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Scientists to examine abalone beds. 12/11/2005. ABC News Online

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Scientists to examine abalone beds

A scientific study will endeavour to find out why some of Tasmania's abalone beds recover quicker from fishing than others.

The Tasmanian Aquaculture and Fisheries Institute will carry out the research over the next three years in the hope of finding ways to better protect the precious resource.

The abalone industry will be worth more than a $100 million to the Tasmanian economy this year.

Professor Colin Buxton from the institute says scientists will be using particular areas on the east coast as test beds, and then apply those results to other beds around Tasmania.

"Some of them seem to be more resilient to exploitation than others and what we're trying to do is understand why it is that some parts of the state seem to have recovered more slowly than others," he said.

Professor Buxton says the research will be a significant help in managing the resource.

"It enables us to understand just how this fishery behaves to exploitation and makes us that much more confident that what we doing is not going to collapse the fishery," he said.

Abalones Along Pacific Coast May Owe Their Huge, Dinner-plate Size To Sea Otters

Abalone divers, who typically despise the California sea otter because of its voracious appetite for the largest and tastiest of the shellfish, may actually have otters to thank for the dinner-plate size of the prized delicacy.

Worldwide, abalones tend to be small, in the range of 2 to 4 inches across, according to evolutionary biologist David Lindberg, professor and chair of integrative biology at the University of California, Berkeley, and a former abalone diver himself. Along the California and Pacific Northwest coast, however, abalones have grown much bigger, culminating in the 12-inch diameter red abalone, Haliotis gigantea, avidly sought by divers and once the center of a thriving commercial fishery.

A surge in the last century in the sea otter population, however, killed off the commercial abalone industry along the central and southern California coast and made it hard for sport divers to find any abalones, let alone large, 12-inch ones. Many divers, fishermen and even wildlife biologists worry that the otter is driving the abalone to extinction.

A new study of the interaction between abalones and California's coastal kelp forests, however, suggests that the sea otter played a key role in driving up the size of the abalones. Unlike kelp and algae in tropical waters, kelp in cold waters like those along the California coast have not developed toxic chemicals to ward off voracious grazers like sea urchins and snails. As a result, abalones, which live off the drifting, dead kelp so abundant along the Pacific coast, thrive and grow huge on the highly nutritious food.

The researchers speculate that the sea otter helped set up this state of affairs. By ruthlessly preying on sea urchins and smaller snails, otters kept the herbivores at bay, and the kelp had no need to develop chemical deterrents. Abalones could, for the most part, hide from otters in rock crevices while gorging like couch potatoes on the tasty kelp washed up on their doorstep.

"We realized with this study that most abalones are small, averaging two inches across, and live on coral reefs in the tropical Indopacific," Lindberg said. "So why does the world's largest abalone live in the same place as this major predator, the sea otter? We think the abundance of kelp, the ability of abalones to stay hidden in crevices and the predation of otters set up an ideal system to ratchet up the size of abalones."

"There is very little doubt that in the old days, before people were part of the system and when otters were abundant along this coast, anywhere abalones occurred, the otters had a very limiting effect on their distribution and abundance," said James Estes, a research scientist and marine ecologist with the U.S. Geological Survey (U.S.G.S.), who works out of UC Santa Cruz's Long Marine Laboratory in Monterey. "I think what was really going on was a dynamic equilibrium, where the populations in the crevices built up and the abalone would be pushed out to the point where otters could get them on the edges of the crevice. There were still lots of them there, but there was still a fair production that was being exploited by sea otters as well."

Estes, Lindberg and Charlie Wray, a former UC Berkeley post-doctoral fellow, published their findings in the current issue of the journal Paleobiology.

Lindberg has always been puzzled by claims that the otters are driving the abalones to extinction, since it is known that sea otters and abalones have shared coastal waters for the past 5 million years. The newcomers to the area, he said, are humans. Middens or refuse piles along the coast show that, historically, the California Indians also loved abalone and were the first to deplete the abalone population along segments of the coast.

"Since we can demonstrate that the large size increase took place in the presence of otters, the only hypothesis left as to the cause of the demise of a lot of abalone stock is human overfishing and probably destruction by humans of habitat," Lindberg said. "Getting an evolutionary grasp on a system gives us power in understanding its ecology and physiology, even if you are talking about management of wildlife stocks."

Colleagues for more than 20 years, Lindberg and Estes had often talked about the interactions along the coast between sea otters, abalones and the abalone's principal food, kelp. Lindberg, a malacologist and former director of UC Berkeley's Museum of Paleontology, specializes in the evolution of mollusks. Estes, who has studied otters for some 35 years, has had a long-standing interest in the history of the kelp forests off the California coast. The two teamed up with Wray, a molecular geneticist, to look at the evolution of abalone size and how abalones may have affected the evolution of kelp.

Estes earlier had suggested that, as the Earth began to cool 45 million years ago, kelp moved out of their tropical homes into cooler waters in temperate regions of the northern and southern hemispheres. The first radiation was into southern oceans 42 million years ago as the Antarctic ice sheet developed, followed much later, perhaps 10 million years ago, by radiation into the northern oceans as the Artic froze over.

The current study, in which Wray used DNA comparisons to determine the family tree of the abalones, supports these dates. The abalones, which originated about the time the dinosaurs died out 65 million years ago, moved into the same temperate areas around the same time as the kelp. Perhaps because the kelp left behind many of the grazers that keep tropical kelp and macroalgae down, the temperate, cold-water kelp never developed the toxic chemicals that are typical of tropical kelp, and abalones were able to grow large on the abundant food.

"In tropical systems, abalones are little bitty things. But wherever one looks around the world where there are kelp forest systems in cold oceans, that's where the bigger abalones occur," said Estes. "One of our major conclusions is that this has happened relatively recently in evolutionary time, starting around 5 million years ago."

Of eight abalone species now living along the Pacific coast from Baja California to British Columbia, six - the red, black, pink, white, green and flat - are all 7 inches across or larger. Several species off the Japanese coast and in Antarctic waters also are significantly bigger than tropical species, which have remained small.

Interestingly, tropical kelp and algae have developed such toxic tissues that abalones no longer feed on them, but instead have turned nocturnal and feed on blue green algae and diatoms that form a scum on reef surfaces. Over time, kelp from the north has even returned to southern waters, yet abalones still avoid it as if it contained the same toxins as the original tropical kelp.

A 40-mm tropical abalone, Haliotis glabra, is dwarfed inside the shell of the world's biggest, the cold water Pacific species Haliotis rufescens, the prized red abalone. (Photo by David Lindberg)

Worldwide, abalones tend to be small, in the range of 2 to 4 inches across, according to evolutionary

To both Lindberg and Estes, though, the California sea otter stood out as an intriguing member of the kelp/abalone community. Fossil evidence shows that otters have long lived along the coast and eaten the biggest and best of the abalone. Otters today take stones and pound on the underwater abalones until the shell margins break, then pry the abalones off the rocks with their paws. Or, they cave in the shells with a rock and come back later to peel the weakened abalones off the rocks. While in some situations, predators can drive prey to become larger to better fight off attacks, in the case of abalones, getting bigger just made them more attractive as a food source.

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"If size is not a refuge, why would you get big, especially where you have a convenient predator taking you out at the same time?" Lindberg asked.

Hence the researchers' speculation that abalones grew large, in part, because of otters. The system lost its balance in the 1700s, when Russians first began slaughtering otters and fur seal for their pelts. By the time otter and seal harvesting was outlawed in the early 1900s, the otter was thought to be extinct. Abalone populations rose, and abalones moved into more open spots, even developing a more peaked shell since they no longer needed a slim shell to hide in crevices.

"We got a taste for abalone in the absence of otters, and now that the otter has come back, we're blaming the otter as a threat to the abalone," Lindberg said.

A remnant population of otters off Big Sur eventually grew to populate the entire central California coast, though it has yet to move south in numbers to the Channel Islands, or north beyond San Francisco.

Lindberg said that the abalone/otter conflict is one of several unforeseen consequences of the Marine Mammal Protection Act, which was signed in 1972 and has led to a rapid rise in sea mammal populations off the California coast. Seabird

nesting areas are being impacted by a burgeoning sea elephant population, while sharks drawn by the mammals increasingly are attacking humans.

"We make management decisions all the time without an evolutionary perspective on how the system assembled over time," Lindberg said. "An evolutionary perspective is critical for understanding ecological context."

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Editor's Note: The original news release can be found here.

This story has been adapted from a news release issued by University of California - Berkeley.

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Harsh penalties proposed for fish poachers

By NIGEL HUNT
30nov05

HARSH new laws and penalties to combat fish thieves and abalone poachers have been proposed by the State Government.

Under the draft Fisheries Management Bill 2005, which was released yesterday, fines of $100,000 and a jail sentence of four years have been proposed for anyone caught trafficking abalone.

And, for the first time, recreational anglers will face heavy fines for possessing more than the prescribed quantity of fish at any time.

The measure, which carries a $5000 fine for a first offence, is aimed at combating fish thieves who catch their legal bag limit of fish, but accumulate them and sell them illegally.

All existing bag and boat limits remain unchanged under the proposed Bill.

Director of Fisheries Will Zacharin yesterday said the new offences recognised the fact that species such as abalone were under threat from organised poaching syndicates operating across southern Australia. "We have people who are now trafficking in these commodities and using them in organised crime syndicates," he said. "The Bill has created the indictable offence of trafficking so it can be referred to other crime agencies."

The new offences and penalties are in line with recently introduced measures in other states. Other proposed new offences in the Bill include:

COMMERCIAL fishing without a licence - $100,000 fine or four years' jail.

SELLING or purchasing fish without an authority - $50,000 fine or four years' jail.

TAKING or damaging a protected species - $10,000 a first offence.

INTRODUCTION or possession of an exotic species - $120,000 fine.

The proposed Bill introduces a demerit point system and establishment of the Fisheries Council as the peak body replacing seven existing management committees.

Copies are on the PIRSA website, www.pir.sa.gov.au/fishing

Academia Sinica team ups abalone survival rates

Academia Sinica's Cellular and Organismic Biology Research Institute has a research station near the sea that is currently attempting to use ozone disinfection to improve the quality of sea water, creating an environment suitable for the growth of small abalone (Holiotis diversicolor) and algae. From breeding seed shells, they have now moved into propagation of abalone. In just over a year, the station has discovered that the seedling survival rate is between 20 and 50%, and to date has propagated about 12,000 abalone which were sent outward to be raised. Observations were also done to determine whether abalone could grow in sea water.

This species of abalone is a shellfish with high economic value. In the 1970s abalone was brought to Taiwan for cultivation, and abalone farming reached a peak in the 1980s and 1990s. People on the northeast coast, down to the south and even on the outlying islands were raising abalone. At the time, this was a follow-on to raising oysters and clams, but abalone shot forward to rapidly become third on the list of shellfish species raised in Taiwan, with hundreds of millions produced annually.

In the first decade of the new century, Taiwan's abalone stocks began falling to a mysterious illness. The survival rate for shoots at growth locations fell to 1%. This was occurring on Penghu and the outlying islands as well, and the situation has not returned to normal even today. This obviously formed a major obstacle to export, and the Council on Agriculture tapped 16 experts to form a team to research the reason behind the calamity. The results mostly point to "a possible infection with some sort of bacteria or virus."

Guo Qianming of Academia Sinica's research station says that he believes the abalone have very likely been infected with a virus. The young sprouts that grow when abalone eggs are fertilized must adhere to something solid and eat algae. If the water quality is poor, this means poor algae growth, and the young abalone can't grow well if they are constantly hungry. Therefore, the station is attempting to improve the water quality, so that the algae will have a good environment to grow in. Guo is leading a team of three scientists – Li Hongcai, Xu Shijie, and Wu Zhengxian – to use a circulating system to better the water quality. Day and night, they think of nothing but abalone.

Guo says that seawater from outside is first filtered for sand and then disinfected using ozone when it enters the system, to kill any bacteria or virus that might be affecting the abalone. Then, the water is filtered by circulation through a simple system of balls and coral to transform the toxins taken out of the abalone beds into beneficial nutrients before the water is released to the sea, maintaining the balance of the water cycle.

Li says that when they began experiments last year, they purchased abalone and the water they were being grown in directly from farmers and brought it all back to the station. At that time, the survival rate was zero. This year, they bought male and female abalone and set up their own artificial breeding program in the water cycle at the station. After four iterations of the experiment, the survival rate is a minimum of between 20 and 30%.

Guo emphasizes that these are merely preliminary results. Although exciting, they cannot be deemed a success yet. The next step will be to investigate the type of algae the abalone like to eat, and do research on them, so as to allow large-scale farming of abalone. This would be the breakthrough the abalone industry in Taiwan is hoping for. Anyone with interest in abalone is welcome to share his opinion by calling (039) 880544.

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