ICHTHYOLOGY

Electronic Fish-Finder

This instrument spots for fishermen the location of fish, indicates about how many there are, their speed and direction of travel, and often their species.

By DON EDDY

➤ IN THE summer of 1947 the crews of 14 commercial seining boats out of southern California ports witnessed a demonstration of fishing magic. For days they had patrolled the fringes of an enormous bed of kelp near Cedros Island off the Mexican coast, waiting for schools of tuna to leave the kelp and return to the open sea. Until that happened they dared not set their nets, for kelp is a heavy, matted seaweed which forms writhing masses that can snarl and sink any seine.

Into this stalemate steamed another seiner—the Caesar Augusto commanded by Capt. Larry Zaunich. Customarily, Capt. Zaunich would have joined the waiting fleet; instead, he nosed his prow into the kelp bed. Before dark that day he was safely out with his nets intact—and 150,000 pounds of fresh tuna in his hold. In port, his bewildered colleagues bombarded him with one question: How did he do it?

"Easy!" grinned Capt. Zaunich. "I used a gadget that found holes in the kelp bed big enough for my seine, and even told me whether there were fish in the holes."

Finds Fish Unerringly

Then a curiosity, the gadget was a Bendix DR (Depth Recorder)—an electronic device which started as a navigational aid but has recently become the most exciting news in the commercial fishing industry. Enabling fishermen to "see" vast distances under water, it finds fish unerringly in sunshine, storm, fog, or darkest night.

The Bendix DR shows fishermen instantly and accurately where fish are, approximately how many there are, how fast and in what direction they are traveling, and in many cases what species.

Although only 2500 of the nation's 83,000 commercial fishing craft are equipped with fish-finders, the total catch of fish last year was 125,000,000 pounds greater than in 1946, when only a few finders were in use.

To watch the fish-finder at work, I stood in the wheelhouse of a 150-foot purse seiner off the Carolina Capes while Capt. Roy Goodwin tracked down menhaden, one of the most valuable of America's commercial fishes. Mounted on the bulkhead in front of the ship's helm was a box about the size of a portable radio. A scroll of paper moved slowly across the face of the box. The paper was lined vertically, representing the undersea area forward and beneath the ship; numbered lines ran horizontally, indicating the depth. Thus the graph was in effect a map of the water for hundreds of feet, divided into sections each representing one minute's travel time of the vessel.

Across the face of the graph horizontally as the ship cruised along, styli were drawing two roughly parallel lines. The top line represented the surface of the ocean; the bottom one showed the jagged, irregular outline of the ocean floor below us. Between the top and bottom lines the styli were also drawing scores of odd-shaped doodles, sometimes singly but often in clusters. "Those are fish," said Capt. Goodwin, "singles and little schools." He watched the device until a big black doodle formed at a depth of about 40 feet and some 100 feet ahead. Ringing for reduced speed, he said, "That's a school of menhaden."

Schools of fish used to be spotted by lookouts until the advent of the fish-finder. Although the lookouts could not see far below the surface, especially in bad weather, Capt. Goodwin clung to tradition by keeping three men in a crow's nest atop the mainmast. They had seen no fish and now reported they still could see none, although the huge school was clearly visible on the fish-finder's graph.

Maneuvering his boat to keep the fish just ahead without getting close enough to alarm them, Capt. Goodwin ordered the longboats away with the seine. By comparing the location of the fish with the longboats' position, he directed the men in them until the school was surrounded, the seine lowered and the purse-line drawn to close it at the bottom. Soon we watched 90,000 shimmering menhaden cascading into the hold, on their way to becoming vitamins, cosmetic oils, livestock feeds and fertilizers. "We'd have missed them entirely without this gadget," the captain said. On two successive weeks previously he had caught 200,000 and 300,000 fish which no one saw until they were netted. "I reckon I've caught a million more fish with the Bendix DR this year than I would have caught without it," Goodwin told me.

Many Fishermen Doing Well

Other menhaden fishermen with whom I talked had done about as well. The two largest schools ever reported were located with fish-finders last summer. Said Joseph C. Jett, of Reedville, Va., a fleet owner who has equipped all his ships: "It's like

MENHADEN FLEET—This fishing fleet at Beaufort, N. C., lets the fish-finder do the work of locating their catch.

SCIENTIFIC FISHING—Capt. Roy Goodwin, skipper of a menhaden boat, watches the smudges on the graph which indicate to him where a school of fish can be found.

being down there in a diving suit, only better because there's practically no limit to the DR's visibility."

The fish-finder operates by sound waves. It has long been known that sound travels through water at approximately 4800 feet per second. The practical use of this knowledge, of course, seemed to be in measuring the depth of water, but little was done about it until, in 1912, the Titanic rammed an unseen iceberg and sank with a loss of 1517 lives.

Underwater Echoes

Spurred by world-wide clamor for a device which would detect invisible navigational hazards, scientists in Europe and America hurriedly began to experiment with underwater echoes.

In the United States, Prof. R. A. Fessenden developed a powerful oscillator to provide sound of great intensity in water and an instrument to convert the travel time of sound into measurement of distance. But sounds of audible pitch were too easily confused with such noises as breaking waves and churning propellers. Then, in France, scientists Langevin and Chilowsky developed an apparatus to project sounds of such high pitch that they were inaudible to the human ear but could be detected by special listening devices.

Now the path for development was clearly marked. In 1918 the United States Navy installed its first echo-sounder. By 1925 echo-sounders had become available to commercial vessels to detect shoals and obstructions. Today, they are used as navigational aids all over the world.

In operation, continuous streams of sounds are emitted from a device on the bottom of the boat. The sounds travel in a widening cone like shotgun pellets and send back echoes when they strike solid objects. Capturing the echoes, the apparatus instantly computes the time elapsed since the discharge of the sound, translates this time into lineal distance, and figures the object's size, shape, and relative density. In some instruments (two others besides the Bendix are made in the United States, one in England and one in Canada) part of this information is conveyed to the mariner by flashing lights or buzzes, but the Bendix DR transfers all of it to a graph where it appears as a pen-and-ink record.

From the earliest tests, experimenters were perplexed by mysterious interferences. Sometimes in deep water with no known obstruction within miles, the echoes bounced from objects which were fairly close to the ship, and apparently moving. Evidently these strange objects were fish, and it was only a step to the realization that if fish could be detected with sound waves, so could submarines. Echo devices in various forms (including radar, which employs the same principle in air) thus became major tools of modern warfare.

First Application to Fish

But through the early years, fish remained only a nuisance to echo-using mariners until a Norwegian, the late Dr. Oscar Sund, then biological research adviser and one of the leading scientists of the Norwegian Institute of Fisheries, realized that an echo device might be a means of finding more fish for a hungry world. In 1935 a research ship carrying the first echo-sounder ever installed for the purpose of finding fish set out for the Lofoten Fisheries off northern Norway. At the controls was Dr. Sund's aide, Dr. Gunnar Rollefsen, now director of the Institute and his country's delegate to the United Nations' subcommittee studying world fisheries.

Long before the fishing banks were reached, Dr. Rollefsen detected echoes bouncing from strange objects just above the floor of the sea. Although this had been presumed to be barren territory, Dr. Rollefsen said: "I believe they're fish, 70 to 80 fathoms deep." Fishermen lowered their lines to 75 fathoms—and immediately caught codfish! As the exploration continued, numerous new fishing banks were found and charted.

Oddly enough, owners of fishing boats were not excited by the Institute's report, even after a commercial boat out of Bergen paid off the cost of an echo-sounder with a single catch. Part of the apathy was due to the high cost of the apparatus and the low price of fish, but most of it was because of the fishermen's stubborn adherence to the ages-old methods of fishing.

Today this resistance has vanished and Norway leads the world in scientific fishing. Nearly all of its major herring boats and more than half of its ocean-going cod boats carry fish-finders. Immensely valuable new fishing grounds in that part of the world are being discovered; the annual catch of herring and cod has been increased by a third.

The Bendix DR grew out of World War II. Echo-sounders then in use were cumbersome and expensive. U. S. military planners during the war assigned a top-secret project to the Bendix Aviation Corporation —to create portable depth recorders which could be operated silently in total darkness in small rubber boats to discover mine fields along enemy shores and to chart enemy harbors in preparation for invasions.

Graph Method Devised

Since flashing lights and buzzing signals were out of the question, the graph method was worked out by electronic wizards, and Bendix DRs preceded invasion troops into countless beachheads. No whisper of their existence was permitted to reach the public, but in 1944, with the war at its height, the U. S. Navy considered the fish-finding potentialities of the device so important for increasing our food supply that a submarine chaser was assigned to aid the Federal Fish and Wildlife Service in tests off the Pacific Coast.

The sub-chaser explored waters where no fish were known to be—and found fish constantly. Aquatic biologist Osgood R. Smith, operating the equipment, once located 21 schools in 86 minutes. These data were released to fishermen toward the end of the war.

The first Bendix DR was installed on the commercial fishing boat Northern Light out of Fort Bragg, Calif., in 1946. It had formerly taken Capt. Ted Aaker four days to fill his hold with sole and rock cod, but with the magic fish-finder he took 3,000 pounds of these fish, a boat load, in two days on his first trip.

Capt. Lawrence Doving installed a fish-finder on his Optu and started through Hecate Strait north of Vancouver Island, B. C., bound for an area at sea where he had been catching dog fish for their livers. No one had suspected there were commercial fish in the Strait, but Capt. Doving was back home the next day with 20 tons of fish. His normal cruise would have been two days each way and eight days of fishing.

Capt. Lloyd Lindwall of Santa Barbara, Calif., ordinarily fished for sea bass, shark, albacore and swordfish off Santa Cruz Island, a half-day's run from his harbor. On his second trip with a Bendix DR he was midway to the island when he noticed doodles on the graph. He set his seine and caught a load of sharks whose livers were worth $10,000.

At Vancouver, B. C., a herring seiner turned the air blue when the fish-finding apparatus was not completed in time for him to sail with the rest of the fleet. Leaving port an hour late, he was chugging in the wake of the other vessels when the

Bendix engineer who was aboard as an observer picked up a dense concentration of fish just ahead. "It isn't possible," the skipper argued. "Every boat in the fleet has passed over them." But the Bendix man persuaded him to set his net—and he was back home in mid-afternoon with a hold full of herring.

Tuna fishermen cruising into South American waters out of San Diego, Calif., were plagued by a shortage of small bait fish, a variety of anchovy, which they throw into the water to attract tuna to the boat. The exasperated skipper of the tuna clipper American Girl installed a fish-finder on his auxiliary bait-scouting cruiser last season—and immediately found bait where none was supposed to be. The graph revealed that the little fish had become wise to the ways of nets and were simply diving under them. The skipper foiled this stratagem by using nets which scraped the bottom. Now that bait is no problem, he expects to add $300,000 to his ship's revenue and great quantities of tuna to the nation's food supply this year.

In Cuba tons of fish were discovered and caught in Havana harbor this spring by the first Cuban boat electronically equipped, although no fisherman had suspected they were there. So impressed was the Cuban government that special funds were appropriated to equip the nation's 60 major fishing vessels. Result: the average fishing cruise has been shortened from 25 to 15 days and the average catch has almost doubled.

Industry is adapting the fish-finder to all sorts of work. Four major oil companies exploring the Gulf of Mexico, and Lake Maracaibo in Venezuela, use Bendix DRs to detect slight variations on the bottom contour to determine the most advantageous drilling locations. At New Orleans a ship-builder uses one to chart the buildup of silt around docks. At San Diego, army engineers use several to maintain checks on the depth of ship channels.

Infinitely more important, military strategists point out that in the event of war, thousands of small craft electronically equipped could constitute a tight ring of never-closing eyes around our sea-coasts, for fish-finders can ferret out mine fields and submarines with the same sureness that radar warns us of the approach of surface vessels and aircraft.

Since DRs cost $890 to $2475, depending upon their size and the extent of the range they can "see," they are not yet practicable for the family rowboat, although they can be operated from ordinary automobile batteries. When smaller models are perfected they can be expected to eliminate even for sportsmen that imponderable called fisherman's luck.

Meantime, while there is a tremendous demand from sport fishing craft, Bendix is allocating almost all its output to commercial fishermen because they believe that this amazing device should be concentrated on providing more food for hungry humanity from the almost inexhaustible resources of the sea.

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MEDICINE

Allergy-Drug Reactions

➤ EVIDENCE of serious reactions and even one death due to some widely used anti-allergy drugs is presented in the JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION (July 23).

Death resulted in a 16-month-old girl who was poisoned by accidentally swallowing an adult dose of a compound with the trade name of Thenylene hydrochloride, according to Drs. Hugh F. Rives, Berl B. Ward, and M. L. Hicks of Dubuque, Iowa.

This drug, and the others which gave severe reactions, are antihistaminic compounds used to check the action of histamine, a poison released by body tissues in allergic reactions. There are many on the market widely used for such allergies as hay fever, hives, and skin inflammation caused by reaction to drugs. Some have even been used to treat colds.

Unfavorable reactions occur in from 25% to 65% of the patients treated with antihistaminics, the physicians stated. Reactions are in the form of drowsiness, vomiting, diarrhea, headaches, nervousness, fainting spells, severe prostration and mental upsets.

Irritation of the brain seems to be responsible for these reactions, the report indicates. The physicians add that there is no effective antidote for these drugs. If the patient exhibits toxic reaction to the drugs, their administration should be stopped immediately and the individual symptoms should receive treatment.

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AERONAUTICS

Photoflash Bulbs on Planes Present no Hazards

➤ PHOTOGRAPHIC flash bulbs in an airplane present practically no hazard, the Civil Aeronautics Board has found, and it sees no reason to require or ask special restrictions in their transportation.

"Although modern photographic flash bulbs have been fired remotely by high frequency radiant energy (radar) under ideal laboratory conditions," the Board states, "to date it has been impossible to fire one by this means under actual or simulated flight conditions in all-metal aircraft."

A tragic crash of an airliner following fire in the air in October, 1947, raised the question of whether or not photoflash bulbs could be flashed or exploded by radar energy from within or outside the plane. The question was also raised whether they could be flashed by impact, friction, radiant energy, elevated temperatures, electrostatic discharges, changing magnetic and electrical fields and the combustible effect on the standard package containers.

Even under extreme conditions met in air transportation, bulbs are not a hazard from these causes, the Board found. When modern but defective bulbs were flashed and exploded electrically in a combustible atmosphere of gasoline vapor, no ignition occurred. The possibility of firing them by impact and resultant friction is extremely remote, if the bulbs are packed in containers.

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ENTOMOLOGY

Insect Eggs Found on Outside of Airliner

➤ AIRPLANES may have to be DDT'd outside as well as inside, to prevent hitchhiking by insect pests. In the scientific magazine, NATURE, is a report of the discovery of a mass of moth eggs on the wing of an airliner from Brazil that landed at the British airport on Trinidad island.

The discovery was accidental. A customs officer who had leaned against the plane wing found a smudge on his uniform. Investigating, he found the egg mass, which was collected by a malaria control officer and identified as belonging to an insect group embracing several harmful species.

Science News Letter, July 30, 1949

AGRICULTURE

Hay Quality Not Bettered By Use of Fertilizer

➤ FERTILIZING land increases the quantity of a crop that can be grown on it but does not raise its quality, experiments at Michigan State College in East Lansing, Mich., indicate.

Two herds of dairy cows were fed on hay produced on poor soils. One herd received hay raised on untreated soil, the other got hay from soil that had been fertilized. No material differences could be found in either the nutritional condition of the animals themselves or in the quality of their milk, although a much larger area of unfertilized soil had to be mowed to provide enough hay for the cows it was called upon to support.

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