

observed to eat a fish suspended on a line into the pen. The next day it ate 100 lb of ling-cod, similarly suspended. The following day it was fed fish suspended from the raft inside the pen; thereafter it was fed by hand. Although it ate heartily during its last month of captivity, the lesions on its skin became more and more extensive.

On 9 October 1964 the whale appeared less interested than usual in its fish at feeding time. It took three fish but refused to rise out of the water to obtain them. After swimming listlessly for a few minutes, it gave an abortive blow, while partly underwater, and then sank out of sight. Two-and-a-half hours later the whale was lifted out of the water. It was found to be dead and an autopsy was made. During the last two days of its life the saline content of the pen reached 12 per 1,000 the lowest level which was recorded.

During the period of its captivity, the whale became famous under the name of 'Moby Doll'. Its small size and small dorsal fin led its keepers to believe it to be female. Not until it died was it identified as a male.

One of the most interesting aspects of its behaviour in captivity was the whale's lack of aggressiveness. Killer whales are predators that feed on seals, sea-lions, porpoises and other whales, as well as fish. People working round the specimen in captivity always treated it with a certain amount of respect but it never showed any retaliatory or hostile behaviour. Once it started feeding, it learned quickly to take fish from the hand of its feeder. It always did this in a slow and deliberate manner.

On autopsy it was discovered that the skull had been clipped by the harpoon and that there was some infection present in the lungs and kidneys. The debilitating effects of the wounds and the long period of starvation, together with the problems associated with the low salinity of the water within the pen brought about the animal's death. It is believed, however, that this species could adapt quite well to captivity and would make a fascinating exhibit.

At post-mortem, the animal was found to be an immature male, measuring 15 ft 4 in. long and weighing 2,300 lb.

## VOICES OF THE FELIDAE

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ONE of the most popular buildings at Philadelphia Zoo is the modern (1951) Carnivora Building which houses almost exclusively members of the family Felidae. It is a handsome stone structure, finished inside with tile, terrazzo and plaster, making it easily cleaned and virtually odourless. However, having had my office in the building since its opening, I soon realised that all these hard surfaces produced a rather noisy environment and in December 1964 an acoustic ceiling was installed in the form of 3,000 square Geocoustic Units of glass foam (Pittsburgh Corning Corp). They not only make the ceiling more attractive but they dramatically reduce the noise that formerly reverberated round the building.

The objectionable noises were those made by large crowds of visitors, and especially those of screaming, shouting groups of school-children. We did not wish to eliminate the sounds of the cats themselves, for we feel that such natural sounds make the animals more interesting to the visitor.

When the lions, *Panthera leo*, roar, many people ask whether they are angry, upset or hungry. In my opinion, none of these factors causes them to roar in chorus, although a lion will growl or utter brief roars of rage. Lions are social animals and they roar to maintain their social grouping - i.e. to communicate, to let other lions know that they exist and have a territory. In my experience, the stimuli that trigger roaring in lions are all auditory. I have concluded that it does not take much to make them roar.

I have been frequently asked at what age a lion first roars. Since our lion cubs are usually sold at an early age, I have only had one opportunity to make any observations on this. On 10 May 1961 two cubs were born and the female was retained for breeding. On 13 May 1964 I wrote in my diary that "Elsa", the lioness, roared for the first time while sitting on her shelf. She had a viscous discharge from her vagina and rubbed against me as though in oestrus. Thus, she

this call when they are in oestrus and even when locked outdoors our male Siberian tiger will answer them. Otherwise our tigers are quiet beasts.

Female leopards, *Panthera pardus*, roar only when they are in oestrus but males are more vociferous and roar regularly to establish territory. However, there is much individual variation. Female leopards roar longer than males and, in our animals at least, they have deeper, more resonant voices. The sequence of coughing roars of the leopard have been likened to the sawing of wood. Compared to the jaguar, the individual roars are uttered more slowly and the average series in our male African leopard is 11 roars uttered in 7.1 seconds. Our male Chinese leopard, *P. pardus japonensis*, roars longer and more resonantly. I have counted up to 14 roars in a series that lasted for 11 seconds. Our female black leopards, mother and daughter, roar the longest of all our leopards and I have recorded two 19-second series and one 20-second series. The roars of our male black leopard are intermediate between those of the female black leopards and the male African spotted leopard. The average duration of a series of his roars is 9.5 seconds.

By contrast, the roaring of the jaguars is much more rapid and sustained. The roaring patterns of the male and female are very similar, with one notable difference: the male always prefaces his roaring with one or two moaning sounds and then breaks into the true roaring, averaging 50 roars in a series which lasts for 28 seconds. The series starts rapidly, reaching a crescendo midway, when the animal seems to hesitate, then resumes the original rapidity and finally slows down at the very end and finishes with a sigh. Our large male, 'Chaco', is the most vocal cat in the building and he is especially responsive to the roaring of the leopards—more than he is to that of the female jaguar! Many roaring duels occur between him and the male leopards. On one occasion he roared three times in three minutes which allowed a bare 30-second interval between each series. He has had as many as 12 roaring sessions in a single day. His more active periods are at 1200 hours and between 1600–1800 hours. At noon

the visible stimulus of the open door to the kitchen possibly acts as a conditioned reflex to remind him of food—he usually starts roaring while staring intently into the kitchen. However, often present as well are noises such as slamming doors, shouting children, passing of trains, the Audio Tours Tape in front of his cage and the other various sounds that, like the lions, will start him roaring. Also like the lions he roars while pacing, standing, sitting, lying down, in daylight and in the dark. The only occasion when he has failed to roar was when he was given a powerful tranquilliser (Tranimal, Hoffman-La Roche) between 25 February and 15 March 1963 in order to trim his overgrown dew claws. He remained silent during this period.

The female jaguar's roaring follows a pattern very like the male's except that she does not moan in advance or end in a sigh. Her roaring averages 50 roars to a series lasting 27 seconds. It is not as loud as the male's and she only roars when she is in oestrus. Her oestrous cycle is approximately 25 days and she remains in oestrus for an average of nine days. Her roaring is frequent during the middle of oestrus and tapers off during the last few days. She often roars in a sitting position but I have seen her roaring while either standing or lying down.

As already stated, the Snow leopard does not normally roar. Our male's typical call is a loud and piercing yowl or caterwaul, 'ow-w-w-w-w' which almost suggests a human cry of great pain. His main time for vocalising is between 1400 and 1500 hours, just before feeding time, so his yowl is probably a hunger call. Usually, after being fed, he is quiet, but on rare occasions I have heard him resume his yowls at 1630 hours on dark wintry afternoons. During the warm weather he is very quiet and ceases calling altogether.

Like the Snow leopard, the male Eurasian lynx becomes vocal just before feeding time and utters his soft 'whoo-oo-oo'. However, the lynx also calls after the 1500 hours feed, usually around 1515 to 1545 hours. On one occasion he called at 1635, causing first the male Chinese leopard to roar, then the male African leopard and finally a chorus of lions. Like the Snow leopard, the lynx is vocal

## Stock

struggle and simply attempted to avoid the boat.

The initial objective had been to kill the whale. However, as the fishing boat started to tow the creature, it became apparent that it was swimming strongly and would follow the boat when tension was applied to the line.

The whale was taken into shore and tied briefly to a mooring while an attempt was made to assess its injury. Spectators rushed to the scene in boats; the whale then became frightened and swam into a bed of kelp. At this point it became extremely distressed and uttered shrill whistles, so intense that they could easily be heard above the surface of the water 100 yards away. The animal was quickly towed out to deeper water in the channel. When it became certain that the whale was not tiring, it was decided to tow it to dry-dock in North Vancouver, 50 miles away, where more detailed observations could be made.

The trip to the dry-dock took 16 hours. During the voyage the whale kept the line slack and did not struggle. It became frightened and hesitant in the dry-dock but was herded in by small boats and by pulling on the harpoon line, which had been transferred to a stage suspended over the dock from a moveable crane. The dry-dock was converted into a pen for the whale by lowering the stage to a depth of 15 feet and by rigging it with cargo nets at either end.

Upon entering the dry-dock, the animal began swimming in slow counter-clockwise circles, a pattern it continued to follow throughout its life in captivity. After two days the dorsal fin began to develop a noticeable bend to the left which was considered to be a result of the continuous counter-clockwise swimming. It was never observed to rest or sleep. It surfaced to breathe approximately every 90 seconds. On occasion, it would stay under the water for two or three minutes and sometimes it would take two or three breaths fairly rapidly.

The whale manifested no apparent distress, either from the wound or the voyage, and plans were started to keep it in captivity. The rope was removed the following day and the whale given 30 million units of SR

penicillin as a prophylactic wound infection. The penicillin was injected into the dorsal region, just above the dorsal fin, with a 4 in. No. 18

Six days after capture the whale was given a further 15 million units of SR penicillin with a syringe mounted on an 8-ft pole. One gram of penicillin was injected by a 'capture gun' in the dorsal region.

A semi-permanent pen. 45 was constructed inside an abandoned Canadian Army Base, Jericho, in the outer harbour. The pilings were driven in the middle of the pier and the pen was enclosed by chainlink fencing. The location was 100 yds from the mouth of the Fraser River. The water conditions vary considerably from the water at times was fairly clear. The average saline content of 23 per 1,000 parts of water it became extremely muddy. The saline content dropped to 12 per 1,000 parts of water within the pen varying from 9 to 21 ft at the shallow end and to 24 ft at the deep end.

The dry-dock was towed to its present location on 24 July 1964 and the whale was transferred. Although the whale was not eaten since capture it appeared to be in good health and the harpoon wound healed. The whale continued to reject food. Furthermore, it began to show signs of its shyness of people. If several people were together on the pier, it would swim to the far end of the pool. It never showed any tendencies of any kind. For the first time a man was employed to spend his day on a raft in the pool in order to win the whale's confidence.

On 6 August 1964 the whale was again restrained at one end of the pen and the wound was inspected and the whale was taken. It was injected with 100 million units of SR penicillin, 1 g of thiamine, 100 mg of Vitamin B<sub>12</sub> and 1 g of atarbutolol into the dorsal fin.

During the last week of July the whale showed keratotic lesions began to appear on its skin. These lesions, caused by the wound, progressed relentlessly until the whale was taken.

On 9 September the whale was

first roared at three years of age but as her cage was far removed from the other lions and adjacent to rather quiet tigers this may have had an inhibiting effect on her.

I have observed the lions roaring at any time of the day or night and they will roar standing, sitting, lying down and even stretched out on their sides. It may be started by a male or a female, usually the former, and one by one the rest join the chorus. A typical chorus of our five lions lasts an average of 36.0 seconds. They roar more in the afternoon than in the morning but are almost sure to roar in the early morning, stimulated by my talking to their keeper, even if we are a considerable distance away. The most frequent time for roaring is 1510 hours. This is because they are fed at 1500 hours and by 1510 the keepers are rolling the stainless steel feeding buckets back to the kitchen. When originally designed, these buckets had soft, rubber-tyred wheels. When they wore out they were replaced by hard rubber wheels. These make a tremendous noise which invariably triggers the roaring of the lions.

So important is roaring to a lion that it will stop eating to roar. On several occasions I have observed this happen when a lion that was an especially fast eater would start roaring, stimulated by the feeding bucket. The other lions would let go of their meat and join in the chorus!

Directly behind the building lie the main tracks of the Pennsylvania Railroad. The rumbling passage of trains, especially long freight trains, is another regular lion-roaring stimulus. As the train traffic increases in the late afternoon, the lion roaring usually keeps pace. Many times when lions have roared I have detected no auditory stimulus but it is often shortly before a train rumbles by and I suspect they hear better than we do, or else feel the vibrations of the train.

The lions are easily stimulated by the sounds made by the other Felidae. The angry roar of a tiger charging a keeper will cause the lions to roar, almost without fail. The caterwaul of a tiger, which sounds like 'ah-oooh', will also start the lions roaring. The series of human-sounding cries of the leopards, *Panthera pardus*, at the climax of their mating

embrace will also cause the while the roaring of both jaguars, *Panthera onca*, will also to roar in reply. However, in they are more likely to respond than to the jaguars. On one lions began to roar with no apparent at 1706 hours and a male joined in. The lions then roared one starting before the others first series.

For about a year, a pair of Manned wolves, *Chrysocyon l.* kept at the end of the building tigers live. The male, usually raise his muzzle in the air and of extremely loud, harsh, squ to me, closely resemble those Red fox, *Vulpes vulpes*, high. Although the lions were just the Manned wolf, its cries start them roaring.

Other stimuli have been a the slamming of a door, loud children, loud human voice and on the Audio Tours Sto are activated by a key and taped lecture on the animals t at). Even the calls of the su cats have started the lions. least three occasions the ca Fishing cat, *Felis viverrina*, li off; and I have five record duck-like 'who-oo' of the lynx, *Lynx lynx*, causing the. On one occasion when th leopard, *Panthera pardus*, ro anger (the only time in my these cats roar) it started th

Very hot weather depresses behaviour and on humid temperature is 90 F or more other cats usually roar very l the weather turns cooler, the increases.

Our tigers utter single roar provoked and this normal lions to roar but, unlike the not seem to roar to commu same way. Their call is a m or, as Schaller (1968) phrases and' indicating 'Here I am