

# Chapter C6: Benefits Analysis for the Ohio River

This chapter presents the results of EPA’s evaluation of the economic benefits associated with I&E reductions at Ohio River facilities. The economic benefits that are reported here are based on the values presented in Chapter C4, and EPA’s estimates of current I&E at in scope facilities (discussed in Chapter C3). Section C6-1 summarizes the estimates of economic loss developed in Chapters C4 and C5. Section C6-2 presents the economic benefits from reduced I&E at facilities that are in scope of the § 316(b) Phase II rule, and Section C6-3 discusses the uncertainties in the analysis.

| <b>CHAPTER CONTENTS</b> |   |
|-------------------------|---|
| C6-1                    | Economic Benefits of Reduced I&E of Fishery Species At Ohio River Facilities ..... C6-1 |
| C6-2                    | Summary of Omissions, Biases, and Uncertainties in the Benefits Analysis ..... C6-3     |

## C6-1 ECONOMIC BENEFITS OF REDUCED I&E OF FISHERY SPECIES AT OHIO RIVER FACILITIES

Table C6-1 shows the losses in recreational landings due to I&E at Ohio River facilities based on the I&E data presented in Chapter C3. In evaluating this information, it is important to bear in mind that most I&E losses at Ohio River facilities are forage species, and therefore fishery yield represents only a portion of total losses.

**Table C6-1: EPA's Estimate of Annual I&E at Ohio River Facilities Expressed as Lost Recreational Fishery Yield**

| Species         | Ohio River Case Study Facilities (9)                         |  | In Scope Ohio River Facilities (29)                          |  | All Ohio River Facilities (48)                               |  |
|-----------------|--|--|--|--|--|--|
|                 | Loss to Recreational Catch from Impingement (number of fish) | Loss to Recreational Catch from Entrainment (number of fish) | Loss to Recreational Catch from Impingement (number of fish) | Loss to Recreational Catch from Entrainment (number of fish) | Loss to Recreational Catch from Impingement (number of fish) | Loss to Recreational Catch from Entrainment (number of fish) |
| Black crappie   | 452  | 1,284  | 615  | 1,939  | 676  | 1,967  |
| Bluegill        | 47   | 1  | 123  | 4  | 127  | 4  |
| Channel catfish | 1,805  | 2,648  | 2,389  | 5,896  | 2,560  | 5,990  |
| Longear sunfish | 9  | 3,938  | 13   | 5,062  | 14   | 5,104  |
| Paddlefish      | 54   | 16   | 131  | 36   | 133  | 36   |
| Sauger          | 429  | 1,638  | 1,158  | 3,868  | 1,176  | 3,925  |
| Smallmouth bass | 165  | 16,170   | 287  | 37,577   | 304  | 38,135   |
| Striped bass    | 21   | 0  | 84   | 0  | 85   | 0  |
| Sunfish spp.    | 37   | 3,663  | 57   | 12,777   | 62   | 13,007   |
| Walleye         | 21   | 12,666   | 55   | 16,223   | 57   | 16,564   |
| Whitebass       | 2,791  | 2,014  | 7,958  | 5,331  | 8,137  | 5,422  |
| Yellow perch    | 0  | 1  | 0  | 1  | 0  | 1  |
| <b>Total</b>    | 5,832  | 44,038   | 12,870   | 88,713   | 13,332   | 90,155   |

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Table C6-2 presents EPA’s estimate of the current annual economic loss to recreation from impingement at Ohio River facilities and Table C6-3 displays this information for entrainment. Results are given for both the benefits transfer analysis conducted in Chapter C4 and for the RUM analysis in Chapter C5.

**Table C6-2: EPA's Estimate of Recreation Losses Resulting from Impingement of Recreational Fishery Species at Ohio River Facilities (\$2000)**

|       | Ohio River Case Study Facilities (9) |          |              | In Scope Ohio River Facilities (29) |          |              | All Ohio River Facilities (48) |          |              |
|-------|--------------------------------------|----------|--------------|-------------------------------------|----------|--------------|--------------------------------|----------|--------------|
|       | Basic Analysis                       |          | RUM Analysis | Basic Analysis                      |          | RUM Analysis | Basic Analysis                 |          | RUM Analysis |
|       | Low                                  | High     |              | Low                                 | High     |              | Low                            | High     |              |
|       | \$12,461                             | \$27,259 | NA           | \$27,155                            | \$59,405 | \$2,237,962  | \$28,101                       | \$61,550 | \$2,295,072  |
| Total | \$12,461 to \$27,259                 |          |              | \$2,237,962                         |          |              | \$2,295,072                    |          |              |

NA = data not available

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**Table C6-3: EPA's Estimate of Recreation Losses Resulting from Entrainment of Recreational Fishery Species at Ohio River Facilities (\$2000)**

|       | Ohio River Case Study Facilities (9) |           |              | In Scope Ohio River Facilities (29) |           |              | All Ohio River Facilities (48) |           |              |
|-------|--------------------------------------|-----------|--------------|-------------------------------------|-----------|--------------|--------------------------------|-----------|--------------|
|       | Basic Analysis                       |           | RUM Analysis | Basic Analysis                      |           | RUM Analysis | Basic Analysis                 |           | RUM Analysis |
|       | Low                                  | High      |              | Low                                 | High      |              | Low                            | High      |              |
|       | \$111,182                            | \$212,532 | NA           | \$191,722                           | \$385,959 | \$5,821,313  | \$195,108                      | \$392,566 | \$5,937,419  |
| Total | \$111,182 to \$212,532               |           |              | \$5,821,313                         |           |              | \$5,937,419                    |           |              |

NA = data not available

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Table C6-4 summarizes the baseline economic losses from I&E at Ohio River in scope facilities and displays the expected benefits from a range of I&E reductions. The baseline losses (including both the benefits transfer and RUM results) range from \$3.4 million to \$4.6 million per year for impingement and from \$9.1 million to \$9.7 million per year for entrainment. The benefits of I&E reductions at in scope facilities are \$1.7 million to \$2.3 million per year for a 50% reduction in impingement and \$0.91 million to \$0.97 million per year for a 10% reduction in entrainment.

**Table C6-4: Summary of Current Economic Losses and Benefits of a Range of Potential I&E Reductions for In Scope Facilities on the Ohio River (\$2000)**

|                            |      | Impingement | Entrainment | Total        |
|----------------------------|------|-------------|-------------|--------------|
| Baseline losses            | low  | \$3,384,000 | \$9,075,000 | \$12,458,000 |
|                            | high | \$4,561,000 | \$9,718,000 | \$14,279,000 |
| Benefits of 10% reductions | low  | \$338,000   | \$907,000   | \$1,246,000  |
|                            | high | \$456,000   | \$972,000   | \$1,428,000  |
| Benefits of 20% reductions | low  | \$677,000   | \$1,815,000 | \$2,492,000  |
|                            | high | \$912,000   | \$1,944,000 | \$2,856,000  |
| Benefits of 30% reductions | low  | \$1,015,000 | \$2,722,000 | \$3,738,000  |
|                            | high | \$1,368,000 | \$2,915,000 | \$4,284,000  |
| Benefits of 40% reductions | low  | \$1,353,000 | \$3,630,000 | \$4,983,000  |
|                            | high | \$1,824,000 | \$3,887,000 | \$5,712,000  |
| Benefits of 50% reductions | low  | \$1,692,000 | \$4,537,000 | \$6,229,000  |
|                            | high | \$2,281,000 | \$4,859,000 | \$7,140,000  |
| Benefits of 60% reductions | low  | \$2,030,000 | \$5,445,000 | \$7,475,000  |
|                            | high | \$2,737,000 | \$5,831,000 | \$8,567,000  |
| Benefits of 70% reductions | low  | \$2,369,000 | \$6,352,000 | \$8,721,000  |
|                            | high | \$3,193,000 | \$6,803,000 | \$9,995,000  |
| Benefits of 80% reductions | low  | \$2,707,000 | \$7,260,000 | \$9,967,000  |
|                            | high | \$3,649,000 | \$7,774,000 | \$11,423,000 |
| Benefits of 90% reductions | low  | \$3,045,000 | \$8,167,000 | \$11,213,000 |
|                            | high | \$4,105,000 | \$8,746,000 | \$12,851,000 |

## C6-2 SUMMARY OF OMISSIONS, BIASES, AND UNCERTAINTIES IN THE BENEFITS ANALYSIS

Table C6-5 presents an overview of omissions, biases, and uncertainties in the benefits estimates. Factors with a negative impact on the benefits estimate bias the analysis downward, and therefore would raise the final estimate if they were accounted for.

**Table C6-5: Omissions, Biases, and Uncertainties in the Benefits Estimates**

| <b>Issue</b>   | <b>Impact on Benefits Estimate</b> | <b>Comments</b>   |
|--|------------------------------------|---|
| Long-term fish stock affects not considered                                      | Understates benefits               | EPA assumed that the effects on stocks are the same each year, and that the higher fish mortality would not have cumulatively greater impact.   |
| Effect of interaction with other environmental stressors                         | Understates benefits               | EPA did not analyze how the yearly reductions in fish may make the stock more vulnerable to other environmental stressors. In addition, as water quality improves over time due to other watershed activities, the number of fish impacted by I&E may increase. |
| Recreation participation is held constant  | Understates benefits               | Recreational benefits only reflect anticipated increase in value per activity outing; increased levels of participation are omitted. RUM analyses do embody participation increases, however.   |
| Boating, bird-watching, and other in-stream or near-water activities are omitted | Understates benefits               | The only impact to recreation considered is fishing.  |
| Effect of change in stocks on number of landings                                 | Uncertain                          | EPA assumed a linear stock to harvest relationship, that a 13 percent change in stock would have a 13 percent change in landings; this may be low or high, depending on the condition of the stocks.  |
| Nonuse benefits  | Uncertain                          | EPA assumed that nonuse benefits are 50 percent of recreational angling benefits.   |
| Use of unit values from outside the Ohio River                                   | Uncertain                          | The recreational values used are not from studies of the Ohio River specifically.   |
| Extrapolations to other facilities   | Uncertain                          | \$/MGD basis for extrapolation over- or understates benefits of other facilities in the watershed.  |
| Water quality changes  | Understates benefits               | Water quality has improved in the river since the sampling year, which suggests that current I&E would be appreciably higher than observed in the data collection period.   |
| One year of data   | Uncertain                          | The available data is from 1977, which is nearly 25 years ago so it is unknown whether the year is representative of current I&E  |