CONCLUSION

The yo-yo is not nearly so effective as popularly imagined to be. At the present time, we cannot foresee this automatic type fishing device replacing either the set hook or trotline in popularity. Based upon data gathered during this project, there is no reason why this device should not continue to be a legal fishing tool.

ACKNOWLEDGMENTS

Thanks are due to the personnel of the Fisheries Section, Louisiana Wild Life and Fisheries Commission and to Mr. Melvin O. Lantz, sportsfisherman, for their assistance in gathering data.

The authors wish to express their gratitude to Mr. A. P. White, Jr., who so graciously furnished samples of the fishing device and a list of areas in which the greatest volume of yo-yo sales occur.

LITERATURE CITED

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COMMERCIAL FISHING COSTS AT OAHE RESERVOIR, SOUTH DAKOTA

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INTRODUCTION

In connection with the Bureau of Commercial Fisheries biological and exploratory fishing investigations at Oahe Reservoir, an opportunity arose in 1965 and 1966 to collect data on fishing costs incurred by commerical fishermen operating at the reservoir. This information was developed principally for background use in the Bureau's survey of commercial fishing for the Missouri Basin Comprehensive Study and for individual reservoir project review activities associated with pre-construction evaluation of commercial fishery potentials.

The purpose of this paper is to present an analysis of two seasons' fishing costs for full-time fishermen operating on Oahe out of Mobridge, South Dakota. To the extent that gear and fishing methods used are similar to other commercial reservoir fisheries, the data presented here may be applicable in other areas of the Midwestern U. S.

THE FISHERY

Oahe Reservoir is a flood control impoundment on the Missouri River mainstem. Construction on the dam, located near Pierre, South Dakota, was begun in 1948 and closure effected in 1958. Insofar as the fish populations are directly related to impounded waters, 1959 is considered the first year of impoundment. When the reservoir is filled to normal levels the conservation pool will total 313,000 surface acres. Through the spring of 1967 the maximum pool reached was approximately 280,000 acres. At maximum operating pool the reservoir will extend 230 miles upstream to Bismarck, North Dakota.

Commercial fishing at Oahe was initiated in July of 1964 and landings totaled 335,575 pounds the first season. The catch increased to 665,700 pounds in 1965 and then dropped to approximately 460,000 pounds (preliminary estimate) in 1966. The fishery is operated on a contract basis with the South Dakota Game, Fish and Parks Depart-

ment. The contracting agent employs a number of commercial fishermen to operate on the reservoir and guarantees a specified price for their landings prior to the start of the season. A share of receipts from fish sold by the contractor is paid to the State of South Dakota amounting to one-half cent per pound for buffalofish and three cents per pound for catfish. All fishing operations are supervised by State personnel.

A fish plant has been constructed at Mobridge with cooling and ice storage facilities. Processing at the plant prior to shipment includes viscera removal, washing the fish with a spoilage retardant and packing the iced fish in boxes. Over 99 percent of the catch is sold to distributors and wholesalers in Iowa, Illinois and New York.

The primary species landed commercially include buffalofish, catfish, carp and goldeye. Buffalofish accounted for over 95 percent of total landings in 1964 and 1965. In 1966 buffalofish represented an estimated 76 percent of the catch, carp 14 percent, goldeye 9 percent and catfish 1 percent. The greater variety of species landed in 1966 reflects the availability of markets for carp and goldeye and the decline in abundance of marketable-size buffalofish.

The fishing season at Oahe is approximately seven months for full-time fishermen, beginning in April and extending through October. Fishermen average 16 to 26 days of fishing per month, depending upon the weather. Although the entire reservoir is open to commercial fishing, most effort is distributed within 60 miles of Mobridge.

FISHING GEAR AND EQUIPMENT

Gill nets and hoop nets are the only gear used at Oahe. The lack of suitable cleared areas has prevented the use of haul seines in the fishery. In 1965 fishermen operated 8 to 12 hoop nets each and from 14 to 20 sections of gill nets. The units of each gear fished per fisherman increased in 1966 when as many as 38 hoop nets and 25 gill net sections (per fisherman) were operated. The average gill net section used measures approximately 300 feet long, is hobbled to a depth of 6 feet and is 4-inch mesh, bar measure (8-inch extended). The nets are constructed of nylon. Hoop nets are 5 to 7 feet in diameter, contain 7 or 9 hoops per net and are fished with 100-foot leads.

In addition to nets, equipment used by each fisherman included 1 to 3 boats, 1 or 2 outboard motors, a boat trailer, truck, part-time use of a car and miscellaneous small tools.

SAMPLE

During the 1965 season, nine commercial fishermen operated at Oahe; however, only five of these could be considered active. The remainder fished only occasionally and several participated in an experimental gear research program at the reservoir, thus fishing costs for these individuals were not considered representative. Questionnaires were distributed to the five active fishermen and four were returned representing landings of 411,600 pounds or 62 percent of landings at the reservoir in 1965. In 1966 there were only three full-time fishermen active and each completed a questionnaire. Landings of these fishermen were 451,000 pounds or over 90 percent of Oahe landings in 1966. A Bureau of Commercial Fisheries employee, acquainted with the fishermen and familiar with their operations, assisted them in completing the questionnaires. Only one fisherman was included in both the 1965 and 1966 surveys.

Of the seven questionnaires received for the two seasons, one was not included in the budget analysis to follow. This fisherman received his nets and other equipment in return for a share of the receipts and was unable to supply information on costs incurred in net repair. The following data then are based on six completed questionnaires representing detailed fishing expenses for three fishermen in 1965 and three in 1966. The fishermen involved accounted for 750,496 pounds or 67 percent of total landings at the reservoir during the two seasons.

FISHING COSTS

Variable costs—Annual variable costs include expenditures on boat, motor, truck and car repairs, gas and oil, ropes, anchors, repair and replacement of gill nets, hoop net repairs, purchases of special clothes used for fishing, wages and taxes. Costs of gill net replacement were included with variable costs because a gill net section at Oahe generally lasts less than one season while hoop nets may be used up to five years. Variable costs per fisherman averaged $3,294 annually or 2.6 cents per pound of fish landed.

Fixed costs—Included in this category are those expenses that do not change as a result of fishing effort. They include insurance, license fees, depreciation and interest on investment. No data were obtained on the amount of interest paid on outstanding loans but these appeared not to be significant additions to total expenses. Fixed costs per fisherman averaged $1,559.

Average costs for insurance and license fees were $216. Those fishermen occasionally using their personal car in the fishery were asked to estimate the portion of total car use attributable to fishing. Insurance and license fees charged to fishing costs were allocated accordingly.

Depreciation was calculated by the straight line method according to the fishermen's estimate of the average length of service of each item, including boats, motors, trucks, cars, boat trailers and hoop nets. Average annual depreciation per fisherman was $1,212 with hoop nets and trucks accounting for the major share of the charges.

An additional charge made to the fishing operation was interest on invested capital. Presumably a fisherman could receive a minimum five percent annual return on his investment in the fishery if he were to invest a cash equivalent elsewhere. The average total depreciated value of fishing equipment was estimated at $2,629. Based on a five percent return, a charge of $131 was made against the operation.

Opportunity costs—In order to fully describe the economic returns provided by the fishery an additional charge was calculated representing opportunity costs of the fishermen's labor and managerial skills. These costs are an attempt to estimate the next best alternative income available to a fisherman. Thus he has the economic alternative of seeking other employment and his income from fishing should at least equal that of his next best alternative employment opportunity. Whenever returns to his labor and managerial abilities used in the fishery fall below his opportunity costs, it will pay the fisherman to leave the fishery.

On the basis of the general educational level of the fishermen and the area of the country in which they would be likely to seek other employment, opportunity costs were estimated at $375 per month for the number of months fished at Oahe. On the average this amounted to an annual charge of $2,500 for a fishing season of slightly less than seven months.

Total costs—Average total costs including opportunity costs were $7,353 or 5.9 cents per pound of fish landed (Table 1). Average gross income was $7,229, thus the average fisherman was able to cover $2,376 out of opportunity costs of $2,500. Excluding opportunity costs, total expenses averaged $4,853 or 3.9 cents per pound.

All fishermen interviewed in this study had other sources of income in addition to commercial fishing employment at Oahe. The return of $2,376 on labor and $131 on invested capital in the fishery represented approximately 75 percent of average annual income from all sources.

Over several seasons attrition from a fishery can be expected whenever opportunity costs are not fully covered. On the average, fishermen at Oahe were able to make about 98 percent of their opportunity costs and to this extent little if any attrition would be likely. It is recognized, however, that considerably more data on the circumstances of each fish-

TABLE I—AVERAGE COSTS AND INCOME FOR SIX COMMERCIAL FISHING OPERATING UNITS AT OAHE RESERVOIR, SOUTH DAKOTA.

	Dollars		Cents Per Pound
Gross Income	7229		5.8
Variable Costs	3294		2.6
Gas, oil, equipment repair		1001	
Gill net replacement, repair		711	
Hoop net repair		344	
Wages paid, miscellaneous		1238	
Fixed Costs	1559		1.3
Insurance, license fees		216	
Depreciation		1212	
Interest on investment		131	
Opportunity Costs	2500		2.0
Total Costs	7353		5.9
Net Profit (Loss)	(124)		(0.1)

erman is necessary before a precise estimate of employment alternatives is possible. Because the monthly income estimated in this report assumes relatively high mobility for the fishermen to obtain off-season employment, it is believed that opportunity costs may be somewhat understated. Even with the alternative income estimated above the fishery provided only minimal returns to the capital and labor utilized. Any decline in the average value of the catch would involve definite net losses unless catch rates per unit of effort were increased accordingly.

There are some indications that fishing costs at Oahe are higher than those of comparable reservoir and river fisheries because of the relatively high net repair expenses incurred and the long distances travelled to fishing grounds. Considerable damage to nets has resulted from debris drifting through the reservoir, particularly trees and limbs, and from stationary objects such as stumps. As the reservoir stabilizes and unobstructed fishing grounds are located, net repair costs are likely to decrease. This situation emphasizes the need for adequate clearing of seining and netting areas and the removal of loose debris prior to impoundment.

COSTS AND FISHING EFFORT

In addition to expressing fishing expenses in absolute values or on a per pound basis costs were also calculated in terms of unit of effort, i.e., per hoop net or gill net section lifted. When the fisherman is able to predict probable catch rates, a notion of his variable costs per unit of effort can indicate whether it will pay him to set his nets at any given time.

Costs were allocated to each gear type according to repairs and replacement costs attributable to gill nets and repair and depreciation chargeable to hoop nets. The variable costs remaining after repair and replacement were subtracted, were allocated according to the number of lifts made and weighted on a 60 to 40 ratio with hoop nets receiving the larger share. This procedure is based on the somewhat greater time and labor involved per hoop net lift relative to gill nets. The ratio used stems from a general familiarity with the fishing operations and was not derived empirically.

The fishermen surveyed averaged 874 gill net sections lifted per season and 1,084 hoop nets. Gill net repair and replacement was $0.80 per lift and hoop net repair was $0.40 per lift. The allocation of other variable costs amounted to $1.00 for gill nets and $1.50 for hoop nets.

An additional charge of $0.30 was made to hoop nets for average annual depreciation. In summary, variable costs per lift were $1.80 for gill nets and $2.20 for hoop nets.

Average landings per unit of effort were 55.5 pounds for gill nets valued at $4.20 and 84.8 pounds valued at $3.80 for hoop nets. The residual of catch value less variable costs amounted to $2.40 for gill nets and $1.60 for hoop nets. According to the average value per pound received for the catch of each gear, the fishermen required on the average 23 pounds per gill net lift and 48 pounds per hoop net lift to cover variable costs. Over the full season it would be necessary for the fishermen to cover all costs. At any one time, however, it would have paid the fishermen to set their gear when landings per unit of effort were expected to exceed the above rates.

THE CORPS OF ENGINEERS AND THE FISHERIES EFFORT

George W. Allen, *Biologist*
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It is seldom that a Corps of Engineers representative has the opportunity to address a group of conservationists except either in a defensive capacity or in the role of arbiter in a project dispute, neither of which is enjoyable. The opportunity for the Corps of Engineers to express itself as an agency that is interested in, and working for, the conservation effort is welcome indeed. Having been active at the state level in marine fisheries and wildlife for many years, I am only too well aware of the general feeling in the past that many Federal agencies seem to be invading the prerogatives of the state conservation efforts. I can assure you at this time that the Corps of Engineers does not want to, nor does it intend to, venture into the fields of fisheries and wildlife management. It has always been the policy of the Corps to turn the management of these resources in our project areas over to the states involved, and attempt to coordinate project activities so that the minimum of damage will be done to these resources and their lot will be to improve wherever and whenever possible.

We have all heard of the detrimental aspects of some Corps of Engineers projects with respect to the wildlife resources. In the past I am sure that many of us have heard Corps personnel at one time or another say that the Corps is not in the business of raising fish or quail. To a certain degree this has been true, but not entirely so. It is true, however, that the request by a Congressional leader in Washington for an impoundment in his state does not indicate that the proposed multimillion dollar structure is for the raising of trout or bass. Such requests are based on one or more primary considerations, hydro-electric power, navigation, flood control, water quality, recreation, or water supply are considered as factors in the calculations for determination of the cost-benefit ratio. The approval, by necessity, has been based on justification in the above mentioned fields. Because of this, primary consideration in project operations is given to these fields.

We all like to talk of the "good old days," when those days might not have been as good as we would like to believe. The vagaries of recollection tend to emphasize only what we want to believe. This is true of the fisheries efforts and stream conditions of the past.

A few of us here can still remember when many of our streams were not materially affected by the impoundments that now appear to be everywhere. There is some question, however, of the value of the fisheries statistics from those halcyon days of yore. Most of them were based on stories told in the barber shop or the hardware store.

The real effect of an impoundment or any other development can only be determined through an undertanding of the before and after