THE SAUSALITO HUM

A Paper Presented to the Chit Chat Club

on 13 April 1987 by

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For the past several summers, houseboat residents on Richardson's Bay, Sausalito, have complained about an eerie, monotonous drone, a loud and mysterious sound that begins each evening after sundown during July and August. Emanating from the mud, it penetrates boat hulls until the early morn. Likened to the din of a squadron of low-flying B-17s, the sound is so loud, so obnoxious in fact, that floating Sausalitans are awakened from a sound sleep.

The cause? Speculations have ranged broadly. Secret military experiments? As you know, the Army Corps of Engineers, an obvious candidate, maintains a research lab on the waterfront. Others blamed the sewage plant, and claimed that it operated only at night so as not to deter sensitive tourists. And of course, the extraterrestrials. (Sausalito is a lovely vacation spot: Were one an intelligent Martian, what better place to land?) After considerable expense, extensive acoustical mapping of the bay bottom by technical consultants, and continual denial of guilt by all federal and municipal parties concerned, a San Francisco State University biologist named Tom Neisen picked up and read the morning edition of the Chronicle, particularly famous for its coverage of mysterious and far-out phenomena. In it, he read of the still-unsolved mystery of the hum, and on a fluke called the appropriate Marin County agency and suggested that the source might be biological. A fish perhaps.

Fish do make noise. Centuries before Jacques Cousteau appeared on the screen backed by a chorus of gurgling pops, grunts, and snorts, the subject of sonorous fishes had captured the ears and attention of both Aristotle and Pliny. Perhaps life in ancient Greece and Rome, uncluttered by the sounds of modern society, allowed them cleaner access to the noises of Nature. Subsequently, studies of submarine sounds have been a prime research target of the Office of Naval

Research, particularly since WW II. Researchers have discovered that sound in the sea comes from a variety of sources, such as the echolocation behavior of whales and porpoises, the popping and snapping of shrimps, and the groans, croaks, creaks, yelps, sobs and hoots of a variety of fishes. Sound transports well within the aqueous environment and is particularly useful as a means of communication when the medium is murky. Fish produce sound in three separate ways. Sudden underwater movements by a large shark or grouper displace water and can result in a loud low-frequency "thump". The stridulatory sound of teeth impacting jaws or hard prey parts is not unlike the sensation created by chalk on a chalkboard or by the grinding of your molars. This sound is amplified by a specialized resonating chamber, variously called the gas bladder, air bladder or swimbladder, possessed by many kinds of fish. Recall the last time you cleaned a fish -- among the viscera and lying just beneath the backbone is a viscous, shiny sac which is used by the fish to compensate for the density of its flesh. This gas bag acts as a ballast chamber to allow a fish to equilibrate its density to that of the water, remaining effortlessly, neither floating nor sinking. And, as well, this bladder is a perfect resonating chamber that acts as a drum, for which the east coast "Drumfish" is so-named. Other fishes called croakers, grunts and toadfish have perfected this noise-making ability with specialized muscle attachments to vibrate the drum, as rapidly as 150 times each second. The Atlantic Toadfish, for example, can produce a variety of grunts, growls and hums, entitled the "boatwhistle" or "foghorn" calls, when it is in search of a mate. The Pacific relatives, also and variously called Toadfish, Singing Fish, Sapos, or Midshipmen have an equally creative reportoire.

Such knowledge is the stuff of ichthyologists, but unknown to most who aren't even sure of the proper spelling of the discipline. Thus when Tim Underwood, the Marin County Environmental Hazard and Noxious Noise Specialist was advised, "A fish perhaps," his response was justifiably incredulous. A fish? Capable of creating sounds that would awaken an entire bayful of residents shielded by ferrocement hulls? "Hardly."

But Mr. Underwood, now desperate for assistance, placed a call to the Aquarium. I was, until then, blithely unaware

of the racket and the gravity of the problem, hence my somewhat arrogant ichthyological aside in response to his query, "From what you describe, it's obviously Porichthys notatus".

As a graduate student studying fish in Baja California, I had been kept awake on the beach by a monotonous hum with a fundamental frequency between 98-108 Hz (not unlike the mournful resonance of the bassoon of the "Grandfather's Theme" in Peter and The Wolf) easily two-three decibels above ambient sound. A brief investigation disclosed that six-inch-long male toadfish were guarding intertidal nest sites and hoping by humming to attract mates who were gravid, and sexually willing as well. These fish are not only noisy, but also put on a son et lumiere show with their bioluminescent light organs, called photophores. This abundant, cryptic, bottom-dwelling species spends the majority of its life offshore, probably buried by day in the sand bottom and feeding nocturnally upon near-bottom shrimp. It uses its photophores as well to counter-illuminate its body so that the downwelling moon and starlight is matched by the weak glow of its underside, acting as a camouflage and making it invisible to predators lurking below. During mating and egg guarding, it moves into the shallow water of bays and estuaries to allow its young an opportunity to grow within those rich nursery grounds. And then they disappear into the northeastern Pacific, not to be heard from until the following summer.

Back in Sausalito, Frank Hubach, an acoustician, and his staff of ex rock-and-roll technicians had demonstrated that the sound was not mechanical in origin. They joined forces with me in order to demonstrate a biological source of the sound. Fish were captured, held in aquaria, and acoustically monitored. Not a sound. Apparently, the males only hum while attracting a mate, and are then silent. Simultaneously, a series of clandestine operations were planned to disrupt the toadfish trysts and demonstrate that, by silencing a few Porichthys, we had identified the culprit. A cache of small explosives was secured from the Police department in Chinatown and with them we rowed out by the dark of the moon to interrupt the amorous males with weighted cherry bombs. Visions of exploding submarine depth charges were all for naught. A dull thud, a flash of light, and the continuing hum of toadfishes everywhere.

Back to the lab. After a frustrating series of experiments, including gentle prodding, hormone injections, rigorous prodding, and playback sounds, it appeared as if the male fishes were all hummed out. The evidence would await the following season. But then, through the ichthyological network, I learned that Dr. Jules Crane of Cerritos College, California, had the smoking gun in his possession. Years earlier, a student of his had taped the sound of fish in the laboratory. Crane forwarded the toadfish tapes to Hubach and me and within seconds a comparison of sound spectrographs evidenced the identical voiceprints. Final proof was achieved by locating and capturing an amorous male, mid-call, at midnight in Sausalito harbor with a shrimp trawl, and simultaneously silencing the source. That adventure was filmed by the CBS Evening News Team and reported by Dan Rather, who curiously closed the evening news with "If you believe this, then you think that Bullfrogs can grow hair." Texans aren't easily convinced, it appears, and barely educable in things ichthyological.

Phase I of the investigation was completed. Phase II, the news releases (then, second only to Humphrey the wayward whale and neck-and-neck with the California "killer bee" invasion in popularity) and the silkscreening of T-shirts soon followed. Phase III, the corrective measures, remains.

This interim report gives one time to reflect upon problem solving in California. The noxious noise, I discovered, has plagued coastal residents along the Pacific coast for decades. Not insignificant funds had been spent in search of the wrong answer by the Navy and by others in Seattle, Puget Sound, and elsewhere I learned, but no one had considered the lowly toadfish. A quick search into the recent ichthyological literature discloses that Porichthys notatus is now known as the Plainfin Midshipman, so-named for the luminous rows of bioluminescent buttons on its ventral surface which are reminiscent of a naval cadet's jacket. But in dusting off older volumes on the shelf, such as The Fishes of North and Middle America, the 1896 bible of American ichthyology by David Starr Jordan and Barton Warren Evermann, one discovers that the toadfish was previously known as the "Singing Fish". Dr. Jordan, then the President of Stanford University and of the California Academy of Sciences, noted that it was a very abundant species which lived from Alaska to Baja California, and made "a peculiar

humming noise with its air bladder, hence the name singing fish."

A half century later, author Will Cuppy enlightened readers with his description of the "Common Crooner or Singing Fish of the California coast." Cuppy's anatomical and functional analysis, presented in his book How to Become Extinct, was succinct and bemused:

> You have wondered, doubtless, how he does it, and I can't say I blame you. I've wondered myself, and I come of a musical family .... The bladder itself acts as a resonator or amplifier for the constantly moving gases, which is a break for the Crooner. Without his amplifier, he would be only one more Toadfish. That's all he is anyhow .... One hardly knows what to think of a fish who will go to such lengths to do something for which he is completely unequipped, even to using organs originally designed for quite other functions. Maybe the Common Crooner deserves all our sympathy and encouragement for managing to express himself against such frightful odds. I doubt it.

As did others. Since its original description as a new species in 1854, there have been more than a score of masters theses, two doctoral dissertations, and numerous published scientific articles about the Plainfin Midshipman, its curious courtship behavior, the musculature of its peculiar gas bladder, and the sounds it produces. But to what end? Except for Dr. Neisen, who, like dozens of his colleagues had heard of the Sausalito hum or perhaps saw it on the Today Show or the Dan Rather Evening News, no learned ichthyologist came forward and shouted "J'accuse!"

I did, however, receive a call last August from an old Sausalito salt named Charlie Merrill. Charlie's then 102-year old aunt, Aline Ford Pierce, telephoned him to condemn as "media clap-trap" the purported discovery of the singing fish. Aline invited us out to lunch and brought with her the January 1905 issue of The Northern Crown. She had recalled reading "Big River and Its Singing Fish" by Eugenia Jamison Cox. Cox had described the mysterious sound of the "humming or singing fish," heard "on sultry evenings in July and August of the year -- a noise almost identical with that of the Chinese musical kite." An apt description, which Eugenia had put into rhyme:

> At mid-night when a falling twig startles with fright,
> And all faireis [sic] are out to inhabit the night,
> When grim pines, change to hob-goblins, the light of
> the moon,
> Then it is you may hear the fish sing at the boom!

Aline, the daughter of the founder of the Mendicino Lumber Company, amazed us with tales of hearing the noise through the end of an oar submerged in the shallow estuary. Her favorite, however, is found in the August 1892 issue of The Overland Monthly. In "Staging in the Mendicino Redwoods", a rambling discourse about the picturesque characters and scenery of the northern California logging camps, one met up with Nigger Nat, a trapper for the logging crew. Nat extolled "' Ha'nted Flat'" and said:

> I don't go much on ha'nted things myself, but there's cert'nly somthin' curi's 'bout that place. Long ago a man killed his pardner there, an' since then, folks say, cattle put there breaks through the corral an' runs off. Guess it's prob'ble the musquiters won't let 'em stan', fur they's dreadful pesky here o' nights. One man tol' me he foun' his oxen ready yoked at sunrise, an' durin' the night he heard scary noises. Likely 'nough 't was the 'Singin' Fish?' Well, that's sing'lar! Some folks calls 't the 'Drum Fish.' 'T ain't exactly singin' it does, but a sort o' rumble, soundin' mournful down the river till yer hair stan's up. It begins 'bout sunset, and lasts fur two 'r three months every summer. It's a leetle too early fur it yet, -- say 'bout the first o' June. Folks come way up from the city to hear it, an' they's all puzzled to know what does the singin'; but mostly thinks it's a fish. I've made up my mind it's a bullhead, but that ain't sayin' how it makes the music alongside the logs.

Why is it then that a century later, Northern California residents remain unconvinced when told that the cause of the Sausalito hum is a hand-sized fish? As an example, I cite the August 12th, 1985, editorial of the Marin Independent Journal, entitled "Do lovesick fish sing in Sausalito?" This, the largest newspaper in the county, seriously opined just prior to the final proof: "We don't believe for an instant that the drone keeping Sausalito houseboaters awake at night is caused by a bunch of romantic toadfish humming their version of the Indian Love Song ....

Only the species that developed the atomic clock, the digital watch and the on-time European train is capable of creating such a commotion .... When God's creatures make a noise, it's more often pleasant and soothing than not ... the only animal capable of filling an entire bay with obnoxious sound is man." Such anthropocentric arrogance could come only from an editor unfamiliar with the screeching whine of a thumb-sized cicada, the bellow of a bullfrog, or a cacophony of crickets.

The explanation, I suggest, lies in the yuppification of Sausalito. Modern Sausalitans are so urbanized that they are all but ignorant of the springtime crescendo of a chorus of amorous animals. For these urbanized professionals, the noises of Nature have been drowned out by the machines of mankind. Significantly, complaints about the hum came primarily from the youngish residents of houseboats that look and cost like floating condominimums -- quite different than the post-war, partially submerged broken-boat community that once characterized Sausalito. The young, urban professionals are living aboard split-level floating homes, selling for $100,000-200,000 or more, and equipped with the latest floatation hulls made of modern materials such as ferrocement and fiber-reinforced resins that coincidentally transmit the sound of the singing fish. Therein lies the rub. The old salts, rusting away in their WW II-vintage, converted landing craft and broken-down barges, are acoustically insulated from the racket by hulls made of wood and steel.

I now exit, entering Phase III, silent but slimy culprit in hand. Yet the yuppies remain incredulous and indignant. Why, you might ask, with the sound source no longer a mystery, neither sewer plant nor submarine, would the houseboaters remain in a snit? The answer perhaps lies in the irrevocable nature of the noise. Sewage plants can be shut down. The Army Corps of Engineers can be rezoned. But romantic fish? Nothing but sex will quell their ardor. And, with Marin County's zeal for environmental protection and quality of life, it is likely that, with each passing summer, the Toadfish will only become more numerous and noisier.

The answer is abundantly clear and best distilled in the face of a houseboater and wharfside waitress named Pamela Tate that I interviewed at Fred's Place. Eyes

squinting, cheeks tightened, teeth clenched, and lips pursed, her bilious countenance said it all -- "Because," she told me, "you can't sue a fish."