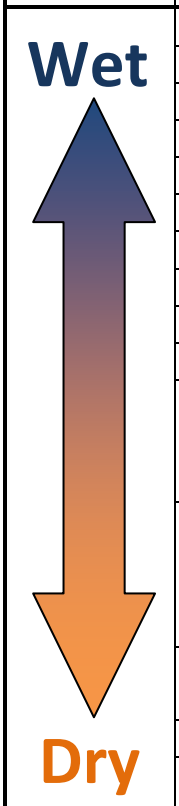
MODULE 3.8, HANDOUT #1: Key principles for successful wildlife management

Principle	What should conservancies do?
1. Size and openness of area: the larger and more open the area under wildlife management, the more productive and resilient it is likely to be, and the less intensive is the required level of management	• have as large an area as feasible for their core wildlife zone • not fence in their wildlife zone, but manage open systems, and • work together with their neighbours (other conservancies, national parks, etc) to co-manage larger landscapes
2. Diversity of species: the greater the number of indigenous species that occur in an area in reasonable abundance, the more productive, stable and resilient is that ecosystem. This is related to energy flow pathways through ecosystems	• try and maintain and, where appropriate, re-establish the full suite of indigenous biodiversity that historically occurred in that area (subject to socio-economic considerations), particularly the widest diversity of indigenous herbivores, and • maintain the abundance of indigenous herbivores at optimal levels taking into account ecosystem capacity, veld condition, climatic factors and economic considerations
3. Ecological capacity: both the grazing and browsing capacity of an area, which is not fixed but highly dynamic. Some of the main factors that influence ecological capacity include habitat, climate (mainly rainfall), stocking levels (both wildlife and livestock together) and the area's history of use or abuse	• monitor wildlife and livestock numbers and range condition on a regular basis and adjust accordingly, and • maintain a conservative approach to ecological capacity to manage first and foremost for good ecological productivity, because this is turn will lead to good wildlife (and livestock) productivity.
4. Applying an ecosystem approach: an ecosystem consists of all the living organisms and non-living aspects such as soil, water, climate all interacting with one another in many millions of different ways. Ecosystems are hugely dynamic. Ecosystems in good condition are more productive, show greater stability and greater resilience than degraded ecosystems. This means that they can both absorb greater shocks (e.g. droughts) and recover better from such shocks	• consider the whole, interrelated and dynamic ecosystem when planning and making management decisions, and • strive to manage ecosystems for their most productive, stable and resilient states – i.e. aim first and foremost to have healthy, diverse and productive ecosystems. If ecosystems are healthy, the chance is that so will be the wildlife, livestock and people
5. Animal population dynamics: effective wildlife management requires the application of a basic knowledge of the population dynamics of key wildlife species, including: growth, age and sex composition, numbers, movement and distribution, and their social organisation or behaviour. These aspects are all linked to the population's potential to increase, which in turn is linked to potential utilization and economic returns	• ensure that key people in conservancies acquire a good level of knowledge on the relevant wildlife biology and population dynamics parameters of the main wildlife species in their conservancy, and • regularly monitor these parameters (e.g. numbers, distribution, age & sex ratios as well as trophy size trends, together with climatic and rangeland condition data) and use the information on a regular basis to make wise decisions for management and utilization

MODULE 3.8, HANDOUT #2: Habitats of different wildlife species

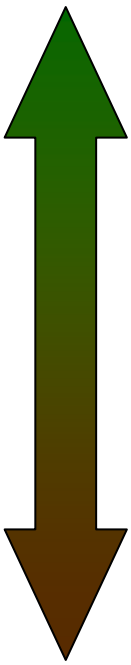
Wet to Dry habitats	Species confined to fairly restricted habitat conditions	
	Habitat	**Species**
	Open water (rivers, lakes)	Hippopotamus
	Dense reed beds in permanent water & large floodplains	Sitatunga
	Seasonally & permanently wet floodplains	Red Lechwe
	Damp grasslands near permanent water	Reedbuck
	Mainly dry grassy floodplains	Puku
	Floodplains to adjacent woodlands	Waterbuck
	Reed beds to dense woodlands and thickets	Bushpig
	Dense riparian woodlands	Bushbuck
	Dense to scrubby woodlands	Impala (Common)
	Short grassland next to thick cover	Oribi
	Open woodlands and adjacent grasslands	Tsessebe Roan Antelope Sable Antelope
	Open woodlands to semi-arid savannas	Red Hartebeest Eland Grey (Common) Duiker Steenbok
	Thickets and undergrowth in semi-arid to arid savannas	Black-faced Impala Damara Dik-Dik
	Highlands & escarpment in semi-arid savannas to desert	Hartmann's Mountain Zebra
	Semi-arid to arid savannas & deserts	Springbok Gemsbok (Oryx)

Species ranging over a broad set of habitats	
Habitat	**Species**
Floodplains, grasslands, woodlands to grassy savannas	White Rhinoceros
Floodplains, grasslands, woodlands to semi-arid and arid savannas	African Savanna Buffalo
	Blue Wildebeest
	Burchell's Zebra
	Warthog
Floodplains, woodlands, savannas to desert margins - including riparian belts of ephemeral rivers into desert	Elephant
Riparian woodlands, open woodlands to semi-arid savannas and desert margins (including ephemeral rivers into desert)	Giraffe
	Kudu
Riparian woodlands, open woodlands and thickets, savannas to desert	Black Rhinoceros

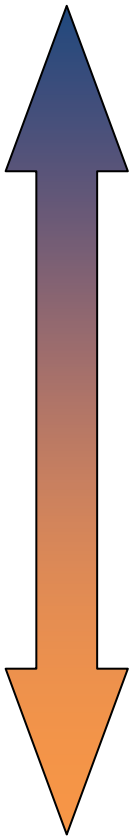
MODULE 3.8, HANDOUT #3: Habitat and food selection by wildlife in Namibia (from Bothma & du Toit 2010 with some modification)

Wildlife species	Habitat requirements	Food	Main feeding spectrum					
			Low selective grazers, bulk & roughage	Highly selective grazers	Mixed feeders	Highly selective browsers, fruit & forbs	Tall grass grazers	Short grass grazers
African Savanna Buffalo	Open woodland & savanna, tall grass, shade especially in summer	Grasses, occasionally browse	√				√	√
Black Rhinoceros	Shrubs & trees to about 4 m, woodlands, open to dense savanna & desert	Mainly browse				√		
Black-faced Impala	Dense thickets in semi arid to arid savannas	Browse, grasses & forbes			√	√		√
Blue Wildebeest	Open woodland & savannas with shade, short grasslands	Mainly grasses (rarely browse)		√				√
Burchell's Zebra	Open woodlands & savannas & grasslands	Grasses	√				√	√
Bushbuck	Riparian thickets & other dense undergrowth	Mainly browse, some grasses				√		
Bushpig	Reeds and grasslands to forest and woodlands with undergrowth	Omnivorous, mainly browse, grasses, roots, earthworms, etc			√			
Damara Dik-Dik	Dense thickets & shrub undergrowth in savanna	Browse, growing tips, fruit, occasionally grasses & forbs				√		
Eland	Range from woodlands to dry open savannas	Browse & grasses			√			
Elephant (African)	Range from woodlands to dry open savannas to desert	Browse, twigs, branches, bark & grasses	√		√		√	
Gemsbok (Oryx)	Open semi-arid to arid savannas, shrubby grasslands & deserts	Grasses & some browse, bulbs, tubers, rhizomes & fruit		√			√	√
Giraffe	Woodlands, savannas to dry river courses in desert	Browse				√		
Kudu (Greater)	Woodlands, open - dense & arid savannas, broken & rocky terrain	Browse				√		
Grey (Common) Duiker	Woodlands, savannas, thickets & riparian belts	Browse, twigs, flowers, fallen fruit, occasionally grasses & forbs			√	√		
Hartmann's Mountain Zebra	Hilly & mountanous terrain & mountain plateaus in semi arid & arid savannas	Mainly grasses	√					√
Hippopotamus	Open waters deep enough to submerge & sloping sandbanks	Grasses	√					√
Impala (Common)	Riparian belts, woodlands & savannas, including heavily utilised areas	Browse, grasses & forbs			√			√
Klipspringer	Rocky outcrops, cliffs, mountains in high to low rainfall areas	Browse				√		
Oribi	Open, flat grassland areas & floodplains with short grass interspersed with taller patches & clumps of bushes	Short grasses, sedges & other forbs		√				√
Puku	Reiverine areas, floodplains & dambos	Grasses		√			√	√
Red Hartebeest	Open grassy woodlands & savannas, extending into arid savannas	Grasses, some browse & fruit		√				√
Red Lechwe	Shallow, inundated floodplains	Grasses, sedges, inundated plants		√			√	√
Reedbuck	Tall grasslands & reeds near floodplains & open water	Grasses		√			√	
Roan Antelope	Open woodlands, medium to tall grasslands & wetlands, with scattered low shrubs, sweet & sour veld	Medium to tall grasses		√	√		√	
Sable Antelope	Open woodlands with scattered low shrubs b ordering wetlands, medium to tall sweet grasslands	Grasses, occasionally browse		√	√		√	
Sitatunga	Semi-aquatic, deep papyrus clumps & reedbeds	Water plants, reeds		√			√	√
Springbok	Semi arid to arid savanna short grasslands & desert	Grasses, browse & forbs			√			√
Steenbok	Open woodlands & savannas with scattered tall grass clumps & shrub	Browse & forbes, some grass				√		√
Tsessebe	Woodland-grassland edges, palatable shorter grasses, shade, few stones	Grasses		√			√	√
Warthog	FloodplaIns, woodlands, savannas with short heavily utilised grass	Grasses, forbes, shrubs, fruit			√			√
Waterbuck	Open woodlands, floodplains and grasslands	Grasses		√			√	
White Rhinoceros	Flat woodlands and savannas (not arid) with short grasslands	Grasses	√					√

MODULE 3.8, HANDOUT #4: Diet of different wildlife species

Grasses to woody plants	Mean percent (%) diet		Species	
	Grasses & herbs	Woody plants (& fruits)		
Grasses & forbs  **Woody plants**	90-100	0-10	Burchell's Zebra Hartmann's Mountain Zebra Hippopotamus Red Lechwe Oribi Puku Reedbuck Tsessebe White Rhino	**Mainly grazers**
	75-90	10-25	African Savanna Buffalo Blue Wildebeest Red Hartebeest Roan Antelope Sable Antelope Waterbuck	
	60-75	25-40	Gemsbok (Oryx) Impala	**Mixed feeders**
	40-60	40-60	Eland Springbok	
	25-40	60-75	Elephant Steenbok	
	10-25	75-90	Bushbuck Damara Dik-Dik Kudu Grey (Common) Duiker Klipspringer	**Mainly browsers**
	0-10	90-100	Black Rhinoceros Giraffe	

MODULE 3.8, HANDOUT #5: **Water dependence of different wildlife species** (from Bothma & du Toit 2010)

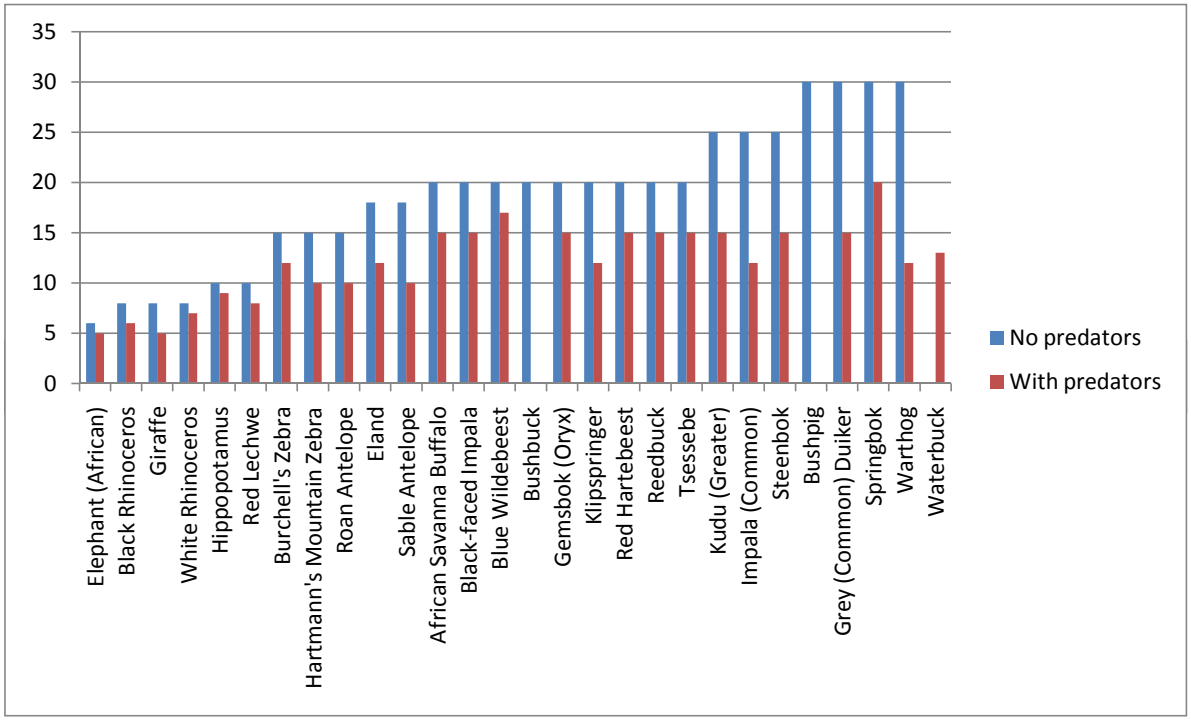
Water dependence		Species
Water dependent  **Independent of water**	Water dependent	African Savanna Buffalo Black-faced Impala Black Rhinoceros Blue Wildebeest Burchell's Zebra Bushbuck Bushpig Elephant Hartmann's Mountain Zebra Hippopotamus Impala (Common) Kudu Puku Red Hartebeest Red Lechwe Reedbuck Roan Antelope Sable Antelope Sitatunga Tsessebe Warthog Waterbuck White Rhinoceros
	Occasionally	Eland Giraffe
	Not water dependent	Damara Dik-Dik Gemsbok (Oryx) Grey (Common) Duiker Klipspringer Oribi Springbok Steenbok

MODULE 3.8, HANDOUT #6: Population dynamics parameters of wildlife in Namibia

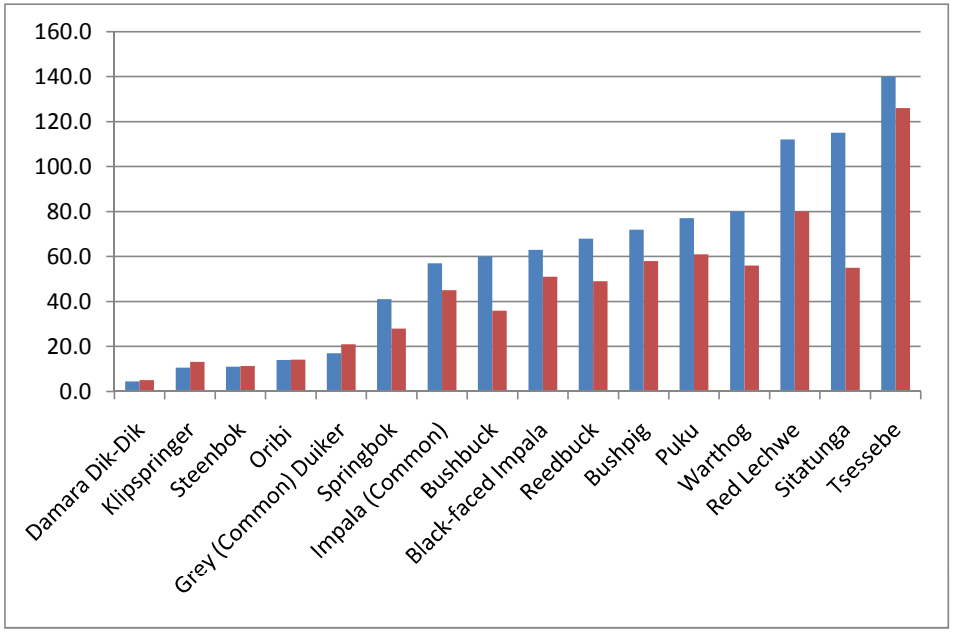
Mating season, gestation period, birth season, approximate weaning age and breeding characteristics of wildlife (from Bothma & du Toit 2010 with modifications). Note: these are general data for southern Africa, often from single studies in specific areas. There may be considerable variation in many of these parameters across southern Africa. It is recommended that information is recorded from each conservancy and region in Namibia to determine local statistics and data. Seasonality is particularly variable, both across southern Africa and between seasons.

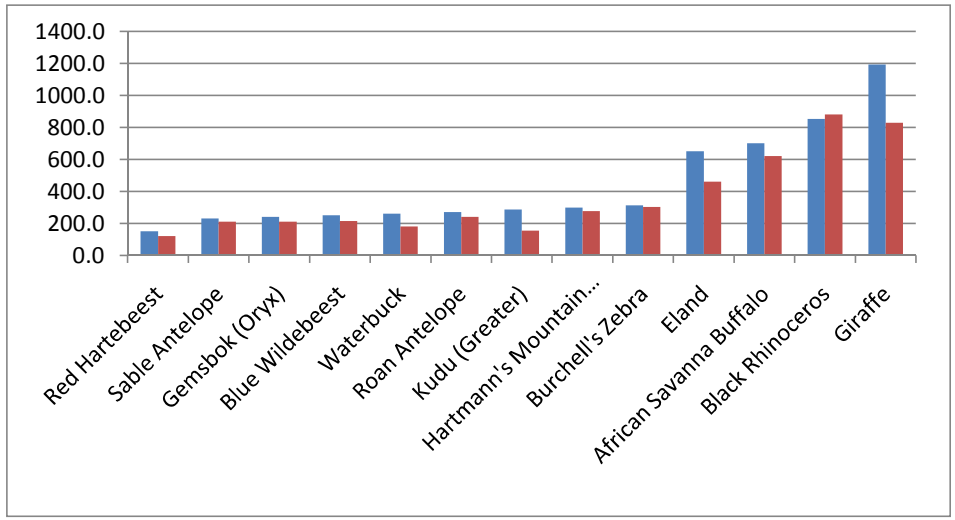
Wildlife species	Mating season	Days pregnant	Births		Weaning age (days)	Age of sexual maturity (months)		Age of first mating (months)		Age of female with first birth (months)	Weight of infant at birth (kg)	Life expectancy in nature (years)	Females per male at adulthood	Approx % population growth rate per year		Mean mass of adults (kg)	
			Season	Peak		Male	Female	Male	Female					No predators	With predators	Male	Female
African Savanna Buffalo	Mar-May	330-346	Oct-Apr	Jan-Feb	150-210	30-36	36-38	84-96	37-49	48-60	24-42	22	5-15	20	15	700	620
Black Rhinoceros	Whole year	450	Whole yr	Ma-Jul	540	96	66-72	96-108	69-81	84-96	45	35-40	0.8-1.0	8	6	852	880
Black-faced Impala	Apr-May	194-200	Dec-Jan	Jan-Feb	120-180	16-18	13	36-60	18	23	4.5	12	2.7	20	15	63	51
Blue Wildebeest	Mar-Aug	250-260	Nov-May	Jan-Feb	240	16	16	48	18-27	26	16	18	1.5-2.2	20	17	250	215
Burchell's Zebra	Whole year	360-390	Whole yr	Oct-Mar	270-420	48	15-22	60-72	30	43	30-40	22	1.5	15	12	313	302
Bushbuck	Whole year	180-200	Whole yr	Apr-May	180	10-11	10-11	11-12	11-12	17-18	3.5-4.5	10	1.3-2.2	20		60	36
Bushpig	Whole year	110-120	Oct-Feb			18-21	18		18	22	0.7-0.8	15		30		72	58
Damara Dik-Dik	Jun-Nov	170-180	Dec-Apr	Dec-Jan	90-120	8-9	6-8				0.5-0.8	4	1.0			4.5	5.1
Eland	Whole year	271-279	Whole yr	Jul-Aug	120-150	18	18	60	18	27	30	15	1.5	18	12	650	460
Elephant (African)	Nov-Apr	660	Sep-May	Jan-Mar	720	120	108	420	108-264	132-228	120-160	65	2.0	6	5	5,000	3,000
Gemsbok (Oryx)	Whole year	261-275	Whole yr	Aug-Sep	105	18-24	20-24	60-84	20-24	29-33	9-15	20	1.2	20	15	240	210
Giraffe	Whole year	450-457	Whole yr	Mar-Jul	240-300	36-42	42-48	96	48-60	63-75	60-90	25-28	2.0	8	5	1,192	828
Kudu (Greater)	Jun-Jul	260-280	Dec-May	Jan-Feb	120	18	18	60	18-24	24-31	16	14	1.4-1.8	25	15	287	155
Grey (Common) Duiker	Whole year	195	Whole yr		90-120	12	8-9			15-17	1.4-1.9	12	1.0	30	15	17	21
Hartmann's Mountain Zebra	Whole year	362-364	Whole yr	Nov-Apr	300	36	24	60	36	48	25-30	25-30	1.5	15	10	298	276
Hippopotamus	Whole year	225-257	Whole yr	Oct-Mar	150-180	84	36-48	96-120	40	48	30	45		10	9	1,546	1,385
Impala (Common)	Apr-Jun	194-200	Oct-Jan	Dec-Jan	120-180	16-18	13	36-60	18	23	4.5	12	2.0	25	12	57	45
Klipspringer	Whole year	210-215	Whole yr	Dec-Jan	120-150	12	12	1	8		1.0		1.0	20	12	10.6	13.2
Oribi	May-Jun	200-210	Oct-Jan	Nov-Dec	60	14	12				1.6-2.5	13	1.0-2.0			14	14.2
Puku	Whole year	224-230	Whole yr	Jun-Nov	196-200						5.8		1.5			77	61
Red Hartebeest	Feb-Apr	240	Sep-Feb	Sep-Nov	150-210	30	18	36-48	28	36	13-15	15	1.5-2.0	20	15	150	120
Red Lechwe	Whole year	225(?)	Whole yr	Oct-Dec	180-210(?)	15	12-24	15	12-24	20-32	5			10	8	112	80
Reedbuck	Whole year	225-240	Whole yr	Sep-May	90		10-24	48	18	26-30	4.0	9	1.5	20	15	68	49
Roan Antelope	Whole year	276-290	Whole yr		150-180	30-36	20-24	60-72	24-28	33-37	16	12-19	4.0	15	10	270	240
Sable Antelope	May-Jul	191-210	Whole yr	Jan-Mar	60-90	32	24	72	24	36	13-18	13-15	3.0	18	10	230	210
Sitatunga				Jun-Jul												115	55
Springbok	Whole year	165-180	Whole yr	Sep-Jan	120	12	6-12	24	6-12	12-18	4-5	10	1.25	30	20	41	28
Steenbok	Whole year	160-180	Whole yr	Aug-Mar	90	9	7		6	13	0.9	9	1.0	25	15	11	11.3
Tsessebe	Jan-Apr	235-245	Sep-Dec	Oct-Nov		36-42	18-24	54	18-28	24-36	10-12	15	3.0	20	15	140	126
Warthog	May-Jul	160-175	Oct-Dec	Nov-Dec	90	18	18	30	18	24	0.4-0.8	17	1.5-2.0	30	12	80	56
Waterbuck	Whole year	270-280	Whole yr	Oct-Mar	210	14	13	60-72	24-36	32-44	13	16	1.5-1.8		13	260	180
White Rhinoceros	Whole year	480	Whole yr	Mar-Apr	365-540	96-120	60-72	120-144	62-68	78-84	45-60	35-40	1.0	8	7	2,100	1,650

Wildlife species	No predators	With predators
Elephant (African)	6	5
Black Rhinoceros	8	6
Giraffe	8	5
White Rhinoceros	8	7
Hippopotamus	10	9
Red Lechwe	10	8
Burchell's Zebra	15	12
Hartmann's Mountain Zebra	15	10
Roan Antelope	15	10
Eland	18	12
Sable Antelope	18	10
African Savanna Buffalo	20	15
Black-faced Impala	20	15
Blue Wildebeest	20	17
Bushbuck	20	
Gemsbok (Oryx)	20	15
Klipspringer	20	12
Red Hartebeest	20	15
Reedbuck	20	15
Tsessebe	20	15
Kudu (Greater)	25	15
Impala (Common)	25	12
Steenbok	25	15
Bushpig	30	
Grey (Common) Duiker	30	15
Springbok	30	20
Warthog	30	12
Waterbuck		13

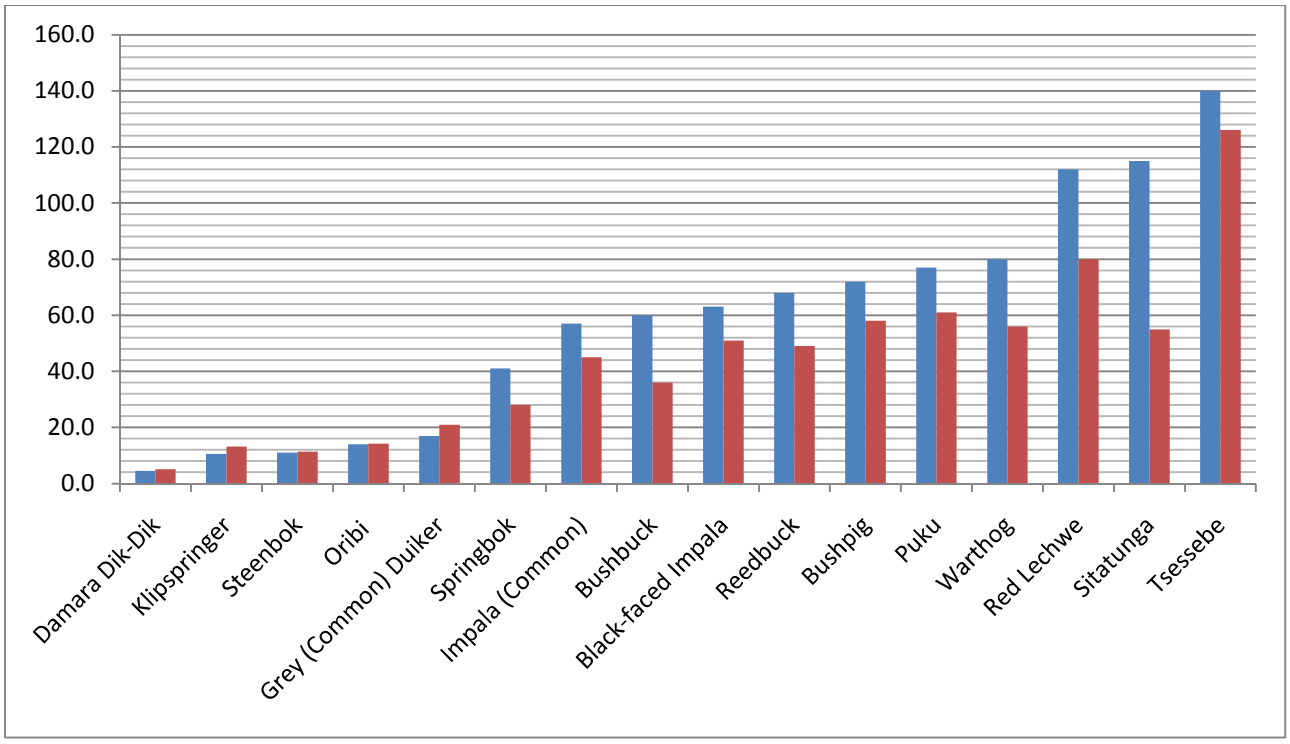


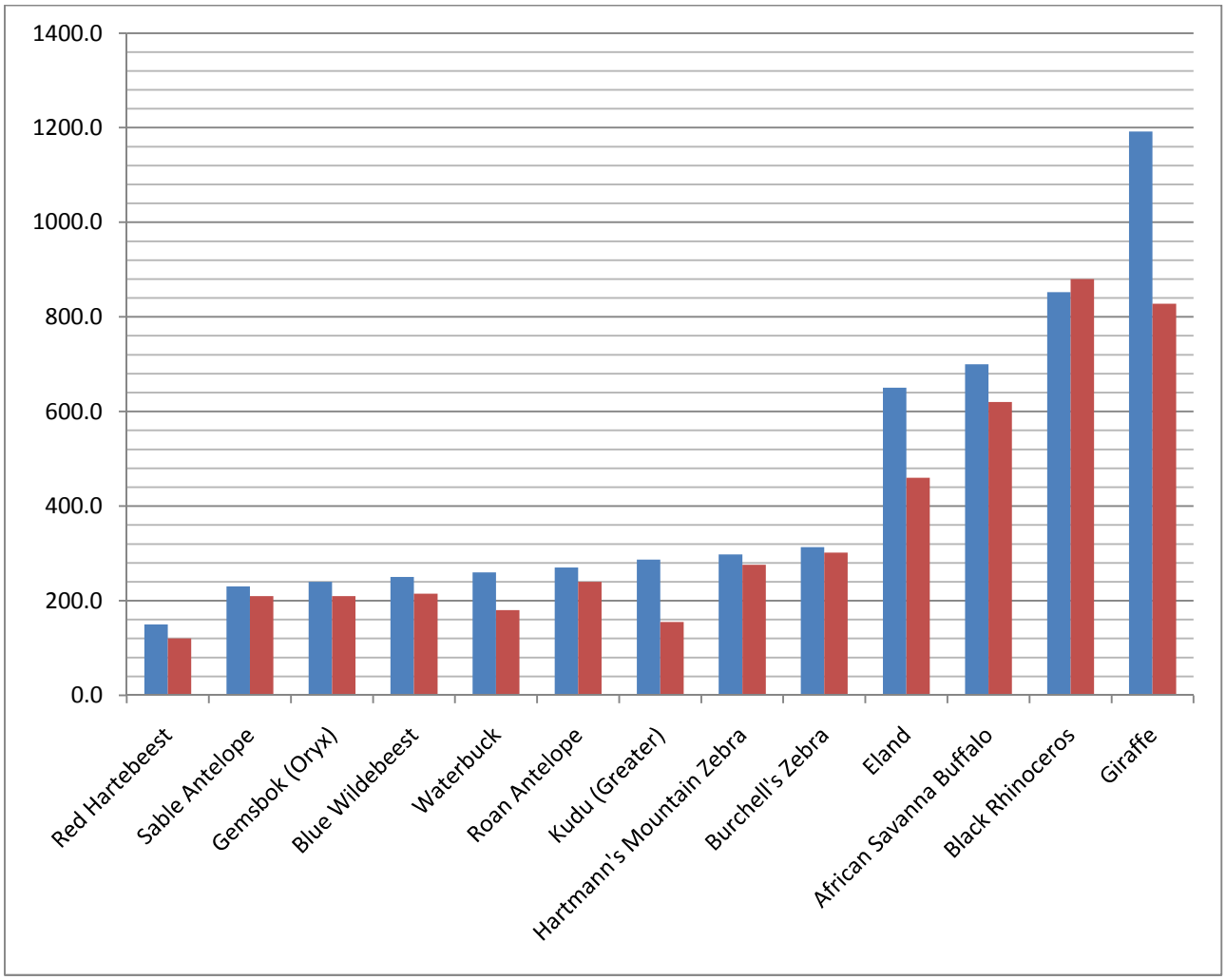
	Mean mass (kg)	
Damara Dik-Dik	4.5	5.1
Klipspringer	10.6	13.2
Steenbok	11.0	11.3
Oribi	14.0	14.2
Grey (Common) Duiker	17.0	21.0
Springbok	41.0	28.0
Impala (Common)	57.0	45.0
Bushbuck	60.0	36.0
Black-faced Impala	63.0	51.0
Reedbuck	68.0	49.0
Bushpig	72.0	58.0
Puku	77.0	61.0
Warthog	80.0	56.0
Red Lechwe	112.0	80.0
Sitatunga	115.0	55.0
Tsessebe	140.0	126.0
Red Hartebeest	150.0	120.0
Sable Antelope	230.0	210.0
Gemsbok (Oryx)	240.0	210.0
Blue Wildebeest	250.0	215.0
Waterbuck	260.0	180.0
Roan Antelope	270.0	240.0
Kudu (Greater)	287.0	155.0
Hartmann's Mountain Zebra	298.0	276.0
Burchell's Zebra	313.0	302.0
Eland	650.0	460.0
African Savanna Buffalo	700.0	620.0
Black Rhinoceros	852.0	880.0
Giraffe	1192.0	828.0
Hippopotamus	1546.0	1385.0
White Rhinoceros	2100.0	1650.0
Elephant (African)	5000.0	3000.0
Wildlife species	Male	Female



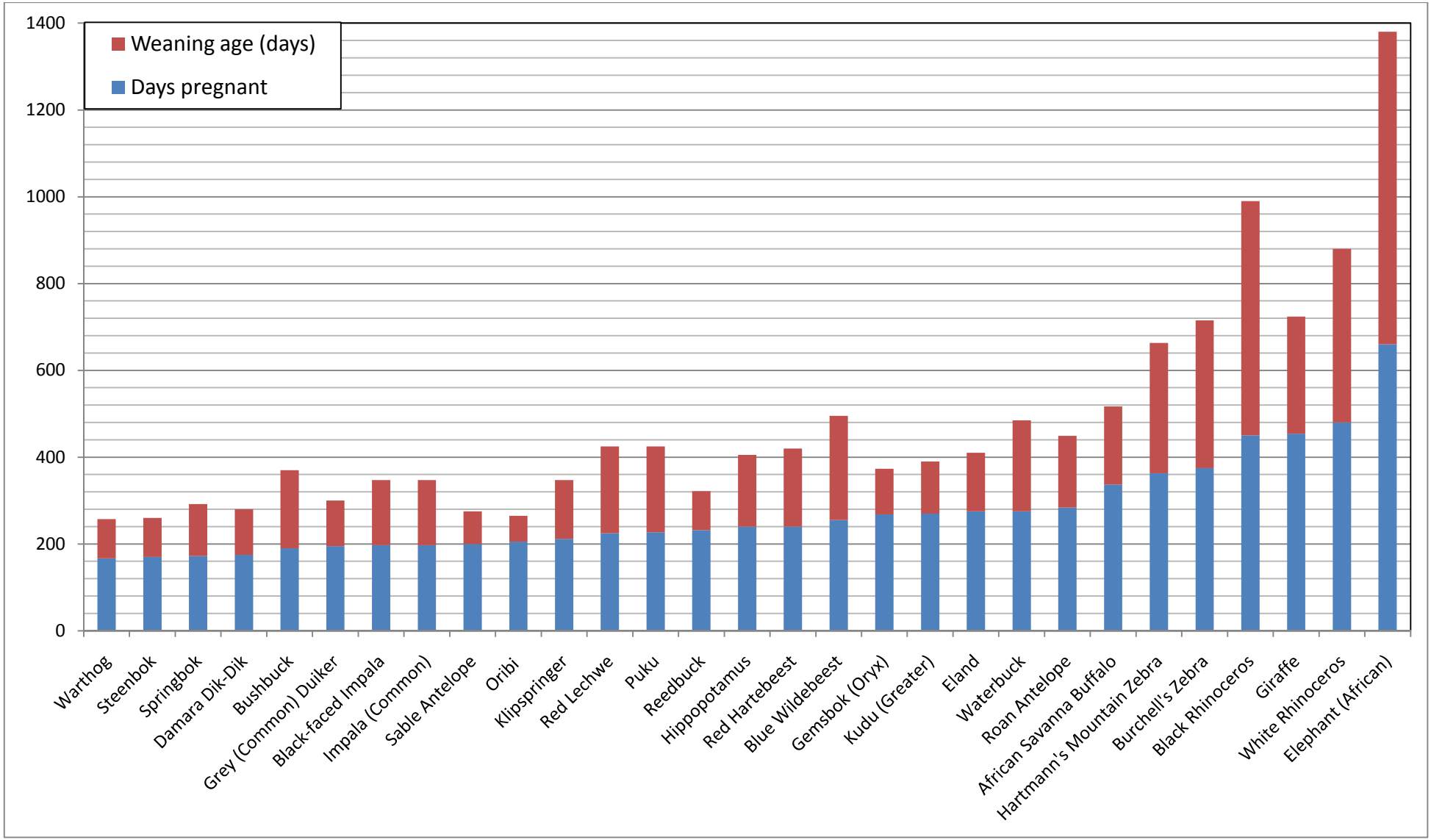


MODULE 3.8, HANDOUT #7: Average mass in kg of adult animals (male blue, female red), excluding Hippopotamus, White Rhinoceros and African Elephant





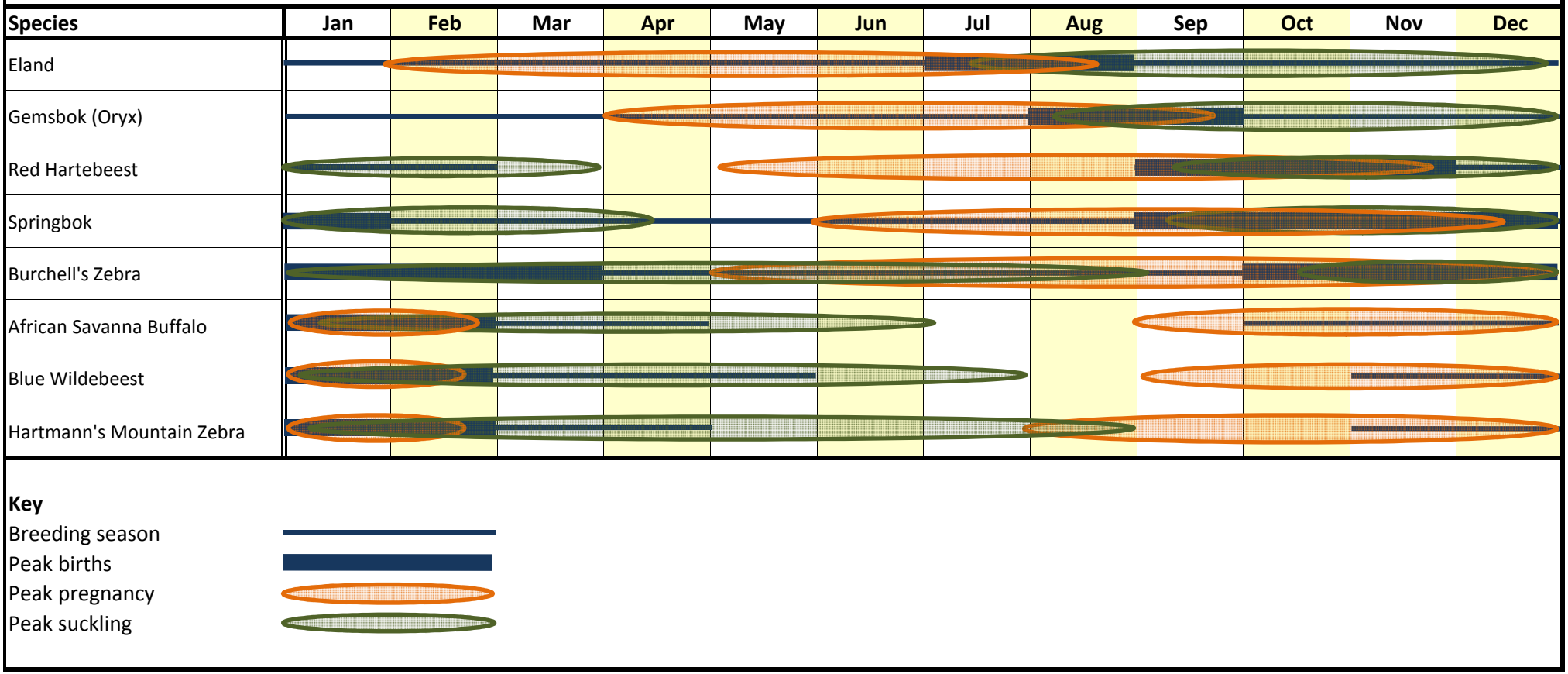
MODULE 3.8, HANDOUT #8: **Length of pregnancy and weaning age, in days, for different wildlife species in Namibia** (from Bothma & du Toit 2010 with modifications)



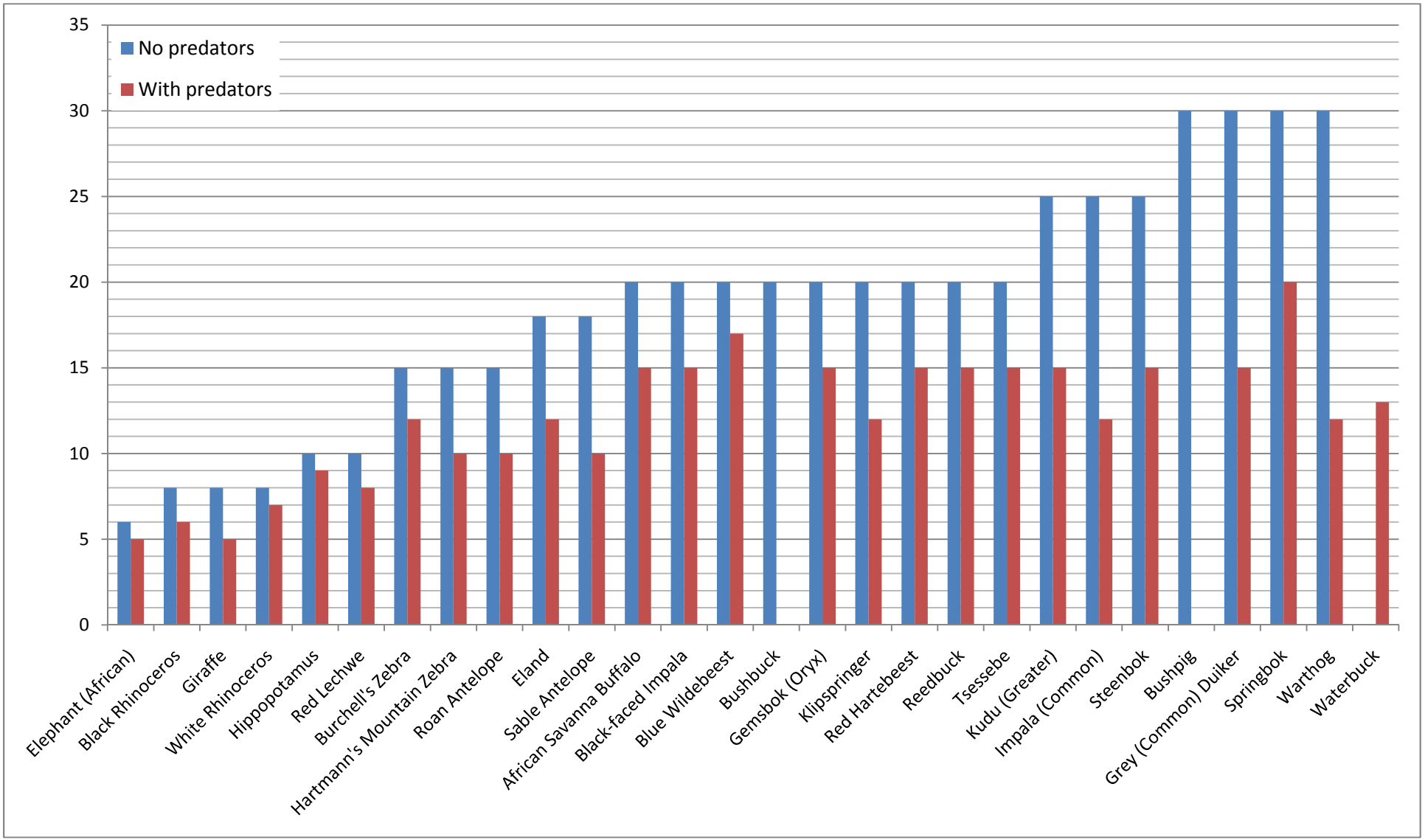
MODULE 3.8, HANDOUT #9: Birth seasons and peaks per category of wildlife in Namibia

Category	Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Plains game	Eland												
	Gemsbok (Oryx)												
	Red Hartebeest												
	Springbok												
	Burchell's Zebra												
	African Savanna Buffalo												
	Blue Wildebeest												
	Hartmann's Mountain Zebra												
Woodland species	Tsessebe												
	Impala (Common)												
	Bushpig												
	Sable Antelope												
	Roan Antelope												
	Bushbuck												
Wetland species	Puku												
	Sitatunga												
	Reedbuck												
	Red Lechwe												
	Waterbuck												
	Hippopotamus												
Browsing species	Giraffe												
	Black Rhinoceros												
	Damara Dik-Dik												
	Klipspringer												
	Black-faced Impala												
	Kudu (Greater)												
	Grey (Common) Duiker												
Other species	Steenbok												
	Oribi												
	Warthog												
	Elephant (African)												
	White Rhinoceros												

MODULE 3.8, HANDOUT #10: The peak pregnancy, birth and suckling periods of plains game in Namibia



MODULE 3.8, HANDOUT #11: Indicative annual percentage increases for populations of wildlife living with and without predators



MODULE 3.8, HANDOUT #13: *Self-assessment evaluation for participants*

Participants receiving training in Module 3.8 are not subject to formal assessment. However, in order for you to assess the knowledge and skills you have acquired on "Wildlife Biology / Behaviour", and for the trainer to ascertain how effective the training has been, you are encouraged to answer for yourself the following questions and discuss your answers – as part of a group or individually – with your trainer.

1. **Can I explain what is meant by "wildlife biology"?**

2. **Can I list the five key principles for effective wildlife management and explain what each means?**

3. **Can I explain what is means by the term "habitat" and why having an understanding of the habitat needs of different species is important?**

4. **Do I understand the different diets of wildlife species: grazers, browsers and mixed feeders - and can I place the species in my conservancy into the correct categories?**

5. **Can I explain the difference between water dependent and water independent species, and can I place the species in my conservancy into the correct category?**

6. **Can I explain the most important points of good water and water point management?**

7. **Do I understand the term "population dynamics"?**

8. **Can I explain how the weights of different species, together with sex ratios, diet and numbers can be used to determine biomass?**

9. **Can I explain how information on the breeding seasons of wildlife can be used to determine best harvesting times to cause least disturbance to species?**

10. **Can I explain how information on annual population increases can be used to plan both population growth targets and harvesting levels in my conservancy?**

11. **Can I list five six aspects of predator-prey relationships relevant to my conservancy?**

12. **Can I explain the term "wildlife behaviour", and give relevant examples for wildlife management in my conservancy?**