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ESTIMATED REGIONAL IMPACTS OF WHITEWATER BOATING ON THE COLORADO RIVER BELOW DIAMOND CREEK IN 1991

[David Robinson]
09/08/95

WHITEWATER BOATING IN THE IMPACT AREA

The Colorado River through the Grand Canyon is nationally and internationally known for its whitewater boating. Since the 1960's, whitewater boating has grown to become a significant industry and has brought additional income to area businesses and supported employment in the region.

The majority of whitewater boating in the Canyon originates at Lee's Ferry or Phantom Ranch in the upper reaches of the Canyon. Whitewater boating trips in the lower Grand Canyon originate at Diamond Creek on the Hualapai Indian Reservation. Both commercial and private whitewater boating trips launch at Diamond Creek.

Considerably fewer whitewater boating trips launch in the lower Canyon than in the upper Canyon. In 1991 for example, 16,622 individuals took whitewater boating trips that launched at Lee's Ferry and 2001 individuals took trips that launched at Diamond Creek.

This analysis focusses on the regional economic impacts of whitewater boating below Diamond Creek in calendar year 1991. During 1991, 1,527 individuals took commercial whitewater boating trips and 474 individuals took private whitewater boating trips originating at Diamond Creek. Table 1 illustrates whitewater boating use below Diamond Creek by month and category for 1991.

The expenditures made by whitewater boaters are quite important to local businesses. These expenditures support local restaurants, bars and hotels. Whitewater boaters also make frequent gas stations, grocery stores, and equipment stores.

These expenditures are also important to the Hualapai Tribe. The Hualapai Tribe operates Hualapai River Runners, a commercial rafting company which offers 1 and 2 day rafting trips. The Tribe also charges a fee for river access, put-ins, and takeouts at Diamond Creek. In 1991, the Tribe derived approximately 33% of its income from these river related and river based activities.

ESTIMATED DIRECT EXPENDITURES BY WHITEWATER BOATERS

Whitewater boating in the upper reaches of the Grand Canyon has been studied rather intensively (Bishop et al 1988; Boyle et al 1988; Boyle, Welsh, and Bishop 1993; Poe,

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Lossin, and Welsh 1995; Shelby, Brown, and Baumgartner 1992; Stewart and Carpenter 1989). However, there are no similar studies on boating in the lower Canyon and there is little primary data available on whitewater boating below Diamond Creek. As a consequence, the approach used in this analysis is similar to the benefits transfer approach (Walsh, Johnson, and McKean 1993) where economic data from one activity in another geographic area is applied to a like activity in the geographic area of interest. In particular, this analysis is based on data and expenditure patterns observed in the upper Canyon.

The assumed percentage of nonresident whitewater boaters used in this analysis is shown in Table 2. These data are derived from Bishop et al (1988) and are assumed to approximate the pattern of boater origin in the lower Canyon. Professional judgement was used to determine the length of an average trip. Data on the assumed length of trip are shown in Table 2. The assumed total length of an average whitewater trip is quite important for this analysis. Total trip length is used to weight the reported trip expenditures for whitewater boaters in the upper canyon and obtain the expenditures used here.

To reiterate, the majority of the expenditure data used in this study were derived by weighting the expenditures found in Bishop et al (1988) by the number of days assumed for each category of trip originating at Diamond Creek. Actual data was obtained only for rafting fees, takeout fees, and, lodging (privately owned).

Professional judgment was used to derive local purchase coefficients for each category of expenditure. Data on direct expenditures and local purchase coefficients are shown in Tables 3-5.

Based on the expenditure pattern of whitewater boaters in the upper Canyon, we expect that boaters in the lower canyon made expenditures in a number of categories including gas, food and drink, lodging, guide services, and outdoor equipment. The approximate direct regional expenditures made by commercial and private whitewater boaters are illustrated in Tables 3-5.

The estimated regional expenditures described in Tables 3-5 are of considerable importance because they support local businesses and provide employment for local residents. In this sense, these expenditures provide some measure of the local impacts of whitewater boating in the region.

The Multiplier Effect

Direct expenditures alone do not fully measure the impacts of the expenditures made by whitewater boaters in the region. Regional expenditures by whitewater boaters represent revenues for local businesses. Local businesses and residents spend part of the money they receive to purchase goods and services from other individuals and local businesses. These individuals and businesses, in turn, spend a portion of their revenue in the region, and so on.

A portion of each dollar spent by whitewater boaters is re-spent over and over in the region and the impact of each dollar of direct expenditure by whitewater boaters is far greater than one dollar. This effect is typically referred to as the multiplier effect.

Multiplier Example

An example can be used to demonstrate the multiplier concept more clearly. Suppose that all of the businesses, government agencies, and households in a hypothetical county spent 40 percent of the money they receive from recreational expenditures on goods and services in the local area. The other 60 percent of the money they receive is spent to buy goods and services outside of the region. Each dollar spent by whitewater boaters will stimulate an initial \$1 worth of local economic activity. That \$1 is re-spent by businesses, government agencies, and households. Of that \$1, \$0.60 is spent outside the county and \$0.40 is spent inside the county. Of that \$0.40, \$0.40 x 40 percent = \$0.16 is re-spent in the region and \$0.40 x 60 percent = \$0.24 is spent outside of the county. After six successive re-spending, the money that circulates inside the hypothetical county is less than \$0.01. In this example, the effect of each \$1 of direct expenditures is:

initial expenditure =		\$1.00
	\$1.00 x 40% =	\$0.40
	\$0.40 x 40% =	\$0.16
	\$0.16 x 40% =	\$0.06
	\$0.06 x 40% =	\$0.03
	\$0.03 x 40% =	\$0.01
	=====	
total impact =		\$1.66

This example for a hypothetical county illustrates that each additional dollar of direct expenditure produces \$1.66 in local economic activity.

From the example above, a simple multiplier can be calculated as follows: $(\$1.66/\$1.00) = 1.66$. This multiplier relates the amount of direct program expenditure to the total amount of local economic activity produced by the expenditure. In practice, there are different multipliers for each sector of the economy and the size of these multipliers differ depending on the economic structure of the region. In general, the more complex the economy, the larger the multipliers and the greater the impact on the local economy from each dollar of expenditure.

Multipliers allow the impact of expenditures to be more fully assessed. For instance, suppose that a total of \$101.00 was spent in the hypothetical county discussed previously.

Using a multiplier of 1.66, this direct expenditure would create $\$101.00 \times 1.66 = \167.77 in local economic activity.

Methodology Used in this Analysis

The U.S. Forest Service's Impact Model for Planning (IMPLAN) version 91-F was used for assessing the regional economic impacts of expenditures made by whitewater boaters. IMPLAN (Taylor et al., 1993), is a sophisticated framework for assessing regional impacts and allows the estimation of multipliers at the county level using secondary data. The multipliers estimated by IMPLAN are based on the concept described previously for a hypothetical county. However, unlike the example discussed, IMPLAN multipliers are specific for each business sector thus allowing a more accurate appraisal of regional economic impact.

For this analysis, two Arizona counties, Coconino and Mohave, were assumed to capture the bulk of the local economic impacts generated by whitewater boating.

The Results

Using IMPLAN, multipliers were developed for this local impact region. The IMPLAN multipliers for this impact region corresponding to the categories of expenditures made by whitewater boaters are reported in Table 6.

The output multipliers shown in Table 6 are, in general, smaller than those for more highly industrialized regions. There are two reasons for this. First, regions that produce manufactured goods generally have more complex economies with more extensive inter-linkages between the economic sectors. There is very little manufacturing in the Coconino and Mohave Counties and there are few inter-industry linkages in this relatively simple economy. Consequently, inputs for the goods and services produced in the region must come from outside of the region. Second, small impact regions, such as the one used for this analysis, have very high "leakage" rates. Leakage is the amount of money spent on goods and services which are produced outside of the impact region. For example, much, if not all of the gasoline used in the region is manufactured elsewhere. For each dollar spent on gasoline in the region, a large percentage, perhaps as much as 90%, represents payments to suppliers outside of the region. These leakages or payments to industries outside of the region do not benefit the residents of Coconino and Mohave Counties.

As shown in Table 6, the IMPLAN output multiplier for boating gear (IMPLAN sector 462), is 1.5659. This indicates that for each dollar spent in the region, 1.5659 dollars of economic activity are generated. As shown, some categories of expenditures have a much greater impact on the local economy than others. For example, the multiplier for car rentals

(IMPLAN sector 492), is 1.3689 while the multiplier for guide fees (IMPLAN sector 502) is 1.6765. This illustrates that each dollar spent on guide fees will have a greater impact in the local economy than would a dollar spent for car rentals. It is probably the case that this reflects the greater use of labor and the lower leakage rate in that sector.

Conclusions

Using the assumptions and methods described, nonresident whitewater boaters taking trips originating at Diamond Creek spent \$604,476 in the local area. As shown in more detail in Table 7, it is estimated that this initial expenditure produced \$380,442 (1991 dollars) in additional regional output. The total regional impact associated with whitewater boating is **\$984,918** (1991 dollars).

TABLE 1. WHITEWATER BOATING BELOW DIAMOND CREEK IN 1991

Month	Hualapai River Runner Clients Taking 1-Day Trips	Hualapai River Runner Clients Taking 2-Day Trips	Private Individuals Launching at Diamond Creek
January	0	0	0
February	0	0	0
March	0	0	80
April	0	0	12
May	123	131	153 ¹
June	269	49	57
July	241	136	37
August	261	85	30
September	165	67	25
October	0	0	65
November	0	0	15
December	0	0	0
TOTAL	1059	468	474

Note: this Table does not include trips which originated upstream of this reach.

Source: Ms. Laura Duncan
Hualapai Wildlife Management Department
PO Box 300
Peach Springs AZ 86434

¹Includes one 32 person non-Hualapai commercial trip.

TABLE 2. PERCENTAGE OF NON-RESIDENT BOATERS AND ASSUMED TOTAL TRIP LENGTH BY CATEGORY

	Assumed Percentage of Non-Residents	Assumed Total Trip Length (days)
1-Day Commercial Trips below Diamond Creek	98.5	2
2-Day Commercial Trips below Diamond Creek	98.5	4
Private Trips below Diamond Creek	98.5	5

TABLE 3. ESTIMATED DIRECT EXPENDITURES AND LOCAL PURCHASE COEFFICIENTS FOR INDIVIDUALS TAKING 1-DAY COMMERCIAL WHITEWATER BOATING TRIPS. UNITS: PER PERSON PER TRIP

	Estimated Direct Expenditures by Non-Residents Taking 1-Day Commercial Trips (1991\$)	Estimated Percentage of Non-Resident Expenditure Within the Impact Region
Rafting Fee	\$235.00	100%
Gas and Oil	\$10.48	50%
Airfare	\$48.36	0%
Car Rental	\$6.24	100%
Food and Drink (Grocery Store)	\$15.97	100%
Food and Drink (Restaurant)	\$4.00	100%
Personal and Miscellaneous Gear	\$20.45	50%
Lodging and Camping (Privately Owned)	\$47.50	100%
Lodging and Camping (Government Owned)	\$1.10	75%
Boating Gear	\$0.0	0%
Equipment Rental	\$0.0	0%
Takeout	\$0.0	0%
Shuttle	\$0.0	0%
Tow Across Lake	\$0.0	0%
Other	\$11.06	100%
Total	\$400.16	

TABLE 4. ESTIMATED DIRECT EXPENDITURES AND LOCAL PURCHASE COEFFICIENTS FOR INDIVIDUALS TAKING 2-DAY COMMERCIAL WHITEWATER BOATING TRIPS. UNITS: PER PERSON PER TRIP

	Estimated Direct Expenditures by Non-Residents Taking 2-Day Commercial Trips (1991\$)	Estimated Percentage of Non-Resident Expenditure Within the Impact Region
Rafting Fee	\$345.00	100%
Gas and Oil	\$10.48	50%
Airfare	\$48.36	0%
Car Rental	\$6.24	100%
Food and Drink (Grocery Store)	\$15.97	100%
Food and Drink (Restaurant)	\$4.00	100%
Personal and Miscellaneous Gear	\$20.45	50%
Lodging and Camping (Privately Owned)	\$47.50	100%
Lodging and Camping (Government Owned)	\$1.10	75%
Boating Gear	\$0.0	0%
Equipment Rental	\$0.0	0%
Takeout	\$0.0	0%
Shuttle	\$0.0	0%
Tow Across Lake	\$0.0	0%
Other	\$11.06	100%
Total	\$510.16	

TABLE 5. ESTIMATED DIRECT EXPENDITURES AND LOCAL PURCHASE COEFFICIENTS FOR INDIVIDUALS TAKING PRIVATE WHITEWATER BOATING TRIPS. UNITS: PER PERSON PER TRIP

	Estimated Direct Expenditures by Non-Residents Taking Private Whitewater Trips (1991\$)	Estimated Percentage of Non-Resident Expenditure Within the Impact Region
Rafting Fee	\$23.72	0%
Gas and Oil	\$25.17	50%
Airfare	\$15.41	0%
Car Rental	\$1.40	100%
Food and Drink (Grocery Store)	\$5.99	25%
Food and Drink (Restaurant)	\$53.88	25%
Personal and Miscellaneous Gear	\$21.82	100%
Lodging and Camping (Privately Owned)	\$1.78	100%
Lodging and Camping (Government Owned)	\$7.14	100%
Boating Gear	\$34.19	0%
Equipment Rental	\$9.42	50%
Takeout	\$2.55	100%
Shuttle	\$10.27	100%
Tow Across Lake	\$2.34	100%
Other	\$0.19	100%
Total	\$215.24	

TABLE 6. MAPPING IMPLAN TYPE III MULTIPLIERS TO EXPENDITURE CATEGORIES FOR THIS ANALYSIS.

Expenditure Categories	IMPLAN Sector Identifiers From Aggregated Industry Matrix 1985 Data Set	IMPLAN Type III Output Multipliers for the Impact Region (Coconino + Mohave Counties)
Rafting Fee	502	1.6765
Gas and Oil	493	1.2980
Airfare	446	1.4576
Car Rental	492	1.3689
Food and Drink (Grocery Store)	463	1.5284
Food and Drink (Restaurant)	491	1.4853
Personal and Miscellaneous Gear	463	1.5284
Lodging and Camping (Privately Owned)	471	1.5992
Lodging and Camping (Government Owned)	515	1.2847
Boating Gear	462	1.5659
Fishing Equipment, Bait, and Licenses	462	1.5659
Guide Fees	502	1.6765
Equipment Rental	502	1.6765
Takeout Fees	502	1.6765
Shuttle Fees	502	1.6765
Tow Across Lake	502	1.6765
Other	463	1.5284

TABLE 7. ESTIMATED REGIONAL IMPACTS OF WHITEWATER BOATING IN THE IMPACT REGION.

	Number of 1991 Trips by Non-Residents	Estimated Regional Expenditure Per Trip (1991\$)	Aggregate Direct Expenditure In Region (1991\$)	Economic Activity Generated In Region (1991\$)
1-Day Commercial Trips Below Diamond Creek	1,043	\$336	\$350,550	\$572,367
2-Day Commercial Trips Below Diamond Creek	461	\$446	\$205,625	\$337,956
Private Whitewater Boating Below Diamond Creek	467	\$103	\$48,301	\$74,596
Total	1,971		\$604,476	\$984,918

TECHNICAL ANALYSIS NOTES

For this analysis, 1991 expenditures were deflated to 1985 dollars for impact analysis and the results were then inflated to 1991 dollars using a Gross Domestic Product (GDP) Inflation. The inflation used in this analysis was 1.186.

The 1985 Arizona IMPLAN data set was used in this analysis.

Expenditures at the retail level should correctly be classified as an IMPLAN impact sector and analyzed accordingly. However, given the limited secondary data which were available for this analysis, this approach was deemed unwarranted.

Cross reference: LOTUS file = HUALIMP.WK3
 this file = HUALIMP.006

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INFORMAL MEMORANDUM

From: David Harpman, USBR Economics Group- Denver

**To: Mr. David Wegner, GCES- Flagstaff
Dr. Kerry Christensen, Hualapai Tribe**

Subject: Report on Recreation Impacts

Date: 8 September 1995

**GLEN CANYON ENVIRONMENTAL
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FLAGSTAFF, AZ**

Attached is our report on the regional impacts of whitewater boating for trips originating at Diamond Creek in 1991.

It should be clearly noted that the estimates of regional impact described in this report are based on extremely limited data. A considerable improvement in accuracy and defensibility could be obtained if expenditure data, specific to this particular site, were available. We would be pleased to facilitate collection of this data provided that funding is made available to do so.

If there are any questions please feel free to call me @ (303) 236-8080 x539.

cc: Ms. Amis Holm, SWCA.

