The Salt Seekers

Getting fresh water from salt water is a world problem, but the salt itself, without which man cannot live, is also a valuable resource of the sea

By Gary Rogers

➤ AN EVER-INCREASING number of water purification plants costing millions of dollars are being built to handle the world's critical fresh water shortage. Yet the very substance these stations are designed to eliminate—salt—is being extracted from the ocean at the same time, by installations of a different sort.

Actually, salt, one of the world's most common compounds—and one man cannot live without—may be obtained in a variety of ways. One method is by mining in much the same way as for coal. A shaft is sunk into the earth and salt is blasted into pieces to be brought to the surface. Another method is by pumping heated water deep underground into salt domes where the salt is dissolved and brought to the surface.

Solar evaporation of sea water is one of the oldest systems that man has devised for obtaining the all-important salt crystal.

Evaporation of sea water for salt dates back more than 4,000 years, and history has shown that the availability of salt has been a primary cause for many of the important events of civilization, ranging from Roman wars to Marco Polo's explorations.

The far-flung salt trade in ancient Greece gave rise to the expression, "not worth his salt." Special salt rations given early Roman soldiers were known as salarium agrentum, the forerunner of the English word "salary."

Largest Solar 'Salt Farms'

Around the edges of San Francisco Bay are the largest solar salt "farms" in the United States. Here the evaporation methods of the ancients have been refined and improved to such an extent that more than a million tons of this valuable mineral are harvested annually.

Indians produced the first salt in the San Francisco Bay area. Now more than 60,000 acres are under production. While the Indians merely scooped depressions into the soft shoreline tide flats for their salt, modern techniques are much more involved.

The San Francisco area is almost ideal for the production of solar evaporated salt, having a relatively short rainy season with a moderate amount of rainfall, and considerable periods of wind and sun—the prime ingredients of the evaporation process.

To begin solar evaporation, billions of gallons of sea water are poured from the Bay into shallow ponds, some covering as much as 800 acres. Then evaporation begins, a six-year process that will eventually increase the salt content of the water from 3% to 25%.

The ponds are formed by building levees approximately three feet high on the tide flats of the Bay. While covering more than 40 square miles, the ponds are actually built in an intricate series. Sea water flows from large concentration ponds to smaller "lime" ponds, and finally to crystallizing or harvesting ponds approximately 40 acres in size. The function of the concentration ponds is to increase the salinity of the water to the point where salt will crystallize on the hard clay bottoms of the harvesting ponds.

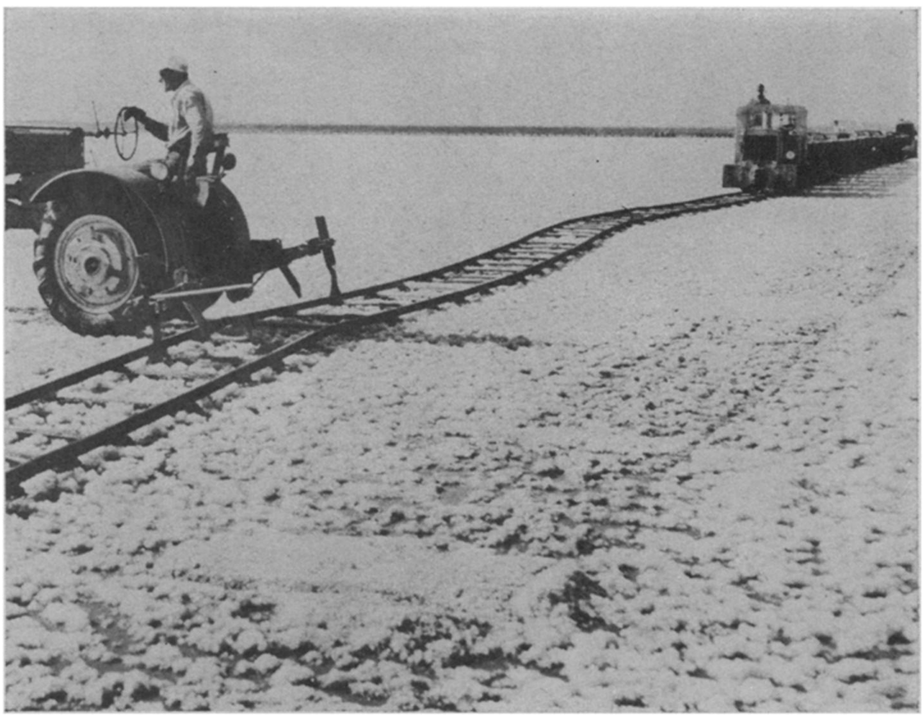
As wind and sun decrease the volume of liquid and thus increase the salt percentage of the brine, periodic hydrometer readings are taken to determine the exact salinity of the various concentration ponds. This data tells the salt "farmers" exactly when to pump the contents of several concentration ponds into one lime pond.

At this time, various minerals in the brine become insoluble, and fall to the bottom of the ponds. Most notable is calcium sulphate, or lime, which gives the intermediate ponds their name. In the lime ponds, evaporation continues until the brine reaches such a level of concentration that the lime has dropped out completely.

Careful Measurements Made

Careful measurements pinpoint the time when salt crystals are just beginning to fall out of solution. It is critical to move the brine out of the crystallizing ponds at the right time because, if allowed to evaporate further, other elements such as magnesium and iron would mix with the salt giving it a bitter, unpleasant taste.

When the brine is drained off, a fresh batch is brought in. The process is repeated from February through September, at which time a four- to six-inch



Leslie Salt Company

SUN-DRIED SALT—After harvesting, a miniature locomotive traveling on portable tracks carries the salt to the washing shed where it is placed on huge piles before being processed into a variety of grades and packages.

layer of salt, 99% pure, has "grown" on the bottom of the ponds.

The old brine is sold to nearby chemical plants where bromine and magnesium compounds are removed.

The harvest season usually begins about the first week in September and is completed by the first of December, the object being to delay the start to obtain the heaviest possible crop, and yet finish before the rainy season.

Harvesting is done by huge machines which scoop salt layers off level pond bottoms and load it into hopper cars. Small locomotives, operating on portable narrow-gauge tracks, haul the salt to a washing building where a bath of brine removes dirt and particles of clay and calcium, as well as any traces of the original brine.

A final mist of fresh water bathes the salt crystals before they are moved by conveyor belts to huge 100-foot-high storage piles.

Contrary to widespread belief, only a small proportion (about 5%) of the salt finds its way into the home. Approximately 90% of the total annual harvest is used by industry, where it is directly or indirectly involved in the manufacture of more than 14,000 different items, ranging from the making of steel to the paper on which this story is printed.

Basically, there are three kinds of salt:

1. Crude salt that has been washed and stockpiled, and is sold to industry.
2. Kiln dried salt that has been washed and dried at 365 degrees F.; it has a purity of 99.7% and is used for livestock feeding, water softening and some food industries.
3. Vacuum refined salt that has been washed, then dissolved and recrystallized; it has a purity of 99.96% and is used by the canning industry and for home table use.

Wars have been fought and the course of history changed because of a scarcity of salt.

Today, science and industry are using the world's almost limitless supply of sea water to bring man greater quantity and better quality of this all-important ingredient.

AGRICULTURE

Food Crisis Heals Slowly

➤ FARMERS in the developing, overpopulated areas of the world are still threatened with the loss of their entire crop to drought, floods, pests or plant diseases while such total failure is practically unknown to modern, educated growers.

At a symposium on agroclimatology, the study of climate and weather for the benefit of agriculture, 125 scientists from 36 countries concluded that the world's food problems will not be solved quickly by applying science to farming.

There are, however, several steps that can be taken to make the farmer less subject to the whims of nature, as evidenced by the success of western farmers at virtually weather-proofing their land.

The use of shelter belts for wind protection can increase crop yields considerably, research has shown, but their misuse can be devastating. In hot dry climates, cutting wind speed may result in dangerously high temperatures. Similarly, shelter belts may reduce temperatures to harmful lows on clear nights in the arid zone.

"Integrated" insect control programs may help farmers fight pests and do away with the use of insecticides alone, the symposium at the University of Reading, England, was told. Temperature, winds and moisture all influence the times insect pests move in to destroy crops.

Plant disease is also affected by climate because disease spores may be influenced by local weather conditions.

Radiation received on the earth can be measured to estimate the efficiency of plants in converting this "fuel" into food crops through photosynthesis, Prof. M. I. Budyko of the Geophysical Observatory, Leningrad, reported.

Vast man-made changes in climate are not likely to occur in the immediate future, the symposium scientists believe, reducing the often-raised possibility of increasing food production.

Replying to a suggestion of eliminating the polar ice-caps by covering them with carbon black to increase their solar absorption, Prof. R. O. Sutcliffe of the University of Reading said, "If all the ice were to be removed from the polar regions, I believe it would soon return again. The mountains of Greenland and Antarctica would serve as roots to catch more snow and ice. If polar regions were flat, then the ice caps would not return until continental drift brought mountains to the poles over hundreds of millions of years—but they are not."

If more modern and highly technical improvements continue to be suggested, the Reading symposium concluded, new bridges must be built between the scientist and the farmer and between the various branches of science itself. Meteorologists must learn to use less mathematics in talking to agronomists—and agronomists must learn more mathematics to understand them.

All scientists must strive to bring technology to a practical working level.

The symposium was sponsored by the United Nations Educational, Scientific and Cultural Organization (UNESCO).

PUBLIC HEALTH

New Sewage Treatment Reduces Growth of Algae

➤ A NEW PROCESS for treating sewage that greatly reduces the amount of phosphate is under development.

Phosphates are a major problem in sewage control because they are an essential plant food stimulating the growth of algae, a green plant that clogs streams, rivers and lakes. Algae choke off the oxygen supply in water, not only killing fish but greatly reducing plankton, the passively floating or wealthy swimming animal or plant life on which fish feed.

Dr. Gilbert V. Levin of Hazelton Laboratories, Inc., Falls Church, Va., became concerned with the problem of controlling phosphates in sewage when he started working for his Ph.D. at Johns Hopkins University, Baltimore. During this research, for which he was awarded a doctorate in 1963, Dr. Levin found that sewage microorganisms can be used as "living conveyor belts."

He has since worked out a process using microorganisms already present in sewage to concentrate and remove dissolved phosphates. The green algae feeding on phosphates are believed partially responsible for fish kills now occurring in Lake Erie, Lake Tahoe in California, the Potomac River, as well as many other bodies of water.

The discovery gives a fast and relatively inexpensive way to deal with one of the most baffling problems in water pollution control—the explosive, water-choking, fish-killing growth of algae.

The most complete waste treatment now in use removes most of the impurities from domestic effluent, except for phosphates.

Dr. Levin told the American Chemical Society meeting in New York that aeration in excess of rates usually used for sewage treatment caused the microorganisms present to take up most of the phosphate dissolved in the sewage effluent. This effect was demonstrated on a full-plant scale at the District of Columbia sewage treatment plant when its operations were modified to test Dr. Levin's findings.

Scientists at the Hazleton Laboratories are now developing a pilot plant for the city of Manassas, Va., using the phosphate removal process as a central feature, in collaboration with Wiley & Wilson, consulting engineers of Lynchburg, Va.

Dr. Levin and his co-workers are set to start on a large-scale sewage control project for the City of Detroit, where they will be working with Hubbell, Roth & Clark, consulting engineers.

Proof of the effectiveness of microorganisms in phosphate removal on a large scale is seen in the experience of engineers in San Antonio, Texas, who reduced phosphate levels considerably by changing the level of dissolved oxygen in activated sludge.