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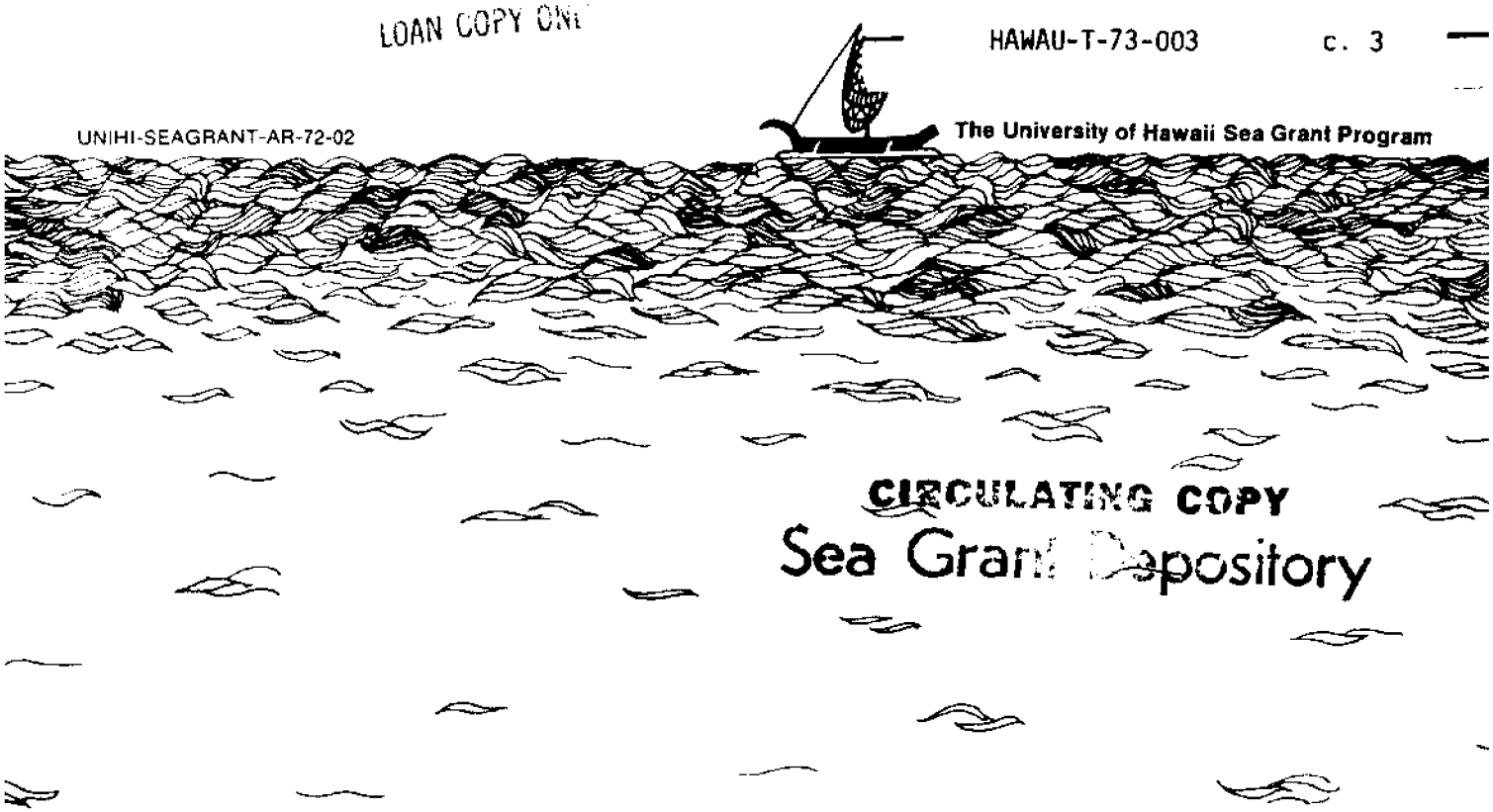

Impact of Recreational Fishing Expenditures on the State and Local Economies of Hawaii

Robert G. Hoffman and Hiroshi Yamauchi

June 1973

IMPACT OF RECREATIONAL FISHING EXPENDITURES ON THE STATE AND LOCAL ECONOMIES OF HAWAII

by

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PRELIMINARY CONSIDERATIONS

Background of the Study

Recreational fishing is enjoyed by thousands of fishermen each year in Hawaii. From an economic standpoint this activity can also be measured in millions of dollars spent annually. Because of the increased number of fishermen, and because they have limited access to the sea, a great deal of concern for the problem has been brought to public attention in recent years.

A lack of data on recreational fishing prompted the Hawaii State Division of Fish and Game to conduct inshore surveys of recreational fishing activities between July 1958 and June 1961, and to compile the results in a series of unpublished reports (3, 4, 5). Instantaneous counts of fishermen and their gear were made with the aid of aircraft and boats along the coastal areas. The fishermen were categorized according to what types of fishing and what kinds of gear they used. It was estimated that during the three-year period 550,000 sport-fishing trips were made yearly to Oahu's coastline. The weekly counts of fishermen were carried out along the shoreline in each quarter of the year. Approximately 9,000 fishermen were sighted; of these, 32 percent were counted on Sundays, 28 percent on Saturdays, and from Mondays through Fridays, each day's count ranged from 6 to 9 percent of the week's total. It was estimated that fishermen spent 4,215,523 hours fishing.

In the earlier reports by the State Division of Fish and Game, it had been recommended that the economic value of inshore sport fishing should be determined in future surveys. However, since no adequate statistical procedure was available for this purpose, the recommendation was never carried out. Later reports repeatedly stressed that "...the possibility of determining the economic value of local inshore sport fishing should be investigated" (3).

The survey was discontinued after June 1961 because of a serious shortage of manpower. However, it was the intention of the State Division of Fish and Game to resume the survey and extend it to the Counties of Hawaii, Maui, and Kauai as soon as sufficient personnel were made available.

In 1966, the State Division of Fish and Game directed its efforts at monitoring the activities of certain organized groups, such as shoreline and boat-fishing clubs. Questionnaires were prepared so that fishermen could report the results of their fishing trips. One survey form was designed for the use of inshore fishermen and another for the use of offshore fishermen. It was later recommended that the activities of sport fishermen be monitored through the use of log-book type questionnaires. This method would permit comparing information concerning species, composition of catch, and the variation of fishing success among localities, islands, and seasons. However, before the project got under way, unforeseen circumstances altered the course of action.

A Marine Resources Advisory Panel, which was formed as part of the Governor's Advisory Committee on Science and Technology to assess the economic potential of the marine resources of the state, issued its first report in 1967 on the commercial and recreational resources of the sea. The report pointed out its concern that "...a comparable statistical data-gathering system", such as was employed in commercial fishing, was not available for sport fishing (6). The same report further suggested that "...the assessment of economic and recreational significance of Hawaii's sport fishing would probably entail the implementation of a statewide survey or census." In conclusion, this report recommended that:

> Information such as number, age, sex of sport fishermen and the expenditures they make. . . is not only desirable but essential for planning purposes. The findings of the survey will determine to a great extent how much emphasis to place on the development and management of our marine sport fishery resource and what alternative approaches to pursue in order to achieve our resource development and management objectives.

The report by the Marine Resources Advisory Panel to the Governor occasioned a Resolution by the Senate during the Fourth Legislature of the State of Hawaii, Budget Session of 1968 (7). This Senate Resolution stressed that since "...little factual information exists on the economic impact of sport fishing upon the State, it shall be resolved that the Division of Fish and Game, Department of Land and Natural Resources, State of Hawaii, determine what economic studies would be required for evaluating the sport potential of the State."

Besides the above criteria, the Senate Resolution also stressed that "Whereas population growth and the explosive growth of tourism in the next few years will put even greater pressures on the recreational resources of the State, including ocean and freshwater game fishing; and, whereas, planning for the best utilization of sport fishing resources requires estimates of their contribution to the economy of the State..." that a study on recreational fishing in Hawaii would not only be found most useful, but also a necessity (7).

Objectives and Scope of the Study

The primary purpose of the study herein described was to reduce the information gap concerning the socio-economic aspects of recreational fishing in response to the needs expressed in the previous section.*

More specific objectives included the following:

a. To estimate participation in the various kinds of recreational fishing activities

b. To estimate the expenditures of recreational fishermen

c. To estimate the economic impact of recreational fishing on the State of Hawaii

With regard to objective (a), participation in recreational fishing activities was treated and analyzed in several different ways. Fishing activities were classified in three categories: saltwater fishing, freshwater fishing, and fishing in unspecified areas. The total numbers and percentages of fishermen were estimated for each of the four counties and for the State of Hawaii. Fishermen were then grouped into the following socio-economic categories: household relationship, age, ethnic background, education, income, and occupation.

The total number of fisherman days and the average fishing days per fisherman were also estimated for each of the four counties and the State of Hawaii. Numbers of fishing days were determined for each of the specified major fishing categories: saltwater, freshwater, and fishing in unspecified areas. Fishermen's preferences for fishing areas were also determined.

With regard to objective (b), three basic expenditure categories were considered, namely, (1) transportation costs, (2) food and other additional on-site costs, and (3) equipment costs such as rods, reels, line, lures, bait, etc. The cost data are presented and compared for each of the counties and the state as a whole.

For objective (c), a local income multiplier model was used to estimate the economic impact of recreational fishing expenditures on the state's economy. The model, similar in principle to the Keynesian

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*The original objectives of the study also included projections of the future demand for recreational fishing. However, since no previous studies had been carried out in Hawaii in detail, the necessary trend for such an analysis could not be adequately established. Attempts were made to apply secondary data to certain parameters by means of econometric functions. The estimates for these functions were of poor quality and, therefore, not expanded upon. For future demand analysis, the information found in the present study should prove to be most useful.

national income multiplier, takes into account both the direct and indirect income effects of fishermen's expenditures and also corrects for import leakages in the first and subsequent rounds of expenditures.

Summary of Survey and Sampling Methods

Random samples of households in each of the four counties in the state were selected and the household members were interviewed about their participation in various types of fishing. Socio-economic data were also collected in the course of the interviews, to find out more about fishermen and to evaluate the economic impact of their aggregate fishing activities on the state and local economies.

The field surveys were conducted in two separate phases during 1969 and 1971, one for Oahu, covering a year's period within 1968 and 1969, and the other for the three neighbor island counties, covering a year's period during 1970 and 1971. Experience gained from the first Oahu phase served to modify and improve on the conduct of the survey for the other counties, although essentially the same kinds of data were collected throughout the state.

The Oahu phase of the survey was carried out by a telephone-interview sampling technique. Although many samples were collected, the exclusion of unlisted and non-telephone users caused some bias in the estimates. To improve the statistical data from the neighbor islands, a house-to-house survey based on area-sampling techniques was used. The change in the sampling procedure also permitted keener insight into the problems of the sampling districts.

Table 1 summarizes numbers of respondents and nonrespondents in the sampling surveys, by counties, and reasons for nonresponse. Out of 6,400 attempted interviews in the City and County of Honolulu, 62.4 percent were completed. The percentage of response for the neighbor islands survey was 73.1 percent for the County of Hawaii, 73.5 percent for the County of Maui, and 73.0 percent for the County of Kauai. The percentage of interview response for the entire state was 64.7 percent.

TABLE 1. NUMBERS OF RESPONDENTS AND NONRESPONDENTS IN THE SAMPLING SURVEY
(Oahu Data, 1968 - 1969; Neighbor Island Data, 1970 - 1971.)

County	Sampling Data for Respondents				Nonrespondents and Reasons for Nonresponse					
		Households Surveyed Successfully								
	Number of Fishermen Surveyed[c]	Households w/one or more Fishermen	Households w/no Fishermen	Total, Households Responding	Direct Refusal	Non-contacts	Dis-connected Telephone	Incomplete Interviews	Other Reasons	Total, Households Not Responding
Oahu[a]	1,928	1,223	2,773	3,996 (62.4%)	379	813	556	183	473	2,404 (37.6%)
					Refusal	Not Home after 3 Calls	Vacant House	Language Barrier	Other Reasons	
Hawaii[b]	313	190	243	433 (73.1%)	22	74	18	11	35	160 (26.9%)
Maui[b]	317	220	191	411 (73.5%)	29	46	42	10	21	148 (26.5%)
Kauai[b]	384	214	219	433 (73.0%)	42	55	35	4	26	162 (27.0%)
Total	2,942	1,847	3,426	5,273 (64.7%)	--	--	--	--	--	2,874 (35.3%)

[a]On Oahu the survey was conducted by telephone.

[b]On the neighbor islands a house-to-house survey was conducted.

[c]These figures represent fishermen who were 12 years and older.

PARTICIPATION IN RECREATIONAL FISHING IN HAWAII

The concept of "participation" in recreational fishing needs clarification, since it is possible to attach various meanings to this seemingly simple term. One interpretation is to consider only the number of individuals in the population who claim to have gone fishing without a license at least once over a given one-year period. Further, only persons 12 years and above may be counted, thereby conforming to the practice of the Federal Bureau of Sport Fisheries. Fishermen can be identified according to their various socio-economic characteristics, such as household relationship (and thereby sex), age, ethnic origin, education, occupation, income, etc. Their participation may be linked to the various types of fishing activities in which they engage and the various areas in which they go fishing. Furthermore, the extent of their participation -- in terms of activities and areas -- may be weighted according to how frequently they go fishing. This frequency aspect may be expressed in terms of hours, days, trips, or some other convenient unit of measure. The present study considers these various aspects of participation in recreational fishing, but does not go further into specifying types of gear used or numbers of fish species caught.

Numbers and Distribution of Recreational Fishermen

As indicated in Table 2, the estimated total number of recreational fishermen, 12 years old and above, in the State of Hawaii was 122,400. Approximately three-fourths (92,500) of these fishermen were from the City and County of Honolulu. The Counties of Hawaii (12,300), Maui (10,600), and Kauai (7,000) then followed at the participation levels indicated. In each county, fishermen participated in all the major categories of saltwater fishing, freshwater fishing, and fishing in unspecified areas. For the City and County of Honolulu only, these categories also included fishermen who went to the neighbor islands to fish. As was expected, saltwater fishing predominated in all the counties. On Kauai, however, approximately 10 percent of those who fished were freshwater fishermen, whereas in the other counties, freshwater fishing varied from a low of 0.5 percent to 3 percent. Within the saltwater fishing category, the largest number of fishermen were shoreline fishermen (68.1 percent), then came boat fishermen (12.1 percent), and finally, divers (10.2 percent).

TABLE 2. DISTRIBUTION OF RECREATIONAL FISHERMEN AMONG MAJOR FISHING CATEGORIES
(Oahu Data, 1968 - 1969; Neighbor Island Data, 1970 - 1971.)

Fishing Category	Percentage Distribution for each County and for the State				
	City & County of Honolulu	County of Hawaii	County of Maui	County of Kauai	State of Hawaii
Saltwater fishing					
From boat	13.0	8.5	12.1	5.8	12.1
From shoreline	66.1[a]	82.6	65.9	72.2	68.1
While diving	10.0[a]	6.7	16.5	10.3	10.2
Subtotal	89.1	97.8	94.5	88.3	90.4
Freshwater fishing	2.7	1.3	0.4	9.4	2.7
Unspecified[b]	8.2	0.9	5.1	2.3	6.9
Number of Fishermen	92,500	12,300	10,600	7,000	122,400

[a]Derived from weighted average of the other three counties.

[b]For City and County of Honolulu only, "unspecified" category includes going to neighbor islands to fish.

Socio-Economic Characteristics of Recreational Fishermen

There is a fairly consistent pattern in the distribution of recreational fishermen according to household relationships among all the island counties (Table 3). More than half of the members were male heads of households. Sons (approximately 20 percent) followed in fishing participation; then wives (approximately 16 percent), daughters (approximately 6.7 percent), and others (approximately 6.1 percent).

TABLE 3. DISTRIBUTION OF RECREATIONAL FISHERMEN ACCORDING TO HOUSEHOLD RELATIONSHIP
(Oahu Data, 1968 - 1969; Neighbor Island Data, 1970 - 1971.)

Household Relationship	Percentage Distribution for each County and for the State				
	City & County of Honolulu	County of Hawaii	County of Maui	County of Kauai	State of Hawaii
Head of household	50.2	52.5	55.9	49.2	50.9
Wife	15.5	19.7	14.7	18.8	16.1
Son	21.5	16.2	15.0	18.3	20.2
Daughter	7.1	3.8	6.9	6.5	6.7
Other	5.6	7.7	7.5	7.2	6.1
Number of Fishermen	92,500	12,300	10,600	7,000	122,400

The distribution of fishermen's ages (Table 4) is definitely skewed toward the younger age levels. The largest age group was made up of teenagers from 12 to 18 years of age (approximately 19 percent). For the state as a whole, the average age of fishermen is about 30 years.

In the distribution of fishermen by ethnic groups (Table 5), Japanese and Caucasians predominated (together, approximately 60 percent). The other ethnic categories were Hawaiian, part-Hawaiian, Filipino, Chinese, mixed, and others. As a percentage of total individuals within each ethnic group, the pattern may be expected to differ considerably.

TABLE 4. DISTRIBUTION OF RECREATIONAL FISHERMEN AMONG AGE GROUPS
(Oahu Data, 1968 - 1969; Neighbor Island Data, 1970 - 1971.)

Age Group	Percentage Distribution for each County and for the State				
	City & County of Honolulu	County of Hawaii	County of Maui	County of Kauai	State of Hawaii
12 - 18 years	19.9	13.5	17.6	17.4	18.9
19 - 25 years	15.7	14.8	13.2	13.5	15.3
26 - 32 years	16.7	19.6	10.1	12.4	16.2
33 - 39 years	15.0	12.6	12.2	12.5	14.4
40 - 46 years	14.9	12.2	15.1	15.7	14.7
47 - 53 years	9.5	13.7	12.9	14.5	10.5
54 - 60 years	5.5	6.5	7.2	8.3	5.9
61 - 67 years	2.2	3.8	8.2	3.9	3.0
68 years and over	0.5	3.2	2.5	1.8	1.0
Number of Fishermen	92,500	12,300	10,600	7,000	122,400

TABLE 5. DISTRIBUTION OF RECREATIONAL FISHERMEN AMONG ETHNIC GROUPS
(Oahu Data, 1968 - 1969; Neighbor Island Data, 1970 - 1971.)

Ethnic Group	Percentage Distribution for each County and for the State				
	City & County of Honolulu	County of Hawaii	County of Maui	County of Kauai	State of Hawaii
Chinese	6.6	0.6	3.0	0.8	5.4
Filipino	7.1	10.0	15.5	31.6	9.5
Japanese	37.6	38.1	36.5	27.5	37.0
Caucasian	25.5	17.2	9.9	9.8	22.4
Portuguese	1.7	6.9	5.1	7.4	2.8
Hawaiian	1.6	5.4	6.9	7.5	2.8
Part-Hawaiian	10.4	12.3	15.0	12.3	11.1
Mixed	3.3	7.0	6.7	1.8	3.9
Other	6.3	1.6	1.3	1.3	5.1
Number of Fishermen	92,500	12,300	10,600	7,000	122,400

Fishermen were categorized according to the highest level of education attained (Table 6). The educational composition of the fisherman population ranged from less than eighth grade to college level and above. Most of the fishermen belonged in the category of high school educational level (approximately 46 percent). Also significant was the fact that in all counties, 20 percent of the fishermen had an eighth grade education or less. One-third of the fishermen had completed college or had at least some college education. Very few fishermen reported that they had finished trade or business schools.

TABLE 6. DISTRIBUTION OF RECREATIONAL FISHERMEN BY EDUCATIONAL LEVELS
(Oahu Data, 1968 - 1969; Neighbor Island Data, 1970 - 1971.)

Educational Level	Percentage Distribution for each County and for the State				
	City & County of Honolulu	County of Hawaii	County of Maui	County of Kauai	State of Hawaii
College	15.0	11.1	11.0	8.5	13.9
Some college	21.8	11.3	10.5	7.0	18.8
Trade school	1.0	5.5	3.8	6.7	2.0
Business school	0.4	3.7	0.9	2.0	0.9
High school	46.0	48.5	42.0	46.9	46.0
8th grade or less	15.8	20.0	31.7	28.8	18.4
Number of Fishermen	92,500	12,300	10,600	7,000	122,400

Recreational fishermen throughout the state represent all sectors of their communities; they may be businessmen; federal, state, and local government employees; students; housewives; retired persons; or others (Table 7). Predominant are students and government employees (federal, state, and local), each of these categories representing more than one out of five fishermen in the state.

Fishermen were asked to report their per capita income levels in categories of $2,000 intervals, ranging from $2,000 and less to $18,000 and above (Table 8). Only a very small number of fishermen indicated that they had an income of $18,000 or more. In the case of Honolulu, income ranges were slightly different, $12,000 - $14,999 comprising 3.8 percent

TABLE 7. DISTRIBUTION OF RECREATIONAL FISHERMEN BY EMPLOYMENT CATEGORIES
(Oahu Data, 1968 - 1969; Neighbor Island Data, 1970 - 1971.)

Employment Category	Percentage Distribution for each County and for the State				
	City & County of Honolulu	County of Hawaii	County of Maui	County of Kauai	State of Hawaii
State and county government	8.75	10.55	10.90	10.17	9.2
Federal government	16.57	1.96	2.26	3.63	13.1
Sugar	0.35	8.56	7.06	19.80	2.9
Pineapple	1.02	0	13.22	0.77	2.0
Agriculture	0.05	4.92	1.27	1.72	0.7
Hotel and tourist	0.95	8.21	5.42	8.64	2.5
Construction	7.42	13.82	6.98	4.71	7.9
Retail & wholesale	15.69	5.92	4.18	4.69	13.1
Manufacturing	0.46	0	1.62	1.02	0.5
Finance, insurance, & real estate	2.37	2.62	0.97	0.51	2.2
Transportation & Communication	4.70	2.62	2.57	4.99	4.3
Self-employed	3.83	1.63	2.65	1.55	3.4
Housewife	7.69	11.84	10.32	10.41	8.5
Student	22.93	17.44	22.71	20.63	22.2
Retired	2.38	4.59	6.17	3.64	3.0
Others	4.83	5.25	1.62	3.07	4.5
Number of Fishermen	92,500	12,300	10,600	7,000	122,400

TABLE 8. DISTRIBUTION OF RECREATIONAL FISHERMEN BY INCOME LEVELS
(Oahu Data, 1968 - 1969; Neighbor Island Data, 1970 - 1971.)

Annual per Capita Income ($)	Percentage Distribution for each County and for the State				
	City & County of Honolulu	County of Hawaii	County of Maui	County of Kauai	State of Hawaii
Under 2,000	7.0	26.3	26.5	10.7	10.8
2,000 - 3,999	17.7	20.2	20.8	15.6	18.1
4,000 - 5,999	22.7	13.1	18.3	36.8	22.2
6,000 - 7,999	8.9	15.7	15.9	18.5	10.8
8,000 - 9,999	13.2	10.6	10.1	10.7	12.5
10,000 - 11,999	5.7	7.4	2.9	3.9	5.5
12,000 - 13,999	3.8[a]	3.8	4.1	1.5	
14,000 - 15,999	7.2[b]	1.6	0.3	1.6	9.7
16,000 - up		1.3	1.0	1.8	
No answer	13.7	--	--	--	10.4
Number of Fishermen	92,500	12,300	10,600	7,000	122,400

[a] $12,000 - $14,999

[b] $15,000 - up

while $15,000 and above comprised 7.2 percent. On Oahu 13.7 percent of the respondents refused to give their income. In the case of the neighbor islands, however, the respondents' refusal rate was much lower because of the survey technique used. Very significant differences existed in the income categories between the City and County of Honolulu and the neighbor islands. Income distributions were definitely skewed toward the lower income levels (those below $6,000). The skewness was particularly pronounced for the Counties of Hawaii and Maui, and smaller for the Counties of Honolulu and Kauai. On Oahu, a small but significant number of fishermen had incomes of $15,000 and above; these were probably deep-sea fishermen with relatively high incomes, who lived in Honolulu. At the lower income levels (those below $6,000 per year) as income increased, participation rates also increased. Perhaps the additional income for low-income fishermen allows them to purchase better gear or more bait, or affords them more traveling expenses. At annual income levels above $6,000, however, the situation is reversed: participation rates tend to fall as incomes increase. This suggests that income is an important constraint in the real opportunities to take advantage of other leisure activities that may substitute for fishing.

Numbers and Distribution of Fishing Days

The total number of fishing days for the State of Hawaii is estimated to be in excess of 4.3 million days, two-thirds of which were accounted for by fishermen from the City and County of Honolulu. The rest of the fishing days were distributed, at approximately 10 percent each, among the neighbor islands. For all the counties, most of the fishing days were credited to saltwater fishing (approximately 90 percent), with only 2 percent to freshwater fishing and 7.4 percent to fishermen who fished in unspecified areas (Table 9).

The annual average number of fishing days per fisherman in the state is calculated at 35.8 days. Although the number of freshwater fishermen was highest for the County of Kauai, the average number of fishing days in the County of Maui (23.8 days) exceeded by far those days spent by fishermen in the County of Kauai (13.7 days). This variation may be due to the fact that fishermen on Kauai have easier access to both freshwater and saltwater fishing, whereas fishermen on Maui must travel greater distances between the two fishing areas (Table 10).

Estimates on fishermen days for the various fishing activities in different areas are useful in the public management of recreational fishing. Although attempts were made to derive these estimates both in the telephone and house-to-house surveys, it was difficult to represent accurately the estimates of fishermen days by fishing areas and activities. Some of the major practical problems that were confronted in accomplishing this objective were as follows:

TABLE 9. DISTRIBUTION OF FISHING DAYS BY MAJOR FISHING CATEGORIES
(Oahu Data, 1968 - 1969; Neighbor Island Data, 1970 - 1971.)

Fishing Category	Percentage Distribution for each County and for the State				
	City & County of Honolulu	County of Hawaii	County of Maui	County of Kauai	State of Hawaii
Saltwater fishing	87.6	99.1	97.2	95.2	90.7
Freshwater fishing	2.4	0.2	0.2	1.9	1.9
Unspecified[a]	10.0	0.9	2.6	2.6	7.4
No. of fisherman days	2,961,000 (67.6%)	405,000 (9.3%)	548,000 (12.5%)	462,700 (10.6%)	4,376,700 (100%)

[a]For the City and County of Honolulu only, "unspecified" category includes going to neighbor islands to fish.

TABLE 10. DISTRIBUTION OF AVERAGE DAYS PER FISHERMAN BY MAJOR FISHING CATEGORIES
(Oahu Data, 1968 - 1969; Neighbor Island Data, 1970 - 1971.)

Fishing Category	Percentage Distribution for each County and for the State				
	City & County of Honolulu	County of Hawaii	County of Maui	County of Kauai	State of Hawaii
Average number of fishing days	32.0	32.9	51.7	66.1	35.8
Saltwater fishing	31.5	33.3	53.2	71.3	33.4
Freshwater fishing	25.6	6.3	23.8	13.7	24.8
Unspecified[a]	40.0	27.0	25.9	74.5	38.5

[a]For the City and County of Honolulu only, "unspecified" category includes going to neighbor islands to fish.

- A large number of fishermen participated in multiple activities in various areas at different times and even on the same day. For instance, many fishermen indicated that, while they were surfcasting, they may have also engaged in spinfishing or netting or scuba diving. Other fishermen indicated that they sought out better fishing areas to increase their catch. For statistical purposes, it is extremely difficult to measure accurately fishermen's efforts by a definite unit such as "fishing days", since fishermen in practice may vary their fishing activities in one location or travel from area to area on the same day.

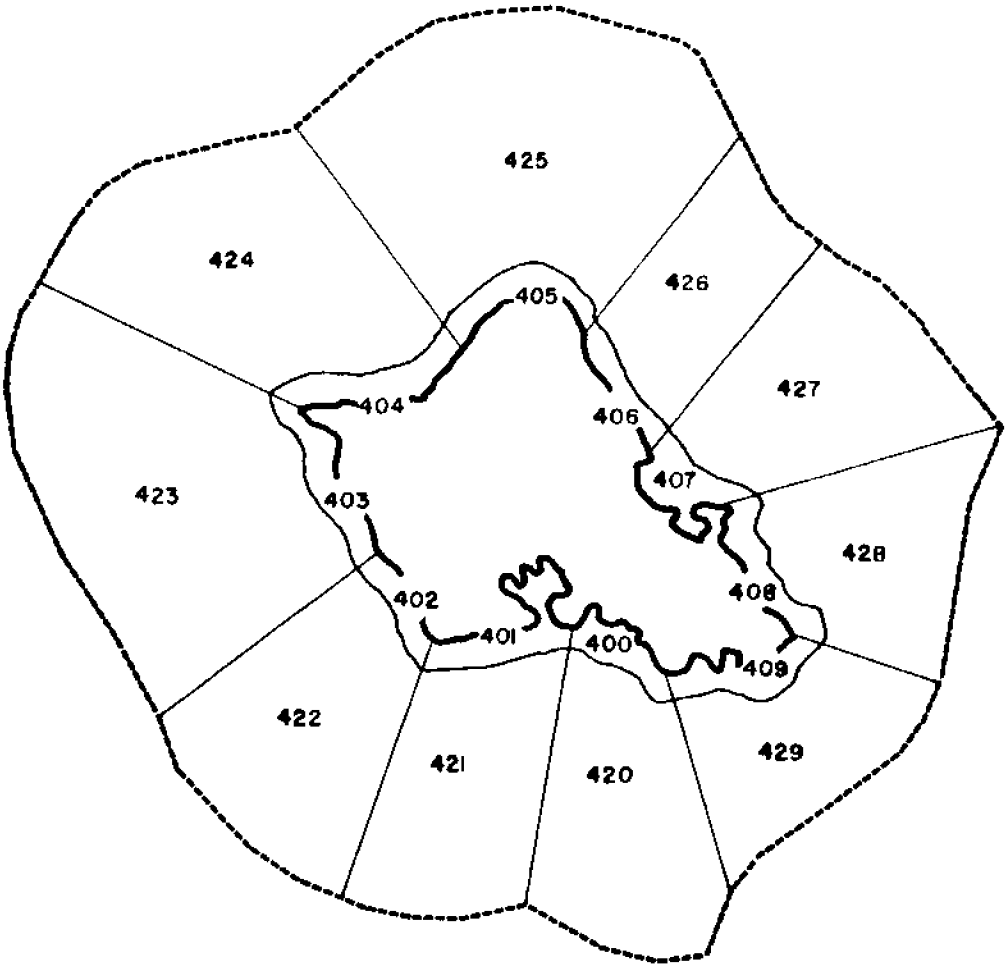
- Fishermen's recall was another problem that arose in accurately estimating fishermen days. Fishermen were able to indicate where they fished most often, but found it difficult to recall with any degree of confidence the number of days they went fishing in that area. Fishermen were able to recall the approximate number of fishing days over a definite but limited span of time. However, they found it more difficult to relate it to specific fishing activities, since many fishermen participated in a wide range of fishing activities.

- Even for fishermen who may have had better recall, some indicated that they were reluctant to point out their favorite fishing areas for fear of revealing their preferences to other fishermen.

These major problems were common to both survey techniques used for this study. Such problems may not apply to on-site surveys that are oriented toward the fishery resources and the fishing practices in the specific areas. Nevertheless, fishermen's preferences can be estimated by tallying the number of fishermen who reported fishing in certain areas.

Preference Ordering of Fishing Areas

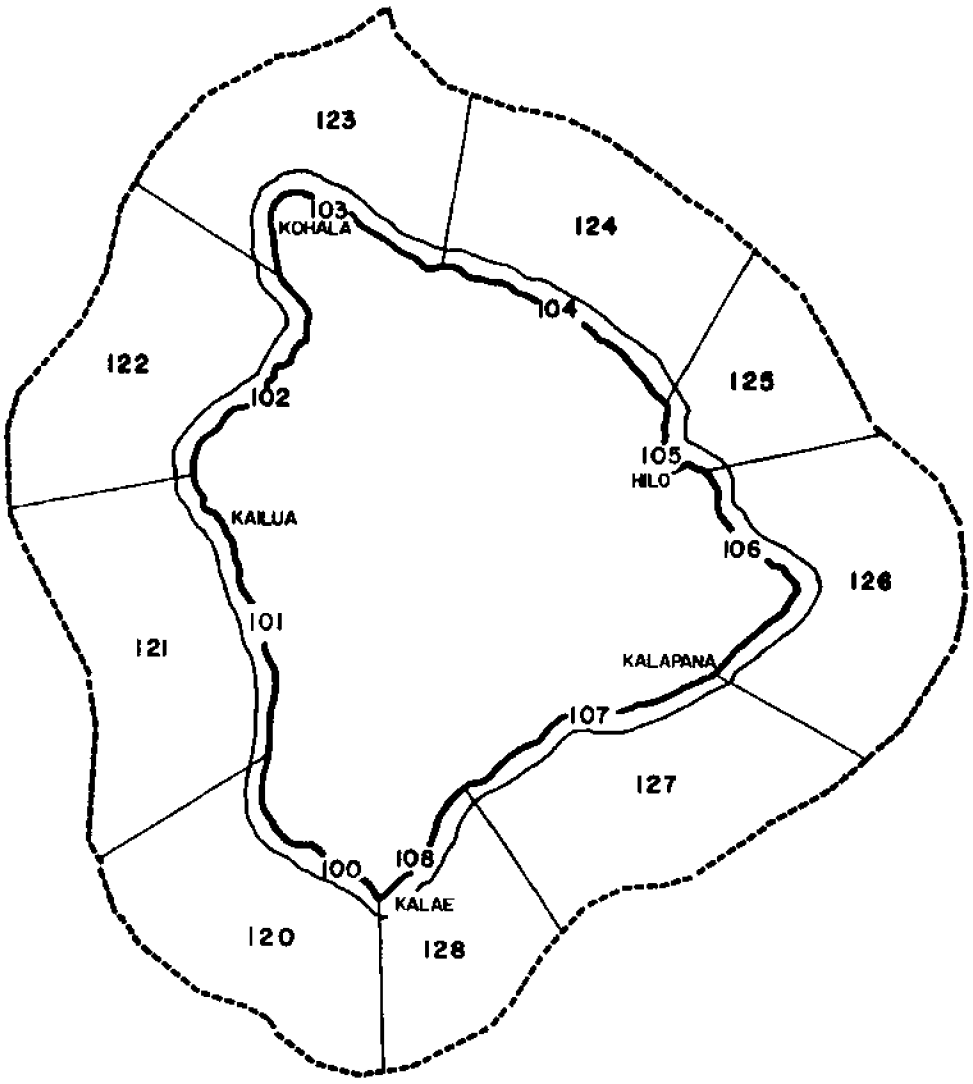
Figures 1 through 4 show the recreational fishing areas by islands, using the fishing area codes of the Hawaii State Department of Land and Natural Resources. For each fishing area, the percentage of fishermen who frequent the area is indicated. These percentages are not weighted by days or trips which might change the preference ordering slightly. For convenience, the area code numbers and the fishing areas they represent, together with the estimated percentages of fishermen, are listed separately.



AREA CODE	INSHORE AREAS	PERCENTAGE OF TOTAL INSHORE FISHERMEN
403	MAILI PT. TO KAENA PT.	14.6
400	DIAMOND HD. TO HONOLULU AIRPORT	13.3
407	KAAAWA PT. TO MOKAPU PEN.	12.3
409	MAKAPUU PT. TO DIAMOND HD.	10.6
408	MOKAPU PEN. TO MAKAPUU PT.	9.7
401	HONOLULU AIRPORT TO BARBERS PT.	9.6
404	KAENA PT. TO PUAMALU	8.6
405	PUAMALU TO LAIE	8.0
406	LAIE TO KAAAWA	7.9
402	BARBERS PT. TO MAILI PT.	5.4
		100.0

AREA CODE	OFFSHORE AREAS	PERCENTAGE OF TOTAL OFFSHORE FISHERMEN
420	DIAMOND HD. TO HONOLULU AIRPORT	22.0
423	MAILI PT. TO KAENA PT.	18.8
427	KAAAWA TO MOKAPU PEN.	18.2
429	MAKAPUU PT. TO DIAMOND HD.	8.7
421	HONOLULU AIRPORT TO BARBERS PT.	8.4
426	LAIE TO KAAAWA	7.0
428	MOKAPU PEN. TO MAKAPUU PT.	6.3
424	KAENA PT. TO PUAMALU	4.9
425	PUAMALU TO LAIE	3.4
422	BARBERS PT. TO MAILI PT.	2.3
		100.0

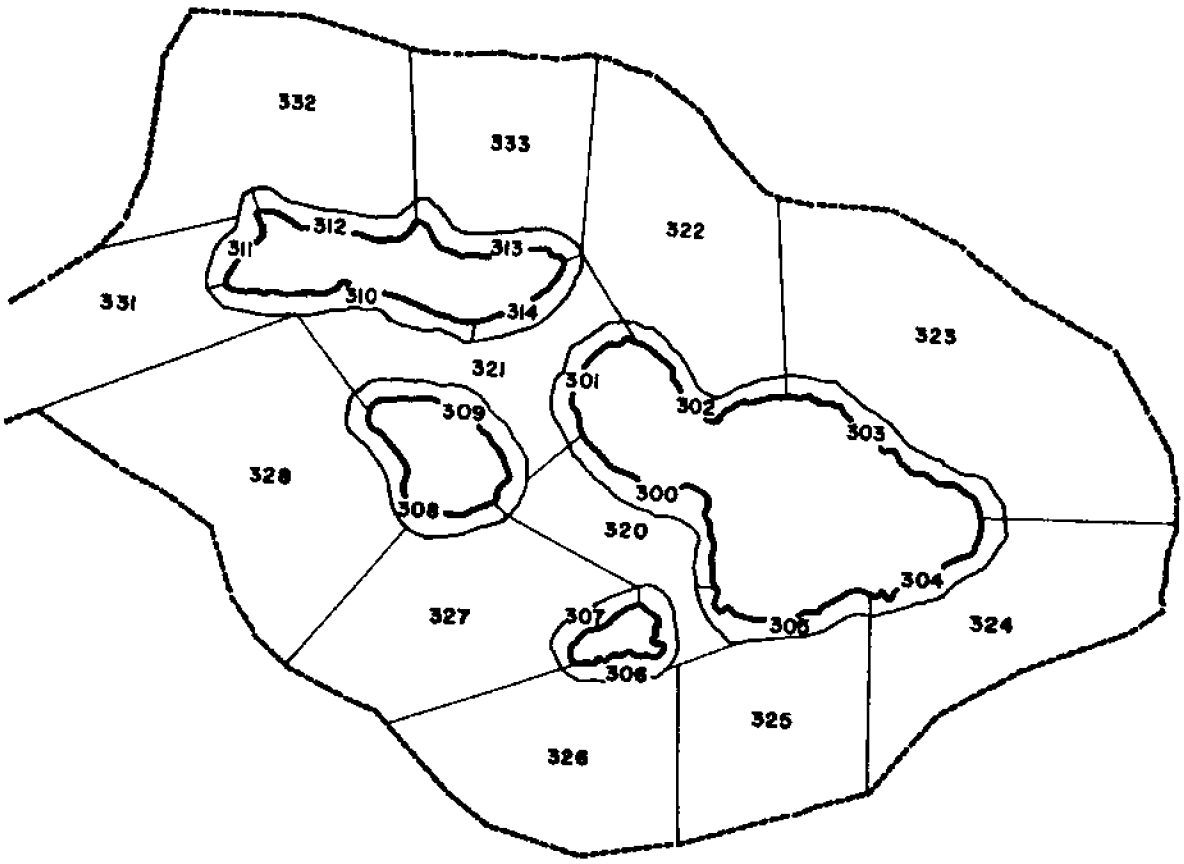
FIGURE 1. ORDER OF SALTWATER FISHING AREA "PREFERENCES" CITY AND COUNTY OF HONOLULU.



INSHORE AREAS		PERCENTAGE OF TOTAL INSHORE FISHERMEN
AREA CODE		
101	HOOPULOA TO KEAHOLE PT.	26.9
105	ALIA PT. TO LELEIWA PT.	20.8
106	LELEIWA PT. TO KALAPANA	12.6
102	KEAHOLE PT. TO MALAEA PT.	12.5
108	PUNALUU TO KALAE	11.9
100	KALAE TO HOOPULA	6.0
103	MALAEA PT. TO KUKUIHALE	4.3
107	KALAPANA TO PUNALUU	2.6
104	KUKUIHALE TO ALIA PT.	2.4
		100.0

OFFSHORE AREAS		PERCENTAGE OF TOTAL OFFSHORE FISHERMEN
AREA CODE		
121	HOOPULOA TO KEAHOLE PT.	47.5
120	KALAE TO HOOPULOA	26.4
125	ALIA PT. TO LELEIWA PT.	9.2
123	MALAEA PT. TO KUKUIHALE	4.3
126	LAEIWA PT. TO KALAPANA	4.3
124	KUKUIHALE TO ALIA PT.	3.4
122	KEAHOLE PT. TO MALAEA PT.	2.8
128	PUNALUU TO KALAE	1.5
127	KALAPANA TO PUNALUU	0.6
		100.0

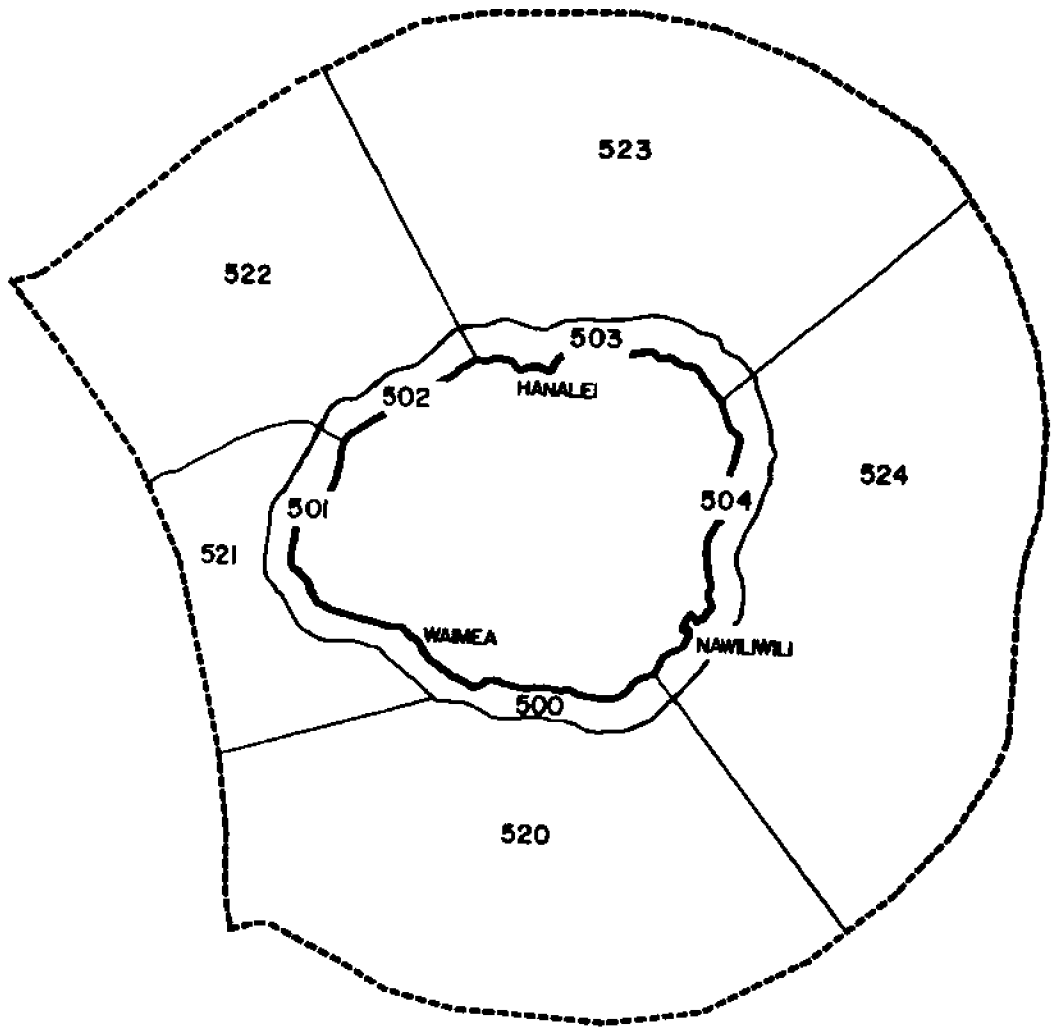
FIGURE 2. ORDER OF SALTWATER FISHING AREA "PREFERENCES" COUNTY OF HAWAII.



AREA CODE	INSHORE AREAS	PERCENTAGE OF TOTAL INSHORE FISHERMEN
300	MAKENA TO PUUNOA PT.	31.6
302	NAKALELE PT. TO PAUMELA	30.8
303	PAUMELA PT. TO HANA	14.3
301	PUUNOA PT. TO NAKALELE	5.0
304	HANA TO APOLE PT.	3.7
312	ILIO PT. TO MAKANALOA	3.6
309	KAENA PT. TO KAMAIKI PT.	2.6
310	KAMALO TO LAAU PT.	2.5
314	CAPE HALAWA TO KAMALO	2.5
306-307	LANAI ISLAND	1.8
308	KAMAIKI PT. TO KAENA PT.	1.2
305	APOLE PT. TO MAKENA	.4
311	LAAU PT. TO ILIO PT.	.0
		100.0

AREA CODE	OFFSHORE AREAS	PERCENTAGE OF TOTAL OFFSHORE FISHERMEN
320	MAKENA TO PUUNOA PT.	47.0
321	PUUNOA PT. TO NAKALELE	21.5
332	ILIO PT. TO MAKANALUA PEN.	7.3
322	NAKALELE PT. TO PAUMELA PT.	7.0
324	HANA TO APOLE PT.	5.0
332	ILIO PT. TO MAKANALUA PEN.	5.0
323	PAUMELA PT. TO HANA	2.4
326	KANA PT. TO KEALAIKAHIKI PT.	2.1
333	MAKANALUA PEN. TO CAPE HALAWA	1.8
327	KEALAIKAHIKI PT. TO CAPE KUIKUI	.9
325	APOLE PT. TO MAKENA	.0
328	CAPE KAEA TO KAENA PT.	.0
		100.0

FIGURE 3. ORDER OF SALTWATER FISHING AREA "PREFERENCES" COUNTY OF MAUI.



INSHORE AREAS		PERCENTAGE OF TOTAL INSHORE FISHERMEN
AREA CODE		
504	MOLOAA TO KAWELIKOA PT.	39.6
501	PUOLO PT. TO MAKAHA PT.	21.5
500	KAWELIKOA PT. TO PUOLO PT.	20.4
503	KAILIU PT. TO MOLOAA	18.1
502	MAKAHA PT. TO KAILIU	0.4
		100.0

OFFSHORE AREAS		PERCENTAGE OF TOTAL OFFSHORE FISHERMEN
AREA CODE		
524	MOLOAA TO KAWELIKOA PT.	43.3
521	PUOLO PT. TO MAKAHA PT.	31.3
523	KAILIU PT. TO MOLOAA	11.2
520	KAWELIKOA PT. TO PUOLO PT.	10.5
522	MAKAHA PT. TO KAILIU	3.7
		100.0

FIGURE 4. ORDER OF SALTWATER FISHING AREA "PREFERENCES" COUNTY OF KAUAI.

ECONOMIC IMPACT OF RECREATIONAL FISHERMEN'S EXPENDITURES

Expenditures by Recreational Fishermen

Recreational fishermen's expenditures for each county are grouped into three major categories which correspond to different phases of a recreational fishing experience. The first category includes land transportation expenses which a fisherman incurs while traveling to and from the fishing area. The second category combines all additional living costs, such as for food, beverages, etc., while the fisherman is en route to or at the fishing area. The third category includes all equipment, and auxiliary and other miscellaneous expenses, necessary for actual fishing. Table 11 presents the overall pattern of aggregate expenditures throughout the state.

The estimated annual expenditures by all recreational fishermen in the state totaled about $16.1 million. As expected, by far the largest part (72 percent) of these expenditures was incurred by fishermen from Honolulu. The distribution by counties was as follows: City and County of Honolulu, $11.6 million; County of Hawaii, $1.8 million; County of Maui, $1.5 million; and County of Kauai, $1.1 million. For each county, these expenditures were further broken down into three major categories: (1) transportation costs; (2) food, beverages, and additional on-site living expenses; and (3) cost of gear and auxiliary equipment necessary for actual fishing. Within these categories, costs varied considerably among counties, reflecting the differences in the complex mixture of recreational fishing activities in each of the counties. On a per-fisherman basis, however, the overall average annual expenditures were somewhat more uniformly distributed: City and County of Honolulu fishermen spent $125 per fisherman; County of Hawaii, $151 per fisherman; County of Maui, $148 per fisherman; and County of Kauai, $157 per fisherman.

TABLE II. FISHING EXPENDITURES BY MAJOR COST CATEGORIES
(in thousands of dollars and in percent)
(Oahu Data, 1968 - 1969; Neighbor Island Data, 1970 - 1971.)

Cost Category	City & County of Honolulu ($1000)	County of Hawaii ($1000)	County of Maui ($1000)	County of Kauai ($1000)	State of Hawaii ($1000)
Transportation	$ 4,340 (37.4%)	$ 769 (41.5%)	$ 777 (49.5%)	$ 333 (30.2%)	$ 6,219 (38.5%)
Additional living Cost	$ 2,033 (17.5%)	$ 635 (34.3%)	$ 341 (21.7%)	$ 447 (40.6%)	$ 3,456 (21.4%)
Equipment	$ 5,238 (45.1%)	$ 447 (24.1%)	$ 451 (28.7%)	$ 322 (29.2%)	$ 6,458 (40.1%)
Total	$11,611	$ 1,851	$ 1,569	$ 1,102	$16,133
No. of Fishermen	92,500	12,300	10,600	7,000	122,400
$ per Fisherman	125	150	148	157	132

Method for Measuring Economic Impact of Recreational Fishing on Hawaii

The economic impact of fishermen's expenditures for recreational fishing is measured in terms of additional income that is generated for a local economy. The initial expenditures in a county in the State of Hawaii will generate still other spendings. One portion will be paid for imports, while another goes to local suppliers of goods and services. These expenditures, in turn, will generate additional expenditures. The final result of the expenditure pattern is the multiplier effect. At each successive round, a gradually smaller amount of the original expenditures is spent outside of the community. Although the input, in terms of recreational fishing expenditures, is spread over a number of rounds, it is not necessary to trace out for each round of spending the additional income that is generated within the local economy.

To estimate the total impact of recreational fishing expenditures on the Hawaiian economy for a given period of time, the local impact multiplier, which is a modification of the more familiar Keynesian income multiplier, was applied. In algebraic terms, the expression may be represented as follows:

$$\text{Total income increase} = A \frac{1}{1 - BC}$$

where A = initial expenditure remaining in local area
B = marginal propensity to spend disposable income locally
C = proportion of expenditures of local people that accrues as local income

Without parameters A and C, the familiar Keynesian multiplier for the macro-economy, $1/(1-B)$ is identified. Factors A and C both adjust for leakages from the economy. Parameter A adjusts for the types of leakages which are specific to the first round of expenditures by recreational fishermen. Subsequent rounds of expenditures are for general consumption and so must be netted out for leakages which are general to all types of consumption expenditures. As additional income accrues in successive spending rounds, the multiplier is adjusted for income leakages due to imports which are invariably imbedded in the goods and services sold locally. Parameter C, the part of local expenditures that remains as local income, accounts for this effect.

While the concept of the local income multiplier is relatively simple, the precise empirical magnitudes of the parameters are difficult to ascertain. Values for these parameters can only be reasonably constructed from secondary published sources. The First National Bank of Hawaii (now called First Hawaiian Bank) published in 1960 a study entitled *The Impact of Exports on Income in Hawaii* (1), giving ratios of created income to total expenditure for various types of Hawaiian household expenditures. From these data, source parameter A was constructed as follows:

$$A = .419t + .489v + .419f$$

where t = total transportation costs
v = total additional living costs
f = total costs for fishing equipment

The cost coefficients represent those parts of the respective expenditures which may be expected to accrue to the local economy. The expenditure categories in the 1960 study were not broken down into fine details to allow identification with the recreational fishing cost categories. Only those items that were most closely associated, in terms of value added locally, were chosen. These included automobile and other transportation for t; food, alcoholic beverages, and tobacco for v; and furnishing and equipment, fuel, lighting, and refrigeration for f.

For subsequent spending rounds, local income may be expected to accrue according to the values assigned to parameters B and C. It is reasonable to expect a fair degree of stability over time for these parameters. For parameter B, the most recent empirical study on the aggregate-consumption function for Hawaii derives a value of 0.77 for long-run marginal propensity to consume (2).

In estimating parameter C, again the 1960 study (2) provides the best available information. In 1960, the weighted average fraction of local income created from 13 categories of household expenditures was calculated at 0.496. Even if household-expenditure patterns and local ratios have shifted within the different spending categories since 1960, in the aggregate the weighted average may still be expected to remain near 0.5.

To derive a numerical value for the multiplier, 0.77 is substituted for parameter B, and 0.5 is substituted for parameter C in the expression $\frac{1}{1 - BC}$.

$$\text{Multiplier} = \frac{1}{1 - (0.77)(0.5)} = 1.63$$

Then the numerical value, 1.63, is multiplied by the estimates of parameter A, namely, $(.419t + .498v + .419f)$, which result in the economic impacts on the state and local economies.

Estimated Economic Impact on the State and Local Economies

Table 12 presents a summary of both recreational fishing expenditures and their estimated economic impact on the state and local economies for the survey period, 1969 and 1971. The total economic impact on the state was estimated at around $11.5 million. Most of this accrued to Honolulu (71.5 percent) with the three neighbor island Counties of Hawaii, Maui, and Kauai accruing about 12 percent, 10 percent, and 7 percent respectively. The percentage distributions of expenditures versus increases in incomes differ slightly among counties, because of the different leakage factors that apply to varying proportions of expenditure categories.

Equipment and transportation costs each contributed approximately two-fifths to the increase in income derived from recreational fishing expenditures, while additional living expenditures were responsible for the remaining one-fifth of the impact. The increase in income due to transportation costs was proportionately higher in the Counties of Hawaii, Maui, and Kauai than in the City and County of Honolulu. Most of the impact in the City and County of Honolulu was derived from equipment costs. However, the economic impact due to transportation costs was also high. The increase in income from equipment expenditures was lowest in the Counties of Hawaii and Kauai. In a similar way, the impact due to additional living costs was lowest in the Counties of Hawaii and Maui and highest for the County of Kauai.

TABLE 12. ECONOMIC IMPACT OF RECREATIONAL FISHING EXPENDITURES ON THE STATE AND LOCAL ECONOMIES
(in thousands of dollars)
(Oahu Data, 1968 - 1969; Neighbor Island Data, 1970 - 1971.)

Cost Category	Fishing Expenditures ($1000)					Increases in Incomes ($1000)				
	City & County of Honolulu	County of Hawaii	County of Maui	County of Kauai	State of Hawaii	City & County of Honolulu	County of Hawaii	County of Maui	County of Kauai	State of Hawaii
Transportation costs (t)	$ 4,340	$ 769	$ 777	$ 333	$ 6,219	$ 2,964	$ 525	$ 530	$ 227	$ 4,247
Additional living costs (v)	2,033	635	341	447	3,456	1,650	515	277	362	2,806
Equipment costs (f)	5,238	447	451	322	6,458	3,577	305	308	220	4,411
Total	$11,611	$ 1,851	$ 1,569	$ 1,102	$16,133	$ 8,191	$ 1,345	$ 1,115	$ 809	$11,464
% of State total	72.0%	11.5%	9.7%	6.5%	100%	71.5%	11.7%	9.7%	7.1%	100%

IMPLICATIONS OF THIS STUDY

A fairly comprehensive picture of the total number of recreational fishermen in the state, their socio-economic characteristics, and the economic impact of their expenditures was estimated for the first time, where no such information had existed previously. As with all aggregate analyses, however, the total and average figures do not reveal all significant aspects of this subsector in the economy, and more detailed analyses of disaggregated data are necessary, especially where homogeneous groupings are possible.

Now that a first approximation of the aggregate picture has been developed, it would appear useful to compare the economic impact of recreational fishing with that of commercial fishing in the state. While no attempt at such a comparison was made in this study, all indications tend to confirm the belief of many, including the members of the 1967 Governor's Marine Resources Advisory Panel, that the recreational fishing sector provides greater benefits to Hawaii than the commercial fishing sector. However, while such a comparison on a more specific basis may be useful for broad policy purposes, the comparison is a much more difficult task than appears on the surface. The economic impact, as estimated in the present study, was determined only from recreational fishermen's expenditures. It excluded investment expenditures by fishing supply stores and other businesses which supply the goods and services purchased by fishermen. Also excluded were government expenditures such as the expenditures of the State Division of Fish and Game in their management of coastal fisheries for recreational purposes.

The study does consider imports of the goods and services necessary to support recreational activities. These are the first and successive-round leakage factors built into the local multiplier formula. The formula excludes expenditures by visitors that involve such activities as charter boat fishing and the Kona International Billfish Tournament. Vague areas still exist as to what actually constitutes recreational fishing versus commercial fishing. Before such a broad comparative assessment can be fruitfully undertaken, a much more definite separation of these two "sectors" is necessary.

This then leads to an important area of concern to the state. At present there is wide consensus that, although many so-called "recreational" fishermen are not licensed to sell their catches in the fish

markets, a substantial amount of these catches nevertheless still finds its way into the local markets. The various dimensions that are involved in this gray area between "recreational" and "commercial" fishing were not addressed in this study; they deserve further exploration.

Even within the recreational fishing sector as adopted for this study (i.e., all unlicensed fishermen), definitional problems still remain. The total recreational fishing experience is a complex bundle of activities, which includes prior planning and subsequent recall of the actual act of fishing. Additional complexities are introduced by the overlapping and joint nature of various types of fishing activities that are carried out in one or more areas during a fishing day or trip and throughout the year. This is true not only for the more prevalent types of activities within the saltwater fishing category, but also across the saltwater and freshwater fishing categories, especially in Kauai County where a high degree of substitutability exists between the two during the course of the year.

Since the gathering of effort-catch statistics* was not within the scope of this study, not much can be said about the fishery resources themselves, except to emphasize a common complaint that was volunteered by many fishermen who were interviewed. Shoreline fishermen, especially, often complained that, on the one hand, there were too few fish in areas where open and free access to the coastline existed and, on the other hand, in areas where fish were more plentiful, closed or limited accessibility prevented participation from reaching the otherwise desired levels. The historic roots of this problem stem, of course, from the basic land-tenure changes under Hawaii's mid-19th century "Mahele" (land reforms) and from the transition in Hawaii's form of government from early monarchy to the present state-hood status. The land-use patterns which developed around these and other important institutional changes over time have placed considerable stretches of coastline frontages under the control and restricted use of the military, large private estates, and agricultural plantations, and also contiguous series of small beach properties under several private owners. This problem has, in recent years, been compounded by the so-called further "taking over" of coastline areas by resort developments and squatter-type settlements. The problem here extends far beyond simple fishery resource management; it involves complex institutional issues of easements, regulations, compensation, etc. These issues constitute another and perhaps the most important area of concern for the public control of recreational fishing.

Essentially all recreational fishing activities in the coastal waters of the state are directed toward the capture of fugitive resources which dwell in or enter into the common jurisdictional waters of the federal and state sovereigns, and thus are subject to potential regulation. Therefore, additional social benefits might be provided by a positive

*Such information can more effectively be developed through on-site creel censuses, fishermen's log-books, etc., which are oriented more to the fishery resources rather than to the human population base of the state.

management program which is both efficient and equitable. In most mainland states and in other parts of the world as well, management usually involves some form of fisherman registration and fee. Except for a brief abortive attempt in 1949, Hawaii has traditionally followed the spirit that fishing is a free benefit for all to enjoy, as expressed in its State Constitution:

> All fisheries in the sea waters of the State not included in any fish pond or artificial inclosure shall be free to the public, subject to vested rights and the right of the State to regulate the same. (8)

At this point, with the new information generated by this study, a strong case can be made for the increased monitoring of certain types of activities. However, the need for a comprehensive registration program for all recreational fishermen is not yet conclusively demonstrated and, furthermore, the likelihood of such a justification appears remote. There is definite evidence that participation in recreational fishing as a whole is distributed in a skewed fashion toward the younger age groups, and that participation of older fishermen is heaviest in the lower income groups. This suggests that a comprehensive registration program for all recreational fishermen will result in a highly inequitable restriction on the total leisure time activities available in the state. Also, it is not yet altogether clear what potential social benefits can be derived from a comprehensive registration program, and -- where such social benefits exist -- whether they would exceed not only the administrative costs, but also whatever social costs may attend the implementation of such a comprehensive registration program. Further refinement of the data generated here, along with additional information which might be developed through more concentrated site- and resource-oriented surveys, could go a long way toward developing the kind of selective registration and variable-fee schedules which would be compatible with an efficient and equitable program of coastal fishery resource conservation. Such efforts are, without a doubt, called for and should be given a high priority at this time.

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4. Project Report Number F-5-R-8, covering survey period July 1, 1959 - June 30, 1960. November 2, 1960. (Unpublished.)

5. Project Report Number F-5-R-9, covering survey period July 1, 1960 - June 30, 1961. October 27, 1961. (Unpublished.)

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8. Hawaii State Constitution, Section 3, Article X. *Sea Fisheries.*