Rosalind Franklin's image

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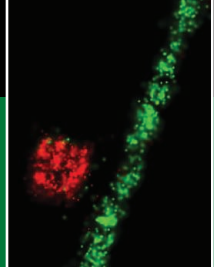

GE Essay Prize Winner

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LETTERS

edited by Jennifer Sills

Fishing for Data in the Ross Sea

WE ARE AMONG THE SCIENTISTS OBJECTING TO THE ECO-CERTIFICATION OF ROSS SEA ANTARCTIC toothfish (*Dissostichus mawsoni*), as described by E. Stokstad in his News Focus story "Behind the eco-label, a debate over Antarctic toothfish" (24 September, p. 1596). The public perceives a certification by the Marine Stewardship Council (MSC) to mean an environmentally friendly fishery, not one characterized by the "dearth of key data" as indicated in the article.

Significant data deficiencies lead us to conclude that an eco-friendly label for this fishery is scientifically indefensible. Credible life history data are missing: Spawning areas, eggs, and larvae have never been found, spawning intervals are unknown, and most density-dependent aspects of ecological relationships are undetermined (*1*, *2*). Stock assessment is problematic because severe Antarctic pack ice conditions for more than 9 months a year prevent scientists from effectively using standard models, which require random tagging over time, space, and age classes (*3*). The number of fish harvested by illegal, unregulated, and unreported fisheries is likely substantial (*4*, *5*). Finally, ecosystem effects of removing 50% of spawning biomass [the fishery's stated management goal (*6*, *7*)] of this slow-to-mature species are unlikely to be neutral: The large, adult toothfish targeted by the fishery are a key structural link in the food web of the Ross Sea (*8*–*11*), currently the most pristine marine area on Earth (*12*).

As with MSC-certified fisheries elsewhere, toothfish certification requires that industry eventually provide missing biological data (*13*, *14*). However, the harsh Antarctic environment makes data collection painstaking and often prohibitively expensive. Thus, such expectations are unrealistic for a commercially viable fishery. Instead of a certification that lacks proper data, a moratorium should be placed on further Ross Sea fishing until the quality of science at least equals that of certified fisheries elsewhere (*13*).

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14. Marine Stewardship Council, "Ross Sea toothfish longline" (October 2010); www.msc.org/track-a-fishery/in-assessment/southern-ocean/ross-sea-toothfish-longline.
15. The opinions of R.L.B. Jr. do not represent an official position or endorsement of third-party certification schemes for fisheries by NOAA and the U.S. Government.

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Assisted Colonization: Move Ahead with Models

MOVING SPECIES OUTSIDE THEIR NATURAL ranges has long been recognized as risky ("Home, home outside the range?", R. Stone, News Focus, 24 September, p. 1592). Current accepted procedure allows for translocations outside the historic range only reactively—when there is no suitable habitat left in that range (*1*). For example, flightless birds such as kakapo and takahe have been introduced to offshore islands because exotic mammalian predators had rendered them unable to persist on the New Zealand mainland. Soon, we may have to move species proactively as a means to save them from anticipated shifts in habitat due to climate change. Proactive assisted colonization is understandably contentious. The best way forward involves careful modeling and collaboration.

There are many cautionary experiences from invasive species and biological control releases (*2*). However, tools such as structured decision-making enable us to make decisions in the face of uncertainty about ecological roles and relationships that we will have least cause to regret. We can construct models around the fate of species if we leave them to face climate change either by adapting, by moving, or by dying out. We can explore a deliberately moved species' prospects of (i) dying out at its human-selected destination, (ii) establishing and becoming a pest, or (iii) settling down within desired population limits.

The test case in the News story of the two butterflies in the United Kingdom (*3*) is an example of the low-risk and potentially reversible type of experiment that we should be starting now. With assisted migration recognized as one means to reduce the impacts of climate change on biodiversity (*4*), we need international guidelines on the conditions under which it may be an acceptable solution. Consequently, the IUCN Species Survival Commission has established a task force from within its Re-introduction and Invasive Species Specialist Groups to review and update its 1998 guidelines to explicitly accommodate these issues surrounding assisted colonization. The task force will report to the World Conservation Congress in 2012.

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Assisted Colonization: Facilitate Migration First

IN HIS NEWS FOCUS STORY "HOME, HOME outside the range?" (24 September, p. 1592), R. Stone explores the risks and current data gaps associated with the practice of assisted colonization—actively translocating species from degrading ecosystems to locations more favorable to long-term survival. As Stone discussed, many scientists assert that the practice, also known as assisted migration, should play a substantial role in combating the effects of climate change on the survival of species that cannot successfully migrate or adapt. In addition to its risks and uncertainties, however, assisted colonization presents many ethical and legal issues (*1*), and may be more appropriate as the choice of last resort. An intermediate strategy between doing nothing and active translocation is facilitated migration, which involves securing the conditions necessary for successful species migration to and eventual settlement in more hospitable environments (*2*). Facilitated migration might include, for example, conserving migratory corridors and areas believed likely to transition into habitat suitable for a species' new range.

Although it may not work for all climate-threatened species, such as those stranded on mountaintops by rising temperatures, facilitated migration presents none of the thorny ethical issues of assisted colonization and, if carried out properly, is perfectly legal under laws such as the Endangered Species Act. It also helps scientists focus on forward-looking planning and conservation to ensure that both the habitat of a species' future and a way to get there are in place when needed. Facilitated migration should be developed in science and in policy as an important option for countering the effects of climate change on species

Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the previous 3 months or issues of general interest. They can be submitted through the Web (www.submit2science.org) or by regular mail (1200 New York Ave., NW, Washington, DC 20005, USA). Letters are not acknowledged upon receipt, nor are authors generally consulted before publication. Whether published in full or in part, letters are subject to editing for clarity and space.

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survival and, where possible, should be used before turning to assisted colonization.

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Assisted Colonization: Protect Managed Forests

IN HIS NEWS FOCUS STORY "HOME, HOME outside the range?" (24 September, p. 1592), R. Stone presents a lucid view of the strengths and weaknesses of assisted colonization of endangered species. Unfortunately, the focus on assisted colonization is overshadowing far-reaching climate change adaptation programs targeting forests managed for producing timber, producing nontimber products, or stocking biomass to capture CO_2.

In an effort to help managed forests respond to the effects of changes in climate, some propose the intentional translocation of tree species outside of their ranges. Forest managers seek to increase forest resilience by introducing new genotypes and new species (*1*). Social pressure to adjust managed forests in response to climate change should not be underestimated; managers are pushed to make decisions immediately, and risks of introducing maladapted genes and invasive populations are inherent to this type of strategy. Some have even proposed introducing subtropical species from the southern hemisphere in northern temperate countries because of the species' suitability to future warmer climates (*2*). As a result, exotic trees could be introduced legally into rural landscapes, thereby modifying terrestrial ecosystems for centuries in the name of responding to climate change.

We agree with Stone's conclusion that scientists should closely advise programs considering assisted colonization, and we add a similar plea for managed forests programs. The attention paid to the ecological, ethical, and legal issues of assisted colonization of endangered species should not eclipse the risk assessment of natural and managed forest adaptation strategies.

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CORRECTIONS AND CLARIFICATIONS

News Focus: "Killer bots are getting human" by J. Bohannon (1 October, p. 30). The game referred to as "Ultimate Tournament 2004" is actually named "Unreal Tournament 2004."

News of the Week: "New type of cosmic dust tells of galaxy's violent history" by Y. Bhattacharjee (24 September, p. 1590). The reference to "unprecedented images of the cloudshine feature" should have read "unprecedented images of the coreshine feature."

News Focus: "Has China outgrown the one-child policy?" by M. Hvistendahl (17 September, p. 1458). In the graph "Having fewer babies anyway" (p. 1459), the top label on the *y* axis should have been 5, not 5%. The graph has been corrected in the HTML version online.

Letters: "Archaeology augments Tibet's genetic history" by P. J. Brantingham *et al*. (17 September, p. 1467). The Letter referred to both the Report by T. S. Simonson *et al.* and the Report by X. Yi *et al.* Only the Report by X. Yi *et al*. should have been cited; T. S. Simonson *et al*. did not estimate a divergence time for high-altitude Tibetans.

Policy Forum: "Achieving scientific eminence within Asia" by A. S. Huang and C. Y. H. Tan (17 September, p. 1471). References 12 and 13 were incomplete. Reference 12 should be "Y. Shi, Y. Rao, *Science* **329**, 1128 (2010)." Reference 13 should be "S. Tole, R. D. Vale, *Science* **329**, 1441 (2010)." The references have been corrected in the HTML version online.

Brevia: "Island biogeography reveals the deep history of SIV" by M. Worobey *et al*. (17 September, p. 1487). A grant was omitted from the acknowledgment. The study was supported in part by Public Health Service grant RR000164.

News Focus: "The dour Frenchman on malaria's frontier" by M. Enserink (3 September, p. 1142). The profile stated that combining an artemisinin-derived drug with another antimalarial was a novel concept in the early 1990s. In fact, others had explored that idea before. Researchers from the Guangzhou College of Traditional Chinese Medicine in Guangdong, China and the Roche Far East Research Foundation Hong Kong described the first clinical trial in which artemisinin was combined with other drugs: G. Q. Li, K. Arnold, X. B. Guo, H. X. Jian, L. C. Fu, *Lancet* **2**, 1360 (1984).

News of the Week: "NSF misfires on plan to revamp minority programs" by J. Mervis (23 July, p. 376). Stephen Cox was identified incorrectly. He is project director for the greater Philadelphia region Louis Stokes Alliance for Minority Participation program.

Review: "Development of monocytes, macrophages, and dendritic cells" by F. Geissmann *et al*. (5 February, p. 656). Reference 71 was incorrect. It should be A. Aziz *et al*., *Science* **326**, 867 (2009).

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