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SPECIAL ISSUES

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September

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VHS discovery heaps more pressure on aquaculture in Washington, Maine

Seattle, Wash.—Federal fisheries officials ordered the destruction of four million eggs and young fish after discovering viral hemorrhagic septicemia (VHS) at two government hatcheries in the Puget Sound area. The discovery led to immediate protests over the importation of Atlantic salmon into Washington—although no salmon were known to be infected with the disease.

Fisheries officials said they will have to kill all marine life in rivers near the Makah National Fish Hatchery and the Glenwood Springs Hatchery if the virus is detected in those streams.

The investigation was expected to take about a month. Electrical shocks would be sent through the streams to kill all marine life if the virus was detected.

Almost as soon as the deadly virus was discovered, some fisheries officials took advantage of the problem to renew their protests against the farming of Atlantic salmon in Washington. However, fish farmers pointed out that their Atlantic salmon eggs undergo screening for VHS before they are brought into the U.S.

VHS kills rainbow trout and steelheads by weakening their kidneys. The disease can spread quickly through fish urine and feces, biologists said. Salmon can also carry the disease, though they are less vulnerable to it than trout.

One federal fisheries official said the disease "leapfrogged from Europe to Puget Sound," but no one knew how it

reached the United States.

Haavard Rabben, general manager of Global Aqua USA, which raises Atlantic salmon in Puget Sound, said the disease has not been found in European Atlantic salmon for 20 years.

Even though there was no evidence that Atlantic salmon were responsible for the virus, the mere suspicion may already have had some negative impact on aquaculture in the area.

The fish kill story even got heavy attention in the *New York Times*—at the same time that the *Sierra Club Magazine* was also carrying a predominantly negative story about aquaculture in Puget Sound.

The *Times* quoted Jerry Grover, a Fish & Wildlife Service fisheries manager in Portland, Ore., as saying "if you want to have a fish farm, you should stay with the stock from the local area."

Dr. Marsha Landolt, a fisheries professor at the University of Washington, said the mere discovery of the virus may hurt salmon and trout exports because some other countries might not accept "fish that have been near this disease."

COMING UP IN APRIL

Special Reports on Aeration & Oxygen Management

Abalone and sturgeon farming in California

An update on Florida aquaculture

Genevieve Trosclair
Water Farming Journal, 3400 Neyrey Dr., Metairie, La. 70002

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Mechanical oyster dredgers win court battle in Florida

Tallahassee, Fla.--Florida has lost a key court battle in its attempts to keep mechanical harvesters out of leased oyster beds, but the state may seek other ways to protect the habitat in Apalachicola Bay.

Circuit Judge Lewis Hall last month ordered the Florida Dept. of Natural Resources to issue permits to three lease applicants and to allow them to use whatever devices they wish to harvest the oysters on their leases.

He issued a permanent injunction against DNR, forbidding the agency to interfere with mechanical harvesting.

The case grew out of a controversy between fishermen who use long-handled tongs to harvest oysters and lease holders who want to use mechanical dredging. They have accused each other of violating lease rights.

DNR argued that the dredging damages the oyster habitat.

The governor's office indicated that he will continue to support efforts to halt the dredging. The state was expected to begin reviewing leases for any other violations.

USDA will rule on genetic fish testing

Washington, D.C.--The USDA was scheduled to conduct a hearing March 23 to determine whether Auburn researchers should be allowed to release genetically altered fish into outdoor ponds for additional testing. The question has stirred controversy since researchers successfully implanted genes from trout to carp.

Siegel, Dryden Form Trade Service

New York, NY- Siegel Chemical announced it has formed an association with Dryden Aquaculture Ltd. of Scotland to import and export aquaculture and fish processing equipment between Europe and North and South America.

"In many cases American equipment is not available in Europe and vice versa," Siegel's Luis Reichman said.

Temp problems will probably limit King Crab culture

Kodiak, Alaska—Temperature problems may make the culturing of king crabs economically unfeasible, according to Braxton Dew, a biologist with National Marine Fisheries Service. He recently completed a study on juvenile red King Crab in Womens Bay.

Japanese researchers have been experimenting with King Crab culture.

Dew observed temperature problems as he studied the movement and feeding of a pod of juvenile crabs.

"As the water got warmer, podding crabs began to spend more of their time foraging for food and less time in the podding formation," Dew told the *Alaska Journal of Commerce*.

"They also moved to deeper water as temperatures dropped, as deep as 90-100 feet."

Because of these problems, Dew said, crab pens would either have to be moved with water temperature or the temperatures would have to be controlled artificially. Both alternatives would make current culturing techniques unrealistically costly, he said.

Source: *Alaska Mariculture Report*

Alabama lacks facilities for crawfish—Jensen

Auburn, Ala.—Auburn University receives "hundreds of questions about growing crawfish in Alabama" but Fisheries Specialist John Jensen says "there

are few opportunities to grow crawfish here profitably."

He cited these reasons why Alabama growers would have difficulty competing with crawfish brought in from Louisiana:

—"Large areas of flat bottom land for crawfish production are few and far between in Alabama."

—"Most water in Alabama is less than 50 parts per million hardness and alkalinity and would need to be limed, adding to the cost of production."

—"Low cost water for filling ponds in October is not usually available."

"It probably would be less expensive to buy crawfish in Louisiana to sell in Alabama than to grow them locally," Jensen said.

Canadians requests Salmonid center

New Brunswick—The Atlantic Salmon Federation has asked the Canadian government to establish a Centre of Excellence in Salmonid Aquaculture Research (CESAR).

The proposal was one of 158 submitted after the Canadian government established a Network of Centres of Excellence in Canada to provide \$240 million for applied research.

About 15 of the proposals are expected to be approved this summer.

The objective of the Centre of Excellence program is to coordinate research in aquaculture and other fields.

It would probably be based at the Hunsman Marine Science Centre.



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MARKETING AQUACULTURE

Continued from Page 9

spected product is the magic phrase.

"You truly have the ability to capitalize on what the market wants, what Americans want, which is to eat more fish and seafood."

"You can promote farm fish as a product, not a commodity, with all the attendant-cross benefits."

"In the future consumption of fish and seafood in this country, a lot of people believe, is aquaculture. I believe firmly that the future is yours."

Brand name marketing is "the way to go"

"There is an enormous opportunity for the Frank Perdue of seafood. We have been waiting for him for years. The potential is there.

"If the quality is there, the brand name is the way to go."

Seafood counters having supply problems

"The big problem with fish retail is that the people who are buying fish are also the meat buyers. . .

"Meat guys don't like fish. They don't like to get their knives in fish. They don't like to put fish on their block. They say it makes it smell. That's probably because they have been handling bad fish.

"Wherever you have had a super-market chain that made a commitment to selling fish...it has been successful.

"They're running into a problem now though. They put a large investment into a service counter and then they can't get the fish to back that effort up.

"I think the full service counters

have peaked. You talk to the majors—the Krogers, the Winn-Dixies, they'll tell you they are losing money on the full service counters."

Packaging is key to selling frozen fish

"I believe in quality frozen fish. The sooner that fish is properly processed and properly frozen and stored properly, the better quality you are going to have at the end.

"A good quality frozen scenario...is going to get the cost down in the store where they can actually sell seafood at a profit and the public is also going to start believing in that product."

"A lot of the problem with marketing frozen fish is in the packaging. You go into the majority of retail stores and its just a tray-wrapped frozen product.

"They put it into those frozen counters that go through defrost cycles and it just builds up all this crystallization and ice on the product. Within a

B.C. got poor start in building salmon image--Redmayne

Anaheim, Cal.—British Columbia got off to a poor start in building an image for its salmon, Seattle seafood food dealer Graham Redmayne told the California Aquaculture Association.

The introduction of the first big BC salmon harvest in 1988 illustrated "how to break the promise of aquaculture—how to do it wrong," Redmayne said.

"Their introduction to the market-

place this past fall was the classic production-driven introduction," Redmayne said. He added:

"Last fall just about every broker, trader, wholesaler, distributor, retailer around here started getting calls on 2-to-4 pound jack salmon. As most of you know when the salmon reaches sexual maturity, it is called jacking out.

"You've got to get that fish out of

the water in a hurry because they start deteriorating in quality rapidly and very soon you've got an unmarketable fish.

"So all of a sudden here's all these 2-to-4 pounders, and 2-to-4 is not a red hot item. Food services like a big 6-to-9 pound salmon. They get a better yield. Retail likes a 4-to-6 pounder, a size in which the appearance is better.

"So 2-to-4 is just not a desirable product. Couple that with the fact that these are all basically No. 2 fish because their skin color has gotten dark and the flesh has started to undergo some changes.

"Is this anyway to say hello to a market? No.

"Of course there are always opportunists out there and a number of them said where there's a problem, their is an opportunity and markets were developed for this fish.

"For instance you can filet a 2-to-4 pound fish and get an attractive piece of fish at a reasonable price, because in the glut the price went down dramatically.

"But now again we're in the production driven mode, so this glut is followed by an acute shortage. Farmers

Continued on next page

B. C., Norway Promoting Images

Vancouver, Canada—Faced with tremendous growths in production, the Norwegian and British Columbian salmon industries have launched expensive new promotion programs to market their products in the United States.

The British Columbia Salmon Farmers Association is using the campaign to promote its new fish quality assurance program. The association kicked off with a reception at Sea Fare in Los Angeles.

The B. C. quality program includes inspections and a seal for the salmon that meets the new standards established by the association.

The group estimates that British Columbia will produce about 12,500 tons of salmon in 1989—almost double the 1988 production.

Meanwhile the Norwegian Salmon Marketing Council has hired a New York public relations agency and has opened an office in New York to promote its salmon in the U.S.

According to Seafood Trend, the Norwegians will spend about \$1 million to protect and perhaps expand its estimated 10,000-ton market in the United States. Norway expects to increase its production 50% this year, jumping from 80,000 to 120,000 metric tons.

week it looks like the devil, even though it might have been a great piece of fish going in there.

"That hurdle has not been overcome. There has been some pretty sophisticated overwrap films—such as the Trigon film machine that does a skin pack that really pinches it down tight.

"That's a step in the direction we have to go, because the freezers in stores are just brutal to fish with the temperature cycle going up and down."

Live fish tanks sell "wherever they're tried"

Redmayne agreed that there is still a large market for selling live fish—fish that one person in the audience called "swimmingly fresh." Redmayne said:

"There is a lot of sizzle to selling a live product.

"Certainly the infrastructure is there. There are probably 10 or 12 different live tank suppliers. There are some real sophisticated, attractive systems. In one system you can have clams, oysters, lobsters, crab and trout swimming around. This gets the public. All the kids go right to those tanks and you've drawn the parents.

"It works wherever it has been tried."

B.C. off to poor startContinued from Page 22

said 'we've now got to let our fish grow. We can't be on the market.'

"But what happens to all the people who developed markets for this fish? They've got a bad attitude about this fish.

"This failure to make a commitment to the market has led to a very negative attitude. I sell a lot of farm salmon from British Columbia and it is an uphill battle. People really don't want to hear about it that much."

"A lot of poor fish has hit the market. The farmers don't know what they have in their pens as the Norwegians do.

"In British Columbia, when they want to harvest a pen, they pump the pen, The Norwegians bail the fish out. They count as they come out. They know exactly what they've got all the way through the processing pipeline.

"But when you're pumping fish out, you don't really know what you have until the fish is through the plant. So a lot of No. 2 fish is being sold as No. 1 fish.

"Time and time again at cuttings where buyers are comparing the Norwegian fish, the Chilean coho, the New Zealand, Scottish, Irish, and Canadian, consistently the British Columbia farm salmon comes in last—in appearance, taste, texture, you name it.

"BC farm salmon at the moment has a very bad name on the market," Redmayne said.

Norwegian salmon "is No. 1 anywhere you go"

Norwegian farmed salmon are rated best around the world because the product has been carefully planned, Redmayne said. He added:

"They gave out a limited number of licenses. Every farmer had massive backup from research people, scientists and aquaculture experts.

"There was a close coordination with SAS (Scandinavian) Airways to develop the proper packaging to make sure the fish reached the market in good condition.

"In the Scandinavian manner, they are not afraid of government subsidies so every pound of fish that is flown on SAS has about a 25¢ per pound government subsidy to hold down the freight cost

"The bottom line is that anywhere you go the No. 1 salmon—as far as the quality perception goes—is the Norwegian.

"They virtually own the European market. This has really hurt the wild salmon guys in Alaska. They have lost all their markets in Europe.

"Everybody wants the Norwegian product."

Safeway Stores "burned" twice by salmon industry

Redmayne said the Safeway Store chain has been let down twice by the farm salmon industry.

"Last year the promotion was going to be on Chilean cohos and they had ads booked. They were ready to roll with a big Lenten promotion

"Unfortunately, the Japanese came in and had a better price. Chileans no longer spoke English. They spoke Japanese. Safeway was let down badly. And was very bitter.

"Safeway this Lent decided to go with BC farm salmon. Unfortunately the BC salmon farmers didn't deliver either.

"A lot of it can't be called their fault. We had a terrible storm last week. That cold air mass from Alaska headed south and it hit the salmon farmers very hard.

"There were 100 mile-an-hour winds. A number of pens were washed up on the beach. A number of farms broke up. A number of farms sank as the buildup of ice came down.

"So you can't blame the farmers too much. But the bottom line is Safeway got burned again," he said.

Alaskans trying to raise pink scallops

Anchorage, Alaska—After concluding a two-year joint project with the Japanese without successfully capturing the weathervane scallop spat, the Kodiak Area Native Association (KANA) has shifted its efforts toward the development of the abundant pink or spiny scallops.

KANA and cooperating villages are now attempting to raise pink scallops, and are seeking additional funding to carry on research and test marketing of the species.

Pink scallops have gained some popularity in seafood restaurants where they are marketed as "singing scallops."

Since pink scallops are considerably smaller than weathervane or rock scallops, they are eaten whole, rather than extracting only the abductor muscle.

This presents an additional problem of having to ship live animals, and increases concern over Paralytic Shellfish Poisoning. PSP generally is not a problem when only the abductor muscle is eaten, since the toxins concentrate in the viscera.

Source: Alaskan Mariculture Report

Aquaculture Feed Mills

Here are some of the major aquaculture feed companies in the United States. Primary contacts, brand name and types of feed are provided when available.*

A.J. Balshi, Inc.

350 Fisher Avenue Catawissa PA 17820

(717) 356-7161

"Zing" salmon, trout

Alabama Farmers Cooperative, Inc.

P.O. Box 2227 Decatur AL 35602

Tom Hill

Catfish

Alabama Feed Mills

P.O. Box 2026 Tuscaloosa AL 35401

Buddy Cory (205) 752-2588

"Bama" catfish, trout & tilapia

Anderson Energizer Feeds

P.O. Box 290 Lonoke AR 72086

James Neal Anderson (501) 676-3166

Catfish

Aqua Mana Aquatic Feeds

1150 Pomeroy Road Nipomo CA 93444

Brian Evans (805) 473-1154

Shrimp, crawfish, crab, prawns, lobster

Associated Feed & Supply Co. Inc.

5213 West Main Turlock CA 95380

Jon Lindskoog 209 667-2708

Catfish, trout, sturgeon, gold fish, koi, bait fish

BioProducts Inc.

Box 429 Warrenton OR 97146

503 861-2256

Salmon, trout, bass, walleye, catfish, sturgeon

Biosponge Aquaculture Products

23 East Brundage Sheridan WY 82801

Verl Stevens (307) 672-0745

Catfish, trout, salmon, tilapia, bass

Bluebonnet Milling Company

P.O. Box 2006 Ardmore OK 73402

(405) 223-3900

Catfish

Burris Milling, Inc.

1012 Pearl Street Franklinton, LA 70438

David Burris (504) 839-3400

Crawfish; alligator, turtle

Cargill Nutrena Feeds

801 S. Popular St. Florence AL 35630

205 764-1331

Catfish

Cole Grain Company

P.O. Box Muskogee OK 74402

Mitchell Fram (918) 683-2060

Catfish

Cosby-Hodges (Doane Products)

P.O. Box 10767 Birmingham AL 35202

Earl Clements (800) 633-6576

Catfish floating feed, 26%, 32% & 36% protein

Dahjang Company USA

2135 Huntington Drive, San Marino CA 91108

(818) 584-0505

Delta Western

P.O. Box 878 Indianola MS 38751

Lester Meyers (601) 887-1226

Catfish

DuPont-Aquaculture Division

P.O. Box 1089 Orange TX 77630-1089

C.J. Daigle (409) 866-6191

"Crawdeaux" crawfish bait & crawfish feed

Fuzzy's Feeds

P.O. Box 457 Florence AL 35631

(800) 621-9756

Catfish

GoldKist Agri-Services Mill

4800 Lake Guntersville Guntersville AL 35976

205 582-3114

Catfish

Goldkist Feed Division

P.O. Box 2210 Atlanta GA 30301

Idaho Aquatic Foods

P.O. Box 1262 Boise ID 83701

(208) 377-2201

Trout

Kruse Grain & Milling

P.O. Box 5000 El Monte CA 91734

Jim Gibson 800-854-1781

Catfish, koi, tilapia

Lone Star Feed Mill

Keatchie LA

Crawfish bait

MFC Greensboro Farmers Co-op

P.O. Box 358 Greensboro AL 36744

205 624 8351

Catfish

MFC Services

P.O. Box 1262 Madison MS 39110

John Neimi (601) 856-2400

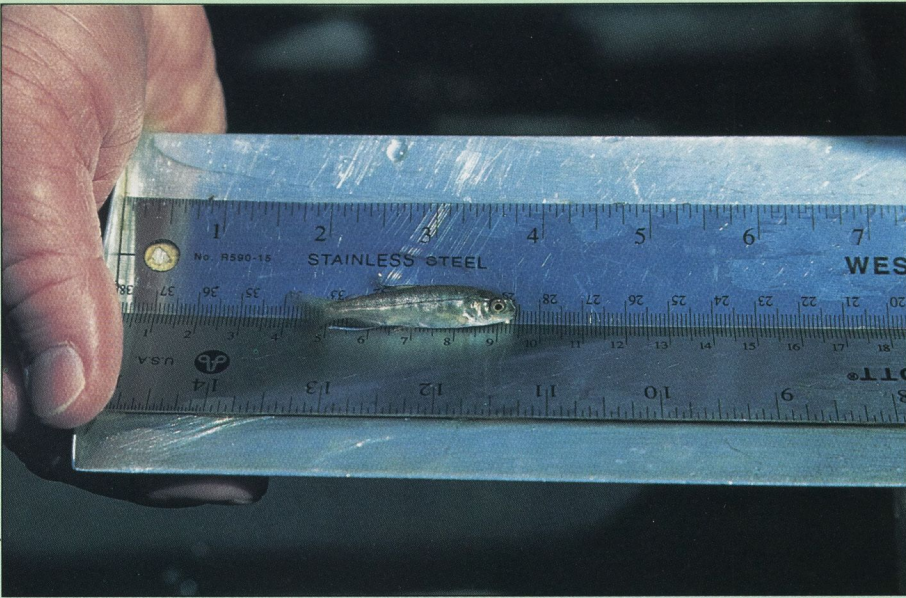
Catfish

MFC Tri-County Co-op

Box 451 Aliceville AL 35442

205 373-6369

Catfish



Jack Kelly Clark

Samples of juvenile salmon and steelhead are netted out of the creek and measured to determine growth rates.

Although monitoring adult spawning salmon is a good way to gauge stock health, the real key to the health of salmonid habitat is juvenile salmon (smolt) production. During the past 5 years, Rellim biologists and I have monitored juvenile coho and chinook salmon production and compared it to adult spawning escapement. The results are just beginning to show a system in biological balance that can withstand fluctuations in adult returns and changing environmental conditions.

Restoring salmon habitat and increasing production also require educating landowners, enhancement groups and the public — those who will be responsible for covering the “costs” of improving and restoring salmon resources. In 1983, Northern California Sea Grant advisors organized the first statewide enhancement conference, which functioned as a valuable source of information about technical needs and project funding sources. These conferences continue as a primary information outreach to community-based restoration groups with guidance from the Salmonid Restoration Federation.

Extension Sea Grant staff have also coordinated programs for the Spring-Run Chinook Salmon Workgroup on

the Sacramento River. Habitat improvement actions taken by this group of farmers, landowners, fishers, forest managers, irrigation districts, environmentalists and resource agencies have delayed a potential Endangered Species Act (ESA) listing of this stock.

The recent and potential listings of salmon and steelhead species under the Federal ESA have brought home the need for community cooperation in restoring salmonid habitat and healthy stocks. Not only are these resources important to the economic viability of many communities, they are also symbols of our commitment to a healthy environment and biodiversity.

J. Waldvogel is the California/Oregon Sea Grant Extension Advisor, Del Norte and Curry counties.

Further Reading

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Toole C, Waldvogel J. (eds.). 1989–1994. Proceedings of the 7th-12th Salmonid Restoration Conferences. UC Cooperative Extension.

Waldvogel J. 1988. Fall Chinook Salmon Spawning Escapement Estimate for a Tributary of the Smith River, California. Second Interim Report (1980–87), UCSGEP-88-5. 22 p.

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Over the past 25 years since the creation of Sea Grant, U.S. fisheries have moved from a development and Americanization phase to the current focus on issues of sustainability, ecosystem management, globalization, overcapitalization, bycatch of nontarget species, comanagement and allocation among user groups. Similarly, there has been a transition in Sea Grant research and extension focus from increasing fishers' production to concentrating on management-related issues. The commercial and recreational fishing industry, fishery managers, conservation organizations and concerned citizens are looking for innovative fishery-management approaches.

California's situation

Historically, California has had one of the world's most productive fisheries (Leet et al. 1992). Prevailing northwesterly winds and other factors combine to cause the upwelling of deep, cold nutrient-rich water to the sunlit surface. This leads to tremendous blooms of plankton (tiny plants and animals) that serve as the food base for the production of a large and diverse population of marine organisms. The intensity of this upwelling varies significantly, which makes it difficult to predict year-to-year variations in fish and shellfish populations (see page 36).

The sardine and tuna fisheries were California's most dominant during much of this century. Sardine landings grew to 700,000 tons during the 1930s before collapsing in the late 1940s. The relative importance of the roles overfishing and changes in oceanographic conditions played in the collapse is still widely debated. After 40 years, sardine stocks have begun to recover and a small, conservatively managed fishery has resumed.

As the sardine fishery declined, the tropical tuna fleet expanded. Landings grew to more than 300 million pounds, worth more than all of the other fish landed in the state. However, by the early 1980s, most of the tuna harvesting and processing industry had moved out of California. A combination of high labor costs, foreign competition

and regulations related to dolphin protection resulted in the rapid shift of much of the fishing to the western Pacific and processing to American Samoa, Thailand and Puerto Rico. Between 1980 and 1985, the value of tropical tuna landings in California dropped tenfold, to \$35 million annually.

Since the early 1980s, the nontuna fisheries have intensified and their value has doubled in real dollars. Much of this growth has been spurred by demand from the Pacific Rim for species such as sea urchin (see sidebar, *right*), herring, sablefish and other bottomfish. Important fisheries such as salmon, abalone, white seabass and some rockfishes have suffered serious declines. Loss of habitat (rivers and estuaries), poor water quality and overfishing are most often cited as reasons for the declines in abundance.

Marine recreational fishing is economically significant. California marine anglers annually land about 30 million fish and spend about \$750 million. Some species such as striped bass, sturgeon and abalone in Northern California are allocated solely for recreation.

Fisheries management

How are wild fish and shellfish populations managed? Two primary issues must be addressed. The first is to determine how many fish can be safely harvested each year and still sustain the population through reproduction and growth. The second challenge of the fish manager is to allocate the harvest among user groups such as commercial, recreational and Native American fishers. This also includes allocating some of the resource as forage for other fish, birds and marine mammals. Both issues are difficult and are a focus of much research and debate.

To determine what the sustainable rate of harvest could be requires estimates of the population size as well as variables such as growth rates, natural and fishing mortality rates, reproductive success and the effects of changes in the ocean environment on these variables. The unpredictable variability in ocean conditions and rapid

continued on p. 32



Jack Kelly Clark

Until 1994, the United States was the world's largest supplier of uni, or sea urchin roe, to Japan.

Aquaculture boosts urchin roe production

Susan McBride

Red sea urchins, with their hedgehoglike shells and five skeins of edible golden roe, are a gourmet treat, especially in Asia. Each year California divers harvest as many as 25 million pounds of the red sea urchins that many people find delicious and for which they are willing to pay dearly.

The commercial fishery for sea urchins in California began in the 1970s. However, the history of the sea urchin fishery dates back to the 1700s, when sea otters, a major predator on sea urchins, were hunted nearly to extinction. With the demise of the sea otter, the sea urchin population grew unchecked.

In the 1970s, economic factors coincided to make the urchin fishery successful. Commercial air freight between the United States and Japan allowed sea urchin uni, which is consumed raw and fresh, to be flown to markets in Japan. Also, the dollar depreciated relative to the yen, making American goods, including sea urchin roe, less expensive to the Japanese (Muraoka 1990).

Sea urchins are harvested commercially worldwide, particularly in Japan, France, Chile and the United States. The United States has been the world's largest harvesting nation of sea urchins since 1988 and was the world's largest supplier of sea urchins and sea urchin roe to Japan until 1994 (Sonu 1995). However, harvests have plummeted in recent years, creating

special incentives to the state's urchin divers and processors to use this valued resource efficiently.

One intriguing possibility emerged from early research, which showed that the yield of urchin roe is sensitive to food availability and may increase with preferred foods (Vadas 1977; Larson et al 1980; Lawrence et al 1997). In 1990, Sea Grant Marine Advisor Leigh Johnson demonstrated that urchins kept in seafloor enclosures could be "fattened up" if fed kelp. Gonad yield was measured as the wet weight of the gonads divided by the whole animal weight, and multiplied by 100 to give a percentage value called the "gonad index." Johnson found that over 2 months, the experimental "penned" animals had a gonad index almost double that of the controls (16.1% vs 8.4%) (Leighton and Johnson 1992).

These results were of great interest to the urchin industry, which had cooperated with Leigh Johnson in the studies, because selling fattened urchins in seasonal markets when supply is lowest and prices are highest would be an effective way to maximize resource value and improve market opportunities.

In response to industry requests, we initiated a series of experiments to determine whether red sea urchin could be held and fattened in culture systems on land. In addition to industry members, my collaborators include a number of professors and students at

fish print by Chris Dewees



To limit mortality from fishing in California, some species of rockfish are managed with both fleetwide quotas for the entire season and with trip limits for each vessel to spread the catch out over a longer time period. The recreational fishery for rockfish is managed with daily bag limits (currently 15 fish).



Jack Kelly Clark

Increased fishing pressure and habitat degradation are among factors causing declines in some fish populations.

Sustaining ocean fisheries poses challenge for resource managers

Christopher M. Dewees

California is one of the world's most productive and intensely harvested marine fisheries areas. Increased fishing, habitat degradation, expanding human population and decreases in water quality and quantity have put great stress on the state's coastal marine resources. Research and extension activities funded by California Sea Grant, DANR and the California Resources Agency focus on improving the methods and policies needed to manage fisheries. Significant changes in the way we manage these resources are likely to occur in the 21st century.

In recent years the news media have been filled with reports of fishery collapses and fishery problems around the world: the closure of the cod fishery off New England and the Canadian Maritimes, and the listing of some Pacific Coast salmon runs under the Endangered Species Act. These events have led to significant social and economic turmoil in communities that rely on natural resources.

At the same time, there is such a market glut of some species of salmon from Alaska that salmon prices have plummeted to such a level that the fish are given away to food banks. Also, in recent years, squid landings in California have skyrocketed. This presents a confusing picture of the state of fisher-

ies and brings home the realization that fisheries are dynamic, complex and difficult to manage on a sustainable basis.

Harvesting wild fish and shellfish has historically been important for subsistence and commerce. Except for some local depletions, primarily of shellfish, overharvesting was seldom a problem until modern fisheries developed over the past 150 years. Many, including the influential British scholar Thomas Huxley during the 1880s, believed that the major ocean fisheries were inexhaustible. As recently as the 1960s, many people felt that the oceans would be the answer to world hunger.

Events of the past quarter-century, such as the explosion of improved technology enabling more efficient harvesting, globalization of markets, improved transportation and seafood-handling techniques, and increased demand for seafood have made it clear that the sea is not inexhaustible. World fish catches peaked in 1989 at about 89 million tons and are declining. The challenge facing fisheries managers is how to stop these declines and maintain healthy sustainable fisheries (see page 28). *continued on p. 29*



Jack Kelly Clark

Instream traps are used to corral juvenile salmonids. Although small sections of old growth timber have been clear cut near West Branch Mill Creek, a major salmon spawning tributary of the Smith River, data collected over 17 years show natural fluctuations in a healthy salmon population.

Salmon restoration depends on improved habitat

Jim Waldvogel

The streams and rivers that California's salmon and trout call home during the freshwater portion of their life cycle have deteriorated over the past 50 years, resulting in decreases in the populations of these salmonids. Habitat deterioration and population changes are caused by natural occurrences (floods, fires, El Niños, drought, predators and changing ocean conditions); land-use practices (mining, timber harvest, highway construction, agriculture, grazing and urban development); increases in fishing effort; and major diversions of water resources and the damming of rivers.

Restoration of California's salmon and steelhead populations depends on the principle of managing natural stocks. The genetic diversity and population viability of individual runs of salmon requires that watershed and habitat conditions throughout a species range be restored or protected.

Improving degraded habitat, protecting stream quality, providing adequate clean water and flows, reducing fish harvest when appropriate and

the long-term monitoring of fish runs are all part of the equation for restoring salmonid populations.

In recent years, the excellent returns of chinook salmon to the Sacramento and Klamath river systems have been direct reflections of improved ocean conditions and hatchery fish production. Natural salmon production, however, continues to decline in most watersheds.

In 1979, when I became Sea Grant Advisor for Del Norte County, the Smith River was in the process of be-

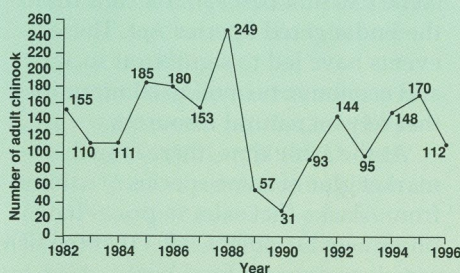


Fig. 1. Adult chinook spawning estimates for West Branch Mill Creek, Smith River (1980-1996).

ing designated a Wild and Scenic River. The Smith was described as an "excellent" salmon and steelhead stream; however, no evaluation criteria for natural salmonid stocks existed. Because of the need for a good research index stream (a stream that reflects healthy, natural fluctuations in a fish population), I initiated a 20-year chinook salmon spawning escapement study in 1980 on West Branch Mill Creek, a major salmon spawning tributary of the Smith River.

The study section, on private timber land owned by the Rellim Redwood Company, is surrounded by lands that belong to the California State Park and Redwood National Park System. At the inception of the study, the West Branch watershed consisted of old-growth redwoods. Although small sections of old growth were clear cut between 1986 and 1995, the stream habitat has remained largely intact.

The 17 years of data collected on Mill Creek shows natural fluctuations in a healthy salmon population (fig. 1). The data reflect changes in natural environmental conditions (drought and flood) that have allowed the fish to withstand certain habitat changes. The study is also providing valuable information about coexisting coho and chum salmon populations.