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The great rhino U-turn

After 17 years, researchers finally unlock the mysteries of Sumatran rhino reproduction

BY JEREMY HANCE ON 28 SEPTEMBER 2018

Mongabay Series: Asian Rhinos

- *As the 20th century drew to a close the Sumatran rhino captive breeding program, launched in 1984, had yet to produce a single calf.*
- *Home to the last two Sumatran rhinos in the United States, the Cincinnati Zoo made several key discoveries about the species' reproductive behavior, including the fact that females only ovulate when they have contact with males.*
- *Andalas, the first Sumatran rhino bred in captivity in more than a century, was born in Cincinnati in 2001. This success, and the subsequent birth of four other calves, has led to a re-evaluation of the program as a whole.*
- *Now, attention is turned to breeding centers in the rhinos' original habitat as the future of captive breeding efforts.*

This is the third article in our four-part series "The Rhino Debacle." Read [Part One](#) and [Part Two](#).

As we walk out into the zoo enclosure, Cossatot comes over to greet me. Cossatot is a capybara, the size of a very big dog; his species is the world's largest rodent. He quickly determines from smelling my hands that I've neglected to bring him a treat. Looking a bit put out, he goes back to lounging in his one-man kingdom. But where Cossatot reigns was once the domain of an even larger, far more endangered animal. Little does Cossatot know, but his kingdom has made history. I'm visiting the old Sumatran rhino enclosures of Cincinnati Zoo with Terri Roth, head of the zoo's Center for Conservation and Research of Endangered Wildlife (CREW), and Paul Reinhart, leader of the team that cared daily for the rhinos.



Terri Roth inside one of the two enclosures at the Cincinnati Zoo that once housed Sumatran rhinos. Today the enclosures house a regal capybara named Cossatot and two emus. Image by Jeremy Hance for Mongabay.

Roth jokes that the enclosures have fallen far from their glory days when they housed arguably the rarest large terrestrial mammal on Earth. The two enclosures — one for the male rhino, Ipuh, and the other for the female, Emi, and her calves — are now the domain of Cossatot and a pair of nervous emus. Above them are half-million-dollar metal structures that look like giant rectangular umbrellas, built to shade the rhinos' eyes from the sun, just as the canopy does in the rainforest, and prevent severe eye damage.

"Every day we walk in here and I look at those pictures," Reinhart says, pointing to photos of all the rhinos — Ipuh and Emi, Andalas and Suci, and, most beloved of all, Harapan — that once called Cincinnati home.

"I miss all of them," he says.

Last Chance for the U.S.

In February of 1995, one year before Terri Roth would take the job as director of CREW, two Sumatran rhinos died within five days of each other at San Diego Zoo. This left just three Sumatran rhinos in the whole of the United States: Rapunzel, Emi and Ipuh, the sole male.

Over a decade before, in 1984, conservationists had kick-started a [grand plan to capture Sumatran rhinos in the wild](#) and breed them in facilities in Indonesia, Malaysia, the U.K. and the U.S. The bill for this large-scale undertaking was paid by the U.S. and U.K. zoos. Although conservationists were able to capture 40 rhinos over 11 years, [the program had turned into a catastrophe](#). By 1995, nearly half of the 40 rhinos were already dead due to poor feeding practices, disease, accidents and simple ignorance. Moreover, not a single rhino had been bred in captivity. Now, there would be no more rhinos coming to the U.S. Due to a lack of success, the catching had ground to a halt, with the last rhino caught in Sabah, a Malaysian state on the island of Borneo, in 1995.

By this time, the U.K. had only one rhino, a male named Torgamba. Peninsular Malaysia had eight, but no luck breeding. Sabah had five, but only one female. Indonesia had two in captivity, both females.



Male, Ara, gets some alone time with female, Pajang, at Sungai Dusun in Peninsular Malaysia. Sungai Dusun attempted to breed their animals, but to no avail. Ara and Pajang would die within one day of each other from a disease that hit Sungai Dusun in 2003, killing off all of its animals. Image by Mohammed Khan bin Momin Khan.

The U.S. zoo community, down to its last three rhinos, had one final shot at doing what it promised it could back in 1984: making a baby rhino. But the U.S. rhinos were scattered: Ipuh was at Cincinnati, Rapunzel at the Bronx Zoo, and Emi at L.A. Zoo.

Roth says it was the Cincinnati Zoo director, Ed Maruska, who convinced the other zoos to send their females. "They thought, 'Well, if anyone will do it, then Maruska will do it.'"

By August 1995, just months after San Diego lost its two rhinos, the three survivors were all brought together at Cincinnati.

"I'd become very much smitten by the beast," Maruska remembers of seeing his first Sumatran rhino. "It was a hairy animal. It was very unusual, very primitive looking. I thought in every shape or form, Cincinnati's going to be a part of this program."

Maruska then made his second big move: he hired Roth in 1996.

"Ed said, 'We have got to breed these rhinos. It's the last chance,'" Roth remembers.

No pressure.

Cracking it

Terri Roth's office is full of rhinos: sculptured metal rhinos, stuffed toy rhinos, plastic rhinos, wood rhinos, and cinema-sized rhino posters. She doesn't have an unnatural obsession with rhino replicas: nearly all of these are gifts, she says. Roth, who owns a small cattle farm over the border in Kentucky, has become something of a celebrity in the small circle of rhino people, because she accomplished something that many had begun to despair would never happen.

It's not that no one had been trying to breed the rhinos from the time they were brought into captivity — they had. But the animals would fight, sometimes viciously, whenever they were brought together. And even when mating happened, something was off: the females weren't getting pregnant.

The first thing Roth wanted to figure out was what was going on with the reproductive cycle of the females. They trained the two females, Emi and Rapunzel, to undergo ultrasounds without anesthesia, which would have been too risky. They quickly discovered that Rapunzel would never have children: she had a large mass in her uterus. So now the U.S. was down to an Adam-and-Eve scenario: Emi and Ipuh.

They focused all their energy on Emi.

"We were working on her, three times a week, ultrasounds, conditioning her for blood collection, monitoring her for about eight months and I still couldn't figure out her reproductive cycle," Roth says. "You're beating your head against the wall."

Basically, Emi wasn't ovulating.

It was in the summer of 1997 that Roth made a risky, but fateful, decision. She decided to put Emi and Ipuh together, even though they didn't know Emi's ovulating schedule. Solitary in the wild, males and females will frequently fight like hell when brought together. Sometimes the fights result in injury to one of the animals — not something you generally want to risk with a species on the edge of extinction.



Ipuh enjoys a meal of browse next to the pool in his enclosure at the Cincinnati Zoo. Image courtesy of the Cincinnati Zoo.

To mitigate the risk, Roth and her team decided to do all they could to make sure Ipuh and Emi weren't too ornery.

"We thought, 'Let's do it when it's hot. Let's do it after the male has had its breakfast.' We put them out. Ipuh would eat his browse. He'd go into the pool, sink down and then we put Emi in.

"The keepers were all on alert. They were ready to jump in if they're needed to. It actually worked pretty well because [Ipuh] was not really interested in picking a fight," Roth says. "He was just in the water ... Sometimes, Emi would go over to the pool and blow at him." There were "no big skirmishes," Roth recalls. "For the most part, they ignored each other."

Reinhart adds that "it could have gone wrong every single day," but they kept going.

And they did, for 42 days. Forty-two days of keepers having to put two near-one-ton, critically endangered animals into a potentially perilous situation.

"Then one day, there was just this total difference," Roth says. "We put [Ipuh] out there and [Emi] went towards the pool and he started coming out of the pool.

"It was the most agreeable situation, shockingly. There was no chasing. There was [no] sparring, he just came out of the pool, started following her around and after a while started mounting her. We were ecstatic."

But Ipuh was not exactly a seasoned lover.

"He tried ... we even got lights out and left them together as late at night as we possibly could," Roth says. "He mounted her and mounted her and mounted her and finally got exhausted but never was able to breed her."

But that first encounter did lead to something historical.

"Two days after that ... I did the ultrasound where I saw she ovulated for the first time," Roth says.

A light bulb went off. It turns out the Sumatran rhino is an induced ovulator, which means the female needs something to kick-start her reproductive cycle. In the case of this species, Roth believes it's the interaction with a male that allows a female to

ovulate. Roth says they don't even have to copulate to ovulate — they just need to spend time with a male at the right time in their cycle.

"We've even seen situations where the males run her around but not even [mount] her, and she's ovulated. I think the ovulation is partly a response to the excitement of being with the male," Roth says.



Researchers at the Cincinnati Zoo trained female rhinos to accept ultrasounds without anesthesia, allowing every stage of ovulation and pregnancy to be carefully monitored. Image courtesy of the Cincinnati Zoo.

Still, the team didn't know how long Emi's cycle would be, so they started up again with the daily introductions, and 21 days later Ipuh and Emi tried again.

"She conceived on that one. That was the first pregnancy, which was shocking because it's pretty quick," Roth says. "We saw the little fetus developing. We saw a heartbeat. We sent out the press release. A week later, the embryo was gone. We thought, 'At least we knew he was fertile. We knew things were working.'"

Indeed, the team had the information they needed: they knew Emi needed interaction with a male in order to ovulate, they knew her cycle was around 21 days,

and they knew how long the follicle would grow during the cycle. Breeding had started to go well; pregnancy, not so much.

"Then she lost the second one, then she lost the third one and it actually became more challenging for me because people started saying, 'It's because of the ultrasound exams that she's losing the pregnancy,'" Roth says. "I was forced to reduce the amount of work I was doing with her, instead of increasing it. Then we were learning less."

At this point, Roth started to run lots of blood tests to see if she could find anything amiss, comparing them with blood samples from other captive rhinos in Indonesia and Malaysia.

Then Emi lost her fourth pregnancy, and her fifth.

"Finally, I just said, 'Let's just put her on the progesterone supplement because we don't think it will harm anything, and it seems like it could only help and not hurt,'" she says. Progesterone is a hormone produced in the ovaries that becomes elevated during pregnancy. This was in 2000, four years after Roth was hired. It worked — the sixth pregnancy finally stuck. But no one had any idea how long it would last.

"The only thing I could find was somebody had at some point said it was a seven-month gestation, which we didn't believe because no rhino is that short," Roth says.

In fact, 16 months later, Emi gave birth to a baby boy: Andalas. He was not only the first Sumatran rhino born in captivity in 112 years, but the first tangible success of that tragedy-filled program launched in 1984.

The Cincinnati effect

Cincinnati Zoo, the second-oldest in the country, sits smack-dab in the city among the rolling hills surrounding the Ohio River. Generally considered one of the world's top zoos, it has a long history of breakthrough captive-breeding successes, from giraffes to trumpeter swans to bison.

But perhaps none of the zoo's past glories could compete with the birth of Andalas.

In many ways, Tom Foose, conservation coordinator for the Association of Zoos and Aquariums (AZA) and the driving force behind the 1984 meeting to launch the captive-breeding program, had a point about *why* U.S. and U.K. zoos should have a crack at breeding Sumatran rhinos: the world's best zoos had both the expertise and the technology to have the best chance of success.

"That's what I love about the Sumatran rhino story because it's a perfect example of how zoos can contribute," Roth says. And Cincinnati was even more distinct than many zoos. Not only did it have a long history of captive breeding and expertise, but it also had an entire research facility, CREW, devoted to this kind of work.

"We often have a discussion here at CREW about the disconnect between the reproductive sciences and conservation. There is so much power in that kind of technology, but it's used so little in real conservation efforts," Roth says.



Andalus, the first Sumatran rhino bred and born in captivity in over a century. Photo courtesy of the Cincinnati Zoo.

At the same time, Cincinnati Zoo, and the zoo community in general, suffered relentless criticism over the program.

"We felt it constantly. Partly because westerners, partly because zoo, probably partly because female," Roth says.

Maruska says they took "a lot of fire" even from the wider zoo community. They were accused of taking wild animals out of their habitat just to exhibit them; they were told they'd never succeed.

"We faced the same with the California condor," Maruska says. "We had people from the Audubon Society saying, 'Let the birds die in dignity.' Well, there is no dignity in extinction. Come on."

Roth remembers that the zoo was even accused of making up pregnancies during the period when Emi was losing one after another.

"And then the negative stuff about, 'They're losing pregnancies, they must be doing something wrong there. Cincinnati is a bad environment,'" she says. "But we just kept at it. I just kept our eyes on the goal, and this is what we need to accomplish."

Roth and the Cincinnati team may be the single most important reason for the eventual success. Roth was able to make astoundingly difficult decisions and then, perhaps even more importantly, stay the course when the criticism became overwhelming.

"Terri was the person that really did the job," Maruska says.

It just took them — and everyone, in fact — much longer to produce calves than anyone could have expected at the 1984 meeting.

"Hell, I think we did a yeoman's job with a handful of animals," Maruska says. "I believe that if we had our full complement of animals, we'd [have] been a lot farther than we are today. I really do."

The next step for Roth, however, was proving that Andalus wasn't a fluke, and that Emi and Ipuh could replicate their little miracle.



In this 2017 image, Zulfi Arsan, head veterinarian at Indonesia's Sumatran Rhino Sanctuary, hand feeds US-born rhino Andalas. Photo by Jeremy Hance for Mongabay.

Fast forwarding

In 2004, Emi gave birth to her second calf, Suci. Then, in 2007, she gave birth to her third, Harapan. She successfully carried both these calves without the use of synthetic hormones.

"People thought it was really risky, but I really wanted to prove that they could do this themselves in a managed breeding program," Roth says. Still, she believes the progesterone was vital for that first pregnancy in getting Emi over the "hump."

"Once they're producing, just keep them producing because everything is healthy, and everything is working right, you don't want to stop that," she says.

Unfortunately, Emi died in 2009 of iron storage disease, though at the time the team had no idea what was wrong. It's an "insidious" disease, according to Roth, that can only be diagnosed after death.

In 2013, the zoo decided to euthanize Ipuh. Suffering from cancer, Ipuh had stopped eating and was barely able to walk.



Detail of Ipuh, whose taxidermed remains are currently housed at the University of Cincinnati. Photo by Jeremy Hance for Mongabay.

"It's hard to describe when they were born, it's even harder to describe when an animal passes away," says Reinhart, who spent 22 years caring for Ipuh. "[He] contributed so much to the species and the knowledge and the propagation of these animals and he stayed with us to the very end." Today, his preserved body rests at the University of Cincinnati.

An even bigger heartbreak came a little over a year later when Suci, Emi and Ipuh's daughter, died from iron storage disease, the same sickness that took her mother.

"With Suci, we suspected it when she started showing the same symptoms that Emi did," Roth says. For a while, Suci, just 9 years old, improved with aggressive treatment, but a few months later her health worsened. "Her liver was just too damaged," Roth says.

She believes iron storage disease was an issue at Cincinnati because the rainforest rhinos have evolved to live with multitudes of parasites and biting insects that constantly drain them of blood.

"They're trying to absorb as much iron as they can from what little iron they get on their diets because they have this constant load of parasites. They're bleeding, and they're having to build up tissues that parasites have chewed down, so they need it all the time," she says. "We bring them into our zoos or our facilities and we get rid of all the parasites, and they don't have that outlet anymore, so they're not losing iron anymore."

By the time of Suci's death, the Sumatran rhino program had shifted significantly. During the period when Cincinnati Zoo was struggling to produce just one calf, many experts began to feel the best thing for the species would be to bring them into managed sanctuaries in their local environment. This way, the rhinos would have direct access to their wild, natural foods and, many experts believed, this might help induce mating and decrease the chance of disease.



Harapan, born at the Cincinnati Zoo in Ohio, now lives at the Sumatran Rhino Sanctuary in Way Kambas National Park in Lampung, Indonesia. Photo by Rahmadi Rahmad/Mongabay-Indonesia.

In 1998, Indonesia opened the Sumatran Rhino Sanctuary (SRS) deep in Way Kambas National Park, a park also home to some of the last wild Sumatran rhinos on Earth. Two females were brought from zoos in Indonesia that year, as was Torgamba, all the way from the U.K. Unfortunately, breeding between these pairs was never successful.

Still, by the late 1990s, the SRS and the Sungai Dusun rhino center in Malaysia — where six rhinos would die in 2003 — were beginning to be seen as the future of the program.

In 2007, the U.S. sent Andalas, the first calf born in captivity, thousands of miles to the SRS in the hope that he could find an unrelated mate. It was time for the Cincinnati staff to transfer what they learned overseas.

“We really work hard here, that whatever we develop here it’s not about ‘mine, mine, mine,’” Roth says. “That’s why I was just so pleased that they were able to do it in Indonesia.”

Andalas mated successfully with Ratu, a wild rhino found roaming near a village in 2005 and brought to the SRS for her safety. Their union produced Andatu, a male, in 2012, and Delilah, a female, in 2016.

“It is a really good template; the hardest thing is to get people to follow it,” Roth says of the subsequent breeding successes. One of the most challenging bits is simply allowing the animals to spar, which Roth believes is a natural part of their breeding process.

“You have to have confidence that you knew what you’re looking at,” she says. “And to hold your ground and say, ‘No, keep them together, keep them together, keep them together,’ because after an hour or two, they’re going to settle down and they’ll breed.”

Cincinnati then made one of its toughest decisions yet: to send Harapan, its last rhino, and the public’s favorite, to Indonesia.

“Many of us really wished we could just get more rhinos. We wished we could have gotten a female from Indonesia and bred her with Harapan, and kept the program going. That was hard,” Roth says. But it was clear that the best thing for the species was to let Harapan go.

In 2015, Harapan, took the same journey from Cincinnati to Sumatra as his elder brother, in the hope that he, too, would breed successfully with one of the females at the SRS. Harapan was the last rhino in Cincinnati — and the last Sumatran rhino in the U.S.



Zookeepers load the crate in which Harapan will travel from Ohio to Indonesia. Image courtesy of the Cincinnati Zoo.

"We miss him here," Reinhart says. "He's in a better place, but he was our last born and we really loved him here. I do miss him still."

Harapan's arrival in Sumatra marked not only the last Sumatran rhino leaving the Western Hemisphere, but also 20 years since the close of the original captive-breeding program. The 1984 program was still a long way away from achieving a sustainable population in captivity that could, if nothing else, ensure the species wouldn't go the way of the dodo, the Tasmanian tiger and the woolly rhino. However, conservationists had ensured that by 2015 there was still a chance to do so.