# OceanBights

## The Magazine of the Catalina Marine Society

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Contents

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The Catalina Marine Society is a nonprofit membership corporation founded in 2009 in Los Angeles to marshal volunteer resources to study the marine environment of Santa Catalina Island and the Southern California Bight.

Submissions. The magazine may publish submitted articles that pertain to our mission statement. Contact the e-mail address below for more information.

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## This Issue

There was no planned theme to this issue of *OceanBights* for why would we break tradition? But two themes developed. First is local sightings of two endangered species; green turtles and giant black seabass (Mary Ann Wilson's article). The first time I saw a giant black sea bass (I was a pre-teen) it was in the bed of my neighbor's truck. And, he needed a truck to transport it. I've also had interesting encounters with them in Malibu, where one stole my supper. Mary Ann describes the fisheries history, natural history and current research on these behemoths at Santa Catalina Island.

Sightings of sea turtles are also becoming more common and we have an article on a surprisingly local population, and how, you, too, can go see them.

The second theme is the very warm water we have experienced this summer and fall. It may influence turtles, kelp and sea stars, and if it portends a large El Nino, every animal will probably be affected. This topic is touched on in a tribute to the Catalina Conservancy Divers and their efforts to measure marine species at the island.

Finally, we introduce Cassandra Heredia who has written her first article for *OceanBights*. She describes the plight of our fisheries and efforts to sustain them, especially the works and dedication of the Ocean Defenders Alliance, where individuals go to heroic lengths to save our macro marine fauna.■

## El Nino Predictor, Please!

What this country needs is a good El Nino predictor. I was prompted to write this during a recent hellacious rain storm, a symptom of El Nino. However, starting in the summer and continuing into the fall, the predictions for El Nino have become weaker, even tepid though the water temperature at Santa Catalina Island has been unusually warm: a harbinger of an El Nino. (See the last issue of *OceanBights* for a winter-summer temperature comparison at the island.) Strong El Ninos have dramatic effect on our phytoplankton, kelp, fisheries and marine mammal populations. Indeed, time series of populations are strong indicators of El Nino years. If we cannot predict an El Nino, we cannot predict and manage these resources. To promote accurate predictions, I suggest that **the government gives a prize for develop-ment of an accurate El Nino predictor. Let's call it the "EL" prize.■**

## Return of the Giant Sea Bass, King of the Kelp Forest

Mary Ann Wilson

Back in April 2011, my friend and I were diving off Casino Point on Santa Catalina Island in chilly waters when we looked up and saw four large black fish. They were about four to five feet long, cruising slowly in around 20 feet of water at the edge of the kelp. To my friend they looked like underwater cows; to me they seemed more like mellow hippies on floating motorcycles. Whatever they were, I was in awe of them. We were told they were giant sea bass (GSB), *Stereolepis gigas*, which return to the waters off Catalina Island every summer, and we were the first to see them that year.

These apex predators have had a rough time, being nearly fished to extinction until saved by legislation. Commercial fishing of giant sea bass began in Southern California in1870 when fish were taken with hand lines. But as the take declined between 1915 and 1920, fishermen switched to gill nets, temporarily increasing catch. Commercial landings peaked in 1932 at 115 tonnes but then decreased rapidly. By 1935 most commercial fishing had shifted to Mexico. And by 1980 commercial landings in California waters had declined to 5 tonnes.

In 1981, the California State Legislature banned commercial and recreational fishing for giant sea bass, but still allowed commercial fishermen to retain and sell two

Mary Ann Wilson

fish per trip if caught incidentally in a gill net or trammel net. This law also limited the amount of giant sea bass that could be taken in Mexican waters and landed in California. The law was amended in 1988, reducing the incidental take to one fish in California waters.

After the moratorium was enacted in 1981, catches decreased substantially. From 1983 to 1992, incidental catches remained low, ranging from 1.7 to 5.9 tonnes.

But the moratorium didn't prohibit fishing over giant sea bass habitats where they could be caught incidentally. Entangled giant sea bass that would exceed the catch limit if landed were discarded at sea or distributed among fishing boats.

Other fish have also suffered from nets and overfishing. Soup fin sharks became scare in the early 1940s, while leopard sharks declined in the mid-1980s. In a drastic move to save the fish, gill nets were banned as of 1994 from within three miles of southern California's mainland. This regulation signaled a turning point for fish populations. In a presentation given this past October, Dr. Larry Allen, biology department chair at CSUN, said the Proposition 132 ban on gill nets is what turned the tide for many commercially fished species. "We've seen a response of halibut, a response of giant sea bass that we've published, a response of leopard sharks and soup fin sharks and a variety of other large elasmobranchs which seem to

June 1906 world record 428 lbs. Library of Congress

have gotten some relief from commercial fishing."

Dr. Allen worked for 20 years before seeing a juvenile giant sea bass in 1993. His first observation:

> "Last year while trawling in Newport Bay on a sampling trip for Cal Fish and Game's BENES program targeting local sport fishes, something memorable happened...Almost as soon as the trawl had hit the deck, my chief research assistant, Motz (Tom Grothues), began yelling something about a black sea bass. I was on the back deck in an instant grumbling in disbelief. I had never seen or heard of a black (or now, more properly, a giant) sea bass being taken from inside Newport Bay in all of my 20 years of experience there. But, sure enough, there it was. An absolutely gorgeous little fish about 6 inches long. It was reddish-bronze in color with jet-black circular spots and huge black fins…From the likes of this tiny, elegant fish -- the largest, the eldest, and most magnificent of our nearshore fish species will emerge." (*Western Outdoors News, 1993*)

He was right. A scientific monitoring program conducted quarterly by SCUBA divers with the Vantuna Research Group (see *OceanBights* Vol. 3 No 1) didn't report any along Palos Verdes Point from 1974 to 2001. The giants finally were seen there from 2002–2004. That's when Allen decided it was time to begin a study of giant sea bass. But his article entitled "The decline and recovery of four predatory fishes from the Southern California Bight" was turned down by Science, Nature and PNAS, because "there was one reviewer that simply didn't believe our data. He thought we made it up," Allen said. It was finally published 2008 in Marine Biology.

Juvenile GSB
Photo thanks to Phil Garner

Giant sea bass start life as brightly colored orange juveniles with large black spots, and ride the sand riffles in shallow water. According to Allen, the juveniles gorge on opossum shrimp, while the darker adults eat pretty much anything they want including fairly large spiny lobsters which they are more than capable of sucking out of their crevices with their large, gaping mouths. As the only "megacarnivore" inhabiting the kelp beds in southern California, they also consume Pacific mackerel, ocean whitefish, midshipmen, stingrays, white croakers, small sharks, crabs, and mantis shrimp.

Historically, giant sea bass were distributed from Humboldt Bay to southern Baja California and the Sea of Cortez with populations concentrated south of Point Conception in shallow rocky reefs. According to Allen, the current primary range is Pt. Conception south to about Punta Abreojos, Baja Mexico and in the northern Gulf of California (north of the Midriff Islands). "We think they occur off the coastline of southern Baja California, but if they occur there, they are probably in deep water — say 200 to 400 feet," Allen said. "We also think they or their larvae migrate around the tip of Baja joining the populations on either side of the peninsula, based on anecdotal and personal observations as well as genetic data."

Very little is known about giant sea bass, but their increasing numbers enable better research on lifespan, size, mating and population diversity. In recent years, scientists have determined that the *Stereolepis gigas* are not even related to sea

bass. They're in a completely different group of fish, the wreckfish (Polyprionidae) which are very distantly related to groupers.

To estimate age, Allen counted the number of annuli on otoliths from 64 heads, obtained from the Santa Barbara Fish Market between January 2010 and May 2013. These fish were incidentally caught by fishermen working between the Northern Channel Islands and northern Baja Mexico. When he counts the rings he places a dot on each ring to ensure accuracy. Then he figures out how much bomb radiocarbon it has, and fits that into the calibration curve of bomb radiocarbon present in the Eastern Pacific. Bomb radiocarbon was produced from atmospheric nuclear testing in the 1950s and shows a very distinct pattern in most oceans, as the atmospheric fallout worked its way into the bony structures of all fishes and invertebrates. In 2012 Larry Allen and Allen Andrews were the first to validate annual growth rings for one individual and provide a verified maximum age, 76 years, for giant sea bass using bomb radiocarbon validating techniques.

Wild, live fish are being studied at Catalina. Two of Allen's students, JR Clark and Parker House, received WIES Wrigley Institute Summer Graduate Fellowships and spent three months diving off Catalina Island, first locating the giants' aggregations, then trying to determine their size, densities, and mating behavior. They also hope to learn what impact their return will have on kelp bed fish populations. Grants and $6,000 dollars in crowd funding help to pay for the students' underwater hydro-acoustic equipment and sea scooters.

To find the minimum population size around the entire island, they chose eight sites: four where they thought they'd see giants and four where they thought they wouldn't see them, and did the back side as well as front side. Those eight sites were Johnson's Rocks, Little Geiger, Empire Landing, Twin/Goat (between Goat Harbor and Twin Rocks), Italian Gardens, Casino Point, The Vee's, and Little Harbor. There were 4 periods within roughly two-week long windows that sampling was conducted.

GSB Researchers JR Clark (left) and Parker House.

Sites with the most individuals and biomass were Little Harbor, Goat Harbor, and the Vee's. At the Vee's they saw an aggregation of 24 individuals in two different sampling periods. To accurately size giants underwater, the students use length-calibrated lasers and a GoPro video camera mounted on top of SeaDoo SeaScooters. Two laser beams calibrated four inches apart are pointed directly (90 degrees broadside) at an individual fish so that the laser dots are visible in the video. Stills are later extracted from video and then measured using a software program. Using length to weight relationships, biomass is determined for different areas.

Their calculated average biomass for the eight sites was 36.29kg/1000m$^2$, which was higher than expected. House said this was due to the unexpected and very large aggregation at the Vee's. The most individuals observed were 36 counted during the sampling period from July 15 to July 23, 2014. The least were seen during June with only nine individuals. The giants ranged from 0.9 to 2.7 meters while the majority were around 1.3 m (4.2 feet) in length. The International Game Fish Association all-tackle world

Largest GSB measured: 9 ft long!
Courtesy of Parker H. House

record for this species is 563 pounds 8 ounces, caught at Anacapa Island in 1968. But the largest one seen this summer was 2.7 meters or 8.9 feet and weighed at least 325 kilograms or 800 lbs, and is the largest ever measured.

"It was relatively easy to count the individuals as many stayed in a general area," House said. "Many of them have different characteristics; some had many parasites on their face, or scars on their fins or sides, or blotches so you can more easily identify one fish from another, although they do change color. Some would be near us and would show a certain color pattern, but once they moved away, you would see these patterns change. We think the changing of color pattern may be a signal for mating as well as communication to the other individuals."

"Many fishes change color when they are ready to mate," Clark added. "A good example is the kelp bass, which presents a yellow or orangey mask when males are in the spawning season. We have seen some color change, from a light to dark color type change. This has been previously described as a spawning type activity in giant sea bass."

Another way to identify spawning and courting behaviors is by their sound. The students had just gotten down to one of their sites when they heard a BOOM -- the sound of a very loud bass drum. "The first time I heard it I thought something was wrong with my tank," House said. "So I checked my pressure gauge to see if it had dropped, but it wasn't us. We looked around and a giant sea bass was coming straight to us, and then he checked us out and took off. We think the sound could be either a call to try and get us away because they were courting in that area, or to see if we were potential mates."

Spawning in giant sea bass has only been seen in an aquarium where there are just two individuals. Because of their size and the enormous amount of eggs the females carry -- up to 60 million -- GSB are thought to be group spawners, but Clark believes that they are pair spawners because they are frequently seen in pairs, even when they are in large aggregations.

The students use the sounds giant sea bass make to distinguish one fish from another and also to measure the density of giants in a specific area. Clark uses a DSG-Ocean Acoustic Datalogger, which is an omnidirectional hydrophone (underwater microphone) that can record data over many days. He distinguishes giant sea bass sounds from other fish by looking at the decibel range and sound frequency they produce and comparing them with giant sea bass sounds recorded in an aquarium. This enables him to analyze mating strategies and describe spawning behavior of giant sea bass in detail. "Although there may be some echoing in the sounds produced in the aquarium it will allow me to ground truth sounds and get a general decibel range to work with," he said.

Whatever the giants spawning behavior is, their genetic diversity is small. Allen and Andrews used mitochondrial and nuclear microsatellite techniques to determine genetic diversity. They found all the giant sea bass, those in the northern Gulf of California, as well as off Southern California and Baja, were closely related.

They're basically one panmictic group — a panmictic population is one where all individuals are potential partners. "Our estimate is 152 breeding females, with maybe an upper limit of 500 and a range of 84 to 539," Allen said. "So we're dealing with a fish that's not genetically diverse anymore; relatives are breeding with another, and we don't know what that says to the ultimate sustainability of these populations. Sobering."

**However, the king of the kelp forest has returned.** Recently a Giant Sea Bass Count was organized by researchers at the University of California, Santa Barbara and California State University, Northridge. Recreational divers could report any sightings around Southern California during the first week of August. Giant Sea Bass sightings numbered 23. Their results can be seen at: http://www.seasketch.org/#projecthomepage/53dbacf69743984a77bd896d.

Next year's giant sea bass count will probably be in early August, but check and "like" the Facebook page, The Giant Sea Bass Collective, at https://www.facebook.com/giantseabass, to get updates. ■

## Volunteer for our Depth-Profiling Program

Can you deploy a 7-lb instrument from a boat or kayak? CMS has an active program to measure ocean chemistry around Santa Catalina Island and we could use your help. Contact us for more information.

Hydrophone and GSB
Courtesy of Parker H. House

## Society News

The Catalina Marine Society has expanded its Board of Directors. Boardmembers are Karen Norris, Mike Doran, Dirk Burcham, Paul Dimeo, David Tsao, Shawn Broes, Jonathan Davies, Jim Updike and Craig Gelpi. Jim serves as president.

We also are expanding our outreaching activities with two projects. **A video, narrated by Jon Davies, and produced by Shawn Broes describes servicing our CMS Thermograph Array via boat**. It can be viewed from YouTube: http://youtu.be/0XWThEaDL90

The other project is a fish identification class spearheaded (pun intended) by Mike Doran and CMS member Gerald Winkel (also of REEF). Although still in its development stages regarding dates, the venue will be the Aquarium of the Pacific. Announcements will be made to the CMS Friends e-mail list. If you are interested please contact karen@catalinamarinesociety.org.

## The Turtles are Coming

CMS Staff

We have seen many warm-water-preferring species in Southern California with the onset of the extremely warm temperatures this year. Trigger fish, basking sharks, sperm whales, cardinal fish, slender molas, and more. But there is one warm-water animal that apparently has taken permanent residence in Northern Orange County/Long Beach area: green sea turtles *Chelonia mydas*. We have long read reports about green turtles in San Diego Bay, and within the last decade, we saw a picture of a sea turtle off Santa Catalina. But a non-breeding colony was recently found to exist in the San Gabriel River between its mouth and the upriver power generation plants. Now, truth be told, the first time we searched for turtles there we found none. But we had heard enough reports, and seen enough images of turtles with a background that we recognize, to believe they are there. But before we could find one, Aquarium of the Pacific divers Jason Aurand, Lindy Yow, Jerry Vertigan and Andrew Solomon, deploying sensors for our Continental Thermograph Array, reported seeing one at Cress Street and shot a video as proof. Then, on a dangerous turtle hunting expedition, I had 3 sightings in the San Gabriel River. (Perhaps, I saw the same turtle 3 times but I did see at least one large turtle.) They DO live in metro LA. By the way, the danger is real and due to the adjacent well-used bike path and the non-zero probability of being pegged by a fast cyclist.

These are the same species of turtles that are commonly seen in Hawaii. In fact, on a recent trip there we saw several turtles on our diving and snorkeling outings on the South Shore.

What makes this local sighting special is that **all sea turtle species are endangered**. This unfortunate state makes the San Gab turtles the subject of intense study by citizen scientists, especially ones associated with the Aquarium of the Pacific. We communicated with one of the volunteers, Pam Ryono, who has been observing the turtles for the Aquarium since 2008. On one prolific day in 2011 she and her husband saw 26 different turtles. Observing on another day near when I went, they observed 5 or 6, in line with the number I believe I saw in an hour.

Talking with long-time cyclists on the bike path of death she heard that turtles have been seen in the river for 25 years. The Aquarium maintains a video with lectures from experts and the citizen scientists who observe the turtles. It can be obtained from http://www.aquariumofpacific.org/multimedia/player/lecture_archive_dr._lance_adams_dan_lawson_hugh_pam_ryono and it presents the history of turtle sightings in the area and other interesting data.

**In the San Gab there are thought to be a dozen resident** small (young) turtles forming a non-breeding, feeding colony. Green sea turtles can grow to 3 to 4 ft in length and weigh up to 550 lbs, so they are big animals (a very large one, named Wrinklebutt, producing the upper weight limit is known to live in San Diego Bay).

➔ see *Turtles* on page 13

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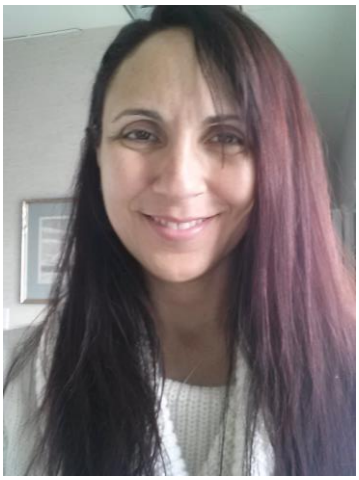
## Reducing Loss of Marine Fauna: Ocean Defenders Alliance

Cassandra Heredia

Humans have been fishing the deep seas for over 40,000 years. Our oceans have supplied what seemed like limitless bounties that fed our families and in the process led us to unfamiliar lands with exotic peoples, opening our eyes to wonderful and exciting discoveries. The oceans also make our lovely blue planet habitable, so the very health of the waters and the creatures within it directly relate to the quality of life we can expect here on Earth. However, while we appreciate what the oceans have to give us on the surface, **we are usually unaware about what is happening just beneath us.** With its bottomless waters and ostensibly unending supply of resources, civilizations must have thought the bounties would never run out. Unfortunately, in the past 50 years we have proven to do what no one thought possible: we have overfished our oceans to the point of extinction for most big fish populations. We have become so super-effective at commercial fishing that we have perilously changed the ecological balance.

Gear that has made fishing more effective litters the ocean floors as it gets lost, broken, or simply tossed overboard. This 'ghost gear' commits other marine life to injury or, in many instances, death. When we combine overfishing and ghost gear with pollution from causes like pesticide run off, plastic trash and oil spills, obviously the health of our oceans and the creatures within it are in jeopardy, and have been for at least a generation.



Cassandra Heredia

As individuals, we sometimes find difficult to believe that one person can make a difference against any of the threats compromising the health of our oceans and therefore our planet. But individuals can make a difference. And if a person is dedicated, others will support him. One such dedicated individual is Kurt Lieber, founder of Ocean Defenders Alliance (ODA).

In 2009 ODA began tackling the *Infidel* off Catalina Island. *Infidel* was a trawler that sank in 2006 in 150 feet of water when it harvested too great a load, taking 9000 pounds of deployed net down with it, and in doing so committed scores of unsuspecting marine animals to an early demise. When the *Infidel* sank, the netting wrapped and twisted around the vessel and rigging, and to date still traps animals like sea lions that become entangled and cannot escape. This continues despite thousands of pounds of the netting having been painstakingly cut and hauled away from *Infidel* by ODA and other concerned divers over the years. As disturbing as this is, *Infidel* is only a small indicator of the much larger problem. Netting, as well as other items such as lines and traps lost or left behind by commercial, traditional and recreational fishing practices used in our oceans are responsible for the deaths of roughly 360,000 cetaceans and turtles, as well as other animals, every year. To date, ODA has removed over 20,000 pounds of abandoned net, hundreds of traps and tens of thousands of feet in lines in our SoCal waters.

Kurt understood the effects our actions have on the oceans from the first time he freed a lobster stuck in what was obviously an abandoned trap. Moving to Southern California in 1979 to pursue diving, he became aware early on of what was happening on the ocean floor. During the El

Nino event of 1982, 90% of the kelp died and recovered very slowly after the event. As he began investigating why, he noticed the degradation of the ocean environment. In addition to the ghost gear that inadvertently traps many marine animals, 'dead zones' are also proliferating. A 'dead zone' is an area where all oxygen is depleted from the water. Though it is sometimes caused by natural events it is often produced by manmade, nutrient-rich runoff, which promotes growth that consumes the available oxygen and consequentially suffocates any living creature in the area that needs oxygen to survive – including the creatures that help keep the oceans' ecosystems functioning as we remember. In 1975 only one 'dead zone' was recorded; as of 2014 there are over 500 worldwide. Still, there hopeful signs that we are becoming more aware and concerned with restoring the health of our oceans and the creatures that make the sea their home.

In 2002 Kurt officially started ODA, http://www.oceandefenders.org, as a nonprofit organization and funded it entirely on his own, but over the past twelve years ODA has gradually seen support build. In 2006, the same year *Infidel* sank, donations of money and time started to come in to help the cause. Finally in 2012 there was enough funding so that Kurt could start paying himself and commit full time to his passion of guiding ODA's mission. In 2014, Kurt and two dedicated members drafted and presented a grant proposal to Mr. Bob Barker, whom Kurt had met during his time volunteering early on with Sea Shepherd, another charitable organization. Mr. Barker, well known for his generous spirit, awarded ODA $150,000 so that Kurt could purchase a new vessel worthy of the extended trips he believes are necessary to make more headway in the fight against the debris that litters the oceans. *Mr. Barker's LegaSea* is quite a step-up from the previous ODA vessel, the *Clearwater*. Having been on the *Clearwater* almost three years ago, I can say she served her purpose as best as she could, but she is not a comfortable boat and limited the type and distance of trips that could be made to retrieve gear. The *Mr. Barker's LegaSea*, a 55' Chris Craft with a full galley that sleeps 6 plus the skipper, has been outfitted to make outings for divers as comfortable as possible, including a custom dive ladder that was generously built and donated by ROC Industries, Inc.

Kurt Lieber

Granted, the *Mr. Barker's LegaSea* also gets 2 gallons to the mile (not a misprint), so significant funding is required even to cover fuel costs, but it's an incredible step up from where ODA started 12 years ago.

One of the ways that Kurt is hoping to gain ground on the fight against ghost gear is to foster working relationships with the local fishermen. **He knows that outreach with the fishermen is crucial to mitigate the amount of ghost gear** into our oceans. He hopes to build a rapport so that when gear is lost, broken, or needs to be discarded fishermen will contact ODA first and Kurt can get to it before it goes down or, at the very least, get to it before it does damage. According to Kurt, Los Angeles City Councilman Joe Buscaino has offered to arrange a meeting among the pertinent parties.

While these encouraging steps are being made locally, positive steps on a global scale are also gaining headway, but not without challenges.

On November 17, Japan, the United States and Mexico voted to adopt a 43% decrease in fishing of Bluefin tuna; 96% of the Bluefin population is gone and most of those that remain are juveniles that if caught will not be allowed to mature and grow to revive the population. A year ago a 489 pound Bluefin tuna fetched $1.7 million; at one time this was an average size Bluefin but this size has now become rare. Because Mexico does not always adhere to regulated fishing policies due to economic motivators, the Japanese government may suggest to its importers not to purchase Bluefin presented from Mexico, but it would be voluntary. American eel, Chilean seabass (really toothfish), Atlantic cod, and certain sharks (due to finning, recently banned in California) can all be added to the list of big fish that are at an appalling 10% or less of their historical populations.

The measure to limit the Bluefin take for 2015-2016, advocated by the National Oceanic and Atmospheric Administration (NOAA) and applauded by the environmental legal organization Earthjustice, is an indicator that we are becoming aware of the impact of under-regulated commercial fishing. But our response may be too late to save the fish. For

Removing ghost trap.
Credit: Walter Marti

example, the supply of Atlantic cod once seemed endless; now the supply seems hopeless. Canada banned the Atlantic cod catch almost 20 years ago, hoping to see a recovery in the cod population. Research shows that the results of the ban have been disappointing. In Newfoundland, conventional fishermen and the villages built around this honorable tradition have become ghost towns while the Canadian government (taxpayers) supports residents with subsidies to the tune of $4 billion. Even with this example NOAA seriously overestimated the cod population more than two years ago and now current reports are that NOAA is initiating emergency action, severely limiting this season's catch in the Gulf of Maine, impacting fishermen who expected to keep their livelihood and take care of their families without subsidies.

**This year Kurt will be presented with the Ocean Hero award** for both his commitment to restore our oceans and his steadfast work in removing ghost gear. He will receive the award from ocean awareness champion, Dr. Sylvia Earle and her organization, Mission Blue (http://mission-blue.org/about/). Dr. Earle is a living legend in the ocean and dive communities and was Time magazine's first 'Hero for the Planet'. Among her accomplishments are setting the record for the deepest dive without a tether in a JIM (atmospheric diving) suit in 1979 and spending an historic two weeks in an underwater pod for the Tektite project in the Indian Ocean, https://www.facebook.com/sylvia.a.earle. As the interview for this *OceanBights* article was being conducted, Kurt was preparing to travel to St. Petersburg for the Blue Ocean Film Festival, http://www.blueoceanfilmfestival.org/, where Dr. Earle's recently released documentary, also named 'Mission Blue' (available on Netflix), would be a finalist in the competition.

ODA divers removing net.
Credit: Jeff Larson

The documentary brings to light the frightening impacts of improperly regulated commercial overfishing as well as disasters such as the BP oil spill on our oceans and ecosystems.

While some things are changing for the better, other things stay the same. The *Infidel* is still in the waters off Catalina. And though ODA made four trips from 2009 to 2011 to remove debris and enlisted the help of the trawler *Captain Jack* to haul it away, and with other divers also working to clean it up, there is much to do. The work is slow as the *Infidel* lies in 150 feet of water, at a depth that requires technical diving expertise.

The ocean floor around Catalina has more than *Infidel* littering the environment and since owners are not usually held accountable to haul up vessels if they sink, so the vessels stay. What also stays the same are that dive trips take resources – divers volunteering

their time, fuel, air to fill the tanks, donations of special skills like carpentry, electrical work, welding, first aid/EMS, coordinating educational events for kids, and anything else that makes the ODA run. Funding issues are still the most difficult since ODA is the only organization that does this type of work without funding from NOAA. Kurt is the skipper but the volunteer crew and donations make it happen.

When asked what has changed for the better, Kurt says awareness of the problems that plastics pose to the environment has been a paramount step. That this issue finally entered the public consciousness proves that public education and awareness does make a difference. (Reports on plastic in the environment have been published in previous issues of *OceanBights*: Vol 2, No 2 and Vol 4, No 2). Kurt hopes that the problem of ghost gear can also reach that consciousness. When asked if he's ever thought about quitting, without missing a beat he says, "not one day; this isn't a job, this is my life." So, the one good thing that will stay the same is Kurt's commitment to helping our oceans recover.■

Pam Ryono looking for turtles, and one that was spotted.
Credit: Hugh Ryono

➔ *Turtles from page 8*

Green turtles are perhaps the largest of the hardshelled turtles (softshell leatherbacks, *Dermochelys coriacea,* are larger). Indeed, Pam has seen two greens which she has estimated to be the size equivalent of a 500 lb turtle housed in the San Diego Zoo.

Our turtles will be sexually mature when they are between 20 and 50 years old. They can live up to 100 years and may breed every 2 to 4 years, laying 100 to 200 eggs per clutch. So a single female could lay 7000 eggs in her lifetime. That's a lot of calcium.

Green turtles are known to travel large distances between their feeding grounds and their breeding grounds. For example, almost all Hawaiian green turtles breed on French Frigate Shoals (where a French frigate shoaled), roughly 700 miles from the Big Island. Dan Lawson of the National Oceanic and Atmospheric Administration (NOAA) in Long Beach, writes that genetic studies on our local turtles find

that they are related to the Mexican population of green turtles. The San Gabriel turtles are likely to breed in Baja California, perhaps Magdalena Bay. The distance between Los Angeles and Magdalena Bay is 750 miles, so our turtles may be making a migration similar to that which the Hawaiian turtles make to lay their eggs in the sand. These eggs are a vestige of their terrestrial past. In fact, the development of the egg was an advancement that permitted animals to leave the sea but that now anchors them to land.

In the continental United States, they are known to breed in Florida on the central and southeast coasts where perhaps up to 1,000 turtles nest. Worldwide, the two largest nesting populations are found at Tortuguero National Park on the Caribbean coast of Costa Rica, where on average, 22,500 females nest per season; and, Raine Island, on the Great Barrier Reef in Australia, where 18,000 females nest per season.

Turtle power plant as seen from the 2nd St bridge. Outflow is in center of image.

Turtles hatch in the sand nest, dig their way up and out, and in a made-for-TV moment which we have all seen, race to the ocean or get eaten by about anything with a gut. Once in the water they are out to sea to hide where they must be carnivorous as there is not much flora to eat besides phytoplankton. When larger, green turtles come to coastal areas to benthic feed, eating exclusively sea grasses and algae off the bottom. Hence they must stick close to shore as green plants can only live in the sunlit shallows.

They apparently prefer warmer temperatures as their distribution includes the tropics and subtropics worldwide, roughly between $30^{o}$ N and $30^{o}$ S, though they do live in the Mediterranean, where they are critically endangered, and have been seen as far north as Alaska.

Now, I must admit, I was never a fan of turtles except in soup (with sherry). But that's only because I haven't thought much. They are fascinating animals. Evolutionary speaking, their ancestors developed on land, but their ancestor's ancestors ultimately came from the sea. So the naïve question is: why did they leave the ocean originally if they found it feasible to return. Of course, this is just evolution taking its unguided walk through time, exercising environmental and ecological opportunities as they develop and are presented to the physiological and genetic adaptability of the species.

One would think that the number of terrestrial-type animals that evolve back to live in the marine environment would be small. However, surprisingly to me, there are many types of terrestrial animals who feed and live, to varying degrees, in the sea. These include animals that feed only there, e.g., various birds from eagles to penguins; to those that may live their entire

life, birth to death, in the ocean. (In my mind, a real marine animal sleeps in the ocean.)

There are **only 7 species of marine turtles** contrasted to 300 species of fresh-water turtles, which I think indicative of the evolutionary path taken. For comparison with other species whose clade made the round trip to the ocean, there are 78 species of whales, dolphins and porpoises; 62 species of sea snakes; 33 species of pinnipeds; 4 species of dugongs and manatees; and, a few species of sea or marine otters. Of these, only the cetaceans, dugongs, some species of sea snakes and otters can spend their entire lives, birth to sleep to death, in the ocean. These species manage to bypass the land-anchoring external egg, giving birth to live young at sea. Unfortunately, many of these species are also on the endangered list.

For this reason there is much local research on sea turtles. As reported in an earlier issue of *OceanBights* this research is related to understanding their natural history, a requirement to craft tools and legislation that will better protect these threatened species. Our turtles are amenable to study by interested, though perhaps not technical, volunteers. Observing the numbers and locations of turtles is important to understanding their life history, stresses and population developments. Kim Thompson helps organize the AoP citizen-science effort. She says there are approximately 40 active volunteers observing the turtles along the San Gabriel River. More information on this program can be obtained by this link she provided: http://www.aquariumofpacific.org/news/story/citizen_science_project_seeks_volunteers.

What brings the turtles to San Gabriel River? The one(s) I saw were in the outfall of a power plant, where warm water is discharged, as can be seen in the accompanying images. They were not near the outfall stream, they were in the stream. Cold-blooded reptiles need warm surroundings to be active and others have suggested that the sea turtles seek the warmth of the outfall water. This idea is bolstered by the fact that another, similar, though larger colony is located in the southern end of San Diego Bay – near a power plant outfall. However, the San Diego colony has been there since the mid 1800's, prior to power plants. Of course, shallow San Diego Bay, especially in the southern part, would be much warmer than the surrounding Pacific Ocean, and may be attractive to heat-seeking reptiles.

I wondered whether the turtles are drawn to SoCal because of an improving environment or are diffusing outward from an increasing population in Mexico. Dan said that scientists do not know. And Lance Abrams, veterinarian at AoP who works with locally stranded turtles, has the opinion that they may not be expanding their range because there are historical records that indicate

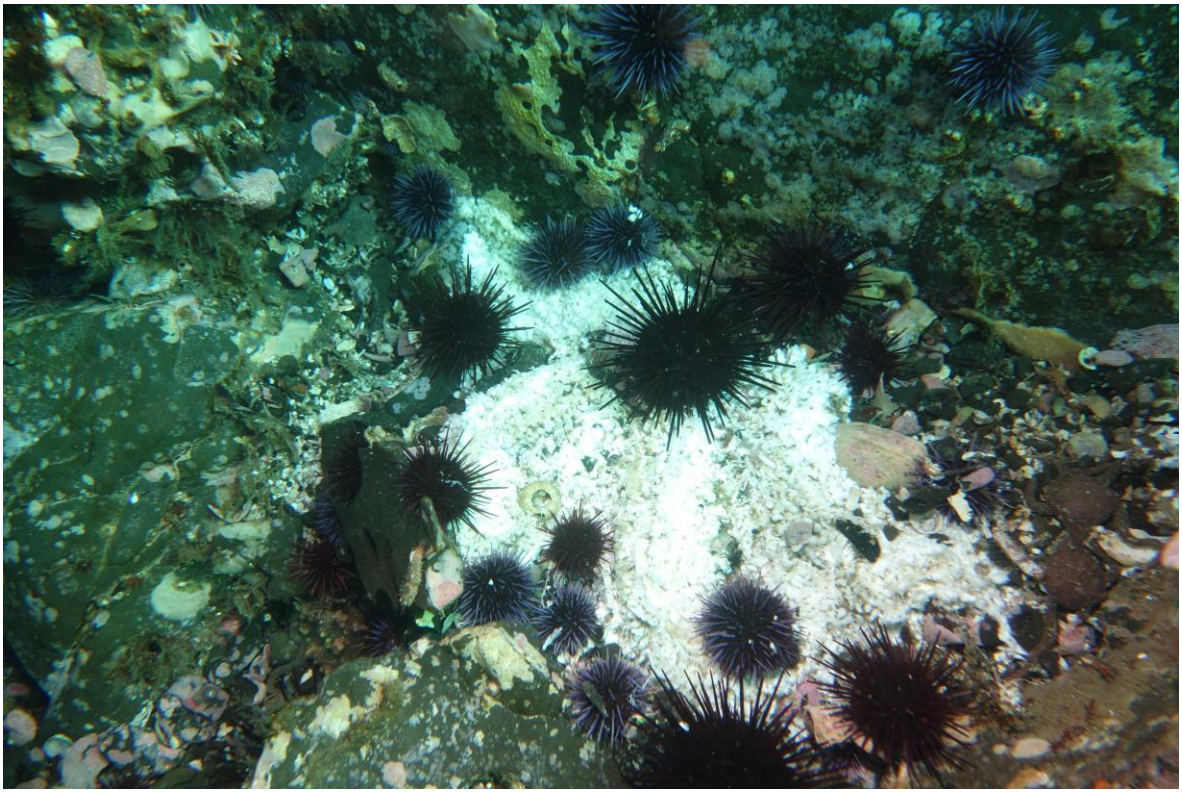
Be careful what you catch.
From H. Ryono.

turtles have always been in the area. But to me, any of these scenarios represents good news.

With warming ocean temperatures and established feeding colonies found, I predict green sea turtle sightings will become more frequent in the immediate future. Perhaps we will see them moving farther along the coast, maybe to the LA/Long Beach Harbor complex or to the warmer-water islands such as San Clemente. My hope is that their numbers will improve sufficiently so we can move them off the endangered list though perhaps not quite to the menu.■

## Whither the Sea Stars?

Perhaps you have heard about our recent mussel-gathering expeditions and you can read about one in the last *OceanBights*. Unfortunately, the last two trips are also notable for what we didn't see: sea stars. The ochre sea star (*Pisaster ochraceus)* is a well-known predator of mussels and seeing them harmlessly stranded during extremely low tide provides amusement and a view from the beach into their natural history. Sea stars (formerly starfish if you are an old geezer) are curiously shaped animals and epitomize the ocean environment to children. They are distributed worldwide (children and sea stars, with 1 species of the former and about 1,500 of the latter). However, they are getting pretty thin on the West Coast (sea stars, not children, who are actually getting fat). Apparently, there is a virus-transmitted disease, termed sea star wasting disease, which kills most species of sea stars. When they contract the disease, lesions develop on their



Result of Sea Star Wasting Disease: urchins munch the remains of a wasted sea star.
Credit: U.S. Geological Survey
Department of the Interior/USGS
U.S. Geological Survey/photo by Kevin Lafferty

outer surfaces, then their arms fall off (what a way to go ☹) and they die. The die off apparently began in SoCal in the summer of 2013 and has pro-pagated northward to Alaska. Dr. Bill Bushing has provided a running commentary on the results of the disease at the Avalon Dive Park. It appears on his blog.

Ocean epidemiology fascinates me, as I know that merely counting underwater fauna is a challenge (see the article on sea urchins, this issue). Viruses are small, less than 0.2 microns in size, and by controlling the size of particles that have access to sea stars, say by filtering out larger particles (e.g., bacteria), a virus can be implicated when the stars get the disease, especially if the filtered fluid came from stars with the disease. The disease was also transmitted when ocean water was used in aquaria housing healthy sea stars, but was not transmitted when the ocean water was treated to destroy viruses. Individual virus types may be difficult to identify if they cannot be amplified (grown to large populations) to the stage where they are amenable to laboratory study. However, megagenomic studies that look at the genetic potential of a sample containing many types of viruses show that genetic material associated with densovirus occurs in greater quantities in stars that exhibit wasting-disease symptoms. Densoviruses, composed of single-stranded DNA, infect invertebrates including crustaceans and insects.

➔ *see Stars, page 21*

## Adopt-A-Thermograph Program

The CMS is seeking donors and site managers for its Adopt-A-Thermograph program. These sponsors will extend and complete the Continental Thermograph Array that is currently under development. Adopt-A-Thermograph is directed by David Tsao. For more details, contact David at david@catalinamarinesociety.org or Craig at craig@catalinamarinesociety.org.

## Crowd-sourcing and CCD Urchin Counts

CMS Staff

Crowd-sourcing is a relatively new expression that describes the process of obtaining support from a large group of people. Volunteer-based organizations like the Catalina Marine Society are a perfect example of pure crowd-sourcing. Another example is the Catalina Conservancy Divers (CCD). These divers and their supporters have produced a remarkable set of data, which includes over two decades of species and temperature measurements obtained around Santa Catalina Island using only volunteers. **This data collection is one of the longest local time series we know of.** The CMS has made great use of CCD long-term data, deriving insight from them into oceanic processes that affect Southern California. And, CMS volunteers have formatted, organized and continue to maintain an archive of recently-collected CCD temperature data sets.

Unfortunately, the CCD recently dissolved. This event triggered a reflection on this crowd-sourced organization's formation, workings and accomplishments. Although much has been written about the temperature monitoring work (and variants of it continues with the CMS Continental Thermograph Array and work at the Channel Islands National Park), the marine-life census activities are not as well known.

The CCD was begun in 1992 by a group of ardent

divers who wanted to replenish the declining abalone population at Catalina. They coordinated with Dr. Bob Given, the initial director of the Wrigley Institute of Environmental Studies (WIES) and then a board member of the Catalina Conservancy. Given put the infant CCD in contact with the then-director of WIES, William MacFarland, and his wife Florence McAlary, then a professor at USC. These contacts sparked the CCD legacy, and the organization became a support group of the Catalina Island Conservancy with scientific direction from WIES. Although the abalone project did not materialize, marine-life census work did. (Abalone planting has recently taken place on the backside as described in the first issue of *OceanBights*, Vol 1, No 1.)

Few scientists will complain about having too much data. The problem is more likely a scarcity of data. Some questions cannot be answered with a short-term dataset. Consider climate and if it is warming. If temperatures from just a few years are used to address the question of whether the climate is warming, the answer may not be correct. A single summer may be warmer or cooler than the summer before. However the overall trend, measured over a long period of time is what is important. The same issues apply to marine fauna and flora, whose populations may vary enormously over the short term, thereby obscuring long-term trends.

However, the collection of long-term datasets is difficult. Instruments need to be acquired, maintained, deployed, and collected. Measured data need to be downloaded, stored, and organized. **Making useful species counts requires protocols and training.** Diver logs must be deciphered and the results tabulated. The cost is high simply in terms of time, not to mention the actual expense of the equipment, training and transportation. Much of this effort is undertaken by **volunteers with the time, training (SCUBA certification and plenty of diving experience) and resources that make them a rather select group**. Finally, to be useful, the data must be analyzed and placed within context if anything is to be learned. And, the results must be distributed if they are to make an impact. The latter considerations led to the formation of the CMS.

There are a number of well-known long-term marine-related datasets for Southern California, both government and grant funded as well as volunteer based. Scripps has been measuring ocean temperature off its pier since 1916. They take advantage of cheap labor in the form of graduate students, a convenient location, and university funding.

The California Cooperative Fisheries Investigation (CalCOFI) has conducted ship-based data collections to investigate initially the collapse of the sardine fishery and later the state of the California ocean since the late 1940's. This relatively expensive collection is funded by the state of California. The Vantuna Research Group (*OceanBights* Vol 3, No 1) has been making measurements since 1966. They too rely on government and college funding as well as student serfs to maintain operations.

The Channel Islands National Park has performed kelp monitoring in the northern Channel Islands since 1982 (also *OceanBights* Vol 3 No 1), again, of course, government funded.

Non-government/college organizations such as Reef Environmental Education Foundation (REEF) and ReefCheck rely on armies of volunteers and are national and international in scope. REEF

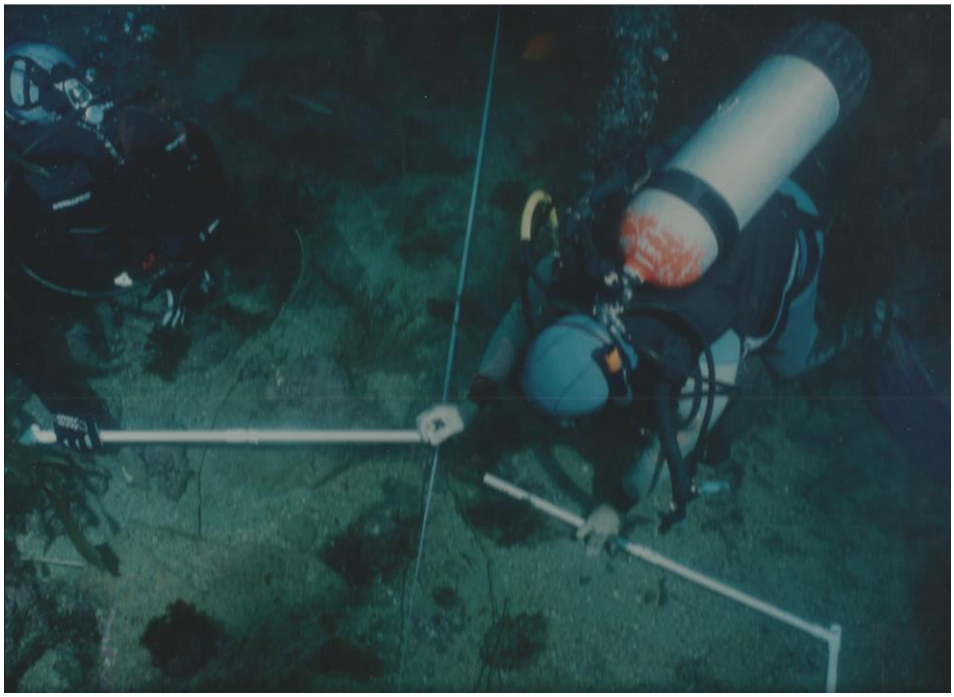
CMS to give lecture on Ocean Acidification
Sharkbait Dive Club, Tuesday Feb 10, 2015
http://www.sharkbaitdiveclub.org

started conducting fish surveys in 1993 and has collected an amazing 188,000 surveys worldwide with over 15,000 volunteers. In California and the Pacific Northwest, over 1000 surveyors have collected over 30,000 surveys. Just 25 surveyors collected a third of the data.

ReefCheck began its surveys in the tropics in 1997 and in California in 2007. They have trained more than 1200 divers in California, resulting in 650 surveys collected at 97 sites in the last 9 years. About 70 sites are surveyed annually; some sites are surveyed less frequently and some sites more. Hence, the CCD is the oldest of the surveying volunteer groups, and, until recently, had the longest-running monitoring program in the region.

The CCD at times had a couple of hundred members. Species identification classes were taught and divers were tested in the field and certified. Many of the divers went on to become American Academy of Underwater Sciences (AAUS) certified and could dive at WIES. However the number of active divers at any time was just a few dozen. In the first couple of years, a group of a dozen divers conducted quarterly urchin and kelp surveys. In the next few years the number of active volunteer divers expanded to just over 30. Over the lifetime of the CCD (22 years), just 40 divers completed a total of 34 urchin surveys and 73 kelp surveys. Ari Requicha was one of the original volunteers and was one of the last volunteers! He completed 15 urchin surveys. Also noteworthy is Jukka Pylkkamen ("JP") who completed 34 kelp surveys. These two volunteers were responsible for nearly half of the total surveys over a 22-year span. That's dedication! (There are multiple divers per survey.)

**Other heavy surveyors are Mike Doran and Dirk Burcham,** both of whom currently serve on the CMS board of directors.



CCD divers constructing quadrant
CCD historical photo.

The resulting data from these collections have been used in a couple of peer-reviewed articles by McAlary. The first paper concentrated on kelp growth rates during the 1992-1993 El Nino. The second article correlated bottom water temperatures (hourly temperature measurements at a variety of Catalina sites collected by the CCD since 1992!), kelp densities and growth rates, and urchin

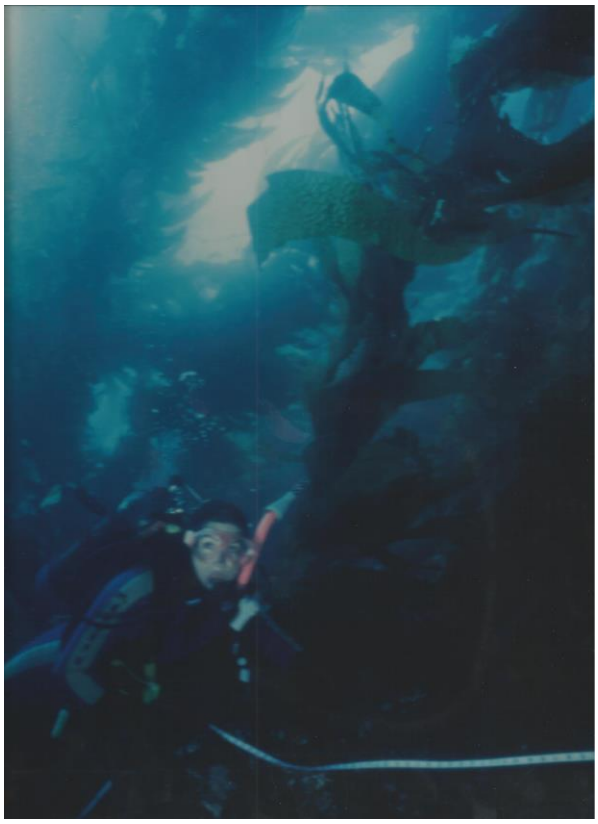
distributions for a seven-year period including two El Ninos (1992-1993 and 1997-1998). **The El Ninos are noted for much warmer water.** The warmer water tends to be nutrient poor, which leads to a severe decline in the kelp forests. This, in turn, leads to dramatic decreases in urchin populations. McAlary thought that the observed increase in the black (crowned, *Centrostephanus coronatus* ) urchin populations may have been a response to ocean warming. However with such a short collection period bookended by El Ninos, she was unable to definitely address that question.

CCD conducting census
CCD historical photo.

The CCD recently concluded its urchin and kelp surveys. The run of 22 years of data spans multiple El Ninos: the strong 1992-93 and 1997-98 observed in the first period of CCD monitoring, and the weaker 2002-03, 2004-05, and the 2009-2010. For each urchin survey, the number of 3 species of urchins (purple, (*Strongylocentrotus purpuratus)*, red (*Strongylocentrotus franciscanus*), and crowned) are counted within a 2-meter by 60-meter transect at 3 depths (5, 10, and 20 meters). There was no time limit on the duration of the survey, so the area was searched carefully for all sizes of urchins. The first chart (page 22) shows the density of each species of urchin at the 5-meter depth for the 22 year period. The peak in urchin densities followed by the steep decline associated with the 1992 and 1997 El Ninos and noted in the McAlary paper is obvious. The benefit to the much longer duration of monitoring is clear: later El Ninos do not have associated peaks and subsequent drops in urchin densities, even for the crowned urchins. All three species show a long-term decline in densities at 5-meter depth. The second chart (page 23) shows the total density (the sum of all the species counts) of urchins for the three depths that the CCD monitored. The long-term

decrease in urchin densities occurs at all three depths.

There have been a number of long-term local, marine data collections. Several of these efforts are either explicit government projects, or are funded indirectly through government grants to universities and colleges. Another two Goliath efforts, REEF and ReefCheck are powered by crowds of volunteers. **The CCD's work was a true "David" effort – a small group of dedicated divers who maintained focus over two decades and successfully collected many surveys** around an island at great personal expense in both time and money. And their data are the only data for Santa Catalina Island and will likely be the baseline to which future studies decades hence will be compared.■



CCD measuring the Kelp forest
CCD historical photo

➔*Stars, from page 17*

Scientists are not sure what triggered the current outbreak. Densovirus has been around a long time as it is known to exist in old museum specimens of sea stars. Speculation is that the warm water temperatures may be conducive to the operation of the virus, or that it may have recently mutated into a more deadly strain. Perhaps colder temperatures in the future will abate the die off or the remaining stars will develop immunity to the effects of the virus. We miss the stars.■

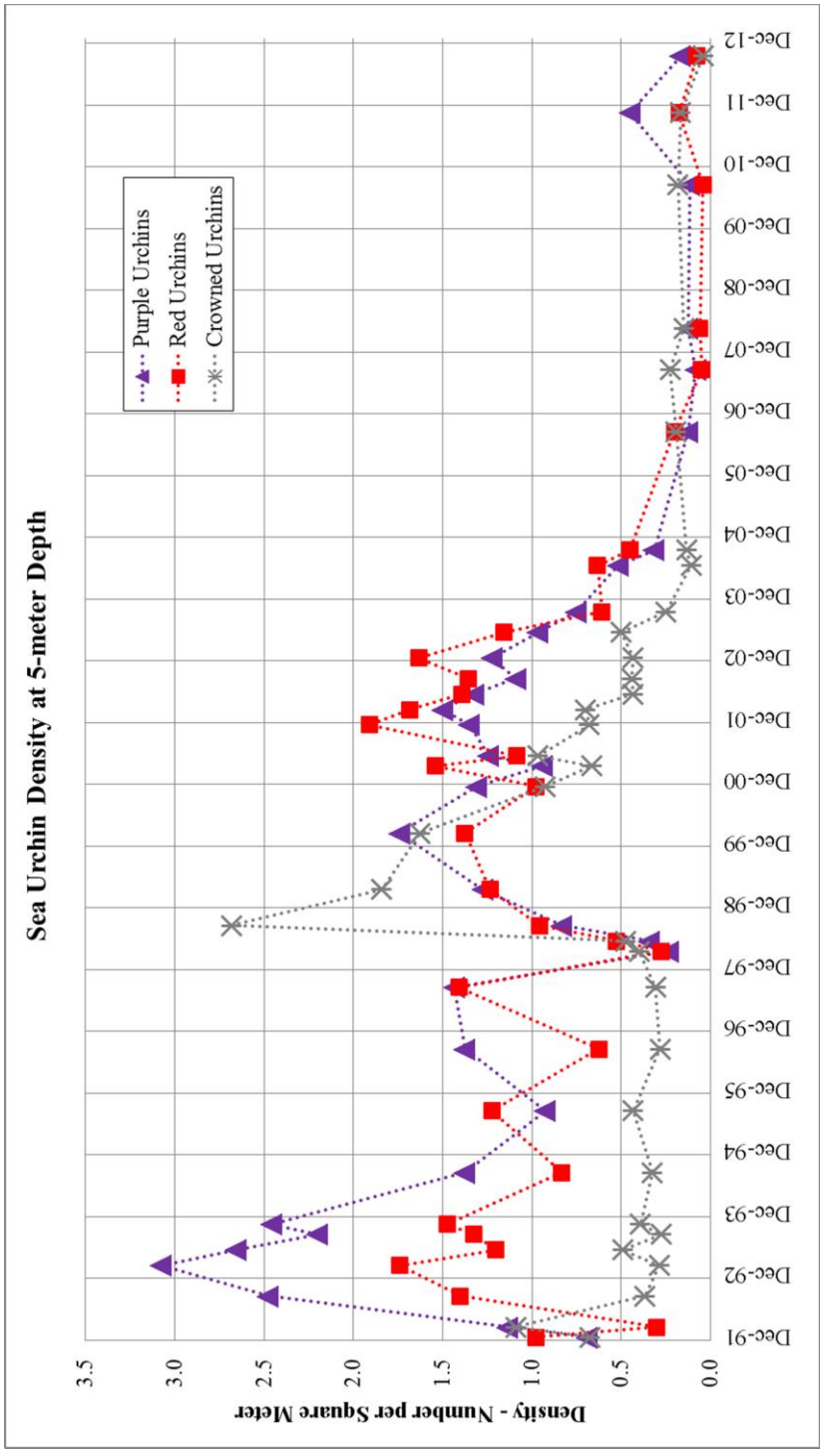
## New CMS Lecture

We are developing a new presentation on **ocean acidification** that will describe what is meant by the term and expectations for its effect on the ocean. The work that the CMS is doing to measure pH off Catalina will be placed in a global context. It will be appropriate to yacht clubs, dive clubs and other ocean-related/ocean-loving organizations. ■

### Upcoming Meetings

Southern California Academy of Sciences 2015 Annual Meeting, Loyola Marymount University, May 15-16.

Ocean Sciences 2016, New Orleans, February 21-26, 2016.


Sea Urchin Density at 5-meter Depth
Purple Urchins
Red Urchins
Crowned Urchins
Density - Number per Square Meter
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Dec-91
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
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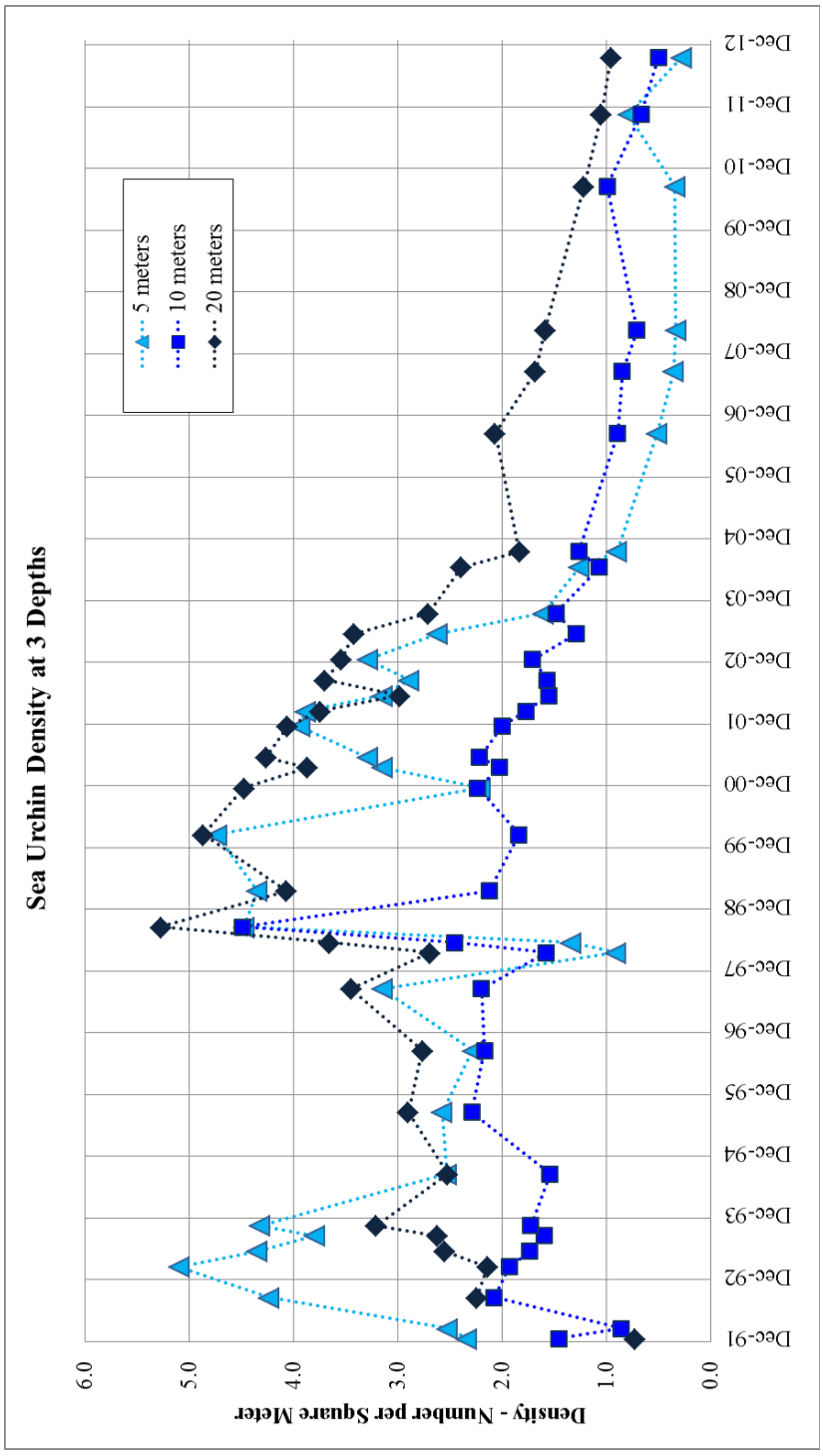
Dec-12


Sea Urchin Density at 3 Depths
5 meters
10 meters
20 meters
Density - Number per Square Meter
0.0
1.0
2.0
3.0
4.0
5.0
6.0
Dec-91
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
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Dec-98
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Dec-12

# Catalina Marine Society Membership

**Catalina Marine Society Members support the goals of the Society through their dues and also elect the Society's directors. Membership is described in the bylaws and is granted to those who: 1) agree with the mission statement; 2) pay the annual dues (currently $20); and, 3) submit an application that is approved by the board. An e-application is available on**

**http://www.catalinamarinesociety.org/CMSMembership.html**

Manual Membership Application

Please send the following required information to the Catalina Marine Society via e-mail or post to the address below.

Name, e-mail address, postal address, reason you wish to join the Society, and that you agree with our mission statement.

Dues can be paid through the "Donate" link or checks made payable to the "Catalina Marine Society" sent to the following address:

**Catalina Marine Society**
**15954 Leadwell Street**
**Lake Balboa, CA 91406**

If you are interested in contributing to the work of the Society in other ways, please let us know. Categories and examples of needed volunteer work are listed below.

**Lab**

Data analysis
GIS
Programming

**Field**

Boating
Diving
Instrument calibration
Hardware/Equipment fabrication and mounting

**Office**

Web design/programming
Graphics
Photography/Videography

**Magazine/newsletter**

Reporting
Publishing
Editing
Departments

**Fund raising**

Event planning
Event volunteer
Grant writing

**Press/publicity**

Public speaking
Newspaper articles