

El Niño Responsible for Decline of Black Abalone off Southern California

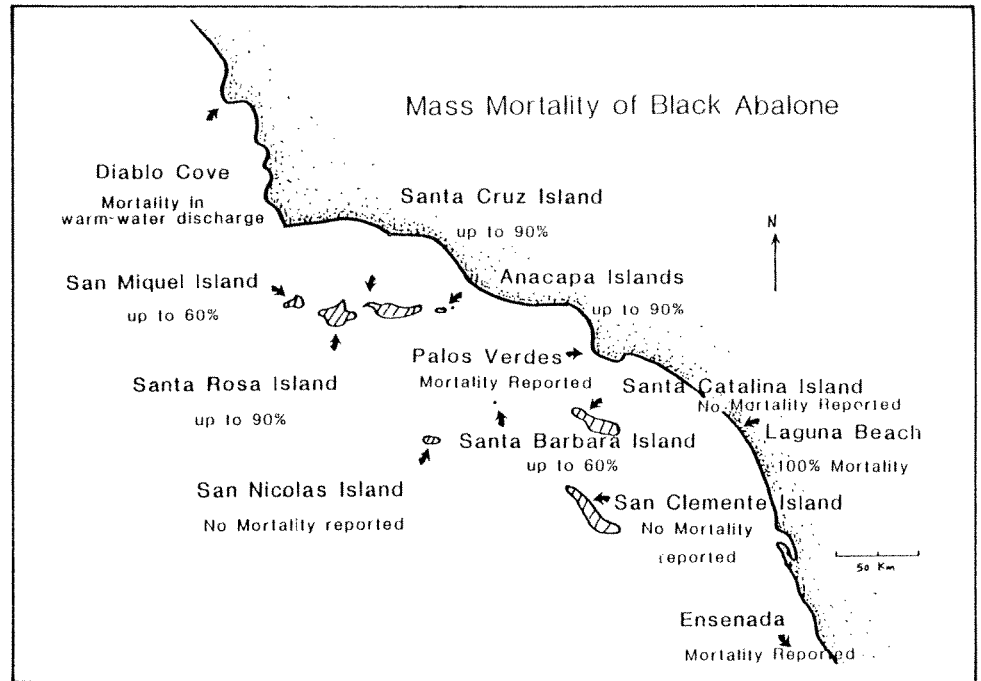
By Brian N. Tissot*

CORVALLIS, OREGON — From 1983 to 1984, Southern California experienced the largest El Niño event recorded. El Niño is a disruption of the normal ocean current patterns off Peru and Ecuador that can have strong effects on the California coast. An influx of warm, nutrient poor water combined with fierce winter storms had devastating effects on the coastal kelp forests throughout Southern California. In 1985, when conditions returned to normal, it appeared that few long-term changes had occurred. At this time, however, the black abalone, *Haliotis cracherodii*, an intertidal gastropod that occurs at high densities on the offshore Channel Islands, began a long, slow decline that has resulted in mortality exceeding 95 percent in some areas (figure 1).

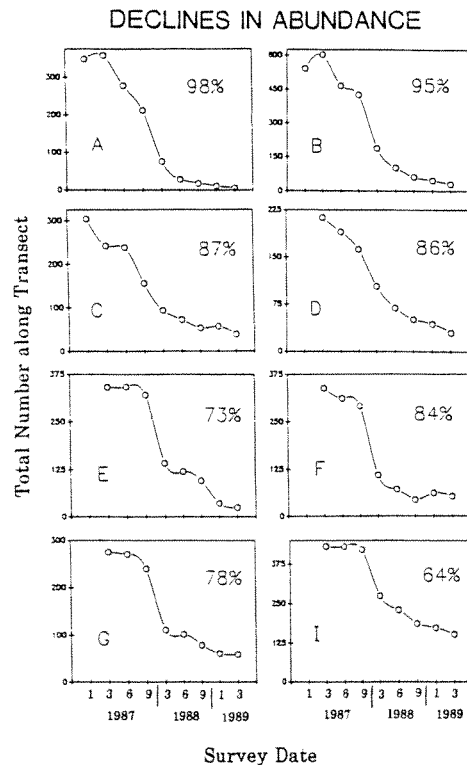
Because the abalone decline was slow, it was not until the spring of 1988 that National Park Service personnel, who have been monitoring the marine resources on the California Channel Islands since 1982, noticed a change. The Park Service measured black abalone declines on four Channel Islands: Anacapa, Santa Barbara, San Miguel, and Santa Rosa. My own study, which began in January 1987 on Santa Cruz Island, was severely impacted by the mass mortality. In eight intertidal areas the density of abalone declined from an average of 50 per square meter to seven per square meter between 1987 and 1989, an overall decline of 83 percent (figure 2).

The Abalone were dying from what is known as the "withering" syndrome: individuals lose weight and become so weak they are dislodged by waves and die. One possible cause of this condition is a small protozoan parasite, a Coccidian, which has been identified by Ron Heidrick and coworkers at the University of California at Davis. The parasite occurs primarily in the left kidney of "withered" abalone. However, there are problems with attributing mass mortality to the parasite: (1) the parasite infects both healthy and "withering" abalone; and (2) infection may be a secondary factor, occurring *after* the abalone begins to weaken. Clearly, as is the case with most infections, a stress factor is involved. And in the case of the California Channel Island black abalone, the stress was provided by a dramatic decline in kelp, their principal food, following the 1983-84 El Niño and the lesser 1986-87 El Niño.

Over the course of my three-year study, I have measured the growth of over 500 abalone by tagging, measuring, and recapturing individuals at three-month intervals. The shell growth rates that I measured during the first half of 1987 averaged 0.3 mm/month: this is less than half the average rates measured in 1969 and 1984 at the same site. Between September 1987 and March 1988, the interval of greatest abalone mortality,



Geographic distribution of black abalone mortality in Southern California. Mass mortality was concentrated in the California Channel Islands where the black abalone were most abundant.



Decline in the total number of black abalone along eight permanent transects on Santa Cruz Island, 1987 to 1989.

shell growth declined to zero! Clearly, abalone were starving, and probably had been doing so off and on since 1983.

Black abalone feed primarily on drifting pieces of seaweed: they lift their foot and capture kelp being car-

ried along in the current. Because drift feeding is an efficient way of foraging, black abalone rarely move to look for food. Over a 10-day period in March 1988, a time of peak mortality, very little drift kelp was available for the abalone at eight sites I had been monitoring on Santa Cruz Island.

During the late spring of 1988, however, food returned: strong recruitment of baby kelp plants caused tremendous growth of the kelp forests and drift algae increased dramatically throughout the Channel Islands. Between June 1988 and June 1989 abalone mortality subsided and eventually reached normal levels. Simultaneously, shell growth surged to 3 mm/month resulting in a marked band of thin, new shell material. Although the "withering syndrome" is still present in the population, it would appear that most of the decline is over.

Two questions are often asked: are humans responsible for this decline? And, will the black abalone recover? Unfortunately, we are partially responsible for the decline in the kelp forests which led, in turn, to the abalone mortality. In addition to the storms and nutrient poor waters of the El Niño's, high densities of purple sea urchins (*Strongylocentrotus purpuratus*) also contributed to kelp forest destruction. When the kelp forests were decimated in 1983 the normally sedentary urchins formed "urchin fronts" that voraciously devoured all the available kelp. "Urchin barrens" — rocky areas devoid of aquatic vegetation — resulted. These "barrens" are partially due to human exploitation of the urchin's principal enemies: sea otters, crabs, spiny lobsters, seastars, and large fish. Thus, overharvesting of marine resources in essence "destabilized"

(Cont'd on Page 4)

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[Brian Tissot is an HMS 1988 scholarship awardee. See also HSN December 1989 p 11.]

Black Abalone (Cont'd from Page 3)

the ecosystem and added to the effects of the large El Niño.

It is disheartening to look out over intertidal regions that were once covered with black abalone but now support only an occasional individual here and there. This situation is all the more serious when you consider that the black abalone is the only California species that is still fairly abundant. Given the low human exploitation of the black abalone in the California Channel Islands, it is likely that this species will once again regain its former abundance. However, due to its slow growth, it may take 10 to 30 years to reach pre-1985 levels.

* * * *

Anchatinella (Cont'd from Page 1)

And brought in snails as big as dogs
That scared away the fish and frogs.
And then more snails that liked to eat
Up other snails, just for a treat.

Cows and goats soon stomped away
The ground where grass and bushes lay
And all the roots that held the trees
Where their friends raised their families.

Anchatinella took a look
At the sweet, laughing little brook
That had seen fires burn the trees
And frighten away bugs, birds, and bees

Who once had lived so happily
In such a home, in such a tree
As he had dreamed that he would be
Destined to raise a family.

Anchatinella sat and thought
About the mail he never got
And when he heard a rumbling sound
He raised his head and looked around.

A car stopped short before his tree.
A little girl laughed merrily,
"Look Daddy, there's the little snail.
I've one just like it in my pail!"

"I'm glad you raised this pretty snail
With colors bright and colors pale.
We'll place him on the tree to see
If he would like some company."

She reached inside and found the snail
With colors bright, and colors pale,
And placed him on the little tree
to give our friend some company.

"*Anchatinella!* That's my name too!
I guess that I belong to you.
And we'll be happy as can be
If we can keep our little tree!"

"And if we two could somehow rear
a child, we'd have one every year!
And maybe we won't have to fear
that someday we'll all disappear!"

"Perhaps one day we all will see
Anchatinellas living free
of red and yellow, pink and green,
As bright as we have ever seen!"

So year by year, and one by one

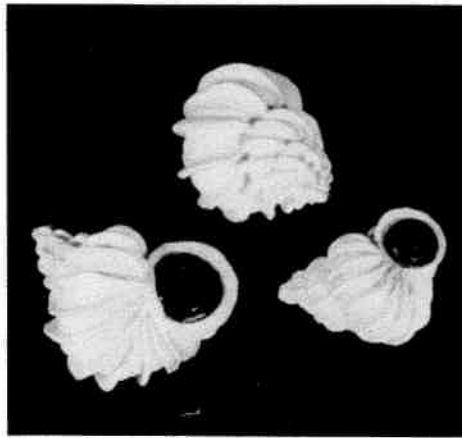
In this small tree beneath the sun
Achatinellas came to share
The happiness of our snail pair.

And so, one day, our little snail
Forgot that no one sent him mail
And lived in happy harmony
With all the snails upon his tree.

[An attractive folded card with the above drawings in color on the outside and the poem on the inside is available. The card also shows an *Achatinella* asking: "Can you children and big people help us? Will you? Who needs help besides snails? What about the trees? What about the flowers? Can we all take care of the pretty things around us?" Write *Children's Awareness Series*, P.O. Box 279, Middletown, CA 95461 for details.

TAB]

Fabulous Fakes



See the pretty wentletraps. They have different colors. Note the range in sizes. A millionaire's collection? Well, maybe, but not for the reasons you would expect. All three shells are modeled in rice-flour paste — an old Chinese custom. HMS member T. C. Lan of Taiwan sent this photo of a set of *Epitonium pernobilis* Fischer & Bernardi. Lan adds that specimens actually are being sold — as fakes. Photo: Lan

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