

# Chapter I1: National Benefits

## INTRODUCTION

This chapter summarizes the results of the seven regional analyses and presents total monetary values of national baseline losses and final rule benefits for all 554 facilities subject to the final rule.

Greater detail on the methods and data used in the regional analyses is provided in the previous chapters of this Regional Study Document. See Chapter A5 for a discussion of the methods used to estimate I&E, and Chapters A9 through A15 for discussion of the methods used to estimate the value of I&E losses and the benefits of the rule. The results of the regional analyses are presented in Parts B through H.

### CHAPTER CONTENTS

I1-1	Calculating National Losses and Benefits	I1-1
I1-2	Summary of Baseline Losses and Expected Reductions in I&E	I1-1
I1-3	Value of National Losses and Benefits	I1-3
	Appendix to Chapter I1	I1-5

## I1-1 CALCULATING NATIONAL LOSSES AND BENEFITS

In total, EPA found 554 facilities to be in scope of the section 316(b) Phase II final rule. However, the regional estimates of baseline losses and final rule benefits reflect only the 541 in-scope facilities that completed section 316(b) questionnaires (excluding three facilities in Hawaii). In order to calculate national losses and benefits for all 554 facilities, EPA estimated values for the three facilities located in Hawaii and the 11 other facilities that did not complete the questionnaire. To calculate losses and benefits for the three Hawaii facilities, EPA extrapolated losses and benefits from four coastal regions (the North Atlantic, Mid-Atlantic, Gulf of Mexico, and California regions), based on total intake flows in those regions and in Hawaii. To estimate commercial and recreational losses and benefits for the 11 facilities that did not complete the section 316(b) questionnaire, EPA developed and applied a set of statistical sample weights to the commercial and recreational losses and benefits of all facilities that did answer the questionnaire. Finally, to calculate national losses and benefits for all 554 in-scope facilities, EPA summed losses and benefits from all of the regional analyses, from the three Hawaii facilities, and from the 11 facilities that did not return the section 316(b) questionnaire.

EPA notes that quantifying and monetizing reductions in impingement and entrainment (I&E) due to the final section 316(b) rule is extremely challenging, and the preceding sections of this Regional Study Document discuss specific limitations and uncertainties associated with estimation of commercial, recreational, and non-use benefits. National benefit estimates, which are based on the regional estimates, are subject to the same uncertainties inherent in the valuation approaches used for assessing the three benefits categories. The combined effect of these uncertainties is of unknown magnitude and direction (i.e., the estimates may over- or understate the anticipated national-level benefits); however, EPA has no data to indicate that the results for the commercial and recreational benefit categories are atypical or unreasonable. As mentioned in Chapter A12, EPA has estimated non-use values only qualitatively.

## I1-2 SUMMARY OF BASELINE LOSSES AND EXPECTED REDUCTIONS IN I&E

Based on the results of the regional analyses, EPA calculated total I&E losses at the current baseline and under the final rule. In Table I1-1, the baseline results are presented for three measures of I&E:

1. Age 1 equivalent losses (the number of individual fish of different ages impinged and entrained by facility intakes, expressed as age 1 equivalents);
2. Foregone fishery yield (pounds of commercial harvest and numbers of recreational fish and shellfish that are not harvested due to I&E, including indirect losses of harvested species due to losses of forage species); and
3. Foregone biomass production (the expected total amount of future growth, expressed as pounds, of individuals that were impinged or entrained, had they not been impinged or entrained).

<b>Region<sup>a</sup></b>	<b>Age 1 Equivalents (millions)</b>	<b>Foregone Fishery Yield (million lbs)</b>	<b>Foregone Biomass Production (million lbs)</b>
California	312.9	28.9	43.6
North Atlantic	65.7	1.3	289.1
Mid-Atlantic	1,733.1	67.2	110.9
South Atlantic <sup>b</sup>	342.5	18.3	28.3
Gulf of Mexico	191.2	35.8	48.1
Great Lakes	319.1	3.6	19.3
Inland	369.0	3.5	122.0
<b>Total (weighted)</b>	<b>3,449.4</b>	<b>165.0</b>	<b>717.1</b>

<sup>a</sup> Regional estimates are unweighted. National totals are sample-weighted and include Hawaii.

<sup>b</sup> EPA estimated I&E losses in the South Atlantic by extrapolating results from the Mid-Atlantic and Gulf of Mexico regions.

Source: U.S. EPA analysis for this report.

Table I1-1 shows that total national losses of age 1 equivalents for all 554 facilities equals 3.4 billion fish. Nationwide, EPA estimates that 165.0 million pounds of fishery yield is foregone under current rates of I&E, and 717.1 million pounds of future biomass production is lost. The table shows about half of all age 1 equivalent losses, or 1.7 billion fish, occur in the Mid-Atlantic region. The Mid-Atlantic region also has the highest foregone fishery yield, followed by the Gulf of Mexico region and the California region. The largest amount of foregone future biomass production, 289.1 million pounds, is attributable to I&E in the North Atlantic region. More detailed discussions of the losses in each region are provided in Sections B through H of this Regional Study Document.

EPA also calculated the total national I&E losses prevented by the final rule. These prevented losses were based on the expected reductions in I&E at each facility due to technology required by the final rule. Table I1-2 presents average regional expected reductions in I&E. The table also presents estimates of regional and national prevented I&E losses, expressed as age 1 equivalents lost, foregone fishery yield, and foregone biomass production. The table shows that, at the 554 national in-scope facilities, the final rule reduces age 1 equivalent losses by 1.4 billion fish, prevents 64.9 million pounds of fishery yield from being lost, and prevents 217.1 million pounds of future biomass production from being lost.

Table I1-2 also shows that the expected reductions vary across the regions. Facilities in the Gulf of Mexico are expected to make the largest average percentage reductions in impingement (59.0 percent), and facilities in the Mid-Atlantic are expected to make the largest average percentage reductions in entrainment (47.9 percent). More than half of age 1 equivalent losses that are prevented by the final rule, 846.4 million fish, are attributable to facilities in the Mid-Atlantic region. Judged by prevention of fishery losses, the final rule generates the largest benefits in the Mid-Atlantic region; judged by prevention of foregone biomass production, the final rule generates the largest benefits in the North Atlantic region. More detailed discussions of regional benefits are provided in Sections B through H of this Regional Study Document.

Region <sup>a</sup>	Expected Reductions in I&E Under Final Rule				
	Impingement	Entrainment	Age 1 Equivalents (millions)	Foregone Fishery Yield (million lbs)	Foregone Biomass Production (million lbs)
California	30.9%	21.0%	66.39	6.10	9.19
North Atlantic	43.8%	29.1%	19.34	0.37	84.28
Mid-Atlantic	53.5%	47.9%	846.37	34.28	54.66
South Atlantic	43.7%	17.1%	76.67	5.31	6.31
Gulf of Mexico	59.0%	31.9%	89.55	13.84	16.50
Great Lakes	51.5%	40.1%	159.52	1.73	8.51
Inland	47.2%	16.4%	116.83	1.06	20.90
<b>Total (weighted)</b>	<b>n/a</b>	<b>n/a</b>	<b>1,420.20</b>	<b>64.92</b>	<b>217.09</b>

<sup>a</sup> National totals are sample-weighted and include Hawaii. Hawaii benefits are calculated based on average loss per MGD in North Atlantic, Mid-Atlantic, Gulf of Mexico, California, and the total intake flow in Hawaii.

Source: U.S. EPA analysis for this report.

### I1-3 VALUE OF NATIONAL LOSSES AND BENEFITS

Based on the monetized regional values of baseline losses and the final rule benefits presented in Sections B through H of this document, EPA calculated estimates of the total national monetized losses and benefits for all 554 facilities subject to the final rule. Table II-3 and Table II-4 present these results, for each region and for the nation as a whole.<sup>1</sup> Because EPA did not estimate non-use benefits quantitatively, the monetary values of national losses and benefits presented in these tables reflect use values only. As mentioned in Chapter A12, the Agency was not able to monetize benefits for 98.2 percent of the age-one equivalent losses of all commercial, recreational, and forage species for the section 316(b) Phase II regulation. This means that the estimates of losses and benefits presented in this section represent the losses and benefits associated with less than two percent of the total age-one equivalents lost due to I&E by cooling water intake structures, and should be interpreted with caution. See Chapter A9 of the Regional Case Study document for a detailed description of the ecological benefits from reduced I&E.

Table II-3 shows that the total national value of fishery resources lost to I&E includes \$23.2 million in commercial fishing benefits, \$189.4 million in recreational fishing benefits, and an unknown amount in non-use benefits (2002\$, discounted at three percent). The total use value of fishery resources lost is approximately \$212.5 million per year. Total commercial and recreational losses are greatest in the Mid-Atlantic region, at \$8.4 million and \$89.6 million, respectively, for a total use value of \$97.9 million in the Mid-Atlantic region. More detailed discussions of the value of the losses in each region are provided in Sections B through H of this document. Additionally, as a sensitivity analysis, the appendix to this chapter presents the value of baseline losses evaluated at a seven percent discount rate.

<sup>1</sup> All benefits in this chapter are calculated using a three percent social discount rate. For comparison, Chapter D1 of the EBA presents total national and regional social benefits using a seven percent discount rate.

**Table I1-3: Summary of Monetary Values of Current I&E Losses  
(millions; 2002\$; 3% discount rate)**

Region <sup>a</sup>	Use Value of I&E Losses			Non-Use Value of I&E Losses <sup>b</sup>	Total Value of I&E Losses
	Commercial Fishing	Recreational Fishing	Total Use Value		
California	\$6.1	\$7.5	\$13.6	n/a	n/a
North Atlantic	\$0.5	\$4.9	\$5.4	n/a	n/a
Mid-Atlantic	\$8.4	\$89.6	\$97.9	n/a	n/a
South Atlantic	\$1.9	\$30.0	\$32.0	n/a	n/a
Gulf of Mexico	\$4.1	\$12.4	\$16.5	n/a	n/a
Great Lakes	\$1.0	\$29.4	\$30.4	n/a	n/a
Inland	n/a	\$10.6	\$10.6	n/a	n/a
<b>Total (weighted)</b>	<b>\$23.2</b>	<b>\$189.4</b>	<b>\$212.5</b>	<b>n/a</b>	<b>n/a</b>

<sup>a</sup> Regional numbers are unweighted. National totals are sample-weighted and include Hawaii.

<sup>b</sup> EPA estimated non-use values only qualitatively.

Source: U.S. EPA analysis for this report.

Table I1-4 presents EPA's estimates of the national and regional values of reductions in I&E under the final rule. The table shows that the final rule results in national monetized use benefits of \$82.9 million per year (2002\$, discounted at three percent) and an unknown amount of non-use benefits. Recreational fishing benefits, which are \$79.3 million, make up the majority of total national monetized use benefits. National commercial benefits are relatively small, at \$3.5 million. The final rule is expected to generate the largest commercial and recreational benefits in the Mid-Atlantic region (\$1.7 million and \$43.4 million, respectively), resulting in total use benefits in the Mid-Atlantic region of \$45.0 million. More detailed discussions of regional benefits are provided in Sections B through H of this Regional Study Document. Additionally, as a sensitivity analysis, the appendix to this chapter presents the value of the monetized benefits of the final rule evaluated at a seven percent discount rate.

**Table I1-4: Summary of Social Benefits (millions; 2002\$; 3% discount rate)<sup>a</sup>**

Region <sup>b</sup>	Use Benefits of I&E Reductions			Non-Use Benefits of I&E Reductions <sup>c</sup>	Total Benefits of I&E Reductions
	Commercial Fishing	Recreational Fishing	Total Use Benefits		
California	\$0.5	\$2.5	\$3.0	n/a	n/a
North Atlantic	\$0.1	\$1.4	\$1.4	n/a	n/a
Mid-Atlantic	\$1.7	\$43.4	\$45.0	n/a	n/a
South Atlantic	\$0.2	\$6.9	\$7.1	n/a	n/a
Gulf of Mexico	\$0.7	\$6.2	\$6.9	n/a	n/a
Great Lakes	\$0.2	\$14.0	\$14.1	n/a	n/a
Inland	n/a	\$3.0	\$3.0	n/a	n/a
<b>Total (weighted)</b>	<b>\$3.5</b>	<b>\$79.3</b>	<b>\$82.9</b>	<b>n/a</b>	<b>n/a</b>

<sup>a</sup> Discounted to account for lag in implementation and lag in time required for fish lost to I&E to reach a harvestable age.

<sup>b</sup> Regional numbers are unweighted. National totals are sample-weighted and include Hawaii.

<sup>c</sup> EPA estimated non-use values only qualitatively.

Source: U.S. EPA analysis for this report.

# Appendix to Chapter I1

This appendix summarizes the monetary values of current I&E losses and the monetary benefits of the final rule using a 7 percent social discount rate instead of a 3 percent rate. The results of this sensitivity analysis are presented in the following tables.

Region <sup>a</sup>	Use Value of I&E Losses			Non-Use Value of I&E Losses <sup>b</sup>	Total Value of I&E Losses
	Commercial Fishing	Recreational Fishing	Total Use Value		
California	\$4.4	\$6.1	\$10.5	n/a	n/a
North Atlantic	\$0.4	\$4.3	\$4.7	n/a	n/a
Mid-Atlantic	\$7.3	\$82.5	\$89.9	n/a	n/a
South Atlantic	\$1.7	\$28.1	\$29.8	n/a	n/a
Gulf of Mexico	\$3.4	\$11.2	\$14.6	n/a	n/a
Great Lakes	\$0.9	\$26.7	\$27.6	n/a	n/a
Inland	n/a	\$9.5	\$9.5	n/a	n/a
<b>Total (weighted)</b>	<b>\$18.9</b>	<b>\$172.9</b>	<b>\$191.8</b>	<b>n/a</b>	<b>n/a</b>

<sup>a</sup> Regional numbers are unweighted. National totals are sample-weighted and include Hawaii.

<sup>b</sup> EPA estimated non-use values only qualitatively.

Source: U.S. EPA analysis for this report.

Region <sup>b</sup>	Use Benefits of I&E Reductions			Non-Use Benefits of I&E Reductions <sup>c</sup>	Total Benefits of I&E Reductions
	Commercial Fishing	Recreational Fishing	Total Use Benefits		
California	\$0.4	\$1.9	\$2.3	n/a	n/a
North Atlantic	\$0.1	\$1.2	\$1.2	n/a	n/a
Mid-Atlantic	\$1.5	\$38.5	\$39.9	n/a	n/a
South Atlantic	\$0.2	\$6.2	\$6.4	n/a	n/a
Gulf of Mexico	\$0.6	\$5.5	\$6.2	n/a	n/a
Great Lakes	\$0.2	\$12.2	\$12.4	n/a	n/a
Inland	n/a	\$2.6	\$2.6	n/a	n/a
<b>Total (weighted)</b>	<b>\$3.0</b>	<b>\$70.0</b>	<b>\$72.9</b>	<b>n/a</b>	<b>n/a</b>

<sup>a</sup> Discounted to account for lag in implementation and lag in time required for fish lost to I&E to reach a harvestable age.

<sup>b</sup> Regional numbers are unweighted. National totals are sample-weighted and include Hawaii.

<sup>c</sup> EPA estimated non-use values only qualitatively.

Source: U.S. EPA analysis for this report.