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CONSERVATION STATUS OF BIRDS OF CENTRAL PACIFIC ISLANDS

By Warren B. King

1. By special permission reprinted from THE WILSON BULLETIN, Vol. 85, No. 1, March 1973, pp 89-103.
2. As indicated in the June 1972 issue of THE BULLETIN (84:222) the Conservation Committee of the Wilson Ornithological Society decided to concentrate for this year on bird conservation problems in the Pacific Islands. This report is the second contribution from the committee on this subject.--Gustav A. Swanson, Chairman
3. Paper No. 88, Pacific Ocean Biological Survey Program.

First of Three Installments

In the course of investigations conducted by the Pacific Ocean Biological Survey Program (POBSP) of the Smithsonian Institution, field workers paid visits to a large number of islands in the central Pacific Ocean, many of which are or were important because of the abundance of their bird resources. Visits to many central Pacific islands by biologists have been infrequent, and reports on the conservation status of the biota are difficult to glean from the meagre published information currently available. Berger (1972) has reported on the status of birds from the main Hawaiian Islands, so these will not be discussed here.

...Most of this report is based on surveys conducted between 1963 and 1968; in a few instances the information is current to 1972.

The report will stress man's influence on the islands, even though in some instances it would be difficult to show direct causal relationships between man's activities and deterioration of the bird fauna. In other instances it is all too blatant. I will also indicate where avian predators or potential predators have been introduced, as far as is known. Finally, I will point out where populations of birds are of more than passing significance in terms of the central Pacific breeding avifauna as a whole. There are few landbirds in this area but the seabird populations are vast and varied. This report will stress the status of the latter.

In general, among seabirds, the shearwaters, petrels, and storm petrels are the most sensitive to disturbance and predation. Ground-nesting tropicbirds, terns, boobies, and frigatebirds are somewhat less sensitive, while the tree-nesting boobies, frigatebirds, and noddies are least sensitive. A rapid assessment of the relative health of an island as a seabird habitat may be made by comparing the species representation in these three groups with the species one might predict would occur on an island taking into account climate, vegetation, and terrain. King (1967) lists the seabirds known to occur in the island groups covered in this report.

Northwestern Hawaiian Chain

Theodore Roosevelt proclaimed the Northwestern or Leeward Hawaiian Chain a wildlife refuge in 1909, since which time it has enjoyed relative stability and protection. Seven islands comprise the Hawaiian Islands National Wildlife Refuge. The refuge is administered from Oahu with actual visits to the refuge once or twice a year, dependent upon the cooperation of the U.S. Coast Guard. The administrator has no boat to patrol the islands

over which he has jurisdiction.

Nihoa (0.25 square miles)—Nihoa has two endemic landbirds, the Nihoa Finch (Psittirostra cantans ultima) and the Millerbird (Acrocephalus familiaris kingi), both listed as endangered by the U.S. Department of Interior (1966). The population estimate for 1971 of the former is in the low thousands, and of the latter in the low hundreds (J. Sincock, pers. comm.). Both populations are thought to be stable, and the habitat may be saturated.

In addition Nihoa has representative populations of all the seabird species that are found throughout the Northwestern Chain. Of special significance are its population of Bulwer's Petrel (Bulweria bulwerii), estimated at up to 250,000, the largest known population of this species in Hawaii, and perhaps in the world; Great Frigatebirds (Fregata minor) estimated at 10,000; up to 25,000 Wedge-tailed Shearwater (Puffinus pacificus), and up to 100,000 Sooty Terns (Sterna fuscata) (Clapp, Kridler, and Fleet, in prep.).

Although unauthorized visits to this island are kept to a minimum because landing is difficult, personnel from a U.S. Navy vessel recently placed a sign near the top of the island announcing their visit.

Necker (0.07 square miles)—Necker Island is smaller than Nihoa, has no landbirds, and supports smaller numbers of the same seabirds that breed on Nihoa. Fifty thousand Sooty Terns breed on Necker (Clapp and Kridler, in prep.). It is equally difficult of access, and is less frequently visited than Nihoa.

French Frigate Shoals (0.17 square miles)—French Frigate Shoals is a group of 13 islands, the largest of which, Tern Island, is the site of a U.S. Coast Guard LORAN A Station. Tern Island, now half of the land area of French Frigate Shoals, is mostly man-made, having been enlarged from 11 acres to 56.8 acres in 1942 for a U.S. Navy Air Facility; it now accommodates the station, a runway, and a 129-foot antenna (almost no bird mortality has been caused by this tower). Nineteen Coast Guard personnel inhabit Tern Island. The Coast Guard facility was formerly on East Island, but that island is now abandoned and seabirds breed there again in large numbers. A written agreement drawn up in 1965 between the Coast Guard and the U.S. Bureau of Sport Fisheries and Wildlife forbids use of any but Tern Island by the Coast Guard. Between 1952, when the Station moved from East to Tern Island, and 1965, there was apparently no formal agreement about the use of the refuge by the Coast Guard. Coast Guard personnel have been permitted to keep dogs (three are presently on the island), and at one time or another, but not presently, cats and pigs were present as well. The dogs are restricted to Tern Island, where they occasionally harass green sea turtles (Chelonia mydas) and Hawaiian monk seals (Monachus schauinslandi). French Frigate Shoals is the most important breeding site for green sea turtles in the Hawaiian Islands. Seabirds continue to breed there in undiminished numbers; a breeding population of 120,000 Sooty Terns is present. No rats occur there in spite of military activity.

The Refuge Manager, Eugene Kridler, introduced 27 Nihoa Finches to French Frigate Shoals in March 1967. They have nested in crevices in piles of concrete blocks near the buildings on Tern Island. The population had declined to three by 1968, but was back to nine by 1971 (Amerson, 1971).

Gardner Pinnacles (0.01 square miles)—Gardner Pinnacles is nearly impossible to land on from the sea. In 1961 or 1962 the U.S. military made an unauthorized landing on Gardner Pinnacles as part of their HIRAN project, one purpose of which was to determine the exact location of several of the Northwestern Hawaiian islands for navigational purposes. Among other activities the landing party blew the top off the island with explosives to create a flat area for future helicopter landings. Part of the work of the Refuge Manager in his 1969 inspection of Gardner Pinnacles was to clear some of the refuse left behind by the military.

Because of its small size Gardner Pinnacles has small populations of the representative seabirds, including the northernmost breeding population of the Blue-gray Noddy (Procelsterna cerulea) (Clapp, in press).

Laysan (1.56 square miles)—Laysan has had a colorful history which includes guano mining, feather poaching, seal killing, and egg collecting on a massive scale. It had five endemic land or water birds, two of which, the Laysan Teal (Anas laysanensis) and the Laysan Finch (Psittirostra c. cantans), survived defoliation of the island by introduced European rabbits (Oryctolagus cuniculus) and exist now in relatively stable

numbers. The story of the extinction of the other three landbirds from Laysan is too well known to need repeating here (see, for example, Laycock, 1970). The teal fluctuates in abundance, having dropped recently to the very low hundreds in September 1971 (J. Sincock, pers. comm.). With a population of about 10,000 birds (Ely and Clapp, in press) the Laysan Finch has apparently saturated its habitat. Laysan has the largest known population of several species of seabirds: 300,000 Laysan Albatrosses (Diomedea immutabilis) 40,000 Black-footed Albatrosses (Diomedea nigripes), 200,000 Wedge-tailed Shearwaters, and 2,000 to 3,000 Sooty Storm Petrels (Oceanodroma markhami), the last nesting along the edge of the central lagoon in an area where storms must cause frequent flooding of burrows. Other notable populations include several hundred thousand Bonin Petrels (Pterodroma hypoleuca), a Sooty Tern colony of approximately 2,000,000 birds, several thousand Red-tailed Tropicbirds (Phaethon rubricauda) and 1,000 Blue-faced Boobies (Sula dactylatra) (Ely and Clapp, in prep.).

There have been numerous authorized and unauthorized visits to Laysan. Among the latter was a U.S. Military visit in early 1963 as part of the HIRAN project. Burrgrass (Cenchrus echinatus) became established as a result of this visit, expanding outward concentrically from the abandoned military campsite on successive visits by POBSP or refuge personnel. The Refuge Manager has been successful in controlling this species. A second inadvertent introduction, hairy horseweed (Conyza bonariensis), became established in the late 1960's and promises to be more difficult to eradicate.

In 1970 a Japanese fishing vessel was shipwrecked on the reefs surrounding Laysan. The crew members lived briefly on Laysan before being rescued. The vessel was known to contain rats of uncertain species, but they may not have reached the island. The U.S. military was granted a special use permit to lay large canvas tarpaulins on Laysan and Lisianski as high resolution targets for satellite reconnaissance. The Refuge Manager collected 18 pounds of seeds of 20 species of alien plants from these tarpaulins. A letter from the Secretary of the Interior was required to convince the U.S. military that the tarpaulins should be removed.

Lisianski (0.07 square miles)--Lisianski Island has large populations of seabirds, including the largest known population of Bonin Petrel, estimated roughly at one million birds. Other notable populations include 8,000 Laysan and 3,000-4,000 Black-footed Albatrosses, a Sooty Tern colony of approximately 1,000,000 birds, and large colonies of Great Frigatebirds, Red-footed Boobies (Sula sula), and Red-tailed Tropicbirds. Historically there was a large population of Bulwer's Petrels, but these evidently were extirpated, or nearly so, by rabbits (Clapp and Wirtz, in prep.). Alexander Wetmore exterminated the rabbits on Laysan and Lisianski in 1923.

Pearl and Hermes Reef (0.14 square miles)--Pearl and Hermes Reef, comprised of nine islets, is presently uninhabited. A pearl-oyster gathering industry thrived between 1928 and 1930 on this atoll. The pearl fishermen built four houses which survived until World War II. Rabbits were introduced in the early 1920's but were extirpated within three years. Pearl and Hermes Reef has large populations of Bulwer's Petrels and Sooty Storm Petrels in addition to smaller populations of most of the other seabirds relative to populations on other Northwestern Hawaiian islands (Amerson, Clapp, and Wirtz, in prep.).

In 1967 the Refuge Manager transplanted 12 Laysan Teal and about 100 Laysan Finches to Southeast Island (34 acres), the largest of the atoll. The former did not survive. The latter have bred successfully and have increased to several hundred at last census in 1971 (J. Sincock, pers. comm.) and may well have saturated their habitat on Southeast Island.

In 1961 or 1962 there was an amphibious landing on Southeast Island. An 18-foot observation tower, 50 oil drums and a dismantled house were left behind. The amphibious vehicle left tracks across the island which persisted for several years. The tread of the vehicle probably carried seeds of the mustard Brassica to the island. A major portion of each visit by the Refuge Manager is now spent treating the fast-spreading Brassica with herbicides and pulling up new plants.

Midway (3.1 square miles)--Midway is not in the Hawaiian Islands National Wildlife Refuge. It has been a U.S. Naval Station since 1903. It has two major islets, Sand Island, the site of the Naval Air Station, on which 2,000 military personnel reside, and Eastern Island, which has runways as well, but has in the recent past been used as a large communications base. Midway has had continuous human occupancy since 1903 and is the most

altered of the Northwestern Hawaiian Chain. Fairly large numbers of seabirds continue to nest on Midway in spite of the efforts of the U.S. Navy to remove them from some parts of the island. Both albatrosses, which were killed in vast quantities by Japanese plume hunters, increased markedly from U.S. Navy protection, but have declined somewhat in recent years.

Sand Island is officially a bird sanctuary; a \$50 fine accompanies the killing of an albatross, or "gooney," as they are known there. The official posture of the U.S. Navy toward the birds of the island is one of benevolence, yet there is constant conflict between birds, primarily the two species of albatross, and the military's interest in maintaining safe air transport. Cessation of the Early Warning Barrier flights caused air traffic at Midway to decrease sharply in the past few years, and aircraft strikes of birds, once a problem of major dimensions (Robbins, 1966), has declined accordingly. However, the price for decreased air strikes has been the paving over in 1964 of all land 750 feet from the centerline of each of the three runways on Sand Island, necessitating the destruction by asphyxiation of 18,000 incubating albatrosses, 13 percent of Midway's and about 5 percent of the world's population. Recently all active nests on Sand Island's golf course have been destroyed to keep the area open for recreation. Here we have an example of the ethical paradox by which government sanctioned mass killing is permissible, while the same activity conducted on a small scale by individuals is heavily penalized.

Sand Island still maintains large breeding populations of both albatrosses and Red-tailed Tropicbirds. Black Noddies (Anous tenuirostris) and White Terns (Gygis alba) breed in good numbers in introduced Casuarina trees between the barracks. Introduced populations of Canaries (Serinus canaria) and Rock Doves (Columba livia) have been maintained for many years. Laysan Rails (Porzanula palmeri) survived on Midway until 1944. An attempt to reintroduce them to Laysan by Alexander Wetmore in 1923 failed because the vegetation had not yet recovered.

Eastern Island has Midway's remaining population of frigatebirds and boobies, and a substantial colony of 350,000 Sooty Terns. The Sooty Tern colony relocated on Eastern Island after official harassment programs on Sand Island in 1957 and 1958 chased them off. Unofficial policy, confided several times to POBSP personnel engaged in field work on Eastern Island, was the encouragement of the destruction of Sooty Tern eggs, young and adults. Navy personnel participated in "chick-stamps," and admitted to clubbing adult Sooty Terns from the air with sticks on several occasions. Dogs were brought from Sand Island to Eastern for the express purpose of running them through the incubating albatrosses.

Fisher (1966 and 1970) gives accounts of the destruction of hundreds of albatrosses on Eastern Island from striking guy wires of the antennas of the communications system there. In 1967 the antennas were demolished by explosives and pushed by bulldozers to the sea's edge through the thousands of Sooty Terns then incubating eggs in the antenna fields.

The black rat (Rattus rattus) is present on both islands of Midway and probably preys on seabirds and their eggs. Cats are forbidden on Midway.

Kure (0.33 square miles)—Kure is under the jurisdiction of the State of Hawaii. It is a wildlife sanctuary. It has a 4,000-foot runway of packed, crushed coral, and a U.S. Coast Guard LORAN C Station was constructed there in 1960. A complement of 24 Coast Guard personnel is normally present. The LORAN C antenna is a 625-foot tower, guyed by steel cables that fall just short of spanning the island's width. A 70-foot radar reflector tower is also present. The Coast Guard personnel have not seriously disturbed the breeding seabirds of Kure. Dogs have been kept as pets intermittently, and a pig, scheduled as the prime attraction at a feast, also became a pet, but these have not caused undue damage.

A colony of 25,000 Sooty Terns which became established in 1963 originated, in part at least, from displaced individuals from the harassed Midway population. The populations of Blue-faced Boobies and Hawaiian monk seals have declined historically, the former due to disturbance associated with construction of the antenna, the latter due to repeated disturbance by man and at certain times by dogs.

A squirrel monkey (Saimiri sp.) lived free on the island from 1961 to 1967, but rarely disturbed birds.

The Polynesian rat (Rattus exulans) population on Kure fluctuates widely from season to season (20-77 rats per acre). Kepler (1967) reports this rat preys on Laysan albatrosses, Bonin Petrels, Sooty Terns, and Brown Noddies (Anous stolidus) on Kure. Bonin Petrels lay up to 500 eggs annually on Kure, but no egg hatched during the five

years POBSP personnel were present (Woodward, in press).

Kaula Rock (0.21 square miles)--No account of the Northwestern Hawaiian Chain should omit Kaula Rock. Most accounts do. While it is south of and closer to Niihau, the westernmost Main Hawaiian island, its avifauna is typical of the Northwestern Chain. The only avifaunal survey of the island was in 1932 (Caum, 1936), and it revealed that Kaula is inhabited by Bonin Petrels, Brown Noddies, Sooty Terns, Blue-gray Noddies, Gray-backed Terns (Sterna lunata), White Terns, possibly Black-footed Albatrosses, Bulwer's Petrels, Wedge-tailed Shearwaters, Red-tailed Tropicbirds, three booby species and Great Frigatebirds (Fregata minor).

Kaula is under the administrative jurisdiction of the U.S. Department of Navy and has been used as a bombing target by the Navy since 1952. In 1932 a lighthouse was constructed on the summit of Kaula. The construction crew reported the presence of a rat of unknown species on the island.

To be continued

American Ornithological Union Checklist Supplement

By Erika M. Wilson

In 1886 the A.O.U. published a checklist of bird species seen in the United States. They have expanded and up-dated the checklist by publishing new editions and issuing supplements which appear at irregular intervals in the A.O.U. journal, The Auk. In April 1973 the Committee on Classification and Nomenclature issued the first supplement to the 5th edition of the checklist.

Changes in the checklist are of two types: (1) Changes which seek to unify the nomenclature so that ornithologists all over the world can talk about specific species without misunderstandings, and (2) Changes which seek to classify birds more accurately on the basis of new knowledge of species relationships.

The first type of change is made in keeping with the decisions of the International Code of Zoological Nomenclature. Five such changes affect the listing of species in the H.A.S. handbook, HAWAII'S BIRDS, (1971).

p. 19 SHOVELER becomes NORTHERN SHOVELER.

p. 32 The scientific name of the WANDERING TATTLER is slightly changed in its spelling Heteroscelus incanum becomes Heteroscelus incanus.

p. 78 KNOT becomes RED KNOT.

p. 78 PIGEON HAWK becomes MERLIN.

p. 78 SPARROW HAWK becomes AMERICAN KESTREL.

These last two changes have been urged for some time, because these birds are not true hawks; they are falcons. Their new official names are less misleading and have been used unofficially by many ornithologists.

The second type of change is in classification of species. The A.O.U. Committee decides to reclassify a species when it feels there are sufficient scientific grounds to do so; the papers on which the Committee bases its reclassifications are listed in the supplement after each change. There are six changes of this type which affect the H.A.S. handbook, HAWAII'S BIRDS (1971).

p. 19 The genus of ducks formerly classified as Spatula has been merged with the genus Anas; the scientific name of the NORTHERN SHOVELER is now Anas clypeata.

p. 26 The CHUKAR is considered a separate species from the ROCK PARTRIDGE; its scientific name is now Alectoris chukar.

p. 33 The SANDERLING, with several other shorebirds, has been included in the genus Calidris from its former genus Crocethia. Its scientific name is now Calidris alba.

p. 75 The CARDINAL has a new generic name as do all members of the Richmondinae. This change, directed by the International Code, replaces the entire sub-family name of Richmondeninae with the name Cardinalinae. The CARDINAL is now properly called Cardinalis cardinalis.

p. 78 The COMMON TEAL and the GREEN-WINGED TEAL have been merged into one species, the GREEN-WINGED TEAL. The two races may be distinguished by the names "Eurasian Green-winged Teal" and "American Green-winged Teal," but for life lists they are now considered one species.

There are many other changes in the A.O.U. supplement, some of which merge species, others of which create new species. H.A.S. members should note that the A.O.U. has

decided to expand the next edition of their checklist to include all of geographical North America, including the Hawaiian chain, Mexico, the West Indies, and Central America. Peterson's A FIELD GUIDE TO WESTERN BIRDS (1961) will be the basis for Hawaiian species names unless sufficient evidence is presented to the contrary. The A.O.U. ruling provides us with an opportunity to give several Hawaiian races of North American birds distinct common names, as in the case of the Hawaiian Stilt. Mainland birdwatchers will want to read the April 1973 issue of The Auk (Vol. 90, No. 2, pp. 411-419) for additional information.

TELL 'EM NOW: NO EELS! NO HOW! NO WAY!

By Alan C. Ziegler

At an October 24 Public Meeting at Laie, Oahu, Pacific Aquaculture Corporation (also known as Fish Farms Hawaii) announced it had decided it might not be such a good idea to try to ship eels into Laie, after all. The firm's spokesman, Kenneth Kato, further disclosed for the first time at this Meeting that the original 100,000 young eels OK'd for importation by Mr. Frederick Erskine, head of the State Department of Agriculture, were in reality only a "starter" lot. Between 10 and 20 MILLION eels will be maintained in the State when (and if) Mr. Erskine allows this private company's operation to begin.

Mr. Erskine apparently now has given up in his attempt to get Kenneth Kato's eel operation established anywhere on Oahu but says, unless persuaded otherwise, he may now help Kato & Associates look for a Neighbor Island site at which to carry out their eel-raising scheme. The islands of Hawaii and, particularly, Kauai were specifically mentioned.

So, if you don't especially care to have Mr. Erskine talking our Board of Agriculture into permitting these millions of eels to be imported to your Island, telephone or write your local Officials and Legislators, as well as your County's Member of the Board of Agriculture (listed below), as soon as possible.

Chairman: Frederick C. Erskine, Dept. of Agriculture, PO Box 5428, Hon. HI 96814, 941-3071
Oahu: Irwin Higashi, 94-075 Leokane St, Waipahu, Oahu 96797, 677-9105 (1st term expires 12/31/76)

Kalfred Yee, Garden City, Kahala Mall, Hon., HI 96816, 737-9858 (1st term expires 12/31/73 or later)

Wallace Nitta, 41-520 Hihimanu St, Waimanalo, Oahu 96795, 259-7911 (2nd term expires 12/31/73)

Maui: Fred M. Ogasawara, 44 Market St, Wailuku, Maui 96788, 244-9623 (2nd term expires 12/31/75)

Kauai: John K. Teves, R.R.1, Box 410, Kapaa, Kauai 96746, 822-4981 (still serving beyond end of 2nd term, which legally expired 12/31/69)

Hawaii: Position vacant

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The following resolution with a cover letter was sent to Mr. Frederick Erskine, Members of Board of Agriculture, Office of the Governor, Office of Environmental Quality Control, and News media representatives on 19 October 1973 by Acting President Wayne Gagne:

RESOLUTION RELATING TO THE PROPOSAL TO RAISE FRESHWATER EELS IN HAWAII

WHEREAS, Hawaii's free-running streams support a unique and valuable but little known ecosystem containing such life forms as Koloa, Hihiwai, Opae, and O'opu, four of which (O'opu nakea, O'opu nopili, Lentipes concolor and Lentipes siminudus) are now on the rare, endangered and threatened species list of the American Fisheries Society; and

WHEREAS, eels are general predators of various fish and young water birds and are extremely difficult to contain in captivity because they are capable of climbing and moving overland; and

WHEREAS, the State's Guidelines for the Preparation of Environmental Impact Statements call for an E.I.S. before an exotic animal is brought to Hawaii; and

WHEREAS, the majority of scientists reviewing the eel proposal have advised strongly against its approval; and

WHEREAS, there has been no opportunity for individuals and organizations to study and comment on this proposal; now, therefore,

BE IT RESOLVED, by the Hawaii Audubon Society at its October 15, 1973 general meeting that the Board of Agriculture be asked to re-evaluate its action permitting the importation of 100,000 eels; and

BE IT FURTHER RESOLVED, that copies of this Resolution be sent to Frederick Erskine, Chairman, and the Board of Agriculture; the Office of Environmental Quality Control; the Office of the Governor; and representatives of the news media.

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HONOLULU STAR-BULLETIN, 6 October 1973, page A-8: The Unagi Eel Controversy by Harry Whitten

The following article is very important for everyone to read and find ways to stop the government agencies to permit questionable undertakings despite opposition from scientists and public without thorough hearings. Any suggestions? Please write to Kojima, 725-A 8th Avenue, Honolulu, Hawaii 96816.

"Slippery as an eel" is a descriptive phrase with an obvious meaning.

Action last week by the State Board of Agriculture in approving importation of elvers (young eels) for an eel farm has raised a slippery question for which all the answers are not obvious. The Board approved the application of Pacific Aquaculture Corp., doing business as Fishfarms Hawaii, to import thousands of unagi eels for the proposed eel farm near Laie despite warnings from several scientists. Mixed in with the arguments over eels are such matters as food needs in the Orient, Hawaii's need for new industries, and the possibility of eels escaping and damaging Hawaii's ecosystem.

What is a unagi eel? ...The unagi, popular among both Japanese and Chinese, has the scientific name of Anguilla japonica (Japanese eel) but related species are found in Australia and throughout the South Pacific. The European eel, also savored as food, is a close relative. The eel, while shaped like a snake, is a fish.

The demand for eel is so great in Japan that the Japanese import eels from Australia, the Philippines and other Pacific areas, and Europe to supplement unagi in their home islands.

"There is a world shortage," says Frederick C. Erskine, Chairman of the Board of Agriculture. "The Japanese are paying \$3-4 a pound for it. We want some of the action for Hawaii." He said that the eel venture is not something new sprung on the public, that the Agriculture Department has been trying for the last two years to develop an aquacultural industry for unagi, and that he has studied unagi farms on trips to Japan. On his most recent trip he also looked at how unagis are raised on Taiwan.

Fishfarms would raise eels primarily for shipment to Japan; what eels are sold on the local market would be killed first. Live unagi have been imported into Hawaii and sold at certain local markets since 1948 at least. Because of worry that unagi might be released into the wild, either by accident or purpose, the Board of Agriculture will not permit markets to import live eels in the future.

Erskine said that the board would not have approved Fishfarms application if it believed the farms' eels might get loose. ...The eels would be raised in a closed system. The farm would have a big sump, from which water would be taken to specially made steel tanks, lined with plastic, where the eels would be grown. The water would flow from the tanks to other tanks where prawns would be grown, and then back to the sump. Fishfarms promised security measures to prevent theft.

Erskine said that representatives of the Agriculture Department and State Fish and Game Division will monitor the eel farm's operation, step by step, and stop the operation if security measures are inadequate.

The eels will not be released in streams.

Michio Takata, Fish and Game Division director, admitted he was dubious at first about the importation but agreed to go along if adequate security measures were adopted and if the importer were held responsible for eradicating any that escaped. He said the eels, if they did become established, would upset the fresh water ecology although there is a question if escaped eels would serve as a nucleus for a breeding population.

Dr. John A. Maciolek, marine biologist, thinks it quite probable that the eels would escape and become established here. They would pose a hazard to native species, such as 'opae (native shrimp), if they became established. "We have no native eel," he says. "Native fauna has no protection." He said eels are avaricious feeders and could clean out drainage systems. The Japanese eel is naturally a creature of flowing streams. It would take several years for a colony to become established and there's no certainty eels could establish a colony here if they did escape. They live in fresh water but return to the ocean to spawn in salt water. The migration from fresh water, to the

ocean, and back up the streams takes several years. The migration is instinctual; no one can predict whether they would return to Oahu streams.

The Agriculture Board has also been criticized for its procedure in approving the eel farm's application; Alan Ziegler, zoologist and member of the Animal Species Advisory Commission, says much is not known about eels and the issues should be discussed at hearings. He thinks eels are bound to get loose sooner or later. Erskine says the Agriculture Board cannot hold public hearings because it is required by law to get the advice of scientific advisory committees before acting. It consulted with its Advisory Committee on Invertebrates and Aquatic Vertebrates before approving the application. The board is switching to a new system, whereby advice is given by a new Advisory Committee on Plants and Animals, the first meeting of which was held Friday. The Board will hold a public meeting on the eel question, Erskine said. Time of the meeting will be publicized and interested persons will be invited, he said.

A question has also been raised about a neurotoxin in the eel's blood which would cause serious infection if it got into cuts or wounds of persons cutting up eels. The toxin is not in the teeth. Maciolek points out that eels would bite if they are stepped on, however.

Every once in a while a fresh-water eel is found in Hawaii which, while not native, has been here for a number of years. This is Flutea alba, the so-called rice field eel. It lives in old taro patches, Kawainui Swamp or warm, muddy water. It is very secretive and apparently causes no damage. It is brown and yellow in color, two or three feet long. Its bite is not venomous, but infection could develop from the bite. There's not much possibility of being bitten by it, however.

The eel farm project raises several environmental questions for which clear answers are not yet evident. (1) The farm would probably be a welcome addition to Island economy--if environmental damage doesn't result from escaped eels. (2) The security measures are probably sufficient to prevent escape--but many scientists doubt if it's possible to be certain. (3) The legal requirements for action by the Agriculture Board were met--but Maciolek and others think the action should be reconsidered.

Ziegler and others point out there are a great many things about eels that local scientists and government officials don't know, because they've had no reason up to now to find out. They think there should be more public discussion. In the meantime, they point to damage done to Hawaii's ecosystem by exotic mammals, birds and plants, although no damage was expected when the exotic species were introduced.

HONOLULU STAR-BULLETIN, 27 October 1973, page A-10: The Case Against the Eels by Harry Whitten

Pacific Aquaculture Corp. has decided not to raise eels in a commercial farm at Laie, after finding the community was dead set against the project. The corporation still has a permit from the State Board of Agriculture to import 100,000 elvers, or baby eels. ...

Before the controversy is forgotten, it might be well to hear the views of Dr. Claus Sattler, who probably has more first-hand knowledge concerning eels than most of the others who have expressed opinions. ...

The European or Atlantic eel (Anguilla anguilla) is common throughout Europe and is the variety proposed for raising at Laie, although importation would be from Japanese suppliers. Here are Sattler's opinions on major questions raised about eels:

Would they escape? Very probably. They might escape while being handled, or get into mud, or into holes. Their food value increases possibility of poachers stealing them. Unlike other fish, eels can survive in air for a considerable time, can travel on land, through wet grass or mud. Dr. John E. Bardach, head of the Hawaii Institute of Marine Biology, agrees they would probably escape and get into streams.

Can they establish a breeding population? Probably not. Bardach says chances are practically nil. Sattler agrees chances would be improbable, but hesitates about being absolutely certain. Eels live in fresh water, but return to salt water to spawn. Most authorities say the Atlantic eels spawn in the Sargasso Sea, but Sattler says it is not known for sure where they spawn. He points out that fauna are sometimes quite adaptable; that some Hawaiian insects, for instance, have changed their habits pretty rapidly. If the Japanese suppliers found difficulty getting elvers from Europe and brought in Pacific eels, close relatives of the European eel, chances of establishing a breeding population

might increase. This could be disastrous to fauna in streams on Kauai or the Big Island.

Would eels be a danger to Hawaiian streams? Very definitely, says Sattler. Even if they never establish a breeding population, escaped eels could pretty well clean out the fauna in Hawaiian streams before they die of old age. Eels live for years and are voracious eaters, mostly of other animal life. Sattler says that Hawaiian fauna are unique. The Hawaii Audubon Society points out that Hawaii's free-running streams support a little known ecosystem containing such shellfish as hihiwai, 'opae, and o'opu. Some varieties of o'opu are on the rare, endangered and threatened species list of the American Fisheries Society. The koloea, or Hawaiian duck, is found along Kauai streams, and eels are known to kill young waterbirds.

Other objections to eels? Sattler says there has been talk about the toxin in eel's blood, but he sees no direct danger. ...There is a toxin, but it has to be injected into blood stream to cause infection. The eel is not apt to bite a person wading or swimming in streams, although Sattler has been bitten when he caught eels on spears. He says European folklore contains many stories about what eels have done. These stories emphasize that respect should be given to what eels can do, he says.

ALOHA to new members:

Patricia Bloedon, 1020-B Spencer St, Honolulu, Hawaii 96814
 Timothy A. Burr, 45-090 Namoku St, Kaneohe, Oahu 96744
 Mrs. Erika Wilson, 1504 Liholiho St, #401, Honolulu, Hawaii 96822
 Winifred Y. Yamashiro, 3168-B East Manoa Road, Honolulu, Hawaii 96822

1973 Christmas Bird Count

The Honolulu Christmas bird count is scheduled for Sunday, 16 December 1973. The count is conducted within a circle 15 miles in diameter, centered close to Nuuanu Pali. This same area has been covered each year since 1954. General coordinator will be Erika Wilson with groups assigned to territories as follows:

Group A: Kaelepulu Pond, Kawainui Swamp, Kailua residential area, and Kaneohe MCAS
 Group B: Aiea Trail
 Group C: Keehi Lagoon, Salt Lake, and Nuuanu Valley
 Group D: Punchbowl and Tantalus
 Group E: Manoa Valley, Manoa Falls Trail, and downtown Honolulu
 Group F: Kapiolani Park, Zoo, and Ewa side of Diamond Head
 Group G: Diamond Head Crater (inside) to Paiko Lagoon and Kuapa Pond & residential

All members and guests are welcome to participate in the count. Please call Erika Wilson, 523-1843 to arrange meeting place and time.

Full details and discussion of count plans will be given at the annual meeting.

HAWAII'S BIRDS, a field guide, is available for \$2.50 postpaid, Airmail 50¢ extra. Send in orders to: Book Order Committee, Hawaii Audubon Society, PO Box 5032, Hon., HI 96814

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DECEMBER ACTIVITIES:

10 December - PLEASE NOTE DATE. Annual meeting at the Waikiki Aquarium Auditorium at 7:30 p.m. Program for the night: (1) Elect officers (2) Work out details of the Christmas bird count (3) Initiate new sound color film (about 1/2 hour) -- Guided by the Nene.
 16 December - Christmas bird count.

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