This is the first of two parts of an article by seaman R.A. Priest which we reprint from the Seamen's Journal, June and July issues, 1976.

The oceans and seas of the world contain 330,000 cubic miles of water, covering most of the planet except for 29 per cent of the surface which is occupied by the continental land masses.

The floor of the ocean has mountains, valleys, escarpments, plains, shelves, volcanoes, and rolling hills, far more spectacular than any to be found on land.

The mid-oceanic ridge is a continuous mountain chain running submerged for 40,000 miles and equal in area to all the continents. It varies in height from 1,000 to 10,000 feet and is seldom less than 700 miles wide.

The deepest trench is the Philippines Trench which descends to a depth of 37,782 feet; compare this with the Grand Canyon which is a mere 4,000 feet deep.

The dimensions of the ocean sound impressive, but its chemical and physical properties are far more impressive. Although they are extremely complex, they have remained virtually constant for hundreds of millions of years. Such a constant balance is dependent on extremely subtle controls which allow the ocean to respond flexibly to external changes and to balance its own internal processes.

VITAL TO LIFE

In this article, I will endeavour to set out some of the ways in which man is upsetting these subtle controls but, first, we must look at the functions of the ocean in maintaining the balance of life on this planet.

The ocean is not just one big puddle of spectacular dimensions. In fact, it is continuously active. Without these activities, life on this planet would cease to exist.

Let's now look at some of these activities.

Heat energy is being continuously absorbed from the sun and mechanical energy from the winds. Carbon dioxide and other gases are being breathed in from the atmosphere. It absorbs huge amounts of a large variety of materials which arrive via rivers, rain, snow and melting polar ice.

The ocean mixes all these materials and distributes the sun's heat energy, releasing heat to the atmosphere. It breathes out oxygen and other gases, eliminates excess materials by sedimentation and the formation of sedimentary rocks.

So, as you can see, the ocean is more than just a place in which to float ships.

Seawater is very rich chemically and contains in solution almost every known element. This is due to its ability to dissolve chemicals and to the wide range of chemicals which enter it.

The relative proportions of seawater have probably remained constant for the past 600 million years. When considering the vast and many chemical changes that have occurred on land during the same period, this fact becomes very relevant.
Although we do not fully understand the elaborate controls which maintain seawater's rich composition, the fact that this composition is maintained must be one of the biggest factors controlling the whole ecological balance of the planet.

The ocean achieves this by being in perpetual motion (it was recently discovered that even the deepest parts, previously thought to be stagnant, are moved by powerful currents). This continual movement acts like a gargantuan cocktail shaker mixing up all the chemicals thoroughly.

GLOBAL THERMOSTAT

Another important job that the ocean does for us is in its role as the global thermostat. If it was not for the sea, our continents would experience temperatures like those on the surface of the moon.

Seawater has a capacity to store heat exceeded only by liquid ammonia. This implies that it requires an enormous quantity of heat to increase the temperature of the ocean by the smallest amount, which means that the temperature of the ocean changes much more slowly than that of the atmosphere above it.

For instance, a one per cent increase in the quantity of solar energy reaching the earth would raise the atmospheric temperature by 15°C, while it would only raise the ocean temperature by a mere 0.01°C.

The temperature of the ocean is so constant that it acts as a stabilising influence on the temperature of the continental land masses and the atmosphere. This function is also helped by the ocean movement which brings down cold polar water to cool the equatorial regions.

ORIGIN OF LIFE

The next function of the oceans we can look at is the creation and maintenance of living organisms, including man.

It is thought that life originated in the sea over 3,000 million years ago.

The similarity in chemical composition of all living organisms is surprising. It is even more surprising that their composition is similar to that of seawater.

Even man, who likes to consider himself as a superior life form, carries within his body a portable ocean. Blood plasma and other bodily fluids are peculiarly similar to brackish seawater and we all start life as a foetus floating in a sea of amniotic fluid.

Now scientists maintain that the ocean has its own blood stream and that seawater performs much the same function as blood plasma. It provides a constant environment and acts as a transport medium for nutrients, waste products, dissolved gases and heat.

It is obvious that the ocean has been a dominant influence in the development of life on our planet. The shared chemical composition of seawater and living organisms is, therefore, no coincidence.

The four major forms of life all started in the sea.

The first is Monera, a primitive one-cell organism with a very simple internal structure. They exist today as bacteria and algae.

The second group is known as protista and has the ability for photosynthesis (process by which green plants use the energy of sunlight to build up complex materials from carbon dioxide and water). This group is multi-cellular and more complex. They can be seen as seaweed, fungi, slime and protozoa.

The third group is metazoa. They were as complex as the protista but could not photosynthesise and therefore had to obtain energy by eating protista or each other. Their descendants include sponges and all animal life.

The fourth group, which appeared much later, was the metaphyta which evolved from seaweed-like protista. Descendants of this group are mosses, ferns, plants, and trees.

The most abundant form of life is still marine life, the basis of which is plant life.

This marine plant life, most of which is
microscopic and floats freely on the surface bathing in sunlight, taps solar energy by photosynthesis and converts it to the chemical energy which fuels all other forms of life. This stuff floating all over the ocean is called phytoplankton and is a critically important, if little appreciated, form of life. Later on we will see that it could also be our undoing.

Sea life is distributed in such a way that the open ocean is far less productive than the coastal areas. This is caused by the availability of essential nutrients which are more abundant in coastal areas due to the run off from the land. It is in these areas that man finds most of his seafood and dumps most of his wastes.

Now that we have a brief idea of how the ocean works and how important it is to the balance of nature, we can proceed to investigate how we may be upsetting this balance - for, with no life in the seas, there would be no life for humanity.

TAKING LIFE OUT OF THE OCEAN

Most ecological problems are caused by man putting something into the environment. This certainly is one of the reasons for the decline of life in the seas but, in this section, we will deal with another aspect of that decline - the exploitation of the sea; taking life out of it.

The ocean is man's last hunting ground and he is busy indiscriminately removing everything he can find in it.

It is now known that sea life is not infinite and consequently the amount we can take without depleting populations or causing the extinction of species is limited.

Overhunting of the oceans is at an incredible level and is inexcusable. The species in most danger are marine mammals, including the whale.

Modern whaling is aided by harpoons with explosive tips and factory ships which process carcasses on the spot. These innovations have escalated the annual kill since the day of the old whaler, although even then - 100 years ago - concern for the numbers of whale taken was being expressed in some quarters. Herman Melville was moved to ask "whether leviathan can long endure so wide a chase, and so remorseless a havoc?"

SAD TRUTH

As recently as 12 years ago, 65 per cent of the annual world kill was taken in Antarctic waters. It has since dropped to 10 per cent. The yield of whale oil has dropped from 2,000,000 barrels to 400,000 during the same period.

This doesn’t mean that we aren’t trying to catch that many any more. No, the sad truth is that there just aren’t many whales left.

The majority of the world catch is taken by the Soviet Union (43 per cent) and Japan (42 per cent) with the remaining 15 per cent going to a number of countries including Australia (1.5 per cent).

Not only is the whaling industry digging its own grave but it has yet to grasp that uncontrolled hunting is economic suicide, to say nothing of the butchery of a beautiful and useful marine species.

BALANCE UPSET

Now, I can hear you saying “What about the International Whaling Commission?”

This Commission was set up to regulate the industry but they have been very slow to take any effective action. They set quotas to limit each nation’s catch but do so by weight rather than species. The quotas have done little to halt the depletion of stocks.

You may ask: “Why worry about whales, how are they so important?” To answer that, we must look at the ecological role of whales.

The whale’s diet consists of microscopic shrimp-like krill and other forms of plankton. The whale consumes these in such large quantities that he is an important factor in the control of the krill population. Removing the whale will upset the balance between plankton and other marine organisms.

Other mammals also have problems. Schools of yellowfin tuna always have a small porpoise as an inseparable companion. When the tuna are netted, so is the porpoise which often panics and dies. On the west coast of North America, a quarter of a million died this way in 1970.
No one knows why this bond between the small porpoise and the yellowfin tuna exists, but no doubt it serves some useful purpose. Man will probably discover its meaning after he has severed the bond.

FISH EXPLOITATION

Getting away from mammals, let us look at the fish scene. Not only whales but also fish are being exploited out of existence.

The first indication that something was wrong was from an observation during experiments carried out in the North Sea before the First World War. It was noticed that the size of plaice being caught was getting smaller and that larger fish were being removed at a greater rate than small fish could replace them.

Scientists tagged some fish and released them. Up to 70 per cent of the tagged fish were re-caught the very next season, suggesting that that amount of the total stock was being removed every year.

The nations which at that time fished in the North Sea could not agree on suggestions for restoring the stock but, after 1914, were too busy killing each other to worry anyway.

The period 1914-1918 was a great time for the fish. Their problems were solved for a while as fishing in the North Sea became an extremely dangerous pastime.

After the war, fishermen found their catches were back to what they had enjoyed previously. The plaice had had a respite, but not for long. By the end of the 1920s, less fish were being caught and their average size was once again diminishing.

DUBIOUS BLESSINGS

The Second World War came to their rescue once more and the fish responded by increasing their stocks and their average size.

The lessons learned in the North Sea led to a study of the effects of over-fishing on fish populations - a study which is far from complete.

Since the Second World War, big business and technology have bestowed their rather dubious blessings on the fishing industry and, in doing so, have accelerated its passage along the road to ultimate collapse.

Their much vaunted increases in yield have been so “successful” that fishery after fishery has sunk into commercial extinction. It is predicted that by 1985 the maximum sustainable world catch of between 100 and 200 million cubic tons could be reached.

The world fish catch increased ten-fold in the century from 1850 to 1950, doubled in the next decade and increased by half in the decade after that.

The problem is that, rather than spread the load among a wide variety of fish species in a wide range of locations, the fishing industry has concentrated on attacking those particular species which sell well and on attacking them where they concentrate for breeding and migrating. All this for economic reasons, of course.

Out of 20,000 species, only five are required to make up a third of the world catch.

The Peruvian anchoveta, weighing in at 10.4 million tons, tops the list followed by the Atlantic herring, at 3.8 million tons.

These two species are used for fishmeal and fishoil industries and are obliging for the fishermen by their habit of forming into vast shoals.

The other three main species are the Atlantic cod, the Alaskan wall-eye pollack and the South African pilchard.

SMALL AREA

All these fish come from a small area and it is estimated that an area the size of California produces about half the world’s fish supply. While half the world’s fishing grounds are being fished to exhaustion, the other half remains virtually untapped.

The reasons for this are completely economic. The biggest market for fish is the fishmeal industry. This industry requires large, expensive processing plants sited close to their source of supply, plus a continual supply of fish.

When the supply exceeds the sustainable yield of the fish ground, as it usually does after a short time, then it is too bad.

A case in point is the Peruvian anchovyeta industry, which has risen from a minor fishery with a catch under half a million tons to the world’s biggest single species fishery
with annual catches over ten million tons. In the process, it has made Peru the world’s leading fishing nation.

This was only achieved by investment of vast amounts of capital. From 1957 to 1962, the anchovy catch increased fourteen-fold. The best year was 1970 with a mammoth catch of 12.6 million tons, well above the sustainable level.

HALT CALLED

A halt was finally called by the Peruvian Government in 1971 and fishing was banned for three months. The season’s catch was limited to ten million tons, which also exceeded the sustainable yield.

Unfortunately, the reasons for this action were economic and not ecological. The government had decided to cut production of fishmeal to keep the prices high.

The fishmeal industry is probably one of the most wasteful users of the ocean’s resources. A ten million ton catch of anchovies could produce enough protein concentrate to combat the protein deficiencies of all the people of Latin America. Instead, it is reduced to two million tons of fishmeal and exported to nations to feed livestock and poultry.

This means that one source of protein is being used to produce another source of protein, but the people who get to eat the pork, steaks, and turkeys don’t need that protein as much as those in the nations where the fish was caught.

STARVATION AND DISEASE

It is in the developing countries that fish protein is most needed because it is in these countries that the population explosion is most marked.

In fact, these countries only a decade ago used to export grain but now have to import it from the developed countries. The net result of this is starvation, disease and misery.

The most important aspect of starvation is a lack of protein. Severe protein deficiency leads to diseases such as kwashiorkor, which strikes children and is characterised by grotesque distention of the stomach (remember the pictures of Biafran and Ethiopian children).

In many of these countries, the majority of what little protein is available is derived from fish. On the other hand, in developed countries where the population is almost static, the consumption of fish protein is exploding. This is caused by the increasing use of fishmeal to feed poultry and pigs, etc.

Already over half the US poultry feed is fishmeal. One cannot help feeling that the fish would be better used directly as food for humans.

However, it is unlikely that the wasteful use of an increasingly large proportion of the world fish catch for fishmeal will be curtailed, as this would cause the poultry industry to collapse. It would also be an embarrassment to the pig-raising industry.

The fishmeal industry is not only harming the balance of the ocean’s ecological structure but it is also widening the gap between rich and poor nations.

Consider the fact that three-quarters of the world catch is landed by 14 out of 200 fishing nations. Of these, only one, Peru, could be described as a developing nation.

NOT ONLY VICTIMS

Whales and fish are not the only victims of over-hunting. Crustacea, especially shrimps, are also being widely over-fished.

The annual shrimp catch in the USA was 6.3 million pounds in 1936. Two decades later it had crashed to 10,000 pounds.

Coastal pollution no doubt played a considerable part in this collapse but it was not the only reason.

There is no doubt that the mass removal of living organisms from the sea has a bad effect when it has commercial implications.

An example is, once again, the Peruvian anchovy industry. Anchovy are an important source of food for the guano bird which, in turn, produces nitrogenous guano fertiliser. Obviously, no anchovy and no guano bird equals no fertiliser. A simple equation isn’t it?

The simple fact is that the combined effect of pollution and over-fishing is putting at risk one of man’s greatest food resources at a time when he needs it most.