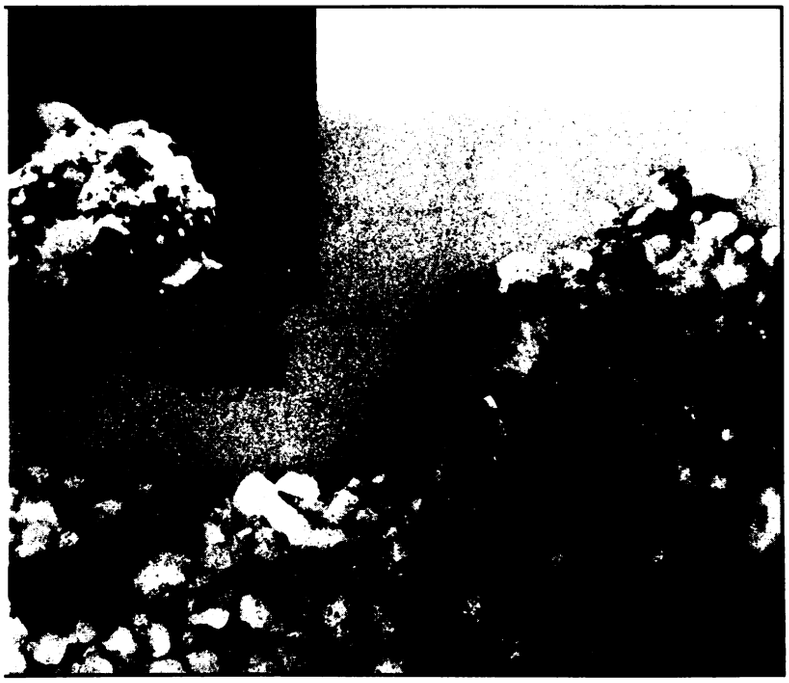
Compleat angler: Fish's fake fish gets fish



Anglerfish, which looks like a rock, lures prey by waving an appendage shaped and pigmented remarkably like a small fish. Inset: time exposure showing movement of bait.

David B. Grobecker

Izaak Walton had an artificial minnow that would "beguile any sharp-sighted trout in a swift stream." A Philippine Island fish has now been found to have evolved with the same strategy. It lures its fish dinner with a home-grown replica of a small fish, cast on a flexible spine.

Anglerfish in the Antennariidae family have evolved an especially efficient set of feeding behaviors and structures. These fish sit immobile, mimicking an algae-encrusted rock, while wiggling an attached, conspicuous bait. The lures often resemble invertebrates, such as worms or shrimp. Now Theodore W. Pietsch and David B. Grobecker of California State University report an undescribed species, which they found in a tropical fish store, whose bait resembles a small, swimming fish.

The newly discovered *Antennarius* is of irregular shape with mottled cream, brown, red and black coloration. At the end of a 27 millimeter spine is a flat tissue, 14 millimeters long. That bait is brown and white with black, eyelike pigment spots and some vertical bands. Filaments and compressed extensions resemble a fish's fins. "The bait is nearly an exact replica of a small fish that could easily belong to any of a number of percoid families common to the Philippine region," Pietsch and Grobecker report in the July 28 SCIENCE.

Lured by the bait, prey fish will swim right up to the angler's mouth. High-speed movies reveal that in only 4 milliseconds it can engulf its prey, Pietsch says. During luring the angler rotates the bait in a large circle in front of its mouth. Pietsch and Grobecker propose that the resultant undulation of the thin tissue creates an alluring, fish-like low-frequency pressure stimulus for the potential prey. When the bait is not in use, smooth muscle fibers fold it irregularly into a tight ball and the flexible spine is laid back against the angler.

Pietsch sees food luring as an important energy-saving strategy among hundreds of sea and terrestrial animals. Spiders, whales, turtles, cheetahs and other animals remain motionless, while offering enticement to would-be predators, their prey. The species of fish just described appears to represent the ultimate product of the Antennariidae evolutionary success, Pietsch and Grobecker conclude. □

The fluid-bed: Coming to a boil

Imagine a child's sandbox. Air is pumped in through thousands of tiny holes in its floor. As the air rises more and more rapidly, it lifts the grains of sand, suspending them in a churning turbulent mass. The sand is hot, and as low-grade coal or urban waste or even wet sludge is piped into the bed, it burns rapidly and completely. The surface looks like bubbling molten lava.

Its name, fluidized-bed combustion (FBC), belies its importance. While people could ignore low-grade coal, FBC was little known and unappreciated (SN: 8/27/77, p.134). But times have changed. Because FBC occurs at lower temperatures than does combustion in normal boilers and furnaces, nitrous-oxide fumes, a major constituent of smog, are reduced well below Environmental Protection Agency standards. And by mixing in limestone with the sand, sulfur that normally goes up the stack is instead tied to the lime.

Increasing interest in FBC is evidenced by a new report sponsored in part by the U.S. Department of Energy and prepared by INFORM, a nonprofit research and education organization based in New York City. The report, *Fluidized-Bed Energy Technology: Coming to a boil,* looks at how 70 major energy companies in ten countries are gearing up to utilize FBC.

Several firms in the United States are now offering fluidized-bed units for small-scale industrial applications, and a number have been installed and are operating. According to the INFORM report, the Foster Wheeler Corp., the Energy Resources Co., and the Fluidyne Engineering Corp. are at the cutting edge of FBC technology in the United States. Seven large-scale industrial prototypes, moreover, are under construction in the United States and Britain. Lagging behind their European counterparts, U.S. developers have had some technical problems, such as feeding coal into the bed. The European experience seems to be more straightforward and encouraging than has been the case here.

But FBC is too good to pass up, and American manufacturers will probably iron out the problems, according to the report. The turbulence of the bed, for instance, maintains a uniform temperature throughout, and the thermal capacity of the sand keeps this temperature stable. Heat is transferred to boiler tubes or walls not only by convection and radiation, as in conventional fireboxes and boilers, but also by conduction, through the continual impact of hot sand on surfaces in the bed. The rate of heat transfer is thus increased by a factor of four or more, suggesting the possibility of a more compact and less expensive unit for the same output.

Another type of fluidized-bed combustion involves burning coal at high pressures — from six to ten atmospheres — for much better thermal efficiency. Although that process is more complicated than atmospheric FBC, the INFORM report notes that work is progressing rapidly. The Curtis-Wright Corp. is installing a 13,000-kilowatt pressurized system at its main plant in Wood Ridge, N.J. Expected to be in service by 1979, it will provide a growing data base for the still larger units desired by electric supply systems. And at least three electric supply systems — American Electric Power, British Columbia Hydro and the Tennessee Valley Authority — are already involved in detailed feasibility studies of various types of fluidized-bed generating stations. From the evidence at hand, the INFORM report concludes that "fluidized-bed combustion is on the threshold of becoming a major energy technology." □