



**SAIGA ANTELOPE
CAPTIVE HUSBANDRY
REPORT**

JANUARY 2017

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Introduction

On the 11th May 2016 I embarked on a journey to Russia and Kazakhstan. The aim was to travel to as many Saiga Antelope (*Saiga tatarica*) "captive breeding centres" or "breeding centres" as possible in the space of two weeks. Because of the distance to each of the captive breeding centres the total number visited was three, including a visit to a provincial nature reserve in the Astrakhan Oblast to observe wild saigas. The goal of my trip was to collect as much information as possible on the husbandry of Saiga and collate that information into a usable husbandry guide for all captive Saiga keepers. This is an ongoing project and it is my hope to visit more captive breeding centres and revisit previous captive breeding centres in order to obtain more data.

As of this paper being written there are six known captive breeding centres in the world for Saiga antelope (this number does not include zoos or those affiliated with zoos). Four of these are in the natural range states of the Saiga antelope; they are in the following locations: Rostov, Yashkul, Astrakhan, in Russia; near Tasqala in Kazakhstan. The other captive breeding centre within or close to saiga range is a facility in the Gansu province of China. There is also a semi-natural captive breeding centre at Askania Nova, Ukraine. They all seemed to be fairly successful at breeding Saiga antelope so I was confident I would be able to learn a lot from them.

Saiga antelope have a very sobering history in captivity. Many zoos (worldwide) have attempted to keep Saiga within their collections with very few having any success. The most likely cause of death has been disease or trauma. Historically there are many zoos that have kept Saiga in their collection in both America and Europe and in the range states of the species. Some notable zoos are Berlin Tierpark, San Diego Zoo and Cologne Zoo. We can learn a lot from all the zoos that have kept Saiga in the past, regardless of whether they were successful or not. It is imperative to the survival of captive populations of Saiga Antelope that information is collected from these sources and collated into a usable format.

The captive breeding centres that exist today have encountered problems, but tend to be slightly more successful than the zoos, potentially due to the fact they are in the range states of the species. The successes or failures in Saiga captive husbandry could be down to many factors, however.

Translators

I acquired the services of three different translators during my time in Russia and Kazakhstan depending on where I was. Although they were very useful and without them I would not have been anywhere near as successful as I was, certain questions were misunderstood, and many questions went unanswered. If another trip is planned, then a translator with an extensive knowledge of zoos and animals would be very useful, including a working vocabulary of English as well.

Rostov Captive breeding centre - 12th May

The first visit was to a captive breeding centre situated in a small village near to Rostov-on-Don in the Rostov oblast in Russia. The centre is called the Centre of rare animals of European steppes. I was shown around by the director of the centre, Anatolyi Nikolaevich Dolzhikov,. The captive breeding centre resembled a small commercial petting zoo or farm with animals like ostrich, various horse breeds and small mammals. The centre was used by students and researchers to study the Saiga on an apparently regular basis. The Saiga were seen

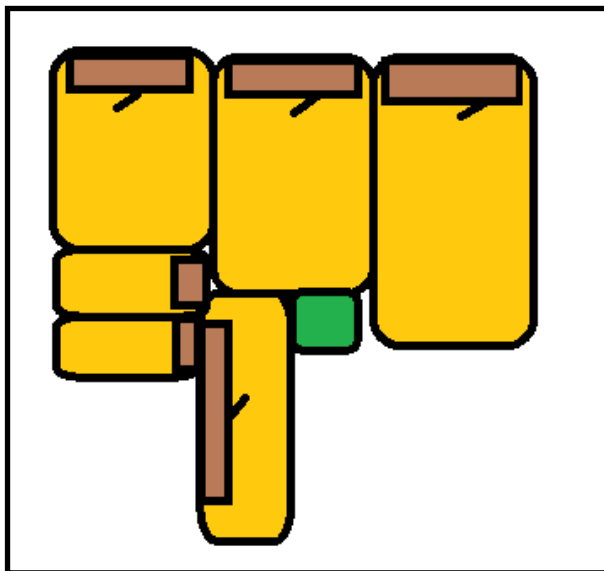
from a small watch tower-like building situated next to the enclosures. Rostov captive breeding centre had around forty Saiga antelope.

Enclosures

The saiga were kept in pens with walls made of asbestos attached to chain link fencing. The pens were very small compared to that of modern day zoo standards. There was no grazing in these enclosures only dirt substrate. There were four main pens each with different groups of Saiga. One with only sub-adult males (three). Two pens contained young females apparently not breeding (ten in one paddock, three young females in another). The fourth pen had breeding females that had given birth or were expected to very soon (eleven adults and five new born calves). We were also shown one small pen about the size of a large dog kennel with one adult male. There were more of these pens, but it is unknown how many pens there were and how many males they held there. The single lone adult males were used for breeding however there was no apparent way for the male to get into the main set of four enclosures, it is possible that they caught the chosen male before the breeding season and placed him in the enclosure with the specified females.



Photographs of the Saiga and two of their enclosures at Rostov captive breeding centre.



A rough sketch of the enclosures at Rostov. (Drawn from memory).

The green box is the watchtower and brown are the shelters/houses

There was no furniture in or around the enclosures. There were no trees in the enclosure but plenty of trees on the outside. There is definite potential to expand the enclosures and incorporate the trees as well. This would help to improve the shelter situation and also increase the topography of the ground. It would allow some grazing as well. Areas that the saiga could hide from stressors, like keepers or each other, would really improve the well-being of the animals.

There was evidence of damage to the asbestos walls and also a few animals had either broken horns or damaged legs. The enclosures had shelters that resembled small dark sheds. There was little evidence of the Saiga using them. Anatoly mentioned that when catching up the animals for veterinary procedures and other management purposes, he would use these shelters for this task. It was unclear as to whether he had already managed this or planned to in the near future. The sheds were also made from asbestos.

Behaviour

The Saiga at Rostov seemed very inactive. There was no fighting between males. The females and the young males tended to lie next to one another. The odd animal may wander around the enclosure but very infrequently. None of the animals were grazing on the grass piles provided and no ruminating was apparent. The visit to the captive breeding centre took place late morning so the animals could have gorged on the grass in the morning. You would expect to see some ruminating behaviour though. The females that were pregnant were a lot more active. Even those that had had their calves seemed to be busy investigating the enclosure. No pacing was evident.

Breeding

Breeding at the Rostov captive breeding centre seemed to be quite successful. There were around ten potentially pregnant females in the largest enclosure. Two females gave birth during my stay at the captive breeding centre. Both mothers and young seemed healthy, active and alert. The enclosure does not allow the mother to move away from the rest of the herd for parturition. However she did not show any signs of stress. Other females tended to investigate without any aggression from either party.



Photo of mother and calf born minutes before.

Management

Young males are kept together for around two years of their life before they become sexually mature. They are then separated into smaller pens and used for breeding. Males are kept separate from females throughout most of the year. In November one male is introduced to the females for one month before being removed again and placed into the original smaller enclosure.

Diet

In each enclosure there was a pile of cut grass in a corner near each shelter where the keeper can throw it over the fence via a ladder. There did not seem to be any old grass underneath or anywhere else in the enclosure so the grass pile was possibly cleaned on a daily basis and replaced with fresh grass. Anatoly mentioned providing browse on a regular basis. There was no evidence of this in either enclosure however he may have been stating that he is going to try it. No supplement like a pelleted feed was apparently provided but it is unknown whether they supply this in the winter due to low forage availability.

Thoughts

The enclosures are not suitable for the species. The asbestos walls break easily but provide a solid wall for the Saiga to harm themselves upon. The shelters were potentially objects of fear for the saiga if they had been caught up in them before and it is unlikely they will use them. The substrate is unsuitable as it becomes very cloying when it is wet and because of the compaction of the earth it did not drain well. But it is also unsuitable for the very fact there is no grazing. The enclosures had no furniture or any features what so ever

The Saiga did not look at their best. Coats were patchy, their winter coat had not completely shed, but also they were very wet due to the lack of suitable shelter. The inactivity could be due to the lack of grazing or general lack of enclosure furniture. The lack of space could prove to be problematic in future particularly as the herd grows. Though the conditions are sub-standard the saiga at the captive breeding centre bred regularly. According to the owner, numbers have increased every year.

Recommended improvements

- Give the Saiga more space (more enclosures and a lot more space within each)
- Change the topography of the enclosure (build up ground for hills or mounds and introduce furniture which will allow the Saiga to hide away from one another).
- Include rest paddocks to allow grass to grow.
- Introduce a system of identification and daily record taking.
- Make the shelters more suitable for the species (perhaps even including trees in the design of the enclosures if it is possible).
- Reduce the use of asbestos

Yashkul - 14th - 17th May

The Centre for Wild Animals of the Republic of Kalmykia is directed by Yuri Arylov who was also my host for the duration of my stay in Russia. The centre is situated near Yashkul which is 90km East of Elista. Yuri is a scientist and expert in Saiga antelope. His captive breeding centre was created in order to keep and breed Saiga antelope in a bid to learn more about the species. The captive breeding centre is used by many researchers and students interested in studying saiga. The Yashkul captive breeding centre was previously funded by the Republic of Kalmykia government. That funding has stopped and no further support from the Russian government has been received. The Saiga Conservation Alliance currently funds the centre.

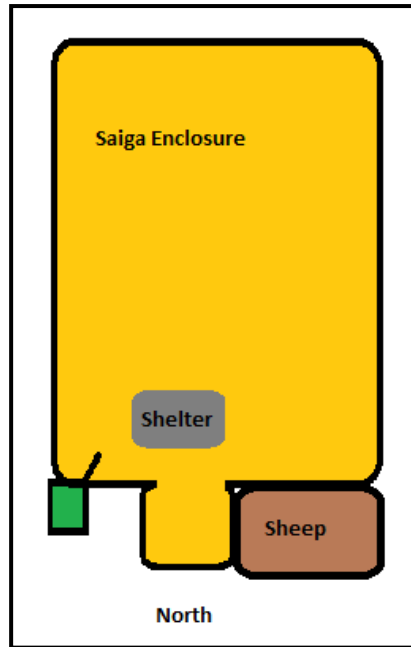
In 2015 almost one hundred animals died at the centre due to an unknown disease. At the time of the visit there were only three Saiga antelope at the centre, one male and two females. During the stay at least one calf was born. The visit was around three days. It allowed for a prolonged study of the Saiga which helped to achieve a better picture of what those specimens did throughout each day depending on weather and other factors that might affect them.

Enclosure

The enclosure at Yashkul is vast and is also singular. It is difficult, bordering impossible, to see the Saiga in their enclosure with the naked eye. The substrate is grass and there are no trees in the enclosure. The whole enclosure is typical steppe habitat. The fencing is chain link fence with asbestos used towards the entrance of the enclosure at the north side. To the right hand side of the entrance are shelters and a potential catching area which had not been used for a long while.

The surrounding landscape is much the same with a few trees dotted about. Bordering the Saiga enclosure is a small sheep pen near the north entrance and to the south is a farmyard consisting of sheep and cattle. Both species can reach the Saiga fence.

The enclosure has a watchtower near the entrance but at this current time this is rendered useless as you cannot see the antelopes from it. When there were over a hundred animals in the enclosure it had more of a use and was used regularly by researchers and others interested in the species.



The enclosure at Yashkul breeding centre. The picture is in no way to scale. The enclosure is vast. The green box is a watchtower.

Behaviour

The Saiga barely used the north side of the enclosure (the entrance and nearest side to human habitation and dogs). There were no faeces near that area. When the Saiga were spooked by humans or loud noises they ran around the enclosure the same circuit every time. At that point they entered the asbestos fenced area but spent no more than a few seconds at a time there. They preferred the south side of the enclosure because it was the furthest point away from any of their stressors.

The difference in behaviour in comparison to the animals at the Rostov captive breeding centre was striking. These animals moved constantly. They grazed throughout the day. Occasionally they were out of sight due to them lying down, but not often. The male was very active throughout the day. He charged the females a few times but they took no notice. The female did not visit the calf at all during the times they were being watched. One can only assume she was waiting until it was safe to do so. This is a natural behaviour that has been seen in the wild.

Breeding

The Saiga were left to their own devices when it came to breeding. Even when there were a large number of animals in the enclosure there was no way to stop any individuals from breeding. During the visit a calf was born which was noted down by the keeper. Because of the size of the enclosure it is not possible to catch the calf to sex it or to provide inoculations. They will not know the sex until it is older and shows sexual dimorphism.

Management

There was little to no management of the Saiga at the centre. The animals were checked throughout the day by binoculars. Fence damage was checked for regularly. The area for management was near the entrance to the enclosure. It did not look like it had been used for some time. None of the animals had any notable features or identification like tags or collars, etc.

Diet

The diet for the animals consisted of the grass that existed naturally in the enclosure. In the winter they provide pellet.

Thoughts

The Yashkul captive breeding centre on arrival is picturesque and exactly what you want to see in a Saiga antelope enclosure. The large enclosure allows the Saiga to exhibit more natural behaviours and also allows them the opportunity to remove themselves from stressful situations should they choose to. On closer inspection it does fall short of a few details that may have caused the die off in 2015.

The enclosure is vast which provides challenges when keeping any species. There is no way to properly check on the animals, you cannot get very close. If an animal is wounded then there is a chance this is missed on inspection. Even if the problem is spotted, due to the nature of Saiga and their enclosure there are very few possibilities of catching them. If a catch-up were to be attempted it could result in more injuries and definitely higher levels of stress. Higher numbers of animals may also result in an increased need for this type of management. An interesting comparison would be to compare the behaviours of the saiga pre-2015 and after the die off. Higher numbers of animals could show varying degrees of behaviour change. An increase in herd size could force animals nearer to the north side of the enclosure. An increase in herd size also increases parasite numbers but due to the size of the enclosure it is hard to know when this could be a factor. Inbreeding would eventually become an issue if the breeding centre was involved in a managed breeding program. With multiple males in such a large area it is very difficult to know who the sire is.

On all sides of the enclosure were various livestock. Both sheep and cattle could reach the fence and potentially touch noses with the Saiga. This is a potential hazard for disease transmission. One notable disease that would be prevalent during the birthing season is malignant catarrhal fever (MCF). It is typically a fatal disease that affects mainly ruminants. Animals are infected by aerosol transmission. Sometimes no clinical signs are evident but it can show up as alopecia and weight loss. Death can be sudden. The disease can affect large numbers or just a few in a herd. It is most prolific during the breeding season as it is shed during parturition. Goats and sheep tend to be carriers of the disease and not affected outright. It is unknown whether Saiga antelope are affected by MCF, however it is very likely due to similar species being susceptible. This is one possible outcome of livestock being close to the fence. Dogs were consistently barking throughout the day; a potential stressor. It also could be the reason for the animals preferring to spend almost all of their time on the south side of the enclosure, further away from the main building.

Recommended improvements

- Changing the enclosure to improve the management of the species (splitting them into two or three enclosures).
- Removing proximity to domestic species and other disturbances (dogs barking).
- Changing the topography of the ground (building hills and mounds).
- Installing shelters in various parts of the enclosure (allow the Saiga to choose their shelters).
- Introducing a system of identification (even if you can't see it from afar, if the animal dies you will be able to identify which animal died and who they are related to).
- Less use of asbestos

Stepnoi reserve, Astrakhan

The visit to Astrakhan was short but extremely helpful in creating a picture of how Saiga antelope behave in the wild. The Stepnoi State Nature Reserve in Astrakhan is home to around three thousand antelope. The reserve is managed by a small team of rangers who regularly take stock of sightings, manage the habitat and protect the reserve and its inhabitants from poachers. My host Vladimir Kalmykov (the reserve Director) was very proactive when it came to communicating with locals. He regularly met with farmers and other land users and encouraged responsible farming and land use.

The visit consisted of one evening and half a day. Both evening and morning were spent in a hide overlooking an artificial water hole, designed to attract animals like Saiga antelope and important bird species. Upon arrival it was stressed that it is unlikely that Saiga will be spotted. The Saiga decided that this was not the case. The evening spent in the hide was non-eventful as far as Saiga go. But the morning proved well worth the wait. Four Saiga antelope came in from the west and stayed for around thirty minutes. They were constantly on the move looking for the best grazing spots. It was a group of three males and one female. Two of the males looked younger and tended to fight more, but not seriously. They left in the same direction as they arrived in. Around thirty to forty minutes after they left they returned again with another female. This pattern occurred throughout the morning until a large group of males arrived at the water hole towards noon. There was a report of a large herd of five to six hundred animals coming in from the west around twelve but these were not seen at the hide. The groups seen at the water hole were small in number and more males than females.

Throughout the time of watching the wild Saiga, it was apparent that these animals are constantly on the move. They do not sit still for long. When they graze it is very fast paced. They only drink for a few seconds and then move on. They spent forty minutes (maximum) at the water hole and then left, to then come back three more times that morning, every time spending no more than thirty to forty minutes. The males in the group, particularly the young ones, were regularly play fighting. Fights would only last ten to twenty seconds and no one would be chased off, stopping was mutual.

Kazakhstan - 19th - 21st May

The Tasqala captive breeding centre in Kazakhstan was probably the most remote place out of all my stops. However that did not diminish the resources the captive breeding centre had. Tasqala was a young captive breeding centre, started only a few years prior to the visit. It is owned and funded by the University of Uralsk* and run by numerous employees of the university. The Director is Bibigul Sarsenova.

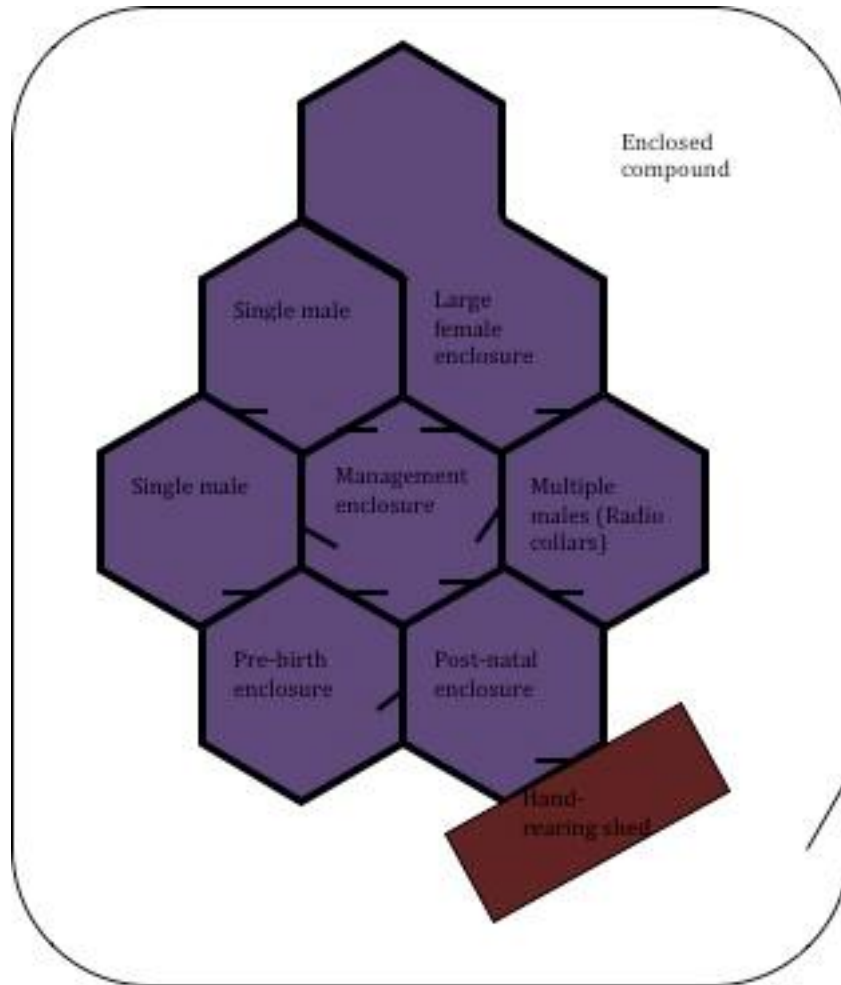
The herd they have is small but slowly on the increase. There were around fifteen Saiga - not including newborn calves - at the captive breeding centre. They started with a few wild caught specimens which they hand-reared and from which they have subsequently bred three more generations. The differences of this captive breeding centre to the other two in Russia are obvious. The Tasqala captive breeding centre is very hands-on with their Saiga. The majority of the Saiga they have are used to the presence of humans in and about their enclosure. Some animals even come up to their keepers. Older males tended to be more fearful and even aggressive. One male had a broken leg but it was unclear how it happened. Apparently it was too dangerous to try and fix the leg which had broken twice during his lifetime.

Enclosure

The enclosures at Tasqala had a honeycomb layout to them. There were six enclosures in all. The middle enclosure at the centre of the honeycomb was a management paddock. They used this paddock to move animals to different enclosures. During the visit it was used to move females with calves to a larger paddock. Two enclosures housed around four to five females, one with calves, the other with pregnant females. Older males were kept in separate paddocks of similar size. Three young males shared an enclosure. There was a larger enclosure to the back of the complex reserved for the females after calving season. Females and males could meet through the fence. Each enclosure had its own shelter. All of the shelters seemed to be used regularly.

The enclosures were fenced with chain mesh. The fences had dried rushes lined around the whole enclosure to soften any impacts from the Saiga. The shelters were made out of asbestos panels. The enclosures were roughly three times the size of the enclosures at the Rostov breeding centre and had fewer animals to each enclosure as well. The substrate was steppe grassland. There seemed to be plenty of grazing for the animals. The grass was also long enough for calves to hide. There were no interesting features in the enclosure, no furniture or natural features like trees or rocks.

There were no other animals around the captive breeding centre. The nearest livestock could get to the Saiga enclosures was about one hundred metres.



A rough sketch of the Tasqala breeding centre enclosures. Small shelters were installed into a corner of each of the enclosures.



Photo of a Saiga sitting next to a fence lined with rushes. This technique was used to reduce the risk of injury should a Saiga run into the fence. This behaviour was not seen regularly at Tasqala, but not unheard of.



Photo of Bibigul the Director of the Tasqala captive breeding centre and a Saiga mother and her calf. In the background is a nursing hut for calves and the research hut and living quarters for the researchers use.



Photo of part of a female enclosure with shelter.

Behaviour

The Saigas in Kazakhstan seemed to be very active throughout the day. Certain individuals paced, particularly the young males and pregnant females. One reason for the pacing could be the biting insects which tended to be a lot worse in Kazakhstan than at the other breeding centres. Calves tended to hide or follow their mother. All the animals regularly grazed and sat ruminating for a good period during the day.

Breeding and Management

Males were kept in separate pens. One male was introduced to the females early November and removed at the end of December. All of the females were either pregnant or had just had calves and were in their respective enclosures. New mothers were moved to a "post-natal" pen after parturition.

All the animals at the captive breeding centre were tagged and had their own ID number and name. The keepers could choose who was breeding with whom. They actively tried to reduce inbreeding and were planning to bring in a new male so they would not get into a bottleneck situation.

The three young males were wearing GPS radio collars around their necks. They were in "training" for release. The main purpose of this was to see if the males had any problems with the collars day to day.

Diet

This time of year grazing was the only source of nutrition for the Saiga. It was not determined whether they get extra supplementation in the winter. The pens were rested for one to two months regularly. After I suggested it, a willow branch was provided for each of the Saiga. A few individuals ate the leaves but the bark was untouched. It is unclear if the captive breeding centre will continue to feed willow or other browse species.

Thoughts

The husbandry techniques used at the Tasqala breeding centre was a different approach to the other two breeding centres. It had its similarities to Western zoo techniques. The methods used, such as individual identification, a hands-on approach and record-taking echoed Western zoo practices. Each individual was recognisable by its own collar tag. Records for each animal were kept safe and a daily diary was used to note down births, deaths and any important behaviour. The hands-on approach helped towards conditioning the animals to human presence. Injuries were minimal due to the animals appearing to be calm. Saiga are an extremely sensitive and flighty animal, the hand-rearing of individuals certainly reduced this flightiness and seemed to reduce stress levels. It also allowed the centre to collect a lot of data which will inevitably be useful in the future.

Hand-rearing and being very hands-on with the animals can have its drawbacks however. Hand-reared animals have been known to display unusual behaviours that can be detrimental to the individual or herd dynamics. Hand-reared animals can also be more aggressive and prove to be harder to manage in certain situations. Some zoos exhibit a no hand-rearing policy for these reasons and many more. It would be unlikely that these animals could be used for reintroduction. Separate enclosures would need to be constructed where management was slightly altered. It is important for reintroduced animals to fear humans, for example, so an enclosure and management set up like seen at Yashkul could have potential for this. The behaviour most apparent to this group of Saiga was that they paced. The females were being moved to a larger enclosure after they had given birth. It is unclear whether this lessened the pacing behaviour. A more extensive behaviour sampling study would need to be carried out to learn about this. Each enclosure could be improved dramatically if it had extra features and furniture. Even simple features like a few mounds or a small pond would change the topography of the enclosure and maybe benefit each of the animals. It is worth looking into - in the wild the Saiga can mostly choose where they want to go, they do not have that option here, so it's important to give them as many options as possible. The larger enclosure was also further away from males, which are a potential stressor for females during the birthing season.

Recommended improvements

- Improve complexity of the enclosures (furniture, places to hide)
- Adopt strategy to deal with increased pacing (study the behaviour of captive Saiga to determine what might encourage the animal to start this behaviour).
- Improve basic husbandry (having a dedicated experienced animal keeper working with the species could really improve the individual animals at the centre. It would also allow someone to study behaviours at the same time).
- Improve hand-rearing regime (The hands-on approach works for this centre however it is not perfect and could be slightly adjusted).
- Look at diet improvements (Could a pellet be introduced on a daily basis?)

Overview

The trip was helpful in determining the needs of Saiga. It certainly opens up more questions and the need for a more extensive trip. With a better idea of what the scope is, another trip could be more focussed on perhaps one captive breeding centre. With advice the centre could enter a phase of testing in order to learn more about the Saiga in captivity. For example, improvements in fencing could be developed, enhancements in diet - such as seeing whether a pellet could provide all they need (particularly useful in captive husbandry held in out of range states), and better general husbandry and welfare. All three breeding centres offered varying levels of husbandry techniques. It is hard to identify which were successful and which were not due to the very fact that every centre was breeding their Saiga. The centre that had the most space and held the most promise actually fell short due to its current lack of animals.

Of all my communication with various zoo keepers and experts that have worked with Saiga, everyone is of the same opinion: Saiga need space, and a lot of it. They need areas that allow them to run a good distance away from stressors. The two captive breeding centres that didn't have a lot of space for their Saiga were doing very well in breeding. This highlights that Saiga are no ordinary species to be keeping in captivity. Breeding seems to be very easy. But keeping them alive, happy and disease-free seems to be more difficult. Saiga look to be extremely susceptible to disease. The challenges are much the same as in the husbandry of Musk Ox (*Ovibos moschatus*). It will not matter if you can breed Saiga, if in a few years time they all diminish from some unknown factor. In such small enclosures, diseases or at the very least parasites are likely to be high in number. Faecal sampling and blood tests could help to identify a number of these factors.

Should another trip take place, then the Tasqala captive breeding centre in Kazakhstan would be the best place to focus the project on. The enclosures allow for a higher degree of management and the animals are calm and easier to study. This establishment is the beginning of what a zoo would try to achieve with Saiga antelope. The staff at the breeding centre are researchers, not animal keepers. Therefore there are definite changes to be made to the general husbandry of the animals but every time a change or improvement was suggested they were willing to try anything to improve the lives of their Saiga. Changes in the levels of interaction between keepers, an improvement in diet - their small paddocks cannot supply everything they get in the wild - and

better enclosure design could improve the centre dramatically and if such changes are successful, then the other breeding centres could adopt those improvements as well. There is so much more to be learnt from Saiga.

When speaking to all of the captive breeding centres they all claimed that rainfall was increasing every year with global climate change as the culprit. This could be one of a number of factors affecting Saiga. It could be weakening them and increasing the risk to other factors like parasites. Therefore it is important to provide dry areas for the Saiga in a captive situation. These need to be shelters that the Saiga are not fearful of and that take into account that animals need space. They should not just be areas for catching saigas. Multiple structures should be provided in various areas of the enclosure so that they can choose where to shelter.

Due to the nature of the Saiga's diet it is difficult to provide a range of foodstuffs in a captive setting. Creating an enclosure with variable heights, depressions and other such natural features can encourage different flora. By creating these features one can also allow areas where Saiga can find natural shelter (trees), remove themselves from the rest of the herd if they feel the need to (hillocks or plateaus) or even find higher levels of ground to improve visibility therefore security for the animals (rocks, etc.). Who knows, they may even use natural or man-made features in ways we would not necessarily expect from this steppe species.

Breeding programs

This is very difficult for the older captive breeding centres due to many animals with little or no known history or pedigree. Creating a pedigree or studbook for existing animals in all of the breeding centres currently holding Saiga may be very difficult depending on the records of those breeding centres. The historical data for zoos is available even if it is a bit sketchy depending on the zoo; it is possible to date certain individuals back to the 1970s but again it would be difficult to do and might not be a useful use of time.

In order to create a useful and viable captive population for the potential use of reintroduction, a studbook is integral. It would be useful to start with the Kazakhstan breeding centre where the data have been collected. This could then allow saiga managers to create a pedigree that links all of the breeding centres whilst numbers are relatively low, and to build it from the ground up. Records can be created and kept by the relevant breeding centre and the whole collection of breeding centre records could be held by a "studbook keeper". This studbook keeper could either hold one large studbook for all zoos and breeding centres in the world, or two separate studbooks which can complement one another.

Captive breeding and zoos

One purpose of the project to Russia and Kazakhstan was to see if Saiga were suitable for Western zoos and whether we could be successful in creating a viable captive population. Western zoos have a rocky relationship with Saiga antelopes. Almost all of the zoos that have had Saiga in the past have not failed due to negligence. All one has to do is look at the successes of other species in these zoos and the high level of experience which their keepers. The Saiga are an anomaly, an anomaly that needs more time and effort put into researching their needs. It is obvious that breeding Saiga is relatively easy. Breeding has occurred in numerous facilities but these populations have only lasted a small amount of time and have not been sustainable in creating successful breeding populations.

There are many zoos in Europe with the expertise to look after Saiga. But this has proven to be a waste of resources in the past with the species dying off very quickly. Zoos like Cologne and Berlin Tier Park have excellent success rates in breeding all manner of exotic species, including Saiga historically. But this did not help in the long run to keep Saigas alive and well. If we are to attempt to bring Saiga into Western captivity again then perhaps a different approach is necessary. Climate is obviously an important factor for Saiga and this needs to be addressed when choosing suitable zoos. One Strategy is to choose zoos with similar climate to the natural range states of the species. Collections situated in Spain or Italy have very dry weather throughout the year however their winters might be too short. Hungary has similar weather patterns to parts of Russia and Kazakhstan however their winters are humid and with climate change, we could start to see an increase in wet weather. The other option is to consider American zoos; the climates can vary greatly over the different states and there might be an easy choice there, in particular the southern states. How successful they can be in providing individuals for release is another matter entirely when you consider how sensitive Saiga are to being transported. There may not be a perfect solution to this problem and this will need to be taken into account when deciding whether we should take Saigas back into Western zoos at all.

In order to create a starter population for Western zoos an existing centre needs to be willing and prepared to meet those demands. There are potentially a few ways to go about this. One would be to acquire young animals from a centre or even straight from the wild and hand-rear them at a specified zoo, ensuring these individuals are more suitable to captivity. The topic of hand-rearing is mentioned in a separate paragraph below due to its problematic nature. The offspring of these founders will then be parent-reared. These secondary individuals will be used to a captive setting and their flightiness should be reduced.

The second option is to acquire adults from the existing captive breeding centres. It would require fewer resources but has a greater risk of failure. It could also mean that you could not transport as many animals, again increasing the risk of failure. This method may be quicker however in establishing a breeding population. It would be important to receive animals from multiple sources to ensure no inbreeding occurs, but bearing in mind the potential genetic differences between saiga populations in the different countries.

Hand-rearing

It is no secret that Saiga like to run. Some of the deaths that have occurred in zoos and other facilities historically have been due to animals running into fences. If we to go ahead with bringing Saiga into zoos once more it needs to be done correctly and hand-rearing could be the way forward.

The hand-rearing of any species can be met with an array of reactions. It can cause problems with animals' mental state. In many accounts animals can be a danger to themselves and to their keepers but also some species struggle to breed if an individual has been hand-reared. Not that this is the case in the individuals observed in the Kazakhstan centre, but it could be the reason for the pacing seen in almost all of their animals. Hand-rearing has its uses however, and done correctly and for the right reasons it can be a useful tool, particularly in Saiga and other species that have a very small flight distance. When hand-rearing, it is important to minimize the amount of time spent with the animals. When they are at a point where you can entice them onto a bucket with teats this can help to reduce the imprinting. Another option is to feed with a screen between you and the animal. It is difficult to achieve this initially as you have to force the animal to take the milk, but

when they are more confident this is doable and has been used in other species. Smaller teats would be needed but it is workable for the Saiga.

Conclusions

All of the recommendations shown in this report are based on my own experiences and there will be times where people will not agree with what has been said. It is also important to note that the recommendations are based on the assumption that funding is not limiting, so I do not expect all of them to be implemented quickly or some of them at all. Some may be impossible, but that does not mean they should not be highlighted as worth consideration.

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