LETTERS

edited by Jennifer Sills

Fighting Algae in Kaneohe Bay

"CALL THE HOSE BRIGADE!" (RANDOM SAMPLES, 10 AUGUST 2007, P. 729) DESCRIBES AN EFFORT to remove a massive nuisance algae bloom killing corals in Kaneohe Bay, Hawaii, by sucking it up with huge barge-mounted vacuum cleaners. Unfortunately, this will give only temporary results and will fail in the long run unless the nutrient excess that fuels the rapid growth is removed. Kaneohe Bay is a classic example of coral reef eutrophication: Benthic algal blooms caused by point discharges of sewage killed the reef in the 1970s, but died when the outfall was removed, allowing the reef to gradually recover (*1*). With continued suburbanization of the watershed, uncontrolled nutrients that discharge to the bay from golf courses, lawn fertilizers, and road runoff have again raised the nutrient concentrations (*2*, *3*) above the thresholds for nuisance algae (*4*–*6*). Aside from the temporary success in Kaneohe Bay, there are very few examples of algae being successfully removed. In one bay in Jamaica where all the land-based nutrients were diverted, nuisance algae that were choking the reef began to die in weeks, and only a few dying clumps of weedy algae remained 2 months later (*7*). If algae are starved of nutrients, they die very quickly, and will not return unless nutrient thresholds are again exceeded. But no amount of sucking them off will work when they grow right back because they are overfertilized. It is the suckers paying for this well-intentioned, but ultimately futile, effort who will be hosed unless the underlying causes of eutrophication are removed.

THOMAS J. GOREAU

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***Gracilaria salicornia* in Kaneohe Bay, Hawaii.** This exotic red alga, shown here overgrowing reef-building corals, is one of the species targeted for removal using the underwater vacuum cleaner known as the Super Sucker.

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Response

T. J. GOREAU FEELS STRONGLY THAT THE PRIMARY cause of algal overgrowth of the coral reefs in Kaneohe Bay is eutrophication. We think he may have missed the point. While we agree that nutrient enrichment and overfishing are both important in causing algal blooms and coral-algal phase shifts on reefs around the world (*1*–*6*), including Kaneohe Bay in the 1970s (*7*), the story today is much more complicated (*8*–*12*).

First, the species of algae targeted for removal by the Super Sucker are non-native or alien species introduced to Kaneohe Bay for aquaculture research in the 1970s and have been growing unchecked since that time. These species are native to the western tropical Pacific and are cultivated for the carrageenan and agar industries in numerous areas covering thousands of hectares where eutrophication is not a problem (*13*).

Second, exotic species are considered one of the largest threats to global biodiversity where they alter ecosystem structure and function and cause substantial economic losses (*14*). The methods to remove alien algae from reefs in Kaneohe Bay were developed as a means to prevent or reduce negative effects of an invading species, while buying time for the development of biological control methods with the native sea urchin *Tripneustes gratilla* (*15*). Preliminary data (*8*) are encouraging, as areas that have been cleared by the Super Sucker remain clear of alien algae and have increased coral recruitment after just 2 years.

Third, some introduced species are successful in new environments because they are competitively superior and because they have no natural predators. While nutrient enrichment can increase algal growth rates, more recently published nutrient concentrations from across Kaneohe Bay (*16*) have consistently reported values below Lapointe's "threshold values." Other factors such as reduced herbivory are also clearly important, but our data show that these algae are not preferred food sources for herbivorous fishes in Hawaii (*9*). Because these alien algae are able to grow in low-nutrient environments and are not readily consumed by herbivorous fishes, they may be able to spread to Hawaii's most pristine reefs. Given this, we believe that it is our responsibility as scientists and conservation biologists to take action and help to prevent the death of yet another coral reef.

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Taihu Lake Not to Blame for Wuxi's Woes

THE ALGAL BLOOM OBSERVED IN TAIHU LAKE IN the summer of 2007 and sensationalized in a News Focus story ("Doing battle with the green monster of Taihu Lake," 31 August 2007, p. 1166) is certainly a serious environmental and ecological problem. However, the issue that drew public attention to Taihu Lake and the very visible bloom was actually a separate incident that affected the aesthetic quality of water in the city of Wuxi.

Environmental monitoring indicated that the first wave of algal bloom occurred in Taihu Lake in late April 2007. However, the offensive taste and odor in the drinking water of Wuxi City occurred from the end of May to early June. It has since become clear that the taste and odor were not caused directly by algal bloom in Taihu Lake, but were instead the result of an intrusion into the main water intake of Wuxi City by a distinct black water "agglomerate" of unknown origin; the duration of this agglomerate can be tied to ammonium levels, which increased suddenly—from an average value of about 0.23 to 0.97 mg/liter—on 28 May and began to decrease gradually after peaking at 4.0 mg/liter on 31 May. The unusually high concentrations of ammonium observed during this time are not normally associated with the processes in algal blooms. Samples were collected on 4 June 2007 from both the drinking-water intake and the water agglomerate. Analysis of the samples, which had strong septic and marshy odors (*1*, *2*), detected dimethyl trisulfide (*3*, *4*) at concentrations of 11,399 and 1768 ng/liter in the two samples, respectively—high enough to account for the odors (*5*, *6*). Dimethyl trisulfide and related alkyl sulfide compounds are produced by many bacteria (e.g., *Pseudomonas* sp.) that break down the amino acids methionine and cysteine into hydrogen sulfide, methylmercaptan, and dimethylpolysulfides (*7*–*11*). The sample analysis also detected two typical algal metabolites—2-methyl-iso-borneol and geosmin (*12*–*14*)—that give earthy or musty odor to water, but these concentrations were much lower than the dimethyl trisulfide. It is clear from these findings that dimethyl trisulfide and related alkyl sulfide compounds, not 2-methyl-iso-borneol and geosmin, were the main odor-causing compounds in Wuxi's water supply. Although it is not clear where the black-water agglomerate and the alkyl sulfide compounds came from, it is unlikely that these compounds are the direct metabolites of algae. Of course, degradation of cyanobacteria might also produce such compounds.

It is well known that some cyanobacteria—such as *Microcystis aeruginosa*, the main visible culprit in Taihu Lake—do produce a range of toxins that can be harmful to human health. Further systematic monitoring data of raw water samples from the same water intake in Wuxi were collected on 4 and 8 June 2007 for the analysis of dissolved microcystins. The analytical results show that microcystin-Leu-Arg (MC-LR) and microcystin-Arg-Arg (MC-RR), some of the most frequently recorded microcystins associated with algal blooms worldwide (*15*, *16*), were undetectable for the sample of 4 June and were present only in small amounts (64 and 72 ng/liter, respectively) in the sample of 8 June. The level of microcystins detected did not exceed the WHO Drinking Water Guidelines maximum of 1 μg/liter.

The algal bloom in Taihu Lake in 2007 was in fact not much different from those in previous years. According to the local monitoring data, algal density near the water intake during the odor event period (end of May 2007) was much lower than the highest value recorded in August 2003. The trigger for public concern about the water supply was in reality a complex chemical event of biological origin, which has not previously been associated with blooms of *Microcystis aeruginosa* in Taihu Lake.

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Correcting the Record on the Data Quality Act

AFTER DONALD KENNEDY INDICATED IN HIS Editorial on medical marijuana ("Turning the tables with Mary Jane," 4 May 2007, p. 661) that the Data Quality Act (DQA) (*1*) could be useful for public interest groups as well as industry, Schick *et al*. ("The tobacco industry and the Data Quality Act," Letters, 17 August, p. 898) complained that the Editorial failed to mention the documented leadership role that Phillip Morris played in the genesis of the DQA. However, the Schick *et al*. Letter confused the Data Access Act with the DQA. The DQA implemented provisions of the Paperwork Reduction Act (PRA) of 1995 (*2*) that required the Office of Management and Budget to issue guidance on federal information dissemination; it has nothing to do with access to raw data.

Neither Phillip Morris (a multiproduct company) nor any other tobacco company (or nontobacco company for that matter) played a leadership role in the genesis of the DQA. While working with the Center for

Letters to the Editor

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Regulatory Effectiveness in Washington, DC, I was personally involved with the development of the DQA, and no industry entity contributed to its formulation. Moreover, as is evident from its plain wording, the genesis of the DQA lay in the information dissemination provisions of the 1995 PRA, and hearings and debate on those provisions began at least as early as 1989.

The DQA provisions underwent public consideration by Congress starting in 1998, and discussions proceeded almost continuously until its enactment in 2000 [e.g., (*3*–*5*)]. Entire commentary articles have been based on the false premise that it was enacted covertly [e.g., (*6*)].

Finally, it should be noted that the DQA has been used extensively by public interest groups, private citizens, and other non-industry petitioners challenging government information on subjects other than medical marijuana (*7*).

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References and Notes

1. 44 U.S.C. § 3516, note, Pub. L. 106554, Sec. 1(a)(3) [title V, Sec. 515], Dec. 21, 2000. The Act does not have an official title, and it is also frequently referred to as the Information Quality Act.
2. 44 U.S.C. §§ 3501 *et seq*.
3. H.R. Rep. No. 105–592 at 49–50 (22 June 1998).
4. Hearings Before the Subcommittee on Treasury, Postal Service, and General Government Appropriations of the House Committee on Appropriations, 28 March 2000, Part 3, at 477–79, 509–17, 558.
5. H.R. Rep. No. 106756 at 54–55, 83 (18 July 2000).
6. L. Rosenstock, *JAMA* 295, 2407 (2006).
7. All federal agencies maintain a Web site that lists and describes DQA petitions submitted to them and their responses.

TECHNICAL COMMENT ABSTRACTS

COMMENT ON "The Southern Ocean Biological Response to Aeolian Iron Deposition"

Philip W. Boyd and Douglas Mackie

Cassar *et al*. (Reports, 24 August 2007, p. 1067) proposed that aerosol-iron input enhances Southern Ocean export production. Their conclusion critically depends on aerosol-iron modeling simulations not validated with iron-deposition data and dust dissolution rates based on Northern Hemisphere atmospheric chemical conditions (low pH). This diminishes the relevance of their findings and demonstrates that applying such models to this region is premature.

Full text at www.sciencemag.org/cgi/content/full/319/5860/159a

RESPONSE TO COMMENT ON "The Southern Ocean Biological Response to Aeolian Iron Deposition"

Nicolas Cassar, Michael L. Bender, Bruce A. Barnett, Songmiao Fan, Walter J. Moxim, Hiram Levy II, Bronte Tilbrook

Net community production in the Southern Ocean is correlated with simulated local dust deposition, and more so with modeled deposition of soluble iron. Model simulations of the latter two properties are consistent with observations in both hemispheres. These results provide strong evidence that aerosol iron deposition is a first-order control on net community production and export production over large areas of the Southern Ocean.

Full text at www.sciencemag.org/cgi/content/full/319/5860/159b

CORRECTIONS AND CLARIFICATIONS

News Focus: "In the HIV era, an old TB vaccine causes new problems" by M. Enserink (16 November, p. 1059). The story stated that the live TB vaccine Bacille Calmette-Guérin (BCG) was developed by researchers at the Pasteur Institute in Paris. In fact, Albert Calmette and Camille Guérin did most of their work at the Pasteur Institute in Lille, beginning in 1897 and persevering under extremely difficult circumstances during World War I. In 1919, Calmette joined the Pasteur Institute in Paris, by which time the vaccine development was essentially complete. BCG was first used in Paris in 1921.