



## HAWAIIAN MONK SEAL INSHORE DIVING BEHAVIOR

by Mark J. Rauzon<sup>1</sup> and Karl W. Kenyon<sup>2</sup>

Hawaiian monk seals (*Monachus schauinslandi*) were observed diving and surfacing at Tern Island, French Frigate Shoals, Northwestern Hawaiian Islands (23° 52' N, 166° 17' W) from 22 March to 27 May 1977, 18 to 22 May 1979 and 11 to 21 March 1980. Seals were also seen diving into a school of *opelu* (*Decapterus* spp.) on 18 February 1981 at Nihoa Island (23° 06' N, 161° 58' W). The only other published observations on diving of monk seals are Taylor (1977) who reported underwater air storage in coral caverns by this species; Whittow (1978) who reported submergences of a captive seal and Sergeant et al. (1978) who reported a diving depth of 75 m by a closely related species, *M. monachus*. Habitat use by an endangered marine mammal is an important consideration when measures are to be formulated for the preservation of that species. It is for this reason that we report here the frequent and prolonged use of inner atoll lagoon waters by individually recognizable Hawaiian monk seals. No such previous habitat use by monk seals has been recorded.

During daylight hours, we timed visible phases of diving behavior including: time of surface, number of respirations while at the surface, and time submerged. Nocturnal behavior could not be monitored although the pattern of sounds resembled exhalations noted during the day. Standing behind bulkheads which contain Tern Island, we looked down on seals swimming in a channel that had been dredged to depths of 2 to 9 m. The channel contains metal debris that serves as habitat for many marine organisms, including species such as Spiny lobster (*Panulirus marginatus*), octopus (*Cephalopod* spp.) and eels (*Muraenidae* and *Congridae*) which are found regurgitated on the beaches by seals. Several attempts were made using snorkling gear to obtain underwater observations.

Five adult seals were repeatedly recognized by their scars, white pelage marks or distinctive over-growths of green algae (*Pringsheimiella scutata*) (Kenyon and Rice, 1959). One seal, occasionally two, were usually present in the observation area. Juvenile seals rarely entered the diving area, although several habitually hauled out on Tern Island. Twice, passing juveniles were threatened by adults. On two occasions while snorkling, we observed diving seals; they emitted the deep-throated "bubbling" sound (Kenyon and Rice, 1959). By observing their underwater movements, we determined that the seals were not sleeping on the bottom as other phocids are known to do (Scheffer and Slipp, 1944; Lockley, 1967).

During 94 hours of observation, we timed 265 dives. Dives averaged 9.5 minutes (SD = 5.4, Range 1 - 31 min.). Identified seals accounted for 152 dives (57%). Approximately 7% of the longer dives may represent "double-dives", twice as long as the average dive length. We may have failed to see animals surfacing close to the bulkhead or out of our field of vision. Although these suspect dives are included in our analysis, their effect on the mean duration was less than 1 min. (8.6 vs. 9.5 min.). We grouped dive durations by 3 minute intervals to express variability (Table 1). Most dives (70%) lasted 4 to 12 min.

Between dives, the typical seal would remain motionless at the surface, often with eyes closed and mid-back exposed. While exhaling, it would raise its head; while inhaling it would dilate its valve-like nostrils (Fig 1). The head was usually lowered beneath the surface for several seconds until the next breathing cycle. We counted 2,046 breaths during 241 surface breathing periods. These averaged 8.5 breaths per breathing period (Range 1-14). We timed 163 breathing periods which

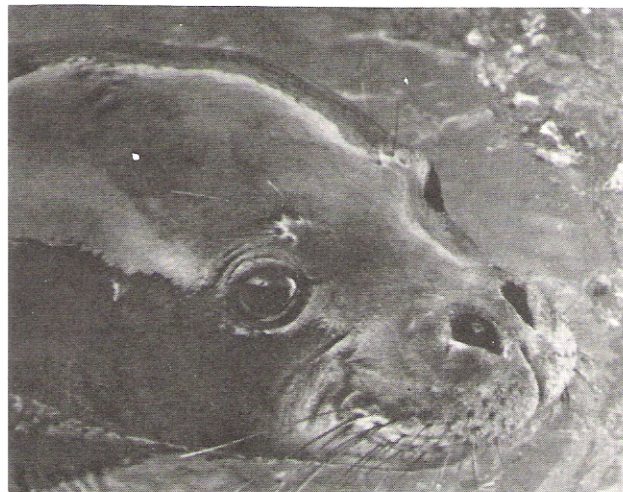


Fig. 1. Adult female Hawaiian monk seal, inhaling, nostrils expanded, immediately prior to diving. Note vestigial auricular pinna posterior to the eye. This seal, having whitetipped foreflippers, dove for long periods in lagoon waters near Tern Island, French Frigate Shoals, Northwestern Hawaiian Islands. (KWK 77-9-31, 22 March 1977).

Table 1. Length of dives by Hawaiian monk seals grouped by three minute intervals.

Length of dives Min.	Number	Dives
		%
0 - 3	18	6.8
4 - 6	62	23.4
7 - 9	88	33.2
10 - 12	35	13.3
13 - 15	29	10.9
16 - 18	15	5.7
19 - 21	8	3.0
22 - 24	6	2.3
25 - 27	2	0.75
28 - 31	2	0.75
Totals	265	100.0

averaged 58.3 s (Range 15-120 s). Upon completing a breathing cycle, the seal would roll forward, exposing progressively the back, sides and hind flippers above the surface as it submerged. A similar behavior has been observed in the related Bearded seal (*Erignathus barbatus*) (Kenyon, 1962) but not in any other *Phoca* spp.

Individual seals spent many continuous hours diving. One adult female (possibly pregnant) identified by white tips on both front flippers, was monitored for 9.4 h until darkness obscured her activities. Repeated observations of recognizable seals suggest that certain individuals habitually dive in the same waters. One white-spotted adult male was observed in the diving area repeatedly each year of the three Tern Island observation periods. Observations made at Nihoa of seals diving into fish schools suggest this diving behavior relates to underwater foraging. However, at no time did we see prey brought to the surface.

We thank the National Fish and Wildlife Laboratory and the Hawaiian Pacific Islands National Wildlife Refuge, both of the U.S. Fish and Wildlife Service, for their cooperation in making this study possible. Invaluable logistical support was provided by the U.S. Coast Guard and the National Oceanic and Atmospheric Administration's research vessel, TOWNSEND CROMWELL. We thank R.L. DeLong, C.H. Fiscus, A.M. Johnson, D.W. Rice, V.B. Scheffer and G. Van Blaricom for helpful criticism and M. Naughton for field assistance.

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## KILAUEA FOREST RESERVE TO BE PROPOSED FOR LOGGING

The Bishop Estate and a logging concern, Campbell-Burns Wood Products Company, Inc., are carrying out the preliminary motions towards seeking permission from the State Board of Land and Natural Resources to "selectively log koa from Kilauea Forest Reserve, according to several sources. This is through a "Conservation District Use Application". Kilauea is one of the very few, if not the only, remaining areas of relatively pristine native upper elevation koa and ohia forests on the Big Island. It is a special area in several ways. It covers approximately 4,000 acres from about 6,000 feet elevation down to the National Park at about 4,000 feet. Its proximity to the National Park makes it an area that is relatively accessible. The effects of logging, even selectively (where only certain, usually large, well-formed trees are removed) may be profound.

In a meeting with Bishop Estate held in early May, representatives of the State Division of Forestry reportedly favored the selective logging in this forest. However, federal scientists at the meeting, speaking for themselves and not necessarily for the agency

expressed opposition to the logging. In a summary statement, the scientists expressed the need for some areas, such as Kilauea, to remain unlogged. They suggested that such areas are needed to act as reference points for future generations. They compared the logging of Kilauea to the destruction of old and valued books in a library. Even selective harvesting would, they said, probably cause essentially "irreparable" changes to the ecosystem.

Kilauea Forest Reserve is very special to Hawaiian ecologists of many different disciplines. The International Biological Program funded much research in the Reserve, as well as in the adjacent Keauhou Ranch and the Mauna Loa Strip of Hawaii Volcanoes National Park. The U.S. Fish and Wildlife Service's "Hawaii Forest Birds Recovery Team" has identified Kilauea Forest Reserve and Keauhou Ranch as top priorities for land acquisition in their efforts to preserve the 'Akiapolaau, the Hawaii Creeper and the 'Akepa from extinction. The Nature Conservancy has also indicated interest in acquiring the properties. In addition to being important for the preservation of these three endangered birds, the Reserve and Keauhou Ranch also have the only populations of the endangered Hawaiian Vetch, estimated by various authorities to be extremely rare. This plant is a member of the pea family and is very susceptible to grazing by cattle. Since Keauhou Ranch has large numbers of cattle being grazed by a lessee, the plant's future on the Ranch is tenuous, at best.

Since a good case can be made for the preservation of at least Kilauea, if not Keauhou Ranch as well, we should examine the question of logging from the standpoint of the landowner.



Clearcut in ohia-koa forest at Keauhou Ranch. Is this in store for Kilauea?

Bishop Estate, whose primary mandated function is the maintenance of Kamehameha Schools, stands to gain about \$2 million for the timber rights in the Reserve, according to some people in the Estate. It is not unreasonable to say that the Estate would prefer to have its investment in land realized, so as to promote the aims of the Estate. It is possibly important to realize that the Estate probably didn't have a lot of choice in the matter when Kilauea was put into Conservation District status. (The "Forest Reserve" designation, since Kilauea is private and not state land, no longer apparently applies). However, if Bishop Estate and Campbell-Burns proceed with their plans, they can expect rather intense opposition from many groups and individuals, not the least of whom will be, of course, the Hawaii Audubon Society.

It certainly would be in the best interest of most parties concerned about the area, if some degree of protection to both Kilauea and Keauhou Ranch could be initiated, and if some compensation to the Estate for lost revenue could be made. There are different mechanisms for accomplishing this, including "conservation easements". Logging is not the only issue here. Logging in itself, as the federal scientists suggested, will probably have important effects. However, grazing by cattle, sheep, or goats have far more profound and long-lasting effects on native Hawaiian ecosystems. Grazing by cattle is considered by several experts to be the main problem in native forests today, aside from the effects of omnipresent feral pigs. Regeneration of most native plants is effectively stymied by cattle grazing. Perhaps Bishop Estate might address this problem a bit more seriously, since they indicate that they are truly interested in seeing a viable koa timber industry in Hawaii. Perhaps conservationists would be more receptive to the Estate's plans for harvesting timber on its lands if these lands were not being rapidly transformed from native forest to pastures. Campbell-Burns is perhaps an unwitting accomplice in this apparent land management practice of converting forest to pasture. By the terms of their timber lease on Keauhou Ranch, they are required to pile the debris from their logging, a practice which facilitates access by cattle to much of the logged forest. In fact, essentially the only areas where the Hawaiian Vetch is found in Keauhou are sites where such piling of debris has fortuitously prevented cattle access. As this debris disintegrates from the processes of time and weather, the vetch will inevitably diminish in numbers.

The logging of Kilauea Forest Reserve, no matter how carefully done, will certainly

result in some changes. One federal scientist compares the logging of Kilauea to the Greeks tearing down the Parthenon. Once Kilauea is gone, an important segment of Hawaiian history will be gone forever. Conservationists in Hawaii have an obligation to future generations to work with Bishop Estate to insure that our generation will not be the last to have walked in wonder in the rich diversity of a pristine native Hawaiian rain forest.

*C.J. Ralph*

## PAPAYAS AND TREE FARMS VS. REMNANT LOWLAND FOREST

The following excerpts are from testimony for the public hearing held in Hilo on April 15, 1982 by the State Board of Land and Natural Resources on commercial use of the Conservation District for: Conservation District Use Application (CDUA) by the State Division of Forestry and Wildlife for tree farming and interim papaya use on State-owned lands in the Halepua'a section of the Nanawale Forest Reserve, Puna District, Hawaii Island.

At its February 22, 1980 meeting the Board of Land and Natural Resources approved the request by the State Forester for "experimental work on this pilot project...for reforestation."

The Board approved "a right-of-entry to Diamond Head Papaya for exploration purposes and commencement of site preparation activities, as per the recommended interim papaya cultivation use and subsequent return to the State for tree farming."

After the Hawaii Audubon Society learned about the project at the end of March (1980), a letter was sent to Chairman Susumu Ono calling for compliance with State regulations (a CDUA, a public hearing on commercial use of Conservation District lands, and an environmental assessment publication in the Environmental Quality Commission's Bulletin). The Society also asked for protection of the "remarkable quality of the State-owned, low elevation remnant native forest at Halepua'a."

In reply, Mr. Ono wrote on April 16, 1980 that "an environmental assessment is being prepared." We looked for its publication in the EOC Bulletin but it

never appeared. No CDUA was filed; no public hearing was held.

On Friday afternoon of October 24, 1980, I found out by accident that Diamond Head Papaya was bulldozing in the Halepua'a forest and that 20-25 acres of the forest had been cleared by this day. Convinced that this was an illegal action in violation of State laws, the Society engaged a Hilo attorney, T. Anthony Gill, to pursue the matter with the State Forester. After Mr. Gill delineated the bulldozing as an unlawful activity to him, the State Forester agreed "to halt further bulldozing and other clearing activities pending an environmental assessment of the project."

The cleared land was immediately planted to papaya and remains in cultivation to this day by Diamond Head Papaya in spite of the violation of State law.

In November 1980 Mr. Delan Perry presented the Governor with a petition signed by about 100 neighboring residents, farmers and landowners protesting the bulldozing of the Nanawale Forest Reserve and requesting that it be preserved as a unique native Hawaiian forest.

The Division of Forestry calls this project "reforestation." That is a nice-sounding euphemism for the uninformed, but it really means destruction. It is actually deforestation--turning a diversified native forest into a farm of sequential mono-cultures, first of papaya and then eucalyptus.

The Hawaii Audubon Society...ask(s) for the maintenance and protection of that diversified lowland forest (Halepua'a section of Nanawale) in public ownership. We ask the Board to reject this reckless scheme to transform Conservation District forest land to papaya fields and eucalyptus plantations.

Halepua'a is an exceptional remnant of the kind of forest that once was common in lower Puna. Much of the former forest was bulldozed away for agricultural purposes. At elevations of only 100 to 380 feet, Halepua'a remains a cool oasis, surrounded by farm lands and abandoned papaya fields. This remnant of our natural heritage should not be destroyed in 1982, not with the knowledge we have today on the cultural and biological values of the native Hawaiian forest communities that remain.

To allow the forest to continue to exist is not a "waste" or lacking in benefits. That forest is home to dozens of native Hawaiian species that exist

nowhere else outside of Hawaii. Ferns, flowering shrubs, vines, flowering trees and the native invertebrates associated with native plants--such as the Kamehameha butterfly and the mamaki tree. It is habitat for the endangered 'Io (the Hawaiian Hawk) and Pueo (the native owl).

To protect that forest from the bulldozer is to pass on to future residents a bit of their natural heritage--those wonders of nature that set Hawaii apart from all other states and lands.

Other values of the forest are for 1) ongoing natural processes of growth, succession and evolution of forest organisms, 2) watershed collection of rainfall and fog drip, 3) recreation use, for hiking and nature appreciation, and 4) aesthetic values of a forest in the midst of farmland.

The Office of Environmental Quality (OEQC) has informed me this week that DLNR has filed a negative declaration on the project. In our view, DLNR has made an improper determination when it says that bulldozing away 417 acres of forested Conservation District land will not have a significant effect on the environment.

We propose...that the project will have significant environmental effects and thus requires the preparation of a full EIS, where the public is informed in an objective manner of what is lost when the forest is destroyed. In the EIS process, concerned citizens have the chance to respond to the detailed plans of the project, and DLNR has the responsibility to reply to citizen's concerns. An EIS is clearly called for when this kind of land use in the Conservation District is proposed.

We have no objection to the concept that "if the Division of Forestry can demonstrate that a viable forest crop can be grown on abandoned papaya fields, it will serve as an important incentive to get private landowners to utilize their abandoned papaya fields." (1982 EA, P. 1-4) The Society's point is that you don't need to destroy a forest first to accomplish that goal.

*Mae E. Mull  
Big Island Rep.*

## HELP!

### THE ENDANGERED SPECIES ACT

One quarter of all species of plants and animals on Earth may disappear in the next 30 years because of man's direct and indirect destruction of habitat. And the rate of extinction is increasing.

The Endangered Species Act of 1973 is the federal law that provides for the conservation of animal and plant species that are currently in danger of extinction (endangered) and those that are close to being endangered (threatened). The Act has special significance to Hawaii since over half of the 52 endangered bird species on the federal list are found only in Hawaii. In addition, seemingly countless native Hawaiian plant species have the very dubious distinction of being excellent candidates for endangered status. The only native Hawaiian land mammals, the Hawaiian monk seal and the Hawaiian hoary bat, are also listed on the federal endangered species list.

The Act expires this year unless it is reauthorized. The Endangered Species Act has very recently been worked over by both the House and the Senate, since both houses of Congress must agree to renew it and the President must sign it by October 1, 1982. What has come out of the subcommittees are HR 6133 and Senate Bill 2309. Needless to say, anti-regulation forces, mainly in the form of development industries like forest products or utilities have been lobbying intensely in order to gut this law, and the current administration is blatantly sympathetic.

The bills, as written, both provide less protection than the current expiring Endangered Species Act. One example is the amendment which would legalize "incidental taking" of endangered species by permit. Currently, the Endangered Species Act does not allow "incidental" taking. This type of amendment could make enforcement of the Endangered Species Act even more difficult than it already is.

So what can you do? Write to the President, your Senators and Congressmen. In Hawaii, write to Sen. Dan Inouye and Sen. Spark Matsunaga at U.S. Senate, Washington, D.C. 20510, and Rep. Cecil Heftel and Rep. Daniel Akaka at U.S. House of Representatives, Washington, D.C. 20515. Write immediately.

Tell them that you want the Act reauthorized for multiple years and not just the one year that anti-conservation interests seek.

Tell them that you do not want a legal mechanism to allow "incidental" take of endangered species.

Tell them that you are against the amendment that would replace the 3 member review board for the Endangered Species Act exemption process with either the Secretary of Commerce or the Secretary of Interior (an especially bad idea in this administration).

Tell them that you want this administration to stop undermining wildlife conservation in this country by drastically cutting back the U.S. Fish and Wildlife budget, especially in the endangered species area. (Funding for endangered species listings alone is proposed to have a 1983 budget of 2.0 million as opposed to the 4.1 million of 1981.)

For more information, write immediately to: Ken Berlin, Chairman, Endangered Species Act Reauthorization Coordinating Committee, P.O. Box 50771, Washington, D.C. 20004.

*Marie Morin*

## JUNE PROGRAM:

### HAWAII'S ENDANGERED PAST

The Monday, June 21 general meeting at McCully-Moiliili Library will feature a free movie entitled *Hawaii's Endangered Past: A Matter of Time*. The movie is being loaned by the Society for Hawaiian Archaeology; an archaeologist from the Society will accompany the movie in order to answer any questions. The Society for Hawaiian Archaeology has similar conservation/preservation goals to the Hawaii Audubon Society, with the emphasis on archaeological sites.

The meeting begins at 7:30 p.m. Everyone is cordially invited to attend.

### ACHIEVEMENT AWARD

Robert J. Shallenberger, Supervisory Wildlife Biologist with the U.S. Fish and Wildlife Service Hawaii Area Office, was one of ten people in the nation who was recently awarded the Arthur S. Flemming Award. This award, sponsored by the Jaycees of Washington, D.C. for the past 34 years, honors outstanding professional achievement in young federal employees.

Among other things, Rob has been a natural resource researcher, editor, writer, and photographer. He is also a past president of the Hawaii Audubon Society and editor of the Hawaii Audubon Society publication, *Hawaii's Birds*.

## ALOHA TO NEW MEMBERS

The Society welcomes the following new members and hopes that they will join in our activities to further the protection of Hawaii's native wildlife:

Joint with National: William D. Baisley, Kalaheo; Richard J. Blangiardi, Honolulu; Naidah Cabrido, Ewa Beach; Daniel G. Dart, Honolulu; Louis D. Whiteaker, Volcano; Ramon V. Diaz, Agana, Guam; P.D. Dietrich, Honolulu; Carol A. Dietrich, Pearl Harbor; William Dunn, Honolulu; Presley K. Ewing IV, FPO San Francisco; Bryan Harry, Honolulu; Debbie Hopson, Volcano; George S. Humphrey, Capt. Cook; Gordon Johnson, Mountain View; B.J. Williams, Honolulu; Brian R. Pellar, FPO San Francisco; Ralph A. Shapley, FPO San Francisco; Clarence Shirai, Pearl City; George R. Stuart, Honolulu; Bessie Twigg-Smith, Honolulu; William Twigg-Smith, Holualoa; Vismeg-Wheless Family, APO San Francisco; Kathleen Walburn, Kamuela; D.M. Walther, Keaau; Helen R. Ware, Honolulu.

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Junior: Chris S. Bachand, Hickam AFB; Elton Junior, Waimea.

*Kammy Wong  
Susan Schenck*

## JUNE FIELD TRIP TO

### WAAHILA RIDGE

One Sunday, 20 June the Society will conduct a field trip to explore the forest birds of Waahila Ridge. Interested persons should meet at 7:30 a.m. next to the State library downtown on Punchbowl and King, on the Punchbowl side. Bring water, lunch, binoculars, raingear and interested friends. Call the leader, Maile Stemmermann at 949-3430 for more information.

HAWAII AUDUBON SOCIETY  
BY-LAWS

A committee to review the Hawaii Audubon Society by-laws is being formed this summer. Members who have suggestions or comments on this topic, or who would like to participate in the committee, call Susan Schenck at 488-4974 or write c/o Hawaii Audubon Society, P.O. Box 22832, Honolulu, Hawaii 96822.

JULY 'ELEPAIO PASTE-UP

The July edition of the 'Elepaio will be pasted-up beginning at 5:30 p.m. on June 17 (Thursday) at the home of Marie Morin, 1415 Victoria Street #1515. Call Marie at 533-7530 beforehand, in order to obtain further information. All members are welcome to come and help.

MEMBERS WELCOME AT BOARD MEETINGS

The Board encourages members to attend and participate in the monthly Board meetings. It is a good way to get more involved in conservation issues and in the workings of the Society.

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New members who send in dues between January and September will receive, if they request them, all back issues of the 'Elepaio for that year. After September, the dues are counted for the following year.

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## CALENDAR OF EVENTS

- June 14 (Monday). Board meeting at the home of Wayne Gagne, 2310 Ferdinand Ave., Honolulu, at 7 p.m. (941-5659).
- June 20 (Sunday). Field trip to Waahila Ridge trail. Meet at 7:30 a.m. on the Punchbowl St. side of the State Library. Bring lunch, water, rain-gear. Leader: Maile Stemmerman (949-3430).
- June 21 (Monday). Regular meeting, featuring film, *Hawaii's Endangered Past: A Matter of Time*. McCully-Moiliili Library, 2211 S. King, 7:30 p.m.

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