Cancer Kills Many Sea Lions, and Its Cause Remains a Mystery

By INGFEI CHEN

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For 14 years, since they first reported that a disturbing proportion of deaths among rescued California sea lions were caused by metastatic cancer, researchers have been trying to pinpoint the source of the illness.

In 1996, Dr. Frances Gulland, the director of veterinary science at the Marine Mammal Center in Sausalito, and colleagues at the University of California, Davis, found that a striking 18 percent of deaths in stranded adult sea lions were the result of tumors in the reproductive and urinary tracts.

“It’s such an aggressive cancer, and it’s so unusual to see such a high prevalence of cancer in a wild population,” Dr. Gulland said. “That suggests that there’s some carcinogen in the ocean that could be affecting these animals.”

The center has not observed the same syndrome in other seals.

Years of study have led researchers to think the answer lies not with any one culprit, but with several. Their research has added to a body of evidence concerning industrial contaminants in the ocean and their effects on the health of its inhabitants.

Sea lions have had to cope with a variety of challenges lately. There was the animals’ mass exit from Pier 39 in San Francisco late last year, which experts suspect was driven by a hunt for a better food supply. Also in 2009, the Sausalito mammal center had an unusually busy year. It took in a record 1,370 sick and injured California sea lions, and doctors found major problems in many, including malnutrition, parasitic diseases and bacterial kidney infections. Some had brain seizures from a toxic algae poisoning.

But the cancers are what Dr. Gulland found most worrisome.
One day last month, a volunteer rescue crew netted an ailing sea lion stranded on Stinson Beach and drove back to the hospital, which was newly rebuilt and reopened last summer. The thin, lethargic 200-pound young adult male had paralysis in its genital area and in its swollen hind flippers, clear signs of cancer.

“It’s pretty distressing to see,” Dr. Gulland said.

The veterinary team had to euthanize the animal. A post-mortem examination revealed not only cancer in the penis, but also tumors riddling the lymph nodes, lower spine, kidneys, liver and lungs. The disease typically starts around the penis in males and the cervix in females, then spreads. In an average year, the Marine Mammal Center sees 15 to 20 California sea lions with cancer.

The center always performs a post-mortem dissection. That work is “really what tells us about health trends in the ocean,” Dr. Gulland said.

The nonprofit center is one of the two biggest marine mammal rescue-and-rehabilitation facilities in the world — the other is in the Netherlands — dedicated to researching the health troubles of the animals it finds, said Dr. Sylvain De Guise, a veterinary scientist at the University of Connecticut.

Members of the medical staff in Sausalito, Dr. De Guise said, “have been pioneers at going beyond treating one individual at a time and releasing it, and have tried to understand the bigger picture, the causes and consequences.”

Ordinarily, veterinary experts do not see much cancer in wild animals, but there has been little monitoring for the disease. Recently, however, cancer has emerged as a key concern for some endangered species, including green sea turtles, Attwater’s prairie chickens and Tasmanian devils, said Denise McAloose, a veterinary pathologist at the Wildlife Conservation Society in New York City.

In addition, about 18 percent of dead, stranded beluga whales in the St. Lawrence River estuary in Canada were found to have intestinal tumors or other cancers, which have been linked to industrial pollutants.

No one knows how much of the general California sea lion population has tumors, or if the current rate is higher than before. No diagnostic test for the disease exists, said Dr. Robert DeLong, a research biologist at the National Marine Mammal Laboratory in Seattle who has participated in the cancer studies.

In his field observations among a colony of 100,000 animals in the Channel Islands — the
birthplace for most California sea lions that travel the state’s coast — Dr. DeLong said he saw two to five sea lions a year with huge advanced tumors.

When Dr. Gulland and Dr. Linda Lowenstine, a veterinary pathologist at the University of California, Davis, began investigating the cancer mystery, the obvious suspect was environmental contaminants. The Channel Islands lie off the Southern California Bight, where, from the late 1940s until the early 1970s, manufacturing companies discharged millions of pounds of DDTs and PCBs into the sea. Cleanup continues, but the chemicals linger.

But if those chemicals are solely to blame, the researchers asked, why was cancer originating mainly in the uro-genital tract, and not in the kidney or liver, as one would expect?

“That didn’t really fit,” Dr. Lowenstine said.

But, in examining sea lion tumor cells with an electron microscope, Dr. Lowenstine noticed what looked like viral particles. And indeed, in a major discovery in 2000, a different team of researchers in Washington, D.C., identified a herpesvirus in the sea lions, a close relative of the human herpesvirus that fosters Kaposi’s skin cancer lesions in AIDS patients. Recent studies by the California researchers have shown that the sea lion virus likes to live in the reproductive tract and, among adults, is twice as common in males — infecting 45 percent of them — as in females.

But environmental contaminants are not off the hook. Because it takes several “hits” of environmental or genetic damage to turn a healthy cell into cancerous one, the researchers speculated that the virus and chemicals could be interacting to trigger tumors.

Sea lions accumulate high concentrations of PCBs and DDTs in their blubber from eating contaminated fish; mothers also pass the compounds to babies. An analysis by the California researchers and experts at the Northwest Fisheries Science Center in Seattle found that animals with higher blubber PCB concentrations were more likely to have died of cancer.

“PCBs are notorious for two different things,” Dr. Lowenstine said. They can suppress the immune system, which may increase a sea lion’s vulnerability to the herpesvirus infection, but they also have estrogen-like hormonal effects.

In research published last summer, Dr. Lowenstine and Dr. Gulland and their associates began exploring the possibility that the contaminants interact with hormone receptors in the reproductive tract of sea lions to help promote cancer.

Meanwhile, a third piece of the puzzle is genetics. Another study revealed that animals with cancer are more inbred than those without it, so bad genes are probably also at work.
But proving cause and effect in the cancer mystery is difficult, the investigators said, especially given that experiments cannot be done on sea lions, which are federally protected.

“We don’t have all the answers by any means,” Dr. Lowenstine said. But the scientists are now mapping out a large study of 300 sea lions to study which of the three prime suspects — virus, PCBs or genetics — is most strongly tied to cancer.

To the California investigators, sea lion cancer is further evidence that what people do on land directly influences what happens to marine mammals in the ocean. And what makes them sick might affect us, too.

“Sea lions do eat a lot of the same things we do,” Dr. Gulland said. “So we really should start paying attention to what we’re putting into the oceans.”