FACTSHEET No. 6

DISEASES IN SHELLFISH

1. Algal blooms or phytoplankton can create toxins. These toxic algal blooms are often referred to as 'red tides' and are increasing in frequency. Many once harmless dinoflagellates (having runners or runner-like branches) now produce dangerous or deadly toxins. Bivalves (such as molluscs, cockles, mussels, scallops and oysters) feeding on these blooms can accumulate the toxic compounds in their flesh in very high concentrations. The compounds may then pass up the marine food chain to crustacea etc. feeding on the bivalves. There are four recognised groups of illnesses associated with toxins from unicellular algae. These are:

i. Paralytic Shellfish Poisoning (PSP)
ii. Diarrhetic Shellfish Poisoning (DSP)
iii. Neurotoxic Shellfish Poisoning (NSP)
iv. Amnesic Shellfish Poisoning (ASP)

PSP is associated with the algae genera *Alexandrium, Gymnodinium* and *Pyrodinium.* When ingested by humans the effects can cause numbness of the mouth and fingertips. This is followed by impaired muscle co-ordination. Respiratory problems and paralysis can also occur and may be fatal. All confirmed human poisoning has so far been associated with mussels in England and Wales.

DSP toxins are produced by the algae of the genera *Dinophysis* and *Prorocentrum*. These can cause diarrhoea, nausea, vomiting and abdominal pain. (1). Another DSP producer, *Prorocentrum lima* has been recorded at nine sites in Scotland. (2).

ASP is caused by domoic acid which is produced by marine diatoms of the genus *Pseudonitzschia*. This can cause vomiting, diarrhoea, abdominal cramps and loss of short-term memory. The effects on memory loss may persist. (1).

(NSP This is not known in the UK. (1).)

In August 1997 an extensive dinoflagellate bloom identified as *Gymnodinium* cf. *mikimotoi* occurred. This bloom can cause mortalities in a number of marine organisms, but was the only recorded bloom of this species in Scottish waters within the last five years. (2).

PSP has been a serious problem in some areas of Scotland for many years and there have been regular closures of those fishing areas of up to 2 months at a time since 1990. (2).

In addition, *Escherichia coli* (*E.Coli*) and *Salmonella* have been found in molluscs examined according to EU shellfish bed classification regulations, and thermophilic *Campylobacter* spp. Were found in 42% of 380 shellfish. (3). Bivalves can also take up antibacterial chemicals which are used to fight diseases in fish and which can enter the environment. (4).

Pacific oyster larvae are prone to be affected by a herpes-like virus, with high mortalities in France. (5). Two year old flat oysters, *Ostrea edulis* L., found in Cork Harbour, have been found to be affected by the parasite *Bonamia ostreae*, which spreads quickly and causes rapid mortality. (6). Pacific oysters, *Crassostrea gigas*, also suffer from Mikrocytosis caused by the pathogen *Mikrocytos mackini*, and Oyster Velar Virus Disease (OVVD) which is known to kill oyster larvae in America. Manila clam can be affected by brown ring disease, apparently caused by the bacterium *Vibrio tapetis*. (7).

In addition to the two serious diseases in bivalve molluscs, *bonamiosis* and *marteiliosis* (caused by the pathogen *Marteilia refringens*) which affect flat oysters, there are a number of other listed diseases. These are hapiosporidiosis, marteiliosis (caused by the pathogen *Marteilia sidneyi*) perkinosis, iridovirosis and mikrokytosis. They mainly affect pacific oysters, American oysters, Argentine flat oysters, Chilean oysters and abalone. Bonamiosis is the only one present in England. Haplosporidiosis, mikrokytosis, perkinosis, iridovirosis and marteiliosis are notifiable diseases of molluscan shellfish. (8) (9). Fish disease can be imported although there are very strict controls in Britain.

A project has been undertaken to analyse *E.coli* data in conjunction with the evaluation of information on sewage discharges. A comparison was made of the effect of crude, primary, secondary and tertiary treated discharges on the *E.coli* concentration at routine monitoring points within 2 kilometres of each type of discharge. Concentrations of *E.coli* in shellfish taken from the monitoring points in the vicinity of secondary-treated discharges were markedly lower than in those from monitoring points in the vicinity of crude or primary-treated discharges. Sources of other forms of pollution were possibly the reason that there was little apparent beneficial effect of tertiary treatment for shellfisheries. *E.coli* was found in greater concentration in mussels, followed by oysters and clams. (10). Raw oysters can carry fatal flesh-eating bacteria which cause the disease *necrotising faciitis*. This develops in humans from a bacterial infection and causes skin to die and melt within hours. The disease can also be transmitted through contaminated seawater and air. Mortality rates can be as high as 50%. (11).

Shellfish also have an increased susceptibility to disease when they are stressed. Flat oysters, Pacific oysters and other molluscan shellfish such as clams, mussels and scallops are all susceptible to *Bonamia* and *Marteilia*. (12).

In addition to diseases from natural algae, high levels of bacteria have been found in mussel and oyster beds of the Teign, Dart and Avon rivers. Causes may be due to run off from fields after heavy rainfall, or lack of sunlight, as ultraviolet rays kill bacteria. Sewage is another possible cause, but there is no certain proof that any of these are the cause. (13). However, oil spills are certainly the cause of contamination by polyaromatic hydrocarbons in mussels from Prince William Sound, Alaska. The blue mussel, *Mytilus trossulus*, from the rocky intertidal zone in temperate USA waters is eaten by many wildlife species. Aromatic hydrocarbons are known to cause sublethal and acute toxicity to a variety of biological organisms. After the Sea Empress spill off Newford Haven large numbers of dead or moribund shellfish, mostly bivalve molluscs, were washed ashore, including cockles, striped Venus (*Chamelea*

gallina)and razor shells (*Ensis siliqua*) and later the rayed troughshell (*Mactra stultorum*). Polycyclic aromatic hydrocarbons (PAH) such as benzo(a)pyrene are potent human carcinogens. Crustacea also accumulated the smaller PAH such as naphthalene, phenanthrene and alkylated derivatives in affected areas. These compounds can remain in their tissues for some time. Combustion processes can also contaminate bivalve shellfish from PAH releases. (14).

Shellfish 'pests' include American tingle, Grepidula and Mytilicola.

2. Crayfish, lobster and crab:

Crayfish: The native British crayfish, *Austropotamobius pallipes*, has been endangered by a lethal plague brought in with the North American species of crayfish, the signal crayfish, *Pacifasticus leniusculus*. The plague takes the form of a fungus which can wipe out whole populations of the native species. Signal crayfish, along with all North American species, are carriers of the disease and are not immune to infection. But they are resistant unless unduly stressed. This resistance relies on an ability to stop the growth of the fungus by encapsulating it with melanin. In the European crayfish this process is too slow to be effective and the plague has devastated natural crayfish populations throughout Europe. (15). Other diseases are Porcelain disease and Exoskeletal disease. (16).

Lobster: The two most important species of clawed lobster are *Homarus gammarus*, the European lobster and *Homarus americanus*, the American lobster. Specific to both species is the disease Gaffkaemia, which may be carried by lobsters from abroad and infect native species. (17). Without treatment massive mortality can also occur from bacterial growth on lobster eggs. (18).

Crab: Black spot disease.

3. More Non-natural causes:

In the US Centre for disease Control, it is estimated that waterflesh, including shellfish, causes 66% or some 325,000 annually of all US poisoning. Since only the most visible cases are recognised, the actual figures may be much higher. Cadmium, lead, chromium and arsenic are found in shellfish. These impair mental development and can lead to cancer even at low levels. No Food and Drugs Administration (FDA) action level exists for lead in seafood. (19).

Mercury is a dominant toxic metal in sea-food sold in Hong Kong. This can cause fertility and general health problems, (20) and paints which contain ribulytilin can alter the sex of dog whelks and affect other marine animals and should be phased out. (21). Most of Scotland's fish farmers use copper-based paints and anti-fouling agents to prevent fish cages from being clogged by mussels, algae and seaweed. Zinc is used to galvanise the cages and is a component of salmon feed. Sediments become severely contaminated causing harm to crustacea by damaging their reproductive abilities or killing them. Dipping sheep in synthetic pyrethroids can cause river pollution, toxic to invertebrates. (22).

Crabs at a nuclear plant in Normandy showed high levels of radiation. Cogema is authorised to dump slightly radioactive waste in the water and the crabs from there could travel several miles a day. (23). Between 1993 and 1995 radioactivity monitoring of the Irish Marine Environment was carried out to assess contamination and estimate the risks to human health. Exposure has arisen from various sources of artificial radioactivity including atmospheric testing of nuclear weapons during the 1950s and '60s, the Chernobyl nuclear accident and controlled discharges of radioactive effluent from nuclear installations. The main source of artificial radioactivity in the Irish Sea is the routine discharge of low-level liquid radioactive waste from the Sellafield nuclear fuel reprocessing plant on the Cumbrian coast. A Report stated that, whilst the concentrations of potassium-40 in fish and shellfish are considerably higher than those of many other natural radionuclides (*Radionuclide* – an unstable nuclide that emits ionising radiation. The emissions may be either alpha, beta or gamma radiation), its presence in seafood does not result in an increased radiological hazard. (24).

Prawn/shrimp aquaculture: apart from destroying the mangroves, the waste from prawn farms in the mangrove forests of the Third World, which consists of dangerous chemicals and antibiotics, has also polluted coastal waters, fresh water canals and ground water supplies. Acid sulphate soil contamination, prawn farm created pollution and related disease outbreaks in the ponds along with other, natural imbalances, eventually cause the farms to close down. High demands for prawns in the industrial world and the large amounts that can be earned through prawn aquaculture, are tempting countries like Malaysia, Vietnam, Cambodia, India, Iran, Yemen, Mexico and others to enter the same trap. (25). And 'Taura syndrome' is affecting shrimp mariculture in Ecuador, Honduras, Panama, Japan and China. It has also affected Tedas shrimp farms and is moving up the Gulf coast. Taura, named after a river in Ecuador, is a syndrome, with three viruses and one vibrio implicated. In some areas mangrove networks are removed to create the ponds. They lack vegetation to filter and cleanse incoming water carrying nutrients and organisms, and adequate ingresses and egresses. The shrimp are also fed many types of foodstuffs including hamburger meat. Pesticide levels are high in many areas; Chloramphenicol and other broad-spectrum antibiotics are flooded into the ponds to decrease contamination. The result is immunodeficient shrimp suffering from multiple opportunistic infections (OIs). One suspected viral agent is a baculovirus which is insect-borne. In other areas, such as in scallop farms, rickettsial agents have emerged. There is concern about the dissemination of antibiotic-resistant or insensitive (eg viral and protozoan) organisms in downstream water systems. (26).

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