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*Jennifer Stock:* And welcome to Ocean Currents. This is your host, Jennifer Stock and I'm glad to be with you here today on Monday. On this show we dive into all sorts of ocean topics globally, locally, sometimes focusing on our national marine sanctuaries here off the coast of Point Reyes, but today we're going to talk about rockfish and all sorts of interesting research happening with rockfish with Dr. Milton Love. So, without further ado, I'm going to bring Milton Love on and see if we can get connected here. Milton, are you live with us on the air?

*Milton Love:* I think I am, Jennifer.

*Jennifer Stock:* Welcome. Thanks so much for joining us!

*Milton Love:* Well, thank you.

*Jennifer Stock:* So, Dr. Milton Love is a research biologist at the Marine Science Institute at the University of California in Santa Barbara. He is a writer contributing to several marine themed films, curriculum, magazines, and articles. He is also an author, most recently the award winning Rockfishes of the Northeast Pacific, co-authored with Mary Yoklavich and Lyman Thorsteinson. He also wrote Probably more than you wanted to know about Fishes of the Pacific Coast, a humorous and informative read about fish in the Pacific Ocean. He has also been a lecturer of marine science courses, currently Dr. Love leads the Love lab at the University of California Santa Barbara where his lab focuses on researching the ecological role natural gas and oil platforms in southern California play and rocky reef fishes associated with them. So, welcome again and thanks for joining us today.

*Milton Love:* Well, thank you very much. One last thing. The motto of our lab is, "We get paid to think so you don't have to."

*Jennifer Stock:* Oh, that's great. So, I'm hoping you'll share some of that today. So, let's just start with this one very simple question: Why do you like rockfish so much?

*Milton Love:* Oh, man. I think I associate...I kind of resonate with them. I actually have a tattoo of a rockfish on my arm of a cowcod, which is one of the larger species and I think it's because my father took me fishing on a boat off the Malibu pier when I was about ten and we went out to some local reefs and I think on the boat that day, people caught maybe 12 or 14 different species of rockfish on the same rock and there were yellow ones and red ones and green ones

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and all kinds of colors and it just kind of blew me away and I've been fascinated by them ever since. There are so many kinds off California that, you know, there's something to offend everyone.

*Jennifer Stock:* Wonderful. So, what are some of the characteristics of rockfish? I read the first few chapters of the Rockfishes book, which is just an excellent resource, and was really getting, I mean, I knew some basic things, but you and your co-authors really went into some detailed biology. Can you give us some just rough descriptions, some of their cool adaptations?

*Milton Love:* Oh, yeah. Well, when you have maybe 50 species of any kind of fish off a coast like we have off California, basically, anything you can think of that a fish has, you'll find a rockfish that fills the bill. There are rockfish that probably never leave their caves unless they have to and are shaped like casaba melons and there are ones that act like mackerels. They're shaped elongated and kind of like little torpedoes and they swim way above the rocks and you have ones that live in tide pools. There's ones right off your coast there that you'll find 5 or 6 pound rockfish living right in the tide pool, three feet deep and on the other hand, you have rockfish that live in 3 or 4 thousand feet of water. So, it's just about everything you can think of and as I mentioned, they come in colors all the way from black to bright red and everything in between.

*Jennifer Stock:* How about some of the adaptations with the depth? I mean, having a fish that lives in inter-tidal zone and then also having similar related cousins or brothers and sisters of rockfish at huge depths down to 7,000 meters, what are some of the adaptations for living that deep?

*Milton Love:* Well, the first one is that once you find species that live deeper than about 100 to 200 feet of water, they all tend to be either reddish or orange and that's because when you get below 100 feet of water, there's almost no light down there except for blue and so, if you have red pigment, it doesn't show up red. It shows up as black. So, you wind up with all of these deep water rockfishes all colored, you know, variations on reds and oranges and yellows and that's so they all look black. That's the first thing. Then you tend to find that these deepwater fish live very, very long lives.

The oldest rockfish we know of, oldest individual, was 204 years old. It was a rockfish that lived off of Ketchikan, Alaska. It was caught a few years ago and, you know, basically these fish are refrigerated. Nothing happens to them and they can live for centuries.

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*Jennifer Stock:* The age thing is definitely an advantage in regards to reproduction. Why don't you talk about that a little bit?

*Milton Love:* Well, that's an advantage and a disadvantage. Generally fish and this includes rockfish, fishes that live a long time and therefore may reproduce literally for 100 years, every single year, it's good in one sense because every single year you've got a chance to, for your young to survive, but what it implies is that your young almost never survive. If you turn it around and find fishes that only survive for a year, for instance, there are little gobies off the coast here that only live for a year or 18 months. What that implies is that most years, somebody reproduces. A fish that lives 100 years, that implies that that fish almost never successfully reproduces.

It may produce larvae, but they all die and in the case of the rockfish, one of the reasons it's so hard to have big fisheries for them is that they don't reproduce very successfully and therefore they're easy to overfish and, in fact, many species of rockfish have been overfished.

*Jennifer Stock:* Yeah, that's definitely something that's been in the news on our part of the coast here being that we have so many rockfish up here. How do they reproduce? They produce larvae, but how do they...do they mate?

*Milton Love:* Yeah, they do indeed. They have internal fertilization. The male actually has something that looks like a little bit of male genitalia and the sperm goes into the female and here's, actually, the fun part, at least if you're a female, I suppose, and that is that the sperm are stored inside the female. They don't actually fertilize the eggs for a couple of months and then when the eggs are ready to be fertilized, somehow the female triggers this. We don't know how and the eggs are fertilized. They stay in the female for a couple months and develop into little larvae and then the female will actually emit the larvae, which are tiny and can't really fend for themselves and a big cowcod, for instance, may produce two or three million larvae at a time.

*Jennifer Stock:* And is there specific areas that they spawn? Is it just generally wherever they're hanging out they're going to spawn and then those larvae get caught up in the currents?

*Milton Love:* Yeah, I think that that's absolutely right. Actually, no one has...well, I'm trying to think if anyone has actually seen any

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rockfish spawn, actually release larvae. I think that's happened once or twice in Puget Sound, but other than that, no one has seen it. It's assumed that it takes place at night when most people aren't around to look, but no one knows. Some rockfish do make migrations in order to reproduce they'll move either inshore or offshore depending on the species, but most fish, like the ones that are sitting off your coast there, blue rockfish, black rockfish, vermilion and so forth, they don't seem to go anywhere.

They'll stick to their reefs and spawn right there, as far as we know.

*Jennifer Stock:* Interesting. So, that's one of the questions I've had as far as out at Cordell Bank: What is the recruitment and how do these fish find their way offshore to rocky areas where they...

*Milton Love:* *They're right on and...well, in a way we have kind of ideas of how that happens. Basically, the larvae drift around in the plankton and, for a while, they probably can't cope with currents at all. They're just wafted wherever the currents take them--could be in shore, could be offshore, just depends on the year and the season. At some point, they are old enough, they're actually the little juvenile fish and they're old enough so they can actually swim fairly well with the currents or even against them and in some ways, they begin to seek out their next habitat, usually a rock or a kelp bed or something like that and it's kind of a question of how they actually find it. One thing we know is that reefs are actually noisy places. You've got little pistol shrimps snapping and you've got currents running over the rocks and it's actually fairly noisy and it's kind of assumed that these little fishes that are drifting around can actually hear reefs and they can actually home in on the sound and that may explain why a fish can find Cordell Bank even though it kind of sits in the middle of nowhere. It's probably a fairly noisy place.*

*Jennifer Stock:* Wow. Interesting. So, we need to get some hydrophones down there and see what you're hearing.

*Milton Love:* And see what you're hearing, yeah, and by the way, rockfish actually produce sounds. They don't do it often, but they're not like...oh, there are fishes like croakers or midshipmen that you have up in your area, which predictably make sounds. Rockfish do make sounds and they hear very well. It's unclear why rockfish make sounds. It may actually be kind of an antagonist thing between individuals or it could be a way of males and females getting together, but they do make sounds. So, their hearing is pretty good.

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*Jennifer Stock:* Very cool. For those just tuning in, this is Ocean Currents and we're talking with Dr. Milton Love from the University of California at Santa Barbara. We're talking about rockfish. So, one of the things I was really interested in in your book, the Rockfishes book, was some of the...how these rockfishes got scientifically named and we have them in the genus *Sebastes*. Can you give a brief history of when they were discovered, by whom, and how they were named?

*Milton Love:* Yeah, sure. Well, the first thing to remember is that the scientific name of any organism, it could be a fish or a plant or a bacteria, basically whoever, whatever scientist discovered that organism and writes a description of it and puts it in a scientific journal, that person has the right to give it its scientific name, species name and the first person actually to do that with rockfish was one of the great, really, one of the great biologists of all time - - a guy named Cuvier, who was a Frenchman, one of the few scientists who managed, by the way, to not only survive the French Revolution in the government, but also was hired after the French revolution under Napoleon and when Napoleon fell, he was still in the government under the new Louie, under the monarchy. So, I mean, he was like one of the great survivors of all time and he was the first person to give rockfish their scientific name, which is *Sebastes*, which means "magnificent" in Greek and he found one that lived in the Atlantic, it's not the same species that live out here.

So, he was the first person to describe them on that coast and the first guy off here to describe the very first rockfish, actually, a group of rockfishes on the Pacific coast was a guy named Ayers who was a physician in the Gold Rush and he lived in San Francisco and there were no real scientists, trained scientists, but there were usually doctors who kind of hung out at the fish markets in San Francisco in 1850, 1851, 1852 and, you know, basically, all the fish then were undescribed. No one had ever described them before. So, he would just wait for something new to come along and buy it and write it up and then he would give the names and so, the first eight or ten species of rockfish on the Pacific coast that were recognized were done by Joseph Ayers.

*Jennifer Stock:* It's so interesting...just some of that history. I just find that so fascinating.

*Milton Love:* Yeah, actually, what's interesting about Ayers descriptions is...if I write a description of an organism, and I've done that with fish

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parasites, I'll write it up, I'll send it to the journal or Parasitology and eventually it gets published, but there were very few scientific journals in 1852. So, what Ayers would do, he would actually write the descriptions for the Platford Times, which was a newspaper, a daily newspaper in San Francisco and so, the first descriptions of rockfishes were actually in daily newspapers. There would be a little drawing and a description on the fish and then the name of the fish.

I looked at one recently. You can go to the Bancroft Library at UC Berkeley. They have on microfilm some of these old issues and there's a description of the fish and right next to it is an ad for opium and an ad for morphine and, I mean, all these things that were legal at the time, you know, highly unlike the typical journal today.

*Jennifer Stock:*

Wow...different reporting instrument. Now, so, those are the names given...now they're given by scientists once you discover, but there's also something you wrote about in regards to some of the colloquial names.

*Milton Love:*

Oh, sure, the common names and for rockfish in particular there are just scads of names that fishermen given them and, of course, the first common names, at least for rockfishes, have tended to be the ones that the first commercial fishermen gave to them and usually those are either in Italian or Sicilian or occasionally in Spanish because those are the first commercial fishermen, again, back in 1850, 1860, 1870 and usually, in San Francisco.

So, for instance, Boccaccio, which is the official common name of a rockfish right off your coast there. A lot of them used to be off Bodega and Cordell. Boccaccio means "big mouth" in Italian and, indeed, if you look at it, they have a very large mouth. The flag rockfish is called Pelloso in, I think it's called that...in Spanish. The Mexican fishermen called it that and that means "clown" in Spanish and if you look at it, it's this vividly colored fish with these alternating red and white bars and it's, you know, very clown-like. So, there's tons of these name. In many cases, though, rockfish look so similar to one another, one species to another, that they were just kind of grouped. For instance, many of the rockfishes off your coast that live in twenty or thirty feet of water and live in caves, were just called gophers.

So, gopher rockfish, if you went to the Monterey Fish Market in 1870 there would be 5 or 6 species that were called gophers because they were all about the same and they all did the same

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thing. They would hide in holes. So, there was a lot of overlap and, of course, when I was a kid and I did a lot of fishing when I was a kid in Los Angeles, we called them all rock cod. I mean, all rockfish were called rock cod by sport fishermen and commercial fishermen.

*Jennifer Stock:* Yeah, it's definitely interesting, especially with people following Seafood Watch guides and you go and you ask it's very confusing. You really have to ask, almost, what species is it?

*Milton Love:* Well, it is and historically, most processors had no idea what species it was and certainly 30 years ago, particularly in the LA area, I would go to a processor...I actually did a lot of my science at fish processors because I didn't have any money to actually do research on rockfish. So, I'd just go at 6 o'clock in the morning into a fish processor and whatever rockfish were brought in, I would just sex them and take their ear bones out and do all kinds of stuff and the processors had no idea what any of the fish were and even if they were, like, 15 or 18 species sitting on the concrete floor, they would just all lump them together.

*Jennifer Stock:* There's about 100 species of rockfish?

*Milton Love:* Worldwide, there's about 105. As we speak, two more that we didn't know existed off California are being described and that's what's very confusing. For instance, right off your coast, you have a rockfish that's called the blue rockfish, probably is...it's not the most abundant of the near shore species, pretty close to it. Every sport fishing boat will catch blue rockfish. Well, it turns out, there's actually two species of blue rockfish. Genetically, the rockfish can tell each other apart and about 6 months ago there was a guy at the National Marine Fisheries Service who finally said, "You know, there's actually two species here." And he actually figured out how to tell them apart by looking at them.

So, every year or so, someone comes up with yet another species.

*Jennifer Stock:* Wow. Well, some of the interesting things I've been reading about, historical-ecology-wise, people are trying to piece together the past of commercially-valuable fish through menus and research. Do we know...do we have evidence that Native Americans and early Spanish settlers here in California caught and ate rockfish?

*Milton Love:* We have a lot of evidence for Native American consumption and, in fact, you can make that case for rockfish all the way from the Aleutian Islands to Northern Baja California. Indigenous peoples

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used rockfish. It depends on the area and it depends on the tribe and their access to the ocean, but there's no question that rockfish were heavily utilized in some areas. The more open coast you had and therefore, the less the local peoples were apt to take boats out, the less rockfish consumption. The problem is if you go to a native midden site, one of these old, essentially, garbage heaps where people would throw bones, you'll find lots of rockfish bones, but it's very hard to tell the species apart by looking at their bones.

So, all we know is that many of the tribes ate a lot of rockfish, but because there's very few surviving California Native Americans, we don't really know what they ate. Up in the northwest, where the tribes weren't decimated as much, people in the 1870's, 1880's, 1890's actually would watch what the people were catching. So, we have a much better idea of what they caught up there.

*Jennifer Stock:*

Interesting. In the back of your book, speaking of eating fish, rockfish, you have quite a list of parasites found on rockfish. Should fish-eaters beware?

*Milton Love:*

Let's start out by saying that all animals have parasites. Humans, even in societies like ours where the numbers of parasites, the average person has is very small, even here, most of us have one or two parasites that we're not even aware of. For instance, living in our mouths, I can't remember the statistics, but something like 30 percent of people in the United States have a little amoeba that lives in our mouths, doesn't cause any harm, but, you know, it's there.

So, parasites are perfectly normal in all animals and many plants and so, rockfishes like any other kind of animal have parasites and most of the parasites die as soon as the fishes die, but there are a couple of parasites that indeed, will survive the fish's death and will survive refrigeration of the fish and indeed, if they are consumed when the parasite is alive, they do cause problems and those are...they're nematodes. They're parasitic worms and the larvae live in fish flesh and adults actually live in harbor seals or sea lions and actually don't cause the harbor seal or sea lion any problem.

They live in the intestines. However, if a human consumes one of these worms alive, the worm will actually burrow into the stomach lining of the diner and it causes symptoms similar to ulcers or stomach cancer and the only way to get rid of the worm is actually, they used to actually open people up surgically and it was a big deal. Now, what they do is they go down through your throat with

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a little fiber-optic camera and they can actually look around the wall of the stomach and when they find the parasite, they actually pluck it out, which is still not the kind of thing you want to do on a Saturday afternoon. Surely, you have something better to do.

Now, fortunately, and I must say, that in countries with very high raw fish consumption, not just rockfish, but fish in general, the number of infections...it's usually called cod worm disease or anisakis...hundreds of people a year will come down with this. In the United States, it's exceedingly rare. The last statistic I read, which was years ago, was that maybe 1 or 2 people a year come down with cod worm disease in California. So, it's not very common, but nobody should actually come down with it because the worm is actually quite visible. If you go to a sushi parlor, and that's the usual place, you know, you would consume raw fish, the worm itself has about the thickness of a pencil lead and is usually kind of a brownish color and if you stretched it out, would be a quarter of an inch long or half an inch long. So, it's not, like, invisible.

*Jennifer Stock:* Yeah, it's pretty visible.

*Milton Love:* It's pretty visible and you don't want to like, announce, you know, hold up a piece of fish and go "No worms in here!" Because guys are armed with cleavers in those places. So, you don't want to make a big deal about it, but nobody should really come down with anything if you just look at what you're eating, which is always good advice, by the way, don't you think?

*Jennifer Stock:* Yeah, definitely. Well, it just caught my eye because the pages kept going and going and going and I was, like, "What?"

*Milton Love:* By the way, speaking of eating rockfish, I think there's nothing wrong with commercial fishing and sport fishing. I have actually been both in my time and buying fish is fine as long as the fish isn't over-fished, but to me, there's something kind of bizarre about eating fishes that are older than your grandmother. I mean, there are still fish that are 100 or 150 years old that are caught commercially and people eat them. I just think that's wrong. I'm not saying it's scientifically wrong, I just think it's wrong and I actually coined the phrase, "Never eat anything older than your grandmother," just to kind of cover my feelings about it.

*Jennifer Stock:* That was one of the questions I had for you. So, you got ahead of me there. That's perfect, though, and so, that's just morally, of course, but then, of course, on top of the biological reason of the

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fact that there are more of a kind when they're older. They produce more larvae.

*Milton Love:* Not just more...there was work done about five years ago by a lovely man, Steve Berkeley, who just recently passed away who was a biologist at the University of California Santa Cruz and he found that not only are larger rockfish, not only do they produce more larvae, but the larvae are actually healthier. The larvae of...produced by large, they're called, actually BOFFS, big old fat females, B-O-F-F. Larvae that are produced by BOFFs are able to survive in the wild better than larvae produced by younger females and this is actually one of the rationales for keeping some large fish in a population is that they actually produce larvae that stand a better chance of surviving to the next generation than if you had nothing but small fish.

*Jennifer Stock:* And it seems that over time we're seeing less and less of these large fish. You were saying you used to fish when you were ten. What were the size of the fish that were caught then, recreationally versus what you're seeing now?

*Milton Love:* Well, actually, you know, it was a mixed bag. I've thought a lot about that because even though I can't remember the name of my cousins, I think I remember every fish I ever caught, which is probably some sort of psychosis as far as I can tell and even then, the fishery along the coast of southern California, and I grew up in Santa Monica Bay, even then there were very few large rockfish being caught in the...kind of, close to port, within 10 miles of port and I now realize, that was in the 60's, that people have been fishing those reefs for 30 or 40 years by the time I got there.

On the other hand, if you went out to the Channel Islands, the fishes were all big and that's because there was relatively little fishing pressure. Now, I actually take a little two-person submarine out and we look at fish populations on reefs and platforms. So, now I actually go to the same places I used to fish and I go down and I count the fish and I see how big they are and there's very few big fish anywhere. There's always a few, but the densities of large fish are...rockfishes, are just in the garbage can.

*Jennifer Stock:* Yes. Well, you know what? We're just coming up on a break and I'd like to come back to that in just a few minutes is just talking about where have we gotten to with this rockfish population and also talk a little bit about your research that you're doing down in southern California on the oil platforms. So, if you don't mind to hang with us for just a few minutes. We're going to take a short

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break. Those of you just tuning in, you're listening to Ocean Currents and we're talking with Dr. Milton Love. We're talking about rockfish today and please stay with us to continue the conversation.

(Music)

*Jennifer Stock:*

We're back here with Dr. Milton Love from University of California Santa Barbara and we've been talking about rockfish and, Milton, if you wouldn't mind, how do you think we've gotten to this state in regards to the rockfish populations here on the west coast?

*Milton Love:*

Oh, I always sum it up by saying there's too damn many people catching too damn many fish and that's, I mean, that's really the case and by the way, it's not true to say that every species of rockfish has been hammered equally badly nor that every bit of the coast is the same as every other bit of the coast. Clearly, southern California where you've got six million recreational anglers, let alone commercial fishermen, there's just been a hell of a lot more pressure put on fish populations down our way than, likely, off of Cape Mendocino or Point Arena. So, I don't want to paint this equally gloomy picture everywhere for every species on every strip of the coast, but in general, on the Pacific Coast, we've had an awful lot of fishing by both commercial and sport fishermen for a long time and certain species have been overfished clearly by commercial fishermen. If you go into the gulf of Alaska, the Pacific Ocean Perch fishery was overfished in the 1960's by the Russians and the Japanese before the Americans even got there. On the other hand, in my neck of the woods here, the local reefs here are never fished by commercial fishermen, it's always sport fishermen and they're just denuded of large fish.

So, it's kind of a mixed bag and I always kind of like to take just a moment to say that I kind of sympathize with, particularly with, recreational anglers who always say, "You know what? We just don't see this overfishing." You know, I can go...I'm just paraphrasing, but they'll say, "I can go out and fill my boat up with..." and you know, they'll say blue rockfish or black rockfish or cow cods and so, I just don't believe that there's overfishing going on and I kind of sympathize with that. I don't necessarily agree with it, but I do sympathize because one of the kind of subtleties about my business is that it's often easier to catch a fish than it is to count it and fishermen tend to be very good at finding, kind of the remnant group of fish. So, they're kind of good at catching them and finding them, but not necessarily knowing how

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many there used to be or there were on some of these reefs and as an example, I know that there was a study done using sport fishing boats, Bodega Bay sport fishing boats, Moss Landing got some money and some researchers would go out on the sport fishing boats and they would tag rockfish that were caught and they tagged a lot of fish and so, at first glance, you'd go, well, you know, what's the problem? They tagged hundreds and thousands of fish, but almost all of them were juveniles.

There was almost no adult fish that were caught, even though the habitat was perfectly good, there should be adult fish there, and the implication is that the adults have been caught. So, that's kind of some of the subtleties that I run up against as a scientist.

*Jennifer Stock:* Interesting. So, they seem to be slow to catch up to that adult stage where they're reproductive and keeping the population going forward, but it seems like we have a lot of juveniles right now.

*Milton Love:* Yeah, and in some places there's tons of juveniles, which is a great thing.

*Jennifer Stock:* Now, are some species more vulnerable than others? It seems like we have some species that have been classified as overfished. How come these are more vulnerable than others?

*Milton Love:* Well, there's usually two reasons, or at least several reasons. First of all, there's some species that lend themselves to being caught in very great numbers and are economically very important because they're large, like canary rockfish, which live in your area and are, you know, used to be very abundant off your area and further north. You can catch huge numbers of those in trawls. So, it's very efficient to catch them. They grow large.

There was a vast economic demand and because they take so long to mature, it may take a canary rockfish eight or ten years to become an adult, they just often don't have a chance to even reproduce once before they're caught. On the other hand, you get some of these species that just don't grow large. They're not the kind of fish that people target and they may reproduce within two or three years and so, they can reproduce themselves very quickly and they're not caught in great numbers. So, their populations actually tend to rise.

There's probably more of some of these small fish than there ever have been because the big fish aren't around to eat them anymore.

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- Jennifer Stock:* Interesting. So, moving on a little bit...since you've spent a lot of time in the water in southern California, you've been doing research on the oil and gas platforms in southern California. Can you tell us a little bit about the platforms and what you're trying to find out there?
- Milton Love:* Yeah, well, basically since 1995 people in my lab have been looking at the fish populations that live around oil platforms. There's about 27 of them off southern California and then we compare that with what we see living on natural reefs and most of this research is funded by the federal government because at some point, the platforms aren't going to be economical to operate and the oil companies are just going to say, "Okay, we're all done."
- And the question is, "Are we going to require the companies to pull the platforms out completely or to leave them partially in place to remain as reefs?" And so, basically I've been paid to try to figure out how important platforms are as fish habitats and it turns out that at least some platforms may be very important as fish habitats. Ironically, maybe more important than many reefs, which drives some people crazy and causes them to call me bad names.
- Jennifer Stock:* What natural reefs are you comparing to in that bio-region?
- Milton Love:* Oh, reefs in any depth from about, gosh, ten feet of water to about 1,200 feet of water. We've looked at 150, 200 reefs and almost all the platforms. So, I have a pretty good frame of reference.
- Jennifer Stock:* And the Channel Islands general area?
- Milton Love:* Oh, all around the Channel Islands and, actually, out as far as you can go before you drop off the continental shelf. So, out 120 miles and almost all the way down to the Mexican border. I mean, all up and down the coast and this, by the way, is true not just for the research I've done, but the research that, for instance, Mary Yoklavich has done off of Monterey and Big Sur and what we've found is two things:
- One is the platforms tend to act as marine reserves because they're not fished as heavily as reefs are. So, you still see high-densities of large rockfishes and lean cods around platforms and you rarely find that around natural reefs. So, that's the first thing and the second thing is that platforms tend to be much better nursery grounds for some species of rockfish.

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For instance, little rockfish and Boccaccio and the like, than our natural reefs and that's not because there's anything like, magical, about a platform. Nobody sprinkles it with magic dust, you know?

It's because if you think about it, a little fish, a little rockfish that's kind of drifting around in the plankton may be 50 feet below the surface. It's looking for a place to settle out. Well, the platform is this humongous reef that goes from the bottom all the way to the surface, whereas a natural reef could be a ten foot tall rock that's down about 400 feet.

So, who's more likely to be found by this little fish? The platform or the reef? Well, the platform. They're just easier to run into and they're also quite noisy like any other reef. So, they're probably easier to hear too. So, that's the reason that platforms tend to be actually better nursery grounds. So, you know, when I report all this in scientific papers or I go to meetings, inevitably there are people who just say, "You're lying," and fortunately for me, what I do is not rocket science. Everything we do is videotaped. So, I always say the same thing, you know, "If you don't believe me, you can come to the lab, I'll give you a beer, and you can look at 13 years of videotape yourself."

*Jennifer Stock:*

Well, some of it, you even have on your website. I took a look and it was just beautiful video footage mainly because a lot of it looks like Cordell Bank, a rocky reef habitat and just really, really dense and you said earlier that a lot of folks don't fish near these platforms, but why not? Is there regulations about how close that recreational anglers can get to a drilling platform?

*Milton Love:*

Yeah. Well, it used to be kind of a mixed bag. It used to be that off Long Beach, people fished around the platforms all the time because it was kind of the thing that they learned to do whereas up our way, no one actually thought much about it. So, people didn't do it very often. Now, since 9/11 the oil companies get very squirrely if you come up in a little boat and they don't actually like you to be around and they'll call the Coast Guard. So, in general, not always, but in general, and so, people have just kind of learned that this is a no bueno and so, fishing pressure is relatively low.

The people who do fish off platforms are the people who work on them and I once asked a guy about that and he said, "You know, for the first week or two you're working on the platform, yeah, you fish a bit, but after that you get kind of bored of it and when your shift is over, all you want to do is have a Dove bar." And I went,

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"Okay." And he said, "Yeah, now that this other oil company took over the platform, we don't get Dove bars anymore."

And I'm going like, "Alright..." And then he started complaining about the apples. He said, "Yeah, we don't get galas, all we get are delicious apples and they're all mealy." And I'm thinking like, "What's my role here? Is this like the labor action?" Because I can sing labor songs. I can sing Joe Hill and stuff like that. Is this like a Kum-by-yah moment? Fortunately, then he stopped.

*Jennifer Stock:* So, I've heard there's some interesting culture on those platforms.

*Milton Love:* Clearly. They're actually very interesting. I'm not the greatest fan of oil development, but in terms of engineering, a platform is amazing, even if you despise the oil industry, but the fact that they don't fall over and they're in 1,000 feet of water in a gale, you at least have to go, "Well, that's amazing." If nothing else.

*Jennifer Stock:* Yeah, they are architecturally pretty interesting.

*Milton Love:* They are.

*Jennifer Stock:* So, these were put in in 1958, around...

*Milton Love:* Oh, the earliest ones were in the late 50's and the last one was put in, I think in the early 90's and now there's a moratorium on any oil development and I imagine it's going to be decades, if ever, before anybody puts another one out. So, eventually, these platforms are not going to be economical to operate.

*Jennifer Stock:* So, what is...some of them will probably be closed because they're going to be drying up, their source. What are the different choices involved when one is decommissioned? What are the options out there? I mean, aren't they mandated to remove it?

*Milton Love:* Yes. Right now the oil companies have signed an agreement either with the federal government or the state government that says, "Once we aren't making any more money we are going to remove these," and they very well might. Now, particularly the federal government has the right to say, "You don't have to do that. You can cut them below the water line or cut them 100 feet below the water line or tip them over or two them someplace else and leave them as an artificial reef."

So, legally, the government can change its mind and the question now is, "Is the government going to do that?" Now, there are

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various forces in our society that are working at odds with each other. On one end, you have sport fishermen who tend to go, and I'm generalizing, sport fishermen go, "Well, these are just great big reefs filled with fish. Why would we want to blow them up?" And that's actually what you do. You blow them up and in the process you kill all of the fish. Why would we want to do that and kill all of these fish and kill all of this habitat? So, that's one extreme. On the other end you have some members of the environmental community who say, "We hate the oil companies and we don't like artificial structures in the ocean and therefore, why would we reward the oil industry by letting them keep part of their platforms in?" And then you have people kind of in between and my job as a biologist is just to be neutral. All of those views, or both of those views, are perfectly fine, and there's not a right or wrong there and all I do is tell people what, you know, what I find about the fish.

*Jennifer Stock:*

Now, there is an artificial reef program as well, isn't there, where they're looking at areas to potentially put artificial reefs to help bring back fish stocks. So, how does that fit in with the oil platforms if they're decommissioned?

*Milton Love:*

Yeah, well, California has only a very small artificial reef program. They had a big one, relatively speaking, in the 50's and 60's. Then interest kind of dried up, but now, the reefs that are put in, they tend to be like, they'll sink a ship off San Diego and it's explicitly designed as a place for divers to go. It's not designed as a place to bring back fish populations and the problem is that it's very hard to know when you sink something if you're just going to redistribute the fish...if you're going to pull fish from natural reefs to your artificial reef or if you're actually going to produce fish..if there's going to be more fish in California because you sank something. It's very hard to know before you do it if that's going to happen. So, people tend to be, scientists in particular, tend to be pretty hesitant about recommending artificial reefs.

There's a series of big ones that are going to be going in near the Santa Onofre Nuclear Power Plant near San Clemente and that's mitigation. The hot water from the power plant killed off part of a kelp bed and so, the artificial reef is meant to kind of replace that kelp bed, but we don't have a very strong artificial reef program compared to Florida or Louisiana or places like that.

*Jennifer Stock:*

Do you know why?

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*Milton Love:* It's cultural. So much is cultural. I mean, so much of what we do has no scientific underpinnings, but it's just because a state's people have decided, "Yeah, this is a good thing." Now, in my view, the state of Alabama has gone much too far. In Alabama there are places where if you're done with your washing machine, you can throw it overboard. There are areas that have been de-markated as artificial reef sites and you can throw lots of stuff overboard. No one has ever proven that an artificial reef made out of a washing machine is a particularly good artificial reef, but that doesn't stop the people of Alabama from saying, "Yeah, we want to do that."

*Jennifer Stock:* Well, I also know in New York, they've been putting subway cars that are decommissioned overboard.

*Milton Love:* Yeah, right and we actually did that...some of the early artificial reefs in California, we meaning the Fish and Game Department. They actually put wooden trolley cars down, just as kind of models of what an artificial reef can do and indeed you do get a lot of fish really fish, but the problem with the wooden ones, of course, is they rot away real fast and anything that's metal, thin metal, will only last a few decades. Platforms, people often ask, "Well, how long would a platform last?" Because all it is is steel and it's been estimated that it would last about 400 years before it started to fall apart.

*Jennifer Stock:* Interesting. So, there's a lot of different points of view here, a lot of different facts to consider with this process. What is the timeline right now for the conversation, the debate? I understand there was a Rigs to Reef Conference last year and what's the timeline? Is there a public input part...of this debate..or?

*Milton Love:* Well, right now, because oil keeps going up in value, the oil companies couldn't even guess when they want to decommission because remember, it's strictly economics. These are not do-gooder organizations and as soon as they lose money or perceive that the profit margin is not high enough, they will then start saying, "Okay, we're all done." Now, ten years ago, when oil was whatever, \$10 a barrel, people were going like, "Well, this can't last very long. They're going to have to pull these things out." At \$108, or \$109, I think it closed today, that could take a long time. So, I mean, I've been saying, oh, probably 5 years they'll start decommissioning them, but I've been saying that since 1995. So, what do I know?

*Jennifer Stock:* Interesting.

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- Milton Love:* Yeah, no one really knows.
- Jennifer Stock:* You started studying reefs at the Rigs in 1995. What type of succession have you seen underwater in regards to colonialization of invertebrates and fishes? I mean, you must have seen a huge change in the last few years.
- Milton Love:* No none.
- Jennifer Stock:* Really?
- Milton Love:* No, none to speak of because by the time I started looking at them...
- Jennifer Stock:* They were already settled?
- Milton Love:* Yeah, certainly the invertebrates don't seem to change once you get the massive numbers of mussels and sea stars and so forth. That must happen really fast. No one knows because no one's never followed the succession, but you're talking like, from the surface to about 100 feet down, the platforms are covered in mussel shells and, in fact, there's mussels on top of mussels on top of mussels and then below that you get lots of big anemones and sponges and so forth and all of that must happen very fast because by the time I got there, it had all happened and the only thing that changes in terms of fish from year to year is that the midwaters of the platforms, not the bottom, but up above are nursery grounds for fish and the fish tend to live there only six months or a year and then they swim away. They go someplace else. So, every year, you get different numbers of fish. Some years you get, and I'm not kidding, some years you'll get 350,000 baby Boccaccio and the next year you'll get 0 baby Boccaccio and that just has to do with oceanographic conditions. Some years it's great for survivorship of some fish and some years it sucks.
- Jennifer Stock:* Wow. So, we're getting close to the top of the hour here, but I'm dying to ask you, what has been one of your most memorable moments underwater?
- Milton Love:* Oh, you know what? I have two. One was actually off Monterey working with Mary Yoklovich in the same kind of study looking at natural reefs and there's some place off of Monterey and, god forbid, I'm not going to tell anybody where it is, and it's a reef that no one has fished and we just know that for a fact. It's just very hard to find and every single fish on it is big, huge, sometimes larger than maximum recorded length and the first time I went

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down on it, it was like watching woolly mammoths walk over a mountain. It's stunning how every single fish is big and that's probably the way everything looked 200 years ago before a lot of people were fishing. So, that was one. I mean, that really was...I had trouble driving home to Santa Barbara that night and the other time is when I actually got stuck, when the submarine, there were only two people in the sub and when we got stuck on the bottom for about five minutes and it's never happened before and it's never happened since and at that point, you're going like, "How much air do we have in this?" And, you know, you're trying not to scream and panic, but you sure remember that for a long time.

*Jennifer Stock:* Well, I was in the Delta submersible out at Cordell and that was the first thing they told me when we got in. They said, "By the way, If I happen to pass out, this is where you turn the air on." I was like, "Oh, good to know."

*Milton Love:* Exactly and so, what was your experience in the Delta sub?

*Jennifer Stock:* Diving on Cordell bank when we started doing some work out there and I'm the education coordinator and I said, "I need to see it before I can talk about it."

*Milton Love:* Was it cool diving in the sub?

*Jennifer Stock:* It was wonderful. Yeah. I would say one of my most memorable experiences because I don't get to be out in the ocean as often as most of you marine biologists types. I get to translate it, but I get limited experiences. So, it was really, really fun.

*Milton Love:* I mean, really the only time I'm out on the water is the week or two that I have the sub and, you know, I live a life of quiet desperation and so, this is the high point of my year every year. It's just incredible going underwater.

*Jennifer Stock:* It is quite impressive. Well, Milton, thank you so much for your time today. It's really fascinating. I was really looking forward to interviewing you after reading some of your books and the humor you use, and the way you write are just very engaging. I highly recommend folks that are listening to check out "Rockfishes of the Northeast Pacific" or "Probably More Than You Wanted to Ever Know about Fishes of the Pacific Coast" to just get some great anecdotal and scientific information about fishes here. So, thanks again.

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*Milton Love:* It was lovely and I'd be happy to bore your listeners again if you so desire.

*Jennifer Stock:* I would love that.

*Milton Love:* Sure, alright thanks.

*Jennifer Stock:* Thanks again. Take care.

*Milton Love:* Okay, bye bye.

*Jennifer Stock:* We've just been talking with Milton Love, who is a research biologist at the Marine Science Institute at the University of California Santa Barbara and we've been talking about rockfishes and what to do with these oil rigs in southern California and it's hard to imagine that there's anything positive out of oil rigs for the environment, but it seems like we have a debate on hand of what to do with these things as they are decommissioned in the future, as they're providing some incredible habitat for invertebrates and fishes and some commercially valuable fishes down in southern California.

So, stay tuned on that. You can learn more about Dr. Milton Love's lab, the Love Lab, very cool name, by just searching online, Dr. Milton Love, and you'll get right to him on the internet there. So, we'll be back in just a little bit with an announcement before we wrap up the show.

(Music)

*Jennifer Stock:* Thank you for joining us today on Ocean Currents. This show is broadcast once a month on KWMR one Monday at 1 o'clock. My next show will be May 5th and we'll be talking with a humpback whale researcher doing research in the north Pacific, Dave Mutella, from the Hawaiian Island Humpback Whale National Marine Sanctuary, who's just wrapping up his field season where the humpback whales are congregating around the Hawaiian Islands out in Hawaii right now. So, we'll be talking more about humpback whales next month. Thanks again and have a wonderful afternoon.

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