

For several of these species, EPA is using an ecological niche model (DCN 40650) to predict their possible geographic distributions in the United States. EPA is also examining the geographic distribution of CAAP facilities raising these non-North American species, potential habitat for these species, and existing requirements (e.g., those contained in State regulations) for reducing escapes of non-natives that already apply to CAAP facilities producing non-natives. There are many limitations on data in such an evaluation (e.g., limited information on escape rates, the likelihood of escapes, and the consequences of escapement), but this analysis provides some insight into the scope of non-native species concerns at CAAP facilities. EPA will consider this analysis as one factor to assess the need, if any, for reporting, BMP implementation, or other requirements regarding non-native species in the final regulation. You can find a draft memorandum describing EPA's preliminary analysis in the record for this notice (DCN 40649). EPA will continue to collect and evaluate data to assess concerns associated with escaped non-native aquatic animals from CAAP facilities and the effectiveness of technologies and management practices to prevent animals from escaping in the effluents from CAAP facilities.

Finally, EPA is also performing literature searches to collect examples of risk and cost-benefit analyses that have been performed for non-native or invasive species. Such analyses include:

- Leung, B., D.M. Lodge, D. Finoff, J.F. Shogren, M.A. Lewis, and G. Lamberti. 2002. "An ounce of prevention or a pound of cure: bioeconomic risk analysis of invasive species." *Proceedings of the Royal Society of London, Series B* 269: 2407–2413. This paper describes a quantitative modeling framework to analyze risks from non-indigenous species to economic activity and the environment. The model identifies the best allocation of resources to prevention vs. control, acceptable invasion risks and consequences of invasion to optimal investments. The paper reports on an application of this model to a non-CAAP invasive species (zebra mussels), but the quantitative and systematic risk analysis approach may be useful for its examples (DCN 40568).

- Kolar, C.S. and D.M. Lodge. 2002. "Ecological predictions and risk assessment for alien fishes in North America." *Science* 298: 1233–1236. This paper uses a risk assessment approach and statistical models of fish introductions into the Great Lakes to develop a quantitative approach for

targeting prevention efforts on species most likely to cause damage (DCN 40569).

- **Federal Register.** 2003. Ballast Water Management Program for U.S. Waters, proposed rule. 68 FR 44691–44696. The U.S. Department of Homeland Security/Coast Guard recently proposed mandatory ballast water management practices for vessels equipped with ballast tanks to address possible threats to marine and freshwater resources, biological diversity, and coastal infrastructures from unintentional introduction of nonindigenous species. The Coast Guard performed a regulatory evaluation including an estimate of the proposed rule's effects on invasion rates. The regulatory evaluation also included monetized damages from invasions, but did not attempt to monetize the benefits of their proposed rule (DCN 40570).

These examples describe tools that could potentially be used to assess risks and benefits of control options for escapes. Even if EPA can not conduct assessments of risks and benefits from controls on CAAP facility escapes, examples such as those mentioned above may provide useful context for a qualitative discussion and highlight data needs.

#### 4. Water Quality Impacts

At proposal, EPA described data and literature it compiled on water quality impacts of CAAP facilities in the United States. EPA drew on several sources to characterize these impacts, including open literature publications reporting on water quality and biological observations downstream of CAAP facilities. Another resource EPA evaluated was the National report of State listings of impaired waters (TMDL listings or State 303(d) reports). EPA also used a water quality model (QUAL2E) to simulate potential downstream water quality impacts under baseline and proposed regulatory scenarios. EPA's proposal estimated that the regulatory requirements would create pollutant load reductions at 23 flow-through and recirculating facilities in the scope of the proposed regulation, leading in turn to water quality improvements valued at \$22,000 to \$113,000 annually. Based upon these sources and its water quality modeling, EPA concluded that some CAAP facilities may have measurable adverse downstream impacts.

EPA will use materials submitted with public comment on the proposed rule (see Section III.E. of today's notice) and other data and literature to improve our characterization of the likelihood for

CAAP facilities to affect water quality and aquatic ecosystems. Key highlights of this new information include:

First, the National Association of State Aquaculture Coordinators (NASAC) submitted a report describing NASAC's close examination of the States' listings of impaired waters that EPA used in analyses supporting the proposal to help characterize the prevalence of water quality impairments in the U.S. due to aquaculture (DCN 70583). (See Section III.E. for details.) NASAC found that of the seven States listing aquaculture as a possible source of impairment to certain specific waterbodies within their borders, only two verified that aquaculture facilities actually were a source of impairment. NASAC also found that for the two States that did confirm aquaculture as the source of reported impairments for the listed waterbody, changes at the facilities had been undertaken to address the source of impairments. (Refer to Section III.E. for a discussion of the NASAC report.)

Second, EPA received more publications and unpublished technical reports of which it was not aware at proposal and which describe studies of downstream water quality and biological impacts of CAAP facility effluents. Covering a range of facilities and geographic regions, some of the studies report adverse water quality and ecological impacts; others report limited or no impacts. These reports will help characterize the potential range of environmental impacts of CAAP facilities and we have put them in the record supporting this action. Examples include:

- Fries, L.T. and D.E. Bowles. 2002. "Water quality and macroinvertebrate community structure associated with a sportfish hatchery outfall." *North American Journal of Aquaculture* 64: 257–266. These authors examined aquatic impacts associated with a large CAAP facility (four million largemouth bass fingerlings, one million channel catfish fingerlings, 12,000 kg live forage for captive broodstock, and 67,000 rainbow trout (winter only)). Based on the data covering a period from October 1996 to July 1998, the authors concluded that "the hatchery effluent did not substantially affect downstream water quality and benthic communities, despite the relatively high total suspended solids and chlorophyll-a levels in the effluent." Their data showed " \* \* \* that sportfish hatchery operations can have negligible effects on receiving waters, even in environmentally sensitive systems" (DCN 40621).