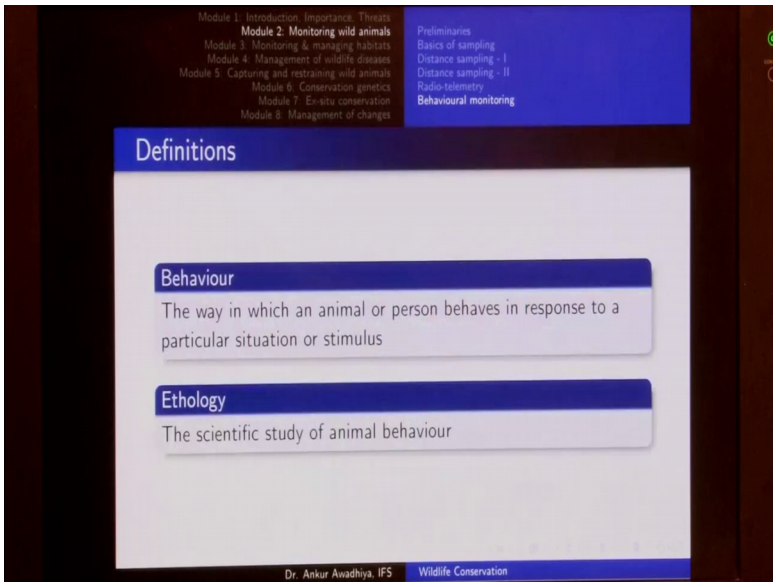
Wild Life Conservation
Dr. Ankur Awadhiya
Department of Biotechnology
Indian Institute of Technology, Kanpur

Lecture – 10
Behavioural Monitoring

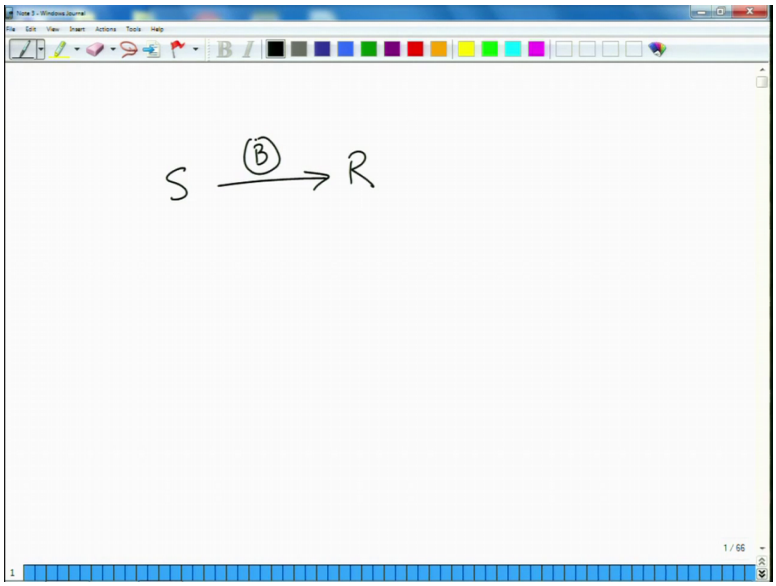
[FL] Moving forward in our module on monitoring wild animals, today we are going to have a look at behavioral monitoring.

(Refer Slide Time: 00:23)



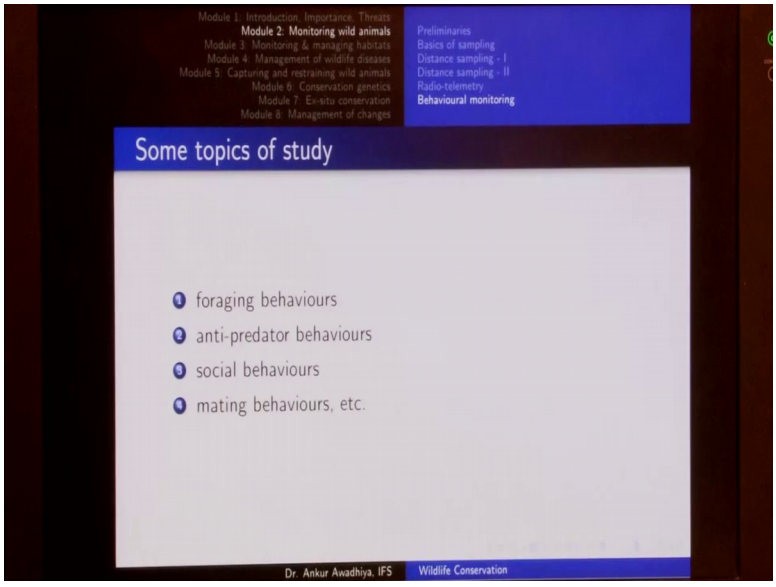
Now, what is behavior is the way in which an animal or a person behaves, in response to a particular situation or a stimulus.

(Refer Slide Time: 00:38)



So, essentially if we have a stimulus which produces a response, then what is acting here is the behavior, it is the way in which the person or an animal behaves in response to a particular situation or a stimulus. Now, the scientific study of animal behavior goes by the name of ethology.

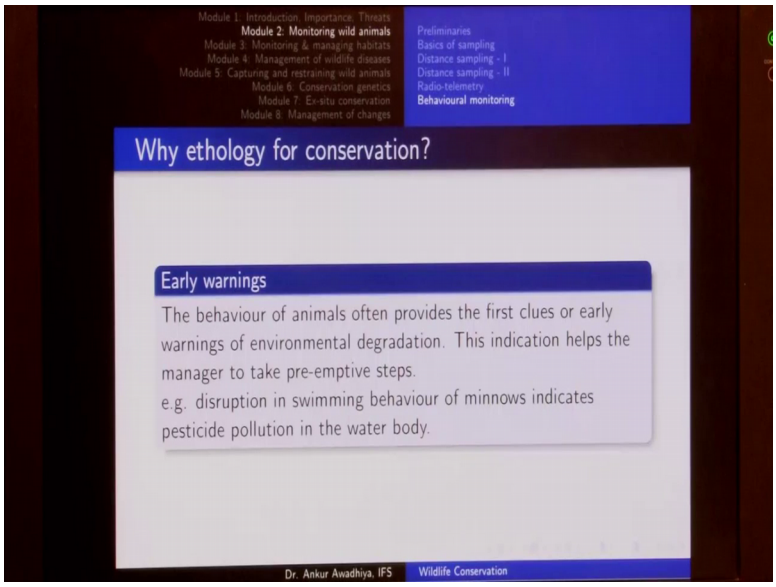
(Refer Slide Time: 00:58)



Now, ethology studies a number of behaviors such as foraging behaviors or the behavior of an animal feeding itself, anti predator behaviors which are behaviors through which an animal avoids, its predators it avoids being eaten upon, social behaviors such as

formation of groups formation of groupness licking of other animals. Grooming of other animals mating behaviors in which an animal looks for a mate, and then this then performs some sorts of displays to attract a mate and finally, when it has chosen a mate then it mates with the animal.

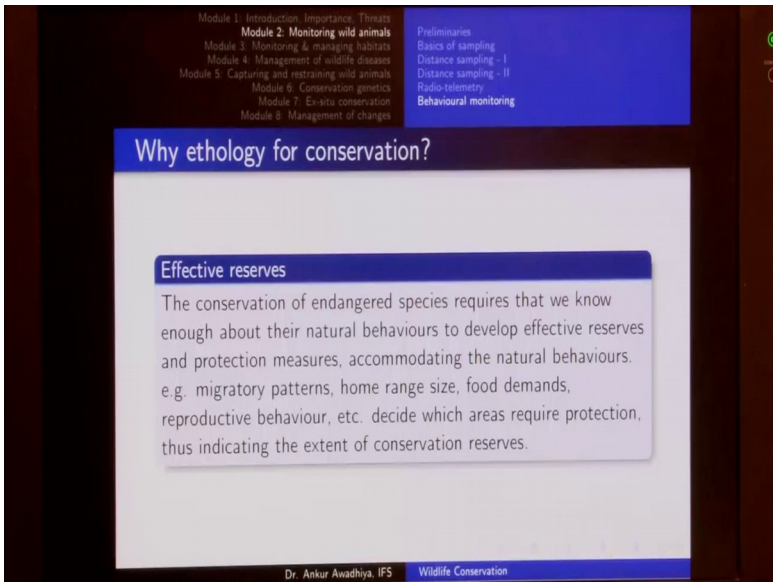
(Refer Slide Time: 01:36)



Now, the question is why is behavior or ethology important for conservation, there are several reasons, one it performs it gives us a clue of early warnings. The behavior of animals often provides the first clues, or early warnings of environmental degradation. This indication helps the manager to take preemptive steps for example, disruption in swimming behavior of minnows, indicates pesticide pollution in the water body.

Now, in any of our protected areas we are going to have some water bodies, there will be some land there will be some trees, now if there is any environmental degradation. So, how does a manager come to know about it, one we can go for physical and chemical parameters tests of the water, or else we can just have a look at the behavior of the animals. So, in case of any pollution in case of any degradation, that also acts as the stimulus which will produce some sort of response or some sort of behavior and if we know this behavior we can very clearly know, that there is something going wrong in the system.

(Refer Slide Time: 02:40)



Secondly ethology is important for the construction of effective reserves. The conservation of endangered species requires that we know enough about their natural behaviors, to develop effective reserves and protection measures accommodating the national behaviors. For example, migratory patterns, home range size food demands reproductive behavior etcetera decide which areas require protection thus indicating the extent of conservation reserves.

So, to give a concrete example if we consider animals such as tigers so, a tiger in general needs more than a 100 square kilometer of area, which would be its home range. So, home range is the area in which this tiger would be roaming about and, it would form it would use this area for different purposes for feeding for finding a mate and also for protection.

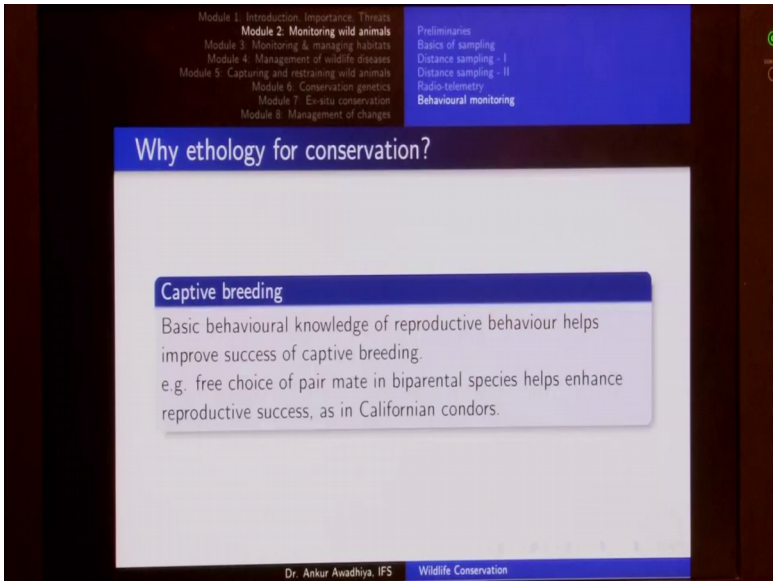
Now, if we know through ethology so, this is a natural behavior of the tiger so, we would know that if we are to construct a tiger reserve then the minimum area has to be more than hundred square kilometers one thing. Secondly, we know that in the case of tigers as soon as the males become sub adults, they are forced out of their pride and then they have to go and form another territory somewhere else.

So, if we know this information and if we know that our tigers in our tiger reserve are getting into this age of sub adulthood, we know that these tigers are going to move outside of our tiger reserves, to disperse themselves and to form another territory. So,

during these times it becomes crucial that we also in enhance our level of protection in all the migrative or the dispersal routes.

So, for instance because we know that the behavior of tiger makes them to use paths such as Nalas or roads for dispersal and even things like. If they have a an agricultural field on the way they are going to use that as a path for dispersion. So, even areas outside of our tiger reserves would require more protection and this is something that we will come to know by knowing the natural behavior of the tigers.

(Refer Slide Time: 04:57)

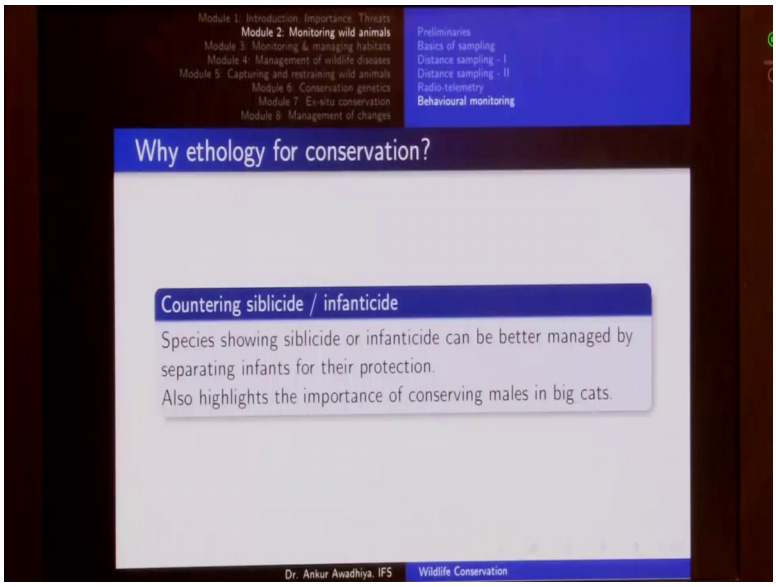


Next it is important for captive breeding, basic behavioral knowledge of reproductive behavior helps improve success of captive breeding. Now, captive breeding is something that we are going to discuss in a later module, but an example is that free choice of pair mate in by parental species helps enhance reproductive success as in Californian condors.

Now, condors are birds of prey so, Californian condor is a bird of prey that is found in California. And this is a species that has been taken out of from the brink of extinction. Now, in this species we have males and females and there is a process that that is known as free choice of pair mate. So, essentially if you have male and female birds and, if you keep one male bird and one female bird together in the hope that they are going to mate together, then in most of the cases they do not mate, because they require some amount of free choice.

So, essentially in place of keeping a male and a female bird together, you keep a group of males with together with a group of females. So, they will choose amongst themselves which mate do, they prefer and once they have chosen their mates, then only they are going to perform their breeding. So, if we did not have this information about free choice of the pair mates, then we would not be able to breed these animals effectively in captivity.

(Refer Slide Time: 06:22)



Next ethology is important to counter siblicide or infanticide so; species that show siblicide or infanticide can be better managed by separating infants for their protection. And this also highlights the importance of conserving males in the big cats. Now, what we are saying here is, that in the case of some birds, in one nest they would lay a clutch that would have more than one egg.

So, for instance there are three eggs that are laid, now why would a bird want to lay more than one egg, because any animal wants to increase its chances of reproductive fitness. So, it wants to leave more and more progeny behind, now for instance if this bird knows that I am going to get enough food to have three chicks, then it would lay three chicks.

On the other hand if it lays three eggs and, then the there is our food shortage. So, only one of those chicks would be able to get sufficient nutrition so, as to be live two to maturity in the next generation.

Now, in such a situation there are a number of species in which we observe siblicide. So, what happens is that the first chick that has emerged out of or that has hatched out of the egg, is going to kill all its brothers and sisters that are going to emerge out later. Now, if we know that that we are going to have this situation, because we know the behavior of the species and if we are conserving this species, then we would want to separate out these different eggs.

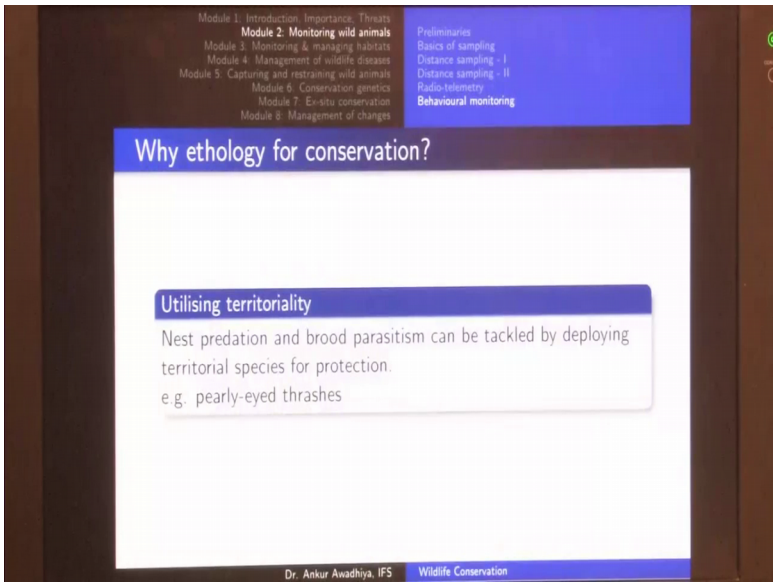
So, essentially as soon as the first egg has hatched we would take this chick out. And we would raise it up in a capital situation. So, we would put up incubators so, that this chick is also able to grow and at the same time the other eggs, because they have not been killed off. So, they would also grow as another bird. So, in place of having just one bird in the nest out of 3 x we would be having say three birds out of the same nest.

Also in the case of big cats such as tigers, we have observed that if there is situation, in which you have a male tiger and that male tiger has produced say 5 cubs with a female. Now, we generally think that if we want to conserve us species, then females are more important than males, because males are replaceable.

But what happens in the case of big cat species such as tigers or lions, is that if the male dies off by some means, then there would be another male coming to take its place, when that male comes it kills off all the young ones of the of the previous male. So, that the female becomes receptive to mating and breeding again.

So, this phenomenon goes by the name of infanticide. Now, if we know that for a particular species, they show a behavior of infanticide, then it becomes crucially important that the males should also be conserved. So, essentially ethology provides us clues on what to conserve and how to conserve it.

(Refer Slide Time: 09:37)

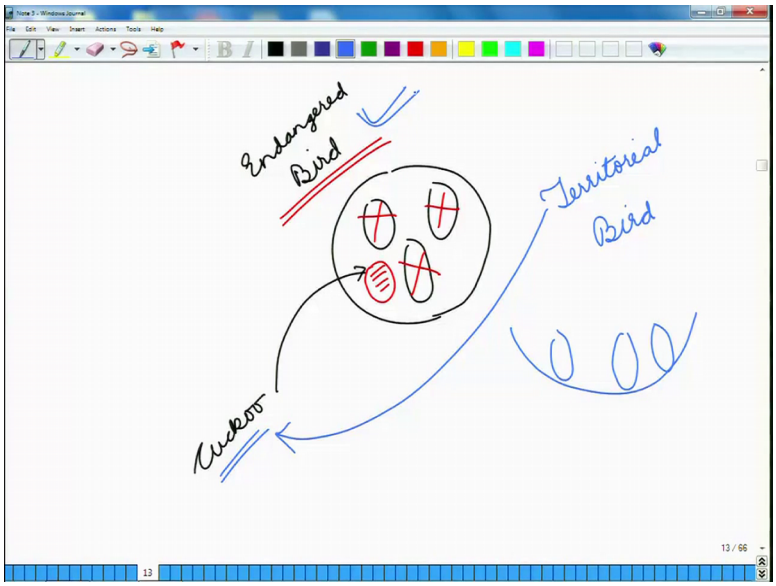


Next ethology is important for utilizing territoriality. Now, territoriality is a behavior in which an animal has a fixed territory, it considers that space as invalid and it defends it against other animals. Now, there are some animals in which we see nest predation and brood parasitism, now in the case of nest predation cuckoo and brood parasitism cuckoo is a very good example.

So, what this bird does is that it does not make its own nest. So, it would go to the nest of some other bird say a crow, or maybe even the nest of some endangered species, then it would lay its egg in that particular nest. And when the young one comes out it kills all the other eggs, it just throws them out of the nest.

Now, in the case of endangered species, we can counter nest parasitism or brood parasitism, by employing some other species that have a territorial behavior.

(Refer Slide Time: 10:44)



So, for instance if we have this particular nest, in which there are three eggs and then you have a bird which is an endangered bird and, you have a cuckoo so, the cuckoo would lay its egg here. So, let us depict it by a red egg and once this egg hatches, then the chick will throw out all of these other eggs.

Now, what we are losing here is the are the eggs of an endangered bird. So, to counter this situation we could put side by side, another nest which belongs to some bird, which shows a highly territorial behavior. Now, in this situation when this bird sees cuckoo coming near to its nest, it might even take a actions against cuckoo.

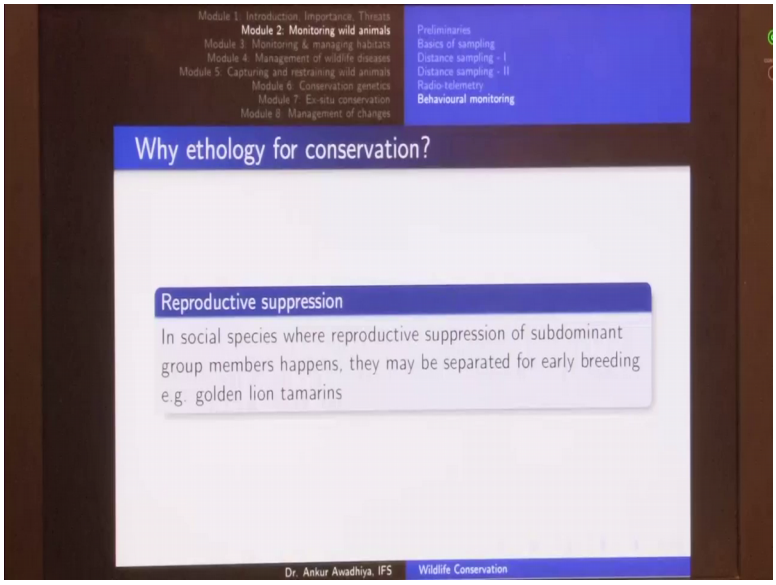
So, it would drive it off so, not only the eggs of this territorial bird are protected, but at the same time it is also protecting the eggs of the endangered bird. So, ethology or the science of animal behavior can be used to protect some species. Now, to see a how a territorial behavior occurs let us have a look at this video.

(Refer Slide Time: 12:06)

So, what we are observing in this case is penguins in boulder beach, now boulder beach is a location in South Africa. So, all of these birds are having their own clutches so, you will see a male a female and a chick somewhere inside. So, like this bird is sitting on a chick to warm it up. Now, we can see here that all of these clutches are at certain distances of each other. So, all of these birds maintain a territoriality around their clutches and, these two these two clutches I mean or these two sets of birds are now fighting in a territorial display.

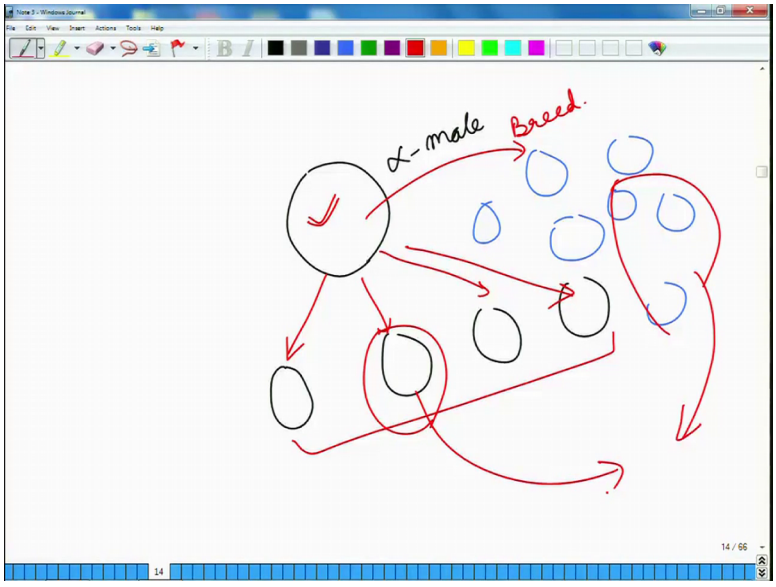
So, what happens in a territorial display is that both of these birds are pecking at each other. And then the this clutch is showing a dominant behavior. So, it is giving out a sound and its going up whereas, these two birds are showing a recessive behavior, in which they are keeping their heads down. So, essentially such kinds of territorial behaviors can be made use of in protecting a bird from nest or brood parasitism.

(Refer Slide Time: 13:43)



Another way in which ethology is important for conservation is to avoid reproductive separation. Now, in social species where reproductive separation of sub dominant group members happens, they may be separated for early breeding. The classical example is that of golden lion tamarins.

(Refer Slide Time: 14:01)



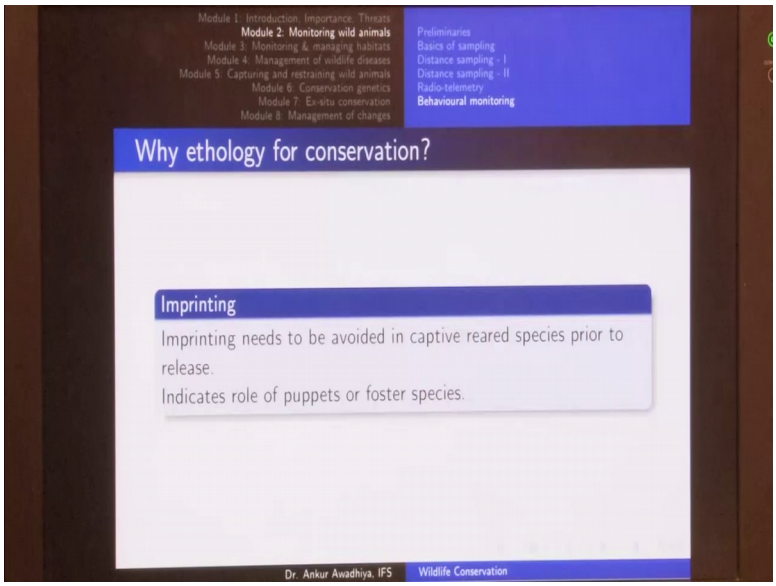
Now, what do we mean by a reproductive separation. So, in some animals we observe that there is an animal that goes by the name of alpha male. So, this is the dominant male in the group, there would be some other males, which are not dominant males. So, which are not alpha males.

And then there would be group of females. Now, what happens is that this alpha male dominates over all of the other males. And because of this dominant behavior so, as we saw in the previous video that we had a fight of territoriality. Similarly in this case this alpha male is going to fight with all of these males to keep them dominated. And then this male is going to breed with all the females.

Now, if we know that for a certain species this behavior occurs and if we wanted to change the genetic profile of this group, if we have this alpha male then these males would not be able to reproduce. But if we took out some females out of this group and, if we took out one of these sub dominant males and kept them together, they would be able to breed together.

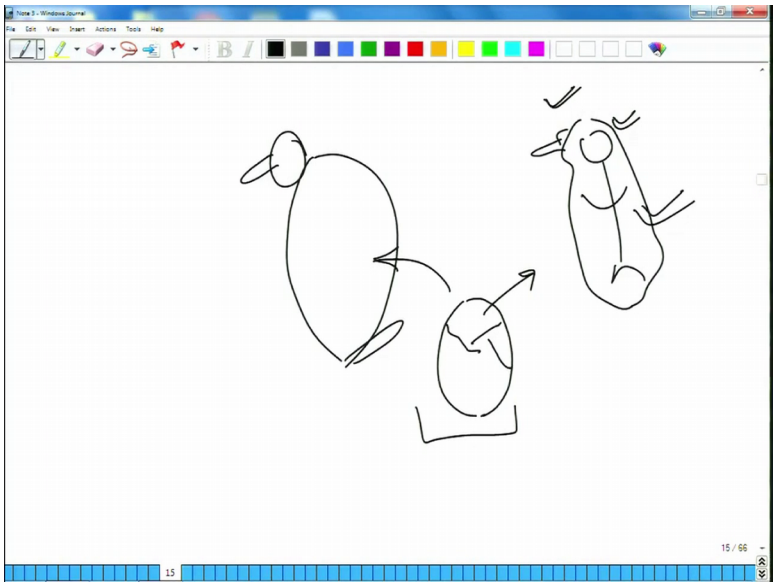
So, essentially in the case of reproductive separation, it is seen in the case of social species, where there is a reproductive separation of sub dominant group members and if they if we separate them, then they can be used for early breeding, or to increase the population size.

(Refer Slide Time: 15:40)



Another way in which ethology helps in conservation is in the case of imprinting. Now, imprinting is a phenomenon so, which is generally seen in a number of animals and in mostly in birds.

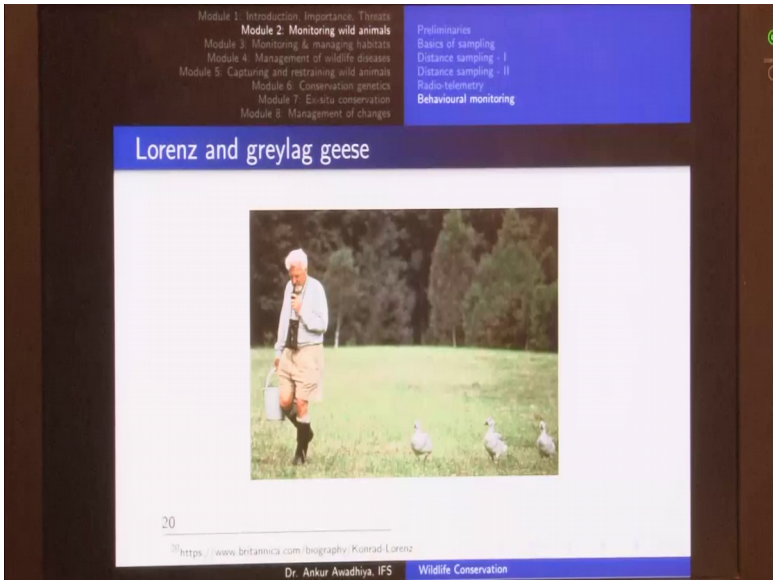
(Refer Slide Time: 15:56)



So, what happens is that if you have an egg and when the chick emerges out of it. So, how does the chick know which of the birds of which of the things nearby is its mother. So, what it does is it imprints itself. So, this is one phenomenon in which it recognizes a bird nearby, as its mother or a thing which it can trust.

So, essentially anything that is present near the egg when the egg is hatching, and is moving is thought to be as a mother and it is thought of as a trust figure. Now, what happens is in the case of captive breeding of animals, when we have kept this egg in an incubator and when this chick hatches, then when it sees a human being nearby, then it considers that this human being is its mother.

(Refer Slide Time: 16:54)

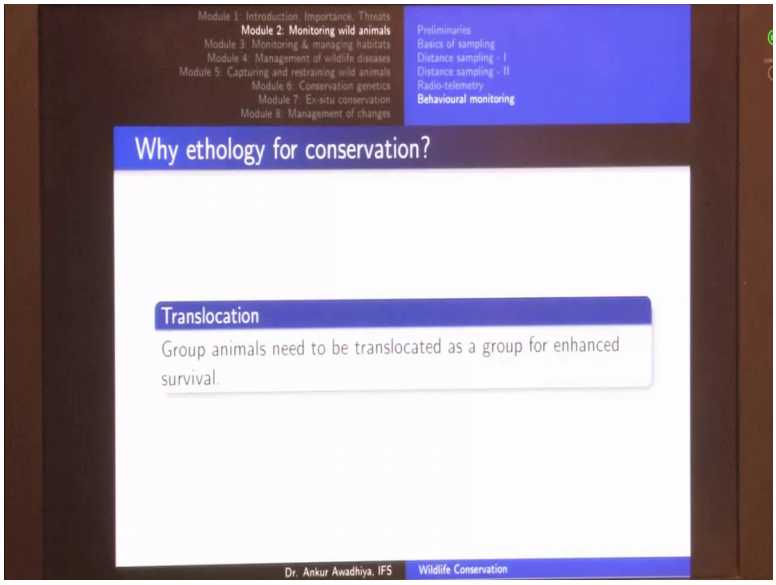


Now, a classic example is that of Konrad Lorenz who also got a Nobel Prize for such studies. Now, what we see here is that these are geese which when they had emerged out of the egg, they saw Konrad Lorenz nearby, they took him as their mother figure. And just like in the national scenario we observed birds following their mother, these chicks started following Konrad Lorenz which is fine for some time, but then it was also seen that these birds then fail to recognize members of their own species as themselves.

So, for instance even when these birds grow older, they would only recognize human beings as members of their own species they would perform sexual displays in front of (Refer Time: 17:39) of humans, but not in front of other animals of the same species. So, basically they would show their sexual preferences to humans and not to the other geese. So, essentially when we have we when we release these birds out from captivity, they would not be able to breed in the natural circumstances.

So, the knowledge of ethology tells us that we need to prevent these behaviors, and to prevent these behaviors these days we deployed decoys. So, in the case of decoys what this person would be doing is that he or she would be wearing dress which makes him or her look like a bird. So, in that case the chick that has emerged would recognize that this is the shape of a member of my own species and it would not imprint on the human beings.

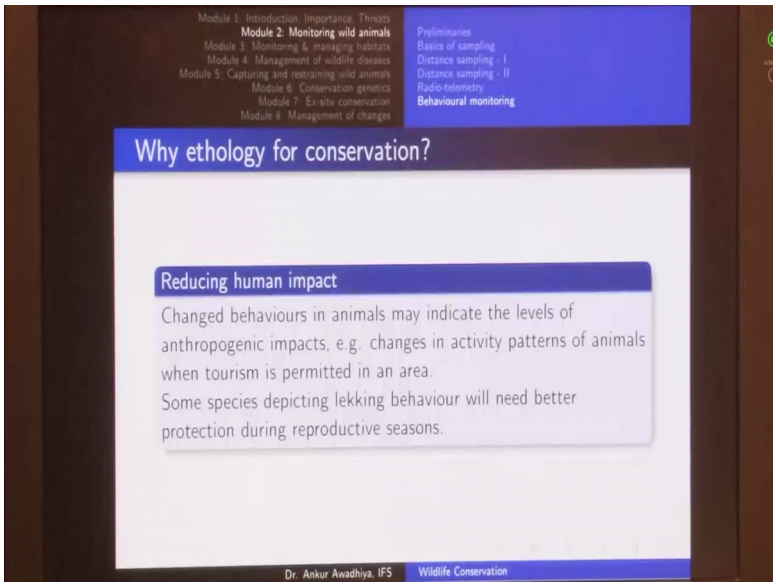
(Refer Slide Time: 18:32)



Another way in which ethology is important for conservation is in the case of translocation, now translocation is the process in which we move an animal or a group of animals, from one place to another place. Now, group animals need to be translocated as a group otherwise this translocation will not work. So, for instance in the case of animals such as wild dogs, or in the case of animals such as monkeys.

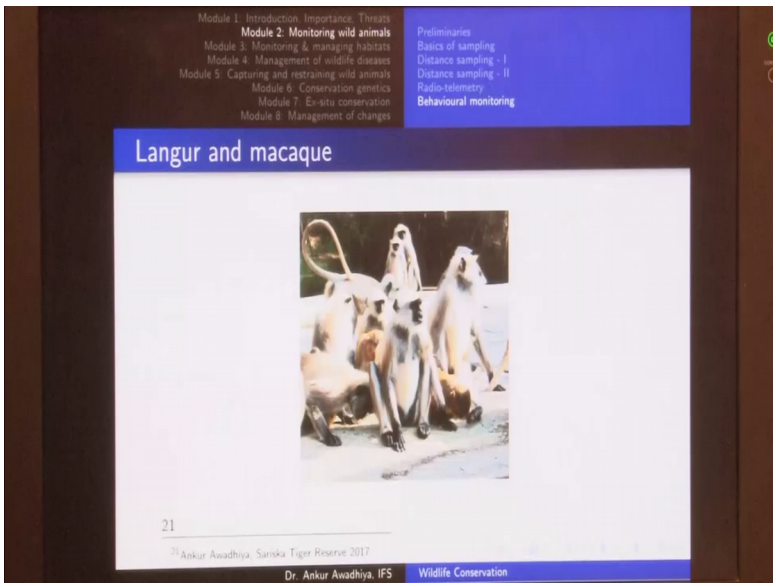
So, if there is a monkey menace somewhere and, if you take out some members of the group and you and you place them somewhere else then these members of the group will feel extremely threatened. So, will be so, will the members the left out members of the group whereas, if you translocate this group as such in total, then their social bonding is maintained say their social interactions is maintained and so, this translocation is much more successful.

(Refer Slide Time: 19:26)



Another way in which ethology is important for conservation is to understand and reduce human impacts. So, when whenever there is a human impact on the wildlife, then their behaviors are the first way in which we understand that, they are having an impact of human beings. Also some species that depict lekking behavior will need better protection during their reproductive seasons characteristic.

(Refer Slide Time: 19:53)



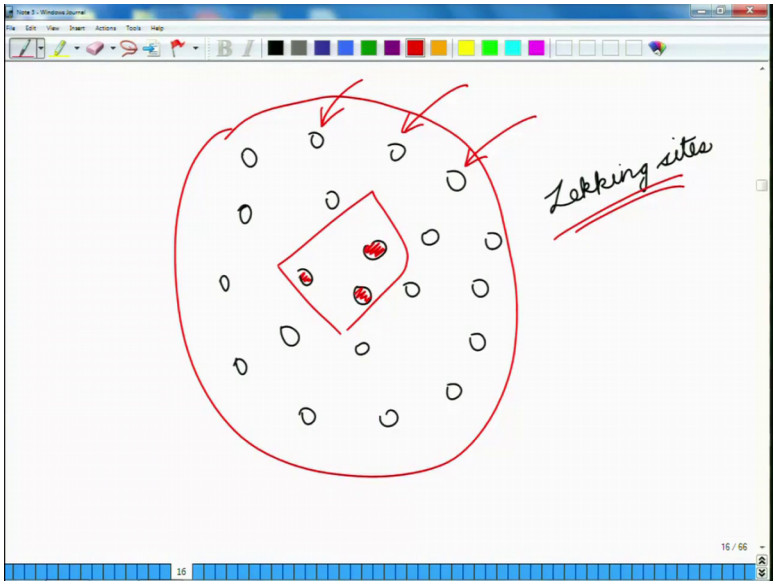
So, let us see what this human impact looks like. Now, in this picture we are seeing some Langurs and we are seeing some monkeys or macaques. So, this is a macaque in these

larger animals are Langurs. Now, in a traditional natural situation, we would find that the Langurs reside deep inside the forest whereas; the macaques live mostly on the periphery they live near the human habitations.

Now, in this particular case this is a picture from the Sariska Tiger Reserve and there humans have a tendency of feeding these animals. So, these animals which naturally live very far apart and do not show any form of interaction whatsoever, if we see this picture and here we see a quite a lot of food items that are thrown down. So, both of these animals are now together.

Now, this is one example in which we can say that there is a human, impact on both of these species, because of which their natural behavior has changed also in the case of animals. That should lekking behavior, now lekking behavior is seen in a number of deer species.

(Refer Slide Time: 21:03)



So, what happens is that during the breeding season, we would have all the males that are together. So, they would sit in a big group or they would stand in a big group, but they will all be together.

So, such sites where there is a congregation of animals is known as lekking sites. Now, why are these lekking sites important, because they give an indication to the females of

the species about the relative dominance of all these different males. So, traditionally all the males towards the inside of the group, will be the more dominant.

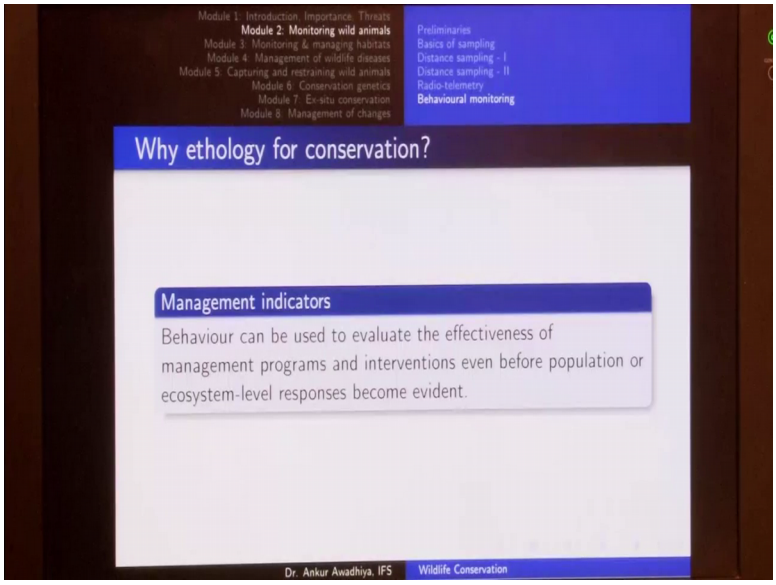
Because they are essentially taking up the center place and they are displacing all the other sub dominant or non dominant males towards the periphery, why is that important because if a predator comes, then it would preferentially be attacking all the males at the periphery. And the central males would be safe.

Now, if a female comes there the female would know that these are the most dominant males and so, it would breed with these males, but in the case of conservation lekking sites become extremely crucial, because in the breeding season. So, say in the rainy season most of the times.

If we know that in the rainy season we would have a big congregation of animals, then it is also possible that we would be having a poacher nearby to poach these animals. Because these animals are doing their sexual displays, they would not pay much of an attention to the poacher and so, it is a very easy time for the poachers to hunt these animals.

Now, if we know that a certain species shows such lekking behaviors, we can enhance our protection during these times so, that these animals are saved from poachers.

(Refer Slide Time: 22:57)



Another way in which ethology is important for conservation is as management indicators. So, behavior can be used to evaluate the effectiveness of management programs and interventions, even before population or ecosystem level responses become evident.

So, a classic example in this case is the case of breeding of animals or captive breeding of animals. So, for instance if you take snakes together so, you took some male pythons and you took some female pythons, you kept then them together. And the aim is to have captive bread pythons so, that we could increase their population.

Now, the results of captive breeding would come after quite a lot of time, but this captive breeding would depend on how congenial the environment is for the pythons. So, for instance if you have this enclosure in which you are exposing these pythons to the elements. So, you are getting enough I mean quite a lot of sunshine you are getting quite a heavy downpour, then it is quite possible that these pythons are not going to mate.

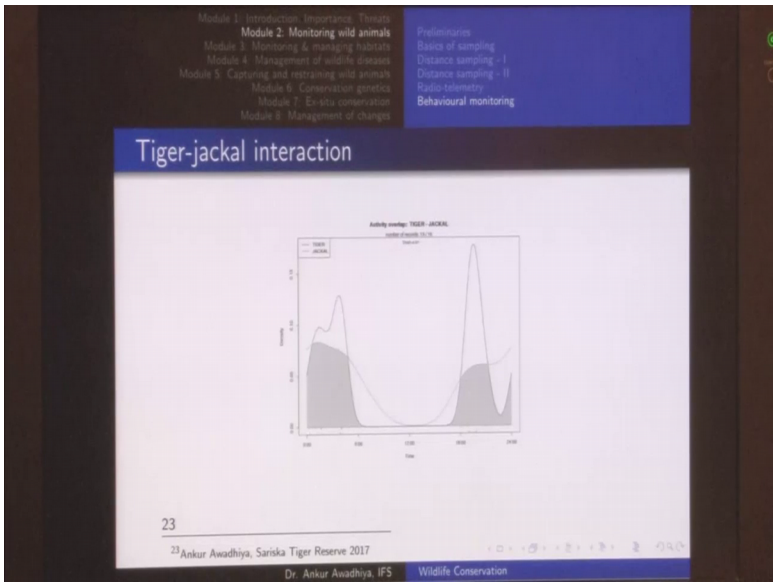
On the other hand when you provide them with some amount of shade some amount of areas to hide themselves, then there would be a mating scene in these animals.

Now, mating is a behavior that tells us whether our management interventions are good enough for these animals. So, whether when we have put up a shade for these animals is the shade working for these animals or not is this shade a very small shade. So, that it does not serve its purpose is that is shade is so, big that the inside becomes very cold and these animals are not able to cope with it.

So, essentially whether these animals are comfortable there or not can be seen by the mating behavior. So, even though our aim in captive breeding was to raise the population of these animals was to increase the population of these animals. The behavior can be the first indicator to see whether our management interventions are working or not.

Now, some examples of doing these behavioral studies are to follow. So, one example is that of activity patterns.

(Refer Slide Time: 25:09)



So, in the case of activity patterns what we do is we plot the timings from 0 hours to 24 hours. So, essentially we are taking from midnight to midnight and, then we are plotting the activity level of different species here together.

So, one example is that of activity patterns so, in this example here we have plotted the time on the x axis. So, it goes from 0 hours to 24 hours. So, it is essentially from one mid night to another midnight. And then on the y axis we are plotting the activity level of the animals or the number of animals that we have seen in our camera trapping exercises.

Now, here we are depicting the activity overlap between tiger and chital. Now, chital as we know is a deer species and is a prey species for tiger. So, tiger predates upon the chital, now the these dark lines show the tiger. So, a tiger is mostly active from our study we found out that it is mostly active at say 5 O clock in the morning and close to around 8 O clock in the night these are the times where it shows the maximum level of activity.

On the other hand in the case of chital, we see that the activity is right after this animal is done with so, it shows maximum activity at around 6 O clock and around 5 O clock in the evening. Now, in the afternoons both these animals rest. So, why should we expect such a behavior, we expect such a behavior, because tigers are nocturnal species. So, they can see very clearly in the night, but chitals are not nocturnal species they require some amount of light.

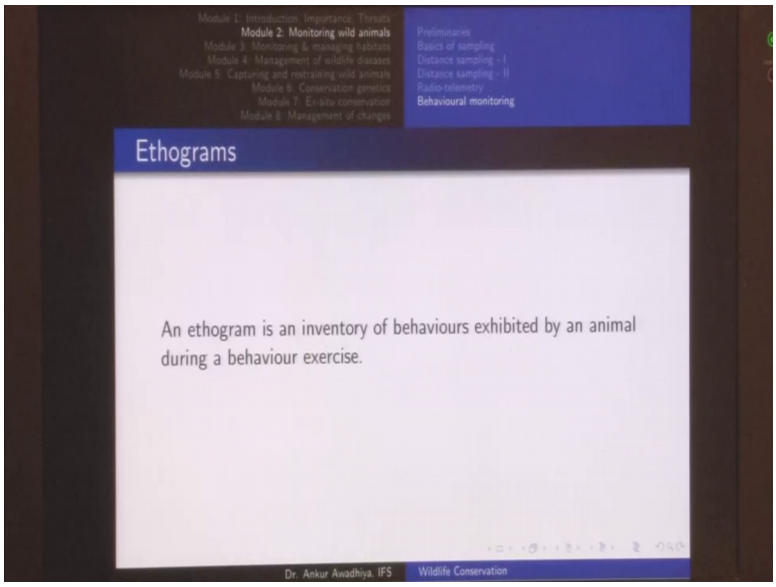
So, essentially chitals will not be showing in appreciable movement after darkness, but at the same time both of these animals I mean a chital is trying to avoid the tigers. So, both of these curves do not overlap so, it is in the interest of the tiger to have some level of overlap with the chital, but it is in the interest of the chital to have no overlap with the tiger, because of which we are seeing such figures.

Now, if we look at a similar scenario in which we are not looking at a predator and a prey species, but in this case we have a tiger and a jackal. Now, a jackal is not a prey for a tiger. So, in this case we would observe that the level of overlap between both of these species is very high, which is what we should also be expecting, because both of these are predatory species.

Now, activity curves become important, because we can use this information to understand the level of human impacts that are going on in this area. So, for instance in the case of tiger, if we see that that this beggar is getting some amount of a (Refer Time: 28:05) disturbance in the nighttime. So, what it would do is it would try to hide itself and then it would show some level of activity, when there is the sun outside.

So, any change in the activity pattern of the animal is an indicator, that there is some level of disturbance that is going on.

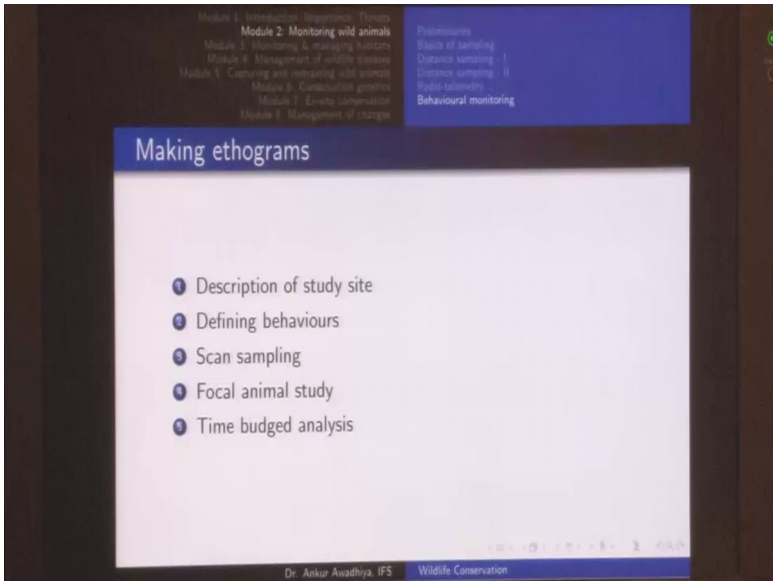
(Refer Slide Time: 28:22)



The next topic is that of ethograms. Now, ethology is the science of animal behavior, ethogram so, here we have ethos which is the behavior and gram which is a record. So, any ethogram is an inventory of behaviors exhibited by an animal during a behavior exercise.

So, when we are observing an animal we can list out with various activities that it performs and, this inventory of behaviors would be called an ethogram. So, how do we make a ethogram?

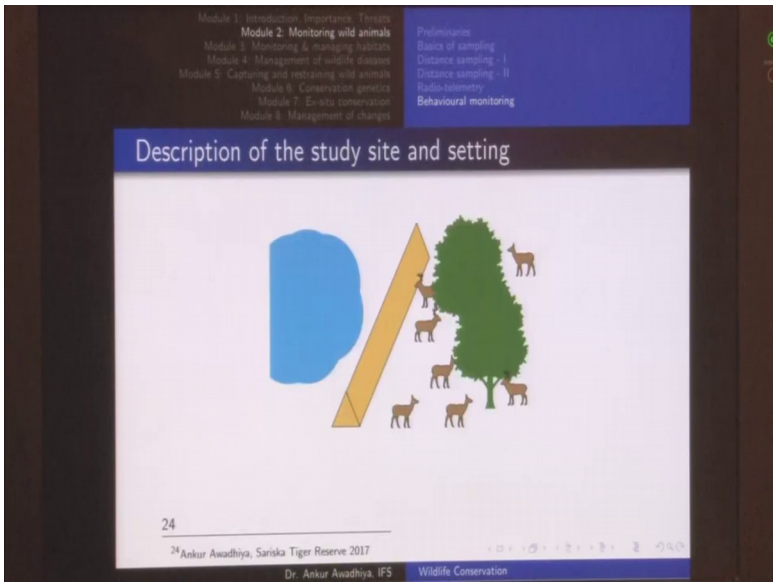
(Refer Slide Time: 28:51)



So, making of an ethogram consists of these five things, one is description of the study site, where we are doing our study, then we define the behaviors, now definition of behaviors is important, because if we see say an animal say a chital that is standing and looking somewhere. Then person A might say that that this animal is looking person B might say that that this animal is standing and person C might say that this animal is not doing anything.

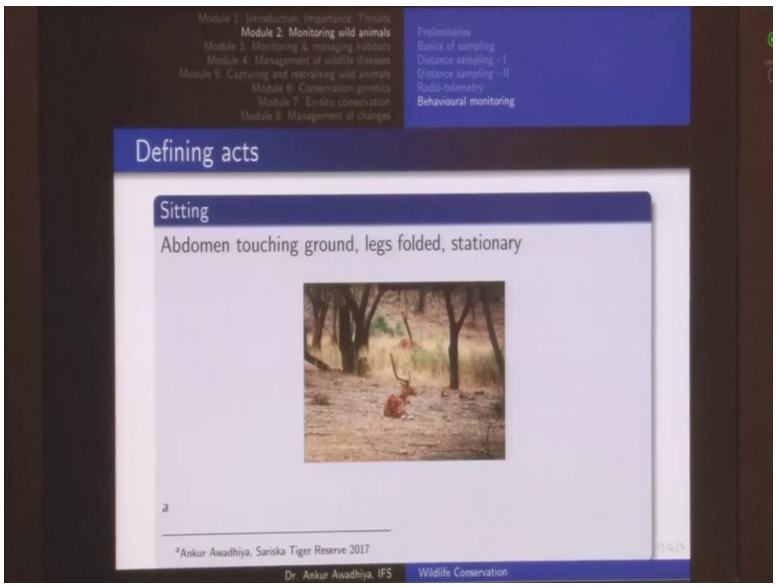
So, in whenever we are doing a scientific study it is important to codify all the behaviors. So, we clearly defined what behavior means what, then we perform a scan sampling and a focal animal study followed by a time budget analysis.

(Refer Slide Time: 29:39)



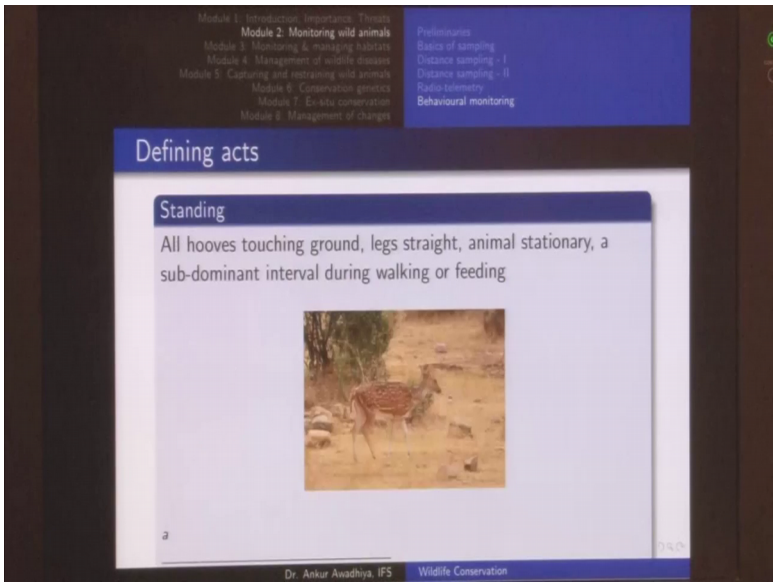
So, let us look at one example to see it in more detail. So, description of the study site and the setting. So, this experiment that we did in Sariska Tiger Reserve, here we had an elevated platform, which was a road that was passing through the forest. And here we had a water body here we had some trees and we had some chital. So, when we start our making of our ethograms, we start by describing the scene where we did this experiment.

(Refer Slide Time: 30:07)



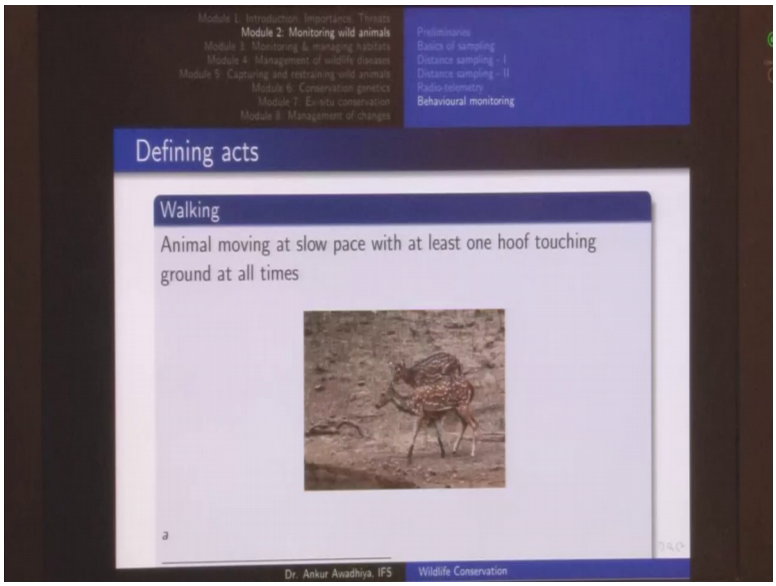
Followed by definition of the acts so, in this picture we can see a chital that is sitting. So, we defined sitting as a behavior in which the abdomen is touching the ground, the legs are folded and the animal is stationary it is not moving.

(Refer Slide Time: 30:23)



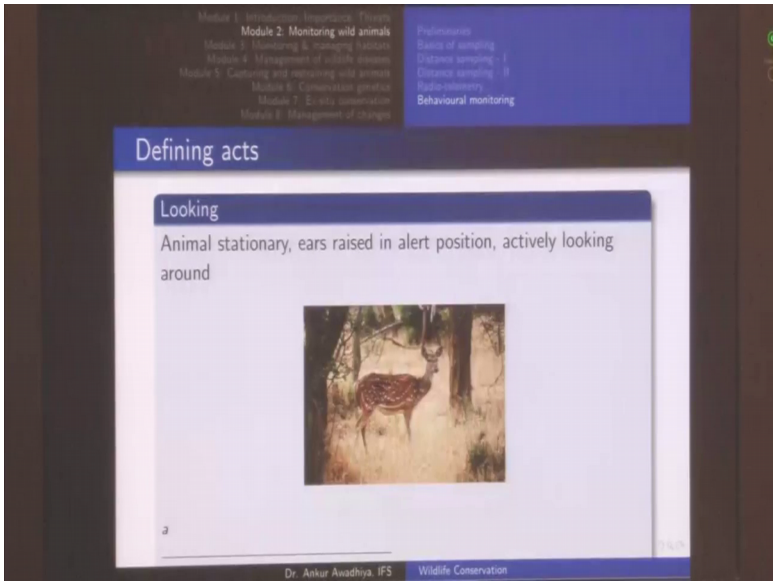
Then next behavior is that of standing all the hooves are touching ground, legs are straight the animal is stationary. And this is a sub dominant interval during walking or feeding. So, while the animal is walking and while the animal is feeding, it would take a break and it would just stand. And while it is a standing it would also look around to search for predators.

(Refer Slide Time: 30:46)



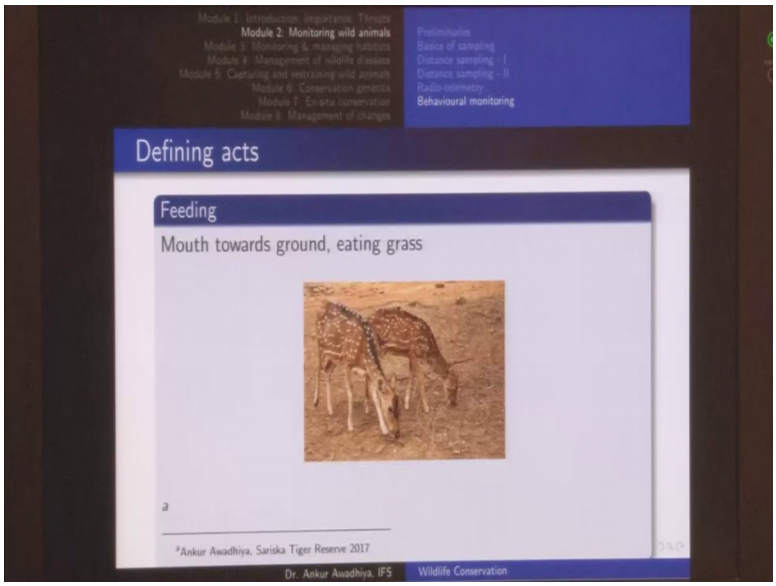
Next behavior is that of walking so, the animal is moving at a slow pace, with at least one hoof touching ground at all times. Now, why is this behavior different this behavior important to be defined, because we can confuse between walking and running so, we will come to running in a short while.

(Refer Slide Time: 31:03)



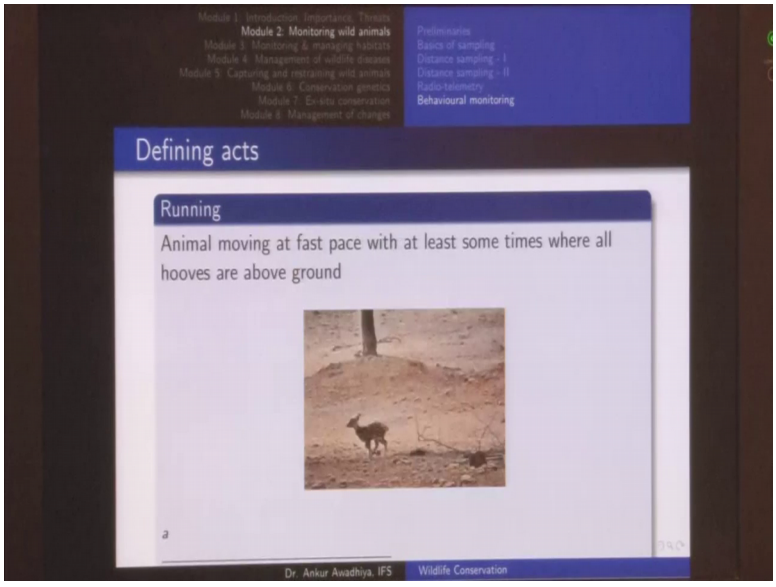
Next is looking. So, in this case the animal is stationary, the ears are raised in alert position and it is actively looking around.

(Refer Slide Time: 31:25)



So, we differentiate looking from standing because in this position we can see that the ears are erect and the animal is actively looking around it is not just passing its time, but it is actively looking around feeding is a behavior in which the mouth is towards the ground and it is eating grass.

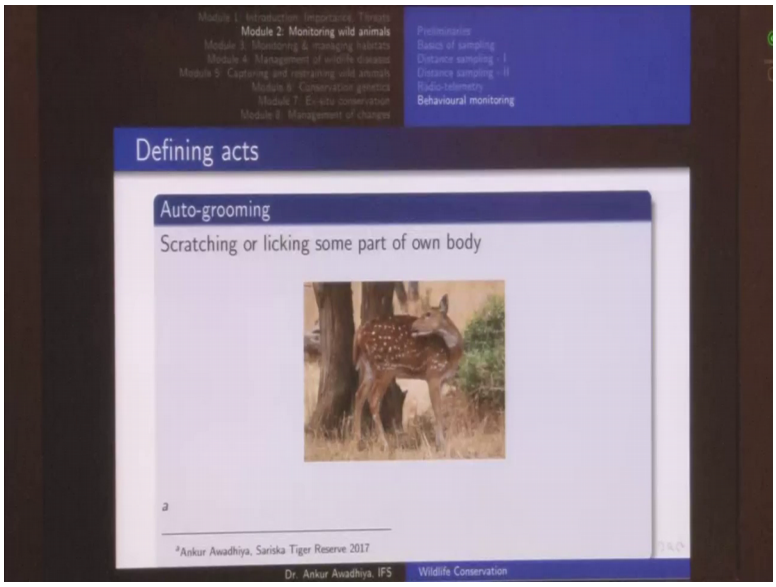
(Refer Slide Time: 31:31)



And running is a situation in which the animal is moving at a fast pace, with at least some times where all the hooves are above ground.

So, essentially we can differentiate between walking brisk walking and running, because in the case of running there would be some points, when all the hooves are above the ground whereas, in the case of walking or brisk walking at all times there would be some hoof that is on the ground.

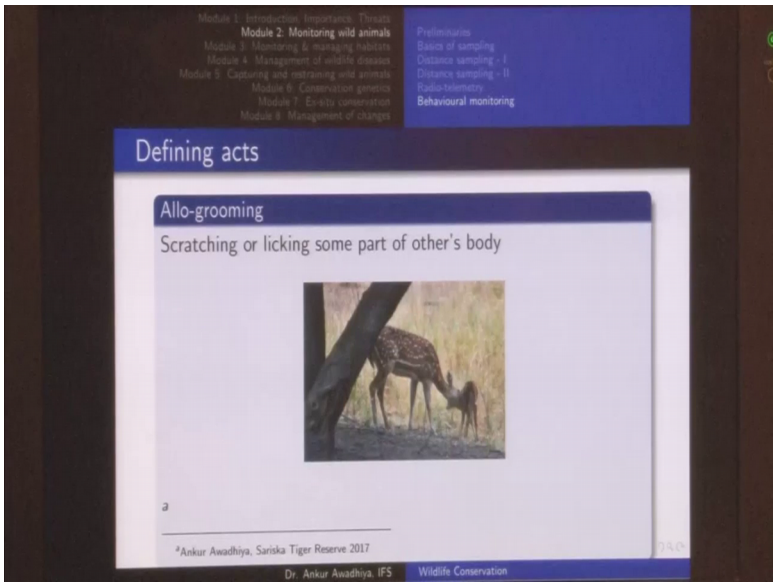
(Refer Slide Time: 31:56)



Next we have auto grooming; now grooming is a behavior in which the animal is trying to clean itself, or it is trying to make itself look much more presentable.

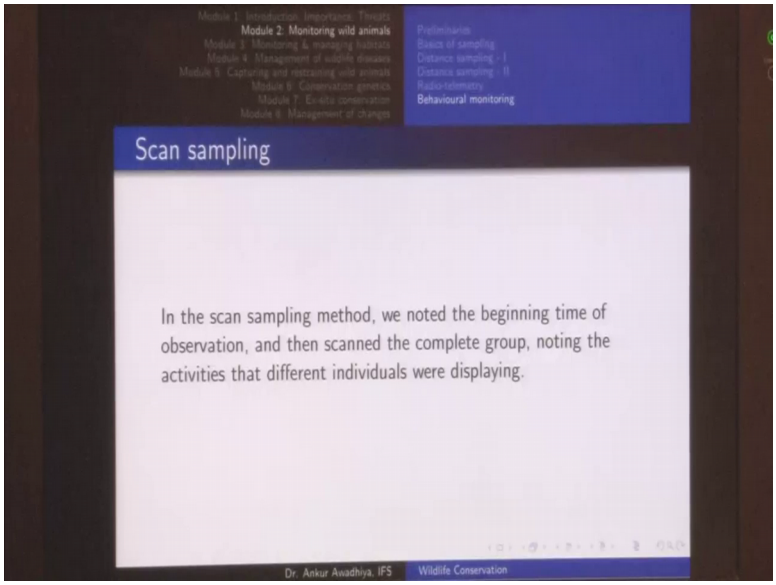
So, for instance in the case of humans when we perform this behavior. So, the next behavior is that of auto grooming, auto grooming is scratching or licking some part of own body. Now, this is a behavior in which the animal is trying to clean itself or to make itself look more presentable. So, essentially like in the case of humans, when we part our hairs when we are doing something like this, this is auto grooming. So, the animal is grooming itself so, which is auto plus grooming

(Refer Slide Time: 32:37)



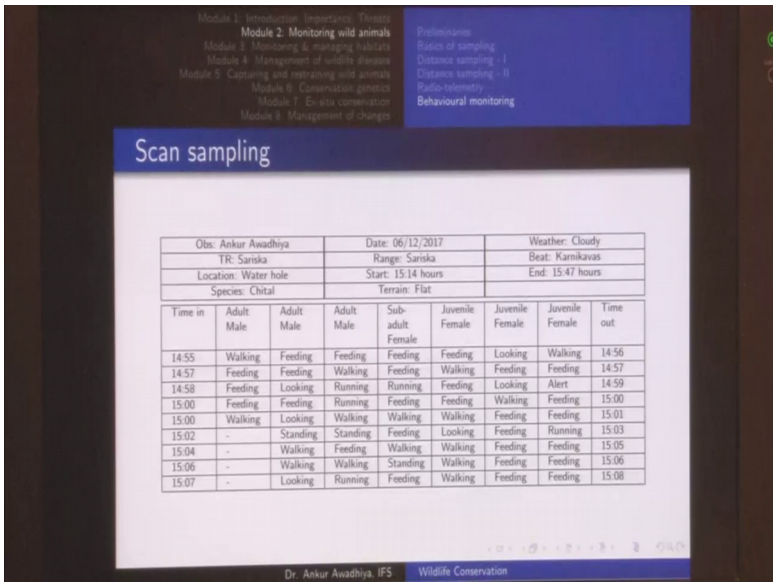
Another act is called Allo grooming. So, allo grooming is scratching or licking some part of somebody elses body, in most situations this involves the mother and the child, or it involves two mates. So, which are trying to sniff around trying to lick each other to clean it clean themselves and also to provide signals that, they are receptive to mating or in the case of mother and child the mother is taking care of the child.

(Refer Slide Time: 33:04)



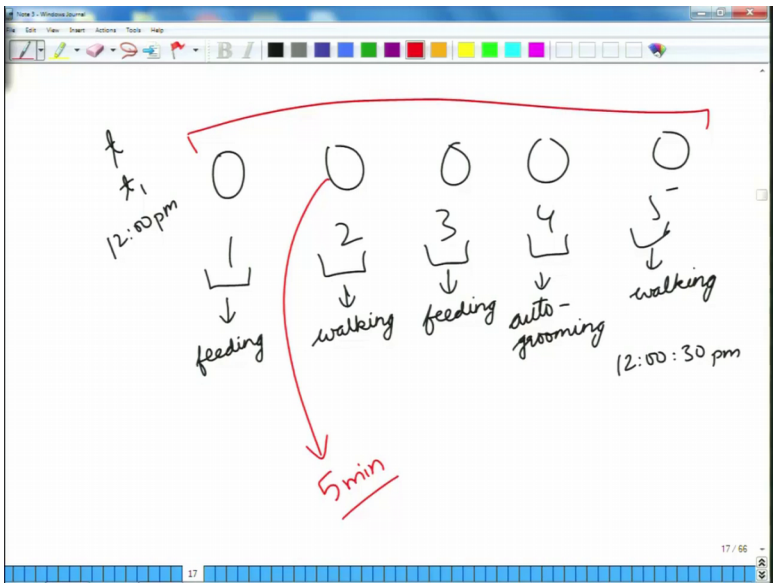
So, once we have defined all these behaviors, then we can begin with scan sampling.

(Refer Slide Time: 33:09)



Now, in the scan sampling what we do is that when we have a group of animals. So, suppose we have these five animals will note down time so, t is equal to t 1. And then we will look at each of the animals for a short duration to understand what each of them are doing.

(Refer Slide Time: 33:35)



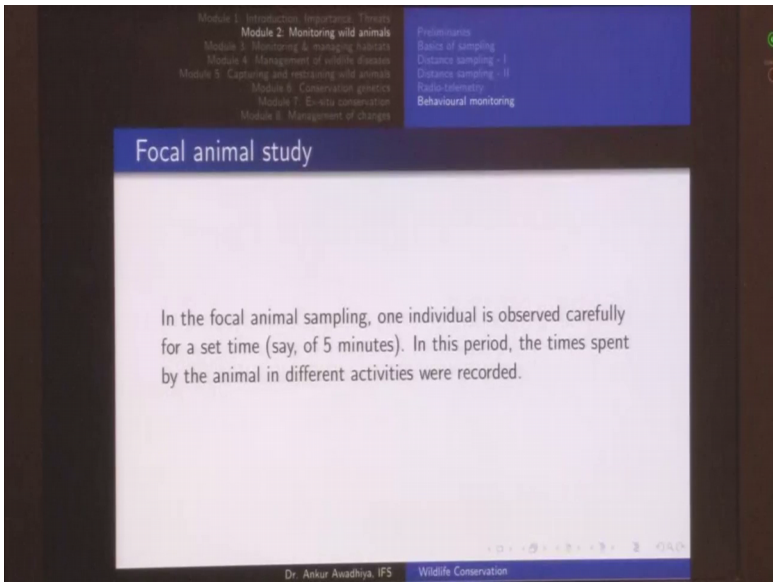
So, for instance we start at twelve p m and then we see that the first animal is feeding, then we look at the second animal this second animal is walking. The third animal again

is feeding the fourth animal is say auto grooming, then the fifth animal is walking. And then we note the end time again. So, suppose it was 12 00 30 pm.

So, we took 30 seconds to scan these five animals. Now, coming to the slides this is how one such sheet would look like. So, we begin at 14:55 hours so, this is 2:55 pm then we have listed all the different animals. So, the adult male was walking adult male was feeding adult male was feeding sub adult female was feeding juvenile female was feeding, juvenile female was looking juvenile female was walking and at the end our time in the watch was one 456.

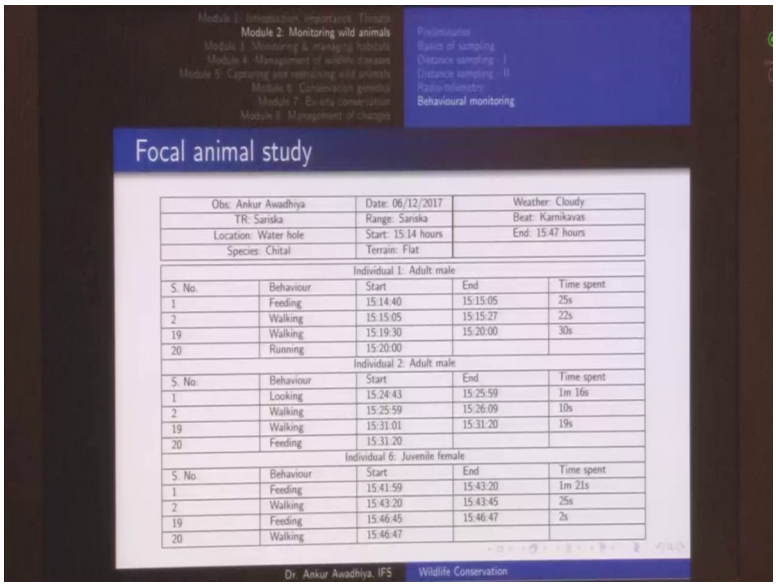
So, we took one minute for this scan. Once we have done from there to here, next we do this process again so; we are going to repeat this process again and again. So, that we are scanning the whole group to see what different animals are doing.

(Refer Slide Time: 34:57)



The next way of understanding the behavior is focal animal sampling. So, now, in the case of focal animal sampling in place of looking at all of these animals together, we would say look at this individual for a period say 5 minutes, to understand what it is doing at different points of time.

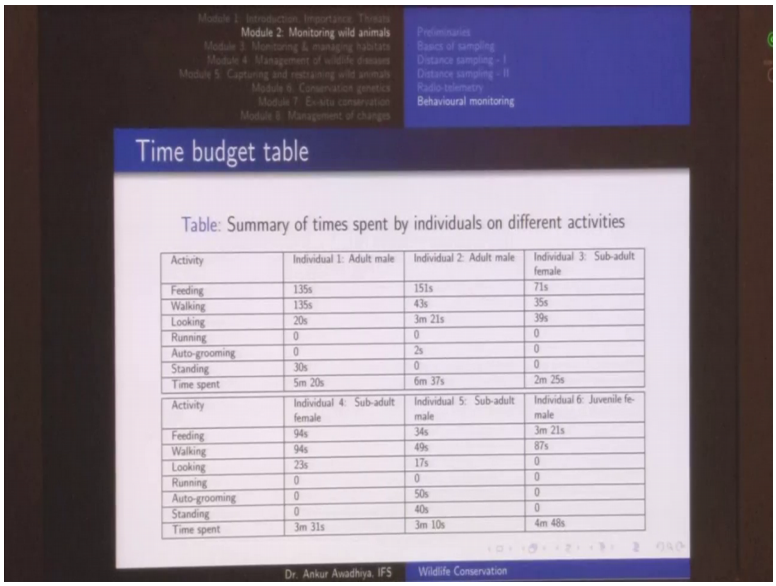
(Refer Slide Time: 35:18)



So, coming back to the slides so, this is how the sheet would look like. So, we have serial number 1 to 20 so, we took 20 observations for each animal. So, the first animal individual one adult male so, its behavior was feeding so, we started at 15:14:40 we ended at 15:15:05, then at 15:15:05 this animal started walking and it continued its walking behavior till 15:15:27, then at 15:15:27 it started some other behavior.

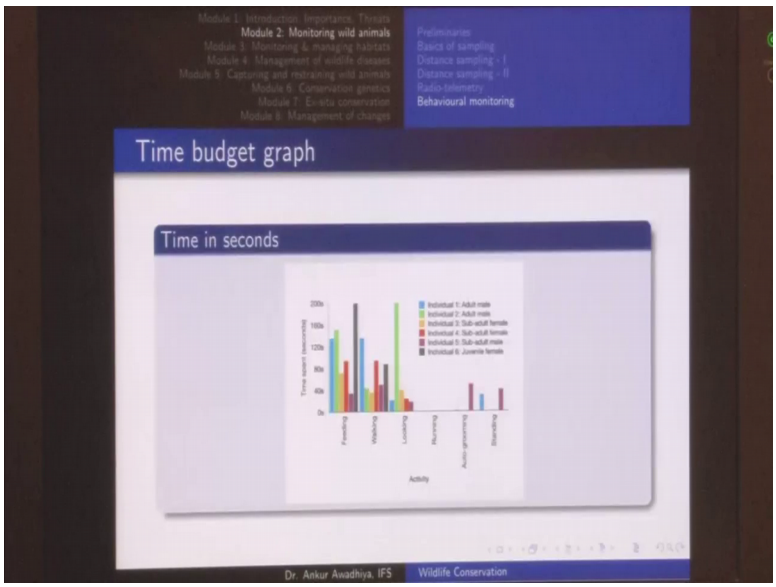
So, so for want of off space we have only shown the first two and the last two end teeth for every animal, but what we are trying to see is how much time did this animal spend on feeding. So, in the first go its it fed for 25 seconds, then it walked for 22 seconds and so, on for each and every animal. So, in this case this is focal animal sampling, because we have we are focusing all our attention on just one animal.

(Refer Slide Time: 36:20)



Now, from the previous chart we can make a time budget table. So, in the case of a time budget table we can see, that out of this time of 5 minutes and 20 seconds that we observed individual 1, how much time was spent on feeding, how much time was spent on walking how much time was spent on looking and so, on and similarly for all the different animals in the group.

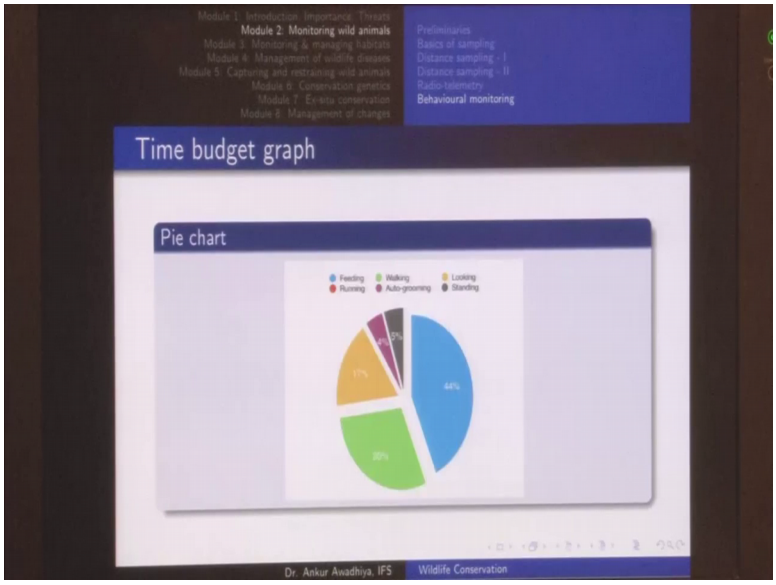
(Refer Slide Time: 36:45)



Once we have made that we can convert these charts into our time budget graph. Now, in the case of a time budget graph, we list all the activities on the x axis, the time spent on the y axis and we represent different individuals by different colors.

Now in the first go we can see that feeding is an activity that is dominating all the different individuals, because this region is showing activity by all the animals. Similarly walking, then looking is done by 1 2 3 4 5 animals auto grooming is done only by one animal, standing is done only by two animals and running is not done by any animal. Now, we can represent it in terms of time or in terms of percentage.

(Refer Slide Time: 37:25)



Now, this can also be converted into pie charts. So, in this pie chart we can see that feeding took most of the time of these animals followed by walking followed by looking. Now, why is it important to quantify all of these information is that, if we performed one such experiment now. So, for instance there is a forest in which we are planning to establish a new road.

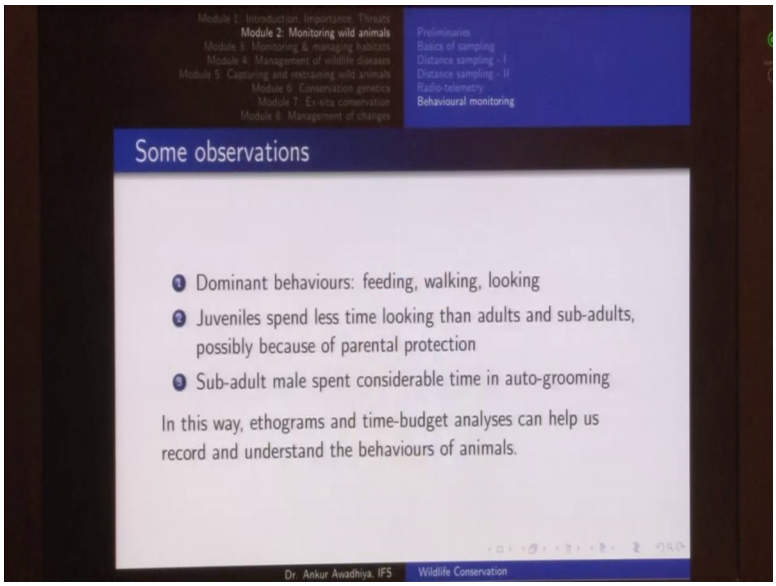
Now, will this road have an impact on the animals, will this road show some form of disturbance in the lives of the animals is what we want to quantify. So, what we would do is that before this road is constructed, we would perform one such experiment or a set of such experiments. And once this road has been made and it is and is being used by vehicles, we would perform this experiment again.

Now, if you observe that earlier, the animals were spending like 44 percent of their time feeding, when this road was not built, but after this road was built they spent say 25 percent of their time on feeding and in the case of looking this 17 percent increase to 50 percent.

So, in that case we would say that the animals are feeling threatened they are feeling stressed, because of which the time that they should be alerting to feeding is now being allotted into looking and for predators or looking for dangers, why is it important because if the animal is not able to feed itself properly. Then it would also not be able to reproduce properly. So, essentially our prey population would then go towards a decline.

So, when we have quantified all these values, then it becomes possible to compare these values from at some other point of time, or at some other place.

(Refer Slide Time: 39:12)



So, some observations from our data that we looked at just now, is that the dominant behaviors were feeding walking and looking. So, most of the animals were doing feeding walking or looking, juveniles spent less time looking than adults and sub adults probably because of parental protection.

So, this is something that we can see here so, if we look at the juvenile. So, here we have only one examples number 6. So, juvenile spent very less amount of time looking.

Similarly did the sub adult however, the adults spend much more time. So, thus first individual spent a bit less time, but then the second individual spent quite a lot of time.

So, essentially because the juveniles and the sub adults are under the protection of the adults so, they can spend less time looking around, because they are others who are looking around for them, sub adult male spent considerable time in auto grooming so, it was trying to make itself look much more presentable. So, it was growing up. In this way ethograms and time budget analysis can help us record and understand the behaviors of animals which becomes extremely important for monitoring of animals certain times that is all for today.

Thank you for your attention jai hind.