

Michigan**Science**



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BY THE NUMBERS

Beyond propaganda and rhetoric, numbers tell the real story



KETTERING UNIVERSITY PROFESSOR Dr. Homayun Navaz turned down the velocity of cold air and raised the temperature to 32 degrees to improve energy efficiency in a refrigerated display case, resulting in significant energy savings and colder food. By reducing the velocity by 30 percent, the food became one degree colder due to 12 percent improved infiltration while the power required was reduced 13 percent. Refrigerated display cases are responsible for nearly 50 percent of all energy consumed in grocery stores, convenience stores and supermarkets. More efficient infiltration results in a significant decrease from 83 percent to 71 percent of the cooling load — the biggest energy draw for refrigerated display cases. The nationwide annual savings for reduced infiltration rate version of vertical display cases has been calculated at approximately \$170 million to \$200 million, with a reduction in carbon dioxide emissions of more than 500,000 tons.

▶ For more information, visit www.agentfate.kettering.edu/AirCurtain/main.html.

BECAUSE THE COSTS of renewable energies are four times higher than previously expected, North Carolina's Progress Energy stated that it could not meet state mandates after considering more than 100 proposals to generate electricity from solar, wind and agricultural waste sources. North Carolina imple-

mented the mandates in a 2007 state law, which included cost caps intended to protect customers from large price increases. According to the Raleigh, N.C., News & Observer: "The state law limits the utility to spending \$1.5 billion on renewable resources by 2021, the year the state's clean energy requirement is fully phased in. That's when Progress and Duke Energy will have to get 7.5 percent of its electricity from renewables and 5 percent from energy efficiency programs. Currently, less than 2 percent comes from the alternative resources." According to the newspaper, "The cost caps for renewables is much less than expected nuclear costs, but renewables would generate a fraction of the power. Residential customers would pay no more than \$10 a year from 2008 to 2011, \$12 a year to 2014 and \$34 a year thereafter. The cap for commercial customers starts at \$50 a year and tops out at \$150 a year. The cap for industrial customers starts at \$500 a year and peaks at \$1,000 a year."

▶ For more information, visit www.newsobserver.com/business/story/1435874.html.

ALEX ALEXIEV, HUDSON Institute adjunct scholar, reports that efforts by the Chinese to become more energy efficient do not include renewable energy plans and, in any event, are not yielding positive results. "To the Chinese, energy efficiency means more efficient coal-burning equipment, co-generation, coal liquefaction, and other improvements of their primarily coal-based energy industry," wrote Alexiev. "Despite marginal improvements in this area, China is now the largest carbon dioxide emitter in the world and can, at best, slow down but not stop carbon emissions growth for the foreseeable future." Alexiev relies on statistics from Beijing's State Electricity Council to report that the percentage of energy gener-

ated from renewables in China has declined over the past two years in favor of pursuing nuclear energy. Japan is also seeking to increase its use of nuclear power from the current 30 percent to 41 percent over the next decade, while limiting its renewables target to 3 percent in 2010. Despite major subsidies for solar energy over the past 30 years, California currently produces only 0.2 of its energy needs from the sun. In the meantime, Germany generates 15 percent of its energy from solar and wind power sources, exceeding the European Union's 12.5 percent target for 2010. However, costs for electricity in Germany have risen 38 percent from 2006 to 2007 due to the fact that solar panels cannot "convert more than 25 percent of sun energy into electricity, while wind power's 'load factor' — i.e., electricity produced per installed capacity — seldom exceeds 20 percent." The inability of renewables to provide baseload capabilities has forced Germany to back up solar and wind with conventional energy sources. In the meantime, Italy and Sweden have rescinded their nuclear energy moratoriums, which were adopted in the 1980s. Italy established goals of meeting 25 percent of its electricity needs from eight new nuclear plants. England has announced plans to upgrade eight nuclear reactors and build 10 new plants. France, according to Alexiev, "already derives 80 percent of its electricity from 58 reactors ... and is aggressively moving forward with third-generation reactors at home and abroad." Ukraine has announced plans for 11 new reactors over the next 20 years, while India plans to build 40 new reactors over the next 22 years to increase its energy yield from nuclear energy from the current 3 percent to 45 percent.

▶ For more information, visit www.hudson.org/index.cfm?fuseaction=publication_details&id=6163.

THE THIRD DEGREE

Test your reading of this issue of *MichiganScience*. Students in grades six through 12 can compete for a \$100 gift certificate from Edmund Science Kit. The winner will be determined by a random drawing from entries with all the correct answers. Please send entries to walker@mackinac.org.

- Who won a Nobel Prize for discovering proof that either a black hole or a neutron star must be created when a star of a certain size dies?
A. Robert C. Balling Jr.
B. Subrahmanyan Chandrasekhar.
C. Arthur Eddington.
D. Kenneth Braun.
- By what percentage did the cost of electricity in Germany increase when the country began to generate 15 percent of its energy from solar and wind power sources?
A. 15 Percent. B. 27 Percent.
C. 38 Percent. D. 42 Percent.
- Which species of fish traveled from the Black and Caspian seas to the Great Lakes in the ballast water of European ships?
A. Goby.
B. Spiny Dogfish.
C. Goramy.
D. Asian Carp.
- According to a Universidad Rey Juan Carlos study, how many jobs – on average – will be lost for every green job that is created?
A. 1.5. B. Four.
C. 2.2. D. Nine.
- Which of the following was NOT the name of a division in the 2009 FIRST Robotics Competition Championship?
A. Galileo. B. Newton.
C. Archimedes D. Edison.
- In which compass direction do winds predominantly blow across the Great Lakes?
A. North. B. West.
C. South. D. East.
- Fill in the blank: "Refrigerated display cases are responsible for nearly ____ percent of all energy consumed in grocery stores, convenience stores and supermarkets."
A. 50. B. 30.
C. 65. D. 25.
- Which renewable energy resource is achieving its promised goals?
A. Wind. B. Solar.
C. Mini-hydro. D. None of the above.
- What do Asian Carp primarily eat?
A. Holoplankton and Picoplankton.
B. Zooplankton and Phytoplankton.
C. Bacterioplankton and Acterioplankton.
D. Phytoplankton and Meroplankton.
- From what Caribbean country or countries does the United States receive most of its imported ethanol?
A. Grenada.
B. Barbados.
C. Trinidad & Tobago.
D. Haiti.
- Bonus Question: In which city does "Casey at the Bat" take place?
A. New York.
B. Boston.
C. Detroit.
D. Mudville.

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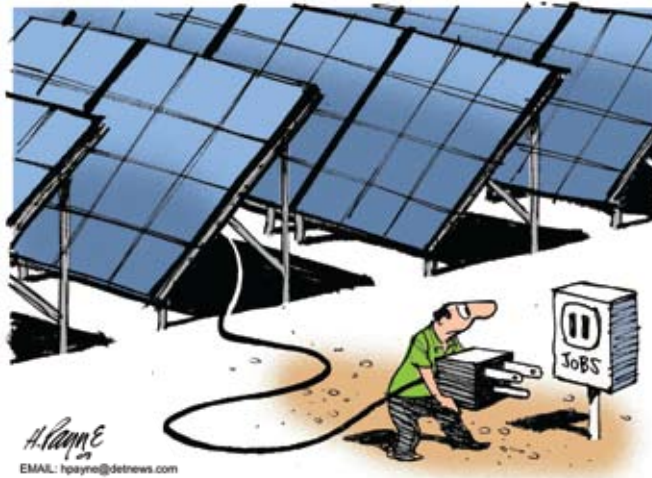
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FIELD OF DELUSIONS

IN THE FILM and book “Field of Dreams” protagonist Ray Kinsella hears a voice that whispers, “If you build it, he will come.” This may work as justification for constructing a baseball diamond in the middle of an Iowa cornfield, but as an analogy upon which to base a whole new economy, it’s nothing more than fantasy. Yet such seems to be the case with the green jobs mantra — proponents pat each other on the back that renewable energy mandates will provide major environmental payoffs in terms of a sustainable future and more jobs. Putting aside the arguments against the promises of a sustainable future for another day, the claims for job creation are as fictitious as Shoeless Joe Jackson redeeming his legacy in Kinsella’s cornfield.

Last November, the Mackinac Center’s Russ Harding wrote that “Mandating more expensive forms of alternative energy takes money out of the pocket of consumers and drives up business costs, resulting in the loss of jobs.” Harding’s prescient analysis is supported by a March 2009 study released by Gabriel Calzada Alvarez, Ph.D., of the Universidad Rey Juan Carlos in Spain, which bluntly states: “Europe’s current policy and strategy for supporting the so-called ‘green jobs’ or renewable energy dates back to 1997, and has become one of the principle justifications for U.S. ‘green jobs’ proposals. Yet an examination reveals these policies to be terribly economically counterproductive.”

Note that Alvarez doesn’t simply write counterproductive, but “terribly counterproductive” — a distinction roughly equal to the disparity between actors Wally Cox and perpetual baddie Jack Palance portraying Ty Cobb, perhaps baseball’s all-time most despicable superstar. The URJC study concludes that for every green energy job created, 2.2 “on average” will be lost,



“or about nine jobs lost for every four created, to which we have to add those jobs that non-subsidized investments with the same resources would have created.” Nine jobs lost for every four created is akin to the Mudville nine of “Casey at the Bat” fame.

The URJC study also found that the number of promised green jobs was exaggerated as only one out of 10 created was actually permanent. The remaining jobs were in construction, fabrication and installation, administration and projects engineering — at the cost of 110,000 jobs in other areas of Spain’s economy. The study concludes that every “green” megawatt created “destroyed 5.28 jobs on average elsewhere in the economy: 8.99 by photovoltaics, 4.27 by wind energy, 5.05 by mini-hydro.”

The nearly \$36 billion spent on Spain’s renewable energy portfolio furthermore resulted in a market price of only \$10 billion of energy created. In order to resolve the debt incurred by subsidies for this boondoggle, Spain would need to raise its comprehensive energy rate by 31 percent. Additionally, “the average annuity required payable to renewables is equivalent to 4.36 percent of all VAT collected, 3.45 percent of the household income tax, or 5.6 percent of the corporate income tax for 2007.”

The damage to Spanish businesses wrought by increased energy costs due

to renewables mandates has also been severe. One company, Ferroatlantica, a producer of iron alloys, saw its percentage of energy as a total cost of production rise from 37 percent in 1997 to 43 percent in 2005. In 2006, Ferroatlantica moved its operations to France, stating: “Only internationally competitive energy prices will allow us to support such a basic industry, not only because it belongs

to a strategic sector, but also to support employment and generate wealth.” Other companies reported energy cost increases of nearly 55 percent.

Harding wrote in November: “First we had the dotcom bubble and then the housing bubble. Is the green energy bubble next?” Indeed, the URJC study identifies the empty promises of solar, wind and mini-hydro as bubbles — depicting each as falling significantly short of promised goals; each costing far more than originally estimated, and each creating far fewer jobs than government dreamers predicted.

In terms of our current energy needs, it’s the World Series, the bases are loaded and we’re seemingly determined to bring a minor leaguer to the mound. With apologies to Ernest Lawrence Thayer:

Oh, somewhere in this favored land the sun is shining bright; But not enough to generate energy everywhere, nor with all the wind’s might. The jobs promised all the workers also haven’t panned out. There is no joy in Mudville — mighty renewables have struck out. ■

Agree with this article? Disagree? Write an email to walker@mackinac.org telling us why and we may print it in our next issue of MichiganScience.

SHIPWRECKED!

120-Year-Old Ship Discovered



THOSE FAMILIAR WITH the riveting high seas drama of “The Perfect Storm” may be less familiar with equally noteworthy tales of our inland seas. On April 2, a reminder of the Great Lakes’ ferocity surfaced with the announcement of the discovery of a 120-year-old shipwreck off the coast of South Haven. The wreckage was that of the steamer Joseph P. Farnan, which sank in the summer of 1889.

The Farnan was found by Michigan Shipwreck Research Associates¹, a non-profit organization based in Holland, Mich. Aside from information it gleaned from the shipwreck itself, MSRA learned about the Farnan disaster from a log entry provided by the South Haven station keeper. MSRA co-founder Craig Rich cited this particular shipwreck as a good example of the troubles that a working steamer faced in the 1800s.

Built in Cleveland in 1887, the Farnan was a typical steamer, transporting food and other goods to ports throughout the Great Lakes. The day that it sank started

with business as usual.

On July 20, 1889, at around 8:00 a.m., Captain Loren G. Vosburgh, his wife, Belle, and 10 crewmen set out from St. Joseph, Mich., bound for Escanaba in the Upper Peninsula, approximately 350 miles away. The day turned ugly when the ship encountered a storm shortly after departure.

Thus began a relentless six-hour battle with the weather, a fight that ended when a fire started in the engine room. No one knows how the blaze began. Because the water pumps were damaged, the crew was unable to quench the fire, and the flames spread, engulfing first the lifeboats stowed nearby and eventually the entire ship.

As the fire spread, the captain, his wife and the crew fastened together bits of wooden fenders and hatch covers² as makeshift life rafts. Approximately 17 miles west of South Haven, they abandoned ship in their juryrigged rafts, with some of the crew suffering from burns.

The Farnan’s plight became known on

shore when a South Haven watchman spied smoke on the horizon. Because the fire had progressed so quickly, a rescue team rode out to the scene in a small steamboat, forgoing the slower rowboats they usually used. Remarkably, the entire crew was saved. The ship itself was last seen completely consumed in flames.

To discover the lost vessel, the MSRA worked closely with the National Underwater and Marine Agency, founded by novelist Clive Cussler. The wreck was located using side-scan sonar technology, which provides images of the sea floor for surveying and for locating potentially hazardous items on submarine and shipping routes.

Researchers presented their discovery of the Farnan on April 25 at “Mysteries and Histories Beneath the Inland Seas,” an annual shipwreck show co-hosted by MSRA and the Joint Archives of Holland. The violent weather that destroyed the Farnan may not have been a once-in-a-century “Perfect Storm,” but the steamer’s story shows that the peril of sea travel is every bit as real in our inland seas as on the high seas of the Atlantic.

The mission of the Michigan Shipwreck Research Associates is to “preserve and promote Michigan’s submerged maritime history.” Its research can be read in detail at, www.michiganshipwrecks.org. A blog, www.michiganshipwrecks.blogspot.com, provides updates on shipwreck hunting news. ■



¹ Underwater photo of Farnan wreckage provided by Valerie van Heest, Director MSRA. Drawing courtesy of Robert Doombos, colorized by Valerie van Heest, Director, MSRA

² Fenders on ships act like fenders on cars, except that on ships they are placed on the beams (the sides) to protect them when the ship docks. Hatch covers are placed over a ship’s hatchways, which are openings in the deck that allow a ship’s cargo to be lowered into its hold.



HIGH SCHOOLS EXCEL AT ROBOTICS COMPETITION

MICHIGANDERS HAVE GOOD reason to say “domo arigato, Mr. Roboto!” On April 18, teams from Michigan high schools dominated the finals of the 2009 international *FIRST*[™] Robotics Competition in Atlanta, Ga., with Milford High School’s “Heroes of Tomorrow” winning as part of the first-place three-team “alliance.” Three Michigan teams comprised the runner-up alliance: the Utica Community Schools’ “Thunder-Chickens,” the Oakland County Schools’ “Truck Town Thunder,” and Berkley High School’s “Da Bears.”¹

Considering that this year’s competition began with 1,680 teams from all over the world, placing four teams in the top six qualifies as a Great Lakes State smack-down.

¹ All four teams have Web sites. See www2.huronvalley.k12.mi.us/schools/mhs/activity/hot_team/index1.htm, www.thunderchickens.org/, www.trucktownthunder.com/, and www.247dabears.com/Home/tabid/36/Default.aspx, respectively.

Contrary to what the name might suggest, the *FIRST* Robotics Competition has been held annually since 1992. *FIRST* — “For Inspiration and Recognition of Science and Technology”² — is the nonprofit organization responsible for the competition. This year’s FRC drew students and robots from schools around the world, including Brazil, Canada, Germany, Israel, Turkey, Mexico, the Netherlands, the United States and the United Kingdom.

The FRC has experienced meteoric growth in participation and interest. In its inaugural year, “28 teams competed in a high school gym in New Hampshire,” said *FIRST* Communications Manager Marian Murphy. Seventeen years later, nearly 1,700 teams participated in the FRC competition, stretching from late February to mid-April. Bill Miller, director of the *FIRST* Robotics

² For more about the organization, see <http://www.usfirst.org/>.

Competition, projects that next year’s FRC will host more than 1,800 teams. This year, Michigan high schools fielded 132 teams, with 16 of them competing for the first time.

A rookie team might not seem like a serious threat in a sophisticated competition like the FRC. But the *FIRST* game design committee tries to level the playing field by changing the competition each year. The list of allotted materials used in building the robots is tweaked, and the rules of the game are changed.

For instance, this year’s game features a slick surface for the robots to maneuver on, mimicking the gravity on the moon’s surface to commemorate the 40th anniversary of the Apollo 11 moon landing (the competition was even called “LUNACY[™]” this year). In addition, the robots had to haul payload trailers, with

each team's robot competing to scoop up game balls and dump them into opponents' trailers. Veteran teams that had previously perfected their robots' performance on carpet "had to go back and redesign for a slick surface and for pulling a trailer," said Miller.

Volunteers mentor each team during the FRC's design, build and competition phases. Mentors include parents, teachers, engineers, inventors and scientists. Lori Gleason, a teacher at Milford High School and a nine-year mentor to the "Heroes of Tomorrow" team, provided a window into the process: "The engineers [from the General Motors Milford Proving Grounds] give me their drawings, and I help the students in my sub-group plan the best way to machine the given part." The HOT team is provided access to three-dimensional mills and lathes in the GM Milford machine shop. Through mentorship, "[The students] get to work with world-class professionals who inspire them to achieve what they may otherwise not even dream of," explained Gleason.

"We are so blessed to have the mentors that we have," said Megan Crowley, 17, a senior at Milford High School and head of the "chairman sub-group" for the Milford HOT team.³ "They really are able to take this experience to another level." Crowley has enjoyed a relationship with *FIRST* since the seventh grade, when she got involved in the *FIRST* LEGO® League.⁴ At the time, she was recovering from a broken toe, and her mother encouraged her to join. "I didn't have much say in the matter," recalled Crowley, "but I'm really glad that it happened."

Michigan students followed a different path to the FRC championship this year. While other U.S. and international teams qualified for the finals through one of nearly 40 regional tournaments, Michigan teams



Megan Crowley, 17, (second from left) celebrates a win at the *FIRST* Robotics Competition World Championship in Atlanta, Ga., with other members of the HOT team from Huron Valley Schools.

were part of a *FIRST* pilot program that allowed them to compete against each other on weekends in March and early April. "It's like 'March Madness,' but with robots," said Crowley. After a final state tournament, Michigan's best teams qualified to go directly to the FRC Championship in Atlanta.

More than 20,000 students, mentors, spectators, event volunteers, family members, corporate sponsors and invited guests packed the Georgia Dome each of the three days of the FRC championships. The 349 qualifying teams were randomly divided into four divisions named after famous scientists: Archimedes, Curie, Galileo and Newton. Teams within each division were also randomly grouped into three-team alliances. "Just like in the real world, teams work with and compete against one another," explained Miller.

In each division, the eight individual teams with the best records each chose two other teams to be part of their alliance, and the eight resulting three-team alliances competed to determine a division champion. The four division champion alliances then competed in the championship finals.

Milford's HOT team — along with teams from Illinois and California — belonged to the last alliance standing. "The HOT team

has become the most decorated team during a single season in *FIRST* history," said Gleason. The team has won not just the *FIRST* Championship, but also the Michigan State Championship, the GM Industrial Design Award (twice), the Johnson & Johnson Gracious Professionalism Award and numerous other awards and accolades.

"*FIRST* Robotics is ... a varsity sport for the mind," *FIRST* in Michigan Director Francois Castaing told WWJ Newsradio 950 on April 19.⁵ "It is the only varsity sport where everybody becomes a pro."

The sports comparison seems apt, considering the FRC's competition fields, tournament-style organization, Georgia Dome venue and \$9.8 million in scholarships.⁶ Competitors learn cooperation, leadership, creativity and problem-solving in real-world scenarios under the supervision of veterans in the field of engineering. "The team has a hard deadline and is working with limited time, resources and money," said Miller. "There are a lot of people who think *FIRST* is about kids building robots. Really, it's about *FIRST* and robots developing leaders who will solve the technological problems of the future." ■

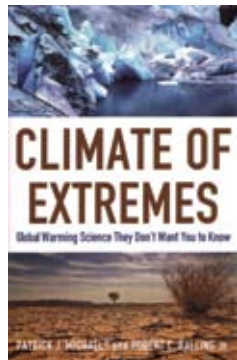
3 http://www2.huronvalley.k12.mi.us/schools/mhs/activity/hot_team/index1.htm.

4 See www.usfirst.org/what/fll/default.aspx?id=390.

5 See www.wwj.com/Michigan-Shines-In-FIRST-Robotics-Championship/4228425.

6 See www.my.usfirst.org/scholarships/index.lasso.

SCIENTISTS PATRICK J. Michaels and Robert C. Balling Jr. deliver what the title implies in their new book “Climate of Extremes: Global Warming Science They Don’t Want You to Know.” The authors agree the planet is warmer, but provide a concise, fun and effective unmasking of unscientific global-warming doomsday scenarios and a discussion of why prophets of doom trump sober science in public policymaking. If you want to join the battle, here is your armory.



Logical rules run the universe, but they are discovered by scientists with human flaws. An extreme but not isolated example of this is Arthur Eddington and Subrahmanyan Chandrasekhar. In 1935, Chandrasekhar, still a graduate student, discovered what we now call the “Chandrasekhar limit” — proof that either black holes or neutron stars must be created when a star of a certain size dies. The discovery was vigorously rejected by Eddington, a leading astrophysicist and a disbeliever to his dying day that black holes existed. Eddington’s hostility was so intense and his reputation so great that few would publicly defy him and support Chandrasekhar’s theory. Thinking his career in jeopardy, Chandrasekhar abandoned one of his greatest discoveries and didn’t return to it for decades.¹

Though Chandrasekhar paid an unfair price for his “heretical” thinking, he avoided scientific purgatory. He lived to see his discovery accepted and won a Nobel Prize.

But what if a scientist like him were accused by critics of advancing an idea that threatened the very survival of humanity? And what if this allegation came from powerful members of the media and prominent politicians with influence over science funding?

No matter how correct a scientist believed

himself to be, and no matter how defensible his views, he might easily choose to stay quiet to retain his job, reputation, research money and chance to live in peace.

Those causing such a “Climate of Extremes” are the real danger portrayed by this book. “Blacklisted” appears on the dust jacket to define the intimidations directed at scholars — such as Michaels and Balling, both climatologists — who accept the premise of a warming globe but do not believe the evidence supports a “gloom-and-doom vision of climate change.” Michaels explains that he will be departing his job as Virginia’s official climatologist — which he has held since 1980 — because the governor of that state will no longer abide Michaels’ heresies. He introduces two other state climatologists under similar pressure from other politicians. Media accounts comparing climate disaster skeptics to Holocaust deniers are retold.

And Vice President Gore makes an appearance on Page One and checks in regularly thereafter. Despite the attention Gore has drawn to climate issues, his pronouncements have not always comported well with the actual science of climate change.

As the chapters roll by, theories of global warming causing more dangerous hurricanes, floods, tornadoes, droughts, heat waves, rain, snow, cold snaps and other maladies are each disproven by a multitude of credentialed experts in the relevant fields speaking from peer-reviewed science journals. The flawed assumptions behind some iconic symbols of the warming doom cult — such as the famed “hockey stick” graph — also get revealed in a readable and entertaining fashion. And along the way, you’ll get a wonderful tutorial on what causes various forms of nasty weather.

Throughout it all, politicians and various media outlets unintentionally provide embarrassing examples of what happens

when selling an agenda trumps telling the truth. The New York Times and Washington Post serve up some of the worst errors. One example: A 2001 Post story fingers global warming as the cause of disappearing glaciers in Peru. Unfortunately, going back three decades, no record of net temperature change for that region could be found.

Many of these media mistakes have a basis in research that was mischaracterized or exaggerated, or that was overruled by subsequent research. Other problems are caused by the scientists themselves. A particularly troubling example is the creator of the temperature history used by the United Nations Intergovernmental Panel on Climate Change. Michaels and Balling describe his refusal to provide the supporting data for his work to a skeptical researcher because of his belief that the researcher would “try and find something wrong with it.” Such stonewalling throws critical inquiry out the window.

Keeping secrets to avoid criticism is very rare in scientific research, as are public exaggerations and personal vilifications. But all of these are, sadly, common in politics. “Climate of Extremes” is a valuable read because it makes abundantly clear that a powerful scientific culture may be becoming corrupted by politicians’ worst behavior.

Unfortunately, the authors’ scientific discussion is followed by only a single “modest proposal” — that academic papers be subjected to more transparent peer reviews. This is a solid idea, and they certainly make a strong case for it. But after providing a long list of errors and misunderstandings about global warming in public debate, the authors probably need to help fix more than academic procedure. Hopefully, the authors will write another terrific book giving us some better ideas about how to keep politics from overwhelming science. ■

Would you like to comment on this book or this article? Write an email to walker@mackinac.org telling us why, and we may print it in our next issue of MichiganScience.

¹ See Kip S. Thorne, “Black Holes & Time Warps: Einstein’s Outrageous Legacy,” Pages 158-163.

Ethanol: *By the Numbers*

- **THE ENERGY INDEPENDENCE and Security Act of 2007** increased the annual amount of renewable fuels (including ethanol) that must be blended into the nation's gasoline supply. The 2009 corn-ethanol mandate of 10.5 billion gallons is set to increase to 15 billion gallons in 2015. In 2022, the total mandate for all renewable fuels (including ethanol) is 36 billion gallons.¹
- **THE ETHANOL INDUSTRY** enjoys a range of government subsidies and benefits. Chief among these are a domestic-blending credit and a tariff on imported ethanol. Domestic ethanol production enjoys a 45 cents-per-gallon subsidy from the federal government, regardless of the ethanol's country of origin. In other words, other countries that export ethanol to the United States, to be blended into the U.S. gasoline mix, receive the subsidy. In addition, the U.S. ethanol industry is protected against foreign ethanol producers in the form of a 2.5 percent ad valorem tariff and a 54 cents-per-gallon tax on ethanol imported into the United States.²
- **U.S. ETHANOL FACILITIES** produced 19,545 million barrels of ethanol in January 2009. Additionally, the United States imported 371,000 barrels of ethanol during the month of January, all of which arrived from non-OPEC countries (209,000 barrels from Trinidad and Tobago alone).³
- **U.S. ETHANOL PRODUCTION** in January 2009 fell 3.9 percent from December 2008. January's annualized production figure of 10.25 billion gallons represents about 83 percent of U.S. plant utilization. The decline in ethanol production in January was fully expected by the market due to the large number of ethanol plants that have been idled this year due to poor ethanol profitability. According to estimates by Bentek Energy, U.S. ethanol production fell by another 1.2 percent in February and 5.7 percent in March.⁴
- **OF THE 193** refineries in the United States — whose collective nameplate capacity is 12,375.4 million gallons per year — there are currently 170 plants in operation, totaling 10,314.4 mgy.⁵
- **FOR PURPOSES OF** comparison: DTN Ethanol Center reports the following numbers of ethanol plants, as of



- April 7, 2009, for all types of feedstock (corn, switchgrass, wood pulp, etc.): 167 operational plants, 36 plants not producing, 19 plants under construction, 229 plants planned, 49 plants on hold and 19 plants cancelled.⁶
- **FOR FURTHER COMPARISON:** According to Ethanol Producer Magazine, as of April 7, 2009, there were 168 plants producing ethanol, 37 not producing, 15 plants under construction and one plant with plans to expand.⁷
- **TWELVE RECENTLY IDLED** VeraSun plants have an annual capacity of 1.2 billion gallons, or 60 percent of the total idled capacity in the United States (about 2 million gallons).⁸
- **ON MARCH 6,** 2009, an ethanol coalition called Growth Energy formally requested from the EPA that the current 10 percent cap on the amount of ethanol that may be blended into gasoline be increased to 15 percent. EPA must respond within 270 days from the date of the request.⁹
- **ACCORDING TO THE EIA,** 59 percent of energy-related subsidies are associated with end-use applications or with fuel consumed outside the electric-power sector. These subsidies totaled \$9.8 billion in FY 2007. About one-third of energy subsidies unrelated to electricity production are related to the promotion of alternative fuels, particularly ethanol and biodiesel. For energy subsidies unrelated to the production of electricity, ethanol/biofuels received the most in subsidies in 2007 compared to the amount of energy produced: \$5.72 per million British Thermal Units. Solar energy was the next largest recipient, at \$2.82/MMBtu. Refined coal, at \$1.35/MMBtu, was the only other fuel to take in more than \$1/MMBtu.¹⁰ ■

1 See www.frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_bills&docid=f:h6enr.txt.pdf (Page 32).

2 Federal Ethanol Incentives and Laws, Alternative Fuels & Advanced Vehicle Data Center, United States Department of Energy, www.afdc.energy.gov/afdc/ethanol/incentives_laws_federal.html.

3 Petroleum Supply Monthly March 2009 (with data for January 2009), Energy Information Administration, www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/petroleum_supply_monthly/current/pdf/psmall.pdf.

4 Ethanol Outlook Report, CME Group, For the week of April 6, 2009, <http://cmegroup.barchart.com/ethanol/archive/1239022742CME-Weekly-Ethanol-06-Apr-2009.pdf>.

5 Renewable Fuels Association, <http://www.ethanolrfa.org/industry/locations/>.

6 Plant List, DTN Ethanol Center, <http://www.dtnethanolcenter.com/index.cfm?show=47&mid=48>.

7 Plant List, Ethanol Producer Magazine, <http://www.ethanolproducer.com/plant-list.jsp>.

8 Ethanol Outlook Report, CME Group, For the week of April 6, 2009, <http://cmegroup.barchart.com/ethanol/archive/1239022742CME-Weekly-Ethanol-06-Apr-2009.pdf>.

9 Growth Energy To EPA: Lift Cap, Create Jobs, Press Release, March 6, 2009, <http://www.growthenergy.org/2009/news/showitem.asp?id=24>.

10 Federal Financial Interventions and Subsidies in Energy Markets 2007, Executive Summary, Energy Information Administration, <http://www.eia.doe.gov/oiaf/servicrpt/subsidy2/pdf/execsum.pdf>.

THE BATTLE TO KEEP ASIAN CARP OUT OF THE GREAT LAKES



BY ALYSSA CARDUCCI

AFTER A LONG delay, the U.S. Army Corps of Engineers recently announced plans to power up a \$9 million electrical barrier designed to keep Asian carp, an invasive species, out of Lake Michigan. The barrier had been scheduled for operation in late January, but plans were halted when defective cooling pipes were discovered. Now that they have been replaced, the barrier can be switched on.

The barrier, known as Barrier IIA, is located in the Chicago Sanitary and Ship Canal and created by two rows of electrodes that pass through the water and emit direct current.¹ The electrical current is calculated to repel Asian Carp if they attempt to cross from the Mississippi River, where they are presently located, into Lake Michigan. The Corps and state and federal environmental agencies hope that Barrier IIA will be a permanent solution to the threat the fish pose to the ecology of the Great Lakes.

Asian carp mainly eat zooplankton and phytoplankton, but because of the carp's size and rate of consumption, they can drive out native species of fish if food sources become limited. An Asian carp can weigh up to 100 pounds and eat up to 40 percent of its body weight daily.

The carp were first introduced to the United States in the 1970s when catfish farmers imported two species of the fish, Bighead and Silver, to remove algae and suspended matter from their ponds. During flooding in the 1990s, the carp escaped into local waterways and the Mississippi River basin. They have been migrating north ever since, and they now dominate the Illinois and Mississippi rivers.

The Aquatic Nuisance Species Task Force, an intergovernmental organization with representatives from 10 federal agencies, lists Asian carp as a nuisance. This finding allows natural resource management agencies to actively control the fish.

The only thing currently preventing the carp from entering the Great Lakes is an experimental barrier that has been active since 2002. This older, smaller barrier has been operating at a power of 1 volt per inch. According to biologists, that voltage is enough to repel adult Asian carp, but not juvenile carp.

Safety questions have delayed operation of the new barrier, which can run at 4 volts per inch. Concerns remain that the barrier could spark flammable cargoes on Great Lakes vessels or kill or injure someone immersed in the ship canal.

According to an Army Corps of Engineers news release, the U.S. Coast Guard's concerns about this problem have been addressed by the Corps' decision to activate the barrier at just one-quarter strength.² The release also stated that as a safety feature, "[A]ll red flag barges (with flammable cargo) [are] to be escorted by Army

Corps-provided bow boats as they transit the barrier area."

While this measure will certainly limit the risk involved, the Army Corps still plans to explore options with the Coast Guard and navigation industry for safely testing Barrier IIA at higher voltages. In the meantime, the Corps is advising boaters who travel through the Sanitary and Ship Canal to pass through quickly and exercise extreme caution.

Although biologists agree that the electrical barrier is the best way to combat the fish, there are other, perhaps less efficient, ways to control Asian carp. In recent years, fishing for Asian carp has become more popular. Some processing plants — such as Schafer Fisheries, interviewed by National Public Radio — are selling more than 2 million pounds annually, mostly to Asian-American communities in such areas as California, New York and Chicago.³

Illinois state Sen. Mike Jacobs would like to see the market for Asian carp expanded. For example, he hopes to see it on the menu in state prisons, he told NPR. The senator also said: "Some people say that smoked, it's better than salmon. But the name — carp — is likely putting non-ethnic Americans off trying the fish."

More fishing could help ensure that the non-native carp do not overcrowd the native fish of the Illinois and Mississippi rivers. Biologists say that carp are becoming a dominant fish. If Asian carp enter the food chain in the Great Lakes, they could disrupt a \$4.5 billion-per-year industry based on fishing indigenous species, according to NPR.

There is still a threat that Asian carp will breach the Great Lakes barrier during a flood. Officials are continuing the search for ways to limit this threat. While the Great Lakes remain in jeopardy, Army Corps officials are working with the Coast Guard, recreational boaters, the commercial navigation industry and other groups to enhance safety in the barrier area.

For now, the Corps is trying to limit the risk to Great Lakes ecology. According to an April 7 Army Corps news release, "Both Barrier IIA and the demonstration barrier will operate at the same time to provide redundant back up." But as Mike Hoff of the U.S. Fish and Wildlife Services told Environment & Climate News,⁴ "Once [Asian carp] get into Lake Michigan, there's nothing to stop them from getting into the other Great Lakes." ■



1 See, for instance, www.epa.gov/glnpo/invasive/asiancarp/.

2 See www.piersystem.com/posted/443/Army_Corps_Start_Up_Release.246087.pdf.

3 See www.npr.org/templates/story/story.php?storyId=5542199.

4 See www.heartland.org/publications/environment%20climate/article/24726/Coast_Guard_OKs_Operation_of_Asian_Carp_Electric_Fence.html.

GREAT LAKES BOTULISM

BY ROBB FREDERICK



THE FISH DIE first.

They eat zebra and quagga mussels and swim through cladophora, a branching algae that is native to Great Lakes coastlines.

Cladophora has long been a nuisance to humans. In the 1960s and '70s, it bloomed and coughed up thick mats of green weed onto beaches.¹ They rotted, giving off the smell of sewage.

A drop in phosphorus levels brought fewer blooms in the 1980s. But according to the prevailing scientific theory, the introduction of new species — zebra and quagga mussels — helped make the Great Lakes water clearer, multiplying the amount of cladophora by allowing it to receive sunlight in deeper water.²

In late summer, when that water is warm, storms break off tendrils of cladophora, which decompose, drawing oxygen from the water. That anaerobic condition triggers the release of the botulism toxin from botulism spores commonly found in fish and aquatic sediments.³ The mussels filter the toxin from the water and store it. When they are eaten by round gobies — small, blotchy fish native to the Black and Caspian seas — they expose the

gobies to a high concentration of the toxin.⁴

Gobies arrived in the ballast water of European ships. The fish quickly thrived, reproducing as many as six times in a summer. By 2002, nearly 10 billion of them were in Lake Erie alone.⁵ Gobies poisoned by the botulism toxin become easy prey for migrating waterfowl: gulls, grebes, ducks and loons.

The birds, in turn, are paralyzed. The toxin attacks their voluntary muscle systems, leaving them unable to fly. Ducks in the water drag their wings. In time, their eyes close. Their necks go limp. They drown.

Those deaths are estimated at more than 50,000 in the Great Lakes between 2002 and 2006.⁶ The birds die in waves. Nearly 3,000 loons, gulls and red-breasted mergansers littered a several mile stretch of Sleeping Bear Dunes National Lakeshore in 2006. A year later, on Beaver Island, part of Charlevoix County, a smaller die-off washed up four piping plovers — black-necked shorebirds that are protected by the Endangered Species Act.⁷

“That’s a heartstring,” said Mark Breederland, an exten-

1 The blooms were caused by high phosphorus levels, brought on by lawn fertilizers and septic systems that drained into the Great Lakes. For more background: <http://www.glwj.uwm.edu/research/aquaticceology/cladophora/>.

2 See, for instance, http://www.glwj.uwm.edu/features/news/documents/070901_Cladophora.pdf and <http://www.csmonitor.com/2006/0330/p14s01-sten.html>.

3 Type C botulism was first identified in Lake Michigan in 1936. Type E appeared in 1963, according to Michigan Sea Grant. Both varieties are common in spore form in soils and other anaerobic habitats, and in the intestinal tracts of animals.

4 The species, *Neogobius melanstomus*, was first seen in the St. Clair River in 1990.

5 Estimate from an underwater camera survey, Johnson, T.B., et. al, Ontario Ministry of Natural Resources.

6 See <http://www.miseagrant.umich.edu/habitat/avian-botulism-faq.html#whyconcerned>.

7 Plovers were hunted throughout the 19th century for their feathers, which were used to decorate hats. The Migratory Bird Treaty Act of 1918 protected the species, but environmental changes due to development and beach use continue to depress the population. There are now fewer than 2,000 pairs along the Atlantic coast. For more background: <http://www.fws.gov/northeast/pipingplover/pdf/plover.pdf>.

sion educator for Michigan Sea Grant, a partnership of Michigan State University and the University of Michigan. "It got people's attention."

The rash of bird deaths has drawn new attention to the possible links between cladophora, quaggas and botulism. Research continues, however, as scientists attempt to verify the theory outlined above.

The anaerobic conditions that foster the botulism toxin are being studied by a coalition of partners, including the state Sea Grant extensions, the U.S. Geological Survey's National Wildlife Health Center, and groups like Common Coast Research and Conservation, a Hancock nonprofit that in 2008 published a field guide for identifying beached waterfowl.

This research has not solved the botulism problem. Scientists are not even sure where the cycle starts, as infected birds can fly significant distances before the paralysis sets in. What they do know is that the end result — more than 25,000 dead birds on the shores of Lake Erie in 2002, and 7,500 more in Lake Michigan in 2007⁸ — poses a far larger ecological problem than weeds stinking up the beaches.

The outbreaks are complicated by the common nature of botulism. The toxin is present in every animal carcass, so biologists cannot automatically rule out other causes of death.

Animals that are infected but not yet dead often are still in, or on, the water. Researchers are not likely to find them. Breederland said identifying the disease in fish is especially complicated, noting, "You need to have a fish that is so fresh its gills are still red."

There is a benefit to the infection's speed. A Type E botulism infection — as opposed to the Type C strain common in Western states — spreads quickly. This limits the risk to humans.⁹ "If you catch a fish and it fights on the way in, there's a 99.9 percent chance it's a good fish," said Eric Obert, the extension director for Pennsylvania Sea Grant.

Botulism outbreaks generally end with the waterfowl. There is no evidence of infection in coyotes or other scavenging mammals. Researchers at the U.S. Geological Survey's National Wildlife Health Center¹⁰ know of just one dog that has succumbed to the toxin: a U.S. Fish and

Wildlife employee's retriever that gagged on maggots in an infected duck it picked up.

The birds are still a problem.

Scientists have been discussing how best to dispose of them. Some researchers bury them on the beach. Some ship them to funeral homes for cremation. Others send them to the USGS national lab, where biologists inoculate mice with serum or tissue extracts. If the mice die, the bird was carrying the Type E botulism toxin.¹¹

The fact that some of those birds washed onto state and national parks is especially troubling. "When this first occurred in 2006, in Sleeping Bear Dunes, it was limited to an 11-mile stretch," Breederland said. "And that's wilderness. It's very pristine.

"We can pick on Green Bay, or on these industrialized parts of Michigan, where you expect some pollution," he said. "But this is a national park. You have to ask yourself, What's going on?" The staff at the USGS lab has asked the same question. But with so many birds spread over so large an area, there is no obvious place to start.

"If we're going to figure out exactly what is going on in the environment, through higher levels of the food chain, including fish-eating birds, the Great Lakes represent a huge area," said David Blehert, a microbiologist at the lab. "We would be better off if we had some idea of where in the Great Lakes we should start looking."

There are patterns to the die-offs. Whitefish Point in Lake Superior, Presque Isle State Park in Lake Erie and the Bruce Peninsula in Lake Huron are all eastern sites relative to the lakes that hold them.

The predominant winds on each lake blow to the east, so it makes sense that the birds wash up there.

What scientists need is an accurate time-and-geography model that can better identify exactly where the birds were infected. Blehert has a plan for that. He wants to float decoy birds on the lakes and track them with GPS transmitters to better understand how a dead bird is carried away from the spot where it is first affected. "We can track the movements of live birds," he said. "To some degree, the movement of a decoy should be easier. You'd put it in at point A and trace it."

The trick is building the right decoy: correctly estimating the speed, buoyancy and appeal to scavengers of an actual dead loon. Blehert might have an answer for that, too. He could just use real dead loons. ■

8 See <http://www.seagrantsunysb.edu/botulism/pdfs/Proc03/9-Overview.pdf> and <http://glrc.us/documents/botulism/appendixB/upper-history.pdf>.

9 People are more likely to get botulism from food that was not canned properly than from fresh kills. Cooking fish or waterfowl to an internal temperature of 180 degrees should destroy the botulism toxin. Health agencies nonetheless recommend that hunters or anglers not consume animals that appear sick, especially in areas where avian botulism has been reported.

10 The lab is in Madison, Wis. For more background, see <http://www.nwhc.usgs.gov/>.

11 The process, called a mouse neutralization test, is costly and time-consuming. The USGS lab has partnered with a Wisconsin firm to develop a faster, field-ready test. Cladophora image courtesy of Bruno Navez.

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