NATIONAL ACADEMY OF SCIENCES

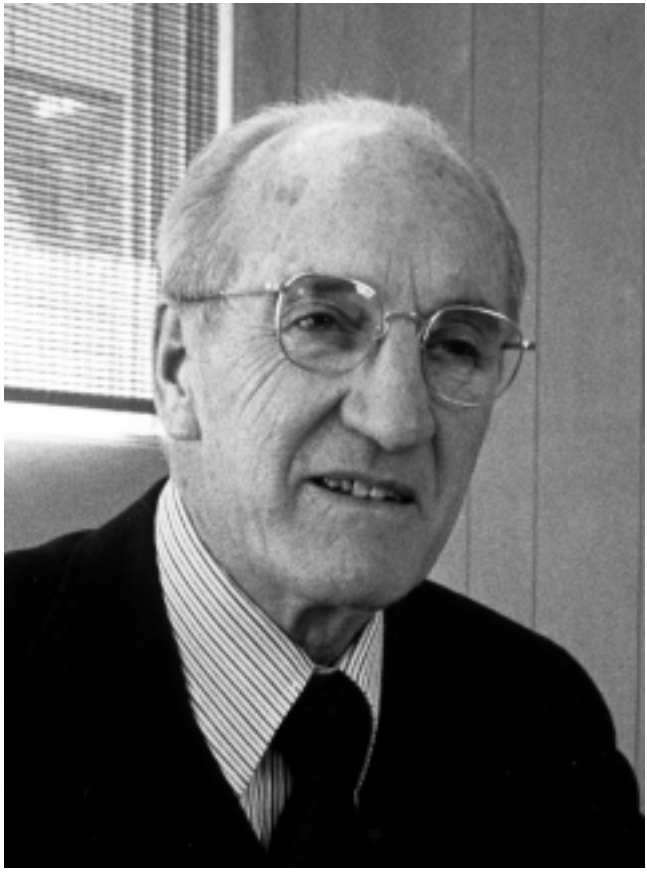
ARTHUR DAVIS HASLER
1908–2001

A Biographical Memoir by

GENE E. LIKENS

Biographical Memoirs, VOLUME 82

PUBLISHED 2002 BY
THE NATIONAL ACADEMY PRESS
WASHINGTON, D.C.



A. D. Hasler

ARTHUR DAVIS HASLER

January 5, 1908–March 23, 2001

BY GENE E. LIKENS

ARTHUR DAVIS HASLER did pioneering limnological research across a broad spectrum of ecological subdisciplines from ecophysiology and behavior of fish to experimental manipulation of entire lake ecosystems. His work on the mechanisms whereby salmon find their way back from ocean feeding areas to home streams for spawning, for which he was best known, was not only brilliant and innovative but also provided a framework for management of these important fisheries throughout the world.

Hasler was born in Lehi, Utah, the second son of Mormon parents, Walter Thalmann Hasler, a physician, and Ada Broomhead Hasler. His Mormon background played a significant and important role throughout his life, particularly regarding his active role in public service. He was among those who strongly advocated for acceptance of African-American membership in the Mormon Church.

He married Hanna Prusse in 1932, and they had six children: Sylvia, Frederick, Bruce, Galen, Mark, and Karl. Hanna was a trained vocalist (soprano) and music was a large part of the family's activities. Hasler's passions went far beyond science. His love of music and poetry was legend among his students and colleagues. He recited the works of Mörike, Heine, or Goethe at every opportunity and played

the horn (waldhorn) for some 30 years in the University of Wisconsin Symphony and the Madison Civic Symphony. He frequently greeted a woman with a kiss to her hand. On long road trips to research sites and scientific meetings it was not uncommon for Hanna to break out the songbooks, pass them out in the car, and lead everyone in singing. In those days a major professor and graduate students often took long trips together by car to field sites and professional meetings. Hanna died in 1969. In 1971 Hasler married Hatheway Minton Brooks, who shared his love for a healthy environment, and with her own six children forged a close and loving extended family. Hasler had 32 grandchildren and 17 great-grandchildren.

He received a B.A. degree, majoring in zoology, from Brigham Young University in 1932 and a Ph.D. degree in zoology and physiology from the University of Wisconsin-Madison in 1937. He was awarded honorary doctor of science degrees from the Memorial University of Newfoundland in 1967 and Miami University, Oxford, Ohio, in 1988.

Hasler had interrupted his schooling at Brigham Young University in the late 1920s to serve a three-year mission to Germany for the Church of Jesus Christ of Latter Day Saints. It was during this time that his love for the German language began.

After working for the U.S. Fish and Wildlife Service as an aquatic biologist on the Chesapeake Bay during 1935-37, he and Hanna moved to Madison where he completed his Ph.D. in 1937 at the University of Wisconsin, under the supervision of well-known limnologist Chancey Juday. He was hired there as an instructor of zoology in 1937 and promoted to assistant professor in 1941. After serving with the U.S. Strategic Bombing Survey in Germany in 1945, he returned to the university in 1945 as associate professor of zoology and was promoted to full professor in 1948, and

served in that capacity until he retired in 1978. During that time 52 doctoral students and 43 masters students received degrees under his supervision.

Hasler actively published in the peer-reviewed literature for almost 50 years from 1935 to 1984. He authored, co-authored, edited, or contributed to 7 books and over 200 scientific publications.

For more than a hundred years the University of Wisconsin-Madison has been an international center for limnology. Started by Edward A. Birge and Chancey Juday in the late 1800s, the Wisconsin School of Limnology was continued, strengthened, and enlarged by Hasler from 1946 to 1978. He supervised a large, active, and diverse limnology program conducted in several scattered and some rather Spartan structures on campus, known affectionately as the Lake Lab. In 1963 he became director of the Laboratory for Limnology coincident with the construction of a new and proper Limnological Laboratory on the shoreline of Lake Mendota. He fought aggressively and successfully with the faculty and administration of the university against the construction of a 600-car parking lot on the site and extending into Lake Mendota. His final plea at the faculty hearing was a quote from St. Mark: “Go thy way and sin no more.”

Hasler was one of the preeminent ecologists of the twentieth century. When he was elected to the National Academy of Sciences in 1969 only two other ecologists (G. E. Hutchinson and C. L. Hubbs) had ever received this prestigious honor. Hasler was a Fulbright research scholar in Germany in 1954-55 and a Fulbright visiting professor at the University of Helsinki in 1963. He was elected to the Societas Scientiarum Fennica in 1965, the American Academy of Arts and Sciences in 1972, the Royal Netherlands Academy of Science in 1976, and the Wisconsin Academy of Sciences, Arts, and Letters in 1988. He received 10 distinguished

scientist awards, including the Award of Excellence from the American Fisheries Society in 1977, the Distinguished Service Award from the American Institute of Biological Sciences in 1980, and possibly most significantly, the Citizen of the Year Award from the Mendota-Monona Lake Property Owners Association in 1987.

An important measure of his influence in professional biology was his service as president of the American Society of Limnology and Oceanography (in 1951), the Ecological Society of America (in 1961), the International Association for Ecology (1967-74), and the American Society of Zoologists (in 1971). Hasler also was the founding director of the Institute of Ecology (1971-74). He was awarded the Naumann-Thienemann Medal from the International Association of Theoretical and Applied Limnology, the highest international award in limnology, in 1992. He was an exchange scholar for the National Academy of Sciences in China in 1983 and in the Soviet Union in 1986.

With very broad interests and expertise he could equally well have carried the scientific descriptor of limnologist, ecologist, fishery biologist, zoologist, and conservationist. He conducted research and informed public policy in all of these disciplines.

Hasler is best known for his research on salmon olfactory imprinting, a powerful and ingrained sense of smell that enables these fish to return to the exact stream of their birth for spawning after traveling thousands of kilometers in the ocean. He often told the story about the genesis of this discovery when he was vacationing in the Wasatch Range of the Rocky Mountains of Utah, where he had spent much time as a boy. Hiking up a mountain, yet out of sight of his favorite waterfall, he suddenly had what he called a “déjà senti” experience, “as a cool breeze, bearing the fragrance of mosses and columbine, swept around

the rocky abutment, the details of this waterfall and its setting on the face of the mountain suddenly leapt into my mind's eye" (1966, p. 65). Among other things these smells reminded him of childhood memories and of home. If smells could trigger such memories in a human, they must be at least as evocative for salmon, Hasler reasoned. This revelation led to a rich and productive series of experiments and field trials on olfactory and solar orientation in fishes.

Hasler's pioneering research using manipulation of entire lake ecosystems provided a powerful new tool for ecology. Following the early lead of his major professor, Juday, who had added fertilizer to lakes to increase fish production, Hasler greatly developed and expanded this new experimental approach for studying large ecosystems (lakes) within their natural settings. He recognized early that entire ecosystems were just too complex to study piecemeal or only in the laboratory. His first efforts were focused on trying to enhance the productivity of fish in the thousands of acidic brown-water lakes in the upper midwestern United States. The brown staining by dissolved organic matter in these lakes prevented light penetration and thereby reduced productivity of aquatic plants at the base of the food web. Adding finely ground lime (calcium and magnesium hydroxide) to two small lakes in northwestern Wisconsin in 1950 resulted in alkalization and increased transparency of the water (1951). The stage was set for a rigorous whole-lake experimental manipulation, so he found two lakes on the northern Wisconsin-Michigan border, located on property of the University of Notre Dame, that were shaped like spectacles or an hourglass. He obtained permission to bulldoze an earthen dam across the narrow constriction between these two lakes in 1951 and thus formed the now famous setting for whole-lake experiments by creating two separate lakes, Peter and Paul. Subsequently, Peter Lake was treated with

hydrated lime to flocculate and precipitate the dissolved organic carbon in these humic brown-stained lakes, while Paul Lake was maintained as an untreated reference in this experimental manipulation (Stross and Hasler, 1960).

Other lakes were artificially circulated using compressed air to reduce ice cover and prevent winterkill of fish, experimentally manipulated with additions of hydrogen peroxide to reduce color, manipulated by additions of hydrated NH_4 through rather primitive aeration systems on the bottom of lakes to increase productivity, and labeled with radioactive tracers to study water circulation and biological transport of nutrients from deepwater to surrounding landscapes. These field experiments in whole-lake ecosystems had varied levels of success, but the overall approach was innovative and powerful. Inspired by this model for the study of complex natural ecosystems, W. E. Johnson, one of Hasler's Ph.D. students, and J. R. Vallentyne designed an experimental lakes area in Ontario, Canada, that used whole-lake manipulation very successfully in studies of lake eutrophication, acidification, and toxification by heavy metals. Likewise, F. H. Bormann, R. S. Pierce, N. M. Johnson, and the author (another Ph.D. student of Hasler's) adopted an experimental approach in studies of watershed ecosystems in the Hubbard Brook Valley of New Hampshire. This small watershed approach—in association with a nutrient flux and cycling model and entire watershed manipulations—helped establish fundamental understanding of northern hardwood forest ecosystems.

Hasler always freely acknowledged the role of travel and his many professional colleagues, students, and visitors in expanding his reach in scientific inquiry and influence. He insisted that graduate students in residence meet with and discuss their research with each visiting scientist. Because of the international stature of his program, there was a constant flow of visitors to the Lake Lab. Hasler's contem-

poraries were the noted animal behaviorists Nobelist Karl von Frisch and Konrad Lorenz; Wilhelm Einsele, limnologist and chemist; and G. Evelyn Hutchinson, limnologist and ecologist. He considered them scientific heroes.

Hasler made it a point to provide not just academic training for students but personal advice as well. He usually had a large number of students under his supervision, but he took special interest in each of us. His achievements, career, and style were an inspiration for us, and he invested much time promoting us after we left the "nest."

The National Science Foundation was just beginning to fund science shortly after Hasler started his research career at the university. He successfully obtained financial support for his research from the Atomic Energy Commission, Office of Naval Research, and of special significance, wealthy landowners in northern Wisconsin. Several research projects were supported for decades by and on the properties of these philanthropists. He was able to convince these landholders of the practical importance of this research, and thus of its benefit to them.

Not only was Hasler a preeminent scientist but he was also a preeminent statesman of science. Constantly working to enhance organizations, networks, and teams to promote the betterment of ecology and the conservation of natural resources, he had few peers, and his efforts have provided a continuing legacy. Late in his career he tried to initiate a "Salmon for Peace" project, which attempted to bring together the governments of Russia and China to restore and manage the salmon population in the Amur River, which had been depleted because of overfishing. Even though this effort was unsuccessful, it clearly demonstrated his desire to apply ecological understanding to practical problems.

Hasler played a key role in developing and promoting the fact that land-water interactions are important for what

occurs in lakes, such as variable water quality. His early classic paper on cultural eutrophication (1947) helped to guide efforts regarding sewage diversion, fertilizer and manure runoff, and soil erosion from agricultural fields to lakes. He focused much attention on his beloved Lake Mendota, which he could see from his office window at the university. Prior to these efforts much of lake management still revolved around the idea of a lake as a microcosm (Forbes, 1899). John Magnuson, who succeeded Hasler as director of the Laboratory for Limnology, said of Hasler: "He was a big thinker and had grand ideas. He believed you were not done in research until you dealt with its application to society." During an era when a Washington presence was not in fashion, Hasler spoke out frequently, eloquently, and effectively on environmental issues that he knew about and cared about. Hasler was an outstanding scientist, a wonderful mentor and friend, and an effective spokesman for the protection of natural resources.

Although he had survived four bouts of cancer (colon, lung, skin, and prostate) starting in 1972, all without major chemotherapy, he continued to be active in campus activities until December 2000. He died peacefully in March 2001 at 93.

ER IST'S
By Eduard Mörike

Frühling läât sein blaues Band
Wieder flattern durch die Lüfte;
Süâe, wohlbekannte Düfte
Streifen ahnungsvoll das Land.
Veilchen träumen schon,
Wollen balde kommen.
- Horch, von fern ein leiser Harfenton!
Frühling, ja du bist's!
Dich hab ich vernommen!

I am pleased to acknowledge Hatheway Hasler, Linda Holthaus, and William Schmitz for details and suggestions; autobiographical materials from the National Academy of Sciences and the University of Wisconsin-Madison; and various *Limnology News* newsletters from the Center for Limnology, University of Wisconsin-Madison, in the preparation of this memoir. A transcript of an oral interview by Laura Lord Smail, University of Wisconsin-Madison, Oral History Project in 1977 was especially helpful.

SELECTED BIBLIOGRAPHY

1935

The physiology of digestion in plankton Crustacea. I. Some digestive enzymes of *Daphnia*. *Biol. Bull.* 68(2):207-14.

1938

Fish biology and limnology of Crater Lake, Oregon. *J. Wildl. Manage.* 2(3):94-103.

1939

With R. K. Meyer and H. M. Field. Spawning induced prematurely in trout with the aid of pituitary glands of the carp. *Endocrinology* 25(6):978-83.

1947

Eutrophication of lakes by domestic drainage. *Ecology* 28(4):383-95.

1948

With W. G. Einsele. Fertilization for increasing productivity of natural inland waters. In *Transations of the 13th North American Wildlife Conference,* ed. _____ pp. 527-52. _____: _____.

1949

With T. J. Walker. Detection and discrimination of odors of aquatic plants by the bluntnose minnow (Hyborhynchus notatus). *Physiol. Zool.* 22(1):45-63.

1951

With W. J. Wisby. Discrimination of stream odors by fishes and its relation to parent stream behavior. *Am. Nat.* 85(823):223-38.

With O. M. Brynildson and W. T. Helm. Improving conditions for fish in brown-water bog lakes by alkalization. *J. Wildl. Manage.* 15(4):347-52.

1954

Odour perception and orientation in fishes. *J. Fish Res. Board Canad.* 11(2):107-29.

1955

With J. A. Larsen. The homing salmon. *Sci. Am.* 193(2):72-75.

1956

Perception of pathways by fishes in migration. *Q. Rev. Biol.* 31(3):200-209.

1958

With R. M. Horrall, W. J. Wisby, and W. Braemer. Sun-orientation and homing in fishes. *Limnol. Oceanogr.* 3(4):353-61.

With W. R. Schmitz. Artificially induced circulation of the lake by means of compressed air. *Science* 128(3331):1088-89.

1960

Guideposts of migrating of fishes. *Science* 132(3430):785-92.

With G. E. Likens. Movement of radiosodium in a chemically stratified lake. *Science* 131(3414):1676-77.

1964

Experimental limnology. *BioScience* 14(7):36-38.

1966

Underwater Guideposts—Homing of Salmon. Madison: University of Wisconsin Press.

1967

With M. E. Swenson. Eutrophication. *Science* 158(3798):278-82.

1968

With B. Ingersoll. Dwindling lakes. *Nat. Hist.* 77(9):8-31.

1969

Cultural eutrophication is reversible. *BioScience* May:425-31.

1970

With R. M. Horrall, A. B. Stasko, and A. E. Dizon. Orientation cues and tracking of salmonid fishes. *Proc. Natl. Acad. Sci. U. S. A.* 66(1):13-14.

1972

With D. M. Madison, R. M. Horrall, and A. B. Stasko. Migratory movements of adult sockeye salmon (*Oncorhynchus nerka*) in coastal British Columbia as revealed by ultrasonic tracking. *J. Fish Res. Board Canad.* 29(7):1025-33.

1975

With J. C. Cooper. Morpholine as olfactory stimulus in fish. *Science* 187:81-82.

1976

With A. T. Scholz, R. M. Horrall, and J. C. Cooper. Imprinting to chemical cues: The basis for home stream selection in salmon. *Science* 192(4245):1247-49.

1983

With A. T. Scholz. *Olfactory Imprinting and Homing in Salmon.* Berlin: Springer-Verlag.