

$Z_a$  = instantaneous annual total mortality rate for fish of age  $a$

EPA would like to note that it verified that the correct equation was used for the case study analyses. The error was only in the transcription of the equation in Chapter A5.

#### (2) Trophic Transfer Rates Used To Model Production Foregone

For the case studies submitted at proposal, EPA used a simple model of trophic structure and trophic transfer efficiency to estimate the yield of harvested species that is lost because of the loss of forage species to impingement and entrainment (see Chapter A5 of Part A of the section 316(b) Phase II Case Study Document for details). The net trophic transfer efficiency in that model was 2.5 percent. Based on additional review of the scientific literature, EPA has modified the model so that the net trophic transfer efficiency is 20 percent. This transfer efficiency is used in natural resource damage assessments involving injuries to fish, as discussed in Reed *et al.* (1994). Although this change in transfer efficiency increases the portion of the total yield attributable to the consumption of forage fish, the net effect is insignificant because the trophic transfer pathway accounts for a very small portion of the total foregone yield.

#### (3) Impingement and Entrainment Extrapolation

To obtain regional impingement and entrainment estimates, EPA extrapolated losses from facilities with impingement and entrainment data to facilities without data. These results were then summed to obtain a regional total. This analysis was done separately within each region for different water body types (estuaries/tidal rivers, oceans, Great Lakes, inland freshwater rivers and lakes).

Average annual results for facilities with impingement and entrainment data were averaged and extrapolated on the basis of operational flow, in millions of gallons per day (MGD), to facilities without data. The extrapolation method used, by region, is:

(Total losses at case study facilities/ Flow at case study facilities) \* Total flow in the region

The flow values used in this calculation have been weighted (weighted flow = average daily flow \* weight) using the same facility weights applied in the cost analysis. The purpose of this weighting is to calculate costs and benefits for all 551 in-scope

facilities, based on surveys received from 540 facilities.

The regional analyses incorporated data for many more facilities than were evaluated for proposal, and thus improved the basis for EPA's national benefits estimates.

#### (4) Impingement

In the case studies prepared for proposal, EPA determined that all impinged fish are age 1 because of a lack of data on the actual ages of impinged fish. As several commenters pointed out, this biases estimates low because impinged fish may include older individuals that are closer to harvestable age. This is confirmed by data on the ages of impinged fish presented in studies conducted at Salem (PSEG, 1999) and Millstone (Northeast Utilities Environmental Laboratory, 1992). To address this concern, the current studies relax the assumption that all impinged fish are age 1, and assume instead that the ages of impinged fish are 1 and older, and follow an age distribution that is implied by the associated survival rates. This approach takes into consideration the common observation that relatively few older, larger fish are impinged. The effect of this adjustment is that a higher proportion of impinged fish are assumed to survive until harvest. As a result of this adjustment, the estimate of foregone yield associated with impingement increases by a factor ranging from about three to ten, depending on a species' age-specific survival rates.

#### 4. Recreational Fishing Benefits

For the final rule analysis, EPA's analysis of recreational fishing benefits from reduced impingement and entrainment will be based on region-specific models of recreational anglers' behavior for seven of the eight study regions: North Atlantic, Mid-Atlantic, South Atlantic, Gulf of Mexico, Northern California, Southern California, and Great Lakes. EPA's analysis of benefits for the interior U.S. region will combine an original random utility model (RUM) for the Ohio River and a benefit transfer approach for other rivers, lakes, and reservoirs affected by impingement and entrainment. Additional detail on the methods EPA will use throughout the recreational benefits analysis are provided in DCN 5-1008 and DCN 5-1009. These methods are similar to the methods used for the Delaware Bay, Tampa Bay, and Ohio River case study analyses, but EPA developed the travel coast models at the regional levels.

For the NODA, EPA developed recreational anglers' behavior models

for three of the six coastal regions including Northern and Southern California and the Mid-Atlantic. Today's notice presents results only for the Northern California Region because impingement and entrainment data are not available for the Mid-Atlantic and Southern California regions at this time. For the final rule analysis, the Agency intends to expand the Tampa Bay case study used in the proposed rule analysis to include the whole Gulf of Mexico region and to develop an original travel coast model for the Great Lakes region. For the South Atlantic EPA is considering using the recreational anglers' behavior models developed by NMFS. The NMFS model is appropriate for benefit function transfer for the North Atlantic region, because it estimates region-specific values for the most important species affected by impingement and entrainment (e.g., winter flounder). The Agency will further assess the applicability of the South Atlantic NMFS model for estimating benefits from reduced impingement and entrainment in the South Atlantic region when impingement and entrainment data for this region become available. If necessary, EPA will estimate a recreational behavior model for the South Atlantic region to support valuation of the most important species affected by impingement and entrainment in this region.

The regional recreational fishing studies use information on recreational anglers' behavior to infer anglers' economic value for the quality of fishing in the case study areas. The model's main assumption is that anglers will get greater satisfaction, and thus greater economic value, from sites where the catch rate is higher due to reduced impingement and entrainment, all else being equal. This benefit may occur in two ways: First, an angler may get greater enjoyment from a given fishing trip when catch rates are higher, and thus get a greater value per trip; second, anglers may take more fishing trips when catch rates are higher, resulting in greater overall value for fishing in the region.

EPA will rely on the following primary data sources in the regional analyses of recreational fishing benefits:

- For the six coastal regions, EPA intends to use the NMFS Marine Recreational Fishing Statistics Survey (MRFSS) combined with the Add-On MRFS Economic Survey (AMES) (NMFS, 1994; 1997; 2000);
- For the Great Lakes region the Agency is considering using the 1995 Michigan Recreational Anglers survey to develop a RUM model. The Agency will