1) there is a lack of dose-response relationship information;
2) there is difficulty in capturing all benefit values; and
3) there needs to be an evaluation of irreversibilities and the all or nothing feature.

7.4.1.1 Dose-Response Relationship

The need for data from the Effects Groups for the various receptor categories has been stressed at several points. Although some data are available, a clear statement is needed of changes in output (e.g., water availability with fish populations) as related to LRTAP effects (i.e., changes in pH). This must be further extrapolated over geographical areas and over the short and long term to derive estimates of total quantity changes (Table 7-3).

In the absence of these data, meaningful benefit estimates are impossible. Changes in producer cost would provide an alternative estimate of benefits of LRTAP control with yield and catch held constant.

7.4.1.2 Inclusion of All Values

A second concern is the extent to which the methods recommended will fully capture the value of the benefits. Some methods can provide only a partial measure, since they cannot capture option and legacy values. Although their exclusion results in an underestimate, determination of the actual size of this underestimate is difficult. Some economists think the underestimates are large in situations dealing with unique assets, or major changes in an entire geographical region (e.g., New England). The matter is further complicated by the issue of property rights, discussed under equity consideration. Thus, one should be cautious in assuming that any benefit figure is a reflection of the full value to society. This may be less of a concern where measurable values are sufficient to indicate the desired choices.

7.4.1.3 Irreversibilities and the All or Nothing Feature

There are additional limitations to conventional economic analysis. The physical dose-response relationships with respect to LRTAP deposition may be irreversible and the rate of damage may not be monotonically related to deposition. This is called the all or nothing feature or nonconvexities.

First, once a certain level of damage has occurred, reduction in LRTAP may not result in an improvement in environmental quality. Hence, the effects of LRTAP may be irreversible (i.e., certain species may never be restored). If so, current market or inferred prices will substantially understate the value of these resources to society. From the perspective of benefit valuation, it is imperative