

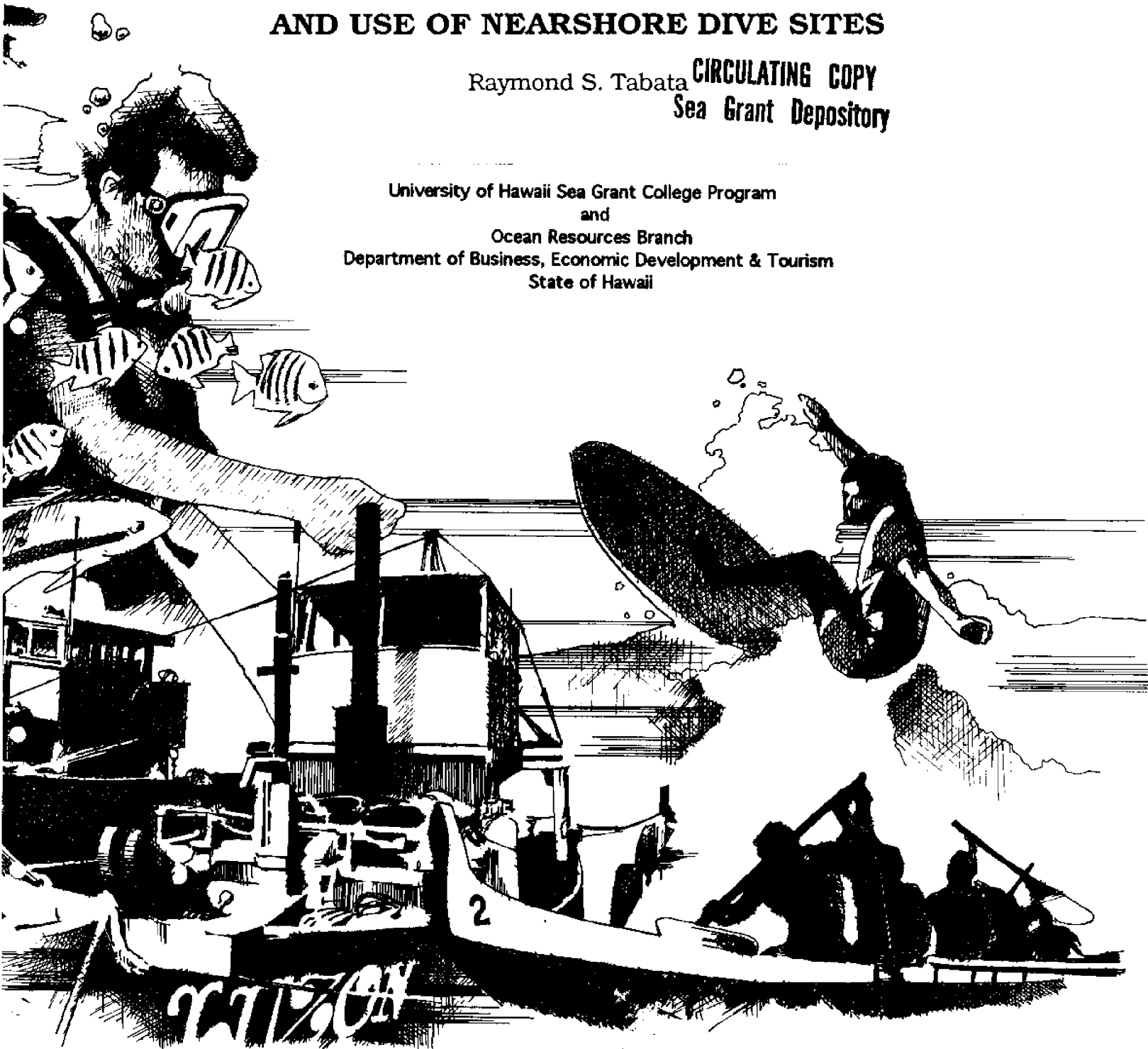
Studies on Marine Economics

LOAN COPY ONLY

HAWAII'S RECREATIONAL DIVE INDUSTRY AND USE OF NEARSHORE DIVE SITES

Raymond S. Tabata **CIRCULATING COPY**
Sea Grant Depository

University of Hawaii Sea Grant College Program
and
Ocean Resources Branch
Department of Business, Economic Development & Tourism
State of Hawaii



LOAN COPY ONLY

**HAWAII'S RECREATIONAL
DIVE INDUSTRY
AND USE OF NEARSHORE DIVE SITES**

Raymond S. Tabata **CIRCULATING COPY**
Sea Grant Depository

Sea Grant Marine Economics Report

July 1992

UNIHI-SEAGRANT-ME-92-02
UH Sea Grant College Program
Honolulu, Hawaii

Contribution No. 98
Ocean Resources Branch
Department of Business, Economic Development & Tourism
State of Hawaii



This work is the result of Sea Grant Extension Service (A/AS-1) sponsored in part by the University of Hawaii Sea Grant College Program under Institutional Grant No. NA89AA-D-SG063 from NOAA Office of Sea Grant, Department of Commerce; and by the Ocean Resources Branch, Hawaii Department of Business, Economic Development & Tourism. The U.S. Government is authorized to produce and distribute reprints for governmental purposes notwithstanding any copyright notation that may appear hereon.

This report has been cataloged as follows:

Tabata, Raymond S.

Hawaii's recreational dive industry and use of nearshore dive sites. Partially sponsored by the Ocean Resources Branch, Dept. of Business, Economic Development & Tourism, State of Hawaii. Honolulu: Sea Grant College Program, University of Hawaii at Manoa, July 1992

54 p.

Sea Grant Marine Economics Report UNIH-SEAGRANT-ME-92-02; Ocean Resources Branch Contribution No. 98

1. Scuba diving - Hawaii - Economic aspects. 2. Aquatic sports - Hawaii - Economic aspects.

GC1021.H3U4.No. 92-2

PREFACE AND ACKNOWLEDGMENTS

Except for the introduction chapter which was updated for this publication, the remainder has been adapted from an M.A. thesis submitted in May 1989 to the Graduate Division of the University of Hawaii in partial fulfillment of the requirements for the degree of Master of Arts in Geography. I thank Dr. Joseph Morgan who chaired the thesis committee and Dr. Nancy Lewis and Dr. Juanita Liu for serving on this committee.

I am grateful to Mr. Grant Murakami who worked as an extension assistant in the Sea Grant Extension Service; Grant set up the database for the survey, handled data input and tabulation, and assisted with interviews. Special thanks to Mr. Alan Hoof of the Geography Department for producing the four dive site maps. Mahalo to Ms. Barbara Brundage, executive director of Dive Hawai'i (formerly Destination Hawaii), Ms. Tina Clothier, Ms. Lisa Choquette of Dive Makai, Ms. Jane Cambouris and Mr. Terry O'Halloran of The Ocean Recreation Council of Hawai'i (TORCH), for their valuable assistance with questionnaire design, survey pre-testing, dive site identification, and background on the dive industry. Thanks also to the 47 dive operators who cooperated with the study in 1987 and who patiently met with the interviewers and provided valuable information and insights. Finally, thanks to Dr. Jan Auyong, now with the NCRI for her helpful advice on survey and questionnaire design.

The original thesis and report resulted from a study sponsored by the "Sea Grant Extension Service" project (A/AS-1), which is funded by the University of Hawai'i Sea Grant College Program under Institutional Grant No. NA 85AA-D-SG082 from NOAA Office of Sea Grant, Department of Commerce.

<i>list of tables</i>	v
<i>list of figures</i>	vii

CONTENTS

INTRODUCTION	CHAPTER I
OBJECTIVES	1
SIGNIFICANCE OF DIVE TRAVEL	1
WHO'S THE DIVE TRAVELER, SOME DEMOGRAPHICS	2
RESEARCH QUESTIONS	4
HYPOTHESES	4
LITERATURE REVIEW	4
Environmental perception and outdoor recreation	5
Environmental preferences	5
Diver preferences	5
Summary	6
METHODOLOGY	6
Definitions	6
Data Collection	6
Analysis	7
Testing of Hypotheses	7
HAWAII'S RECREATIONAL DIVE INDUSTRY	CHAPTER II
NUMBER OF OPERATIONS	9
LOCATION OF OPERATIONS	9
SCUBA CERTIFYING AGENCY	10
YEARS OF OPERATION	10
FLOOR AREA OCCUPIED	10
THE DIVE BOAT FLEET	10
TOURS SOLD	11
SCUBA CERTIFICATIONS	11
PLACE OF RESIDENCE	12
GROSS REVENUES	12
BOAT VERSUS SHORE DIVES	12
SUMMARY	13
DIVE SITE CHARACTERISTICS	CHAPTER III
DIVE SITES USED BY OPERATORS IN 1986	15
Popular Dive Sites	16
Most Popular Sites as Indicated by "Popularity Scores"	18
Most Popular Sites as Indicated by Tour-Days	19
DIVE SITE USAGE	20
Best Months for Diving	20
Site Usage for "Intro" and "Certified" Dives	22
Usage for Boat and Shore Dives	23
Travel Time to Boat Dive Sites	24
Maximum Diving Depths and Bottom	
Times for Popular Dive Sites	25
DIVE SITE CHARACTERISTICS	26
Kaua'i	27
O'ahu	27
Maui County	28
Hawai'i	28
SUMMARY AND CONCLUSIONS	28
Hypothesis 1	28
Hypothesis 2	29
IMPLICATIONS FOR RESOURCE MANAGEMENT	30
APPENDIX A SAMPLE OF SURVEY QUESTIONNAIRE	33
APPENDIX B LIST OF DIVE OPERATORS IN HAWAII	41
APPENDIX C LIST OF DIVE SITES USED IN 1986	43
FOOTNOTES	49
BIBLIOGRAPHY	51

TABLES

1. Number of Sites Used by Dive Operators — 1986	15
2. Most Popular Sites Used by Dive Operators — 1986	16
3. Estimated Travel Times Between Port and Boat Dive Sites Reported by Operators — 1986	25
4. Average Diving Depth Ranges Reported by Respondents — 1986	25
5. Bottom Times Reported by Respondents — 1986	26

FIGURES

1.	PADI Certifications 1980-1989	2
2.	PADI International Certifications by Regional Office 1988	2
3.	Skin Divers Subscribers Survey; Household Income 1991	3
4.	Skin Divers Subscribers Survey; Age Distribution	3
5.	Skin Diver Subscriber Survey Overseas Destinations in Past 3 Years, Top Ten Destinations	3
6.	Passenger capacity for 6-packs and USCG-certified vessels	10
7.	Introductory Dive Tours Sold in 1986 by Dive Operations Interviewed	10
8.	Certified Tours Sold in 1986 by Dive Operations Interviewed	10
9.	Snorkel Tours Sold in 1986 by Dive Operations Interviewed	10
10.	Scuba certifications in 1986 reported by Dive Operations Interviewed	12
11.	Average percentages of 1986 tour customers' residence as reported by Dive Operations Interviewed	12
12.	1986 Gross Revenues Reported by Dive Operations Interviewed	12
13.	Average Percentages of 1986 Revenues Derived from Boat Dive Tours	13
14.	Average percentages of 1986 revenues derived from shore dive tours	13
15.	Popular Sites Used by Kauai Dive Operators — 1986	16
16.	Popular Sites Used by Oahu Dive Operators — 1986	17
17.	Popular Sites Used by Maui Dive Operators — 1986	17
18.	Popular Sites Used by Hawaii Dive Operators — 1986	18
19.	Popularity Scores for Kauai Dive Sites	18
20.	Popularity Scores for Oahu Dive Sites	19
21.	Popularity Scores for Maui County Dive Sites	19
22.	Popularity Scores for Hawaii Dive Sites	19
23.	Estimated Tour-Days for Popular Dive Sites on Kauai	19
24.	Estimated Tour-Days for Popular Dive Sites on Oahu	19
25.	Estimated Tour-Days for Popular Dive Sites in Maui County	20
26.	Estimated Tour-Days for Popular Dive Sites on Hawaii	20
27.	Best Months for Diving at Popular Kauai Dive Sites	20
28.	Best Months for Diving at Popular Oahu Dive Sites	21
29.	Best Months for Diving at Popular Maui Dive Sites	21
30.	Best Months for Diving at Popular Hawaii Dive Sites	21
31.	Use of Popular Sites on Kauai for Introductory and Certified Dive Tours	22
32.	Use of Popular Sites on Oahu for Introductory and Certified Dive Tours	22
33.	Use of Popular Sites in Maui County for Introductory and Certified Dive Tours	23
34.	Use of Popular Sites on Hawaii for Introductory and Certified Dive Tours	23
35.	Use of Popular Kauai Sites for Shore and Boat Dives	23
36.	Use of Popular Oahu Sites for Shore and Boat Dives	23
37.	Use of Popular Maui County Sites for Shore and Boat Dives	23
38.	Use of Popular Hawaii Sites for Shore and Boat Dives	24
39.	Comparison of average preference scores for all popular sites by island	27
40.	Kauai profiles of dive operator preferences for site characteristics	27
41.	Oahu profiles of dive operator preferences for site characteristics	27
42.	Maui County profiles of dive operator preferences for site characteristics	28
43.	Hawaii profiles of dive operator preferences for site characteristics	28

CHAPTER I. INTRODUCTION

THE PROBLEM	1
OBJECTIVES	1
SIGNIFICANCE OF RECREATIONAL DIVING	2
RESEARCH QUESTIONS	3
HYPOTHESES	3
LITERATURE REVIEW	3
Environmental perception and outdoor recreation	3
Environmental preferences	4
Diver preferences	4
Summary	4
METHODOLOGY	5
Definitions	5
Data Collection	5
Analysis	5
Testing of Hypotheses	6

1 Snorkeling and scuba diving are now among the most popular activities for tourists traveling to the tropics and subtropics. Scuba diving has become one of the fastest growing sports in the world. The annual expenditures on scuba equipment, lessons and travel are increasing rapidly and expenditures on scuba travel are growing at the fastest rate of the three, according to industry experts.

3 Better understanding of the spatial distribution of dive sites and how it may be related to environmental preferences of dive tour operators will aid in the management of marine resources. How do dive tour operators in Hawai'i select where they take their customers and what spatial and temporal patterns result from their choices?

5 How do various factors — such as location of resort areas, wind and wave conditions, marine life, and underwater scenery — influence a dive tour operator's selection of dive sites?

OBJECTIVES

The objectives of this study are to: (1) describe the recreational dive industry in terms of dive shop locations, general operations, types of services offered, customers, and revenues; (2) describe the variety, distribution and use of popular dive sites; (3) evaluate how operators select popular sites; and (4) offer recommendations relating to resource management.

SIGNIFICANCE OF DIVE TRAVEL

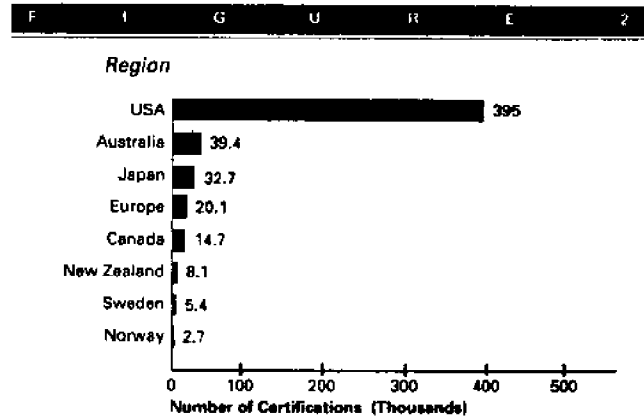
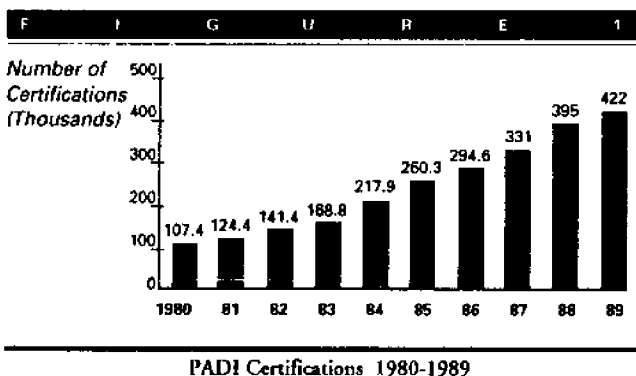
Divers travel extensively to view coral reefs, wrecks, caves, "walls," "blue holes," and tame marine life. Even in places far removed from the ocean, divers enjoy their sport in quarries, lakes, streams, ice ponds, and underwater caves. Divers enjoy many types of diving and are willing to travel extensively to pursue their hobby. According to Skin Diver, nearly two-thirds of subscribers traveled outside the U.S. for dive trips and took an average of nearly four overseas trips; the average trip was over a week.

Many destinations in Florida and the Caribbean that offer dive resorts and dive yachts cater solely to recreational divers. Major diving destinations, especially in the Caribbean, look at dive travel as a primary means of developing tourism. Places such as the Caymans, Bonaire, and U.S. Virgin Islands depend on dive travel to support their tourism industries which have been promoted as "sun, sea and surf" destinations.

Diving magazines advertise numerous tours to exotic places such as the Great Barrier Reef, Palau, Philippines, and the Red Sea. Airlines such as Qantas and Continental also promote dive travel to areas they serve. Submarine tour companies such as Atlantis are operating in Hawaii, introducing today's non-divers to a whole new underwater realm; these customers could be tomorrow's dive traveler.

Recreational diving is a growing sport. In 1975, it was reported that there were 474,000 active divers (U.S. Dept. of Commerce, 1975). Since then, the sport has grown considerably. Monaghan (1988) reported an "industry consensus" that there were between 1.7 and 2.0 million divers in the United States. According to PADI, the number of certifications in the U.S. steadily increased from 107,000 in 1980, to 422,000 in 1989. Worldwide, for 1988, the U.S. led all regional PADI offices in certifications (PADI, 1990).

Japan certified 33,000 divers in 1988, second only to Australia which certified 39,000 (PADI, 1988). This places Japan in the position of being an important source of dive travelers, especially in the Pacific Basin. Perusal of Japanese diving magazines reveals numerous dive shops, dive clubs, and tours to exotic places such as Truk, Palau, Philippines and the Red Sea.



PADI International Certifications By Regional Office 1988

ECONOMIC IMPORTANCE

Dive travel in the U.S. contributes significantly to local economies. A Michigan study documented diver activity in the Great Lakes region, including travel and expenditure patterns (Peterson, Sundstrom and Stewart, 1987). The study found that divers travel considerably and contribute significantly to local economies for non-diving goods and services-- including lodging, dining, entertainment and shopping.

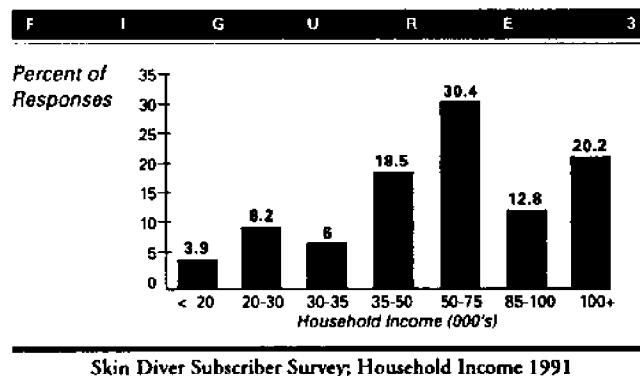
In the Pacific, tourism has been growing at a phenomenal rate. For example, Hawaii's arrivals grew from 243,000 to nearly 7 million in 1990; visitor expenditures now exceed \$11 billion annually, making tourism Hawaii's foremost industry. Diving is an important aspect of tourism in that a significant number of tourists engage in scuba diving or snorkeling. A survey of 23 dive shops in Hawaii (out of 44 shops) revealed that they grossed nearly \$7 million in 1982 (van Poolen, 1983). This study, conducted in 1987, found that 47 dive shops generated an estimated \$20 million in 1986.

WHO'S THE DIVE TRAVELER?

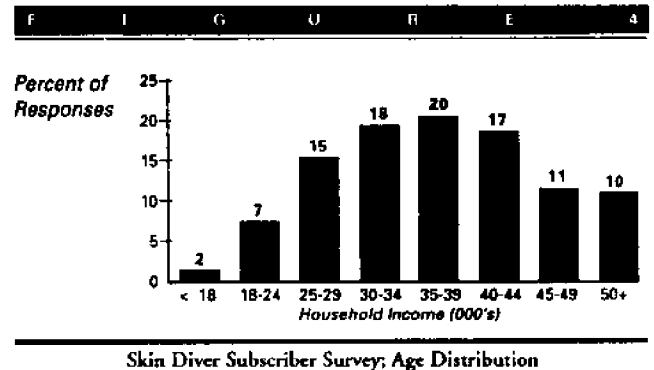
Divers are generally well educated, young, and financially secure. The sport is also male dominated, although there are increasing numbers of women becoming scuba divers. Also, due to advances in technology, scuba diving is less physically demanding; this has allowed older and less fit individuals to take up the sport. Rice (1987)

described three general types of divers: (1) "hard core"; (2) "tourist"; and (3) "potential." The "hard core" diver chooses a destination for it's flora and fauna or the challenges of local diving conditions. The "tourist" diver includes scuba diving as part of a vacation. The "potential" diver is a novice who wants to try scuba diving. This typology suggests that there is a range of interests among dive travelers as far as their motivation is concerned. Another way to classify divers would be along an "adventure" - "educational" spectrum: "adventure" divers seek excitement (i.e., wall dives, drift dives) while "educational" divers really want to see unique marine life or interesting underwater geology.

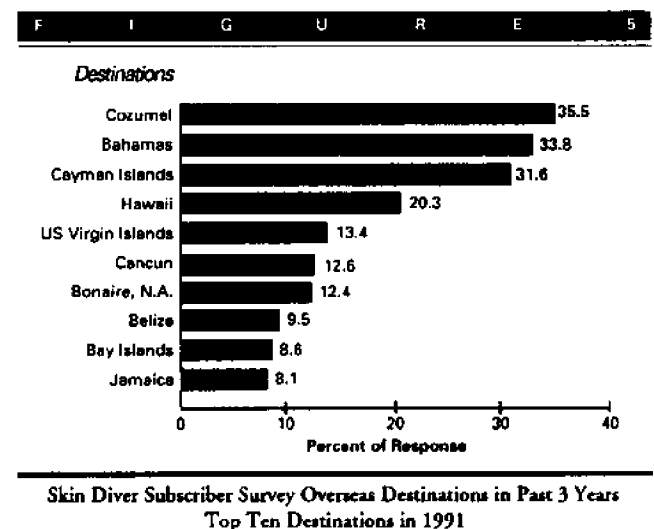
Skin Diver Magazine (1991) provides among the best available data on divers in the U.S., their interests, and travel characteristics. Their biannual surveys of their readership indicate that divers comprise a distinct group of consumers. Subscribers have an average household income of \$70,200 compared to the U.S. average of \$31,000. Sixty-nine percent of readers are male while



64% are married. The median age in the 1991 survey was 36.7 years. They spent an average of \$3,150 per dive trip. Eighty-three percent attended college or beyond, compared to 37% for the U.S. as a whole. Seventy-two percent of subscribers have occupations as owners, or in managerial, technical, professional, or sales positions - compared to the U.S. average of 30%. Another survey conducted by Underwater USA (1988) indicates very similar demographics for their subscribers.



Where are they traveling to? In the continental U.S., Florida destinations account for five of the top six. Outside of the continental U.S., Bahamas and Caribbean destinations dominate -- with the Bahamas, Caymans, Cozumel and Bonaire topping the list. Elsewhere, Hawaii tops the list with Australia and Micronesia following in popularity. Overall, the top 10 destinations outside of the continental U.S. include Cozumel, the Bahamas, Caymans, Hawaii and the U.S. Virgin Islands.



Need for study. This study will attempt to better define resource requirements for recreational diving as viewed by dive tour operators. As tourism grows in areas with popular dive sites — such as along the southern coast of Lana'i or the Kona-Kohala region of the Big Island — there will be increasing pressures on the marine environment. Water pollution, fresh water runoff, litter, siltation, anchor damage, trampling, and souvenir collecting can cumulatively destroy the natural resources used by the dive shop industry. Improved understanding of how divers use the marine environment will aid in future resource management efforts.

RESEARCH QUESTIONS

This study will be largely descriptive in identifying existing spatial patterns of dive sites used by commercial tour operators and evaluating environmental features which make certain sites relatively attractive. The primary research questions to be pursued in the study include:

1. What does Hawaii's recreational dive industry look like (i.e., business location, certifying organizations, years of operation, shop size, gross revenues, dive boat characteristics, numbers and characteristics of customers)?
2. What dive sites are being used by dive operators on various islands and which ones are most frequently used?
3. What are the seasonal patterns in the use of particular dive sites and what environmental factors (e.g., wave exposure, prevailing winds, etc.) might explain the patterns for the various islands?
4. How far do dive operators travel (i.e., travel time) from harbors to their favorite boat dive sites?
5. To what extent are popular dive sites used for boat or shore dives on the various islands? How are these sites used for introductory versus certified dive tours?
6. What are the typical dive depths and diving times for popular sites on the various islands?
7. How important are various environmental features (e.g., water clarity, ocean conditions, outstanding marine life, etc.) in a dive operator's decision to use a particular dive site? Are there any differences in preferences among popular sites on the same island, or among the different islands?

HYPOTHESES

Hypothesis 1. It was hypothesized that the spatial patterns in the use of nearshore areas for diving vary from island to island. For example, Kona operators commonly use dozens of sites between Kawaihae and Honaunau, with most boats departing from the Keauhou-Kailua resort area. Maui operators, on the other hand, are more scattered in Kihei, Ma'alaea, and Lahaina, with destinations as far as Molokini, Lana'i, Moloka'i, and Kaho'olawe — but with fewer dive sites along Maui's own shores. O'ahu operators are concentrated in Waikiki-Ala Moana, but most popular dive sites are found at Maunalua Bay, Pupukea, and the Wai'anae coast. Finally, Kaua'i operators prefer the Ha'ena and Po'ipu areas.

Hypothesis 2. A second hypothesis was that dive operators prefer individual dive sites due to various distinctive attributes (e.g., water clarity, geological features, wrecks, marine life, etc.). For example, one site might be favored because of exceptional arches and pinnacles, while another one might be popular due to a sunken wreck.

LITERATURE REVIEW

The study is based on the concept of "environmental preferences", which relates individual perceptions of the environment with patterns of recreational patterns reflected in the landscape. This study of Hawaii's dive operations and their use of the marine environment generally belongs in the area of recreation geography. As early as 1935, Brown raised the problem of defining recreation and tourism. A continuing theme for 50 years has been the neglect of recreation and tourism studies by North American geographers, especially compared to the Europeans (Carlson, 1980). Smith (1983) defined recreation geography as "...the systematic study of recreation patterns and processes on the landscape." He intended that the term, "recreation," include tourism, leisure, sport, and games.

Environmental perception and outdoor recreation

Mercer (1970) reviewed works pertaining to emerging research regarding environmental perception and the use of outdoor recreation sites. He concluded that:

A major assault on the individual recreationist's decision-making process is required. What information does the recreationist have at his disposal? How does he evaluate that information? What does 'satisfaction' mean? Can it be measured? Can users be grouped meaningfully on the basis of their environmental likes and dislikes? These are immensely complex questions and yet successful recreation planning demands that we make every effort to provide adequate answers.

Mercer noted that many of the early works on perception focused on the motivations and attitudes of the users of wilderness environments; since then, studies have extended to other kinds of recreation environments such as parks, campgrounds, public beaches, boating areas, and vacation home sites. In a more recent review of the literature pertaining to environmental perception (Saarinen et al, 1980), it was pointed out that the major characteristics of the field were "...the recency of its development, the lack of a well-developed methodology, its interdisciplinary nature, and the prominence of planning and concern for current environmental issues; geographers were then beginning to develop and critically assess theories and methodologies."

Environmental preferences

In the area of environmental preferences, a few researchers have studied environmental characteristics which influence recreational behavior (Hecock, 1970). For example, Knopp (et al, 1979) used cluster analysis to classify users according to environmental preferences. Lucas (1964) was one of the early pioneers in the study of user perception of resources in recreational settings. He concluded that: "All resources are defined by human perception." An understanding of differing perceptions can be used to develop management plans to accommodate different user groups. Wetzstein and Green (1978) used principal component indexes to assess scenic beauty in public forests and wildlands; attributes such as miles of streams, number of peaks and lakes, length of trails, and number of campground units were used to define relative scenic beauty among 39 wilderness areas.

Diver preferences

More specifically, the literature on diver preferences for various environmental attributes is very limited. Skin Diver Magazine surveys of its readership show that divers are attracted by features such as reefs, wrecks, lobsters, abalones, shells, walls, "drifts", and caves. A more recent survey of Underwater USA Magazine readers found that 65.5% of respondents enjoyed reef diving; 59.8% enjoyed wreck diving. In a Great Lakes area study, Somers (1979) found that nearly 40% of respondents enjoyed coral reef diving; they also enjoyed wrecks, underwater photography, ice diving, spearfishing, treasure hunting, and cave diving. Another study by Holecek and Lothrop (1980) suggests that divers with special interests, such as wreck diving, are more willing to travel farther to enjoy their sport. In a series of studies of Michigan sport divers, attractions and attributes were examined (Peterson and Sundstrom, 1987). Divers were attracted to particular areas by features such as "good dives", "scenery/beautiful area", "clear water", and "shipwrecks."

A 1984 New Zealand study is one of the few studies which begins to identify diver preferences for environmental features. Matheusik (1983) provides the best analysis of diver preferences among Canadians. Of 36 resource attributes examined, seven were found to be reliable indicators:

For the resource setting scales, both populations of divers on the average placed more importance on good water quality, natural geological formations, diversity of marine life, and safe and easy access than they did on low dive trip costs, boat facilities and other services. Among the four most preferred resource setting attributes, good water quality had the highest mean for Ontario divers, while diversity of marine life had the highest mean for British Columbia divers.

Finally, O'Reilly (1982) provides some insights into dive site preferences among recreational divers in Texas. Of 24 listed attributes, the five most frequently mentioned were expected clarity, marine life/lots of fish, cost, accessibility, and underwater scenery.

Summary

The study of environmental preferences is an area of investigation that demands more attention from geographers. Studies of divers' environmental preferences require immediate attention because the recreational diving industry is growing rapidly, particularly with respect to dive tours. It will be increasingly important to better understand how dive operators select their sites and how popular areas can be better managed to accommodate dive tours.

METHODOLOGY

The general approach used in the study was to evaluate dive site preferences and choices from the viewpoint of commercial dive operators. This contrasts with studies of the environmental preferences of individual divers. The operator is an "intermediary" decision-maker between the resource and the user; the operator generally predetermines what sites will be visited by customers who are unfamiliar with specific dive sites — especially those accessible only by boat. Presumably, an experienced dive operator will know what dive site features would be attractive and satisfying to customers — that is, what "sells." The operators' preferences should generally reflect the desires and expectations of customers. On the other hand, the operator will also need to balance other practical factors such as travel time and safety.

Definitions

The term "dive operator" in this study includes (1) dive shops which have a retail store offering a variety of services, including tours; and (2) dive tour operators who mainly offer shore or boat dives, without necessarily having a "shop" or office. A "dive site" is defined as a specific nearshore location where tour customers are taken for either boat or shore dives; dive sites are usually given a nickname commonly used by dive operators in an area.

Data Collection

A survey questionnaire (Appendix A) was used in personal interviews. This method has two advantages: (1) it yields the highest response rate of any survey method; and (2) given effective interviewers, it permits the use of a rather lengthy survey instrument (Sheskin, 1985). The questionnaire was personally administered to owners or managers of 47 dive operations out of 60 identified (see Appendix B for a list of current operations). Most of the other dive businesses which were not interviewed are considered very small operations; their omission from the study should not substantially affect the findings.

The questionnaire was designed to be administered in about 30 minutes with mostly close-ended questions. A few open-ended questions were included to obtain general, qualitative information and to ease the interviewee into the more detailed parts of the survey. The questionnaire contained two parts: (1) description of the individual dive shop's services, operations, customers, and sales sources; and (2) identification of dive sites used, description of usage patterns, and evaluation of dive site attributes.

In rating the importance of certain dive site attributes, a Likert scale was used to have respondents rate individual items on a scale (i.e., 1 = not important, 5 = very important). The Likert technique has proven to be popular because it is relatively simple to develop and administer; it also performs very well in reliably ordering people with regard to particular attitudes and has been shown to be highly reliable when compared to other scaling techniques (Oppenheim, 1956). Babbie (1973) stated that the value of the Likert approach was the "...unambiguous ordinality of response categories..." which make it possible to judge the relative strength of agreement by the respondent; also, the format permits straightforward index construction.

The questionnaire was reviewed by the executive director and board of directors for Destination Hawaii, a statewide association of dive operators (now called Dive Hawaii). The survey questionnaire was field tested over several months prior to the actual personal interviews which were conducted during Summer and Fall 1987. Raw data was recorded with dBASE III+; tabulations and basic statistical analyses were performed with Microsoft CHART 3.0 and the WordPerfect Library 2.0 calculator program. Charts and graphs were originally produced with Microsoft CHART 3.0.

Analysis

Data on dive shops (Part 1 of survey) were tabulated and summarized for each variable. For variables such as numbers of tours and dive courses sold, a state total was derived for all respondents with island subtotals. For variables such as percentages of customers visiting from various areas (i.e., mainland U.S., Japan, etc.), means and standard deviations were determined for each island and the entire state.

The dive site data (Part 2 of survey) were analyzed by island. First, all dive sites used were identified and mapped to show the general location of important sites; "popularity" scores and "estimated tour-days" were developed for each site to indicate relative popularity. Then, for each site identified by operators as a favorite one (i.e., selected among the top three sites by at least one operator), the relative importance of various attributes was described and compared with other sites.

Testing of Hypotheses

The first hypothesis was qualitatively tested by analyzing the spatial distribution of dive sites around the various islands and identifying possible explanations for the patterns (i.e., seasonal wind and wave conditions, proximity of harbors and resorts, etc.).

The second hypothesis was tested by comparing the average rating scores for each site's environmental attributes. Average Likert scale values were derived for each variable, then compared site by site. The three most popular sites on each island were then compared qualitatively to determine whether there were any discernible differences among them. Because each dive operator did not evaluate identical sets of dive sites (i.e., each operator had a different set of favorite sites), the use of statistical tests such as Chi-square or Kendall's coefficient of concordance was not deemed feasible to assess possible "significant" differences in responses. Therefore, it was necessary to use a qualitative approach to evaluate whether selected dive sites could be distinguished from one another.

CHAPTER II HAWAII'S RECREATIONAL DIVE INDUSTRY

NUMBER OF OPERATIONS	7
LOCATION OF OPERATION	7
SCUBA CERTIFYING AGENCY	8
YEARS OF OPERATION	8
FLOOR AREA OCCUPIED	8
THE DIVE BOAT FLEET	8
TOURS SOLD	9
SCUBA CERTIFICATIONS	10
PLACE OF RESIDENCE	10
GROSS REVENUES	10
BOAT VERSUS SHORE DIVES	10
SUMMARY	11

The first part of the survey was designed to provide a profile of the recreational dive industry in Hawai'i. Its purpose was to describe: (a) the industry's size — in terms of sales and revenues; (b) general location and description of operations; and (c) place of residence of tour customers.

NUMBER OF OPERATIONS

It is difficult to precisely determine the number of dive operators in existence at a given time because of turn-over in ownership, changes of business names, or business failures. However, the number of dive operations appears to have grown substantially. Van Poolen (1983) identified 44 shops in 1982; this study identified 60 in 1987. A more recent listing shows 56 operations in 1988¹ (see Appendix B for listing as of April 1989). The increased number of operations is consistent with the large number of "young" shops that have been operating five years or less, particularly on O'ahu and Hawai'i.

LOCATION OF OPERATIONS

For this study, 47 of 60 dive operations identified (78.3%) were interviewed on the four islands: Kaua'i - 4; O'ahu - 15; Maui - 14, and Hawai'i - 14. Most of the operators interviewed on the neighbor islands are close to their main customer base of visitors. For example, Kaua'i shops are concentrated in the Kapa'a and Po'ipu/Koloa areas — the resort centers. Similarly, most Maui shops are in Kihei or Lahaina/Ka'anapali. Big Island operators are mostly based in the Keauhou and Kailua-Kona areas.

In contrast, many O'ahu operators are close to the Waikiki hotel district; others have located closer to residential and military centers such as in windward and central O'ahu. This is consistent with the greater dependence of O'ahu operators on the resident and military market compared to neighbor island operations.

Places of operations vary from island to island. Many O'ahu and Maui operations are in commercial or business districts, as well as shopping centers and malls; this could be due to shops locating closer to visitor and resident populations. On the Big Island, however, there are many operations in residences, harbors, and hotel/resort areas. This is possibly due to: (a) operations specializing in dive tours which do not need a retail outlet; (b) availability of harbor facilities close to visitors; (c) more hotels offering guest activities such as scuba diving; or (c) minimal investment needed for new "six-pack" dive tour businesses.

SCUBA CERTIFYING AGENCY

PADI (Professional Association of Dive Instructors) and NAUI (National Association of Underwater Instructors) were listed by most operators. 42 operations were certified by PADI and 27 by NAUI. Affiliation with a major agency is important because the agencies promote the sport and help individual dive shops with marketing, improving operations, group liability insurance, and staff training. Training more divers also increases the numbers of potential dive shop customers seeking dive tours, new equipment, and various services (e.g., repairs, air fills, rentals, etc.).

YEARS OF OPERATION

The rapid growth of the dive industry in Hawai'i is reflected in the "age" spread of operations among the four islands. O'ahu and Hawai'i share the distinction of having the most respondents with "young" operations (0-1 years and 2-5 years). The average years of operation for O'ahu and Hawai'i were both 4.4 years. Maui respondents, however, reported an average of 7.1 years; nine of the 14 Maui respondents reported that they operated at their present location 6-9 years or more. This difference between O'ahu/Hawai'i and Maui operations may indicate that Maui operations kept pace with the maturing

tourism industry on that island. The Big Island is still developing tourism, while O'ahu might be still responding to the explosive growth of tourism in the 1980s.

FLOOR AREA OCCUPIED

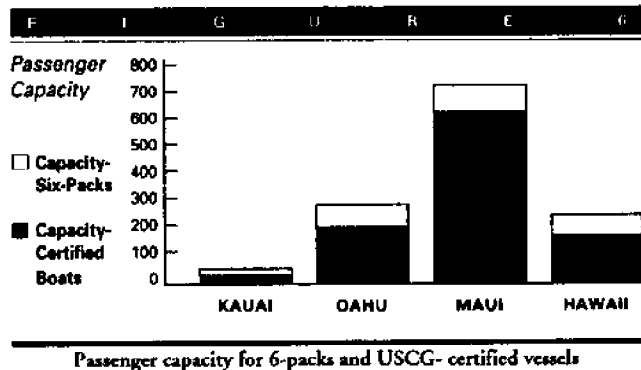
While most of the 47 respondents had a dive shop where they ran their sales and tours, four indicated they did not occupy any "floor area;" these operators essentially ran small dive tours out of a home. O'ahu shops tend to be large (1000 ft² or greater), reflecting the larger resident/military market for retail sales and services. Maui tended to have more medium-size shops ranging from 500-1000 ft². On the Big Island, however, five of 14 respondents had facilities smaller than 500 ft², indicating the smaller base of operations needed for dive tour operations.

THE DIVE BOAT FLEET

Number of boats. The 47 respondents reported a total of 66 dive boats used for tours: Kaua'i - 4; O'ahu - 18; Maui - 27; and Hawai'i - 17. In terms of number of boats per operation, 20 of the 47 respondents reported using one boat while 13 reported using two boats. One- and two-boat operations predominate the industry, while eight operators reported using no boats at all; the latter either do not provide tours or specialize in shore dives. A few large operators, primarily on O'ahu and Maui, have three- and four-boat businesses.

"Six-packs" vs. USCG-certified. The dive boat fleet can be also examined in terms of the number of "six-packs" compared to U.S. Coast Guard (USCG) certified vessels. "Six-packs", which carry up to six paying passengers, do not require USCG documentation; however, USCG documentation is needed for larger operations. Many of the smaller operations tend to have "six-packs". The state's dive boat fleet is split nearly evenly between the two categories. The "six-packs" generally require less initial investment and operating costs, but also have less range.

Passenger capacity. When the fleet is analyzed with respect to passenger capacity (as opposed to number of boats), the capacity of USCG-certified vessels far exceeds that of "six-packs." This is due to the generally larger size of certified vessels, and therefore, greater passenger carrying capacity. Figure 6 illustrates the

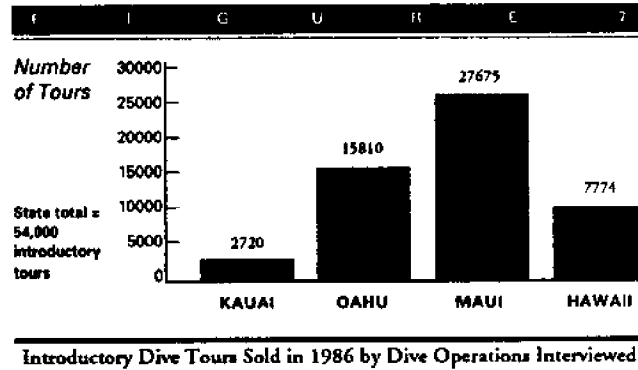


dominance of USCG-certified vessels with respect to dive boat passenger capacity. Maui alone accounted for over half the total capacity of the 47 operators interviewed.

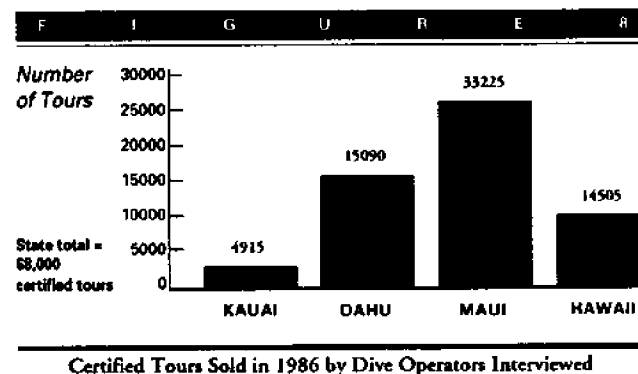
Vessel sizes. Finally, the dive boat fleet can be broken down by vessel size (i.e., hull length). Smaller vessels — many of which are “six-packs” — dominate the fleet, particularly in the 20-29 foot range. Big Island operators tend to have vessels in the 20-49 foot range, possibly because: (a) there are numerous dive sites within close range of harbors in the Keauhou-Kona area; and (b) many of the dive businesses have small operations. Maui operators, in contrast, have more in the 30-60+ foot range, consistent with the relatively large tour operations and greater operating distances. For the most part, O’ahu operations either have no boats or smaller boats in the 10-39 foot range. This is probably due to the popularity of shore dives and the relative proximity between harbors and favorite boat dive sites.

TOURS SOLD

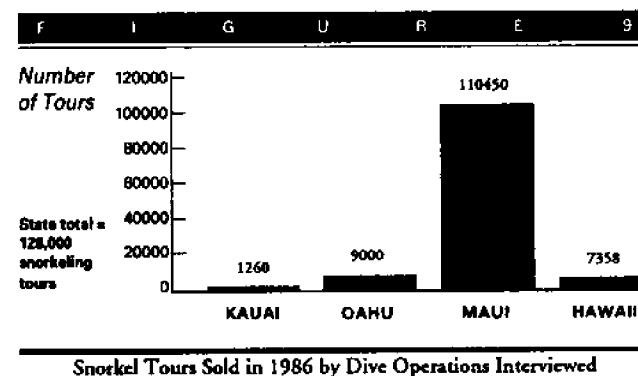
The 47 respondents reported selling 250,000 tours in 1986; of the 250,000 tours, 54,000 were “introductory” tours, 68,000 were “certified” tours, and 128,000 were snorkeling tours. Introductory tours are designed for uncertified scuba divers desiring an underwater experience. Figure 7 shows that Maui dominated this market with 51.3% of the state total; O’ahu was second with 29.3%. Certified tours are for scuba divers with at least “open water” (i.e., “basic”) certification. Figure 8 indicates that Maui accounted for 49.0% of this market, with O’ahu and Hawaii nearly tied for second with 22.3% and 21.4%, respectively. Finally, snorkeling tours were offered by many respondents. Figure 9 reveals that most of the reported snorkel tours were sold by Maui operators,



Introductory Dive Tours Sold in 1986 by Dive Operations Interviewed



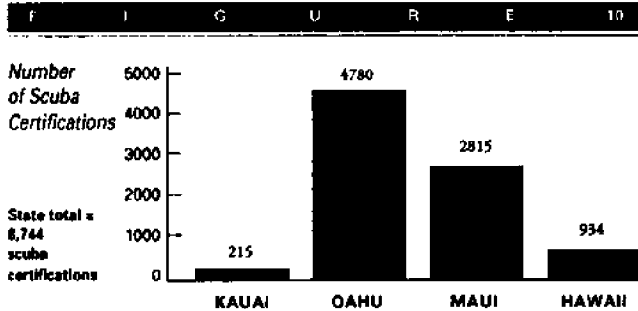
Certified Tours Sold in 1986 by Dive Operators Interviewed



Snorkel Tours Sold in 1986 by Dive Operations Interviewed

SCUBA CERTIFICATIONS

Respondents certified nearly 9,000 individuals in 1986. Figure 10 shows that O’ahu dominated this area with nearly 5,000 certifications —largely resident and military. Neighbor island operators noted that they certify mostly tourists.



Scuba certifications in 1986 reported by Dive Operations Interviewed

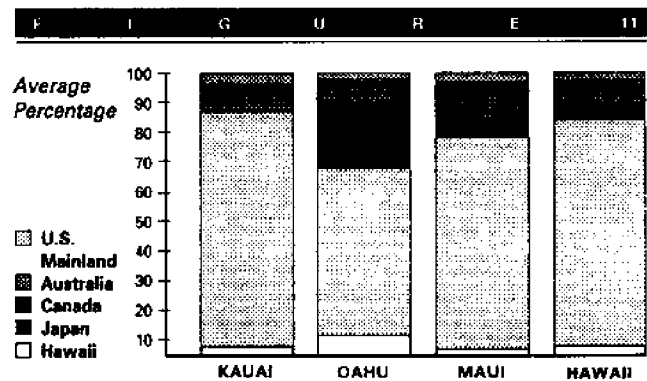
PLACE OF RESIDENCE

Customers' residences, as reported by respondents, generally reflects the profile of Hawai'i visitors as a whole, but vary from island to island. For example, the bulk of divers who purchased dive tours came from the U.S. mainland. Australians and Canadians made up a small proportion of dive customers; however, Canadians made up an average 11.8% of Maui's customers, compared to 5.6%, 5.9%, and 5.9% for Kaua'i, O'ahu, and Hawai'i, respectively. This could be explained by the relatively high number of Canadians who have invested in Maui condominiums. Relatively few Japanese frequented dive shops, except on O'ahu, where operators reported that an average 21.7% of their customers were Japanese; this compares with 1.0%, 4.6%, and 4.2% for Kaua'i, Maui, and Hawai'i respondents, respectively. O'ahu also had more residents as dive tour customers — 12.2%, compared to 3.7%, 2.7%, and 4.5% for Kaua'i, Maui, and Hawai'i, respectively. Figure 11 summarizes the customer residence data. O'ahu operators clearly serve more residents and Japanese visitors than do operators on the other islands. O'ahu's profile probably reflects the large resident and military population and the longer stay of Japanese visitors on O'ahu.

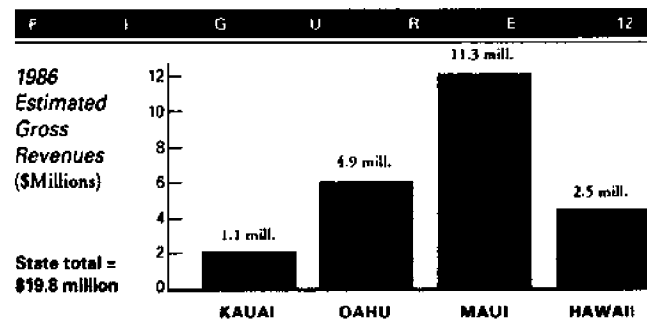
GROSS REVENUES

Growth of the recreational dive industry is related to the overall growth of tourism in the state of Hawai'i. Diving, like many other ocean recreation activities such as charter fishing, whale-watching, and sailing, represents an optional activity for the tourist. The state's Department of Business and Economic Development (DBED) concluded that recreational diving is one of the fastest

growing segments of the ocean recreation industry. In 1987, the ocean recreation industry generated an estimated \$269 million gross revenue³⁴. DBED projects that the ocean recreation industry will generate \$481 million by 1990. The 47 dive operators interviewed in this study reported total gross revenues of \$19.8 million in 1986, almost one-fifth of ocean recreation's total. Figure 12 shows that Maui operators generated more gross income than the other islands combined.



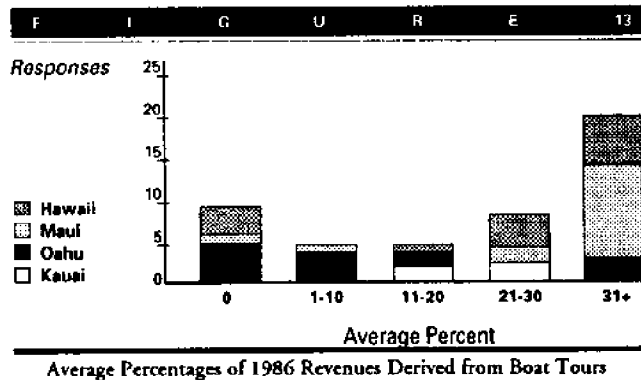
Average percentages of 1986 tour customers' residence as reported by Dive Operations Interviewed



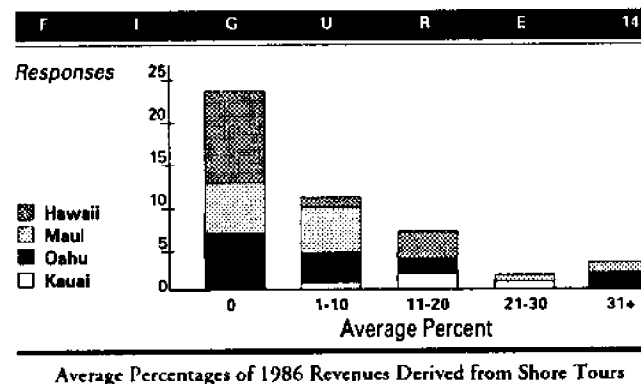
1986 Gross Revenues Reported by Dive Operations Interviewed

BOAT VERSUS SHORE DIVES

Boat Dive Tours. Regarding sources of revenues, 20 of the 47 respondents reported that more than 30% of total revenues came from boat dive tours (Figure 13); this was especially important for operators on Hawai'i and Maui. O'ahu operators, however, relied less on boat dive tours because of their greater dependence on shore dives, retail sales, and other services.



Shore Dive Tours. In contrast, few respondents relied on shore dives to generate revenues. Only three operations statewide generated more than 30% of total sales from shore dive tours; 23% of all respondents reported that none of their income was derived from shore dives. Figure 14 summarizes the relative importance of shore dive tours.



SUMMARY

The recreational dive industry has grown substantially from about 44 businesses in 1982 to 60 in 1987. The 47 operations surveyed generated \$19.8 million in gross revenues in 1986. As of December 31, 1986, the 47 operators reported having 300 full-time and 95 part-time employees and another 145 individuals on various contracts. Maui operators sell most of the introductory dive and snorkel tours in the state while O'ahu leads in scuba certifications.

Boat Dives. Dive operators reported that boat dive tours were relatively important sources of income, while the inverse was true of shore dive tours. This finding is consistent with the size and nature of the dive boat fleet in Hawai'i. Maui and Hawai'i, which tend to rely more heavily on boat tours, lead in average boat size, number of boats per operation, and passenger capacity. This indicates that providing adequate harbor facilities and management of popular boat dive sites are high priorities for operators who depend on boat dive tours.

Shore Dives. For operators who specialize in shore dives, assuring adequate shoreline access and management of popular shore dive sites are also important. Issues relating to access across public lands (i.e., state and county parks) and permits for commercial operations in the conservation district, such as those which surfaced in the recent Hanalei River controversy, need to be resolved.

Environmental Impact. The increasing numbers of operators and dive/snorkel tours will require closer attention to managing popular areas. The impacts of tour boats (e.g., anchor damage to coral, fish feeding, etc.) and individual divers (e.g., collecting specimens, trampling, breaking coral, etc.) must be managed. Also, incompatible uses (e.g., fish and shell collecting, taking of coral for the souvenir market, jetskis, etc.) and environmental degradation must be controlled to protect popular sites.

CHAPTER III. DIVE SITE CHARACTERISTICS

DIVE SITES USED BY OPERATORS IN 1986	13
Popular Dive Sites	14
Most Popular Sites as Indicated by "Popularity Scores"	16
Most Popular Sites as Indicated by Tour-Days	17
DIVE SITE USAGE	18
Best Months for Diving	19
Site Usage for "Intro" and "Certified" Dives	20
Usage for Boat and Shore Dives	21
Travel Time to Boat Dive Sites	22
Maximum Diving Depths and Bottom Times for Popular Dive Sites	23
DIVE SITE CHARACTERISTICS	24
Kaua'i	25
O'ahu	25
Maui County	26
Hawai'i	26
SUMMARY AND CONCLUSIONS	26
Hypothesis 1	26
Hypothesis 2	27
IMPLICATIONS FOR RESOURCE MANAGEMENT	28

The second part of the survey was designed to: (a) identify dive sites used by tour operators in 1986; (b) determine the relative popularity of various sites for dive tours; (c) describe usage patterns at various dive sites; and (d) identify characteristics considered important by dive operators in choosing dive sites.

DIVE SITES USED BY OPERATORS IN 1986

Interviewees were presented a list of known dive sites and asked to check off all sites used for dive tours during 1986. The names were compiled from several diving guides and listed in clockwise geographic sequence for each island (see Appendix C). Interviewees were also able to add other sites to the list. Respondents indicated that they used a total of 196 individual sites in 1986 (Table 1).

ISLAND	SITES
Kauai	26
Oahu	50
Maui County:	
Maui	39
Lanai	21
Moloka'i	3
Hawaii	54
Total	196

Number of Sites Used by Dive Operators -- 1986

Popular Dive Sites

Interviewees were then asked to select the three sites they used the most during 1986; they were also asked to rank the three sites from 1 to 3 (1 = used most). Of the 196 total sites, 69 were selected among the top three sites by at least one respondent:

Figures 10 through 13 show the general locations of the sites identified as the most popular sites for dive tours². "Major" sites on the map indicate those selected by at least one respondent as one of their three most-used sites; "minor" sites were used by the respondents in 1986, but not mentioned as one of their three most-used sites. Further analyses of the most-used sites by (a) popularity "scores" and (b) estimated tour-days shows that there are distinct use patterns for each island.

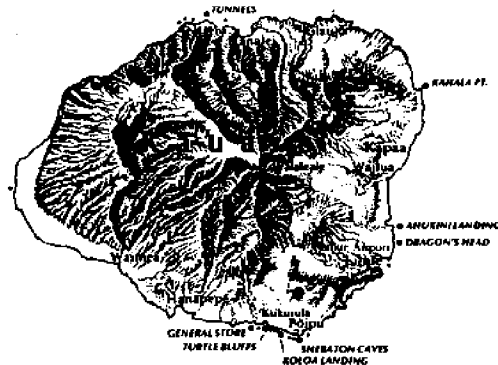
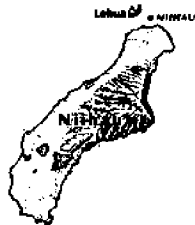
ISLAND	SITES
Kauai	6
Oahu	23
Maui County:	
Maui	12
Lanai	7
Hawaii	21
Total	69

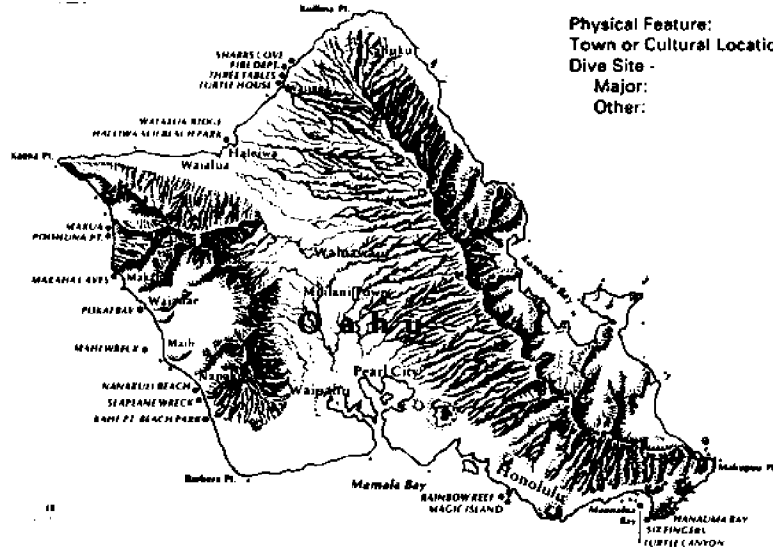
Most Popular Sites Used by Dive Operators - 1986

FIGURE 15

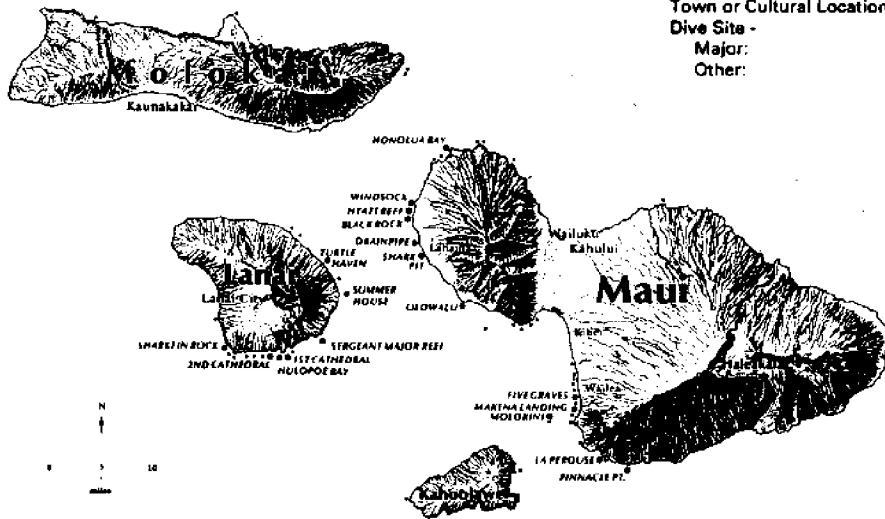
Popular Sites Used By Kauai Dive Operators

Physical features: Mt. Waialeale
 Town or Cultural Location: Uluhe
 Dive Site -
 Major: • General Store
 Other: - - -

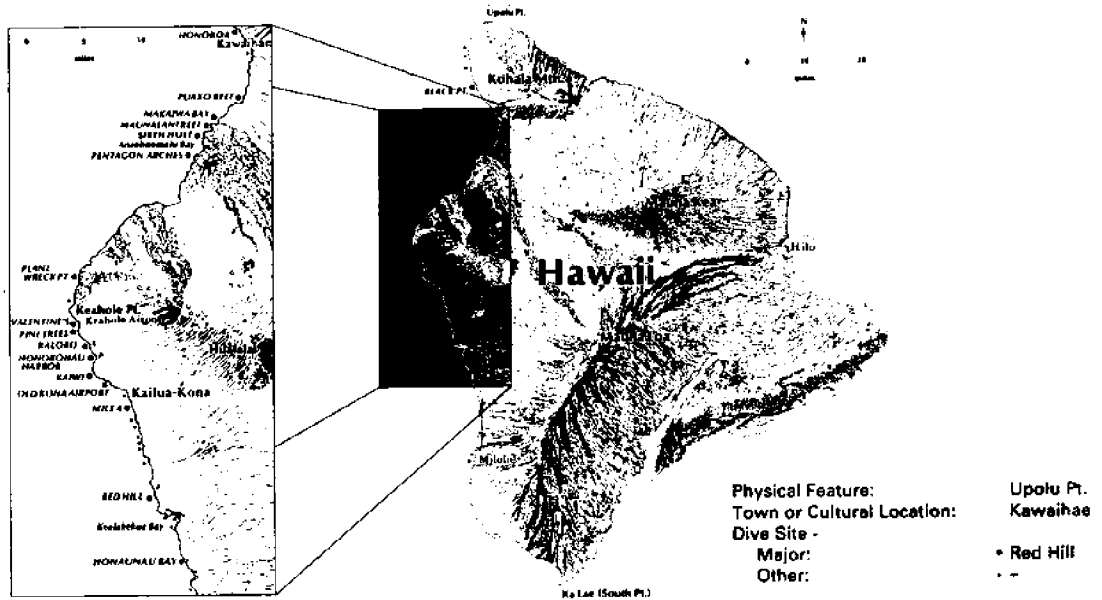




Physical Feature:	Keena Point
Town or Cultural Location:	Mililani Town
Dive Site - Major:	• Shark's Cove
Dive Site - Other:	◻



Physical Feature:	Maleakala
Town or Cultural Location:	Lanai City
Dive Site - Major:	• Olowalu
Dive Site - Other:	◻



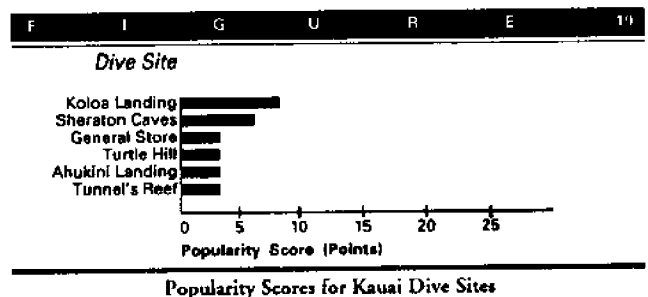
18

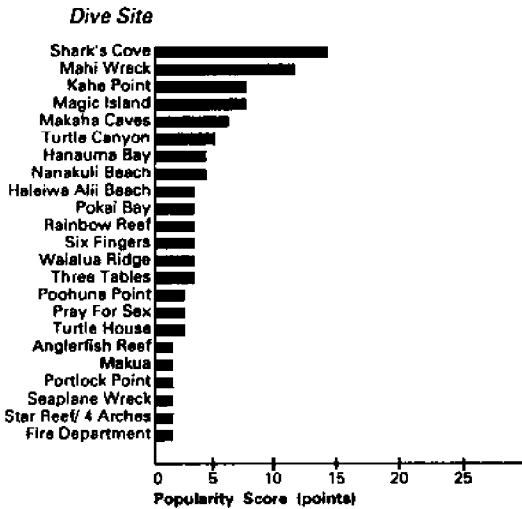
Most Popular Sites as Indicated by "Popularity Scores"

Scores were derived for each dive site by assigning points based on respondent ratings. A first choice received 3 points while a third choice received 1 point. For example, if three respondents rated a particular dive site as their first choice, the site would receive a popularity "score" of 9 (3 respondents x 3 points).

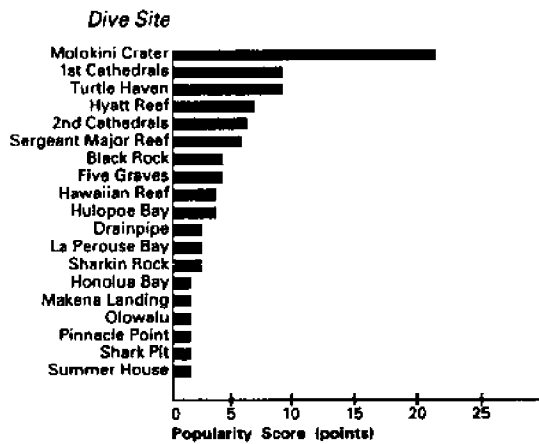
Figures 19 through 22 indicate the relative popularity of dive sites for the four islands where dive operators are located. On Kaua'i, the three sites with the highest scores are all located on the south shore near Po'ipu, one of the three resort areas on the island. On O'ahu, Shark's Cove near Pupukea scored highest, although it is used mostly during the summer months; the "Mahi" wreck near Ma'ili on the Wai'anae coast scored a close second.

In Maui County, Molokini Crater completely out scored all other sites; four of the next five sites are on the south shore of Lana'i — a major destination area for dive charters. Finally, for the Big Island, "Pine Trees" (immediately north of Honokohau Harbor), Kaiwi (immediately south of Honokohau Harbor), and "Red Hill" were by far the three most popular diving areas in West Hawai'i.

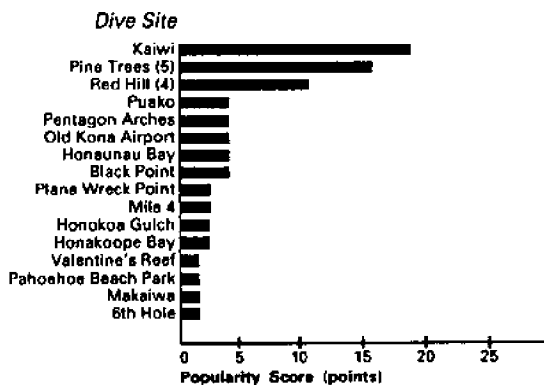




Popularity Scores For Oahu Dive Sites



Popularity Scores For Maui County Dive Sites



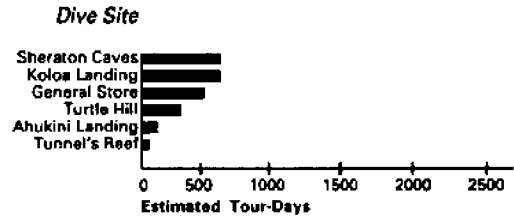
Popularity Scores For Hawaii Dive Sites

Most Popular Sites as Indicated by Tour-Days

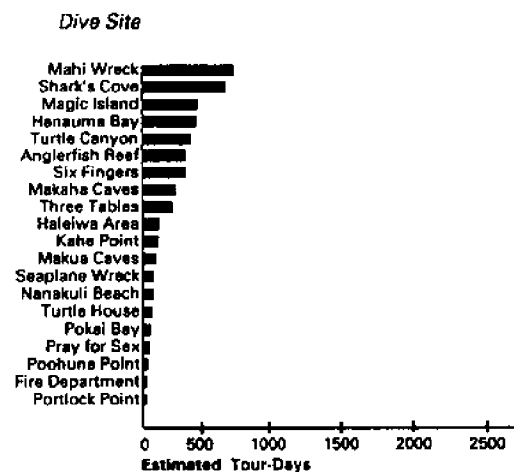
A second method was used to indicate relative popularity of dive sites. Interviewees were asked to estimate the number of days they used each of their three top sites during 1986. Total "tour-days" were then computed by adding estimates for each site. For example, if five respondents indicated a dive site among their top three, their estimated days of use for that site were added to derive "estimated tour-days" for that site.

Figures 23 through 26 indicate the relative popularity of major sites according to estimated usage for 1986. On Kauai, the top four sites were all located in the Po'ipu resort area on the south shore of the island. On O'ahu, the "Mahi" wreck, Shark's Cove, and Magic Island were used heavily; the next four sites were all located in the

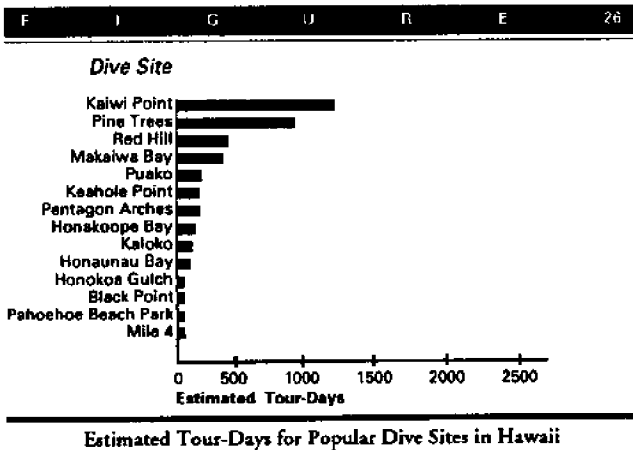
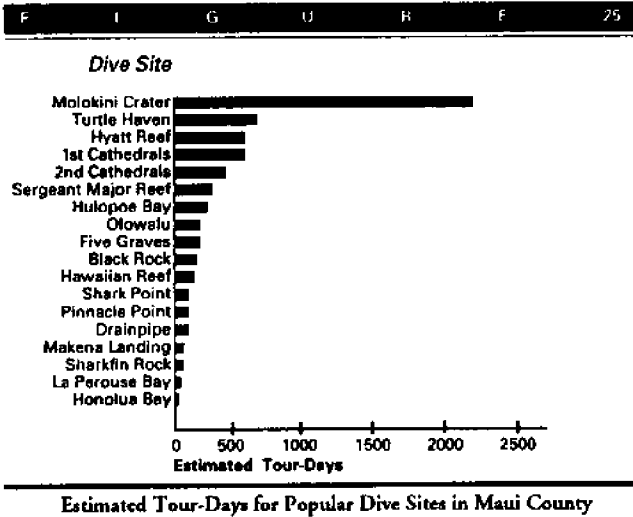
19



Estimated Tour-Days for Popular Dive Sites on Kauai



Estimated Tour-Days for Popular Dive Sites on Oahu



Hanauma Bay to Maunalua Bay area. In Maui County, Molokini Crater exceeded all other sites in the state in terms of estimated tour-days; four of the next five sites were on the south shore of Lana'i. On the Big Island, Kaiwi Pt. and Pine Trees were used for dive tours much more than other sites; "Red Hill" followed close behind.

In summary, rating the popularity of dive sites according to "popularity scores" and "tour-days" resulted in very similar rankings — especially for the top three to five sites for each island. For subsequent analyses, "tour-

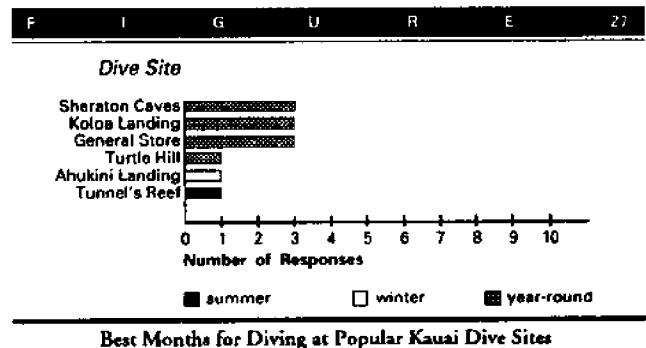
days" were used to show relative popularity, as this provided a means to more finely distinguish one site from the next. For example, on O'ahu Kahe Point and Magic Island had the same "popularity score", but Magic Island was actually used much more than Kahe Point in terms of "tour-days."

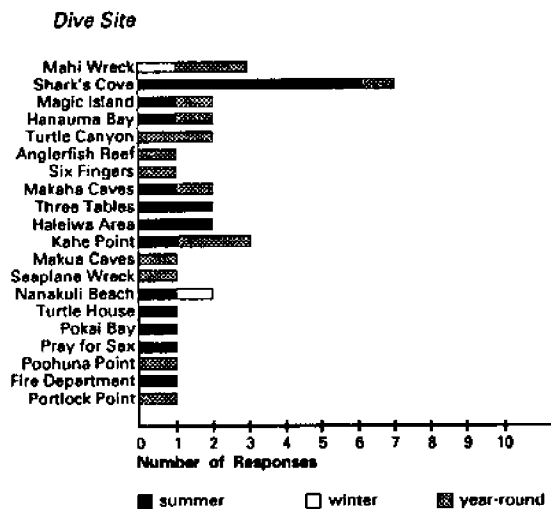
DIVE SITE USAGE

For each of the three sites identified as one of their most-used areas, respondents were asked to indicate when and how the site was used (i.e., best months, used for "introductory" tours or "certified" tours, used for shore or boat dives, used for night dives, diving depths, and bottom times).

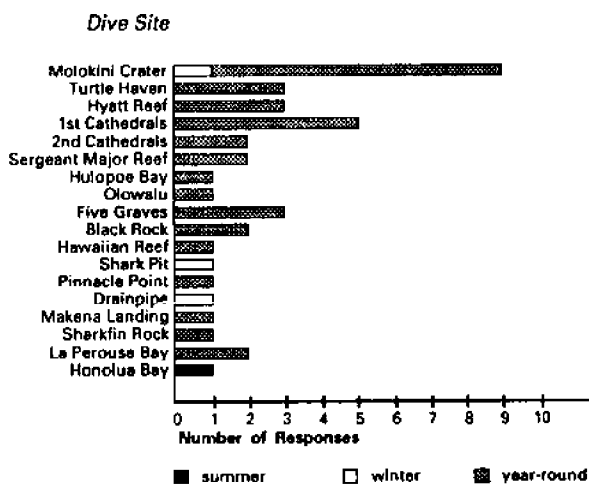
Best Months for Diving

Interviewees were asked to indicate whether each of their three favorite sites were best for diving in the summer, winter, or year-round. Figures 27 through 30 list responses for each site by island (each respondent rated three sites).

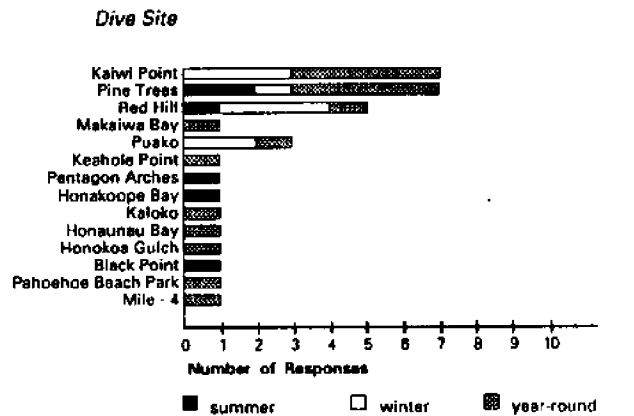




Best Months for Diving at Popular Oahu Dive Sites



Best Months for Diving at Popular Maui Dive Sites



Best Months for Diving at Popular Hawaii Dive Sites

Neighbor Island Operators. In general, operators on Kaua'i, Maui, and Hawai'i rated most of their dive sites as being well-suited for diving year-round. On Kaua'i, the three most popular sites were considered "year-round" sites by at least three respondents; 10 of 12 responses were "year-round." Similarly on Maui, the more popular sites generally were considered by more operators as "year-round" sites; for example, eight respondents rated Molokini as "year-round." Of 41 Maui responses for 19 sites, 36 were "year-round." On the Big Island, "Pine Trees" and "Kaiwi," the two most popular sites, were rated "year-round" by four operators each; of 36 total responses, 20 indicated "year-round".

For Kaua'i, Maui, and Hawai'i operators, having a broad "menu" of generally dependable sites probably helps with trip flexibility. On Kaua'i, "Koloa Landing," "Sheraton Caves," and "General Store" are all on the South shore — generally sheltered year-round from tradewinds. Most of the top sites in Maui County are generally sheltered from tradewinds year-round; the major exception would be during periods of "Kona" weather. On the Big Island, all the sites are on the Kona-Kohala coastline which is generally sheltered. Operators have a few favorite sites along the coast which are favorable when high surf is generated by northwest winter swells.

O'ahu Operations. The preferences of O'ahu operators seem to differ substantially from the other three islands. A number of O'ahu sites were considered by operators to be "summer" sites. For example, "Shark's Cove," the most popular site, was rated by six operators as best suited for summer diving. In all, "summer" sites received 19 responses, compared to only 2 for "winter" and 17 for "year-round." Most of the "summer" sites are located on O'ahu's north shore or Wai'anae coast — both areas which are exceptionally calm during summer months; the only exceptions are "Magic Island" and "Hanauma Bay" which are close to Waikiki, O'ahu's resort center.

Tradewinds. Hawaii's prevailing tradewinds seem to be a major factor influencing operators' general preferences for dive sites. During the late spring and summer months (May - September), a subtropical high pressure zone north of the islands produces northeasterly winds which cool the islands 80-95% of the time. These tradewinds also generate swells which affect the north-east (windward) coastlines of most of the islands; conversely, the leeward sides are generally sheltered.

During the October - April period, tradewinds blow 50-80% of the time (Blumenstock and Price, 1972). "Kona" or "variable" winds occasionally occur in these months. Southerly to southeasterly winds, caused by a low pressure system located near or north of the islands, may stir up waters on south-exposed shores but result in exceptionally calm waters on northern shores.

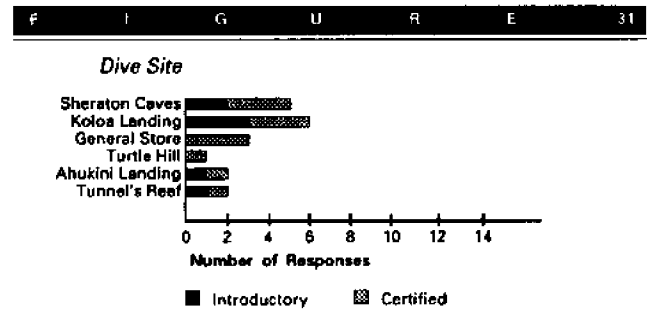
Storm swells. Besides prevailing tradewinds, the other two meteorological factors which affect selection of dive sites are summer/winter storm swells and "Kona" storms. From June through August, swells from winter storms in the Southern Hemisphere create high surf along the south-exposed shorelines of the islands; during these periods, diving is better in areas not exposed to south swells.

From October through January, swells from storms in the Northern Hemisphere create high surf on shores exposed to the northwest. Places such as Shark's Cove, Honolua, the Na Pali coastline of Kauai, and portions of the Kailua-Kona coast may be closed out to diving during this season; the south shores would then be preferred for diving. As a general rule, surfing and diving do not mix since they require opposite ocean conditions.

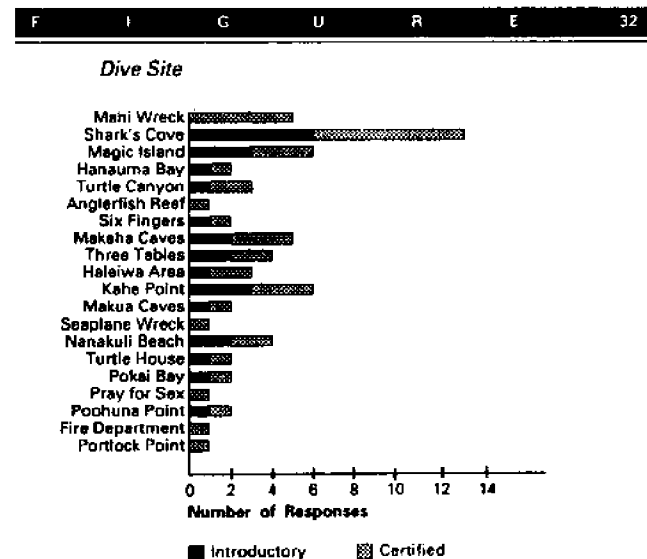
Seasonal surf and wind conditions can, therefore, help to explain the relative popularity of most dive sites used for tours. High surf and strong winds create choppy surface conditions; they also stir up sediment and generate strong currents. These conditions are not conducive to enjoyable dive experiences.

Site Usage for "Intro" and "Certified" Dives

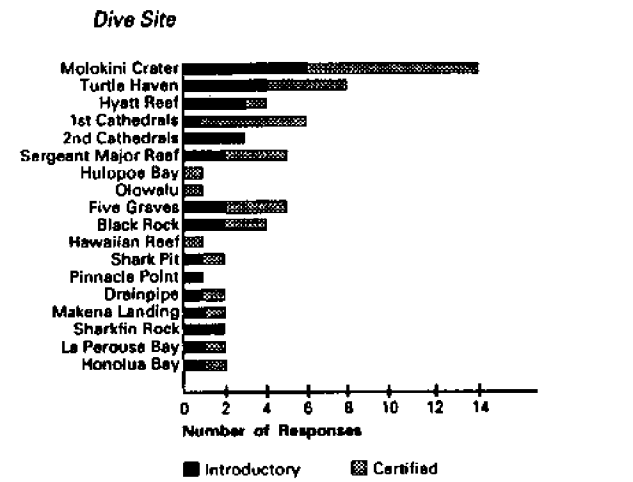
Dive tours can be classified as "intro" or "certified" tours. "Intro" tours introduce uncertified divers to scuba diving. "Certified" tours, on the other hand, are intended for divers certified by a recognized agency such as PADI or NAUI. In 1986, respondents reported selling 54,000 "intro" tours, compared to 68,000 "certified" tours. Figures 31 through 34 summarize the extent to which popular sites are used for these types of tours on each island.



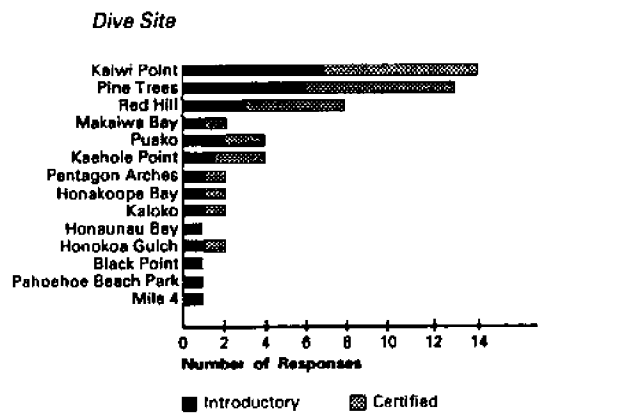
Use of Popular Sites on Kauai for Introductory and Certified Dive Tours



Use of Popular Sites on Oahu for Introductory and Certified Dive Tours

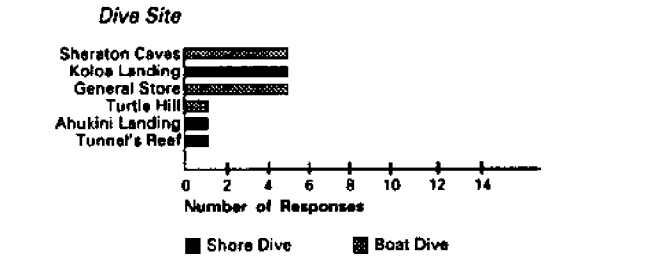


Use of Popular Sites in Maui County for Introductory and Certified Dive Tours

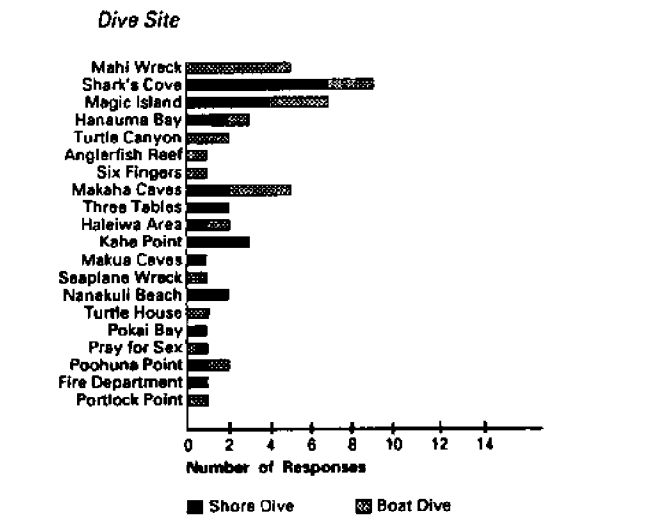


Use of Popular Sites on Hawaii for Introductory and Certified Dive Tours

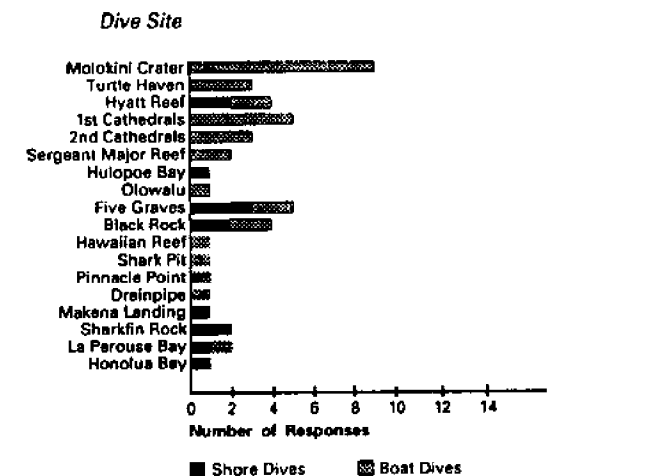
Most of the dive sites were used by operators for certified divers, and to a lesser extent, for novices on introductory dives. In general, popular sites were rated by more operators as being suited for certified dives. Operators seem to favor sites which are attractive to both experienced and new divers. For the former, the sites must offer interesting features or animals to observe, while for the latter, the sites should be relatively calm and safe. Because many dive tours take both "intro" and certified divers, operators probably prefer sites which can satisfy both groups if possible.



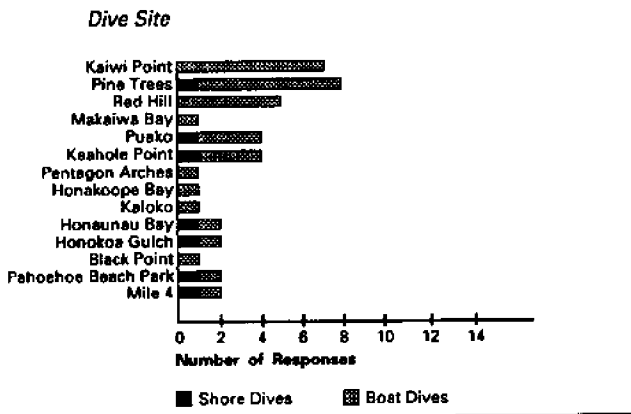
Use of Popular Kauai Sites for Shore and Boat Dives



Use of Popular Oahu Sites for Shore and Boat Dives



Use of Popular Maui County Sites for Shore and Boat Dives



Use of Popular Hawaii Sites for Shore and Boat Dives

Usage for Boat and Shore Dives

Access to dive sites is critical to dive tour operations. Most of the respondents heavily relied on boats for access to their favorite sites; a few specialized on shore dives — especially on O’ahu where harbor facilities are relatively limited. Boats are needed to reach desirable areas inaccessible from shore (e.g., Kona-Kohala coastline, Southern Lana’i). Figures 35 through 38 summarize how respondents get to their favorite sites.

On Kaua’i and O’ahu, there seems to be an even split between use of sites for shore and boat dives. On Kaua’i, sites such as “Koloa Landing” are easily reached from shore, while others such as “Sheraton Caves” and “General Store” require a boat. On O’ahu, “Shark’s Cove” is a shore dive for most, while the “Mahi” is some distance offshore and requires a boat for access. One factor favoring shore dives is the convenience and low capital cost involved in shore dives; only a van is needed to reach dive sites. Another factor might be the lack of harbor space and launch ramps on Kaua’i and O’ahu.

Maui and Hawai’i operators, in contrast, predominantly use their favorite sites for boat dives. On Maui, this is probably the case since most of their favorite sites are offshore (i.e., Molokini) or off another island

(i.e., Lana’i). On Hawai’i, operators have a large number of sites along the Kona-Kohala coast which can be easily reached from the main harbors at Keauhou Bay, Kailua Bay, and Honokohau Harbor. In addition, much of the coastline lacks public access at the shoreline, therefore favoring boat access.

Travel Time to Boat Dive Sites

Interviewees were asked to estimate travel time to their favorite boat dive sites. Although most of the responses were usable, there seemed to be some confusion on the question, especially when the dive shop and harbor were in different parts of the island. Because of the length of the questionnaire and variety of transportation modes used by operators, detailed information on total travel time between a shop and dive sites could not be obtained. For example, one shop might have customers gather at dockside ready to depart; another might provide pickup service at hotels, transport customers to dockside, then take them to a dive site by boat. However, data was adequate to generalize travel times from harbors and ramps to dive sites on the different islands.

Kaua’i. On Kaua’i, the various shops which utilize dive sites in the Po’ipu area have relatively short “drive” times from Kukuiula Harbor. Most respondents reported travel times about 15-20 minutes between Kukuiula Harbor and sites such as General Store and Sheraton Caves.

O’ahu. On O’ahu, boat dives close to nearby harbors are typical for most sites on the south shore (i.e., Mamala and Maunalua Bays) and the Wai’anae coast. Travel times for Maunalua Bay sites (e.g., Turtle Canyon, Six Fingers) range from 15-20 minutes from Koko Marina. Travel times for Wai’anae sites (e.g., “Mahi”, “Makaha Caves”) mostly range from 15-30 minutes from either Wai’anae Small Boat Harbor or Poka’i Bay.

Maui. Maui dive operations differ from Kaua’i and O’ahu operations in that many of their favorite sites are far from boat facilities. Most boat dives depart from Lahaina Harbor, Ma’alaea Harbor, or Kihei launch ramp. Molokini trips can take up to an hour from Lahaina or 20-45 minutes from Kihei. The south coast of Lana’i, which has many of Maui operators’ favorite sites, requires a “drive” up to 2 hours from port; for example, “1st Cathedrals” is 1.5 hours from port, according to two operators.

Hawai'i. Kona/Kohala operators tend to have moderate travel times. Most of their favorite sites in the "Pine Trees" and "Red Hill" areas, for example, are only 15-30 minutes from Honokohau Harbor, Kailua Bay or Keauhou Bay. The longest ride reported was 40 minutes.

Summary. In summary, Maui appears to be the exception in terms of typical travel times. Maui operators reported considerably longer travel times from port to dive sites. Various respondents explained that the longer trips were due to several factors: (1) availability of high quality dive sites at nearby islands (i.e., Lana'i, Molokini); (2) the scenic boat ride to other islands, particularly

T	A	B	L	E	3
---	---	---	---	---	---

ISLAND	MINIMUM	MAXIMUM	n=	AVERAGE	S.D.
Kauai	10	35	7	19.3	7.3
Oahu	10	40	22	19.6	7.3
Maui	10	120	36	46.0	29.5
Hawaii	5	40	34	19.4	8.8

Estimated Travel Times Between Port and Boat Dive Sites Reported by Operators -- 1986

during the winter humpback whale season; (3) relatively poor condition of nearshore waters around Maui island due to siltation, runoff, and resulting murky conditions and poor reefs. Table 3 summarizes average travel times to sites identified as boat dive sites.

Maui operators have the greatest variation in travel times with a standard deviation of 29.5. Coupled with their highest average travel time of 46.0 minutes (compared to 19.3 to 19.6 for the other islands), it seems clear that Maui dive tours take advantage both of sites fairly close to operations (i.e., near resorts, harbors, or shops) and sites farther away -- especially off Lana'i and Molokini.

Maximum Diving Depths and Bottom Times for Popular Dive Sites

In planning each dive trip, dive operators must continually balance a number of factors: (a) experience levels and desires of customers; (b) weather and water conditions for a given day; and (c) "bottom time." Recom-

mended "bottom time" for a single dive is determined by the maximum depth reached on that dive; for a series of dives, allowable "bottom times" are based on maximum depths on preceding dives and "surface interval" times between dives. Various dive tables produced by the U.S. Navy and diving agencies (i.e., PADI, NAUI) help divers plan their dives to optimize bottom time and ensure adequate safety margins.

Ideally, operators attempt to keep maximum depths to less than 60 feet; this normally allows nearly an hour of "bottom time" while accommodating depth limits for divers with "open water" (i.e., basic) scuba certification. Also, to reduce the risk of decompression sickness (i.e., "bends"), operators generally allow considerable safety margins for diver error and individual susceptibility.

T	A	B	L	E	4
---	---	---	---	---	---

ISLAND	AVERAGE	S.D.	AVERAGE HIGH	S.D.
Kauai	38.5	18.7	65.8	19.2
Oahu	28.6	18.4	62.7	23.4
Maui	25.1	15.2	57.7	21.2
Hawaii	22.6	9.8	70.1	27.8
Statewide	26.5		63.4	

Average Diving Depth Ranges Reported by Respondents -- 1986

The survey results verify that most popular sites accommodate dives shallower than 60 feet depth. Table 4 summarizes the data on diving depth ranges reported by respondents.

Diving depths. The data on diving depth ranges indicate that operators generally prefer sites having depths up to about 60 feet. Certain sites have operating depths exceeding 60 feet but are used primarily for advanced certified divers. For example, the "Mahi" wreck on O'ahu can be dived at about 70 feet at deck level, but at 90 feet on the ocean floor. "General Store" on Kaua'i is generally dived between 50 and 90 feet, permitting basic divers to dive on the lower end and more advanced divers on the higher end. The "Kaiwi" site and "Pine Trees" area in Kailua-Kona can be dived as shallow as 15 feet, but as deep as 130 feet. The range of diving depths will, in turn, affect the "bottom time" available during tours.

Bottom Times for Favorite Dive Sites. For a given dive, "bottom time" (i.e., time elapsed between beginning of descent and surfacing) is inversely related to maximum diving depth. Deeper dives generally mean less diving time. Dive operators attempt to trade off depth, "bottom time", and adequate safety margin to lessen the risk of diving accidents. Because the bulk of certified divers have only "open water" (i.e., basic) level certification, their diving depth is usually limited to 60 feet; at this depth, "bottom time" is normally planned for 45-60 minutes on the first dive. Table 5 summarizes responses for usual "bottom times" for popular dive sites. The

ISLAND	MINIMUM	MAXIMUM	n=	AVERAGE	S.D.
Kauai	25	45	12	35.4	8.6
Oahu	15	72	43	37.0	10.2
Maui	10	60	38	37.4	9.2
Hawaii	15	60	34	47.9	9.5

Bottom Times Reported by Respondents -- 1986

results indicate that average "bottom times" are very similar among the islands except for Hawai'i where the average "bottom time" is about 10 minutes more. Compared to the other three islands, this could indicate that: (a) dives are generally in shallower waters; or (b) customers are generally less experienced, thereby necessitating shallower dives. Another possible interpretation is that many Big Island dive sites are relatively close to operations (i.e., shop or harbor), allowing more time during dive tours for actual diving.

DIVE SITE CHARACTERISTICS

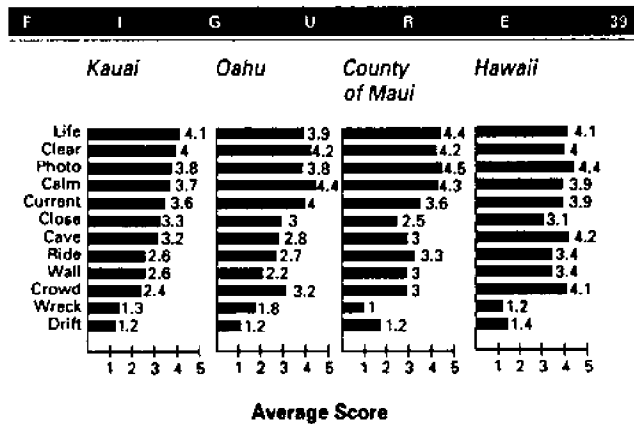
It was hypothesized that dive operators among the various islands would rate site characteristics differently. This hypothesis was based on varying site and situational conditions among the four major islands. For example, one island might have more extensive areas with protected waters, while another may have harbors close to many suitable diving areas. For the former, calm water may be less of a determining factor in selecting a site, while for the latter, travel distance may not be too important.

When average scores for all sites by island are examined, slight differences can be seen. For each of their favorite sites, interviewees were asked to rate how important 12 factors were in their decision to use the site on a scale of 1 to 5 (1 = not important; 5 = very important). The 12 factors were:

Questionnaire Item	Keyword
1. outstanding marine life	life
2. good underwater visibility	clear
3. good for underwater photography	photo
4. generally calm waters	calm
5. no strong currents	current
6. close to harbor or dive shop	close
7. caves, lava tubes, arches	cave
8. enjoyable ride to site	ride
9. presence of pinnacle or wall	wall
10. not crowded	crowd
11. diveable wreck or plane	wreck
12. drift dive possible	drift

Figure 39 shows that preference "profiles" are somewhat similar among the four islands. The top five items (i.e., "life", "clear", "photo", "calm", and "current") generally rated higher than the remainder of the list. "Wreck" and "drift" rated the lowest in general. Closer examination, however, shows interesting differences. "Caves" (i.e., caves, lava tubes, arches) rated much higher among Hawai'i operators — an average score of 4.2 compared to 2.8 to 3.2 for the other islands. This could be explained by the Big Island's geologically "young" lava formations along the shoreline. For Maui and Hawai'i operators, an enjoyable ride to the dive site seems to be more important than for Kaua'i and O'ahu operators. This may be due to relatively short boat rides on Kaua'i and the relative importance of shore dives on

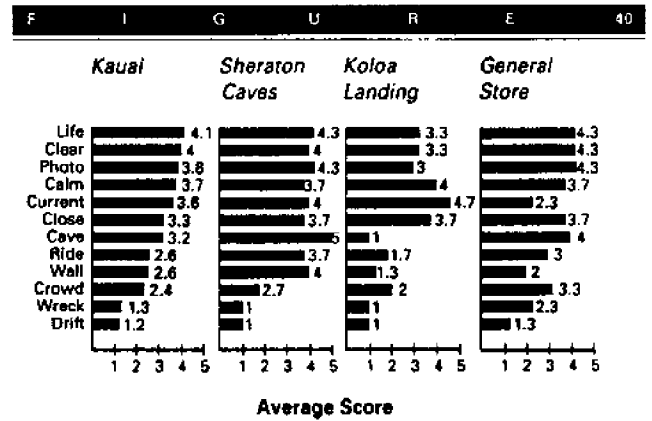
O'ahu. Interestingly, Hawai'i operators seem to prefer sites that are not crowded (4.1 compared to 3.2 for O'ahu operators and 3.0 for Maui). This could be due to the larger number of relatively small dive operators on the Big Island who specialize in personalized tours and seek uncrowded spots. An island-by-island analysis, however, reveals more interesting patterns.



Kauai Profiles of Dive Operator Preferences for Site Characteristics

Kauai

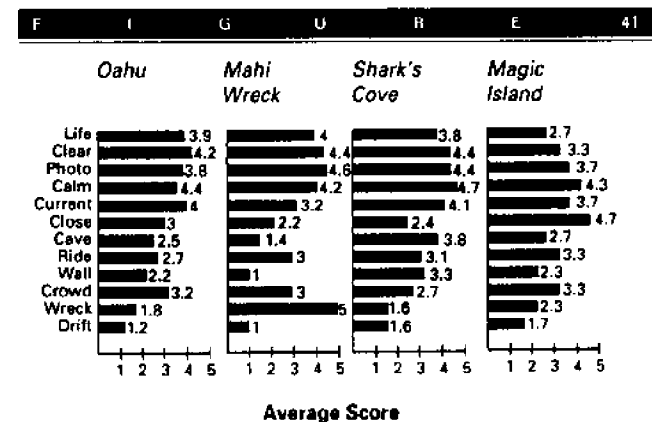
Kauai's overall preference profile shows that marine life, clear water, and photo opportunities rated relatively high. The profiles, however, for the three most popular sites (in terms of tour-days) differed from the island profile and for each site. For example, "Sheraton Caves" was rated highest for its geological features (i.e., caves, lava tubes, and arches); the ride to the site was also rated higher than the island average (i.e., 3.7 versus 2.6). "Koloa Landing," on the other hand, was rated highest for lack of strong currents and calm waters, but relatively lower than the island average for marine life, clear water, photo opportunities, and enjoyable ride. This can be explained by the ease of access to this shore dive and relatively calm waters. "General Store" rated highly for geological features, lack of crowds, and wreck, but lower on lack of strong currents. Dive operators named the site, "General Store," because the site offers a variety of items for divers — geological features, abundant marine life, a large anchor from a wreck, and nice coastline. Figure 40 shows how the Kauai profile compares to the three most popular sites.



Kauai Profiles of Dive Operator Preferences for Site Characteristics

O'ahu

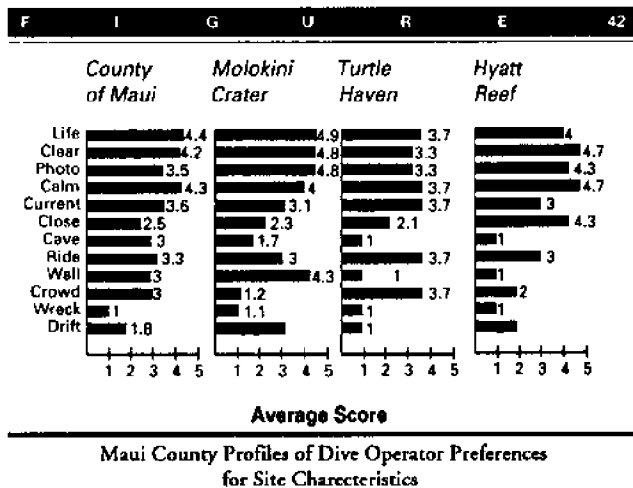
O'ahu's overall profile differs slightly from Kauai (see Figure 41). O'ahu operators generally rated calm waters and lack of crowds slightly higher. There are marked differences, however, between O'ahu's general profile and individual sites. The "Mahi Wreck," for example, rated very highly for its wreck, while rating low for geological features (i.e., caves, walls); closeness of the site seemed relatively unimportant possibly because the wreck is close to harbors. "Shark's Cove" rated highly on lack of currents (during the summer months, when this site is used heavily) and geological features (i.e., caves, walls). "Magic Island" rated particularly high on being close (4.7 versus 3.0 for O'ahu), but lower on marine life and clear water. This could be due to its proximity to Waikiki, a major source of "resort divers" — novice divers who want an introductory experience. "Magic Island" is a convenient site for introductory dives, but not necessarily best for water clarity and abundant marine life.



Oahu Profiles of Dive Operator Preferences for Site Characteristics

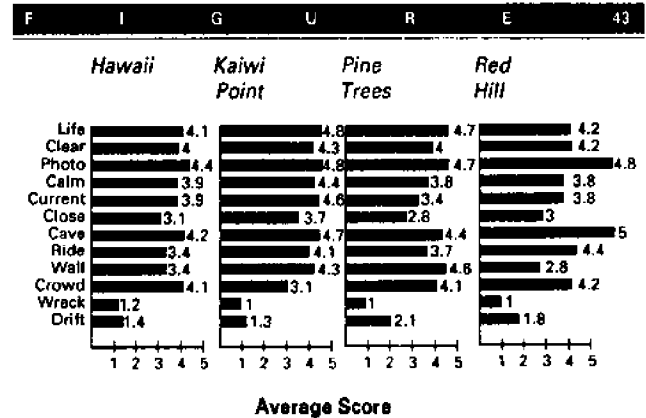
Maui County

Maui County operators generally rated sites highly on geological features, enjoyable rides, and lack of crowds (Figure 42). "Molokini Crater" rated especially high on marine life, water clarity, photo opportunities, and presence of "walls" (i.e., steep drop-offs). Also, like Maui in general, being close to the dive site rated fairly low — suggesting that most of the desirable sites are far from harbors. "Turtle Haven" on the northeast corner of Lana'i is rated much higher for the enjoyable ride and lack of crowds — while rating somewhat lower for water clarity, photo opportunity, and geological features. Finally, "Hyatt Reef" at Ka'anapali rated especially high for being close (4.3 versus 2.5 for Maui); again, like "Magic Island" on O'ahu, "Hyatt Reef" might appeal more to resort divers staying in the Lahaina/Ka'anapali areas.



Hawai'i

The Big Island has an interesting profile in that geological features (i.e., caves, lava tubes, arches, walls) rate quite highly, along with enjoyable rides and lack of crowds (Figure 43). "Kaiwi Point" between Honokohau Harbor and Kailua Bay is nicely situated between the region's major small boat harbor and resort center. "Kaiwi Point" also rates high for water conditions and things to observe, especially geological formations, but lack of crowds is less of a consideration. "Pine Trees" has a profile very similar to "Kaiwi Point." "Red Hill" differs slightly in that marine life and water clarity are slightly less important while geological formations (especially caves, lava tubes, arches) are very important. The ride down to the "Red Hill" area, north of Kealahou Bay, is also quite enjoyable with spectacular views of the coastline.



Hawaii Profiles of Dive Operator Preferences for Site Characteristics

SUMMARY AND CONCLUSIONS

Analyses of dive site usage reveals that operators select their favorite sites based on a number of considerations. The major factors affecting these choices of sites include: (a) exposure to seasonal wind and wave conditions; (b) proximity of suitable dive areas to harbors and operations; (c) suitability of sites for novices and more experienced divers; (d) suitability for shore or boat dives; (e) suitable depths for diving; and (f) environmental features attractive to divers.

Figures 15 through 18 showed the spatial pattern of favorite dive sites among 47 operators. In general, most of the sites are located in areas protected from prevailing northeasterly tradewinds. A few favorite sites are in areas normally exposed to tradewinds, but are used during "Kona" weather when windward waters are especially calm. Some sites on northwestern coasts (i.e., O'ahu's North shore) are not suitable for diving in the winter due to high surf; but, during summer months, these same areas offer glassy-smooth diving conditions.

Hypothesis 1

Hypothesis 1 — that spatial patterns in the use of nearshore areas for diving vary from island to island — is supported by the study.

Kaua'i. Most of the favorite Kaua'i sites tend to be concentrated near Po'ipu, one of the island's resort centers. The Po'ipu area is generally protected from prevailing tradewinds most of the year and is less suitable only during periods of strong "Kona" (southerly) winds, local storms, or large summer swells from storms in the Southern Hemisphere. The most-used sites — "Koloa Landing", "Sheraton Caves", and "General Store" — are all in the Po'ipu area and rated as "year-round" sites. In addition, two of these three sites were used for both intro and certified divers, providing the operators with flexibility in booking customers. Finally, Kaua'i operators rated 12 environmental features very similarly to operators from the other three islands with minor exceptions; Kaua'i operators considered factors such as "enjoyable ride", "lack of crowds" and "calm waters" as a little less important.

O'ahu. Most of O'ahu's favorite sites are along the Wai'anae coast and the southeastern coast. These areas are generally sheltered from prevailing tradewinds and only occasionally affected by winds or waves from the south; they are also fairly close to Waikiki and major harbors. The one major exception to this pattern is the popularity of north shore sites (e.g., "Sharks Cove", "Three Tables") which are ideal during the summer months — which also coincides with one of Hawaii's tourist peak seasons. The study reveals that many sites are favored by operators as "summer" sites, while others are considered suitable "year-round." While a few sites such as the "Mahi Wreck" are used for certified dive tours, many others such as "Shark's Cove" and "Magic Island" are used for both intro and certified dives. A number of sites are almost exclusively boat dive sites while others are primarily for shore dives. O'ahu's general pattern of usage indicates that a few sites are "specialized" to accommodate experienced divers or considered ideal during certain seasons; most, however, are generally suited for mixed experience levels all year-round. Regarding the 12 environmental features, O'ahu operators as a whole rated "outstanding marine life" lower while rating presence of a "diveable wreck" as slightly more important.

Maui. The favorite Maui sites are generally along the southwestern coast of Maui island and the southern coast of Lana'i — all accessible from the Lahaina/Ka'anapali and Kihei/Wailea resort areas on Maui. Maui is unique among the islands in the exceptionally long average travel times to dive sites. Maui operators are able to sell charters to relatively distant destinations for several reasons: (1) Maui is the only island that has other

major islands nearby; (2) the trip across to Lana'i, Kaho'olawe, Moloka'i, or Molokini can be an exciting experience—especially if whales or dolphins are present; and (3) some of the best diving areas can be found in remote places such as southern Lana'i. Maui sites were overwhelmingly considered by operators as being suitable "year-round", an important factor in being able to accommodate large numbers of tourists throughout the year. Most of the Maui sites were deemed suitable for both intro and certified tours with few exceptions. Maui — along with Big Island operators — considered most of their favorite sites as suited for boat dives; this reflects the need for boats to reach distant destinations. Finally, in looking at the 12 environmental features, Maui operators rated "close to harbor or dive shop" lower while rating "enjoyable ride" higher.

Big Island. Favorite sites were all located on the leeward side of the island, mostly in the Kohala and Kona districts. The leeward waters are, however, calm year-round except for occasional storms, high winter surf, and winds from the southeast. Most of the favorite sites were considered "year-round", with the top four also considered suitable in the winter months. Most of the sites are also suitable for "intro" and certified dives. The favorite sites are predominantly used for boat dives mainly due to limited shore access to desirable sites. Moreover, many sites are easily accessible from Keauhou Bay, Kailua Bay, and Honokohau Harbor — the three major boat facilities in West Hawai'i. Finally, Big Island operators considered "caves, lava tubes, and arches" and "lack of crowds" more important than did operators from other islands.

Hypothesis 2

The second hypothesis — that dive operators prefer individual sites due to distinctive attributes (e.g., water clarity, geological features, wrecks, marine life, etc.) — is borne out by the findings. In the previous section on dive site characteristics which described preference "profiles" island-by-island, it was clear that for a given island, individual sites had distinctive features. For example, on Kaua'i, "Koloa Landing" rated highest for lack of currents while "Sheraton Caves" scored highest on presence of geological features (e.g., caves). "General Store" scored highest on "marine life", "clear water", and "underwater photography". Similarly on O'ahu, "Magic Island" rated highest on "close to harbor or dive shop", while the "Mahi Wreck" scored highest on the presence of a wreck.

While it may appear self-evident that individual dive sites are unique and easily distinguished, this study documented that dive operators perceive that each site has certain favorable attributes. These attributes are helpful in marketing specific sites to different clientele based on diver needs and preferences. Some sites are well-suited for both introductory and certified dives, while others are better for experienced divers. Many sites feature something special such as caves, pinnacles, sharks, turtles, or eels. The “menu” or “palette” of dive sites used by operators helps to allocate limited resources to accommodate a growing number of divers. Having a wide range of sites available also reduces crowding at dive sites while allowing flexibility in scheduling.

IMPLICATIONS FOR RESOURCE MANAGEMENT

The study demonstrates that dive operators use a variety of criteria for selecting their favorite sites. An overriding consideration is the seasonal variation in wind and wave patterns which affect the suitability of different coastal areas for diving. The variety of available sites must be maintained to ensure that dive operators will have a wide assortment of sites available according to seasons and weather conditions. For example, areas diveable during summer months, “Kona” weather, or high winter surf would enable a dive operator to offer dive tours at alternative sites.

The general finding that “outstanding marine life” and “good underwater photography” are high on all the operators’ list of preferred environmental features indicates that selected sites should be managed to maintain diversity and abundance of marine life. This means that the habitat itself must be protected. Activities such as anchoring in coral must be controlled. Alternatives such as day-use moorings allow operators the alternative to hook up their boats to metal eyebolts embedded in the reef; these moorings have been proven to be both convenient and environmentally sound. Activities such as collection of coral heads for the souvenir market must be curbed in popular diving areas to protect habitat and to preserve the underwater landscape. Also, activities such as dredging and underwater construction (e.g., dynamiting) must be carefully reviewed for potential adverse effects on reef areas. Activities of divers need to be controlled to protect the marine environment. Divers

need to be educated about the effects of trampling upon coral heads, touching or brushing against coral heads, and collecting specimens. Most operators already discourage specimen collecting, but few instruct customers to avoid damaging living coral.

The high rating of “good underwater visibility” indicates that turbidity must be minimized in popular diving areas. Many of the best diving sites in the state boast excellent water clarity, especially in areas with extensive lava or boulder substrata, where there is little silt to be stirred up. Nonpoint pollution, particularly from construction sites and agricultural areas, must be strictly controlled to prevent sedimentation in the nearshore. Sediment will not only result in increased turbidity, but also kill live coral.

Finally, the popularity of particular sites for special features such as caves and wrecks indicates the potential for creating popular sites. For years, dive operators have been “cultivating” new sites which offer something different — whether they are a tamed eel, sleeping shark, cathedral-like caverns, or a shipwreck. Artificial reefs are an especially attractive option for creating new diving opportunities while removing some pressure on natural areas.

While the state’s Marine Life Conservation Districts (MLCDs) were created primarily for recreational snorkeling and diving, many (with the exception of areas such as Molokini Crater, Kealahou Bay, and Sharks Cove) are not heavily used by dive operators. The survey revealed that the majority of favorite dive sites are not in established MLCDs. Also, the state’s most successful artificial dive site — the “Mahi Wreck” — is not officially managed to protect the marine life that has thrived there since its sinking only seven years ago.

It is hoped that this study will prompt a closer look at the resources needed to support recreational diving for residents and visitors. Perhaps there will be increased awareness of the variety of factors important to snorkelers and scuba divers and the importance of protecting those attributes requisite to an enjoyable underwater experience. Through studies of recreational activities such as scuba and snorkel tours, recreation geography can gain a better understanding of the intricate relationships between people and their environment that shape patterns of recreational activity.

Future Research. This study indicates that dive operators discriminate among specific dive sites based largely on customer needs, as well as operational considerations (i.e., water conditions, proximity, etc.). Future research could examine more closely the specific environmental features which appeal to dive operators. For example, for a given site, what are the primary factors which influence the operator's choice of the site? Is it possible to rank the various factors and find agreement among several operators who use the same site? Also, it may be useful to compare the preference scores for all popular sites, rather than just the few examined for each island. It would aid comparison if operators on each island were all asked to evaluate the same set of most-used sites. In summary, further exploration is warranted to uncover why individual operators use their set of favorite sites. Results of such study will aid in market segmentation for dive tour marketing and resource management.

APPENDIX A:
SAMPLE OF SURVEY
QUESTIONNAIRE

UNIVERSITY OF HAWAII
SEA GRANT EXTENSION SERVICE
STATEWIDE DIVE OPERATOR SURVEY

1987 (rev 7/7/87)

D I V E O P E R A T O R S U R V E Y

What scuba certifying organization(s) are you a member of?
 NAUI PADI NASDS SSI YMCA other:

If your dive operation is a certified training facility, under which organizations?
 NAUI PADI NASDS SSI YMCA other:

How many years has this business been operating at this location? _____ years.

What is the total floor area occupied by your business?
 n/a < 500 sf 500-1,000 sf 1,001-1,499 sf 1,500+

Is your business a paid member of TORCH? yes no

Are you on the TORCH mailing list? yes no

If your dive operation owns or charters a dive boat(s), please complete:

Boat(s) Used	1	2	3	4
Name of boat	_____	_____	_____	_____
Own or charter	_____	_____	_____	_____
Boat make	_____	_____	_____	_____
Hull type	_____	_____	_____	_____
Hull length (feet)	_____	_____	_____	_____
Main power	_____	_____	_____	_____
USCG cert for hire	_____	_____	_____	_____
If yes, # of passengers	_____	_____	_____	_____
Usual load, # of passengers	_____	_____	_____	_____
Usual crew size	_____	_____	_____	_____

DIVE CUSTOMERS

Please estimate how many scuba/snorkeling tours and courses your operation sold in 1986 (includes sales to repeat customers):

introductory scuba dive tours: _____
 certified scuba dive tours: _____
 snorkeling tours: _____
 total tours sold _____
 scuba certification courses: _____

Of all the customers who bought a diving or snorkeling tour in 1986, what estimated percentage came from the following areas?

Hawaii (residents/military)	_____%
Mainland U.S.:	_____%
List top five producing states: (1) _____ (2) _____ (3) _____ (4) _____ (5) _____	
Japan	_____%
Canada	_____%
Australia/New Zealand	_____%
Europe	_____%
other areas:	_____%
TOTAL	100 %

35

What estimated percentage of your diving/snorkeling tour customers in 1986:

came to Hawaii primarily for diving/snorkeling? _____%
were newlyweds? _____%
purchased a dive travel package? _____%
were repeat customers from a previous trip to Hawaii? _____%

**How did customers find out about your dive business?
Select what you consider the three most important means:**

Destination Hawaii promotion/advertising
your advertising in:
local media _____
Underwater USA _____
Skin Diver magazine _____
other national media _____
referrals by dive operators _____
word-of-mouth among customers _____

**How much did your dive business spend for advertising in 1986?
[not including Destination Hawaii advertising]**

national advertising (e.g., Skin Diver ads): \$ _____
local advertising (drive guide, rack cards, etc.): \$ _____

1986 DIVE TRAVEL PACKAGES

If your dive business offered dive travel packages in 1986 (i.e., airline/hotel/car/dives), how many different ones were there? _____ (If none, go to question 18)

For 1986's most popular package for certified divers (i.e., largest number of customers), please indicate:

Name of overseas air carrier: _____
Name of inter-island carrier(s): _____
Name of hotel/condo: _____
Location (town/city): _____
Number of nights accommodations provided: _____

Name of car rental firm: _____
Number of days of car rental included: _____

Number of boat dives (tanks): _____
Number of escorted night dives (tanks): _____
Number of escorted shore dives (tanks): _____
Equipment provided with package: all TPW other

What portion of 1986 sales of this package was booked by:

travel agents or mainland dive operators _____%
wholesalers _____%
direct reservations _____%
other (please specify): _____%
TOTAL 100 %

What was the full retail price for this package? \$

Approximately what percentage of the full retail price was paid to:

dive operator (gross revenue) _____%
air carrier(s) _____%
hotel/condo _____%
car rental firm _____%
booking agent (i.e., commission) _____%
other (please specify): _____%
TOTAL 100 %

MAJOR SOURCES OF REVENUES:

Of your business' total gross sales in 1986, what percentage came from the following general categories (see questions 19-21 for details):

Dive courses and tours	_____%
Diving equipment sales, repairs, rentals, air fills	_____%
Miscellaneous (photography, other sports, clothes)	_____%
Total	<u>100</u> %

DIVE COURSES AND TOURS

(please indicate the estimated percentage of total sales of dive courses and tours derived from each type of service)

<u>Types of service</u>	<u>% of sales</u>
scuba diving certification courses	_____%
snorkeling courses	_____%
boat dive tours (certified and intro)	_____%
shore dive tours (certified and intro)	_____%
Total [should equal line 1, question 18]	_____%

DIVING EQUIPMENT SALES, REPAIRS, RENTALS

(please check off services provided):

<u>Types of service</u>	<u>Provided? (check off)</u>
dive/snorkel equipment sales	_____
dive/snorkel equipment repairs	_____
dive/snorkel equipment rental	_____
photographic eqpt. sales/service	_____
air fills	_____

MISCELLANEOUS SALES/SERVICES:

(please check off items provided):

<u>Types</u>	<u>Provided? (check off)</u>
other water sports sales/services	_____
other (clothing, souvenirs, etc.)	_____

How many employees did your business have as of Dec. 31, 1986?:

full-time: _____ part-time: _____ contract: _____

What months would you consider as your "peak seasons" for tours?

Jan [] Feb [] Mar [] Apr [] May [] Jun []
Jul [] Aug [] Sep [] Oct [] Nov [] Dec []

What kinds of differences, if any, have you observed in the types of customers you serve during your peak versus off-peak seasons?

In your opinion, what have been some major trends affecting the dive industry in Hawaii and on your island?

Where do you see the industry going in the next 5 to 10 years?

What do you think needs to be done over the next 5 years to help the industry?

What was your estimated total gross sales for 1986?
\$ _____ (ROUND TO NEAREST \$10,000)

How does your 1986 gross sales compare with 1985?
 ___ % more about the same ___ %less

1. **(SHOW LIST OF DIVE SITES)** Please review the list of dive sites provided for your island and check off any used for dive tours during 1986. If there are any which are not listed, please add them to the list.
2. From among the sites which you checked off, please select the three (3) which you used most last year.
3. Rank these three according to the total number of times visited by you for dive tours last year (1 = site most used).
4. For these three sites, please complete one form for each site.
(PROVIDE THREE FORMS, ONE AT A TIME)
5. Do you think that diving conditions on this island are different from the other islands? If yes, what are the main differences?
6. Do you have any personal concerns about the use or management of any of your favorite dive sites?
7. Do you have any specific suggestions for improving dive sites in Hawaii?

INTERVIEW NUMBER:
WORKSHEET FOR SITE: (1) (2) (3)
SITE NAME:

Best months for diving:
 Summer months (approximately May-August)
 Winter months (approximately November-February)
 Mostly year-round

Total estimated number of days used - 1986: _____ days
 Is site used for introductory dives? yes no
 Is site used for certified dives? yes no
 Is this a shore dive site? yes no
 Is this a boat dive site? yes no
 Estimated travel time from harbor: _____ minutes
 Is site used for night dives? yes no
 Diving depth range: to _____ feet
 Usual bottom time (minutes): _____ minutes

Please indicate how important each of the following factors is in your decision to use this site. Rate each item on a scale of 1-5. (1 = not important; 5 = very important).

	1	2	3	4	5
good underwater visibility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
generally calm waters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
no strong currents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
not crowded	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
close to harbor or dive shop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
caves, lava tubes, arches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
diveable wreck or plane	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
presence of pinnacle or wall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
drift dive possible	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
enjoyable ride to site	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
good for underwater photos	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
outstanding marine life	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX B: LIST OF DIVE OPERATORS IN HAWAI'I (APRIL 1989)

Kaua'i (8)

Aquatics Kaua'i
Dive Kaua'i
Fathom Five Divers
Get Wet Kaua'i
Kaua'i Divers
Ocean Odyssey
Poipu Dive Company*
Sea Sage Diving Center
Wet-N-Wonderful Ocean Sports

O'ahu (21)

Aaron's Dive Shop
Aloha Dive Shop
Aquaventure
Bojac Aquatic Center
Breeze Hawaii Diving Adventures*
Dan's Dive Shop
Divestar of Hawaii*
Down Under Divers
Elite Dives Hawaii
First Dive Tours*
Hawaiian Sea Adventures
Leeward Dive Center
Modern Divers of Hawaii*
Oahu School of Diving & Pro Dive Shop
Ocean Adventures
Pacific Quest Divers
Rainbow Divers
South Seas Aquatics
Steve's Diving Adventures
Vehon Diving Ventures
Waikiki Diving Center

Maui (16)

Aquatic Charters of Maui
Beach Activities of Maui
Capt. Nemo's Ocean Emporium
Central Pacific Divers
Destination Pacific
Dive Maui
Hana Bay Divers
Hawaiian Reef Divers
Hawaiian Watercolors
Lahaina Divers
Bob's Maui Dive Shop
Maui School of Diving
Mike Severns Scuba Diving
Scuba Schools of Maui
Steve's Diving Adventures
The Dive Shop of Kihei

Hawai'i (18)

Capt. Nemo's Ocean Sports
Dive Makai Charters
Dolphin Divers
Fantasy Divers
Gold Coast Divers
Jack's Diving Locker
King Kamehameha Divers
Kohala Divers
Kona Aggressor*
Kona Coast Divers
Kona Reef Divers
Let's Go Shore Dive 'N'
Mauna Lani Sea Adventures
Nautilus Dive Center
Red Sail Sports (Hyatt Regency Waikoloa)*
Sandwich Isle Divers
Sea Dreams Hawaii
Sea Paradise Scuba

* indicates a new operation that began after the 1987 survey was conducted.

APPENDIX C:
LIST OF DIVE SITES
USED IN 1986

Response indicates the number of respondents who used a given site in 1986. "1st", "2nd" and "3rd" indicate the number of respondents who identified a given site as a first, second, or third choice for the sites they used the most during 1986 (i.e., "1st" indicates the site they used most).

KAUAI

DIVE SITE NAME	RESPONSE	1ST	2ND	3RD
Ni'ihau	1			
Waikapalae Wet Cave	1			
Cannon's Reef	1			
Tunnel's Reef	4			1
Oceanarium	1			
Do Drop Inn	1			
Truck Stop	1			
Ahukini Landing	4	1		
Dragon's Head	2			
Aquarium	2			
Brenneke's Drop	3			
Sheraton Caves	3		3	
Poipu Beach	2			
Tortuga	1			
Ice Box	1			
Koloa Landing	4	2	1	
Fast Lanes	1			
Sculptured Reef	1			
Fishbowl	2			
Spouting Horn Reef	1			
Turtle Bluffs/Hill	1	1		
Oasis Reef	3			
General Store	3			3
Mana Crack	2			

OAHU

DIVE SITE NAME	RESPONSE	1ST	2ND	3RD
Malaekahana	1			
Crouching Lion	1			
Pyramid Rock	1			
Moku Manu Islands	1			
Bird Rock	1			
Twin Islands	1			
Makapuu Beach	2			
Makapuu Pt.	3			
Blowhole	5			
Lanai Lookout	3			
Palea Pt.	1			
Hanauma Bay	7		2	
Six Fingers	2	1		
Anglerfish Reef	1			1
Portlock Pt.	6			1
Turtle Canyon	4	1	1	
Big Eel Reef	1			
Kahala Barge	2			
Fantasy Reef	3			
Diamond Head Marker	1			
Magic Island	7	3		1
Rainbow Reef	4			
Reef Runway	2			
Iroquis Pt.	3			
Barbers Pt.	2			
Kahe Pt. Beach Park	3	2		1
Seaplane Wreck	4			1
Tits		1		
Nanakuli Beach	8		2	
Twin Holes	1			
Mahi Wreck	11	3		2
Pokai Bay	4	1		
Makaha Caves	9		3	
Yokohama	1			
Poohuna Pt.	2		1	
Makua	3			1
Pray for Sex	1		1	
Star Reef	4			1
Ed's Place	1			
Kaena Pt.	6			
Mokuleia Beach Park	2			
Haleiwa Alii Beach Park	1	1		
Haleiwa Trench	1			
Waialua Ridge	1	1		
Chun's Reef	1			
Turtle House	1		1	
Waimea Bay	3			
Three Tables	8	1	1	1
Fire Department	1			1
Shark's Cove	10	1	2	3

DIVE SITE NAME	RESPONSE	1ST	2ND	3RD
Molokini Crater	11	6	3	
Nakalele Pt.	2			
Honanana Bay	1			
Mokolea Pt.	1			
Kahakuloa Bay	2			
Hawaiian Reef	2	1		
Pauwela Pt.	1			
Kawee Pt.	1			
Nuu Bay	1			
Kanaloa	1			
Pinnacle Pt.	1			1
La Perouse Bay	7		1	
Ahihi Bay	6			
Apartments	1			
Oneuli Beach	3			
Makena Beach	4			
Makena Landing	1			1
Tank & Landing Craft	1			
Five Graves	7		1	2
Haloa Pt.	1			
Wailea Beach	2			
Marty's Reef	1			
Ulua Beach	4			
Kamaole Park 2 & 3	1			
Hidden Pinnacles	3			
McGregor Pt.	6			
Manuohole (Wash Rock)	3			
Scenic Lookout	5			
PaliOlowalu	13			1
Black Rock (Sheraton)	13			1
Shark Pit	1			1
Drainpipe	1		1	
Hyatt Reef	10		2	
Windsock	8	2		1
Kapalua Bay	4			
Slaughterhouse	4			
Honolua Bay	11			1
Honokohau Bay	4			

LANAI

DIVE SITE NAME	RESPONSE	1ST	2ND	3RD
Sergeant Major Reef	12			1
Manele Bay	2			
1st Cathedrals	11		3	2
Hulopoe Bay	4	1		
2nd Cathedrals	10	1	1	1
Lobster (Wash) Rock	9			
Monolith	4			
Menpachi Cave	5			
Grand Canyon	4			
Lighthouse	6			
Sharkfin Rock/Reef	8			2
Kuamalapau	3			
No Name Bay	6			
Fish Rock	7			
Knob Hill		8		
Containers	1			
Keomuku	2			
Turtle Haven	7	2	1	
Fish Hotel	1			
Summer House	1			1

MOLOKAI

Mokuhooniki Rock	6
Moomomi Beach	1
Kalaupapa	1

KAHOOLAWE

Ulua Ridge	5
Grotto	1
Kuia Shoal	1

HAWAII (BIG ISLAND)

DIVE SITE NAME	RESPONSE	1ST	2ND	3RD
Kapaa Beach Park	1			
Mahukona Beach Park	3			
Lapakahi State Historical Park	1			
Black Point	1	1		
Honokoa Gulch	2		1	
Spencer Beach Park	1			
Kanekanaka Pt.	2			
Puako Reef	5		1	1
Makaiwa Bay	1	1		
Mauna Lani Reef	1		1	
Sixth Hole	1			1
Pentagon Arches	1	1		
Plane Wreck Pt.	7			2
Simon's Cellar	1			
Around-the-Block	1			
Black Hole	1			
Wawaiole ("Valentine's")	3			
Carpenter's (Pine Trees)	1	1		
Golden Arches (Pine Trees)	7	1	2	
Pine Trees	5			1
Pyramid Pinnacles (Pine T.)	7		1	1
Skunk Hollow (Pine Trees)	1		1	
Haunted Caves	3			
Honokohau Harbor	7			
Kaiwi (Kona Cathedrals)	8	5	1	1
Old Kona Airport	7			1
Kailua Reef	5			
Alii Drive	5			
Mile 4	1		1	
Pahoehoe Beach Park	1			1
Magic Sands Beach	5			
Kahaluu Beach Park	3			
Heeia Bay	2			
Kona Surf	5			
Chimney	6			
Boatwreck Reef (Red Hill)	1			1
Deep Reef (Red Hill)	3			
Domes (Red Hill)	4			
Fantasy Reef (Red Hill)	6		1	
Hammerhead Pt. (Red Hill)	6			
Henry's Cave (Red Hill)	3			
Long Lava Tube (Red Hill)	2		1	
Northern Lights (Red Hill)	3			
Spiral Lava Tube (Red Hill)	1			
White Tip Condos (Red Hill)	3			
Cook Pt.	6			
Kealahou Bay	8			
Keei Beach	4			
Kaopapa Ledges	3			
Honaunau Bay	4	1		
Hookena Beach Park	3			
Papa Bay	1			
Milolii	2			
South Point	1			

NOTES

1 A few operators that specialize in Molokini snorkel tours account for a large number of the snorkel tours reported in this study. Also, approximately 100 other sail/snorkel operators in the state were not interviewed for this survey.

2 Certain dive sites were combined for mapping purposes to show areas used by dive operators which contain a number of individual dive sites. For example, "Red Hill" between Keikiwaha Pt. and Keawekeheka Pt., just north of Kealahou Bay, contains at least nine individual sites known by popular names such as "Boatwreck Reef", "Dome", "Hammerhead Pt.", and "Long Lava Tube". Similarly, "Pine Tree", north of Honokohau Harbor, includes five individual sites such as "Pyramid Pinnacles", "Skunk Hollow", and "Golden Arches".

3 Molokini presents a special case. Although Molokini is sheltered from the tradewinds by Haleakala in the early morning hours, operators report a regular wind-shift phenomenon in the mid-morning. The ocean surface affected by the tradewind shifts in an eastward direction, literally sweeping across channel waters and Molokini Crater, creating choppy seas inside the crater. As a result, Molokini operators race toward the crater in the early morning, run their dive tours, and depart around 10:00 or 10:30 am before the seas become rough. This creates a 2-3 hour "window" during which several dozen dive and snorkel tour operators converge on Molokini Crater.

BIBLIOGRAPHY

Babbie, E.R.

1973. *Survey research methods*. Wadsworth Publishing Co., Inc. Belmont, California.

Blumenstock, D.I. and S. Price.

1972. "Climate of the States: Hawaii" in *A natural history of the Hawaiian Islands, selected readings*. (E. Alison Kay, ed.). University Press of Hawaii. Honolulu.

Brown, R.M.

1935. "The business of recreation." *Geographical review* 25(3): 467-475.

Brundage, B. and R. Tabata.

1986. *Dive Hawaii*. University of Hawaii Sea Grant Extension Service. Honolulu.

Carlson, A.W.

1980. "A bibliography of geographical research on tourism." *Journal of Cultural Geography* 1(1): 161-184.

Cooper, C.E.

1947. "Tourism." *Journal of Geography* 46(3): 115-120.

Cutter, S.L. K.F. Nordstrom, and G.A. Kucma.

1980. "Social and environmental factors influencing beach site selection." in *Resource allocation issues in the coastal environment: Proceedings of the Fifth Annual Conference*, West, N. (ed). The Coastal Society. Arlington.

Hacock, R.D.

1970. "Recreation behavior patterns as related to site characteristics of beaches." *Journal of Leisure Research* 2(4): 237-250.

Hoffman, P.

1984. *Comprehensive guide to scuba diving in Hawaii*. Press Pacifica. Kailua, Hawaii.

Holecek, D.F. and S.J. Lothrop.

1980. Shipwreck vs. nonshipwreck scuba divers: characteristics, behavior, and expenditure patterns. Michigan Sea Grant Program. Publication MICH-SG-80-205. Ann Arbor.

Hutchinson, R.J.

1988. "Scuba vacation — learning scuba in Hawaii is the adventure of a lifetime." *Hawaii Magazine* (October 1988), pp. 19-35.

Kinnunen, R.E., J.R. Lempke, T.C. Sundstrom.

1987. Behavior patterns of divers visiting the Alger Bottomland Preserve. Michigan Sea Grant College Program, MICHU-SG-87-505. Ann Arbor.

Knopp, T.B., G. Ballman, and L.C. Merriam, Jr.

1979. "Toward a more direct measure of river user preferences." *Journal of Leisure Research* 11(4): 317-333.

Lucas, R.C.

1964. "Wilderness perception and use: the example of the Boundary Waters Canoe Area." *Natural Resources Journal* 3, January 1964: 394-411.

MacDonald, C.D. and H.E. Deese.

1988. "Opportunities for development: a growth scenario and situation analysis of Hawaii's ocean industries." in *Oceans '88 proceedings, 13th annual oceans conference, volume 3*, pp. 880-890. October 31 - November 2, 1988. Baltimore, MD. Marine Technology Society and IEEE, Washington, D.C.

Mak, J. and W. Miklius.

1977. Guam's visitor industry: an economic assessment (prepared for Economic Planning Division, Bureau of Planning, Government of Guam). Agaña.

Matheusik, M.E.

1983. Sport divers and underwater parks: a market segmentation analysis. M.S. thesis, Texas A&M University. College Station.

Matthews, H.G.

1978. *International tourism: a political and social analysis*. Cambridge: Schenkman.

McMurry, K.C. and C.M. Davis.

1954. "Recreational geography" in *American geography: inventory and prospect*, P.E. James and C.F. Jones (eds.). Syracuse, New York: AAG by Syracuse University Press.

Mercer, D.C.

1970. "The role of perception in the recreation experience: a review and discussion." *Journal of leisure research* 3: 261-276.

Mitchell, L.S.

1969. "Recreational geography: evolution and research needs." *Professional Geographer* 21(2): 117-119.

Monaghan, R.

1988. "Just how many active divers are there? — 3.5 million or 700,000?" *Undercurrents* 13(1): 9-12, January 1988.

Morgan, J.R.

1983. *Hawaii, a geography*. Westview Press. Boulder.

New Zealand Dept of Lands and Survey.

1984. *The Cape Rodney to Okakari Point Marine Reserve visitor survey, 1983-1984* (prepared for the Cape Rodney to Okakari Point Marine Reserve Management Committee). Auckland.

O'Reilly, M.B.

1982. Sport diving in Texas: a study of participants, their activity, and means of introduction. M.S. thesis, Texas A&M University. College Station.

Oppenheim, A.N.

1956. *Questionnaire design and attitude measurement*. New York.

Pacific Area Travel Association.

1977. *Truk: a study of tourism development*. San Francisco: PATA.

Peterson, J.P. and T.C. Sundstrom.

1987. A profile of 1986 diver activity in the Thunder Bay Bottomland Preserve. Michigan Sea Grant College Program, MICHU-SG-87-507. Ann Arbor.

Peterson, J.P., T.C. Sundstrom, R.E. Kinnunen.

1987. 1986 recreational diving activity in Michigan Bottomland Preserves. Michigan Sea Grant College Program, MICHU-SG-87-506. Ann Arbor.

Professional Association of Dive Instructors.

1981. *The retail dive store: management and operation*.

Rice, K.

1987. "Special report: scuba diving — dive market requires specialized skill, information." *Tour & Travel News*, February 9, 1987, pp. 24, 26-27.

Robinson, L.

1987. "New mooring system could reduce coral damage." *Makai Newsletter* 9(5):1,5. May 1987. University of Hawaii Sea Grant College Program.

Saarinen, T.F. and J.L. Sell.

1980. "Environmental perception." *Progress in Human Geography* 4(4): 525-548.

Sheekin, I.M.

1985. *Survey research for geographers*. Resource Publications in Geography. Association of American Geographers. Washington, D.C.

Skin Diver Magazine.

1985. 1985 subscriber survey. Los Angeles: Petersen Publishing.

Skin Diver Magazine.

1987. 1987 subscriber survey. Los Angeles: Petersen Publishing.

Skin Diver Magazine.

1989. 1989 subscriber survey. Los Angeles: Petersen Publishing.

Skin Diver Magazine.

1991. 1991 subscriber survey. Los Angeles: Petersen Publishing.

Smith, S.L.J.

1983. *Recreation geography (themes in resource management)*. New York: Longman, Inc.

Somers, L.H.

1979. Profile of a Great Lakes diver. Michigan Sea Grant Reprint MICHU-SG-79-301. Ann Arbor.

Thorne, C. and L. Zitnik.

1984. *The divers' guide to Hawaii*. Honolulu.

Thorne, C.

1984. *The divers' guide to Maui*. Honolulu.

Travel and Tourism Consultants International.

1981. *Travel market yearbook 1981*. New York.

van Poolen, H.W.

1983. Recreational scuba diving industry survey and business analysis, State of Hawaii, 1982. Working Paper No. 52. University of Hawaii Sea Grant College Program. Honolulu.

Wallin, D.

1984. *Diving and snorkeling guide to the Hawaiian Islands*. Pisces Books. New York.

Wetzstein, M.E. and R.D. Green.

1978. "Use of principal component attractiveness indexes in recreation demand functions." *Western Journal of Agricultural Economics*, July 1978: 11-21.