

HUSBANDRY MANUAL FOR



BARBARY SHEEP *Ammotragus lervia*

Mammalia : Bovidae

Author: Rebecca C Altin
Date of Preparation: August 07
Western Sydney Institute of TAFE, Richmond
Course Name and Number: Captive Animals Certificate III
(1068) RUV3405A
Lecturer: Graeme Phipps

TABLE OF CONTENTS

1	INTRODUCTION	5
2	TAXONOMY	6
2.1	NOMENCLATURE	6
2.2	SUBSPECIES.....	7
2.3	RECENT SYNONYMS.....	7
2.4	OTHER COMMON NAMES	7
3	NATURAL HISTORY	8
3.1	MORPHOMETRICS	8
3.1.1	<i>Mass And Basic Body Measurements</i>	8
3.1.2	<i>Sexual Dimorphism</i>	9
3.1.3	<i>Distinguishing Features</i>	9
3.2	DISTRIBUTION AND HABITAT	9
3.3	CONSERVATION STATUS.....	10
3.4	LONGEVITY	10
3.4.1	<i>In the Wild</i>	10
3.4.2	<i>In Captivity</i>	10
3.4.3	<i>Techniques Used to Determine Age in Adults</i>	10
4	HOUSING REQUIREMENTS	11
4.1	EXHIBIT/ENCLOSURE DESIGN	11
4.2	HOLDING AREA DESIGN	11
4.3	SPATIAL REQUIREMENTS	11
4.4	POSITION OF ENCLOSURES	12
4.5	WEATHER PROTECTION.....	12
4.6	TEMPERATURE REQUIREMENTS.....	12
4.7	SUBSTRATE	13
4.8	NESTBOXES AND/OR BEDDING MATERIAL.....	13
4.9	ENCLOSURE FURNISHINGS	13
5	GENERAL HUSBANDRY	14
5.1	HYGIENE AND CLEANING	14
5.2	RECORD KEEPING	18
5.3	METHODS OF IDENTIFICATION	18
5.4	ROUTINE DATA COLLECTION	19
6	FEEDING REQUIREMENTS	20
6.1	DIET IN THE WILD.....	20
6.2	CAPTIVE DIET	20
6.3	SUPPLEMENTS	23
6.4	PRESENTATION OF FOOD	24
7	HANDLING AND TRANSPORT	25
7.1	TIMING OF CAPTURE AND HANDLING	26
7.2	CATCHING BAGS.....	26
7.3	CAPTURE AND RESTRAINT TECHNIQUES	26

7.4	WEIGHING AND EXAMINATION	30
7.5	RELEASE	30
7.6	TRANSPORT REQUIREMENTS	31
7.6.1	<i>Box Design</i>	33
7.6.2	<i>Furnishings</i>	33
7.6.3	<i>Water and Food</i>	33
7.6.4	<i>Animals per Box</i>	33
7.6.5	<i>Timing of Transportation</i>	33
7.6.6	<i>Release from Box</i>	33
8	HEALTH REQUIREMENTS.....	34
8.1	DAILY HEALTH CHECKS.....	34
8.2	DETAILED PHYSICAL EXAMINATION	37
8.2.1	<i>Chemical Restraint</i>	37
8.2.2	<i>Physical Examination</i>	37
8.3	ROUTINE TREATMENTS.....	37
8.4	KNOWN HEALTH PROBLEMS	38
8.5	QUARANTINE REQUIREMENTS	48
9	BEHAVIOUR.....	49
9.1	ACTIVITY	49
9.2	SOCIAL BEHAVIOUR.....	49
9.3	REPRODUCTIVE BEHAVIOUR	51
9.4	BATHING	51
9.5	BEHAVIOURAL PROBLEMS	51
9.6	SIGNS OF STRESS	51
9.7	BEHAVIOURAL ENRICHMENT	52
9.8	INTRODUCTIONS AND REMOVALS.....	53
9.9	INTRASPECIFIC COMPATIBILITY.....	53
9.10	INTERSPECIFIC COMPATIBILITY	53
9.11	SUITABILITY TO CAPTIVITY	53
10	BREEDING.....	54
10.1	MATING SYSTEM.....	54
10.2	EASE OF BREEDING	54
10.3	REPRODUCTIVE CONDITION.....	55
10.3.1	<i>Females</i>	55
10.3.2	<i>Males</i>	55
10.4	TECHNIQUES USED TO CONTROL BREEDING.....	55
10.5	OCCURRENCE OF HYBRIDS	55
10.6	TIMING OF BREEDING	55
10.7	AGE AT FIRST BREEDING AND LAST BREEDING.....	55
10.8	ABILITY TO BREED EVERY YEAR.....	56
10.9	ABILITY TO BREED MORE THAN ONCE PER YEAR.....	56
10.10	NESTING, HOLLOW OR OTHER REQUIREMENTS.....	56
10.11	BREEDING DIET.....	56
10.12	OESTROUS CYCLE AND GESTATION PERIOD.....	56
10.13	LITTER SIZE	57
10.14	AGE AT WEANING	57

10.15	AGE OF REMOVAL FROM PARENTS	57
10.16	GROWTH AND DEVELOPMENT	58
11	ARTIFICIAL REARING OF MAMMALS	59
11.1	HOUSING.....	59
11.2	TEMPERATURE REQUIREMENTS.....	59
11.3	DIET AND FEEDING ROUTINE.....	59
11.4	SPECIFIC REQUIREMENTS.....	60
11.5	DATA RECORDING.....	60
11.6	IDENTIFICATION METHODS.....	60
11.7	HYGIENE	61
11.8	BEHAVIOURAL CONSIDERATIONS	61
11.9	USE OF FOSTER SPECIES	61
11.10	WEANING	61
11.11	REHABILITATION AND RELEASE PROCEDURES	61
12	ACKNOWLEDGEMENTS	62
13	REFERENCES	63
14	BIBLIOGRAPHY.....	64
15	GLOSSARY	65
16	APPENDIX	68

1 Introduction

The Barbary Sheep (*Ammotragus lervia*), is a species of Caprinae (goat-antelope) found in rocky mountains in North Africa. Although it is rare in its native North Africa, it has been introduced to North America, southern Europe and elsewhere.

Ammotragus lervia derives from the Greek ammos ("sand", referring to the sand-coloured coat) and tragos ("goat"). Lervia derives from the wild sheep of northern Africa described as "lerwee" by Rev. T. Shaw in his "Travels and Observations" about parts of Barbary and Levant.

Little is known about the Barbary Sheep outside of the zoo culture, though an extraordinary asset to any institution. They are an active, well exhibited mammal and are loved by most that have the opportunity to watch them. It is unfortunate that in many institutions, they have been looked at and are cared for in a manner of complacency, which has manifested itself in there being little or no sound guidelines on their husbandry (within Zoos).

Barbary Sheep stand 80 to 100 cm (30 to 40 inches) tall at the shoulder and weigh 40 to 140 kg (90 to 310 lb). They are a sandy-brown colour, darkening with age, with a slightly lighter underbelly and a darker line on the back. Upperparts and outer legs are uniform reddish-brown or grayish-brown. There is some shaggy hair on the throat (extending down to the chest in males) and a sparse "mane". Their horns have a triangular cross section. The horns curve outwards, backwards then inwards, and reach up to 50 cm (20 inches). The horns are smooth, but wrinkled at the base. Scientists say that the horns can grow to be about six inches long.

These distinctive features and their wondrous abilities to survive make this an ideal species for education within the Zoo, as well as behavioural and ecological research, of which both can potentially better the species' future both in captivity and in the wild.

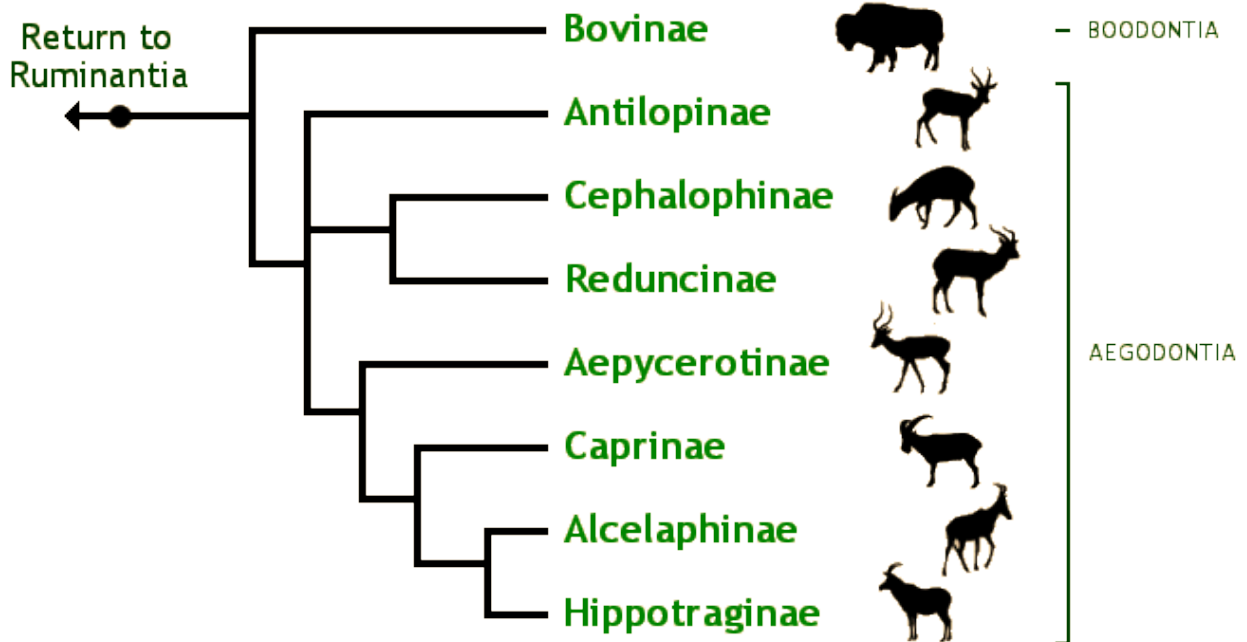


2 Taxonomy
2.1 Nomenclature

Class: Mammalia
Order: Artiodactyla
Family: Bovidae
Genus: Ammotragus

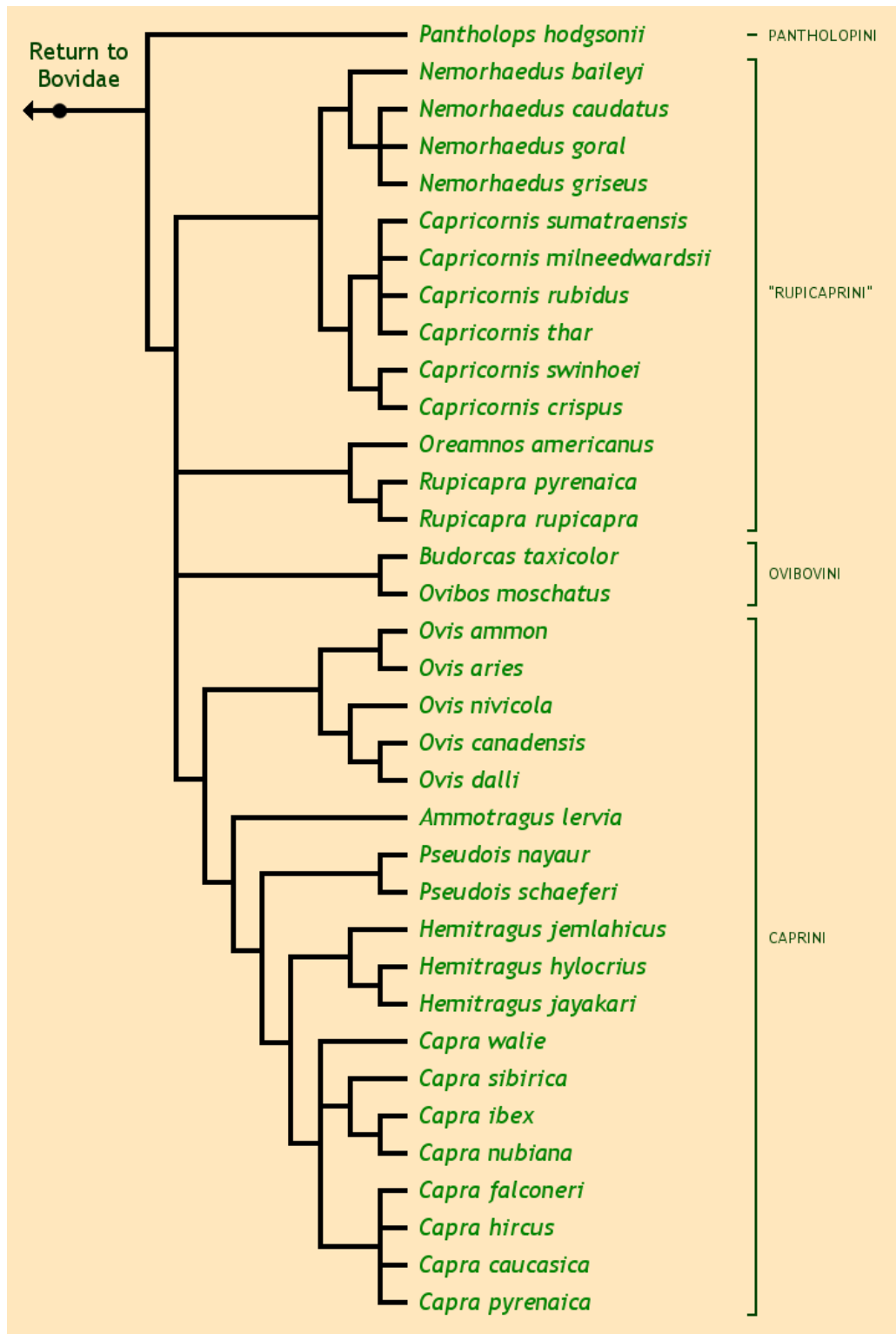
The Bovid Family Tree

(branch lengths are not proportional to time)



2.2 Subspecies

Subfamily: Caprinae



2.3 Recent Synonyms

Aoudad, Arui, Audad, Maned Sheep, *Ammotragus lervia*, Wild sheep

2.4 Other Common Names

Aoudad, Barbary Sheep

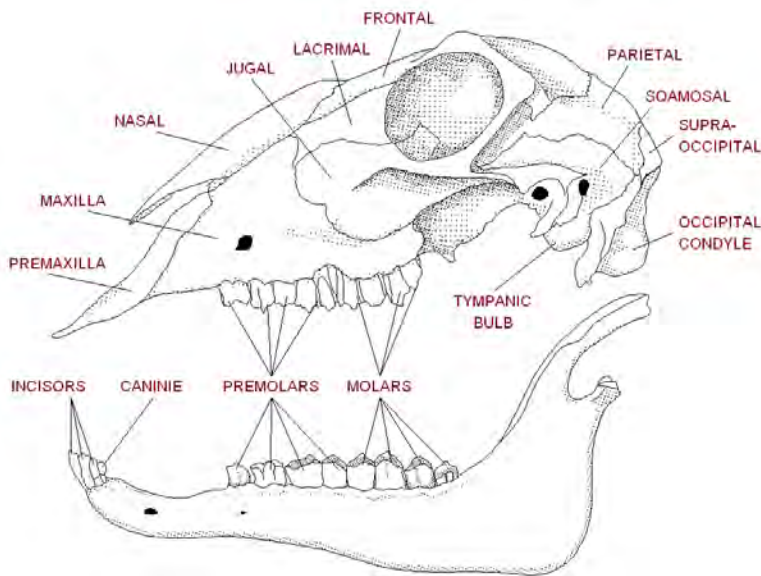
3 Natural History

3.1 Morphometrics

3.1.1 Mass And Basic Body Measurements

Barbary Sheep stand 80 to 100 cm (30 to 40 Inches) tall at the shoulder and weigh 40 to 140 kg (90 to 310 lb) with horns that can reach up to 50 cm (20 inches).

Sheep Skull



Barbary Sheep horn



3.1.2 Sexual Dimorphism

Sexual dimorphism is evident. Males can be up to 145 kg, while females are much smaller, the largest are up to 68 kg. Both males and females have horns that curve outward, backward, and point inward toward the neck. Males have horns that almost touch in the front, growing to a length of 33 inches (84 cm). Females' horns are smaller, only reaching a length of about 20 inches (51 cm) but have the same shape.



MALE



FEMALE

3.1.3 Distinguishing Features

The most distinguishing feature of the Barbary Sheep is the long, bushy tuft of hair that covers their neck and chest, sometimes covering a portion of the legs as well.



3.2 Distribution and Habitat

Barbary sheep are found in Mauritania, Morocco, southern Algeria, northwest Chad and Sudan, and were introduced into south-eastern Spain and south-western United States (parts of Texas, New Mexico, California) and Mexico and in arid mountainous areas of the Sahara of Africa.

These sheep live in small groups comprised of old and young animals of both sexes. They are expert climbers and can ascend and descend slopes so precipitous that man can negotiate them only with great difficulty. Consequently, they are difficult to hunt. Their food consists of a wide variety of vegetation including grasses, forbs, and shrubs. Apparently, they are capable of producing metabolic water and can survive for long periods without access to fresh water. However, when water is available they utilize it for both drinking and bathing.

These sheep were first brought to the United States in about 1900 and have been reared in zoos and on private preserves for a number of years. They were first released in the wild in New Mexico in 1950 and in Texas in 1957, when 31 were released southwest of Claude in Armstrong County. Thirteen more were released near Quitaque. These introductions were highly successful in the Palo Duro Canyon area. By May of 1966 the population had increased to an estimated 400-500 sheep. By 1963, the population had increased to such a level that a controlled hunt was deemed advisable.



3.3 Conservation Status

Conservation status - Vulnerable



3.4 Longevity

3.4.1 In the Wild

In the wild Barbary Sheep have an estimated life span of 10 - 14 years but may live longer.

3.4.2 In Captivity

In captivity Barbary Sheep have been known to live as old as 20 years.



3.4.3 Techniques Used to Determine Age in Adults

<u>Age</u>	<u>Condition of Dentition</u>
3 weeks	Deciduous dentition complete and consists of four pairs of deciduous incisiform teeth and three pairs of deciduous premolars.
8 months	First permanent molar erupted or erupting.
17 months	Second permanent molar erupting.
18 months	First (inner) permanent incisor erupts.
21 months	Third permanent molar erupting; deciduous premolars being replaced.
23 months	Second deciduous incisor shed.
27 months	Permanent dentition except for outer two pairs of incisiform teeth; last molar not fully exposed.
36 months	Third pair of permanent incisiform teeth present; last molar fully exposed but unworn.
48 months	Fourth (outer) pair of deciduous incisiform teeth (the canines) being replaced.
60 months	Full set of permanent teeth.

4 Housing Requirements

4.1 Exhibit/Enclosure Design

Any exhibit should be designed with the capabilities of the species and individual that it is intended for in mind. Equally important are the physical and behavioural requirements of the animal. Any enclosure housing Barbary Sheep must be designed and constructed with the following conditions in place.

- The exhibit must be secure, and constructed in such a way that it is impossible for the animals to exit in any way other than the intension of the keepers. Therefore if housed in an open enclosure the fences/walls must be high enough so that they cannot jump over the top with the aid of any furniture etc.
- There must be an area within the exhibit where individuals or groups can retreat from the viewer's gaze where it is able to feel safe. It would be best for this area to receive less light than the rest of the exhibit, as the slight darkness will give the animal a sense of invisibility and feeling of security. It is crucial that this "safe place" is of a large enough size to fit the entire herd, or if a particularly large population is kept there must be enough of these areas so that they can sleep and rest together as in the wild.
- The shape, size and overall design of the exhibit must, preferably without sacrificing any aesthetic properties, enable the captives to display natural behaviours. The ability to act normally is vital to the lively hood of the animal, as well as their mental and physical condition. By allowing the exhibited animals to act like this not only maintains a healthy state of being but also enables people to have a better understanding of the animal, making their visit a worthwhile and fulfilling experience.
- The exhibit should be designed in such an ergonomic way that routine cleaning and maintenance is easy and can be quickly finished, so as to cause as little stress as possible and increase work productivity.

4.2 Holding Area Design

The maintenance and management of Barbary Sheep that are off-exhibit should be no different to that of those for viewing of the public, though it is not necessary to make the enclosure appealing to humans. A holding area such as a quarantine enclosure should be a large enough size that it can healthily house a high number of individuals to their spatial requirements, as there may be an unexpected influx of new arrivals.

A holding area must have the same security and shelter fixtures as to an actual exhibit. It should also, like the exhibit, be designed ergonomically to enable ease and effectiveness of maintenance.

4.3 Spatial Requirements

Pens of individually housed adult sheep should be no less than 4 m long and 2 m wide to make certain that the animal has enough room to comfortably turn around and to make a few steps in one direction.

In the group-housing situation, the minimum floor area per animal should be 4m² to allow for social spacing and hence to minimize agonistic conflicts resulting from spatial restriction.

All enclosures must be high enough to prevent animals from jumping over them.

4.4 Position of Enclosures

Barbary Sheep enclosure positioning in a captive environments, is of no consequence, as long as the following occur:

- Lots of shelter is provided in order for the animal to avoid annoying wind, rain or sun conditions.
- No matter the direction of the weather condition the animals can still escape either by entering a shelter or changing location in the enclosure itself.
- Water and food is readily available.
- The fall or rise of the ground is not at uncomfortable angles that the animals would not be used to in the wild.

4.5 Weather Protection

Ventilation

Ventilation is normally of little consequence to sheep. However, newborn lambs become extremely susceptible to hypothermia when air movement exceeds 1m/s. Indoor housing necessitates some air movement to ensure that toxic gases formed during metabolic processes and decomposition of urine and faeces are removed.

If the manure is removed regularly, ventilation rates of 0.5-1.5m³/hour/kg live-weight are recommended to reduce the likelihood of respiratory diseases.

Ventilation systems should be designed in such a way that drafts at animal level are avoided while adequate air movement above animal level is guaranteed.

Lighting Sheep are relatively fearful when experiencing sharp contrasts in lighting. This has practical implications in the context of handling because the animals are reluctant to move from bright to dark (e.g., shade) areas. A uniform lighting pattern (minimum of 4 Watts/m²) is therefore recommended. Sheep are seasonal breeders, with decreasing daylight initiating the onset of the reproductive cycle. Exposure to the natural light rhythm is therefore important for indoor-housed animals that are assigned to breeding programs.

Shelter

Either housed inside or outside a shelter to escape uncomfortable conditions must be supplied. These Shelters/escapes must be large enough to hold all animals either together in the one or separately around the enclosure allowing the animal to choose which shelter to take refuge.

4.6 Temperature Requirements

Small ruminants are well adapted to extreme temperatures, with their fleece/coats providing an insulative layer that protects them from cold and heat. The comfort zone for sheep is wide, ranging from 0-30°C (32-85°F). Exceptions are the neonate and the newly shorn animal that are susceptible to cold, especially if they are wet or if they have not fed. Sheep are particularly sensitive during the first 7-10 days after shearing.

If animals are recovering from surgery, it is advisable to keep the ambient temperature slightly higher than normal, as physiological thermoregulation is inadequate during the first 24 hours following anaesthesia. Under such conditions a temperature of 20-28°C (68-82°F) is recommended. The neonatal lamb is also most comfortable within this temperature range.

Sheep rely on evaporative cooling from the respiratory tract. Consequently, high humidity associated with high temperatures is stressful to the animals as it interferes with their ability to regulate body temperature. If indoor temperatures rise above 30°C (85°F), a

comfortable environment can be maintained by keeping the relative air humidity below 60%.

4.7 Substrate

The choice of bedding and flooring is dependent on the age and physiological state of the animals. A 0.15 m (6 in.) layer of straw or coarse (to prevent "balling") sawdust mixed with wood shavings are recommended as comfortable, species-appropriate bedding. Wooden slatted floors or metal mesh floors are also well accepted by the animals. The gap between the slats should be 14-16 mm (0.6 in.) to allow easy passage of faecal material and guarantee safe footing for the animals. The grid of the mesh should be 20 mm (0.8 in.) to provide adequate support for the animals' feet. The area below the floor has to be accessible for easy cleaning or should be equipped with an automatic flushing system.

4.8 Nestboxes and/or Bedding Material

As mentioned above the bedding material is dependent on the age and physiological state of the animals. A 0.15 m (6 in.) layer of straw or coarse sawdust mixed with wood shavings are recommended as comfortable, species-appropriate bedding. (Nest boxes are not used)

4.9 Enclosure Furnishings

In Order to minimize stereotypic behaviour the enclosure should contain obstacles that allow the animals to utilize different senses. Branches for smelling, leaf litter or old hay to dig in, rocky out-crops to jump around and climb as well as to take refuge and leave their young, should all be provided.

S.Hanna's Taiwan Photo Gallery, 2005



5 General Husbandry

5.1 Hygiene and Cleaning

All enclosures should be cleaned daily to remove faecal matter and uneaten food. Drinking water dishes/troughs should be cleaned and refilled daily (or weekly if water facility holds a large volume of water). When all individuals permanently leave an enclosure, it should be scrubbed out if possible and thoroughly cleaned before any new animals are admitted.

A chemical found in metal polishers, petroleum distillates, may cause short-term and long-term problems for the animals. In the short-term, the animals may experience cloudiness in the eyes while long-term they may suffer kidney, skin, eye, and/or nervous system damage. The chemicals found in disinfectants, phenol and cresol, may cause kidney or liver damage, fainting, dizziness, and/or diarrhoea.

Vinegar and borax make good alternatives for air freshening sprays to eliminate odours.

A safe trough/shelter cleaner can be made by mixing lemon juice and borax. Alternatively try mixing baking soda, vinegar, or straight bleach with water. Remember that you should not mix bleach with any other chemicals and to use all of the above to a minimum.

All Bedding material, branches and hay should be replaced either daily or weekly depending on the weather conditions.

ALTINA WILDLIFE PARK

ANIMAL RISK LEVELS BY SPECIES

LOW / MINIMAL DANGER	
	<ul style="list-style-type: none">- Barbary Sheep- Fallow Deer- Goats- Himalayan Tahr- Hog Deer- Indian Blackbuck Antelope- Rusa Deer-
MODERATE DANGER	
	<ul style="list-style-type: none">- Alpacas- Camels- Domestic Horses- Giraffe- Maned Wolf- Mongolian Wild Horses
HIGH DANGER	
	<ul style="list-style-type: none">- Asian Water Buffalo- American Bison- Eland Antelope- Ostrich- Red Deer-
EXTREME DANGER	

ALTINA WILDLIFE PARK

ANIMAL RISK PROTOCOLS

Danger Level	Protocol
Low/Minimal	Single Employee may enter enclosure and perform all maintenance and feeding activities without fear of attack or injury. These animals are either domesticated or very timid and very accustomed to human interaction.
Moderate	Single employee may enter enclosure and perform all maintenance and feeding activities, care should be taken to observe the current behaviour of the animal especially during rutting season. These animals are not accustomed to human interaction.
High	Single employee may enter enclosure and perform all maintenance and feeding activities, care should be taken to observe the current behaviour of the animal especially during rutting season. At all times the employee must carry a communication device and maintain a clear escape path from the enclosure. If possible animals should be separated from the employee when undertaking activities within the enclosures. These animals are wild and not accustomed to human interaction and may attack when confronted, stressed or spooked.
Extreme	Under no circumstance is there ever to be a single person entering the enclosure. A minimum of two (2) employees are required to perform all maintenance and feeding activities. When entering the enclosure a Park vehicle is to be used to shield employees from the animals and a communication device is to be carried at all times and a clear exit path to be established. These animals are wild and not accustomed to human interaction and will attack when confronted, stressed or spooked.

ALTINA WILDLIFE PARK

ENCLOSURE MAINTENANCE PROCEDURE

SPECIES: Barbary Sheep

SCIENTIFIC NAME: Ammotragus lervia

RISK LEVEL: Low / Minimal

Fencing and Gates: Inspect enclosure looking for:-

- Broken Wires
- Damaged Posts
- Sturdiness
- Rusting Joints, Couplings, etc
- Any protrusions or sharp objects
- General Age & Conditions

Terrain: Inspect enclosure looking for:-

- Pot Holes
- Wet/Muddy or Water logged areas
- Debris or fallen branches etc

After inspection then the employee will perform the following tasks:-

- Rake, collect & remove all faeces
- Rake , collect & remove all stale hay/food
- Check water condition and refresh if necessary
- Where a concrete trough supplies water to the animals it is to be emptied and pressure washed before refilling.
- All rubbish is to be cleared by front end loader and taken to the park's composting area. Where practical the loader can be driven into the enclosure to collect all rubbish.

5.2 Record Keeping

It is important to establish a system whereby the health, condition and reproductive status of captive Barbary Sheep are routinely monitored.

Records should be kept of:

- Identification numbers, all animals should be identifiable
- Any veterinary examinations conducted
- Treatments provided
- Behavioural changes or problems
- Reproductive behaviour or condition
- Weights and measurements
- Changes in diet
- Movements of individuals between enclosures or institutions
- Births with bloodline details if known
- Deaths with post mortem results

The collection of information on individual physical and behavioural patterns can contribute greatly to the husbandry of these species. It also allows the history of each individual to be transferred to other institutions if required and greatly facilitates a cooperative approach to data collection amongst institutions. In most of the larger institutions ARKS (for general information on births, transfers and deaths), SPARKS (breeding studbook species) and MedARKS (veterinary information) are used. These systems have been developed by the International Species Information Systems (ISIS), which is part of the Conservation Breeding Specialist Group (CBSG) software. As these are standardised, there is a high degree of efficiency in transferring information between institutions.

5.3 Methods of Identification

- Tattooing – has been used successfully on the inside of the ear and the medial aspect of the hind leg/thigh.
- Visual identification – As most Barbary Sheep show a fair degree of variation in pelt colour, horns size and scars from fighting, visual identification can often be used but recommended to accompany another form of identification just in case.
- Ear tags – Have been used, including self piercing, nylon disc swivel tags. Although ear tags can be lost and can become entangled, they are highly visible which has been the advantage that animals don't need to be caught up for identification. To locate veins in order to avoid them when making a hole through the ear, shine a torch up against the ear.
- Ear notching - usually left ears for females and right for males and each animal notched in different areas along the edge of the ear so differences can be noticed.
- Microchip Implants - is an identifying integrated circuit placed under the skin of an animal. The chips are about the size of a large grain of rice and are based on a passive RFID technology.

5.4 Routine Data Collection

The following must be recorded as soon as occurrence has been noticed:

- Any veterinary examinations conducted
- Treatments provided
- Behavioural changes or problems
- Reproductive behaviour or condition
- Weights and measurements when handling animals
- Changes in diet
- Births
- Deaths
- Faeces check

6 Feeding Requirements

6.1 Diet in the Wild

Their food consists of a wide variety of vegetation including grasses, forbs, and shrubs. Apparently, they are capable of producing metabolic water and can survive for long periods without access to fresh water. However, when water is available they utilize it for both drinking and bathing.

In studies conducted in New Mexico, Herman Ogren found that 79 species of plants were included in the diet of these sheep; of these, 13 were grasses, 20 were shrubs and the remainder forbs. Mountain mahogany (*Cercocarpus breviflorus*) was the most sought-for single plant. On a yearlong basis this species comprised nearly 22% of the items found in rumens of the sheep. Ogren found some seasonal variation in the diet. In winter, grasses comprised 86% of the rumen contents; browse, 11%; forbs, 3%. In spring, summer, and fall the browse species, mainly oaks and mountain mahogany, comprised about 60% of the diet; grasses, about 26%; and forbs (various species of "weeds") made up the balance. On a yearlong basis, browse species comprised 49% of the diet; grasses, 42%; forbs, 9%.

6.2 Captive Diet

Sheep are exclusively herbivorous mammals. Like all ruminants, sheep have a complex digestive system composed of four chambers, allowing them to break down cellulose from stems, leaves, and seed hulls into simpler carbohydrates. When sheep graze, vegetation is chewed into a mass called a bolus, which is then passed into the first chamber: the rumen. The rumen is a 5- to 10-gallon (19–38 l) organ in which feed is fermented via a symbiotic relationship with the bacteria, protozoa, and yeasts of the gut flora. The bolus is periodically regurgitated back to the mouth as cud for additional chewing and salivation. Cud chewing is an adaptation allowing ruminants to graze more quickly in the morning, and then fully chew and digest feed later in the day. This is beneficial as grazing, which requires lowering the head, leaves sheep vulnerable to predators, while cud chewing does not.

During fermentation, the rumen produces gas that must be expelled; disturbances of the organ, such as sudden changes in a sheep's diet, can cause potentially fatal conditions such as bloat. After fermentation in the rumen, feed passes in to the reticulum and the omasum; special feeds such as grains may bypass the rumen altogether. After the first three chambers, food moves in to the abomasum for final digestion before processing by the intestines. The abomasum is the only one of the four chambers analogous to the human stomach (being the only one that absorbs nutrients for use as energy), and is sometimes called the "true stomach".

Sheep follow a diurnal pattern of activity, feeding from dawn to dusk, stopping sporadically to rest and chew their cud. Ideal pasture for sheep is not lawn-like grass, but an array of grasses, legumes and forbs. Types of land where sheep are raised vary widely, from pastures that are seeded and improved intentionally to rough, native lands.

Common plants toxic to sheep are present in most of the world, and include (but are not limited to) oak and acorns, tomato, yew, rhubarb, potato, and rhododendron.

A sheep's ruminant system

Sheep are largely grazing herbivores, unlike browsing animals such as goats and deer that prefer taller foliage. With a much narrower face, sheep crop plants very close to the ground and can overgraze a pasture much faster than cattle. For this reason use managed grazing, where a flock is rotated through multiple pastures, giving plants time to recover.

Paradoxically, sheep can both cause and solve the spread of invasive plant species. By disturbing the natural state of pasture, sheep and other livestock can pave the way for invasive plants. However, sheep also prefer to eat invasives such as cheatgrass, leafy spurge, kudzu and spotted knapweed over native species such as sagebrush, making grazing sheep an effective way of restoring native pastures.

Other than forage, the other staple feed for sheep is hay, often during the winter months. The ability to thrive solely on pasture (even without hay) varies with breed, but all sheep can survive on this diet. Also included in most sheep's diets are minerals, either in a trace mix or in licks.

Naturally, a constant source of water is also a fundamental requirement for sheep. The amount of water needed by sheep fluctuates with the season and the type and quality of the food they consume. When sheep feed on large amounts of new growth and there is precipitation (including dew, as sheep are dawn feeders), sheep need less water. When sheep are confined or are eating large amounts of cured hay, more water is typically needed. Sheep also require clean water, and may refuse to drink water that is covered in scum or algae.

Many sheep breeders/keepers flush ewes and rams with grain during breeding to increase fertility. Ewes are also flushed during pregnancy to increase birth weights, as 70% of a lamb's growth occurs in the last five to six weeks of gestation. Otherwise, only lactating ewes and especially old or infirm sheep are commonly provided with grain. Feed provided to sheep must be specially formulated, as most cattle, poultry, pig, and even some goat feeds contain levels of copper that are lethal to sheep. The same danger applies to mineral supplements such as salt licks.



MALE BARBARY SHEEP

Altina Wildlife Park

Recommended Dietary Sheets

SPECIES: **Barbary Sheep**

SCIENTIFIC NAME: **Ammotragus lervia**

- Barbary Sheep are to be placed into paddocks with adequate green feed, natural grasses/ or irrigated pastures.
- Roughage such as hay (oat and vetch, clover, small amounts of Lucerne) to be given on a daily basis in rotation.
- Salt mineral blocks that have depleted to be replaced. (Always to be available.)

Daily Recommended Volume Per animal

Approximately 3 kg Oaten Hay
1 kg Salt Bush once a week
1 Litre Grain Chaff Mix once a week

Limited quantities of bread and corn can be offered for visitor interaction or conditioning as well as enrichment exercises.

Comments/changes:

6.3 Supplements

'Supplementary feeding' is the addition of feed to pasture to improve animal performance. When supplements are fed to stock there are three possible outcomes, depending on whether energy or protein supplements are used and on how the pasture and supplement interact during digestion.

- **Supplementation** – the supplement is eaten and pasture intake is not reduced. This is rarely achieved.
- **Substitution** – the supplement reduces pasture intake. This usually occurs when supplementing green pasture and the supplement is more digestible than the pasture. However, it may have the advantage of making the green feed last longer.
- **Complementation** – the supplement increases pasture consumption. This can occur with low quality pasture or crop residues.

The most likely cases in which supplementation will be profitable are:

- ensuring the survival of weaners in summer and early autumn on dry feed;
- maintaining ewes in a satisfactory condition during late pregnancy and lactation to avoid excessive lamb losses

Grain is best fed whole to sheep. Cracking grain increases the risks of grain poisoning.

When dry pasture is being supplemented there is no need to add minerals or vitamins. If the period of feeding on dry feed is extended to greater than four months, then vitamin A and calcium will be required. In nearly all cases it is cheaper to feed grain or hay supplements directly to weaners than to feed a block or lick which may contain the same product.

Self-feeders are available in which intakes can be limited by adjusting the size of the opening. The response obtained from feeding lambs or ewes while at pasture or on a crop will vary depending on the quality of the pasture and supplement fed. If the problems of substitution are to be avoided, the quality of all factors of the diet needs to be known.

Supplements will interact with the pasture on offer, and this affects the animal's response. If basic pasture information is known, the feeding program can be fine-tuned to achieve the desired animal production.

- Management factors can ruin a feeding program. Attention must be paid to:
- Worm control
- Clean water.

It is well known that sheep are neophobic to new foods and although they will sample a number of available feeds, they will normally eat the most familiar one. Consequently sheep, and to a lesser degree also goats when exposed to new food will eat very little until they overcome their fear and recognize the food as acceptable. If the food has flavours that were previously associated with negative consequences, the animal will be averse and may even starve rather than eat.

Sheep have an intrinsic need to ruminate and to chew the cud. The overall fibre content of the ingested food should be about 40% to satisfy this need. A lack of fibre may lead to the

development of behavioural disorders such as bar chewing and wool biting/chewing. Sheep tend to develop digestive problems due to acidosis when their diet is high in readily fermentable carbohydrates such as wheat or barley. They require at least a period of 10-14 days to safely adjust to a high-energy cereal/grain diet.

Mineral imbalances are common problems when the animals are completely dependent on an artificial diet. They are highly susceptible to copper poisoning, which can readily be avoided when molybdenum (2kg) is added to the diet. Rams often develop urinary calculi (small stones). Feed formulations with extra sodium chloride (3-4%) are the best prevention against this problem because the salt ensures that the animals drink sufficient quantities of water.

Feed troughs should not have any sharp edges and corners. They have to be shallow enough so that the animals can maintain visual contact with each other. Trough space per adult animal should be 0.30 m (1 ft.) to allow all animals of the flock to forage at the same time. This situation circumvents agonistic disputes arising from competition over access to feeding space. Drinking water must be clean, fresh and free of copper. It should be provided in self-filling bowls which are cleaned regularly.

6.4 Presentation of Food

Wild sheep live in heterogeneous mountain and valley grassland environments. This suggests that the animals are very responsive to variation in their environment. Field studies conducted in sheep show that ewes respond to the addition of trees, logs and earthen mounds by increasing their repertoire of behaviours compared to those seen in barren paddocks. The animals are responsive to such environmental enrichment presumably because it reduces boredom resulting from under stimulation.

Sheep kept in deep litter pens readily accept "toys," such as plastic drums and suspended balls to counteract boredom. Such enrichment objects may also have a therapeutic value if the animals are afflicted by behavioural pathologies such as wool biting/chewing and bar chewing.

Sheep also respond extremely well to browse or hay varieties having different scents present. You can create this effect by putting hay or browse into a different species enclosure for a day or so, making sure that the animal does not have any infectious diseases or unhygienic habits of urinating on the browse or hay. It is mostly suggested you use a scent from another ungulate E.g.: Himalayan Tahr, Domestic sheep, goats etc.

Troughs are always great for hygiene purposes as well as an ease of feeding for the keeper but occasionally sprinkling grain such as corn around the rocks and grass can make the sheep explore their enclosure and entertain themselves for a while too.

Browse, apples, carrots, banana, sweet potato, frozen ice blocks can all be scattered also to provide alternate tastes and smells.

ALTINA WILDLIFE PARK

Animal Transport Procedures

Hazard Identification

Safe, injury free transportation of animals to and from animal establishments or from one enclosure to another.

Risk Assessment

- Inadequate area allocated which could induce physical or psychological stress.
- Unfamiliar routine for animal transport inducing stress or possible injury.
- Untimely date or season for transportation resulting in unnecessary cold or hot conditions, this could cause physical stress.

Risk Control

- An assessment must be made prior to transportation for an adequate area to be allocated for species ensuring low / no risk of animal injuring itself. This includes ensuring transportation trailer / box / crate etc has no protrusions that could injure the animal. Discussions are to be held with the animal carers, manager and directors prior to transportation.
 - Animals to be transported must be conditioned to enter and exit transportation trailer/ box / crate for a required period prior to transport date. Each period of conditioning will depend on individual animal / species. It is to be standard procedures that before transportation date the animal / species will be familiar, relaxed and comfortable in entering / exiting trailer / box / crate whichever is applicable. Giraffe and animals listed in the Extreme Danger Risk Level must adhere to IATA Live Animal Regulations whilst other existing species can be transported with the totally enclosed Park Trailer / box or crate if appropriate.
 - When choosing transportation date it is required to take into account the weather and season currently in progress. If animal is to be transported to another institution with a different weather/ season pattern that what it is currently experiencing, an appropriate date must be sought for the animal's best welfare state to be taken into consideration.
 - Communication between institutions is imperative and at all times the animals' welfare takes first priority.
 - All appropriate records and permits to be available and included for transport with animal/s
-

7.1 Timing of Capture and Handling

All Barbary Sheep must be handled or captured during the cool of the day either during the winter months, early in the mornings or later in the afternoon to prevent any heat or sun stress etc.

7.2 Catching Bags

Not used for Barbary Sheep Capture.

7.3 Capture and Restraint Techniques

A thorough understanding of sheep behaviour is the first step towards developing an effective method of handling sheep. Their strong flocking and following behaviour tends to make sheep easy to handle, relative to other animal species. Conversely, sheep will prove difficult to handle if you force them to act in ways that are not natural for them.

Reasons for handling:

- Body condition scoring
- Catching
- Deworming
- Dipping
- Ear tagging
- Foot soaking
- Hoof trimming
- Loading
- Pregnancy testing
- Shearing
- Sorting
- Treating
- Ultrasound scanning
- Vaccinating
- Weighing

Flight zone

One of the most basic concepts in handling sheep and other livestock is the flight zone. All animals have a flight zone. A flight zone is an animal's personal space. It is where the animal feels comfortable and unthreatened. When a person is outside the animal's flight zone, the animal will turn and face the handler. It is best to work on the outside of an animal's flight zone. If the flight zone is penetrated too deeply, animal behaviour can be unpredictable and dangerous. Sheep are not large, but they are quick on their feet and strong for their size. Pile-ups can result in small enclosures, causing injury to the animals, especially the small or weak ones.

The size of an animal's flight zone varies. It depends how wild or tame the animal is. Sheep that have not had much human contact will have a large flight zone, whereas pet/hand reared sheep may not have a flight zone. Sheep confined to a small space will have a smaller flight zone than sheep confined to a large area. Frequent, gentle handling tends to diminish the size of the flight zone. At the same time, sheep have excellent memories and can remember rough handling.

Point of balance

Point of balance is another important handling concept. The point of balance is at the animal's shoulder. All species of livestock will move forward if the handler steps behind the point of balance. They will back up if the handler stands in front of the point of balance. Many people make the mistake of standing in front of the point of balance while trying to get sheep to move forward through a chute. Sheep will usually refuse to move if they see people up ahead.

Moving sheep

Very often, you need to move sheep, to bring them in from a pasture or to move them to another pasture. You can train the sheep to come to a vocal command or rattle of the feed bucket. Most sheep will come when they think they are going to get grain to eat. If these don't work, it will be necessary to go out to the field to get the flock and either drive them from behind or lead them with a feed bucket or lead sheep. Pet sheep are difficult to drive and make good lead sheep. If the sheep aren't familiar with where you want to move them, you may need several people to act as herders. Always move sheep slowly, calmly, and quietly. Do not allow splinter groups to develop.

To move individual sheep, hold the sheep under its jaw and push its dock ("go-button").

Small numbers of sheep can be halter-broken for ease of moving and handling.

Attempting to lead a sheep that is not halter-broken is usually a futile exercise.

Catching sheep

There are situations in which you need to catch an individual sheep. The smaller the catch pen, the easier it will be to catch the sheep. No one likes to chase sheep and the more you chase sheep, the harder it will become to catch them, not to mention the unnecessary stress you are causing both of you.

Once the sheep are in the catch pen, manoeuvre them into a corner and use your arms or a portable gate to form a visual barrier. Always approach sheep calmly and slowly. Cup your hand under the jaw of the sheep you want. Grab the bony part of the jaw, not the throat. Point the sheep's nose upward to stop its forward motion. If you keep the sheep's head up, you will be able to maintain control of it. Sheep have a lot more power when their head is down. If you cannot get close enough to the sheep to grab it under its jaw, you can reach for its hind leg or rear flank. Reach for the hind leg above the hock, and then move your other hand up to control the head as soon as possible. Adult sheep are able to kick strongly, so this method works best for small sheep or young lambs. To catch an adult sheep, it is better to grab the rear flank.

Restraining sheep

There are many different ways to restrain a sheep, depending upon what you need to do to it. Once you've caught the sheep, you can press it against a wall or straddle it to limit its movement. A halter is one of the easiest ways to restrain a sheep for treatment or close inspection.

Tipping sheep

If you want to trim a sheep's hooves or gain access to its underside you'll probably want to set the sheep on its rump. Setting a sheep on its rump is called tipping. Sheep in this position struggle very little and are easy to work with. To rest comfortably on its rump, the sheep should be off centre, so that it is sitting on its hip and not its dock. If the sheep struggles, you can place a hand on its brisket to move it into a better position. There are several ways to tip a sheep. The method you use often depends upon the size of the sheep.

Here's a common method for tipping sheep:

- Stand to the side of the sheep.
- Hold the sheep's head in your left hand by placing your hand under its jaw.
- Your left knee should be near or just behind the sheep's left shoulder.
- Your right leg should be touching the sheep's side near its left hip.
- Place your right hand on the sheep's back over the hips.
- Turn the sheep's nose away from you towards its shoulder.
- You should feel the weight of the sheep lean against your legs.
- Put pressure on the hips with your right hand so the sheep cannot pick its back feet off the floor.
- Take a step back with your right leg.
- The hind leg of the sheep should start to go down.
- Continue to bring the head around until the sheep is sitting down with its back leaning against your legs.

Tipping larger sheep can be more difficult especially males. A large sheep can be tipped by reaching underneath its body and grabbing its farthest legs, until it drops to its rump. Sometimes, this is a two person job. Small sheep or lambs can usually be tipped by holding them under their front legs, lifting them, and using your knee to push their rumps out.

Restraining devices

Mechanical restraining devices make it easier, faster, and safer for one person to handle a sheep. A gambrel restrainer is a device made out of PVC plastic. It is placed over the sheep's neck and has slots on either side to hold both front legs of the sheep. Without the use of its front feet or the ability to raise its head, the sheep is immobilized.

Chemical techniques are very rarely used. Occasionally to make stronger Barbary Sheep easier to handle A.C.P. 10 is used to make stronger animals slightly drowsy. Each mL contains Acepromazine Maleate 13.5mg which is equivalent to Acepromazine 10mg. Dosage = sheep 0.25mL + 0.5mL per 50 kg of body weight.

ALTINA WILDLIFE PARK

Animal Escape Procedures

Dangerous Animals = Bison, Giraffe, Buffalo, Eland, Carnivores.

- Ensure that all visitors are safe from escaped animal. If needed evacuate to the front car park/caretakers cottage.
- Ensure all Perimeter Fence gates are securely closed.
- Alert senior management, caretaker and relevant keepers. Manager on Duty or Director to be assigned as Scene Coordinator.
- Keeping staff to collect appropriate equipment eg pitchforks & await directions from Scene Coordinator.
- Alert vet for tranquilliser/capture equipment.
- Primary Gun Handler of day to collect firearms, vet and zoo Ute (Must be enclosed).
- Unless directly involved in emergency, CB channels to be kept clear. Emergency status will be called off once animal is completely contained.
- Alert Dept of Primary Industries within Two (2) Hours of animal escaping.
Ph: 02 63913725
- If animal is extremely dangerous notify police on 000 and ask for Animal Offender squad to mobilize and come to zoo ASAP in case animal escapes from zoo grounds. Also notify adjacent land holders of impending situation.
- Keep animal under constant supervision (at a safe distance). Animal **SHOULD NOT** be approached until strategies have been discussed between firearms and/or vet team and Scene Coordinator for best course of action.

NO ESCAPE FROM ZOO GROUNDS

After assessing the situation Scene Coordinator confirms to either destroy animal or contain and recapture.
Gun Handler/Vet/Keepers to carry out resulting decision. AO squad no longer needed.

ESCAPE FROM ZOO GROUNDS

AO squad take immediate action to contain the situation.
When situation contained AO squad no longer needed.

- When an animal has been re-captured/destroyed, Dept of Primary Industries need to be re-notified. Ph: 02 63913725, as well as all other contacts previously notified.
- Scene Coordinator gives all clear. Team discusses and evaluates emergency event ASAP

7.4 Weighing and Examination

The usual way to weigh sheep is as they walk over a weigh plate placed in the handling yards. Otherwise a more advanced option is developing an automated system to weigh sheep as they walk over a weigh plate placed in the paddock. Placing this weighing plate in a location where the animal needs to pass through to get to a desired place would make this more successful. This system will provide regular body-weight monitoring of sheep without the need for mustering.

Examination on the other hand is more successful when handling the animal directly. (As mentioned above in 7.3 Capture and Restraint Techniques) Once the animal is captured and restrained and a VET is present an overall health check can be done and blood, faeces, urine, skin etc samples can be taken and /or treatment can be administered or decided upon for either long or short term (depending on the situation).

7.5 Release

Barbary Sheep can be readily released by gradually opening the Box door. If an individual has been removed from its herd (and if a subordinate animal), for more than a day it may need to be placed in a holding area, where the herd is visible, prior to being let into the enclosure to minimise aggression upon its return.

7.6 Transport Requirements

Altina Wildlife Park

Animal Acquisition Policy

- Animals will primarily be sourced from ARAZPA Institutional Lists or from reputable Private breeders.
- Animals to be acquired must be accompanied by correct and accurate details on their medical/management history.
- Where animals are sourced directly from the wild we will ensure that there will be no negative impact to the wild population.
- If the sending Institution has not quarantined the animal to be acquired, a recommended time period will be observed according to the species.
- When acquiring an animal through open exchange with another ARAZPA Institution the animal will not be sold or disposed of without first seeking approval or agreement from the initial sending Institution.
- In the case of Confiscated animals, the animals must be thoroughly checked over by a Vet and all necessary actions taken to improve the health and welfare of the animals for the benefit of the species.
- When acquiring an animal through private purchase, you must endeavour to follow ASMP recommendations and act always in the best interest of the animal/s.

Altina Wildlife Park

Animal Disposition Policy

- Preferentially surplus animals must be offered firstly to ARAZPA Institutions and only after this avenue has been exhausted then to allow private or non-ARAZPA Institutions and organizations the chance to acquire.
- Animal/s to be disposed of will be quarantined for a recommended time period to ensure a clean bill of health.
- Animals to be disposed of must be accompanied with all relevant documentations pertaining to their medical/management history.
- An animal previously acquired through open exchange will not be disposed of without first seeking approval from the initial sending Institution.
As a consequence, no profit will be made through the subsequent disposal of the animal.
- Altina Wildlife Park may also dispose of specimens from its collection by approved Euthanasia if necessary. (Refer to Euthanasia Policy No. AE-001).
- The disposal of animals to the wild will follow a recommended plan stated by an appropriate wildlife agency such as National Parks & Wildlife, Wires, etc.

7.6.1 Box Design

The Box needs to be large enough to allow the Barbary Sheep to lie down and sit down comfortably and tall enough for it to stand comfortably. The box should be well ventilated with handles on each side for easy lifting by two or more people. Further specific details of the box design can be found in IATA Live Animals Regulations (1999).



7.6.2 Furnishings

Crates are to be lined with plastic and carpet to provide a non-slip floor.

7.6.3 Water and Food

Food is not generally required, as they will often regurgitate during travel. For short journeys of several hours in cool weather, water may not be required, however in most cases water should be provided in a deep bowl to reduce the amount of splashing.

7.6.4 Animals per Box

One individual per box.

7.6.5 Timing of Transportation

Preferably overnight for long journeys or early mornings or late afternoons for short journeys.

7.6.6 Release from Box

Place the box in the lock-off area for release and then keep it in the holding area for several days before releasing it into the main exhibit or holding yards depending on quarantine requirements.

8 Health Requirements

8.1 Daily Health Checks

Each Barbary Sheep should be observed daily for any signs of injury or illness. The most appropriate time to do this is generally in the morning when the enclosure is being cleaned or when they are fed. During these times, each animal within the enclosure should be checked and the following assessed:

- Coat Condition
- Discharge from the eyes, ears, nose, mouth or anus
- Appetite
- Faeces number and consistency
- Changes in demeanour
- Body condition, whether the ribs are showing may suggest that other more dominant animals are stopping the Barbary Sheep from eating
- Injuries, which may include lacerations, punctures, or lameness
- Physical checks for ticks, which need to be removed as they may cause paralysis.

ALTINA WILDLIFE PARK

Animal Handling Procedures

Hazard Identification

- Animal welfare.

Risk to Animals

- Illness / Sickness / Disease - Due to poor feed practice, Contact with other diseased animals, plants or materials
- Injury / Disability
- Age related / Stress or interaction with other animals
- Escape of Animals – Due to human error or poorly maintained enclosure
- Orphaned or Donated – Due to poor weather

Risk Control

The handling of animals encompasses any of the following categories

1. Feeding (Refer to appropriate Feed Sheet)

2. Contact with other diseased, animals, plants or materials.

The recommended procedure for this risk is to primarily identify the reason for the disease eg. Noxious plant and seek vet direction for an action plan. If instructed refer to Quarantine Procedure and / or Euthanasia Procedure.

3. Handling animals that have age-related / stress or injuries / disabilities that occur with interaction with other animals, enclosure or the result of human / machinery interaction.

The recommended procedure for this risk is to follow a strict protocol of involving vet advice and subsequent recommended action.

4. Handling escaped animals due to human error or poorly maintained enclosures.

The recommended procedure for this risk is to refer to the Escaped Animal Procedure

5. Orphaned or Donated animals.

The recommended standard procedure for these animals should follow directions from the Animal Euthanasia Policy.

Altina Wildlife Park

ANIMAL WELL-BEING & CARE

Checklist for Animals-well Being & Care:

1. All animals are to be checked for any sign of injury or illness everyday.
2. All animal food is to be checked daily. (Refer back to food lists)
3. All water troughs are to be cleaned on a daily basis. Dams and water in the enclosures are to be checked. (Need to be Flushed Fortnightly).
4. All areas and perimeters to be checked for soundness and security, for the animals well being.
5. Any animals that may become ill or injured are to be reported to the manager as soon as possible and quarantined until fully recovered.

Gino - 02 6962 1184
0438 626 992

Gloria - 02 6962 6992
0412 060 342

6. If managers cannot be contacted, the veterinarian can be contacted for advice and treatment if needed.

David Harding - 02 6962 3142

Brian Taylor - 02 6964 4165

Hazard control methods required for the safe operation of the above:

- Do not enter the enclosure alone.
- Sick animals need to be analyzed by Vet or keeper if Quarantine is needed.
- To ensure no spread of disease, gloves are to worn at all times and any contaminated material must be incinerated.
- Skin contact with animal needs to be avoided.
- Seek Managers/Vets advice for handling.

8.2 Detailed Physical Examination

8.2.1 Chemical Restraint

Chemical restraint is very rarely used. Occasionally to make stronger Barbary Sheep easier to handle A.C.P. 10 is used to make stronger animals slightly drowsy. Each mL contains Acepromazine Maleate 13.5mg which is equivalent to Acepromazine 10mg.

Dosage = sheep 0.25mL + 0.5mL per 50 kg of body weight.

8.2.2 Physical Examination

The physical examination may include the following:

- Body condition - Best assessed by muscle palpation in the area over the scapula spines and temporal fossae.
- Temperature - The normal body temperature of a sheep hovers around 102.3 °F and ranges from 100.9-104°F and can be taken rectally
- Weight - record and compare to previous weights. Trends in body weight give a good general indication of the animals state of health, provided age, sex and geographical location are taken into account. Animals in captivity should be weighed monthly to indicate trends.
- Pulse Rate - Normally 70 - 80 heartbeats per minute at rest.
- Respiratory rate - Normally 15 - 30 breaths per minute.
- Fur - Check for alopecia, ectoparasites, fungal infections or trauma.
- Eyes:
 - Should be clear, bright and alert
 - Normal bilateral papillary light response
 - Normal cornea reflex
 - Should not have any discharges
- Also check for presence of lumps over the body and auscultation of lungs
- Anus:
 - Should be clean
 - Check for faeces around perineum; this may indicate diarrhoea
- Males
 - Check Testes - size (length, width, depth) and consistency (firm - not squishy)
 - Extrude penis and assess.

8.3 Routine Treatments

Barbary Sheep at Altina Wildlife Park are treated every 6 months with Fasimec Pour on drench (dose rate is 1 mL / 10 kg body weight) and all toes trimmed at the same time.

FASIMEC Pour-On contains Abamectin, a member of the macrocyclic lactone family of chemicals. It is effective against sensitive strains of internal and external parasites. It also contains Triclabendazole, a member of the benzimidazole family of chemicals, effective against all three stages of liver fluke. Resistance may develop to any chemical.

Indications

For the treatment and control of adult and immature stages of:

Gastro-intestinal roundworms:

Barbers Pole Worm (*Haemonchus placei*)

Small Brown Stomach Worm (*Ostertagia ostertagi*) (including inhibited stages)

Small Intestinal Worm (*Cooperia oncophora*) (*Cooperia punctata*)

Stomach Hair Worm (*Trichostrongylus axei*)

Hookworm (*Bunostomum phlebotomum*)

Large Bowel Worm (*Oesophagostomum radiatum*)

Whipworm (*Trichuris* spp.)

Thin Necked Intestinal Worm (*Nematodirus spathiger*)

Intestinal Threadworm (*Strongyloides papillosus*)

Lungworms (*Dictyocaulus viviparus*)

Liver fluke (*Fasciola hepatica*) including adult (12 week old), immature (6 week old) and early immature (4 week old) larvae

Sucking and Biting lice

Long nosed sucking lice (*Linognathus vituli*)

Short nosed sucking lice (*Haematopinus eurysternus*)

Biting lice (*Bovicola bovis*)

Little sucking lice (*Solenopotes capillatus*)

Cattle tick: (*Boophilus microplus*) - Aids in control

(Not recommended in strategic dipping programs for cattle tick control)

8.4 Known Health Problems

Parasites: Sheep, as a group, tend to be very susceptible to parasites and their damage.

Experts suggest that this is due to a combination of several factors, including:

- The small faecal pellets of sheep disintegrate very easily thus releasing the worm larvae onto pastures.
- Haemonchus is often the major parasite of sheep and its blood sucking characteristic makes it very damaging.
- The ability and tendency of sheep to graze close to the ground where larvae numbers are higher drastically increases their exposure to parasites.
- Sheep, unlike many other animals, have very little aversion to grazing areas of high faecal contamination.
- Sheep have a flocking instinct that encourages them to graze close together.
- The Haemonchus worm is a very prolific egg layer thus worm numbers can build up very rapidly.
- Even older sheep are unable to develop immunity that controls the parasite life cycle.

Lice

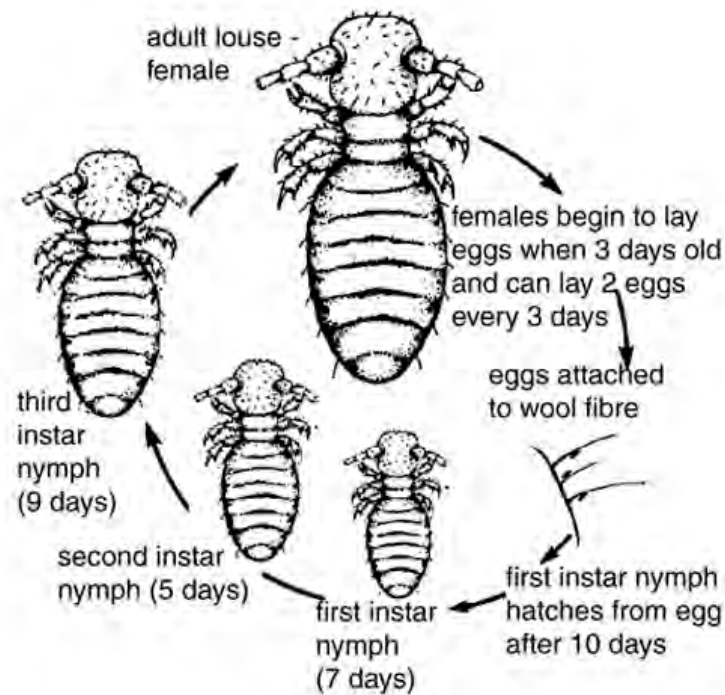
Seasonality:

- Lice populations undergo seasonal fluctuations that vary according to the biology of the louse and affected host.
- Found at higher numbers on affected animals in winter and early spring, and are generally absent or extremely rare in summer and autumn.

Transmission and Cycle:

- Lice vary from 0.3 to 10 mm long with a head much broader than the rest of the body.
- The entire life cycle of lice occurs on the host.
- Lice lay eggs directly onto fur.
- Transfer of lice between hosts occurs from physical contact.
- Lice are very well adapted to a particular host and even to specific areas on a host's body; lice will not survive on other host species.
- A generation of lice usually lasts 45 days.

Lice Life Cycle



Signs and Symptoms:

- Small infestations of lice are commonplace on animals and do not often cause harm to the host.
- Large numbers of lice may be found on: older or young animals, animals in poor nutritional condition, those suffering from a concurrent illness, or those that are inefficient at grooming.
- Lice leave the host 1-2 days following death of the host.
- Animals may become immune to the effects of lice infestation resulting in reduced survival of eggs, fewer eggs being produced, and a reduction in feeding on host tissues.
- Lice may cause the following in animals:
 - Anaemia
 - Itching
 - Inflammation of the skin
 - Skin sensitivity
 - Allergic reactions
 - Intense grooming
 - Fur mats
 - Loss of hair
 - Secondary infections at the location of bites
 - Reduced survival in winter due to hair loss
- Death may result from heavy infestations in young animals or those in poor condition from other disease conditions.

ALTINA WILDLIFE PARK RECOMMENDS FASIMEC POUR ON DRENCH FOR PREVENTION OF LICE EVERY 6 MONTHS!

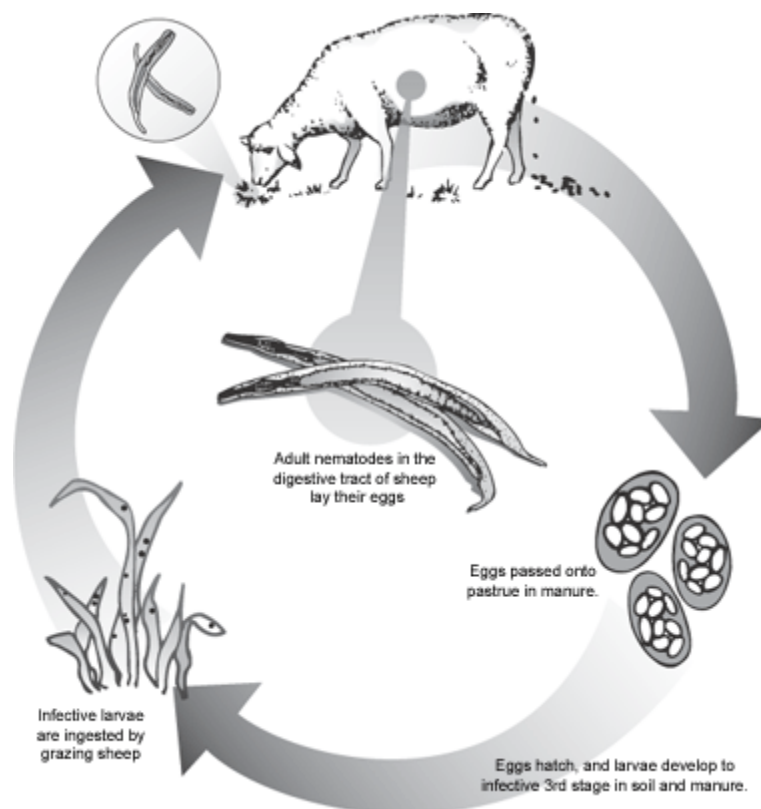
Worms

Adult worms live in the abomasum and lay eggs in huge numbers that are then passed in the manure. Following passage onto the pasture in the manure, they must develop into infective larvae before they are capable of infecting the sheep. The period of time required for the hatching of the egg and development of the larvae is dependent on weather conditions, but it may be as little as five days or as long as several months. Larvae develop and survive best under warm, wet conditions. This explains why parasitism is a much greater problem in moist climates than in dry, arid climates. It also explains the seasonal occurrence of parasitic disease following periods of warm, moist weather.

After larvae have developed into the stage where they are infective, they must be eaten by the sheep in order to complete their life-cycle. The larvae have a limited ability to transport themselves from the manure onto the pasture plants. Therefore, continuation of the cycle depends on disintegration of manure during rains, which transports larvae in splashes and small currents to the surrounding grasses. When sheep are forced to graze pastures very closely, the number of larvae ingested usually increases because the concentration of larvae is higher in the lower parts of pasture plants. The fact that sheep naturally tend to graze selected areas of the pasture very closely, even when other pasture is available, is one of the characteristics that makes them so susceptible to worms.

Once the larvae are eaten, they must continue the development process before becoming adults and being able to lay eggs. This requires a very specific time period; about 14 to 21 days depending on the variety of Worm. These specific periods of time become important when strategic parasite control programs are initiated.

Worm Life Cycle



Stomach worms cause the loss of large quantities of blood and protein, which results in weakness and anaemia. Anaemia is characterized by paleness of the gums and the linings of the eyelids. When there is a rapid build-up in the number of parasites, sheep may die suddenly due to excessive blood loss, even if they are in good body condition and appear healthy. When the build-up is slower, sheep lose weight, become anaemic, and their wool becomes brittle and may fall out. Weak animals may go down, develop pneumonia, and eventually die. A condition known as "bottle jaw" (where fluid accumulates under the skin of the lower jaw) may develop as a symptom of low protein levels.

Diarrhoea may or may not occur as a result of parasitism. Diarrhoea results from intestinal irritation and from disturbed digestion of food. Infections with *Haemonchus* very rarely result in diarrhoea. The other worm species are more likely to cause diarrhoea.

By the time symptoms appear, significant damage has already occurred, and prompt action is necessary to prevent further loss.

Many of the symptoms mentioned are also symptoms of other diseases. Therefore, it is wise to consult a veterinarian in order to arrive at an accurate diagnosis. Only after an accurate diagnosis is made can an effective treatment and control program be undertaken.

In addition to the examination of faeces for parasite eggs, pasture grass may be examined to determine approximate levels of pasture contamination, and total parasite counts can be obtained from an autopsy.

Control programs are based on understanding these important principles. They have been developed and revised as some of the newer concepts discussed above have become known. The most effective programs require the use of de-wormers to some extent. However, well planned programs will provide for a minimal amount of de-wormer usage. This provides a number of benefits, including 1) decreased cost due to less de-wormer usage, 2) decreased parasite resistance caused by indiscriminate use of de-wormers, and 3) decreased production losses due to parasitism since de-wormers are used to prevent rather than treat disease.

Many control programs used in the past, although well intentioned, resulted in the sheep having only a few days without worms before the process of reinfection began. Sheep quickly returned to worm burdens of essentially pre-treatment levels. This resulted because the treatment programs did not stop the pasture contamination build-up; and therefore, sheep were de-wormed and returned to very heavily contaminated pastures. Effective control programs should, therefore, combine the preventive use of de-wormers with appropriate grazing management.

Table below: De-wormer Products Approved and Under Development for Sheep

	Approved Products			Products Under Development		
Generic Names	Levamisole	Thiabendazole	Ivermectin	Fenbendazole	Morantel	Albendazole tartrate
Trade Names	Levasole, Tramisol, Prohibit	Equizole Suspension	Ivomec Sheep Drench	Panacur, Safe-Guard	Rumatel	Valbazen
Manufacturer	Malinckrodt, AgriLabs	Merck-Agvet	Merck-Agvet	Hoechst-Roussel	Pfizer	Smith-Kline Beecham
Dosage Forms	Drench, bolus	Drench, bolus, paste, feed pre-mix & top dress	Drench (injectable not FDA approved) paste	Drench, paste, feed block	Bolus, feed pre-mix	Drench
Parasites	Control	Control	Control	Control	Control	Control
Haemonchus Adults	All	All	All	All	All	All
Young (immature)	Most	Most	All	All	Most	All
Ostertagia Adults	All	All	All	All	All	All
Young (immature)	Some	Few	All	All	Few	All
T. Colubri formis Adults	All	All	All	All	All	All
Young (immature)	All	All	All	All	All	All
Lung worms	All	Few	All	All	None	all
Tapeworms	None	None	None	Most	All	all
Comments	Some documented resistance in the U.S.		Effective against nasal bots. Some external parasite control (sucking, lice, ticks, keds)		Cross resistance with thiabendazole	

**ALTINA WILDLIFE PARK RECOMMENDS FASIMEC POUR ON DRENCH FOR PREVENTION OF WORMS EVERY 6 MONTHS!
IF NOT AVAILABLE IVOMEK CAN ALSO BE USED!**

Liver Fluke

Liver fluke are fleshy, flat worms about two cm. long. Adult liver fluke live in the bile ducts and juvenile fluke in the liver tissue. Liver fluke mainly infect cattle and sheep.

Liver fluke have an indirect life cycle using snails as the intermediate host. The presence of the snail is essential for transmission of the fluke. Without the snails, the fluke cannot become infective to the sheep or other hosts. This explains why fluke infections occur only in the areas where the snails survive.

The hermaphroditic adults lay eggs in the bile ducts of the sheep's liver and they are eventually excreted in the dung. A fluke can lay 20,000 – 50,000 eggs per day. These eggs hatch and the larvae (called miracidia) infect the snail.

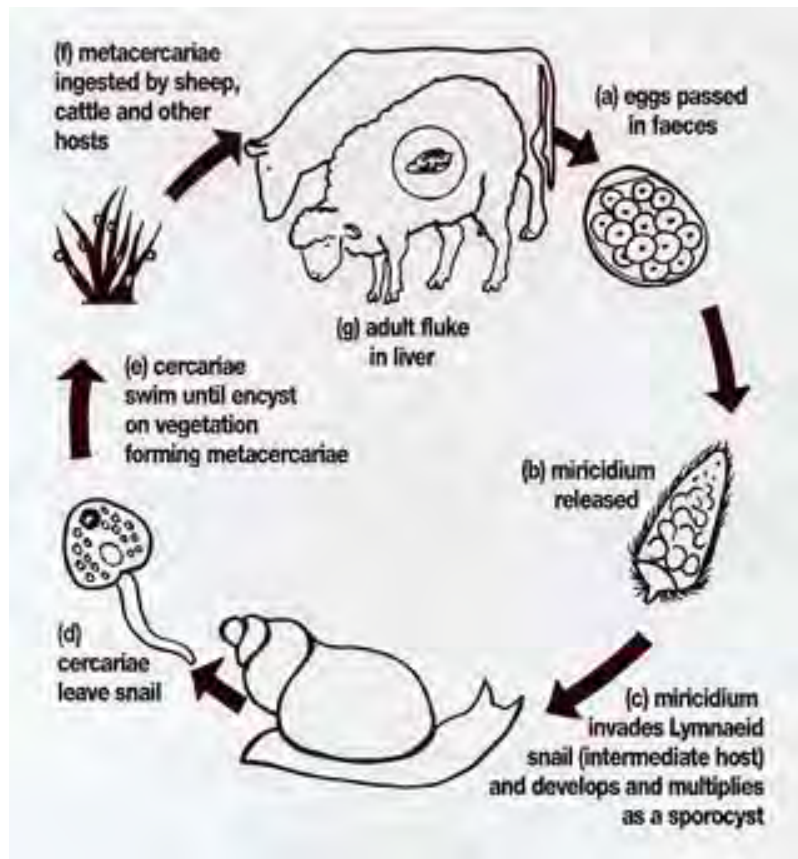
Each larva is capable of multiplying inside the snail to many hundreds of the next larval stage (called metacercariae). These emerge from the snail, attach to vegetation and form a cyst.

The cyst is able to survive very harsh environmental conditions. The transition from egg to cyst takes between five and seven weeks when conditions are favourable, and may be much longer if conditions are not so favourable. When the sheep or other host eats the cyst, it loses its tough wall in the small intestine and the immature fluke emerges.

The immature fluke migrates through various tissues for four to six days until they reach the liver. In the liver they wander through the liver tissue for five to six weeks, eventually settling in the bile ducts. The immature fluke is only about 2mm in length, but can cause enormous damage to the liver tissue.

The full life cycle takes from seven weeks in summer and up to 25 weeks in winter. The adult fluke can live for 10 years. If things go right for a fluke it can produce over 10,000,000,000 infective cysts.

Liver Fluke Life Cycle



After sheep eat the fluke cyst on grass, a juvenile fluke is released into the sheep's gut and starts its journey to the liver.

The fluke then moves through the liver for six to seven weeks, eating liver tissue and blood. They grow to adults and enter the bile ducts where they feed on blood.

The flukes' eating behaviour causes serious damage to the liver and anaemia due to blood loss. The liver damage and anaemia lead to loss of body weight, reduced wool growth, and reduced milk production and poor breeding performance in ewes. The degree of damage and economic loss varies - the more fluke in the liver the more serious the disease. A well-fed sheep can cope with about 20 fluke.

Acute fluke disease (*fasciolosis*) occurs soon after sheep are moved to heavily cyst contaminated, wet areas during drought where they eat several hundred fluke cysts in a short space of time. Many fluke develop at once and the result is fatal within a few weeks. Prior to death sheep may have jaundice or abdominal pain, or be reluctant to move. Chronic fluke disease occurs after a slow accumulation of fluke and is caused by adult liver fluke in the bile ducts. Animals become progressively more anaemic, listless and weak, lose their appetite, lose condition and are reluctant to move.

Some animals develop 'bottle jaw' - a swelling under the lower jaw associated with severe anaemia. These signs may lead producers to misdiagnose the fluke infestation as a barbers pole infestation.

Black disease is a fatal, liver disease of sheep set off by fluke infection. Sheep can be vaccinated against black disease using Clostridial (5-in-1) vaccine.

Liver fluke can be diagnosed two ways:

1. **Conducting a fluke egg count.** This is done differently to a normal worm egg count. It provides a 'present or absent' diagnosis. Because of the potential of fluke to rapidly increase and the damage they cause, if fluke are present the sheep should be treated.
2. **Conducting an 'Elisa' test on blood or milk.** This test indicates presence or absence of fluke in a flock.

Both methods have limitations therefore a Vet should always be consulted first.

Treatment options:

- Narrow spectrum, short acting specific for fluke - **Triclabendazole**
- Narrow spectrum (fluke and barbers pole) short acting - **Nitroxynil**
- Narrow spectrum (fluke and barbers pole) long acting on barbers pole - **Closantel**
- Broad spectrum, short acting - **Oxyclozanide**

Resistance to Triclabendazole has been found in fluke in some very localised districts in NSW and Victoria.

ALTINA WILDLIFE PARK RECOMMENDS FASIMEC POUR ON DRENCH FOR THE PREVENTION OF LIVER FLUKE EVERY 6 MONTHS.

ALTINA WILDLIFE PARK

Animal Treatment Procedures

Hazard Identification

- Physical and Psychological balance for Animal Welfare.

Risk to Animals

- Physical injury due to other animals, enclosure, disease or human interaction.
- Psychological effects due to boredom, isolation from herd or human interaction.

Risk Control

- Physical injury prevention will encompass procedures that pertain to appropriate species feeding and routine health check standards as follows. Refer to Animal Handling Procedures Ref: = AH-001.
- For enclosure maintenance refer to appropriate procedures for each animal enclosure. Refer to Animal Enclosure Procedures
- All other procedures to handle disease and injury due to human interaction must follow standards for the injury sustained. Eg Quarantine Policy

Psychological prevention due to boredom, isolation from herd or human interaction is to be referred in the first instance to Directors and Managers on site for review and recommended schedule to alleviate the psychological effect on the animal in question

Altina Wildlife Park

Euthanasia Policy

Cases for Euthanasia is to be referred in the first instance to the Directors/Manager or Supervisor in Charge and must cohere to ARAZPA's Euthanasia Policy.

He/she must determine if the case for Euthanasia is a Medical/Welfare issue or if it is an Animal/Species Management issue.

Euthanasia is only to be considered as a last resort when all other possible measures have been exhausted.

Euthanasia is to be carried out Humanely with minimal psychological and physiological stress to the animal.

Animal Medical/Welfare Cases.

Conditions:

- If the animal is suffering due to an irreversible disease, disability, injury or age-related factors such as abandonment of young at or near birth, degenerative conditions or general reduction in fitness associated with increased age.
- Where a member of the public has donated or sought assistance in the handling of sick, injured or orphaned animals.

Action:

- Consult Veterinarian for appropriate action.
Under direction proceed with one of the following procedures;
 - i) Apply to include in Institutions Species List.
 - ii) Assist in the welfare and rehabilitation for release into the wild.
 - iii) Euthanize if required.

Animal Management Cases.

Conditions:

- Whereby the production of surplus animals is unavoidable or accidentally produced.
- Where a genetic or ASMP program goal is compromised such as the pairing of related offspring producing mutations or unrecommended young.

Action:

- If the animal is ASMP managed, first consult with the program coordinator for appropriate action, in any case one of the following procedures could be implemented:
 - i) Euthanize.
 - ii) Dispose to other Institutions (Giving priority to ARAZPA members).
 - iii) Possibly Neuter if directed or necessary.

8.5 Quarantine Requirements

Altina Wildlife Park

Quarantine Policy

Prior to action for Quarantine or Isolation Cases the Directors/Manager/Supervisor and Veterinarian are to be notified.

All animals to be quarantined will be for a Vet recommended period of time.

1st Probable Case for Isolation or Quarantine

1. New species or animal to be introduced to the existing animal collection.

Action

- All newly acquired animals to be Isolated and Quarantined for a minimum of 2 months before being released into already existing enclosure. The exception to this policy will only be deemed appropriate if the newly acquired animal/s is/are the first to be released into a newly constructed enclosure.

2nd Probable Case for Isolation or Quarantine

2. Injured or sick animals either from outside sources or from within the existing animal collection requiring isolation or treatment.

Action

With Veterinary consultation animals will be isolated from all others in separate yards, pens, enclosures or in Quarantine/Isolation Area. The following procedures should take place.

- Close monitoring of the animal/s is expected with a minimum of 2 daily visits necessary for animal welfare checks.
- Sick or injured animals are to be quarantined in corresponding species yards until a thorough Vet check has been performed and diagnosis pronounced. Animals are to be treated and quarantined according to Vet directions.
- Orphaned animal/s to be Isolated or Quarantined in designated enclosure or yards and reared until ready for natural release into original herd/species enclosure. The exception to this option will be if according to ASMP recommendations it is not viable to rear or retain the animal that is orphaned.

NB When dealing with Quarantined animals the following procedures must be followed.

- i. Cleanliness of enclosure, removal of faeces etc.
- ii. Washing and sterilization of equipment etc.
- iii. Unused protective clothing must be worn with each new animal being treated: such as gloves, etc.

9 Behaviour

9.1 Activity

Active yearlong; primarily diurnal.

The colour of the Barbary sheep blends perfectly with the rocks where it lives. In the evening and early mornings, it climbs down to the sparsely vegetated valley floor to feed. It lives in family groups led by a large male, and other adult males are excluded. Old males and pregnant females are solitary. It moves among rocks and overhangs with great agility, leaping impressive lengths. Mating usually occurs in the autumn, but may occur at other times.

9.2 Social Behaviour

Like most other ruminants, sheep are social animals that need the presence of other co specific in order to experience a state of well-being. This is particularly true in the research setting where stressful experimental manipulations are best counterbalanced by the presence of a familiar companion. Sheep should therefore be housed in a social setting whenever possible. Research protocols requiring individual housing must be scrutinized carefully to ensure that the time period of social deprivation is limited to the very minimum. Behavioural changes such as augmentation of aggression (usually subtle in female animals but very obvious in males), increased/ decreased activity (for example during isolation from other group members), incomplete/ abnormal reproductive behaviours, decreased foraging, decreased grooming/ stretching, stereotypes, teeth grinding, increased vocalization, increased respiration rate, unusual posturing, reduced alertness, apathy, and anorexia are reliable indicators of impaired well-being. The flow chart below gives some guidance to identify well-being problems. Sheep seem to be rather stoical, allowing easy recognition of impaired well-being.

Sheep are conspicuously vigilant and their natural response to fear-inducing situations is to instantaneously congregate (flock) and flee. Sheep have a strong need to flock and this species-typical behaviour requires at least three animals. Hence the saying that "One sheep is not a sheep".

Free ranging animals always maintain uninterrupted visual contact with at least one other member of the flock. This safeguards the coherence of the flock and its acute alertness and quick reactivity to fear-provoking stimuli. Indoor-housed animals should therefore always be positioned in such a way that they can see at least one other co specific.

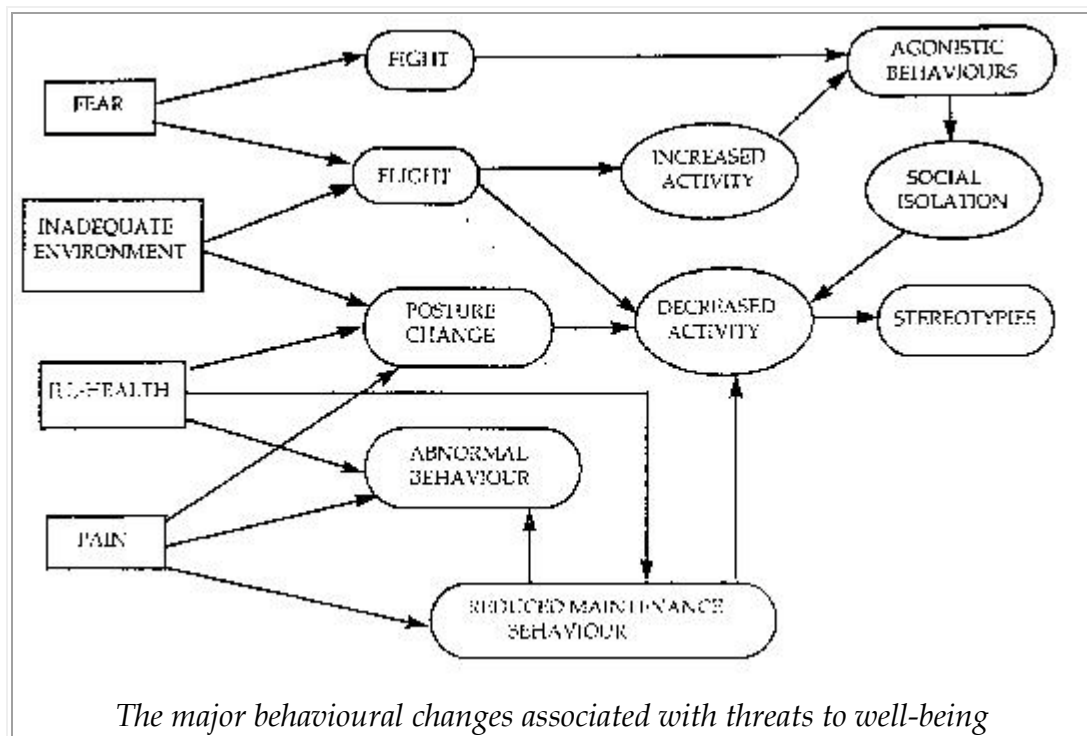
Visual isolation is extremely stressful for sheep, and under no circumstance should they be housed by themselves. An individual animal should never be exposed to a potentially stressful situation, such as venipuncture and drug application, without the presence of a familiar co specific.

Sheep establish social dominance hierarchies which are based on differences in age, sex and possibly body-weight and horn-size. These rank-determining factors must be taken into consideration when new groups are formed in order to avoid aggressive conflicts. It is preferable to establish groups of animals who are already familiar with one another and are of the same age and sex.

Adult males tend to exhibit intense, agonistic behaviours if they are grouped with each other or placed in situations of territorial or sexual competition. It is therefore good advice to house mature rams in separate pens.

In the wild, juvenile males (less than 2 years old) form compatible male-only groups.

Hence, they can be housed without undue risk in groups of up to 20 animals. However, excessive and possibly injurious socio-sexual mounting may become a serious problem in such groups, unless they are monitored very carefully on a daily basis.



Like most other gregarious animals, sheep not only establish a rank order that is based on dominance-subordination but also one that is based on leadership, with particular subjects leading, and the rest of the group following from one location to another, e.g., from a grazing area to a water hole. In the context of confinement, individual animals can readily be trained to lead others during routine handling procedures such as weighing and veterinary examination. The preferable means for movement is to allow the animals, as a group, to move away from the handler to the target location. The use of fear stimuli such as dogs and noise is not recommended in confined areas where the animal cannot escape. Taking advantage of such voluntary movement minimizes stress responses during handling, thereby enhancing the reliability of research data collected.

Sheep are relatively fearful by nature. Any changes in their surroundings make them apprehensive. Even a change of the diet results in the animals being reluctant to eat the unfamiliar foodstuff. The human shape elicits especially strong fear response which can only be modulated with patient conditioning.

The inherent neophobia of sheep makes it an imperative that animals subjected to experimentation be carefully habituated to all new, i.e. fear-inducing situations. The adjustment to the stress associated with new food, new housing arrangements, to new experimental conditions, and new personnel is best buffered by working with an animal in the presence of one, or preferably several familiar, well-experienced co specific.

9.3 Reproductive Behaviour

Gestation Period: 160 days.

Young per Birth: 1, rarely up to 3.

Weaning: At 3-4 months.

Sexual Maturity: After 18 months.

Life span: 20 years.

Although breeding can occur throughout the year, there is a peak from September to November, with the subsequent young being born from March to May. Rocky outcrops, cliffs, and steep, rugged areas are used for lambing. These rocky areas provide protection from predators and disturbance. Females may give birth twice per year. Newborns are able to negotiate the rocky hills almost immediately after birth. They nurse for about six months and reach sexual maturity at about 18 months of age.

Males fight for access to females. A linear dominance hierarchy exists within each sex and age class. Males are dominant to females, which are dominant to young.

Females usually separate themselves from the herd close to giving birth. Hiding in a well sheltered and comfortable location she gives birth.

Usually lying flat with her head down is a dead giveaway that she is about to give birth or hiding her new born/s.

Once the baby is clean and capable of walking the mother will take the baby back into the herd but will still stay on the out skirts and lie flat when danger or uncertainty is present.

9.4 Bathing

Their food consists of a wide variety of vegetation including grasses, forbs, and shrubs.

Apparently, they are capable of producing metabolic water and can survive for long periods without access to fresh water. However, when water is available they utilize it for both drinking and bathing.

Especially on warm days any bathing places are readily used by all members of the herd, and some can remain sitting in the water for long periods of time. Subsequently they regularly wallow about in a sandy depression. When doing this they mostly shovel sand on their body with their horns and work over their coat with the horn tips, the hooves of the rear legs, as well as with the lips and teeth.

9.5 Behavioural Problems

Barbary Sheep appear to suffer little from behavioural problems.

9.6 Signs of Stress

The environments in which we keep many of our animals (eg laboratory animals, intensively farmed animals, captive animals on display) may be impoverished and relatively barren, even if they do provide for the basic needs of the animals (eg food, water, companionship, protection from climatic extremes, injury and disease etc.). The welfare of animals that are deprived of their basic needs will be compromised and behavioural changes will often reveal this state of poor welfare. However, even if the basic needs of an animal are met its welfare may still be compromised as a result of living in an impoverished environment. Animals appear to have a requirement for 'optimal' levels of stimulation from their environment and a lack of stimulation has been linked to

the development of abnormal behaviours (e.g. isolation, sweating, loss of appetite, and other animals bullying and continuous fighting/biting). Behavioural changes that may indicate that an animal is suffering are sometimes subtle and difficult to detect because the behaviours themselves may appear 'normal'. However, closer study will reveal that they are being performed in inappropriate situations, directed to inappropriate objects, or being conducted to extreme (e.g. highly repetitive and/or for large proportions of the animal's time). Just because such behaviours are not overt and obvious does not indicate that an animal is not suffering. These abnormal behaviours suggest that the animal is not coping with the situation it is in, and as a result, its welfare will be poor.

This link between barren environments and the development of abnormal behaviours has motivated people to design devices and techniques for the so-called "enrichment" of the animals' environment.

The wild is always perfect.

9.7 Behavioural Enrichment

Wild sheep live in heterogeneous mountain and valley grassland environments. This suggests that the animals are very responsive to variation in their environment. Field studies conducted in sheep show that ewes respond to the addition of trees, logs and earthen mounds by increasing their repertoire of behaviours compared to those seen in barren paddocks. The animals are responsive to such environmental enrichment presumably because it reduces boredom resulting from under stimulation.

Sheep kept in deep litter pens readily accept "toys," such as plastic drums and suspended balls to counteract boredom. Such enrichment objects may also have a therapeutic value if the animals are afflicted by behavioural pathologies such as wool biting/chewing and bar chewing.

Sheep also respond extremely well to browse or hay varieties having different scents present. You can create this effect by putting hay or browse into a different species enclosure for a day or so, making sure that the animal does not have any infectious diseases or unhygienic habits of urinating on the browse or hay. It is mostly suggested you use a scent from another ungulate E.g.: Himalayan Tahr, Domestic sheep, goats etc.

Troughs are always great for hygiene purposes as well as an ease of feeding for the keeper but occasionally sprinkling grain such as corn around the rocks and grass can make the sheep explore their enclosure and entertain themselves for a while too.

Browse, apples, carrots, banana, sweet potato, frozen ice blocks can all be scattered also to provide alternate tastes and smells.



9.8 Introductions and Removals

Any animals that are removed from their herd should be returned as soon as possible, especially in the case of more subordinate individuals. If a subordinate individual has to be removed for treatment for more than a day, it may be worthwhile to hold it in an adjacent holding area for a further day or two to allow the other Barbary Sheep to re-establish auditory, olfactory and visual contact prior to its return. The release of an animal to its group in this situation is best undertaken in the morning to maximise the time that it can be closely monitored to assess how well it reintegrates into the herd. Upon return some aggression is expected as the sheep re-establish their position within the herd, however they should work themselves out within several hours. If, by the end of the day, you are not happy with how the animal is settling into the group it may be worthwhile removing the Barbary Sheep overnight into the holding area and putting it back in with the herd the next morning.

9.9 Intraspecific Compatibility

Usually mixed groups of Barbary sheep including males, females and young of all ages, seem to get along very well, but occasionally males can get aggressive to each other as they mature. If this starts to occur the separation of the males unintended for breeding should be separated into a bachelor herd to prevent aggressiveness.

9.10 Interspecific Compatibility

Barbary Sheep are usually very docile animals and will accept almost any herbivore species to live amongst or around it as long as it does not compete with it directly for territory for example Big Horn Sheep. In Australia the use of guard animals are used to protect both the domestic sheep and other species of sheep. At Altina Wildlife the use of Donkeys and Alpacas as guard animals has proven very successful especially if the particular animal (in this case Alpaca) has had enough time to bond and grow with the herd.

9.11 Suitability to Captivity

Barbary Sheep are very easy to domesticate therefore their suitability to captivity is very impressive especially if all animal standards, rules and regulations are followed.

10 Breeding

Gestation Period: 160 days.

Young per Birth: 1, rarely up to 3.

Weaning: At 3-4 months.

Sexual Maturity: After 18 months.

Life span: 20 years.

10.1 Mating System

Barbary Sheep are - Polygynous – having more than one female as a mate at one time.

During estrus, females lick the sides of the prospective mate. The animals may touch muzzles. The male mounts the female and achieves copulation. Males defend groups of females from other males.

Breeding usually occurs from September through November, but the timing can vary. Gestation lasts about 160 days, so most lambs are born between March and May. However, births have been seen as late as November. Most births produce a single offspring, but twins are born one out of every six or seven births.

The timing of sexual maturity varies among males. Sperm have been found in one male at eleven months; however, this is probably not the norm. Females are considered sexually mature at 19 months; however, females as young as 8 months of age have produced offspring.



10.2 Ease of Breeding

Barbary Sheep generally breed well in captivity and will re-enter oestrus if the young are lost. Barbary sheep can also breed twice yearly if correct diet and health conditions are supplied.

10.3 Reproductive Condition

10.3.1 Females

Reproductive condition of females can be divided into several categories including:

- Juveniles - The vagina is imperforate, the utter is not clearly visible and the weight is below that of adults.
- Non Breeding Adults - The vagina is perforate or imperforate and they are the adult weight; a sperm plug may be present.
- Pregnant - Can be determined in the more advanced stages of pregnancy using palpation and the utter is usually enlarged.
- Lactating - The teats are large and elongated and surrounded by rings of bare skin. It is very often to express milk from the utter.

10.3.2 Males

The reproductive conditions of males are not easily defined once they have obtained adult body size. The testis must be firm with epididymis distinct.

10.4 Techniques Used to Control Breeding

Barbary Sheep seem to breed readily in captivity so the major emphasis on controlling breeding is to stop reproduction when not required. Several techniques can be used to stop reproduction including separating the female (or male if easier) during the breeding season and/or using hormone injections, though care needs to be taken with these as if they are used too frequently they can cause infertility, obesity and behavioural problems. Animals, especially males that are no longer required to breed are generally surgically de-sexed.

10.5 Occurrence of Hybrids

There are currently no hybrids. Scientists have tried to cross Barbary Sheep with a domestic Goat but where unsuccessful due to the different number of chromosomes in each species.

The subspecies are classified mainly according to their distribution in North Africa:

- *Ammotragus lervia lervia* Pallas, 1777. (vulnerable)
- Egyptian Barbary Sheep *Ammotragus lervia ornatus* I. Geoffroy Saint-Hilaire, 1827. (extinct in the wild)
- *Ammotragus lervia sahariensis* Rothschild, 1913. (vulnerable)
- *Ammotragus lervia blainei* Rothschild, 1913. (vulnerable)
- *Ammotragus lervia angusi* Rothschild, 1921. (vulnerable)
- *Ammotragus lervia fassini* Lepri, 1930. (vulnerable)

10.6 Timing of Breeding

Although breeding can occur throughout the year, there is a peak from September to November, with the subsequent young being born from March to May.

10.7 Age at First Breeding and Last Breeding

The timing of sexual maturity varies among males. Sperm have been found in one male at eleven months; however, this is probably not the norm. Females are considered sexually mature at 19 months; however, females as young as 8 months of age have produced offspring. Ages for both male and female to cease breeding are unknown.

10.8 Ability to Breed Every Year

Although breeding can occur throughout the year, there is a peak from September to November, with the subsequent young being born from March to May. Barbary Sheep generally breed well in captivity and will re-enter oestrus if the young are lost. Barbary sheep can also breed twice yearly if correct diet and health conditions are supplied.

10.9 Ability to Breed More than Once Per Year

Although breeding can occur throughout the year, there is a peak from September to November, with the subsequent young being born from March to May. Females may give birth twice per year because of the gestation period being 160 days.

10.10 Nesting, Hollow or Other Requirements

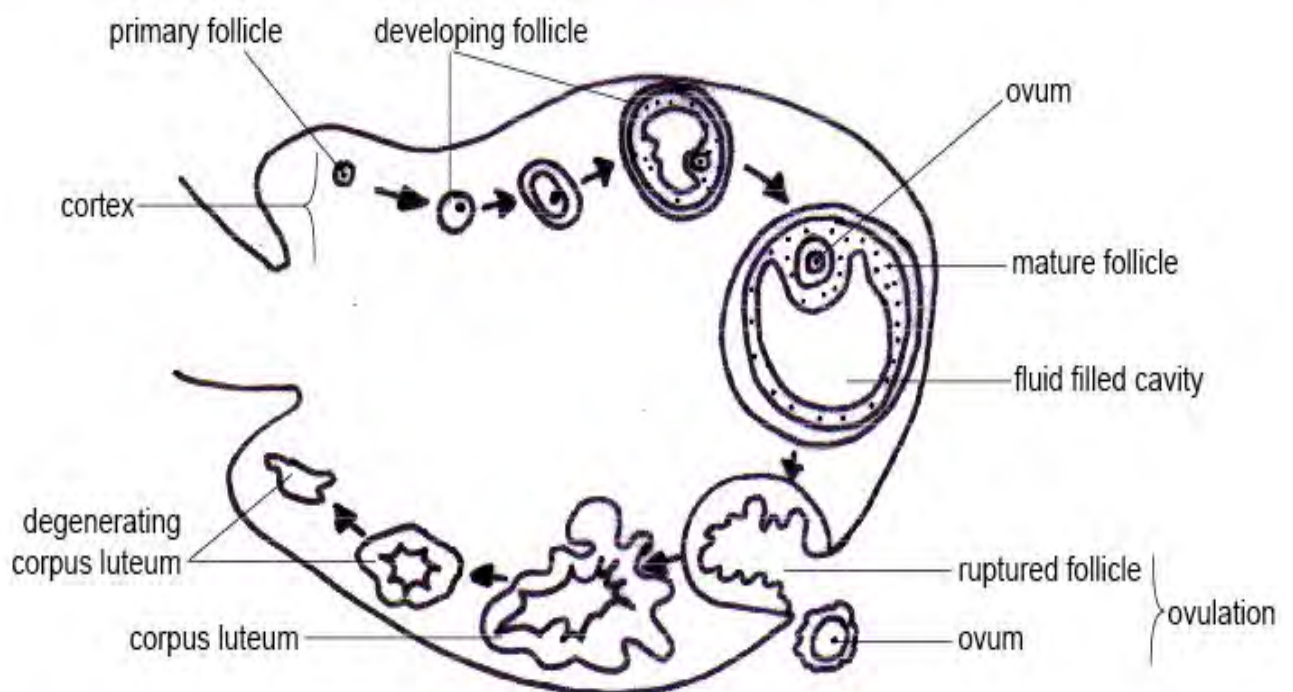
Rocky out-crop to hide young as well as a shelter with Hay as bedding as a option to give birth in.

10.11 Breeding Diet

Many sheep breeders/keepers flush ewes and rams with grain during breeding to increase fertility. Ewes are also flushed during pregnancy to increase birth weights, as 70% of a lamb's growth occurs in the last five to six weeks of gestation. Otherwise, only lactating ewes and especially old or infirm sheep are commonly provided with grain.

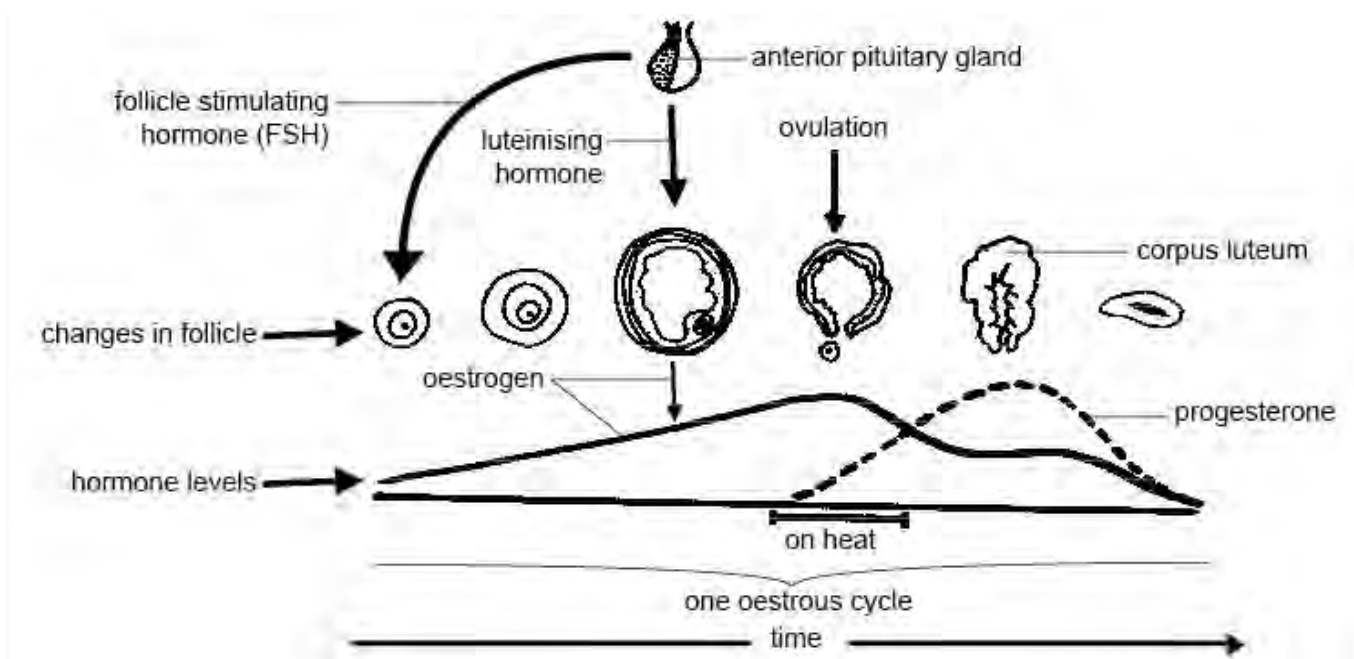
10.12 Oestrous Cycle and Gestation Period

Gestation Period: 160 days.



The ovarian cycle (above) showing from the top left clockwise: the maturation of the ovum over time, followed by ovulation and the development of the corpus luteum in the empty follicle.

The **oestrous cycle** (below) is the sequence of hormonal changes that occurs through the **ovarian cycle**. These changes influence the behaviour and body changes of the female.



10.13 Litter Size

Young per Birth is usually 1, rarely up to 3.



10.14 Age at Weaning

Weaning: At 3-4 months (naturally)

10.15 Age of Removal from Parents

6-8 months or not at all (captive herds)

10.16 Growth and Development

Birth weight (g) and growth rate (g/day) of Barbary lambs

	Single males	Single females	Twins
Birth weight (kg)	3.6	3.4	3.1
At 10-30 d (g)	220	200	170
At 30-90 d (g)	180	170	150

<u>Age</u>	<u>Condition of Dentition</u>
3 weeks	Deciduous dentition complete and consists of four pairs of deciduous incisiform teeth and three pairs of deciduous premolars.
8 months	First permanent molar erupted or erupting.
17 months	Second permanent molar erupting.
18 months	First (inner) permanent incisor erupts.
21 months	Third permanent molar erupting; deciduous premolars being replaced.
23 months	Second deciduous incisor shed.
27 months	Permanent dentition except for outer two pairs of incisiform teeth; last molar not fully exposed.
36 months	Third pair of permanent incisiform teeth present; last molar fully exposed but unworn.
48 months	Fourth (outer) pair of deciduous incisiform teeth (the canines) being replaced.
60 months	Full set of permanent teeth.

11 Artificial Rearing of Mammals

Artificial rearing of this species, though rarely, would be an imperative method of husbandry to ensure the survival of some individuals. First and foremost, it is inadvisable to attempt to hand rear Barbary Sheep unless a permanent plan is set in place for the inevitably behaviourally altered specimen/s; that is; that a definite method of amicable re-introductory is determined to avoid territorial aggression. Do not hand raise a Barbary Sheep that has no herd to be later introduced to, as these are social animals and will not thrive physiologically without the opportunity to exercise natural social behaviours. Animals within a captive institution should not be artificially reared unless there is no other option.

11.1 Housing

One of the most important factors one must take into account when constructing or deciding upon housing is the need of assurance of minimal stress to the artificially reared young. Some ways to create stress free rearing facilities are by ensuring that the young are situated off exhibit and away from the business of the everyday husbandry of other animals (as in a quarantine room). Maintaining optimum hygiene within the housing will also lower stress levels as well as the young lamb's chances of contracting diseases.

11.2 Temperature Requirements

Lambs are most comfortable within a temperature range of 20-28°C (68-82°F).

11.3 Diet and Feeding Routine

Newborn lambs require small and frequent meals, ideally six meals per day for the first 3 days. Most brands of milk replacer will have instructions for how to make up the mixture and how much to feed for the age of the lamb. Ensure the milk replacer is suitable for lambs as those made for calves are not suitable for lambs. It should contain about 30% fat, 23% protein and 23% lactose.

Generally, the dilution is 250g to 1 litre water, and lambs will consume 1 to 2 litres daily. You can handfeed lambs or train them to use self-feeders, which are much less labour-intensive. Lambs that use self-feeders can feed as often as they like and tend not to overfeed. Also, using a self-feeder avoids problems associated with varying the amount of milk replacer fed and the timing of the feeds. If hand-feeding, use a lamb teat and a glass bottle that can be easily cleaned.

After three days, reduce to two to four feeds per day, and at five weeks of age you can reduce to two feeds per day. Increase the amount fed per meal according to the lamb's appetite and manufacturer's instructions. Try not to overfeed so that the lamb is overfull and appears bloated. If you have a self-feeder, you will need to start by bottle-feeding using cold milk, then encourage the lamb to use the feeder at about 6 hour intervals.

You can start offering solid food from a few days of age. Obtain a high quality starter lamb feed and only supply as much as will be consumed over the next 24 hours or so, to prevent the feed becoming contaminated with faeces.

You can wean the lamb off milk replacer at about four weeks of age, providing the lamb is eating some solid food, and is doing well.

11.4 Specific Requirements

A newborn lamb needs a warm, dry and sheltered area out of the wind and hot sun. Provide bedding in the form of straw or shredded newspaper that can be easily replaced when soiled. In cold environments, provide the lamb with a heat source such as a heating lamp until it is able to maintain its own body temperature.

11.5 Data Recording

As soon as a juvenile Barbary Sheep is brought in for hand rearing, its species, sex, appropriate age and parents identity (if known) should be recorded. During the process of hand rearing, there are other considerably important pieces of information that will require recording. Keeping records like this will assist in different ways, such as if a veterinarian wishes to know an animals history to help diagnose that animal, or simply to have records of growth curves by which to compare future progeny.

Some of the information that will need to be recorded is:

- Date
- Time that the information is recorded
- Animal's body weight to the nearest Kg/g
- General assessment of activity or demeanour
- Chrematistics (e.g.: consistency) of faeces and urine
- Frequency of urination and defecation
- Amount of food offered
- Type of food
- Food consumption each time
- Veterinary exams and results

11.6 Identification Methods

- Tattooing – has been used successfully on the inside of the ear and the medial aspect of the hind leg/thigh.
- Visual identification – As most Barbary Sheep show a fair degree of variation in pledge colour, horns size and scars from fighting, visual identification can often be used but recommended to accompany another form of identification just in case.
- Ear tags – Have been used, including self piercing, nylon disc swivel tags. Although ear tags can be lost and can be become entangled, they are highly visible which has been the advantage that animals don't need to be caught up for identification. To locate veins in order to avoid them when making a hole through the ear, shine a torch up against the ear.
- Ear notching - usually left ears for females and right for males and each animal notched in different areas along the edge of the ear so differences can be noticed.
- Microchip Implants - is an identifying integrated circuit placed under the skin of an animal. The chips are about the size of a large grain of rice and are based on a passive RFID technology.

11.7 Hygiene

A high standard of hygiene is a necessary part of successfully hand rearing Barbary Sheep. Particular attention should be paid to ensure the following:

- Clean, fresh bedding is maintained at all times.
- Personal hygiene is maintained by the disinfecting of hands both before and after handling young.
- Hands are cleaned between feed of different individuals.
- Boiled water is used when making milk formulas.
- Young Barbary Sheep's skin and hair are cleaned thoroughly of spilt milk formula, urine and faeces and dried quickly.
- All feeding equipment is washed and sterilised with an appropriate antibacterial agent or boiled for 10 minutes.
- Teats may be stored in the refrigerator after washing to avoid the collection of bacteria.
- Milk is heated up only once, and leftovers are discarded.
- Contact with other animals is avoided unless they pose no health risk (e.g. if they have had clean faecal sample examination results returned).

11.8 Behavioural Considerations

Barbary Sheep are a social species, and will then obviously do better psychologically if reared with others of the same or similar species. Also they are quite active after weaning, so ample space should be provided. Also, being an inquisitive species, they should be provided with some form of behavioural enrichment as described in section 9, Behaviour.

11.9 Use of Foster Species

African Barbary Sheep have very similar social qualities as the domestic sheep. Best results occur when the young Barbary Sheep are introduced very young (days old). It is best, usually, to cross-foster within the same genus, therefore due to obvious differences the domestic sheep is recommended.

11.10 Weaning

You can start offering solid food from a few days of age. Obtain a high quality starter lamb feed and only supply as much as will be consumed over the next 24 hours or so, to prevent the feed becoming contaminated with faeces.

You can wean the lamb off milk replacer at about four weeks of age, providing the lamb is eating some solid food, and is doing well.

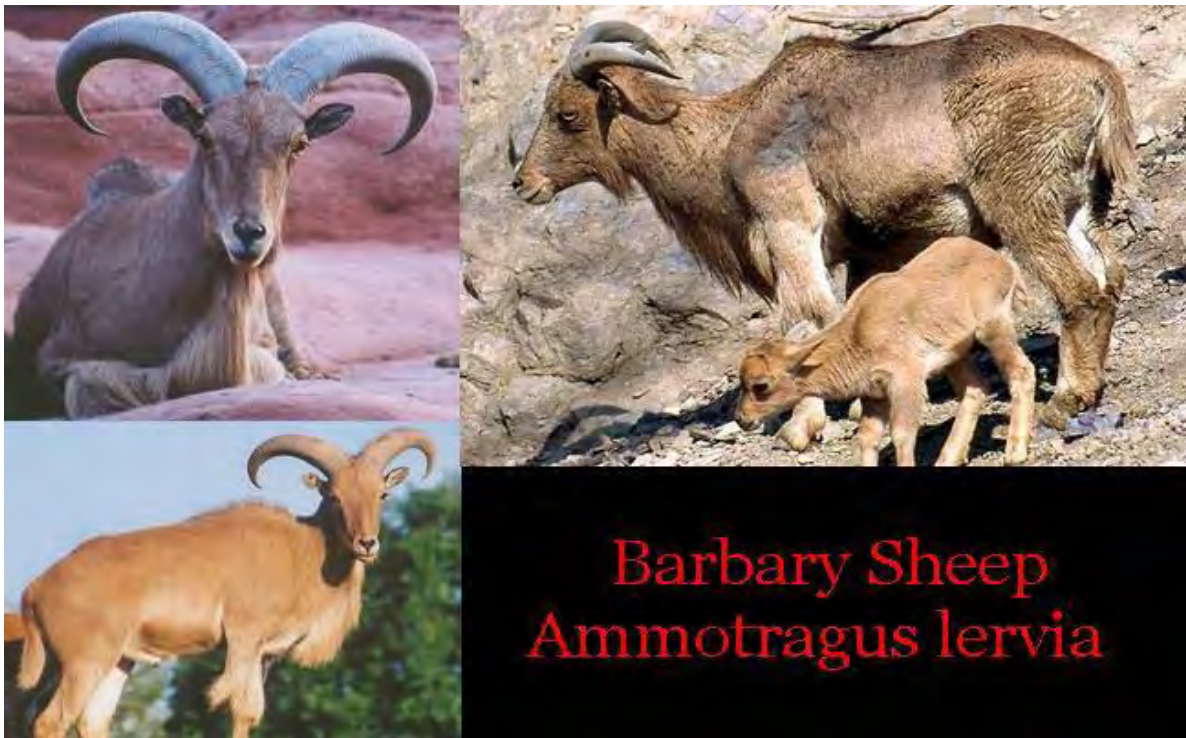
11.11 Rehabilitation and Release Procedures

Hand reared Barbary Sheep are maintained within captivity. If specimens must be released, follow all normal weaning practices. For release, preferably release a small herd or at very least a trio rather than a singular animal.

Releases should take place in the early morning or late afternoon as this is when the species become more active and feel most comfortable, they will then have all day/night to get their bearings.

12 Acknowledgements

Sincere thanks to Graeme Phipps, Jacki Salkeld & Bard Walker for their continuous advice and valuable scrutiny throughout the entire production of this manual. Many thanks to Pascale Benoit of Western Plains Zoo, Dubbo, for a number of very helpful references. Also a very big thanks to all the managers and staff of Altina Wildlife Park, without the continuous support and encouragement, as well as the employment opportunity, the completion of this manual would not have been possible.



13 References

- http://en.wikipedia.org/wiki/Barbary_Sheep
- commons.wikimedia.org/wiki/Image:Barbary_Shee...
- www.cnhexotics.com/aoudad.html
- www.rowlandward.com/RecordBook/RecordBook.asp...
- Australian Mammals Biology and Captive management - Stephen Jackson
- The Behavioural Guide of African Mammals - Richard Despard Estes
- Understanding science & nature Animal Behaviour - Time Life Series
- The kingdom Field Guide to African Mammals - Jonathan Kingdon
- Animal Kingdom - Eyewitness Books
- Animal - The definitive Visual Guide to the World's Wildlife
- Grzimek's Encyclopedia Mammals - Bovids
- Walkers Mammals Of the World - Sixth edition Volume II - Ronald M Nowak - Artiodactyla
- The Encyclopedia of Mammals - Edited by David Macdonald - Goat Antelopes
- Altina Wildlife Policies and Procedures etc
- ag.ansc.purdue.edu/.../parasite/parasite.htm
- http://www.petalia.com.au/Templates/StoryTemplate_Process.cfm?Story_No=1440
- www.dpi.nsw.gov.au/.../health/external/lice
- www.nal.usda.gov/awic/pubs/oldbib/qb9259.htm
- www.animalcorner.co.uk/farm/sheep/sheep_about.html
- en.wikipedia.org/wiki/Sheep
- www.blpbooks.co.uk/broad_leys_books/starting_with_sheep_extract.php
- <ftp://ftp.fao.org/docrep/fao/010/x6542e/x6542e09.pdf>
- en.wikipedia.org/wiki/Lambing
- en.wikipedia.org/wiki/Bighorn_Sheep
- <http://www.weeds.org.au/cgi-bin/weedident.cgi?tpl=plant.tpl&state=&s=&ibra=all&card=H08>
- <http://www.aussiecrates.com.au/livestock-crates.asp>
- <http://www.monash.edu.au/researchoffice/animal/assets/resources/sheepsheet2001.rtf>

14 Bibliography

- http://en.wikipedia.org/wiki/Barbary_Sheep
- <http://www.adelaidezoo.com.au/files/1072.pdf>
- http://www.zoofriends.org.au/zoonooz/zoonooz_sep02_article1.html
- commons.wikimedia.org/wiki/Image:Barbary_Shee...
- www.cnhexotics.com/aoudad.html
- www.rowlandward.com/RecordBook/RecordBook.asp...
- landofoz.blogspot.com/category/general
- www.pbase.com/koblenz/image/75742536
- <http://books.google.com.au/books>
- <http://www.nsrl.ttu.edu/tmot1/ammolerv.htm>
- <http://www.redbubble.com/people/markfaulconbridge/art/1477425-1-barbary-sheep>
- http://www.saharacconservation.org/web/scf_barbary_profile.php
- www.ultimateungulate.com/Artiodactyla/Ammotragus_lervia.html
- justinsullivan.com/dubbozoo/barbarysheep.php
- www.seekbooks.com.au/book/Barbary-Sheep
- [flickr.com/photos/mugley/2683975619](http://www.flickr.com/photos/mugley/2683975619)
- Australian Mammals Biology and Captive management - Stephen Jackson
- The Behavioural Guide of African Mammals - Richard Despard Estes
- Understanding science & nature Animal Behaviour - Time Life Series
- The kingdom Field Guide to African Mammals - Jonathan Kingdon
- Animal Kingdom - Eyewitness Books
- Animal - The definitive Visual Guide to the World's Wildlife
- Grzimek's Encyclopedia Mammals - Bovids
- Walkers Mammals Of the World - Sixth edition Volume II - Ronald M Nowak - Artiodactyla
- The Encyclopedia of Mammals - Edited by David Macdonald - Goat Antelopes
- Altina Wildlife Policies and Procedures etc
- ag.ansc.purdue.edu/.../parasite/parasite.htm
- www.dpi.vic.gov.au/DPI/nreninf.nsf/childdocs/...
- http://www.petalia.com.au/Templates/StoryTemplate_Process.cfm?Story_No=1440
- www.dpi.nsw.gov.au/.../health/external/lice
- www.animaethics.org.au/reader?MlvalObj=29611&doctype
- en.wikipedia.org/wiki/Sheep
- www.lifestyleblock.co.nz/articles/sheep/03_pet_lambs.htm
- www.accidentalsmallholder.net/forum/index.php?topic
- www.blpbooks.co.uk/broad_leys_books/starting_with_sheep_extract.php
- www.ext.vt.edu/news/periodicals/livestock/aps
- www.moredun.org.uk/feature-article.asp
- <ftp://ftp.fao.org/docrep/fao/010/x6542e/x6542e09.pdf>
- en.wikipedia.org/wiki/Lambing
- en.wikipedia.org/wiki/Bighorn_Sheep
- www.desertusa.com/big.html
- <http://www.weeds.org.au/cgi-bin/weedident.cgi?tpl=plant.tpl&state=&s=&ibra=all&card=H08>

- www.bighornsheep.org/
- <http://sl.farmonline.com.au/news/state/agribusiness-and-general/general/toxic-plants-on-the-rise/1376757.aspx>
- <http://www.aussiecrates.com.au/livestock-crates.asp>
- <http://www.monash.edu.au/researchoffice/animal/assets/resources/sheepsheet2001.rtf>

15 Glossary

Abomasum - the fourth or true stomach of cud-chewing animals, lying next to the omasum.

Agonistic - pertaining to the range of activities associated with aggressive encounters between members of the same species, including threat, attack, appeasement, or retreat.

Alopecia - is the medical description of the loss of hair from the head or body

Anaesthesia - Loss of feeling or sensation. Usually the result of artificial means.

Analogous - corresponding in function, but not evolved from corresponding organs, as the wings of a bee and those of a hummingbird.

Anorexia - Complete loss of appetite.

Anxiolytic - a mild sedative, such as diazepam, used for relief of anxiety.

Apathy - lack of interest in or concern for things that others find moving or exciting.

Auditory - pertaining to hearing, to the sense of hearing, or to the organs of hearing.

Auscultation - the act of listening, either directly or through a stethoscope or other instrument, to sounds within the body as a method of diagnosis.

Behavioural Enrichment - Food or devices provided to captive animals to enhance natural behaviours and activity patterns.

Bronchitis - Inflammation of one or more bronchi (any of the larger passages conveying air within the lungs). Signs of acute bronchitis include fever and an irritating cough.

Convulsions - A series of involuntary contractions of the voluntary muscles.

Dehydration - An excessive loss of water from the body. It can be tested by pinching the skin and letting it go. If it does not fall back in a few seconds it may be severely dehydrated.

Dentine - One of the hard tissues of the teeth that constitutes most of its bulk. It lies between the pulp cavity and the enamel and where it is not covered by enamel is covered by cementum, the third hard substance of the tooth.

Dermatomycosis - A fungal infection of the skin.

Dimorphism - the occurrence of two forms distinct in structure, coloration, etc., among animals of the same species. Compare

Distribution - The area or range that is occupied by a species.

Diurnal - active by day.

Ectoparasite - A parasite that lives on the surface of the host.

Emesis - The act of vomiting.

Endoparasite - A parasite that lives within the body of the host.

Epididymis - an elongated organ on the posterior surface of a testis that constitutes the convoluted beginning of the vas deferens.

Ergonomic - Design factors, as for the workplace, intended to maximize productivity by minimizing operator fatigue and discomfort

Foster species - When a lactating female of one species is used to rear the juvenile of another species.

Forbs - Herbaceous flowering plants that are not graminoids (grasses, sedges and rushes). The term is frequently used in vegetation ecology, especially in relation to grasslands.

Gastritis - Inflammation of the lining of the stomach.

Gestation Period - The duration of pregnancy.

Growth Chart/Curve - A graph that shows the relationship between age and body measurement such as body weight, head length, head width or total length.

Habitat - The natural environment occupied by a particular organism.

Harem - a form of social organisation in which a male controls more than one female for mating.

Herbivorous - Animals that subsist in their natural state entirely by eating plants and plant products.

Hermaphroditic - an animal in which reproductive organs of both sexes are present.

Heterogeneous - different in kind; unlike; incongruous.

Hierarchy - A form of social organisation in which there is an order and each individual has a rank or status from the top ranked most dominant animal to the least ranked most subordinate individual. The rank in turn reflects the individual's priority to feeding and mating success.

Hybrid - An offspring of parents of different strains, variation, species or subspecies.

Imperforate - Lacking a normal opening: *an imperforate anus*.

Infirm - feeble or weak in body or health, esp. because of age; ailing.

Interspecific - Between species

Intraspecific - Within species.

ICUN Status - International Union for the Conservation of Natural Resources Status.

Extinct: A taxon in which there is no reasonable doubt that the last individual has died

Critically Endangered: A taxon facing an extremely high risk of extinction in the wild in the near future

Endangered: A taxon that is not endangered but is facing a very high risk of extinction in the wild in the near future

Vulnerable: A taxon that is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium-term future

Lower Risk: A taxon that does not fulfil any of the threatened categories. Taxa in this category can be separated into three subcategories that include:

1. Conservation Dependent (cd). Taxa that are the focus of a continuing taxon-specific or habitat-specific conservation program, the cessation of which would result in the taxon qualifying for one of the three threatened categories listed above within a period of five years.
2. Near Threatened (nt). Taxa that do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.
3. Least Concern (lc). Taxa that do not qualify for Conservation Dependent or Near Threatened.

Unknown: (Data Deficient); When there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status.

Laryngitis - Inflammation of the mucous membrane of the larynx, characterised by cough, pain on palpation over the larynx, dysphagia and possible regurgitation through the nose.

Lethargy - A condition of drowsiness or indifference.

Longevity - Age until which an individual lives.

Mating System -

Monogamous - mating of a male with a female involving no extra individuals of either sex. Usually the bond operates through the breeding season and in some cases may extend through the adult life of two individuals.

Polygynous - where a male has more than one female partner, during a single breeding season.

Polyandrous - where the female has more than one male at a time (usually during a single breeding season).

Polygamous - a pattern of mating in which both males and females have more than one sexual partner during a single breeding season.

Morphometrics - The measurement of body parts.

Myopathy - Disease of the muscles. Usually the result of a build-up of lactic acid in the muscles.

Neonate - A newly born animal.

Neophobic - In psychology, neophobia is defined as the persistent and abnormal fear of anything new.

Nomenclature - a set or system of names or terms, as those used in a particular science or art, by an individual or community, etc.

Nulliparous - Never given birth.

Oestrous Cycle - The regular interval between periods during which the female is sexually active.

Olfactory - of or pertaining to the sense of smell: *olfactory organs*.

Omasum - the third stomach of a ruminant, between the reticulum and the abomasum; the many plies.

Paratenic Host - An animal acting as a substitute intermediate host of parasite, usually having acquired the parasite by ingestion of the host; no development of the parasite takes place but the phenomenon aids in the transmission of infection.

Paresis - Slight or incomplete paralysis.

Post-partum Oestrus - when a female is ready for mating shortly after giving birth. This is generally 1-3 days after birth.

Posterior - Towards the back or rear.

Precipitous - **1.** Of the nature of or characterized by precipices: *a precipitous wall of rock*

2. Extremely or impassably steep: *precipitous mountain trails*.

Proglottids - Segments that make up the body of a tapeworm.

Protozoan - A phylum comprising the unicellular eukaryotic organisms.

Quarantine - Restrictions placed on entering or leaving premises where a case of communicable disease exists or is suspected.

Reproductive Status - Condition of males and females with respect to reproduction. Eg non breeding, pregnant or lactating.

Reticulum - the second stomach of ruminating animals, between the rumen and the omasum.

Sedation - The allaying of irritability or excitement, especially by administration of a sedative.

Sexual Dimorphism - When there is a difference in body size between the two sexes.

Social Behaviour - Behaviour between individuals within a species.

Solitary - Individuals that avoid the company of others.

Stereotypic Behaviour - Constant and repetitive actions, such as vocalizations, grooming, walking or weaving, which would otherwise be seen normally in the species.

Stress - An individual under pressure or tension.

Subspecies - The rank below the species level.

Temporal - Lasting or existing only for a time.

Tremor - A continuous repetitive twitching of skeletal muscle, usually palpable and visible. Tremor is also a sign in many other diseases of the nervous system.

Tumour - A growth of tissue in which cell multiplication is uncontrolled and progressive. A cancer.

Venipuncture - the puncture of a vein for surgical or therapeutic purposes or for collecting blood specimens for analysis.

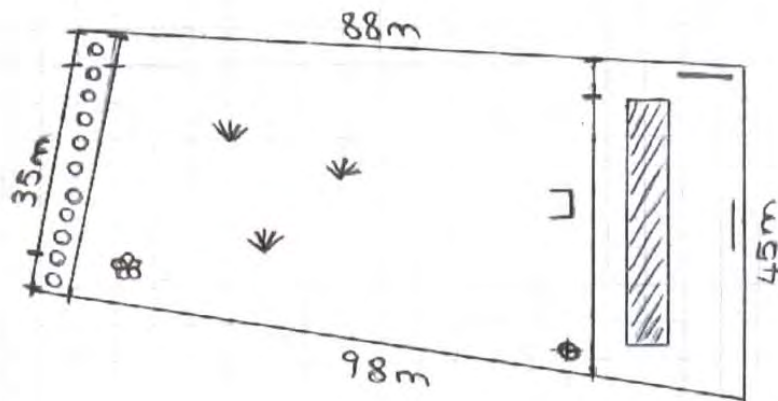
Weaning - The act of separating the young from the dam that it has been suckling, or receiving a milk diet provided by the dam or from artificial sources.

Barbary Sheep enclosure at Altina Wildlife Park

BARABRY SHEEP ENCLOSURE

SCALE = 1:10

1CM = 10M



KEY

- Gates —|—
- Hallway
- Rocky Out-Crop
- Water Trough —
- Feed Trough —
- Saltbush Trees x 6
- Acacia Trees
- Hay Saver
- Shelter

Entire Area between the Hallway and Front Viewing section is planted with Lucerne.

Fence Details

200mm to 230mm x 3.6m Pine Strainer Post with 150mm x 3.6m Pine Strainer Posts at each corner. Depth of Post in ground 1.2m. Pine Posts 150mm x 3.6m at 6 m Intervals. Depth in ground 1.2m. Accompanied by 1.9 Deer Fencing with 2 x 3.15mm Pain Wire spaced 150mm above Deer Fencing
Height of fence 2.2m.

Product name: FASIMEC Pour-On

[Front Panel of immediate container]

POISON

KEEP OUT OF REACH OF CHILDREN

READ SAFETY DIRECTIONS

FOR ANIMAL TREATMENT ONLY

FASIMEC® Pour-On

Flukicide and Broad Spectrum Anthelmintic

Active Constituents:

5 mg/mL ABAMECTIN

300 mg/mL TRICLABENDAZOLE

For the treatment and control of roundworms, liver fluke (all 3 stages)
and external parasites.

5 Litres

Product name: FASIMEC Pour-On

[Back Panel of immediate container]

FASIMEC POUR-ON

FASIMEC Pour-On contains Abamectin, a member of the macrocyclic lactone family of chemicals. It is effective against sensitive strains of internal and external parasites. It also contains

Triclabendazole, a member of the benzimidazole family of chemicals, effective against all three stages of liver fluke. Resistance may develop to any chemical.

Indications

For the treatment and control of adult and immature stages of:

Gastro-intestinal roundworms:

- Barbers Pole Worm (*Haemonchus placei*)
- Small Brown Stomach Worm (*Ostertagia ostertagi*) (including inhibited stages)
- Small Intestinal Worm (*Cooperia oncophora*) (*Cooperia punctata*)
- Stomach Hair Worm (*Trichostrongylus axei*)
- Hookworm (*Bunostomum phlebotomum*)
- Large Bowel Worm (*Oesophagostomum radiatum*)
- Whipworm (*Trichuris* spp.)
- Thin Necked Intestinal Worm (*Nematodirus spathiger*)
- Intestinal Threadworm (*Strongyloides papillosus*)

Lungworms (*Dictyocaulus viviparus*)

Liver fluke (*Fasciola hepatica*)

including adult (12 week old), immature (6 week old) and early immature (4 week old) larvae

Sucking and Biting lice

- Long nosed sucking lice (*Linognathus vituli*)
- Short nosed sucking lice (*Haematopinus eurysternus*)
- Biting lice (*Bovicola bovis*)
- Little sucking lice (*Solenopotes capillatus*)

Cattle tick: (*Boophilus microplus*) - Aids in control

(Not recommended in strategic dipping programs for cattle tick control)

DIRECTIONS FOR USE

Restraint

DO NOT USE in dairy animals producing or which will in the future be producing milk for human consumption.

Dosage and Administration

FASIMEC Pour-On dose rate is 1 mL / 10 kg body weight.

Apply along the backline of the animal, using a standard pour-on applicator, in a strip starting between the shoulder blades. This product is not to be given orally or injected.

Live weight (kg)	Dose Volume (mL)	Doses per Pack 5L
Up to 50	5	1000
51 - 75	7.5	666
76 - 100	10	500
101 - 125	12.5	400
126 - 150	15	333
151 - 175	17.5	285
176 - 200	20	250
201 - 250	25	200
251 - 300	30	166
301 - 350	35	142
351 - 400	40	125
401 - 450	45	111
451 - 500	50	100
501 - 550	55	90
551 - 600	60	83
601 - 650	65	76

NOT TO BE USED FOR ANY PURPOSE, OR IN ANY MANNER, CONTRARY TO THIS LABEL

UNLESS AUTHORISED UNDER THE APPROPRIATE LEGISLATION

For cattle over 650 kg, dose at rate of 1 mL / 10 kg body weight. A representative sample of animals should be weighed before treatment either with scales or weigh band. Dose according to the heaviest animal by live weight in the group (cows, bulls, calves, heifers, etc.). Do not under dose. Where there is a large variation in size within the group, draft into two or more lines based on bodyweight, to avoid excessive overdosing.

FASIMEC CATTLE Pour-On is rain fast. Rain occurring as early as 2 hours after treatment will not affect the efficacy of the product.

A white deposit may form on the back of treated animals. This is quite normal. It is not a sign of treatment failure and should not be interfered with. Do not brush off or wash off.

This deposit may last for a few days or weeks depending on weather conditions.

Temporary skin reaction may occur along the application site, especially if applied during very hot weather. This should resolve without treatment. If signs persist or worsen, contact your veterinarian.

WITHHOLDING PERIODS:

MEAT: DO NOT USE less than 49 days before slaughter for human consumption.

MILK: DO NOT USE in dairy animals producing or which will in the future be producing milk for human consumption.

EXPORT SLAUGHTER INTERVAL (ESI): DO NOT USE less than 140 days before slaughter for export.

The ESI stated on this label was correct at the time of printing. However, before using this product, users are advised to confirm the current ESI.

SAFETY DIRECTIONS

Harmful if swallowed. Will irritate the eyes and skin.

Avoid contact with eyes and skin.

If product in eyes, wash it out immediately with water. Wash hands after use.

When opening the container and using the product, wear cotton overalls buttoned to the neck and wrist and a washable hat, elbow-length PVC gloves and goggles.

After each day's use, wash gloves, goggles and contaminated clothing.

FIRST AID

If poisoning occurs, contact a doctor or Poisons Information Centre, Phone 131126. If skin contact occurs, remove contaminated clothing and wash skin thoroughly.

Material Safety Data Sheet

If additional hazard information is required, refer to the Material Safety Data Sheet. For a copy phone 1800 633 768.

PROTECTION OF WILDLIFE, FISH, CRUSTACEANS AND THE ENVIRONMENT

Dangerous to fish and other aquatic life. Do not contaminate dams, rivers or waterways with the chemical or used containers.

DISPOSAL

Disposal of Containers and Unwanted Chemicals

This container can be recycled if it is clean, dry, free of visible residues and has the drum MUSTER logo visible. Triple or pressure rinse container for disposal. Dispose of rinsate or any undiluted chemical according to State legislative requirements. Wash outside of the container and the cap.

Store cleaned container in a sheltered place with cap removed. It will then be acceptable for recycling at any drum MUSTER collection or similar container management program site. The cap should not be replaced but may be taken separately.

STORAGE

Store below 30°C (Room Temperature).

MATERIAL SAFETY DATA SHEET

STATEMENT OF HAZARDOUS NATURE:

Not hazardous according to the criteria of the National Occupational Health and Safety Commission.

COMPANY DETAILS:

Novartis Animal Health Australasia Pty Ltd.

A.C.N. 076 745 198

54 Waterloo Road,

North Ryde NSW 2113

Telephone No.: (02) 9805 3555

Fax No.: (02) 9888 8387

PRODUCT NAME: FASIMEC Pour-On Flukicide and Broad Spectrum Anthelmintic

Formulation type: Topical solution/suspension **Dangerous Goods Class:** None allocated

Active Ingredients: 1. Triclabendazole

2. Abamectin

Subsidiary Risk: None allocated

Chemical type: 1. Benzimidazole derivative

2. Macrocyclic lactone

Hazchem Code: None allocated

UN Number: none allocated **Poisons Schedule:** 6
(triclabendazole)

USE: For the treatment of triclabendazole-sensitive Early Immature, Immature and Mature liver fluke.

For the treatment and control of abamectin-sensitive strains of roundworms and lungworm (including benzimidazole, levamisole, and morantel-resistant strains), and sucking lice in cattle.

Refer to the product label for full use instructions.

PHYSICAL DESCRIPTION/PROPERTIES

Appearance: Clear brown liquid

Specific gravity (H₂O=1) 1.1-1.2 (20°C?)

Behaviour in water: Soluble

Viscosity: Ford #4 cup average.

16-24 sec @ 20°C

INGREDIENTS -

CAS No. Proportion

Triclabendazole [68786-66-3] 300 g/L

Abamectin [71751-41-2] 5g/L

Solvent/Oil to 1L

HEALTH EFFECTS

ACUTE:

SWALLOWED Harmful if swallowed. Nausea and drowsiness. Low to moderate acute oral toxicity (LD₅₀ around 500 mg/kg bodyweight)

EYE Irritating to eyes

SKIN Low dermal toxicity. Slight skin irritant. Unlikely to cause allergic reaction.

INHALED Unlikely. Low inhalation toxicity

CHRONIC:

Limited evidence of a carcinogenic effect. Toxic: danger of serious damage to health by prolonged exposure if swallowed

Triclabendazole technical has been extensively tested on laboratory mammals and in test-tube systems. The administration of large doses of triclabendazole technical was associated with benign liver tumours in female mice. No evidence of mutagenic, carcinogenic, teratogenic or reproductive effects was obtained. The relevance to humans of the liver tumour finding is doubted.

Abamectin has been extensively tested on laboratory mammals and in test-tube systems.

FIRST AID:

Swallowed: If poisoning occurs contact a doctor or **Poisons Information Centre (Ph: 131126)**.

Eye: If product in eyes, wash it out immediately with water. Hold eyelids apart and flush the eye with large quantities of clean running tap water for at least 15 minutes.

Skin: If skin contact occurs, immediately remove contaminated clothing and wash affected skin thoroughly with soap and water.

Inhaled: If inhaled, remove affected person from contaminated area to fresh air and seek medical attention.

ADVICE TO DOCTOR

No specific antidote exists. Treat symptomatically.

ALWAYS READ AND FOLLOW THE LABEL INSTRUCTIONS AND WARNINGS

EXPOSURE STANDARDS

No exposure standards have been set for the components of this product.

Exposure Potential - Swallowing & inhaling is unlikely under normal conditions of usage. Significant skin uptake does not occur.

ENGINEERING CONTROLS

No special requirements. Product is used outdoors.

Store away from oxidising materials, in original tightly closed container in a cool dry place. Protect from direct light.

PERSONAL PROTECTION

May irritate the eyes and skin. Avoid contact with eyes and skin. Wash hands after use.

Personnel involved in cleanup should wear full protective clothing (cap, waterproof overalls buttoned to the neck and wrist, rubber boots). Wear goggles and impervious elbow-length rubber gloves (neoprene/nitrile/PVC) when handling spilled material.

STORAGE AND TRANSPORT

Store below 30°C (Room Temperature) in tightly sealed original containers in a dry secure place away from feed and food. Store out of direct sunlight. Keep out of reach of children, unauthorised persons and animals.

SPILLS AND DISPOSAL

In case of spillage or leak it is important to take all steps necessary to:

- Avoid eye and skin contact.
- Avoid contamination of dams, rivers or waterways with the chemical. Dangerous to fish and other aquatic life

Procedure for spill:

- (1) Isolate the hazard area and keep all bystanders away.
- (2) Wear full protective clothing (cap, waterproof overalls buttoned to the neck and wrist, rubber boots), goggles and impervious elbow-length rubber gloves (neoprene/nitrile/PVC).

(3) Reposition any leaking containers so as to minimise further leakage.

FASIMEC POUR-ON FLUKICIDE AND BROAD SPECTRUM ANTHELMINTIC (4)

Dam and absorb spill with an absorbent material (sand, soil or other non-combustible material).

(5) Shovel the absorbed spill into labelled drums.

(6) Disposal of the absorbed material will depend upon the extent of the spill.

- For quantities up to 50L of product bury in a secure landfill site.

• For quantities greater than 50L seek advice (use emergency contact number below) from the manufacturer before attempting disposal. Contain in a secure location until disposal method is established.

(7) Decontaminate the spill area with detergent and water and rinse with the smallest volume of water practicable.

(8) Thoroughly clean all non-disposable items contaminated or used in the cleanup. Run-off from fire control or dilution with water may cause water pollution. Heavily contaminated soil near water sources should be removed and containerised.

Dispose of empty, used containers by:

This container can be recycled if it is clean, dry and free of visible residues and has the drum MUSTER logo visible. DO NOT burn empty containers or product.

1. Triple or pressure rinse the container for disposal with water.
2. Dispose of rinsate or any diluted chemical according to State legislative requirements.
3. Wash outside of the container and cap.
4. Store cleaned container in a sheltered place with cap removed.
5. It will then be acceptable for recycling at any drum Muster collection or similar container management program site.
6. The cap should not be replaced but may be taken separately

OTHER INFORMATION

Triclabendazole technical is highly toxic to fish [LC50 (96 h), rainbow trout = 0.14 mg/L] and slightly toxic to birds. **Abamectin technical** is very toxic to certain aquatic species.

Note: This product is a registered veterinary chemical and must therefore be used in accordance with the container label directions.

A comprehensive package of toxicological and environmental data for the active ingredients of this product has been submitted to the Federal health and environment authorities and has been evaluated by expert toxicologists and environmental scientists.

CONTACT POINT: Regulatory Affairs Manager - Animal Health - (02) 9805 3555

This Material Safety Data Sheet summarises our best knowledge of the health and safety hazard information of the product and how to safely handle and use the product in the workplace. Each user should read this MSDS and consider the information in the context of how the product will be handled and used in the workplace including in conjunction with other products.

If clarification or further information is needed to ensure that an appropriate risk assessment can be made, the user should contact this company.

10 Recommended Plant species appropriate for Barbary Sheep to consume.

1 Lucerne/Alfalfa (*Medicago sativa*)

Alfalfa



Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Fabales
Family: Fabaceae
Subfamily: Faboideae
Tribe: Trifolieae
Genus: *Medicago*
Species: *M. sativa*

Medicago sativa is a cool season perennial legume living from three to twelve years, depending on variety and climate. It resembles clover with clusters of small purple flowers. The plant grows to a height of up to 1 meter (3 ft), and has a deep root system sometimes stretching to 4.5 meters (15 ft). This makes it very resilient, especially to droughts.

2 Old Man Saltbush (*Atriplex nummularia*)

Frost Tolerance: Needs a protected area in Phoenix

Sun Exposure: Full sun to light shade

Origin: Australia

Growth Habits: Evergreen bush to 6 feet tall (1.8 m), 8 feet spread (2.4 m)

Watering Needs: Little water when established does well on brackish water

Propagation: Seeds, cuttings



3 **Acacia**
(*Acacia greggii*)

Acacia



Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Fabales
Family: Fabaceae
Subfamily: Mimosoideae
Tribe: Acacieae
Genus: Acacia
Miller

Acacia is a genus of shrubs and trees belonging to the subfamily Mimosoideae of the family Fabaceae, first described in Africa by the Swedish botanist Carolus Linnaeus in 1773.

Acacias are also known as thorn trees or wattles, including the yellow-fever acacia and umbrella acacias.

There are roughly 1300 species of Acacia worldwide, about 960 of them native to Australia, with the remainder spread around the tropical to warm-temperate regions of both hemispheres, including Africa, southern Asia, and the Americas.

Sizes vary depending on variety.



4 **Mistletoe**
(*Viscum album*)

Mistletoe



Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Santalales
Families: Santalaceae
(Viscaceae)
Loranthaceae
Misodendraceae

Mistletoe is the common name for a group of hemi-parasitic plants in the order Santalales that grow attached to and within the branches of a tree or shrub.

Mistletoe species grow on a wide range of host trees, and commonly reduce their growth but can kill them with heavy infestation. *Viscum album* can parasitise more than 200 tree and shrub species. Almost all mistletoes are hemi-parasites, bearing evergreen leaves that do some photosynthesis, and using the host mainly for water and mineral nutrients. Size varies depending on the family the parasite belongs to, the tree or shrub it has grown on as well as the age of the host.

5 **Oat**
(*Avena sativa*)

Oat



Kingdom: Plantae
Division: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Poaceae
Genus: *Avena*
Species: *A. sativa*

The common oat plant (*Avena sativa*) is a species of cereal grain grown for its seed, which is known by the same name (usually in the plural, unlike other grains). While oats are suitable for human consumption as oatmeal and rolled oats, one of the most common uses is as livestock feed.

As a grain though, it can heat up the blood and cause infertility in goats, sheep etc therefore not recommended, but as a fresh grass and dry grass (Hay) it is safe to feed to these varieties of animals.

Size of the plant varies very often depending on water availability, soil quality, and temperature whilst growing.

6 Tufted Vetch
(*Vicia cracca*)

Tufted Vetch



Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Fabales
Family: Fabaceae
Subfamily: Faboideae
Genus: *Vicia*
Species: *V. cracca*

Tufted Vetch *Vicia cracca*, also occasionally known as Cow Vetch or Bird Vetch, is a common species of vetch native throughout most of North America, Europe and Asia. It occurs in grassy fields and meadows, and roadside ditches.

Tufted Vetch is similar to a pea in growth habit, sending out noose-like tendrils from the tips of its leaves when it contacts another plant and securely fastens itself. This can cause "strangling" of smaller plants. An individual plant may reach a length (or height) of 2 m and its tap root may extend up to 1 m. The leaves are 3-8 cm long, pinnate, with 8-12 pairs of leaflets, each leaflet 5-10 mm long.

7 Clover
(*Trifolium*)

Clover



Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Fabales
Family: Fabaceae
Subfamily: Faboideae
Tribe: Trifolieae
Genus: *Trifolium*
L.

Clover are small annual, biennial, or short-lived perennial herbaceous plants. The leaves are trifoliate (rarely 5- or 7-foliate), with stipules adnate to the leaf-stalk, and heads or dense spikes of small red, purple, white, or yellow flowers; the small, few-seeded pods are enclosed in the calyx.

8 **Paspalum**
(*Paspalum dilatatum*)

Paspalum



Division: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Poaceae
Subfamily: Panicoideae
Tribe: Paniceae
Genus: Paspalum
L.

Paspalum is a genus of the grass family (Poaceae). Commonly known as paspalums, Bahiagrasses or Dallis grasses they are usually tall American perennial grasses. They are most diverse in subtropical and tropical regions.

Growth Habit: Paspalum is a tough grass that can grow up to 150cm in height, however it normally grows a flattened tuft of leaves, with only the seed heads standing erect. This low growth habit helps it to survive mowing and slashing. The plant also has short rhizomes.

Type of plant: A summer growing perennial.

Flowers: The tall flower stalks support 3 to 7 thin, long spikes carrying many seeds. The spikes grow horizontally outwards from the stalk.

Fruit/Seed: Seed is produced in summer.

Dispersal: Seeds are spread when disturbed as they stick onto clothing, wool or hair. Mowing, slashing and roadside grading operations readily transport the seeds to new areas.

Distribution: Common in all Australian states in pastures, roadsides, gardens or lawns.

9 **Barley**
(*Hordeum vulgare*)

Barley



Kingdom: Plantae
Division: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Poaceae
Genus: *Hordeum*
Species: *H. vulgare*^[1]

Barley (*Hordeum vulgare*) is an annual cereal grain, which serves as a major animal feed crop, with smaller amounts used for malting and in health food.

Barley is a an annual grass with erect culms, 60 to 120 cm tall; blades flat, mostly 5 to 15 mm wide, with the auricle well developed; spike erect or nearly so, 2 to 10 cm long, excluding awns; the three spikelets sessile; glumes divergent at base, narrow, nerveless, gradually passing into a stout awn; awn of lemma straight, erect, mostly 10 to 15 cm long

10 Millet

(*Panicum miliaceum*)

Millets, probably first cultivated in Asia or Africa more than 4,000 years ago, range in height from 1 to 4 feet (0.3 to 1.3 m), with the exception of pearl millet, which has stalks 5 to 10 feet (1.5 to 3 m) tall and about 1 inch (2.54 cm) thick. The heads may be spikes or racemes, in which the flowers are borne on stalks of about equal length along an elongated axis, or panicles, clusters of small florets. With the exception of pearl millet, seeds remain enclosed in hulls after threshing. Hulled seeds are usually creamy white.



3 Toxic Plants NOT recommended for consumption for Barbary Sheep

1 Bathurst Burr

(*Xanthium spinosum* Linnaeus)

An erect, much branched, mainly summer-growing annual herb commonly 30 to 60 cm high, occasionally to 1 m, reproducing by seed. Most germination occurs after rain or irrigation in late spring and summer. Older plants produce burrs in February while late germinating plants produce them when only a few weeks old. Plants generally die early in winter but mature plants may be found at any time of year.

Stems - Greenish yellow with fine short hairs, armed at the base of each leaf and stem node with one or two triple-pronged yellow spines which are 1.5 to 2.5 cm long.

Leaves - up to 7 cm long, alternate and divided into three lobes; dark green and shiny above with prominent pale veins, downy and pale green or whitish beneath.

Flowers - creamy green, small and inconspicuous, wind pollinated, appearing from February to July. Female flowers occur beneath the leaf axils; male flowers at the ends of stems.

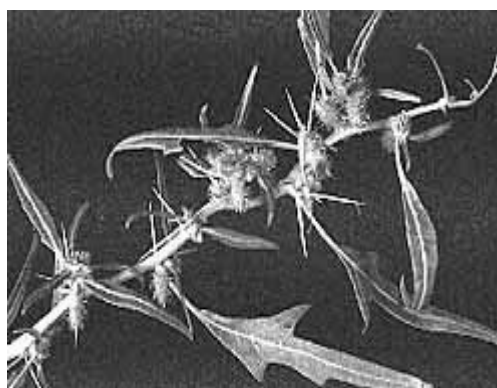
Fruit - an ovoid, straw-coloured, hairy burr, 1 to 1.5 cm long and 4 to 5 mm wide, covered with many yellow-orange hooked spines and sometimes with one or two straight terminal beaks. When ripe the burr is hard and woody. Other species of *Xanthium* found in Australia have burrs which are considerably larger.

Seeds - flat, brown or black, 1 cm long, two in each burr. Seed may remain dormant in the soil for three years.

Roots - branched taproot to over 3 m depth, often with extensive lateral roots.

Bathurst burr is common in pastures (particularly around stock yards and watering points) and infestations occur frequently along water courses. It is rarely grazed by livestock because of the long spines. The burrs are one of the most common contaminants of wool. They become entangled in the neckline and belly wool, requiring severe skirting and devalue the product. Burrs also cause irritation to shearers and damage shearing equipment. Spines on the burrs damage the feet of sheep and other animals.

Hydroquinone is present in the seed and persists in the young plants, making the seedlings toxic to sheep, goats, cattle, horses, pigs and poultry. Poisoning may result in nausea, vomiting, depression and death.



2 Billy buttons (*Ixiolaena brevicompta*)

Billy buttons or plains plover daisy (*Ixiolaena brevicompta*) is a small herbaceous plant, that can grow to approximately 60 cm in height and diameter, but most specimens grow to between 20 and 30 cm. Although sometimes found as an isolated plant, it is more commonly found in thick stands covering many hectares on black floodplain country. Billy buttons grows throughout the year in response to rainfall or flooding. Observations in the Cunnamulla district indicate that most growth occurs in late winter and early spring.

Billy buttons produces a mass of flowers about 1 cm in diameter. The flowers mature into quite dense seed heads during late spring and early summer.

Signs

Consumption of the mature seed head affects sheep in two ways:

- Sudden death: animals that are disturbed run a short distance (10-30m) then suddenly collapse and die
- Tiring syndrome: animals are barely able to exercise and show hind leg weakness and staggering - some collapse and die, others recover. Recovery may take up to 14 days.

Signs of the disease appear first in lambs 3-6 months of age within 7 days of starting to graze pasture heavily infested with billy buttons. Adult stock show signs of the disease after a further 7-14 days. The disease is believed to be caused by crepenynic acid, an unusual fatty acid present in the seed of billy buttons.

Management

Several strategies can be implemented to avoid sheep being poisoned. On properties where thick stands are found, billy buttons can be prevented from setting seed by stocking infested paddocks heavily when the plant is still green and actively growing.

Consumption of the green plant has no known ill effect on sheep, and can be considered a useful stock feed. Stock readily consume the plant before it matures.

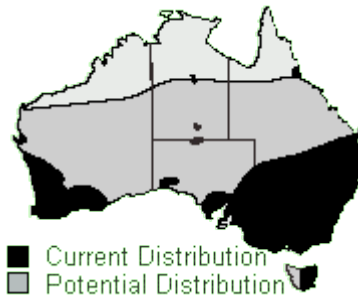
However, once the seed heads mature, care should be taken when grazing infested pastures. Sheep that consume large quantities of this seed, i.e. approximately 50% of their daily intake, for 1-2 weeks will be affected.

If an infested paddock has to be used, it should be grazed very heavily by adult stock for short periods of time (1-2 weeks) or until some animals show symptoms of poisoning. Provided that the animals are then moved onto a pasture with low levels of billy buttons, the vast majority of animals should remain in good health. A second and third mob of adult sheep can then be taken onto the infested pasture. Observe the sheep carefully and move them again as the first signs of poisoning occur. The length of time that each successive mob can graze the infested pasture before showing signs of poisoning should increase, as sheep actively seek out mature seed heads for consumption, thereby lowering the overall seed head burden in the pasture.



3 Paterson's Curse

(*Echium plantagineum*)



Alternative Name(s): Salvation Jane

Family: Boraginaceae.

Form: Herb

Origin: Native of the Mediterranean region across to Portugal.

Flowers/Seedhead: To 3 cm long. Flowers all year but mainly late winter to early summer.

Description: Erect annual herb to 60 (rarely to 150) cm high. Stems one to several. Stems and leaves hairy with coarse hairs and sometimes shorter soft hairs. Leaves oval to lanceolate; basal leaves, in a rosette, to 20 (rarely to 30) cm long, with a short stalk; stem leaves reducing in size towards flowers.

Distinguishing features: Distinguished by leaves with spreading hairs having an enlarged base; flowers in caterpillar-like curved spikes; funnel-shaped flowers, usually purple but also blue or pink, less often white, unevenly lobed; stamens with filaments much longer than anthers, 2 stamens longer than the others and projecting past the flower tube; fruit consisting of 4 tuberculate three-sided nutlets (although some may not develop).

Dispersal: Spread by seed. Long distance spread often via fodder.

Confused With: Vipers Bugloss, *Echium vulgare*, which has 4 stamens projecting past flower tube (as opposed to 2 in Paterson's Curse).

Notes: Initially introduced as an ornamental. Poisoning of sheep after years of grazing has been recorded; poisonous to pigs and horses. Crowds out more useful pasture species. Considered to be useful for build up of bee numbers early in the honey production season. Biological control agents have been released for control of this species.



Purplish flowers with 2 longer stamens

Wauchope, NSW



Seedling

photo J.J.Dellow



Juvenile

photo J.J.Dellow



Dense growth, Cadia, NSW, November

photo J.J.Dellow

Altina Wildlife Park
OBSERVATION SHEET FOR SHEEP AFTER SURGERY

Sheep - Ear Tag Number:	Start Date & Surgery Date:
Procedure:	Comments:

OBSERVATIONS (Day in relation to surgery)	-3	-2	-1	0	1	2	3
DAY / DATE / TIME							
Eating							
Drinking							
Vocalisation							
Rectal Temperature							
Heart Rate							
Respiration Rate							
Standing up							
Discharge from the surgical site							

These daily observations should start 3 days before surgery.

On the day of surgery and for 3 days after surgery, observations should be made each morning and afternoon.

From day 4 post-surgery observations should revert to daily.

Please Note:

1. Analgesia should be administered for at least 24 hours and thereafter as determined by daily observation, any evidence of pain and speed of return to normal behaviour.
2. If heart rate or respiration rate increase, if the rectal temperature changes $\pm 1.5^{\circ}\text{C}$ from the pre-surgery temperature, or if there is discharge from the wound, please contact the Animal Welfare Officer (9905 9907) or your Animal House Manager. Altina Wildlife Park

OBSERVATION SHEET FOR SHEEP AFTER SURGERY

Sheep - Ear Tag Number:	Start Date & Surgery Date:
Procedure:	Comments:

OBSERVATIONS (Day in relation to surgery)	4	5	6	7	8	9	10	11	12
DAY / DATE / TIME									
Eating									
Drinking									
Vocalisation									
Rectal Temperature									
Heart Rate									
Respiration Rate									
Standing up									
Discharge from the surgical site									

These daily observations should start 3 days before surgery.

On the day of surgery and for 3 days after surgery, observations should be made each morning and afternoon.

From day 4 post-surgery observations should revert to daily.

Please Note:

1. Analgesia should be administered for at least 24 hours and thereafter as determined by daily observation, any evidence of pain and speed of return to normal behaviour.
3. If heart rate or respiration rate increase, if the rectal temperature changes $\pm 1.5^{\circ}\text{C}$ from the pre-surgery temperature, or if there is discharge from the wound, please contact the Animal Welfare Officer (9905 9907) or your Animal House Manager.

Altina Wildlife Park
ANIMAL MONITORING SHEET

AEC Project No. _____ Investigator _____

Animal ID No. _____ Species /Strain/ _____

Animal Details (sex, age etc) _____

- Each animal is examined and observed for abnormalities at each time point (weekly or daily as appropriate)
- Observations are recorded in the table
- Normal clinical signs are recorded as "N"
- Abnormalities are recorded as "A" and severity is scored in brackets eg Breathing: A (3)
- Comments concerning abnormalities are recorded in the comments section of the table
- Additional observations tailored to the monitoring requirements for each animal experiment are to be added at "Other"

CLINICAL OBSERVATION (N or A)	DATE						
UNDISTURBED							
Coat							
Activity							
Breathing							
Movement/ gait							
Eating							
Drinking							
Alert/Sleeping							
ON HANDLING							
Alert							
Body condition							
Bodyweight (g)							
Body temperature (°C)							
Dehydration							
Eyes							
Faeces							
Nose							
Breathing							
Urine							
Vocalisation							

OTHER (specify)							
COMMENTS							
INITIALS:							

Signature of Chief Investigator

Date

CLINICAL SIGNS SEVERITY SCORE

SIGNS	0	1	2	3
Activity	normal	isolated, abnormal posture	huddled/inactive OR overactive	moribund OR fitting
Alertness/Sleeping	normal	dull or depressed	little response to handling	unconscious
Body condition*	normal	thin	loss of body fat, failure to grow	loss of muscle mass
Body weight*	normal weight and growth rate	reduced growth rate	chronic weight loss >15% OR failure to grow	acute weight loss >10% chronic weight loss 20% OR failure to grow & weight loss
Breathing	normal	rapid, shallow	rapid, abdominal breathing	laboured, irregular, skin blue
Coat	normal	coat rough	unkempt; wounds, hair thinning	bleeding or infected wounds, or severe hairloss or self mutilation
Dehydration	none	skin less elastic	skin tenting	skin tenting & eyes sunken
Drinking	normal	increased OR decreased intake over 24 hrs	increased OR decreased intake over 48 hours	constantly drinking OR not drinking over 24 hours
Eating	normal	increased OR decreased intake over 24 hours	increased OR decreased intake over 48 hours	obese OR inappetence over 48 hours
Eyes	normal	wetness or dullness	discharge	eyelids matted

Faeces	normal	Faeces moist	loose, soiled perineum OR abnormally dry +/- mucus	running out on handling OR no faeces for 48 hrs OR frank blood on faeces
Movement/gait	normal	slight incoordination OR abnormal gait	incoordinated OR walking on tiptoe OR reluctance to move	staggering OR limb dragging OR paralysis
Nose	normal	wetness	discharge	coagulated
Urine	normal		abnormal color/volume	no urine 24 hrs OR incontinent, soiled perineum
Vocalisation	normal	squeaks when palpated	struggles and squeaks loudly when handled/palpated	abnormal vocalisation
Other				

* these criteria may not apply in some situations (eg tumor growth, obesity/metabolic studies)

SPECIAL HUSBANDRY REQUIREMENTS**

--

ALTINA WILDLIFE PARK

Daily Enclosure and Animal Record Sheet

Date: _____

Animals	Feed		Water		Enclosure Hygiene		Comments	Behaviour/ Health Check		Comments
	Yes	No	Yes	No	Good	Poor		Good	Poor	
Alpacas										
American Bison										
Asian Water Buffalo										
Barbary Sheep										
Camels										
Cattle										
Domestic Horses										
Eland Antelope										
Fallow Deer										
Giraffe										
Goats										
Himalayan Tahr										
Hog Deer										
Indian Blackbuck										
M. Wild Horses										
Maned Wolves										
Ostrich										
Pigs										
Red Deer										
Rusa Deer										

Action taken regarding health and hygiene check: _____ Animal Identification where applicable: _____

Comments:-

Authorised Personnel: _____
Signed: _____

