Southwest Fisheries Center Honolulu Laboratory
Manuscript Report File MRF-005-89H

# REPORT ON OAHU SMALL BOAT HARBOR FISHERY POTENTIAL

## -- Heeia Kea and Maunalua Bay --

Samuel G. Pooley
Southwest Fisheries Center Honolulu Laboratory
National Marine Fisheries Service, NOAA
2570 Dole Street
Honolulu, Hawaii 96822-2396



August 1989

Honolulu Laboratory
National Marine Fisheries Service
2570 Dole Street
Honolulu, HI 96822
(808) 943-1221

# Report on Oahu Small Boat Harbor Fishery Potential

## -- Heeia Kea and Maunalua Bay --

March 2, 1988

Prepared by

Sam Pooley

## Introduction

The objective of this report is to estimate the potential economic benefits from expanding mooring and launching facilities at Maunalua Bay (Hawaii Kai) and Heeia Kea (Kaneohe Bay) on Oahu. Benefits must be based on net revenue increments from commercial or subsistence fishing. Benefits from recreational fishing or non-fishing boating experiences are excluded by Corps of Engineers rules.

Heeia Kea is nestled on the edge of Kaneohe Bay, to the west of Kaneohe. The State boating facility contains a two-lane launching ramp, a fuel and off-loading dock, a line of commercial and charter fishing moorages, and two lines of recreational boat moorages. A glass bottom tourist boat also ties up at Heeia Kea. The off-loading area is sufficiently large to accommodate aku (skipjack tuna) sampans. Reports are that competition for the existing commercial fishing moorages is stiff. Access to the open ocean is fairly straightforward but ocean conditions are frequently windy. Heeia Kea is the best access to North shore fishing areas, except for Haleiwa, 35 miles to the west (along a tight, two-lane highway).

This side of Oahu has another State launching ramp, to the east of Kailua (near Lanikai), which is less favorable for fishing boats and at which no additional facilities are available. Kaneohe and Kailua Bays are also sites of numerous private and semi-private launching ramps and slips which accommodate small-sized vessels.

Heeia Kea is on the margin of urban Oahu and "the country", the area along the North shore of Oahu stretching from Kaneohe to Haleiwa, back through agricultural lands to leeward Oahu, and further along the North shore to Waialua and Mokuleia. It is a distinct community although the boating facilities draw from throughout the Kaneohe/Kailua area.

Maunalua Bay at Hawaii Kai, east of Honolulu on the South shore, contains a two-by-one bifurcated State launching ramp with no supplementary facilities. The Bay is used increasingly for recreational and charter activities, such as canoe paddling and jet skis. These launch ramps are the most convenient access points for urban Honolulu between the Kailua launching ramp on the Windward side and the harbors of Honolulu (15 miles through central Honolulu to the west. [The area near the Maunalua Bay ramp is currently being used as an off-loading site for dump trucks removing sludge and debris from the Jan 1, 1988 floods. Although access to the ramp technically is unimpeded, we anticipate that fishing from this ramp will be reduced substantially in 1988. Near-shore fishing will also be hindered by the high silt content of the water and destruction of reef life which were caused by flood run-off.]

Population growth in the vicinity of both Heeia Kea (Kaneohe) and Maunalua Bay (Hawaii Kai) is burgeoning. In both locations, surface transportation is congested during weekday rush hours and over weekends. Residents in both areas have expressed a strong interest in harbor improvements, but the **commercial** scale of these interests has not been clearly identified. However residents are also worried about increased congestion in the neighborhoods and increased competition in the launching and fishing areas.

Both areas attract part-time fishers who sell part of their catch (47% for Oahu as a whole) and distribute much of the rest to family and friends for subsistence purposes (46% for Oahu as a whole). These results come from a key-respondent study undertaken by Meyer (1987) on the economics of non-commercial fishing in Hawaii. Meyer also points out that 58% of the fishing residents on Oahu indicated they fished to have the chance to eat fresh fish, 31% to have a chance to earn extra money, and 12% as part of their culture. Therefore subsistence is an important component of Oahu fishing practices, and it is expressed in the analysis below at the commercial value of the fish landed.

Meyer's study also queried recreational fishing club members as to harbor needs on Oahu: for both Heeia Kea and Hawaii Kai, more or improved launching ramps was a high priority. The need for moorage facilities was not identified by these respondents.

Our characterization of the two proposed Oahu developments for small-scale commercial fishing vessels emphasizes the contradictions of any development scenario: significant constraints exist which may tend to limit the commercial fishing potential of both existing facilities. Improvement in the facilities undoubtedly increase commercial and subsistence fishing opportunities, but in the absence of direct evidence from existing boat owners, only indirect evidence exists to construct these development scenarios.

The statistical information on both sites is limited to two sources: State of Hawaii Division of Aquatic Resources (HDAR) commercial fish landings records and a Corps site survey conducted in 1985. Unfortunately neither source of information really is adequate for a benefit analysis. Therefore the values which are estimated in this report must be viewed as provisional. A better procedure would be to undertake another survey of commercial fishing vessels owners who use these sites. A similar special survey was conducted at Kahului in 1987 and led to a substantial revision of estimated benefits for that project. However, in the case of Heeia Kea and Maunalua, sensitivity analysis of the present results suggests that the existing information would have to be radically revised to increase benefits.

**Current Use**

Although the HDAR data are subject to significant levels of under-reporting, they form the only long-term basis for examining small-boat fishing activity in Hawaii. The HDAR data (Appendix Table 1) show an average of **535** commercial fishing trips from **Heeia Kea** (Port 573) from 1983-86, and **1180** commercial fishing trips from **Maunalua Bay** (Port 501). These data are plotted in Figures 1-3.

The Corps site survey results (Appendix Table 2) were interpreted to estimate commercial and subsistence fishing from **Heeia Kea at 1,855 trips** and from **Maunalua Bay at 1,370 trips** based only on the **sample** responses. The sample included 32 commercial or subsistence fishing vessel owners using Heeia Kea and 29 using Maunalua Bay. (Extrapolation of these results requires assumptions concerning the relationship between the respondents and the entire fishing population which would use these sites. However independent observation of these sites suggests that the sample of respondents may represent those who have the greatest avidity to use these sites, and therefore may well reflect current conditions on a "full-time equivalent" use basis.)

The HDAR data seem to undercount the full landings of commercial fishing trips. Although the reason for this is not known, our work on the Kahului site provides a basis for comparison. There the HDAR data showed an average landing of

109 pounds per trip for 624 trips in 1986. The special survey conducted in mid-1987 showed an average landing of 206 pounds per trip for 1796 trips. This suggests an undercounting of almost 50% on catch rate and 3-fold on trips.

If we view the relationship between the Kahului HDAR data and the special survey data as reflective of conditions on Oahu, then we can make an "adjustment" to the HDAR data for Oahu. This would suggest a **catch rate at Heeia Kea of 302 pounds per trip for 1540 trips** and **a catch rate at Maunalua Bay of 210 pounds per trip for 3400 trips.** The trip results for Heeia Kea are quite consistent with the Corps survey interpretation of trip activity, but the Corps survey found a smaller number of trips for Maunalua. (It is possible that the sample problem is greater for Maunalua which is more likely to draw fishing vessels from all of Honolulu, compared to Heeia Kea which is a more self-contained community. However this is only speculation.)

**Project Benefit Estimation**

HEEIA KEA

We have chosen to combine information from the Kahului special survey with the HDAR and Corps site information for Heeia Kea in order to estimate the benefits WITH the proposed project. The Kahului survey provides information on the cost profile of participant fishing vessels. The proportionalities of the Kahului survey data to the HDAR data for Kahului are applied to Heeia Kea. Finally, the Corps site information is used to calculate trips per vessel from Heeia Kea.

Table 1: WITHOUT Project Fishing Conditions

| | | | | | | |
|---|---|---|---|---|---|---|
| Heeia Kea: | HDAR trips | 535 | X | 2.15 | = | 1150 trips |
| | CPT | 160 | X | 1.55 | = | 249 pounds/trip |

where **2.15** is the ratio of Kahului special survey number of trips to HDAR Kahului trips in 1986 (1302/606),

and where **1.55** is the ratio of the Kahului special survey catch rate to the HDAR catch rate for Kahului in 1986 (143/92).

The Corps site survey showed 1855 trips from Heeia Kea from 32 commercial and subsistence fishing boat owners, or **58 trips per year** for each vessel from Heeia Kea. This is more trips than even the expanded HDAR figure given above (1150). However the ratio of the two might be viewed as the percentage

of total trips that is purely commercial (62%) while the remainder may be considered subsistence trips.

In the Kahului project we found an average of 68 commercial and subsistence fishing trips per year WITHOUT the project, and we will use the Maui activity levels as representative of Oahu where relatively similar conditions pertain. Oahu-wide catch rates will be assumed to be equal to those at Heeia Kea for Heeia Kea vessels. (Island-wide activity and catch rates are required in order to pro rate the fixed costs of owning a fishing boat.)

Table 2: WITHOUT Project Economic Condition (per vessel)

Heeia Kea Trips = 58/vessel (Corps site survey)

Total trips (including other Oahu sites) for Heeia Kea vessels = 68/year

CPT = 249 pounds @ $1.54

Net Revenue = $4,601
Labor Income 4,872

Total Income $9,473

[Revenue and income from Figure 4.]

These data show that a typical small fishing boat operating out of Heeia Kea, Oahu could gross $26,075 per year in actual or subsistence fishing revenue. However, given the cost of fishing, net revenue (after costs) is only $4,601 and labor income is only $4,872. The activity level is such (68 trips per year) that alternative sources of income are likely.

Figure 4 presents the cost and revenue information. Economic projections **were not** adjusted for "full-time equivalents" as was done in the Kahului project. However the increments in income remain valid.

WITH Project Condition

We then assume that WITH a project, trips from Heeia Kea would increase to the level of those at Haleiwa, which has greater capacity. However we must also assume that catch rates would decline to the Haleiwa level representing the resource dependent impact of increased fishing on the "resident" Heeia Kea fish population.

Table 3: WITH project fishing condition

Total trips from Heeia Kea: 2.98 X 1150 = 3427

where 2.98 = (1596 Haleiwa / 535 Heeia Kea HDAR trips), and 1150 is the estimated number of current trips at Heeia Kea.

CPT declines by 14% : 214 pounds

where 14% = [ 1- (138 CPT Haleiwa/160 CPT Heeia Kea)]

WITH the project: Trips = 93/Vessel
(83 from Heeia Kea)

CPT = 214 pounds

Trips per vessel are expected to increase because of the responses to the Corps site survey and the current "congestion" at Heeia Kea. However, we have expanded the number of trips by only half the level suggested by the Corps site survey, because some trips would be taken away from other sites. This information is incorporated into our cost-earnings simulator.

Table 4: WITH Project economic condition (per vessel)

Net revenue = $4,822
Labor income 5,730

Total income 10,552

Net benefit per vessel:

Net revenue basis: $ 747
Total income basis 1059

[Figure 5.]

Although the increase in number of trips per vessel at Heeia Kea is substantial (43%) and the decline in catch rate is rather modest using these assumptions (14%), the per trip net revenue ($57.50) and labor income ($55.75) for these vessels is quite low. As a result, increments in trips does not produce a high net benefit level. If the vessels were able to increase their catch rates substantially WITH the project (as suggested with the Kahului project) or were able to increase the value of their catch, then higher benefits would be expected. Unfortunately too little information currently

exists for Heeia Kea on which to estimate such benefits. Figure 6 estimates WITH project economic conditions with a higher catch rate: net revenue is $5,923 and total income is $13,038.

**Total Project Benefits**

Net benefits WITH the project at **Heeia Kea** are calculated on **41 commercial and subsistence fishing vessels**, based on the total number of trips expected from the site.

Table 5: Total benefit WITH project

| | WITH | | WITHOUT | | NET |
|---|---|---|---|---|---|
| Gross revenue per vessel: | $30,649 | - | 26,075 | = | $4,574 |
| Net revenue per vessel: | $5,348 | - | 4,601 | = | $ 747 |
| Total income per vessel: | $10,532 | - | 9,473 | = | $1,059 |

Heeia Kea fleet benefits:

Net revenue: 41V X $ 747 = $ 30,627 per year

Total income: 41V X $1,059 = $43,419 per year

3427 trips/83 per vessel = 41 vessels
[Table 3]

As anticipated by the per trip calculations, the total estimated net benefit WITH the project using the available information is quite small. Alternative estimations could be used to indicate an upward range to possible benefits. For example, benefits from improvements in Kahului harbor, which is situated somewhat similarly to Heeia Kea, were estimated at $150,000 to $262,000 per year. We would judge the Kahului benefits to represent an upper bound on possible benefits from improvements at Heeia Kea. Using the sensitivity results from Figure 6, estimated project benefits are $54,202 on a net revenue basis and $146,165 on a total income basis.

The Corps site survey used a contingent valuation method for estimating the perceived value of harbor improvements at Heeia Kea. Utilizing only the "willingness to pay" for berthing figures for the commercial and subsistence fishing vessel owners provides an estimated benefit for 41 vessels of **$8,774 per year** (Appendix Table 2).

Another possibility is that the use level of Heeia Kea might increase even more than indicated in the Corps site survey with an improved launching ramp or with expanded moorage facilities. In other words, the number of vessels using the facility might increase dramatically. However, in this case the "carrying capacity" of the off-shore fishery resources on north Oahu would have to be considered. Even if one only considers pelagic species there would be a reduction in density with more fishing. This was taken into account partially by the reduction in catch rate from the current Heeia Kea level to the Haleiwa level.

However, if the number of trips were even greater, then an estimation of resource dependency would have to be made. Using the area of fishing information from HDAR landings reports suggests that for each additional 215 trips, catch per trip declines by 11.5 pounds. (See Appendix Table 3 and Figure 7). This effect is quite dramatic. If applied to the WITHOUT and WITH project condition, the resource density effect would have decreased catch rates at Heeia Kea **in half.** Benefit per vessel would be substantially reduced, and so would project benefits.

MAUNALUA BAY

The Corps site survey at Maunalua Bay did not provide sufficient evidence for increased commercial or subsistence fishing trips at this site (Appendix Table 2). The survey showed that trips per vessel would increase about 12%, but part of this increase might be a shift from other locations. The average vessel took 47 trips per year from Maunalua Bay, but these could not be classified as entirely commercial and subsistence fishing trips.

Therefore the benefits for Maunalua Bay must be based on the the contingent valuation approach. The Corps site survey found 28 commercial or subsistence fishing vessel owners at Maunalua Bay. Their "willingness to pay" for project improvements was $431 a year per vessel. With an adjusted HDAR activity level of 3400 trips per year from Maunalua Bay, we estimate 72 commercial or subsistence fishing vessels actually use Maunalua Bay today. Therefore total project benefits for Maunalua would be **$31,032 per year**, with 83% ($9,972/$12,072) being related to the proposed moorage ($25,757). These results appear to be consistent with the Heeia Kea commercial fishing benefit estimates.

There are three important qualifications to the Maunalua results. First, the information on which to base a WITH and WITHOUT project comparison is quite weak, especially since presently there are no mooring facilities at Maunalua upon which to base a comparison. Second, Maunalua is convenient to Hawaii's most popular small boat fishing grounds, Penguin

Banks between Oahu, Molokai and Maui. Therefore it is quite possible that there would be considerable interest in a full-fledged small boat harbor in Maunalua, with some vessels shifting from other sites. However, third, it is also important to realize that the Penguin Banks area is probably fished to or beyond its capacity (Cf. Ralston and Kawamoto, 1987).

**Conclusion**

Although there are many reasons why it would be legitimate to support the development of fishing facilities for small boats on Oahu, it is extremely difficult to do so on a commercial fishing operations basis. This dilemma is a significant one for Oahu fishing boat owners, and is reflective of a general problem of ocean use on Oahu. Unfortunately this conclusion is little help to commercial and subsistence fishers on Oahu.

-0-

## References

Meyer Resources Inc. 1987.
A report on resident fishing in the Hawaiian Islands. Southwest Fisheries Center Administrative Report H-87-8C.

Ralston, Stephen and Kurt E. Kawamoto. 1987.
An assessment and description of the status of bottom fish stocks in Hawaii. Southwest Fisheries Center Administrative Report H-87-7.

## Acknowledgment

A.C. Todoki and J.J. Czyz provided the computer summaries of the HDAR data used in this report.

Appendix Table 1: Oahu port data, 1983-86
(Excluding Aku boats and longliners)

HEEIA KEA (573) 1983-86

| | 1983 | 1984 | 1985 | 1986 | AVERAGE |
|---|---|---|---|---|---|
| TRIPS | 528 | 616 | 517 | 478 | 535 |
| CATCH | 90355 | 83029 | 82763 | 83398 | 84886 |
| CPT | 171.13 | 134.79 | 160.08 | 174.47 | 160.12 |

MAUNALUA BAY (501) 1983-86

| | 1983 | 1984 | 1985 | 1986 | AVERAGE |
|---|---|---|---|---|---|
| TRIPS | 1378 | 1292 | 1013 | 1038 | 1180 |
| CATCH | 177495 | 138256 | 105612 | 111284 | 133162 |
| CPT | 128.81 | 107.01 | 104.26 | 107.21 | 111.82 |

HALEIWA (542) 1983-86

| | 1983 | 1984 | 1985 | 1986 | AVERAGE |
|---|---|---|---|---|---|
| TRIPS | 1443 | 1720 | 1583 | 1639 | 1596 |
| CATCH | 160426 | 240945 | 207871 | 277187 | 221607 |
| CPT | 111.1753 | 140.0843 | 131.3146 | 169.1196 | 137.92 |

WAIANAE (532) 1983-86

| | 1983 | 1984 | 1985 | 1986 | AVERAGE |
|---|---|---|---|---|---|
| TRIPS | 3170 | 3203 | 3230 | 3682 | 3321 |
| CATCH | 382907 | 331806 | 369646 | 429566 | 378481 |
| CPT | 120.7909 | 103.5923 | 114.4415 | 116.6665 | 113.87 |

Data: Hawaii Division of Aquatic Resources

File: H8386P
OAHU3.PRN

Appendix Table 2: Corps Oahu site survey results (Strata 1)

Heeia Kea

For vessel owners indicating commercial or subsistence fishing (USEMOST ? = 1, 4): 32 vessels

DAYS USE PER YEAR: 1855 58 days/vessel

WITH A PROJECT:

1710 DAYS FOR MOORAGES, 1765 FOR RAMPS = 3475 DAYS

(108 days/vessel)

Willingness to Pay:

Prefer Moorage: $1800

Prefer Ramp: $2920

Total: $4720 for 22 vessels

($214 per vessel)

Total Project Benefit: 41 X 214 = $8,774

--continued--

Appendix Table 2: Continued

Corps Oahu site survey results (Strata 1)

Maunalua Bay

For vessel owners indicating commercial or subsistence fishing (USEMOST ? = 1, 4): 29 vessels

DAYS USE PER YEAR: 1370 47 days/vessel

WITH A PROJECT:

156 DAYS FOR MOORAGES, 1320 FOR RAMPS = 1476 DAYS

( 53 days/vessel) (N = 28)

Willingness to Pay:

Prefer Moorage: $9972

Prefer Ramp: $2100

Total: $12,072 for 28 vessels

($431 per vessel)

Total Project Benefit: 72 X 431 = $31,032

## Appendix Table 3: North Oahu Fishing Areas, 1977-86
## Trolling Gear (6)

Trips

| HDAR Fishing Area | 1977 | 1978 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | Average |
|---|---|---|---|---|---|---|---|---|---|
| 425 | 141 | 137 | 301 | 430 | 552 | 637 | 825 | 503 | 441 |
| 426 | 128 | 121 | 343 | 374 | 447 | 471 | 787 | 532 | 400 |
| 427 | 326 | 313 | 789 | 667 | 663 | 829 | 1812 | 902 | 788 |
| 428 | 114 | 75 | 236 | 197 | 361 | 410 | 486 | 311 | 274 |
| Average | 177.25 | 161.5 | 417.25 | 417 | 505.75 | 586.75 | 977.5 | 562 | 476 |

Pounds Caught

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 425 | 23,197 | 26,273 | 38,961 | 67,885 | 81,859 | 106,799 | 86,641 | 125,607 | 69,653 |
| 426 | 25,938 | 21,881 | 45,036 | 43,625 | 48,104 | 42,260 | 44,843 | 74,375 | 43,258 |
| 427 | 50,026 | 71,744 | 85,187 | 76,397 | 76,582 | 76,979 | 121,961 | 116,248 | 84,391 |
| 428 | 16,804 | 12,630 | 16,355 | 17,938 | 40,294 | 35,160 | 23,453 | 35,065 | 24,712 |
| Average | 28,991 | 33,132 | 46,385 | 51,461 | 61,710 | 65,300 | 69,225 | 87,824 | 55,503 |

Catch per trip

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 425 | 164.52 | 191.77 | 129.44 | 157.87 | 148.30 | 167.66 | 105.02 | 249.72 | 164 |
| 426 | 202.64 | 180.83 | 131.30 | 116.64 | 107.62 | 89.72 | 56.98 | 139.80 | 128 |
| 427 | 153.45 | 229.21 | 107.97 | 114.54 | 115.51 | 92.86 | 67.31 | 128.88 | 126 |
| 428 | 147.40 | 168.40 | 69.30 | 91.06 | 111.62 | 85.76 | 48.26 | 112.75 | 104 |
| Average | 167.00 | 192.56 | 109.50 | 120.03 | 120.76 | 109.00 | 69.39 | 157.79 | 130.75 |

Data for 1979-80 not available

Data: Hawaii Division of Aquatic Resources (HDAR) commercial landings records

File: H7786G.CAL
Oahu2.prn

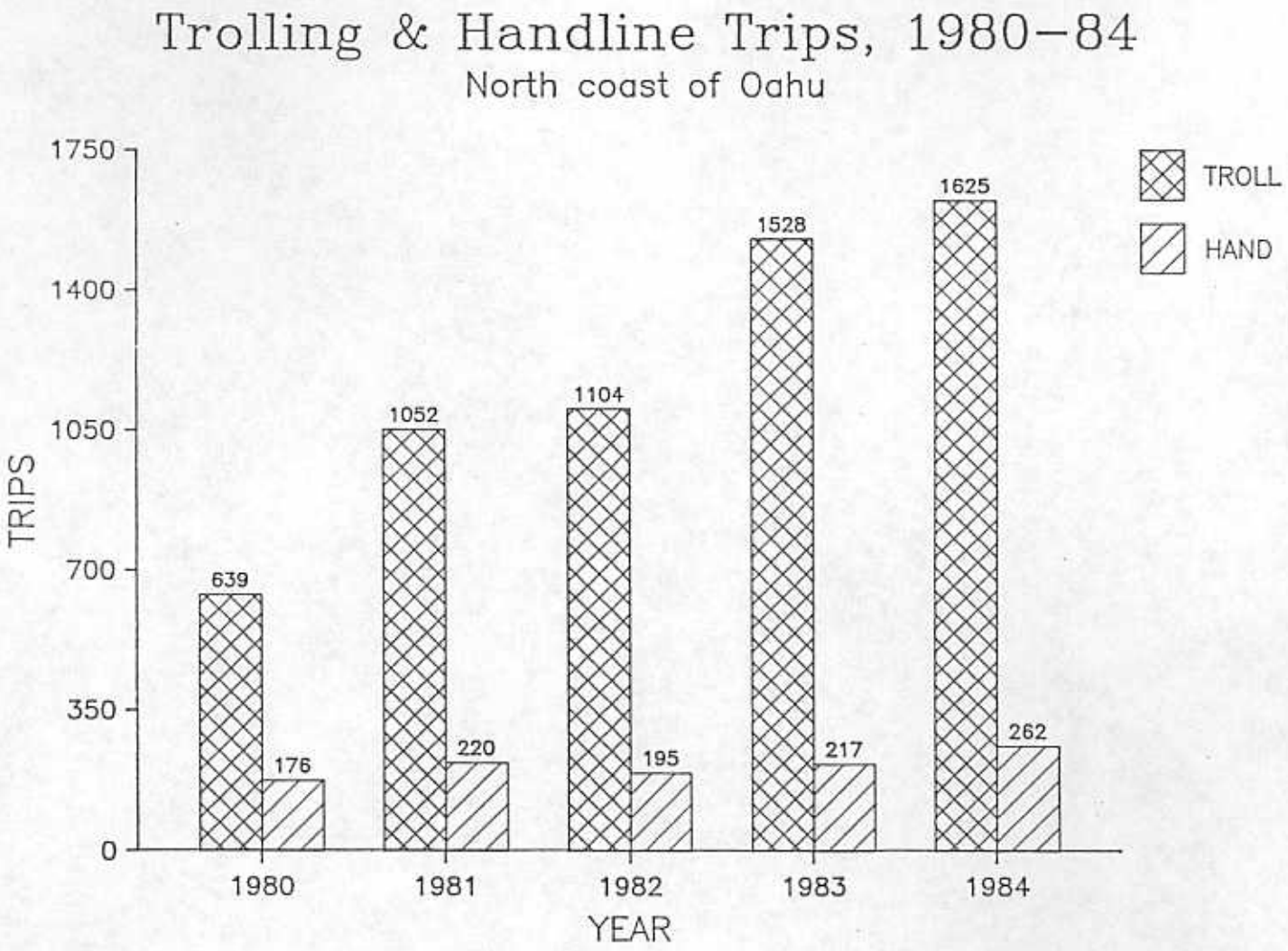


Figure 1: Trips from Oahu small-boat ports
(Excluding Aku boats and longliners)

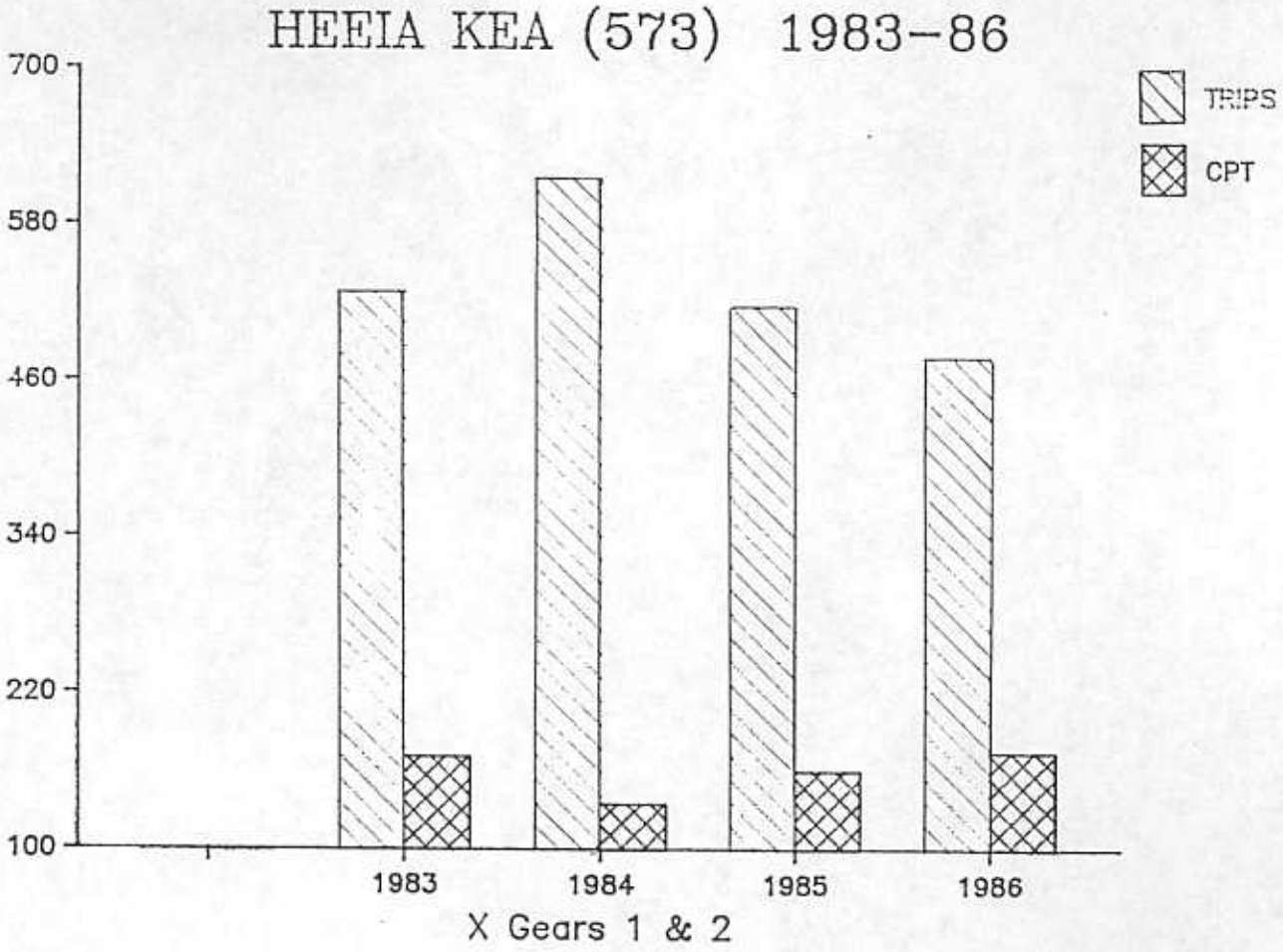


Figure 2: Trips and Catch per trip from Heeia Kea, 1983-86

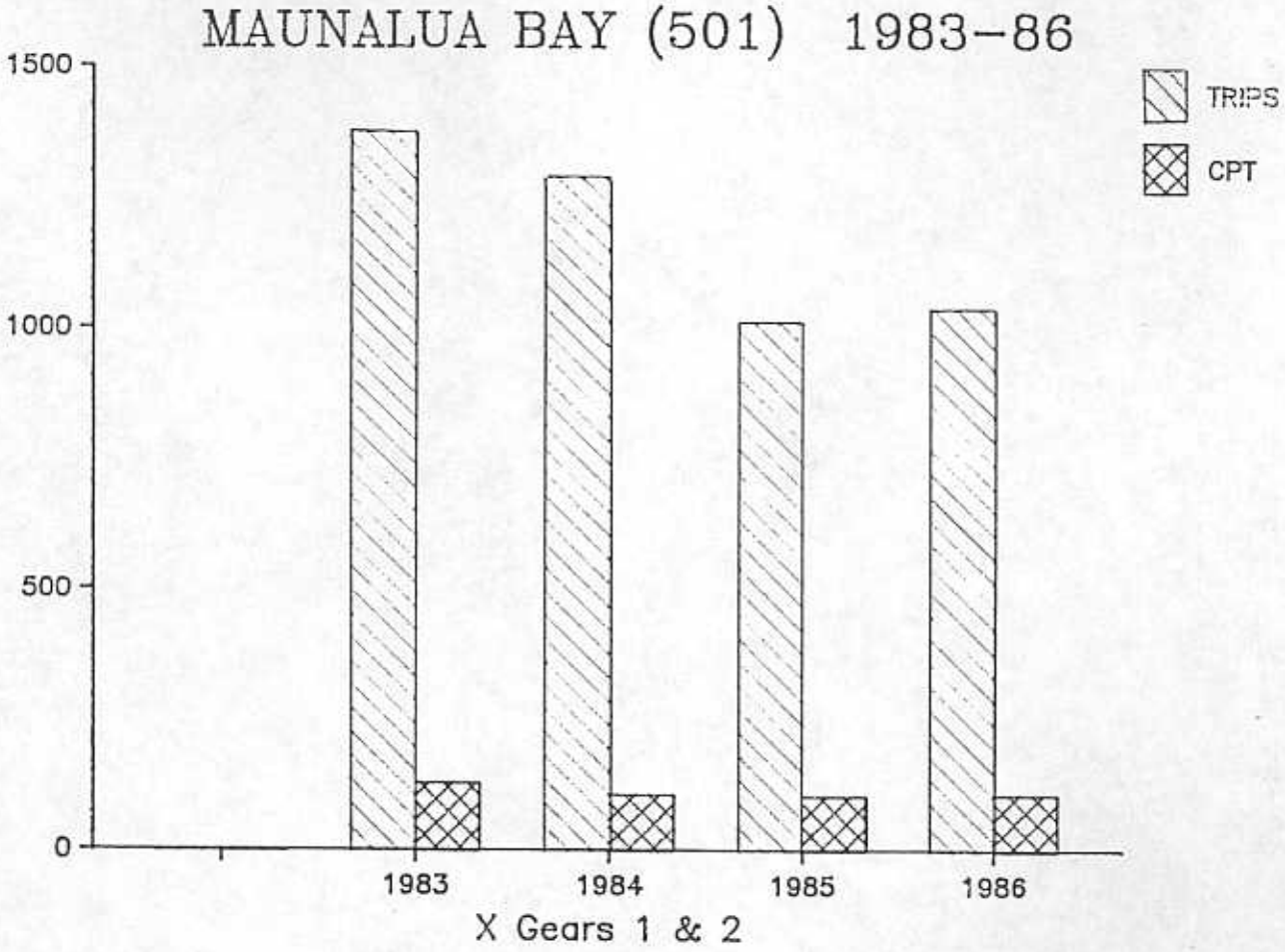


Figure 3: Trips and Catch per trip from Maunalua Bay, 1983-86

Figure 4: Heeia Kea vessel operating condition

Combined estimate of operating characteristics

1987

| Income Statement | Full-time operation<br>Hypothetical cost and revenue data | |
|---|---|---|
| Revenue ..... | | $26,075 |
| Fixed Costs ..... | | $7,041 |
| Capital Cost & Recovery | $3,062 | |
| Annual Repair | $2,755 | |
| Vessel Insurance | $507 | |
| Other | $717 | |
| Operating Costs ..... | | $14,432 |
| Fuel & Oil | $3,713 | |
| Ice | $1,013 | |
| Bait | $1,754 | |
| Handling | $333 | |
| Supplies | $945 | |
| Gear | $1,394 | |
| Other | $408 | |
| Crew Share | $4,872 | |
| Total Cost ..... | | $21,474 |
| Net Revenue ..... | | $4,601 |
| Operating Parameters | | |
| Investment | $31,233 | |
| Trips | 68 | |
| Catch per trip | 249 | 16,932 |
| Crew share | 29.50% | |
| Crew | 1 | |
| Shared Costs | $9,561 | |
| Product Price per pound | $1.54 | |

File Name HEEIA12 12/11/1987

Figure 5: WITH Project condition, Heeia Kea

Combined estimate of operating characteristics

1987

| Income Statement | Full-time operation Hypothetical cost and revenue data | |
|---|---|---|
| Revenue | | $30,649 |
| Fixed Costs | | $7,041 |
| Capital Cost & Recovery | $3,062 | |
| Annual Repair | $2,755 | |
| Vessel Insurance | $507 | |
| Other | $717 | |
| Operating Costs | | $18,260 |
| Fuel & Oil | $5,078 | |
| Ice | $1,386 | |
| Bait | $2,399 | |
| Handling | $456 | |
| Supplies | $1,293 | |
| Gear | $1,907 | |
| Other | $558 | |
| Crew Share | $5,184 | |
| Total Cost | | $25,301 |
| Net Revenue | | $5,348 |
| Operating Parameters | | |
| Investment | $31,233 | |
| Trips | 93 | |
| Catch per trip | 214 | 19,902 |
| Crew share | 29.50% | |
| Crew | 1 | |
| Shared Costs | $13,076 | |
| Product Price per pound | $1.54 | |

Figure 6: Sensitivity test, Heeia Kea WITH project condition

Combined estimate of operating characteristics
1987

| Income Statement | Full-time operation<br>Hypothetical cost and revenue data | |
|---|---|---|
| Revenue ..... | | $33,155 |
| Fixed Costs ..... | | $7,041 |
| Capital Cost & Recovery | $3,062 | |
| Annual Repair | $2,755 | |
| Vessel Insurance | $507 | |
| Other | $717 | |
| Operating Costs ..... | | $18,999 |
| Fuel & Oil | $5,078 | |
| Ice | $1,386 | |
| Bait | $2,399 | |
| Handling | $456 | |
| Supplies | $1,293 | |
| Gear | $1,907 | |
| Other | $558 | |
| Crew Share | $5,923 | |
| Total Cost ..... | | $26,040 |
| Net Revenue ..... | | $7,115 |
| Operating Parameters | | |
| Investment | $31,233 | |
| Trips | 93 | |
| Catch per trip | 232 | 21,530 |
| Crew share | 29.50% | |
| Crew | 1 | |
| Shared Costs | $13,076 | |
| Product Price per pound | $1.54 | |

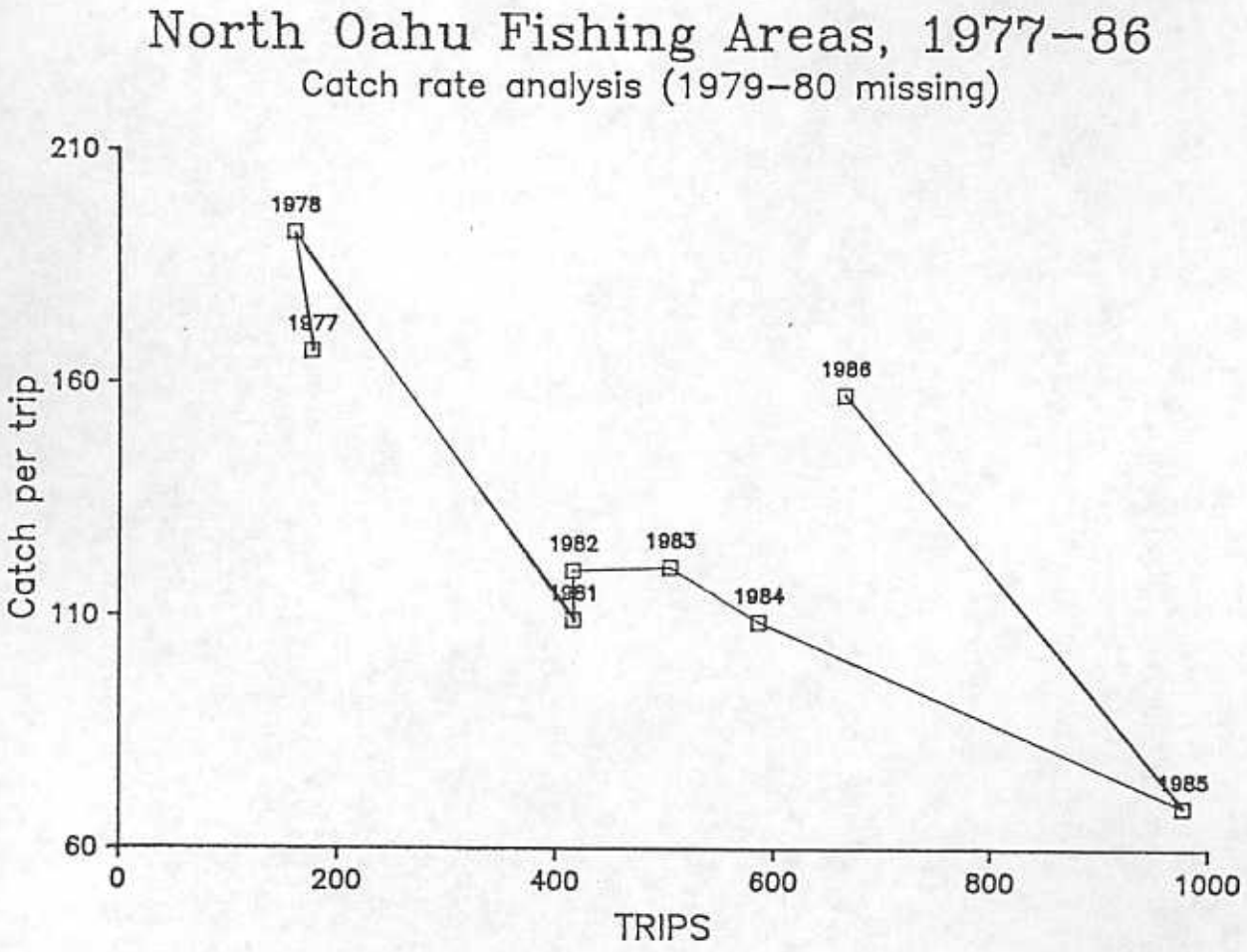


Figure 7: Catch rate analysis, north Oahu fishing areas, 1977-86