPLOSIONS HAVE BEEN PREVIOUSLY DOCUMENTED IN SOUTHERN AFRICA, GENERALLY IN THE FIRST FEW YEARS FOLLOWING A SEVERE DROUGHT.**

INITIAL CARCASSES FOUND WERE TOO PUTREFIED FOR MEANINGFUL DIAGNOSTIC PATHOLOGY

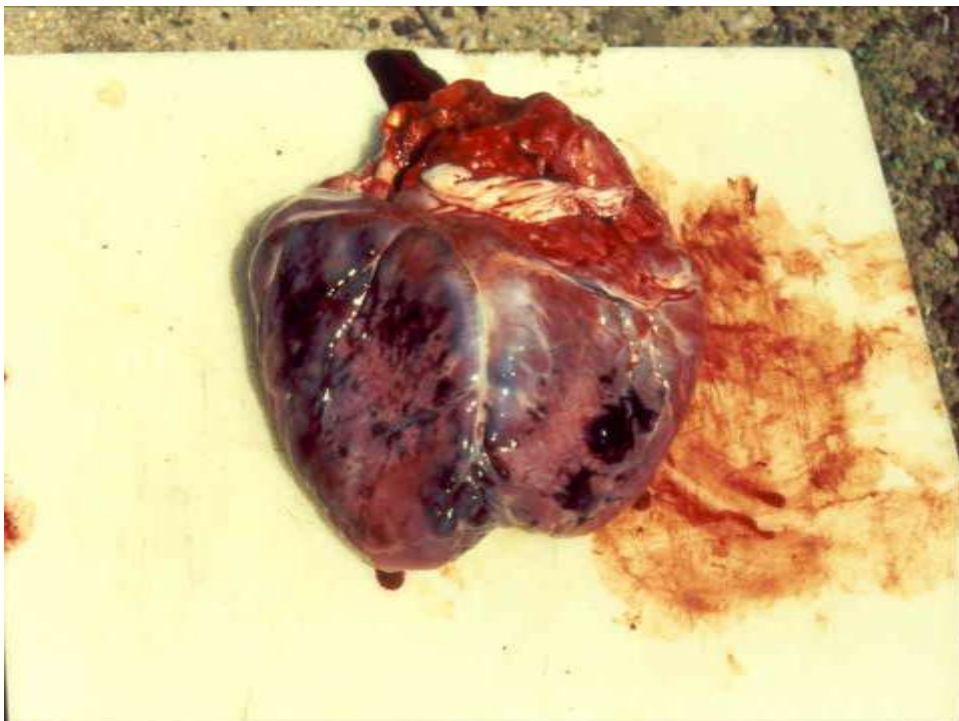
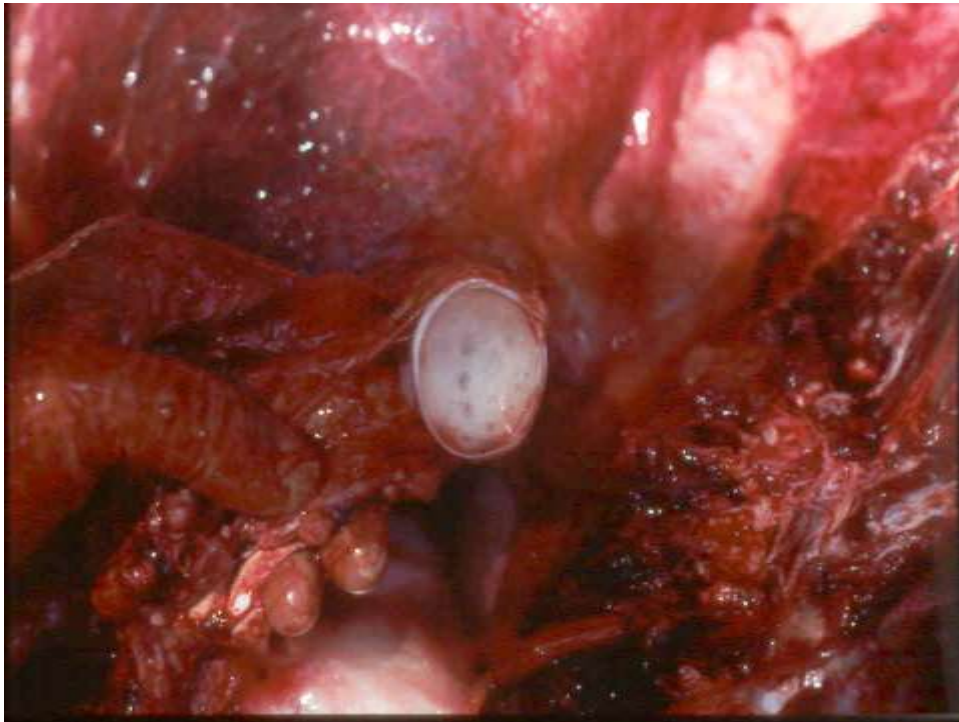


SUBSEQUENTLY, FRESH CARCASSES WERE LOCATED AND NECROPSIED

MOST SIGNIFICANT MACRO – LESIONS INCLUDED :

- ACUTE DEATHS – ANIMALS IN GOOD CONDITION
- ACUTE PULMONARY OEDEMA (INTERSTITIAL AND ALVEOLAR) WITH FROTH ALSO PRESENT IN ALL AIRWAYS INCLUDING THE TRUNK.
- SUB-EPICARDIAL PETECHIAE AND ECCHYMOSES
- PALE STREAKY AREAS IN THE MYOCARDIUM
- ASCITES (SEVERE) AND HYDROPERICARD
- HEPATOMEGALY AND CONGESTION
- OEDEMATOUS MEDIASTINAL AND MESENTERIC LYMPH NODES





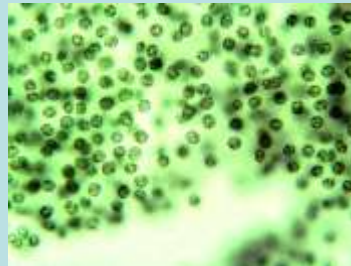
MORPHOLOGICAL DIAGNOSIS

- **ACUTE CONGESTIVE HEART FAILURE (LEFT AND RIGHT SIDED)**
- **HISTOPATHOLOGY REPORTED DISSEMINATED FOCAL LYMPHOCYTIC MYOCARDITIS, ACCOMPANIED BY NECROSIS OF MYOCYTES**

AETIOLOGICAL DIAGNOSIS

- **A CARDIO VIRUS KNOWN AS ENCEPHALOMYOCARDITIS VIRUS WAS ISOLATED FROM MYOCARDIAL TISSUE.**

EXAMPLE # 5 : CYANOBACTERIAL BIO-INTOXICATION



THE FIRST DETECTED OUTBREAK

- FROM MARCH 2005, A CLUSTER OF UNACCOUNTABLE DEATHS WERE RECORDED BY THE RANGER AT CROCODILE BRIDGE IN THE SOUTH EASTERN CORNER OF THE KRUGER NATIONAL PARK.
- SEVERAL BLOOD SMEARS WERE SENT TO THE SKUKUZA LABORATORY AND WERE NEGATIVE FOR ANTHRAX
- THE RANGER WAS REQUESTED TO NOTIFY THE STATE VET OFFICE IF HIS FIELD PERSONNEL LOCATED ANY FRESH CARCASSES.

**ON 18TH MAY 2005, A FRESH ZEBRA
CARCASS WAS FOUND, REPORTED AND
NECROPSIED**

MACRO PATHOLOGY

- ADULT STALLION
- ACUTE DEATH - IN GOOD CONDITION
- SEVERE ICTERUS (JAUNDICE)
- LIVER ENLARGED, FRIABLE, MOTTLED ORANGE IN COLOUR
- PULMONARY OEDEMA AND EMPHYSEMA

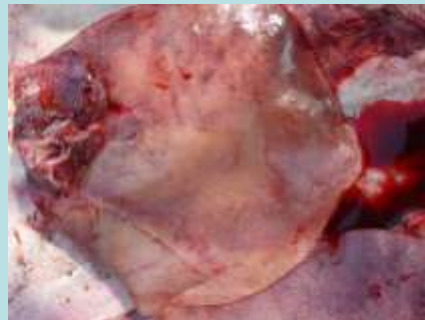
HISTOPATHOLOGY (MORPHOLOGICAL DIAGNOSIS)

- SEVERE ACUTE CENTRIOBULAR TO MID-ZONAL HEPATIC NECROSIS WITH HAEMORRHAGES.

AETIOLOGICAL DIAGNOSIS

- LESIONS COMPATIBLE WITH ACUTE ALGAL INTOXICATION

POST MORTEMS



PROBLEM INVESTIGATION

- **INTENSIFY SEARCH FOR MORE CARCASSES**
- **SCRUTINISE RANGER'S RECORDS OF ALL CARCASSES DETECTED IN THE AREA IN THE AREA TO DATE**
- **INVESTIGATE WATER EMPOUNDMENTS IN THE IMMEDIATE AREA FOR SIGNS OF ALGAL BLOOM.**
- **COLLECT WATER SAMPLES FOR ALGAL IDENTIFICATION AND TOXICITY TESTING**
- **GIS MAPPING OF ALL CARCASSES**

FINDINGS

- **THERE WERE VISIBLE ALGAL BLOOM AT NHLANGANZWANE AND MPANAMA DAMS**
- **MULTI-SPECIES INVOLVEMENT, INCLUDING RUMINANTS, HIND GUT DIGESTORS AND PREDATORS**
- **CARCASSES WERE SPATIALLY CLUSTERED AROUND THESE TWO POINT SOURCES**
- **TEMPORAL CLUSTERING OF CARCASSES WAS EVIDENT FROM RANGERS RECORDS, PROBABLY RELATED TO WIND AND WIND DIRECTION, CAUSING RAFTING OF ALGAE ON DOWNWIND SHORES**

ANIMAL DEATHS SUSPECTED TO BE ASSOCIATED WITH THIS CYANOBACTERIAL BLOOM

- **MOST CARCASSES FOUND CLUSTERED IN REASONABLE PROXIMITY OF THE TWO "POINT SOURCE" DAMS WERE ASSUMED TO HAVE DIED OF CYANOBACTERIAL INTOXICATION.**
- **THESE MORTALITIES OCCURRED BETWEEN MARCH AND JULY, 2005 AND WERE RECORDED IN RANGERS DIARIES OR DETECTED BY FOLLOW-UP VETERINARY SURVEILLANCE PATROLS.**
- **BOTH PRE- AND POST CONFIRMATION OF DIAGNOSES (MAY / JUNE), VERY FEW FRESH CARCASSES WERE FOUND.**
- **TYPICALLY, MOST CARCASSES CONSISTED OF WHOLE AXIAL AND APPENDICULAR SKELETONS, COVERED BY SKIN WITH INTERNAL ORGANS AND FLESH HOLLOWED OUT BY VULTURES.**
- **CARCASSES OF A VARIETY OF SPECIES INCLUDING HERBIVORES AND CARNIVORES WERE FOUND**

SUSPECTED ECOLOGICAL RISK FACTORS

- **WARMER THAN NORMAL AUTUMN AND EARLY WINTER PERIOD**
- **STILL WATER IMPOUNDMENTS**
- **HIGH HIPPO DENSITIES : DUNG AND URINE HAVE SIGNIFICANT CONCENTRATIONS OF NITROGEN AND PHOSPHATES.**
- **HIPPO MOVEMENTS IN THE WATER BODY STIR UP THE ACCUMULATED SILT AND SLUDGE**
- **THIS MAY RESULT IN INCREASED EUTOPHICATION OF THE WATER BODY**

CARCASS SPECIES ANALYSIS

WILDEBEEST, WHITE RHINO'S, AND ZEBRAS WERE OVER-REPRESENTED RELATIVE TO THEIR POPULATION DENSITIES IN THE AREA– WHY ??

HYPOTHESIS

- **THESE SPECIES APPROACH WATER HOLE FROM DOWN WIND – WHERE ALGAE HAS RAFTED.**
- **THESE SPECIES FREQUENTLY DRINK IN THE LATE AFTERNOON / EVENING WHEN THE ALGAE HAVE BECOME BUOYANT AND CAN RAFT**
- **THESE SPECIES DO NOT WADE PAST THE “SCUM LINE”.**

EXAMPLE # 6 : PANSTEATITIS IN CROCODILES IN THE OLIFANTS / LETABA DRAINAGE SYSTEM

AN EMERGING ENVIRONMENTAL HEALTH ISSUE

HISTORY

- On 28th May 2008, several crocodile carcasses were reported by the trails ranger, in the Olifants river near the Trails Camp.
- First decomposed crocodile was necropsied by Dr Dewald Keet on 29th May. He reported that the crocodile was in good condition, had an empty stomach and had hard yellowish fat.
- Thereafter several old crocodile carcasses were necropsied with very similar findings.
- Live lethargic crocodiles were also seen





NECROPSY FINDINGS WERE CONSISTENT

- MAINLY LARGE CROCODILES : 2 – 4 METERS LONG WERE AFFECTED
- ANIMALS WERE IN GENERALLY IN EXCELLENT BODY CONDITION : ALMOST EXCESSIVELY FAT
- GASTRO INTESTINAL TRACTS WERE EMPTY EXCEPT FOR GASTROLITHS IN STOMACH
- MOST FAT DEPOTS (ABDOMENAL, THORACIC AND TAIL) CONTAINED LARGE AMOUNTS OF HARDENED, RUBBERY, OCHRE COLOURED FAT
- SOME DEGENERATIVE CHANGES WERE SEEN IN HEART MUSCLE AND SKELETAL MUSCLE





SUMMARY

- **WHAT I HAVE HOPED TO DO IN THIS PRESENTATION IS TO HIGHLIGHT AND ILLUSTRATE THE IMPORTANCE OF LOW TECH SCANNING AND MEDIUM TECH TARGETED SURVEILLANCE FOR DETECTING AND MONITORING HEALTH ISSUES IN FREE-RANGING WILDLIFE.**
- ***IF YOU DON'T LOOK, YOU WON'T FIND !!!***
- **THANKS FOR LISTENING TO THE RAMBLINGS OF AN OLD FART !!**

THE END

