"THE NEW ZOOS"
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EPISODE OPEN

ALAN ALDA If these polar bears look happy, I want you to know I'm at least partly responsible.

ALAN ALDA (Narration) We find out why zoo life today is, for many of the animals, one long party.

ALAN ALDA ...that's a very strange experience.

ALAN ALDA (Narration) How aquariums learn about life at sea. And how zoos are not only helping save endangered species... But even training them for an eventual return to the wild.

ALAN ALDA I'm Alan Alda. Join me now, as Scientific American Frontiers explores The New Zoos.

ALAN ALDA For a long time now, I've hated zoos. It's not that I hate the animals. I hate that we catch them in the wild and then cage them up. But most of all I hate that look of surly resentment and depression as they pace up and down, back and forth, hour after hour. But it turns out that the zoos I hate are mostly the zoos of my childhood. Because the zoos we'll be visiting in the show are the opposite of the zoos I remember in almost every way. This place is a good example, the San Diego Zoo. Like most zoos these days, its animals rarely come from the wild. And cages are where the inhabitants mainly go for a little peace and quiet. And pacing -- well, we'll be getting to that. Keeping their animals not only healthy, but happy -- that's the priority of zoos like this. And in the next hour, we'll find out not only how, but why.

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POLAR BEAR PICNIC

ALAN ALDA Why are we carrying this out here?

JOANNE SIMERSON Well, although you really wouldn't find palm fronds in the natural habitat of polar bears, we found that our San Diego polar bears love to play with them in the water and tear 'em up. So it keeps them active physically and gives them a little social interaction because often they'll play tug of war with it. And then once we get things decorated, what we're going to do is we're going to take this fat free salad dressing and see how they use their nose -- because they have a terrific sense of smell - how they'll follow the salad dressing to different areas.

ALAN ALDA So they get the impression there's been a fat free animal in here...

JOANNE SIMERSON Exactly...

ALAN ALDA And they're tracking it down and we lead them to this?

ALAN ALDA (Narration) I'm in the new polar bear exhibit at the San Diego Zoo. In case you're wondering, the five bears that live here are still snoozing away in their bedrooms out back.

JOANNE SIMERSON OK, here comes another one.

ALAN ALDA (Narration)

JOANNE SIMERSON, the keeper, has me helping make the bears' day more interesting.

JOANNE SIMERSON Do you want to put a little dressing up there?

ALAN ALDA Yeah, yeah.

JOANNE SIMERSON Just dribble it.

ALAN ALDA (Narration) What we're doing here with the salad dressing and the palm fronds is part of a hot new trend in zoo keeping -- new to an old zoo hater like me, at least. Along with much more naturalistic enclosures, the intent is to make zoo life more like life in the wild -- not that there's much fat free dressing in

the wild, but hey, a smell's a smell. Zoo keepers have a name for what we're doing:

ALAN ALDA Enrichment!

JOANNE SIMERSON Enrichment is a real zoo wide thing. Harry works in our forage department. He's kind of our king of icebergs.

ALAN ALDA (Narration) Miniature icebergs are one of the polar bears' favorite enrichment items. A second iceberg is left temptingly on shore, and also garnished with the odor du jour. From the other side of the glass, it's nice to see that my handiwork is a hit. The key to a successful enrichment program, according to JoAnne, is novelty. Every day, the bears get something new. It's the first time they've seen palm fronds in months. All this is a far cry from the zoos of my childhood.

ALAN ALDA One of the things that put me off zoos was seeing animals pacing. I couldn't take it after a while, they looked so depressed. Was I right about that? Is pacing a sign of depression or some kind of stress?

JOANNE SIMERSON We don't really know. It bothers us just as much as it does anyone. So we've had observers down here four hours every day since we opened this exhibit to find out what makes this bear pace more and what is it about this exhibit that this bear doesn't pace at all. And we still don't know.

ALAN ALDA (Narration) So far this morning, pacing doesn't seem to be on the bears' agenda.

ALAN ALDA Look at those people up there with their cameras.

JOANNE SIMERSON Oh here comes Buzz. There he goes, boom!

ALAN ALDA (Narration) The San Diego Zoo is home to five polar bears. Four of them are youngsters who've lived here only a few months.

ALAN ALDA Right on top of the ice.

ALAN ALDA (Narration) That was Neil who just jumped in. Along with the other two-year old male, Buzz, Neil was born in the Louisville Zoo. Both Neil and Buzz settled in here quickly. By contrast, the two young females, Chinook and Shakari, were born in the wild.

JOANNE SIMERSON She's washing her face.

ALAN ALDA (Narration) They turned up at the town dump in Manitoba, Canada, when they were 6 or 7 months old, apparently abandoned by their mother, and they were taken into custody by the Canadian Wildlife Service. After a spell of rehabilitation, they came to San Diego still not used to captivity.

ALAN ALDA Now look, who's that?

JOANNE SIMERSON That is Chinook.

ALAN ALDA Chinook. Chinook looks pretty happy, I have to tell you. I mean this makes me feel good for a guy who can't stand to see pacing animals in the zoo. I'm really glad to see this. Now does Chinook sometimes lose her happy demeanor and start pacing anyway? What's her day like?

JOANNE SIMERSON Chinook is what we consider a great success story. When she first got here from the rehab facility she was at, she paced. We don't see her pace anymore. What did we do? We enriched the exhibit, we provided toys, we provided mental stimulation, physical activity -- and it worked.

ALAN ALDA (Narration) But just moments later, there was Chinook's companion, Shakari.

ALAN ALDA This is weird. She was playing in the water a second ago, now it looks like she's pacing.

JOANNE SIMERSON She is. This is a typical pacing pattern, especially for Shakari. Can you see what started her off?

ALAN ALDA No...

JOANNE SIMERSON There was absolutely nothing...

ALAN ALDA And you don't know either...

JOANNE SIMERSON No, no clue. But if you watch her, look how relaxed she is. A lot of animals that you see doing the stereotypic pattern seem to be agitated, and they kind of shut down mentally, they aren't aware of their environment. Look, she just watched that bird fly across. Her nose is going in the air. So this leads us to believe that in this case, this is just something she does.

ALAN ALDA (Narration) So it may be that for some individual animals, pacing is a necessary part of daily life in a zoo -- even though nowadays zoo keepers do everything they can to keep their animals entertained -- and so to better entertain their customers. But for JoAnne, entertainment takes second place to what she

sees as the primary mission of the new zoos -- making people more aware of the plight of animals in the wild.

JOANNE SIMERSON Look how close you got to those polar bears. The next time you hear about something happening to polar bear habitat, you're going to react to that because you've had such a personal experience that you're not going to get someplace else. It will be hard to be apathetic.

ALAN ALDA You know my question was before, I can understand, I really do understand educating the public, but if it's at a cost to the animals, we have to be sure it's worth the cost, we have to know what the cost is, and we have to be sure it's worth it...

JOANNE SIMERSON Absolutely.

ALAN ALDA I can't tell from looking at it, but it sure looks, and from what you say it sounds, as though the cost isn't nearly so great as it used to be.

JOANNE SIMERSON You make me feel so good, I'm so glad you feel better!

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THE WILDER, THE BETTER

ALAN ALDA (Narration) In almost every zoo today, keepers are trying to think up new ways to enrich their animal's environment. This is the Metro Toronto Zoo, where one of the orangutans is getting to model a new tee-shirt...while another prefers a robe. Clothing's scarce in the rain forest, but orangutans in the wild do like to wrap themselves in large leaves. Trying to mimic aspects of the wild experience in the zoo often involves hiding food so that the animals have to search it out. Zookeepers have an informal network for exchanging enrichment ideas like this, but the Metro Zoo has gone one step further.

SUZANNE MACDONALD is a York University psychologist who's bringing a scientist's eye to making zoo animals happier.

SUZANNE MACDONALD It seems really simple to just scatter food around an exhibit or just give an orangutan a tee-shirt, but when you're dealing with very intelligent animals like orangutans or other species, that is enough to stimulate them, stimulate their interest, stimulate their creativity, make them think. And challenging them that way is a very important part of enrichment.

ALAN ALDA (Narration) It's trying to find out how animals think so as to keep them challenged that's Suzanne's specialty. This is an experiment to see just how well orangutans can remember where food has been hidden. In the orangutan's private playroom at the zoo, some jugs contain food while others are empty. Kartiko swings into action. He's never played this game before, but he lucks out right away. Getting to the next jug involves some tricky trapeze work -- which turns out to be all for nothing. So it's onward and upward. This time, the climb was worth it. A few hours later, Suzanne hides food in the same locations as before. This time, Kartiko doesn't hesitate. And now he skips the empty jugs and goes straight for the ones that have food. Kartiko returns to his observers for congratulations. But then he's joined by another orangutan, Dinar. Dinar checks an empty jug -- but then beats Kartiko to his favorite full one. What interests Suzanne is that Kartiko doesn't seem annoyed -- regretful perhaps, but not mad. To Suzanne, the whole experiment nicely illustrates the behaviors that come naturally in the wild, and so should be encouraged in zoos.

SUZANNE MACDONALD Orangutans are very good at remembering exactly where food is located. That's what you'd expect based on where they live in the rain forest, because they have to remember where fruiting trees are located. We also learned that they have a particular strategy that they tend to use, they tend to go from one location to the next closest one, which means they save themselves some time in between, so they take the shortest possible route, which is a very efficient strategy, very smart. And we also learned that orangutans don't compete with each other for food. Other animals, if you place two animals in competition for one small bit of food, they'll fight to the death. But with orangutans it's hands off, they don't want to compete, and I think that reflects their solitary nature in the wild.

ALAN ALDA (Narration) You don't see many animals pacing in the Metro Zoo. But these saki monkeys from South America once did the monkey equivalent -- obsessively grooming each other, hour after hour.

SUZANNE MACDONALD We're not talking about occasionally, we're talking about all day long, to the point that they were losing parts of their fur on their arm. So we decided we had to do something to break this behavior up.

ALAN ALDA (Narration) The something that worked involved the saki's favorite food, sunflower seeds. Hidden in these custom designed feeders, the seeds have to be dug out by the monkeys, making them work for their supper as they'd have to in the jungle.

SUZANNE MACDONALD This kind of enrichment project has a ripple effect on their entire behavior. Because it doesn't just affect their grooming or stopping

them from grooming, or affect their feeding behavior, it seems to affect all the behavior they do.

ALAN ALDA (Narration) Including, surprisingly, their mating behavior. Where before the monkeys' physical interaction was confined to grooming, now their interest in each other has become much more romantic. There's been a decided lack of romance in the air over at the gibbon enclosure, where this male and female -- despite years of sharing living quarters -- have never taken the first step to parenthood. Suzanne, working with graduate student Dawn Nicolson, decided to try a little couples' therapy with the aid of something not often employed in zoos. Suzanne's apparently not the only one to enjoy the Girl from Ipanema. But the music is just to see how the gibbons react to an unusual noise. These are the sounds that matter. It's the call of a male gibbon -- and it gets an immediate reaction. In the wild, gibbons call all the time. But these two gibbons had hardly ever called-- until the sudden apparent intrusion of another male. But now the female starts venturing a few tentative calls of her own. The unseen male seems intriguing.

SUZANNE MACDONALD She is actually listening to the advertisement of another male and saying, yeah, here I am and what do you think of me? Basically it's a little bit of a courtship going on and she should not be doing that if she's well-bonded with her mate.

DAWN NICOLSON She actually is responding because she's trying to play the market a little, she would maybe prefer to be with a different male.

ALAN ALDA (Narration) This is all very bad news to the male in residence, who responds with the gibbon version of taking off his coat and rolling up his sleeves.

DAWN NICOLSON He thinks there's another male there, so he's displaying to that male his strength to show he's more dominant than the other male. He has to protect the pair bond.

ALAN ALDA (Narration) And in the act of protecting it, maybe he starts believing in it. It's the old, old story -- there's nothing like a rival, real or imagined, to shake up a stale relationship. Soon they're both talking -- this time together. Now that's enrichment.

SUZANNE MACDONALD Using sound as enrichment I think is one of the sort of under-represented ways to enrich animals, and I hope that we can use more of it in the future. Because we have to take the animal's own perceptual world and try to enrich it. And we often forget that animals use sound to communicate.

ALAN ALDA (Narration) From an animal doctor concerned with her patient's happiness we go next to one concerned with their basic health -- and to a very different kind of zoo.

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DOCTOR FISH

ALAN ALDA How many fish in this tank do you think are in trouble, medically?

HOWARD KRUM This is a good ward.

ALAN ALDA (Narration) It's morning rounds for the medical team at the New England Aquarium in Boston.

ALAN ALDA You come around every morning and make rounds like this and check for illness?

HOWARD KRUM Yeah, we have case list just like in a hospital...

ALAN ALDA (Narration) Dr. Howard Krum is the leader of the veterinary team here. Among his thousands of potential patients, the fish he's most concerned about in this tank are the sand tiger sharks, two of which have developed hunchbacks.

ALAN ALDA How long ago did you notice a problem?

HOWARD KRUM Well it takes weeks and weeks to develop, and it started very gradually, but then over the past couple of weeks it's accelerated.

ALAN ALDA So only within the space of a few weeks this severe deformation has occurred?

HOWARD KRUM It's gotten a lot worse in a short period of time, yes.

ALAN ALDA (Narration) But today, Howard Krum has a more urgent case to take care of. Here in the aquarium's hospital is a very sick puffer fish, an elderly patient who is reported to have a swollen abdomen -- though she could have fooled me. Called a bridal burrfish, her problem is dramatically revealed by her X-ray.

HOWARD KRUM And what we noticed when we took the X-ray to try to figure out what was going on in her abdomen is that she had this mass that appears to be a stone, a calcified... like you'd get a kidney stone or a bladder stone? That's what we're thinking it is.

ALAN ALDA Have you ever done this surgery before?

HOWARD KRUM No I haven't, and I don't think anybody has.

ALAN ALDA (Narration) The New England Aquarium's Medical Center is unusual not only for its sophistication, but also because it is itself one of the exhibits. So Dr Krum and his team do most of their fish doctoring with an audience. Fast asleep after swimming around in a bucket spiked with anesthetic, the bridal burrfish is prepared for surgery. A tube carries water laced with the same anesthetic over her gills to keep her both alive and unconscious. I'm touched by the team's concern and impressed by their professionalism. But I'm a little surprised that high tech equipment like an ultrasound heart monitor is being used on an aging fish that isn't even very rare.

HOWARD KRUM When we bring an animal here, we try to give it the best care possible. We feel that is the responsible thing to do, period. So it doesn't matter if it's an aging bridal burrfish or really one of the more exotic specimens we're working on, we feel like we have to do what's best for the animal, to the best of our capabilities.

ALAN ALDA (Narration) After a tense 25 minutes of cutting through the tough spiny skin, and opening the bladder without damaging any blood vessels...

ALAN ALDA Oh my god, look at the size of it!

HOWARD KRUM Since that was the first time we ever did that procedure, it's good to get practice doing it, period, regardless who it's on. We're doing something new everyday, so it's building up a repertoire of capabilities for other animals.

ALAN ALDA Do you think it's premature to congratulate you on a historic first?

HOWARD KRUM It seems to have worked so far, so we're happy. We're happy that she recovered and is recovering right now. So thank you.

GUTHRIE ROAR

ALAN ALDA (Narration) Next on the veterinary team's rounds is a visit with Guthrie.

JOANNE COLWELL Target!

ALAN ALDA Now why does he put his nose on the blue thing like that?

JOANNE COLWELL That's a focal point for Guthrie, it gives him a point of reference for where he should be when the trainers are going in and out of his pen.

ALAN ALDA Is he like really good at staying on target?

JOANNE COLWELL He's really good at staying on target.

ALAN ALDA Because I hear that I'm going into the pen with you.

JOANNE COLWELL You are going into the pen.

ALAN ALDA I heard that just a second ago. So get onto the target will you Guthrie? Get on the target. How do I make him get on target?

JOANNE COLWELL Target!

ALAN ALDA Now why did he do that for you?

JOANNE COLWELL Because I have the food...

ALAN ALDA You have the fish in your pocket, OK. OK, don't forget the target thing, OK, keep that in mind.

ALAN ALDA (Narration) Guthrie, as you've probably guessed by now, is a performing sea lion.

JOANNE COLWELL OK, I'm going to go in first, and the last person in shut the gate behind us.

ALAN ALDA Last person in shut the gate.

ALAN ALDA (Narration) Guthrie's been trained to cooperate...

ALAN ALDA Vay is mir! Watch out!

ALAN ALDA (Narration) ...but he weighs well over a quarter ton.

HOWARD KRUM So if we wanted to do an eye exam...

ALAN ALDA I'm looking for a quick way out of here in case he starts to roll around.

HOWARD KRUM ...we'll go down, and we can take a look, and he'll hold himself still and he'll let us shine the light in his eye -- that's good. Now she'll reward him for his good behavior.

ALAN ALDA Now Guthrie, open your mouth. Oh very good. A little wider.

JOANNE COLWELL Hold it...

ALAN ALDA Black teeth! Terrific. A little yellow on the tip of his tongue there.

OANNE COLWELL He's kissing the camera now.

ALAN ALDA You know what he does? He makes a kissing sound. GUTHRIE ROAR

HOWARD KRUM Another medical behavior that Guthrie can do is, if he had any respiratory problems, if he had sniffles or sneezes or anything like that, or we thought there was anything wrong with his lungs, and we wanted to get a culture of what was going on, we could ask him to blow into a petri dish with media on it, so it's a very easy way to get a sample of what's in his nose...

ALAN ALDA Oh so you can see what grows? So how does he do that?

JOANNE COLWELL Sneeze! Good boy.

HOWARD KRUM And you can see, even on that, that's plenty of sample.

JOANNE COLWELL Guthrie, grin.

ALAN ALDA I can understand training him so he'll accept medical procedures -- examinations and that sort of thing, that's good for his health. Does training him to perform in a show for the entertainment of humans, that extra training which doesn't really directly seem to affect his health, is that good for him or bad for him, or doesn't it matter?

JOANNE COLWELL I think it's actually good for him, it actually stimulates his mind, and he enjoys it.

ALAN ALDA (Narration) Watching him perform, it's easy to believe that -- at least most of the time -- Guthrie does enjoy it. It's back to the idea of enrichment again.

Our last stop today is to check on some harbor seal pups that had been found abandoned a few weeks ago on New England beaches. My reputation as a skilled animal handler had obviously preceded me.

CONNIE MERIGO So what we're going to do is have you bottle feed number one. And you might just want to put these on, again you don't want to get bit.

ALAN ALDA I don't want to get bitten. Why don't I want to get bitten?

CONNIE MERIGO Well seals can have a, they've got a bacteria in their saliva that can potentially be very hazardous to us. If you get bit and get some of that saliva in the cut or in the open wound, it can be toxic to your system and it can go systemic.

ALAN ALDA What, do you think I'm crazy? I'm not crazy. I'm fun-loving, I'm curious, but I'm not crazy. You feed it.

CONNIE MERIGO Well, it's just a bottle and there's not going to be a lot of risk...

ALAN ALDA That's good. I'll be over here, and I'm sure it will be very cute. What's wrong with that?

ALAN ALDA (Narration) Number one is one of several harbor seal pups being rehabilitated here at the aquarium before being released back into the wild. They're fed, not milk, but a special fish mash.

CONNIE MERIGO And I think he's all done.

ALAN ALDA (Narration) Many of the abandoned seal pups also have medical problems. Number four here was suffering from severe malnutrition when he was brought in a month ago.

HOWARD KRUM Let's take a look in his mouth. And so just like we did on the sea lion, we're taking a look around. Of course, these guys aren't trained to open their mouths or do anything. We don't want to train them because they're going to be released.

ALAN ALDA What about just handling it like this? Does that have an adverse affect on its being accepted back into the...

HOWARD KRUM It doesn't seem to be. These animals, as far as anyone knows, they are accepted back into the wild and off they go.

ALAN ALDA (Narration) As it happens, seal number four will help test the belief that the rehabilitated pups make it when released. Four months after my visit with him, he's been brought to a beach in Biddeford, Maine, near where he was originally found. Glued to his back is a miniature transmitter that will radio data up to a satellite.

HOWARD KRUM What we're trying to do is really just try to complete the story. We know where the animal came from, we know what was wrong with it. And we feel that it's healthy. So now we're going to try to track it and find out where it is and how deep it's diving and how much time it spends out of the water, that kind of thing. So hopefully we can get the final picture and know how well he does.

ALAN ALDA (Narration) Under the gaze of the local media, seal pup number four and a companion check out the real world after a cozy five months in Dr Krum's care at the New England Aquarium. After its release here in mid October the pup was tracked for over a month, during which it swam down to Cape Cod, and appeared to be diving and foraging successfully. And as we'll see in the rest of our show, this is only one example of how zoos and aquariums are increasingly playing a role in the lives of animals in the wild.

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TUNA IN THE TANK

ALAN ALDA (Narration) This is the world's largest window into life in the open ocean -- the 13 inch thick, 54 ft long, acrylic window of the new Outer Bay exhibit at California's Monterey Bay Aquarium. Inside the million gallon tank are yellowtail and skip jack tuna -- fish rarely kept successfully in captivity -- along with other ocean-going species like the eerie ocean sunfish, or mola. But for fish used to the wide open ocean, even a giant tank isn't enough to guarantee health and happiness -- as the aquarium staff soon discovered when it came to feeding their tuna.

ALAN ALDA Why do you feed them squid? Is this what they eat in the wild?

TOM WILLIAMS No, not necessarily. But what happened was when we fed them what they fed in the wild and we fed them every day, they got too fat.

ALAN ALDA How did you know they were fat? Did their belts need to be opened a notch?

TOM WILLIAMS Yeah, kind of like us, you know, they had to switch their belts.

ALAN ALDA Can you tell by looking at a fish that it's fat?

TOM WILLIAMS No, what happened was they would die because they were fat. And when we necropsies them, when we opened 'em up, we'd get in there and open up and in the white muscle itself there was actually after about five minutes there was pools of fat, fluid fat. And so they were literally just getting overfed on fat.

ALAN ALDA And this was from being fed what they normally eat in the wild. So what, don't they get enough exercise in the tank?

TOM WILLIAMS Not as much, you know. And besides, they don't have to... a tuna remember in the wild goes for long distances between food, and so all of a sudden now they're going to, instead of having to work for their food and swim all around, they're being fed, every other day.

ALAN ALDA (Narration) And as I was about to discover, it's not just when and what you feed the tuna, but also how.

ALAN ALDA So what's the idea? How do we do this?

ALAN YOUNG So the idea is, we're going to take the food, we don't want it in a concentrated point when we throw it in the water, otherwise the tuna will all rise up to it and collide. So we want to lay a nice strip down this way, across the front this way and just keep it going. Keep it away from the window because the tuna will actually head that way at about 40 miles per hour sometimes...

ALAN ALDA And they'll bang their nose on the glass. Oh, I got it all over my face! I got squid juice on my face.

ALAN ALDA (Narration) During the tuna's feeding frenzy, the lone mola in the tank seemed to just hang around, waiting. What he was waiting for was...

ALAN ALDA What's this?

TIM COOKE This is a target that we've developed here, because the tuna swim around so quickly and you saw during the feeding that there's no way the mola's going to get enough to eat. If I threw food in right now, the mola wouldn't even know the food was in the water before the tuna gulped it up.

ALAN ALDA So he sees you act like the tooth fairy here.

TIM COOKE Right.

ALAN ALDA Do you see him out there?

TIM COOKE Yes, I can see him right there.

ALAN ALDA Oh yeah, yeah.

TIM COOKE Here he comes.

ALAN ALDA (Narration) In the open ocean, mola can grow up to 10 feet long. This one is just a baby -- and eats like one, too.

ALAN ALDA It's a very strange experience. He really just sucks it right out of your hand.

TIM COOKE Yeah, he's a great animal, great animal.

ALAN ALDA Look, he's getting his picture taken by the other camera. He really is into that. What is he...?

TIM COOKE He's probably fairly angry. Did you see the bubbles come out of his mouth?

ALAN ALDA Yeah.

TIM COOKE He was actually spitting at the camera. He's coming around again...

ALAN ALDA Really. Isn't he used to cameras in there?

TIM COOKE No, he's not used to cameras. I believe this is the first time he's been filmed underwater.

ALAN ALDA (Narration) It's not only underwater cameras that can upset a mola -- so too can another mola...

ALAN ALDA He's got a chin like a guy who needs a shave. A little stubble.

ALAN ALDA (Narration) In the first days of the tank, there were several molas here -- and they spent most of their time bumping their faces against the walls. It seems they couldn't stand the sight of each other.

ALAN ALDA Bumping into the walls. That's a sign of what?

TIM COOKE A sign of stress, probably of frustration, that they couldn't get away from one of their others.

ALAN ALDA It wasn't enough that they got at opposite ends of the tank, they actually tried to get out of the tank to get away from each other?

TIM COOKE Even though this seems like a very large tank at a million gallons, it's very small compared to the Pacific Ocean itself.

ALAN ALDA (Narration) The cure for the mola's misery turned out to be simple. The unhappy ones were released. This one arrived alone -- and showed no signs of wall-bumping. So he's remained alone ever since -- apparently happy to be the only mola in his million gallon world. But it's the tuna here that are the giant tank's main attraction. And learning how to keep tuna happy and healthy in captivity has already had a major spin-off -- one that may help save one of the ocean's most endangered species. On the beach outside the aquarium, I'm talking with tuna expert Heidi Dewar about the world's most valuable fish, the giant bluefin tuna, highly prized in Japan for sushi and sashimi.

HEIDI DEWAR Recently I heard that one fish, I don't know how big it was, but one individual fish, went for $90,000.

ALAN ALDA (Narration) Next door to the Aquarium is the Tuna Research and Conservation Center. Inside are tanks where yellowtail tuna are playing a key role in helping understand -- and perhaps ultimately save -- their bluefin cousins. Researcher OK, he's going to come back in this corner. This is him right here.

ALAN ALDA (Narration) We're trying to corral a yellowtail tuna that has a tracking tag implanted in its belly. Catching and handling live tuna without harming them takes a lot of practice. A tuna's skin is very delicate, so it has to be gently guided into a sort of underwater stretcher. It also takes practice to do the surgery necessary to quickly and safely implant the tags; this fish is having some stitches removed. The researchers' ability to perfect their skills on these captive yellowtail tuna was critical to carrying out an ambitious project to tag bluefin tuna in the Atlantic Ocean last winter. In a project called Tag A Giant, sports fisherman joined the tuna researchers in catching bluefins off Cape Hatteras. Bluefin fishing is regulated by an international commission that sets seasons and quotas; but the fact is these rules are based on only a vague understanding of how many bluefin tuna still live in the Atlantic and how far the fish can travel. The tags Heidi and her colleagues implanted record, among other measurements, where the tuna go and how deep they swim.

HEIDI DEWAR We put out 160 tags off of Cape Hatteras, and we'll be happy if we get seven to ten of those back.

ALAN ALDA And the only way you'll get them back is if the fish is caught by a fishing company?

HEIDI DEWAR Exactly. The fish that have these inside have green external tags on the outside, which green for money. So if a fisherman sees these, then they know that this tag is inside and they'll get a thousand dollar reward, which is pretty... and usually they get a hat.

ALAN ALDA That's kind of a gamble. That's a scientific gamble you're taking.

HEIDI DEWAR It is. And the reason that we're... the next step is to actually marry this data storage technology with satellite technology.

ALAN ALDA Now what's this, this is a different kind of...?

HEIDI DEWAR This is a pop-up satellite tag actually, and we put 37 of these out in bluefin tuna at Cape Hatteras. And what this will do is we can attach it to the fish externally, again using techniques that we test here first to make sure it's not going to impact the fish, and then at a predetermined time when we program it to come off, this little piece of 3/16 stainless on the end will corrode away and the tag will come to the surface and talk to...

ALAN ALDA It floats up. What does it talk to?

HEIDI DEWAR It talks to the NOAA weather satellites actually and says, "Here I am."

ALAN ALDA (Narration) Thirty five of the 37 pop-up tags did as they were meant to, each signaling to the satellites where its tuna was when the tag detached. And so far, two of the implanted tags have been recovered, from bluefin tuna caught off New England. The hope is that when and if more tags are returned -- perhaps from as far away as the Mediterranean -- their information might help formulate more scientifically-based bluefin tuna fishing quotas. Meanwhile, back at the Monterey Bay Aquarium, the tuna in the Outer Bay exhibit lounge in luxury on their low-fat diet, unwitting participants in an ambitious attempt to protect their endangered relatives who are still at large.

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ZOOS AS ARKS

ALAN ALDA (Narration) No animal more symbolizes the plight of the world's endangered species than the giant panda. With fewer than a thousand still living in an ever shrinking habitat in China, captive animals are becoming increasingly important to the species' survival. And of giant pandas in captivity, Bai Yun, now living in the San Diego Zoo, maybe one of her species' last best hopes.

ALAN ALDA Don't eat the whole thing at once...

ALAN ALDA (Narration) Because she's here, not just to charm her visitors, but to teach researchers about panda life.

ALAN ALDA You know, she's very cute. She was resting her head on her paw, looking at me with her big eyes, look at that, and she's very gentle when she takes the cookie, look at that. But is that...should I be careful? Is this animal dangerous?

DON LINDBURG Very seductive, isn't it, this whole thing? There's the potential for significant injury, simply because she has a pretty nice set of teeth.

ALAN ALDA What are you studying here mostly?

DON LINDBURG We're focusing on the communication system of pandas, particularly their sense of smell. Because they're a solitary kind of animal, they need to communicate across distances and in ways that the message gets out when they're not in face to face contact. So the best way to do that is to put out a signal, a scent mark, on a post, a tree stump or a rock or something like that.

ALAN ALDA (Narration) The panda's scent gland is just under the tail. By collecting and analyzing the scent, Don Lindburg and his colleagues hope eventually to decode what it says.

ALAN ALDA How specific do the messages get? As a human, when I smell an animal, I get one message. I get the word "skunk," or I get the words, "my carpet is ruined," you know, like that's it. Do they have more...are these smells more complex, can they get more information out of a smell than just an animal's been here?

DON LINDBURG Well, we think so. But that's precisely what this study is all about -- what kind of information can they get from a scent mark?

ALAN ALDA (Narration) One assumption is that these scent marks are especially important in the giant panda's notoriously finicky mating behavior. Along with Bai Yun, Shi Shi, a male, is also here in the San Diego Zoo, in the hope that between

the two a little passion might be stirred. The animals were introduced to each other last spring.

DON LINDBURG When two pandas meet in the wild, the normal response is to expel the intruder. That's supposed to change on one occasion primarily, and that is when she wants to mate. And in this instance the communication seemed not to transpire...

ALAN ALDA He had the problem, not her.

DON LINDBURG That's correct. If the female approached him, he would either give an aggressive vocalization or literally lunge at her, occasionally even bite her to drive her away.

ALAN ALDA (Narration) Shi Shi's surliness may be explained by his battered nose, the result of an old injury in the wild. Perhaps he simply can't smell Bai Yun's messages, and that's why he ignores them. Both Shi Shi and Bai Yun are watched almost every waking moment as the research team attempts to understand the panda's world. Valerie Hare's been recording Bai Yun's behavior in an complex code even during our filming.

ALAN ALDA You put these codes together in a sentence? Like at lunch you get together and say I saw her do 1a and 2c today...

VALERIE HARE Exactly, and of course we can talk and no one else can...

ALAN ALDA ...tell what you're talking about. But what do you hope to gain from this? How will you put it together?

VALERIE HARE Well we give this material to the researchers like Dr Lindburg, and they go through it and they can see here she sat still looking at you and then, Alan fed. And then she stood up on her hind feet, remember that?

ALAN ALDA And you were watching and writing that down all the time...

VALERIE HARE Everything she did.

ALAN ALDA (Narration) By watching so closely, the San Diego researchers hope to gain insights into panda biology that will help the species survive in the wild. And of course, there's the hope that Bai Yun will yet overcome Shi Shi's apparent indifference to fatherhood. The idea that zoos should contribute to the world's wild animal population rather than draw from it is probably the most profound of the changes to have overtaken zoos since the days I so disliked them.

RANDY RIECHES ...you can drive right up to these animals...

ALAN ALDA (Narration) I'm here on safari, not in Africa but a few miles north of San Diego in the San Diego Wild Animal Park, which was created specifically to breed animals for exhibition in zoos -- especially animals whose continued existence in the wild is imperiled. Our first stop in the park is amid a group of extremely friendly Ugandan giraffes.

ALAN ALDA How old is this park?

RANDY RIECHES We've been here 25 years. And during that 25 years we've had over 20,000 animals born here at the Wild Animal Park.

ALAN ALDA Really. And how many of those are considered endangered species?

RANDY RIECHES Of those 20,000, roughly about almost half, almost 50% of those animals have been endangered species that have been sent to zoos within the United States and internationally to other facilities worldwide.

ALAN ALDA The giraffe is not endangered is it?

RANDY RIECHES This species of giraffe will probably be the first species that is listed. The population is dropping dramatically.

ALAN ALDA Is that because vegetation is disappearing or what?

RANDY RIECHES Actually, vegetation is disappearing because of farmland, encroachment of farmland, and the fact that they are occasionally hunted for their tails, which are used as fly swatters.

ALAN ALDA I can't believe it. Kill a whole gorgeous animal like that to swat a fly.

ALAN ALDA (Narration) The friendliest Ugandan giraffe has a noticeably bumpy forehead.

ALAN ALDA Why does this guy look so different from the others?

RANDY RIECHES He's an adult male, and as adult males become mature you see a lot of calcium deposits on their forehead around the ossocones, the horns, and this protects the cranial area when they're necking -- standing shoulder to shoulder and taking their head and slamming it into the abdomen of the other male.

ALAN ALDA That's what they call necking?

RANDY RIECHES That's what they call necking, yeah. He has actually sired numerous calves here. He will be displaced by the younger male and this older male will then go to another zoo that actually needs to change bloodlines.

ALAN ALDA (Narration) Our friend's planned departure is part of an intricately choreographed exchange of breeding animals among zoos around the world. By constantly mixing bloodlines, the goal is to avoid the dangers of inbreeding.

ALAN ALDA Where are we going now?

RANDY RIECHES We are actually leaving Africa and now we're crossing continents. We're now going into Asia.

ALAN ALDA (Narration) The Asian enclosure at the Wild Animal Park, like the African one, has hundreds of animals roaming freely. Only predators like lions and tigers are kept apart -- for obvious reasons. The Park has been especially successful at breeding endangered rhinoceros species -- including this one, the Indian rhino.

ALAN ALDA Why do so many animals approach the truck like this?

RANDY RIECHES Because all the animals come to the feed trucks.

ALAN ALDA Oh feed trucks come by here. I see. No wonder. He really looks like he's seen an old friend here.

ALAN ALDA (Narration) It took seven years of trying before the first baby Indian rhino came along, but since then 26 others have been born at the park.

ALAN ALDA Has there been any one big lesson you've learned about how to breed wild animals?

RANDY RIECHES Space. In one word I would say space.

ALAN ALDA Space. How do you mean, space?

RANDY RIECHES Once we took animals from a zoo environment and placed them in these larger areas, we have increased the breeding potential of these species by tenfold.

ALAN ALDA (Narration) The success of captive breeding programs as zoos have become more like the wild has meant that the flow of animals from the wild into

zoos has been largely halted. And in a few cases, as we'll see in our last story, it's even been reversed.

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RETURN TO THE WILD

ALAN ALDA (Narration) A couple of hours drive north of Rio de Janeiro in Brazil are a few remnant patches of a forest that once stretched for hundreds of miles. Most of the land is now pasture, most of the animals, cows. But in this narrow strip of forest, the Poco das Antas reserve, the trees are home to a thriving population of golden lion tamarins, a species of monkey once on the brink of extinction. What's most extraordinary about these monkeys is that they are almost all the descendants of animals born in zoos. My first glimpse of golden lion tamarins was also pretty extraordinary. Because these animals at the National Zoo in Washington DC are -- as far as I could see -- free to roam wherever they please.

ALAN ALDA How far do they go from here? I mean this is wide open. At night, do they sleep under lock and key or...

BEN BECK No, no, they sleep in that plastic picnic cooler that you see up there. And they're free, literally free, to go anywhere they want. Why don't they? When people ask me that question I ask, well, why don't you go to Pittsburgh? They've got their shelter here, they've got their mate here, they've got their food here, there's no reason for them to go anywhere else.

ALAN ALDA Yeah, but just once in a while, doesn't somebody just take a walk?

BEN BECK We've had it happen And we go find them. You can see they're wearing little radio transmitters.

ALAN ALDA Oh, you can find them with the transmitters.

BEN BECK Right, but it's very rare.

ALAN ALDA (Narration) Ben Beck coordinates a program that takes golden lion tamarins born in zoos around the world and reintroduces them to the Brazilian forest. Before they go, the monkeys come here for a sort of training course in jungle survival skills -- including how to find insects and grubs.

BEN BECK This container tries to induce them to stick their hands in and probe for these things.

ALAN ALDA Oh I see, they have to get used to foraging.

BEN BECK Right, because in the wild this stuff is going to be under bark and under leaves and so they have to get used to search for food rather than just sit and wait for it. BELINDA Let me just right now lower this one and we'll hook it up here.

BEN BECK OK, here comes the rope. Now we have our choice.

ALAN ALDA I hook it onto one of these...

ALAN ALDA (Narration) The idea is to make the food as tricky to get at as it would be in the Brazilian forest.

BEN BECK Being out on a rope is a good place for these guys because it's shaky and they have to get used to moving on shaky unstable branches.

ALAN ALDA Now I hear that call coming from someplace. They're calling to each other that there's food around, right?

BEN BECK That's right. That's a food chirp and they do that to notify other members of their family group that they have discovered food.

ALAN ALDA Is that chirp particular to that family...

BEN BECK Yes.

ALAN ALDA Would another family have a different kind of chirp?

BEN BECK No, it's a very stereotyped call for the species.

ALAN ALDA So how come other families don't pick up on that? I mean, they're tuned to the same station.

BEN BECK Correct, they're tuned to the same station, but they're in a different area.

ALAN ALDA Oh, OK, I see, because they're very territorial.

BEN BECK That's right, and so the nearest tamarin group might be half a kilometer away. They're both listening to 90.9 but one is in Philadelphia and one is in Washington.

ALAN ALDA She's got her eye on the box but then she ran back again.

BEN BECK Patience is 99% of this business. Waiting for the animals to do what they're ready to do.

ALAN ALDA OK, here she comes. That's the wrong rope.

BEN BECK A truly wild golden lion tamarin would have no trouble getting from where she is to that feeder.

ALAN ALDA Why? Why does this one have trouble?

BEN BECK There's two reasons. First of all, animals that grew up in relatively small cages tend not to develop good mapping skills. They don't know how to get around in a challenging and rearranged environment. And the second reason of course is locomotion. They're not really skilled at locomotion, and these are the things they're going to have to master if they're to survive in the wild.

ALAN ALDA (Narration) Another skill they need to master is what to do with a banana.

BEN BECK Can you imagine having to teach a monkey how to open a banana?

ALAN ALDA It's hard to believe. You'd expect they could just figure it out.

BEN BECK All their life we chop it up into nice little pieces for them. OK Belinda, go for it.

ALAN ALDA So do you have to give them instructions or how do they get into this?

BEN BECK We start out by peeling the peel just a little bit, so they make the connection that the fruit is underneath the rind. And then slowly they begin to open it up. And there are bananas in the forest in Brazil, but they come whole, just like this, and they need to learn how to do it.

ALAN ALDA (Narration) Watching the tamarins learn how to open bananas, I could see why this sort of jungle boot camp seems like a good idea. But even good ideas don't always work out exactly as intended.

ALAN ALDA Why do you do this here? Why don't you just have a situation like this down in Brazil and work with them there in a environment that's really the one they'll be going into?

BEN BECK Where were you ten years ago when we really needed that question to be asked? When we started this in 1986 we really thought that this would be a kind of training ground for them in a safer, more protected environment, where we had veterinarians that are two minutes away. And we really believed intuitively that this kind of experience, what you're seeing here, was going to confer on them some sort of advantage in survival. Well, we just analyzed 14 year's worth of data. And you know what? It doesn't make a bit of difference. Being in this kind of environment before they go to Brazil does not mean that they are more likely to survive than coming right out of a zoo cage.

ALAN ALDA But they still have to learn the same lessons?

BEN BECK They still have to learn the same lessons. So what we're doing is exactly what you said, we continue the training in Brazil by all of this intensive support, and what they do is they learn on their own. We just keep 'em alive.

ALAN ALDA (Narration) In the 14 years that

BEN BECK and his colleagues have been taking golden lion tamarins to the Poco das Antas reserve in Brazil, they've released 147 animals into the forest. These monkeys have come from zoos all over the world. Their nest boxes -- tamarins inside -- are hauled up into the trees. The goal is to build up a population that can eventually be self-sustaining -- which

BEN BECK estimates to be around 2000. So far the population has reached well over 200, most of them the wild born offspring of zoo born animals. The newcomers are a little awed by their surroundings at first, despite their training. And it's here the continued support they get in the wild is critical. They get food just as they did in boot camp, and one of each family group wears a radio collar so they can be tracked if the group wanders away. But while most of the new arrivals cope, their wild-born descendants do far better. When it comes to learning survival skills, there's no substitute for being there. Today the biggest problem is caused by the program's success -- it's running out of room. Here's the real crunch with the whole idea of reintroducing animals into the wild -- there's so little wild left to reintroduce them to. In Brazil the focus now is on getting local ranchers to set aside for golden lion tamarins some of their last remaining patches of forest. Meanwhile, back in Washington, the two tamarins in training will have to wait before packing their picnic cooler for Brazil. Their role now is like that of the other zoo animals I've met -- as ambassadors pleading the case for their wild cousins.

DOCENT You see the tamarins over there? A little bit of orange straight around the tree?

CHILD Yeah.

DOCENT Those guys are called golden lion tamarins and they're from Brazil. But these two were actually born in zoos...

ALAN ALDA I started out on this trip really not liking zoos. Years ago, I saw zoos where the animals were clearly depressed and obsessive, and they just looked like caged animals. And the zoos I'm seeing are different, they have a whole different philosophy, the animals are treated different. This is not like anything I've ever seen. Is this... am I getting the right picture? Have zoos really changed?

BEN BECK Absolutely. Over the past roughly 25 years, there's been a true revolution in zoos, where we've moved away from menageries -- where I have to agree with you, there was some exploitation of the animals -- to organizations that are seriously committed to conservation. And we do this in several ways. One of course is education of our local public. And you don't learn much from seeing animals pacing back and forth behind bars. But in the new exhibits you have the opportunity to feel for the animal, to empathize, to connect, to learn about it. Secondly, zoos have been active in breeding animals as a back-up if you will to the wild populations, and in some cases, re-introducing them to the wild. The third thing is training. We've become training grounds for wildlife managers. And fourth, the techniques that we have been developing for years and years in zoos, such as assisted reproduction, veterinary care, are becoming more and more applicable to wild animals as the wild, national parks, protected areas, become more and more zoo like. The difference between the wild and the zoos is disappearing.

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