

# Biologist Leads Battle for Sea Life on Duxbury Reef

By David Perlman  
Science Correspondent

The great mussel beds of Duxbury Reef lay glistening across the rocks in the ebbing tide yesterday, their blue-white shells stained shiny black by fast-solidifying oil.

Patches of tar, flung by waves above the earlier flood tide, spattered the tilted shale of the reef and anointed barnacles and limpets.

In the reef's crevices, mats of oil and straw clogged the homes of rock crabs and sea slugs. On the surface of tide pools an iridescent, oily film dimmed the watery world of the sea anemones and surf grass lay in black streaks.

But Duxbury Reef is huge, and its population of plants and animals must be numbered by the millions. Although there will be deaths, it appeared yesterday that the great San Francisco oil spill had largely spared the finest intertidal reef on the North American continent.

## LOCATION

Duxbury Reef stands beneath the edge of Bolinas Mesa on the Marin county shore. A mile long, it parallels Agate Beach, then strikes for a thousand yards south into the sea, forming a vast breakwater for Bolinas town.

At high tide only the tops of a few rocks show on the sea's surface, but as the tide ebbs the living reef emerges, criss-crossed by flood channels, green and brown with seaweeds.

Over this weekend an incredibly energetic marine

biologist named Gordon Chan bounded across the rocks of Duxbury Reef, trailing a devoted cluster of students, armed with counters, transect frames and ten-meter ropes.

Dr. Chan, director of the College of Marin's sea grant program, was making the first scientific reconnaissance of ecological damage to the reef since the 840,000-gallon spill followed the crash of two Standard Oil Company tankers last week.

## VOLUNTEERS

Hundreds of young volunteers with pitchforks, rakes, shovels and bare hands were still scraping oil and tar

from Agate Beach and the inner reef yesterday. Now and then a drowned, oil-covered greebe drifted ashore. Occasionally eager hands plucked a blackened live bird from the sea, and carried it tenderly to the rescue center at Bolinas Marine Station.

Out on the tide-washed rocks, however, student patrols barred curiosity-seekers so the damage could be minimized, and the assessment work begin.

Dr. Chan's group moved swiftly over the reef. At a few points they were aghast, but at most they were reas-

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# S.F. Interns to Go Back to Work

Interns at San Francisco General Hospital will end a four-day strike and return to work at 7 o'clock this morning, the city's health director said last night.

Dr. Francis Curry said the interns agreed to return to their jobs after a day of meetings yesterday with members of the hospital staff and faculty of the University of California Medical Center.

Curry said the key to the settlement was a promise that night and weekend laboratory work would be done by technicians, not the interns.

He said the change will go

into effect immediately.

The interns also received assurances that the hospital administration would attempt to expedite promised improvements in X-ray services and to speed the hiring of interpreters and bilingual personnel, Curry said.

He said demands for more emergency equipment and supplies could be taken care of through funds made available by "internal budget revisions."

Curry said that a therapy area at the hospital would be changed into two diagnostic rooms in the effort to im-

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Dan Newton, one of the clean-up volunteers, plucked some of the goo out of the Bolinas tide pool

## Oil Threatens Sea Life

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sured.

In one tide pool far out on the reef, known by Chan as "Starfish Corner," the group counted 21 thick-rayed sea stars clinging to the rocks. The normal count in that pool averages 22. "This makes me reef happy," said Chan.

### ANEMONE

In another pool, where Dr. Chan has been regularly hand feeding a huge sea anemone nick-named "Big Tony" for 13 years, the biologist dipped an arm deep and found Tony safely clinging to his rock.

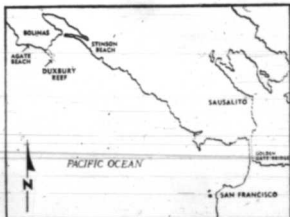
"Tony's the biggest anemone on the whole reef," Chan said. "He measures eight inches across when he's closed up tight and a nearly couple of feet when his tentacles are spread wide. He's pretty sensitive, and he knows when I'm around."

Chan felt Tony's slippery, rubber-like body carefully. "I think he's alright," Chan said.

Then he stroked the blue-green, flowerlike stinging cells of another anemone nearby. They closed hungrily around his finger. "No damage there yet that I can feel," Chan said.

### URCHINS

Purple sea urchins seemed undamaged too, sheltered in the round holes they drill through the reef rock with their own spines. In smaller holes the soft siphons of burled rock clams yielded responsively to a probing finger. Huge black turban snails, 30 years old and two inches long, grazed neatly where the algae was sun-



Duxbury Reef juts out from the Bolinas headland

stained, and seemed to avoid the streaks wherever oil had blackened their green algal pastures.

Pausing along a flood channel, knee-deep in water that washed past his rubber boots, Chan reflected:

"You know," he said, "I've lived on this reef since I was a kid more than 20 years ago. I've collected data here since 1959. I've found little patches of tar and oil lots of times, but never anything like the stuff that's splattered over the reef this time.

"And while things look pretty good so far, there's an awful lot we don't know at all.

"What's happening when oil hits the phytoplankton — the diatoms and the other tiny marine plants at the very bottom of the food chain? We don't know.

"What's happening when oil settles to the bottom in the sub-tidal zone beyond the exposed reef, where the red abalone live? We don't know. We'll have to dive to find out.

"We've only seen one red

rock crab all day, and usually there are dozens. But we don't know if it's the oil or the season. It will take time to find out.

"What will happen if oil has damaged our owl limpets? They're a vanishing species here, and we've never counted more than 16 on the entire reef. We don't even know if they're reproducing or not. We'll have to wait a year before we can assess oil damage to them.

"And look at the mussel beds out there. They're badly covered with tar. Yet mussels are strong, and they're closed up tight, with plenty of water inside them. I only hope they'll be able to wait out the spill before they open up to feed again. They did in Santa Barbara, and I think they probably will here."

### SAVIORS

In a sense, Chan said, the mussels may have proved the saviors of their far more sensitive and fragile neighbors, the clams. For the clams live on the lee side of the reef, sheltered from the heavy seas that drive in from the northwest. The huge mussels, secreting tough and stringy ropes to anchor themselves to rocks, can withstand enormous wave shock.

Across hundreds of feet along the outer end of Duxbury Reef the mussel beds carpet the wave-pounded rocks like chenille rugs. They have absorbed the brunt of the oil there, and the reef's lee side is clean.

Dr. Chan's students began a careful, inch-by-inch count of living organisms along fixed transect lines this weekend. They laid woolen frames a yard square across assigned patches of rock, then counted the animals within each square. That count will continue periodically for months and even years; compared with earlier recorded counts the transects will tell the full ecological story of oil on Duxbury reef.

### HISTORY

To Chan that story, whether good or bad, is only part of the reef's long history of danger. Duxbury's rocks are 28 million years old; a million years ago or so an upheaval along the San Andreas fault first lifted the shale above the sea.

In 1849 the schooner Duxbury foundered there, and since then many other vessels have crashed on the rocks. But still the reef's liv-

ing creatures have abounded.

For the past 20 years, however, the reef has become famed as a fantastically rich home for intertidal life. Thousands upon thousands of students and their teachers have collected specimens there, wiping out colonies and entire populations.

Clam diggers have gouged the rocks for their prey; mussel hunters and snail gatherers have taken booty by the bucketful.

### DESTRUCTION

The oil is terrible enough," Chan said yesterday, "but the people — even teachers and scientists — have been worse. They've destroyed almost all the animals over huge areas of the most accessible parts of the reef."

At long last, effective this March 1, Duxbury Reef has been declared an ecological preserve. Collecting animals and damaging tidepools on the 66-acre reef will be forbidden.

People will be able to look — and to wonder at the multiplicity of life — but not to destroy it. Teachers and students will have a living laboratory — and if the reef survives the oil spill, it may even regenerate and thrive for the future.

## Volunteers Wanted for Oil Cleanup

The Marin Ecology Center renewed yesterday its call for volunteers to help clean oil from beaches. Volunteers may call 383-6161, or meet after 7 a.m. at the parking lot at East Blithedale and Camino Alto, Mill Valley, for transportation.

Other numbers, to offer volunteer services or information:

### Coast Guard

For reports of large oil slicks 765-6603

### Department of Fish and Game

For cleanup of birds and animals 557-0411

San Francisco Switchboard Volunteering 861-6465 or 861-6822

For report of oil slicks 861-6708

### Intercity Telephone Answering Service, San Rafael

For all volunteer work 456-4244 or 456-4253

Standard Oil Company Claims for property damage 894-0990

Volunteering and other inquiries 894-0840

Contractors seeking work on cleanup of beaches 232-1514, Ex. 2336

### Tourism Pays

Madrid

The government announced yesterday that more than 24 million tourists visited Spain in 1970 and spent nearly \$1.7 billion, both records.

Associated Press

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of two tankers on Monday, half has been recovered. Standard said the company said it had 700 workers on the cleanup job yesterday, in addition to the thousands of volunteers.

Much of the spilled oil, meanwhile, has been emulsified — suspended in the ocean water below the surface — outside the Golden Gate. Commander Gordon G. Dickman of the Coast Guard reported yesterday, "It's like a snowstorm where the flakes swirl around in huge masses, never touching the bottom," he said.

The Coast Guard will convene a hearing into causes of the tanker collision at 10 a.m. today, with the two skippers, Captains Morris E. English and Harry H. Parnell, as key witnesses.

At the mouth of Bolinas lagoon, saved in mid-week by day-and-night work by volunteers plus oil company and Marin county crews, a new double boom was under construction yesterday — to reach from the Stinson Beach sand spit to Bolinas.

It should be finished sometime today, Bolinas District Fire Chief Jose Silva reported, and will be faced with wire mesh extending above and below the water, to trap oil globs and oil-absorbing clumps of straw.

Meanwhile, he said, "there's no oil in the lagoon, and we're not too much worried at the moment unless we get a big storm." Aside from the large concentration of floating oil at sea off Bolinas late yesterday, the Coast Guard reported various other light streaks of thin oil, or patches of heavier globs and chunks, southward down the coast to Half Moon Bay and beyond — but no major crisis.

Coast Guard Commander Dickman said tidal currents had carried more than half the spilled oil out through the Golden Gate shortly after the ship collision, and that "the vast majority" of the patches and streaks that remained inside San Francisco Bay have already been cleaned up.

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