

Marine Recreational Fishing and Associated State-Federal Research in California, Hawaii, and the Pacific Island Territories

MARK HELVEY, STEPHEN J. CROOKE, AND PETER A. MILONE

Introduction

Increases in population, per capita income, travel activity, and leisure time will continue to fuel participation in outdoor recreation over the next 25 years (Clawson, 1985). Whether this trend remains balanced among current recreational outlets or shifts to others can only be speculated. In the Southwest Region of the National Marine Fisheries Service (NMFS), which includes all of California, Hawaii, and Pacific Island territories, there are indications that marine recreational fishing will continue to grow in popularity. These include greater recreational use of small harbors and bays (Johnson and Metzger, 1983), de-

mand for more boat slips and berths (Morash, 1986), and continued interest in quality fishing and fishery products (Thompson, 1984; Braekkan, 1985).

In anticipation of this growth, there will be an even greater need to manage fishery resources prudently so that all commercial and recreational fishermen can partake equitably without overharvest of the resource. In particular, state and Federal fishery managers will need to continue monitoring the impact of fishing as well as continue to investigate the biological processes affecting the availability of marine resources. This paper provides an overview of marine recreational fishing within the NMFS Southwest Region and briefly outlines a few of the on-

going and future state-federal research and assistance programs addressing recreational fishing.

Background Information

The responsibilities of the NMFS Southwest Region for living marine resources encompass over 1.3 million square miles of the Pacific Ocean off California, Hawaii, the U.S. territories of Guam and American Samoa, the Commonwealth of the Northern Mariana Islands, the U.S. possessions, and to a lesser extent, the freely associated states of the Marshall Islands, the Federated States of Micronesia, and Palau (Fig. 1).

Three broad climatic regimes regulate the diversity of fishes inhabiting these waters. The cold and productive subarctic waters of northern and central California support large populations of demersal and anadromous fishes of northern affinity such as salmon (*Salmonidae*), rockfish (*Scorpaenidae*), and greenlings (*Hexagrammidae*). The temperate waters of southern California from Pt. Conception to the Mexican border (known as the Southern California Bight), support many demersal fishes of northern affinity such as rockfish plus reef-oriented and pelagic species of southern affinity such as sea basses (*Serranidae*), tunas (*Scombridae*), and jacks (*Carangidae*). Finally,

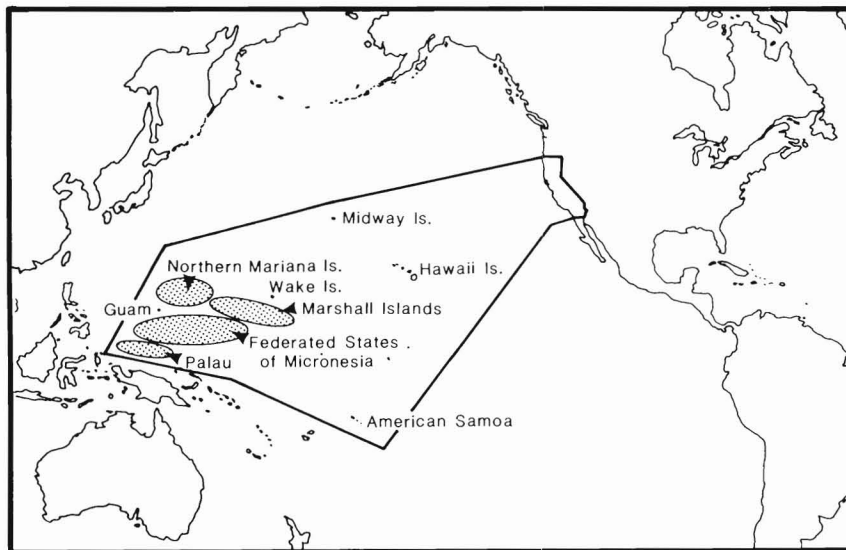


Figure 1.—The NMFS Southwest Region.

Mark Helvey is with the Southwest Regional Office, National Marine Fisheries Service, NOAA, 300 S. Ferry St., Terminal Island, CA 90731. Stephen J. Crooke is with the California Department of Fish and Game, 245 W. Broadway, Long Beach, CA 90802. Peter A. Milone is with the Western Pacific Program Office, Southwest Region, NMFS, NOAA, 2570 Dole Street, Honolulu, HI 96822.

the tropical waters of the central and western Pacific islands support a wide diversity of pelagic and reef fishes including marlins (Istiophoridae), tunas, groupers (Serranidae), snappers (Lutjanidae), dolphinfishes (Coryphaenidae), and goatfishes (Mullidae).

Participation, Effort, and Catch California

The NMFS-supported Marine Recreational Fisheries Statistics Survey (MRFS) originated on the Pacific Coast in 1979. The MRFS provides a database for estimating sportfishing impact on marine resources and is comprised of a telephone survey to estimate total effort for each coastal county and field interviews to determine species composition and weights. All salmon boat anglers are excluded from the survey as each state estimates its own salmon catch.

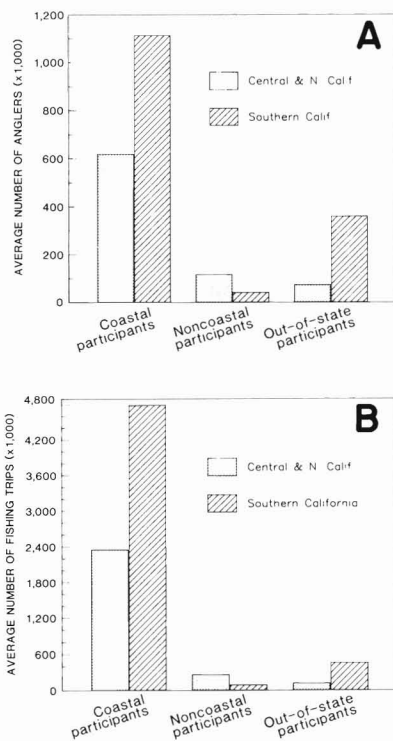


Figure 2.—Distribution by residence of the average number of marine recreational fishermen (A), and average number of fishing trips made by marine recreational fishermen (B) in California waters for 1981-85 based on the MRFS survey.

Data compiled from the California MRFS for 1981-85 (NMFS, 1984, 1985, 1986) indicate that there are nearly double the number of anglers fishing in southern California marine waters as there are in the central and northern part of the state combined (Fig. 2A). Higher coastal population, greater species diversity and moderate weather conditions in southern California account primarily for this difference. Anglers residing in coastal counties make up about 75 percent of all fishermen in the state (Fig. 2A). The average number of trips taken by southern California coastal participants is approximately double that of central and northern participants, but the percentage of total trips by these anglers is about equal (Fig. 2B).

The percent of fishing effort from man-made structures (e.g., piers, jetties) and private/rental boats (i.e., boats individually owned or rented) is almost the

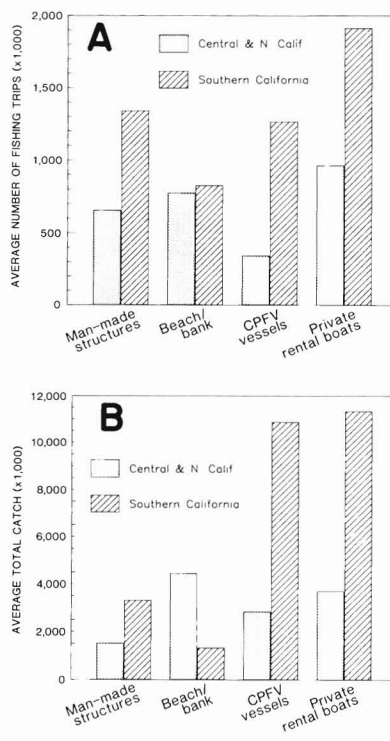


Figure 3.—Distribution by fishing mode of the average number of fishing trips (A), and average total catch (B) made by marine recreational fishermen in California waters for 1981-85 based on the MRFS survey. CPFV = commercial passenger fishing vessels.

same throughout California (Fig. 3A). The private/rental boat mode is the most popular, accounting for more than 35 percent of all fishing trips statewide (Fig. 3A). Fewest fishing trips occur on commercial passenger fishing vessels in central and northern California while fewest trips occur along the beaches in southern California.

The number of fish landed¹ by recreational anglers in southern California from 1981-85 averaged 14.2 million fish weighing 20.4 million pounds, compared with 10.5 million fish weighing 11.8 million pounds in central and northern California. The 74 percent greater weight of fish landed in southern California is due primarily to the availability of larger species such as albacore, *Thunnus alalunga*; bonito, *Sarda chiliensis*, and other pelagic species.

While landing figures are not available by mode, catch by mode can be used to indicate success in different areas. In central and northern California, beach/bank fishing is the most productive because of the high numbers of surfsmelt, *Hypomesus pretiosus*, and northern anchovy, *Engraulis mordax*, caught from the shoreline (Fig. 3B). In contrast, commercial passenger vessels and private rental boats account for 83 percent of the total number of fish caught in southern California.

In southern California, a small proportion of the private boat fishermen account for most of the effort in the billfish fishery. Many of these anglers participate in a tag and release program, and since 1963, have tagged and released over 1,000 striped marlin, *Tetrapturus audax*, and swordfish, *Xiphias gladius*, in the Pacific Cooperative Marine Gamefish Tagging Program. The NMFS's Southwest Fisheries Center in La Jolla, Calif., supervises this program in cooperation with the International Game Fish Association (IGFA). Participation in this program has increased dramatically in recent years because of a change in emphasis by tournament sponsors from landing to tag-and-release.

¹"Fish landed" represents fish retained by fishermen as opposed to "fish caught" which represents all fish landed and all fish released alive or dead due to quota and size regulations.



Figure 4.—A good catch of cowcod, *Sebastes levis*, by a southern California commercial passenger fishing vessel angler.

Nonsalmon sport fishermen in central and northern California catch 93 percent of their fish within 3 miles of the coast compared with 81 percent for southern California fishermen. In addition to the convenience of fishing nearshore, coastal waters support many prized sportfish species that utilize estuarine and riverine

habitats as spawning and nursery grounds.

Presently, the NMFS and California Department of Fish and Game (CDFG) are supporting several investigations to establish the habitat requirements of larval and juvenile fishes at these locations. Currently, assessments of spawning

Table 1.—Rank by landings (numbers of fish) of top ten species and species groups during 1981-85 by California marine recreational fishermen based on the MRFSS survey.

Area and species	1981	1982	1983	1984	1985
Central and Northern California					
Rockfish	1	1	1	2	1
Surfmelt		2	2	1	2
Northern anchovy	2			3	
Sandabs	3	8	3	7	4
Jacksmelt	4	5	6	8	
White croaker	9	7	8	4	3
Pacific mackerel	6	3	4	5	9
Lingcod	5	4	7	10	5
Barred surfperch	7	9		9	7
Redtail surfperch	8	6	10		10
Shiner surfperch					8
Striped surfperch		10			
Pacific herring	10			5	6
Walleye surfperch			9		
Southern California					
Rockfish	1	1	2	1	1
Pacific mackerel	2	2	1	2	2
Pacific bonito	3	5	3	3	7
Barred sandbass	7	3	6	6	3
White croaker	4	4	5	4	5
Kelp bass	5	6	4	5	4
Queenfish	9	8		7	6
Barred surfperch	6	7	8	9	10
Yellowtail			7		
Jacksmelt	8	9	9	8	8
Walleye surfperch	10				
California barracuda		10		10	
California sheephead			10		
Smelts					9

habitat requirements for chinook salmon, *Oncorhynchus tshawytscha*, in northern California and California halibut, *Paralichthys californicus*, in southern California will enable resource agencies to design mitigation projects that compensate for unavoidable habitat losses caused by water-dependent developers.

Rankings by landings by species or by species group have remained fairly stable over the past 5 years (Table 1), although declines in fish landings during the 1982-84 El Niño were noticeable throughout the state. Generally, rockfish landings dominate. This dominance is attributed to the fact that about 60 rockfish species occur in California waters and that they provide reliable, year-round catches (Fig. 4). The Southwest Fisheries Center's Tiburon Laboratory is involved in a long-term study to predict recruitment of rockfish to catchable size in central and northern California (Lenarz and Moreland²) because of their importance to

²Lenarz, W. H., and S. Moreland (editors) 1985. Progress report on rockfish recruitment studies at the Tiburon Laboratory. NMFS Southwest Fish. Cent. Admin. Rep. T-85-02, 19 p., Tiburon, Calif.

Table 2.—Annual total expenditures (tackle and bait costs, boat fees, etc., plus travel and lodging costs), net willingness to pay (see text footnote 4), and annual total value for California marine recreational fishing trips, 1981-85.

Mode	Amounts (\$1,000)		
	Central and N. Calif.	S. Calif.	State-wide
Annual total expenditures			
Man-made structures	21,451	43,850	65,302
Beach/bank	29,376	31,383	60,759
Commercial passenger fishing vessels	31,794	116,761	148,555
Private/rental boats	44,134	87,673	131,806
Subtotal	126,755	279,667	406,422
Annual net willingness to pay ¹			
Man-made structures	19,742	40,354	60,096
Beach/bank	28,458	30,402	58,860
Commercial passenger fishing vessels	4,816	17,687	22,503
Private/rental boats	26,343	52,332	78,675
Subtotal	219,929	188,748	408,676
Annual total value	346,684	468,415	815,099

¹The net willingness to pay dollar values are calculated as all or nothing values for each mode; that is, the amount anglers would be willing to pay in order to continue fishing solely in that particular mode. The subtotal for all modes exceeds the sum of the individual modes because it represents the total value of having fishing in any of the four modes rather than having no fishing at all.



Figure 5.—Landing a large yellowtail, *Seriola lalandi*, on a southern California commercial passenger fishing vessel.

both the commercial and recreational fisheries. In addition, CDFG is initiating a program in southern California to age selected rockfish species taken by recreational fishermen in an effort to resolve questions about recruitment and year-class strength.

Other important species that contribute to landings throughout California consistently are listed in Table 1. In 1982 and 1985, salmon ranked seventh in landings based on CDFG data. Occasionally, as in 1983, yellowtail, *Seriola lalandi*, are a major component of the catch (Fig. 5).

The economic impact of recreational fishing in California has not been extensively reviewed. However, using 1981 MRFSS data, Rowe et al.³ developed per-trip estimates for total actual expenditures and net willingness to pay⁴. When applied to the average number of trips

taken from 1981 to 1985, the annual total value for all trips and all modes statewide in 1985 dollars is estimated to be \$815 million (Table 2).

Hawaii

Recreational fishermen throughout the mainland United States are generally motivated by their enjoyment of the sport as a pastime. By contrast, fishermen in Hawaii are often motivated by a combination of factors which tend to blur traditional distinctions between recreational and commercial fishermen. In Hawaii, many recreational/subsistence fishermen hold commercial fishing licenses and sell a portion of their catch to supplement income. Yet, very few would characterize themselves as commercial fishermen. According to Skillman and Louie⁵, 27 percent of those who own boats sell a portion of their catch but only 3 percent derive more than half of their gross income from fishing. Despite this overlap

between commercial and recreational fisheries, the recreational motivation for fishing appears to predominate among most Hawaiian fisherman (Department of Land and Natural Resources⁶).

Surveys of recreational fishing in the Hawaiian Islands are few. The most recently compiled data comes from the National Recreation Survey by the U.S. Department of Interior (1980) which estimated 154,400 Hawaii residents out of a population base of 707,000 engaged in sportfishing in 1980; those fishermen reportedly made 2.74 million trips.

Shoreline fishing is the most popular mode involving 68 percent of all recreational/subsistence fishermen (Hoffman and Yamauchi⁷). These fishermen primarily use pole-and-line to target a wide variety of species including the highly prized uluas or large-sized jacks, *Caranx*

³Rowe, R. D., E. R. Morey, A. D. Ross, and W. D. Shaw. 1985. Valuing marine recreational fishing on the Pacific Coast. NMFS Southwest Fish. Cent. Admin. Rep. LJ-85-18C, La Jolla, Calif.

⁴Net willingness to pay or "consumer surplus" represents the monetary value an angler would be willing to pay over and above actual out-of-pocket expenditures to maintain existing fishing opportunities.

⁵Skillman, R. A., and D. K. H. Louie. 1984. Inventory of U.S. vessels in the central and western Pacific. Phase 2: Verification and classification of Hawaiian vessels. NMFS Southwest Fish. Cent. Admin. Rep. H-84-12, Honolulu.

⁶Department of Land and Natural Resources, State of Hawaii. 1980. Hawaii coastal zone fisheries management study, Honolulu.

⁷Hoffman, R. G. and H. Yamauchi. 1973. Impact of recreational fishing expenditures on the state and local economies of Hawaii. Univ. Hawaii, Sea Grant Program Rep. AR-72-02, Honolulu.



Figure 6.—A 25-pound “onaga” or red snapper, *Etelis carbunculus*, caught by handline off Hawaii in 140 feet of water.

spp., commonly found in turbulent waters near rocky shorelines. Other common gear types include throw nets, gill nets and spears. The State of Hawaii’s Division of Aquatic Resources is engaged in efforts to survey shoreline fishery resources and fishermen’s participation levels at selective locations throughout the state. This information will be used in developing shoreline “kapu” fishery management programs which involve opening and closing certain areas to fishing activities on a rotating basis.

Offshore recreational fishing is also popular for the estimated 3,500 boat owners (Department of Land and Natural Resources, 1986) in Hawaii who commonly troll for tuna and marlin or handline for deepwater snappers, groupers, and jacks (Fig. 6). These boats are permanently moored or trailered to launch ramps throughout the islands (Department of Land and Natural Resources,

1986). Although most fishing by the recreational “mosquito fleet” occurs on weekends and in the calm summer months, fishing effort does increase when the market demand for certain species is high.

State and Federal support for offshore sportfishing is most visible in the form of fish aggregation devices (FAD’s) which are now deployed in waters throughout the state. Early experiments with FAD’s by the Southwest Fisheries Center’s Honolulu Laboratory (Matsumoto et al., 1981) led to the development of a statewide FAD program which currently numbers 48 buoys. In addition, the State of Hawaii recently established an experimental “trolling alley” comprised of a series of midwater aggregation buoys off the island of Oahu.

Marine recreational fishing generates substantial economic benefits to the State of Hawaii. In 1980, Hawaiian recreational fishermen spent about \$38.3 million on fishing vessels, equipment, repairs, moorage, etc. (U.S. Department of Interior, 1980). The value of fishery landings attributable to these fishermen is difficult to determine; nevertheless, the volume in weight of recreational landings is probably large and comparable to Hawaii’s commercial catch (Department of Land and Natural Resources, 1986).

Charter boat fishing operates year round out of the main Hawaiian Island ports, with the fleet concentrated primarily on the islands of Oahu and Hawaii. The fleet size was estimated at 119 vessels which produced an estimated 73,780 passenger trips in 1982 (Samples et al.⁸). Total expenditures by patrons on charter boats was estimated at \$52.5 million in 1983 (Samples and Shug⁹).

The total fish catch by Hawaii’s charter fleet is substantial and constituted 2.2 million pounds or about 15 percent of the State’s reported commercial catch in 1982. The charter boat catch is particu-

⁸Samples, K. C., J. N. Kusakabe, and J. T. Sproul. 1984. A description and economic appraisal of charter boat fishing in Hawaii. NMFS Southwest Fish. Cent. Admin. Rep. H-84-6C, 130 p., Honolulu.

⁹Samples, K. C., and D. M. Schug. 1985. Charter fishing patrons in Hawaii: A study of their demographics, motivations, expenditures and fishing values. NMFS Southwest Fish. Cent. Admin. Rep. H-85-8C, 95 p., Honolulu.

larly important for certain species such as the blue marlin, *Makaira nigricans* (Fig. 7). For example, the estimated blue marlin catch by the charter fleet in 1982 was 180 percent higher than the reported commercial catch of blue marlin⁹.

This reputation for big-game marlin and tuna fishing is an important adjunct to the State’s tourism industry and has contributed to the growing number of fishing tournaments held in Hawaii, the most famous being the Hawaiian International Billfish Tournament (HIBT) held each August in Kailua-Kona. Six of 13 IGFA records held for Pacific blue marlin catches are from Hawaii (IGFA, 1986). Interestingly, the 1986 HIBT inaugurated a tag and release program by offering teams bonus points for tagging fish (Gaffney¹⁰) and it appears that this will be a common feature of this and other Pacific tournaments.

Pacific Island Territories

The differentiation between commercial and recreational/subsistence fishermen is even less clear in the distant Pacific island territories of the United States. Income levels are generally lower than those in Hawaii, and thus fishing assumes a greater importance because of its subsistence and income producing capability. Although each island area has a small but discrete full-time commercial fishery, the majority of offshore fishermen sell their catch and can be considered part-time recreational and quasi-commercial.

Precise information on sportfishing participation and catch in the Pacific island territories is sparse. Nevertheless, the fishery agencies in Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands are presently engaged in a number of fishery surveys in an effort to generate comprehensive data on the extent of fishery participation, catch, and effort in nearshore and offshore waters. Similar survey programs are planned for the Federated States of Micronesia, Palau, and the Marshall Islands.

Reefwalking and shoreline fishing

¹⁰Gaffney, R. 1986. “Finally a grander!” Hawaii Fish. News (Honolulu), Sept. 1986, p. 14.

with pole-and-line, nets, or spears are methods commonly used by island residents in pursuit of subsistence fisheries. The majority of fishing vessels in the islands are small, trailerable vessels 18-25 feet long. Most of these vessels are used to troll for tunas, marlin, dolphinfish, and wahoo, *Acanthocybium solandri*, often with effort directed around FAD's which are widely used in the Pacific territories. Handline fishing for deepwater snappers and groupers also is common.

A small fleet of charter sportfishing vessels has begun to emerge with the growth in tourism taking place in the U.S. Pacific islands. Presently, six vessels in American Samoa and ten vessels in Guam are available for hire for sportfishing (WPFMC¹¹). Marlin, tunas, and dolphinfish are the principal target species. There also has been an emergence of fishing tournaments in recent years as a means of promoting sport fishing opportunities in each respective island.

Future Direction of State-Federal Programs

A joint NMFS and CDFG task force formed in spring 1986 portrayed the future of California recreational fisheries to 1996 as a period that many associated with the sport would like to avoid. For instance, an increase in Mexican domestic fishing along Baja California was identified as an impediment to the availability of migratory species such as white seabass, *Atractoscion nobilis*; yellowtail, and California barracuda, *Sphyrna argentea*, to California fishermen. A continued decline was predicted for rockfish and lingcod stocks in central and northern California as intense fishing pressure from the commercial and recreational sectors continued. To circumvent these events, both agencies developed, with the participation of private citizens actively involved in recreational fishing, a strategic plan designed to serve as a framework for directing and coordinating their recreational fishing programs through 1996.

The timing of this plan is opportune

¹¹WPFMC. 1986. Fishery management plan for the pelagic fisheries of the western Pacific region. West. Pac. Fish. Manage. Council., Honolulu.



Figure 7.—A blue marlin, *Makaira nigricans*, caught by recreational fishermen off the Hawaiian Islands.

because of the increased emphasis on recreational fishing by both agencies. For instance, with support from a NMFS Saltonstall-Kennedy (S-K) grant, the National Coalition for Marine Conservation-Pacific Region is currently evaluating the relationship between angler expenditures and fish species abundance in California for the NMFS Southwest Regional Office. With similar funds, the University of California Sea Grant Marine Advisory Program is developing strategies for increasing the use of underutilized sportfish. Also, the Southwest Fisheries Center's La Jolla Laboratory recently sponsored a supplemental economic survey of recreational fishing from Monterey northward in conjunction with the MRFSS. The CDFG recently initiated a sportfish age composition study and an egg and larval population study, both supported by Wallop-Breaux funds¹². Further, CDFG has accelerated its efforts

to install artificial reefs in southern California.

In the Pacific islands, emphasis is being placed on obtaining accurate and timely estimates of sportfishing catch and effort. Future research is intended to generate comprehensive information on the participation, catch, and value associated with recreational fisheries. There are plans for further refinement of data originally collected in the Pacific during the 1981 MRFSS and the development of new survey techniques to capture needed fishery information on the unreported

¹²The Wallop-Breaux fund, formerly known as the Dingell-Johnson fund, is derived from Federal excise taxes on fishing tackle, outboard motors, and recreational motor boat fuel and on import duties on sport fishing equipment, pleasure craft, and yachts. The funds are provided to the states and territories for sport fishing related projects.

recreational catch.

There also is increased support for enhancing recreational fishing opportunities in the islands by use of S-K grants. Currently, these funds are supporting the installation of boat launching ramps in Guam and the Northern Mariana Islands, the evaluation of a new mooring design for fish aggregation devices and the development of an artificial reef design in Hawaii for use in turbulent nearshore waters.

In addition, the rapid growth of tourism in the Pacific islands has presented new opportunities for expanding the charter sportfishing industry. Accordingly, the NMFS Southwest Regional Office intends to focus more effort on identifying and developing promising business opportunities in charter sport fishing consistent with the tourism and economic development goals of island communities.

Acknowledgments

We thank W. Craig, H. Frey, S. Fournier, D. Gates, D. Huppert, A. Katekaru, R. Klingbeil, J. Naughton, J. Rutka, K. Samples, R. Skillman and J. G. Smith for critically commenting on the manuscript and B. Beebe for providing Figures 4 and 5, J. Rutka for providing Figure 6 and D. Huppert for compiling Table 2.

Literature Cited

- Braekkan, O. R. 1985. The nutritional value of fish in the diet. *In* R. H. Stroud (editor), World angling resources and challenges, p. 377-384. Int. Game Fish Assoc., Fort Lauderdale, Fla.
- Clawson, M. 1985. Outdoor recreation: Twenty-five years of history, twenty-five years of projection. *Leisure Sci.* 7:73-99.
- Department of Land and Natural Resources. 1986. Hawaii fisheries plan 1985. Dep. Land Nat. Resour., Honolulu, 163 p.
- IGFA. 1986. 1986 world record game fishes. Int. Game Fish Assoc., Fort Lauderdale, Fla, 320 p.
- Johnson, J. C., and D. Metzger. 1983. The shift from technical to expressive use of small harbors: the "play-full" harbors of southern California. *Coastal Zone Manage. J.* 10:429-441.
- Matsumoto, W. M., T. K. Kazama, and D. C. Aasted. 1981. Anchored fish aggregating devices in Hawaiian waters. *Mar. Fish. Rev.* 43(9):1-13.
- Morash, T. 1986. Marine recreation. *Sea Technol.* 27, 4 p.
- NMFS. 1984. Marine recreational fishing statistics survey, Pacific Coast, 1981-82. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Curr. Fish. Stat., 8323, 203 p.
- _____. 1985. Marine recreational fishing statistics survey, Pacific coast, 1983-1984. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Curr. Fish. Stat. 8325, 189 p.
- _____. 1986. Marine recreational fishing statistics survey, Pacific Coast, 1985. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Fish. Stat. 8328, 109 p.
- Thompson, R. B. 1984. Marine recreational fisheries - update 1984. *In* R. H. Stroud (editor) *Marine recreational fisheries* 9, p. 15-26. Natl. Coalition Mar. Conserv., Savannah, Ga.
- U.S. Department of Interior. 1980. 1980 National survey of fishing, hunting and wildlife associated recreation: Hawaii. U.S. Dep. Inter., Fish Wildl. Serv., Wash., D.C.