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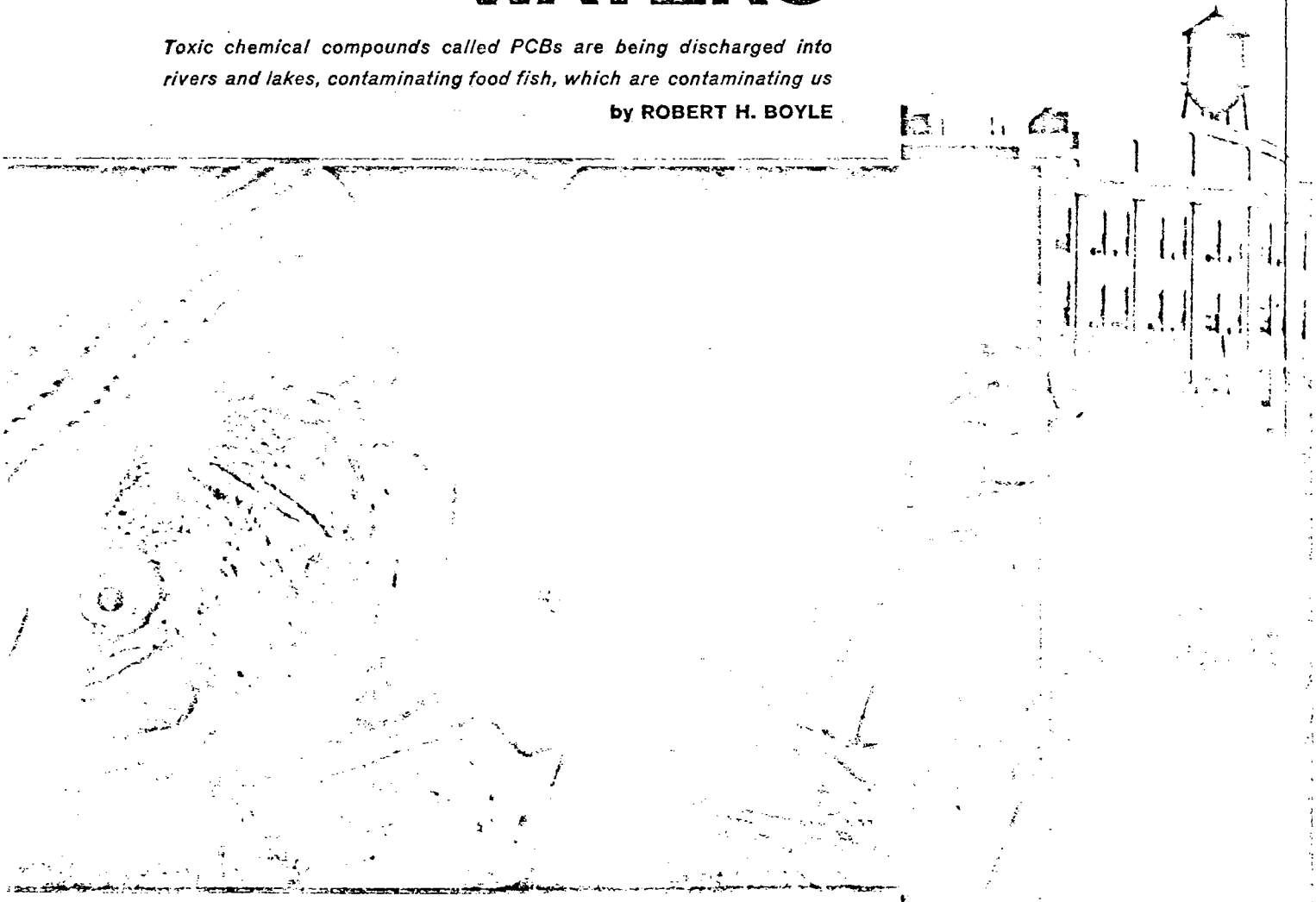
POISONED FISH, TROUBLED WATERS

Toxic chemical compounds called PCBs are being discharged into rivers and lakes, contaminating food fish, which are contaminating us

by ROBERT H. BOYLE

Anglers, commercial fishermen, fish dealers, restaurateurs, Senator Edward Kennedy and just plain citizens were up in arms last week, all because of some colorless, viscous fluids known as PCBs. PCBs is the abbreviation for polychlorinated biphenyls, a group of chemical compounds that are used by industries throughout the world because of their resistance to heat. PCBs are toxic to a wide range of animals, including humans. These chemicals, when ingested in large doses, cause miscarriages and stillbirths, and they are turning up in dangerous amounts in the upper Mississippi River, the upper Ohio, the Hudson River and several of the Great Lakes.



New Yorkers are warned not to eat bass from the Hudson, into which G.E. plants pour PCBs.

PHOTOGRAPHS BY LANE STEWART

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Scientists in the U.S. Environmental Protection Agency have been aware of the PCB menace for several years, but the bureaucrats in charge of EPA have dithered and dallied rather than take effective action. For example, last February EPA officials in New York stayed abatement plans for two polluting General Electric Company plants at Fort Edward and Hudson Falls after the company objected and requested an adjudicatory hearing to challenge PCB limitations. Conservationists maintain that EPA should have acted under Section 504 of the Federal Water Pollution Control Act, which gives the agency the right to sue to halt discharge of pollutants that present "an imminent and substantial endangerment to the health of persons or to the welfare of persons where such endangerment is to the livelihood of such persons. . . ."

Since 1942, G.E., which uses PCBs in the manufacture of electrical equipment, has been dumping them into the Hudson, an average of 30 pounds a day since 1971, 90 pounds on some occasions, the largest nonaccidental release of these poisons yet discovered in the U.S. and possibly the world.

The threat of PCB poisoning became a national concern three weeks ago when Ogden R. Reid, former ambassador to Israel and the new commissioner of the New York State Department of Environmental Conservation, got a copy of an EPA study that prompted him to warn the public against eating striped bass from the Hudson and coho salmon from Lake Ontario. Reid was further upset when he learned that his department, long deplored by conservationists as a sick joke, had known of PCB contamination since 1972 and possibly as early as 1970.

On Oct. 26, 1970, SPORTS ILLUSTRATED published a lengthy article of mine on chemical contaminants in game fish from the Atlantic, Gulf and Pacific coasts, reporting that the WARF Institute in Madison, Wis., which did the laboratory anal-

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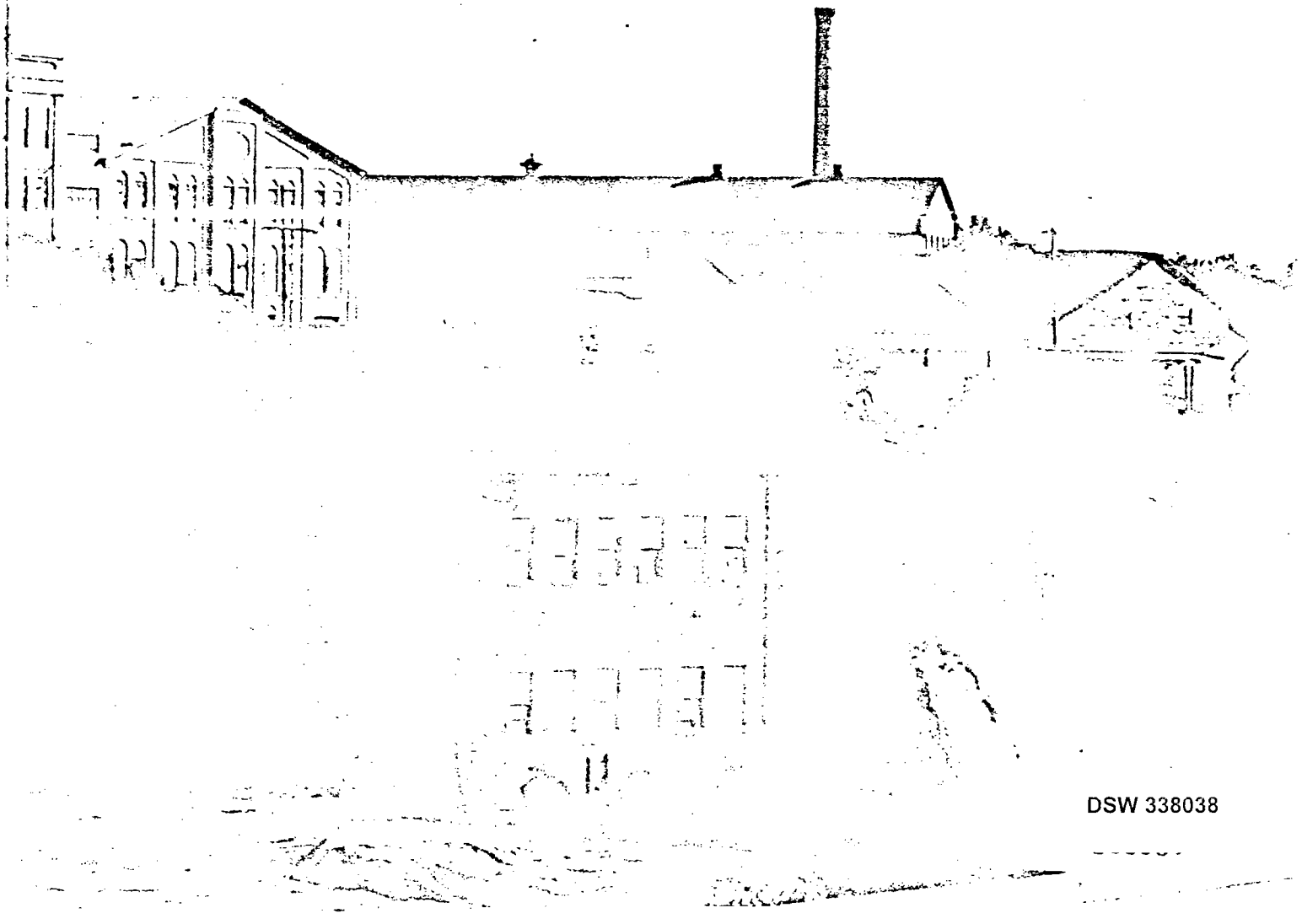

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yses, detected high levels of PCBs in Hudson River stripers. On Feb. 17, 1971 I wrote to Carl Parker, chief of New York's Bureau of Fisheries, telling him that Hudson stripers had 11.4 parts per million of PCBs in their eggs and 4.01 in their flesh. In my report I informed Parker, "These are grim figures, and I certainly think the state should warn fishermen not to eat striped bass eggs." I also noted that the levels in the flesh did not make "great reading," and I suggested he read the SI article. Parker's reply was derisive.

Tests ordered by Reid or previously performed by EPA scientists and New York State disclosed that numerous species of Hudson fish in addition to striped bass were contaminated. These included rock bass, largemouth and smallmouth bass, shiners, white perch, northern pike and sturgeon. Apparently fish can ingest PCBs by taking in bottom sediments, eating lesser organisms or simply by swimming through water that contains PCBs. The striped bass pose a particularly vexing problem, which was Senator Kennedy's immediate concern. After spawning, bass from the Hudson migrate as far north as Massachusetts and as far south as New Jersey, and they are indistinguishable to fishermen from stripers emanating from rivers in the Chesapeake Bay where no serious PCB concentration has yet been discovered in the flesh of adult fish.

The U.S. Food and Drug Administration has placed a tolerance limit of five parts per million of PCBs in fish; according to the EPA National Water Quality Laboratory in Duluth, all Lake Michigan trout and salmon longer than 12 inches exceed that limit. Last May 30, the FDA seized 124,812 cans of Lake Michigan coho salmon because the PCB levels in the canned coho ranged from 7.6 to 10.9 ppm. The FDA also seized 6,480 pounds of frozen Lake Michigan coho and chinook salmon from the Point Adams Packing Company; the PCB levels ranged from 8.2 to 9.2 ppm. Wisconsin Lieutenant Governor Martin J. Schreiber wrote with some foresight last Nov. 8 to A. Gene Gazlay, director of the Michigan Department of Natural Resources: "There exists now a problem with contaminants in Lake Michigan that has the potential of destroying both sport and commercial fishing in all the Great Lakes. This situation could turn any efforts to develop the lake as a future protein source into a futile and frustrating endeavor." Since 1971 Michigan health authorities have advised fishermen not to eat salmon or trout from Lake Michigan more than once a week.

Large lake trout from Lake Superior are generally contaminated, and coho and chinook salmon in Lake Ontario have excessive levels. PCBs appear to be a threat to fish-eating birds in the Great Lakes region. "Severe reproductive failure has been identified in herring gull colonies around Lake Ontario," wrote Karl E. Bremer of the EPA Chicago office on July 24 to the Lake Michigan Toxic Substances Committee. "There is a positive correlation between early embryonic mortality and PCB contamination. The major effect on young birds is to produce symptoms of chick edema disease. . . . Officials have observed unnaturally high mortalities of gulls in recent years from Saginaw Bay and Grand Traverse Bay. Analysis of the liver and brain of a dead herring gull from Grand Traverse Bay in 1973 showed the presence of 2,600 ppm of Aroclor 1254 [a PCB]."

PCB pollution is not restricted to New York and the Great Lakes. Earlier this year the FDA seized and eventually buried 20,000 pounds of carp taken from Lake Pepin, a reach of the Mississippi 70 miles downriver from the Twin Cities. EPA scientists have also discovered excessive levels of PCBs in channel catfish and carp taken from the Ohio River.

On Sept. 29, 1972 Dr. Donald J. Lisk and Carl Bache of the pesticide research lab at Cornell University contributed a paper to *Science* on PCBs in lake trout in Cayuga Lake, N.Y. As a general rule, trout exceeding 24 inches in length had excessive levels, the highest reading of 30 ppm being found in a 9-year-old fish. Queried by SI, Dr. Lisk said no one in government had ever bothered to ask about the findings or the possible sources of the PCBs.

Dr. Ward Stone, a New York State wildlife pathologist, warned conservation department superiors for several years of the PCB crisis. He found his warnings "futile." Dr. Stone says, "No one really cared. In one memo I wrote, 'I hope the department begins to take some of these toxic problems seriously . . . because it is doubtful these problems can be put off. In fact, they have already been put off far too long.' " In autopsies Dr. Stone discerned excessive PCB levels in breast muscles of a number of greater scaup shot on Lake Ontario and Long Island Sound. He also found excessive PCB levels in white-winged scoter dying on Lake Ontario. Moreover, he found 30.16 ppm of PCBs in the liver of a great blue heron from Albany County; 11.05 ppm in the liver and 21.49 ppm in the muscles of a dead herring gull from Oneida Lake; 20.3 ppm in the liver of a porpoise washed ashore at Westhampton Beach, N.Y.; and 49.39 ppm in the brain of an otter from Twitchell Lake in Herkimer County.



Commissioner Ogden Reid got semi-tough.

But not just mammals, birds and fish are affected. The water is, too. In a review of PCBs in the Hudson, Dr. Gilman D. Veith of the Duluth lab reported that "the river for many miles downstream from the G.E. discharge has not been adequately tested. It could be contaminated with PCBs at levels 100 times over the 10-parts-per-trillion guideline set forth by EPA in 1972 and 1,000 times higher than the newly recommended water quality criteria [of one part per trillion]." Poughkeepsie and other river towns draw their drinking water from the Hudson. Water supplies for cities on the Great Lakes may also be endangered. Chicago and Milwaukee draw their water from Lake Michigan, and EPA reports indicate that PCB levels in certain

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areas of the lake range from four to 10 parts per trillion, well above the recommended one part per trillion.

PCBs have been manufactured in the U.S. since 1929 by one firm, Monsanto Industrial Chemicals Company. It is estimated that Monsanto has turned out about 400,000 tons of PCBs between 1948 and 1973. The company's output is about half the world production. PCBs have also been made in Great Britain, France, Germany, Italy, Spain, Czechoslovakia, the Soviet Union and Japan.

PCBs are a family of partially or wholly chlorinated isomers of biphenyls. Monsanto has marketed them under the trademark names of Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262 and 1268. The last two digits indicate the chlorine percentage in the different formulations. Like DDT, PCBs are chlorinated hydrocarbons, but compared to DDT, which may persist up to 15 years, PCBs resemble the Rock of Gibraltar. After the use of DDT was restricted by the Great Lakes states in 1970, DDT residues in Lake Michigan fish dropped 87%. However, the more highly chlorinated of the PCBs are essentially unalterable by microbial or physical chemical action in the environment. Their molecular structure inhibits enzymes from shearing the bonding between the chlorine atom and the biphenyl structure. So far as is known, the only way in which PCBs can be destroyed is in a special incinerator at a temperature of 2,700° Fahrenheit.

The apparent indestructibility of PCBs horrifies ecologists and gladdens industrialists. Just a partial listing of products made with PCBs at one time or another includes hydraulic fluids, plasticizers, adhesives (brake linings and clutch faces), paints, sealants (asphalt and concrete) and printing products (carbonless carbon paper and paper coating). PCBs are still used as filling agents or impregnants in electrical transformers and capacitors. Imported or recycled PCBs are used in such products as heat-transfer fluids. Traces of PCBs have been found in toilet soaps, hard and soft wood pulps, coloring compounds, fish oil and Xerox toners. Ironically, waste paper claimed for recycling is one of the sources of the PCBs that flow into Wisconsin streams emptying into Lake Michigan. These PCBs come from the inks and papers.

In 1971, five years after scientists recognized PCBs as contaminants, Monsanto announced it would voluntarily restrict sales to "closed cycle" systems in transformers and capacitors. However, PCBs were already omnipresent.

Dr. George Harvey of the Woods Hole Oceanographic Institution says PCBs enter the environment from sewage outfalls, industrial and municipal wastes, leaching from dumps and the burning of refuse. PCBs occur in rain and snow. For example, measured snowmelt in Kenosha, Wis. contained .22 parts per billion of PCBs. "The atmosphere is the major pathway of global transport," Harvey has written. "PCBs have been found in all organisms analyzed from the North and South Atlantic oceans, even in animals living under 11,000 feet of water. . . . Based on available data it seems safe to conclude that PCBs are present in varying concentrations in every species of wildlife on the earth."

The concentrations do vary. Dr. Robert Risebrough of the University of California at Berkeley has found levels of from 300 to 1,000 ppm in cormorants and ospreys, and he suspects that deformities in terns born on Great Gull Island in Long Island Sound are caused by PCBs. Researchers in both the U.S. and Canada have discovered that ranch-raised mink suffer adverse reproductive effects when fed PCB-contaminated foods. At Michigan State University, R. K. Ringer, R. J. Aulerich and M. Zabik "confirmed the mink industry's observation that Lake Michigan coho salmon, when fed to breeder mink, resulted in either total cessation of mink reproduction (embryo toxicity) or kit mortality, the degree of complication being dependent upon the percentage of coho salmon fed and the duration of feeding."

Dr. Renate Kimbrough of the Center for Disease Control of the U.S. Public Health Service in Atlanta and a team of researchers have "concluded that the polychlorinated biphenyl Aroclor 1260 had a hepatocarcinogenic [liver cancer] effect in female Sherman Strain rats when fed in the diet." The Kimbrough study will be published in the *Journal of the National Cancer Institute*.

In 1968, more than 1,000 Japanese developed *Yusho* disease when they used rice oil containing an estimated 2,000 ppm of PCBs. The PCBs leaked from pinholes in a factory pipe during processing. Disease symptoms included eye discharges, severe acne, ulcers of the uterus and darkening of the skin. Pregnant women suffered miscarriages and stillbirths, and surviving infants suffered from abnormal pigmentation as the result of transplacental transmission of PCBs.

Recent research by Dr. James R. Allen and Deborah Barsotti of the University of Wisconsin Medical School has demonstrated that even very low PCB levels are dangerous to primates. The scientists started with six rhesus monkeys that ate food containing 25 ppm of Aroclor 1248 for two months. They developed facial swelling, loss of hair—including eyelashes—and acne lesions within a month, and one monkey died from PCB intoxication two months after going off the experimental diet. In another experiment, Barsotti and Allen fed two groups of rhesus monkeys food containing five ppm and 2.5 ppm of Aroclor 1248. Within two months, both groups had lost hair from the face and neck, and their skin was of "a sandpaperlike texture." Both groups developed acne, although the "2.5-ppm group developed the lesions later in time as the PCBs accumulated." In six months both groups reached a steady state concentration of PCBs in adipose tissue. They were then bred to control monkeys that had not been fed PCBs. Six of the eight five-ppm females became pregnant (in contrast to the 12 females in the control group, which was not fed PCBs), four of the six aborted or resorbed the fetus, one gave birth to a stillborn and one to a very undersized infant. All eight in the group of 2.5-ppm females conceived, and of these, three resorbed the fetus and five gave birth to undersized infants. In the light of these findings, it appears relevant that EPA's present calculation is that 50% of the human population of the U.S. now contains one to three ppm of PCBs in its fatty tissues.

What is to be done? Conservation groups are discussing lawsuits, and one organization, the Hudson River Sloop Restoration Inc., has asked Russell Train, the administrator of EPA, to use emergency powers to halt the G.E. discharges. Demand for a nationwide ban on PCBs may be forthcoming, but how PCBs will be removed from ecosystems is not yet known. On his own authority, Ogden Reid is expected to issue an immediate order requiring G.E. to reduce its PCB discharges into the Hudson to zero by Dec. 31, 1976. It is a move in the right direction. By this week would have been better. END

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