

STUDENT PROJECT PROPOSAL TO THE
UNIVERSITY OF HAWAII MARINE OPTION PROGRAM

Publication of a monthly column in the local sailing
magazine "21° North".

Column title: "Fins and Feathers"
by Susan Scott

DURATION

August, 1984 through May, 1985

EDITOR OF PUBLICATION

Layla

ADVISOR

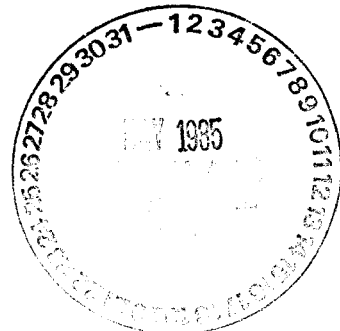
George Balaz

PROPOSAL DATE

August 1984

FINAL REPORT DEADLINE

May 15, 1985



INTRODUCTION

In May of 1984, a news magazine called "21° North" was started in Honolulu. It consists of local sailing news, feature articles concerning boating and items of interest to the general boating community. I propose to contribute a monthly column to this publication about some aspect of marine biology.

This proposal is intended to serve a number of purposes.

First, as a biology major who lives aboard a sailboat, I am interested in the marine life that surrounds me and expect to learn more about this area by researching and writing the articles concerning it. Second, I believe that many marine animals are misunderstood, exploited and unnecessarily harassed. Educating people about the intelligence and habits of some of these creatures is one step toward harmonious living between humans and animals. And last, I want to contribute my energy to the people who have started this publication. The success of "21° North" will be an asset to the Hawaiian community.

METHODS

The following is a proposed list of articles I intend to write. Included are some of the people I will ask for interviews to enlighten and update my articles.

AUGUST, 1984: Dolphins

Dr. Louis Herman, Kewalo Basin Marine Mammal Laboratory Facility

SEPTEMBER, 1984: Sea Turtles

George Balaz, National Marine Fisheries Service

OCTOBER, 1984: Barnacles and the Fouling Environment

Julia Brock, University of Hawaii

NOVEMBER, 1984: Humpback Whales

Gordon Bauer, Kewalo Basin Marine Mammal Laboratory Facility

DECEMBER, 1984: Octopus

Dick Young, University of Hawaii

JANUARY, 1985: Sharks

Leighton Taylor, Waikiki Aquarium

FEBRUARY, 1985: Flying Fish

Dr. Abraham Piiania, UNiversity of Hawaii

MARCH, 1985: Sea Birds

Marie Morin, Department of Land and Natural Resources, State of Hawaii

APRIL, 1985: Tuna

Jim Parrish, Hawaii Cooperative Fishing Unit, Kewalo Research Basin

I will bring copies of "21° North" to the Marine Option Program office for distribution.

On May 15, I will submit a collection of the articles I have written with a summary of my experiences on the project.

May, 15, 1985

SUMMARY

The first "Fins and Feathers" article on dolphins was published in "21° North" in September, 1985. My experience with Dr. Herman was exceedingly unpleasant; he was rude and unreasonable in a manner inappropriate for the circumstances. In spite of this, I researched the topic and wrote an article entitled "Hawaii's Dancing Dolphins". It was well received by readers of the magazine.

However, "21° North" was not so well received. Poor editing, frequent typing errors and bad reporting of events were common complaints.

The next article I researched was about sea turtles. George Balaz was not only helpful and supportive with this article, he continued to advise me.

The next issue of "21° North" was distributed in December, 1984. The sea turtle article was in it but badly typed and printed.

Since only two issues of the monthly magazine had been published in 5 months, I decided to consider other sources for publication of my work. I sent my next piece about barnacles to "Sail" magazine and the former ones to "Cruising World" all in January, 1985. These two national sailing magazines bought all three articles by April.

To date, there have been no more printings of "21° North". I assume Layla, the editor, has gone out of business.

This skill project failed in its original objective but succeeded in a better one--one that I would not have attempted at the start.

Copies of the articles already sold are attached. In addition, a whale article that is currently being submitted to "Cruising World" is included.

TURTLE TIDBITS

Susan Scott

Almost all of us who have spent some time cruising in tropical waters have at least once mistaken the greenish discs floating on the surface of the water for debris--that is until the "debris" lifts it's head, looks indignantly about and then disappears.

These floating frisbees, the animals-in-a-box, are the sea turtles, one of the intact survivors of the Age of Reptiles, a period in the evolutionary history of the earth that occurred some 90 million years ago. Turtles are living fossils of that period, the only change being that they are now somewhat smaller. Their methods of living and reproducing have been quite successful even if viewed as a bit awkward by spying humans. Regardless of their evolutionary history or lack of grace, the sea turtles are unique and fascinating creatures that deserve our attention.

Sea turtles, like whales and dolphins, breathe air with lungs similar to our own. However, unlike mammals, their reptilian heart is divided into only three chambers which creates a comparatively inefficient system of oxygenating blood. This characteristic is one which causes the slow-as-a-turtle reputation although they can and do exhibit bursts of speed when necessary. Since newly oxygenated blood is continually mixing with oxygen-depleted blood, the animal is unable to cope with extended aerobic workouts. Turtles can literally claim a bad heart as an excuse for

being slow.

There are seven different species of sea turtles in the world, all are restricted to living in the tropics and subtropics due to their inability to regulate their own body temperature. Tropical seas provide a constant environment for the animals

who then have no need to hibernate. To gain extra heat, turtles often float about on top of the water. It is during these baskings that they can be spotted by boat--but not for long. These cautious, shy creatures will usually dive when frightened and can stay under water for extended periods of time. Don't wait for one to emerge--large turtles can stay down for over two hours on one breath of air.

Sea turtles differ from their terrestrial cousins, the tortoises in characteristics that are distinctly adapted to the marine environment. The ocean going branch of the family has a streamlined shell for swimming. Broad, flat flippers have replaced stubby, round legs in another adaptation to water. These paddles are efficient, however, only in the water--they are the cause of the clumsy, laborious lumbering about that these animals do when on land.

Given the sea turtles' proficiency in the water, they naturally spend little time ashore. However, the females are nature bound to go to land for the purpose of nesting. During the summer breeding season, males and females migrate long distances to find appropriate nesting beaches. They mate in the water; the male hangs onto the shell of the female with a sort of flipper hook.

The stories about lusty and amorous male turtles are mostly true. They can be indiscriminate in their choice of mates. They will attempt to mate with crude decoys, other males, divers, and even, try to imagine this, rowboats. Unreceptive females may bite pursuing males, leave the water or retreat to a fascinating, little understood "safe zone". This turtle-made reserve is an area where females can go to escape aroused males. It is not known how this territory is established among the turtle community but females go there and males honor it.

Female turtles of all species can store sperm. The eggs they lay could be fertile from a mating that took place years ago.

A gravid female will await a nocturnal high tide to crawl ashore and dig a hole for her eggs. This is no easy task for this marine animal. She must often dig several nests as the walls of those dug in drying sand often collapse. After laying and burying up to 250 eggs, she returns to the sea to begin the ancient cycle over again. She will come ashore again in 2 to 4 years.

The baby turtles emerge from their hole all at once after about two months incubation and some organized digging. All scurry in unison toward the water making good targets for predators. The mortality rate for the hatchlings is often, unfortunately very high.

Three of the seven species of sea turtles are found in Hawaii, the most common being the Pacific Green Sea Turtle or Honu in Hawaiian. It was named not for its shell color but rather for its green colored fat once coveted for soup. It is a gentle, shy creature that can grow up to a whopping 800 pounds. Nesting

is primarily done in the French Frigate Shoals, a National Wildlife Refuge, since most of the beaches suitable for nesting have been taken over by humans. The adult Honu only eats algae and marine vegetation.

The Pacific Hawksbill and Leatherback Sea Turtles can be seen in Hawaiian waters but are not as common as the Green. The Hawksbill is relatively small, about 100 pounds, and was the source of tortoiseshell for jewelry. Leatherbacks are the largest of all the sea turtles weighing up to 1500 pounds. This species eats jellyfish almost exclusively.

All species of sea turtles are considered endangered of extinction due to both hunting of adults and interference with nesting procedures. While sharks are the turtles' greatest marine predator, humans are its deadliest enemy.

It is illegal to take any sea turtle for any reason--it is a crime against the earth to take, annoy or disturb a nesting female or her eggs. The latest data suggests that green turtles may take 40 or even 50 years to reach breeding age, a fact that makes their survival impossible in the face of heavy killing.

Try to imagine navigating your way to the Cayman Islands in heavy fog by following the noise of migrating turtle herds. It happened in the 16th century. If we pay attention to our turtle friends, it can happen again.

CRUISING WORLD

March 5, 1985

Mrs. Susan Scott
P.O. Box 8658
Honolulu, HI 96830

Dear Mrs. Scott,

Thanks for sending in one of the most precious photos I've seen in ages. Although we cannot entertain the idea of another regular column in CRUISING WORLD, I like the idea of doing more articles on marine life.

May I suggest that you shorten your articles to under two pages and resubmit them with appropriate artwork (color transparencies or B&W photos)? I am quite sure that with the proper illustrations, your articles will enhance the pages of our magazine.

I look forward to hearing from you.

Sincerely yours,


Bernadette M. Brennan
Managing Editor

BMB:nb

Enc.

CRUISING WORLD

March 26, 1985

Ms. Susan Scott
P.O. Box 8658
Honolulu, HI 96830

Dear Ms. Scott:

We are pleased to accept your article, "Turtle Tidbits," for future use in our Shoreline column. We will send you a check for \$100 representing First North American Rights to the piece upon receipt of the enclosed contract.

Dates of publication remain tentative; sometimes it takes about a year for a piece to appear in the magazine. We will send you a tearsheet from the issue after publication. Please send all correspondence to the attention of Noreen Barnhart.

Sincerely yours,



Bernadette M. Brennan
Managing Editor

BMB:nb

Enc.

HAWAII'S DANCING DOLPHINS

The dolphins came to the boat suddenly, as if from some secret place. They rode the bow waves effortlessly, revealing hints of creamy-white bellies when, in sideways bursts of speed, they changed sides of the boat to play on. Some jumped while spinning with shocking agility, some slid along the periphery quietly making serpent-like lines of dorsal fins, moving up, then down, breathing and swimming rhythmically. Just as suddenly as they had come, they were gone. To where? Doing what? Who are these fascinating animals whose appearance always brightens an outing on the sea?

The dolphins of the world belong to the suborder Odontoceti which means "toothed whales". There are at least 65 species of dolphins and toothed whales in this group. All have only one "blow hole" or air passage as opposed to the baleen whales which have two.

Dolphins are air breathing, warm blooded mammals who have adapted in remarkable ways to an environment that is usually considered hostile to mammals. Their streamlined bodies are efficient for high-speed swimming. Some can cruise steadily at 25 knots; some have been clocked at 35 knots. The unique position of the blow hole enables the animal to breathe while swimming hence the curvy, fluid motion of the cruising dolphin.

Dolphins have built in SCUBA gear. Blow holes remain tightly closed except when forcefully exhaled open. While the lungs of these creatures are not proportionally larger than other mammals, they have evolved physiological mechanisms that help them conserve oxygen. A high concentration of hemoglobin, the pigment in blood which carries oxygen, maintains a higher-than-usual level of oxygen in the animals body. During a dive, which has been measured as deep as 300 meters, the heart rate slows and blood flow is limited.

in all areas except the heart and brain. This lowered metabolic rate conserves not only oxygen but heat as well.

Baby dolphins are delivered tail first which prevents them from crowning during the birth process. Some species have "birth attendants" who help the newborn to the surface for its first gulp of air. Later, these "aunties" babysit for the calves when the mothers search for food. Because the calf is nursed for a lengthy period, often up to a year, the females usually bear offspring only once every two years. Mothers defend their young, keep them from straying, and even inflict punishment for incorrect behavior.

Unlike fish, the sense of smell is absent in Odontoceti. While the senses of taste, vision, and touch are variable and debatable from species to species, it is an undisputed fact that hearing is the most significant of the senses in this group. Both ears receive sound waves separately thus providing an exacting sense of direction, shape and position of objects in the water. By emitting clicking sounds, a biological sonar system is produced. Among other things, this echolocation is used for finding food which consists of squid and small fish.

The Hawaiian acrobats whose gamboling was described at the start of this article are the Long-snouted Spinner Dolphin or *Stella longirostris*. This exuberant species is one that can be seen commonly by boat off the Hawaiian coasts. They may occur in herds of up to 1,000 however, smaller herds are more common. They associate with small whales-- it is not unusual to see pilot or false killer whales with these spinners. A little understood bond is present between this species and the ahi (yellowfin tuna) and, less frequently, with aku (skipjack tuna). The association is often a death toll for the dol-

phins as they are unintentionally caught in the huge seine nets used by the high seas tuna fishery.

The friendliness and social tendencies of these animals make them easy to train. Their intelligence is apparent in their abilities to follow commands, remember and communicate both with each other and with humans. The sensitivity, intelligence and capacity to care for one another are characteristics that are well worth remembering when leaning over the bow of the boat to enjoy the antics of these aquatic friends.

Susan Scott

CRUISING WORLD

April 4, 1985

Ms. Susan Scott
P.O. Box 8658
Honolulu, HI 96830

Dear Ms. Scott:

We are pleased to accept your article, "Dancing Dolphins," for future use in our Shoreline column. We will send you a check for \$100 representing First North American Rights to the piece upon receipt of the enclosed contract.

Dates of publication remain tentative; sometimes it takes about a year for a piece to appear in the magazine. We will send you a tearsheet from the issue after publication. Please send all correspondence to the attention of Noreen Barnhart.

Sincerely yours,


Bernadette M. Brennan
Managing Editor

BMB:nb

Enc.

January, 1985

BARNACLES ON THE SHIP OF PROGRESS--THE MARINE FOULING PROBLEM

Susan Scott

Since the beginning of maritime activity, the marine fouling phenomenon--the growth of marine plants and animals on submerged surfaces--has been one common problem among all yacht owners, shipowners, and harbor authorities in all parts of the world. These ubiquitous little plants and animals of the oceans, which alone are innocuous, gather together in tenacious communities on everything that any human has ever put into the sea.

One past estimate, based on operating expenses of European commercial vessels shows that in one year fuel consumption due to fouling was increased by as much as 40%. Even a perfectly designed hull, built with beauty and utility for smooth flow will quickly lose its performance if left to the designs of surface-seeking marine creatures.

Perhaps knowing who is living on the bottom of your boat and how they got there won't take the pain out of scraping them off of it, but the facts about this unique community are interesting and can be helpful in controlling them.

Immediately after an unprotected object is immersed in seawater, an organic film adheres to the surface. This film is colonized quickly by micro-organisms, including protozoans, bacteria, and single-celled algae. Attachment of bacteria usually takes place within one hour depending upon local conditions. This initial microscopic community, called the primary or slime film, is the first step in subsequent attachments of macro-fouling organisms.

Almost all fouling organisms reproduce sexually; that is, eggs or spores are produced which must be fertilized to continue development. Fertilized eggs of marine animals turn into larvae which then drift freely about for various periods of time; these make up the animal plankton of our oceans. At the end of this planktonic stage, these microscopic larvae must find a suitable surface for settlement so that they can mature into adulthood-or die. Given this simple biological fact plus all of the boats we leave sitting in the water, one can easily see the resulting battle.

The pattern of arrival and the rate of growth of these larvae depends on a number of variables. The time period for significant fouling is shorter in the tropics than in temperate zones given similar nutrients and larval abundance. Under ideal conditions in the tropics, a non-protected surface can become heavily fouled in as little as 30 days.

A phenomenon called the "founder effect" determines which species settles on the slime layer and thus dominates the community. This simply means that the species who will dominate is the one who gets there first or "founders-keepers" so to speak. Two test stations, only two miles apart in Pearl Harbor, showed different dominating species on each; barnacles on one and the sedentary fan worms (called feather dusters or Christmas tree worms) on the other.

Smooth surfaces are less likely to be fouled than rough surfaces. The larvae of most species prefer pits and grooves so

seams and projections will usually go first. This preference for rough surfaces partly explains the apparent exponential growth rate that occurs once the animals have begun to attach.

Another explanation for the escalation of growth is that many species of fouling organisms are able to send out chemical cues to their own species of drifting larvae which causes more settling in the vicinity. In other words, these remarkable creatures can communicate to adolescents wandering by that they have found a suitable home.

Organic pollution, all too common in our harbors, is viewed by the community members as a tasty, abundant food source. The additional bonus the creatures get for setting up housekeeping in polluted areas is that the added load of organic material found here contributes to the slime layer in such force that antifouling coatings become much less effective--more strikes against water pollution.

Currents across submerged surfaces initially retard fouling however, once the process has started, currents such as those the hull experiences while cruising, actually feeds the animals.

Procrastination about bottom cleaning only fans the fouling flames.

The different kinds of animals that are likely to take up residency on boat bottoms are many and varied. In general, there are three layers of life forms. The primary slime layer has already been mentioned. If diatoms and algae are present in the area, they will add significantly to this primary layer.

The second layer is the macro-fouling group. This is the bulk

of the community and consists of sponges, hydroids (usually dismissed as seaweed but actually animal colonies), tubeworms, barnacles, shrimp-like animals called amphipods, shellfish, and sea squirts. In tropical areas, corals can be added to this generalized list.

If left undisturbed, this group will attract a third layer of creatures who feed on and hide among the masses. These are usually small crabs, sea spiders, free-swimming worms, brittle stars, and more shellfish. Some fish such as blennies and gobies may take advantage of this crowded collection and can be found hiding there.

Complete prevention of fouling is impossible. The best that can be achieved is a retardation in the rate and amount of growth and a delay in the initial development of the community. The most effective way of fighting back is the application of some sort of toxic coating. This method was used at least since 412 B.C. and is the best to date short of storing your boat out of the water.

Copper is the most commonly used toxicant although other metals such as tin are also used. Toxic paint mixtures work by the leaching of the metal complex from the paint thus creating a poisonous environment for marine life. The effectiveness of this process depends upon the leaching rate--the working life of a coating is determined by the amount of leachable metal present in the paint film. Water must flow past the surface to have an effective leaching rate.

So, no, they did not inadvertently paint the bottom of your boat with marine fertilizer. A boat with a new coat of antifouling

paint that sits even briefly in polluted, still, and/or warm water will immediately begin to collect a primary layer of life--the beginning of trouble. It's a good excuse, if you need one, to take the boat out more often. The good news is that the terrible teredo worm, that infamous wood-eater, had not yet acquired a taste for fiberglass.



34 Commercial Wharf
Boston, Massachusetts 02110
(617) 227-0888

4 April 1985

Susan Scott
P.O. Box 8658
Honolulu, HI 96830

Dear Susan Scott:

Your short piece on barnacles was passed to me for consideration as a side feature, a section of SAIL I edit. The piece will work well, and I would like to buy first-time North American serial rights to it for \$125. If this is acceptable to you, please let me know. I will also need to know your social security number so that payment for the piece can be processed; we pay upon publication. On that matter, you should keep us apprised of your current address until the piece does run (which could be as late as a year from now; we work with a long lead time).

I will also need to know a bit about you in order to write the brief author's note we put at the end of each article; please give a couple of lines, with specific reference to your sailing experience and also marine biology experience.

I look forward to hearing from you.

Sincerely,

A handwritten signature in black ink, appearing to read 'Catherine Baker'. The signature is fluid and cursive, with a long horizontal line extending to the right from the end of the name.

Catherine Baker
Copy/Production Editor

April, 1985

HUMPBACK HARMONY

by

Susan Scott

We all stood silent on the starboard deck, stunned, almost shaken by the magnificance of the animal before us. Once again we forgot to take pictures; the scene was too compelling to look away for even a few seconds. The image however, remains without the benefit of photos--four humpback whales surfacing next to one's boat is a sight difficult to forget.

Sailing in the company of the humpback whales is a rather common occurrence in Hawaiian waters in the winter and spring months for it is during this time that the whales visit from Glacier Bay, Alaska. Hawaii now hosts about 500 individuals with the numbers holding steady. Still, it is a pathetic number--in 1905, the Pacific group numbered more than 15,000.

Humpbacks were given their names because of their arching appearance while diving. These peaceful giants provide a spectacular display that is easily spotted while cruising and often can be seen from shore. A fine, misty spout of water off on the horizon is the first indication that whales are in the neighborhood.

You can sail toward the general direction of the spout but federal law prohibits an approach within 300 yards of the creatures. These animals are slow moving, rarely exceeding 5 or 6 knots and, when in Hawaii, often have baby whales tagging alongside. A pursuit is illegal for good reason--harrassing these easily frightened animals can never be justified.

But on a lucky day, a whale will approach the boat or, more

likely, just accidentally swim in your general direction. A 50 foot long, 40 ton animal is able to make a surprise visit because of a number of water adaptive mechanisms that allow dives lasting up to 50 minutes. It was on such a serendipitous occasion, while day-sailing off Diamond Head, that the above mentioned group astonished us with their presence.

Unlike most humans, the whales don't eat much while cruising in tropical waters simply because there isn't much to eat. Tropical waters have no spring "bloom" characteristic of arctic waters so zooplankton, the food staple of the baleen whales, is thinly spread about. Spring in Glacier Bay brings a treasure of newly developed krill, little shrimplike animals, that provide a banquet for the whales.

The song of the humpback is one mystery that is now receiving a significant amount of scientific attention. When in Hawaii, certain "singers" of the group sing a 20 minute song that is repeated exactly the same way, often for hours. Recordings show that all the singers sing the same song which changes gradually throughout the season. The sounds, which are a unique collection of squeaks and growls, can be easily heard from a boat. It is not yet known exactly which whales do the singing or what response it gets, but it is almost certainly some form of communication.

Sailing among these singing, graceful giants is an experience that leaves one with the impression that we are fellow creatures sharing a sea that is vibrant with life. "Save the Whales" movements take on a whole new meaning after such a moving experience.