Mystery Disease Strikes Europe's Seals

Thousands of seals are dying on the beaches of northern Europe. Is it the natural result of viral infection? Are toxic wastes suppressing the seals' immune response? Or are both to blame?

London

"SEAL PUPS are usually very playful and lively," says Lies Vedder, a veterinary surgeon with the Common Seal Rehabilitation and Research Center at Pieterburn in the Netherlands. "But this year, they are not like that at all. They don't grow, they often bite, and they always seem to be in a bad temper; many of them spend a lot of time just screaming."

The Pieterburn center was set up 17 years ago in an effort to halt a drastic decline in numbers of the common (or harbor) seal, *Phoca vitulina*, in the Wadden Sea, off the country's northern coast. Orphaned seals are cared for at the center and later set free, a technique which has led to a significant increase in the seal population; but this year, over 90% of the pups are suffering from a mysterious, frequently fatal disease.

"It is a disaster for us," says Vedder. The disease may have already killed more than 7,000 of the 15,000 to 16,000 common seals previously found off the coasts of Denmark, Sweden, Norway, West Germany, and the Netherlands—over 60% of the seal population in some localities—and may also have spread already to the British coast; the deaths in the Wadden Sea alone have wiped out many years of work by the rehabilitation center.

Two suspect viruses have been discovered in the bodies of the dead seals, one a herpes virus that may be related to a virus previously identified as the cause of a more limited outbreak of a similar disease 4 years ago at the Dutch rehabilitation center, the other a picornavirus (the Picornaviridae family includes the human poliovirus).

If the disease has a purely viral origin, then scientists hope the surviving seals will build up immunity. They also hope that a vaccine can be produced—although administering this to seals in the wild will be virtually impossible.

But some, such as Vedder, feel that the symptoms they have seen suggest the explanation for the disease may be more complicated. In addition to heavy inflammation of the lung, resulting usually in death through pneumonia, these symptoms have also included encephalitis, peritonitis, osteomyelitis, premature abortion, and deep, untreatable skin lesions. The fear is that the seals may be suffering from a suppression of the immune system; and that this may be directly linked to the discharge of toxic chemicals in the North Sea, perhaps to polychlorinated biphenyls (PCBs).

"We have never seen so many problems with bacterial infections with seal pups as this year; for example, I have not seen a single healthy umbilical cord scar," says Vedder. "There seems to be no way of treating them, and the immune system does not seem able to cope; we have no proof that there is immune suppression, but there are certainly indications."

Whether or not this is the case, most of those who have been investigating the seal deaths say they remain open to the hypothesis that chemical pollution may be directly or indirectly implicated, if only by increasing the stress on the seals and leaving them unable to fight what might otherwise be a relatively innocuous viral infection.

"This event could be a natural phenomenon, it could be a natural phenomenon which has been magnified by human intervention, or it could be entirely anthropogenic," says John Harwood, director of the Sea Mammal Research Unit of Britain's Natural Environment Research Council. "We just do not know at present."

One aspect of the disease which may provide a clue to its cause, and suggests that it may be different from the massive die-offs that are known to occur naturally from time to time among seal populations, is the speed with which it has spread.

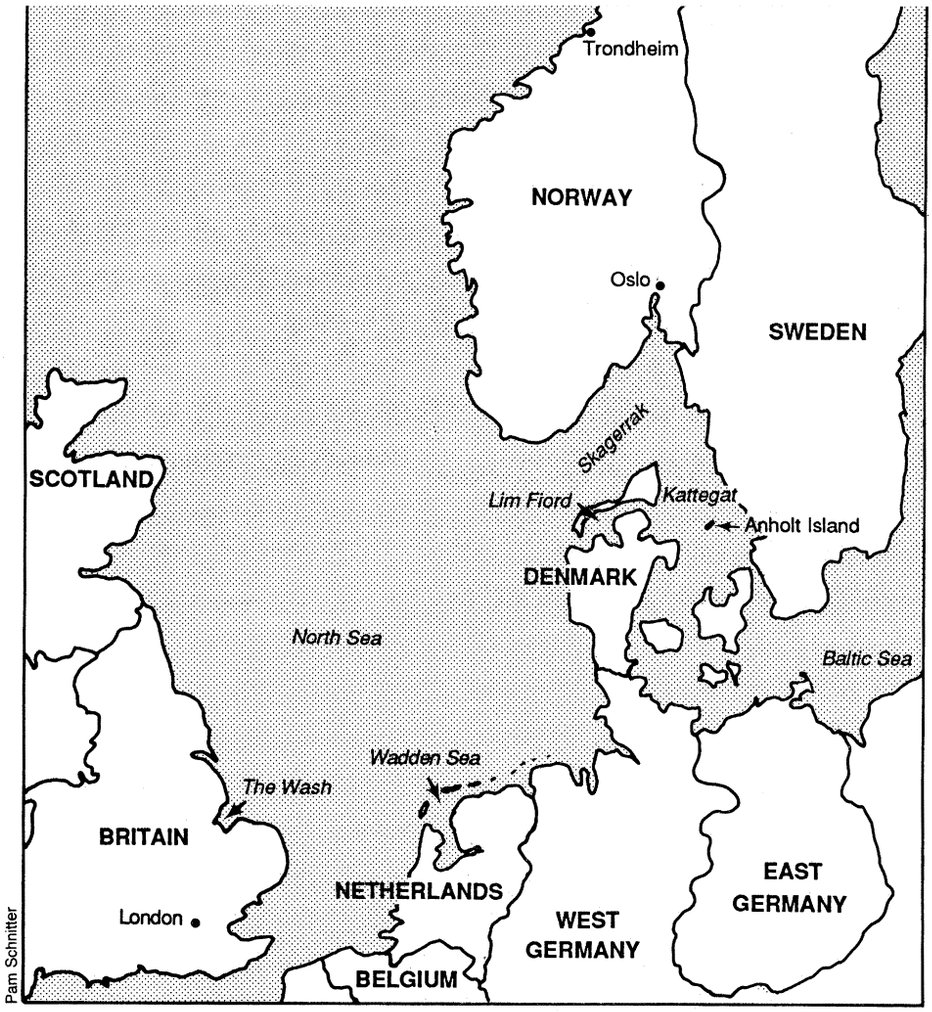
The first evidence that something was wrong came only in April, when large numbers of dying pups were found on the island of Anholt in the Kattegat, the sea that separates Denmark from Sweden. Five months later, seals dying from apparently the same symptoms have been discovered as far north as Trondheim in Norway (about 700 miles along the coastline), and across the North Sea in Britain.

A hypothesis that the disease might have been an influenza virus similar to one which caused an outbreak of pneumonia among common seals in New England in 1979 and 1980 is seen as unlikely. "We have checked 100 seals for influenza virus, and have not found anything, so I think we can count that one out," says Berndt Klingborn of the Swedish Government's Biomedical Center in Uppsala.

One of the first to provide positive identification of the presence of both the herpes and the picornavirus was Albert Osterhaus, head of the Department of Immunobiology at the National Institute of Public Health and Environmental Hygiene at Bilthovn in the Netherlands, who only a few months before the disease outbreak had initiated an international project to establish a global inventory of the viruses found in aquatic mammals.

"Before we can discuss countermeasures, we must know what the cause is," says Osterhaus. "All that we can say at the moment is that we are dealing with a viral infection; but it is still difficult to say which of the two viruses may be the cause of the

Stricken seal pups. *The diagnosis is still elusive for a disease that is affecting 90% of common seal young off the north coast of the Netherlands.*



Threat to seals *in European waters from Sweden to Britain.*

outbreak. All discussion of vaccines is therefore a little premature; they would certainly be very difficult to administer in the wild, although it might be used in sanctuaries."

Even if the disease is shown to be caused by one (or both) of the two viruses, this may not resolve the question of how it has managed to spread so fast, or how it is being transmitted. For example, whether—as was shown to be the case in the U.S. outbreak—the virus is transmitted by birds, or whether it is spreading by some other means.

As for the disease origins, one theory is that it may have been introduced by harp seals, found primarily in Greenland, which have been spotted much further south than normal this year. The disease does not seem to be transmitted easily to grey seals, which according to some reports have suffered from a similar disease but recovered.

Uncertainty over the nature of the disease has given rise to different views on how it should best be treated. In particular, the relative weight to be put on three separate factors: on allowing nature to "take its course" through relying primarily on the buildup of immunity in survivors; on caring for sick seals in the hope that they can be nursed back to health; and on taking measures to reduce environmental stress, for example, by imposing an immediate and drastic cutback in chemical dumping.

In Denmark, for example, the observation that seal deaths have leveled off in some areas after a rapid rise in May and June is suggesting to some that the disease is of purely natural origin, and that there may therefore be little point in human intervention (apart from limiting the spread of the disease by killing all the infected animals that are discovered, rather than trying to look after them and subsequently release those that are cured back into the wild, as is done in the Netherlands and West Germany).

Palle Uhd Jepsen, a wildlife biologist with the Danish Ministry of Agriculture, points out that the death rates have now leveled off in some of the earliest affected seal communities, suggesting that resistance to the disease is being built up in a normal way.

Others such as Minnie Courtney, a marine biologist at the University of London's Queen Mary College (QMC) who has carried out widespread studies into the impacts of organochlorines on the environment, feel that the solution has to be found at the other end of the spectrum, namely by a drastic reduction in the discharges of chemical waste into the North and Baltic seas.

Courtney points out, for example, that the high concentrations of PCBs found in the bodies of seals (partly as a result of their position at the top of the food chain) is known to significantly reduce their fertility. This itself has already significantly lowered the chances that even those that develop immunity will be able to breed sufficiently fast to rebuild the seal population.

The extent to which chemical pollution can be blamed as the primary cause of the outbreak of the disease among the common seals is currently a topic being hotly debated.

Activist groups such as Greenpeace, which have been campaigning for urgent action to clean up the North Sea for some time, have little doubt about the connection. Paul Johnston, a toxicologist working at QMC on research funds provided by the environmentalist association, points out that the seal deaths have coincided with, and may therefore be directly related to, two other major ecological disturbances in the North Sea that have occurred over the past few months, an algal bloom and a rapid decline in the seabird population on the coast of Britain. "These could indicate some very widespread dysfunction in the ecosystem.

In marked contrast, a spokesman for Britain's Ministry of Agriculture, Food and Fisheries, contacted by *Science* at the beginning of last week, said the ministry felt there were at present "no grounds for thinking" that the seal deaths were related to chemical pollution. "Our people believe it is just one of these things that occurs now and again."

Osterhaus, like many of the scientists investigating the disease outbreak, is cautious about drawing overhasty conclusions, certainly without further research, for example, into the difficult area of measuring the effects of low levels of exposure to toxic chemicals on the immune system.

Ottmar Wassermann, professor of toxicology at the University of Kiel, is less cautious. He claims that the large number of toxic chemicals currently being discharged into the North Sea—plus the relative lack of detailed knowledge about the effects of low-level exposures to these chemicals, either individually or in combination—makes the demand for traditional forms of toxicological proof no longer appropriate.

Wassermann points out, for example, that PCBs have been shown to impair the immune system in other mammals, such as mice, rabbits, and pigs. In the absence of any direct data, "we have to take the scientifically clear evidence we have from other mammals and apply it to seals," he says.

Dioxins could be an alternative culprit, he adds, since they can also affect mammalian immune systems in very low concentrations. "We have to look at the seal deaths as an alarm signal which may just be the tip of the

iceberg of the problems we will be seeing with the wildlife in the North Sea. The urgent need is to stop this pollution now in order to prevent further destruction of the ecosystem."

Spurred by the widespread public concern that seals—particularly baby seals—seldom fail to generate, politicians have not been slow to react. The German government has already allocated substantial extra funds for controlling chemical wastes and for research into the seal deaths, while an emergency intergovernmental meeting is being held in Stockholm this week at the suggestion of Swedish Prime Minister Ingvar Carlsson to discuss joint action by all states bordering the North and Baltic seas.

The need for urgent action was underlined at a scientific meeting held in London last week, jointly organized by the School of Biological Sciences at QMC and Greenpeace, with scientists attending from Denmark, West Germany, Norway, the Netherlands, Sweden, and the United Kingdom.

The meeting recommended the immediate initiation of a research project to study the etiological role of the different viruses that have already been found, as well as international effort to investigate the effect of environmental factors, including pollutants, on the immune system of seals. "In addition, measures have to be implemented urgently to protect affected populations" says Courtney of QMC who chaired the meeting. "And, of course, for all these purposes, funds are needed."

For most of the seals in the Netherlands and around the Baltic states, the results of the research will almost certainly come too late. Britain, however, where a number of seals have died in areas around The Wash with similar symptoms to those observed elsewhere, but where the presence of either of the two suspected viruses has not been confirmed, is awaiting the outcome of events with particular concern, since there are currently an estimated 25,000 common seals around the British coastline.

Greenpeace is actively supporting the call for more research. But it is not sitting on its hands until the results are known. A number of "nonviolent" protests, to include the blocking of pipelines dumping chemicals into the North Sea, are planned for the next few months, and the seal deaths will be brandished to justify these actions.

"Last year, we warned the governments of the North Sea states that, unless urgent action was taken, within 5 years the sea could experience a major environmental disaster," says Greenpeace activist Andy Booth. "We were wrong; as it turned out, the disaster we predicted has taken only a few months to arrive." ■ **DAVID DICKSON**

Artificial Insemination Report Prompts Call for Regulation

A new congressional report on artificial insemination may pave the way for increased government regulation of the physicians and institutions performing the procedure.

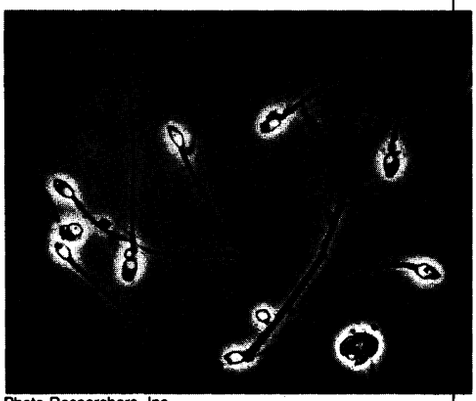
An Office of Technology Assessment report released last week says that although artificial insemination is the most widely used of the "new" reproductive technologies, many of its practitioners do little to protect recipients from genetic disorders and infectious diseases like AIDS potentially passed through donor semen.

The report shows that only 44% of 367 physicians surveyed test donors for antibodies to human immunodeficiency virus, and fewer than 30% test for syphilis, gonorrhea, hepatitis, or chlamydia. Only 48% of physicians screen donors for genetic disorders such as Tay-Sachs disease, sickle cell anemia, or thalassemia.

Moreover, many physicians surveyed display ignorance about the workings of genetic disorders. Some 25% say they would accept a healthy donor with a family history of Huntington's disease (a genetic disorder that usually appears only late in life), while 49% would reject a healthy donor with a family history of hemophilia, even though the latter could not pass the disease along to his offspring.

(Sperm banks do a more thorough job. Of 15 banks surveyed, 14 test all donors for evidence of AIDS virus, while one tests only men from high-risk groups. Twelve banks test regularly for transmissible diseases and 13 screen for genetic disorders.)

HIV-infected donor semen has already been used twice in the United States, although there are no confirmed reports of women having been infected through donated semen. Four women in Australia and Canada carrying the virus appear to have been infected by donated sperm.



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"It is appalling that something as basic and essential as testing anonymous donors for the AIDS virus is not routinely done," said Senator Albert Gore (D–TN) in introducing the report. "And it is often easier to learn whether a prospective donor plays the cello than whether he has a family history of Huntington's disease."

Gore called on the Food and Drug Administration to require sperm banks and physicians to screen semen just as blood banks now test for HIV antibodies. Currently, FDA recommends that all sperm donors be tested for antibodies to HIV. In addition, FDA says fresh sperm should be used only when the donor is in a mutually monogamous relationship with the recipient. Otherwise, sperm should be frozen for at least 6 months, and a second blood test from the donor taken for comparison.

A spokeswoman said Commissioner Frank Young is looking into the question of whether FDA now has authority to regulate sperm banks. FDA is also exploring the trickier question of how individual physicians can be regulated, she said.

Gore is also writing a bill to establish a national data bank to store the medical and genetic histories of anonymous donors. The bill, he said, will ensure the confidentiality of the data, but will also ensure that children born through artificial insemination have access to the data. "Such information can frequently mean the difference between life and death," Gore said.

The OTA report estimates that 172,000 women undergo artificial insemination each year, resulting in some 65,000 babies. Some 30,000 of those babies are conceived using donor sperm, the rest using sperm from the husband or regular sexual partner. In comparison, only 600 babies are born by in vitro fertilization and only 100 to surrogate mothers annually. Twenty states plus the District of Columbia have no laws on the books regulating artificial insemination, and only three states require that donors be screened for disease. ■ **GREGORY BYRNE**