

5.11 RECREATION

Recreation is an important beneficial use of water along the entire Missouri River. Each of the six lakes and the river reaches between the lakes on the Lower River has recreational development. Recreation is also one of the many uses of the Lower River downstream from Gavins Point Dam. This section discusses the effects to recreation benefits from operating the Mainstem Reservoir System under each of the submitted alternative plans and the CWCP.

Recreation benefits (measured in millions of dollars) under the alternatives were estimated using the Daily Routing Model (DRM) and the Economic Impacts Model (EIM). The DRM (Corps, 1998b) is a hydrologic model that estimates lake surface elevation and river flow at 23 reaches using the alternative operation strategies and the historic runoff levels between 1898 and 1997. The EIM (Corps, 1994r) uses the output from the DRM and economic value functions (Corps 1994h) to estimate the economic benefit. The economic value functions for recreation benefits are computed by identifying changes in potential visitation, multiplying this visitation times composite values per visitation (one or more activities are usually associated with a visit), and subtracting any capital costs that may be incurred for facilities in each reach. Visitation computations are based on visitation surveys completed in the early 1990s (to determine changes in visitation based on lake-level and river-flow changes) and measured visitation in 1993. Capital costs are those that are incurred when facilities reach the end of their useful life and require replacement. Also included with the capital costs are the costs for boat ramp repairs and extensions required when lake levels drop. Finally, the resulting benefits were inflated by 12 percent to account for changes in visitation and costs since the early 1990s when the methodology was developed.

Recreation benefits presented in this section of Chapter 5 are National Economic Development (NED) benefits that reflect the willingness of users to pay and include only entry and use fees. Consequently, the resulting values are somewhat less than if the values were Regional Economic Development benefits, which include the NED benefits plus other expenditures that are associated with recreation activities, such as boat and equipment purchases, motel expenses, restaurant costs, etc. It is important to recognize that the estimated economic benefits are used for

comparative purposes only and may not represent actual economic returns under the different alternatives. The models were designed expressly for comparing the effects of changing from the CWCP and not to forecast the future.

Figure 5.11-1 and Table 5.11-1 present the average annual benefits of the alternatives during the 100-year analysis period. These benefits are also broken down for each of the reaches analyzed in Table 5.11-1. Total average annual recreation benefits for the alternatives range from \$84.69 million (under the CWCP) to \$88.00 million (under the MRBA alternative), a difference of 3.9 percent.

The CWCP results in \$84.69 million in average annual recreation benefits. Approximately 71.3 percent of the recreation benefits come from the mainstem lakes. Another 23.3 percent of the benefits come from the Lower River reaches, and the remaining 5.4 percent come from the Upper River reaches (downstream from Fort Peck, Garrison, and Fort Randall Dams). All of the submitted alternatives result in greater total average annual benefits than the CWCP. Looking at individual lakes and river reaches, average annual recreation benefits from the alternatives range between about 9.4 percent lower and 15.0 percent higher than the average annual benefits calculated for the CWCP. With the exception of Lake Sakakawea, each of the lakes has increases in recreation benefits relative to the CWCP; benefits from the river reaches, except for the Fort Peck reach, generally decline relative to the CWCP.

As depicted in Figure 5.11-1, all of the submitted alternatives result in greater recreation benefits than the CWCP. The lowest increase occurs under the MLDDA alternative, which is grouped with the CWCP at the bottom of the scale. The remaining alternatives are grouped in the \$86 to \$88 million range, with the greatest increase occurring under the MRBA alternative. The recreation benefits of the MODC and FWS30 alternatives are near those of the MRBA alternative and are separated from one another by only \$0.02 million. The ARNRC and BIOP alternatives (in descending order) are at the bottom of the upper grouping. Increased drought conservation measures appear to have the greatest influence on total average annual recreation benefits. The five alternatives that feature these measures (i.e., all except the MLDDA alternative) result in the greatest increases over the CWCP.

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Table 5.11-1. Average annual recreation benefits (\$millions).

Lake/River Reach	CWCP	MLDDA	ARNRC	MRBA	MODC	BIOP	FWS30
Fort Peck Lake	2.92	3.08	3.13	3.15	3.25	3.11	3.19
Lake Sakakawea	13.81	13.50	15.70	15.75	15.26	15.14	15.88
Lake Oahe	14.90	15.43	16.41	15.94	16.08	15.85	16.30
Lake Sharpe	7.97	7.97	7.97	7.97	7.97	7.97	7.97
Lake Francis Case	10.58	10.81	10.84	10.85	10.83	10.87	10.88
Lewis and Clark Lake	10.20	10.20	10.20	10.20	10.20	10.20	10.20
Lake Subtotal	60.38	60.99	64.25	63.86	63.59	63.14	64.42
Fort Peck	0.35	0.35	0.38	0.36	0.36	0.39	0.38
Garrison	3.24	3.25	3.18	3.16	3.16	3.16	3.14
Fort Randall	0.99	0.99	0.94	0.99	0.99	0.97	0.97
Upper River Subtotal	4.58	4.59	4.50	4.51	4.51	4.52	4.49
Gavins Point	5.10	5.05	4.62	5.06	5.05	4.85	4.79
Sioux City	11.45	11.37	10.52	11.39	11.36	10.93	10.81
St. Joseph	0.61	0.61	0.60	0.61	0.61	0.60	0.60
Kansas City	0.90	0.90	0.89	0.90	0.90	0.89	0.89
Boonville	0.71	0.71	0.70	0.71	0.71	0.71	0.71
Hermann	0.96	0.96	0.95	0.96	0.96	0.96	0.96
Lower River Subtotal	19.73	19.60	18.28	19.63	19.59	18.94	18.76
Total	84.69	85.18	87.03	88.00	87.69	86.60	87.67

Under the MLDDA alternative, river operations are similar to those under the CWCP except that 2 MAF of storage is used for annual flood control and multiple use rather than as carryover multiple use (i.e., the base of the flood control zone is 55.1 MAF rather than 57.1 MAF). Total average annual recreation benefits under the MLDDA alternative (\$85.18 million) are slightly higher (0.6 percent) than under the CWCP. Average annual benefits from each of the lake reaches except for Lake Sakakawea increase slightly (up to 5.5 percent) relative to the CWCP. In contrast to the other submitted alternatives, the MLDDA alternative results in a slight (2.2 percent) decline in benefits at Lake Sakakawea. In the Upper River reaches, the only difference from the CWCP occurs in the Garrison reach, where the MLDDA alternative results in a very slight increase in benefits, from \$3.24 million to \$3.25 million. As a result, the MLDDA differs from the other submitted alternatives by resulting in a slight increase in recreation benefits in the Upper River reaches; all of the other alternatives result in decreases relative to the CWCP. In contrast to the Upper River reaches (and consistent with the other submitted alternatives), benefits from the Lower River reaches decrease slightly under the MLDDA alternative. Declines in the Gavins Point (1.0 percent decrease) and Sioux City (0.7 percent decrease) reaches result in average annual recreation benefits for these two

reaches of \$0.13 million less than those for the CWCP.

The ARNRC alternative includes a 15-kcfs rise in the spring; however, spring flows are often higher than this amount because no summer evacuation of flood flows is allowed. Consequently, spring flows are increased during wet years to reduce the amount of water in flood storage. The ARNRC alternative includes summertime flows of 18 kcfs between July 1 and August 20. Finally, the ARNRC alternative has the highest level of drought conservation of the submitted alternatives. Total average annual recreation benefits under the ARNRC alternative (\$87.03 million) are about 2.8 percent higher than under the CWCP. Each of the lakes has benefits ranging from no change (Lewis and Clark Lake and Lake Sharpe) to 13.7 percent higher (Lake Sakakawea) when compared to those of the CWCP. All of the river reaches except Fort Peck have decreases in recreation benefits, ranging from 1.0 percent (Hermann) to 9.4 percent (Gavins Point) below the CWCP values. Within the Fort Peck reach, the ARNRC alternative results in an 8.6 percent increase in recreation benefits. The largest increase in benefits occurs at Lake Sakakawea (\$1.89 million), while the greatest decrease is in the Sioux City reach of the Lower River (\$0.93 million decrease).

The MRBA alternative provides higher drought conservation measures than the CWCP. Total average annual recreation benefits (\$88.00 million) under the MRBA alternative are the highest of the submitted alternatives, about \$3.31 million (3.9 percent) higher than the CWCP. Recreation benefits from the mainstem lakes are approximately \$3.48 million (5.8 percent) higher under the MRBA alternative than under the CWCP. In contrast, recreation benefits from the Upper River and Lower River reaches are \$0.17 million (0.7 percent) less under the MRBA alternative than under the CWCP. Similar to the other submitted alternatives except the MLDDA alternative, the MRBA provides Lake Sakakawea with the highest increase in recreation benefits (\$1.94 million, or 14.0 percent) relative to the CWCP. Most river reaches have no change in recreation benefits relative to the CWCP, although three reaches have slight decreases ranging from \$0.04 million (Fort Randall) to \$0.08 million (Garrison), and the Fort Peck reach shows a very slight (\$0.01 million) increase.

Operationally, the MODC alternative is similar to the MRBA alternative except that the summer flat release for navigation from Gavins Point Dam is extended to mid-September for pallid sturgeon as a result of delaying evacuation of water from flood storage. The extension results in an average annual recreation benefit of \$87.69 million, which is slightly lower (\$0.31 million) than the MRBA alternative, but higher (\$3.00 million, or 3.5 percent) than the CWCP. Changes in benefits for the mainstem lakes relative to the CWCP range from none (Lewis and Clark Lake and Lake Sharpe) to \$1.45 million, or 10.5 percent higher (Lake Sakakawea). In contrast, changes in the river reaches range from a \$0.01 million increase (Fort Peck) to a \$0.09 million (Sioux City) decline in benefits relative to the CWCP. Most of the river reaches have no change in recreation benefits relative to the CWCP.

The BIOP alternative includes a 17.5-kcfs rise in the spring, on average, once every 3 years. The BIOP alternative also includes a provision for low summer flows at 21 kcfs during July 15 to August 15 (the “25/21” summer flow option). During the periods June 21 to July 15 and August 15 to August 31, flow releases are set to 25 kcfs. This alternative also has the same drought conservation measures as the MRBA alternative. The BIOP alternative has an average annual recreation benefit of \$86.60 million, which is \$1.91 million (2.3 percent) higher than for the CWCP. Overall, benefits from the mainstem lakes are about 4.6 percent (\$2.76

million) over the CWCP value; the greatest increase (\$1.33 million) comes from Lake Sakakawea. Except for the Fort Peck (\$0.04 million increase), Boonville (no change), and Hermann (no change) reaches, the river reaches have declines in recreation benefits under the BIOP alternative, as compared to the CWCP. The greatest decline occurs in the Sioux City reach, where average annual recreation benefits are \$0.52 million (4.5 percent) lower than under the CWCP.

The FWS30 alternative is similar to the BIOP alternative except that the spring rise is 30 kcfs rather than 17.5 kcfs. The FWS30 alternative has total average annual recreation benefits of \$87.67 million, which is about \$2.98 million (3.5 percent) higher than the CWCP. Of the submitted alternatives, the FWS30 alternative has the largest increase in benefits (\$4.04 million, or 6.7 percent) for the mainstem lakes relative to the CWCP. This increase is offset somewhat by decreases in benefits from the river reaches, however. The FWS30 alternative has the largest decrease in benefits for the Upper River reaches (\$0.09 million, or 2.0 percent), and the second largest decrease for the Lower River reaches (\$0.97 million, or 4.9 percent). Lake Sakakawea has the largest increase in average annual benefits (\$2.07 million, or 15.0 percent), while the Sioux City reach has the largest reduction in benefits (\$0.64 million, or 5.6 percent) relative to the CWCP.

The major differences among the alternatives for recreation benefits occur during periods of drought. Figures 5.11-2 to 5.11-4 provide a graphical depiction of recreation benefits over the 100-year analysis period. Recreation benefits are generally higher for the other five alternatives relative to those of the CWCP and MLDDA alternative during the three major droughts because the higher drought conservation measures result in higher levels in the upper three lakes. The greatest difference is noted during the 1930 to 1941 drought and subsequent recovery period from the lake level declines.

5.11.1 Recreation for Tribal Reservations

Tables 5.11-2 and 5.11-3 allow comparison of how the different alternatives influence average annual recreation benefits for the affected Tribal Reservations during the 100-year period of analysis. Different data are available depending on the location of the Reservations. Effects to Reservations along river reaches are presented as an index of average annual recreation benefits, relative

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to the CWCP (Table 5.11-2). Effects to Reservations on the lakes are presented as average annual recreation benefits, measured in millions of dollars (Table 5.11-3). Changes in recreation benefits are discussed for each Reservation, starting with Fort Peck Reservation in Montana and proceeding downstream.

Fort Peck Reservation, downstream of Fort Peck Dam, currently has one boat ramp. No recreation areas identified along the Missouri River serve the Reservation. With future economic development in mind, the data from Table 5.11-2 indicate that, for the 100-year period analysis, the ARNRC, BIOP, and FWS30 alternatives provide the maximum average annual recreation benefits to the Fort Peck Reservation. Compared to the CWCP, the BIOP alternative provides a 10.0 percent increase, the FWS30 a 9.0 percent increase, and the ARNRC an 8.0 percent increase. The MLDDA alternative provides no increase in average annual recreation benefits to the Fort Peck Reservation, while the MRBA and MODC alternatives provide slight increases of 1.0 and 2.0 percent, respectively.

Fort Berthold Reservation, which is located on Lake Sakakawea, has 15 recreation areas identified on Reservation land. These areas include two cabin

developments, the McKenzie Marine Club and the New Town Marine Club. The CWCP provides \$2.91 million in average annual recreation benefits. The data in Table 5.11-3 indicate that the FWS30 alternative provides the highest recreation benefits to Fort Berthold Reservation at \$3.35 million, a 15.1 percent increase over the CWCP. The MRBA and ARNRC alternatives also provide increased recreation benefits, at 14.1 percent and 13.7 percent, respectively. The MODC and BIOP alternatives provide a middle range increase of recreation benefits to Fort Berthold Reservation, with a 10.7 percent and 10.0 percent increase, respectively. The MLDDA provides the lowest average annual recreation benefits, with a \$0.06 million (2.1 percent) decrease in average annual recreation benefits compared to the CWCP.

Four recreation sites have been identified on Standing Rock Reservation lands along Lake Oahe. The ARNRC and FWS30 alternatives provide the largest increase in recreation benefits over the CWCP, which has a \$0.42 million annual benefit (Table 5.11-3). The ARNRC and FWS30 alternatives both provide a \$0.04 million (9.5 percent) increase over the CWCP. The MRBA and MODC alternatives both have an intermediate increase of \$0.03 million (7.1 percent) in average annual recreation benefits compared to the CWCP.

Table 5.11-2. Index values of average annual recreation impacts to Reservations adjacent to Upper and Lower River reaches.

Reservation	CWCP	MLDDA	ARNRC	MRBA	MODC	BIOP	FWS30
Upper River							
Fort Peck	1.00	1.00	1.08	1.01	1.02	1.10	1.09
Yankton/Ponca Tribal Lands	1.00	1.00	0.95	0.99	0.99	0.98	0.97
Lower River							
Winnebago	1.00	0.99	0.92	0.99	0.99	0.95	0.94
Omaha	1.00	0.99	0.92	0.99	0.99	0.95	0.94
Iowa and Sac and Fox	1.00	1.00	0.98	1.00	1.00	0.98	0.98

Table 5.11-3. Average annual recreation benefits for Reservations adjacent to lakes (\$millions).

Reservation	CWCP	MLDDA	ARNRC	MRBA	MODC	BIOP	FWS30
Fort Berthold	2.91	2.85	3.31	3.32	3.22	3.20	3.35
Standing Rock	0.42	0.43	0.46	0.45	0.45	0.44	0.46
Cheyenne River	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lower Brule	2.94	2.94	2.94	2.94	2.94	2.94	2.94
Crow Creek	1.41	1.41	1.41	1.41	1.41	1.41	1.41
Yankton	1.38	1.40	1.40	1.40	1.40	1.40	1.41
Santee	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Total	9.23	9.20	9.69	9.69	9.59	9.56	9.74

The smallest increase occurs with the MLDDA alternative, with an increase of only \$0.01 million (2.4 percent) in average annual recreation benefits.

One recreation site has been identified on Cheyenne River Reservation. The average annual recreation benefits under any of the alternatives for Cheyenne River Reservation are less than \$5,000. Recreation benefits less than \$0.01 million are not shown in Table 5.11-3 due to rounding off to the nearest \$10,000.

Lower Brule and Crow Creek Reservations, which are located on Lake Sharpe, have no change in average annual recreation benefits under any alternative (Table 5.11-3). For the 100-year period of analysis, there are roughly \$2.94 million in benefits for Lower Brule Reservation and \$1.41 million in average annual recreation benefits for Crow Creek Reservation. Lower Brule Reservation has 10 existing recreation facilities identified on Reservation land, with one identified future site. There are seven existing recreation facilities located on Crow Creek Reservation.

Yankton Reservation has five recreation areas located on Lake Francis Case. The CWCP provides \$1.38 million in average annual recreation benefits for Yankton Reservation (Table 5.11-2). The FWS30 alternative provides the largest increase in average annual recreation benefits compared to the CWCP, with an increase of \$0.03 million (2.2 percent). The other alternatives increase average annual recreation benefits by about \$0.02 million (1.4 percent) compared to the CWCP.

The data for the Fort Randall reach, which includes the majority of Yankton Reservation banks, indicate that all of the alternatives except the MLDDA alternative produce a decrease in average annual recreation benefits compared to the CWCP (Table 5.11-2). The MLDDA alternative has the same benefits as the CWCP. The ARNRC alternative has the largest decrease in impacts to recreation potential for the Reservation compared to the CWCP, with a 5.0 percent decrease in benefits. The smallest decrease in benefits comes

from the MRBA and MODC alternatives, both of which produce a 1.0 percent decrease in average annual recreation benefits compared to the CWCP.

Ponca Tribal Lands are located near the headwaters of Lewis and Clark Lake, and the Tribe currently has no recreation facilities on the lake or along the upstream river reach. If the Tribe were to develop facilities along the river, it could expect to have effects similar to that described above for Yankton Reservation banks along the Fort Randall reach. Ponca Tribal Lands were, therefore, included in Table 5.11-2 with the Yankton Reservation.

Santee Reservation, located on the headwaters of the Lewis and Clark Lake, has two identified recreation areas. No change in average annual recreation benefits occurs under any alternative (Table 5.11-3). For the 100-year period of analysis, all alternatives result in roughly \$0.17 million in average annual recreation benefits for Santee Reservation.

Potential recreation development and use along Winnebago Reservation or Omaha Reservation are included in Table 5.11-2. The CWCP offers the greatest benefits for recreation development. On both Reservations, the ARNRC alternative has the largest decrease in average annual recreation benefits with an 8.0 percent decrease compared to the CWCP. The MLDDA, MRBA, and MODC alternatives, with a 1.0 percent decrease in recreation benefits compared to the CWCP, have the smallest decrease. The BIOP and FWS30 alternatives provide intermediate decreases in recreation benefits, with decreases of 5.0 percent and 6.0 percent, respectively.

Along the St. Joseph reach, recreation development on either Iowa or Sac and Fox Reservations is affected by the Water Control Plans. The recreation benefits index from Table 5.11-2 indicates no change from the CWCP with the MLDDA, MRBA, and MODC alternatives. A decrease of 2.0 percent in average annual recreation benefits occurs with the ARNRC, BIOP, or FWS30 alternatives.

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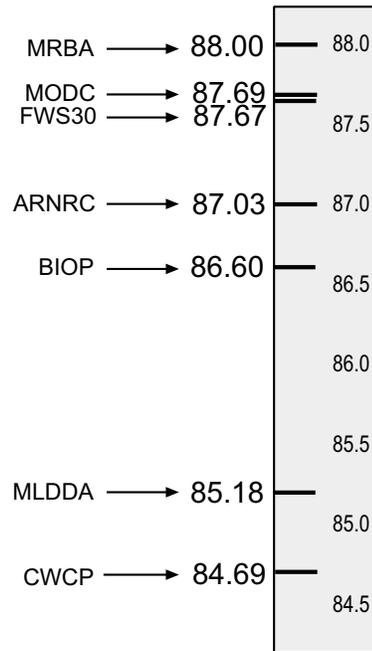


Figure 5.11-1. Average annual recreation benefits for submitted alternatives (\$millions).

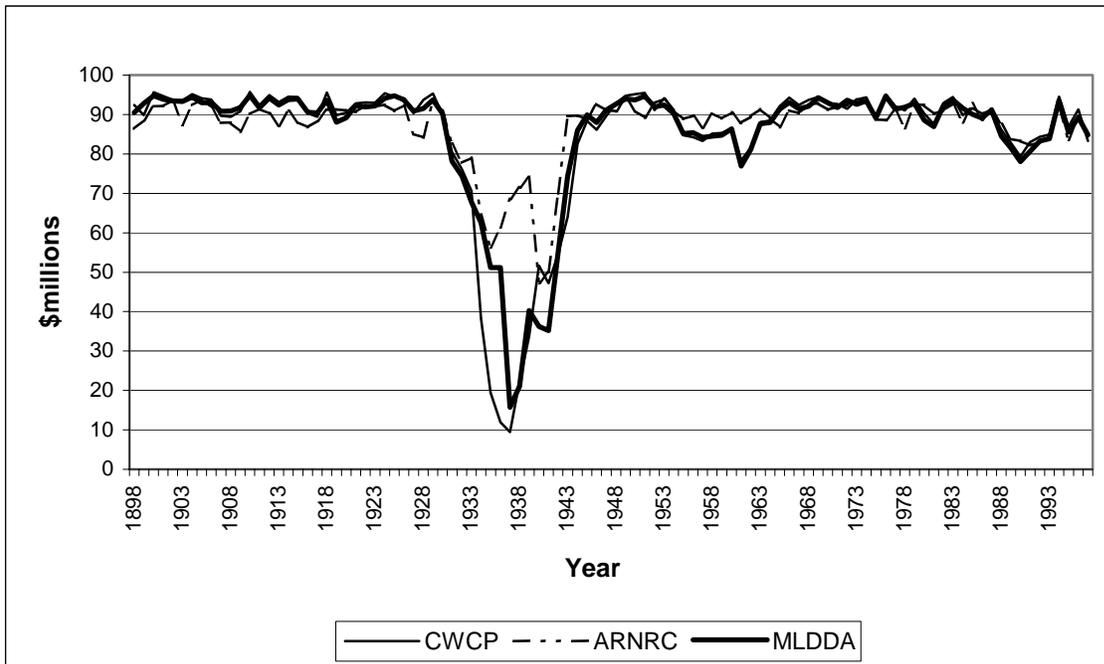


Figure 5.11-2. Average annual recreation benefits for alternatives CWCP, ARNRC, and MLDDA.

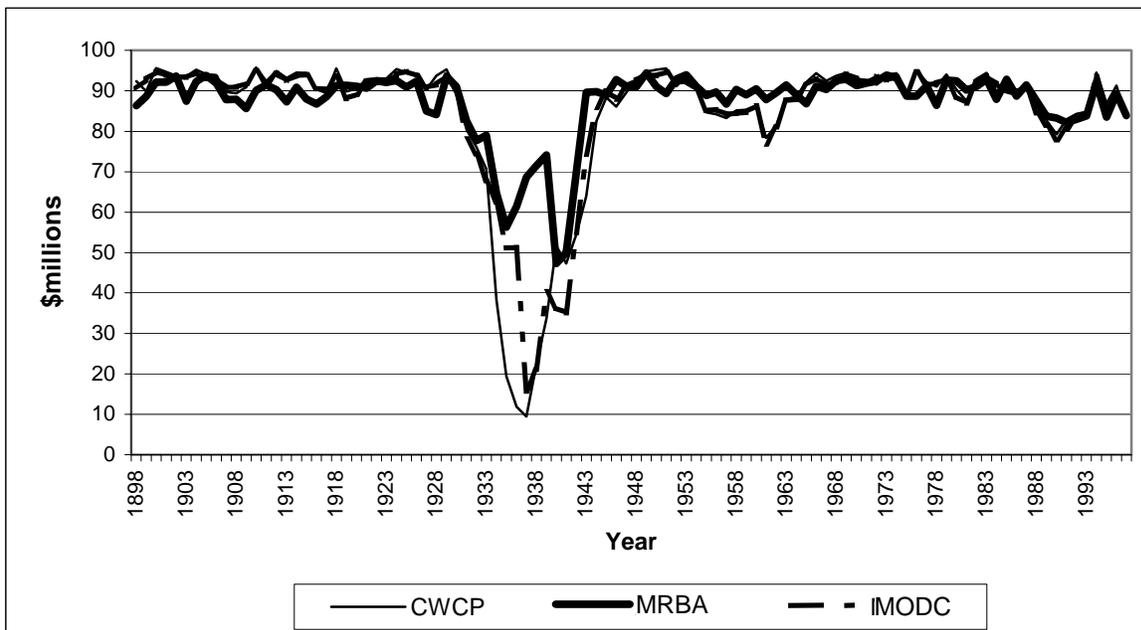


Figure 5.11-3. Average annual recreation benefits for alternatives CWCP, MRBA, and MODC.

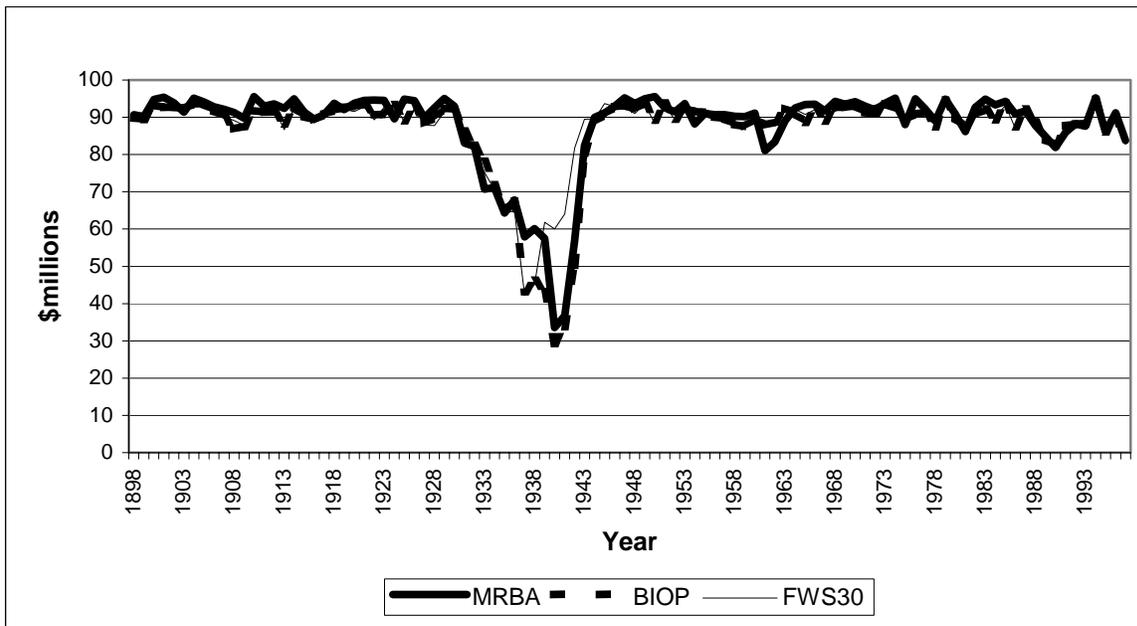


Figure 5.11-4. Average annual recreation benefits for alternatives MRBA, BIOP, and FWS30.

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