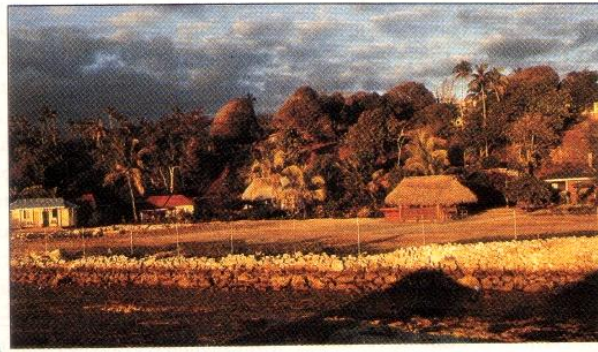


THE RETURN OF THE Giant Clam

By Stephanie Ocko



GARY COSHGARIAN

Reviving
an Ancient
Tradition May
Help Save the
Pacific's Dying
Reefs.

TAUFA'AHAU TUPOU IV, MONARCH of the last surviving kingdom of the Pacific, smiles majestically into a video camera and says, "You're bound to win with aquaculture." Heir to a 1,000-year-old tradition of tribal chieftains, the king sets the cultural standards in the archipelago of Tonga. Chronically overweight, he is a vigorous proponent of physical fitness. No less is he aware of his country's need for environmental repair. On this day, he is speaking out on behalf of giant clams, one of Tonga's most impressive and most endangered species, for a video produced and directed by marine biologist Dr. Richard Chesher. "I think that the culture of giant clams should be encouraged, and where giant-clam circles are arranged, they shouldn't be raided by irresponsible people," the king rumbles. "If we succeed with giant clams, then we can go on to cultivate other species."

"The Giant Clam Circles of Vava'u," the 20-minute video that will include the king's endorsement, represents the first major step in Richard Chesher's campaign to spread a simple but important fact around Tonga: giant clams—the spectacular native beasts that grow up to a meter across—have been harvested nearly to extinction.

To a scientist such as Chesher, a 20-year veteran of Pacific marine biology, the clams' plight is obvious. But convincing Tongans of it is another matter. Chesher's idea is simple: if villagers and fishermen gather giant clams, arrange them in circles in shallow water, and leave them to breed, the clam population could replenish itself within a few years. He chose circles both because they would signal human involvement and because circles would promote clam breeding. But though his intentions are excellent, Chesher is a papalangi, a white man, and therefore an outsider, and Tongans are slow to accept his advice. With the king speaking in behalf of the circles, however, Chesher believes he may finally reach his audience.

It is only a beginning. A modern cash economy has driven fishermen from throughout the South Pacific to fish for profit rather than simply to feed their families or villages. Giant clams have been one of the first victims of the cultural clash: in the last 20 years their meat has been frozen for export; for many more years, their shells have been sold for baptismal fonts or birdbaths. At the same time, the coral reefs where many of the clams live have been decimated by pollutants and destructive fishing methods.

Chesher believes that successful clam circles could demonstrate to the Tongans how they can begin to reverse environmental neglect and purposely nurture other endangered species. "The

concept of leaving some large marine creatures alive in a protected area to have young and replenish the reefs is the very essence of conservation," he explains. "If the giant-clam circles can become a part of the island's lifestyle—a cultural tradition—we will have created a base for a more general environmental awareness." Ideally, environmental awareness in Tongan will spread to other islands where local governments can institute similar conservation measures.

28 EARTHWATCH JUNE 1989



Facing page: Every Tongan male once received eight acres of land at the age of sixteen, provided he agreed to plant it with food crops. For decades, scattering a few sprouting coconuts proved the easiest way to fulfill that stipulation. But as populations have boomed over the last century, Tongans have been forced to put every spare acre to more productive use. At the same time, the growing population and cash economy have been hard on Tonga's seas. Giant clams—sitting ducks to any poacher or hungry fisherman—have been harvested to near extinction.

The dwindling population of giant clams is only a visible symbol of a more widespread danger: all over the Pacific, it seems, coral reefs are slowly dying of environmental neglect. To Earthwatch volunteers who relax on Chesher's research sloop, *Moira*, dreamily watching the waters turn from cobalt to emerald, it's hard to believe. Superficially, Tonga still appears to be the kind of unspoiled tropical paradise that attracted Gauguin from France.

Vava'u's verdant cliffs jut out of the blue Pacific 500 feet or more, cloaked in lush vanilla plantations, coconut palms, and patchy cultivations of breadfruit, taro, and mango trees. The wind is soft, the temperature is right, and the islands seem untouched by death and destruction.

For Richard Chesher, the first sign that all was not as it seemed in the Pacific came in 1969, on a Pacific-wide survey sponsored by the U.S. Department of the Interior. Millions of crown of thorns starfish Chesher found, were rapidly destroying coral reefs. "I realized then," he says, "that man's activities on the coral reefs had unexpected and long-range consequences." The use of pesticides and dynamite and careless reef fishing all combined to kill the living coral. The starfish, meanwhile, were forced to live in diminishing quarters on the remaining coral, creating an unprecedented opportunity for breeding. The resulting horde of starfish gradually overwhelmed the remaining reef, feeding on coral polyps. "In one place on Guam," Chesher recalls, "we found a carpet of starfish, arm to arm, stretching over seven kilometers and killing the reef at the rate of one kilometer per month. "

Chesher thinks that the underlying causes of this environmental upheaval are "a lack of understanding, a lack of consideration." Population increases, the development of commercial fishing, government loans that allow fishermen to buy outboard motors for their boats, and extensive land clearing all contribute to disturbances in the delicate marine ecosystems of the coral reefs. In Tonga, women and children once walked the reefs barefoot at low tide looking for shellfish; today, people stride across the reef in shoes, prying off clams with iron poles, bush knives, and hammers. Fishermen used to catch octopuses with a lure that resembled a rat; today they scoop them out of their nests at low tide, destroying eggs as well as nests. Chesher's Earthwatch interviewers discovered in 1985 that Tongans did not believe that coral was a living organism.

The effects of the destruction are as varied as the causes. Broken coral can become infected with algae that act like a deadly virus. The algae are spread to healthy coral on the microscopic leg hairs of small creatures like crabs that inhabit the coral. So fragile is the reef that stress from radical temperature changes or pesticides can cause breakage that results in sudden coral death, called a shutdown-reaction. During a survey of 100 reef sites in Vava'u with Earthwatch volunteers in 1984, Chesher estimated that 65 percent of the reef was reduced to rubble.

For three seasons, a total of more than 150 Earthwatch volunteers have worked with Richard Chesher to reverse this trend. The teams have interviewed Tongans to see how, why, and to what extent they harvest giant clams, and they've helped develop new clam circles. They've induced spawning by injecting a frozen gonadal extract into a clam circle, and they've spent hours watching television hooked up to an underwater camera, to identify predators.

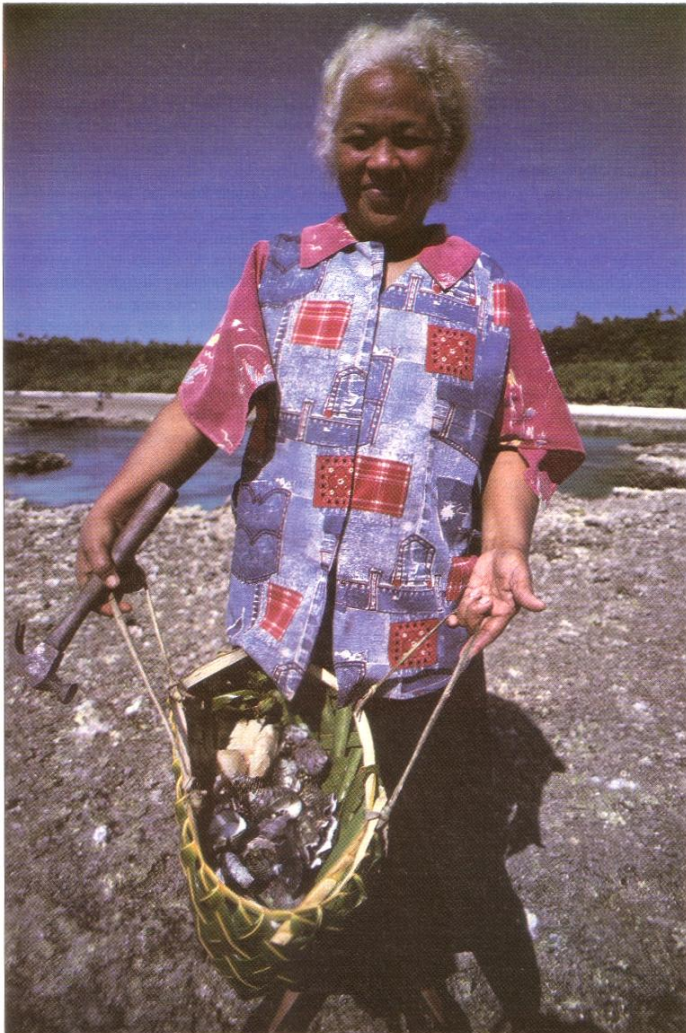
Chesher began his romance with clam circles in the Solomon Islands some 15 years ago. At the time, he was chief scientist for a National Geographic expedition that was looking into long-term changes in coral reefs. Surveying a bay on one of the islands, he happened upon his first giant-clam garden. "The local people had kept the clams in the bay for periods of heavy winds when they couldn't go very far in their dugout canoes," he recalls. "After many years, the big clams produced enough young to keep the villagers clam-happy during the stormy season. Because they never had to eat the older giant clams, these eventually became taboo. When I was there the people no longer remembered why they were taboo. They just were."

Today, Chesher's Earthwatch teams are trying to create similar clam gardens off the village of Falevai in Vava'u, in the most northern island group of the archipelago. The biology behind the clam circle is fairly straightforward. Giant clams are all born males, but at the age of six years they become females as well. Once mature, they procreate by shooting out clouds of sperm, waiting about 20 minutes, then shooting out millions of eggs. People do not grow breathless watching these hermaphrodites breed. When one starts, the group follows suit. Mating near each other, Chesher says, ensures that there will be a certain generational vigor: depending on currents, the sperm of one clam may meet up with the eggs of another. The trouble is because there are only a handful of giant clams left on Tonga-opportunities for group sex are increasingly rare.

For Chesher, the clams' plight offers an excellent opportunity to transfer the concept of animal husbandry from the land to the sea. The basic idea is very simple. Because the largest clams produce the most eggs; a 40-to-50-year-old makes 400,000 times more eggs than a clam at first female

maturity- Cheshier's teams in Vava'u are trying to convince the Tongan people to form circles of 100 big clams in shallow water. These circles will create ideal breeding conditions.

To an experienced eye, giant clams are easy to spot. But to a group of Earthwatch volunteers conducting their first clam survey, they aren't so obvious. The sea teems with life: tiny red, blue, and yellow fish, long skinny fish, jellyfish, puffy orange starfish, lavender blue starfish, brain coral, fan coral, and huge mountainous coral mounds, home to small clams whose shells open and close like the eyes of Argus. Eventually, snorkelers learn to identify the scalloped opening of the giant clam, which looks like a squiggly Charlie Brown smile, either embedded in the coral or sitting, smile up, on the bottom. Clams rarely move, but they open their mantles in the sunlight to feed the algae, which in turn feed them. The algae's intake of ocean nutrients determines the color of the clam's mantle- usually green, spotted brown, or bright purple, but sometimes an exotic satin black with green spots or a tiger-striped black and yellow.



Most Tongans are "unemployed" they support themselves with subsistence agriculture and fishing and don't take part in the cash economy- but overeating is more common than malnutrition. Medical care is free and there is no national debt. Otherwise, the people of the islands have thoroughly assimilated Western culture: they live in European style homes and wear the latest European styles. Traditional culture also persists: women still weave grass into skirts and mats, and harvest clams in woven baskets, cracking them open with hammers

Even full-grown giant clams are not really giant. The very big ones, *Tridacna gigas*, often featured in science fiction movies eating men or trapping helpless maidens, reach a full meter across but are extinct in Tonga. Of the three species that remain, *Tridacna maxima*, *Tridacna squamosa*, and *Tridacna derasa*, the last two are on the IUCN endangered species list. *Tridacna derasa*, or Tokanoa molemole in the Tongans' native tongue, averaging a hefty half-meter across, is the largest of the island's giant clams. It is also the easiest to harvest. Unlike other species, it doesn't anchor itself to the reef and is

easily lifted away by fishermen. While the Tongan Fisheries Act of 1924, designed to protect fish in weirs, has been extended to protect clams when they are arranged in circles, Cheshier believes the law is ineffective because it does not have the community's support. Only community pressure will hold off a Tongan fisherman or poacher.

How best to publicize the fact that clam circles are not only environmentally necessary but profitable in the long term? In Samoa, Cheshier successfully made and distributed educational videos that described environmental problems and solutions. But the system was already in place: American Samoa has had a vigorous educational television program for both adults and children since the mid 1960s. Tonga is a different matter altogether.

The motto on the Tongan Chronicle reads, "The land where time begins." Located south of Fiji and Samoa, just west of the International Date-Line, and north of the tropic of Capricorn, Tonga's 170 islands preserved their cultural isolation for more than 1,000 years. Unlike many of its neighbors, Tonga successfully repelled European colonization; but it was a protectorate of the United Kingdom. In 1970, when Tonga declared its independence, even that connection was severed, leaving English-the Tongans' second language-the chief remnant of British influence.

The islands have a 95 percent literacy rate, but print media are dicey. The Tongan Chronicle, the weekly government newspaper, sometimes doesn't even reach Vava'u, which has a population of about 10,000, plus a constantly changing group of ocean-going yachtsmen who put into the harbor from May to December, and scattered American, Canadian, and Australian Peace Corps volunteers. Chesher theorizes that the real network of daily, usable, valuable information among Tongans is gossip. Every day at noon and all day on Saturday, Vava'uan men gather to talk on the steps of one of the department stores that line the main street. They are cavernous, old, colonial-style buildings with creaky wooden floors, glass display cases, and shelves filled with the latest from the weekly cargo ship-automobile tires from New Zealand, hair clips from Hong Kong, peanut butter and Coca-Cola from the United States. In the open-air farmers' market, women in long dresses chat and barter for vegetables as their children hide smiles from strangers behind their mothers' skirts. On Sundays everyone but the infirm goes to one of the many churches, whose rich choral music swells in the still morning air.

The countryside is sprinkled with neat houses surrounded by gardens, ubiquitous pigs, and cackling chickens. But at night, the interiors of most of the houses glow with blue TV light. Tongans' two most appreciated appliances are sewing machines and VCRs, and the most colorful shop in the town of Neiafu, the capital of Vava'u, is the red and white video store, its window emblazoned with a poster for Hamburger Hill.

In such an environment, Chesher decided the best way to spread information about the clam circles is through videos which will lead, he hopes, to gossip. Working with Earthwatch volunteers, he put together a video script in which the district commissioner of Falevai, representing the community, cares for a circle by watching over the clams and periodically checking their health. One day he catches a poacher, whom he then educates about the long-term effect of the circle. Though King Taufa'ahau Tupou was never part of the original script, it was only a matter of time before he became involved in the project. After all, it was the king who officiated at the placing of the first Tongan clam circle, in 1986, when fishermen gathered 100 *Tridacna derasa* and put them in the harbor in front of his Victorian palace.

When Taufa'ahau Tupou uttered the words, "You're bound to win with aquaculture," at the end of the video, it was a historic occasion: the first time any king had ever spoken in behalf of giant clams. Knowing for certain that the clam circles will work will make it easier for Chesher to sell another idea: a clam gene-bank preserve. The other challenge, to measure how well he might have instilled environmental awareness and awakened Tongans to the concept of caring for the clams and the reef-and spreading the conservation measures to other islands-will be the subjects of future research.

But for the moment, giant clams have hit the media: "The Giant Clam Circles of Vava'u" is available now in the red and white video store in Vava'u, in schools, in video rental parlors throughout Tonga, and is scheduled soon for Tongan cable TV.

Chesher's Earthwatch interviewers discovered in 1985 that Tongans did not believe that coral was a living organism



SUPPLY AND DEMAND

One aspect of Richard Chesher's research is interviewing Tongans to gauge how their attitudes toward giant clams and the environment are changing. Author and teacher Gary Goshgarian was on Team I of the 1987 Giant Clams of Tonga project. He came back with these impressions.

Because it straddles the International Date Line, Tonga is the first country in the world to welcome the new day. Even before the dawn's first blush, a small fleet of fishing boats putters with its catch to the fish market at Vuna Wharf in Nukualofa, the capital city on the island of Tongatapu - an event duplicated on several other islands throughout the kingdom.

By sunrise the place bustles with people picking over the reef fish, octopuses, and mollusks. Beaten-up cars and old pickups full of families pull up to barter, then drive off with piles of fish wrapped in banana leaves. The markets proved good places to get a feeling for Tongans and clams. I quickly became friends with one of the clam ladies, who asked me to take her picture. Each morning, I found her by the same rocks, on a tapa mat, dressed in a bright floral dress, pandanus skirt, and red sunglasses. She'd sit for hours scooping clam meat from shells into jars which she put on sale. I was fascinated by how she worked the small knife with a precise flourish. All the clams she had were only four or five inches a far cry from the birdbaths sold in the shell shops in town. I asked her if the fishermen ever caught big ones anymore.

"All gone," she said, smiling with the shy dignity that characterized the people. One by one she pulled clams out of frond baskets converting them in seconds to gaping cups, which she tossed over her shoulder onto the rocks.

I asked her how they caught the clams. She looked behind her and shouted my question in Tongan to her son, who was unloading clams from his boat. (His Michael Jackson T-shirt seemed out of place to me, next to the ta'ovala grass skirt and bare feet.) He proudly held up a flat piece of steel tied to a length of rope. He made a gesture with his hands that succinctly explained Tongan clamming methods.

No doubt he'd snorkel around some reef until he spotted one of the animals, unmistakable with their wildly iridescent mantles. (You can notice them in 40-foot water.) Without leaving the surface, he'd lower the bar right into the gaping shell, which would shut reflexively. Full up the rope, and the clam comes with it. For those species that wedge themselves into coral substrate, my friend had a three-foot crowbar, which meant part of the reef went with the clam.

He wouldn't say exactly where he got the clams. In fact, fishermen on Tongatabu and Vava'u all said they had "secret spots" where there are plenty of large Tokanoa (literally, "lying there doing nothing"), but in very deep water. I explained to the woman that we were heading to Vava'u, where we would try to help find a place to set up a clam circle. She thought that was a good idea.

-Gary Goshgarian

On the last day of the last Earthwatch expedition of 1988, Julie Hazel, an Australian woman on the final leg of a world tour, tells Chesher that she heard a rumor that the clams in the circle in Neiafu harbor are being harvested. Immediately, the crew of the Moira goes to general quarters and speeds off to the circle. There, Chesher, his companion Freddy Lesne, and Hazel descend 40 or 50 feet in scuba gear, while volunteers haul the clams up with ropes into a skiff. In less than an hour, the skiff is filled with so many Tridacna - some weighing more than 100 pounds - that it floats only a couple of inches above the water. The rumor proves false: all clams are accounted for, and, alive and squirting, they are placed under a blanket and moved out to the circle at Falevai.

Later, as the team lowers the clams back into the water to join their relatives, Chesher whimsically instructs the snorkelers to hover over the circle and think fertile thoughts. Freddy goes down to free the anchor from ocean floor when, by sheer coincidence, she finds a tiny squiggle in the coral. It measures 44 millimeters.

Back in the boat, Freddy is breathlessly excited. "Oooh, a little baby derasa," she says, her voice rising and falling in her liquid French accent "He's so cute!" It's the first evidence that the clams are breeding, and Richard Chesher and Freddy are, well, happy as Tridacnae.

Stephanie Ocko is a science journalist based in Boston, Massachusetts. For descriptions of Earthwatch projects associated with coral reefs, turn to pages 63 (Fiji Coral Communities) and 66 (Who Rules the Reef).

EARTHWATCH JOKE • 1989 33

According to Richard Chesher (shown arranging a clam circle, facing page), islanders once believed that "people grew out of the ground the way trees grew out of the ground." That notion of environmental unity has gradually been lost. Below, Gary Goshgarian finds evidence of a dying breed. Goshgarian's trip was made possible by a generous grant from Air New Zealand.



COMMON GROUND

MARINE ECOLOGY

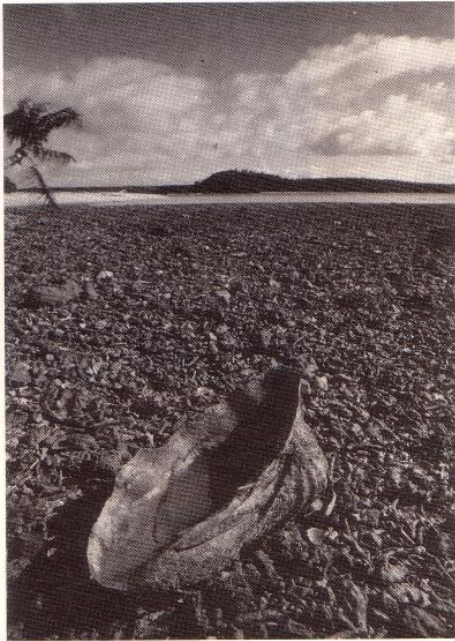
Giant Clams of Tonga DR. RICHARD CHESHER
Marine Research Foundation

VAVA'U, KINGDOM OF TONGA - Giant clams, some more than a meter wide and weighing hundreds of pounds, are woven into the folklore and culture of the Pacific Islands. Certainly the biggest and most famous mollusks in the world, these magnificent animals are on the brink of extinction. Working with the people of Tonga, marine biologist Richard Chesher hopes to revitalize the stocks of these important food animals while instilling a marine-conservation ethic into the community. Modern fishing equipment and a commercial ethos are endangering coral reefs throughout Oceania. Islanders who once found plenty of food on the reefs surrounding their isles are now faced with rapidly diminishing catches. Giant clams-the most vulnerable of food sources have disappeared from many island areas and are now on the IUCN endangered-species list. Yet there is no social or legal mechanism to stop their slow extinction.

The Tongan experiment is an attempt to build public awareness of the need for marine parks and reserves-places where marine animals can grow to maturity and spawn, reseeding the nearby reefs with young. Giant clams are the focal point of this action. By setting up community-organized and protected brood stocks of the remaining large adult clams, Chesher hopes that the Tongans will learn the effectiveness and value of marine conservation.

In the last two years, Earthwatch teams have helped find the best places to put the giant-clam sanctuaries and, with the community, have established two community giant-clam circles. This season, volunteers will evaluate how the clam population has grown and how deeply the concept of marine parks and reserves has penetrated Tongan society. Chesher hopes that if the experiment in Tonga works, it will form a pattern for marine conservation that other island governments can follow. Field Conditions: Volunteers will divide into three teams that rotate tasks. One team, aboard the research vessel *Moira*, will snorkel in Vava'u's clear, shallow waters, sizing clams and mapping their distribution to determine changes in the population over the last two years. Snorkelers will also map clam predators, corals, and crown-of-thorns starfish. A second team will use a boat to measure water

depth and movement in the lagoons and a shore-based team will coordinate boat teams and record data.



Participants will stay in the Tongan-style Stowaway Village Hotel with breakfast and dinner provided by the hotel. Lunches will be prepared aboard the research vessel.

Tonga is the last kingdom of Oceania and one of the most picturesque of all the Pacific islands. The survey sites are protected lagoons bordered by white sand beaches and luxuriant coconut palm foliage. Snorkeling conditions are excellent, with most of the activity in areas with more than 100-foot visibility. During August and September team members keep watch for the Pacific humpback whales, which migrate through Tonga on their way to calving waters. Related interests: Polynesian culture, coral reefs, snorkeling, resource management.

GIANT CLAMS OF TONGA TEAM 1: Jul 11-25, 1989
TEAM II: Aug 1-15
TEAM III: Aug 18-Sep 1 TEAM IV: Sep 5-19 TEAM V: Sep 26-Oct 10 STAGING AREA: Vava'u, Kingdom of Tonga
SHARE OF COSTS: 81,580

Long empty, a giant clam shell litters Tonga's shores. Without the clam circles and the education that goes along with setting them up, Chesher fears that the giant clam is doomed to extinction.

OBLIGING BEASTS

More than 15 years ago, Dr. Richard Chesher saw giant clam gardens in the Solomon Islands and Papua New Guinea where hundreds of giant clams were thriving. Perhaps, Chesher thought, clam circles could revitalize the dwindling stocks of giant clams in the Pacific. By 1986, the Tongans had built the first giant-clam circle with 100 of the endangered *Tridacna derasa*.

"Giant clams are the perfect animals for this kind of culture," says Chesher. "You don't have to feed them, they have no known natural predators other than man, they don't move around, and they live for 80 years or more. All you have to do is leave a community of them alone in shallow, clear water and they will repopulate reefs."