Epidemiology and specific parasites
Module # 9 - Component # 1

Epidemiology
and specific parasites

Objective

Be aware of the impact parasites have on wildlife and know how to manage these parasites so as not to become a problem.

Expected Outcome

- List the most common parasites of wildlife.
- Know the conditions under which parasites can become a problem.
- List the control measures to ensure that parasites do not become a problem.

Ticks on the ears and face of a kudu - Tragelaphus strepsiceros
General epidemiological considerations

Most wild animals are distributed according to species in fairly well-defined geographic regions. Within these regions, particular species will have preferred habitats. Animal species, geographic distribution, and habitat preference will contribute to determining the species composition of parasite burdens and their numerical magnitude. Host behaviour and gender may also influence the size of burdens. Normal, healthy wild animals in large ecosystems frequently harbour nematode and tick burdens, each exceeding several thousand. However, most of these parasites are usually in an immature stage of development and cause little damage. It is generally only when adult nematode and tick burdens exceed several hundred and, in some cases, several thousand that problems can be expected.

The dispersion of parasites, however, is one of over-dispersion. This means that most hosts have only a few parasites, but some have many. This implies that a few hosts harbour a high proportion of the total parasitic population of a particular parasite within a specific environment - of the parasites that are on hosts. Typically, 99% of ectoparasites are in the field, and 1% are on hosts.

Impala: Aepyceros melampus
The reasons for over-dispersion are:

- **Free-living parasites are not randomly dispersed** within a host's environment. Example: An 'unlucky' host will wander into a particularly dense patch of tick larvae.
- **Habitats vary**: thickets, riparian, streams, open plains, woodland etc.
- The **behaviour of ticks varies** from hunters, opportunistic waiters, host preferences.
- The **presence of ticks** on a host **predisposes that host** to attract more ticks.
- The **host's ability to limit infestations**
- The **host's ecology and behaviour**, grooming, wallowing, swimming etc.

One buffalo study revealed the following, and the animal was extremely healthy:

<table>
<thead>
<tr>
<th>Parasite Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 ticks</td>
<td></td>
</tr>
<tr>
<td>3 lice</td>
<td></td>
</tr>
<tr>
<td>5 oestrid fly larvae</td>
<td></td>
</tr>
<tr>
<td>13 nematodes</td>
<td></td>
</tr>
<tr>
<td>4 tapeworms</td>
<td></td>
</tr>
<tr>
<td>1 trematode</td>
<td></td>
</tr>
</tbody>
</table>
An **average adult kudu bull** will harbour a total of **100 000 ticks per year and remain healthy.** Healthy animals can carry many parasite species in heavy numbers and remain healthy.

**Impala, as a species, carry too many ticks for their size.** At any one time, an adult impala may be carrying up to **5000** individuals, kudu average at this number. The **larger the host, the better it is for the adult ticks.**
The role of parasites

In large ecosystems, free from human interference, parasites and predators fulfil an important role in selecting host populations for fitness. Young animals, usually until 12 to 18 months, are often subject to large parasite infections. Weaker individuals and those that do not develop an effective immune response often succumb and are caught by predators before they can contribute to the gene pool - this is the basis for Natural Selection.

Diseased, injured, stressed or maladapted, young or older animals and aged animals frequently have compromised immune systems. They become heavily infected with parasites resulting in a further deterioration in their condition and rapid removal from the environment by predators. Between the parasites and the predators, the population is thus screened for fitness.

Gemsbok skull: Oryx gazelle
Human intervention

Human intervention has severely jeopardised this balance. Not only have humans translocated wild animals to regions in which they did not originally occur, but they have also eliminated predators as they have perceived these to be competition for a limited resource. The humans have themselves then failed to assume the role of the predators.

Translocated animals often suffer severe stress and may never adapt to the new habitat or to the resident parasites that are foreign to them. They thus become a bountiful source of infection not only for themselves but also for the wildlife endemic to the region. Because of the costs involved in the translocated wild animals’ purchase and transportation, it is unlikely that they will be purposely exposed to predators, nor will their owners destroy them if they become heavily parasitised. Consequently, they persist as a reservoir of infection.

Humans have also introduced domestic livestock into wildlife regions and reintroduced wildlife into regions now used for stock farming. This has led to the introduction of foreign parasites to either one of these host groups and cross-infection. In some cases, the parasites have adapted to the new host species with little visible reaction, while morbidity or mortality may be high in others.
Stock farming and the human activities associated with it may lead to disturbance of the habitat preference of wildlife on the farm. Thus, the practice of removing sheep from the mountainous veld of the south-western Free State and Karoo in autumn and winter and placing them in plains camps to avoid contact with *Ixodes rubicundus* (Karoo paralysis tick), and hence paralysis, has led to springbok leaving the plains for the hills where they then become paralysed.

The erection of fences has not only interfered with wildlife movement but also with its migration. It has also placed a finite size on the area available. Movement, and more particularly migration (or micro-migration), allows animals to move from areas of high parasite contamination, while containment ensures their confinement, often at high stocking densities, in highly contaminated localities. In the latter type of environment, cross-infection with parasites between host species is very likely.
Helminthes

Helminthes are internal worm parasites. Little cross-infection normally occurs between the helminths of wildlife and those of domestic ruminants, with the possible exception of:

- *Trichostrongylus axei* (stomach bankruptworm)
- *Trichostrongylus falculatus* (bankruptworm)
- *Nematodirus spathiger* (long-necked bankruptworm)
- *Gaigeria pachyscelis* (sandveld hookworm)
- *Moniezia spp.* (tapeworm)
- *Schistosoma matheei*

Some of the large strongyles, *Habronema spp.*, *Draschia megastoma* and *Oxyurus equi*, can infect both zebras and horses, while *Physocephalus sexalatus* is the only nematode commonly present in the stomachs of both warthogs and domestic pigs.

**Warthog:** *Phacochoerus africanus*
The nematodes of wildlife are generally host-specific or infect animals within a particular genus or a grouping of generically related animals, except for:

- *Trichostrongylus thomasi* (an abomasal or stomach parasite)
- *Trichostrongylus instabilis* (bankruptworm)
- *Trichostrongylus falcatus*
- *Nematodirus spathiger*, which seem capable of infecting a wide variety of wild animals.

Although host specificity for the nematode parasites of wildlife and domestic stock exists, similar or equivalent helminths to those found in domestic stock are encountered in wild animals.

The nematode burdens of grazers (blesbok) and mixed feeders (impalas) kept under extensive conditions will invariably be considerably larger than those of browsers (kudu, bushbuck) under similar conditions (infective third stage nematode larvae climb grass, not trees).
Insects

Oestrid flies/Oestrid larvae (nasal bot fly larvae)

These insects **lay their eggs in either the nasal passages or on the eyes** of their hosts.

- **Oestrus ovis**: sheep, goats, aberrant host grey rhebuck
- **Oestrus macdonaldi, O. variolosus**: wildebeest, blesbok
- **Rhinoestrus spp.**: springbok, zebras
- **Kirkioestrus minutus**: wildebeest
- **Gedoelstia spp.**: wildebeest, blesbok, bontebok; aberrant hosts sheep, goats, cattle, grey rhebuck, other antelope species
Gasterophilid larvae (horse bot fly larvae)

These insects lay their **eggs in their hosts’ coats (hair)**. The animals take the **eggs into their mouths inadvertently through self-grooming or allogrooming**. The larvae end up in the stomach of their host.

- G. temicinctus, G. meridionalis: **zebras**
- G. intestinalis: **horses**

The larvae of the other gasterophilid flies are common to both **zebras and horses**.
Hypodermid larvae (warble fly larvae)

These are parasites of the skin, with larvae burrowing under the skin.

*Strobiloestrus* sp.: klipspringer, grey rhebuck; aberrant hosts cattle, sheep, bontebok

**Klipspringer:** *Oreotragus oreotragus*
Calliphorid flies (blowflies)

These insects are recognisable as being metallic green and blue flies. The larvae of these flies **fulfil an important role in wildlife systems in utilising carcasses.** However, *Lucilia* and *Chrysomyia* larvae may also cause **myiasis**, the parasitic infestation of live animals. This is observed particularly in injured, sick, or aged wild animals. Heavy infestations of *Cordylobia anthropophaga* larvae may occur in jackal pups.

Adult *Chrysomyia marginalis* can play an important role in **spreading anthrax** amongst **browsing antelopes** by **disseminating anthrax spores** from infected carcasses to the surrounding vegetation.
Hippoboscid flies (louse flies)

These insects are ectoparasites. The flies land on the coat of animals, lose their wings and mirror the general ecology of lice. They display an amazing ability to move quite quickly around the coat of their hosts.

Flies belonging to the genus Hippobosca, are generally host-specific to their wild hosts:

- **H. alva**: impalas
- **H. longipennis**: cheetahs
- **H. struthionis**: ostriches

The exception is **H. ruftes** which, in addition to cattle and horses, also infests large wild herbivores, particularly in the drier western regions of the country.

*Lipoptena paradoxa* infests **kudus, nyalas, bushbuck** and **duikers** (all browsers) in the same south-eastern, eastern, and northern regions of the country in which *Amblyomma hebraeum* is found. L. *annalizeae* infests **springbok** in the central drier regions of the country, and L. *binocula* infests **steenbok** and springbok in the arid western regions. Flies of this genus thus display not only host preferences but also habitat preferences.
### Fleas

Fleas are generally host specific and usually infest those animals with lairs, burrows, or nests. Some host species may be infested with more than one flea species. The abundance of *Ctenocephalides felis strongylus*, infesting scrub hares in this country, is not affected by the breeding cycle of the hares as is that of *Spilopsyllus cuniculi*, which infests pregnant rabbits and new-born leverets in Europe. *C. felis strongylus* is most abundant on scrub hares from early winter to spring irrespectively of whether the hares occur in summer or winter rainfall regions. Some of the fleas of wild rodents can transmit plague (*Yersinia pestis*) to humans.

Large animals such as warthogs which utilise burrows, can be very heavily infested with the stick-tight fleas *Echidnophaga larina* and *Phacopsylla inexpectata*.

**Warthog:** *Phacochoerus africanus*
Lice

Lice are probably one of the most host-specific groups of ectoparasites. In addition, they are also permanent parasites and may occupy specific sites on their hosts' bodies. Most host species are infested with more than one species of louse. Impalas harbour five species, while 18 species have been recorded on rock dassies. The largest louse burdens appear to be present in the winter months. Louse burdens may become very large on stressed or aged animals. Lice can be transported from one host to the next by attaching to the legs of flies. This probably occurs most frequently when animals have died.

*Young impala: Aepyceros melampus*
Ticks

Ixodid ticks (hard ticks, shield ticks)

Most adult ixodid ticks of veterinary importance are not host-specific, but they do have host preferences. Their general life cycle is one of:

Adult → Egg → Larvae → Nymph → Adult.

The lifecycle of a hard tick - Ixodes

However, different species have different variations with either one, two or three hosts. The detailed life cycle of ticks may be found in The Field Guiding/Game Ranging Course, module #2, component #3 - ticks and mites.

- Amblyomma hebraeum
- Boophilus decoloratus
- Haemaphysalis leachi
- Hyalomma spp.
- Ixodes rubicundus
- Rhipicephalus appendiculatus
- Rhipicephalus evertsi evertsi
- Rhipicephalus glabroscutatum
- Rhipicephalus punctatus
- Rhipicephalus simus
- Rhipicephalus zambeziensis
Host preferences (adult ticks)

- **A. hebraeum** (bont tick): buffaloes, giraffes, eland, rhinoceroses, cattle, goats.
- **B. decoloratus** (blue tick): kudus, nyalas, bushbuck, impalas, giraffes, eland, zebras, cattle, horses.
- **H. leachi** (yellow dog tick): lions, leopards, hyenas, wild dogs, dogs, cats.
- **Hyalomma** spp. (bont-legged ticks): giraffes, eland, buffaloes, zebras, cattle, horses.
- **I. rubicundus** (Karoo paralysis tick): mountain reedbuck, eland, caracals, sheep, goats.
- **R. appendiculatus** (brown ear tick): buffaloes, kudus, nyalas, impalas, cattle.
- **R. evertsi evertsi** (red-legged tick): zebras, eland, giraffes, horses, sheep.
- **R. glabroscutatum** (smooth brown tick): kudus, bushbuck, mountain reedbuck, gemsbok, goats, sheep.
- **R. punctatus** (brown paralysis tick): scrub hares, goats, sheep.
- **R. simus** (glossy brown tick): warthogs, lions, leopards, hyenas, zebras, cattle, horses, dogs.
- **R. zambeziensis** (Zimbabwe brown ear tick): kudu, nyalas, bushbuck, impalas, cattle.
Several tick species are, however, specific to their wild hosts:

<table>
<thead>
<tr>
<th>Tick Species</th>
<th>Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amblyomma rhinocerotis</td>
<td>Rhinoceroses</td>
</tr>
<tr>
<td>Amblyomma tholloni</td>
<td>Elephants</td>
</tr>
<tr>
<td>Dermacentor rhinocerinus</td>
<td>Rhinoceroses</td>
</tr>
<tr>
<td>Haemaphysalis hyracophila</td>
<td>Dassies</td>
</tr>
<tr>
<td>Rhipicephalus arnoldi</td>
<td>Red rock rabbits</td>
</tr>
<tr>
<td>Rhipicephalus distinctus</td>
<td>Dassies (hyrax)</td>
</tr>
<tr>
<td>Rhipicephalus oculatus</td>
<td>Cape and scrub hares</td>
</tr>
<tr>
<td>Rhipicephalus simpsoni</td>
<td>Cane rats</td>
</tr>
</tbody>
</table>

Rodents, shrews, hares, rabbits, and ground-frequenting birds

These small animals are fair to excellent hosts of the immature stages of many ixodid tick species important to domestic animals. They may also harbour the disease organisms spread by these ticks to animals and man.

Rock hyrax: Procavia capensis
Preferred hosts

- **Mice and rats**: H. Leachi, R. Simus; *Rickettsia conori*
- **Gerbils**: Hyalomma truncatum
- **Rock elephant shrews**: L. rubicundus, R. Punctatus, *Rhipicentor nuttalli*
- **Scrub hares**: A. Hebraeum, Hyalomma spp., R. Appendiculatus, R. Evertsi evertsi, R. Glabroscutatum, R. Punctatus, R. Zambeziensis; *Cowdria ruminantium*
- **Red rock rabbits**: L. rubicundus
- **Helmeted guineafowls**: A. Hebraeum, H. Marginatum rupipes; *C. Ruminantium*

**Scrub hare**: *Lepus saxatilis*
Buffalo

Cape buffalo are excellent hosts of all stages of development of R. appendiculatus. In addition, much of the habitat to which the buffaloes have now been confined in South Africa overlaps that of this tick. Buffalo are also asymptomatic carriers of Theileria parva lawrencei, the cause of Corridor disease in cattle. This organism is transmitted transstadially by R. appendiculatus and R. zambeziensis. Should buffaloes break out of reserves or game farms onto surrounding cattle ranches, infected, engorged, immature ticks may detach from these animals. The ticks will moult to the next stages of development, and these could attach to cattle which will then develop Corridor disease. Because of this, there are strict regulations and even prohibitions on the translocation of buffaloes from regions in which R. appendiculatus and/or R. zambeziensis occur to other regions.

Buffalo populations from the following reserves/provinces, which all lie outside the distribution of R. appendiculatus and R. zambeziensis, consequently fetch premium prices:

- Addo elephant park
- Eastern Cape province
- Vaalbos park
- Northern Cape province
- Willem Prinsloo reserve
- Central free state
Argasid ticks (soft ticks, tampans)

*Ornithodoros porcinus* (warthog tampan) feeds on warthogs while they are in their burrows. Fairly large numbers can be transported by warthogs when they leave these burrows. These ticks are the vectors of the *African swine fever virus* and can survive for long periods without feeding. It is thus possible for them to meet domestic pigs kept on open range in bushveld regions.

- **Soft ticks** may go 8 years without a meal
- **Tampans** may go 5 years between meals

*Ornithodoros savignyi* (sand tampan) was originally probably a parasite of wildlife. Man has now not only removed the wildlife and replaced it with domestic stock but has also killed or disturbed the natural predators of the tick, such as guineafowls.

The tampan detects potential hosts by picking up the carbon dioxide emissions of the host. Incredibly the tampans can do this from 20 cm [7.8 in] below the soil from 13,5 m [44.2 ft] away.

---

**Argasid tick-Ornithodoros moubata**

Coloured drawing by Amedeo John Engel Terzi

---

This course material is the copyrighted intellectual property of WildlifeCampus. It may not be copied, distributed or reproduced in any format whatsoever without the express written permission of WildlifeCampus.
Mites

Mites are generally host-specific or may be specific to closely related host species. However, Sarcoptes scabiei (causing sarcoptic mange) has many hosts. The large carnivores are particularly susceptible to infestation with this mite, and animals under stress exhibit very severe clinical signs.

It is quite probable that S. scabiei infestation plays an important role in population control of the large carnivores, especially when carnivore populations have become too large and prey resources are dwindling. Antelopes under stress may also develop severe infestations of S. scabiei.

These arachnids are tiny and are generally considered ‘permanent parasites’.

Parasitic mite life cycle. Under optimal conditions, the red mite life cycle can be completed in as little as a week.
Conclusion

By their method of killing and feeding, wild carnivores come into close contact with their prey. They often acquire temporary infestations of the ectoparasite species, which are host specific to their prey. The carnivores’ recent kills can often be identified from these. Carnivores are also the final hosts of the tapeworms *Echinococcus* spp. and *Taenia* spp. The cystic stages of these tapeworms are found in the preferred prey species of the carnivores.

Parasites of wildlife need to be considered from two points of view. They are a naturally occurring phenomenon, and game has become conditioned to dealing with them over thousands of years. They are an important natural control mechanism. However, through our own actions, we have produced artificial systems from natural systems. Therefore, it is our responsibility to manage. The degree of management and intervention in the natural processes of parasite and host will differ with every situation. We need to carefully assess the scenario presented and make decisions that may either restore balance or end up with a system more artificial than when we began.

In the following component, we examine all the factors that account for the general biology and control of wildlife and their parasites.