

University of Hawaii, Honolulu, Hawaii

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*EXCERPT -*

COOPERATIVE SHARK RESEARCH AND CONTROL PROGRAM

FINAL REPORT 1967-69

*HAWAII*

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by

Albert L. Tester

Senior Professor of Zoology

and

Principal Investigator

and Henle)" (Comp. Biochem. Physiol. 31, in press). A Ph.D. Project "A comparative study of the ecology, life history, and distribution of Carcharhinus menisorrah (=amblyrhynchos) and C. milberti" by Richard C. Wass is being actively pursued and should be completed within a year.

#### THE FUTURE

##### THE SHARK HAZARD IN PERSPECTIVE

Before discussing possible shark control measures, the local shark hazard should be put in proper perspective. First we should recognize that there are three groups of sharks, which we can roughly divide into "deepwater", "offshore", and "inshore".

The "deepwater" sharks, such as Cooke's, the six-gill, the false cat and small dogfish occur at depths generally below 150 fathoms and live and feed close to the bottom. They do not constitute a hazard to man.

The "offshore" sharks, including the voracious great white, mako, silky, oceanic whitetip and other less dangerous species, inhabit mostly the mixed layer of the ocean, from the surface to 150 fathoms or more. They are widespread in their distribution, occurring throughout the Pacific and other oceans and feed on pelagic fish and invertebrates of the photic zone. They constitute a hazard to man, particularly in the event of airplane or ship disaster at sea. They destroy the gear and gorge on the catch of offshore fisheries such as tuna and billfish caught by longlining and trolling.

In Hawaii, only rarely do the dangerous offshore sharks enter shallow inshore waters. Occasionally they will do so, however, as shown by the isolated catches of mako and silky taken during this present program and of great whites taken during the Billy Weaver Program around Oahu and during the Oceanic Institute Program off the Kona Coast of Hawaii. It may be noted that a recent shark incident at Makaha, Oahu (3/8/69), involved a great white (identified by Mr. Richard C. Wass from tooth marks on a surfboard that was bitten) which was probably attracted close to the beach by the carcass of a dead whale stranded

there. There is little hope of controlling the abundance of the vast and far-ranging populations of offshore sharks but, fortunately, as mentioned above, these species rarely enter shallow inshore areas.

The "inshore" sharks of Hawaii include in order of abundance, the sandbar, tiger, galapagos, blacktip, scalloped hammerhead, smooth hammerhead, gray reef, and other less common species. These generally inhabit the shallow water zone from the reef to about 150 fathoms, although some species (e.g., the blacktip) may not go as deep, and others (e.g., the tiger) may go deeper. These sharks feed mostly on fish, crabs, mollusks, and other invertebrates which are on or close to the bottom but some, at least will also feed on prey in midwater or at the surface. The varied diet of the tiger shark, a notorious scavenger, has already been discussed. These sharks rarely penetrate the reef areas. They are seen occasionally by skin and SCUBA divers in deeper waters just beyond the reef. The two species regarded as truly dangerous to man are the large and voracious tiger and galapagos sharks, both of which have been implicated in shark attacks. All species, but particularly the abundant sandbar and less abundant galapagos, may destroy gear and eat the catch of longliners, handliners and trollers. All compete with more desirable food species for food at some level of the food web, and some feed directly on them.

It should be emphasized that the shark hazard to swimmers in Hawaii, while ever present, is remote. There have been only 11 known fatalities, and perhaps double that number of non-fatal attacks, over the past 90 years. The probability of injury or death from shark attack is obviously small compared with that from automobiles. Yet it still exists. The fear engendered by sighting a shark in our inshore recreational areas is real indeed to the swimmer and usually results in widespread publicity that causes apprehension among both local residents and tourists and detracts from the full and pleasurable use of our inshore recreational areas. Somewhat more tangible is damage caused by sharks to the fishermen's gear and catch and the role of sharks as predators on more desirable species.

On the credit side of the ledger, sharks offer a potential source of



food for man, leather for wallets and shoes, teeth for jewelry and pharmaceutical drugs for medicine. In addition, some sharks, particularly the tiger, play a useful role as scavengers and, through their predation, may help control the abundance of smaller shark species which are less dangerous to man but which may be a hazard to the fishermen's catch.

Considering all aspects, some measure of control of shark abundance seems desirable, preferably one which will incorporate the utilization of shark products. Regarding the hazard to man, it might be noted that no truly successful, practical, shark deterrent has yet been devised to protect casual swimmers, divers, and surfers, although the Scott Johnson "bag" (Tester, et al., 1968; Gilbert, 1968) shows considerable promise for protection under special circumstances, e.g., airplane or ship disaster. Thus control of abundance is presently the only feasible method of reducing the probability of shark attack in inshore waters.

#### CONTROL BY BOUNTIES

It has often been suggested that the State should offer bounties on sharks to assist in their "eradication". Operation of a bounty system presents several problems. If rewards were available to all, it would encourage amateur spear fishermen to hunt for sharks thus increasing the probability of provoked attack. It would encourage amateurs to handline for sharks from small boats, a dangerous procedure if a large shark is caught. Others, including children, would catch large numbers of small hammerheads in nursery grounds such as Kaneohe Bay, but this would be somewhat ineffective. Large hammerheads are not particularly abundant, perhaps because of a high natural mortality rate, nor are they particularly dangerous to man; they are less of a hazard than other species to the fishermen's catch and gear.

If the bounty were restricted to commercial fishermen, some benefit might derive by reducing the abundance of inshore sharks on inshore grounds, but there would be little benefit if the bounty also applied to offshore sharks. Moreover, effort would be sporadic and restricted to the fishing grounds, rather than concentrated on both fishing grounds and recreational areas. To be reasonably effective, the bounty might have to be graded as to size of shark and restricted as to species and

However, it should be realized that continuing control of shark populations in inshore waters might require subsidization.

STATE  
CONTROL  
MEASURES

The development of a commercial shark fishery is only a possibility for the future. If continued low abundance of the inshore shark populations is desired, it can be achieved only by a continued Shark Research and Control Program, with emphasis on control. Research would be a by-product, aimed at using catch data to evaluate success of the program in controlling shark abundance and contributing to our knowledge of shark life history and ecology. It is recommended that the State undertake a continuing Shark Research and Control Program, at least until a commercial fishery is developed.

It is reasonably certain from evidence already presented that sharks can be reduced appreciably in numbers (perhaps to 50 or 60% of their original abundance) by moderate fishing effort around Oahu (present program) and to even a greater extent by greater effort (Billy Weaver Program) (Fig. 10). The reduction in abundance has been even more spectacular at Kawaihae (Fig. 11). On the other hand there is still the unresolved question of whether removal of the larger predatory species, such as the tiger shark, will result in an increase in the abundance of smaller species, such as the sandbar shark, which although not dangerous to man play havoc with the fishermen's catch.

The main objective of a continuing control program might be to reduce the abundance of sharks by at least 50% along all populated coastlines used for recreation and on all of the main inshore fishing grounds of all islands. This might be accomplished by a one-boat operation, fishing in 40 to 50 selected areas throughout the State, four times per year. A greater reduction, with expansion to additional areas, would require a two-boat operation at approximately double the cost. A second objective might be to continue research on shark life history and particularly on the effect of fishing on the absolute and relative abundance of the various species. A third objective might be to further investigate the feasibility of establishing a commercial shark fishery.

It is recommended that initially a one-boat operation be conducted,

subject to continuous evaluation and modification. The critical areas, each covering 5 to 10 miles of coastline, might be distributed as follows: south and east coast of Kauai - 4; all coasts of Oahu - 16; south coast of Molokai (including Penguin Banks) - 4; south coast of Maui - 6; west coast of Hawaii - 6; and north coast of Hawaii (including the Hilo area) - 4. Additional areas would be fished as possible. The final distribution of areas among islands and the selection of areas within islands should, of course, be determined by agreement between representatives of all concerned groups (state and county administrators, tourist industry, recreation organizations, inshore fishermen, both sport and commercial).

The above distribution of effort would consume 160 days of actual fishing. A vessel charter could be arranged for 20 fishing days per month, 240 fishing days in all, leaving 80 days (counted as "fishing" days) for travel to and from islands, delays due to weather, and such additional fishing as might be possible.

Fishing should be conducted with longline gear (at least nine basket, 72 hook sets) in quasi-standard fashion, using perpendicular and oblique sets where possible and using suitable bait as can be purchased or caught by the crew between or during regular sets. Also between and during sets the crew should handline for small sharks in all areas.

The Program should be directed by a scientist of the Department of Natural Resources, Division of Fish and Game, who would assume responsibility for vessel operation, cruise plans and cruise reports. A full-time scientist technician, responsible to the director, should be on board during all fishing operations to identify the sharks, to record environmental conditions such as sea state, temperature and depth of fishing, to compile data on number, species, size, sex and maturity stage of all sharks caught, and to supervise the disposal of shark carcasses. He might also supervise the preparation of shark products (filets, fins, teeth, jaws, etc.) for acceptability and marketing experiments.

A firm budget for the above program should be compiled including cost of scientific personnel, vessel charter, vessel operation, crew



wages, gear, bait, and ice. Rough estimates indicate an annual cost for one-vessel operation of about \$100,000. The cost might be borne entirely by the State, or shared on some proportionate basis with the counties.

It is anticipated that if desired, the University of Hawaii would assist in the above program in an advisory capacity. If research funds are made available it could also assist in data processing and interpretation. It is exceedingly important to thoroughly assess the utility of the program in maintaining the shark populations at the desired low level of abundance throughout all islands. It is equally important to learn more about shark life history and ecology.

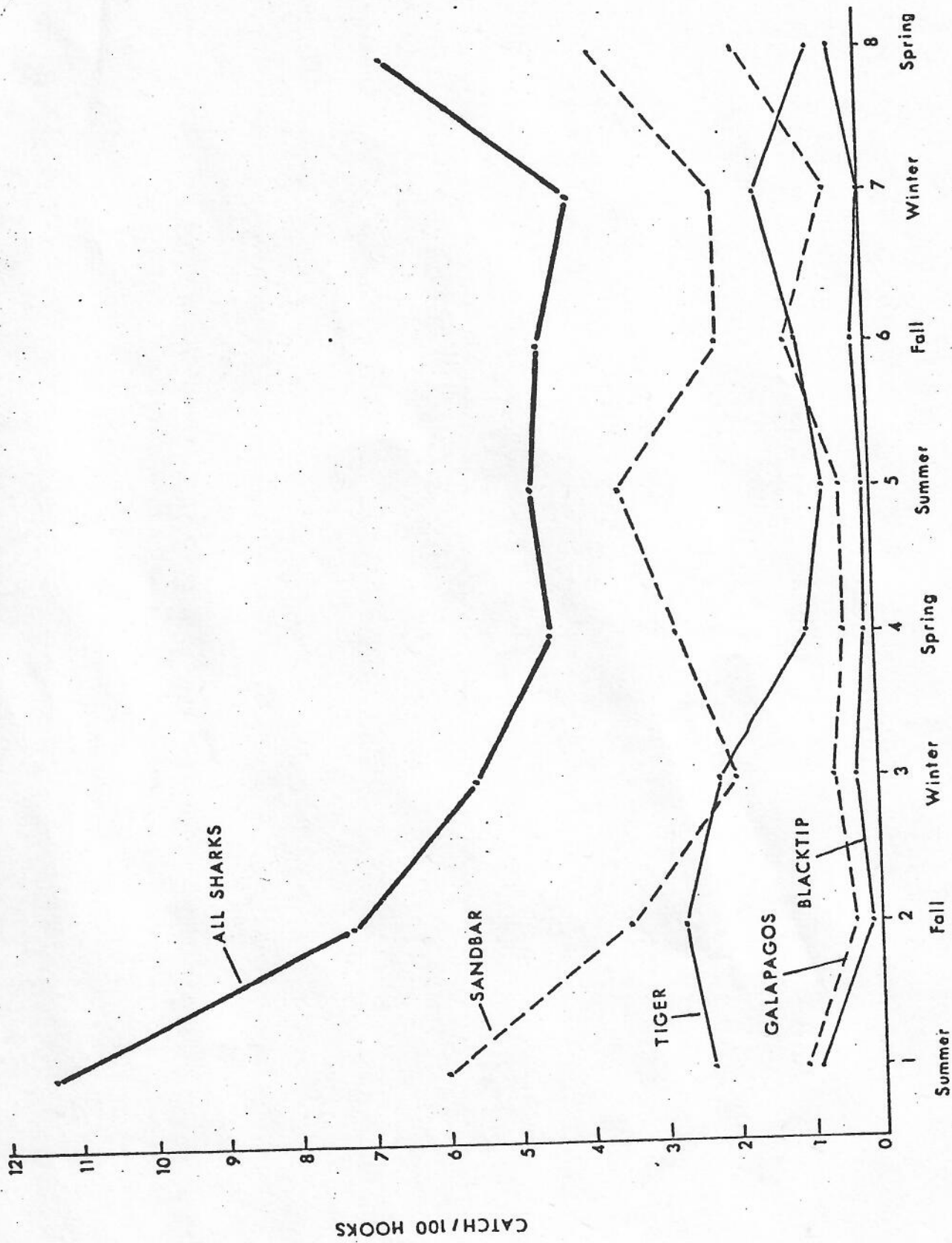


Fig. 9. Trends in catch rates in successive circuits of Oahu.



Diego, has been granted contract to carry out the is killer star. are attempting to learn the and cause of the killer star's



population explosion and the extent of damage so far. The "crown of thorns" starfish has reportedly killed about 90% of the coral along two-fifths of Guam's coastline in 30 months. Coral devastation disrupts the food chain for reef fish, causing grave problems for people who inhabit these islands, as well as destroy the beauty of the South Pacific's marine paradise.

**DOT REPLACES ICC**

Don't be alarmed if the neck of your new scuba cylinder is marked "DOT" (Dept. of Transportation) instead of the usual "ICC" (Interstate Commerce Commission). The ICC is now under the jurisdiction of the DOT, and so all newly manufactured cylinders will be marked "DOT" as of 1/1/70. Cylinders manufactured before this date will bear the ICC label and can be kept in use.

**WSDR RADIO IN ILLINOIS PRESENTS DIVING PROGRAM**

"Let's Go Diving," a Thursday evening radio program beginning at 6:15, presents diving to an estimated audience of 300,000. The program's host, PADI instructor John F. Wendell, dedicates the show's 15 minutes to the safety and enjoyment of the sport. "The idea of the program," states Wendell, "is to introduce diving in the area and let people know that it can be a safe and wonderful sport if the rules of safety are observed."

The large listening audience of all

learn of the smaller lakes which hold useful and enjoyable diving. The program illustrates the relationship between diving and scientific research in the ocean, discloses the new areas of rescue work and salvage, and introduces noted diving guests who relate their personal underwater experiences.

"But most important," says Wendell, "it points out to the people that diving is interesting and very enjoyable to the person who is looking for beauty and adventure."

**LONGHORN SCUBA WEEK**

Governor Preston Smith of Texas designated the week of Aug. 30-Sept. 6 as Skin and Scuba Diving Week in the state. The week began with a spear-fishing contest at Lake Travis, and continued as dive clubs hosted a variety of activities throughout the state.

**U/W SHUTTERBUG CLASS**

Brooks Institute of Photography is starting a new course in underwater photographic techniques on October 27.



The course will run seven weeks. The school utilizes underwater television and video systems to assist in private studies as well as university projects.

**EXCAVATE ... NOT DEVASTATE**

is the concern of the United Kingdom's underwater archaeologists. Britain's ancient wrecks have been the target of unrestricted plunder, and the University of London's Institute of Archaeology is establishing a school for marine archaeology. The school will educate as many divers as possible in the proper methods of underwater excavation, hopefully reducing the number of incidences in which valuable wrecks are destroyed.

A labor strike in the city of Willemstad on the tiny Dutch island of Curacao resulted in burning and looting by a handful of teenagers. Adverse publicity of the unhappy event indicated that the whole island was under siege by rioters. Tain't so: divers are finding that facilities are as intact as before the disturbances. Hotels were not affected and continue to give excellent service. The debris from the few buildings that were burned has been removed, and the visiting diver will find that Curacao's well-known hospitality and service is still the same idyllic backdrop for the beautiful Caribbean at Curacao's front door and that the diving is great.

**UNDERWATER CONGLOMERATE**

Parkway Fabricators and Kayak Corporation of America have joined Great American Recreation, Inc. to form the first U/W corporate conglomerate in the diving recreation field. GAR carries such products as the Parkway Shark Skin Suit, Kayak inflatable boats, and the Scuba/Com communications system.

**SHARK CONTROL SUCCESSFUL**

A two-year program of shark control in Hawaii is coming to a close, and Dr. Tester, professor of zoology at the U. of Hawaii and head of the shark control program, suggested that the program be continued. The two-year project consisted of regular fishing for the sharks to reduce the shark concentration. It served another purpose as well, in that it gave access to valuable data on the beasts. Dr. Tester stressed the fact that if the fishing was not continued, the shark concentration would automatically rise again as it had done in the past. Before the fishing program began, approximately 12 or more sharks were caught per 100 hooks during a 24-hour period. After the two-year fishing period, the ratio had been reduced to four or five — 1/3 the original population.

Dr. Tester suggested that two shark fishing vessels continue the operation under government subsidy. Part of the cost could be met by the commercial use of shark products such as the use of shark teeth for jewelry and shark for food (shark fin soup and shark steak).

**WHILE WE'RE ON THE SUBJECT**

In 1967, Gov. Claude Kirk of Florida was thinking of new industry for the state. He arrived at the possibility of using sharkskin for shoe leather. Kirk observed that sharkskin was thick, tough, and could possibly compete with leather in the shoe market. Since then, sharkskin has become an extremely popular shoe material. Why not? It gives your feet a real bite.