

1969 NARRATIVE REPORT

HAWAIIAN ISLANDS

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Hawaiian Islands National Wildlife Refuge

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Orig to Co 10/21/70

TABLE OF CONTENTS

	<u>Page</u>
Introduction	1
Management and Enforcement	2
Division of Wildlife Services.	3
River Basin Studies.	4
Wildlife Research.	5
Rare and Endangered Species Program.	5
I. General.	7
A. Weather Conditions	8
B. Habitat Conditions	10
II. Wildlife	10
A. Migratory Birds.	10
B. Other Birds.	10
G. Fish	11
H. Reptiles	15
III. Refuge Development and Maintenance	15
A. Physical Development	15
C. Refuge Collections	15
D. Control of Vegetation.	15
IV. Resource Management.	15
V. Field Investigations or Applied Research, Wildlife Management Studies.	16
1. Populations and Movements of the Hawaiian monk seal on the Hawaiian Islands National Wildlife Refuge.	16

2.	Populations and Movements of the green sea turtle on the Hawaiian Islands National Wildlife Refuge	19
3.	Populations and life history of the Nihoa millerbird on Nihoa Island, Hawaiian Islands National Wildlife Refuge	19
4.	Populations and life history of the Nihoa finch on Nihoa Island, Hawaiian Islands National Wildlife Refuge	21
5.	Populations and life history of the Laysan finch on Laysan Island, Hawaiian Islands National Wildlife Refuge	22
6.	Population dynamics and life history of the Laysan teal on Laysan Island, Hawaiian Islands National Wildlife Refuge	22
7.	Wildlife disease and parasite investigations on the Hawaiian Islands National Wildlife Refuge	23
8.	Habitat Studies on Hawaiian Islands National Wildlife Refuge	24
VI.	Public Relations	25
	A. Recreational Uses	25
	B. Refuge Visitors	25
	C. Refuge Participation	28
	F. Safety	29
VII.	Other Items	30

List of Tables

	<u>Page</u>
Table 1 - Stilt and Coot Census Data.	5
Table 2 - Summary of Refuge Trips 1969.	7
Table 3 - Temperature and Precipitation Data, Hawaiian Islands National Wildlife Refuge.	9
Table 3A - Peak Populations of Seabirds on Hawaiian Islands National Wildlife Refuge.	12, 13
Table 4 - Seal Census Data 1969	17
Table 5 - Newly Tagged Seals 1969	17
Table 6 - Monk Seal Tag Returns Recorded During 1969. . .	18
Table 7 - Turtle Census Data 1969	20
Table 8 - Turtle Tagging Data Summary 1969.	20
Table 9 - Turtle Tag Return Data 1969	20
Table 10 - Population Estimates on Nihoa Finch and Millerbirds 1969.	21
Table 11 - Laysan Finch Population Data 1969, March 26 . .	22
Table 12 - Laysan Teal Census Data 1969.	23

HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE

This office has responsibilities and duties which go beyond those of strictly a refuge office. Since the project leader serves as the Bureau administrator and representatives in Hawaii, a broad variety of tasks were performed by the staff for the various divisions as well as general Bureau business. Work handled for the Divisions of Management and Enforcement, Wildlife Services, River Basins and Refuges. These activities are briefly discussed within this report.

MANAGEMENT AND ENFORCEMENT

Throughout the year the office constantly received calls and letters concerning importations. Typical, were questions such as, "Can the flying fox or the blue winged Indian pitta be brought into Hawaii?" Much of this work involves close coordination with the Hawaiian division of Fish and Game, importation inspectors with the State Department of Agriculture, and the Animal Health Division of the U. S. Department of Agriculture.

Under state law, all birds in Hawaii are protected including pest species such as the English sparrow. In addition, it is illegal to possess either live or mounted birds, except those acquired legally. Unfortunately, the States Attorneys look at the question of protecting birds as either something too politically delicate, or simply too insignificant. As a result, we in the Bureau have had to bail out state law enforcement authorities in several cases this year by confiscating birds being held in illegal possession. For example, a state warden confiscated a collection of illegally possessed birds from a taxidermist in Honolulu. Some of the birds were protected by Federal law while all were protected by State law. The States Attorney refused to handle the case because he did not believe in such laws, and state law enforcement officials were directed to return the birds. Bureau personnel accompanied the state personnel and after the birds were returned, those protected by Federal law were confiscated. This was not the only occasion where Bureau personnel had to "save the face" of state law enforcement authorities. Fortunately, we have an excellent working relationship.

During the year, several requests were received for taxidermist permits. In addition several applications were received for permits to possess and display Nene. This office makes recommendations to the regional office as to whether or not such permits should be issued.

Several species of sea birds protected by Federal Law nest by the thousands on small islands off Oahu. From October through November young take to the air for the first time. Catching ocean breezes, some successfully adapt to their air environment while others make it to the main island and are attracted by lights. Many of these first flights occur after dark. The young sometimes are quite aggressive, and capable of inflicting a severe wound. When a person finds one of these birds and attempts to pick it up, they are bitten. They then call a wildlife official and we receive most of these calls. Approximately 40 such calls were received during the period when these first flights occurred. A news release was prepared which

directed people to toss the birds into the air at a windy location near the beach. This helped but we still spent a great deal of time picking up birds.

Periodically, reports were received of people shooting migrant waterfowl, the endangered Hawaiian stilt and other shorebirds. Although the state game wardens attempt to handle most of these complaints, we still have our share.

A depredation problem arose on the island of Kauai during the fall, and Olsen flew there to attempt to handle the situation. Unlike the typical depredations problem, endangered species including the Hawaiian stilt and the Hawaiian duck (Koloa) were involved. Destruction of young taro plants was the main concern. The farmers who complained were visited, and the importance of the rare and endangered forms of Hawaiian wildlife were discussed with them. We hope that through better understanding, the problem will not seem as serious to those involved.

DIVISION OF WILDLIFE SERVICES

Several times throughout the reporting period problems involving pesticide surveillance occurred. The pineapple research industry is constantly attempting to develop more effective means of insect pest control. Some of the chemicals used may have adverse effects on wildlife populations. Refuge personnel have worked together with the Hawaiian Division of Fish and Game officials on such matters and reported these activities to the regional office.

As a result of the increased air traffic stopping in Hawaii from the far east, there have been 12 new insect pests introduced into the state during the past year. Military personnel believe that heavy applications of dieldren sprayed adjacent to the runways may be the only way to control these introductions. This office together with representatives from the Department of Agriculture will make recommendations to the Air Force regarding these control measures.

A considerable amount of time has been devoted to working with the military agencies in relation to cooperative agreements and the developing of wildlife management plans for the bases. A large acreage of Hawaii is controlled by the military installations, especially on the island of Oahu. The importance of these areas to the preservation of some of the rare and

endangered species of waterbirds cannot be underestimated. Cooperative agreements have been established with the U. S. Navy covering the Kaneohe Marine Corps Air Station, Pearl Harbor and Lualualei. The Lualualei plan is complete and the Kaneohe plan is in the final stages of completion. Some work has been completed on the Pearl Harbor wildlife management plan, most of it, however, is in preliminary field investigation stages.

Cooperative agreements have been signed with the Army which has jurisdiction over the Fort Shafter and Schofield Barracks Commands. Little work has been accomplished on the wildlife management plans for these areas, except for the Pohakuola plan on the island of Hawaii which has been completed.

A cooperative agreement with the Air Force has been signed, however, little work has been accomplished on their lands. Bellows Air Force Base has important stilt and waterbird areas. Lack of time and more pressing work has prevented us from planning for this area.

RIVER BASIN STUDIES

Some work has been accomplished for this division during the year. The Kahaluu Soil Conservation Service project was reviewed. There was little opportunity for wildlife enhancement there.

More time was devoted to working with the Corps of Army Engineers in their Keapuka or Kailua - Kaneohe Flood control project. As a result of extensive property damage incurred in the Keapuka subdivision in Kaneohe, the Corps was authorized to begin planning for the construction of a flood control impoundment. Aproximately 150 acres of land would be flooded during periods of high water, however only 26 acres will be permanently inundated. The only wildlife present in the area are a few species of imported songbirds (mynah, rice bird, shama thrush, and possibly a few pheasants). In an attempt to create habitat for endangered species of wildlife in the area, we recommended that 2 or 3 small subimpoundments be constructed which might make suitable habitat for the Hawaiian duck, the gallinule and the coot. The Corps planners at the Honolulu office were enthusiastic about the possibility of creating habitat for an endangered species. The fish and wildlife enhancement parts of the project were well received at the public hearing.

Although field work relating to River Basins studies in Hawaii are handled from this office, recommendations are sent to the

regional office for approval by the Regional Director.

WILDLIFE RESEARCH

This office also has responsibilities relating to the rare and endangered species program on the main Hawaiian Islands. The refuge staff also receives cooperation from endangered wildlife research biologist, John Sincock, on eight wildlife management studies being conducted on the refuge.

Each year a coordinated state-wide stilt and coot census is conducted. This is a cooperative project involving the Bureau research personnel, members of the Hawaii Division of Fish and Game and this office. Table 1 summarized these census data.

Table 1

		<u>Oahu</u>	<u>Maui</u>	<u>Niihau</u>	<u>Kauai</u>	<u>Hawaii</u>	<u>Molokai</u>	<u>TOTAL</u>
1968	Stilt	565	611	70	92	19	0	1,287
7/24	Coot	No count made						
1969	Stilt	785	440	155	109	24	0	1,513
7/24	Coot	164	232	145	1,058	20	48	1,667

RARE AND ENDANGERED SPECIES PROGRAM

Although not a separate divisional activity, a considerable amount of time was spent working on the rare and endangered species program. The greatest problem here in Hawaii is the loss of habitat to the ever growing resort, industrial, and urban growth. Wetlands which harbor the remnant Hawaiian stilt, gallinule, koloa, and coot populations are being altered or destroyed at an accelerated rate. The problem is one of trying to preserve these areas by impressing on the public the importance of our endangered species, a most difficult job. In addition, refuge personnel have attended many meetings with developers and planners in efforts to persuade them to leave a little of their lands for wildlife. Our efforts have been largely unrewarded for it appears that the developer's dollar always wins.

The rare and endangered species program, now one of the Bureau's primary objectives, is one of our most important programs here in Hawaii. Several meetings were hosted by the refuge staff during the year. During May, an ad hoc committee was formed to prepare a list of recommendations concerning the direction of the rare and endangered program in Hawaii. It was composed of personnel from the Bureau, the Hawaii Division of Fish and Game and the Department of Zoology at the University of Hawaii. The wildlife administrator served as chairman. As a result of the recommendations submitted by this committee as well as previous Bureau and State meetings and activities in this program, a meeting involving top Bureau and State personnel was held during December to develop plans for moving ahead on the program as well as to enlist the support of influential groups and individuals. Attending were Fish and Wildlife Commissioner Meacham, Director Gottschalk, Regional Director Findlay, Refuge and Research personnel from the Bureau, Division of Fish and Game Personnel, Department of Land and Natural Resources personnel, and representatives from the Nature Conservancy, The Audubon Society, Wildlife Federation, Wildlife Institute, Outdoor Circle, and several branches of the military. As a result of these meetings more interest in the preservation of endangered species habitat has been stimulated both on the part of the higher Bureau and State officials, the public, and the military agencies.

In addition to the above mentioned meetings the refuge staff has worked with local city-council personnel with regard to the preservation and development in the Kawainui Swamp. Trips were made to Hawaii to survey the wildlife populations of Opaeula Pond and to meet with the representatives from the Bishop Estate which owns the area. We recommended that the area be purchased or preserved under a long term lease in an effort to preserve the best stilt area on the island of Hawaii.

Surveys were made of the Papaa ranch area on Kauai to determine if the area would be suitable for development for waterbird habitat. Although the area may be donated to the Natural *Nature* Conservancy who in turn may donate it to our Bureau to manage, it would be extremely costly to develop for the little waterbird habitat which might be gained.

I. GENERAL

Confusing that table list

Several expeditions were made to the Refuge during 1969 (table 2). Those to Pearl and Hermes Reef were accomplished via Navy helicopter out of Midway. The purpose of the May trip to French Frigate Shoals was to give the N. B. C. Newsteam, Huntley and Brinkley, a story on the refuge. The November trip using a helicopter operating from the USS HALSEY was made to remove military equipment previously placed on Laysan and Lisianaki Islands. Transportation for the two trips was provided by the U. S. Coast Guard Cutter BUTTONWOOD, and the University of Hawaii oceanographic vessel MAHI, was used for transportation for the May-June trip.

where is it?

A detailed trip report was prepared after the completion of each of the refuge trips (see appendix). These reports include data on populations of birds and other animals, information on wildlife management studies, preliminary marine investigations, and notes on habitat conditions on the islands. The material contained in this report is a summary of the highlights from each of the trips.

Table 2

Summary of Refuge Trips - 1969

<u>Month</u>	<u>Islands Visited</u>	<u>Transportation</u>	<u>Days involved</u>	
			<u>Kridler</u>	<u>Olsen</u>
FEB	G	Helicopter, Midway	5	5
FEB	C	FAA flight, Honolulu	5	
MAR-APR	A,B,C,E,F,G	BUTTONWOOD	18	18
MAY-JUN	A,B,C,D,E,F,G	MAHI		15
MAY-JUN	G	Helicopter, Midway	6	
AUG-SEP	C,E,G	BUTTONWOOD	37	37
NOV	E,F	Helicopter, HALSEY		5

Good except for the code

Key for table 2:

A-Nihoa, B-Necker, C-French Frigate Shoals, D-Gardner, E-Laysan, F-Lisianski, G-Pearl and Hermes Reef.

A. Weather Conditions

Since the trips to the refuge are only made infrequently, evidence of unusual weather conditions is reflected by the vegetation, the amount of water in the lagoon at Laysan, or damage noted to signs. The refuge recognition sign placed on Necker during 1968, some 45 feet above the ocean, was gone by March 1969. Although the 6 X 8 foot sign had been anchored with steel guy wires and the main 6 X 6 posts set in holes drilled into solid rock and cemented in place, the sign had been snapped off at the base. Even some of the eye rings holding the guy wires had been straightened. A giant wave of at least 50 feet must have smashed against the shore of Necker and destroyed the sign. Other evidence of severe weather was noted at Laysan where three well defined paths of vegetation, mainly *Eragrostis*, were killed in low areas between the ocean and the interior lagoon. The water was high in the lagoon, and it was concluded that the high waves during a severe winter storm washed partly over the beach and into the lagoon.

On December 1, a strong storm front centered approximately 700 miles northwest of Honolulu, caused severe damage to some of the refuge islands. Coast Guard personnel on Tern Island at French Frigate Shoals, radioed Honolulu for help. The LORAN Station there was on the verge of being destroyed by high waves and the closest facility (vessel or aircraft) which could provide help for the 17 man crew was in Honolulu. Before the radio went out the last message received indicated waves 2-3 feet high were washing across the runway and through buildings. The crew took refuge on the top of the LORAN equipment building. An aircraft was immediately dispatched to the scene and photographs were taken of the crew huddled on the roof of the building. Supplies were dropped and the crew remained there until a ship could be diverted to the area. Two days later, the crew was finally rescued by helicopter from a passing New Zealand vessel, but the island was badly damaged. Part of the island was washed away, buildings were destroyed, and approximately a foot of coral, sand, and rubble was washed up on the 3,000 foot runway. Repair crews are still working on the island repairing buildings and facilities. The Coast Guard estimated damage at approximately \$300,000. Damage to the other islands will have to be determined in future trips.

Monthly temperature extremes and total precipitation at Lihue, Kauai, French Frigate Shoals, and Midway Islands are presented in table 3. These locations represent weather stations at the ends and in the middle of the leeward chain.

Table 3

Temperature and Precipitation Data
Hawaiian Islands National Wildlife Refuge

Month	Midway			French Frigate Shoals			Lihue, Kauai		
	High	Low	Prec	High	Low	Prec	High	Low	Prec
JAN	71	56	1.81	78	59	2.14	78	50	4.97
FEB	77	56	1.34	80	61	4.20	81	62	1.94
MAR	74	57	1.90	80	58	1.48	78	58	1.75
APR	79	61	.80	88	63	.90	83	62	1.52
MAY	83	67	.53	85	63	1.11	85	64	2.80
JUN	83	67	.51	83	67	.67	89	67	.57
JUL	88	70	1.80	89	63	1.25	88	70	1.47
AUG	85	69	7.39	88	64	2.68	86	72	.83
SEP	85	69	3.11	88	60	2.29	86	69	1.49
OCT	86	65	2.37	88	63	2.74	85	63	3.15
NOV	80	63	6.00	88	62	3.90	83	64	7.45
DEC	79	60	<u>1.98</u>	89	50	<u>3.30</u>	84	60	<u>5.91</u>
Extreme	88	56		89	50		88	50	
Total prec:			29.54			26.66			33.85

B. Habitat Conditions

Habitat conditions on the rocky islands of Nihoa, Necker and Gardner Pinnacles remain relatively stable. There may have been some dramatic changes in the vegetation on the smaller sandy islands on the atolls as a result of the extreme high surf and winds associated with the December storm. The extent of these changes cannot be evaluated until trips to the refuge are made later this year.

II. WILDLIFE

A. Migratory Birds

Migrant waterfowl were observed in the lagoon at Laysan on each trip to the island. A flock of 63 pintails was recorded during September. This was the largest number of migrant waterfowl observed on the island since periodic checks began during 1964.

An emperor goose was seen on the lagoon during the March trip; 14 shoveler and 3 green-winged teal were also observed in the same area. Lone pintails were also noted on the waters off Tern and Southeast Islands during the September trip. A cackling goose, barely able to fly, and a dead pintail were observed on the west shore of Lisianski during November.

Shorebirds were found on most of the refuge islands throughout the year. During the fall and winter months, populations increased considerably as the migrants moved in. This was especially true of ruddy turnstones, golden plovers, bristle thighed curlews, wandering tattlers, and sanderlings. The greatest numbers occurred in the shallows of the lagoon at Laysan. As expected few birds of these species were noted on the rocky islands of Nihoa and Necker.

B. Other Birds

Most of the birds found on the Hawaiian Islands Refuge are seabirds. Some of the greatest nesting colonies in the world occur. Throughout the year some species or the other is nesting, but the peak occurs in the winter and spring when albatrosses, terns, petrels and boobies nest here by the thousands. At dusk many more thousands return from a day of fishing at sea and their numbers are overwhelming. The shearwaters and petrels nest in burrows where they can, and thousands of such burrows honeycomb the flat, sandy islands. Frigatebirds and boobies tend to remain around one island although some movement takes place throughout the archipelago and other Pacific Islands. Terns, shearwaters, petrels, and albatrosses are highly migratory.

Censusing such diverse populations is extremely difficult. Some species can be easily censused using the random transect method, while others must be head counted.

Each trip, efforts are made to refine census techniques which are designed to be as accurate as possible in the limited time available on the islands (table 3A). This year transects were run during March at Laysan to determine the number of albatross chicks present. Counts revealed an estimated 77,287 Laysan chicks and 13,979 black-footed chicks. Transects run at Southeast Island at Pearl and Hermes Reef showed 6,075 Laysan chicks and 1,478 black-footed chicks. In May it was possible to make an actual head count of chicks at Southeast Island. This count revealed 5,763 Laysan chicks suggesting that the transects established during March were suitable. However, the head count of black-footed chicks totaled 2,064 suggesting that the March transects for that species were biased. Most black-footed nest on the beach perimeter whereas Laysans are more evenly distributed over the islands.

When time allowed, populations, nests, and/or chicks of the larger and more obvious seabirds were head counted on some of the islands. On Necker it was possible to make a count of the entire island and obtain a reliable estimate of all species present except some of the cliff nesting terns, tropicbirds and some shearwaters. Boobies and frigatebirds were head counted on most islands. The populations of terns, shearwaters and petrels were estimated and considered Class D data. So far no attempt has been made to devise methods to estimate the numbers of petrels and shearwaters which nest in burrows. Compounding the problem is the many thousands of all species returning at dusk to spend their nights at roost. Eventually such attempts will be made but endangered wildlife studies have first priority.

The status of the finch, millerbird, and Laysan teal populations is discussed under wildlife management studies.

G. Fish

The areas surrounding the refuge islands are rich in reef life. The lagoons at French Frigate Shoals and Pearl and Hermes Reef are considered part of the refuge and as such deserve study. The reef life is intimately tied in with the nesting seabirds, seals and turtles.

Table 3A

Peak Populations of
Seabirds on Hawaiian Islands Refuge During 1969

<u>Bird</u>	<u>Nihoa</u>	<u>Necker</u>	<u>French Frigate</u>	<u>Gardner</u>	<u>Laysan</u>	<u>Lisianski</u>	<u>Pearl & Hermes</u>
Black footed Albatross		<u>A175</u> chicks			<u>A14,694</u> chicks		<u>C2,064</u> <u>A13,978</u> chicks
Laysan Albatross	<u>A7</u>	<u>A510</u> chicks			<u>A77,287</u> chicks		<u>C5,763</u> chicks <u>A6,075</u> chicks
Wedge tailed shearwater	<u>A875</u>	<u>A2,000</u> prs.	<u>B52</u>		<u>A</u> thousands		<u>A1,000</u>
Christmas Island shear- water	<u>A50</u>	<u>A1</u>	<u>B4</u>		<u>A7,500</u>		
Sooty Storm Petrel	<u>A2</u>				<u>A2</u>		<u>A250</u>
Bonin Island Petrel					<u>A</u> thousands		<u>B315</u>
Red tailed tropicbird		<u>A20</u> nests	<u>B147</u>	<u>D24</u>	<u>A500</u>		<u>C20</u> nests <u>A11</u> nests
Red footed Booby	<u>A522</u> nests	<u>A700</u> nests	<u>B57</u>		<u>A220</u> nests	<u>A107</u> nests	<u>B56</u> <u>E22</u> nests
Brown Booby	<u>A55</u> nests	<u>A20</u> nests		<u>D20</u>			<u>B99</u> <u>C41</u> nests
Blue faced Booby	<u>A94</u> nests	<u>A230</u> nests	<u>B224</u>	<u>D75</u>	<u>A32</u> nests	<u>A96</u> nests	<u>B40</u> <u>C19</u> nests
Frigatebird	<u>A1,775</u> nests	<u>A850</u> nests	<u>B150</u>		<u>A1,142</u> nests	<u>A105</u> nests	<u>A83</u> nests <u>B280</u>
Laysan teal					<u>A123</u>		
Pintail					<u>A3</u>		
Shoveller					<u>A14</u>		
Golden Plover	<u>A36</u>		<u>B30</u>		<u>A990</u>	<u>A5</u>	<u>B18</u>

<u>Bird</u>	<u>Nihoa</u>	<u>Necker</u>	<u>French Frigate</u>	<u>Gardner</u>	<u>Laysan</u>	<u>Lisanski</u>	<u>Pearl & Hermes</u>
Bristle thighed curlew			<u>B3</u>		<u>A63</u>		<u>B20</u>
Wandering tattler			<u>B1</u>	<u>D1</u>	<u>A135</u>		<u>B1</u>
Ruddy turnstone	<u>A82</u>	<u>A2</u>	<u>B143</u>		<u>A1,580</u>		<u>B260</u>
Sanderling			<u>A3</u>		<u>A1</u>		<u>B2</u>
Gray backed tern	<u>A350</u>	<u>A1,300</u>	<u>B1</u>	<u>D750</u>	<u>A2,000</u>		<u>C100</u> <u>A95 nests</u>
Sooty tern	<u>A6,800</u>	<u>A16,600</u>	<u>B300</u>	<u>D1</u>	<u>A50,000</u>		<u>C40,000</u>
Necker Island tern	<u>A85</u>	<u>A750</u>					
Noddy tern	<u>A2,000</u>	<u>A25</u>	<u>B1,845</u>	<u>D500</u>	<u>A100</u>		<u>B1,930</u>
Hawaiian tern		<u>A500</u>	<u>B667</u>		<u>A700</u> nests	<u>A30</u> nests	<u>B1,720</u>
White tern		<u>A500</u>	<u>B32</u>	<u>D300</u>	<u>A250</u>	<u>A13</u> nests	<u>B14</u>
Laysan finch	<u>A11,882</u>				<u>A11,882</u>		<u>A165</u>
Nihoa finch	<u>A2,993</u>		<u>B5</u>				
Nihoa millerbird	<u>A41</u>						
Emperor goose					<u>A1</u>		
Green winged teal					<u>A3</u>		
Sharptailed sandpiper					<u>A1</u>		
Pintails					<u>B63</u>		
Cackling goose						<u>B1</u>	

Key: A March, B September, C May, D June

This year attempts were made to collect information relating to the species present, their size, and abundance. Data was collected by Jim McVey, graduate student, University of Hawaii, Dr. John Maciolek, Cooperative Fisheries Unit Leader, University of Hawaii, and Dr. George Losey, Assistant Professor University of Hawaii, and refuge personnel. Groups of fish were recorded by family, genus, and species in some cases. Underwater transects were established off several of the smaller islands within French Frigate Shoals, and a single transect was established at Southeast Island, Pearl and Hermes Reef.

The eventual goal in assessing the fish populations within the refuge is to compile a relatively complete list of the fish found in the waters of the refuge. In some cases, fauna of the area may be rare, endemic, or even new to science. For example, during the September trip a new species of Cromis sp. was collected by refuge personnel. The new species will be described by Dr. Randall of the Bishop Museum of Honolulu.

Another reason for investigating the marine fauna associated with the refuge is that this information will add to our knowledge of the refuge ecosystem and help us better understand some of the natural factors which control populations of endangered and threatened species on the refuge islands. For example, we believe that sharks may be the most important predator on the rare Hawaiian monk seal. Although we have yet to find seal remains in the stomach of the sharks caught and examined, the bites on both seals and turtles plus the presence of many sharks in surrounding waters would suggest they take their toll. Also as a result of our marine investigations, we are beginning to note ecological differences between reefs, which may in turn reflect differences in use of them by seals and turtles.

A considerable amount of time was spent searching for the "Crown-of-Thorns" starfish (Acanthaster sp.) at Pearl and Hermes and French Frigate Shoals during the September trip. Approximately 73 hours of diving time, both SCUBA and snorkel were logged by Kridler and Olsen in the search for this starfish. Five specimens were found in Pearl and Hermes Reef while none were observed at French Frigate Shoals. The Crown-of-Thorns does not appear to be a problem here as it is in the Guam, Truk areas.

A single day was spent in search of the Pearl and Hermes pearl oyster. The once exploited population appears not to have made a comeback. A single adult was found by Dr. Maciolek and 2 small spat were found afixed to a dead shell.

H. Reptiles

The green sea turtle, a common inhabitant of some of the refuge islands, will be discussed under the wildlife management studies.

III. REFUGE DEVELOPMENT AND MAINTENANCE

A. Physical Development

Refuge recognition signs were repainted on Laysan, Lisianski, and Pearl and Hermes Reef. Trash left by the military operations was either burned or thrown into the sea on Necker, East, and Southeast Islands.

C. Refuge Collections

A hybrid Laysan-black-footed albatross was collected on Southeast Island during the February trip. Sixteen Nihoa finch and a millerbird were collected on Nihoa Island and loaned to Dr. Andrew Berger at the University of Hawaii for his experiments involving the life history of the Nihoa finch. From the original group, 12 are doing well, and one pair nested after having been isolated from the group.

D. Control of Vegetation

Mustard (Brassica sp.) continues to spread on Southeast Island. Attempts to control the pest plant were made during March. In order to effectively control the spread of this introduced weed we would have to spray the area at the optimum time, something seldom possible with the infrequency of our trips to the refuge.

A clump of Cenchrus sp. was found and destroyed on Laysan near the landing area during March. This weed is common on Tern Island. No efforts have been made to control the species there.

IV. RESOURCE MANAGEMENT

Since the refuge islands are natural areas, protection and surveillance are the only forms of management conducted other than attempts to control weeds.

V. FIELD INVESTIGATIONS OR APPLIED RESEARCH

Wildlife Management Studies: One of the primary objectives of our trips is to collect biological information relating to the endangered species found on the fefuge. Six of the eight studies listed below concern such species. Complete data on each of these studies is collected and reported in detail in the trip reports which are completed after each expedition. The following reports briefly summarize the yearly activities in each wildlife management study.

1. Populations and movements of the Hawaiian monk seal on the Hawaiian Islands National Wildlife Refuge.

Seal census, tagging and return data are summarized in tables 4, 5, and 6. It is difficult to summarize the census data since only rarely are we able to visit all islands on a single trip. If one takes the highest count from each of the islands throughout the year, we find a total of 679 animals. As evidenced by some of our detailed observations on the individual islands, the number of animals found on the beach is simply a percentage of the total seal population. What percent, we do not know. This method, however, may be the best index method of determining trends in seal populations.

Since there is no known method of determining age in monk seals, tagging is confined principally to pups and yearlings. As the tagging program continues we will then have a known age class with which to work. Problems are still being encountered in our tagging program. The pups are relatively easy to handle, but during subsequent years, the tags become more difficult to read since they become partially concealed in the web of the skin on the rear flipper. Likewise, when the animals are adults they may tip the scales at up to 700 lbs and they are impossible to restrain. Use of drugs has been considered but discarded. The animals are usually at the edge of the water and would swim out to sea before the drug took effect. Drowning or shark predation would easily then occur. We resorted to adding a yellow nylon cattle neck tag to the metal tag on the rear flipper. A duplicate numbered metal tag less the plastic one was used as a control on the other flipper. The yellow tag can be easily read, however, several animals have been seen with flippers bitten off thereby raising questions as to whether the tags may be acting as fishing lurs. It is also possible that the wobbling motion of the yellow tag caused by swimming eventually results in it being pulled out of the flipper.

During the year, we tried a new method of freeze branding on seals. Freon 22 in small containers was used with a special spray type nozzle attachment and the spray was directed in a small line at the back of the pups. A symbol numbering system was used. Only a few animals were so marked, and those will have to be

Table 4

Seal Census Data - 1969

<u>Date</u>	<u>Necker</u>	<u>French Frigate</u>	<u>Gardner</u>	<u>Laysan</u>	<u>Lisianski</u>	<u>Pearl and Hermes</u>
FEB 10						<u>153</u>
MAR 22	<u>20</u>					
MAR 27				183	<u>130</u>	62
MAY 26						100
JUN 1-4			<u>6</u>	<u>211</u>	127	
AUG 22-SEP		<u>159</u>				
SEP 9				147		
SEP 11-17						119
NOV 11-14				74	65	

Underlined figures - total of peak counts for all islands - 679

Table 5

Newly tagged seals - 1969

<u>Date</u>	<u>French Frigate</u>	<u>Laysan</u>	<u>Lisianski</u>	<u>Pearl and Hermes</u>
FEB 10				9
MAR 27		38	18	
MAY 26				15
JUN	39	25		8
AUG 22-SEP	4			
SEP 9		2		
SEP 11-17	—	—	—	<u>5</u>
Total Tagged	43	65	32	37

Total animals tagged during 1969 - 176

Table 6
 Monk Seal
 Tag Returns Recorded during 1969

<u>Date</u>	<u>French Frigate</u>	<u>Laysan</u>	<u>Lisianski</u>	<u>Pearl and Hermes</u>
FEB 10				21
MAR 27		12	4	11
MAY 26				15
JUN	9	29	12	
AUG 22	21			
NOV 11		4	4	
SEP 9-17		9		14

Total tag returns during 1969 - 165

observed again to determine the effectiveness of the technique. Even if the method is successful, it is extremely time consuming, and since the animals have to be completely restrained, only pups can be marked.

2. Populations and movements of the green sea turtle on the Hawaiian Islands National Wildlife Refuge.

Turtle census, tagging and return data are presented in tables 7, 8, and 9. A total of 39 turtles was tagged during the year. In addition 25 previously tagged animals were recaptured (table 9). The heaviest turtle tipped the scales at 305 lbs.

No problems have been encountered relating to tagging of turtles. The tags hold well and once an animal has been flipped, (not always so easy to do) the tag can be easily read. Weighing each turtle and taking 6 measurements on a strong and bulky animal is a time consuming job, and data on sexes and weights are accumulating slowly. Most of the animals tagged and measured have been of the larger or older age class (100 lbs and over). Tag return data from this group of animals seems to suggest that the growth rate is extremely slow. Needed are additional data from the smaller animals (20-50 lb. class).

The State has no closed season on turtles and there are no restrictions on the numbers or size which can be taken. Hotels offer turtle meat on their menus and as the tourist industry grows, the demand for turtle will also increase. Coupled with this, there is a growing take by skin divers.

3. Populations and life history of the Nihoa millerbird on Nihoa Island, Hawaiian Islands National Wildlife Refuge.

John Sincock, research biologist from Kauai, and Ernest Kosaka, Division of Fish and Game spent 11 days on Nihoa during the last of May and the first part of June. Census figures were obtained by counting all birds in each of 50, 250ft. random transects. Two counts were conducted 6 days apart. On May 30, the population was estimated at 498 plus or minus 57.6% and on June 6 the estimate was 493 plus or minus 42.3%. Sincock indicated that although the confidence limits were extremely high, our present method is considered the best way of determining millerbird populations on Nihoa (table 10).

Table 7

Turtle Census Data 1969

<u>Dates</u>	<u>Necker</u>	<u>French Frigate</u>	<u>Laysan</u>	<u>Lisianski</u>	<u>Pearl and Hermes</u>
FEB 10					15
MAR 22-27	<u>4</u>	1	2	9	
MAY 26-JUN 1			3	<u>15</u>	<u>14</u>
SEP 11-17		<u>12</u>			<u>27</u>
NOV 11-14			<u>4</u>	12	

Total of peak counts for the islands (underlined) - 62

Table 8

Turtle Tagging Data - Summary 1969

<u>Dates</u>	<u>Necker</u>	<u>French Frigate</u>	<u>Laysan</u>	<u>Lisianski</u>	<u>Pearl and Hermes</u>
MAR 22-27	1	1	2	9	12
MAY 26					2
SEP 9	—	—	—	—	<u>12</u>
Total	1	1	2	9	26

Total of 39 animals tagged during 1969

Table 9

Turtle Tag Return Data - 1969

<u>Dates</u>	<u>Lisianski</u>	<u>Pearl and Hermes</u>
FEB 10	2	9
MAR 22-27	2	
MAY 26		6
SEP 9	—	<u>8</u>
Total	2	23

Total tag returns during 1969 - 25

Table 10

Population Estimates on
Nihoa Finch and Millerbirds- 1969

<u>Date</u>	<u>Species</u>	<u>Number of Transects</u>	<u>Population Estimate</u>	<u>%Error 95% C.L.</u>	<u>Range of Estimate</u>
MAR 21	Millerbird	40	41	199%	0-123
MAR 21	Nihoa Finch	40	2,993	36%	1,913-4,073
MAY 30	Millerbird	50	498	58%	211-785
MAY 30	Nihoa Finch	50	2,987	32%	2,206-3,948
JUN 6	Millerbird	104	493	42%	285-701
JUN 6	Nihoa Finch	104	1,528	40%	924-2,132

Time on Nihoa during the March trip did not permit us to complete the necessary number of finch or millerbird transects. Only 40 transects were completed and 1 millerbird was seen on transect. With these data the population estimate was 41 plus or minus 199%.

Seventeen millerbirds were mist netted and banded by Sincock and Kosaka. In addition during their stay on the island, they found three active millerbird nests and banded one nestling. Several of the millerbirds were held temporarily in a small holding cage and they did quite well as long as they were supplied with moths.

No other work was completed on the millerbird during the year.

4. Populations and life history of the Nihoa Finch on Nihoa Island, Hawaiian Islands National Wildlife Refuge.

During the March trip 40 transects were conducted and a population of 2,993 finch, plus or minus 36% was estimated (table 10). Two complete surveys were conducted by Mr. Sincock and Mr. Kosaka during their stay in June. The first, a 50-transect survey revealed a total of 2,987 birds, plus or minus 32%. The second survey, where 104 transects were run, 1,538 birds plus or minus 39.5% were tallied. Sincock stated that there was some overlap between population limits (2,132 and 2,026) however, the extremes of these counts, 924 and 3,948 left much to be desired in the way of minimizing errors.

A total of 197 finch were mist netted and banded by Kosaka and Sincock during May. Several were kept in a small holding cage and they did quite well feeding on papaya, banana, baby food and boiled egg yolk.

5. Populations and life history of the Laysan finch on Laysan Island, Hawaiian Islands National Wildlife Refuge.

Two finch counts were conducted on March 26. No other counts were made during the year (table 11).

Table 11

Laysan Finch Population Data 1969
March 26

<u>Number of Transects</u>	<u>Number Observed</u>	<u>Population Estimate</u>	<u>%Error at 95% C.L.</u>	<u>Range Estimate</u>
120	329	11,183	29%	7,962-14,404
154	449	11,882	24%	8,985-14,659

During March, 500 Eragrostis clumps were checked for finch nests, however, none were found. The birds appeared most abundant in the Sycios patches towards the interior of the island.

Although no finch counts were conducted during June, 365 Eragrostis clumps were checked and 9 nests were found. Some were in use while young had hatched from others.

6. Population dynamics and life history of the Laysan teal on Laysan Island, Hawaiian Islands National Wildlife Refuge.

Several teal counts were made during the year (table 12). Apparently the population is down drastically from previous years, thus high priority was given to obtaining reliable teal census data.

Table 12

Laysan Teal Census Data 1969

<u>Date</u>	<u>Type Count</u>	<u>Number of Transects</u>	<u>Number Observed</u>	<u>Population Estimate</u>	<u>%Error</u>	<u>Range Estimate</u>
MAR 26	Random transect	120	14	476	77%	111-841
MAR 26	Random transect	154	18	476	64%	170-782
MAR 27	Early AM shore- line count		89			
MAR 27	Beatout method around lagoon		123			
JUN 2	Late PM shore- line count		85			
SEP 9	Beatout count		74			

The random transect method of calculating teal populations is a poor method since most of the birds seem to be confined to a belt approximately 300 feet wide around the lagoon. In using a crew to beatout the vegetation around the lagoon, the man farthest away from the lagoon flushed only a few birds while the observers closer to the edge of the lagoon flushed most of the birds. The early AM or late PM shoreline counts appear to be an adequate census method if there is little wind and if the water levels are down.

Although we know of no way to calculate Class A data with respect to our Laysan teal population, the methods we have used have clearly indicated that the total teal population is down drastically from the figure of approximately 475-500 during 1964. Our best estimate as to the present teal population on Laysan is a minimum of 100 birds and certainly not more than 150. Causes for the decrease are unknown.

During the 5 days observers spent on Laysan during the year, no live young were observed. Two dead downy young were found along the shoreline but both had been dead for some time.

7. Wildlife disease and Parasite investigations on the Hawaiian Islands National Wildlife Refuge.

No work has been accomplished on this wildlife management study during 1969.

8. Habitat studies on Hawaiian Islands National Wildlife Refuge.

Field data relating to cover typing on Necker and Nihoa were collected. Cover type maps are being prepared by Mr. Sincock.

Other than the maps and recording a few observations relating to the condition of a few species of vegetation, no other work was completed on this wildlife management study during 1969.

VI. PUBLIC RELATIONS

A. Recreational Uses

Since the refuge has been declared a natural area, recreational uses are not permitted. Although occasionally, requests have been received from parties interested in recreational fishing on the refuge islands, such requests are denied.

B. Refuge Visitors

<u>Date</u>	<u>Name</u>	<u>Address or Affiliation</u>	<u>Purpose</u>
DEC 18	F. L. Newcombe	Plimmenton, New Zealand ex controller Wildlife Chief, N. Z.	Mutual problems
DEC 18	Dr. Robert Pyle	Smithsonian Project Honolulu	Courtesy
JAN 8	Dr. Harvey I. Fisher	Chairman Dept. Zoology Southern Illinois University	Albatross research
MAR 1	William Patzert	Graduate student ocean- ography, University of Hawaii	Discuss current meter research off refuge
MAR 14	Dr. Tom Howell	U.C.L.A.	Research projects on refuge
MAR 17	George Laycock	Audubon writer	Refuge expedition
MAR 17	Karl W. Kenyon	Bird and Mammal Lab, Seattle	Refuge expedition
APR 9	John Sincock	Research Biologist, Kauai	Mutual projects
MAR	Winston Banko	Research Biologist, Hawaii	Mutual projects
MAR	John Findlay	Regional Director, Portland, Oregon	Endangered species program
APR	Felix Smith	Regional Office, Portland, Oregon	Estuarine studies
APR 21	Roger Clapp	Smithsonian Institution Washington	Research on refuge Islands

<u>Date</u>	<u>Name</u>	<u>Address or Affiliation</u>	<u>Purpose</u>
MAY 1	William Stanley	Commerical Fisherman, Kodiak, Alaska	Commerical fishing refuge
MAY 2	Jack Welch	Wildlife Research, Denver	Courtesy
MAY 5	Glen Hood	Wildlife Research, Hilo, Hawaii	Courtesy
MAY 5	Des. Bartlett	Nairobi, Kenya	Refuge expedition
MAY 20	Dr. Doug Yen	Bishop Museum, Honolulu	Ethnobotanical research, Nihoa
MAY 20	Richard Crossin	Simthsonian Institution	Courtsey
MAY	Beatrice Krauss	University of Hawaii Botany	National Landmarks
AUG	Dr. George Losey	University of Hawaii Coconut Island	Refuge research
AUG	Dr. John Maciolek	Cooperative Fisheries Unit, University of Hawaii	Refuge research
OCT 2	Jim Clark	Corps of Engineers, Honolulu	Keapuka Project Kaneohe
OCT 2	Kenji Ego	Division of Fish and Game, Honolulu	Keapuka Project Kaneohe
OCT 8	Jack Hemphill	Asst. Regional Director Portland, Oregon	Courtsey
NOV 4	Bill Graves	National Geographic, Washington	Book on Hawaii
DEC 7	Commissioner and Mrs. Meacham	Department of Interior, Washington	Inspection & R and E Program
DEC 19	John S. Gottschalk	Director, Washington, D. C.	Inspection & R and E Program
DEC 19	John Findlay	Regional Director, Portland, Oregon	Inspection & R and E Program
DEC 19	Micheo Takata	Director of Hawaii Division of Fish and Game, Honolulu	R and E Program

<u>Date</u>	<u>Name</u>	<u>Address or Affiliation</u>	<u>Purpose</u>
DEC 19	Bill Morse	Wildlife Management Institute, Portland	R and E meetings
	William Foote	Nature Conservancy	R and E meetings
	Ronald Walker	Division of Fish and Game, Honolulu	frequent visitor
	Dave Woodside	Division of Fish and Game, Honolulu	frequent visitor
	Jerry Swedberg	Division of Fish and Game, Honolulu	frequent visitor

C. Refuge Partidipation

- February 6 Kridler gave illustrated talk to Windward Rotary Club, 60 present
- February Kridler and Olsen attended FWPC hearing in Honolulu
- February Kridler spent 4 days with Huntley Brinkley newsteam and accompanied them on a special trip to French Frigate Shoals
- March 10-11 Olsen, Kridler and all Bureau Reps in Honolulu, Hawaii met to discuss R and E program
- April 14-18 Kridler represented Bureau in Pannel Discussion The Impact of Technology, the Pacific Environment University of Hawaii
- April 18 Kridler and Olsen met with Hawaii Wildlife Rederation
- April 23 Olsen attended Conservation Council Meeting, University of Hawaii
- April 15 Kridler presented slide talk to 1,400 members of Kamehamea School, Honolulu
- April 21 Kridler and Olsen attended Hawaii Audubon Society meeting
- April 17 Kridler and Olsen attended air and water pollution seminar at the University of Hawaii
- April 24 Kridler and Olsen met with Fish and Game enforcement personnel relating to mutual enforcement problems
- May 20 Olsen presented slide talk on Refuge program to Kaneohe Lion's club. 40 attended
- May 22 Kridler and Ron Walker, Hawaii Fish and Game, taped 2 TV programs on Rare and Endangered Wildlife which was presented on KHETV in Honolulu
- June 22 Olsen presented illustrated slide talk to St. John's Luthern Church Sunday School.
- June 26 Olsen presented "The Gooney Bird" and an illustrated slide talk on the refuge to Pearl Harbor Medical Officers Association. 50 attended

- July Olsen and Kridler met with Coast Guard officials regarding policies of cooperation between our program and logistic help provided by their vessels.
- July 24 Kridler and Olsen participated in statewide stilt census
- July Kridler presented Bureau's position with regard to commercial fishing on the refuge to the Governor's committee on Hawaii and the Sea
- July 9 Olsen presented illustrated slide talk on the refuge operation to monthly 14th Coast Guard District Officer's association
- July 21 Kridler presented illustrated slide talk to Hawaii Audubon Society
- August Kridler and Olsen appeared on local TV while helping Sea Life park officials in dying red footed boobies
- October 1 Kridler presented refuge slide talk to 20 members of Windward Surfcasting Club
- October Kridler and Olsen attended Air and Water Pollution meetings
- November Kridler and Olsen attended annual wildlife federation meeting in Maui. Kridler presented slide talk to 45 members of the Federation
- December Kridler and Olsen participated in R and E wildlife meetings held in Honolulu.

F. Safety

Both Kridler and Olsen completed the NAUI (National Association of Underwater Instruction) program in SCUBA diving as a government authorized training course. In addition to the SCUBA training, time was devoted to the discussion of water safety, a subject extremely important considering the nature of the work on the Refuge.

No formal safety meetings were held. Periodically, refuge personnel engage in discussion relating how to do our jobs in a safer manner. Rubber suits were acquired for station personnel for use in their landings on rocky islands.

VII. OTHER ITEMS

Hawaii's Endangered Wildlife was published and distributed during the reporting period. Requests have been received from all over the world for copies of the publication and it appears to be giving the general public a broad appreciation for the problems facing Hawaiian birds.

George Laycock, a writer for the National Audubon Society accompanied us on our March trip to the refuge islands. The articles which subsequently appeared in the Audubon are appended to this report.

This report was prepared by Olsen and reviewed by Kridler.

SIGNATURE PAGE

Submitted by:

5/ David L. Olsen
David L. Olsen
Refuge Manager Assistant

Date: 7/1/70

Approved by:

5/ E. K.
Eugene Kridler
Wildlife Administrator

Approved, Regional Office:

Date: 7/13/70

EJS
Signature

Acting RRS
Title



3-69, 14A

Rubber rafts are used for landing on the rocky islands of Nihoa, Necker, Gardner Pinnacles, and La Perouse Pinnacle.



2-64 (slide) - Kridler

Male frigatebird inflates his throat pouch during breeding season and displays to female.



12-69, 19A, Lisianski

The most practical way to visit the refuge islands is by helicopter from a ship. Even with a helicopter, landings are impossible due to the thick concentration of birds. Dangling in a "horse collar" from a helicopter hovering 50' over the beach gives one that certain uneasy feeling.



12-69, 34A - Olsen, Laysan

Growths appeared on several large turtles. One such growth was surgically removed and it weighed well over a pound.



3-69, 14A

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12-69, 34A - Olsen, Laysan

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2-69, #21, Pearl and Hermes Reef
Sooty tern nesting colonies are common on most of the flat sandy islands. It is difficult to estimate their numbers since many of them spend the day at sea feeding, and come to the islands only at night.



3-69, #10 - Kridler, Pearl and Hermes Reef



2-69, #12 - Kridler

On the 34 acre Southeast Island 40,000 Laysan albatross nested.



3-69, #10 - Kridler, Pearl and Hermes Reef

When the young albatross begin to grow their flight feathers they move to shore in preparation for their first flights. Adults desert them, and the young must learn to fly before their body reserves are depleted otherwise they die of starvation. Nature's way to regulate a population.



- Kridler

Young Hawaiian monk seals weigh approximately 20 pounds at birth. They grow rapidly and are weaned at about 7 weeks. One pup just prior to being weaned tipped the scales at 185 lbs.



12-69, 26A - Olsen, Laysan

On the sandy islands monk seals often snuggle down into the sand making a deep furrow.



3-69, 20A - Olsen, Laysan

We believe large sharks are an important predator on the Hawaiian monk seal. A large portion of the back of this seal was torn off. The shape of the injury leaves no doubt that it was inflicted by a large shark.



8-69, B16-- Kridler

He who sticks his nose in someone else's business is in for trouble. This seal, nosing around in a wreck at Pearl and Hermes Reef poked his snout into a section of hard rubber pipe. We don't know how long the pipe was on the animal. It was removed and the animal swam off apparently none the worse, but not before showing its appreciation by trying to bite us.



9-69, J6 - Olsen

Dead or white coral among extensive areas of live coral is a positive sign of the presence of Acanthaster planci, or Crown of Thorns starfish.



9-69, G36A - Olsen

An intensive search for the "Crown of Thorns" starfish revealed only 5 specimens at Pearl and Hermes Reef and none on French Frigate Shoals. Although it has presented a serious threat in some of the western Pacific areas, populations seem stable within the refuge.



9-69, 631A - Olsen

The reef white tip shark *Triaenodon obesus* is the most common shark around Pearl and Hermes Reef. It grows no larger than about 6' and is usually a slow swimming scavenger.



9-69, E23A - Kridler Pearl and Hermes Reef

Other than the monk seal, the porpoise is the only other mammal found within the refuge. Several species have been observed.



9-69, 624 - Olsen

Ulua are common at French Frigate Shoals and Pearl and Hermes Reef. Although they often weigh over 100 lbs they are not aggressive and if nothing else, their size demands respect.



9-69, C25A - Olsen, Pearl and Hermes Reef

Weke or goatfish are found in small schools in the reef areas.



9-69, B19A - Sincock

A 10'2" Tiger shark Galeocerdo culvievii was taken on a shark line in the shallows adjacent to Southeast Island, Pearl and Hermes Reef. Bait used - a 5' reef white tip shark, Triacnodon obesus.



9-69, B13A - Olsen

The black tip shark Carcharhinus limbatus was taken at both French Frigate Shoals and Pearl and Hermes Reef. This 8' specimen was taken off Tern Island. No evidence of seal remains were noted.



3-69, #9 - Kridler

The introduced sow thistle and mustard seems to be spreading in spite of our efforts. Our visits to Southeast Island are infrequent and usually at a time when both the mustard and thistle have gone to seed.



3-69, 2A - Kridler, Pearl and Hermes Reef

Each year we attempt to clean up a little more of the debris left as part of prior military activity on the refuge. The last of the boards used as temporary quarters go up in flames.



2-69, 10A - Kridler

Resolution targets placed on Laysan and Lisianski were finally picked up after the completion of the military operation. Some were rolled up and returned to a destroyer, while others were burned. The fires were fanned by a hovering helicopter.



12-69, 38A - Olsen



3-69, 2A - Kridler, Laysan
Snow and ice on a Hawaiian refuge? No, its simply foam whipped
up from heavy winds across the lagoon at Laysan Island.



9-64, #1 - Kridler, Laysan
Red-tailed tropic bird is a common nesting bird on all islands
of the refuge.



AUDUBON

JANUARY 1970



Robin and holly berries by Thase Daniel.

WINTER VEGETARIANS

What do insect-eating birds eat in winter? It's an old question with a simple answer: They eat seeds, berries, nuts; they go vegetarian. In the spring most small land birds live largely on insects, food with high energy content. Virtually all feed their nestlings on worms and insects because such a high-protein diet is essential for quick growth. But when summer passes, no matter whether they stay North or migrate South, they all live on what is available.

Here in the North the winter robins eat sumac berries, Virginia creeper, viburnum, grapes, winterberries. Purple finches eat various weed seeds and tree seeds, especially of white ash. Pine siskins are especially partial to the seeds of the northern white cedar. Before they go South, flickers eat bayberries and poison ivy berries. And during the winter the downy woodpeckers try to eat all the rest of the poison ivy berries—downies and hairies prefer insect fare, but in winter their diet is about one-fourth seeds and berries.

Those who get tired putting out sunflower seed that evening grosbeaks gulp by the peck might plant a few female boxelders. The grosbeaks like boxelder seeds almost as well as sunflower seeds—and can shell them like peanuts.

The list of winter fare for our common birds is almost endless—all the berries, most tree seeds, many of the nuts, and virtually all the weeds and wildflowers. Brown thrashers eat acorns. Cedar waxwings like wild raisins. Even in the South they all are partially vegetarian most of the winter. Maybe that's why they are so hungry for insects in the spring. Even a man doesn't really like to live on salad the year around.

H. B.



The former invariably preface their writings with a stern warning against anthropomorphizing. Birds are not just little human beings in feathers. Birds do not think. Birds act from instinct. No matter how closely the actions of birds may remind you of your neighbor, or of people you meet on the freeway and in department stores—forget it. Instinct. For example, those birds that make a habit of going around puncturing other birds' eggs or pushing them out of the nest, or building nests on top of other birds' nests that happen to be inhabited—instinct, pure instinct.

Now as to youth: In relative silence, as birdwatcher and mother, I have suffered the attacks of the young on the character, life-performance, and institutions of me and my peers. I see much that is vile in the world and mean to go on blaming others more severely than myself. But I should not dream of castigating—say—the Pacific Ocean.

Yet my own child, when I pointed out to her the majestic power and immensity of the Pacific ("Look how big it is," I said), at once criticized it as a "suburban" ocean. Of Monterey Bay, she claimed that when you looked at it from almost any direction, you could see land on the other side. "This," she said contemptuously, "makes it seem like it's only a lake."

The Big Sur coastline she found more rewardingly dramatic, whereas in fact it is merely melodramatic, a case of God not knowing where to stop.

When I first discovered the thrill of watching birds through binoculars, I had some foolish notion of cementing togetherness with Vicki. "Just take a look through these," I said, handing her the glasses. "It's a whole fresh world, a new dimension, like being Columbus and discovering curves. Take a close-up at that



violet-green swallow on the wire in front of Mrs. Fouts' house."

She accepted the glasses and I was gratified by the intoness she brought to bear in the direction indicated. Just as I thought we were about to *share an interest*, she handed them back.

"Guess what Mrs. Fouts has on her grocery list," she said. "She's got tomatoes and milk and two pounds of sugar and a can of frozen orange juice . . ."

I snatched the glasses. She said, "But I think it's nice that you've got a hobby."

So this is what we are up against, we noble buffs. If experts and infants had their way, we should soon become as extinct as the passenger pigeon, the dodo, and the great auk. As it is, our position is roughly as chancy as that of the whooping crane, the California condor, Kirtland's warbler, and the bristle-thighed curlew.

The scorn of experts and youth is to us as pesticides to the peregrine falcon, the brown pelican, the cormorant, the murre, the shearwater, and all those others. Our eggs grow thin-shelled and unviable. We may be the last of our kind. ■

The Hawaiian Islands of Birds

story and photography
by GEORGE LAYCOCK

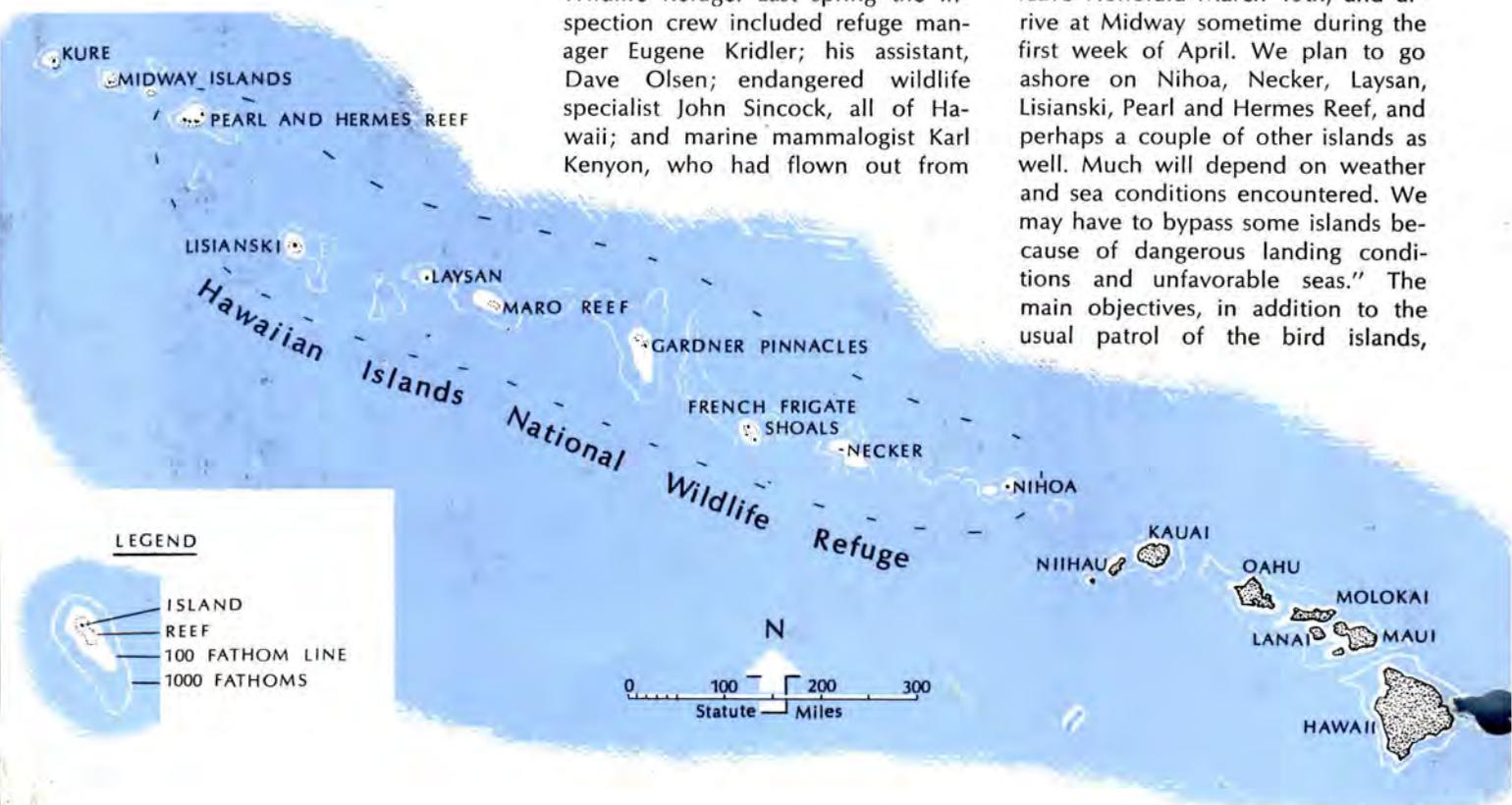
ON A CLEAR WARM MORNING in March the U.S. Coast Guard cutter *Buttonwood*, with Commander Henry Haugen at the helm, eased out of the harbor at Honolulu and began her sluggish journey north-westward across the rolling Pacific toward Midway, 1,100 miles distant. In addition to her able crew of 45

officers and enlisted men, there was aboard a five-man crew referred to by the seamen as "the bird people."

The "bird people" were biologists of the U.S. Bureau of Sport Fisheries and Wildlife—off on their annual inspection tour of the remote and unpopulated little islands that make up the Hawaiian Islands National Wildlife Refuge. Last spring the inspection crew included refuge manager Eugene Kridler; his assistant, Dave Olsen; endangered wildlife specialist John Sincock, all of Hawaii; and marine mammalogist Karl Kenyon, who had flown out from

Seattle. When Gene Kridler decided there would be room for an *Audubon* reporter to join the crew, I signed on eagerly as the fifth "bird man."

With a fine sense of understatement, Gene had written before I left Ohio, "You may find it to be somewhat of an adventure. We expect to leave Honolulu March 19th, and arrive at Midway sometime during the first week of April. We plan to go ashore on Nihoa, Necker, Laysan, Lisianski, Pearl and Hermes Reef, and perhaps a couple of other islands as well. Much will depend on weather and sea conditions encountered. We may have to bypass some islands because of dangerous landing conditions and unfavorable seas." The main objectives, in addition to the usual patrol of the bird islands,



Two hundred feet above the deep-blue Pacific, on a jutting chunk of lava near the summit of precipitous Necker Island, a red-footed booby stretches its wings, protected by our most unusual national wildlife refuge. (Warren R. Roll)





would be to census seabirds, continue studies of rare and endangered species, and tag monk seals and green turtles. Almost as an afterthought, Gene added, "I hope you are agile."

The Hawaiian archipelago is strung out in a line 1,600 miles long, reaching from the Big Island of Hawaii on the southeast end of the chain to the little-known outpost of Kure on the west. From such evidence as they can find, scientists have attempted to piece together the geologic history of the Hawaiian Islands—believed to have been born of a fault in the ocean floor. When stress weakened the crust, molten lava pushed up out of the heart of the Earth. Over the ages hundreds of eruptions added layer after layer to the underwater structures, each of them rising higher toward the ocean's surface until eventually a barren volcanic island emerged from the sea.



This action continues today on the Big Island, whose highest summit, Mauna Kea, stands 13,796 feet above the Pacific and 32,000 feet above its floor, making it the highest mountain—from its base—on Earth. The older islands, the Leewards, have eroded from wind and water until some have sunken again beneath the surface. The rising sea following the Ice Age is believed to have covered them still more. Some islands, though, have been built up by growing coral organisms extracting minerals from the ocean waters and adding limestone to the volcanic shelves.

The main islands of Hawaii are people islands. But beyond this world of tourism lie the Leeward Islands, with all but Midway and Kure within the National Wildlife Refuge System. These refuge islands are known to few and restricted to scientists visiting them under special permit. The remote and fascinating Leewards are Hawaii's bird islands, the nesting grounds for hundreds of thousands of albatrosses, boobies, terns, petrels, and shearwaters. With each approaching nesting season the seabirds converge upon these bits of land from thousands of square miles of open ocean. And as they raise their young, they live in incredible concentrations, making these little is-



The breeding male of the great frigatebird shines in the Pacific sun, its gular pouch a crimson balloon which attracts females flying overhead. The young man-o'-war perched on a Nihoa Island rock survived six weeks of incubation by both parents plus careful guarding as a chick to prevent it from being eaten by another adult. Here, and nowhere else on Earth, is found the bright yellow Nihoa finch.



lands some of the world's most important wildlife areas.

For birds can occupy the Leewards safe in their isolation from foreign species, man included. One of the big concerns of the refuge workers, and the reason for ruling the islands off limits to all but official parties, is that foreign plants and animals might gain entry and upset the fragile ecosystems.

"One pregnant cat, rat, or mongoose," says Gene Kridler, "is all it would take to really upset the wildlife picture on one of these islands." These bird islands were added to the National Wildlife Refuge System in 1909 by executive order of President Theodore Roosevelt. In addition to the islands, reefs, and atolls, the refuge embraces the shallow waters on the coral shelves around the islands, thus this remote wilderness area is unique among the country's more than 300 national wildlife refuges.

During their nesting period, birds here are fantastically tame and unbelievably abundant. These combined

This is Nihoa Island, first of the Leeward chain, first in the Hawaiian Islands National Wildlife Refuge, 146 acres in size, 910 feet high, its lush green slopes crossed by terraces built by ancient Polynesians, its sky ruled by piratical frigatebirds.





Jagged Necker Island, 150 miles beyond Nihoa, covers 41 acres—and those are covered with clouds of seabirds. The author's Bureau of Sport Fisheries and Wildlife party counted 20,000 active nests—500 per acre. Here, a sooty tern with its long forked tail hovers against the blue backdrop of the Pacific, while a brown booby and a blue-faced booby brood their nests. The highest point on Necker is 278 feet, and the ocean pounds its lava shores, making landing—and departure—tricky business for such official visitors.

conditions attracted plume hunters in past decades, and the pages of history carry accounts of this cruelty and destruction on the Leewards that rank among the blackest chapters in man's association with the wild creatures around him.

Today the threats to these little islands take different forms, usually from unauthorized entry or military trespass. But the birds are also given greater protection than they have had in most previous times. Not until the spring of 1963 did the Bureau of Sport Fisheries and Wildlife assign experienced Gene Kridler as the first full-time refuge manager.

In the gray light of our first dawn at sea, I emerged from the passage-way onto the foredeck and joined Gene and the other members of the crew looking hopefully at the bold green slopes of Nihoa in the distance. "The captain is putting a small boat over," Gene said, "and Dave and I'll go in with a Coast Guard crew to see if we can make a landing."

Soon the motor whaleboat, with Chief Petty Officer Charles Miley at the controls, was bobbing along toward the island. Karl and John, who have made many such landings, led the way to the hold, and while awaiting the boat's return we sorted out the equipment needed on shore.

The seabirds had found us, meanwhile, and hundreds of them soared in escort. There were the dark gliding forms of great frigatebirds with their long, graceful wings and deeply forked tails. Black-footed albatrosses rode the drafts in smooth circles around the ship, terns maneuvered among the bigger birds, and red-tailed tropicbirds gleaming white, with slender, delicate tail feathers, joined the formations. Across the choppy sea, great numbers of birds could be seen, like a swarm of angry bees, around the peaks of Nihoa.

From the deck of the cutter we watched the whaleboat returning from its reconnaissance. It rose high on a crest one moment, then was lost from sight in a trough the next. Coastguardsmen lifted our rubber raft up and over the side and lowered it into the water. We handed down our small canvas packs of equipment, then climbed, one at a time, down the swaying Jacob's ladder to the raft. After transferring to

the larger boat we headed for Nihoa, towing the black raft far behind.

"The rocky islands such as Nihoa," Gene had written, "are not easy to land upon, for they do not have beaches. We land by rubber raft. As a wave raises the raft up and against the rocks, we jump one at a time for the rocks and scramble up to safety."

Careful timing is required to jump safely from an unstable raft bobbing about in the turbulent sea. You ride to the crest of the wave and in that second's pause when the raft reaches its peak—and before it begins to fall again—you leap for shore. Once on solid rock, you hardly have time to stop and catch your breath. Equipment has to be tossed from the boat each time it comes in close. With all the equipment and the five-man crew perched on a shelf of black volcanic rock, the two landing craft move off again toward the distant *Buttonwood*.

Nihoa, covering 146 acres, rises in a long sweeping slope on the south to its crest at the top of a sheer cliff 910 feet above the ocean on the north. There are two peaks that stand against the deep blue sky, and their slopes fall away gradually until they meet in a saddle at the head of the little hollow above where we made our landing.

A short distance above the landing site we came upon the remains of old house platforms, garden plots, and other terraces left by ancient Polynesians who were believed to have raised yams and perhaps some other foods when they dwelled here in a colony of perhaps 150 people, about 700 years ago. Little groves of palm trees, *Pritchardia remota*, a species found nowhere else in the world, shade the hollows below the house platforms.

Each year refuge personnel walk transects selected at random and record the birds they find along these routes. From year to year the census figures computed from these samples give clues to whether the birds are holding their own, declining, or increasing in numbers.

My transects lay straight ahead up the little hollow toward the top of the mountain, where seabirds swirled around the ridges. Walking was filled with hazards. Beneath the tangled, sometimes waist-high growth of *Chenopodium* and *Sida*, sharp-edged lava rubble littered the slopes. Frequently the rocks will slide, carrying the victim downhill until, tangled in the vegetation, he stops and regains his footing.

Far up the slope I came upon the first colony of nesting frigatebirds I



had ever seen. Some were on the wing, returning perhaps from the feeding grounds or simply riding the updrafts and soaring effortlessly on wings that span seven feet.

Frigatebirds as a rule remain relatively close to their own islands and seldom roam great distances as do petrels or shearwaters. They have been tamed on occasion and, because of their strong homing in-

soaring overhead. Frigatebirds nest in colonies as if they were sociable. But the nests are spaced out of reach of neighbors, who are not above an act of cannibalism when a small chick is left exposed.

Although frigatebirds can, and do, fish for themselves, catching flying fish as they scoot above the water, they are more inclined to piracy. Colonies of frigatebirds are usually

the ledges below. As I eased away from the cliff a bright yellow male finch came fearlessly along the top toward me. He stopped on the very brink of the rock and stayed there, with the cobalt sky for a backdrop, long enough for me to make a picture of my first Nihoa finch.

Then I turned and viewed the slope I had climbed to reach this pinnacle. Clouds of birds soared back and forth in the brilliant sunlight. Others occupied nests in vast colonies. The biologists of our party were either out of sight among the rocks or working so far away toward the peaks of Nihoa that they seemed small in the distance. For a while I sat and watched the power and grace of the birds, sharply aware of the fact that I might never come here again.

By the time we departed the island and compiled our counts, the bird list for the day included 71 Nihoa finches and ten of the little brown millerbirds. The rough seas and the island's isolation had spared the millerbirds from even being discovered by man until 1923. Old reports tell of the Rothschild Expedition of 1891, and the bypassing of this rugged island because of the roughness of the seas and the hazards of going ashore. Members of that group had no way of knowing that there was an undiscovered bird on Nihoa. Not until 1923, as a member of the Tanager Expedition, did Dr. Alexander Wetmore discover this secretive bird which he described for the first time to the world of science.

Beyond Nihoa 150 miles, jagged and precipitous Necker Island rises 278 feet above the waves which pound against its lava shores. Necker, covering 41 acres and less than a third the size of Nihoa, was the most rugged and inhospitable of the bird rocks on our list. As we tossed and rolled through the night, there was doubt among the old hands in the crew that we would manage this landing. Gene's plan called for going ashore early in the morning and staying until 5 p.m.

Once more we climbed down the swaying rope ladder and leaped for the bobbing raft. And as the whaleboat, towing the raft, approached Necker, frothing waves beat high against the towering lava cliffs. These



A white-capped noddie chick peers from under a parent in a Laysan ironwood.

stinct, used to carry messages between islands in the central Pacific.

On land they lose their grace. They squat heavily on their flat nests of sticks built in the low bushes. If forced to fly, they rise reluctantly and clumsily, padding along the tops of the bushes while frantically beating their wings, depending heavily on a head wind to aid in the takeoff.

Unlike many seabirds, the colors and patterns of the frigatebirds enable an observer to separate them by sexes and to tell immature birds from their elders. The breeding males, slightly smaller than females, are grand creatures, with black feathers reflecting iridescent sheens in the brilliant sunlight. Beneath their bills, in spring, courting males carry their gular pouch as a crimson balloon, which they employ along with a snapping of mandibles and a nervous spreading of wings to attract females

located near colonies of nesting boobies, which unwittingly supply the bold pirates with food. The frigatebird, soaring above, sees the booby returning to its nest from the fishing grounds and swoops down, harassing the hapless booby until it disgorges its catch. The free-falling fish is picked out of the air by the powerdiving frigatebird before it reaches the water.

There are two birds on Nihoa that I particularly hoped to see, for they are found no place else in the world. And as I climbed beyond the colony I caught my first glimpse of an elusive little wrenlike bird that disappeared quickly into a tangle of shrubs. I had seen my first Nihoa millerbird. Later I saw others, but never did one stay in sight long enough for me to photograph it. At the top of the mountain I moved out to the edge of the cliff to see the terns swirling around

were the cliffs of which Dr. Alfred M. Bailey had written when telling of the 1912 trip to Laysan. Enroute, the party hoped to go ashore on Necker. "A great ground swell was running when we attempted to land," Dr. Bailey wrote, "and we were unable to get a boat against the steep rocks, but George Willet succeeded in getting ashore by swimming. He rode a white-crested wave against the cliff and was left dangling as the waters surged away." I looked again at the pounding surf and could see George Willet riding his wave, and decided the rubber raft was a better way. As he had on previous occasions, Gene Kridler led his party around the cliffs to the landing site.

The landing area was a twenty-foot-long lava ledge eighteen feet above the sea. The boat must be carefully guided to this narrow perpendicular wall, and its bow must be held against it long enough for a man to leap onto the rocks. The two youthful Coastguardsmen moved the raft in close and the boat rose on the crest of a wave. Gene, experienced in such landings, leaped for the rocks and scrambled up the wall to get out of the way before the next wave came booming in. The receding water fell away beneath the boat and dropped us far below, almost to the base of the wall. A rush of water cascaded down over us from the rocks above. The next swell carried us back up and Dave, with fine timing, jumped for the rocks. In this manner the whole party went ashore, each man riding his own wave to its crest. Then the packs of scales, bird bands, cameras, food, water, and other equipment were thrown ashore and passed along the line of men, up the rocks and out of reach of the sea.

During the previous September, Gene and his crew had erected a heavy refuge sign supported on sturdy wooden posts cemented in the rocks 45 feet above the ocean. The sign had vanished. Great waves during winter storms had smashed it, broken the marine steel guy wires, and straightened out the steel eye-bolts anchored in the rocks. All that remained were two spots of gray concrete in the black lava.

Above us, black and red cliffs

rose in jagged walls, along which narrow ledges provided a route to the top. Screaming seabirds were everywhere. The same species nest here as on Nihoa, except there were none of the little finches and millerbirds. We worked single file along the series of ledges and switchbacks, higher and higher toward the top of the cliff. In the distance, the *Buttonwood* moved off on some practice exercise for the day.

Necker Island has an amazing concentration of seabirds—more than 20,000 active nests, 500 per acre. Our nest counts showed: sooty tern, 16,500; gray-backed tern, 1,300; white-capped noddy, 500; fairy tern, 500; blue-gray noddy, 750; common noddy, 25; brown noddy, 20; wedge-tailed shearwater, 2,000; Laysan albatross, 510; black-footed albatross, 175; and blue-faced (or masked) booby, 230.

My assignment was the blue-faced booby. I was to count the number of nests on the island, then make indi-

long, sharp, and strong—is freely used against even human invaders. I solved the problem of seeing eggs hidden beneath these birds by holding up the sole of one of my heavy boots within pecking distance. The irate booby struck with such vigor that the effort half lifted it from the nest, and in that brief time I could peer beneath the bird and count the eggs. My notes read: 1 egg, 6; 2 eggs, 59; 3 eggs, 15; 1 egg & 1 young, 16; no eggs, 12; total nests checked, 108.

On top of the barren and rocky little mountain are upright stone shafts of ancient Hawaiian temples, said to bear a striking resemblance to temples in parts of Tahiti. We also found the rotting platforms left by U.S. Air Force personnel who had camped on Necker in 1963 and departed without cleaning up the trash. In addition to their tent platforms, they had left a pile of rusting food cans and other assorted junk. We spent part of our limited time cleaning up behind them.



An Hawaiian monk seal pup nuzzles its mother on the shore of Lisianski.

vidual studies of at least 100 to determine how many contained one, two, or three eggs. What I soon learned about a nesting blue-faced booby is that the big bird possesses a strongly developed sense of territory and has no intention of going along gracefully with the egg count idea. No matter how close you walk to the incubating bird it gives no ground, and the bill of the booby—

Attached to Necker by a narrow shelf of rock is a small rockbound cape, and late in the morning we worked our way across this neck to look down upon a secluded harbor where 20 Hawaiian monk seals were asleep on the rocks. The seals awakened as we approached and stared incredulously at the first humans they had seen in months. Some went back to sleep while others

bumped across the rocks into the sea.

During the afternoon we noticed shifting winds and rising waves. Hopefully, the Coast Guard would come early. But the boats came into sight sharply at five o'clock. The whaleboat held off in the rough seas, while the rubber raft came to take us off the island. Karl Kenyon awaited the rising raft as the waves came far higher than they had during the morning's landing. One carried the raft to the level of the shelf and Karl leaped quickly into the boat.

Now each wave was coming in higher than those before it, and we often had to grab our bags of equipment and scramble up the cliffs to escape. Rushing water broke across the shelf and piled up around us in warm white foam. I congratulated myself on having sealed my metal camera case with masking tape. My turn had come. I stood on the

Behind us, Gene and John, old hands at this business, were still waiting on the rocks. We rode the raft up and back down several times. Each surging wave moved it close against the rocks. The danger was that the bow would hang up on the edge as the sea rolled back out beneath it, standing it on its stern or flipping it over backwards. The swells rolled in steadily higher.

The raft rose again on the wildest wave yet. A wall of water rushed across the ledge before Gene and John could climb to safety, enveloping the biologists and knocking them flat on the rocks. As the sea surged back it pulled with a demonic force, hanging on with foamy fingers reaching into hidden crevices.

This time, as the boat dropped back on the receding wave, I saw Gene and John hanging on to each other and on to the rocks in a frantic struggle to keep the Pacific from

Skillfully they held the raft in close to the rocks and John leaped for it as the raft rode the wave downward twenty feet or more. "I jumped into space like a skydiver," he said later, "and I didn't catch up with the boat until it was at the bottom of the surge." He landed heavily but safely in the raft. Then on the next wave, Gene dove, and as John explains it, "came down spread-eagled on top of the Coastguardsman in the bow." We had lost only a few bags of equipment. All five of us were free of Necker's treacherous shores.

Karl Kenyon had made dozens of such landings, both in the Hawaiians and the Aleutians. "This is the roughest I've ever seen it," he said.

Back aboard the cutter, we dried our clothes and checked our equipment as the *Buttonwood* turned west toward French Frigate Shoal, an overnight run of 85 miles. There are eleven islands within the barrier reef of this atoll, and the largest of them, Tern Island, is the base for a Coast Guard loran station. A crew of twenty men serves on this lonely outpost for tours of one year. This is the only human habitation on any of the refuge islands.

Tern Island is used less by wildlife than it once was. But the nearby islets are home to sea turtles, seals, and more colonies of seabirds. The pristine waters of the lagoon are the heart of a delicate marine ecosystem still undamaged by human activity. But the shoals and reefs and shallow banks in the area have attracted the attention of commercial fishing interests eager to move in on this wonderful laboratory of marine life.

Rough seas forced us to bypass Gardner Pinnacles and head directly for Laysan, two-thirds of the way along the Leeward chain. Here we would find the biggest nesting concentrations anywhere of both the Laysan albatross and black-footed albatross, as well as the thousands of sooty terns which descend on the island each year to raise their young.

Turbulence has marked the history of Laysan, but surely no more fateful day confronted it in historic times than the one in which the Royal Kingdom of Hawaii granted a private company rights to mine guano. The foreman of the operation imported and released six pairs of rabbits to



WARREN R. ROLL

Guano-covered Gardner Pinnacles are the remains of a volcanic island believed to have been 140 square miles in size. Wind and sea have carved it to an outcrop 170 feet high, 600 feet long. Landing here is usually impossible.

edge of the cliff gauging the rise and fall until, finally, a breaker came that promised to lift the raft to the exact level of the ledge. I leaped as the wave crested and landed flat in the middle of the raft, with a seaman steadying me as we slid down the wave to its trough. Dave came in behind me.

pulling them off into its depths. I expected them to slide over the edge of the cliff with the rushing water, but they somehow kept their grip on the rocks. The waves were now more than twenty feet high.

The Coastguardsmen decided to transfer us to the whaleboat. We watched as they moved in again.



La Perouse Pinnacle, 120 feet high, breaking the horizon 480 miles northwest of Honolulu, gave the name to French Frigate Shoal, a crescent atoll with 13 sandy islets where green sea turtles hatch and begin their trip to sea in coral-tinted water, and where yearling Hawaiian monk seals, found only on the Leewards, bark at low-flying albatrosses.



WARREN R. ROLL



WARREN R. ROLL

The ironwood trees of Lisianski Island harbor the lovely fairy tern, with its pure white feathers and coal-black accents and the nest which isn't. For the single egg is laid on the edge of a jagged coral rock, or in the fork of a small branch where the chick clings with the aid of long sharp claws.



provide a fresh meat supply. Rabbits soon overpopulated Laysan and denuded it. Birds dependent on the native vegetation diminished. The rabbits were eventually eliminated, and plant life slowly recovered. But three species of birds known only to Laysan—a small flightless rail, a honeycreeper, and the Laysan millerbird—perished and their names were added to the roles of the extinct in the wake of the rabbit hordes.

Today, Laysan is left largely to the birds, and they patrol the air above the coral sands in staggering numbers, day and night. To stand on this island as the evening sun goes down is a rare and unforgettable experience. Sooty terns are returning from their day of fishing and with them come frigatebirds, albatrosses, fairy terns, and noddies. And with the approaching darkness the shearwaters and petrels sweep back and forth over the island in freewheeling confusion. Wherever you look across the island, clouds of birds fill the evening skies, screaming and calling. The shrieking call of the sooty tern, I was told, is *wide awake-stay wide*

awake, and all night long they repeat it to tired men who, in their tents, attempt to ignore them.

Usually there is no problem landing on Laysan, except to find your path through the dark forms of submerged reefs. The smooth beaches slope gently into blue lagoons, and you simply run your boat up on the shore and step out. But at other times thirty-foot breakers may be following each other through the channel, making landing a suicidal exercise. Laysan is a low island rising scarcely forty feet above sea level. A hike around its shores is a six-mile walk, and in its bowl-like center lies a shallow lake about three times as salty as the surrounding ocean.

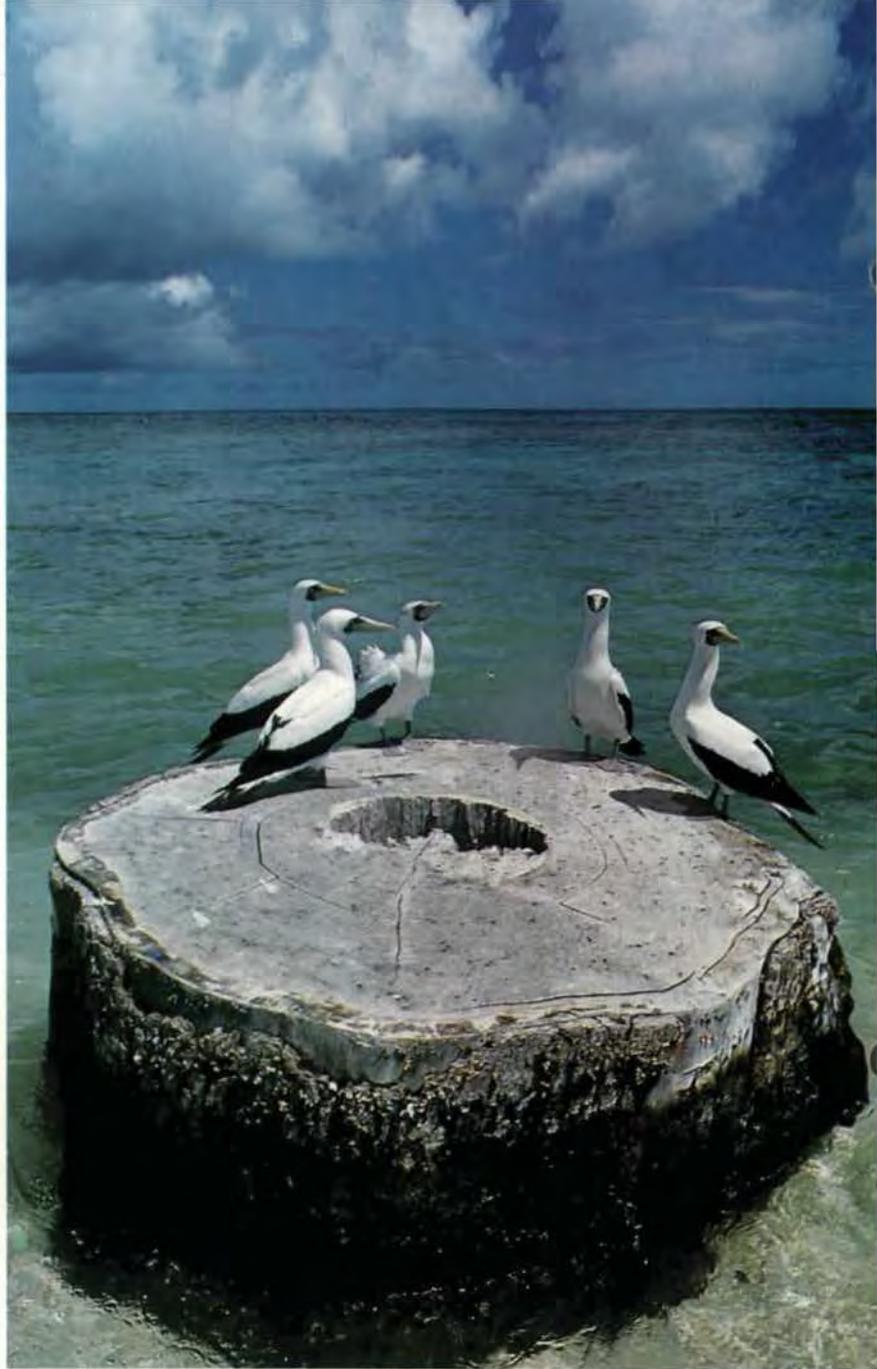
Our first chore was to establish camp, because the itinerary called for three nights and four days on the island for our work with birds, turtles, and seals. On the highest point of land above the beach we set up three small tents in a row, and made a table from an aging sheet of plywood propped up on two metal drums. Then we began the hike around the island to census the seals



Pearl and Hermes Reef is an oblong atoll with a half-dozen islets and a 100,000-acre coral-studded lagoon. And on Sand Island therein, 1,050 miles from Honolulu, albatrosses dance, mate, and raise their young—one per pair. The black-footed albatrosses, portrayed here, keep to the open beach, where their tracks cross the coral sand. The young Laysan albatross staring at the camera has its nest farther inland in the shrubs.



On Laysan, rare teal-sized ducks erupt from the vegetation at dusk to scoop up tiny brine flies from the edge of the lagoon. Christmas Island shearwaters nest in a labyrinth of tunnels in the coral sand, where tribulus flowers add a touch of color.



A section of redwood washed ashore long ago on Lisianski provides an excellent resting place for blue-faced boobies. These refuge islands are visited by bristle-thighed curlews, migrating from the Yukon River.



and tag their pups and yearlings for life history and migration studies.

The following day we walked around the island again, this time counting the rare little Laysan ducks that erupted from the thick vegetation.

This teal-sized brown duck that evolved on Laysan Island lives nowhere else in the wild. During the day the drab little waterfowl seclude themselves in the vegetation around the lagoon. But late in the evening they emerge to waddle over the *Sesuvium* flats in the yellow light of the setting sun, searching for food.

Millions of tiny brine flies form a dark border around the pond and they are an important source of food for the Laysan ducks, which scamper about in sudden bursts of speed on feet that seem scarcely to touch the surface, mouth open and lower mandible but a fraction of an inch above the surface, scooping up flies like a feathered vacuum cleaner.

In our hike we counted 129 Laysan ducks, and although the population is known to fluctuate, the biologists were concerned. There are probably fewer than 200 ducks on Laysan, and for unknown reasons their numbers have been declining in recent counts. There are another 150 birds in captivity around the world. This is one of the world's rarest birds, and introduction of a single exotic predator, or some more subtle change in its environment, could wipe out the only wild population.

Also found only on Laysan is a yellowish finch, which looks so much like the finches on Nihoa that early ornithologists believed they were the same species. But taxonomists have found enough anatomical differences to define them as distinct subspecies. The finches are abundant on Laysan, nesting a few inches above the ground in the clumps of *Eragrostis*, a bunch grass.

Laysan's bird world is divided into three levels. The first is the sky where seabirds soar on tireless wings. Then, on the ground, acres of albatrosses nest, rest, and frequently dance, among their neighbors—sooty terns, noddies, frigatebirds, finches, ducks, tropicbirds, and now and then a booby. But out of sight, beneath the brilliant coral sand, there is the underground

world of the petrels and shearwaters which nest in a labyrinth of tunnels. When you walk on these islands of coral sand you often break through and fall knee-deep into one of the hidden cavities. You learn to step on the highest areas and place your feet near the clumps of grass to avoid the thin-roofed tunnels. But still you break through, climb out wearily, and break through again.

The sandy beaches of Laysan have been known to countless generations of monk seals and turtles. The green turtles of the Pacific have been so heavily preyed upon over the centuries by humans that the turtles now have their own page in the official book of rare and endangered species. The refuge staff, in its annual inspection, runs a census of the turtles and collects data on the

Otherwise, each turtle is given a tag to wear; henceforth he is a numbered creature which, if ever encountered again, can be identified and have the details of his travels recorded.

For weighing turtles, we carried ashore a scale, ropes, and canvas to form a sling. Two strong men can suspend the average turtle between them while a third reads and records the weight. Then the turtle is turned onto its belly to hurriedly slap downhill toward the sea. Through their tagging, the biologists study migration patterns and life history of the green turtle. The most important nesting areas for the green turtles throughout the central Pacific are the little islands of French Frigate Shoals.

Laysan is perhaps the most impor-



A wedge-tailed shearwater crouches in its burrow in Laysan's coral sand.

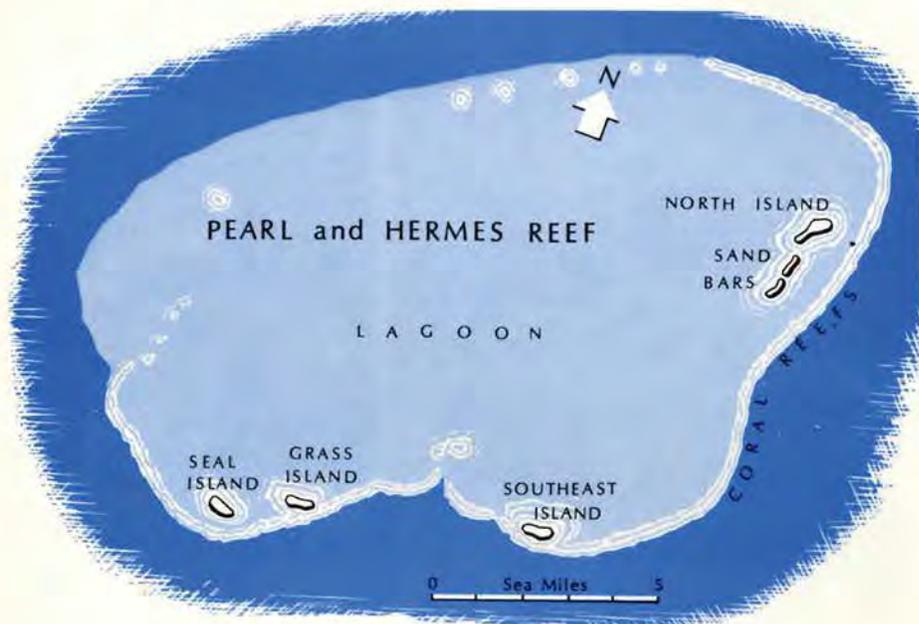
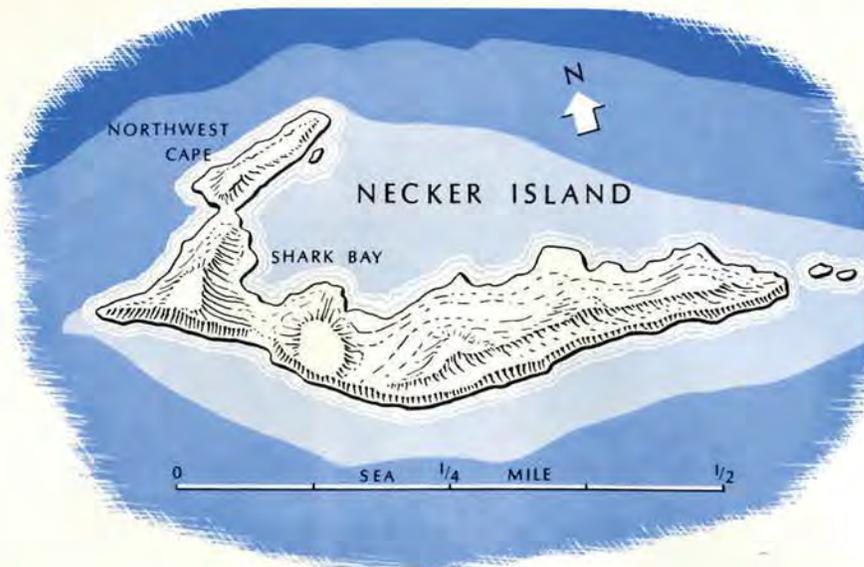
individuals that haul out on the beaches where they come to nest or to loaf in the sun.

Handling a 200-pound turtle is not a simple assignment. The first requirement is to flip the turtle onto its back, and for this you must slip up on the sleeping animal because if he sees you he quickly crawls into the water and is gone. He is helpless when on his back and can not right himself unaided. While he vainly slaps the sand with his broad flippers, biologists measure and weigh him. If the turtle wears a tag in his flipper from some earlier experience, the information is duly recorded.

tant pupping grounds for the endangered Hawaiian monk seal. Almost exterminated by sealers by 1900, it has increased its numbers until, today, perhaps 1,000 survive on the Hawaiian Islands National Wildlife Refuge.

The adult Hawaiian monk seal is usually brownish colored. Females, somewhat larger than the males, may reach weights up to 600 pounds and measure 7½ feet in length.

These seals once lived on the main islands as well as the Leewards. But they have little tolerance for man, and with arrival of the Polynesian people the seals ceased using



The Pacific breaks over the coral reefs of Tern Island, one of 13 sandy islets within French Frigate Shoal. The trees are introduced ironwoods, or Australian pines. As the maps by Bruno Junker show, the bird islands within the Hawaiian Island National Wildlife Refuge vary from precipitous rocks to atolls with vast lagoons.

the main island beaches for pupping. When Karl first visited Midway Island in 1957 he found 70 seals there. When he returned in 1968 there was a single monk seal. One major difference, he felt, was the fact that the section of beach that had been restricted to humans a decade ago had since been opened. People wandered there freely, beachcombing and doubtlessly harassing seals whether they intended to or not.

In 1957 six of the Leewards—Midway, Kurie, Lisianski, Laysan, Pearl and Hermes Reef, and French Frigate Shoal—were important pupping grounds for the monk seals. Two of these, Midway and Kure, lying beyond the refuge boundaries and both occupied by people, essentially have been removed from the list. More than 2,000 persons live on the two square miles of Midway. On Kure, seal numbers have fallen from 130 in 1957 to perhaps half that number today.

Refuge crews annually tag the hind flippers of as many seals as possible so they can identify individuals and gather information on such puzzling questions as the seals' travels, breeding ages and frequency, and life expectancy. The all-black pups weigh about 35 pounds when born. By weaning time, five to six weeks later, they have grown to 135 pounds. And during those weeks the female, turning her layer of fat to energy, has fasted until she resembles a deflated balloon. To catch a seal pup is not difficult, but to hold it once caught is not easy. The task becomes increasingly risky as the size of the seal increases, and consequently the aim is to capture the very young pups and sex and tag them as gently as possible. The old females, how-



ever, object strongly and usually attack the biologists, barking and lunging in a manner that leaves no doubt of their intent. It is also well known that monk seals have strong jaws with rows of pointed teeth.

For handling yearling seals, the refuge crew carries stout canvas strung between two heavy bamboo poles. Two men can pin the animal to the sand long enough for a third to tag and inspect it.

Catching a seal pup is less difficult. The pup is almost invariably lying next to its mother. Slip up on the pair before they awaken, and you can carry the pup off before the mother has time to turn and grab you. Then while one biologist keeps the female occupied, a second and sometimes a third person works with the pup. It is sometimes possible to slip up on a sleeping seal, turn the flipper over very carefully, read the number of the tag, then move off, leaving the seal completely unaware that he has been checked.

One hundred and twenty miles beyond Laysan lay our next target, the low coral island of Lisianski—elevation 50 feet, area 382 acres, and like the other islands nearest it, the home of seals, turtles, and seabirds. During our day ashore on Lisianski, we hiked around the entire island. Except for Laysan, we found more monk seals here than anywhere else. The records at the end of the day showed a census of 130 seals, including twelve pups born recently on the beaches. Four of the seals wore tags from previous years, and during the day we added tags to eighteen more young ones.

There are no birds known only to Lisianski, but the seabirds we had already encountered were also here by the thousands. A few pairs of

fairy terns had established nesting territories near our landing area, but to speak of a fairy tern's nest is unfair to such birds as the Baltimore oriole and barn swallow. This little tern with the pure white feathers and coal-black beak and eyes builds no nest at all; it lays a single speckled egg precariously on the very edge of a jagged coral rock. Or the egg may be deposited in the fork of a small branch where it balances throughout incubation. Later, the tiny chick, with the aid of sharp claws, clings tightly to its "nest."

On Lisianski Island, thousands of the dark little Bonin petrels make their tunnels and raise their young, in one of the greatest concentrations anywhere in the world. And here we continued to find astounding numbers of seabirds wearing metal bands on their legs. "That's the Smithsonian project," I was told, and I made a note to check this in detail back on the mainland. Under a contract with the Pentagon, the Smithsonian sent crews to one Pacific island after the other in history's biggest bird-banding project. In six years they banded two million seabirds at a cost of \$2.8 million. This extravaganza was related to the development and testing of weapons for chemical and biological warfare.

When the military terminated its grand venture into the world of ornithology last June, some observers questioned whether the Pentagon should be permitted to drop the costly program when follow-up work might yield valuable scientific information on seabird life. Banded albatrosses may live 40 years, and other seabirds are also long-lived. Where do they travel, what is their population turnover, longevity, age of first breeding, length of reproduc-

tive life, and their relationship to each other?

Further research on this staggering total of banded birds would be costly, and repeated invasion of the islands would be harmful. One answer might be a sampling, perhaps a concentrated ten-year study on Kure Island, once part of the national wildlife refuge but now a state sanctuary. But more considered thought might well discourage even that. These refuge islands need less, not more, military attention.

There remained but one stop before Midway. Between that island and Lisianski lies Pearl and Hermes Reef, where a 100,000-acre coral-studded lagoon of shallow fertile water is fringed by a reef 48 miles in circumference. Tiny islands, some so low the waves wash over them at high tide, are scattered within the surrounding reef. Biggest of half a dozen little islands is 34-acre Southeast Island. On this unforgettable island, we set up our tents among the seabirds, for our final three nights and four days of refuge work. Two hundred yards farther down the beach we could see, as we set up the tents, that half a dozen green turtles had hauled out to sun themselves on the sand. Several seals also lay there, out of reach of the marauding sharks. As soon as camp was made, Gene and Dave slipped along the beach to surprise the turtles—flipping five before the sixth one awakened and scooted into the ocean.

Southeast Island is sparsely vegetated, but a spreading and prospering field of wild mustard blanketed one end with yellow flowers. How could wild mustard reach this remote coral reef in the middle of the Pacific, and why this island alone of



those we had visited in the Leewards?

Unknown to the Bureau of Sport Fisheries and Wildlife, a military detachment had come ashore with a tracked vehicle sometime in 1961 or 1962. Apparently, mud in the tracks carried a stock of mustard seeds from a former job. The weed is prospering beneath the warm Pacific sun and taking over ground once occupied by native vegetation. The refuge crew had vainly tried to pull up the mustard and eliminate it. This year there was more mustard than ever. But Gene and Dave had brought along a hand sprayer and a supply of herbicide, and Dave spent most of one day spraying mustard. Next year, on the annual inspection trip, they will know the results. But unless they can eliminate this introduced weed the whole ecology of the island may be upset.

Of all the islands visited in this journey through the Hawaiian Islands National Wildlife Refuge, this patch of coral provided some of the best opportunities for bird photography. On the final day I spent the entire time photographing black-footed albatrosses around the beach, Laysan albatrosses farther inland, Bonin petrels, sooty terns, and a flock of a dozen bristle-thighed curlews along the tidal basin across the island from our camp. In one memorable day I exposed 32 rolls of film. Here was an excellent situation for studying the albatrosses, for we were camped in a field of them. In a February visit, Gene and Dave estimated that 40,000 Laysan albatrosses were there along with 10,000 black-footed albatrosses.

There are thirteen species of albatrosses, most of them in the Southern Hemisphere. The two found on the Hawaiian Islands, the Laysan albatross and the black-footed, are among the smaller birds of their family, but they are the size of small geese and have wingspreads that may reach to 6½ feet. We had seen them at sea, wheeling and soaring as masters of their element, rising on the updrafts, going where they chose with scarcely any flapping of those long pointed wings. But on the islands, where they spend four or five months of each year during the lengthy breeding season, the albatross loses much of its grace.

The young albatrosses around our tents sat all day in the little crater-like depressions which are their nests, waiting for the return of a parent bearing food. A common practice with a young albatross is to kick his feet backward one at a time, moving sand from beneath him until he builds a little moundlike nest. In its top is a crater in which he sits like a down-covered basketball. "Sometimes they will build several nests," Karl said. "Kicking sand is a survival mechanism among the black-footed albatrosses. It keeps them from being covered up during sandstorms." The black-footed albatross usually lives on the open beach while the Laysan albatross is more often found in the vegetation inland.

Albatrosses return to these islands in late October and early November to begin their breeding season. Pairs that have nested before are already formed and know precisely where they must go. They usually breed first during their seventh year. They normally stay paired for life, and once a pair has selected its first nesting territory it retains an unshakable loyalty to it, returning each year to nest, within a few feet of where it was the year before.

The female lays one egg. If it breaks or fails to hatch, she does not replace it until the following year. The egg takes 64 or 65 days to hatch and during that time the parents divide the chores of incubation. But there is no daily changing of the guard. When one parent is covering the egg, the other is off at sea—and may not return for as long as 20 days.

During that period the working mate has nothing to eat, and nothing to drink except the drops of rain it can catch by turning its open bill up to the showers. During such a stint of duty its weight may fall by twenty percent.

But at no time can the nest be safely left unguarded. For seventeen days after the young bird hatches, one of the parents must stand guard. After that the young bird, usually large enough to avoid its antagonistic neighbors, squats in the sand and waits unguarded for the return

of its parents from fishing trips.

The birds possess no fear of man, or little for any other creature. They have lived their lives free of any but avian predators and sharks, and seldom encounter a human. Walk close enough to one, young or adult, and it reaches for you with rattling mandibles. When walking between the nests, you are snapped at from all sides.

When a chick recognizes one of his parents returning from the fishing grounds, he should, if away from his nest, return at once. The old birds seem not to return to the chick as much as the nest. "The parent will walk right past him," Karl said, "and ignore his begging until he arrives at the nest. He has to be within a short distance of the nest or he never gets fed."

The first feeding I witnessed was typical. The parent bird tipped its head sideways and partly opened its bill. The chick caught the food coming from it. When the old bird could disgorge no more, it looked around for the nearby chick of some other albatross. Spotting one a dozen feet away, it ran hard with feet flapping the sand and wings extended. The chick saw the large bird coming, turned its back and, squatting in the sand, exposed the back of its neck. The attacking adult grabbed the chick and shook it severely, then pecked it a couple of times and shook it again. Perhaps this stimulates it to regurgitate more food because it returned to feed its own chick a second time. "Sometimes," Karl explained, "a young albatross will be killed by such pecking." Several of the smaller birds had lost the down from the backs of their necks.

From the time the albatrosses arrive on the island, to the day they depart, some practice their stylized courtship dances. Unemployed birds continue to dance long after the nesting adults are busy with other duties. This display involves a series of stances and movements which ornithologists have identified and named, and after watching the albatross dance for a few days you know what movements come next.

The dance usually begins with one of the birds extending its neck toward the mate and turning its head sideways. There is mewing and wail-

ing, and a clacking of bills as the excitement mounts. One or both may point their bills straight up at the sky and call. Then one will lower its bill and stick it beneath an extended wing. Serious students of the albatross have noted that Laysan albatrosses, at this moment, extend only one wing, while the black-footed albatrosses extend both wings. The series of displays may go on for several minutes.

Occasionally a neighboring albatross will waddle up to the dancing couple as if about to cut in, or actually join halfheartedly in the steps. Once I saw four black-footed albatrosses forming their own square-dance set. Why do they carry out the elaborate courtship procedure and why do they continue it so late in the breeding season? "It may," Karl said seriously, "be the way the sexes recognize each other. And some have suggested he added, "that they dance for fun. After all, the days are long out here and there isn't much else to do."

Happily, the albatrosses seem to face no immediate troubles. It is believed there may be 1,500,000 Laysan and 300,000 black-footed albatrosses in the world.

Where an island exists, the seabirds take advantage of practically every square foot of land. Each island produces enough birds to spread across hundreds of square miles of open ocean. Together, the islands within this refuge are home to the breeding populations of all the world's Laysan and black-footed albatrosses, Bonin petrels, Laysan ducks, Laysan finches, Nihoa millerbirds, and Nihoa finches. For hundreds of thousands of years these islands had played this vital role. But outside the refuge, islands which the birds once occupied have been changed by man reducing the total numbers of seabirds that can survive, and rendering those bird islands that remain more important than ever.

Hundreds of miles of open ocean separate these wilderness islands from the main inhabited islands, and each is isolated within the island chain. Today, when we are studying the face of America for areas deserving true wilderness designation, the Leeward Islands of Hawaii merit careful consideration.

These wild islands, wilderness in fact, deserve to be wilderness by official designation as well. And not the dots of land alone, but the shallow ocean shelves around them and the basins within the atolls. These shallow waters belong to the islands ecologically, and where the wilderness embraces them it would protect populations of seals, turtles, and fishes, plus corals and other organisms that have survived together over the ages.

We had been told by Commander Henry Haugen that the time of arrival at Midway was to be "10 hun-

the shade of the officer's houses. "People living here," I was assured by one base officer, "have developed a protective feeling toward the gooneys. If dogs or kids chase the birds, adults reprimand the dogs and kids. And you get used to the noise the birds make at night."

Perhaps the biggest threat of all to the birds of Midway is the possibility that the U.S. Navy base there will enlarge its facilities. The result would be to whittle down still more of the world's population of these magnificent soaring birds of the open seas.



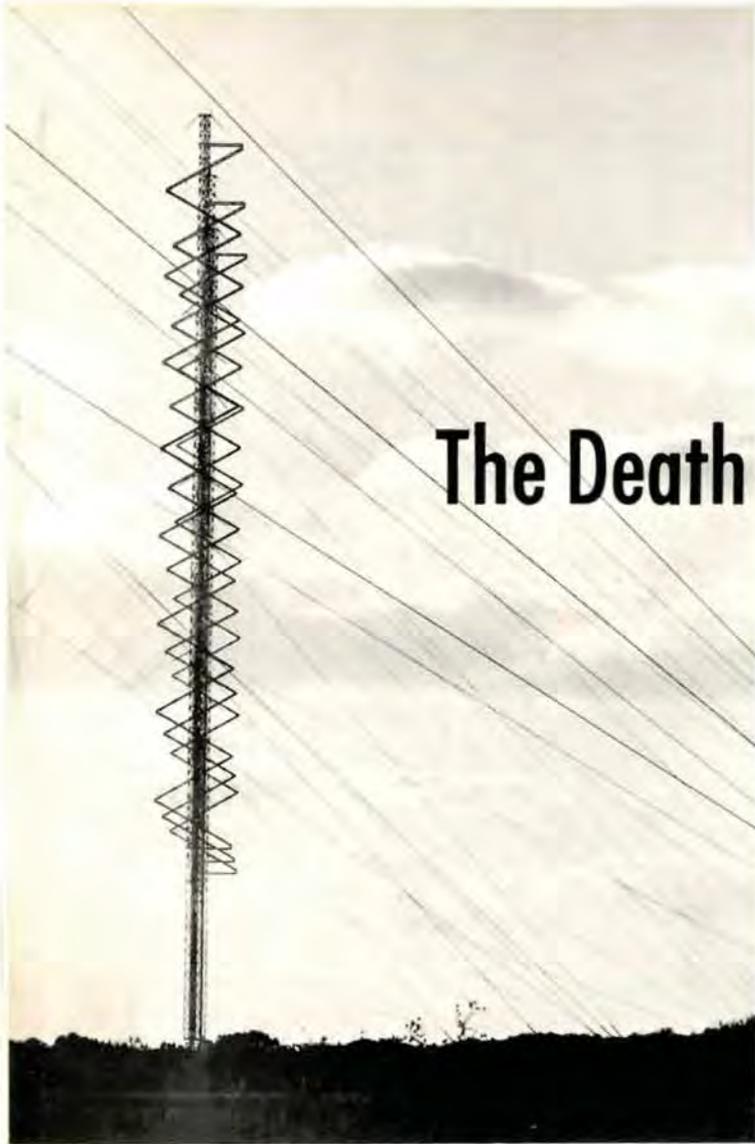
Dave Olson, assistant refuge manager, grabs the flippers of a young monk seal for tagging. The older the seal pup, the harder the biologist's task becomes.

dred hours," and precisely at 10 a.m. on the appointed morning, the *But-tonwood* eased up against the dock. Few islands anywhere have had more controversial conflicts between the native wildlife and invading man than Midway. A succession of past military commanders struggled to eliminate its nesting populations of albatrosses and petrels, sometimes because it was believed the birds presented a hazard to aircraft, and sometimes because the commander did not, as one of them phrased it, "Choose to live in a goddamned barnyard." In recent years commanding officers have brought a more sympathetic view to Midway.

The maze of high towers draped with guy wires and antennas that once killed the flying albatrosses are gone now. The gooneybirds dance in the barrack's yards and nest in

From Midway, twice-weekly charter planes fly between that outpost and Honolulu. We lifted above the sand dunes where flocks of Laysan albatrosses rest near the runways. Our plane roared across the island and the graceful seabirds turned and soared in a manner that put our lumbering craft to shame.

We soon passed over Pearl and Hermes Reef, where we had broken camp the day before. Far below I could see Southeast Island on which our tents had stood. We were too far up to see the birds. But I knew they were down there, the albatrosses, shearwaters, petrels, terns, tropicbirds, boobies, curlews, and others whose ancestors have raised their young on these islands for unknown thousands of years. They were free of human pressure, at least for the moment. And hopefully for a long time to come. ■



The Death of Midway's Antennas

story and photography
by HARVEY I. FISHER

The Pacific atoll of Midway includes two major islands—Sand and Eastern. It was on Eastern that the military erected massive antennas with mazes of cables that took an incredible toll of albatrosses. The antennas, like the one above, have now been demolished and pushed into the sea, and gooneybirds nest amidst their remains.

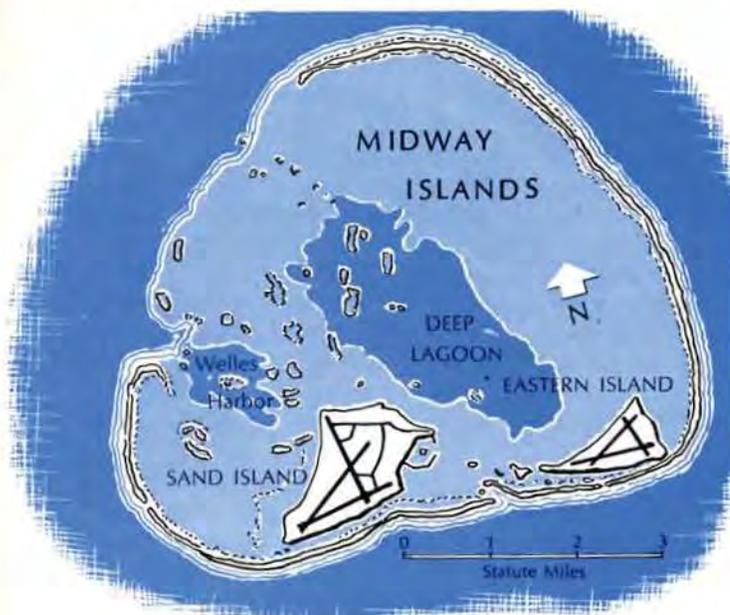
MIDWAY'S DEADLY ANTENNAS are themselves defunct. It was in the July 1966 issue of *Audubon* that I first reported the high toll of Laysan albatrosses exacted by the 300- to 400-foot spires of angle irons and slanting cables operated by the Page Communications Engineers to weld a link in the chain of military communications across the Pacific Ocean. The first of these antennas was erected in the mid-1950's and the last in the early 1960's. Throughout their existence they claimed an avian sacrifice to man's technological progress.

In 1964-65 these towering obstacles killed more than 3,000 mature Laysan albatrosses and thereby nullified the reproductive contribution by the total of 30,000 pairs of albatrosses that nested that year on Midway Atoll's Eastern Island.

But no more, for now the antennas are flat, their metal etched by the force of the wind-driven sand and rusted by the salty brine of the sea. The snarled masses of cables, wires, tubes, and lengths of formed steel serve man still, but now as unsightly anti-erosion devices along the southeastern shore of the island. Theirs was an ignominious fate for, as plastic explosives blew apart the supporting guy wires, the towers crumpled into shapeless masses that bulldozers later shoved toward the sea, trailing copper wires and aluminum tubing like eviscerated entrails.

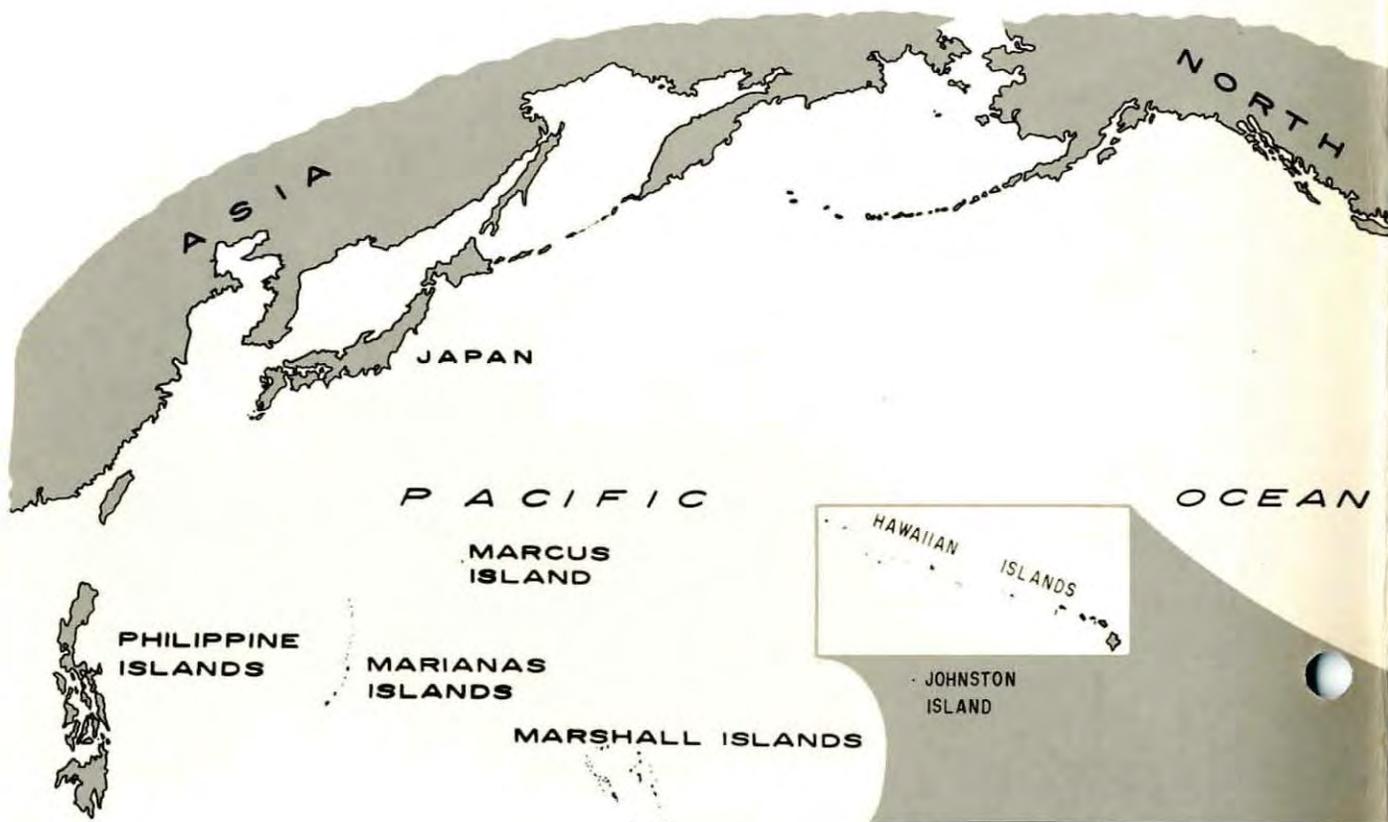
The destiny of the antennas was decided not by the men who molded the explosives around their supports, but by persons thousands of miles away, men whose resolution of problems is based upon economics, military desirability, and expediency. In this instance the need was to facilitate the transmission of messages for the Armed Services. Other ways had been found to bounce signals off the clouds, and pronged satellites whirling across the skies formed pinpoint connections between senders and receivers. For Midway, at least, new systems were in vogue and the antenna site was abandoned in 1967.

The demise of the structures was not an event resulting from a cool-headed resolution of the problem of conserving perhaps a third of the world's population of

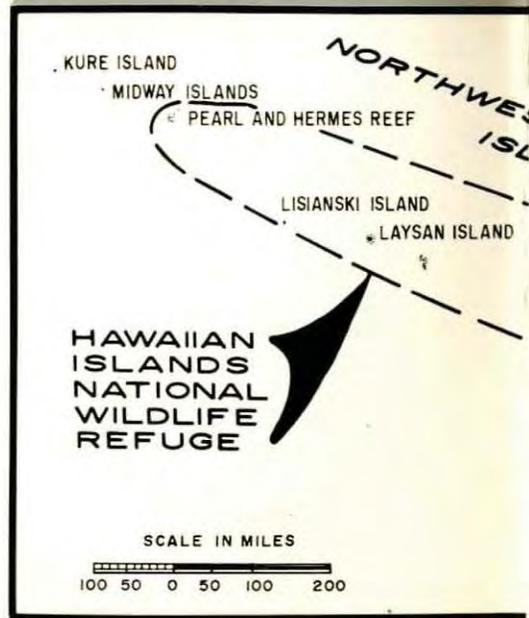


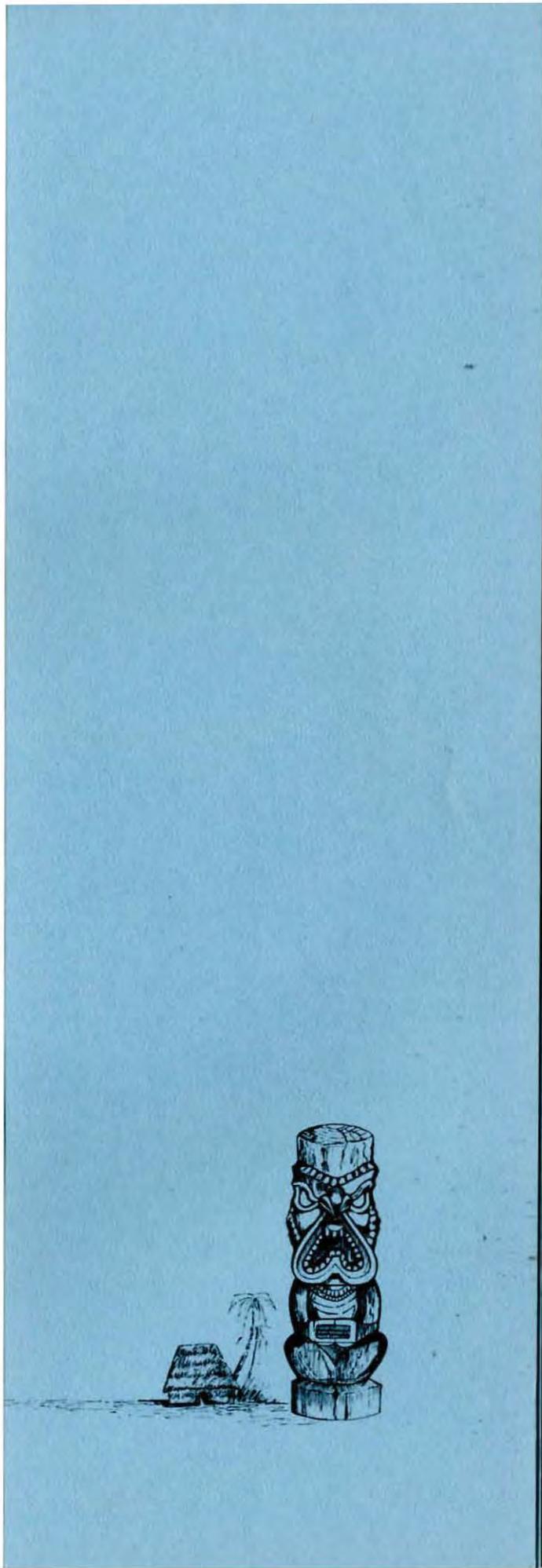
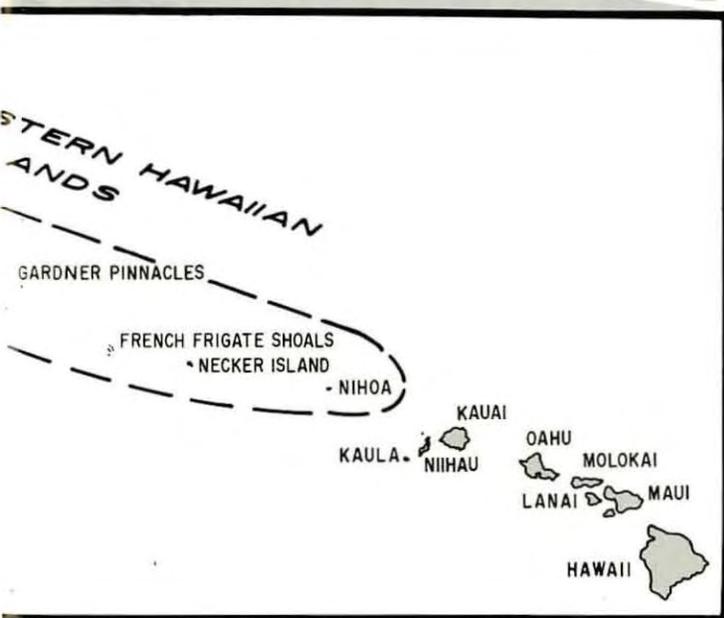
Hawaii's *Endangered Wildlife*





*Hawaii's
Endangered Wildlife*







Introduction

*Hawa
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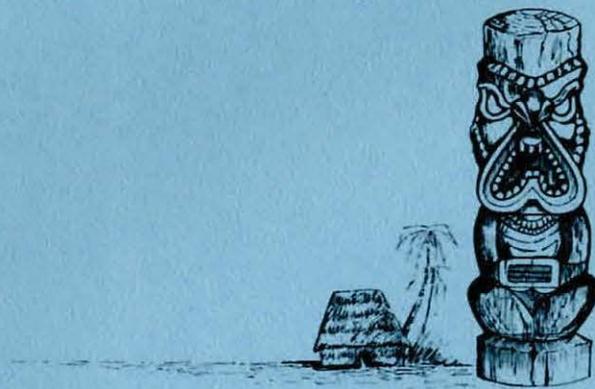
Much of the wildlife native to the Hawaiian Islands has become extinct or is threatened with extinction.

When the Hawaiian Islands were discovered there were about 70 different kinds of birds and two mammal species found here. Within the past 150 years, 24 kinds of birds have become extinct; another 27 are on the verge of extinction. Hawaii has lost more of its native bird life than any area in the world. Those birds on the brink of extinction constitute half of the total of all those considered endangered in the entire United States.

Two native mammals, the monk seal and the hoary bat, are also being considered in the rare or endangered category. When added to the list of birds, over 20 per cent of the national list of jeopardized wildlife are Hawaiian species. Much concern is also manifested for the future of the green sea turtle.

Animal species are the result of evolutionary changes which covered the span of millions of years. Each species and subspecies developed certain characteristics which fitted it for a special niche in the complex world. Yet, in a relatively short time man has caused the extermination of many species through thoughtless actions. Essential habitat has been destroyed or altered by various means. Animals have been introduced which competed with native forms for food and living space, preyed upon them, or brought strange diseases which took a devastating toll. In some cases certain wildlife species have been decimated for oil, feathers, food or sport. Native Hawaiian wildlife has been tragically subjected to all of these.

Loss of such wildlife is the loss of a unique heritage not only to present, but also to future generations of Hawaiians and all other Americans because many of these species are found nowhere else in the world.





CRESTED HONEYCREEPER (AKOHEKOHE)
Very restricted in rain forest areas on the island of Maui.

Scientists consider one of the Hawaiian bird families, the Drepanididae (honeycreepers), as interesting as those birds of the Galapagos Islands which were made famous by Charles Darwin. This family is a vivid illustration of evolution and adaptive radiation, a term used to denote changes in form, habit, or physiology by a group of animals descended from a primitive ancestor. The most striking feature among the honeycreepers is the diversity of the size and shape of their bills. These range from heavy, thick bills adapted for cracking hard seeds to long, sickle-shaped bills admirably suited for probing flowers for nectar or crevices in tree trunks or branches for insects. Their plumages range from deep black to green, to brilliant scarlets.

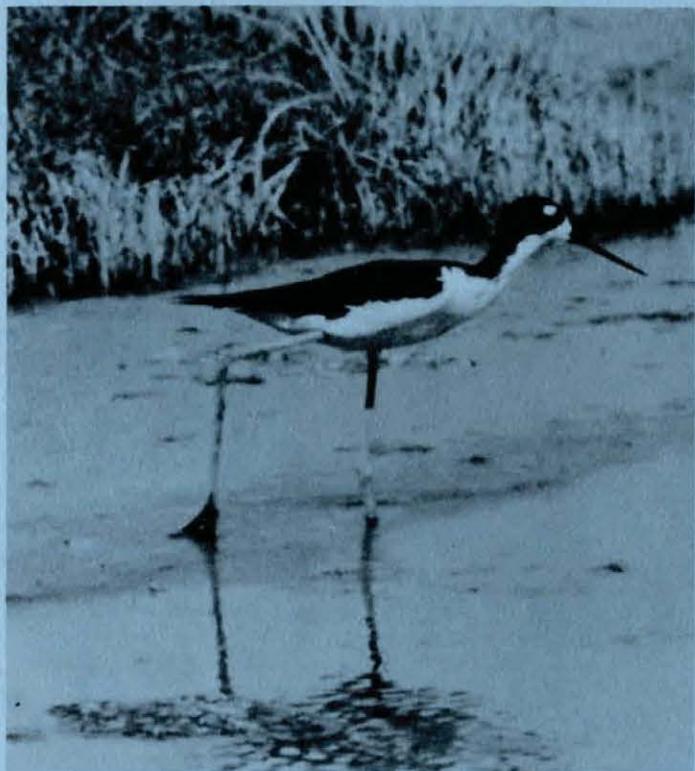
Some birds played an important part in the legends and culture of the ancient Hawaiians. Legend relates how the Hawaiian gallinule (alae ula) acquired its bright red forehead because it was burned while bringing in its bill the gift of fire to the people.



The feathers of the oo, ou, iwi, and apapane were used to make leis and cloaks to adorn the helmets of royalty. Other feathers were used as symbols of authority called kahilis. All these are extremely valuable today as objects of antiquity.

What price can be set on these birds? What will a museum pay for a stuffed one or a zoo for a specimen of a dying species? Can we set a price on the enjoyment of a rare species in its natural environment? Interested persons from all over the world come to Hawaii for a chance to catch a glimpse of the unusual birds and other wildlife. We can get along without these rare birds. We can get along without golf, baseball, music, or art if need be. But would we want to? Each helps make life more complete, interesting, or pleasant.

The sum of human happiness is the fulfillment of the desires and enjoyment of all persons who comprise our population. Preservation of our unique wildlife is a necessary part of the whole. If the endangered wildlife of Hawaii is to be preserved, action is necessary now! Saving Hawaii's wildlife is a challenge for everyone—government, private organizations, industry and individual citizens.



HAWAIIAN STILT (AEO) On Kahana Pond, Maui
Less than 1500 birds have survived the steady destruction of its habitat by man in Hawaii.

Too Late for Twenty-four



KAHILI

Twenty-six species of Hawaiian birds were thought to have become extinct between 1825 and 1963. Two, the Molokai creeper and Maui Nukupuu, have since been rediscovered. But chances of further rediscoveries are very remote.

Causes for the decline or extinction of some species are unknown or obscure. For others, they are dramatically obvious and vivid. This can best be illustrated by what took place when rabbits were introduced about the turn of this century on Laysan Island, a tiny dot in the Pacific between Honolulu and Midway. In the absence of any natural enemies there, the population of these animals literally exploded, and they overran the islands in such numbers that they consumed all the vegetation. As a result the island became a barren waste. The rabbits no longer had food and perished as did thousands of nesting seabirds and their young who were trapped in their burrows by wind driven sands. Most tragic was the extermination of three species of small birds found nowhere else in the world but on this island. The Laysan millerbird was gone by 1923. A scientific expedition that year witnessed the extermination of the last three honeycreepers in a sandstorm. The little Laysan flightless rail was also gone.

Destruction of habitat also occurred on the main Hawaiian Islands. Filling, draining, and drastic alteration of marshes, ponds, and other wetlands has been responsible for reducing the number of waterbirds.

Grazing, especially in lowland forests, by domestic and feral cattle, sheep, goats and pigs destroyed large acreages of native plants used by indigenous birds. The introduction of exotic plants greatly changed other areas. Introduced rats, mongooses, feral dogs and cats, and pigs preyed upon birds, their young, and their eggs. Exotic birds introduced from other lands over many years may have brought with them diseases to which the native birds had no or very little resistance. Mosquitoes which were accidentally introduced probably transmitted some of these diseases from bird to bird.

All these forces are still active today. Twenty-four species gone—how many more will go?



LAYSAN HONEYCREEPER

This bird became extinct in 1923 on Laysan Island. Picture here from book, "Birds of Laysan Island." Photo permission from Dr. Alfred Bailey, Denver Museum.



AKIALOA

Very rare honeycreeper found only in the rain forest on Kauai island.

KAUAI NUKUPUU

Confined to Kauai and Hawaii in very restricted habitat.



Twenty-seven In Trouble

Habitat for waterbirds has declined drastically since 1900. Sub-divisions, hotels, dumps, croplands, and factories have replaced former native environments. The rate of habitat destruction has accelerated in the past decade. Rice and taro fields once provided over 34,000 acres of habitat; today such fields comprise but a few hundred acres. Fewer and fewer ducks and shorebirds visit the islands during their annual migrations across the Pacific.

The numbers of birds dependent on wetlands for food and a place to raise their young have declined as these areas were destroyed. The non-migratory Hawaiian birds like the stilt, coot, duck (koloa), and gallinule are now threatened with extinction because of this loss. Kanaha Pond on Maui, Opaepa on Hawaii, those on the Kaneohe Marine Corps Air Station and Pearl Harbor on Oahu and other small water areas are vital to the survival of these birds. They must be preserved.

HANALEI TARO FIELDS—KAUAI

The best of what is left of favorable waterbird habitat.



KAELEPULU POND—OAHU

Once a favorite waterbird marsh; now drastically changed by housing development.



KANAHA POND—MAUI

The most important waterbird area in Hawaii. Its preservation as a permanent wildlife sanctuary is essential for survival of the Hawaiian Stilt.



WEST LOCH—OAHU

This once excellent waterbird habitat near Waipo is being rapidly diminished by sanitary fill. Some of it still may be saved.

Forest Birds—The majority of Hawaii's endangered birds now live in the forests and mountains of Kauai, Hawaii, Molokai, and Maui. These species have suffered greatly. Twenty are believed to be extinct; 11 are endangered.

The native hawk (io) and crow (alala) are found in small numbers on the island of Hawaii. Indiscriminate shooting has reduced both species to dangerously low levels.

On the mountain slopes of Kauai, the Newell's shearwater (ao) digs its nesting burrow. This is apparently their last stronghold. On Maui and Hawaii, the dark-rumped petrel (uau) is engaged in a similar struggle for existence. The Kauai (oo aa) last of the famous oo, but it, along with the ou and crow are perilously close to joining others in the mists of extinction.



HAWAIIAN GOOSE (NENE)

Habitat generally in lava flows above 5000 foot elevation. Colored leg bands help scientists obtain life history data.



HAWAIIAN CROW (ALALA)

HAWAIIAN HAWK (IO)



KAUAI OO (OO AA)

Last of the famous oo's whose feathers were used for royal cloaks and helmets. This species is extremely rare and is found in the remote rain forests and mountains of Kauai.



One of the most famous of endangered birds is the Hawaiian goose (nene), Hawaii's official bird. An estimated 25,000 inhabited the lava slopes of Hawaii during the late 1800's, but excessive hunting, predation by introduced mammals, and destruction of food and cover by grazing animals reduced the population to less than 50 by 1945. Although careful and costly management has increased the flock to about 500 birds, the nene's future as a wild bird remains precarious.



LAYSAN ISLAND

Only home of the Laysan duck and finch. Three other bird species were exterminated here as a result of man's interference with nature.

Northwestern Hawaiian Islands Wildlife — The small islands strung out in a long chain between Nihoa and Midway are included in the Hawaiian Islands National Wildlife Refuge. On them live four endangered kind of birds; the Laysan duck, Laysan finch, Nihoa finch and Nihoa millerbird. Their future depends on keeping island environments free from change and disturbance. Human use is the biggest threat, for the ecology of these islands is very fragile and changes can be disastrous. A few rats ashore off a boat, a wildfire, a few weed seeds or

LAYSAN DUCK

On Laysan Island their numbers were reduced to 13 by 1923. Restoration of habitat and protection has resulted in their population increasing to about 300 today.



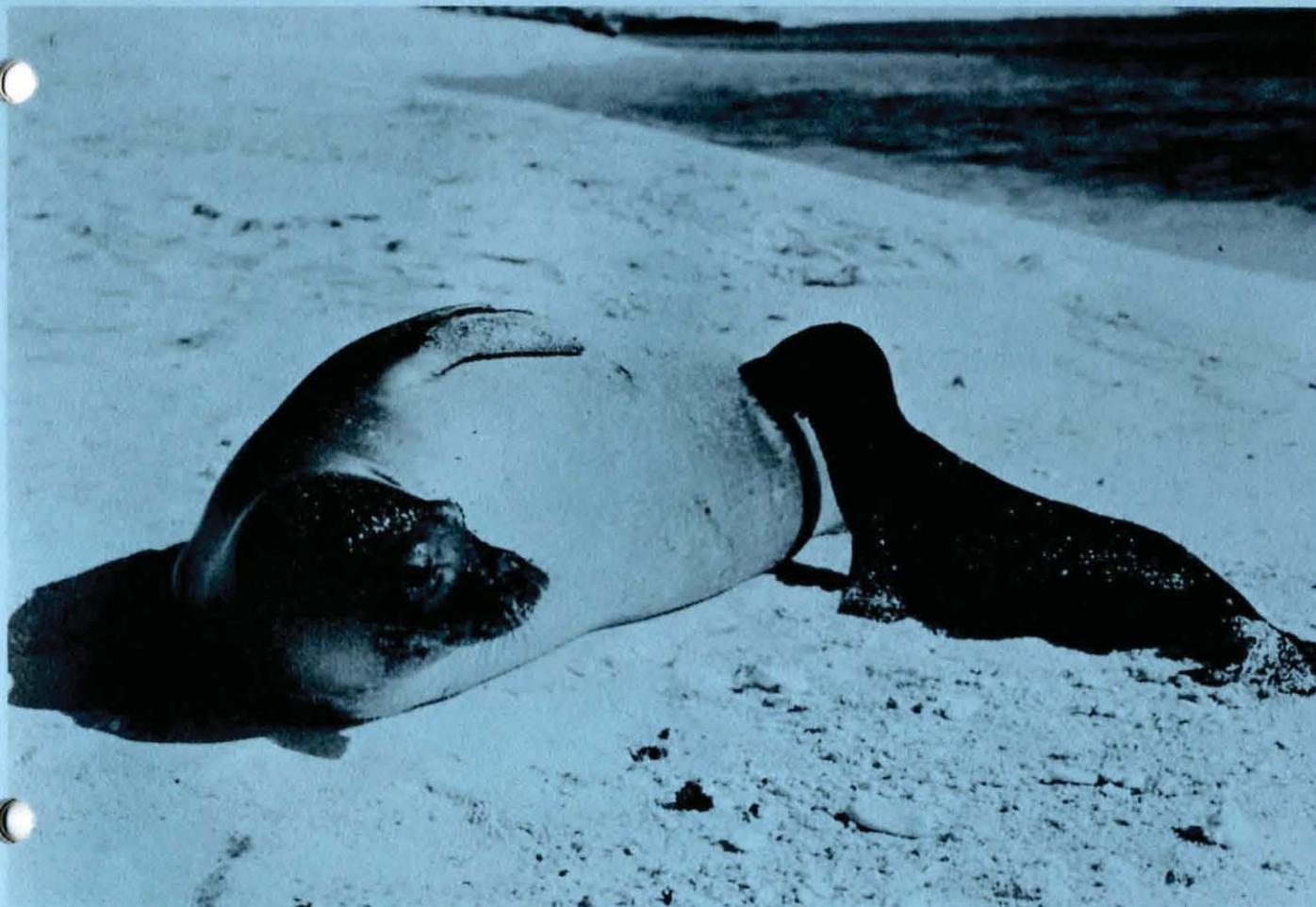
NIHOA ISLAND

Home of the Nihoa finch and millerbird.

destructive insects or their eggs brought in someone's clothing or equipment could mean a swift end of a species.

Also found on these islands is the Hawaiian monk seal. It was nearly exterminated by seal hunters in the late 1800's. Establishment of the refuge in 1909 gave it necessary protection, and now the population is estimated to be about 1,500 animals. It cannot tolerate much human disturbance.

Certain of these refuge islands are the only remaining significant nesting sites for the green sea turtle in Hawaii. The islands must continue inviolate if the turtle is to remain as part of Hawaii's fauna. Because of the value of the refuge to all these animals, only scientists with appropriate permits are authorized to land on the islands.



HAWAIIAN MONK SEAL

Female Hawaiian monk seal and pup on Laysan Island in Hawaiian Islands National Wildlife Refuge. This species is endemic to the remote Northwestern Islands of the Hawaiian archipelago.



GREEN SEA TURTLE

French Frigate shoals in Hawaiian Islands National Wildlife Refuge plays a very important part in the ecology of this wildlife species.



NIHOA MILLERBIRD

This bird is found only on Nihoa Island. An estimated 600 exist here now.

The Action Needed



MONGOOSE

Water Birds—Future survival of the stilt, gallinule, coot and koloa depends mainly on preservation of suitable wetland living areas. The U. S. Bureau of Sport Fisheries and Wildlife and Hawaii Department of Land and Natural Resources have initiated a program to preserve wetlands on all the main islands. The program will include:

1. Working with military agencies for the preservation and enhancement of wetlands on their installations. For example, the Kaneohe Marine Corps Air Station on Oahu has several hundred acres of stilt habitat for which a management plan will be developed. Important stilt habitat also occurs on Navy land at Pearl Harbor.
2. Permanent dedication of certain state and county areas for wildlife such as Kanaha Pond on Maui and Kawainui Swamp on Oahu.
3. Agreements with private landholders to preserve and enhance their wetlands.
4. Possible acquisition by lease or purchase of certain key privately owned wetlands.
5. Possible development of wetlands where none or those of very low quality presently exist.

Forest and Mountain Birds—Emphasis will first be placed on determining where they are found, how many remain, why these birds have declined, and what can be done to overcome decimating factors. This is no small task since most species inhabit high-altitude rain forests far from roads or trails. These forests present very difficult working conditions because of heavy rainfall, thick vegetation, and steep terrain. Federal, State and other scientists will study such areas as Alakai Swamp and other forests on Kauai, the Kipahulu rain forests on Maui, Pelekunu-Wailua plateau on Molokai, and the forests on Hawaii.

Following field surveys, management plans for individual species will be prepared. These may involve habitat preservation of key areas, control of predators, artificial propagation, restriction of certain types of public use on some areas, and similar actions.

Although protected by State law, the hawk and crow are sometimes shot by uninformed persons. Increased public education concerning the value and critical status of these birds, plus continued research of their living needs, will be followed by specific preservation action.



SCIENTIFIC RESEARCH

These forests present very difficult working conditions to scientists because of heavy rainfall, thick vegetation, and steep terrain.

The ground-nesting Newell's shearwater and dark-rumped petrel must be protected from predators. Further investigations may disclose additional nesting areas.

A propagation and release program conducted by the Hawaii Department of Land and Natural Resources in cooperation with the Bureau of Sport Fisheries and Wildlife has been very important in saving the nene from extinction. This program, coupled with field studies of both wild and released birds, will be continued.

FACT GATHERING

Scientist removing apapane from mist net for banding purposes at Alakai Swamp, Island of Kauai. Such banding plays a part in essential life studies.



NENE PROPAGATION—HAWAII

Hawaii's Division of Fish and Game personnel placing colored leg bands on nene at Puhakuloa prior to release in the wild. This banding assists in scientific studies.



NENE HABITAT—HAWAII

A kipuka, or small island of vegetation within rough lava flows, is used as a nesting site by nene. Such areas need to be permanently set aside as nene goose sanctuaries.





TAGGING MONK SEAL

Bureau scientist tagging adult Hawaiian Monk seal for migration studies on Pearl & Hermes Reef. This rare seal is found only in the Northwestern Islands of the Hawaiian archipelago.

Northwestern Hawaiian Islands Wildlife — The birds, seals, and turtles found on the Hawaiian Islands National Wildlife Refuge will continue to be protected and studied. The fact that their remaining populations inhabit a small area makes their situation potentially precarious. Increased efforts will be needed to insure that the ecology of these islands will not be disturbed. Some birds have been transplanted to other suitable islands to prevent extinction of the species should some catastrophe occur on their native island. Studies are in progress to determine the suitability of transplanting other species. Rigid control of all entry must be continued.



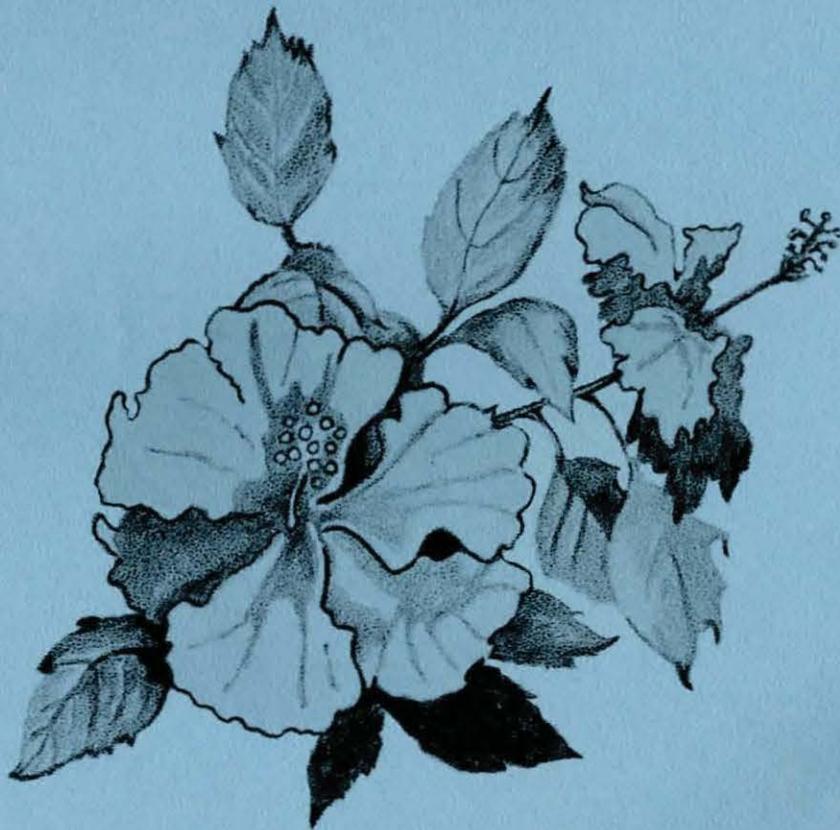
GREEN SEA TURTLE

Tagging green sea turtle for migration studies at Pearl & Hermes Reef, Hawaiian Islands National Wildlife Refuge.

Still a Chance

The words threatened and endangered have been used frequently in this book. They imply that things are bad—and getting worse. This is a true description of the situation today as it relates to Hawaii's endangered wildlife.

It is unfortunate so much has already been lost. Extinct wildlife cannot be brought back, but it is not too late to save those which remain. Government agencies, scientific and educational institutions, private organizations, and individuals working together can preserve Hawaii's unique wildlife for this and future generations of Americans.



HIBISCUS



YESTERDAY

At about the turn of the century—a rice field near Honolulu, Hawaii with wildlife habitat supreme. Photo courtesy of Hawaiian State Archives.

TODAY—1968

Human development has accelerated the disappearance of wildlife and its essential living space.





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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

DECEMBER 1968



HAWAIIAN STILTS IN FLIGHT

Photo courtesy Norman K. Carlson - Bishop Estate Kona, Hawaii



UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORTS FISHERIES AND WILDLIFE