MARINE TURTLES

HAWAIIAN AND OTHER MARINE TURTLES AND NW HI G.H. BALAZS FOLDER

Iwasa Chelonian Museum want to display this scene in color.

ウミガメの話題から

内田 至

Photo by George H. Balazs.

■ 陸に上がるウミガメ

5年前のことです。ウミガメの調査でインドネシアに行ったおり，首都ジャカルタから自動車でボゴールへ向かいました。ボゴールには，オランダが統治時代につくったすばらしい熱帯植物園があるので有名です。と同時に，そこは動物学博物館と国立の農業大学の所在地でもあるのです。私の目的は，農業大学の水産学部にウミガメに興味をもっている若い研究者がいることを聞いたので，調査の前に会っていろいろと知識を得ておくためでした。

ブーゲンビリアの花が咲き乱れる構内の一室で待つことしばらくして，その若い人を紹介されました。

話しがウミガメの飼育のことになったとたんに彼は目を輝かせ，目下飼育中のアオウミガメの子を見ないかということになり，飼育実験室に案内されました。ところが，ほら，スマトラの東部で採集してきたアオウミガメの子ですよと言って，彼が手のひらの上に取りあげたマッチ箱ほどの子ガメを見てビックリしました。それはアオウミガメの子ではなく，まぎれもないタイマイ（別名ベッコウガメ）の幼体であったからです。これは，文献や資料の入手しにくいところでおきる間違いです。多くの標本を見ていないと，水族館の慣れた飼育係員でさえタイマイの幼体とアカウミガメの幼体の区別を間違えることもありますから，仕方のないことかもしれません。

これと同じような例は，わが国にもたくさんあります。とくに多いのは，やはりアオウミガメの未成体とタイマイの未成体との混同です。それは，これらのウミガメを甲の紋様や色彩から区別しようとするのが原因のようです。

例えば，アオウミガメには背甲の鱗板に，と

Protection of the Green Sea Turtle and the Hawksbeak
by I. Uchida.

ウミガメの話題から

内　田　　至

Protection of the Green Turtle

and the Hawksbeak

by Itaru Uchida

どうぶつと動物園 31 (10) : 344. Oct., 1979

きどき放射状の後光が射したような模様のあるものがいます。いつ頃，誰が言い出したのかわかりませんが，この模様からこれをアサヒベッコウなどと呼んだりしたために，これをタイマイと勘違いして解説してあるのを見たこともあります。

また，つい先日みたウミガメの解説記事の中にも次のようなものがありました。「……ウミガメ類は，ふ化後ひとたび海に入ると，雌は成長してから産卵の際に上陸するが，雄は一生涯，陸に上ることなく海中生活を送る……」という解説です。何かウミガメ類の生態を言い得た，もっともらしい解説のように思われますが，どうやらこの解説も誤りのようです。

それは，ハワイ大学のバラーズさんをココナッツ島の臨海実験所にたずねたときのことです。彼がアオウミガメの生態研究のフィールドにしている，ハワイ群島のサンゴ礁の無人島で写した一枚の写真を見せられたとき，私は息をのむほどおどろきました。真白いサンゴ礁の海浜に，真昼間たくさんのアオウミガメが上陸して，甲羅ぼしをしながら休んでいるではありませんか(表題写真参照)。それは，産卵上陸とはあきらかに違います。波打ち際のちょっと上のところで，ウミガメが休んでいるのです。

産卵上陸の際にウミガメがみせる，あの用心深い行動からすれば，日中砂浜に上陸し，気持ち良さそうに熱帯の陽光の下でまどろむ姿などは，ちょっと想像できませんでした。それでも，波打際よりずっと離れたところまで上陸しているものが少ないのは，用心深いウミガメの習性のあらわれかもしれません。要するに，アオウミガメは，上陸を邪魔するものがいないとき，昼日中でも産卵行動とは関係なしに静かな海岸に上陸するということが，この一枚の写真からはっきりしたわけです。

その上，おどろいたことにウミガメは，ハワイモンクアザラシ (*Monachus schauinslandi*) やクロアシアホウドリ (*Diomedea nigripes*) といっしょに昼寝を楽しんでいます。この場所は，まさにウミガメやアザラシや海鳥の楽園といってもいいのではないでしょうか。今の世に，このような島が存在することすら珍しいことだと思われます。

甲羅ぼしと昼寝に上陸してくるウミガメにはオスもメスもいるようです。このような写真を見せられては，先ほどの解説記事などは顔色ありません。静かな，カメにとって敵のいない海岸さえあれば，アオウミガメは産卵行動に関係なく上陸するのではないかと思われます。

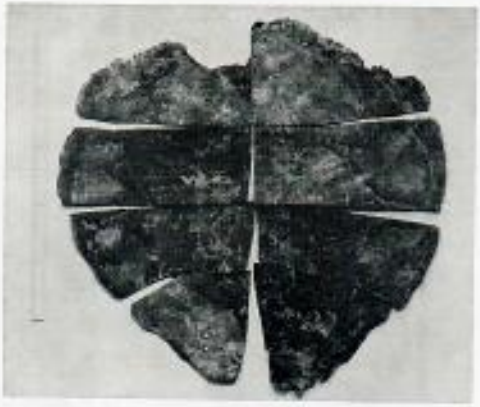
しかし妙なことに，現在このような島が発見されているのは，いずれも太平洋岸だけからで大西洋岸からは一例の報告もありません。太平洋岸のアオウミガメは海浜で午睡を楽しむけれど，大西洋のカメは甲羅ぼしや昼寝をしないということなのでしょうか？　面白い現象だと思われます。私たちがホッとさせられるのは，現在これらの島々は，アメリカ政府の野生動物保護機関や沿岸警備隊の厳重な監視下におかれ，研究者以外は近づけないことです。絶海の孤島の，しかも，強力な行政の保護下でのみ，ウミガメは甲羅ぼしや昼寝が可能なのでしょうか。これらの島々のウミガメやアザラシの眠りを破りたくないものです。

■ 甲を剥がれたウミガメ

さて，もう一つウミガメの話題を紹介いたしましょう。

今年の5月頃です。古くからベッ甲細工の原料となるタイマイの甲羅を輸入しているAさんから，最近マレーシアから輸入した原料中に変なタイマイの甲が混っていたので見に来ないか，という連絡がありました。

タイマイの甲は，その学名 (*Eretmochelys imbricata*) にも示されているように，甲の鱗板の1枚1枚が屋根瓦のように重なっている (imbricate) ところが，他のウミガメ類の甲と著しく違っている点です（タイマイの中には，甲が屋根瓦状に重なっているものばかりではなく，敷石状になっているものもいます)。



8つに切断されたタイマイの背甲（元来は1枚の背甲であった）。**甲の縦が約70cm。**

Carapace of a hawksbeak cut into 8 pieces. Total length was 70 cm.

我が国に東南アジアからこの甲が輸入される場合は，ふつう一匹の甲から大きな鱗板を13枚とり，それらに孔をあけてつづりあわせ，一匹分ずつまとめた上で送られてくるようになっています。ところが，Aさんがみせてくれた甲は全部で8枚の鱗板しかありませんでした。もっとも鱗板の数の異常はときどきみられますので，数だけを問題にするのであれば，そんなに珍しいことではありません。

しかし，この8枚の“鱗板”をよく見ると，どうやらこれは，もともと一枚の甲をノコギリで切断して8枚の甲の小片に分けたものであることが判りました。13枚に切断すると，一片が小さくなりすぎるので8枚に切断したようなのです。つまりこれは，ウロコ状の鱗板がなく，のっぺりとした一枚板のようになっている甲をもったタイマイが捕まったので，この甲を剝がして，わざわざ8枚に切断し，あたかも普通のタイマイの甲のように見せかけて送られてきたものだったのです。

まず，こんなカメがどこで捕れたのか疑問を持ちましたので，Aさんに調べてもらうと，どうもマレーシアのサバ州にあるサンダカンに集荷されたものであることがわかってきました。サンダカン付近で，なぜこんな一枚板の甲をもったタイマイが捕れたのでしょうか。

いろいろ調べてみると，意外な事実がわかってきました。それは，お父さんの代からベッ甲の加工をやってきたTさんが，昔，お父さんから聞いた話だけれどもと言って語ってくれた内容です。それによると，昔，サンダカンのベッ甲集荷人（主として華僑）が，タイマイの甲をとるときに，その都度タイマイを殺してしまうのではもったいないと考え，生きたままタイマイの甲から鱗板を剝がし（多分，熱を加えて柔かくしてから剝がしたと思われる）た後，因幡の白兎のようになったタイマイの背にコールタールを塗って放流することを試みたというものでした。

この荒唐無稽とも思える資源保護の方法がいつ頃までおこなわれていたのかはっきりしませんが，ウミガメの中でも比較的定着性のあるタイマイの生態から考えると，この時に捕れたタイマイは，その処置を受けたタイマイが生き残っていたものである可能性があります。

ウミガメの研究者の多くは，甲を剝がされたウミガメは生存が難しいのでは……と考えていたのですから，このように甲を剝離され，コールタールを塗られて放流されたタイマイが，その後生きつづけ，甲が再生したとなると，これはたいへん貴重な記録になります。それにしても，13枚の甲を抜き取られたタイマイの背甲が再生してくるとき一枚の枚のような甲になるとは……。こんな残酷な実験は，いままで誰もやっていないのでわかりませんが，資源の再生産という点からは関心のもたれるところです。

幸い，今年の秋にインドネシア，マレーシアでウミガメの調査に従事する機会に恵まれましたので，私はサンダカンを訪れるのを楽しみにしているところです。

〔姫路市立水族館長〕

表題写真の掲載にあたっては撮影者ジョージ・バラーズ氏のご厚意を受けました。

Southwest Fisheries Center Administrative Report H-79-23

SUMMARY REPORT OF THE PLANNING WORKSHOP FOR NATIONAL MARINE FISHERIES SERVICE RESEARCH ON MARINE TURTLES IN THE CENTRAL AND WESTERN PACIFIC

Honolulu, Hawaii, 31 July-2 August 1979

Richard S. Shomura (Chairman)
Southwest Fisheries Center Honolulu Laboratory
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
Honolulu, Hawaii 96812

October 1979

The "Planning Workshop for National Marine Fisheries Service Research on Marine Turtles in the Central and Western Pacific," sponsored by the National Marine Fisheries Service (NMFS), was held at the Honolulu Laboratory, Southwest Fisheries Center, on 31 July-2 August 1979 (Appendix 1, Workshop Agenda). Twenty persons attended from the continental United States, Hawaii, American Samoa, Guam, Palau, Federated States of Micronesia, and New Caledonia (Appendix 2). Honolulu Laboratory Director Richard S. Shomura was chairman of the workshop.

The purposes of the workshop were to review the status of knowledge on the turtle resources in the Hawaiian Archipelago and in areas of U.S. jurisdiction and interest in the central and western Pacific and to aid the development of a planning document which will identify long-term research needs, prescribe a time frame required to undertake this research, and establish priorities and estimate costs.

For purposes of clarity the proceedings of the workshop have been organized into four sections: (1) current turtle regulations and enforcement, (2) biology of Pacific turtle stocks, (3) stock assessment, and (4) recommendations for research.

Current Turtle Regulations and Enforcement

Current turtle regulations which appear in the Federal Register (vol. 43, No. 146, p. 32800-32811) were reviewed by representatives from the Western Pacific Program Office (WPPO) of the Southwest Region, NMFS. The Endangered Species Act of 1973, as amended, prohibits import, export, take, interstate commerce, possession, and selling of hawksbill, leatherback, and Atlantic ridley turtles. Exceptions to the Act include the taking of turtles, by permit, for scientific purposes and to enhance propagation or survival, the taking of turtles as a result of economic hardship, and possession of turtles under grandfather clause. The penalties for violating these regulations are fines up to $10,000 in a civil case and up to $20,000 in a criminal case. Citizen suits may also enjoin persons who are allegedly violating provisions of the Act.

Changes in the Endangered Species Act of 1973 added three species to the endangered or threatended lists:

1. Green turtle
   a. Florida and Mexico Pacific Coast - Endangered
   b. All other populations - Threatened
2. Loggerhead turtle - Threatened
3. Pacific ridley turtle
   a. Mexico Pacific Coast - Endangered
   b. All others - Threatened

However, the Act allows the taking of these turtles by permits for scientific uses, to enhance propagation or survival, and for zoological and educational purposes. Taking of green turtles is permitted as incidental catches by fisheries and as subsistence catches in the Trust Territory of the Pacific Islands. Concerning mariculture products, regulations now in effect also

prohibit import of all marine turtles and marine turtle products. After 6 September 1979, further sales of turtle meat and products in interstate commerce will be strictly prohibited. However, because of the very large area--about 1.5 million square miles--enforcement in the Pacific is a problem of major proportion.

Current practices of the U.S. Customs Service were also discussed. In all areas under U.S. and quasi-U.S. jurisdiction, the laws state that there will be no taking of turtles, except in the Trust Territory where subsistence taking is allowed. Customs agents usually confiscate all turtle products that are declared at U.S. ports of entry. In order to retain turtle products, a citizen must be able to prove possession of that article before the laws were enacted.

Legal aspects of turtle harvesting in Micronesia are extremely confusing at the present time. In large part this confusion results from the transitional political status of various entities in the Trust Territory of the Pacific Islands. There are, however, provisions in Title 45, Section 2 of the Trust Territory Code, that prohibit the take of hawksbills less than 68.6 cm (27 in.) long, green turtles less than 86.4 cm (34 in.) long, and any turtles nesting during the periods 1 June-31 August and 1 December-31 January.

In American Samoa, there is no active enforcement of the Endangered Species Act. The primary reasons appear to be a lack of manpower to enforce the Act and lack of awareness of the threatened and endangered status of the marine turtles found in the area. There are no traditional native laws currently in effect which cover turtle conservation. It was noted, on the other hand, that in Western Samoa strong traditional tribal laws governing the conservation of endangered marine resources exist and are enforced.

In summarizing the enforcement difficulties, it was noted that these included the presence of many islands spread over a wide geographical expanse of the Pacific, lack of enforcement personnel, lack of public awareness of the provisions of the Endangered Species Act, and less than vigorous enforcement of existing regulations by the courts. To enhance public awareness, one suggestion was made to develop a brochure which would describe the turtles and the existing regulations. The brochure would be similar to that developed by WPPO to cover the humpback whales in Hawaiian waters. The workshop participants also compiled a list of recommendations relating to regulations, enforcement, and protection of marine turtles in the Pacific islands of U.S. interest (Appendix 3).

Biology of Pacific Turtle Stocks

The discussion on marine turtle resources of the Hawaiian Archipelago included a presentation of a slide show based on a draft report (Balazs, G. H. Synopsis of biological data on marine turtles in the Hawaiian Islands. Being prepared under a NMFS contract No. 79-ABA-02422). The report was not available for distribution at the workshop but will be distributed to workshop participants at a later date. The report covers life history aspects of the green turtle, Chelonia mydas, hawksbill turtle, Eretmochelys imbricata, and leatherback turtle, Dermochelys coriacea, and touches on two uncommon visitors to the Hawaiian Islands, the loggerhead turtle, Caretta caretta, and olive

ridley turtle, Lepidochelys olivacea. The report lists 669 references. Data from unpublished original research conducted by the author (George H. Balazs) are also included. Green turtles are the most abundant of the marine turtles found in Hawaiian waters. Based on available data, it appears that the Hawaiian Chelonia population probably represents an isolated breeding stock.

Briefly, the Hawaiian Chelonia population has not been given nomenclatural recognition. Characters that tend to distinguish them from other Chelonia populations include differences in coloration, steep-sided appearance of the carapace, indentations, or constrictions of the marginals over the hind flippers, and a unique land-basking behavior. Movement of the Hawaiian Chelonia has been studied through tagging. Of the various tags used, only one, Inconel 625 alloy tag, size 681, has been found to be corrosion-resistant in Hawaiian waters. Other identification techniques, such as production of antibodies, epoxy paint, tattoo, carapace notch, vinyl strip attached to the carapace, and plastic tags, have not proved to be satisfactory.

Green turtles occur only at select locations throughout the Hawaiian Archipelago. French Frigate Shoals in the Northwestern Hawaiian Islands has the largest breeding colony. Small groups and separately nesting individuals occur at Laysan, Lisianski, Pearl and Hermes Reef, Midway, and Kure. A resident non-breeding aggregation also occurs at Necker. The principal food source for Hawaiian Chelonia is marine benthic algae in shallow waters.

Hatchlings emerge from their nests in mid-July and early August. From French Frigate Shoals, an estimated 25,000 to 50,000 hatchlings are produced each year. Following a rapid departure from the adjacent waters, the hatchlings are "lost" to human contact and are not seen until they grow into juveniles larger than 35 cm (14 in.) in carapace length.

Based on limited tagging data, there appear to be significant individual differences in rate of growth and hence in age at maturity. Estimates for a 35-cm juvenile to reach a mean size of an adult female range from 11 to 59 yr. Several participants found this wide range difficult to accept and urged research be undertaken on this problem. Observations at French Frigate Shoals indicate that seabirds do not prey on hatchlings. On the other hand, tiger shark, Galeocerdo cuvieri, appears to be a more serious predator on marine turtles. Many carapace parts and bones have been found in stomachs of tiger sharks. Furthermore, it was noted that adult turtles frequently have flippers missing which is presumed to result from shark attacks.

Only a few hawksbill have been observed in Hawaiian waters. This species appears to concentrate along the Ka'u and Puna coasts of the island of Hawaii. Six nestings in 4 yr have been observed along these coasts. Hatchlings have been seen in waters around Oahu.

Sightings of leatherback turtles have been reported in sufficient numbers to indicate that this species is not an occasional visitor to Hawaiian waters. Loggerhead and olive ridley turtles, however, appear only rarely and their occurrence probably results from weakened individuals being swept into Hawaiian waters by the prevailing currents.

Discussion on turtles in other areas brought out that the hawksbill turtle nests all over the tropical Pacific, whereas the Kemp's ridley turtle has been observed to nest only on beaches in Mexico. It was also emphasized that in the central and western Pacific the green turtle populations appear to be small and scattered.

One of the most glaring gaps in our knowledge of the life history of green turtles is that of age at maturity and sexual or reproductive longevity. Even the data collected on Hawaiian Chelonia seem to indicate a considerable variability in the age at maturity.

It was noted that before the depletion of the stocks in Florida waters, juvenile green turtles about the size of "saucers" and "dinner plates" were quite common. Chelonia of similar sizes have only rarely been observed in Hawaii. Speculation about feeding behavior of juveniles brought out that they may be feeding in pelagic waters where "shears" occur, that is, in areas where sharp temperature discontinuities occur. These discontinuities often result in accumulation of living and non-living material along the shear line.

The situation in other Pacific island areas are briefly summarized below.

Kosrae has no record of nesting sea turtles. At Ponape, nesting of green turtles has been observed at Oroluk, Pakin and Ant Atolls, and on some of the reef islands. Truk does not appear to have sea turtle populations of critical importance. Isolated nesting of green turtles occurs at East Fayu and on the flat coral islands. In Palau, green turtles are moderately abundant and hawksbills are abundant.

The results of an aerial turtle survey around Guam in 1975-79 indicated that positive species identification of turtles from a moving aircraft is difficult; however, it is generally believed that green turtles were most prevalent in Guamanian waters. Western Samoa has a program for raising sea turtles wherein hatchlings are kept in ponds, marked, and released after 4-6 mo.

Rose Atoll, under the jurisdiction of American Samoa, has been set aside as a wildlife refuge and landing on the atoll is strictly prohibited, except by permission. This is the only known breeding area for the green turtle in American Samoa; however, virtually nothing is known about the colony. Hawksbills are also believed to nest at this location.

Around the other small, outlying atolls and islands under U.S. jurisdiction, green turtles occur in waters around Johnston Island, which is about 720 nmi southwest of Honolulu. There are also reported sightings of green turtles from Palmyra Island but no evidence of any nesting. There are, however, some sand beaches that may be used for nesting. Kingman Reef contains one small islet but it is not known if nesting takes place there. Howland, Baker, and Jarvis Islands are part of a National Wildlife Refuge; there is no information on occurrence of nesting at these islands. Green turtles have been observed at Wake Island but nesting has never been documented. For those islands outside U.S. control such as Christmas and Malden Islands, information is insufficient; however, green and hawksbill turtles have been reported to nest occasionally at Christmas.

The discussion then turned to the stock of turtles at the Galápagos Islands. About 99% of the turtles occurring there are green turtles and the remaining 1%, hawksbill turtles. The green turtle is widespread, nests on most of the beaches, and shows rather strong, seasonal nesting which begins in January and is completed by March. Several thousand turtles have been tagged to study their movement. Information on feeding pastures, however, are insufficient at the present time.

The Galapagos green turtles are morphologically rather small and are heavily pigmented. The pigments run to either black or yellow; the yellow variety is probably a genetic offshoot. Yellow pigmented turtles never mature sexually and are invariably obese. The Galapagos green turtles lay about 70-80 eggs per clutch.

The workshop participants then touched on turtles of Papua New Guinea. Both green and hawksbill turtles occur around Papua New Guinea and the stocks apparently are in good condition because of the rigidly enforced conservation policies. Green turtles nest along black sand beaches in Papua New Guinea.

The leatherback turtle is the third most important species in Papua New Guinea waters. This species has been observed to nest on black sand beaches. The Pacific olive ridley also occurs in Papua New Guinea and has been observed to be relatively abundant on the island of New Britain; however, there are no extensive nesting grounds for this species in this particular part of the world. The loggerhead turtle, a temperate water species, is an occasional visitor to Papua New Guinea. Of interest is the recovery of a tagged Australian loggerhead turtle which was recovered in Papua New Guinea. The flatback, Chelonia depressa, and the black-pigmented variety of green turtle are also found in Papua New Guinea waters.

Among South Pacific Commission (SPC) island states, the green turtle occurs around the Cook Islands and New Hebrides; New Caledonia possibly has a large population. Among species present in this very vast area of the South Pacific are the hawksbill, loggerhead, and green turtles; however, there is insufficient documentation of the occurrence of the leatherback turtle. The South Pacific Islands Fishery Development Agency (SPIFDA) has done some work on turtles but the project was terminated in 1973. Recent research among SPC countries involves turtle mariculture, especially in the Cook and Fiji Islands.

Five useful references on marine turtles in the Pacific are listed in Appendix 4.

Stock Assessment

Much of what was discussed previously was summarized to get a better perspective on how to plan for research on stock structure of marine turtles. Turtles evidently are long-lived, somewhat similar to cetaceans. There is definitely a need to initiate a population count in order to do any kind of stock assessment work, an urgent need to be able to age turtles accurately, to find out where turtles reproduce, and to examine the mechanisms that regulate populations. Tagging programs are definitely needed. The relative abundance and socio-economic importance of some of the major species of marine turtles in the central and western Pacific were summarized (Table 1).

Table 1.--Relative abundance and socio-economic importance of marine turtles in various U.S. territories and possessions and associated island groups in the central and western Pacific Ocean.

Area	Relative abundance[1]					Socio-economic importance[2]
	Green turtle	Hawksbill turtle	Leatherback turtle	Olive ridley	Other species	
Hawaii	A	L	L	--	Loggerhead is stray	1.00
American Samoa	M	A	?	?	?	2.00
Guam	A	L	?	?	?	2.00
Northern Mariana Islands	--	--	--	--	--	--
Palau	M	A	?	?	?	2.50
Federated States of Micronesia	A	L	L	stray	--	3.00
Marshalls	A	M (prob.)	--	--	--	2.75

[1] A = Abundant
M = Moderate
L = Low
(?) = Not seen
-- = No data

[2] 3.00 = High
2.00 = Medium
1.00 = Low

Recommendations for Research

The following actions were highly recommended by the workshop participants:

1. Continuation of the in-depth study currently being conducted on the Hawaiian Chelonia and other marine turtles in the Hawaiian Archipelago as the results obtained from this research will most likely have wide application to other stocks of marine turtles throughout the central and western Pacific.

2. A "first-look" survey of the 20 green turtle nesting areas (Table 2) to determine the number of females using these nesting sites. The "first-look" survey should include an on-site survey and/or aerial reconnaissance over the nesting grounds. Islands best approached by land are Yap and Ponape (outer islands), whereas those more practically surveyed by air include islands in the Marshalls.

3. Time, personnel, and fund permitting, intensive studies to (a) evaluate hatching rate, localities of feeding pastures for adults, juveniles, and hatchlings, (b) determine reproductive potential of a given population, (c) collect and analyze life history statistics, and (d) conduct experiments to acquire knowledge on the behavior and physiology of marine turtles.

4. High priority be given to a tagging program to study turtle movement and problems of tag shedding and corrosion also be addressed. Tagging should be conducted not only among adult turtles but also hatchlings to determine their movements.

5. The determination of the "critical habitat" of the various species of marine turtles.

6. Aging of turtles should be given high priority. Without data on the age structure of a population, estimates of stock size cannot be derived with much confidence.

7. On-site surveys for one night to find out which species are nesting and to determine where they go. Surveys that run for 1 mo should provide more data on internesting period, whereas a 3-mo survey should reveal how many times turtles are coming back to nest.

8. Tracking of nesting females be given high priority. Research in this area will provide answers to short- and long-term movements of turtles. Information thus gained will aid in management of the stocks; e.g., knowledge of behavior and movement of green turtles during multiple nesting periods is needed for identification of "critical" habitat.

9. An agency be established to serve as a coordinating body and to be a depository for biological data and observations.

Appendix 1

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Fisheries Center
Honolulu Laboratory
P. O. Box 3830
Honolulu, Hawaii 96812

31 July 1979

Planning Workshop for NMFS Research on Marine Sea Turtles
in the Central and Western Pacific

31 July-2 August 1979
Honolulu Laboratory Room 120

Agenda

1. Opening Remarks. (R. Shomura)

2. Review of Current Turtle Regulations in U.S.A. (R. Iversen)

3. Marine Turtle Resources of Hawaiian Archipelago. (G. Balazs, others)

4. Marine Turtle Resources of Other Pacific Island Areas. (M. McCoy, P. Pritchard, H. Hirth, G. Balazs, Fisheries Officers)

5. General Review and Comments of Green Sea Turtles. (A. Carr)

6. Discussion of Research Planning Document. (R. Shomura)

7. Discussions of Specific Topics--

   a) Long-Term Objectives;
   b) Stock Assessment;
   c) Life History;
   d) Socio-Economic.

8. Summary.

9. Closing Remarks. (R. Shomura)

Appendix 2

U.S. DEPARTMENT OF COMMERCE
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List of Participants

George H. Balazs	Hawaii Institute of Marine Biology
Serge Birk	Marine Resources Division, Palau
Archie Carr	University of Florida
Rene Grandperrin	South Pacific Commission, Noumea
Harold F. Hirth	University of Utah
Robert T. B. Iversen	Western Pacific Program Office, Southwest Region, National Marine Fisheries Service, Honolulu
Harry Kami	Government of Guam
Ernest Kosaka	U.S. Fish and Wildlife Service, Honolulu
Mike A. McCoy	Micronesian Maritime Authority, Ponape
John J. Naughton	Western Pacific Program Office, Southwest Region, National Marine Fisheries Service, Honolulu
Eric Onizuka	Hawaii State Division of Fish and Game
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Jeffrey Polovina	Honolulu Laboratory, Southwest Fisheries Center, National Marine Fisheries Service
Peter C. H. Pritchard	Florida Audubon Society/Southeast Region Sea Turtle Recovery Team
Richard S. Shomura	Honolulu Laboratory, Southwest Fisheries Center, National Marine Fisheries Service
Tim Smith	La Jolla Laboratory, Southwest Fisheries Center, National Marine Fisheries Service
Joseph Sylvester	Southeast Region, National Marine Fisheries Service, St. Petersburg, Florida
Richard N. Uchida	Honolulu Laboratory, Southwest Fisheries Center, National Marine Fisheries Service
Richard Wass	Office of Marine Resources, American Samoa
Howard O. Yoshida	Honolulu Laboratory, Southwest Fisheries Center, National Marine Fisheries Service

Appendix 3

Recommendations on regulations, enforcement, and protection for marine turtles in the Pacific islands of U.S. interest.

Area	Recommendations	Remarks
Palau	1. Scientifically supervised pilot headstarting program for hawksbills. 2. Protection of green turtle at Helen Reef and Merir. Tagging of same. 3. Stop sales of hawksbills to tourists.	Personnel changes (McVey, Owens).
Yap	1. Reinforce traditional restraints. 2. Grant "cultural variances" for subsistence use. 3. Avoid use of Yap outer island turtles by others (including Trukese).	Traditional restraints still strong. Provided for in 1978 regulations. Pikelot turtles still exploited by Trukese. Intense Pikelot tagging might temper situation; or might start civil war.
Guam and Northern Marianas	1. Endangered Species Act be enforced.	
Truk	1. Cessation of capture and sale of hawksbills. 2. Institute field studies and tagging.	Capture continuing; level uncertain. Not yet begun. No plans.
Ponape	1. Enforce U.S. law protecting hawksbills. 2. Declare Oroluk turtle sanctuary.	Law being enforced, but not in outer islands or outer villages. No action. Resident human population becoming permanent.
Marshalls	1. Strict enforcement of U.S. and Trust Territory of the Pacific Islands' law. 2. Conduct tagging or beach patrols to provide population estimates.	Main turtle islands controlled by one man or family.

Appendix 4

Background and Working Papers

Balazs, G. H.
1979. Synopsis of biological data on green turtle in the Hawaiian Islands. Final report, prepared for Southwest Fish. Cent., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96812, 180 p., September 1979.

Hirth, H. F.
1971. Synopsis of biological data on the green turtle Chelonia mydas (Linnaeus) 1758. FAO Fish. Synop. 85:1:1-8:19.

Molina, M. E.
1979. Summary of marine turtle sightings made on aerial fishery surveys during fiscal years '75 through '79. Division of Aquatic and Wildlife Resources, Department of Agriculture, Government of Guam, Agana, Guam, 5 p. (mimeogr.).

Pritchard, P. C. H.
1977. Marine turtles of Micronesia. Chelonia Press, San Francisco, 83 p.

[U.S.] Federal Register.
1978. Listing and protecting loggerhead sea turtles as "Threatened Species" and populations of green and olive ridley sea turtles as threatened species of "Endangered Species." Federal Register, 43(146):32800-32811.

COMMERCIAL FISHERIES REVIEW

June 1949 Washington 25, D.C. Vol. 11, No.6

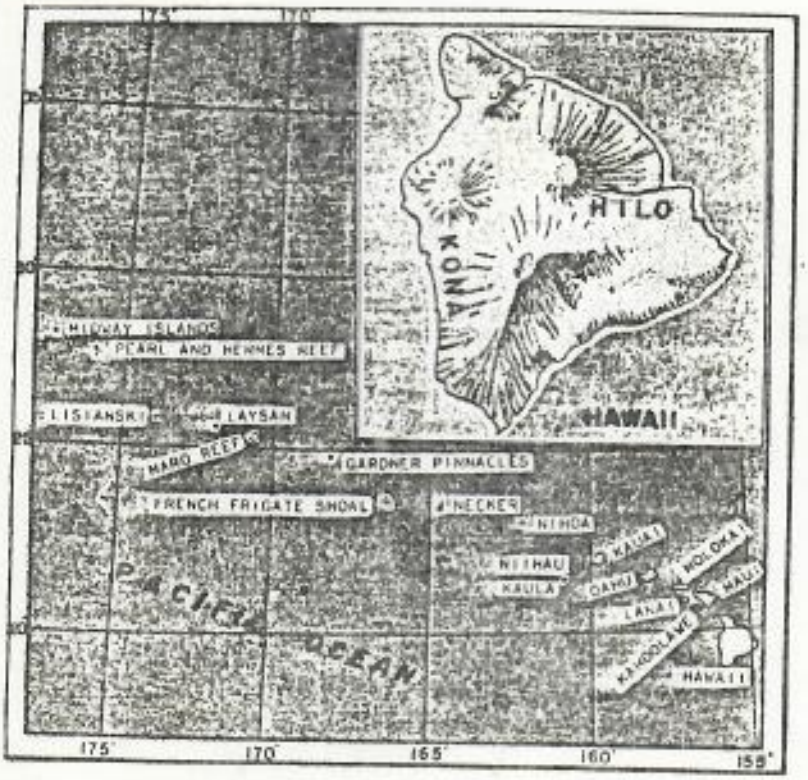
FISHERY EXPLORATION IN THE HAWAIIAN ISLANDS

(AUGUST TO OCTOBER 1948, BY THE VESSEL OREGON OF THE PACIFIC EXPLORATION COMPANY)

By Howard H. Eckles*

INTRODUCTION

From January to October 1948, the Pacific Exploration Company, under contract with the Reconstruction Finance Corporation, operated the motor vessels Oregon and Alaska in the region of the Hawaiian Islands and the Pacific Trust Territories. Scientists from the Fish and Wildlife Service were detailed to accompany these vessels to observe the results of the exploratory fishing and collect biological and oceanographical data. The period from January to June 1948 was covered in a previous report by O. R. Smith and M. B. Schaefer.[1] This present report covers the activities of the M/V Oregon from August to October 1948. The author was aboard as observer from August 11 to September 19, 1948.



THE M/V OREGON CONDUCTED EXPLORATORY FISHING IN THE HAWAIIAN ISLANDS REGION JANUARY-JUNE 1948. INSET SHOWS THE KONA AND HILO COASTS ON THE ISLAND OF HAWAII.

The Oregon, equipped for tuna live-bait fishing, sailed from Honolulu on August 11, to conduct exploratory and fishing operations outside the areas normally fished by the local Hawaiian sampan fishery. A full load of bait was obtained at French Frigate Shoals. Brooks Bank, Rogatien Bank, and part of Gardner Pinnacles Bank to the northwest of French Frigate Shoals were scouted for tuna. The Oregon proceeded along the chain of

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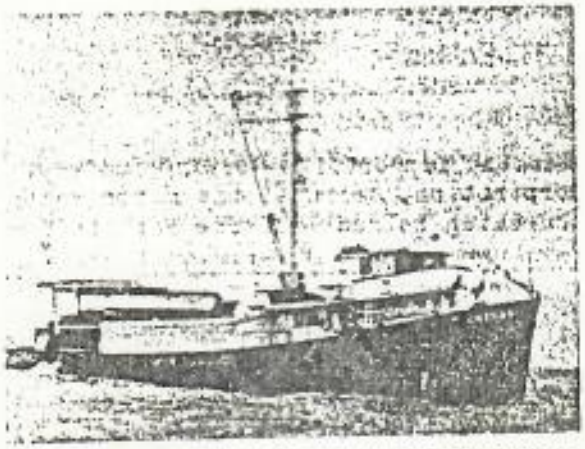
[1] "Fishery Exploration in the Western Pacific (January to June, 1948, by Vessels of the Pacific Exploration Company)," Commercial Fisheries Review, March 1949, page 1.

small islands and banks from French Frigate Shoals to Kauai. Next, the Kona Coast region off the Island of Hawaii and then the area around Maui and Molokai were scouted for tuna. The vessel returned to Honolulu on September 15. During the first part of October, further bait fishing and tuna fishing activities were carried out near Maui and southwest Oahu. This completed the exploratory tour and the Oregon returned to the mainland.

OBSERVATIONS ON BAIT

East Island is the most accessible of the small islands at French Frigate Shoals; so bait was sought there before the other islands were visited. Approximately 300 "scoops"2/ of small silversides (Hepsetia insularum), known to the Hawaiians as "iao", were caught at East Island on August 14 and 15. This is the same species of bait fish which the Oregon caught when she visited this same area in January and February 1948.



THE OREGON ANCHORED AT FRENCH FRIGATE SHOALS.

The bait fishing methods were similar to those already described by Smith and Schaefer. The "iao" found at East Island was mostly found just offshore between the breakers and the reef in schools which ranged in size from approximately 10 to 100 scoops. Usually a surround net, constructed of blanket mesh with openings about 1/5-inch on a side, was used. This net was 18 fathoms long and 2 fathoms deep. The "iao" is not easily frightened, which makes the task of surrounding all or part of a school rather simple. The "iao" found at French Frigate Shoals do not sound or attempt to escape under the lead line, but merely mill in one spot or attempt to jump the cork line. This behavior made it possible to set the net in water which was 2 fathoms or slightly deeper, as long as the net could be pulled into water that was waist or chest deep. The net was usually paid out from the stern of a small skiff while one end was held on shore. When the school was surrounded, the net was pulled in by the lead line. It was often necessary for the fishermen to dive down along the lead line and free it from rocks or snags. Goggles or face plates were used to enable the divers to see clearly under water. When the net was mostly in, a pocket was formed from the webbing and the captured bait was transferred to a bait receiver by lowering a gate on one end and allowing the fish to swim inside. At times, it was possible

VIEW OF A CORAL SAND BEACH, EAST ISLAND, FRENCH FRIGATE SHOALS. SEVERAL SETS FOR IAO WERE MADE JUST OUTSIDE OF THE BREAKERS ON THIS BEACH.

2/A "scoop" is estimated to contain about 10 pounds of fish.

to capture an entire school or to recapture fish which escaped the net, since the "iao" would lie in adjacent areas while the fish caught in one set were being transferred into the bait receiver. Thus, it was possible to reset the net upon these same fish. It was also possible to herd the "iao." Consequently, the fishermen were able to drive a school into the net while it was being paid out.

MAKING A SET ON A SCHOOL OF IAO (HEPSETIA INSULARUM) TERN ISLAND, FRENCH FRIGATE SHOALS. MOST SETS WERE MADE IN WATER WAIST OR CHEST DEEP.

After the first day, August 14, bait was scarce at East Island. So the Oregon was anchored off Gin and Little Gin Islands. Hawaiian fishermen aboard the vessel who had visited the area in March 1948 reported large quantities of "iao" on the sandy shores of Little Gin Island. However, only a few scattered schools were found in August. Seventy-eight scoops were taken during two days' bait fishing there.

The Oregon was equipped with two bait tanks on the deck aft and a well on each side just forward of the midships section, equipped to hold bait, and the methods of transporting and handling bait on the Oregon were similar to those used by California live-bait tuna fishermen off Mexico and Central America. Two hundred scoops were placed in the forward bait tank. These fish started milling almost immediately and survival was good. Bait placed in the after bait tank did not fare as well. Forty scoops were lost out of 180 originally placed in the tank. Part of these fish were handled rather roughly, as it was necessary to hold them longer than usual in the net, and transfer to the bait receiver was difficult. Smith and Schaefer noted a similar difficulty in holding fish in the aft bait tank.

After visiting Disappearing Island and East Island a second time, where no bait was sighted, the Oregon was anchored off Tern Island. This island is not easily reached, due to a wide expanse of reefs and coral heads. Therefore, it was necessary to anchor close by the reef and go in with a power boat and bait receiver. Very large schools of "iao" were present off Tern Island in water 3-15 feet deep. They occurred mainly in the quiet water alongside a dock area. Over 500 scoops were taken during two days. This completed the vessel's bait load of approximately 900 scoops.

CLOSING THE SURROUND NET AROUND A SCHOOL OF IAO AT TERN ISLAND.

During the period August 14 to 19, all of the more accessible islands of French Frigate Shoals had been scouted for bait with the results above noted. Whether the stock of "iao" present in this area would maintain a sizable bait fishery is not known. However, quantities of bait sufficient to supply at least two or possibly three tuna clippers the

size of the Oregon were present during the August period when the vessel was at French Frigate Shoals. Weather conditions were quite favorable during this period, although observations made before and after the time spent at French Frigate Shoals showed the northeast trade winds to be constant in this area, often reaching velocities as high as 25 miles per hour. Thus, calm weather may be the exception and considerable chop might ordinarily be encountered while bait-fishing in the French Frigate Shoals area. These conditions, although not prohibitive, would hamper transferring bait in receivers and brailing from the receiver to the live-bait tanks.

TOWING BAIT RECEIVER, FROM THE SAND ISLANDS OF FRENCH FRIGATE SHOALS, TO THE OREGON. A SKIFF IS PLACED ACROSS THE STERN TO GIVE ADDED BUOYANCY TO THE BAIT RECEIVER.

Mortality of the bait after leaving French Frigate Shoals was negligible after the first day, on which approximately 100 scoops died. This mortality occurred mainly in the two brine wells among the last fish transferred aboard the Oregon, and it is believed that it was mainly due to rough handling, as the "iao" survived well after

TRANSFERRING "IAO" FROM BAIT RECEIVER TO THE TUNA EXPLORATORY FISHING VESSEL, OREGON, OFF FRENCH FRIGATE SHOALS, HAWAIIAN ISLANDS. THE BAIT RECEIVER WAS TOWED FROM THE SMALL SAND ISLANDS IN THE AREA WHERE THE BAIT WAS TAKEN.

coming accustomed to the conditions in the tanks, even though fairly rough seas re encountered. The bait were fed ground-up fish and fish blood daily.

The "iao", though not generally used by Hawaiian skipjack fishermen, has oven to be a good tuna bait. It is readily taken by tuna when thrown as chum. n the Oregon wasn't moving, or was moving very slowly, the bait would school alongside the boat and a few times it was possible to recapture the fish with scoop net and return them to the bait tank. As many as eight "iao" were removed om one skipjack stomach after capture. Most of the bait was expended as chum the tuna schools encountered during the trip, but a few scoops remained aboard Oregon on its arrival at Honolulu on September 15.

Limited observations on bait at other islands in the Hawaiian Chain were sible, although no effort was made to catch bait except at Kihei on Maalaea , Maui. The bait found Kihei is a small ancho- locally called "nehu" choviella purpureus). s fish is not only the t common kind of bait he Hawaiian area, but s also preferred above er species by the Ha- ian skipjack fisher- . It occurs at Kihei schools similar in e to the schools of o," just off the break- and out into deeper er. It prefers muddy andy bottoms and very en occurs in cloudy ers, so that a slight pping or "breezing" the surface is the y indication that a school is present. The Oregon's crew took nearly 400 scoops "nehu" using a 40-fathom by 2-fathom net. However, a somewhat longer and deeper is needed for this fish, as it often occurred in waters three or more fathoms p. The vessel returned to Kihei during the first part of October. This time, lanket mesh seine 72 fathoms long and 5½ fathoms deep in the center was used. s net tapered to 3½ fathoms at each end. Approximately 900 scoops of "nehu" e taken during two days. The "nehu" is both smaller and more delicate than the o." When transferring this bait from the net to the receiver and from the re- ver to the bait tanks, it was necessary to use buckets to make certain that fish were not crowded excessively. The "nehu" lived well in the bait tanks several days, until expended on schools of skipjack.

DIPPING NET INTO BAIT RECEIVER.

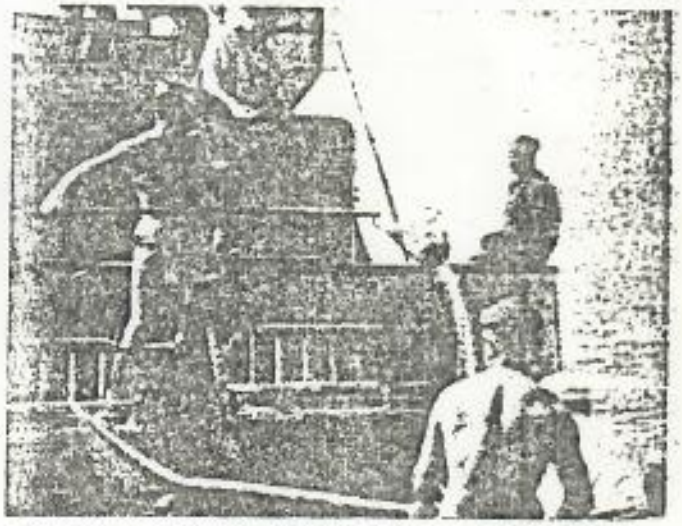
OBSERVATIONS ON TUNA AND TUNA FISHING

After obtaining bait at French Frigate Shoals, a short run was made to the ern side of Gardner Pinnacles Bank, by way of Brooks Bank and St. Rogatien . Calm weather was encountered on the first day's fishing, but thereafter vorable weather conditions prevailed. Numerous black skipjack (Euthynnus o, the western Pacific relative of the black skipjack, Euthynnus lineatus, ch occurs off Mexico and Central America) and a few 15- to 25-pound yellowfin

tuna (Neothunnus macropterus) were taken on troll lines and by the fishermen in the racks on the first day. One small school of one-pole[3] yellowfin tuna was chummed up to the Oregon. These fish swam near and under the boat and took the live bait readily, but took lures (squids) or live-bait hooks reluctantly. Consequently, only a few fish were caught. No further tuna were taken in the area northwest of French Frigate Shoals except by trolling. Black skipjack were numerous and would bite the trolled lures readily. They often were of a large size for this species, being nearly 30 inches long and 15 pounds in weight. However, they did not appear to occur in large schools. Birds were absent on banks at this time and the tuna caught were all located by means of trolling.

TRANSFERRING BAIT (IAO) FROM BAIT RECEIVER TO THE OREGON'S BAIT TANKS.

From August 22 to August 26, the Oregon explored the chain of banks from French Frigate Shoals to Kauai, including waters around Necker, Nihoa, and Niihau Islands. Black skipjack, wahoo (Acanthocybium solandri), and dolphin (Coryphaena hippurus) were taken frequently on troll lines. Black skipjack were abundant on banks and around the islands in relatively shallow water. Sea birds were very common in this area east of French Frigate Shoals. Sooty terns, noddy terns, and wedge-tailed shear-waters were common. Booby birds and the black-footed albatross were present, but tended to remain in the vicinity of the small islands. On August 24, west of Nihoa, the first school of oceanic skipjack (Katsuwonus pelamis) encountered was located by birds "working."[4] The school was chummed up and 26 fish were taken by fishermen in the racks. The fish were small, averaging 4-5 pounds in weight. They were reluctant to approach the Oregon and they did not bite well except for a brief period. During the morning and afternoon of August 25, west of Niihau Island, numerous schools of very small black skipjack averaging 11-12 inches and



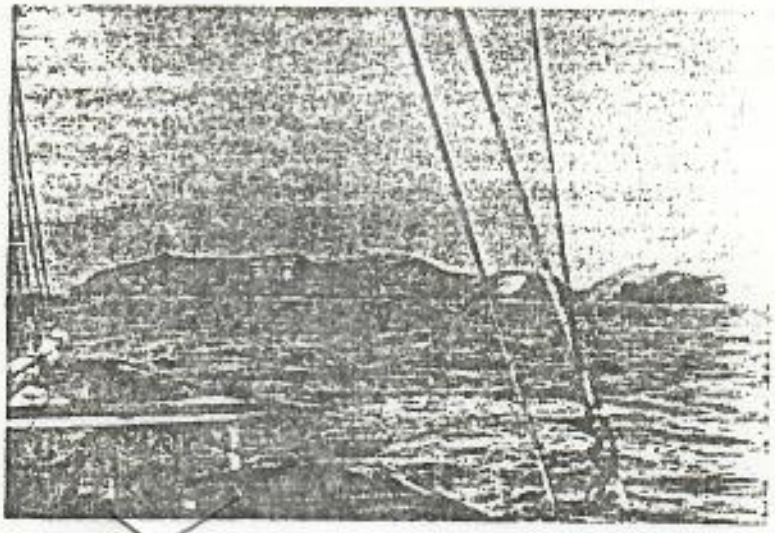
CREW MEMBERS OF THE OREGON BRAILING IAO (HERKETIA INSULARUM) FROM A BAIT RECEIVER INTO LIVE BAIT TANKS. NOTE USE OF THE CROWDER NET.

3/A term used in the eastern Pacific tuna fishery to designate fish under 30 pounds which would ordinarily be caught by one fisherman using one pole.

4/Birds' diving and flying low over the waves while feeding.

one pound in weight were located under birds. These fish took bait readily and were easily caught from racks. However, because the fish were so small, fishing for them was soon discontinued. Two yellowfin tuna were taken on troll lines late the same afternoon, but schools of yellowfin tuna could not be located by chumming these areas. On August 26, numerous schools of oceanic skipjack were located by observing birds diving and feeding at the surface in the area southwest of Niihau Island. Indications were that oceanic skipjack were abundant here, as birds could be seen "working" and fish were jumping over a wide area. Skipjack were chummed up to the Oregon on two different occasions and nearly 100 fish were taken from the racks. These were also small 4- to 5-pound fish. As before, they were reluctant to take either live-bait hooks or "squids," although the "iao" were taken readily.

From August 27 to August 29, tuna were sought in the area 35 miles northeast of Nawiliwili, Kauai. The weather during this period was generally bad for tuna fishing due to rain, poor visibility, and strong northeast trade winds. Four schools of large oceanic skipjack, probably 15 to 25 pounds, were located by birds during the three days. The skipjack were moving fast and were feeding on flying fish. This made it difficult to catch the fish or to maneuver into a position so that bait could be thrown effectively. Strong winds made chumming difficult, because the bait fish were often blown out of position alongside the racks when thrown from the height of the Oregon's bait tanks, which were approximately 10 feet above the water. Rough seas and rolling of the ship made the use of side racks extremely hazardous. The skipjack were seen jumping astern of the vessel after the bait which had been thrown, but none came close enough to the racks to be caught. It was evident that there were commercial quantities of skipjack in this vicinity, but their rapid movement and poor weather conditions made it impossible to make a catch.



VIEW OF NIIHAU ISLAND LOOKING WEST FROM THE STERN OF THE OREGON. NECKER

In the hopes of finding more tuna and better weather conditions, the Kona Coast off the Island of Hawaii and the area northwest of the Kona Coast around to Hilo, Hawaii, were scouted from September 1 to September 9. The southwest side of Maui and the area around Lanai and Kahoolawe Islands were scouted en route. Several schools of small skipjack were spotted by "working" birds, but the fish were scattered and moving rapidly; so chumming was not successful. The weather was generally good, except when crossing channels or outside the lee of the islands. The weather on the Kona Coast was continually good during this period, as there is a lee from the trade winds formed by the high elevation of the Island of Hawaii. However, signs of tuna were scarce and only occasional catches of oceanic skipjack were made. Schools were located by birds "working" at the surface, but the behavior of the fish was so erratic that it was difficult to maneuver the ship into position to chum effectively. At times, a school was worked up astern and

alongside, but the skipjack kept outside the reach of the tuna poles, even though extra long ones were used. An opportunity was offered to observe these schools. The numbers of fish did not appear to be large nor were they concentrated into compact schools. A few fish were apparently spread over a wide area. Local fishermen of the Kona Coast stated that large schools of both yellowfin and skipjack tuna are fairly common on the Kona Coast in the late spring and summer.

DISPLAYING A SMALL YELLOWFIN TUNA (NEOTHUNNUS MACROPTERUS) TAKEN ON ST. ROGATIEN BANK NORTH WEST OF FRENCH FRIGATE SHOALS.

From the Kona Coast, the Oregon proceeded to Maui. The areas around Maui and Lanai were scouted until September 14. One very large school of oceanic skipjack was located to the windward of Maui and was followed and chummed for nearly two hours. Fish were seen breaking the surface and many birds were flying and "working" over an area estimated to be nearly a mile square. However, the main school apparently remained deep, as no fish were brought up to the vessel's racks. The great numbers of birds, and their actions, indicated that an extremely large school of fish were present. Other flocks of birds were seen from time to time, but chumming usually raised no fish.

As the bait supply was nearly exhausted and provisions were running low, it was necessary to return to Honolulu.

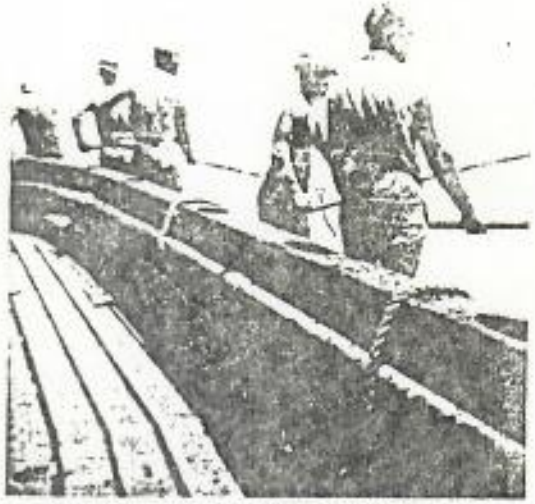
In early October, further scouting was carried out around Maui and southwest Oahu. As before, numerous flocks of birds were present and some oceanic skipjack schools were located. Approximately 60 skipjack, 10 to 15 pounds, were taken southwest of Oahu. These fish were also reluctant to bite.

SUMMARY AND CONCLUSIONS

During the period from the middle of August to early October, approximately 50 schools of tuna were encountered. Only one school of yellowfin tuna was seen, although yellowfin were taken on troll lines at five different times, so that other schools were probably present. Thirteen schools of black skipjack were encountered. These were mainly located by trolling, although three schools were located by following "working" birds. Twenty-one schools of oceanic skipjack were encountered. All of these were located by birds. No oceanic skipjack were taken on troll lines. Fourteen unidentified schools were indicated by large numbers of birds. The oceanic skipjack was most common around Kauai, Oahu, Molokai, and Hawaii, and it is probable that most of the unidentified schools were oceanic skipjack. The black skipjack was most common near the islands and shoals from Gardner Pinnacles to Niihau. Yellowfin tuna were not seen in abundance during this survey, but Hawaiian fishermen reported two large schools of yellowfin near Niihau during September while the Oregon was on the Kona Coast.

OCEANIC SKIPJACK (KATSUWONUS PELAMIS) TAKEN OFF THE KONA COAST, HAWAII.

Whether mainland-style "tuna clippers" would be commercially feasible in the Hawaiian Islands cannot be determined by an exploratory period of such a short duration. It certainly can be stated that the abundance of tuna is sufficient for considerable expansion of the present local fishery carried on by live-bait sampans for skipjack and "fingline"[5/] boats for yellowfin tuna, which is now well established in the waters adjacent to the main islands. Sea conditions resulting from the northeast trade winds make the operation of a tuna clipper difficult in most areas except in the lee of the islands. The rapid and erratic movements of the tuna make a fast and highly maneuverable vessel desirable. A thorough knowledge of local conditions would be essential. Experience is necessary to be able to estimate the movements of a tuna school by observing the movements of birds above them. The tuna in this area rarely stop and feed in one spot; therefore, skill is needed in maneuvering and running with the school to insure effective chumming and the landing of a good catch.



FISHERMEN OF THE OREGON IN THE RACKS.

The sampan-type vessels used in Hawaii are not generally equipped with circulating pumps for live-bait wells, or with refrigeration for holding the catch. The addition of these features to this type of vessel, or the use of a smaller, more rapidly maneuverable tuna clipper, would probably give a more efficient type of vessel for fishing tuna in the Hawaiian area.

5/ A fishery employing long-lines buoyed to fish several fathoms below the surface. Hooks are baited with dead fish.

AQUATIC RESOURCES OF THE RYUKYU AREA

Obtaining a supply of live bait is the most important problem of the Ryukyu skipjack fisherman. The Japanese sardine and anchovy, which are considered best for skipjack fishing, are not available in Ryukyu waters, so the natives resort to whatever species of small fish are present. Most important among these are the Ryukyu sardines, red scads, and cardinal fishes. Ryukyu coastal and offshore operations for the skipjack are limited by the availability of bait; very often boats cannot fish on their regular schedule because of lack of this necessity.

Skipjack fishing vessels operating from Kyushu obtain bait at a large live bait center near Kagoshima Bay, where adequate amounts of sardines (Sardinia melanosticta) and anchovy (Engraulis japonicus) are available.

--Fishery Leaflet 333

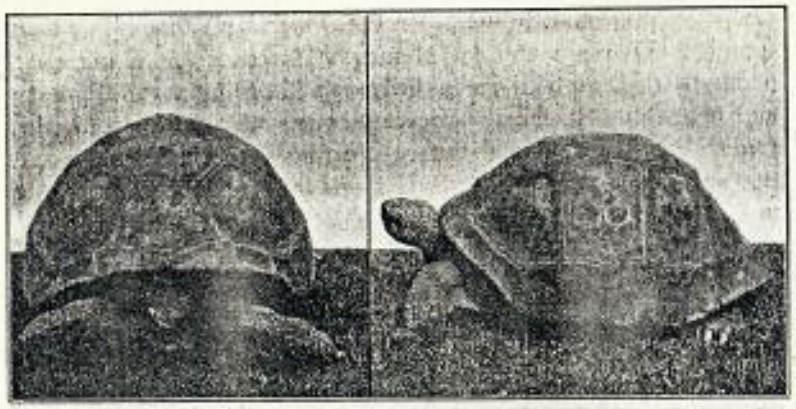
Hawaiian Almanac and Annual for 1904 T.G. Thrum Editor Honolulu, 1903

A HISTORIC TORTOISE OR LAND TURTLE.

(Testudo mycrophyes. Gunther.)

THERE is cared for at Waikiki by an aged couple, retainers of the late Queen Dowager Kapiolani, a tortoise, or land turtle, of great age, of which the following brief history is gathered:

The subject of this sketch was brought to these islands by Captain John Meek "from Kahiki," the natives say, "on his arrival at these islands." This means, from some unknown for-



eign land about the year 1812, but in actual fact it must have been a number of years later.

Captain Meek first touched at these islands as first officer of a vessel in the Northwest trade in 1800; then visited and sailed out of this port as master on trading voyages between Mexico and China from the year 1812, and became a resident of Honolulu in 1825.*

It is known that he brought a number of horses from the coast during those early voyages, and report says he brought

*P. C. Advertiser, Jan. 30, 1875.

cattle also, with many of these land turtles, which latter, very likely, were brought on one of his trips from Mexico. These were said to have been all kept on the Meek premises, on King street, and attracted the attention of the chiefs, foreigners and common people. This fact would bring it to not earlier than 1825.

Upon their disposal, or distribution, this one, illustrated above by a front and side view, was given by Captain Meek to King Kaukeouli, Kamehameha III. During the time the High Chief Paki was chamberlain to the king, it was under his charge and cared for at his Aigupita premises, Ewa-wards of the new Young Hotel, on King street.

After the death of the king and of Paki, this tortoise became the property of B. Namakaeha, first husband of the late Kapiolani, and was taken to his premises at Kaalaa. At Namakaeha's death it was moved to Waikiki, where it has since been cared for by the same two old retainers from Paki's time. Upon the death of Kapiolani a few years ago, it naturally came into the possession of her nephew, Prince David.

This species of Chelonia is remarkable for great age, so the supposition of this one being 100 years old or more may not be far amiss, since it is said to have been of large size and apparently of good age at the time of its arrival at the islands.

There is another similar venerable-looking tortoise in Nuuanu Valley, owned by Mrs. M. E. Foster, which is said to have been brought here on a whaleship many years ago from the Gallipagos Islands, their natural habitat, but no further particulars can be gathered. These two are probably the only ones of their kind on the islands.

HAWAIIAN WIT.—In 1846, in a royal progress of Kamehameha III., a spear exercise was performed before His Majesty and retinue of chiefs at Mokulau, Maui, by an old bald-headed warrior, who said his baldness was the result of his head being so big he could not raise hair enough to cover it.

"Citronella does not attract the melon fly," Dr. Holdaway concluded, "and there is no evidence that oil of citronella is capable of controlling Mediterranean fruit fly, melon fly, or mango fly."

* * * * *

A new product that may have far-reaching effects on Hawaii's economy has come out of the chemical laboratory of Dr. G. Donald Sherman. It's guava powder, a cream-colored, crystalline-like substance, made by cooking the guavas, filtering the juice through a fine-meshed cloth, concentrating it, and finally reducing it to a powder by vacuum drying. Guava jelly as good as that made from fresh fruit can be made from this powder simply by adding water and sugar and boiling up the mixture.

This product, produced commercially, could easily be shipped to distant places and sold for jelly-making to the wholesale trade.

Hawaii's guava trees may become one of our important agricultural assets. In time we may be planting guava orchards.

Dr. Sherman has also been searching for sources of pectin in island products. Pectin is what makes certain fruit juices "jell." All island housewives who've made guava jelly know that the guava contains a large amount of pectin. Now Dr. Sherman has discovered that the blossom and bean of the pink shower tree have even more pectin than the guava. However, the guava pectin is more soluble in water than the shower tree pectin.

Pectin is used commercially in a great many products. In a thick, syrup-like form, it is sold for use in making jellies from fruits that contain little or no pectin. It is also used as a base or carrier in many medicines. It's used in some commercially-made mayonnaise. Sometimes pectin is put into baker's bread to prevent it from becoming stale quickly. Rayon manufacturers use pectin as a sizing agent. It's used also in tempering metals.

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. . . a spear of steel and nerves of steel are all you need for this exciting sport.

Wanna Wrestle With a Turtle?

Author – N.W. Potter

From Hawaii Sporting News

Wrestling with 100-pound turtles 15 to 20 feet underwater, keeping a wary eye out for maurading sharks and tiger eels and other deep-sea predators is the hobby of Jack Kaya, Honolulu sportsman who has a room full of beautiful turtle shell trophies as proof of his efficiency.

Turtle hunting, as practiced by Kaya and a group of his friends, calls for a rugged constitution and nerves of steel. A quarter-inch barbed steel spear is his only weapon on the swimming jaunts that take him far over the reefs for two to four hours afloat.

"The job is to spear the turtles in the soft flesh of the neck," he explained. "Once you sink the spear into the flesh you have to hang on, because a wounded hundred-pound turtle is a rugged customer on the bottom of the ocean. The best system is to get hold of the turtle as quick as you can, then turn him toward the surface. That way his own power is used to bring him to the surface."

The usual turtle is about 30 or 40 pounds, but some of the bigger specimens run up as high as 200 pounds.

The turtle hunters usually go out in groups of four to six, for safety and convenience in case an extra-large turtle is speared. They seldom use boats, preferring to swim out across the reef until they locate a likely spot for their hard-shelled quary.

Spearing turtle isn't the only thrill met by Kaya and his friends, however. There is always the possibility of running into a shark, and frequently they have to give up their sport for the day when a big shark starts to follow the group, or singles out an individual for special attention.

1947

"One of my greatest thrills came, not as a result of a meeting with a shark, but from a 74 1/2-pound Ulua," Kaya said. "Some people say Ulua are as bad as shark, and I have had experiences that make me think this may be so.

"I was diving for lobsters when this giant Ulua started circling me. I couldn't tell if he was going to tackle me, or whether it was a case of curiosity. To be sure I attacked first, and drove my spear through his gills. In the struggle and excitement he got away from me, and we continued diving for lobsters. About 15 minutes later the Ulua showed up on the surface, with my spear still through his gills. Plenty good eating, that one!"

Spearing any Ulua of more than 25 pounds is a risky job, Kaya said, because the fish is so powerful and speedy. Once previously he speared a big Ulua and it was more than a handful, he recalled, dispite the fact his spear entered a vital spot in the fish's head.

Recently there have been more than the usual number of sharks to complicate things, he said, and added that "Maybe the atom bomb explosions at Bikini got the sharks all excited." They seldom attack the swimmers, although they do go after any fish that are wounded by spearmen.

"We clear out as soon as the sharks get to following us around," he added. "We don't stay around to see if they mean business or not." Some reports have been received of sharks up to 20 feet long, but the usual ones seen by Kaya and his friends are six to eight feet long.

If you think Kaya is kidding, stop down at his office, 116 North Queen street, and see the turtle shells he has stacked up. But don't go in for his favorite sport unless you have a pair of stout lungs, a stouter heart, and the ability to stare an eight-foot shark in the eye and still maintain your equilibrium.

* * * * *

Our aloha to an especially durable Honolulu citizen who has figured in the news recently, 17-year-old Mary Lou Berberick, who survived two plane crashes in eight days and intends to keep right on flying.

. . . a knowledge of Reading, 'Riting, and 'Rithmetic does not by itself produce a good citizen.

Character and the Three R's

From Hawaii Educational Review

By Dr. Mildred O. Chaplin

(Editor's note: Dr. Chaplin's thoughtful article is too long to reprint in its entirety here; its main points are therefore reviewed.)

The three R's remained the center of educational attention for a long time because they were considered basic to all other learnings and because their mastery seemed closely associated with character development. Ignorance of them was identified with carelessness, indifference, and shiftlessness; conversely, a mastery of them was supposed to make the individual dependable, resourceful, honest and industrious.

But disappointed teachers came to realize that such desirable bonuses from the three R's were not always forthcoming. People who possessed these tools sometimes did did not use them at all, and sometimes had no scruples about using them for bad purposes. Since there were often no visible results in character improvement, teachers came to think that our need was for the three R's *plus* character education. "So they no longer left dependability, loyalty, courtesy, resourcefulness, honesty to chance but devised direct lessons in these and other traits."

Stilted lessons on these qualities missed fire, however, because it was found that they could not be taught separately and then, in turn, be added up to be good character. It was wrongly assumed that character is additive in nature, that if enough parts were assembled, a whole character would result. "But it is one thing to cut a pie into six pieces and another to take six pieces (each of which *might* have come from a different size of dish and have a different filling) and try to make a pie."

By G.A. MACDONALD AND JERRY P. EATON

The strongest earthquake of the month occurred at 16h56m on October 26 and originated near the summit of Mauna Loa. Several smaller quakes also came from Mauna Loa. Eastward tilting of the ground surface at the edge of Kilauea caldera, accompanied by less than normal northward tilting, may have indicated a small increase of volcanic pressure beneath Mauna Loa.

A series of landslides on the southwest wall of Halemaumau crater began in late September and continued into October. A large segment of the crater rim, estimated to be 100 feet long, 75 feet high, and 5 to 10 feet thick, fell into the crater during the night of October 1. The last large slide occurred on October 10, but occasional small slides continued throughout the rest of the month.

November.—The Hawaiian volcanoes were very quiet through the month of November. The Bosch-Omori seismograph in the Whitney Laboratory recorded only 19 earthquakes during the month, the smallest number since February, 1953. The Sprengnether vertical seismograph at Uwekahuna recorded 100 quakes during November. The Loucks-Omori seismograph in the Mauna Loa station recorded 47 quakes, most of them very small.

An earthquake at 10h37m on November 2 was reported felt at Hilo, Pahoa, and in the Volcano district. It originated at a depth of about 10 miles on the east rift zone of Kilauea, near the caldera. On November 3 and 4 several tiny quakes felt in Naalehu originated very close to that town. A quake felt in central Kona at 8h16m on November 13 originated near Kealakekua, probably on the Kealakekua fault. At 15h on November 21 a sharp earthquake was felt only in the Headquarters area of Hawaii National Park. It originated beneath the northeast edge of Kilauea caldera.

The Pahoa seismograph recorded 17 earthquakes during November. One of these, at 20h15m on November 29, was felt at Pahoa School. It originated at a depth of about 3 miles on the east rift zone of Kilauea southeast of Pahoa. Steam and sulfur gas continued to escape from the vents of the 1955 eruption, particularly those at the old Kalapana road, those south-southeast of Iilewa Crater, and those south of the Kapoho road. There had been no noticeable change in the temperature of the escaping steam since shortly after the end of the eruption. Several places in the last flows southwest of the Kamaili-Opihikao road remained very hot. At one of them the temperature was still about 870°F. There were no signs whatever of any renewal of volcanic activity in Puna.

Tilting of the ground surface at the Whitney Laboratory was almost due eastward throughout the month. Normally at that season of the year the tilting is north-northeastward. The absence of northward tilting during November appeared still to be the result of slow sinking of the top of Kilauea volcano south of the Whitney Laboratory that had continued ever since the end of the Puna eruption. The sinking is believed to have been caused by a small reduction in volcanic pressure beneath the volcano. The eastward tilting, combined with an absence of northward tilting, may have indicated a slight swelling of Mauna Loa volcano, but the evidence was inconclusive.

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December.—Except for the continued liberation of steam along the vents of the 1955 eruption, Hawaiian volcanoes remained quiet during December.

Twenty-nine earthquakes, about the average for months of volcanic quiet, were recorded during December at the Whitney Laboratory. Only 10 earthquakes from the Puna area were recorded at Pahoa during December.

On December 12 and 13 a swarm of tiny earthquakes originated about 45 km beneath Kilauea caldera. The Sprengnether vertical seismograph at Uwekahuna recorded about 200 earthquakes from that source on those 2 days. A total of 307 earthquakes, mostly very small, were registered on the Sprengnether seismograph during the month.

A small earthquake which probably originated in Hualalai volcano was felt at Honokohau at 15h15m on December 7. The earthquake felt on the island of Oahu at 14h23m on December 26 was recorded feebly on the Uwekahuna seismograph. At 14h14m on December 28 an earthquake originating along the southwest rift of Kilauea was felt at the Kapapala Ranch. Later the same day, at 18h02m, an earthquake originating beneath the north rim of Kilauea caldera at a very shallow depth was felt at Kilauea Military Camp.

POSSIBLE VOLCANIC ERUPTION NEAR NECKER ISLAND

On August 20 the crew and passengers of a M.A.T.S. plane flying from Japan to Hawaii sighted an oval area of steaming, turbulent water about 1 mile across, between Necker and Nihoa Islands in the northern part of the Hawaiian Archipelago. The disturbance was first observed from a distance of several miles as a column of "smoke" rising from the water. The approximate position of the disturbance was 23°35′ N., 163°50′ W. The patch of turbulent water was surrounded by a thin line of yellowish surf, and near one end of the oval was what appeared to be an acre or two of dry land. Yellowish water drifted off down current. The next day all this had disappeared. Only a slick on the water surface marked the location of the previous day's activity, and a series of large waves swept outward from the area.

The position lies on the north side of the submarine ridge whose summit is marked by the Leeward Islands of the Hawaiian group, but the depth of water indicated at that point by hydrographic charts of the U.S. Coast and Geodetic Survey is in excess of 2,000 fathoms.

The description is typical of submarine eruptions, and if it is accurate it is difficult to conceive what else could have been the cause of the phenomena observed. The supposed dry land that disappeared so quickly may have been a raft of floating pumice. Hawaiian pumice in general is so permeable that it floats only a very short time.

The disturbance occurred in a part of the Hawaiian Islands in which there has been no previous recorded historic volcanic activity. It is quite possible, however, that such activity may have occurred. The nearby islands are uninhabited. The area lies away from the regular shipping lanes, and only in recent times has it become frequented by many fishing boats. Eruptions could easily have occurred in that area during the 19th century without being observed by anyone. Even today, with frequent air travel over the area, only one plane chanced to see the August 20 event.

On September 22 planes reported brown and yellow streaks in the ocean and "smoke" rising about 385 miles due west of Honolulu and 205 miles south of Necker Island. The reports made a much less definite picture than those of August 20, and it is rather doubtful that the disturbance was of volcanic origin.

PUBLICATIONS OF THE HAWAIIAN VOLCANO OBSERVATORY

In addition to the annual reports of the Volcano Observatory, published as bulletins of the Geological Survey, reports by staff members on volcanic conditions and features in Hawaii and elsewhere appear in other publications. A report on earthquakes and ground tilting and a summary of volcanic conditions appear quarterly in the Volcano Letter, published by the University of Hawaii. Technical papers appear as lead articles in the Volcano Letter and in various technical journals. The latter form a series known as Contributions of the Hawaiian Volcano Observatory.

Publication of the Volcano Letter was discontinued at the end of 1955, and henceforth the quarterly report on volcanic and seismic conditions will be published by the Geological Survey and entitled "Hawaiian Volcano Observatory Summary." Those persons wishing to receive the Summary should request it from the Director of the Geological Survey.

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Pacific Island Ecosystems Workshop

A B S T R A C T S

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STATUS OF SEA TURTLES IN THE HAWAIIAN ISLANDS

GEORGE H. BALAZS

A research program focused on the Hawaiian population of green turtles (*Chelonia mydas*) since 1973 has provided considerable insight on migrations, growth rates, food sources, predation, terrestrial basking, and reproductive ecology. A basic component of this work is the use of corrosion-resistant Inconel 625 alloy tags for the individual identification of adults at the breeding site of French Frigate Shoals and immature turtles captured at foraging pastures throughout the 2450 km long Hawaiian Archipelago.

Both the range and size of the Hawaiian green turtle population have declined within historical times. As in other areas of Polynesia (as well as Micronesia and Melanesia), declines in sea turtles and other easily exploitable marine resources can be attributed to a breakdown in traditional conservation systems brought about by the introduction of cash economies, a decline of traditional authority, and the imposition of new laws and practices by colonial powers.

The hawksbill turtle (*Eretmochelys imbricata*) also occurs in coastal Hawaiian waters, but only in small numbers exclusively around islands at the southeastern end of the Archipelago. The leatherback (*Dermochelys coriacea*) is regularly recorded in offshore areas, but nesting is not known to take place within the Hawaiian chain.

All three species of Hawaii sea turtles receive legal protection under regulations of the Department of Land and Natural Resources, State of Hawaii, and the U.S. Endangered Species Act. A world conservation strategy recently developed for sea turtles offers potential for restoring populations to their former levels of abundance.

Southwest Fisheries Center Honolulu Laboratory
National Marine Fisheries Service
and
Hawaii Institute of Marine Biology
University of Hawaii

THE HAWAIIAN MONK SEAL, MONACHUS SCHAUINSLANDI

GILMARTIN, WILLIAM G.

The Hawaiian monk seal, Monachus schauinslandi, population has experienced a significant decline in the past 20 years with present seal counts approximately one half of those of the late 1950's. Major reduction in seals at the west end of the Northwestern Hawaiian Islands (Kure, Midway, and Pearl and Hermes Reef) have occurred while the population at French Frigate Shoals has increased. Decreases have been attributed to human disturbance, shark predation, ciguatera, and parasites.

Monk seals have been observed breeding in the nearshore waters; they give birth from late Decenber through mid-August (peaking between

March and May) and remain with and nurse their pups for about 5 weeks. Seals are away from the islands for varying lengths of time depending on the season and age/sex class of the animal. They feed on fish and invertebrates associated with the inner reef and outer reef slopes and have been found to dive to 120-170 m.

Because of the endangered status of the Hawaiian monk seal, critical habitat has been proposed and a Hawaiian Monk Seal Recovery Team has been formed to develop a recovery plan for the species.

Southwest Fisheries Center Honolulu Laboratory
National Marine Fisheries Service, NOAA

ISLAND ECOSYSTEMS: SOME ECOLOGICAL CHARACTERISTICS

DIETER MUELLER-DOMBOIS

During the International Biological Program (IBP), from 1971-1976, a multi-disciplinary research team from the University of Hawaii and Bishop Museum worked to discover some of the intrinsic biological organization aspects of island ecosystems. Emphasis was placed on the interaction of native and non-native species. Some 77 technical reports and an equal number of journal articles were published during this period. Late last year, a synthesis book on terrestrial island ecosystems was submitted from this group for review. It was accepted by an outside IBP review panel and will be published soon by Dowden, Hutchinson, & Ross.* Rather than summarize the findings described in this book, which would be hard to do in ten minutes, I will concentrate on a few points only:

a) A brief eco-geographic overview of island ecosystems,
b) Some distributional characteristics of island biota,
c) Ecosystem structure and function: the role of dominant endemics, and
d) Island ecosystem stability: impact of exotic species.

*ISLAND ECOSYSTEMS: Biological Organization in Selected Hawaiian Communities. Dowden, Hutchinson & Ross. IBP Synthesis Series, vol. 15. In Press.

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HISTORICAL CHANGES IN THE HAWAIIAN ENVIRONMENT

H. ST. JOHN, Bishop Museum

(Abstract not available)

MAY 1967

Notes on the Inshore Fishes and Reef Habitats of the Leeward Islands

by

J. Maciolek and R. Wass 1967

The Leeward Hawaiian Islands, from Nihoa to Pearl and Hermes Reef, inclusive, constitute the Hawaiian Islands National Wildlife Refuge.[1/]

[1/] Administered by the U.S. Bureau of Sport Fisheries and Wildlife.

The authors accompanied Wildlife Administrator, Eugene Kridler, on his semiannual wildlife survey of these remote islands in March, 1967. We took that opportunity to observe the inshore fauna by free diving at four general locations along the "flat Island" portion of the chain: French Frigate Shoals, Laysan, Lisianski, and Pearl and Hermes Reef. It was an exploratory venture whose primary purpose was to determine the occurrence and abundance of fishes on these unexploited shoals with respect to possible future research activity.

Our "dives" consisted of surface snorkeling along a pre-determined approximate route, particularly around the periphery of extensive coral formations. We submerged to examine overhangs and pukas, occasionally diving to a bottom depth of 15 or 20 feet. Dark recesses were frequently

probed with a collecting spear or "shark billy."[2/] Progress along the

---

2/ A stout, 4-foot shaft tipped with short, heavy prongs designed to ward off sharks. Based on rumors reaching us prior to the trip, we anticipated numerous selachians--described as being either voracious, pugnacious or only curious. They, however, did not materialize. Three sharks were seen while diving; none of them approached closely.

---

dive route varied with complexity of the subsurface topography, our objective being to cover as much distance as possible while examining all recesses and channels in the reef enroute.

Comments given here are conditional in three respects: they concern a single series of observations which do not allow for seasonal variations in population compositions and abundances; observations, in part, are comparative based on inshore waters of Oahu which are most familiar to us; our progress along a dive route did not allow prolonged scrutiny of a particular locus which is necessary for the detection of small, obscure, or secretive fishes.

Fishes are listed and quantified by location in Table 1. General observations and location details are given in the following text.

French Frigate Shoals.

This is a cresent-shaped atoll, about 15 miles in the longest dimension, with a scattering of sand islands within the fringing reef. Initially, three dives were made at East Island, followed by single dives at Trig and Whale-Skate Islands. The reef patches were at once impressive in that they consisted almost entirely of living coral (mainly Porites and Pocillopora). Also impressive was the abundance of large fish in shallow water, especially

uluas, wrasses, parrotfishes, and unicornfish. One 5-foot ulua approached us repeatedly. Nenue were very abundant and appeared quite unafraid. Most conspicuous by their absence or scarcity were eels (1 moray seen), menpachis, rockfishes, cardinalfishes, triggerfishes (except M. buniva), filefishes, boxfishes (1 seen), hawkfishes (1 seen), and puffers (except C. jactator), several large spiny lobsters were encountered. Pelecypods (especially Arca spp.) were abundant, especially at East Island, and many terebrid gastropods were noted at Trig.

Laysan Island.

This single island, about 6 miles in circumference, was surrounded by large reef patches of living coral similar to that at French Frigate Shoals. In addition, formations of coralline beach rock extended into the water from the east and southwest sides of the island often forming potholes and extensive shallow tide pools which abounded with kupipi and turbine shells. Beach and bottom sand was generally quite coarse. One dive was made near the landing channel (west side) where water deepens rapidly. Coral formations were massive and contained large caves. Again, we encountered many big parrotfishes, wrasses, and surgeonfishes (esp. Naso). Uluas, however, were not abundant in the dive area. Among the common fishes not seen were lizardfishes, eels, menpachis, aweoweos, hawkfishes, damselfishes (except kupipi) filefishes, boxfishes and spiny puffers.

Lisianski Island.

This island is similar to Laysan but only 1/4 as large. Beach and inshore sand was exceedingly fine, almost silt-like. Coral formations were quite large, consisting mainly of living Montipora which was ~~rather soft and~~ structurally weak, containing many small pukas. Stratified beach rock occurred peripherally in places, especially on the north and east sides. Dives were

made along the east, north and west sides. Most of the fish seen were smaller than at previous locations except for uluas and mullets. Large parrotfishes and unicornfishes were uncommon. Juveniles of many species were present. Not observed were; menpachis, aweoweos, hawkfishes, rockfishes, triggerfishes, filefishes, boxfishes and puffers (except C. jactator). Among the gastropods, Conus abbreviatus was very abundant.

Pearl and Hermes Reef.

This is a roughly rectangular atoll with a perimeter approaching forty miles. Diving was done only in the vicinity of Southeast Island (5 dives). Reef conditions were similar to Oahu--various hard corals with much dead coral on reefs, and coral rubble on the bottom. Beach rock occurred on the south and east sides of the island. Leptastrea coral and Echinometra urchins were abundant along the south shore. Several deep, sandy pockets (bottoms not visible from the surface), isolated by shallow coral ridges, occurred to the north. Greater variety and size range of fishes existed here than in other Leeward Island areas. Large aholehole, squirrelfishes and wrasses were noted in tidepools. Parrotfishes were not as abundant as elsewhere. Eels (morays and congers) were common. Most striking was the great variety of wrasses of various sizes. Squirrelfishes, mullet ('ama'ama) and aholehole were exceptionally abundant. The only noteworthy fishes not seen were aweoweos, triggerfishes and boxfishes. Hermit crabs and spiny lobsters were abundant, all of the latter being ~~quite~~ rather large (1-5 lbs.).

Précis

In general, the most striking features of the Leeward Islands' inshore waters were the large proportion of living coral forming the reefs and the abundance of large fishes in shallow water. Thalassoma purpureum, which appears to be rare around the main islands is common along the leeward chain. Other wrasses seemed exceptionally large (Bodianus, Cheilinus, Coris, Thalassoma), as was the unicornfish (Naso). Big, colorful uhu (Scarus) could be approached closely. Uluas (Carangidae) up to 50 lbs. were observed in 2-3 feet of water and within a few feet of the shoreline. Even tunas (Scombridae: yellowfin, skipjack) occurred among the inshore fishes. The general abundance of wrasses, uluas, and nenue was noteworthy. All the above features are probably associated with the absence of human interference and exploitation.

Wrasses were the most diverse group encountered. Many of them could not be identified by underwater observation. Conversely, we saw few damselfishes, hawkfishes, cardinalfishes, eels, and rockfishes. No barracudas, snappers, groupers, and only one menpachi (Myripristis) individual were seen on our dives. Possibly, the abundance of large predatory fishes (uluas, wrasses) in shallow water is a dominant factor causing the populations of inshore fishes in the leeward Islands to differ so from those around Oahu.

Table I. Observations on inshore fishes of the Leeward Islands (Hawaiian Islands National Wildlife Refuge) made while free-diving during the period, 12 - 24 March, 1967.[1/]

Dive Information	French Frigate Shoals	Laysan	Lisianski	Pearl & Hermes Reef	Comments
Number of dives (location)	5	1	3	5	Water progressively colder as latitude increased, reaching 19-20° C. at Lis. & PHR.
Time in water (hours)	7	1+	2	4	

Abundance Key: 1 or 2 = as noted; + = few; ++ = several; X = numerous; XX = very numerous.

Fishes Observed	French Frigate Shoals		Laysan		Lisianski		Pearl & Hermes Reef		Comments
	Abundance	Size	Abundance	Size	Abundance	Size	Abundance	Size	
Sharks (Carcharinidae)									
White tip - *P. longimanus*	1	5'	1	4'					
Unidentified	1	8'							
Eagle rays (Myliobatidae)									
Spotted eagle ray - *A. narinari*			1	3'			1	2'	
Unidentified	1	2'							Light grey (dark spots?)
Lizardfishes (Synodontidae)									
Synodus sp.	++				++		X	to 1'	Specimen taken at Lis.
Moray eels (Muraenidae)									
Unidentified	1	4'					++	to 4'	

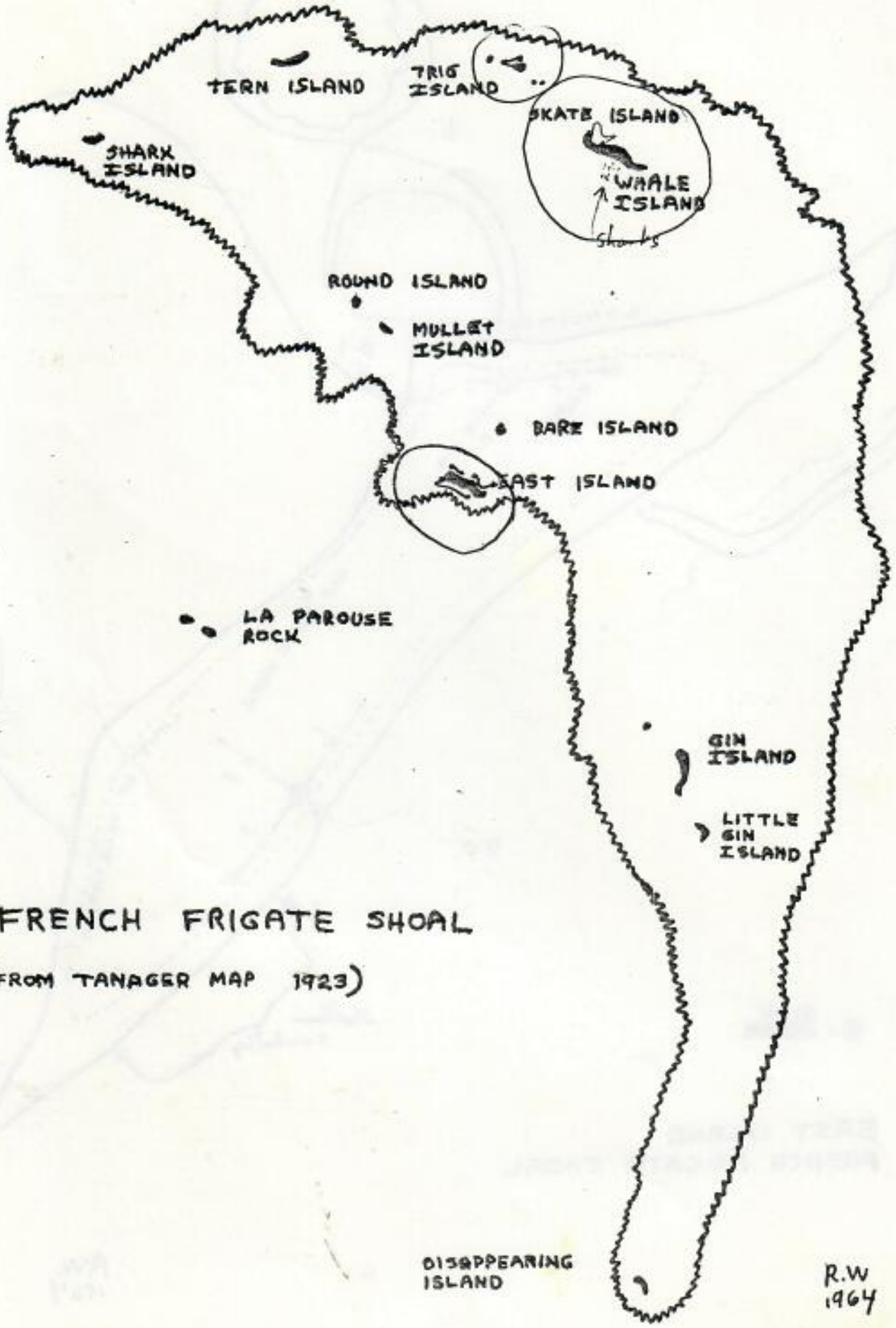
1/ Dives and compilation by J. Maciolek and R. Wass, Hawaii Cooperative Fishery Unit. Exact locations of dives noted on maps in master copy of report.

Fishes Observed	French Frigate Shoals		Laysan		Lisianski		Pearl & Hermes Reef		Comments
	Abundance	Size	Abundance	Size	Abundance	Size	Abundance	Size	
Conger eels (Congridae)									
Unidentified							+	to 4'	
Needlefishes (Belonidae)									
B. platyura	X	1'							Common in weak surf.
Unidentified							++	to 15"	
Halfbeaks (Hemiramphidae)									
Unidentified	++	to 1'							Large school at surface.
Cornet fishes (Fistulariidae)									
F. petimba	++	1'-3'			?		++	to 4'+	Possibily 5' long.
Squirrelfishes (Holocentridae)									
H. sammara	++	to 10"	+		+		X		
Menpachi - Myripristis sp.							1		
H. lacteoguttatus							+	to 6"	
Unidentified	+		+				++		
Flatfishes (Bothidae)									
Unidentified	1	6"							
Gray mullets (Mugilidae)									
Uouoa - N. chaptalii	XX	4"-6"							At E. Is. only.
'Ama'ama - M. cephalus	+		+	to 15"	++	to 30"	XX	to 30"	
Aholehole" (Kuhliidae)									
K. sandvicensis	++	10"	+	8"	X	2"-3"	XX	to 15"	
'Aweoweos (Priacanthidae)									
Unidentified (Prob. P. cruentatus)	++	8"-1'							Large, often outside of pukas.
Cardinal fishes (Apogonidae)					1		?		
Uluas or Jacks (Carangidae)									
Omilu - C. melampygus	X	to 2'+	+	to 2'	X	to 3'	+		

Fishes Observed	French Frigate Shoals		Laysan		Lisianski		Pearl & Hermes Reef		Comments
	Abundance	Size	Abundance	Size	Abundance	Size	Abundance	Size	
Uluas or Jacks (Carangidae)									
Ulua - C. sexfasciatus	++	to 5'			X	to 4'	++		
Ulua - C. cheilio							+		
Ulua - C. gymnostethoides	?		+		X		X	to 2'	5 or 6 vert. bars, when live.
Kahala S. dumerlii					+				
Unidentified (mainly papio)	X		+		++				
Goatfishes (Mullidae)									
Weke - M. samoensis	X	to 12"	++	to 15"	X	4"-15"	X		
Weke-'ula - M. auriflamma	++	to>18"	++	to 15"					
Kumu - P. porphyreus			1				X	to 20"	Large purple one seen.
Moano - P. multifasciatus	+	small	1		++		++		
Moano kea - P. chryserydros	+	small							
Nenues (Kyphosidae)									Probably most abundant and ubiquitous inshore fish on Leeward Is., friendly!
K. cinerascens	XX	to 15"	XX	6"-30"	X		X	to 18"	
Butterfly fishes (Chaetodontidae)									
C. miliaris	X		+		X	2"	XX	to 5"	
F. longirostris	++								
C. auriga	++				+	to 8"	++		
C. fremblii	+		+		+		X		
C. trifasciatus	+				+		+	small	
C. lunula	+								
C. unimaculatus	1		+		+				
C. potteri	1						+		
C. ornatissimus							2	6"	
Hawkfishes (Cirrhitidae)									
C. alternatus	+						++		
P. arcatus							+		
Unidentified							?		
Damselfishes (Pomacentridae)									
D. albisella	X				+		++		
Kupipi - A. sordidus			XX				++		Large specimen taken at PHR.

Fishes Observed	French Frigate Shoals		Laysan		Lisianski		Pearl & Hermes Reef		Comments
	Abundance	Size	Abundance	Size	Abundance	Size	Abundance	Size	
Damselfishes (Pomacentridae)									
Mamo - *A. abdominalis*					++		++		
P. johnstonianus							+		
P. jenkinsi	X				++		X		
C. ovalis							+		
C. leucurus							+		
Wrasses (Labridae)									
A'awa - *B. bilunulatus*	X	to 2'	++		+		++	to 20"	
Labroides phthirophagus	++		++		+		++		
Po'ou - *C. rhodochrous*	+				+		++	to 18"	Specimens taken PHR.
Olani - *T. purpureum*			++		++		++	to 20"	Specimens taken PHR.
T. umbrostigma	+		X		X		X		
T. duperreyi	+		+		X		X		
T. ballieui	X	to 20"	++		++		X	to 18"	
Gomphosus varius	X		+		++		++		
Hilu - *C. flavovittata*	++		+		+		X	to 15"	
C. venusta							++		
Opule - *A. cuvieri*	++				++		++		Specimen taken PHR.
Kupoupou - *C. inermis*							1		
Unidentified	?		?		++		++		Specimen taken PHR.
Parrot fishes (Scaridae)									
S. sordidus					+				
Uhu *S. perspicillatus*	X	to 30"	X	to 30"	++		+	to 2'	Big Uhu uncommon at Lis.
Unidentified	++		++		+		+		
Moorish idol (Zanclidae)									
Z. canescens	++		+		++		+		
Surgeonfishes (Acanthuridae)									
Manini - *A. sandvicensis*	XX		++		X		XX		
Maiko - *A. nigroris*	+				X		++		
A. leucopareius			++		+				
A. achilles	+								
A. dussumeri	1	15"							

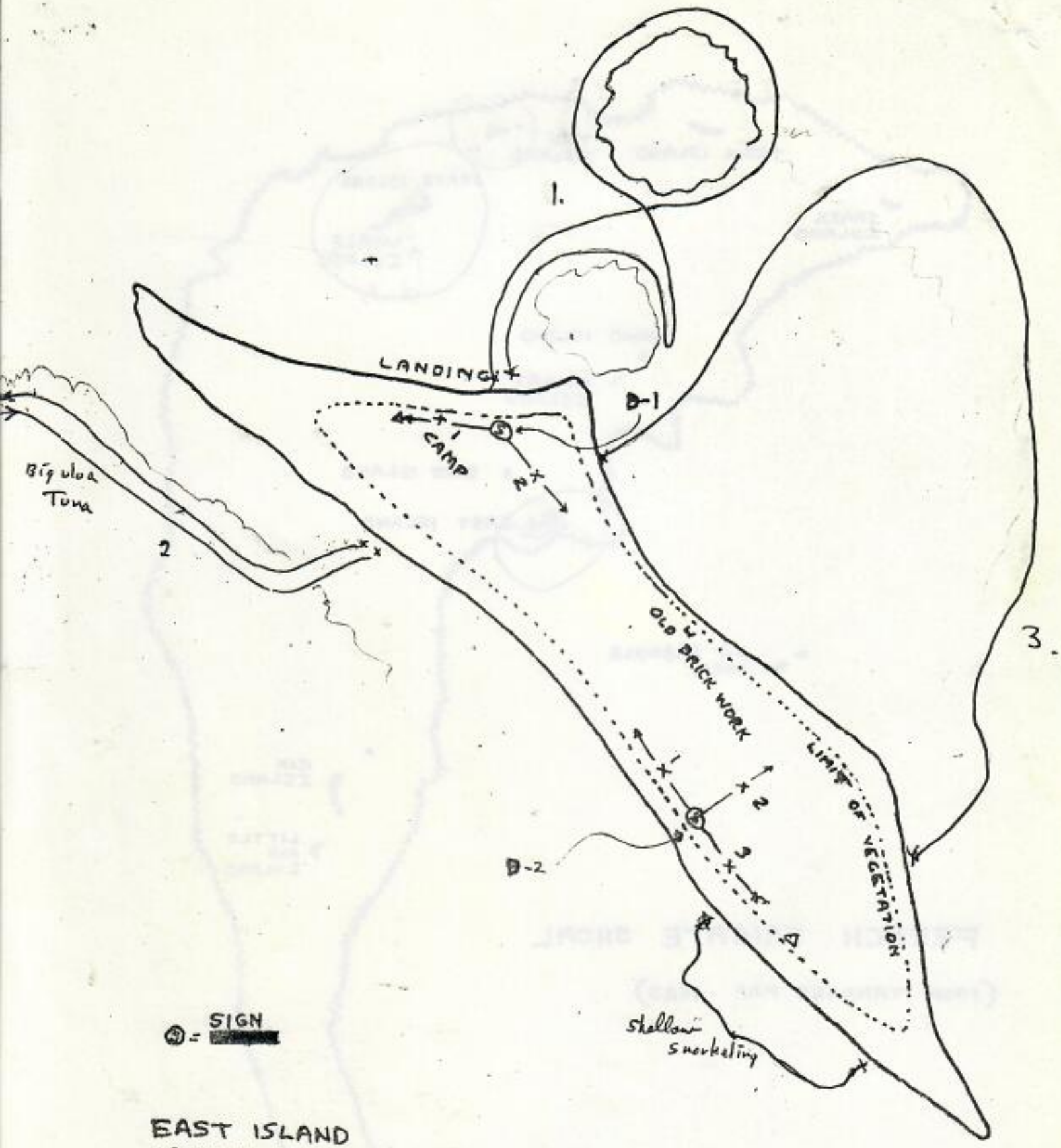
Fishes Observed	French Frigate Shoals		Laysan		Lisianski		Pearl & Hermes Reef		Comments
	Abundance	Size	Abundance	Size	Abundance	Size	Abundance	Size	
Surgeonfishes (Acanthuridae)									
Unicorn fish - N. unicornis	X	to 3'	X	large	+		++		
Yellow tang - Z. flavescens	++		+						
Kole - C. strigosus	++		+		++		+		
Tunas (Scombridae)									
Probably yellow fin T. albacares	1	4'							Near East Is. in 15' water.
Aku - K. pelamis							2	3'	Southeast Is. inshore.
Blennies (Bleniidae)									
Unidentified	+		+						On coral heads and in shallows.
Rockfishes (Scorpaenidae)									
Nohu - S. gibbosa							1		
S. ballieui							++		
Lionfish - P. sphex							1		
Unidentified			1				?		
Triggerfishes (Ballistidae)									
Humuhumu'ele'ele - M. buniva	+	to 15"	1		?		?		
Filefishes (Monacanthidae)									
P. spilosoma							++		
A. pardalis							1		
Boxfishes (Ostracionidae)									
Moa - O. lentiginosus	1	6"							
Sharpbacked puffers (Canthigasteridae)									
C. jactator	++		X	to 3"	++		++		
Spiny puffers (Diodontidae)									
D. hystrix							+	to 14"	



FRENCH FRIGATE SHOAL

(FROM TANAGER MAP 1923)

R.W
1964



EAST ISLAND
FRENCH FRIGATE SHOAL

RW.
1964

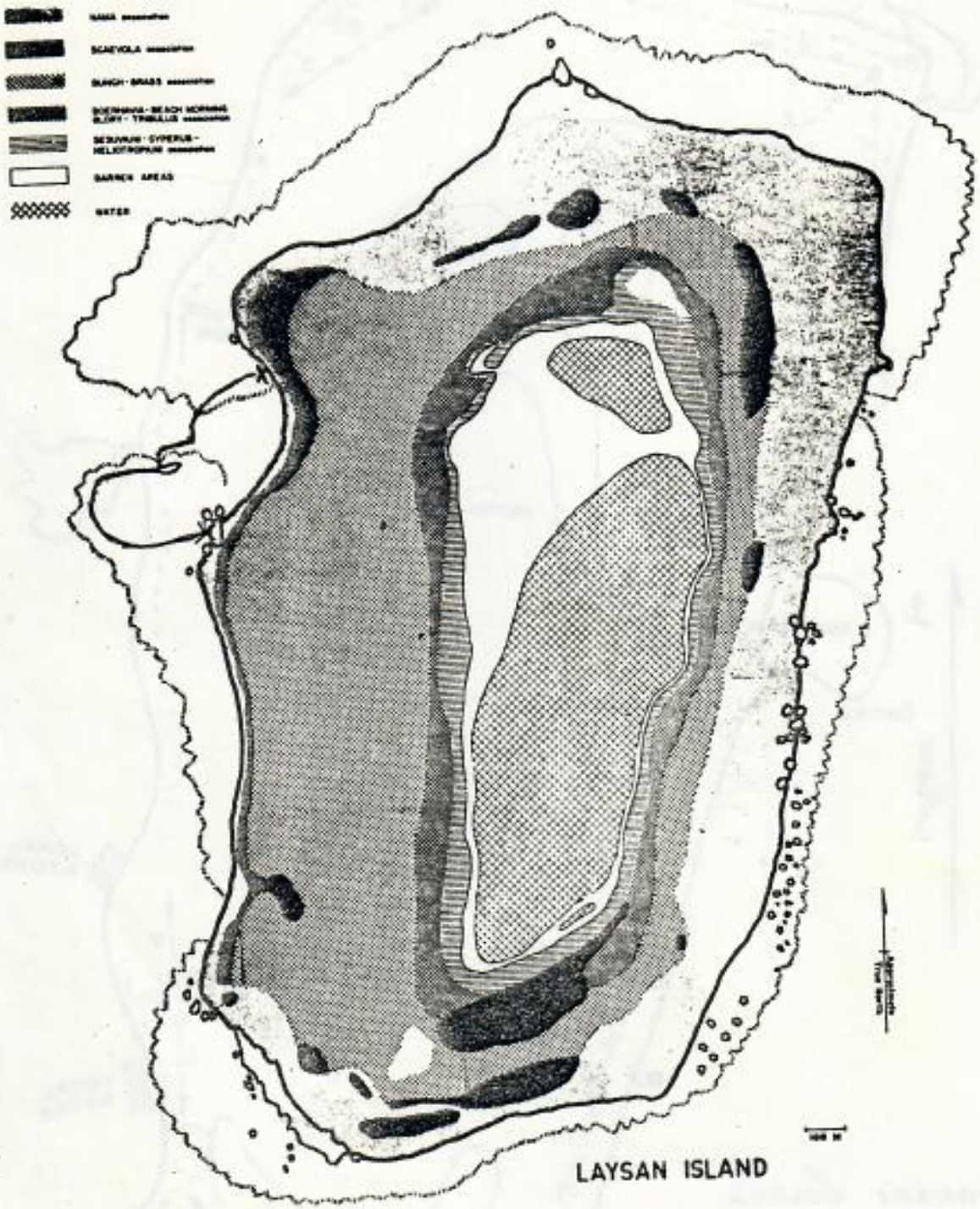
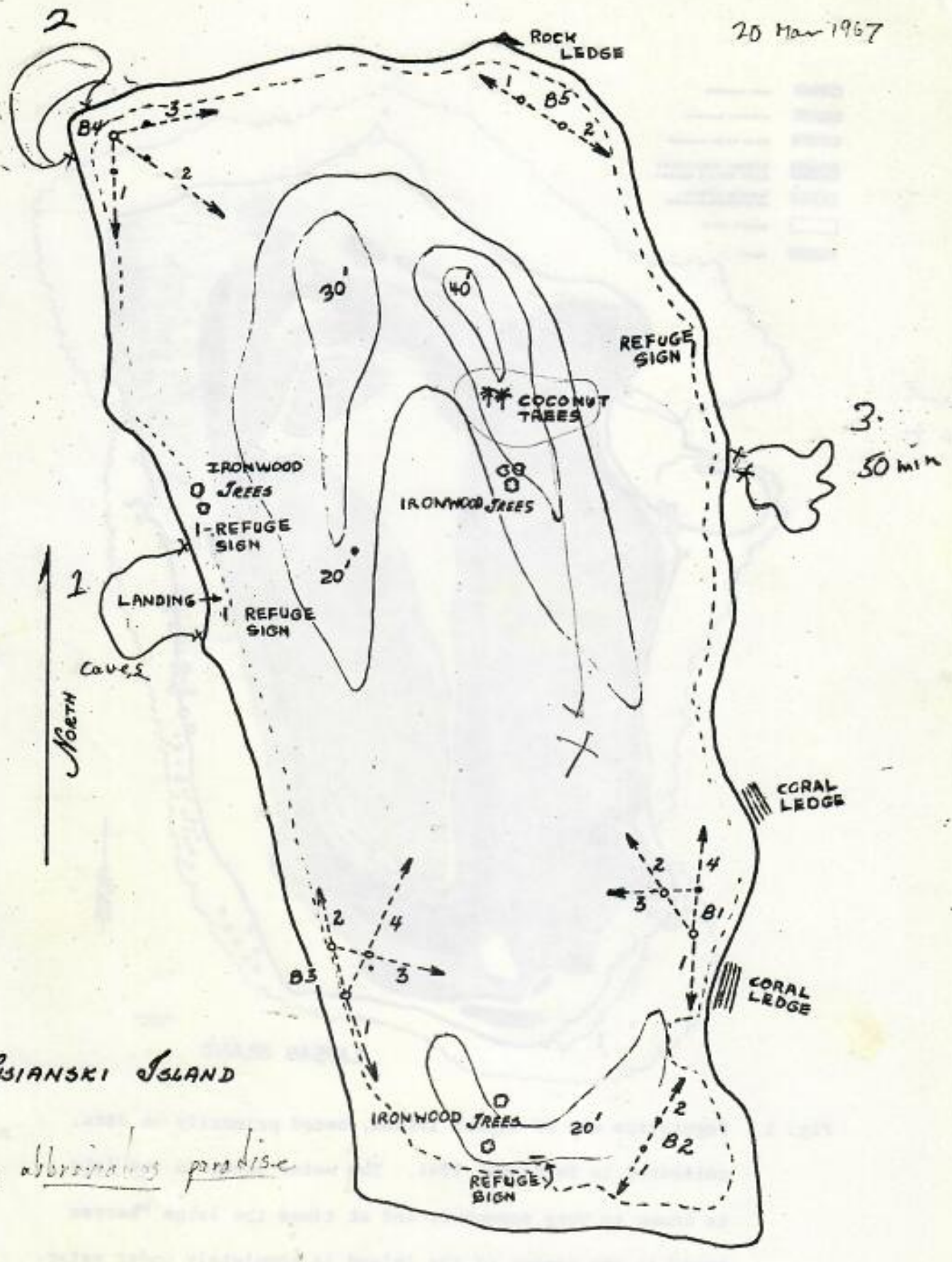


Fig. 1. Vegetation map of Laysan Island, based primarily on data collected in September 1961. The water level in the lake is known to vary somewhat, and at times the large "barren area" in the center of the island is completely under water.

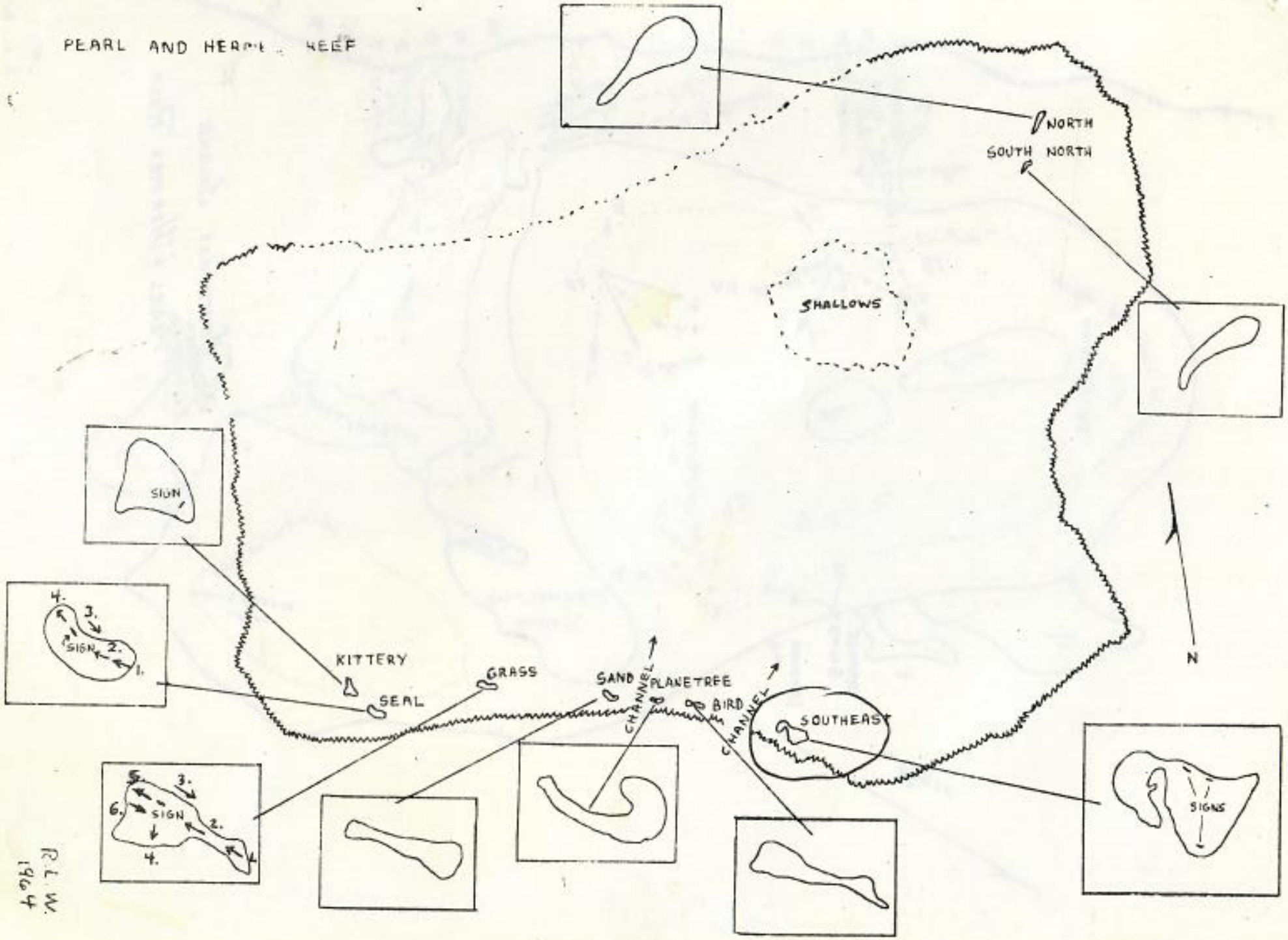


LISIANSKI ISLAND

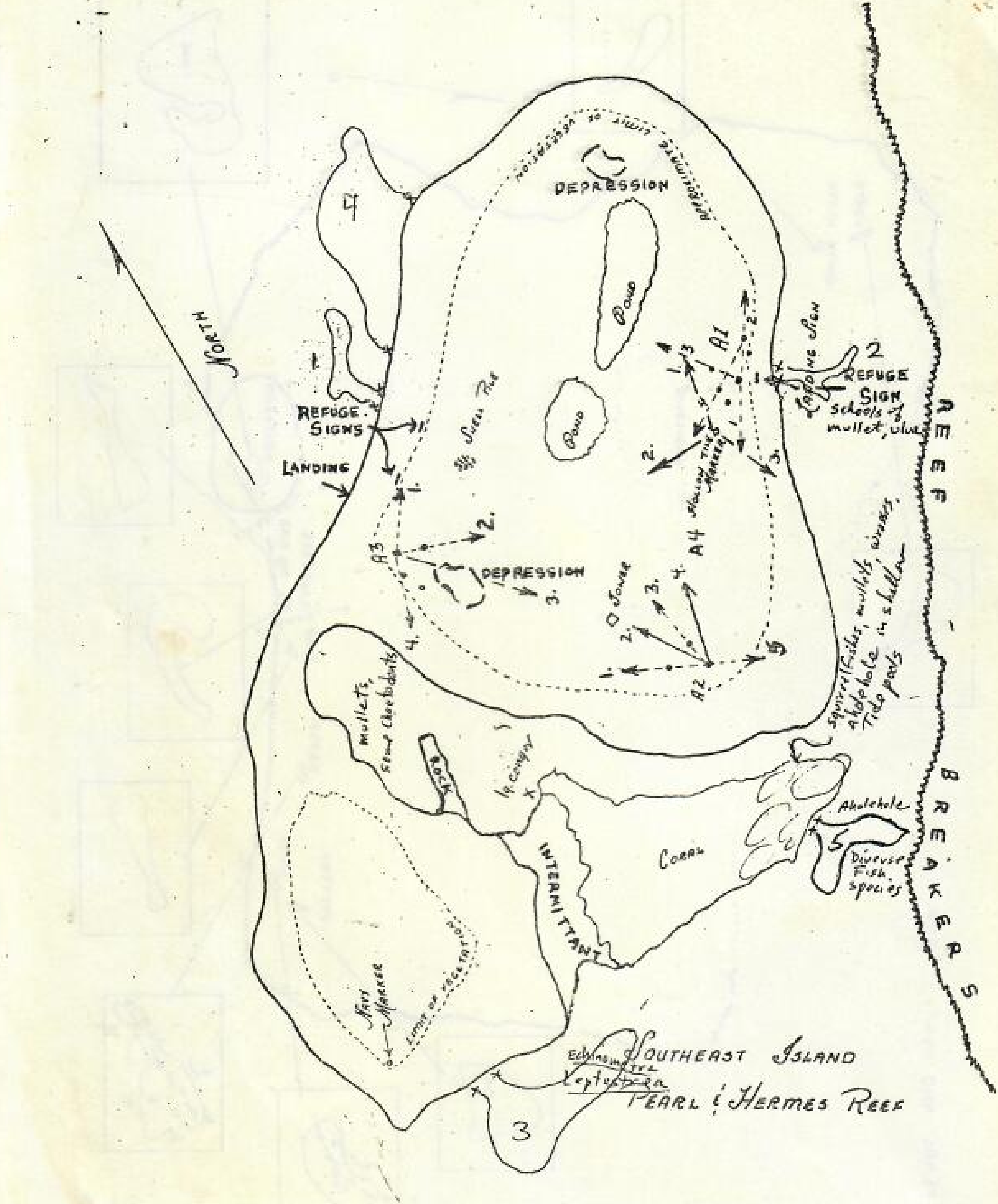
Conus abbreviatus paradise

C.M
R.L.W
1964

PEARL AND HERM[illegible] REEF



R.L.W. 1964


SOUTHEAST ISLAND
PEARL & HERMES REEF
NORTH
REFUGE SIGNS
LANDING
DEPRESSION
DEPRESSION
POND
POND
APPROXIMATE LIMIT OF VEGETATION
LANDING SIGN
REFUGE SIGN
schools of mullet, ulua
REEF - BREAKERS
squirrelfishes, mullets, wrasses, aholehole in shallow Tide pools
Aholehole
Diverse Fish species
CORAL
INTERMITTANT
ROCK
mullets, some Chaetodonts
NAVY MARKER
LIMIT OF VEGETATION
TOWER
A1
A2
A3
A4
2
3
4

C.M.
R.L.W

Photos by Monte and Mazeppa Costa

throw net-

Tony Costa "all caught up in his work"

"To sew" a throw net is to create a fish net by looping and knotting a single strand of line with the use of a shuttle-like needle.

In local idiom the expression "sew net" is used loosely to refer to the skill of constructing the net ("If I sew net all day tomorrow, I think I finish this buggah"). Repair work on the net is called "mend net" ("If I don't mend net tonight, I can't go fish tomorrow").

"Throw net" probably conjurs to most a visual image of the strong Polynesian male, standing or crouching on a reef outcropping, surrounded by the pounding blue Pacific. The moment immortalized in countless post card, calendar, and travel folder photographs is the instant the net is open in a circle in the air in front of the bronze body. Its full 75 foot circumference* laced with lead weights, the net quickly settles to the surface of the sea and immediately sinks to trap fish below.

*This figure varies considerably from net to net.

This man-of-the-sea image is familiar to almost everyone exposed to Hawaiian promotion. It's a good one — appealing, valid, and a fine example of how Hawaii adopts cultural elements from her immigrants and turns them into "uniquely Hawaiian traditions." Throw nets were introduced to Hawaii about 1890 from Japan.

Is this bit of local color still alive in Hawaii? Do "throw net" and "sew net" have any place in fast-paced Hawaii of the 1970s?

Statistically, probably not. There's a lot of talk about the shoreline being fished out. But fishing supply houses offer throw nets for sale. Throw net fishermen — those who fish commercially, for sport, or need — are out there for the lucky sightseer, the determined photographer to enjoy. And they're netting fish.

Very, very few people sew net anymore. Their number grows fewer every year as older practitioners die. Youngsters are not being taught the craft, and those who are, seldom stick with a net from start to finish. It's simply not worth the hassle.

To sew a throw net requires perhaps 150 hours. Or 120 or 160. Whatever. The task complete, the product is seldom sold. Computed at minimum wage scale, the cost of a hand-made net should run $400 to $450 for labor, plus the cost of materials which might run it up somewhere between $50-$100, bringing the total cost to $500, more or less. A perfect machine-made net can be bought for $100 to $150.

The purpose of a net is for use under

EXPLORE KAUAI

By Mazeppa Costa

yesterday's art

(Counter clockwise from upper left) The needle to "sew net." The knot sets the size of the pukas. *Teacher and friend, Akiyama and Tony. A younger Tony knots a first net.*

damaging conditions. It is safe to say, then, no real market exists for expendable $500 throw nets when $100 will buy a ready-made one.

Almost all throw net fishermen — looking into the long stretch of what-must-seem-like countless hours — will opt for purchase of the economical machine-made net. To sew net is an inefficient use of a commercial fisherman's time. Most men who fish for sport or need do not have unlimited time, and the majority prefer to spend the hours they do have catching the fish rather than making the net.

If there is no strong pragmatic reason for making a net, there must be some strong other reason — 150 hours is a lot of time to sit tying knots.

To sew a throw net is to regress to another era, before there were machine-made nets and when attitudes toward time were quite different. In that other time frame, a net maker sits quietly, head down, vision span contained, as he repetitively ties knots hour after hour. A kind of meditation? Yes. Meditation/mysticism — with mysticism being the experience of direct communion with ultimate reality reached through the spiritual discipline of meditation.

Tony Costa, this writer's son, is a young man of twenty who has been making nets and fishing with them since the age of thirteen, when he was taught to sew net and throw net by Andrew Akiyama, contractor and lifelong weekend fisherman.

Here is what Tony has to say.

"Throw nets are conical in shape with an extra fold or pocket at the bottom near the lead weights that are fastened to the lower edge or circumference. The fold is called a bag. It traps the fish that don't get caught in the eyes of the mesh.

"The size of nets vary a great deal, and this size is usually referred to in terms of height. For example, a man could say that his net is 12 feet tall, meaning that when it is held up by the top it hangs down 12 feet. You cannot say how large the diameter is by knowing the height of the net, for the pattern — or *puumana* — of the whole is a cone and infinitely variable.

"Nets are made of line of various weights, sizes, and strengths and of any material used to make string. Materials used in the old days included such things as linen, coconut fiber, and *hau* bark. Today, a monofilament nylon fishing line called *sugi* is the choice kind of line. Strong and available in variable pound test strengths, it lasts well under the effects of sun and salt water.

"Making a net is determined by the kind of fishing planned. A light gauge line for a net to be thrown in calm sandy areas where mullet feed. Light weights are fastened to the bottom. This combination makes a lightweight net easier to throw than a large heavy one.

"If you're going to sew net to throw over *moi*, you use a thick line, maybe 25 pound test, because moi travel along sharp rocky places in white water where the sea is rough. You'll make triple knots because each time the net is thrown it gets tangled on the bottom. And cut.

"In addition to the line and weights, you need a needle and a mesh gauge to sew net. The needle holds the line and is usually made of bamboo or plastic, but it can be of anything you want. I made my first one of koa and my dog chewed it up. The length, width, and thickness of the needle are important. I've seen tiny ones no longer than two and a quarter inches thick. I guess mine is about six inches long. Some are 10 or 12 inches. The mesh gauge, also usually made of bamboo or plastic, is to measure with. You tie the knots on top of it.

"Size of the eyes — the holes — is important. The eyes are what catch the fish. For moi, eyes can be two and three-quarter inches. Legal minimum size is one-and-a-half inches across. Anything smaller would trap baby fish.

"To make a net, the whole thing has to be carefully planned according to the size, shape and weight net you want. And that depends on your size, places you'll be fishing, and what kind of fish

(Continued on page 21)

SCRIMSHAW

Restoring A Maui Tradition

Scrimshaw – the whaler's art of carving or engraving ivory, bone and related materials is very much in evidence in Lahaina, Maui. The true origins of the art form are lost in history, but since the American Indians, Polynesians and Eskimos decorated bone, shell, horn and ivory items long before Columbus landed in the new world, it is almost certain that the American whalers were inspired by the native art they saw en route and in the Pacific whaling grounds. This inspiration, coupled with an abundance of materials and tempered by the endless boredom of life shipboard, created perhaps the only truly American folk art.

Lahaina, the original capital of the Hawaiian Islands, was the focal point of the American whaling fleet from approximately 1820 to 1870 – the golden years of the Yankee whalers. Although antique items are rare, the observant visitor can spot potential heirlooms and truly unique pieces at prices far below their East Coast counterparts. The renaissance of this art form has mushroomed into a cottage industry. With the sponsorship of Pier 49, a quartet of stores in Lahaina and Kaanapali, many young artists have developed into gifted scrimshanders and their ivory creations combine contemporary subject matter with their historical precedents. Jim Marcum, General Manager and Art Director of Pier 49, has strong feelings about scrimshaw.

"We won't trade in whales' teeth. We support Greenpeace, the Cousteau Society and the American Cetacean Society – since these conservationist groups ardently support the total cessation of whaling as we do, we cannot in good conscience continue to buy and sell whale products. Although we have considerable stocks of elephant ivory in the U.S., we feel that the time has come to consider the elephant and ensure its survival. The Federal Government, which already lists the Asian elephant as endangered, is about to make some move on the African elephant. When this happens, there will be quite a scramble in the ivory business and ivory prices will escalate dramatically."

Fine heirloom scrimshaw from Pier 49

With an art pool of some 25 artists, Pier 49 is the biggest producer of quality ivory art in the Hawaiian Islands. Their artists reflect a wide spectrum of social and ethnic backgrounds, as does their art. All major pieces are accompanied by a biographical background of the artist, along with a certificate of authenticity describing and cataloging the piece as to artist, type of ivory, size, weight, subject matter, etc.

"Not all artists can do scrimshaw," claims Marcum. "I'd say we have a success ratio of one in ten. First we need desire, then a willingness to persevere; the strong wrist comes with practice. It takes a lot of concentration and not too many aspirants can hope to progress beyond charms and costume jewelry – but we take them all as far as we feel they can go."

Pier 49 are masters of display. A purchase of a tusk is usually accompanied by a hardwood base – they custom craft everything and can adjust or adapt any piece for any type of presentation, usually at no extra charge to the customer. Their ivory workshop in Lahaina enables them to create unique things to special order. Their mini gallery features many original artworks under one hundred dollars and the customer can choose from a variety of wood and frame styles. Their complimentary mailing service is both fast and efficient and frees the visitor from both the responsibility and inconvenience of excess baggage.

With their unprecedented success in merchandising quality ivory products, Pier 49 is now branching into an allied field – antique prints. With new stores at the Wharf and Mariners Alley, the accent is on Antiques & Collectibles. Besides a healthy nucleus of scrimshaw, these stores feature the most comprehensive display of genuine antique original prints encompassing a wide spectrum of subjects including nautical, geographical and whaling material.

"Fossil material is the material to buy," claims Marcum. "It is the only truly American ivory – it has character, color and history. We buy directly from the Eskimos who dig in the short summer months (when the permafrost is 5 or 6 feet deep). Some of the walrus material is 2,000 years old – mastadon can be 10,000 to 50,000 years, or older. Most of the digging for walrus material is done in the old hunting camps, and the same families will dig there season after season – and the price goes up every year – the Eskimos have a monopoly and as the demand increases the pressure pushes prices ever upwards." Pier 49 has some beautiful Eskimo artifacts on display, and some complete fossil tusks embellished with contemporary scrimshaw.

There is a Pier 49 at Kaanapali's Whaler's Village and also at Lahaina Square (next to McDonald's) – do not miss the outdoor whaling exhibits, especially the authentic Azorean whaleboat on display. With prices for original art on ivory ranging from $4.95 to $5,000, Pier 49 has something for all collectors and all budgets; do come by and visit – you won't be disappointed.

throw net- *(Continued)*

you'll be after. The whole plan is the pattern — the puumana — that includes the size of the eyes and the rate of increase of eyes from the net's beginning. There are many different styles. If you want a net 15 feet tall that flares to 450 eyes at the bottom, you plan it carefully. It must be even on all sides or it doesn't open up clean. After the net is as big as you want it, you add the extra fold that makes the bag at the bottom. Then you put the leads on. They must be evenly spaced around the bottom. The last step: you hang the net; next thread a pole or broomstick through each eye of the bottom row and then put as much weight as possible on each end of the pole. Let it hang for a week or two. This tightens every eye in the net. Finally, you're ready to fish.

"That's another whole thing to learn. You learn different things from different people. I learn something from everybody I fish with. There are little secrets. Some people even wear polaroid glasses to cut the glare. You learn where to go and when, how to spot the fish, and to stalk them. And — very important — you gotta have the eye. You must see the fish. Unless it's a blind throw.

"When you come home, you take care of your net. First you take the *limu* (seaweed) out of the eyes. Then you wash it down good. You don't leave it in the sun. You stretch it out, usually on the clothes line, to dry. Later, you mend it, for most likely you tear it every time you use it. But a good catch is worth a few cuts. The cuts come from the rocks. After you mend net you bundle it up, put it in your rice bag and bring it inside. I put mine under my bed.

"It's harder actually to mend net than to sew net. A friend of the Kealoha's, an old man, full-blooded Hawaiian who lived out at Keehi Lagoon, came all the way out here to Niu to teach Keka and me to mend net. He's dead now.

"Who sews net now? Hardly anybody. A lot of people throw net. All ages. Oriental, Hawaiian, Haole, Filipino — all kinds. But most people won't make them. It's too time-consuming and monotonous to tie knots all day.

"I like to make my own. It suits me. I get just what I want. Sure, you can go to the store and get machine-made nets from Japan. But I think they're not as good. The knots slip. Make your own and every knot is just the way you want it. The whole net is solid. It's something special.

"It suits me to make my own net. I can meditate with it. When I'm fishing I know where every knot is. The whole net is a part of me because I made it.

"I think it's sad the art is dying out."

TOUCHDOWN

HAWAII

TO DO

HAWAIIAN HOLIDAY MACADAMIA NUT FACTORY — On Route 19 (northern route), in Honokaa before Waipio Valley, 775-7743. Watch the process of transforming the raw nut into a gourmet's delight. Free viewing, free samples, over 150 varieties of macadamia nut gifts in their gift shop. Will mail. Open everyday from 9 a.m.-6 p.m.

A NIGHT IN HAWAII — Kona Surf, Keauhou-Kona, the Big Island. Polynesian show and dinner extravaganza. Two shows Monday through Friday from 6 p.m. Reservations 322-3411.

TO DINE

KONA DAZE — Corner of Kuakini Hwy. and Hualalai Rd., Kailua-Kona. Good food with the flavor of old Kona. Daily, breakfast 5:30-11 a.m., lunch 'til 2 p.m., dinner 5:30-9:30 p.m. Dancing from 10 p.m. to closing. Serving exotic spirits and Kona coffee liqueurs. No reservations required. Take-out orders, 329-2833.

SPINDRIFTER — 75-5776 Alii Drive, 329-1344. Reservations recommended for dinner. Lunch specialties omelettes, sandwiches and salads. Dinner: steaks, broiler and seafood specialties, $5.85-$14.95. Breakfast 7-11; Lunch 11-2; Dinner 5:30-10. Entertainment nightly except Mon.

BUZZ'S STEAK HOUSE — On the Kailua-Kona waterfront. Catch of the Day, rack of lamb, steaks broiled over kiawe charcoal, with Buzz's Original famous salad bar, hot homemade bread and fresh artichoke. Dinner daily 5-10:30 p.m. Lunch, 11 a.m.-3 p.m., selection of sandwiches and salads. A super spot for sunsets and sipping. Phone for reservations: 329-1571.

KONA HUKILAU HOTEL DINING — Alii Drive, Kailua-Kona. Top sirloin steak a specialty at only $4.95. 20 other dinner selections: seafoods, steaks and chops, casseroles and unique island dishes. Daily, breakfast 6:30-9:30; dinner 6-9. Phone 329-1655.

ROSEY'S BOATHOUSE — 760 Piilani St., Hilo. Specialties — steaks, seafood and spirits. A spacious, family style restaurant with all dinners including the well-stocked salad buffet. San Francisco style libations in the bar with Hawaiian entertainment. Dinners only, nightly from 5:30-10. For reservations phone 935-2112.

KAUAI

TO DO

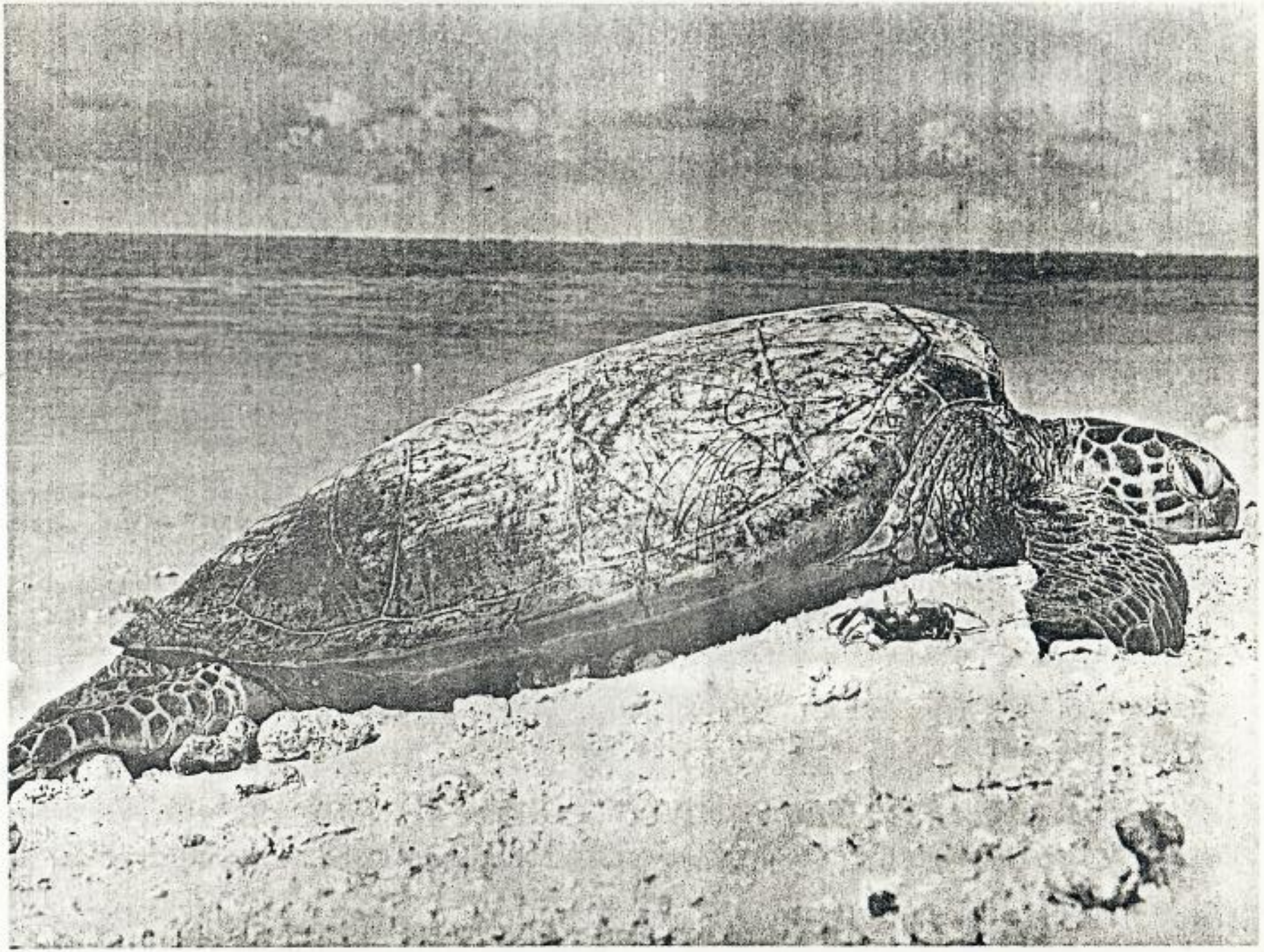
Fly on the wings of a butterfly and listen to the history of Kauai and an orchestrated rhapsody as you watch the scenic wonders of the Garden Isle unfold below. Sound like a dream? It is a dream trip planned by **PAPILLON HELICOPTERS**, Princeville Airport, Hanalei, Kauai; phone 808-826-6591.

OLU PUA — Botanical Garden and Plantation, just off Hwy. 50 on the way to Waimea Canyon, Kauai. The luxurious, lush, estate garden of the Kauai Pineapple Plantation, now a botanic showplace with Hawaii's premier collection of tropical plants, flowers, and trees. Open daily 8:30 to 5, admission $2, telephone 332-8182.

KAUAI RESORT HOTEL — 3-5920 Kuhio Hwy. at the mouth of the Wailua River. 245-3931. Reservations advisable. Kahili Room. Top name entertainment or disco nightly. Showtimes 9:00-11:00 p.m. Cover charge $2.50 and up, 2 drink minimum per person. Call for scheduled entertainment. The night place to be.

KAUAI WINDSURFING EXPERIENCE — Kauai Surf Resort, Kalapaki Beach. All the excitement of surfing with the added speed and challenge of a multi-colored sail. Learn while having fun, safely, with certified, professional instructors. Also at Maui and Kona, Hawaii. Phone 245-9290.

PLANTATION CINEMA 1 & 2 — Above Buzz's Polynesia in the



CATALOGUE OF AMERICAN AMPHIBIANS AND REPTILES

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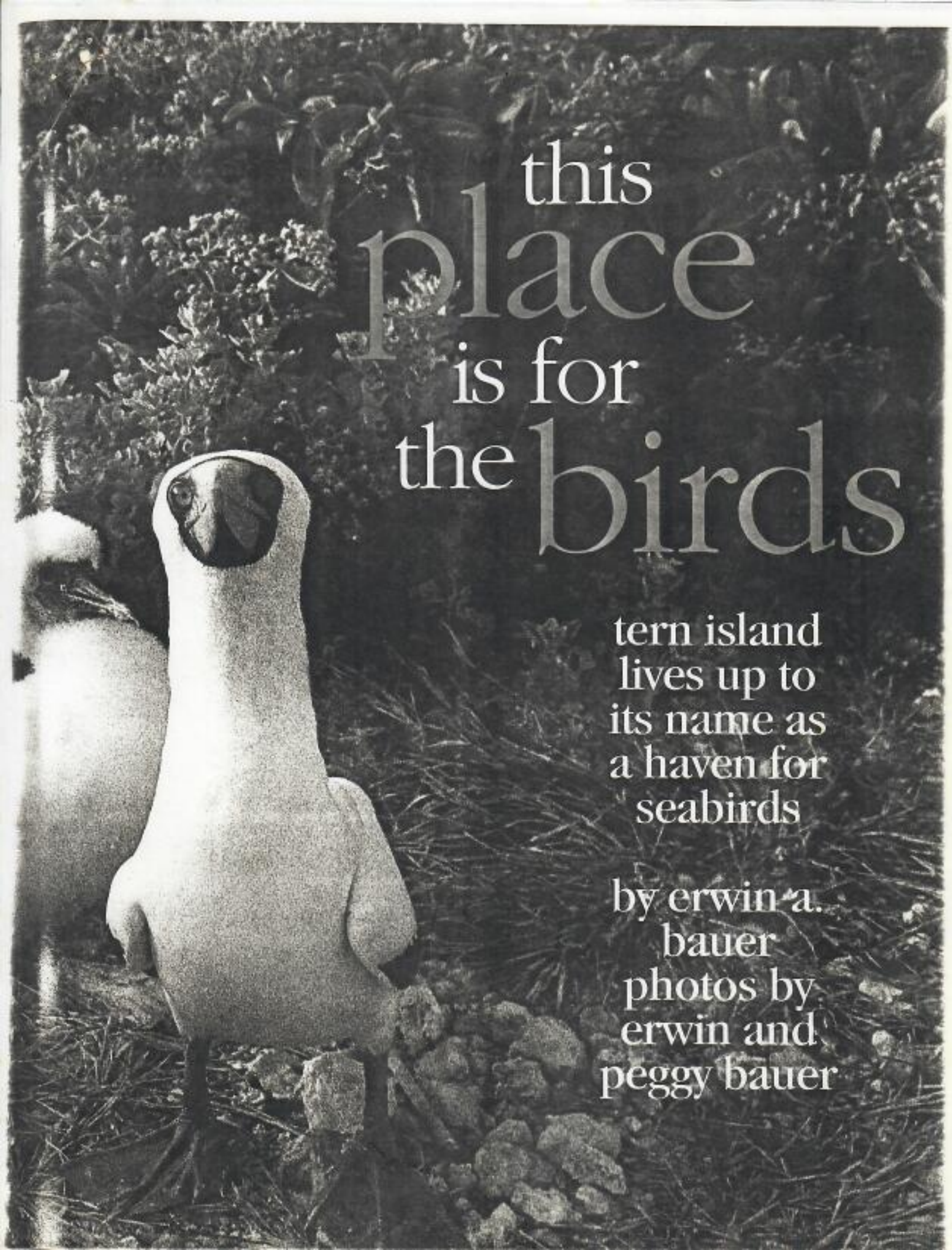
COVERS

FRONT: Drawing by Judith Knight, MPM.
BACK: Hawaiian green turtle (Chelonia mydas agassizi) and ghost crab (Ocypode ceratophthalmus) basking on the beach at French Frigate Shoals. Populations of green turtles throughout the world have declined significantly due to habitat destruction and overexploitation for commercial purposes. George H. Balazs, Univ. of Hawaii at Manoa.
DRAWINGS in text by Tom R. Johnson, St. Louis Zoo.



this place is for the birds

tern island lives up to its name as a haven for seabirds

by erwin a. bauer
photos by erwin and peggy bauer

WILDLIFE CONSERVATION
Volume 96, Number 6 November/December 1993

ALL-AMERICAN ISSUE

FEATURES

DEPARTMENTS

Cover: Art Wolfe photographed this grizzly with his Nikon F-4, equipped with a Nikkor 800mm lens, as it came to the edge of an Alaskan stream for some salmon. A big male grizzly can weigh up to half a ton. Story begins on page 44.
Right: A great frigatebird inflates its scarlet throat pouch to woo a mate. Photo by Erwin and Peggy Bauer.

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THIS PLACE IS FOR THE BIRDS

Tern Island is a haven for frigates and other seabirds

Story begins on page 54

DAYBREAK IS ONLY A PALE LEMON GLOW IN THE EAST AS MY WIFE, Peggy, and I grope toward a small storage building. Carrying armloads of photographic gear, we almost stumble over a pair of albatrosses with a large chick that have bedded directly in our path. They honk and click their bills rapidly to warn us away.

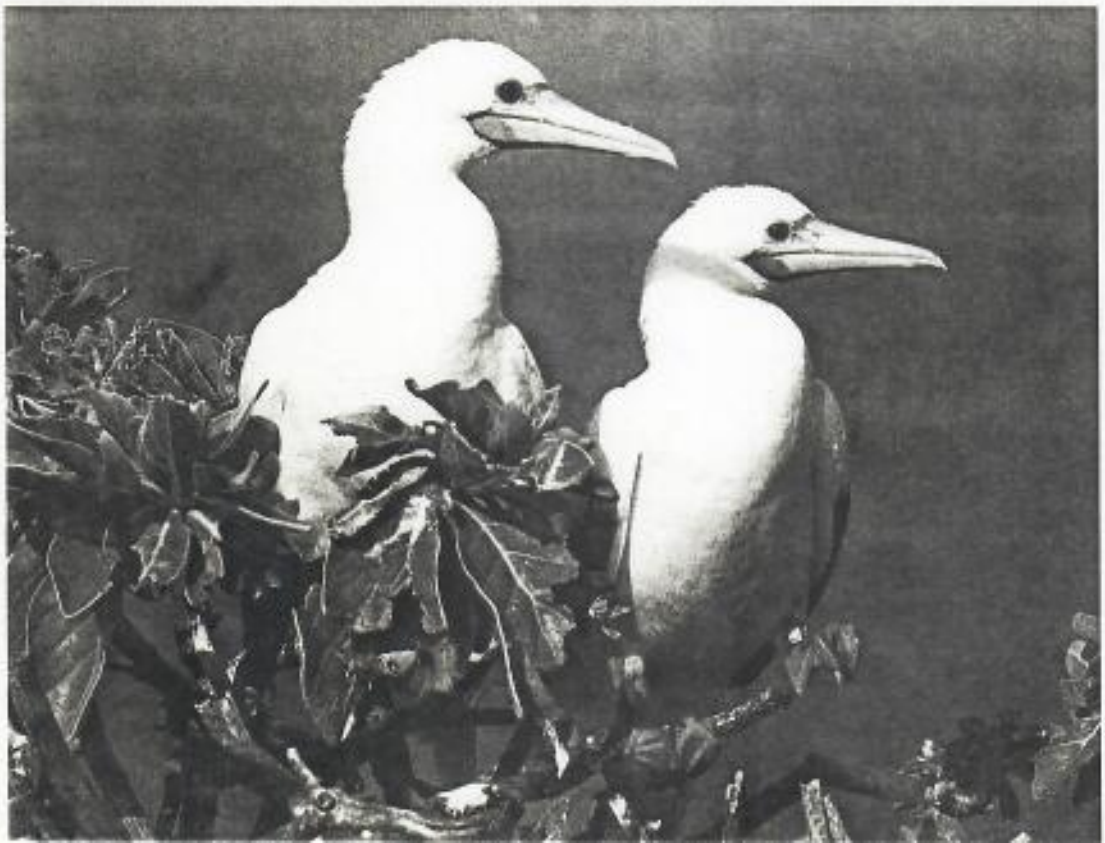
"Not to worry," I say gently to the big birds, "we're friends."

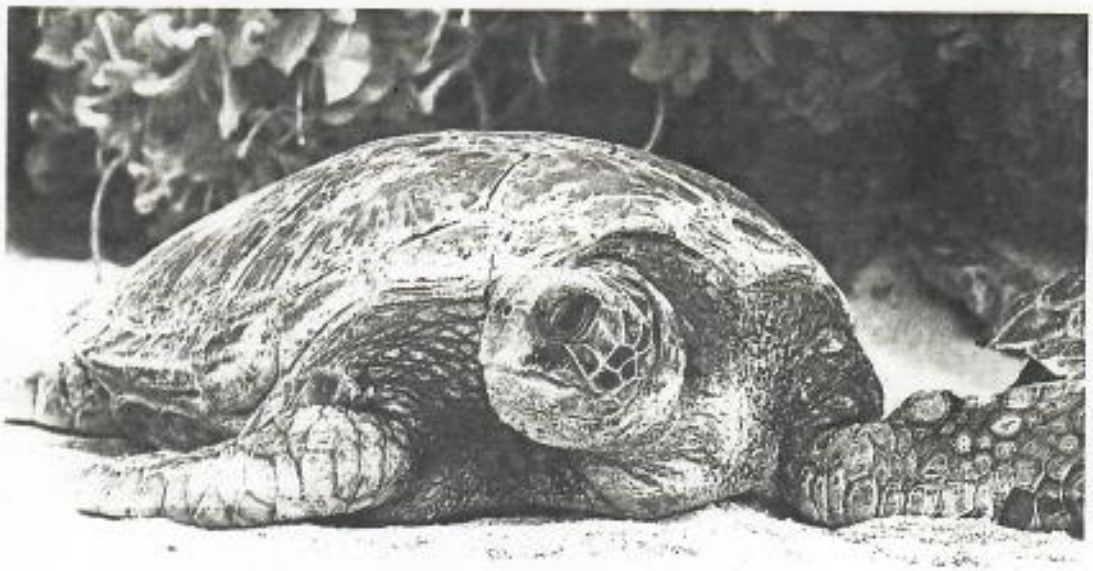
Inside the shed we load our cameras, tripods, and lenses into the wire baskets of two large, rusting tricycles, and I pump air into the flattened tire of one. Then we pedal out onto a bare, deserted airplane landing strip, which extends the length of eight or nine football fields and dead-ends at the sea.

The ride is a strange and surreal experience, especially in the dim early morning light. Along the entire length of the airstrip, we are accompanied by a Halloween symphony of moaning and croaking, braying and yodeling. There are birds on the ground and birds in the air. Some are landing; others are taking off. A few pass so close to us that we can feel the brush of their wings. One briefly lands on my baseball cap. Another catches a free ride atop a telephoto lens sitting in my tricycle basket.

By the time we reach the end of the runway, the sun is just clearing the horizon, washing hundreds of nesting seabirds in its golden glow. For the next two hours Peggy and I exchange not a single word. Instead we use the best of all photographic light to focus on red-footed boobies nesting in heliotrope bushes and male great frigatebirds with their scarlet throat pouches inflated. We expose film with extravagance.

BY DAWN'S EARLY LIGHT: The tropical sun rises on a nesting red-footed booby (above) on Hawaii's Tern Island. Incubation and care of the young are fairly evenly shared by both parents (right). Unlike their red-footed relatives, masked boobies (pages 54-55) nest on the ground.





ON THE BEACH: Thirty-seven-acre Tern Island is part of French Frigate Shoals, an important landfall for green turtles (right) and home to about 800 Hawaiian monk seals (below). Rebuffed by its mother, a seal pup (opposite) tries to nurse on an incoming sea turtle.

tern island is also a sanctuary for monk seals and green turtles

More than once, as soon as I find a bird in a perfect pose in my viewfinder, I am distracted, either by pairs of "dancing" albatrosses or by monk seals that lurch ashore expecting to spend the day sleeping exactly where I am standing. So I gather up my equipment and move. Altogether, the morning is remarkable. No, spectacular. I have spent the last half-century photographing wildlife and wild habitats around the world, and I can say with certainty that Tern Island is one of the most remote and vibrant wildlife arenas left on Earth.

TERN IS THE LARGEST OF THE SMALL SAND AND CORAL ISLANDS THAT MAKE UP French Frigate Shoals, a lonely atoll near the center of the Pacific Ocean. A unit of the Hawaiian Islands, French Frigate Shoals is one of the northwestern groups designated in 1909 by President Theodore Roosevelt as the Hawaiian Islands National Wildlife Refuge. Tern Island lies about 500 miles west of Honolulu. The nearest human settlement is on Kauai, 385 miles away. Midway Island, with a small military garrison, is 500 miles to the west. Beyond these spots, no people live permanently within 1,000 miles or so in any direction. Nor is Tern situated along any major ocean shipping lanes, although its surrounding waters are all too familiar to commercial fishermen.

Nonetheless, Tern Island is a busy place. Each year, from April through June, as many as 400,000 seabirds of 15 species may be based (about half to nest) on Tern, which encompasses only 37 acres of land, plus nearby Whale Skate and East islands. Tern is also a sanctuary for the rare and endangered Hawaiian monk seal. In early 1991 this species' population was estimated at 1,500. (The seal's Caribbean cousin has been considered extinct for 40 years, and probably fewer than 500 Mediterranean monk seals cling to survival in the Mediterranean and along the coast of Mauritania in Africa.) In addition, French Frigate Shoals is an important landfall for the endangered Pacific green turtle.

Our visit to Tern Island in April 1992 was not my first. In 1970, I joined the annual inspection trip, which was led by Gene Kridler, then refuge manager. We stopped at each of the islands in the chain: Nihoa, Necker, Lisianski, Laysan (which has the largest seabird population of all, and endemic species of duck and finch), Pearl and Hermes Atoll, and French Frigate Shoals. We camped for several days on Laysan but wasted little time on Tern because at that time there were few animals there. Coast Guard and other military forces had occupied the island off and on since 1943. After World War II, the Coast Guard built an elaborate station and barracks to house a permanent force of 25, but that base was relinquished in 1979 to the U.S. Fish and Wildlife Service. Since then it has been occupied mostly by a few biologists and wildlife researchers. Access is via a three-and-a-half-hour flight on small aircraft from Honolulu, or a long, sometimes rough boat voyage. As a result, the seabirds have returned en masse to Tern Island.

Our 1992 trip to Tern was part of a regular resupply mission for the staff of four: acting refuge manager and Vermont native Jennifer Megyesi; her volunteer assistant, Rich Schauffler, who had studied Atlantic puffins in Maine and was investigating the island's red-tailed tropicbirds; marine mammalogist Mitch Craig, of the National Marine Fisheries Service, who was keeping an eye on the monk seals (the French Frigate Shoals population of 800 has been undergoing a serious, mysterious decline); and virologist Doug Skilling, of Oregon State University, who was assisting Craig and taking seal blood samples for analysis.

With a density of about 2,500 nesting pairs per acre on Tern Island, the birds would be nearly shoulder to shoulder if the various species did not utilize different habitats. We found them nesting like human apartment dwellers on four levels on, above, and below the same plot of ground. Some species—wedge-tailed shearwaters and Bonin petrels—nest in underground burrows they excavate as skillfully as do the badgers and ground squirrels at home in Montana. Other birds—Laysan and black-footed albatrosses, sooty terns, masked boobies, spectacled, or gray-backed, terns, and brown, or common, noddies—nest on open ground. Red-tailed tropicbirds and Christmas Island shearwaters also nest on the ground, but under vegetation.

Great frigatebirds, red-footed boobies, and black noddies perch and construct their crude nests among the vegetation, either *Scaevola sericea* or *Tournefortia argentea*, the latter an excellent beach-binding plant. White, or fairy, terns build no nests at all, and may balance their single egg on a branch or a rock. They seemed particularly to like the window ledges and crannies of the old Coast Guard buildings. One female fairy tern laid her egg and hatched the chick on the rusted valve handle of an abandoned fuel tank.

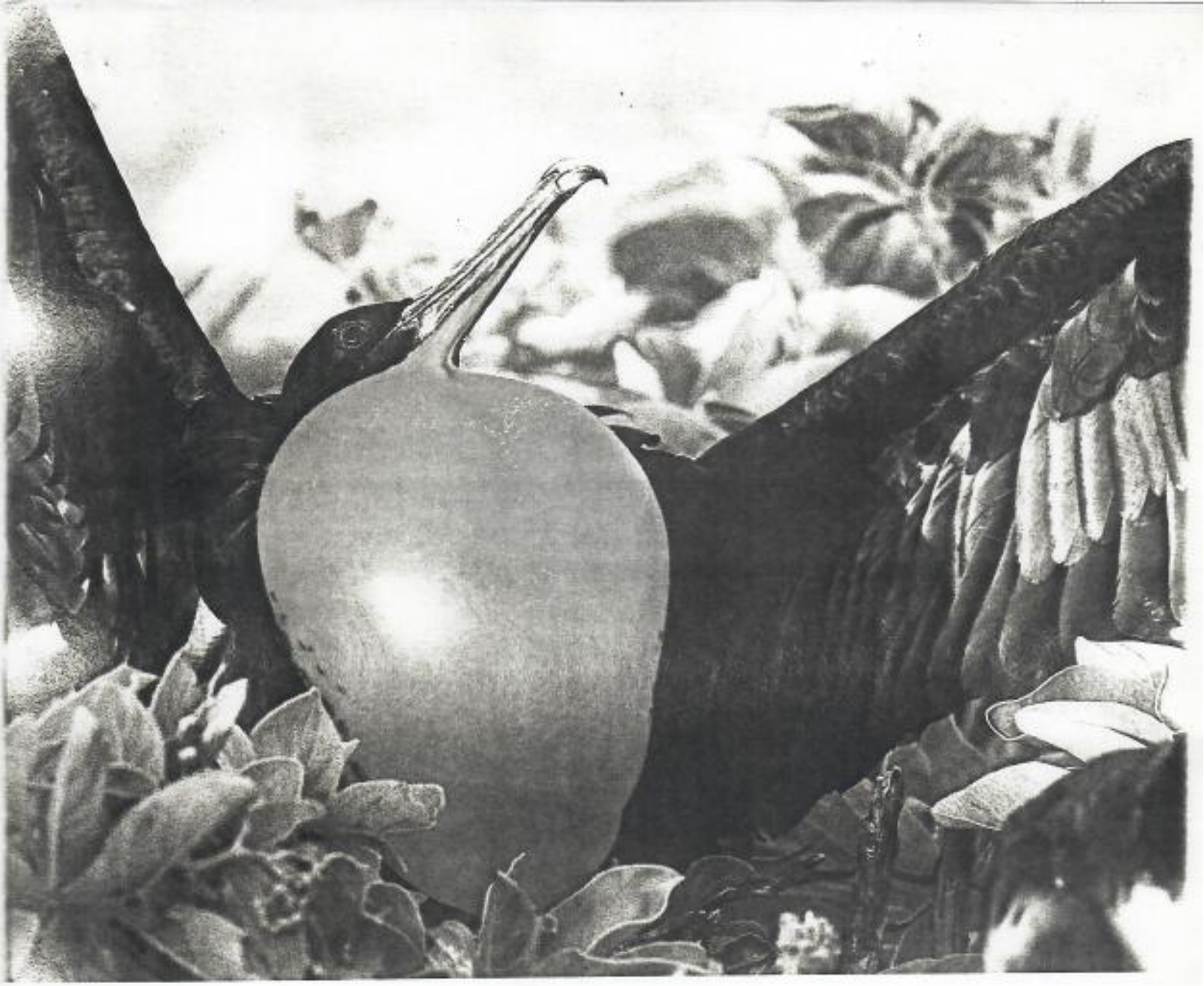
THE COLOR RED: The male great frigatebird inflates his scarlet gular pouch (above), which acts as a resonating chamber for calls during courtship (right). The single chick (above left) remains on the nest until fully grown, perhaps as long as a year.

WE KNOW IT IS EASY TO SPEND TOO MUCH TIME PHOTOGRAPHING male great frigatebirds as they sit watchfully, wings outstretched and quivering, feathers flared behind their red gular pouches, which they inflate like balloons during the breeding season. Each time a female flies overhead, a hopeful male increases the fluttering of his wings and waves his black, hooked bill in her direction. It is almost impossible to stand anywhere on that lonely bit of real estate and not see red spots dotting the terrain.

The frigates' life-style is as interesting as their courtship posturing. They live by preying on—mugging, really—their neighbors. Most of the time they attack boobies and terns in mid-air at sea, causing them to drop their catch. The frigates then capture the fish before it hits the water. During the nesting season, frigates scoop up unattended sooty or noddy tern chicks.

For sheer numbers, the black-and-white sooty terns predominate, making up about 75 percent of the island's bird population. They occupy all the flat ground and even encroach on the airstrip. The largest colony of masked boobies in the Hawaiian Islands nests and raises young among the sooties. During our visit the masked booby chicks were already heavier than their parents.

One morning, as a dark rain cloud covered the sun, I sat down beside the bare runway to eat a candy bar and change film. Some distance away, a masked booby with an all-white chick was preening itself. Something, maybe the crinkling of the candy wrapper or the metallic camera sounds, brought the two boobies waddling directly to my side. The adult pecked gently at my shirtsleeve and, owl-like, studied me until I left.



SEABIRD SPLIT-LEVEL: Tern Island's avian nesters space themselves on available territory. While some choose sites up in the vegetation, Laysan albatrosses (below) and black-footed albatrosses (right) take the ground level. A downy red-tailed tropicbird chick (opposite) sits safely under a bush.

most of the albatross chicks were already as big as their parents

On another day, we made the 30-minute run across the lagoon to Whale Skate Island. Unlike Tern, it is bare, with only one *Tournefortia* shrub in the center, under which many masked boobies had gathered for shade. We also counted 24 monk seals and half that many green turtles basking on the coarse sand beach. As we anchored the boat at one end of the island, several turtles and seals came ashore on the opposite end.

Among the seals hauled out were three large females with pups. Biologists believe that one factor limiting Hawaiian monk seal numbers may be that mothers will abandon their pups if unduly disturbed by people. We kept a safe distance, and through long telephoto lenses watched and photographed one mother nursing her youngster. In time the female rolled over and brushed the baby away. Still hungry, it tried to nurse from a sea turtle that had just arrived in the gentle surf, and of course was brushed away again. The pup then returned to its mother and fell asleep in the shade of her 500-pound body.

Probably no birds were more visible on Tern Island than the Laysan albatrosses, elsewhere called gooney birds—an apt description. Most of the chicks, stoked with a daily diet of regurgitated seafood, were almost the same size as their parents. All day long they sat motionless under the hot sun like fat, brown-feathered Buddhas, their feet upturned for ventilation. Meanwhile, the adults were busy getting food for the chicks. Takeoff is difficult for the heavy birds at any time, but on windless days the effort required is great, and often comical. The albatrosses sought a long, open route on the runway, then ran full tilt into whatever breeze they could discern, large webbed feet pounding ever faster on the hardpacked surface. Huge wings flapping, they always managed to become airborne just before the watery end of the strip. Every return was a desperate, clumsy crash landing that sometimes bowled over unfortunate birds in the path.

Not all the Laysan albatrosses had nested. Perhaps an equal number, not yet mature, spent long hours practicing the species' courtship dances and rituals. Maybe next year . . .

Even in this remote paradise, trouble may be brewing. Craig told us that within the past year the monk seal population may have dwindled by one-third, leaving about only 1,000 animals. As yet there are no clear explanations for the decline.

With military presence almost gone from the northwestern Hawaiian Islands, human interference no longer seems a factor. Deteriorating water quality in the Pacific could be responsible, but more than likely the culprit is overfishing with modern long lines and nets that drift over many miles. Fishing is banned within 50 miles of all the islands in the wildlife refuge, but the regulation is impossible to enforce with a small budget to cover so vast an area. There is increasing evidence of illegal fishing activity.

Megyesi and Craig also said that more of the plastic chemical light sticks used to illuminate Japanese fishing nets had washed ashore during the year on Tern Island than had appeared in all previous years. And they had found Hawaiian monk seals on the beaches with fishhooks imbedded in their mouths. We photographed the desiccated skeletons of monk seals entangled in heavy nets, which had managed to drag themselves and their burdens to shore before dying there. Discarded fishing nets with dead sea creatures enmeshed in them regularly wash ashore on the islands in the wildlife refuge.

The birds cannot escape the fishing industry, either, which sees them as competition for the resources. The researchers found an albatross that had been sprayed with red paint, its eyes outlined in a darker color, in what was probably an act of retaliation.

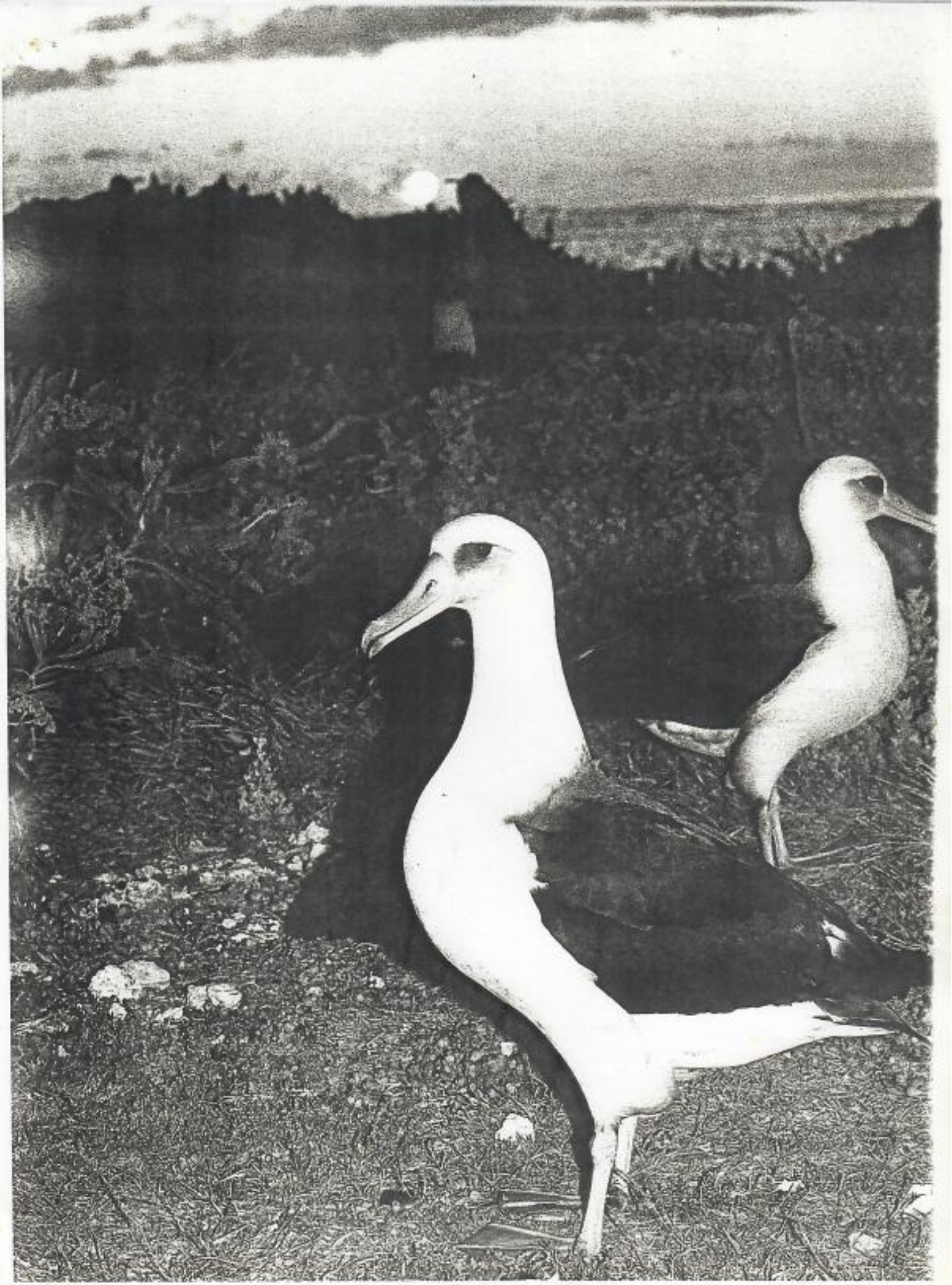
The night before we flew back to the high rises of Honolulu, I did not sleep soundly. Instead I listened, maybe for the last time, to the moaning of the shearwaters, the clacking of albatross bills, and the haunting cries of other birds I could not clearly identify.

Two new books by the well-known photojournalist team, Erwin and Peggy Bauer, are scheduled for publication this fall: Yellowstone *and* Whitetails, *both from Voyageur Press, located in Stillwater, Minnesota.*

Editor's Note

The Bauers were pleased to learn that Tern Island was spared the wrath of Hurricane Iniki, which struck the Hawaiian island of Kauai in 1992 and caused considerable damage there. They report that the 1993 seabird breeding season on Tern was even better than the previous one.

DAY'S END: Few human visitors are allowed to share sunsets with Tern's seabirds (great frigatebirds below, Laysan albatrosses opposite). Nonetheless, the island's wildlife is threatened by human activities—primarily the fishing industry and ocean pollution.



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OFFICE OF DISTRICT SUPERINTENDENT
4967 Kilauea Avenue
Honolulu, Hawai'i 96816

RESEARCH MATERIALS, BULLETIN NUMBER 21
Mrs. Violet Ku'ulei Ihara
January 1980

ENDANGERED NAVIGATORS: TURTLES OF THE OCEANS

This new exhibit is on sea turtles: their place in the animal kingdom, their natural history, their importance to man, and their present status as endangered species. The exhibit is located in the upstairs gallery of POLYNESIAN HALL and will remain on view until May 15, 1980. The exhibit materials were researched and prepared by Carla Kishinami, Curatorial Assistant in Vertabrate Zoology. The following materials are label copies accompanying the exhibit. (SEE MAP - page 12)

DOORWAY: Three hundred years ago, when all sea turtles were vastly more abundant, their migration to and from breeding grounds was a conspicuous phenomenon. Today, with their numbers greatly reduced, they still steer their way through hundreds of miles of ocean using some unknown means to find their way back to their natal beaches to breed and lay their eggs.

(MAKAI WALL) AN ANCIENT RELATIVE OF TODAY'S MARINE TURTLES Near the end of the Age of Reptiles, much of America was covered by shallow seas in which the marine turtle Archelon was common. This 12-foot giant was an early representative of the same group that today includes the green turtle, common in Hawaiian waters.

A shell from an average-size adult green turtle is shown here to give some idea of the great size difference between ancient and modern sea turtles.

"LIVING FOSSILS" The turtles (Order Chelonia) are the oldest surviving line of reptiles. They evolved during the Triassic Period, 200 million years ago, along with the first dinosaurs. It is believed that these early turtles originally were marsh inhabitants and that during the Triassic some moved into the sea. These ancestral turtles gave rise to the hard-shelled sea turtles, Family Cheloniidae, and later to the leather-back sea turtles, Family Dermochelyidae.

The wave of extinction that heralded the end of the Age of Dinosaurs also took with it many of the turtle species. Those that survived changed very little in basic form, remaining very much like their ancestors despite the changing environment.

ADAPTATION TO LIFE AT SEA The skeleton above of a freshwater pond turtle shows the "boney box" that has been the hallmark of the turtles from their early beginnings. This armor plating is divided into upper and lower portions (carapace and plastron, respectively), connected by a bridge at the sides. In life it is covered by horny plates called laminae. It admirably achieves its purpose -- protection -- but greatly restricts the movements of its occupant.

The green sea turtle skeleton below, compared with that of the pond turtle, shows the reduction of the "boney box" that was essential for survival in the ocean habitat. This reduction was needed in order to lighten and streamline the shell and increase its flexibility. Bone reduction also provided room for the powerful muscles of the forelimbs, which had become elongated into effective paddles.

ADAPTATION TO DIFFERENT ENVIRONMENTS The twelve Families of turtles living today have adapted in form and behavior to a variety of habitats. They occur on all the major land masses except for the polar regions, and have made their way to numerous islands. Four well-known Families are illustrated here.

Family Testudinidae, Land Tortoises (Galapagos Tortoise)
Family Emydidae, Freshwater and Marsh Turtles (Red-eared Pond Slider)
Family Trionychidae, Soft-shelled Turtles (Chinese Softshell)
Family Cheloniidae, Hard-shelled Sea Turtles (Green Turtle)

LIFE HISTORY GREEN TURTLE, CHELONIA MYDAS Threatened Species Two species of the genus Chelonia are found today. The flatback, Chelonia depressa, is found only in Australia, while the green turtle, Chelonia mydas, is found in warmer waters throughout the world.

Named for the color of its body fat, this turtle - of soup fame - is regarded by many as the most valuable reptile in the world. Its flesh and eggs serve as an important source of protein in many parts of the globe.

An herbivore, the green turtle spends much of its life feeding in shallow waters that support an abundance of vegetation. It is the most common turtle in Hawaiian waters, and is one of two marine turtles known to nest here.

(MAP SHOWING DISTRIBUTION OF THE GREEN TURTLE) The green turtle is thought to be the most accomplished navigator among the sea turtles; its migrations are certainly the best documented. The extent of some of these migrations has been traced through females that have been tagged on nesting beaches and later recovered in feeding grounds. One of the longest yet recorded is the 1,400-mile journey between Ascension Island and the coast of Brazil.

Adult green turtles range from 30 to 60 inches in carapace length. Shown here is an immature specimen.

HAWKSBILL, ERETMOCHELYS IMBRICATA Endangered Species This hawksbill is best known for its translucent laminae, the material used for the popular tortoise-shell jewelry. It is an inhabitant of rocky places and coral reefs, but is sometimes found in deeper waters.

Little is known of the behavior of the hawksbill. It is omnivorous, is apparently active during the day, and is generally thought to have an aggressive temperament.

Hawksbills are occasionally encountered around the main Hawaiian Islands and are known to nest here.

Adult hawksbills range from 24 to 36 inches in carapace length.

(MAP SHOWING DISTRIBUTION OF THE HAWKSBILL TURTLE) Since its coral reef habitat usually provides the hawksbill with both feeding and nesting areas, it was thought that it did not undertake long-range migrations. Evidence gathered over the past fifteen years, however, indicates that some populations do migrate to distant nesting beaches, but this has not been thoroughly documented.

LEATHERBACK, DERMOCHELYS CORIACEA Endangered Species The leatherback is the only living member of the Family Dermochelyidae. It has "lost" the horny laminae typical of a turtle shell, and the underlying bone has become greatly reduced. A mosaic of small bones is embedded in the leathery skin, which replaces the hard outer laminae.

Almost nothing is known of the behavior of free-living leatherbacks, except that they are omnivorous with a marked preference for jellyfish. Leatherbacks are pelagic wanderers - roaming the deep waters of the open ocean and rarely entering shallow bays and estuaries. They are regularly encountered in Hawaiian waters but do not nest here.

Adult leatherbacks range in length from 4 to 8 feet and weigh from 700 to 1,600 pounds, making them the largest living turtles in the world.

(MAP SHOWING DISTRIBUTION OF THE LEATHERBACK TURTLE) Leatherbacks travel great distances, but whether these trips are random wanderings or regular migrations is not known. Their travels take them into cold waters that are intolerable to other sea turtles, except possibly the loggerheads.

LOGGERHEAD, CARETTA CARETTA Threatened Species Loggerheads wander widely throughout the marine waters of their range and often enter bays, lagoons, salt marshes, and creeks. In the open ocean they spend a great deal of time floating on the surface, presumably sleeping. They have the reputation of being extremely pugnacious. Loggerheads are almost entirely carnivorous.

In former days the loggerhead was reported to reach weights of 700 to 1,000 pounds, but today a specimen weighing more than 300 pounds is rare. Still, loggerheads are considered to be the largest living hard-shelled turtles.

The white spots on the shell in the photograph are barnacles.

(MAP OF THE DISTRIBUTION OF THE LOGGERHEAD TURTLE) The loggerhead has been so consistently persecuted at the nesting grounds, and so many have been destroyed, that the original nesting range cannot be discerned. Although the Hawaiian Islands are considered to be within their range, only rare stragglers are encountered here.

Adult loggerheads range from 30 to 83 inches in carapace length. This carapace is from a very young specimen.

OLIVE RIDLEY, LEPIDOCHELYS OLIVACEA Threatened Species The olive ridley is one of the smallest sea turtles and the most poorly known. There is some evidence that it is primarily an open-water species, feeding mainly on deep-water crustaceans that come to the ocean surface at night. It also frequents shallower coastal waters where it apparently dives deeply for it food.

The olive ridley is usually a nighttime mass nester. Usually on stormy nights, large numbers will ascend the beaches and lay their eggs as a group. It is thought that stormy weather is preferred because the high wind and surf hel to cover tracks and nests.

Adult olive ridleys range from 24 to 28 inches in carapace length. Shown here is an immature specimen.

KEMP'S RIDLEY, LEPIDOCHELYS KEMPI Endangered Species In 1968 the Kemp's ridley was declared the most endangered of all sea turtles. Since the discovery of its nesting grounds in 1947, it has suffered a 99% decline in its population.

The carnivorous Kemp's ridley inhabits the shallow waters of coastal areas. It is a mass nester, even more so than the olive ridley, and unlike any other marine turtle, it usually nests during the day. Like the olive ridley, it prefers to nest when the surf and wind are high. It forms large aggregations offshore before ascending the beach en masse to nest - a maneuver that is thought to overwhelm and confuse its predators. These aribandas (Spanish, "arrivals") were first documented in 1947, when an estimated 40,000 females were filmed covering the beach at Rancho Nuevo, Mexico. In 1979 no more than 450 females arrived there to nest.

Adult Kemp's ridleys range from 20 to 28 inches in carapace length.

The Kemp's ridley has the most restricted range of all the sea turtles. Almost the entire population of breeding females returns to nest on the southern coast of Tamaulipas, Mexico, usually within a few miles of Rancho Nuevo.

By contrast, the olive ridley is found in a narrow band of tropical waters around the world.

(MAP OF DISTRIBUTION OF THE OLIVE RIDLEY AND KEMP'S RIDLEY TURTLES)

('EWA WALL) The leatherback is the fastest and most powerful swimmer of any of the sea turtles. A growth of red algae on this female's neck gives it a pink tinge.

This olive ridley male shows the six lateral laminae that help differentiate it from the green turtle and the hawksbill, which only have four.

Both the flatness of the carapace and its upturned edges identify this turtle as a flatback, a species native to Australia.

The pronounced beak of the hawksbill gives it its name.

HAWAIIAN GREEN TURTLES All marine turtles reproduce by periodically migrating to their breeding grounds, where courtship and mating precede the female's ascent up the beach to lay her eggs. It is widely accepted, but as yet uproved, that marine turtles return to the same nesting beach where they themselves were hatched several years earlier. It is known that the turtles often travel over long distances of open ocean to reach these beaches, and that they return to the same beaches on recurrent nesting seasons, but what guides them on their journey is still a mystery.

Hawaiian green turtles begin their migration from feeding grounds to nesting beaches each March. The females begin laying their eggs in May and continue through July. Formerly, green turtles nested on some of the main Hawaiian Islands, but today the last remaining colonial nesting sites, or rookeries, are in French Frigate Shoals in the Leeward Islands.

LIFE IN THE LEEWARD ISLANDS (MAP OF FEEDING GROUNDS AND MIGRATION ROUTES) The two principal nesting sites in the Hawaiian Islands are in French Frigate Shoals, on Whale-Skate Island (above) and on East Island. Islands to the northwest of French Frigate Shoals may, on occasion, host a few separately nesting females.

Newly hatched Hawaiian green turtles scamper toward the ocean. Hatchlings usually emerge at night and make their way to the water by moving toward the brighter horizon over the ocean.

(MAUKA WALL) Green turtles retire to nooks and crannies in the reef to sleep. Here a turtle pauses to allow smaller "cleaner" fish to nibble at its skin and shell.

In all marine turtles the adult male is easy to identify because of its long, prehensile tail, which extends beyond the hind flippers. The female's tail barely reaches beyond the end of the shell.

Except for the female during nesting, most marine turtles never again return to land after leaving the natal beach. The Hawaiian green turtles are unique in that they habitua habitually come ashore to bask in the sun for hours - sometimes with a friend.

Males use their flippers to clasp the female's shell during mating.

Most marine turtles reproduce in two- to four-year cycles. During the breeding season, the female usually lays two or three clutches of eggs at intervals of 10 to 15 days. Green turtles have been known to nest up to eight times in a season.

A NESTING GREEN TURTLE Most marine turtles use the cover of night to lay their eggs. After the female has cautiously ascended the beach and selected her nesting site, she begins construction of her nest by using all four flippers to fling sand out of the way. Depending on the species of turtle and the consistency of the sand, the body pit thus excavated varies from a slight depression to a deep hole, sometimes twice the depth of the shell.

A female turtle appears to weep while nesting. Actually, these "tears" flow constantly from the salt excreting glands, but can only be seen when the turtle is out of water. During nesting, these "tears" help to wash sand from the eyes and keep them moist.

Using the hind flippers, the turtle carefully scoops out the egg chamber. Usually 100 to 120 of the soft, leathery eggs are deposited, and the nest is completely covered to conceal it before the turtle returns to the sea.

Sea turtle eggs have an incubation period of approximately 50 days. The egg chamber, lying about 2 feet underground, protects the eggs from the flucuating outside temperature.

Hawksbill eggs Loggerhead eggs

The baby turtles are hatched underground, and it take several days for their combined efforts to bring them to the surface. Their final emergence usually takes place at night.

Once the hatchlings enter the sea, they are seldom seen until they are at least one year old. Where the baby turtles go and what they do during this "lost year" is not fully known.

Loggerhead Green Leatherback

PREDATORS ON LAND Turtle eggs are dug up and devoured by a host of predators, including mongooses, monitor lizards, racoons, monkeys, and feral dogs and cats. On their way to the sea, the hatchlings are confronted with even more predators - birds, snakes, and crabs.

At French Frigate Shoals, unlike many turtle rookeries around the world, sea birds like these frigatebirds do not seem to bother the turtle hatchlings.

Ghost crabs kill a great many hatchlings wherever the two are found together.

Ghost Crab Monitor Lizard Mongoose

PREDATORS AT SEA Once the hatchlings enter the water they may fall prey to any number of carnivorous fish, including the jack (Caranx ignobilis), locally known as ulua.

Sharks readily eat hatchlings and will even attack half-grown and adult turtles. This damaged shell from a green turtle was taken from the stomach of the 9-foot tiger shark whose jaws are displayed here.

One of the many predators of turtle eggs and the major predator of adult turtles is seen here. CAUTION: LIVING SPECIMEN MAN

This specimen shown here has probably never killed a sea turtle - don't let it start!

TURTLE FOODS Sea turtles vary in dietary preference, from the mainly herbivorous green turtles that graze on seaweeds and sea grasses - munching on an occasional sponge or mollusk for variety - to the highly carnivorous ridleys with a diet consisting mainly of crustaceans and mollusks.

Loggerheads and hawksbills seem to enjoy a balanced diet of plants and animals. Loggerheads are well known for their ability to crush large conch shells and Tridacna clams in their powerful jaws.

Dictyopteris	Gracilaria	Pinna
Sargassum	Portunus	Tridacna
Codium	Natica	Chondrosia (sponge)

Most sea turtles are known to eat jellyfish. Discarded plastic bags floating in the ocean look like jellyfish to the sea turtle, and can cause death by intestinal blockage. Will your sandwich bag kill a sea turtle?

PARASITISM Several types of external parasites are associated with sea turtles; the most obvious are the barnacles, with ten species found exclusively on sea turtles. Some, like Chelonibia testudinaria, cause very little damage, merely "catching a ride," and probably feeding on the residue of the turtle's meals. The burrowing barnacles such as Stephanolepas muricata may cause some discomfort and severe infestations may do a great deal of harm.

A hawksbill with a minor encrustation of barnacles.

Chelonibia testudinaria - a harmless encrusting barnacle.

Stephanolepas muricata - This barnacle burrows through shell or skin anchoring its barbs deep in the turtle's tissue. It erodes the bone of the shell and can form large tumerous masses. Individuals can reach up to four times the size shown here.

Platylepas sp. - This barnacle sits in shallow pits that it forms in the turtle's skin.

Cylindrolepas sp. - By turning the specimen you can see how barnacles of this genus have burrowed deeply into this lamina, from the edge of a turtle shell. The bone that was sheathed by this lamina was eroded where the barnacles burrowed into it.

IMPORTANCE TO MAN Turtles have long played an important role in man's cultural history. They have figured in his mythology, provided material for his tools and ornaments, and satisfied his hunger. Wherever man and turtle have come in contact, man has benefitted in many ways.

A modern story board from Palau, Caroline Islands, depicts the following legend:

Two lovers met secretly on a deserted beach. The woman used her skirt as a pillow, but when they were ready to leave she could not find it. They assumed that the turtle they had seen nesting nearby had dragged it into the sea. Several days later the lovers returned to the beach and saw the same turtle coming up the beach to nest, still entangled in the skirt. In this way the people discovered the number of days between nestings of the sea turtle.

The mythical fisherman, Urashima Taro, is figured in this oshie. The story is as follows:

One day Urashima Taro came upon a sea turtle being tormented by a group of boys. Taro chased the children away and helped the turtle back to sea. One year later the turtle came upon Taro fishing, and told him that his mistress, the Sea Princess, had invited him to her underwater castle. Taro eagerly went with the turtle and soon found himself in a castle more beautiful than any in Japan. Taro did not know how long he stayed, but one day he told the Princess he had to return to his home. She gave him a box, telling him that it contained the most precious gift she could give him, but warning him never to open it.

The sea turtle carried Taro back to his home, but the villagers there told him that Urashima Taro had been lost at sea 300 years earlier. Filled with sadness for the family he had left behind, he forgot the Princess' warning and opened the box that she had given him. A wisp of smoke escaped, and Urashima Taro aged swiftly - as his lost years quickly passed by.

Mr. and Mrs. Roland Force, 1967

Rubbing of a sea turtle petroglyph from Hilina Pali, Hawai'i Island.

The popular string game of "cat's cradle" is played throughout the Pacific. Some examples of sea turtle figures are displayed.

Honu tane (male turtle) from Bora Bora and Maupiti, Society Islands
Honu wahine (female turtle) from Tahiti, Society Islands
"Turtle" from Yap, Caroline Islands
Honu from Maui and Kaua'i, Hawaiian Islands

Yapese children making the "turtle" string figure.
Illustration from String Figures by Caroline F. Jayne (Scribners, New York. 1906)

In many protein-deficient societies, sea turtles provide a much needed source of meat and eggs. In some areas there is a virtual taboo against killing adult turtles for meat, since they are the providers of the more highly prized eggs. In other areas, adults as well as eggs are taken.

Fishermen after a day of turtle fishing. Such expeditions are often accompanied by a great deal of ceremony. This photograph was probably taken in Fiji about 1915.

In Malaysia and Sarawak only the eggs of the turtle are harvested. The method of collecting turtle eggs shown here is still practiced in the Sarawak Turtle Islands, where their collection and sale are under government control.

At night, egg collectors mark the site of a nest with a tanda, placed so that the black markings are directly over the egg chamber.

Probes are also used to locate nests.

Hundreds of thousands of eggs are collected yearly. Most are sold locally, but some are replanted as a conservation measure.

Women selling turtle eggs in Kota Baharu, Malaysia.

OUR ENDANGERED SEA TURTLES The worldwide decline in the number of sea turtles is attributable to many factors, but the most important are over-exploitation for food and jewelry, and destruction of the nesting habitat by human activity.

Commercial turtle fishing has been made illegal in the United States and several other countries. It is to be hoped that scenes such as this are now a thing of the past.

Sea turtle products confiscated by officials of the U. S. Fish and Wildlife Service from travelers returning from abroad.

All sea turtles have now been declared as either Threatened or Endangered. This means that under Federal law it is illegal to capture or kill any sea turtle, to import sea turtles or products made from them, and to sell sea turtles or their products interstate.

Although several countries now have regulations either prohibiting or limiting the taking of sea turtles, widespread poaching continues to threaten the animals.

Carcass of a ridley turtle killed for skin and eggs, Tlacoyunque, Mexico.

SEA TURTLE FARMING The world demand for sea turtle products cannot be met by the supply of wild sea turtles. Thus farms have been established in various countries to rear sea turtles in captivity. Their initial stock is composed of wild turtles, augmented yearly by fixed quotas of wild-laid eggs - a practice called "ranching." The eventual goal is self-sufficiency, with captive stock producing all the turtles that are eventually marketed.

Opponents of sea turtle farming condemn practices that they believe only hasten the decline of the remaining wild populations. They also contend that promoting turtle products creates a demand that encourages poaching.

Cayman Turtle Farm, Grand Cayman Island, British West Indies, is the largest privately owned sea turtle farm. Their products are no longer allowed into the United States.

One of the farm's two breeding ponds can be seen in the background. The farm claims to have reached the stage of self-sufficiency and is no longer dependent on wild-laid eggs.

SEA TURTLE CONSERVATION Since the need for sea turtle conservation was recognized, many years ago, government officials and scientists worldwide have been working diligently on this problem. Three conservation programs are illustrated here.

Vital information on migration movements and breeding cycles, which can be used to protect the species, is obtained through tagging and tracing adult turtles.

Tagging a green turtle, French Frigate Shoals, Hawai'i.

Tagged Turtle

Hatchery programs, like this one in the Sarawak Turtle Islands, insure that turtle eggs and hatchlings are protected from predators.

These hatchlings will soon be loaded onto boats and released beyond the reef, thus avoiding many reef predators.

Patrols are used in many areas during the breeding season to protect the nesting females from human or other predators.

A Mexican marine guards a female Kemp's ridley on the beach at Rancho Nuevo, Mexico.

Poster campaigns also assist in the fight to save the world's sea turtles. A Mexican poster warns: "Don't kill it! The turtle is becoming extinct. Respect the prohibition." A similar "Save the Sea Turtle" poster was recently circulated in Papua, New Guinea.

We ask that you do not touch specimens in this exhibit but, if you like, you may touch these.

Green sea turtle Hawksbill

Be aware of the laws governing wildlife importation!

PLEASE TAKE ONE (Sea Turtle Sighting Report - Teachers Only, Please!)

(MAKAI RAIL CASES) TURTLE-SHELL AND BONE ARTIFACTS, HAWAIIAN ISLANDS

One-Piece Fishook, makau 'ea

Net Spacers, haha kā 'upena
Robert E. Van Dyke Collection, 1938

Scraper, kahi olonā
Geoffrey C. Davis, 1972

Scrapper, kahi olonā
A. L. C. Atkinson, 1917

Kapa Stamps The turtle shell is cut to form the diamond pattern and lashed onto a bamboo wand. It is then dipped into dye and the motif is transferred onto a piece of kapa, barkcloth. Seth Andres Collection, 1848

TURTLE-SHELL ARTIFACTS, HAWAIIAN ISLANDS

Bracelets worn by Konia and Princess Ruth.
Rings, Kalaniana'ole Collection
Chain from possessions of Princess Kekaulike
Chain from possessions of Princess Kapi'olani
Jewelry box used by Queen Emma, wife of King Kamehameha IV
Nī'au kani, Few's harp with turtle-shell vibrator

Wrist ornaments, kūpe'e - The name Kaumuali'i, ruling chief of Kaua'i in 1794, is written on the larger kūpe'e, probably indicating that it once belonged to him. The handwriting is possibly that of Queen Kapi'olani, his granddaughter. Lucy K. Peabody, Kalani and Edgar Henriques, 1932

Niho palaoa - The incomplete niho palaoa shows how the turtle-shell segments are fastened by pegs to the main shaft of the ornament. Lucy K. Peabody, Kalani and Edgar Henriques, 1932

Engraving, after Choris, of a Hawaiian woman wearing a niho palaoa suspended from a lei of human hair. This unusual miniature plate was published in World in Miniature (London, Achermann, 1824).

This collection of hymns by William Ellis and Hiram Bingham was the first "book" published in the Hawaiian language. Of the 2,000 copies printed by the Mission Press, only nine are known to have been bound with the turtle-shell cover. A contemporary note inside the cover of one of these copies states: "Bound at Oahu by Moku, a native of the Sandwich Islands." These two copies, owned by the Bishop Museum Library, are from the first printing in 1823 and the 1830 edition.

TURTLE-SHELL AND BONE ARTIFACTS (Map showing Cook Islands, Tuamotu Archipelago, Easter Is.)
Cane with Turtle-shell Rings, Hawaiian Islands, Victor Houston, 1942
Plates from a Fan, Easter Island, J. L. Young, 1921

Turtle-bone Cutters, Pukapuka, Cook Islands, Ernest Beaglehole, 1935
Fishhook, Pukapuka, Cook Islands
Trolling Hooks, Tuamotu Archipelago, J. L. Young, 1921
Ear Piercer, Fatuhiva, Marquesas Islands, R. Linton, 1921
Ear Piercer, Hivaoa, Marquesas Islands, R. Linton, 1921
Ear Ornament, Nukuhiva, Marquesas Islands, R. Linton, 1921

TURTLE-SHELL ARTIFACTS (Map showing Tokelau, Samoa, Tonga, Marquesas Islands)
"The Chief at S. ta Christina" (Marquesas Islands). This engraving, after William Hodges, was published in the atlas accompanying Captain James Cook's A Voyage Towards the South Pole. Cook wrote: "Their principal head-dress, and what appears to be their chief ornament, is a sort of broad fillet, curiously made of the fibres of the hulk of cocoanuts. In the front is fixed a mother-of-pearl shell wrought round to the size of a tea saucer. Before that, another, smaller, of very fine tortoise-shell, perforated into curious figures. Also before, and in the center of that, is another round piece of mother-of-pearl, about the size of half a crown; and before this another piece of perforated tortoise-shell the size of a shilling."

Trolling Hook, Ha'apai Group, Tonga, W. C. McKern, 1921
Trolling Hook, Atafu, Tokelau Islands, Gordon MacGregor, 1933
Finger Ring, Samoa, J. Morgan, 1899
Trolling Hook, Tutuila, Samoa, P. H. Buck and A. F. Judd, 1927

TURTLE-SHELL AND BONE ARTIFACTS (Map showing Nukuoro, Kapingamarangi, Futuna, Wallis, Takuu)
Scraper, Takuu, Samuel Elbert, 1963
Food Scoop, Takuu, Irwin Howard, 1965
Fishhooks, Takuu, Samuel Elbert, 1963
Gomb, Takuu, Samuel Elbert, 1963
Trolling Hook, Futuna
Trolling Hook, Wallis, E. G. Burrows, 1933
Trolling Hook, Kapingamarangi, R. O. Smith, 1948
Trolling Hook, Nukuoro
Trolling Hook, Takuu, Samuel Elbert, 1963

TURTLE-SHELL ARTIFACTS, CAROLINE ISLANDS (Map showing Caroline Islands)
Modern Belt, Ernestine Akers, 1956
Necklace, Yap, Micronesian Expedition, 1936
Arm Ring, Yap, Micronesian Expedition, 1936
Arm Ring, Truk
Pendant, Truk, Geoffrey C. Davis, 1952
Necklace and Pendant, Yap, H. G. Hornbostel, 1924
Ear Stretcher, J. S. Emerson, 1889
Bundle of ear ornaments made from marine shells, coconut shell, turtle shell, beads.
Women's money, Palau, Caroline Islands, E. H. Bryan, Jr., 1963

TURTLE-SHELL ARTIFACTS (Map showing Caroline Islands and Marshall Islands)
Fishhook, Yap, Caroline Islands, Micronesian Expedition, 1936
Trolling hook made from pearl shell, turtle shell, human hair, Micronesia, Ben Finney and Henry Holmes, 1959
Fan, Marshall Islands, Leonard Mason, 1964
Fan, Marshall Islands, J. S. Emerson, 1889
Fishhook, Caroline Islands, Mildred Douglas, 1971
Fishhook, Ifaluk Atoll, Caroline Islands

TURTLE-SHELL ARTIFACTS (Map showing New Hebrides, Fiji)
Fishhook, Fiji
Tattooing Instrument, Fiji, W. T. Brigham

Food Scraper, New Hebrides, R. K. Ethridge, 1914
Kava Dish, Espiritu Santo, New Hebrides, R. J. Ethridge, 1914
Initiation Disk, Espiritu Santo, New Hebrides, J. R. Ethridge, 1914
Arm Bands, New Hebrides, R. J. Ethridge, 1914

TURTLE-SHELL ARTIFACTS (Map showing Anuta, Tikopia, Rennel) (MAUKA WALL)
Nose Ring, Anuta, Templeton Crocker Expedition, 1933
Trolling Hook, Anuta, D. Yen, P. Rosendahl, and P. Kirch, 1972
Ear Ornament, Tikopia, P. Kirch, 1978
Trolling Hook, Tikopia, P. Kirch, 1978
Ear Plug, Rennell, Samuel Elbert, 1958

TURTLE-SHELL ARTIFACTS (Map showing Santa Cruz Islands)
Combs, William Davenport, 1960
Earrings, William Davenport, 1960
Earrings, Tinakula, Templeton Crocker Expedition, 1933
Nose Ring, Tinakula, Templeton Crocker Expedition, 1933
Fishhook, William Davenport, 1960
Breast Ornaments, Templeton Crocker Expedition, 1933

TURTLE-SHELL ARTIFACTS (Map showing Solomon Islands)
Breast ornament with turtle-shell frigatebird, Malaita Island, Templeton Crocker Expedition, 1933
Forehead disk, Eric Craig, 1889
Pendant, New Georgia, J. H. L. Waterhouse, 1930
A Solomon Islands boy wearing a crescent-shaped breast ornament. Illustration from Melanesians of the South-east Solomon Islands by W. B. Ivens
A Solomon Islands chief wearing disk ornament with turtle-shell centerpiece. from Melanesians and Polynesians by George Brown.
Trolling Hooks, Santa Catalina Island, Templeton Crocker Expedition, 1933
Fishhook, Sikaiana, Solomon Islands, Templeton Crocker Expedition, 1933
Trolling Hook, Sikaiana, Solomon Islands, Templeton Crocker Expedition, 1933

TURTLE-SHELL ARTIFACTS (Map showing Bismarck Archipelago and Solomon Islands)
Breast Ornament, New Ireland, Bismarck Archipelago
Forehead Disk, New Hanover, Bismarck Archipelago
Chain, New Britain, Bismarck Archipelago
Nose Ring, New Britain, Bismarck Archipelago, E. J. Ford, 1956

TURTLE-SHELL ARTIFACTS (Map showing Bismarck, New Guinea)
Armbands, New Britain, Bismarck Archipelago, E. J. Ford, 1956
Bracelet, Siassi, Bismarck Archipelago
Bracelet, Poom, New Guinea
Ear or Nose Ring, New Britain, Bismarck Archipelago
Ear or Nose Ring, New Guinea
Earrings, New Guinea
Necklace, New Guinea
Ornamental Fishhook, New Guinea
Trolling Hook, Huon Gulf, New Guinea
Fishhook, New Guinea

TURTLE-SHELL ARTIFACTS (Map showing Japan)
Turtle motifs, symbolic of longevity, are often incorporated in the traditional engagement gifts sent to the bride's family from the groom's family.

Here, a bundle of bark fiber is tied with a decorative knot in the shape of a turtle. The two fans are decorated with pictures of the legendary, long-lived Takasago couple, cranes, a turtle, and a treasure boat, all symbols of good luck and long life.

Mr. & Mrs. Tatsuo Hirose, 1978

Yuino Decorative knots in the form of a turtle and a crane symbolize long-lasting happiness. A Japanese proverb says: "Crane for a thousand years, turtle for ten thousand years."

Bachi Pick for a shamisen, a stringed instrument. The strumming edges are of turtle shell laminated onto the body of the pick, which is probably water-buffalo horn. The turtle shell presumably improves the quality of the sound.

In Japan, turtle shell is highly valued and is generally use for jewelry.

Mrs. Ichiro Nakamura, 1977

Sumo kesho mawashi Young boy's ceremonial apron for sumo (wrestling) The embroidered turtle has a dragon-like head and limbs. Its flowing tail is a common aspect of the sea-turtle motif in Japan.

Mr. & Mrs. Tomiki Tomiyama, 1978

ARTIFACTS WITH TURTLE MOTIFS (Map showing Tonga, Easter Islands)

Tongan War Club, Estelle Fuller, 1964

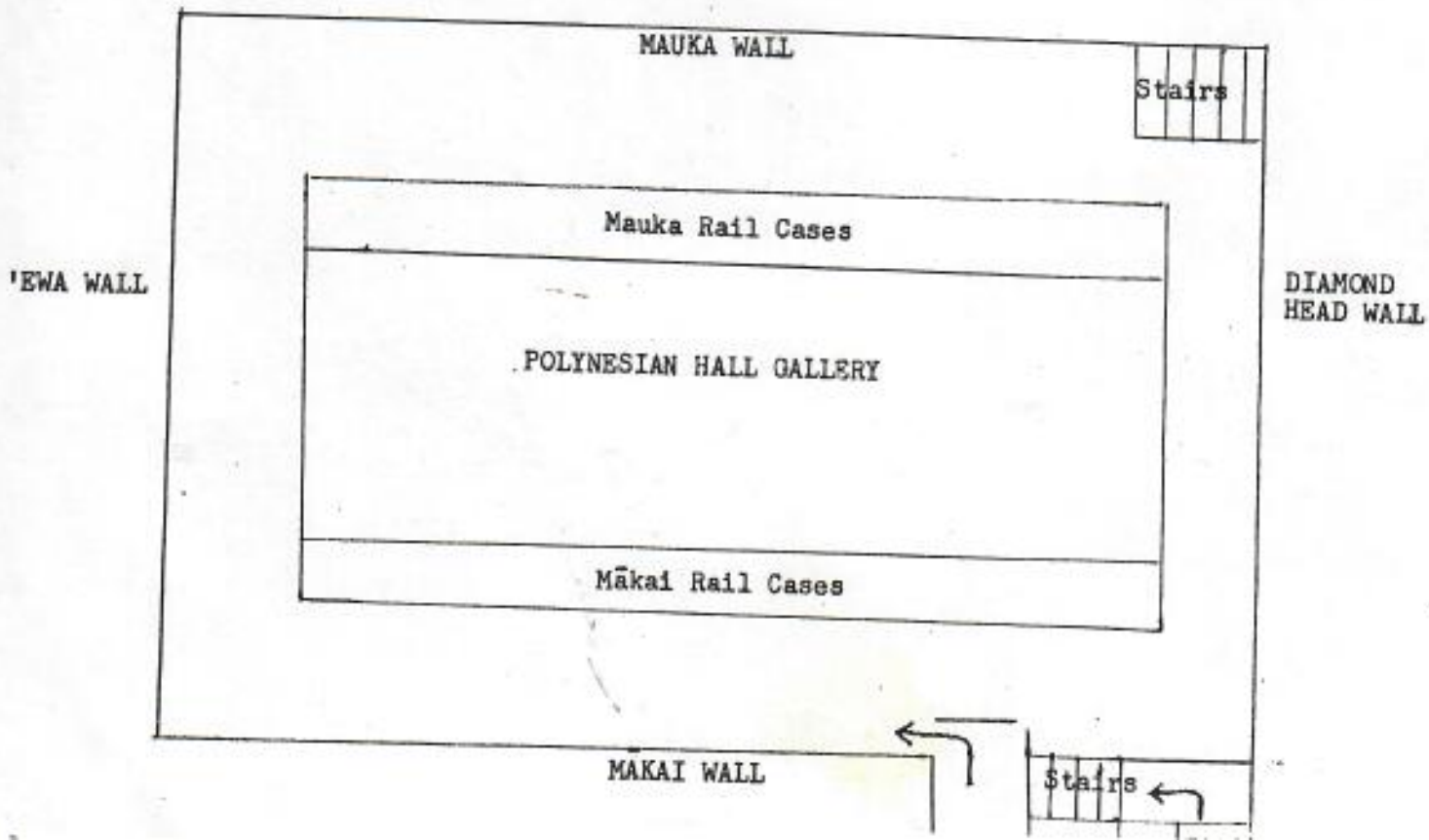
Kūpe'e, Wrist ornament carved from ivory, Kaua'i, Hawaiian Islands, C. M. Hite, 1939

Carved Turtle Head, Easter Island, J. L. Young, 1921

Crown of human bone and carved turtle shell, Marquesas Islands, S. T. Alexander, 1897

Hand kāhili with turtle-shell handle, Hawaiian Islands, Lucy K. Peabody, Kalani and Edgar Henriques, 1932

Turtle-shell bowl from possessions of King Kamehameha I, Hawaiian Islands, Hawaiian Government Collection, 1890



tinguished Service Award of the Department of Commerce (Gold Medal Award) in 1974. The Canadian government's Bedford Institute of Oceanography awarded him the Huntsman Medal for Excellence in Biological Oceanography in 1983.

On April 27, his friends scattered his ashes from the David Starr Jordan in the sea off Point Loma known as Lasker's Lake (an area where in past years Reuben would always be assured of making a good haul of biological samples). On May 3, his friends and co- workers from the Center and from the Scripps Institution of Oceanography, gathered at Sumner Auditorium to think about Reuben and to celebrate a life well lived.

EVENTS

. . . at the La Jolla Laboratory

Betsy Stevens is Winner of Staff Recognition Award

Elizabeth (Betsy) Stevens is the winner of the Staff Recognition Award at the La Jolla Laboratory for the period April through June, 1988. Betsy is a 25-year veteran in the federal fisheries service, starting as a biological aid and progressing to fishery research biologist.

With a referral from the California State Employment office, Betsy came to work for the then Bureau of Commercial Fisheries, joining a number of other fishery aids sorting plankton at the Scripps Field Annex in Pt. Loma. The next year the laboratory and staff were moved to the newly built Fishery-Oceanography Center in La Jolla establishing

Betsy Stevens

quarters on the first floor of Building C. In the ensuing years, Betsy began to work closely with Dr. Elbert Ahlstrom and senior aid Lois Hunter, learning to identify the more than 250 fish larvae routinely found in plankton tows made on CalCOFI cruises in the California Current.

Singly and with her colleagues, Betsy has authored or co-authored 10 scientific papers. Under the direction of Dr. Geoffrey Moser, Betsy, and her colleagues, Elaine Acuna, David Ambrose, and Barbara MacCall, recently completed 23 CalCOFI Data Reports dealing with fish larvae collected on cooperative CalCOFI cruises during the period 1951-1981.

In her leisure time, Betsy and her husband, Bob, a retired school teacher, travel and visit with their five children and five grandchildren (and counting), actively participate in church and charitable activities, and attend lectures and concerts.

. . . at the Honolulu Laboratory

MMES Tags Unusual Turtle

The flipper tag used by the Marine Mammals and Endangered Species Program (MMES) to identify Hawaiian green turtles is now the latest accessory item worn by Moana ("Quiet Sea"), a green turtle puppet. Moana is one of the newest members of Puppets on the Path, an environmental entertainment troupe from Volcano, Hawaii. Since 1983, the troupe has been using puppetry and song to teach people

Zoologist George Balazs tags Moana, while MMES Program Leader Bill Gilmartin assists and puppeteer Kate Schuerch looks on.

of all ages about the animals and plants of the land and sea. According to MMES Program Leader Bill Gilmartin, the troupe works hard to ensure the information presented is scientifically accurate.

Although the flipper tag probably will not compete with the mini skirt and spiked hair in the annals of Vogue, the tag now sported by Moana will help to further educate the public about this threatened species and the kinds of important information that can be gained from tags. In 1987 alone, the troupe entertained over 30,000 people; many of the shows were provided through the Hawaii Department of Education's Artists in the Schools Program. The entertainment troupe is composed of Jo Diotalevi, Dina Kageler, and Kate Schuerch.

Renovations Completed at Honolulu Laboratory

A little paint, new floor tiles and carpeting, and some of the badly needed electrical rewiring are just a few of the renovations completed in early April, according to Administrative Officer Karena Yee. The renovations, which began in November 1987, greatly improved the looks of the Lab's seminar and conference rooms, several offices, and the ladies' restroom.

Besides improving the Lab's looks, the renovations are making worklife easier. In the past, Yee could not use her computer and air conditioner at the same time--a minor nuisance that became a big problem last summer in the hot Hawaiian heat. The renovations also allowed Administration to better serve the Lab by centralizing services.

Most but not all of the work was completed successfully. Some ceilings could not be painted because they are falling down as a result of water damage from the roof, which leaked prior to its being repaired last year. More repairs are still needed so that windows no longer leak and electrical breakers no longer trip.

A few employees have suggested that an open house be held in the newly remodeled ladies' restroom, since much of the staff has not seen the restroom since, much less before, the renovations. The date of the open house has yet to be announced.

From the Director

Thrift Rate on Tax-deferred Federal Retirement Thrift Accounts up Slightly in April

The rate of return on tax-deferred federal retirement thrift accounts as of April, 1988 is 8 5/8 percent, up from 8 1/8 percent in March.

CSRS Refunds Expected in April

According to the Weeky Federal Employees News Digest of March 21, 1988, the good news is that for those who transferred into the Federal Employees Retirement System with less than 5 years of coverage under the old Civil Service Retirement System, refund checks should be sent in mid- to late April. The refund equals 5.7 percent of salary, plus interest which is the difference between the 7 percent federal retirement contribution under CSRS and the 1.3 percent employee share of the fedeal annuity portion of the FERS benefit.

Anyone who transferred to FERS in the"open season" last year with less than 5 years of CSRS coverage--the minimum for vesting in CSRS--is eligible for the refund and may still apply for it, Office of Personnel Management officials say. Interested persons should contact Ginny Hostler at La Jolla for application forms.

OPM officials said the payments have been held up by the need to reprogram the agency's computers as a consequence of a FERS technical amendments bill that passed Congress last year that made the refund slightly larger. Officials expect that checks will be issued in 3-4 weeks for those whose applications already have reached OPM.

Thrift's 'C' Fund Not Ignored

According to the Federal Employees News Digest of March 28, 1988, the October stock market crash apparently did not discourage some federal and postal employees from investing in a new retirement common stock thrift index fund that began this year. During the latest open season they dumped $420,000 into the so-called "C" fund. In contrast, the somewhat safer fixed asset "F" fund received only $281,000.

By far the greatest amount continues to be invested in the safest fund--which uses only government securities. The "G" fund's balance has grown to almost $1.3 billion. It has been active far longer than the other two funds, which began only this year, and is the only one available for individuals under the old CS retirement system.

More Day Care Centers on the Way

Indicative of the growing interest by the federal government in providing day-care centers is the recent report that the General Services Administration plans to triple the number of day-care centers available in federal buildings by the end of this budget year by opening

25 more centers nationwide. Currently, 12 child care facilities are operating in GSA-controlled buildings.

GSA has identified 42 buildings in 33 cities that would be suitable for day-care facilities and will choose the 25 sites among them. The cities include such major federal centers as Los Angeles, Seattle, and Washington, D.C.

Speedier Payments Sought For New Retirees

Rep. Vic Fazio, D-Calif., co-chairman of the Congressional Federal Government Service Task Force, and other members of the group have sponsored legislation to require the Office of Personnel Management to pay interest on civil service retirement payments made more than 90 days after OPM receives a completed application for benefits.

According to an article in the Weekly Federal Employees News Digest Fazio said, "OPM's failure to make prompt retirement payments jeopardizes the financial well-being of many newly retired federal employees. Some retirees have waited up to a year for a full retirement benefit check..." The measure would also require OPM to pay interest on the difference between a partial payment and the full amount due a retiree."

Temporary Leave Transfer Program Now in Effect For Federal Employees

The Office of Personnel Management is establishing a temporary leave transfer program that permits Federal employes to donate annual leave for the use of other Federal employes for medical or family hardship situations. The program was authorized by Public Law 100-202 and will end on September 30, 1988.

According to the Federal Register Vol. 53, no. 45, this rule sets forth procedures under which a potential leave recipient may submit an application to his or her employing agency and establishes rules for agencies to administer the program.

Although we are awaiting official word from WASC, our servicing personnel agency on the details, here are some of the features of this **interim rule**.

You may donate annual leave, but not sick leave, to help an individual facing "a medical or family emergency" causing "substantial loss of income." It is not a loan. There is no provision for possible repayment from future leave earned by the recipient. The amount you can transfer is limited to one-half of your annual leave accrual. If you are forfeiting leave, you can offer "no more than the number of hours remaining in the leave year."

Any transferred leave may be used for the same purposes as if the recipient had accrued it. However, it won't be the basis for a lump sum payment upon separation from the government.

A particularly interesting feature is that annual leave transfers "may be substituted retroactively for periods of leave without pay" or used to **liquidate** indebtedness for advanced annual or sick leave.

The new regulations direct each agency to establish procedures "as quickly as possible" to administer the program.

Further to this was an article in the Federal Employees News Digest of April 11 which stated that the Senate has joined the House in passing a measure (HR-3981) to repair a "snag in the federal leave-sharing program in effect this budget year." The bill exempts the program from a rule that would have prevented lower-paid federal workers from donating leave to higher-paid colleagues facing a family or medical emergency.

FERS Transfer May Still be Possible

The May 2 issue of the Federal Times and the April 25 issue of the Weekly Federal Employees' News Digest carries the surprise news that in effect a "second" FERS Open Season is possible.

The opportunity, however, arises not from Congressional action but from a "belated filing provision" of the original FERS law. OPM officials are interpreting the clause to permit agencies, **at their discretion** to accept late transfer requests up to 6 months into 1988, or until June 30, "in cases where employees did not have adequate access to information." The Federal Times says that to qualify as a belated filer, an employee would have to certify, perhaps in writing, that he or she would have transferred to FERS last year except for late news about what Congress did December 22, 1987. One change Congress made was to exempt employees switching from the old to the new (FERS) retirement system from the law that reduced or eliminates Social Security benefits that they may receive based on their spouse's or survivor's Social Security-covered service. This particular change may be of particular interest to federally employed women who may be able to claim spousal benefits without an offset under FERS.

We have had no official word from WASC on this and the foregoing is presented for information only. The only agency to take advantage of this little known regulation thus far is the Department of Health and Human Services.

Director's
Information Brief
for Southwest Fisheries Center Employees

No. 46 May 17, 1988

In Memoriam

Our dear friend, Reuben Lasker, has left us. We feel his loss keenly and we miss him. Only 58 when he died, Reuben loved people and travel and new experiences. Science was his religion and he devoted his entire life to a search for truth. Although gravely ill, Reuben often remarked that he nevertheless considered himself a lucky man to have had the opportunity to do good research, to work closely with many intelligent and creative people, to have traveled to many countries, and to have the affection and regard of his peers.

Reuben was known world-wide as an expert on food chain dynamics, larval fish physiology and the nutrition of marine organisms. After receiving both his bachelor's degree (cum laude) and master's degree from the University of Miami and his Ph.D. from Stanford University in biology, Reuben came to San Diego in 1956, first as a Rockefeller Foundation Post-Doctoral Research Fellow at the Scripps Institution of Oceanography (SIO) and then as a Lalor Faculty Fellow at Scripps. At the time of his death he held a post of Adjunct Professor of Marine Biology.

In 1958, Reuben was recruited by Jack Marr, then the Director of the Bureau of Commercial Fisheries laboratory in La Jolla, to begin a lifetime of pioneering work on the energy exchange between fishes and their food supply, ultimately to help answer one of the most important and fundamental questions in fisheries- -what determines how many young fish will survive the rigors of life in the sea to become

Reuben Lasker

reproducing adults. Reuben brilliantly combined the disciplines of experimental physiology and biological oceanography in sustained studies on the physiological and ecological factors determining year-class strength in pelagic fish. His concepts are now the basis of several models that successfully predict larval survival in various clupeid stocks.

Reuben's friends numbered in the thousands. His scientific papers, numbering more than 65, were widely read and cited. His paper entitled, "Feeding, growth, respiration and carbon utilization of a euphausiid crustacean", is a citation classic. He served on many doctoral committees and was a guide and friend to many graduate students at Scripps Institution of Oceanography. He served on the Ocean Studies Board of the National Academy of Sciences and as adviser and consultant to the Southern California Coastal Water Research Project, the University of Southern California Institute for Marine and Coastal Studies, The Rosenstiel School of Marine and Atmospheric Science, California Sea Grant Executive Committee, and many others.

In addition to his outstanding scientific career, Reuben brought new stature to NMFS publications when he upgraded the 80-year old scientific publication, Fishery Bulletin, to a quarterly as editor for 4 years (1970-1974). Because of his scientific reputation, Reuben was able to attract to the pages of the Fishery Bulletin outstanding contributions to fisheries science from experts all over the world, bringing the scientific content of papers published to a high level.

Reuben's qualities as a researcher earned him many honors. The U.S. government awarded him the Meritorious Service Award of the Department of the Interior (Silver Medal Award) in 1970, and the Dis-

Columbia Museum, are gathering specimens, photoslides, and data on theraphosid spiders (tarantulas) for a planned book. Although tarantulas are not herps, it is fair to say that herps, herpers, and tarantulas often share the same microhabitat.

The assistance of SSAR members, and friends, is requested. Please send us photoslides and/or data on both Old World and New World tarantulas to aid our project. Photo credits would be given if any photoslides are used, and species names would be provided if determined from the photoslide.

Please forward slides or data to: Dr. Rick C. West, Toral B.C. Museum, 4034 Glanford Avenue, Victoria, B.C., Canada V8Z 3Z6. (604) 479-1533. ●

INFORMATION REQUEST

Information is currently being collected for a North American Regional Studbook on the Chinese crocodile lizard, *Shinisaurus crocodilurus*. If you have had specimens of this taxon in your collection at any time and would like your information published in the studbook, please contact Andy Snider, Reptile Department, Audubon Park and Zoological Gardens, P.O. Box 4327, New Orleans, LA 70178, USA, or call (504) 861-2537. ●

VOUCHER SPECIMENS SOUGHT BY USFWS

The U.S. Fish and Wildlife Service's Forensic Laboratory in Ashland, Oregon, USA, is in need of assistance. Colubrid snakes from Asia, along with crocodilians, sea turtles, boas, pythons, and varanid, iguanid, and tupinambid lizards from around the world are falling prey to the fashion industry in the form of tanned leather. The mission of the Forensic Laboratory is to provide law enforcement agents with accurate and court-defensible species-level identifications of such products.

I am calling upon the general herpetological community to assist in building our reference collection containing voucher specimens of all commercially valuable taxa. If you have materials (preserved specimens, frozen carcasses, raw or tanned hides, etc.) that we might use, please contact: Stephen D. Busack, National Fish and Wildlife Forensics Laboratory, 1490 East Main Street, Ashland, OR 97520, USA. Shipping will be paid for, and a fair market value for any donations will be determined so that donations can be deducted from Federal taxes. ●

AMNH VOLUNTEERS

Approximately 20 volunteer positions are open in 1991 at the American Museum of Natural History's Southwestern Research Station in Portal, Arizona. The volunteer program is run annually and offers students in biological sciences outstanding opportunities to observe and become involved with scientists doing field research. Food and lodging are provided to volunteers in exchange for four hours per day of routine chores, with the remaining time available for research activities.

The program is open to both undergraduate and graduate students - the latter may pursue their own research projects. *Faculty knowing of promising students should alert them to this opportunity* for professional experience toward, development of, and evaluation of, their career goals.

Volunteers are needed between 15 March and November. Appointments are for part of this period, with a minimum appointment of six weeks. Applicants for spring positions (March through May) should submit forms by 15 February., summer volunteers (June-August) by 1 April, and fall volunteers (September-November) may apply any time.

For application forms, write: Resident Director, Southwestern Research Station of the American Museum of Natural History, Portal, AZ 85632, USA. (602) 558-2396. ●

Clemmys PROTECTION RESOLUTION

WHEREAS, it has become increasingly evident that the populations of eastern *Clemmys (C. guttata, C. insculpta, C. muhlenbergii)* face serious survival threats throughout most if not all of their ranges; and

WHEREAS it has become clear that collection from wild populations of *Clemmys* has substantially contributed to these threats; and

WHEREAS, the majority of these populations are protected by law, and thus many wild-caught specimens offered for sale are in fact illegal:

THEREFORE, BE IT RESOLVED, that all collection from wild populations of *Clemmys* be stopped; that purchase of *Clemmys* be limited solely to specimens with clear proof of captive-bred status; and that those who presently maintain *Clemmys* increase their efforts to reproduce them, thereby increasing the availability of captive-bred animals.

Submitted by: AAZPA Turtle and Tortoise Advisory Group Coordinators, Brett Stearns, Chairman, Dave Collins, Dennis Herman, Bern Tryon. ●

SEA TURTLE TAG CENTER OF THE PACIFIC

The Sea Turtle Tag Center of the Pacific is a cooperative program to make available tags, tag applicators, and technical assistance in the tagging of sea turtles for research purposes to government and other qualified organizations in the Pacific islands region of Polynesia, Micronesia, and Melanesia. The program

is jointly conducted by the Southwest Fisheries Center Honolulu Laboratory of the National Marine Fisheries Service, NOAA, and the University of Hawaii's Hawaii Institute of Marine Biology (HIMB). The program is designed in particular to aid those locations where small to moderate numbers of tags (i.e., 100-500) are needed, and local authorities or organizations might not otherwise order them from the manufacturer.

The Inconel tags are self-piercing, self-locking, and simple to use when applied with a special plier-like applicator to the trailing edge of a turtle's front flippers. All tags are imprinted consecutively with a letter-number combination to permanently identify individual turtles. The following inscription appears on each tag:

Write HIMB
University
Hawaii 96744

Persons who report the resighting of a tagged turtle to this address are sent a T-shirt bearing a sea turtle logo. The resighting information that is received is relayed to the tagging organization.

For more information about the availability of tags from the Sea Turtle Tag Center of the Pacific, write to: G.H. Balazs, Southwest Fisheries Center Honolulu Laboratory, National Marine Fisheries Service, 2570 Dole Street, Honolulu, HI 96822-2396. (FAX 808-942-2062) ●

AMPHIBIAN LARVAL BIOLOGY

A course on amphibian larval biology is being offered at the Highlands Biological Station, Highlands, North Carolina, 3-14 June 1991. It will be taught by Dr. Richard Wassersug of Dalhousie University with the assistance of several guest instructors. Credit for the course is available through either Western Carolina University or the University of North Carolina at Chapel Hill. For forther information and application forms, contact: Highlands Biological Station, PO Box 580, Highlands, NC 28741, USA. (704) 526-2692.●

THE ROGER CONANT RESEARCH FELLOWSHIP

The Roger Conant Research Fellowship was established in 1990 to honor the scientific contributions of Roger Conant, the Toledo Zoological Society's first Curator and Research Scientist. It is designed as a vehicle to promote career development in zoo research and management in outstanding undergraduate and graduate students.

Tenure of Fellowship: A flexible two-month period falling between 1 May and 31 August each year.

Stipend: $1,500 for the period of the fellowship. Lodging adjacent to Zoo grounds will be provided by the Society.

Eligibility: Junior, senior, or graduate students from an accredited four-year university majoring in animal husbandry, biology, wildlife management, veterinary science, zoology, or allied field.

Types of Projects: Emphasis will be on student participation in projects developed by Toledo Zoo staff and carried out in the animal departments of the Department of Conservation and Research. Exceptions for student generated research will be made for applicants with demonstrated research potential. All research will be directed or supervised by a Departmental Curator, Research Scientist, or Staff Veterinarian.

Mode of Selection: Selection of Conant Fellows will be made on the basis of merit. Grades, letters of recommendation, and relevant experience will all be considered in making the final selection.

Application: Application materials may be obtained from: Dr. Peter J. Tolson, Conservation Biologist/Research Coordinator, Toledo Zoological Society, P.O. Box 4010, Toledo, OH 43609, USA.

The closing date for applications is 1 April of each year. Awards will be made by 1 May. Two letters of recommendation from persons familiar with the collegiate performance or research potential of the applicant, including a letter from the student's most recent advisor or major professor, are required. A copy of the student's most recent college transcript is also required. No application will be processed until all supplementary materials are received. ●

AAZPA CHELONIAN ADVISORY GROUP FORMED

The Wildlife Conservation and Management Committee of the American Association of Zoological Parks and Aquariums (AAZPA) has approved the formation of a Chelonian Advisory Committee.

The group, initially convened as a Special Interest Group, commenced its activities at a Herpetology Species Survival Plan meeting held in Gainesville, Florida in April 1990.

At that meeting, 21 people, representing many zoos throughout the country, agreed to serve as the group's initial members. Of these, Dave Collins (Burnet Park Zoo, Syracuse, NY), Dennis Herman (Zoo Atlanta, Atlanta, GA), Brett Stearns (Institute for Herpetological Research, Stanford, CA), and Bern Tryon (Knoxville Zoo, Knoxville, TN) were selected as Group Coordinators.

The group's purposes include coordinating with and supporting other on-going chelonian conservation projects, such as the IUCN's Tortoise and Freshwater Turtle Action Plan. One of the group's first projects will be to enlist the cooperation of American zoos in streamlining their chelonian collections by pairing up breedable animals and in making more space available for chelonians most in need of captive management and breeding programs.

The coordinators encourage input from the private sector, as well as from academic and field researchers who are actively involved in conservation and management programs for chelonians.

Bern W. Tryon
Department of Herpetology
Knoxville Zoological Gardens
P.O. Box 6040
Knoxville, TN 37914, USA ●

MEETINGS

SECOND WORLD CONGRESS OF HERPETOLOGY

The Second World Congress of Herpetology will be held at the University of Adelaide, Adelaide, South Australia, 29 December 1993 - 5 January 1994. This international congress is the second of a series that started in 1989 in Canterbury. This meeting will enable all persons interested in herpetology to meet and exchange information to promote the advance of

New Service Ordered Projects

The Research Corporation
UH Annual Report 1979

The day to day working relationships between the University of Hawaii and the Research Corporation have been formalized by an internal agreement. Among the areas covered by this agreement are the guidelines under which a project may be assigned to the Research Corporation for management services and the form used to transfer this responsibility, the "Service Order." The following projects were assigned to the Research Corporation by the University of Hawaii by Service Order during the year.

Listed alphabetically by principal investigator.

DR. W. MANSFIELD ADAMS
Hawaii Institute of Geophysics
Prediction of Conditional Expected Tsunami Inundation of Hawaiian Shorelines
National Science Foundation
$30,945

This project involves the development and usage of a numerical model for tsunami inundation. Application of the computer program will be made to selected coastal areas of the State of Hawaii.

DR. GEORGE H. BALAZ
Hawaii Institute of Marine Biology
Northwestern Hawaiian Islands Fisheries Investigations
Survey and Assessment of the Green Turtle Resources of the Northwestern Hawaiian Islands
NOAA/Sea Grant
$15,460

DR. JAMES BEARDEN
Cancer Center of Hawaii
RDNA-Binding Proteins and Control of RDNA in Tumors
National Cancer Institute
$50,324

The ultimate goal of this research is a better understanding of the mechanisms which control the transcription of specific genes in eukaryotic cells. Of particular interest are the ways in which gene-control processes might be related to the growth and differentiation of cancer cells, and possible ways of exploiting such differences in controlling their growth. The more immediate goals of the research described here are (a) to determine whether proteins can be isolated which bind specifically to ribosomal DNA (RDNA), the genes coding for high-molecular-weight ribosomal RNA; (b) if so to determine their effects on *in vitro* transcription of rRNA, and their possible functional roles *in vivo*; and (c) to use the knowledge gained in these studies to attack the more difficult problems of transcriptional control in structural (single-copy) genes.

MR. FRISBEE CAMPBELL
Hawaii Institute of Geophysics
Digitized Bathymetric Data
Defense Mapping Agency
$15,235

Since the early 1970's the Geophysical Data Processing Laboratory at the Hawaii Institute of Geophysics has had the responsibility of serving as the depository for all data collected on HIG's marine geology and geophysics cruises. The Data Reduction Lab is also responsible for processing this data to get it into a user accessible form so it can be made available to scientists at HIG and to other interested parties including the National Geophysical and Solar-Terrestrial Data Center.

DR. JOHN CRAVEN
Marine Advisory Program
Law of the Sea Institute
NOAA/Sea Grant
$26,838

The primary focus of the Institute will be on the international aspects of law, utilization, and management of the ocean. Emphasis shall be given to the legal, social, political, and economic consequences of the evolving uses of the sea. Accordingly, the Institute will maintain a global perspective and multi-disciplinary identification and seek contributions from all regions of the world and from all relevant social and marine sciences and technology.

DR. JACK DAVIDSON
Marine Advisory Program
Office of the Sea Grant Program
NOAA/Sea Grant
$229,870

The Marine Advisory Program at the University of Hawaii serves as the principal vehicle through which existing marine information and expertise can be brought to bear on the problems and interests of the citizens of Hawaii and other areas of the Pacific. The program also aids in the feedback of field problems and it has taken an active role in pinpointing vital new areas which deserve the attention of the marine community.

MR. TOM DINELL
DR. KEM LOWRY
Pacific Urban Studies & Planning Program
Developing Science and Technology Policy Research for the Hawaii State Legislature
Office of the Auditor
$25,000

This project is designed to: (1) develop basic data and analysis on legislative consideration of policy problems and issues having high scientific engineering, and technological (SET) content; (2) identify and analyze legislative requirements for tapping SET resources; (3) inventory SET resources in the State that are available to the Legislature and identify some of the opportunities and constraints relating to the use of such resources; and (4) assist in the development, testing and evaluation of alternative systems for tapping SET resources and the identification and documentation of the system found to be most useful to the Legislature.

MR. TOM DINELL
Pacific Urban Studies & Planning Program
Hawaii Coastal Zone Management Program
Department of Planning & Economic Development
$175,000

Continuation of project from last year. The project will update, expand, and redesign the permit register to include information on Federal, State, and County permits and approvals required for land and water development in the coastal zone.

MR. TOM DINELL
Pacific Urban Studies & Planning Program
Hawaii Community Development Authority Data Base Management System
Hawaii Community Development Authority
$7,500

The purpose of this project is to design and implement a data base management system to support the redevelopment of Kakaako.

DR. MAXWELL DOTY
Botany Department
The Implementation of Gracilaria Farming in Hawaii
Department of Planning & Economic Development
$16,364

The project's scope of services will consist of investigating potential production sites and monitoring their environmental properties; selecting the most suitable sites for field trials and obtaining the necessary clearances for their use; sampling and monitoring the Gracilaria, or ogo, to determine its various properties; and initiating production through site-adapted and technology-transferred methods.

DR. MAXWELL DOTY
Botany Department
Eucheuma Farming in Ponape
National Oceanic & Atmospheric Admin.
$23,000

Transfer of funds from the Program Management account to Dr. Doty's project to initiate eucheuma farming in Ponape.

DR. GORDON DUGAN
DR. PATRICK TAKAHASHI
Civil Engineering
Demonstration Sewerage Recycling Project
State of Hawaii, Capital Improvement Program
$39,675

The plans for this project are to construct a field demonstration plant for the continuous recycling of chicken livestock wastes through a steady-state algal and fish culture system. That is, chicken wastes will be converted to fishmeal as a part of a waste treatment system with the subsequent refeeding of the fishmeal so produced to the chicken. HIMB has chosen to utilize livestock wastes, and more specifically chicken wastes.

DR. SIDNEY GAINES
School of Medicine
In-Vitro Cultivation of Mycobacterium Leprae in Artificial Media
Lani Booth Estate
$20,171

Continuation of research project to verify the In-Vitro Cultivation of Mycobacterium leprae.

DR. JOSEPH GETTRUST
Hawaii Institute of Geophysics
Participation in the Rose Experiment: Land Stations in Mexico
National Science Foundation
$110,000

The following entails extensive field work (seismology) in Mexico in conjunction with the Rivera Ocean Seismic Experiment (ROSE) funded by the Office of Naval Research. The land seismic measurement program will record ROSE shots generated by the R/V "Kana Keoki" in continental Mexico.

DR. RICHARD W. GRIGG
Hawaii Institute of Marine Biology
Northwestern Hawaiian Islands Fisheries Investigations
Reef and Precious Coral Resources: Comparative Ecology With the Hawaiian Archipelago
NOAA/Sea Grant
$29,090

Basic research goals are (1) to describe the community structure of reef ecosystems throughout the Archipelago across a gradient of increasing latitude and decreasing temperature; (2) to determine if differences in coral reef community organization exist throughout the Archipelago; (3) to determine if differences in growth rate of *P. lobata* exist within the Archipelago; (4) to relate differences (if any) in growth rate of *P. lobata* to temperature and from this relationship extrapolate threshold temperature for reef building and therefore atoll formation; (5) to produce a short-term record (100 years) of temperature at selected islands by analyzing the Sr/Ca ratio within large colonies of *P. lobata*.

DR. DANIEL K. HARTLINE
Pacific Biomedical Research Center
Quantitative Simulation of Simple Neuronal Nets
Public Health Service
$48,293

The primary goal of this research is an intensive quantitative study of a small (30-celled) integrative system, the stomatogastric ganglion of the spiny lobster.

DR. CHARLES HELSLEY
Hawaii Institute of Geophysics
OTEC - Ocean Thermal Energy Conversion
Global Marine Development, Inc.
$115,000

The Hawaii Institute of Geophysics is to provide the vessel "Kana Keoki" and supporting scientific staff for studies of the ocean bottom conditions at selected sites near the Island of Hawaii. These studies shall provide information relative to the suitability of these sites for anchoring the OTEC-1 research vessel.

DR. LOUIS HERMAN
Psychology Department
Dolphin Sensory and Learning-Memory Function: Information Processing Approaches
National Science Foundation
$40,000

Investigation of dolphin cognitive capability employing a simple acoustic language as the tool for exploring these capabilities.

DR. RICHARD HEY
Hawaii Institute of Geophysics
Galapagos Rift System: Test of Propagating Rift Model
National Science Foundation
$180,000

This investigation will involve a detailed geophysical survey to collect magnetic anomaly and bathymetric data relating to the spatial and temporal pattern of spreading center jumps and evolution of the propagating rift. In particular, this experiment is designed to determine how this rift began to propagate.

DR. M. WARD HINDS
Cancer Center of Hawaii
An Investigation of Histological Types of Lung Cancer Among Women in Three Ethnic Groups in Hawaii
Leahi Foundation
$7,000

The purpose of this study would be to standardize histologic typing of lung cancer retrospectively for cases diagnosed among women of three ethnic groups (Hawaiian, Chinese and Japanese), to determine if the incidence rate of various histological types differ among those ethnic groups and to determine which histological types are and are not associated with cigarette smoking.

Pac. Is. Resources/Directory UH

hazards; develop new and improved agricultural products and processes; and improve efficiency in marketing. Research findings in most cases have a direct relation to tropical and semitropical agriculture in the South Pacific. Studies on irrigation efficiency and the use of tropical-soil classification for the prediction of crop performance are currently being done on Pacific Islands other than Hawaii.

Hawaii Institue of Marine Biology (HIMB)

Post Office Box 1346
Kaneohe, Hawaii 96744

Director: John Bardach
(808) 247–6631

Research at the HIMB falls into three broad categories: aqua-culture and fisheries, environmental assessment, and organismic biology and behavior. Illustrative of the activities at HIMB are Sea Grant sponsored projects involving the culture of *moi*, an important food and sport fish, and the development of top minnows as a baitfish for the skipjack tuna industry; an Environmental Protection Agency grant to study the effects of sewage relaxation on Kaneohe Bay, Oahu; and a project sponsored by the State Marine Affairs Coordinator to assess the status of the green sea turtle population in the Hawaiian Archipelago.

Lyon Arboretum

3860 Manoa Road
Honolulu, Hawaii 96822

Director: Yoneo Sagawa
(808) 988–3177

Because of its location within an Oahu rain forest, the Harold L. Lyon Arboretum has an environment suitable for most tropical and subtropical plants. Extensive collections of ficus, palms, native and

Dr. Tom Davis during visit to University of Hawaii campus.

Misael Setile from Truk, TTPI, works on Trukese reading materials in Bilingual Education Project.

endemic plants of Hawaii, taro clones and other economic plants, Hawaiian ethnobotanical plants, and plants representing various Pacific countries are available for study. Personnel are currently actively collecting in Fiji, Guam, Samoa, Tahiti, Marianas, Caroline Islands, and Palau.

Pacific Biomedical Research Center

Sensory Science Building 217
Honolulu, Hawaii 96822

Director: Frederick Greenwood
(808) 948–7401

The Center was established to meet the need for interdisciplinary biomedical research in Hawaii. Its Laboratory for Experimental Marine Biology devotes its attention to problems for which marine organisms provide ideal experimental material and model systems. Research has been undertaken into the chemotherapeutic value of natural Pacific products and of environmental pollution due to pesticide residues.

The Reproductive Biology Program of the Pacific Biomedical Research Center is jointly studying a specific hormone of the reproductive system, relaxin, with the Howard Florey Institute, University of Melbourne, Australia.

Other programs within the Center which include a Pacific focus include the following:

PACIFIC INTERESTED UNIVERSITY FACULTY

Some members of the University of Hawaii's faculty focus their academic concerns solely on Pacific Islands subjects; many more have broader areas of interest, only partially Pacific-related. Almost 200 of the faculty of the University of Hawaii at Manoa have indicated that they share a community of interest in the Pacific Islands, whether or not it be of an exclusive nature, and have expressed the desire to cooperate in University efforts directed toward furthering Pacific Islands teachings, research, and service.

The following is a list of who they are and their general areas of specialty. The faculty member's particular academic area of expertise is indicated by one asterisk (*); two asterisks (**) indicate the geographical areas in which the person has had field experience and publications. (It should be understood that publications unrelated to the Pacific are not noted and, similarly, no reference is made to field work conducted outside of the Pacific Basin.)

Following the alphabetical listing is a listing of faculty grouped according to academic discipline.

ADAMS, William M. Professor, Geophysics. Ph.D. 1957 (St. Louis).
*Seismology.
**Wake Island, Midway, Hawaii.

BALAZS, George H. Junior Marine Biologist, Hawaii Institute of Marine Biology. M.S. 1969 (Hawaii).
*Nutrition, population biology of green sea turtles.
**Hawaii.

BALDWIN, Wayne J. Assistant Marine Biologist, Hawaii Institute of Marine Biology, B.S. 1952 (Humboldt State College).
*Fisheries biology, Icthyology.
**Hawaii, American Samoa.

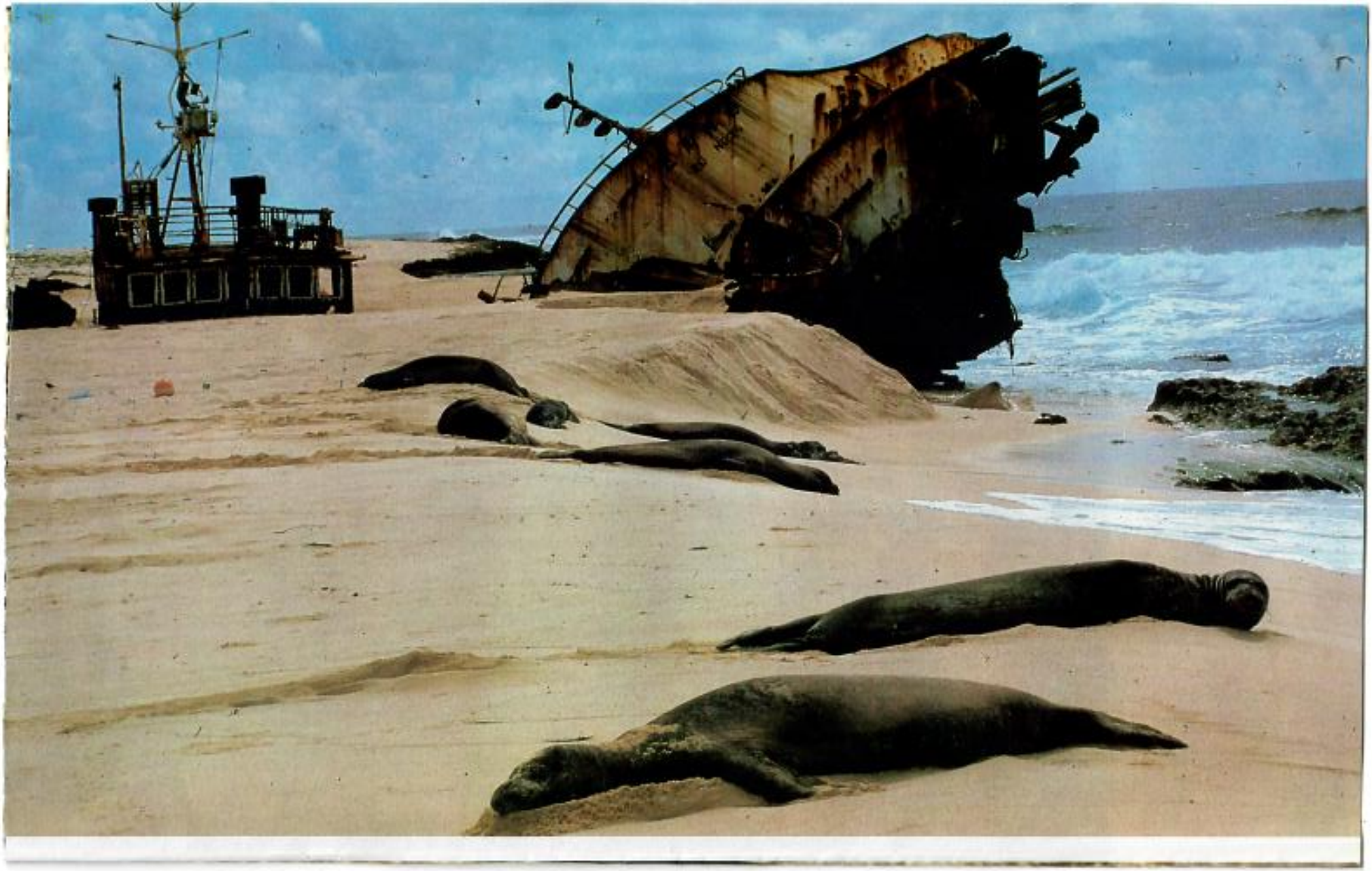
BALL, Harry V. Professor, Sociology. Ph.D. 1956 (Minnesota).
*Sociology.
**Hawaii.

BANNER, Albert H. Professor, Zoology. Ph.D. 1943 (Washington).
*Biology of Indo-Pacific coral, reefs, ecology of snapping shrimps, tropical marine toxins, pollution and ecological balance between coral and algae.
**Phoenix Islands, Line Islands, Gilbert Islands, Marshall Islands, Fiji, Samoa, Tonga, Cook Islands.

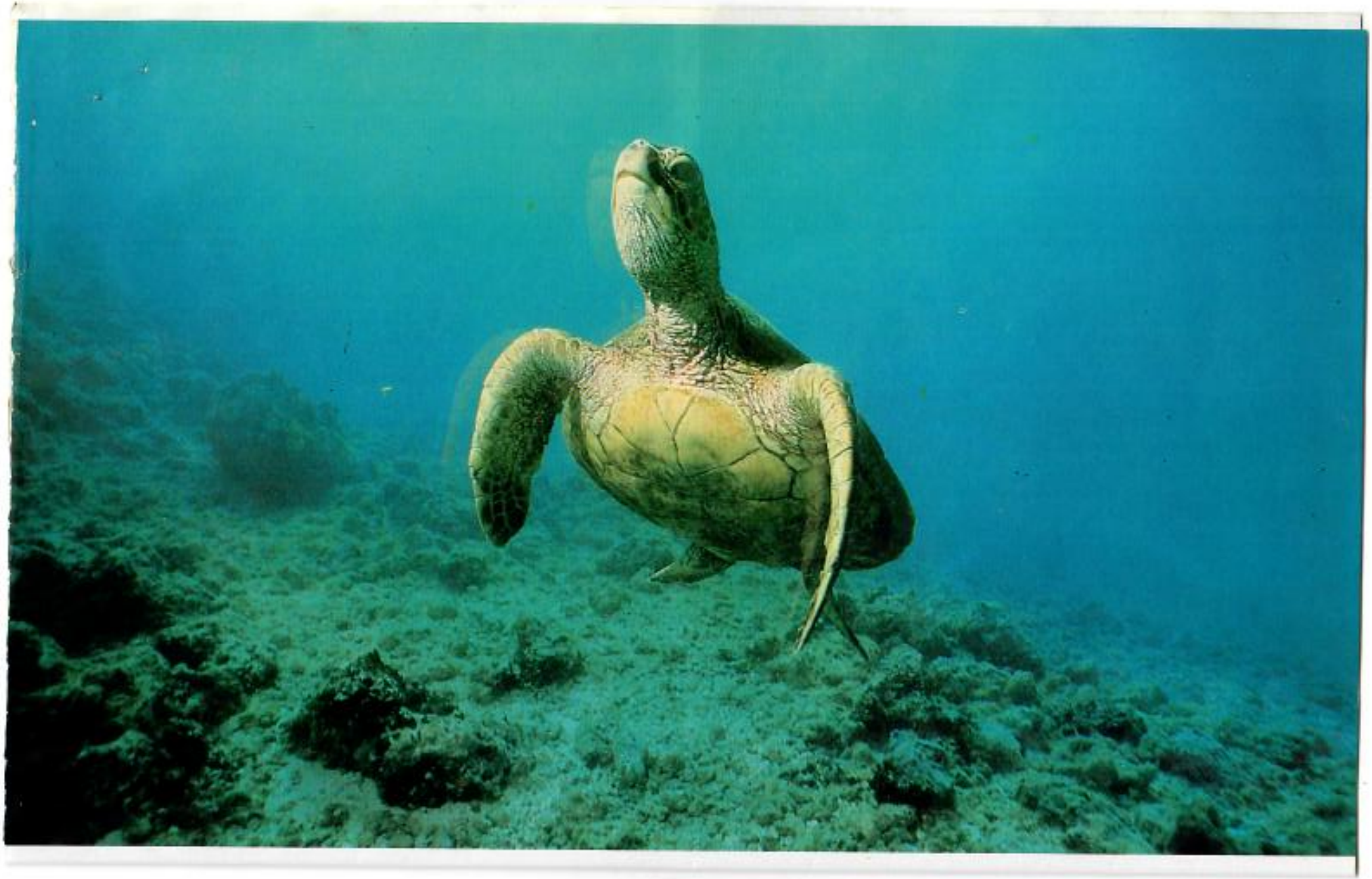
BANNER, Dora M. Assistant Marine Biologist, Hawaii Institute of Marine Biology. B.S. 1949 (Washington).
*Alpheid shrimp.
**Indo-Pacific.

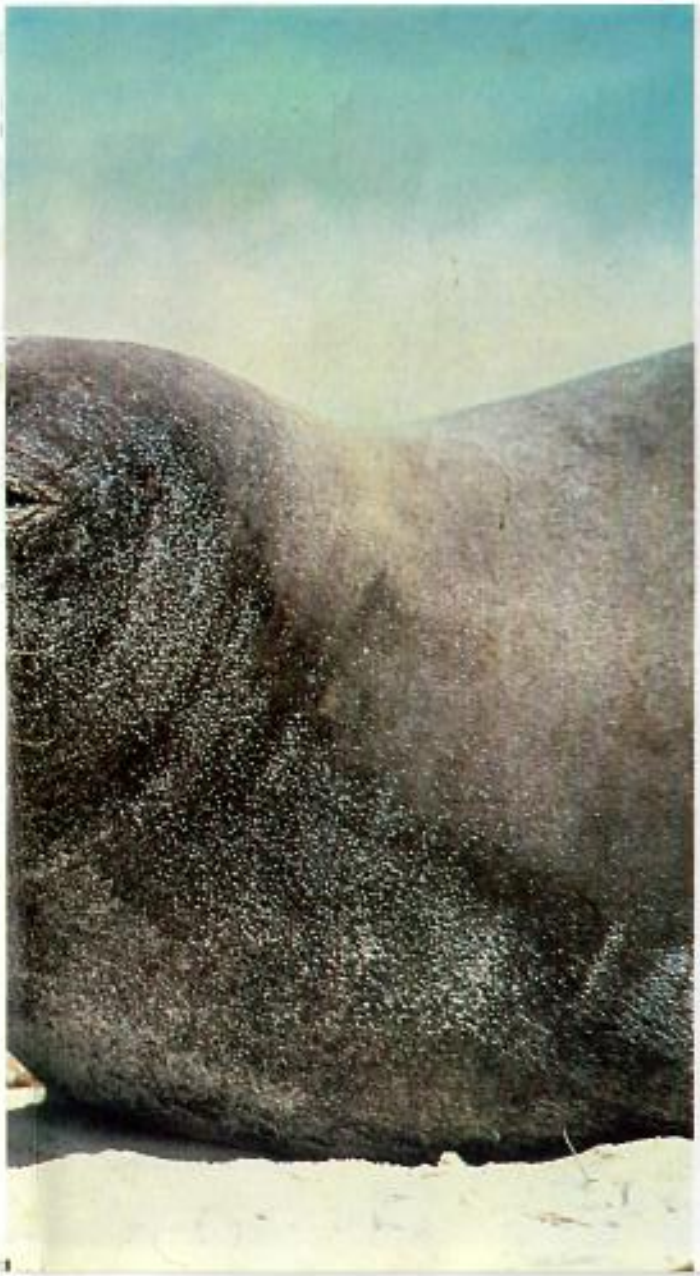
BARDACH, John E. Director, Hawaii Institute of Marine Biology and Professor of Zoology. Ph.D. 1949 (Wisconsin).

Uno stormo di rondini marine grige accompagna un DC 3 nel suo decollo dall'isola di Tern. È questo l'aereo che regolarmente raggiunge i 20 guardiacoste dell'isola rifornendoli dei generi necessari. Gli uccelli sembrano ormai aver acquistato familiarità con questo enorme, strano e rumoroso uccello di ferro. Le rondini marine grige sono numerosissime. Raggiungono infatti la strabiliante cifra di 6 milioni di esemplari. La fotografia, ne rende in parte l'idea.

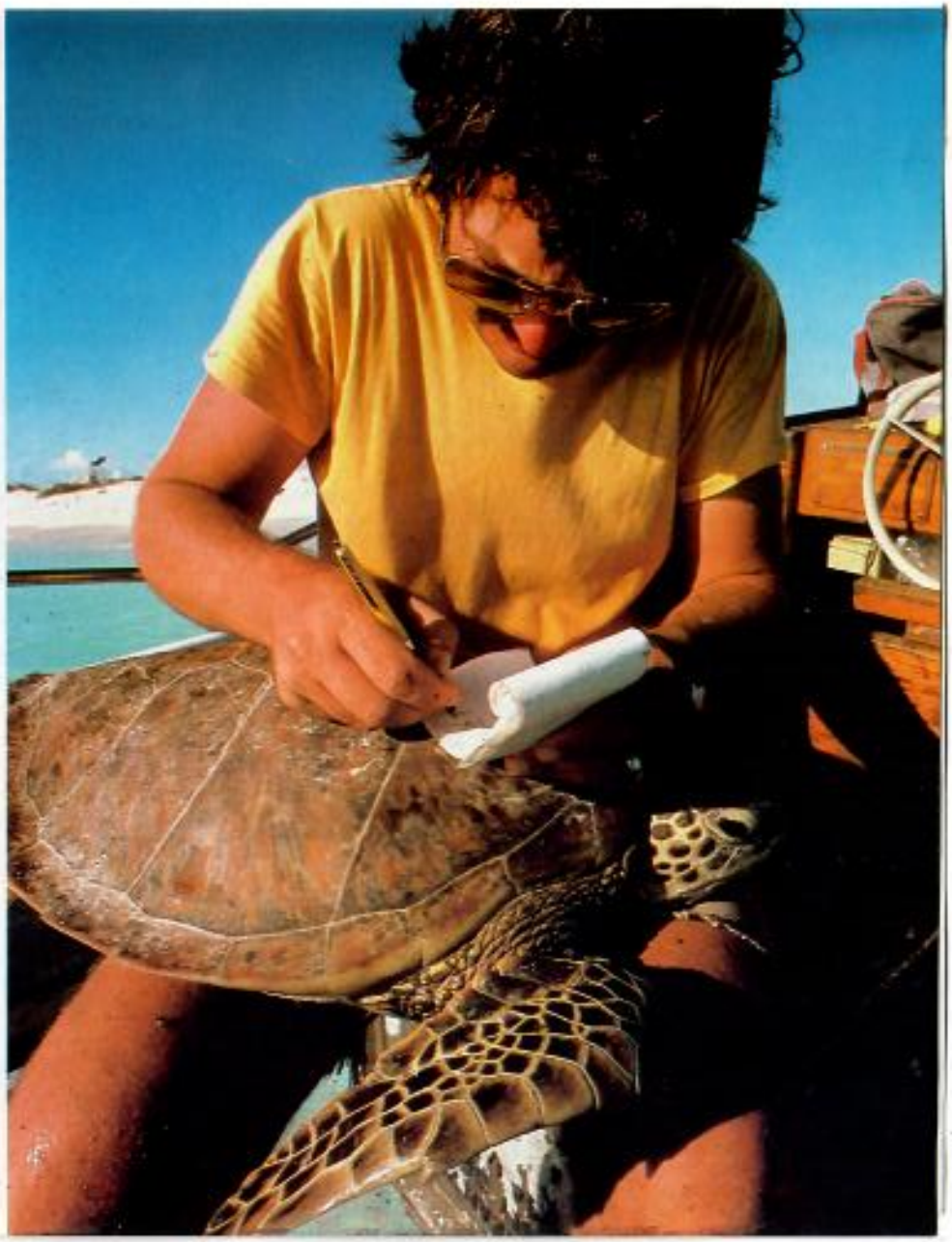


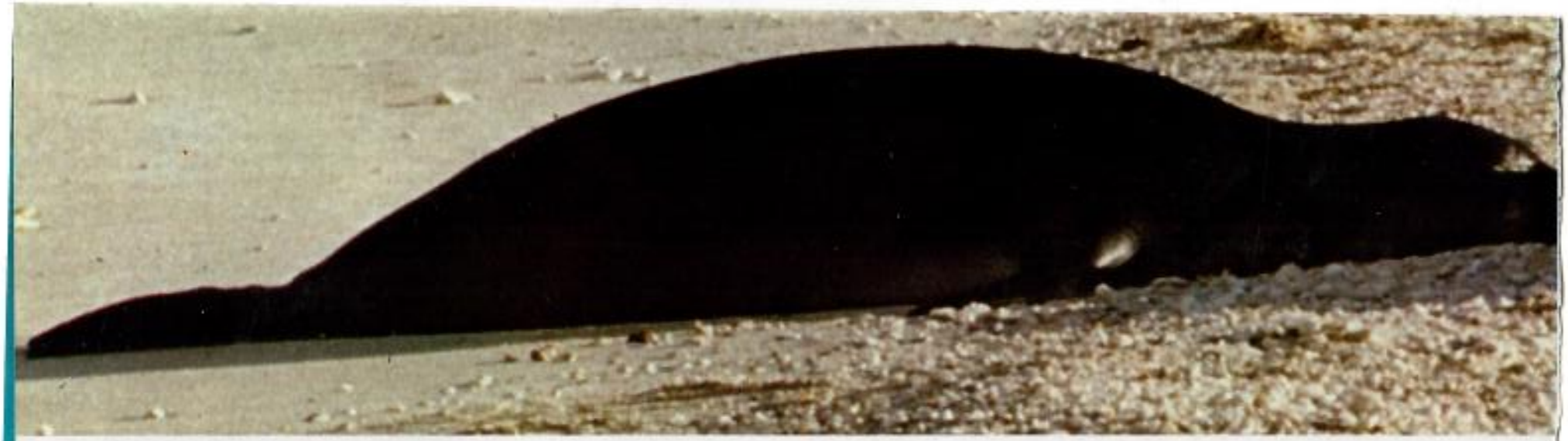
A sinistra, veduta dall'alto delle Secche della Fregata Francese popolate da foche monache. Sempre a sinistra foche monache assieme ai loro piccoli. Questa specie divenuta ormai rarissima, gode oggi della protezione del Fish and Wildlife Service Usa e le Secche della Fregata Francese sono oggi il luogo dove i piccoli di foca monaca sono più numerosi.
Nella pagina di destra, sopra, alcune foche si riposano accanto ad un relitto di nave da pesca giapponese arenatosi sulla costa dell'Isola Laysan nel 1969.
Nella foto a fianco, una foca monaca mentre nuota tra le barriere dell'isola di Laysan.





A sinistra in alto: i gamberetti all'isola di Tern.
Sempre a sinistra in basso, le Secche della Fregata Francese così chiamate da quando una fregata francese vi si arenò. Isola di Skate.
Nella pagina di destra, in alto: una tartaruga verde mentre nuota in queste Secche.
In basso, George Balzas, dell'Istituto di Biologia marina delle Hawaii, mentre «marchia» una tartaruga dell'isola di Skate.
Questo tipo di controllo permetterà agli studiosi di scoprire in che misura queste tartarughe si moltiplicano.
A lato: mamma foca monaca gioca con il suo piccolo.





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di isole in un Parco Federale. Un anno dopo, vennero arrestati e condannati 23 cacciatori giapponesi che, nonostante il divieto, riempirono i loro carnieri di circa 200 mila uccelli. Fu questo, fortunatamente, l'ultimo espisodio di violenza verificatosi in questi luoghi. Da allora, nessuno ha più potuto accedere alle isole senza l'autorizzazione preventiva dell'U.S. Fish and Wildlife Service. E oggi, finalmente le Leedwards sono tornate ad essere la residenza fissa di milioni di uccelli marini: sule, procellarie, berte, rondini marine, uccelli fregata, albatros ed altri ancora. È qui che vivono, che nidificano e che assicurano all'uomo il patrimonio del loro tramandarsi.

Persino le ormai rarissime foche monache hanno trovato qui il rifugio ideale per vivere e moltiplicarsi serenamente. Ed è ancora qui che le tartarughe verdi vengono a deporre fiduciose le loro uova.

Non sempre, però, il variopinto e cinguettante ripopolamento è avvenuto in questi luoghi spontaneamente. Per alcune specie si è reso necessario anche l'intervento dell'uomo. È il caso, ad esempio, degli albatros dell'isola di Laysan. Nel 1906 gli albatros erano talmente numerosi che nacque addirittura un inusuale commercio delle loro uova. Abitanti del luogo riuscivano a raccoglierne migliaia e le vendevano poi a società che ne utilizzavano l'albume per la fabbricazione delle pellicole fotografiche. Poi un giorno, uno di questi «imprenditori» decise di regalare alla propria figlia dei coniglietti. Immediatamente questi ultimi, tenendo fede alla caratteristica che li contraddistingue, diventarono numerosissimi e finirono con il distruggere l'habitat naturale degli uccelli. Il risultato di questa distruzione portò alla scomparsa degli albatros e persino all'estinzione di due specie di uccelli tipici di Laysan: il «millebird» e il rallo. Nel 1923, una spedizione diretta dall'ornitologo Alexander Wetmore ricostituì l'iniziale equilibrio animale nell'isola. Sterminò i conigli e la vegetazione tornò a crescere rigogliosa. Oggi Laysam è tornata ad essere la patria prescelta di ben sei milioni di uccelli.

L'isola di Whale Skale è invece il rifugio adottato, oltre che dai millebird, anche da migliaia di cardellini. E le secche che circondano quest'isola, dette Secche della Fregata Francese da quando vi si arenò veramente una fregata francese, sono l'ambiente naturale in cui le foche monache vivono serenamente. Cacciate per anni indiscriminatamente in tutto il mondo, rischiavano anch'esse di estinguersi. Qui, circa 1.000 foche garantiscono ora il proseguimento della loro specie. Unico attentatore alla loro vita, è lo squalo che spesso sosta in agguato spingendosi quasi fino a riva, in attesa di eventuali prede. I piccoli albatros, sovente, finiscono con il rappresentare il suo spuntino giornaliero. Allevati e amorevolmente nutriti

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