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UNL Aquaculturist Sees Fish Farming Niche in Empty Hog Barns

by Steve Ress,
UNL Water Center

Jim Rosowski sees potential for a freshwater farming niche in the growing number of empty hog barns dotting Nebraska's rural landscape.

For those with a vision, there is an untapped market using resources right under our feet, the University of Nebraska-Lincoln aquaculturist said.

The market potential Rosowski sees is in raising and selling fresh water Malaysian river prawns (*Macrobrachium rosenbergii*). The hardy, blue, shrimp-like crustaceans are now cultured outdoors in India, Bangladesh, China and Vietnam. Thousands of them have been grown to harvest on an experimental basis in an unused hog barn at UNL's Agricultural Research and Development Center (ARDC) near Mead. They are as tasty as any marine shrimp and can be grown to a length of six inches and a weight of one sixteenth of a pound in about six months.

Rosowski, a handful of biology students, and research technician Craig LaPorta raise them in a series of ever-larger tanks that were built earlier this year in the

ARDC hog barn. They harvested all the animals last month and are now busy converting more of the hog barn to additional tanks, aeration and harvesting equipment. The work there follows successful smaller scale attempts to grow prawns at Manter Hall, south of UNL's Memorial Stadium, and research between 1987 and 1993

Rosowski did to grow small, brine shrimp in the former Whittier Junior High building.

We have all the food and other ingredients needed to grow prawns here in Nebraska, including the absolute best source of water in North America, he said about the state's abundant supplies of groundwater and feed grains for formulating high protein shrimp feeds. Chemically hard groundwater is perfect for growing a prawn's shell, he said.

Grown indoors in heated and aerated tanks, adult prawns and tails suitable for marketing to restaurants and grocery stores can be grown in about six months, or half that time for bait-size prawns or prawns to be eaten whole, he said.

Market potential is there. Shrimp is the best selling seafood in the world, with the U.S. currently importing more than \$3 billion worth each year. Growing them

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Malaysian River Prawns are being grown in tanks in a converted hog barn at UNL's Agricultural Research and Development Center near Mead. UNL Aquaculturist Jim Rosowski says he hopes his prawn growing research will help tap a market for Nebraska-grown seafood (photo: Steve Ress).

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Coming Change At the UNL Water Center and Water Sciences Laboratory; Seminar and Tour Activities

from the DIRECTOR



J. Michael Jess

Water Sciences Laboratory

In addition to encouraging faculty member research and providing sources of funding to support it, the Water Center also serves as the administrative parent for UNL's Water Sciences Laboratory (WSL). Through a pooling of resources, the WSL has provided analytical and field support services for numerous faculty member research activities throughout Nebraska and the Midwest since its founding in 1990.

As might be expected with such arrangements, WSL operations are

supported by a variety of funding sources. Nebraska Research Initiative funds, for example, permitted acquisition of mass spectrometers and other iBig ticket items. More recently, a U.S. Environmental Protection Agency grant, made possible by the efforts of Nebraska First District Congressman Doug Bereuter, permitted purchase of additional analytical and field equipment.

Leadership of the WSL changed earlier this year after founding director and hydrochemist Dr. Roy Spalding shifted his academic appointment, or university home, to UNL's Department of Agronomy and Horticulture. Dr. Daniel Snow, who has been with the WSL since its creation, was subsequently named manager of the facility. In response to recent reductions in state appropriations for UNL, organizational changes have resulted in other personnel changes such that the WSL now employs 5.5 Full Time Equivalents.

Also in answer to reductions in appropriations made to UNL, Dr. Snow initiated a review of current expenses and charges for sample analyses. Not surprisingly, his examination revealed increased costs for supplies and other outlays. While those increases are partly offset by improved efficiencies, modest revisions to the list of analytical charges was a necessary result.

To better focus efforts directed toward its analytical laboratory responsibilities, other changes at the WSL

include reassignment of its field services activities. That action will eliminate overlap and duplication of closely related responsibilities delegated elsewhere. Instead of the WSL, the Conservation and Survey Division is now responsible for providing the equipment and tools needed for faculty members' field research.

Future of the Water Center

Although initially prompted by budgetary considerations, next year's implementation of a plan to merge the Water Center with two other UNL entities is designed to improve coordination and direction of units within UNL's Institute of Agriculture and Natural Resources. Thus, as 2003 begins, the Water Center will no longer be an independent entity. Along with the Conservation and Survey Division and the School of Natural Resources Sciences, it will merge into a single unit . . . the School of Natural Resources.

Responsibilities presently assigned to the Water Center will not disappear. Effectively as a component of the new organization, those of us formerly affiliated with the Water Center will continue encouraging and directing faculty research, and to the extent they are available, dispensing funds to support it. The various classes, workshops, conferences and tours previously sponsored by the Water Center also will continue under the umbrella of the new organization.

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WATER CURRENT

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Meet the Faculty

Dr. Kyle D. Hoagland

Aquatic ecologist with interests in ecotoxicology of agricultural pesticides, water quality in general, and lake and reservoir management. Professor, UNL School of Natural Resource Sciences since 1990. Director, UNL Water Center since 2000. Interim Director, UNL School of Natural Resource Sciences since December, 2001.



Kyle Hoagland

Education:

- Ph.D., Life Sciences (Phycology), University of Nebraska, Lincoln, NE, 1981.
- M.S., Aquatic Ecology, Eastern Michigan University, Ypsilanti, MI, 1975.
- B.S., Zoology, Michigan State University, East Lansing, MI, 1973.

Current Research:

- ó Modeling the oxygen budget for Lake Ogallala, a eutrophic reservoir dominated by hypolimnetic inputs from Lake McConaughy
- ó Evaluating the effects of pesticides and their mixtures on aquatic organisms at the individual and community levels
- ó Development and implementation of a comprehensive lake and reservoir strategy for Nebraska as a model for agriculturally dominated ecosystems

Teaching:

- ó NRES 404 - Natural Resources Seminar
- ó NRES 459/859 - Limnology
- ó NRES 468/868 - Wetlands
- ó NRES 866 - Advanced Limnology

Selected Publications:

- ó Schmitt, T.J., M.G. Dosskey and K.D. Hoagland. 1999. Filter strip performance and processes for different vegetation, widths, and contaminants. *Journal of Environmental Quality* 28:1479-1489.
- ó Holz, J.C. and K.D. Hoagland. 1999. Effects of phosphorus reduction on water quality: comparison of alum-treated and untreated portions of a hyper-eutrophic lake. *Journal of Lake and Reservoir Management* 15:70-82.
- ó Nelson, K.J., K.D. Hoagland and B.D. Siegfried. 1999. Chronic effects of atrazine on tolerance of a benthic diatom. *Environmental Toxicology and Chemistry* 18:1038-1045.
- ó Tang, J.-X., B.D. Siegfried and K.D. Hoagland. 1998. Glutathione-S-transferase and *in vivo* metabolism of atrazine in freshwater algae. *Pesticide Biochemistry and Physiology* 59:155-161.
- ó Carder, J.P. and K.D. Hoagland. (continued on page 5)

Dr. Daniel D. Snow

Research Assistant Professor and Environmental Chemist/Lab Manager, Water Center/Water Sciences Laboratory, IANR, University of Nebraska-Lincoln.

Education:

- Ph.D. in Geology, University of Nebraska-Lincoln, 1996.
- M.S. in Geology, Louisiana State University, 1988.



Dan Snow

B.S. in Geology, Southwest Missouri State University, 1982.

Samples of Current Research:

Development of methods for analysis of emerging organic contaminants and applying these methods to understanding their environmental fate and occurrence in Nebraskais ground and surface water. Newly developed methods have focused on:

- ó Trace level analysis and identification of antibiotics, explosives, pesticides and their degradation products using liquid chromatography-tandem mass spectrometry (LC/MS/MS).
- ó Trace level analysis of gasoline oxygenates and algal metabolites using solid-phase microextraction and gas chromatography/mass spectrometry (GC/MS).
- ó Ultra-trace analysis of chlorofluorocarbons (CFCs) and dissolved air for ground water age-dating using a custom-built vacuum extraction system and gas chromatograph with micro-electron capture detector (GC/ECD).

- ó Analysis of redox compounds (uranium, methane and hydrogen peroxide) and fermentation products (hydrogen and carboxylic acids) in water to help characterize microbial respiration and understand contaminant degradation pathways.

Other Recent Research:

- ó Helped to develop a method for precise measurement of nitrogen enrichment resulting from microbial denitrification in groundwater using isotope ratio mass spectrometry (IRMS) for research related to nitrate contamination.
- ó Ph.D. research characterized the geochemistry in areas of high uranium levels in ground water of Central Platte Valley, explored the use of uranium isotopes for fingerprinting sources of tributary influx in the Platte River to help identify sources of pesticide contamination, and developed a method for age-dating recently recharged groundwater using radon-222 in-growth.

(continued on page 5)

Guest Column

The Army Corps' Missouri River Mission

By Brig. Gen. David A. Fastabend
Division Engineer,
Northwestern Division, U.S. Army Corps of Engineers

As Commander of the Northwestern Division of the Army Corps of Engineers, I have been dealing with Missouri River Basin issues for a year.

Until this assignment, most of my military career has been in tactical/combat engineer units. I was once asked which of those previous assignments best prepared me for my responsibilities in the Corps of Engineers. I answered without hesitation: Bosnia. In Bosnia, I found myself between groups with passionate and very divergent views of the future. These groups had great difficulties communicating with each other. Each group was burdened by a legacy of distrust and perceived past wrongdoings. And each group was absolutely convinced that God was on their side.

My experience on the Missouri River has not been all that different. With our responsibilities to manage the nation's inland waterways infrastructure, the Corps is placed squarely in the middle of a wide range of multiple, divergent special interest groups. When you combine that role with the Army's ethic of selfless service to the nation, then you get an agency that is famous at times infamous for its stoic, silent endurance under criticism.

Some people claim ...

- ... the Corps cares only about navigation
- ... the Corps cares only about flood control
- ... the Corps cares only about hydropower.

Those people are wrong. The Corps does care only about one thing. That one thing is not navigation, nor is it flood control, nor is it hydropower. The Corps cares only about executing the will of the American people, as expressed by their elected representatives in Congress, as directed by the administration, and as sanctioned by the courts.

That sounds simple ... but the challenge is that the people of the United States have over time, told us to do many, many things. In the 1930s and the 1940s, the people told us to build, operate and maintain the Missouri River mainstem system for multiple project purposes. Since that original mission, the people have

given us additional instructions. In the 1970s, they gave us the Endangered Species Act and the National Environmental Policy Act. In the 1980s, they gave us the National Historic Preservation Act and the Native American Graves Protection and Repatriation Act.

These additional instructions were given long after the mainstem system was already designed and built. My peer agencies, carefully doing their jobs, have executed their mission and given us findings with respect to these laws, most notably the listing of interior least terns, the piping plover, and the pallid sturgeon.

As you can well imagine, no one was able to ideconflict the multiple instructions given to the Corps. Our guidance is sometimes contradictory, and the resolution of those contradictions is extremely problematic. Frankly, it is impossible for one organization to single-handedly resolve the multiple demands on our limited water resources. This challenge will demand an extraordinary level of collaboration by all stakeholders, public and private, particularly the ones served by forums such as this.

On the banks of the Missouri River recently, someone asked me how it feels to be a human point. It feels a lot better than you might think. In the Corps of Engineers, we are extremely proud of our role in applying the best possible science and engineering judgment in order to balance the multiple purposes of these projects, while complying with environmental law and meeting our trust and treaty obligations to federally recognized tribes.

In the Army, we talk about the honor of being on point. The point position is clearly the most dangerous, and it is typically given to the most competent and trusted soldier in the formation. It is a position of honor. The Northwestern Division of the Corps of Engineers is on point.

In walking point in the Missouri River Basin, we are dealing with what may be the most deadlocked, contentious, and politically polarized water management issues in the nation today. We step on some mines at times, and we are no strangers to sniper fire. We are going to work hard to continue this mission and enlist the help of all the Missouri River stakeholders in addressing the challenges we must face together.

UNL Aquaculturist Sees Fish Farming Niche in Empty Hog Barns (continued from page 1)

locally would give restaurants and grocery stores the opportunity to obtain live or fresh prawns that would carry the cachet of being Nebraska grown.

Several local restaurants and at least one grocery store chain have been approached about the possibility of selling Nebraska-grown prawns and have expressed a great deal of interest in them, Rosowski said.

There are costs to a producer who wants to get into this market, but there also is a growing and as yet untapped market for live or fresh prawns, he said. Set-

up costs include building the tanks, the larger ones made from steel-reinforced concrete blocks, heating and aeration equipment, feed, purchasing the larvae and plastic-mesh habitats. The habitats, that Rosowski and his students designed, stand upright in the tanks and resemble levels of a miniature parking garage. They let the prawns move to different levels as they grow, giving them space to establish territories, and a place to hide when they molt their shells.

(continued on page 8)

From the Director (continued from page 2)

Seminars and Summer Tour

Two of the first activities that will be conducted under the banner of the new School of Natural Resources, but which are well known to most Water Center constituents, will be the spring semester water and natural resources seminars and the summer water and natural resources tour.

The seminar series kicks-off on Wednesday, Jan. 15 at 3 p.m. in Room 116 L.W. Chase Hall on the UNL East Campus. It will be held each Wednesday afternoon at the same time and location through April 30, with the exception of Mar. 19, which is during spring break for students.

A complete list of seminar topics and speakers will soon be available on the Water Center's web site at

<http://watercenter.unl.edu>.

Initial planning also has begun for the annual summer water and natural resources tour. Though still in very early planning stages, it appears the tour will take a close look at political, agricultural, irrigation, conservation and endangered species issues in the Republican River watershed. Right now, it looks as though we'll make a two-day tour of the basin beginning and ending in Kearney, in either the third or fourth full week in July. All the usual cooperators are on-board for this event, as well as The Groundwater Foundation and The Four States Irrigation Council. Planning will continue and we hope to bring you more details from that process in upcoming newsletters.

Meet the Faculty

Dr. Kyle Hoagland (continued from page 3)

- 1998. Combined effects of alachlor and atrazine on benthic algal communities in artificial streams. *Environmental Toxicology and Chemistry* 17:1415-1420.
- 6 Tang, J.-X., K.D. Hoagland and B.D. Siegfried. 1998. Uptake and bioconcentration of atrazine by selected freshwater algae. *Environmental Toxicology and Chemistry* 17:1085-1090.
- 6 Tang, J.-X., K.D. Hoagland and B.D. Siegfried. 1997. Differential toxicity of atrazine to selected freshwater

algae. *Bulletin of Environmental Contamination and Toxicology* 59:631-637.

- 6 Hoagland, K.D., J.P. Carder and R. L. Spawn. 1996. Effects of organic toxic substances. In: Stevenson, R.J., M.L. Bothwell and R.L. Lowe (Eds.), *Algal Ecology*. Academic Press. Chap. 14, pp. 469-496.

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Dr. Dan Snow (continued from page 3)

Current Extension and Outreach Programming:

- 6 Assists NU extension educators, producers and others with questions concerning water quality, water treatment problems, and water testing. Frequently leads tours of the Water Sciences Laboratory for classes, school groups and other off-campus visitors.

Teaching:

- 6 Frequent guest lecturer in classes, seminars and conferences. Team member of Water Quality Workshops funded by the Nebraska Department of Environmental Quality.

Publications:

- 6 Snow, D.D., D.A. Cassada, S.J. Monson, J. Zhu and R.F. Spalding, (accepted) Tetracycline and Macrolide Antibiotics: Trace analysis in water and wastewater using solid phase extraction and liquid chromatography-tandem mass spectrometry. In: Analysis of Emerging Contaminants Using Liquid Chromatography Mass Spectrometry (LC/MS/MS). *American Chemical Society Symposium Series Book*
- 6 Snow, D. D.; D.A. Cassada, S.J. Monson, J. Zhu and R.F. Spalding (2002) Trace analysis of tetracycline and macrolide antibiotics using solid phase extraction and liquid chromatography-tandem mass spectrometry. *Preprints of Extended Abstracts ACS National Meeting, American Chemical Society, Division of Environmental Chemistry*. 42(1), 414-418.
- 6 Zhu, J., D. D. Snow, S. J. Monson, D. A. Cassada and R.

F. Spalding (2001) Analysis of Oxytetracycline, Tetracycline, and Chlortetracycline in Water Using Solid Phase Extraction and Liquid Chromatography-Tandem Mass Spectrometry. *Journal of Chromatography A*, 928, 177-186.

- 6 Cassada, D.A., Y. Zhang, D.D. Snow and R.F. Spalding (2000) Trace analysis of ethanol, MTBE and related oxygenate compounds by solid phase microextraction and gas chromatography/mass spectrometry. *Analytical Chemistry*. 72(19) 4654-4658.
- 6 Cassada, D.A. S.J. Monson, D.D. Snow and R.F. Spalding (1999) Sensitive determination of RDX, nitroso-RDX metabolites and other munitions in groundwater by solid-phase extraction and isotope dilution liquid chromatography-atmospheric pressure electro-spray ionization mass spectrometry. *Journal of Chromatography A*, v.844: 87-95.
- 6 Snow, D.D. and R.F. Spalding (1997) Short-term aquifer residence times estimated from ²²²Rn disequilibrium in artificially-recharged groundwater. *Journal of Environmental Radioactivity*. V.33 n.7: 307-325.
- 6 Martin, G.E., D.D. Snow, E. Kim and R.F. Spalding (1995) Simultaneous determination of argon and nitrogen. *Ground Water*, 33(5) 781-785.
- 6 Snow, D.D., and R.F. Spalding (1994) Uranium isotopes in the Platte River drainage basin of the North American High Plains Region. *Applied Geochemistry*, 9, 271-278.

Web/Email Addresses:

<http://www.ianr.unl.edu/waterscience/dan.htm>
<http://agronomy.unl.edu/fac/nsnow.htm>
dsnow1@unl.edu



Water News Briefs

Mailing List Updates

No updates will be made to the *Water Current's* mailing list until at least October and possibly as late as January, 2003 due to the UNL Water Center's office supervisor being on maternity leave. If you have a change to your mailing label or wish to request a subscription for someone else, please continue to submit those changes, as they will be filed for updating as soon as the office supervisor returns.

If you have questions about this or need to submit a new subscription, change of name or change of address, email your questions or mailing label changes to sress1@unl.edu.

Free 2003 Calendar

Free 2003 calendars are available from the UNL Water Center. The calendar was produced by the Water Center and UNL's Conservation and Survey Division (CSD) and commemorates their dedication to water use, development and conservation in Nebraska.

To get yours, contact the UNL Water Center, P.O. Box 830844, University of Nebraska, Lincoln, NE 68583-0844, email sress1@unl.edu or phone (402)472-3305. Calendars will be distributed on a first-come, first-served basis while supplies last.

Though CSD has previously produced and distributed calendars, this is the first such joint venture between the two units.

In addition to the importance of water in Nebraska's development, the calendar also celebrates the merging of UNL's School of Natural Resource Sciences, Water Center and CSD, which will further strengthen natural resources education, research and outreach programming within

UNL's Institute of Agriculture and Natural Resources.

Special Issue Copies

A limited number of the October, 2002 *Water Current* special issue, celebrating the Bureau of Reclamation's centennial, are available from the UNL Water Center on a first-come, first-served basis.

This 16-page issue of the newsletter devoted nearly one-third of that edition's coverage to a history of Bureau of Reclamation irrigation projects in Nebraska and eastern Wyoming. For additional copies, phone the UNL Water Center at (402)472-3305 or email sress1@unl.edu. Request copies of the October, 2002 edition of the *Water Current* (Vol. 34, No. 5).

High Plains Aquifer Facts

The High Plains Aquifer totals about 174,000 square miles, of which about 63,650 square miles are under Nebraska.

The average thickness of the aquifer is 190 feet, but the Nebraska average is about 342 feet.

The volume of drainable water in the aquifer is 33,250 million acre feet, but Nebraska has about 2,130 million acre feet, or about 65 percent of the total (an acre foot being enough water to cover an acre of land with 12 inches of water).

On the Web

Riparian Areas: Functions and Strategies For Management: pre-publication online document from the National Research Council reports details, definitions, structure and functions of riparian areas, describes human alterations to the riparian ecosystem and documents the current status of riparian areas in the U.S. <http://www.nap.edu/books/0309082951/html>.

Why Watersheds? A slideshow presentation designed to bridge the gap for people who may not understand the whys and hows of watershed protection. Explains what a watershed is, how development impacts watershed health and why protecting watersheds is so important. For a preview, go to www.cwp.org/water.htm.

30th Anniversary of The Clean Water Act

October marked the 30th anniversary of the Clean Water Act, a milestone in efforts to restore and protect U.S. water resources.

Established in 1972, the Clean Water Act was enacted by Congress in response to concern over the condition of U.S. waterways. The act grants the U.S. Environmental Protection Agency (EPA) authority to regulate wastewater discharges, support the creation and rehabilitation of wastewater treatment plants, and protect surface water through the implementation of pollution control programs and establishment of industry standards for the water quality profession.

Over the past 30 years, evidence of the Clean Water Act's success has been widespread and unmistakable. Waters that were once grossly contaminated are now clean and teeming with life, said Water Environment Federation executive director Bill Bertera.

For more information about the 30th anniversary of the act, visit the Year of Clean Water's website at www.yearofcleanwater.org and the EPA's website at <http://www.epa.gov/water/yearofcleanwater/monitoring.html>.

JANUARY, 2003

6-8: Nebraska Turfgrass Conference, Omaha, NE.

15-16: iScientific, Regulatory and Cultural Factors Influencing Water and Environmental Issues in Tropical Pacific Islands, i University of Hawaii at Manoa, Honolulu, HI. For information, phone (808)956-7847 or email wrrc@hawaii.edu.

15-16: iThe Scientific, Regulatory and Cultural Factors Underlying Water Issues in Tropical Pacific Islands, i Pagoda Hotel, Honolulu, HI. Sponsored by the University of Hawaii Water Resources Research Center. For information, contact Peter Rappa at (808)956-3974 or email wrrc@hawaii.edu



FEBRUARY

13: Lower South Platte Symposium, iThe South Platte: Learning How It Works and How To Make It Work. i Contact Joel Schneekloth at (970)345-0508, email jschneek@coop.ext.colostate.edu.

25-26: Twelfth Platte River Basin Ecosystem Symposium, Ramada Inn, Kearney. For information, contact Steve Ress, University of Nebraska-Lincoln Water Center at (402)472-3305 or email sress1@unl.edu.



Muscle and determination helped build U.S. Bureau of Reclamation irrigation projects. Here, men and horses haul backfill material for sluicing into a cut-off trench at Minatare Dam in October, 1913. Additional copies of the October, 2002 Water Current giving the history of Bureau projects in Nebraska and eastern Wyoming are available free from the UNL Water Center (USBR photo).

We're Updating!!

We are updating our mailing list. If you have a change of address, title and/or name, or would like to have your name added to or removed from the **Water Current** mailing list, please let us know. Also, if you know of anyone who might be interested in receiving our publications, please give us their names and we will be glad to add them to our mailing list.

- Change my address
- Delete me from your list
- Add to our list

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MARCH

18-20: Fifteenth Annual South Dakota Department of Environment and Natural Resources Environmental and Ground Water Quality Conference, Ramkota River Center, Pierre, SD. Abstracts are being accepted until Feb. 1, 2003. For information on general topics and program format, contact Gary Haag at (605)773-5855 or email gary.haag@state.sd.us.

27-28: iWatering Your Futurei - 2003 Arkansas River Basin Water Forum, University of Southern Colorado, Pueblo, CO. Call (719)336-9421 or email rappel@co.usda.gov.

APRIL

7-11: International Workshop on Integrated Water Resource Management, Denver, CO. Email Leanna Principe at lprincipe@do.usbr.gov.

23-25: Sixth National Mitigation Banking Conference. For information, go to www.mitigationbankingconference.com or phone (800)726-4853.

UNL Aquaculturist Sees Fish Farming Niche in Empty Hog Barns (continued from page 1)

Prawns can be very aggressive and are territorial, Rosowski said. They can also be cannibalistic if not well fed.

Research and small commercial farming efforts to grow prawns as a cash crop are occurring in more than a dozen states from Arizona and Kentucky to Ohio and Illinois. Earlier this year, Rosowski attended a first-ever convention of people interested in commercializing prawn farming in Mississippi.



Research Technician Craig LaPorta size sorts baby prawns at UNL's Manter Hall. Growing operations have since moved to an unused hog barn at the Agricultural Research and Development Center near Mead (photo: Steve Ress).

Many states actively involved in this growing market have the same climate restraints we do and they're moving forward, he said.

However, there may be nowhere else in the Midwest better suited for farming prawns than Nebraska.

In addition to abundant ground-water supplies, Nebraska has all the feed ingredients, particularly soybean meal and animal byproducts, needed to produce shrimp feed, which needs to be about 40 percent protein for fast and sustained growth indoors.

Prawn farming could benefit existing industries in the state, as well. One example is that distiller's grains, the mash left over from ethanol production, can be fed to prawns. Corn silage is excellent, as well.

By shifting prawns into larger tanks as they grow, continuous, year-round harvesting is possible indoors, which would increase profit potential. Rosowski estimates prawn farmers can raise 11 to 12 pounds per 1,000 gallons of water at a selling price of \$6 to \$10 per pound.

He also thinks it may be possible to produce a single harvest of around 250 pounds of adult prawns from small, one-tenth to one-quarter acre, outdoor ponds.

Prawns can't survive in water colder than 55 degrees but grow ideally in water around 75 to 80 degrees, where they can reach market size in about 75 to 85 days, so we think it may be possible to grow them outdoors between the middle of June and the middle of September as a single harvest crop, he said.

Rosowski's work, in conjunction with undergraduate students, has resulted in applications for patents on a tank heating system, prawn growth and harvesting habitats, and a compact fluidized silica sand biofilter for processing toxic ammonia from the prawns to harmless nitrate. The habitats aerate the water without creating bubbles around the prawns, simulating a natural stream-flow environment, and help remove solid wastes and uneaten food.


Grants from the Nebraska Soybean Board and UNL, including the UNL Water Center, help finance this research.



Terry Bartels displays frozen Nebraska-grown prawn tails. These prawns were harvested from tanks at Manter Hall, south of UNL's Memorial Stadium (photo: Steve Ress).

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