Dispatches

Making ship emissions more ship-shape

Adrian Burton

The US Environmental Protection Agency (EPA) announced a new ruling in December, requiring large reductions in NO_x and sulfur emissions from US-flagged, ocean-going vessels (www.epa.gov/otaq/regs/nonroad/420r09019.htm). Not many people think of ships as important sources of air pollution, but research suggests that ship emissions may be responsible for some 60 000 cardiopulmonary and lung cancer deaths annually, worldwide (*Environ Sci Technol* 2007; **41**: 8512–18). Low-sulfur fuels could substantially reduce this figure (*Environ Sci Technol* 2009; **43**: 4776–82).

Neither are the dangers of ship emissions restricted to coastal areas. "There are enormous health and environmental consequences as a result of marine diesel emissions, affecting both port cities and communities hundreds of miles inland", explains EPA Administrator Lisa Jackson (Washington, DC). "Stronger standards will help make large ships cleaner and more efficient, and protect millions of Americans from harmful diesel emissions. These new rules mark a step forward in cutting dangerous pollution in the air we breathe and reducing the harm to our health, our environment, and our economy."

PDPhoto.org

A new EPA ruling should lead to cleaner smoke out of the stack.

The new rule mirrors the Amendments to Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL), and initially affects all new 30 liter-or-above marine diesel engines on US-flagged vessels. By 2011, these engines must reduce their NO_x emissions to 15–25% below the current standard. By 2016, these emissions must be reduced by 80%. In addition, diesel fuel for ships will generally only be allowed a maximum sulfur content of 1000 parts per million (ppm; some fuels currently have 30 000 ppm). Plans are also afoot to declare the eastern and western US and Canadian seaboards (in places up to 200 nautical miles offshore) as "Emissions Control Areas". Irrespective of flag, all shipping passing through these areas would have to meet the < 1000 ppm fuel standard. The EPA estimates that by 2030, these actions will prevent some 12 000–31 000 premature deaths in the US.

Says Richard Kassel, Director of Clean Fuels and Vehicles at the Natural Resources Defense Council (New York, NY), "This announcement will start the cleanup of these ships, and is an important first step toward reducing pollution from all ships at US ports". ■

Cull of the wild

Nancy Bazilchuk

Swedish officials have authorized the first-ever licensed hunt of the nation's wolf (*Canis lupus*) population since the species was partially protected under Swedish law in 1966. The decision allows hunters to take a total of 27 wolves from the country's population of more than 200 animals.

"We are now implementing the new, large carnivore management policy approved by Parliament. Licensed hunting of wolves is the first step", explains Maria Ågen, Director-General of the Swedish Environmental Protection Agency (EPA; Stockholm). The Swedish Parliament's decision temporarily capped the wolf population at 210 individuals and introduced measures to improve the population's genetic diversity.

Wolves had been hunted nearly to extinction throughout Scandinavia by the 1960s, but the arrival of a pair of animals from a Finnish–Russian pack in 1982–1983 – augmented by the appearance of a solitary male in 1990–1991 – re-established a small but highly inbred population on the Norwegian–Swedish border. Estimates from last winter put the population at between 213 and 252 individuals, but new litters have been born since then. Most of Scandinavia's wolves are found in Sweden.

Per Risberg, with the EPA's Wildlife Management Unit, reports that the Agency received several hundred comments protesting the cull, but also some pressure to increase the number of wolves to be shot. The Världsnaturfonden WWF (Solna, Sweden) has opposed the decision, and has joined with several other Swedish conservation groups to request a meeting with the European Union Commission, says Peter Westman, Conservation Director for the group. WWF Sweden argues that the country's wolf population is neither large enough not sufficiently genetically diverse to support a hunt.

The decision to allow licensed hunting was based on a study by the Swedish University of Agricultural Science that concluded, in part, that if wolf pups lost both parents in January or February, they would still be able to survive. The EPA therefore set the hunting season from January 2 to February 15. Nevertheless, determining the quota was a balancing act, according to Susanna Löfgren, head of the EPA's Wildlife Management Unit. "We cannot permit too many wolves to be shot under license, since we need to have scope for controlled hunting of wolves that attack livestock", concludes Löfgren. ■

Coal-ash regulations delayed

Alison Gillespie

In December 2009, Environmental Protection Agency (EPA) Administrator Lisa Jackson announced that the Agency would postpone the release of any new coal-ash regulations for "a short period of time". An Agency press release explained that more time was needed, given "the complexity of the analysis the Agency is currently finishing".

Many environmental groups have been calling for increased regulation of coal ash for years, but the large spill that occurred in the mountains of eastern Tennessee – at the Kingston Fossil Plant in December of 2008 – has intensified the recent demands for additional regulations. On that occasion, some 3 million cubic yards of ash escaped into the Emory River and another 2.4 million spilled onto land near the site. News reports compared the scope of the disaster to both the Mount St Helen's volcanic eruption in 1980 and the *Exxon Valdez* spill of 1989.

Cleanup at the Kingston site has been slow – by the end of 2009, about 2 million cubic yards had been dredged from the river, but the land areas remained buried under ash. Tennessee's own Department of Environment and Conservation has noted in recent updates that the area's "aquatic habitat has been destroyed". Donna Lisenby (Watauga, NC), a southern Riverkeeper who has conducted water quality tests at the site, says the spill is the most catastrophic she has ever seen. "They have years of work left to do."

There is some suspicion that the EPA's recent delays regarding coal-ash regulation may have more to do with politics than the need for stronger science or more data. "Our organization found the delay pretty disappointing", says Sam Gomberg, Tennessee Valley Energy Policy Associate for the Southern Alliance for Clean Energy (Knoxville, TN). "This isn't a new substance."

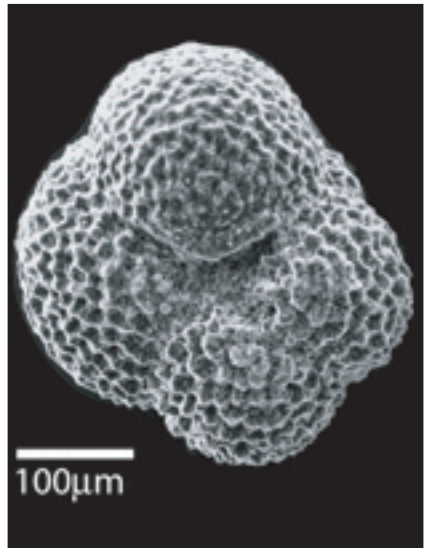
The amount of ash being stockpiled near US coal-burning plants has grown exponentially, because clean air mandates have called for more rigorous filtering at power plants. A report produced by the National Academy of Sciences (Washington, DC) and the EPA in 2006 stated that the solid residues produced from coal combustion in the US would fill one million railroad cars every year. Although some methods of reusing and storing coal ash exist, these remain controversial on account of human health concerns about the heavy metals contained in the waste. ■

An ice-free Arctic Ocean by 2100?

Johanna F Polsenberg

There is new and compelling evidence that the Arctic Ocean may be seasonally ice-free by the turn of the century. Using both the ratio of magnesium to calcium (Mg/Ca) in foraminifera shells and variations in the composition of algal-derived ketones found buried in deep sea sediments as climate proxies, Marci Robinson (US Geological Survey [USGS], Reston, VA) provided the first quantitative climate data from the Pliocene Epoch (3.3 to 3.0 million years ago) in the Arctic Ocean (*Stratigraphy* 2009; **6**: 265–75).

"The Pliocene is the most recent geologic period of warm temperatures that we can use to predict future temperatures", explains Robinson. "The PRISM [USGS Pliocene Research, Interpretation and Synoptic Mapping] Project reconstructions of sea-surface temperature have been performed in most other parts of the globe using foraminifera assemblages but, in the higher latitudes, there aren't enough different foraminiferan species to use traditional assemblage proxies."



M Robinson/USGS

Small organisms such as this foraminiferan (Neogloboquadrina pachyderma) *tell a once and future story of global warming.*

Robinson's research filled gaps in the quantitative Arctic climate data by looking at variations in the Mg/Ca ratios in planktonic foraminiferan fossils collected on the seafloor at depths of between 900 and 2500 m. "I also used an [algal ketone] paleotemperature proxy, a technique totally unrelated to the foraminifera record", continues Robinson, "and it provided similar results".

Both proxies indicate that, during the Pliocene, sea-surface temperatures in the Arctic were between 10° and 18°C, compared to current temperatures around 0°C , according to Robinson. "The decrease in sea ice that we have seen over the past few years in the Arctic may be a prelude to those conditions occurring again."

"The PRISM project focuses on the Pliocene", says PRISM lead scientist Harry Dowsett (USGS, Reston, VA), "because global mean temperature at that time was 2° to 3°C higher than now, which is exactly what is predicted in Intergovernmental Panel on Climate Change estimates for the end of the 21st century. The PRISM [Global Warming Analysis; http://geology.er.usgs.gov/eespteam/prism/index.html] Project has, since 1989, reconstructed temperature fields from this most recent warm period, and then used these global datasets to groundtruth climate models and link to future climate scenarios." ■

The Great Lakes carp lockout

Adrian Burton

In December 2009, the State of Michigan petitioned the US Supreme Court to shut canals around Chicago, IL, to prevent two invasive Asian carp species from entering the Great Lakes. The bighead (*Hypophthalmichthys nobilis*) and silver (*H molitrix*) carp were imported into the US in the 1970s, to clear wastewater treatment facilities and aquaculture ponds of algae. However, during flooding events, the carp escaped into the Mississippi River basin, where populations have grown enormously. Recent data suggest that both species are within a 2-day swim of Chicago, where, via the Chicago Sanitary and Ship Canal (CSSC), they could enter Lake Michigan and, from there, invade the entire Great Lakes system, which could have dire consequences.

Bighead and silver carp can grow to around 100 and 60 lbs (~ 45 and 27 kg), respectively, and their voracious appetites and prolific breeding help them outcompete native species. These could face serious declines, damaging sport and commercial fishing industries worth an annual US$4.5 billion. If the carp alter waterfowl habitat, a US$2.6 billion hunting industry could also suffer.

www.asiancarp.org

Bighead carp (Hypophthalmichthys nobilis) *can grow to a very large size*.

"Michigan made a smart move with this bid to re-open the Court's review of threats posed by the Chicago Diversion [CSSC] to the well-being of the Great Lakes ecosystem", says Henry Henderson, Director of the Natural Resources Defense Council's Midwest Program (Chicago, IL) and former Commissioner of the Environment for the City of Chicago. "The other Great Lakes states should join Michigan in pursuing all available legal steps to permanently separate the Great Lakes from the Mississippi River watershed." The US Army Corps of Engineers installed an electric barrier across the CSSC in an attempt to stop the carp migrating further upstream, but this is expensive and is associated with operational concerns.

According to fisheries biologist Mark Steingraeber (US Fish and Wildlife Service, La Crosse, WI), closing the locks that connect the CSSC to Lake Michigan "is a temporary solution. What is really needed is [to effectively] sever all hydraulic links between the Mississippi River and Great Lakes basins, to transport bulk commodities between the basins [overland], and to accommodate continued but understandably more limited navigation in the Chicago area waterways". ■

Dishing the dirt on antibiotic resistance

Noreen Parks

The use of antibiotics in medicine and agriculture has hugely benefited public health and agricultural productivity worldwide, but those gains are exacting a rising toll in microbial antibiotic resistance (AR) and the emergence of "superbugs", that now represents a major health threat. The problem is well-documented from clinical sources, but knowledge of the environmental prevalence of AR is sketchy. However, a recent study (*Environ Sci Technol;* doi: 10.1021/es901221x) offers a troubling glimpse of escalating levels of AR in soils of the Netherlands.

Microbes of different species commonly exchange genetic material and may harbor 10 or more resistance traits. "As background levels of AR genes increase in the environment, the chance of gene transfer to any microbe also increases", explains David Graham, a Professor at Newcastle University (UK) and a co-author of the study. In the belief that resistance levels might be detectable in historical soil archives, the researchers examined DNA from five soil collections from across the Netherlands, dating from 1940 to 2008. Analyzing the abundances of 18 key genes that confer resistance to antibiotics from four major classes, the team found that levels for 78% of the genes had increased substantially since 1940. The prevalence of some AR genes – particularly for tetracyclines – has soared by 15-fold since the 1970s.

"We believe that the overuse of antibiotics in medicine and agriculture, combined with environmental pollution, has slowly selected for greater background resistance in environmental organisms", says Graham. "No one knows exactly how such increased background levels might relate to disease and superbugs; however, our data suggest a link exists." Recent evidence shows surging levels of multi-resistant *Staphylococcus aureus* (MRSA) in farm animals, Graham notes. "It's possible that soil genes are contributing to this."

The results are all the more consternating in view of advances in waste management and stricter regulations for antibiotic use in agriculture, and they have implications for similar locations around the world, the researchers say.

About 13 million pounds (over 5.8 million kg) of antibiotics – about 70% of the US annual consumption – are fed to livestock, despite studies demonstrating that usage could be slashed without sacrificing production. "Resistant organisms are encouraged in settings where antibiotics are heavily used", says Margaret Mellon of the Union of Concerned Scientists (Cambridge, MA). "Microorganisms exist in an interconnected ecosystem and travel back and forth among humans, animals, and other elements in the environment." ■

Climate change and disease threaten Australian icon

Georgina Kenyon

Koalas are seen as a symbol of Australia, but conservationists warn that unless new conservation strategies are adopted, the koala (*Phascolarctos cinereus*) could decline dramatically in numbers over the next 30 years, and may face extinction. Recent research estimates suggest that koala abundance in the eastern and southern coastal areas of Australia – the regions that include their primary habitat – may be as low as 43 000, and no higher than 80 000, individuals.

A recent IUCN report, *Species and Climate Change* (released 14 December 2009), lists the koala as one of the 10 species in the world "destined to be hardest hit by climate change". According to the report, "Australia's iconic koala faces malnutrition and ultimate starvation as the nutritional quality of eucalyptus [*Eucalyptus* spp] leaves declines as CO_2 levels increase". Says Wendy Foden (IUCN, Cambridge, UK), a coauthor of the report, "Some of our favorite species are…taking the fall for our CO_2 emissions".

Koalas are further threatened by a combination of other factors: the chlamydia bacteria, which may be present in as many as half of Australia's koalas; a retrovirus associated with a condition called KIDS (Koala Immune Deficiency Syndrome); habitat loss from deforestation; and mortality from domestic dog attacks and motor vehicle impacts. A lack of genetic variation between and within koala populations is also of concern to scientists.

According to some, the solution for protecting koalas is simple. "To save the koala, do not cut down their trees", says Deborah Tabart, Chief Executive Officer of the Australian Koala Foundation (AKF; Brisbane). Many campaigners are pressuring the Australian Government to provide incentives for landholders to protect eucalyptus trees on their lands, through grants, tax breaks, or other means.

Although the koala is currently not classified as an endangered species under Australia's Environment Protection and Biodiversity Conservation Act (EPBCA), declining numbers have caused authorities in the eastern state of New South Wales to classify the koala as vulnerable. Meanwhile, the AKF is calling on the Australian Federal Government to list the koala as vulnerable throughout the country under the EPBCA and to introduce legislation to protect koala habitat. ■

Green jobs boom in the Golden State

Robin Meadows

These days, green jobs are a bright spot in California's economic gloom. Statewide, green jobs grew more than twice as fast as jobs overall during the past decade, and continued to increase by 5%, even as the total number of jobs dipped by 1% in 2008, according to a December 2009 report by the nonprofit Next 10 (Palo Alto, CA) and the consulting group Collaborative Economics Inc (Mountain View, CA). "We're starting to see the greening of the entire economy", says Doug Henton, Chairman and CEO of Collaborative Economics. "Green jobs occur all over the state and at a range of skill levels."

The report, *Many shades of green: diversity and distribution of California's green jobs*, defines green jobs as providing products and services that conserve resources and reduce environmental impacts. The fastest growing sectors are green building, transportation, and advanced materials (such as bioplastics), which have expanded by 20%, 23%, and 28%, respectively, since 2005. Although accounting for just a fraction of the state's total employment, the green industry's 160 000 jobs make it comparable to two other industries for which California is famous: the biotech sector, which supports about 60 000 jobs, and the software sector, which has about 250 000 jobs.

T Griffith

Demand is up for green construction, such as this "living roof" on the California Academy of Sciences.

California surpasses the rest of the country in green employment, with Texas and Pennsylvania a distant second and third, at about 55 000 and 39 000 such jobs, respectively, according to *The Clean Energy Economy*, a 2009 report by the Pew Charitable Trusts (Washington, DC) and Collaborative Economics. "California policies encourage green jobs more than other [states' policies]", Henton continues, citing standards that set a 2020 deadline for the state to reduce greenhouse-gas emissions by 25% and for utilities to generate a third of their power output from renewable sources.

The state's dominance of the green industry is likely to continue. "California is the leader in US patents for wind, solar, and battery technology", explains Next 10 founder Noel Perry. "That's a good sign for future job creation." Moreover, venture capital for green technology in the state nearly doubled in 2008, reaching $3.3 billion, which accounts for 57% of the nationwide total, followed by Massachusetts with 10% and Maryland with 3%. Environmentally friendly employment in California will be boosted further once the state receives its share of the $500 million in federal stimulus funds slated for green jobs training. "Green jobs could help push the state forward into an era of economic recovery", Perry predicts. ■

Shooting to save a species

Virginia Gewin

To forestall the ongoing decline of northern spotted owls (*Strix occidentalis caurina*) in Oregon and Washington State, government officials are contemplating a once unthinkable recovery strategy – killing or translocating barred owls (*Strix varia*), the larger, more aggressive species that is displacing the spotted owls. US Fish and Wildlife Service (FWS) officials have recently begun the preliminary stages of an Environmental Impact Statement (EIS) necessary to conduct barred owl removal experiments that would allow the FWS to determine the strategy's merit.

Two factors are at the root of the spotted owl's decline – loss of its old-growth forest habitat and the increasing abundance of the barred owl. "Right now, there is no specific plan, but we need to identify and document all the environmental consequences of any experimental removal of barred owls", explains Phil Carroll, FWS spokesperson (Portland, OR).

US FWS

Northern spotted owl (Strix occidentalis caurina)*. Can killing one species to save another be justified?*

Not surprisingly, the proposal promises to be contentious. "Shooting hundreds, perhaps thousands of barred owls, in perpetuity, is a horrible thing to contemplate – but the [possible] extinction of the spotted owl is also profoundly difficult to accept", admits Bob Sallinger, Conservation Director at the Portland Audubon Society.

Sallinger points out that, although his organization has reservations about the proposal, they did encourage the FWS to conduct the EIS. "We can conclude that shooting barred owls is neither worth the cost nor effective enough or ethically untenable, but that needs to be the result of a thoughtful discussion." Ultimately, says Sallinger, Portland Audubon's position is to err on the side of preventing extinction. But that, he adds, also requires increased protection of old-growth forests – without which any plan to kill barred owls is simply unacceptable.

According to Carroll, FWS is currently in discussions to determine the age and density of trees that will constitute adequately "valuable" habitat to warrant protection. Unfortunately, in the short term, old-growth forest can't be re-established quickly enough to save the spotted owl, which makes any decisions about barred owl management even more pressing.

To help wade through the moral dilemmas resulting from this proposal, FWS isn't relying on science alone and has taken the unusual step of hiring an ethicist. Carroll expects a decision on whether to conduct experimental removal of barred owls later this year. ■

African wars linked to rising temperatures

Jen Fela

In late November 2009, a team of researchers from the University of California at Berkeley, New York University, Harvard University (Cambridge, MA), and Stanford University (Palo Alto, CA) provided quantitative evidence of a link between rising temperatures and increasing civil conflicts in Africa. The study, published in the *Proceedings of the National Academy of Sciences* (2009; doi:10.1073/pnas.0907998106), found that a 1°C increase in temperature in a given year raised the incidence of conflict across the African continent by nearly 50%, based on historical, rainfall, and temperature data collected between 1980 and 2002.

The researchers then used projections from 20 global climate models to quantify future trends and discovered that sub-Saharan African civil wars could increase by over 50% by 2030, resulting in almost 400 000 additional battle deaths (cumulative for 2003 to 2030), due to the increased temperatures predicted to result from global climate change. Alternate historical and conflict data and different climate model projections were used to confirm that the conclusion was the result of increasing temperature and not other variables, such as political or economic changes. Says Marshall Burke, lead author of the study and a Research Associate at Stanford University's Program on Food Security and the Environment, "We weren't surprised there was a connection, but we were surprised that it was so strong, and that the projections under future climate scenarios were so stark".

The authors urge governments and aid donors to focus on helping African countries adapt to climate change. According to Burke, "such assistance could include increased investment in the development of crop varieties better adapted to hot temperatures, or in crop insurance programs to help farmers buffer their income when the climate takes a turn for the worse. The US$100 billion pledge, made in Copenhagen, to help poor countries adapt is certainly a step in the right direction".

Late in 2009, the United Nations (UN; New York) warned that climate change is expected to be a major force fueling human displacement in Africa quite soon, and also stressed the need to help developing countries adjust to the resulting changes, such as food and water shortages. According to the UN Office for the Coordination of Humanitarian Affairs, 99% of the 104 globally reported natural disasters in 2008 were climate-related, and the number of affected Africans has doubled in two decades, from 9 million in 1989 to almost 17 million in 2008. ■