

*Director's
Digest*



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AQUACULTURE FEED MARKET WILL GROW AT 4.4% ANNUALLY TO 1995

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ABSTRACT

THE MARKET FOR AQUACULTURE FEED WILL CONTINUE TO GROW DURING THE FIRST HALF OF THE 1990s, BUT NOT UNIFORMLY ACROSS ALL SPECIES. FEED DEMAND BY CATFISH AND TROUT PRODUCERS WILL GROW AT A SLOWER RATE THAN DEMAND BY BAITFISH AND SALMON PRODUCERS. AT THE SAME TIME, THOUGH, NEW DEMAND WILL SURFACE FOR CRAWFISH PRODUCERS, AND DEMAND FOR FEEDS SHOULD SHOOT UP FOR THE LESS-TRADITIONAL AQUACULTURE PRODUCER. IN THIS ARTICLE, THE EXPECTED FEED DEMAND FOR THE VARIOUS SEGMENTS OF THE EXPANDING AQUACULTURE INDUSTRY IS EXAMINED.

BY 1995, THE U.S. FEED MARKET IS EXPECTED TO GROW TO 1,411 MILLION POUNDS, VALUED AT \$315 MILLION, UP FROM AN ESTIMATED 1,090 MILLION POUNDS VALUED AT \$250 MILLION IN 1989. INCREASED COMPETITION AND SLOWER GROWTH RATES THAT HAVE BEEN FORECAST FOR CATFISH, TROUT AND SOME OTHER SPECIES OF FARMED FISH AND SHELLFISH IN THE U.S. DURING THE 1990s SUPPORT A GROWTH RATE AVERAGING 4.4% FOR FEED USE DURING THIS PERIOD.

ONLY 6.6% OF TOTAL WORLDWIDE PRODUCTION OF FARMED FISH AND SHELLFISH COMES FROM THE U.S. HOWEVER, FEED USE BY U.S. FISH AND SHELLFISH FARMERS IS

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ALMOST 11.1% OF THE WORLDWIDE FEED MARKET. U.S. AQUACULTURAL PRODUCTION CONTRASTS WITH ESTIMATED WORLDWIDE PRODUCTION OF 27.6 BILLION POUNDS (12.3 MILLION METRIC TONS) OF FARMED FISH AND SHELLFISH IN 1989. THE GLOBAL FEED MARKET TOTALED ALMOST 9.85 BILLION POUNDS (4.4. MMT), VALUED AT \$1,935 MILLION.

FEED IS THE LARGEST OPERATING EXPENSE OF MOST FISH FARMS. THE COST OF FEED IS OFTEN 40-50% OF TOTAL COSTS. THE WORLDWIDE TREND IS TOWARD THE DEVELOPMENT OF HIGH-QUALITY FEEDS FORMULATED TO MEET THE SPECIFIC NUTRITIONAL NEEDS OF A SPECIES DEPENDING ON ITS STAGE OF GROWTH.

FEED IS ALSO THE MAJOR DETERMINANT OF SUCCESS IN THE MARKETPLACE. FEED IS THE MAJOR FACTOR CONTROLLING FLAVOR, TEXTURE AND COLOR. IT INFLUENCES THE GROWTH RATE OF THE FISH AND THE FAT CONTENT OF THE FINISHED PRODUCT.

SOME CHEFS COMPLAIN THAT FARMED FISH IS BLAND. NUMEROUS NUTRITIONISTS INSIST THAT FISH SHOULD CONTAIN THE LEVELS OF POLYUNSATURATED OMEGA 3 FATTY ACIDS THAT ARE PRESENT IN THEIR WILD COUNTERPARTS. SALMON FARMS ARE ACCUSED OF POLLUTING THE ENVIRONMENT. THESE ARE SOME OF THE ISSUES CONFRONTING AQUACULTURAL PRODUCERS AND FEED MANUFACTURERS.

THE SUCCESSFUL PRODUCER MEETS ALL THE NEEDS OF THE MARKET IN WHICH HE SELLS HIS PRODUCT, WHICH MEANS PRODUCT OF DIFFERENT QUALITY SPECIFICATIONS TO MEET THE REQUIREMENTS OF DIFFERENT MARKET SEGMENTS. FISH AND SHELLFISH ARE MARKETED BY FOODSERVICE, RETAILERS AND FOOD PROCESSORS. THE TREND IS TOWARD MORE VALUE-ADDED, FRESH REFRIGERATED PRODUCTS INCLUDING BONED FILLETS, SEASONED AND MARINATED PRODUCTS, SMOKED PRODUCTS THAT ARE OFTEN SLICED AND VACUUM-PACKED, PREPARED FRESH PRODUCTS THAT ARE READY TO BAKE OR BROIL, AND REFRIGERATED, READY-TO-SERVE COOKED PRODUCTS. MEETING THE NEEDS OF THE CONSUMER IN TODAY'S MARKETPLACE CONTRASTS WITH THE GOAL OF MANY AQUACULTURAL PRODUCERS DURING THE 1980s-TO GET THE FISH TO MARKET IN THE SHORTEST POSSIBLE TIME.

THE INCREASING TECHNOLOGICAL SOPHISTICATION OF THE AQUACULTURE INDUSTRY BRINGS CHALLENGES AND OPPORTUNITIES TO FEED MANUFACTURERS. INCREASED EMPHASIS ON BETTER FEED UTILIZATION AND REDUCED POLLUTION WILL RESULT IN IMPROVEMENTS IN BOTH FEEDS AND FEEDING METHODS DURING THIS DECADE. FOR EXAMPLE, CLEAR SPRINGS

TROUT CO. OF BUHL, IDA., RECENTLY BEGAN INSTALLING A COMPUTERIZED, OVERHEAD DELIVERY SYSTEM ON ITS FARMS. THIS FULLY AUTOMATED SYSTEM PERMITS CLOSE CONTROL OVER THE FEEDING PROCESS AND IS EXPECTED TO CONTRIBUTE TO BETTER FEED UTILIZATION, REDUCED POLLUTION AND INCREASED PRODUCTION. IN THIS SYSTEM, FINES ARE AUTOMATICALLY REMOVED AND RETURNED TO THE FEED MILL. FEED IS DELIVERED TO THE FISH IN VERY SMALL AMOUNTS IN A CONTROLLED AND FLEXIBLE MANNER.

NEW DEVELOPMENTS IN FEEDS AND FEED INGREDIENTS ALSO IMPACT THE FEED MARKET IN THE U.S. AS A RESULT OF IMPROVEMENTS IN FEED UTILIZATION, GROWTH RATES IN THE FEED MARKET MAY LAG THOSE FOR AQUACULTURE PRODUCTION OF SOME SPECIES DURING THE 1990s. HOWEVER, THE SHIFT TOWARD GREATER USE OF HIGH-QUALITY FEEDS IS LIKELY TO BE VERY PRONOUNCED IN THIS HIGHLY COMPETITIVE WORLDWIDE INDUSTRY. AT THE SAME TIME, NEW SPECIES PROVIDE OPPORTUNITIES FOR GROWTH.

CATFISH OUTLOOK

CATFISH PRODUCTION SLOWED RECENTLY, AND EXCESS PROCESSING CAPACITY BECAME OF FACT OF LIFE FOR THIS GROWTH INDUSTRY OF THE 1980s. THE GENERALLY LOWER PRICES PREVALENT IN THE SEAFOOD INDUSTRY, INCREASING COMPETITION IN THE WORLDWIDE SALMON AND SHRIMP FARMING INDUSTRIES, WHICH ARE BOTH SUFFERING FROM OVERPRODUCTION, AND INCREASING AVAILABILITY OF A WIDER VARIETY OF BOTH FARMED AND WILD SPECIES REDUCE DEMAND FOR CATFISH.

CATFISH FEEDS CONTAIN 50-55% SOYBEAN MEAL, 25-35% CORN MEAL AND 15-25% OTHER NUTRIENTS, SUCH AS WHEAT, BARLEY, OATS, FISH MEAL, MEAT AND BONE MEAL AND FATS AND OILS. APPROXIMATELY 1.5% FISH MEAL IS USED MAINLY FOR TASTE PURPOSES. PROTEIN LEVEL IS TYPICALLY 30-35%.

CATFISH FARMING PROVIDES ALMOST 50% OF TOTAL AQUACULTURAL PRODUCTION IN THE U.S. IN 1989, APPROXIMATELY 400 MILLION POUNDS OF FARMED CATFISH WITH AN ESTIMATED FARM VALUE OF \$310 MILLION WERE PRODUCED. FARMED CATFISH HAS BEEN ACCEPTED BY RETAIL, FOODSERVICE AND FOOD PROCESSOR SEGMENTS AS A HIGH QUALITY PRODUCT THAT IS SAFER AND BETTER TASTING THAN ITS WILD COUNTERPART.

R. ONEAL SMITHERMAN, DIRECTOR OF THE U.S. DEPARTMENT OF AGRICULTURE'S OFFICE OF AQUACULTURE RECOMMENDS A FEED CONVERSION RATE OF 2.0 AS BEING REPRESENTATIVE OF THE OVERALL INDUSTRY IN CALCULATING FEED USE. HOWEVER, MANY FARMS ARE IN THE 1.5-1.7 RANGE.

IN 1989, TOTAL FEED USE IN THE CATFISH INDUSTRY WAS ESTIMATED AT 800 MILLION POUNDS--ALMOST 75% OF THE FISH FEED MARKET IN THE U.S. BY 1995, FEED USE IS EXPECTED TO REACH 1 BILLION POUNDS AND CATFISH PRODUCTION IS EXPECTED TO CLIMB TO 525 MILLION POUNDS.

THE DEVELOPMENT OF OFF-FLAVOR IS THE BIGGEST PROBLEM OF CATFISH FARMERS. OFF-FLAVOR OCCURS MOST FREQUENTLY DURING THE SUMMER. THIS PROBLEM BECAME PARTICULARLY SEVERE IN MISSISSIPPI IN 1989. CATFISH SALES DECLINED 5% IN MISSISSIPPI. GROWERS WERE FORCED TO HOLD FISH, AND THE NUMBER OF LARGE-SIZED FISH THAT WERE MARKETED INCREASED DRAMATICALLY IN A MARKET THAT GENERALLY PREFERS SMALLER SIZES.

CONDITIONS OF THE POND BOTTOM MAY AFFECT BOTH FLESH COLOR AND THE DEVELOPMENT OF OFF-FLAVOR IN FARMED CATFISH. THE CONDITION OF THE POND BOTTOM IS INFLUENCED BY THE QUALITY OF THE FEED AND FEED UTILIZATION. AVERAGE POND SIZE IS BECOMING SMALLER. TODAY MOST PONDS ARE 10-20 ACRES AND STOCKING DENSITIES HAVE INCREASED TO 5,000-10,000 CATFISH PER ACRE IN GROW-OUT PONDS. YIELDS MAY BE HIGHER THAN 5,000 LBS. PER ACRE. IN SOME INSTANCES, TWO SIZES OF FISH ARE GROWN CONCURRENTLY IN A POND. DAILY FEED USE MAY BE AS HIGH AS 100 LB. OR MORE PER ACRE. IMPROVED METHODS OF CONTROL OF WATER QUALITY AND HIGH-QUALITY FEEDS ARE NECESSARY WITH THESE SYSTEMS.

MISSISSIPPI IS THE LARGEST CATFISH PRODUCING STATE AND ACCOUNTED FOR AN ESTIMATED 72% OF CATFISH SALES IN 1989. HOWEVER, OTHER STATES ARE GAINING MARKET SHARE. IN 1989, 9% OF TOTAL SALES WERE FOR CATFISH GROWN IN ALABAMA, AND 8% WERE FROM FARMS IN ARKANSAS. ALTHOUGH PRODUCTION IS INCREASING IN MISSOURI, FLORIDA, NORTH CAROLINA, SOUTH CAROLINA AND OTHER STATES, 95% OF TOTAL SALES IN 1989 WERE FROM THE FIVE LEADING STATES - MISSISSIPPI, ALABAMA, ARKANSAS, LOUISIANA AND CALIFORNIA. RECENT DEVELOPMENT OF PROCESSING PLANTS OUTSIDE OF MISSISSIPPI AND BROADENING OF THE MARKET ARE LIKELY TO LEAD TO FURTHER DEVELOPMENT OF CATFISH FARMS OUTSIDE MISSISSIPPI.

TROUT FEEDS, TROUT FARMING

FARMED TROUT PRODUCTION INCLUDING OUTPUT FROM FEE-FISHING OPERATIONS TOTALED AN ESTIMATED 80 MILLION POUNDS, VALUED AT ALMOST \$125 MILLION IN 1989. FEED USE WAS ESTIMATED AT 140 MILLION POUNDS. LIMITATION ON WATER RESOURCES IS EXPECTED TO BE A LEADING FACTOR IN THE RELATIVELY SLOW GROWTH - AVERAGING 3% - THAT IS FORECAST FOR THE TROUT INDUSTRY OVER THE NEXT FIVE YEARS. PRODUCTION OF 93 MILLION POUNDS AND FEED USE OF 160 MILLION POUNDS IS FORECAST FOR 1995.

IN THE U.S. TROUT FARMING INDUSTRY, FEED AVERAGES MORE THAN 37% OF TOTAL COSTS. TROUT FEEDS CONTAIN A MUCH HIGHER PERCENTAGE OF FISH MEAL, 20-30%, ALONG WITH OTHER INGREDIENTS SUCH AS SOYBEAN MEAL, COTTONSEED MEAL, WHEAT MIDLINGS, WHEY PRODUCTS, FISH OIL AND POULTRY BY-PRODUCTS.

ACCORDING TO THE USDA'S SMITHERMAN, 1.7-1.8 IS THE TYPICAL RANGE FOR FEED CONVERSION ON TROUT FARMS IN THE U.S. AS REPORTED BY FISH FARMING INTERNATIONAL, THE LARGEST PRODUCER, CLEAR SPRINGS TROUT CO., WHICH PRODUCED 18 MILLION POUNDS AT ITS FARMS NEAR BUHL IN 1989, AVERAGES 1.65 ON A COMPANY-WIDE BASIS. WHILE MANY FISH FARMERS PURCHASE MIXED FEEDS, CLEAR SPRINGS OPERATES ITS OWN FEED MILL AND PRODUCES MORE THAN 30 MILLION POUNDS OF TROUT FEED ANNUALLY.

IN THE U.S., TROUT WAS PRODUCED ON 518 COMMERCIAL TROUT FARMS IN 16 STATES IN 1989. PRODUCTION FROM COMMERCIAL FARMS WAS VALUED AT ALMOST \$73 MILLION. IDAHO HAD 24 TROUT FARMS, AND FARMED TROUT PRODUCTION WAS VALUED AT ALMOST \$29 MILLION, APPROXIMATELY 40% OF TOTAL PRODUCTION. EXPANSION IN IDAHO IS RESTRICTED BY LIMITED WATER RESOURCES; THUS OTHER AREAS ARE EXPECTED TO ACCOUNT FOR MOST OF THE GROWTH IN THE FUTURE. CALIFORNIA PRODUCED 12% OF FARMED TROUT ON 24 FARMS IN 1989. NORTH CAROLINA ALSO ACCOUNTED FOR APPROXIMATELY 12% OF PRODUCTION THAT YEAR. THE GREAT SMOKY MOUNTAINS IN THE WESTERN PART OF NORTH CAROLINA HAS 80 TROUT FARMS.

SLOW GROWTH IS FORECAST FOR SALMON FEEDS IN THE U.S.

TOTAL AQUACULTURAL PRODUCTION OF SALMON WAS ESTIMATED AT 83 MILLION POUNDS IN 1989. PRIVATE PRODUCTION OF EGGS AND IMMATURE SALMON FOR STOCKING PURPOSES IS INCLUDED IN USDA PRODUCTION ESTIMATES. SINCE THE USDA REPORTS THAT SURVEY

STATISTICS FOR SALMON AND MANY OTHER SPECIES ARE NOT READILY AVAILABLE, DATA FOR BOTH AQUACULTURAL PRODUCTION AND FEED USE FOR MOST SPECIES ARE ONLY ROUGH ESTIMATES. AN ESTIMATED 55 MILLION POUNDS OF FEED ARE USED IN THE SALMON AQUACULTURE INDUSTRY IN THE U.S. A SIGNIFICANT SEGMENT OF THE SALMON FEED MARKET IS FOR SMOLT FEEDS.

U.S. PRODUCTION OF PEN-RAISED SALMON TOTALED ONLY 6 MILLION POUNDS IN 1988, AND AN ESTIMATED 9 MILLION POUNDS IN 1989. CAGES ALONG THE COASTS IN MAINE AND WASHINGTON ARE THE PRIMARY SALMON FARM LOCATIONS. MOST COASTAL FARMS ARE NOW PRODUCING ATLANTIC SALMON. THERE ARE 13 SALMON FARMS IN THE PUGET SOUND IN WASHINGTON. THERE ARE ALSO INLAND FARMS IN IDAHO, MINNESOTA AND OTHER NORTHERN STATES THAT PRIMARILY PRODUCE COHO SALMON. U.S. PEN-RAISED SALMON IS LESS THAN 2% OF WORLDWIDE PRODUCTION, WHICH TOTALED MORE THAN 500 MILLION POUNDS OF PEN-RAISED SALMON AND ESTIMATED FEED USE OF 800 MILLION POUNDS IN 1989.

A SHIFT TO THE ATLANTIC SPECIES, WHICH CAN BE GROWN AT HIGHER DENSITIES THAN PACIFIC SPECIES, AND DEVELOPMENT OF INLAND FARMS COULD RESULT IN A DOUBLING OF PEN-RAISED SALMON PRODUCTION TO 18 MILLION POUNDS IN THE U.S. BY 1995 WITH FEED USE INCREASING FROM AN ESTIMATED 14 MILLION POUNDS IN 1989 TO 27 MILLION POUNDS BY 1995.

ALTHOUGH THE SALMON MARKET IS LIKELY TO REMAIN HIGHLY COMPETITIVE DURING THE 1990s, CLOSENESS TO MARKET PROVIDES AN ADVANTAGE FOR U.S. GROWERS. HOWEVER, RESISTANCE TO THE DEVELOPMENT OF SEA-CAGE FARMS APPEARS TO BE INTENSIFYING ON BOTH COASTS. SALMON FROM INLAND FARMS NEAR PROCESSING AND DISTRIBUTION CENTERS, SUCH AS THE NEW PROCESSING FACILITY THAT WAS RECENTLY OPENED BY DOMSEA FARMS IN POCATELLO, IDA., MAY BE ABLE TO COMPETE WITH IMPORTED SALMON. THERE ARE ALSO INDICATIONS THAT FISH FARMING MAY BE PERMITTED IN ALASKA IN THE NEAR FUTURE. HOWEVER, EXCESS CAPACITY ON SOME CANADIAN FARMS THAT HAVE ENCOUNTERED FINANCIAL DIFFICULTIES TENDS TO SERVE AS A DETERRENT TO ALASKAN DEVELOPMENT. WORLDWIDE OVERPRODUCTION IS LIKELY TO EFFECT THE SALMON MARKET AT LEAST UNTIL 1992, KEEPING PRICES RELATIVELY LOW AND CONTRIBUTING TO CONTINUED INSTABILITY IN THE SALMON FARMING INDUSTRY.

SALMON FARMS ON THE ATLANTIC AND PACIFIC COASTS IN CANADA PRODUCED APPROXIMATELY 30 MILLION POUNDS IN 1989 AND COULD PRODUCE 42 MILLION POUNDS BY 1995. THE

CANADIAN SALMON FEED MARKET WAS ESTIMATED AT 48 MILLION POUNDS IN 1989 AND COULD REACH 60 MILLION POUNDS BY 1995. HOWEVER, THE MARKET IS COMPETITIVE. SEVERAL U.S. FEED COMPANIES INCLUDING RANGEN, INC., AND THE ASSOCIATED ZEIGLER BROS., BIOPRODUCTS, INC., AND OTHERS ALSO SUPPLY SALMON FARMS IN CANADA. IN ADDITION TO CANADIAN FEED COMPANIES SUCH AS CONNORS BROS., WHITE CREST MILLS AND COREY FEEDS, THIS FEED MARKET IS ALSO SUPPLIED BY A NUMBER OF INTERNATIONAL CONCERNS THAT ARE MAJOR PLAYERS IN THE AQUACULTURE INDUSTRY, E.G., BRITISH PETROLEUM (MOORE-CLARK CO.) AND CULTOR LTD. (EWOS CANADA).

WATER QUALITY AND POLLUTION FROM BOTH FISH AND FEED WASTES WILL AFFECT DEVELOPMENTS IN SALMON FARMING DURING THE 1990s. MANY FARMERS IN NORWAY, THE COUNTRY THAT ACCOUNTS FOR 57% OF THE FARM-RAISED SALMON, AS WELL AS FARMERS IN OTHER COUNTRIES ARE SHIFTING TO NEWLY DEVELOPED, HIGH-ENERGY, HIGH-PERFORMANCE FEEDS THAT ARE MADE WITH HIGH-QUALITY FISH MEAL. SALMON FEEDS MAY CONTAIN 50% FISH MEAL. AN ESTIMATED 60-70% OF THE FEEDS IN EUROPE ARE EXTRUDED. FISH OIL USAGE AT 25% IS POSSIBLE WITH NEW EXTRUSION PROCESSES. NEW EXTRUDED FEEDS HAVE LOW FEED-CONVERSION RATES. FOR EXAMPLE, TROUW, A DIVISION OF BRITISH PETROLEUM, RECENTLY INTRODUCED A NEW FEED THAT PROVIDES A FEED CONVERSION RATE OF 0.9 FOR SALMON GROWN IN COLD WATER UP TO 6.5 LB. IN SIZE. HIGH-PERFORMANCE FEEDS NOT ONLY PERMIT FAST GROWTH AND BETTER FINANCIAL PERFORMANCE, BUT ALSO ARE LOWER IN POLLUTION POTENTIAL.

FEED USE FOR BAIT, TROPICAL FISH

AN ESTIMATED 28 MILLION POUNDS OF BAIT WERE PRODUCED BY APPROXIMATELY 165 GROWERS THAT FARMED MORE THAN 40,000 ACRES OF PONDS IN 1989. APPROXIMATELY 115 GROWERS IN ARKANSAS PRODUCED 75% OF FARM-RAISED BAIT.

FEEDING IS REQUIRED TO ACHIEVE YIELDS THAT AVERAGE 700 LB. OF BAIT PER ACRE. LOSSES TO PREDATORS MAY BE AS HIGH AS 40%. FEED USE IS ESTIMATED AT 40 MILLION LB. OR MORE. THE USDA REPORTED IN OCTOBER 1988 THAT MANY FARMERS EXPERIENCED DIFFICULTY IN OBTAINING HIGH-QUALITY FEEDS DESIGNED FOR BAIT PRODUCTION. INCREASED DEMAND FOR CATFISH FEEDS IN ARKANSAS MAY SERVE TO BROADEN THE AVAILABILITY OF FISH FEEDS IN THIS AREA. REPORTEDLY, PRODUCTION RATES AS HIGH AS 1,000 LB. PER ACRE ARE POSSIBLE IF A CONSTANT SUPPLY OF HIGH-QUALITY FEED IS

AVAILABLE.

HOWEVER, LIMITED WATER RESOURCES SERVE TO RETARD GROWTH IN THE BAIT INDUSTRY IN ARKANSAS. BETTER FEED EFFICIENCY AND HIGHER STOCKING RATES ARE NECESSARY TO INCREASE PRODUCTION.

ROUGHLY 80% OF THE FISH SOLD IN THE AQUARIUM TRADE ARE GROWN ON FARMS. APPROXIMATELY 19 MILLION POUNDS OF TROPICAL FISH WERE PRODUCED IN 1989. DIETS VARY FOR THE LARGE NUMBER OF SPECIES THAT ARE GROWN. FOR EXAMPLE, TROPICAL FISH WERE PRODUCED IN 1989. DIETS VARY FOR THE LARGE NUMBER OF SPECIES THAT ARE GROWN. FOR EXAMPLE, TROPICAL FISH THAT ARE FILTER FEEDERS MAY BE FED ALGAE BLOOMS THAT ARE CULTURED IN THE PONDS IN WHICH FISH ARE RAISED. THIS INDUSTRY SEGMENT USES AN ESTIMATED 10 MILLION POUNDS OR MORE OF FISH FEED. THE MARKET IS CONCENTRATED IN FLORIDA, WHICH PRODUCES 95% OF THE TROPICAL FISH.

POTENTIAL FOR CRAWFISH FEEDS

ALTHOUGH THE USE OF MANUFACTURED FEEDS IS INSIGNIFICANT IN THE CRAWFISH INDUSTRY, MANUFACTURED BAIT HAS REPLACED FRESH FISH USE FOR BAIT ON MANY FARMS. THE HIGHLY COMPETITIVE CRAWFISH INDUSTRY IS CHANGING, ESPECIALLY THE SEGMENT THAT CONSISTS OF HIGHLY MANAGED PONDS AND SWAMPS THAT ACCOUNT FOR 40% OF PRODUCTION. THE RAPIDLY CHANGING CRAWFISH MARKET IS FORCING THIS INDUSTRY TO MEET NEW DEMANDS.

CRAWFISH, WHICH ARE LOW IN THE FEED CHAIN, REQUIRE ONLY 20-25% PROTEIN. ALTHOUGH RAISED PRIMARILY ON RICE STUBBLE, PELLETED FEEDS HAVE THE POTENTIAL TO INCREASE PRODUCTION RATES FROM THE PRESENT 1,500 LB. PER ACRE FOR HIGHLY MANAGED PONDS TO 4,000-6,000 LB. PER ACRE, ACCORDING TO LARRY DE LA BRETONNE OF LOUISIANA STATE UNIVERSITY. THE USDA REPORTED THAT SOME SPECIALISTS PREDICT THAT YIELDS AS HIGH AS 8,000-10,000 LB. PER ACRE "ARE NOT UNREASONABLE IN THE NEAR FUTURE". IF SUPPLEMENTATION WITH MANUFACTURED FEEDS RESULTS IN LARGER CRAWFISH, THE MARKET FOR CRAWFISH FEEDS COULD SURPASS 5 MILLION POUNDS BY 1995. HOWEVER, DE LA BRETONNE SAID THAT RECENT DEMONSTRATIONS USING NEWLY DEVELOPED PELLETED FEEDS RESULTED IN HIGHER SURVIVAL RATES RATHER THAN LARGER CRAWFISH.

AT LEAST 30% OF THE CRAWFISH HARVEST IS CONSUMED OUTSIDE OF LOUISIANA. THE LARGEST SIZE, GRADED 10-13 CRAWFISH/LB., IS IN DEMAND BY THE EXPORT MARKET,

PRIMARILY FOR SCANDINAVIA. AT THE PRESENT TIME, ONLY 5% OF THE HARVEST IS THIS SIZE. THERE ARE AT LEAST SIX PROCESSORS THAT SPECIALIZE IN PRODUCING HIGH-QUALITY, FROZEN-BOILED CRAWFISH THAT IS PACKED IN BRINE AND FLAVORED WITH DILL FOR THE EXPORT MARKET.

IN ADDITION, PREMIUM PRICES ARE ALSO OBTAINED FOR A SECOND CLASS, GRADED 15-25 CRAWFISH/LB., FOR THE URBAN U.S. MARKET, AND, TO SOME EXTENT, FOR THE NEWLY DEVELOPED SOFT-SHELLED CRAWFISH. HOWEVER, RAPID INCREASES IN THE SUPPLY OF SOFT-SHELLED CRAWFISH WITHOUT THE NECESSARY MARKET DEVELOPMENT RECENTLY RESULTED IN LOWER PROFITABILITY FOR THIS SPECIALTY SEGMENT, WHICH COMPETES WITH LOBSTER AND VERY LARGE SHRIMP.

LOUISIANA RAISES CRAWFISH ON APPROXIMATELY 135,000 ACRES OF PONDS AND SWAMPS AND ACCOUNTS FOR ROUGHLY 90% OF TOTAL CRAWFISH PRODUCTION. HOWEVER, CRAWFISH FARMING IS SPREADING TO OTHER STATES. TEXAS FARMS COVER APPROXIMATELY 18,000 ACRES, FLORIDA HAS 2,700 ACRES OF CRAWFISH PONDS AND SWAMPS AND SOUTH CAROLINA HAS 1,000 ACRES. THERE IS ALSO LIMITED DEVELOPMENT IN ARKANSAS, GEORGIA, MISSISSIPPI AND NORTH CAROLINA. IN ADDITION, WILD HARVESTS OF OTHER CRAWFISH SPECIES IN WISCONSIN, MINNESOTA, CALIFORNIA AND OREGON MAY INDICATE POTENTIAL.

OTHER AQUACULTURAL PRODUCTION

AN ESTIMATED 32 MILLION POUNDS OF FARMED OYSTERS WERE PRODUCED IN 1989. HOWEVER, LIKE FARMED MUSSELS AND CLAMS, OYSTERS ARE FILTER FEEDERS THAT ARE RAISED PRIMARILY IN COASTAL LOCATIONS IN THE PACIFIC NORTHWEST, THE GULF OF MEXICO AND NEW ENGLAND. THEY GENERALLY OBTAIN SUSTENANCE FROM THE SEA. CULTURED SHELLFISH PRODUCTION CONTRIBUTES LITTLE FEED DEMAND IN THE U.S.; HOWEVER, WORLDWIDE SHRIMP FEED USE IS EXPANDING RAPIDLY.

THE REMAINING U.S. AQUACULTURAL PRODUCTION, 70 MILLION POUNDS BASED ON USDA ESTIMATES, CONSISTS OF OTHER SPECIES INCLUDING STRIPED BASS, TILAPIA, CARP, REDFISH, STURGEON, MUSSELS, ABALONE, CLAMS, SCALLOPS, ETC., AND MAY INCLUDE EGGS, FRY AND FINGERLINGS SOLD AS END PRODUCTS.

STRONG GROWTH, AVERAGING 16.1% ANNUALLY, IS FORECAST FOR THIS SEGMENT.

TECHNOLOGICAL DEVELOPMENT AND INCREASING CONSUMER DEMAND FOR SEAFOOD PRESENT OPPORTUNITIES FOR THE INNOVATIVE ENTREPRENEURS THAT ARE DEVELOPING MANY OF THESE PRODUCT SEGMENTS. FEED USE IS EXPECTED TO INCREASE FROM AN ESTIMATED 45 MILLION POUNDS IN 1989 TO 110 MILLION POUNDS BY 1995.

DEVELOPING COUNTRIES OFTEN DO NOT HAVE THE TECHNOLOGY AND KNOW-HOW TO SET UP FEED PLANTS AND THUS PROVIDE A MARKET FOR FEED EXPORTS. LEADING INTERNATIONAL CONCERNS OFTEN BECOME INVOLVED IN JOINT VENTURES TO MANUFACTURE FEEDS LOCALLY AFTER FARMS ARE ESTABLISHED. THIS SORT OF ARRANGEMENT OCCURRED RECENTLY IN CHILE (SALMON FARMING) AND IN THAILAND AND THE PHILIPPINES (SHRIMP FARMING). THE INTERNATIONAL MARKET PROVIDES OPPORTUNITIES FOR U.S. MANUFACTURERS OF FEEDS AND FEED INGREDIENTS TO TRANSFER THEIR EXPERTISE IN FEED DEVELOPMENT TO OTHER COUNTRIES AND PROFIT FROM THE LARGE POTENTIAL MARKET THAT IS DEVELOPING IN CENTRAL AND SOUTH AMERICA AND OTHER REGIONS.

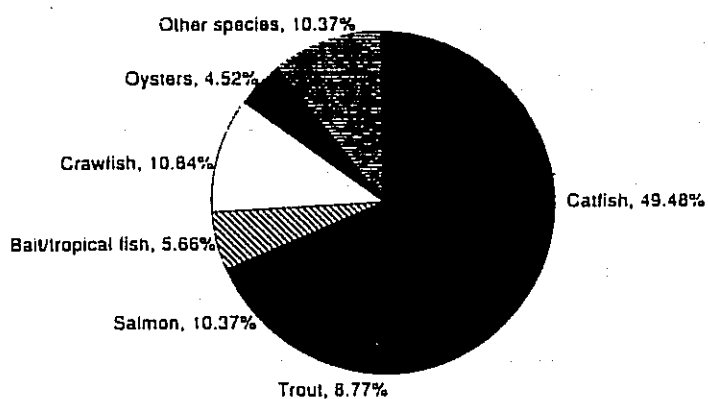


FIGURE 1. U.S. aquacultural production in 1995.

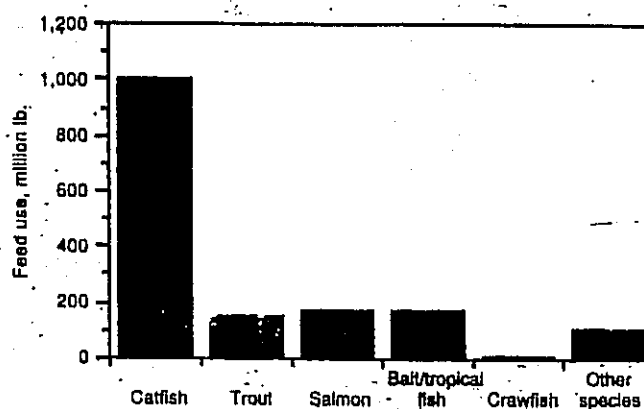


FIGURE 2. The feed market in 1995.

TABLE. The U.S. feed market for farmed fish and shellfish in 1989 and 1995 (million lb.)

	1989 estimate		1995 forecast		1989-1995 Feed use % A.A.G.R. ^b
	Aquacultural production ^a	Mixed feed use	Aquacultural production ^a	Mixed feed use	
Catfish	400	800	525	1,000	3.8
Trout	80	140	93	180	2.3
Salmon	93	55	110	72	4.8
Bait and tropical fish	47	50	60	64	4.2
Crawfish	98	—	115	5	—
Oysters	32	—	48	—	—
Other edible species	70	48	110	110	16.1
Total	820	1,090	1,081	1,411	4.4

^a Private production.

^b Average annual growth rate.

Source: USDA's Situation & Outlook Report and Industry sources.