

Growing Missouri's Aquaculture Industry: Marketing Study



MX 464



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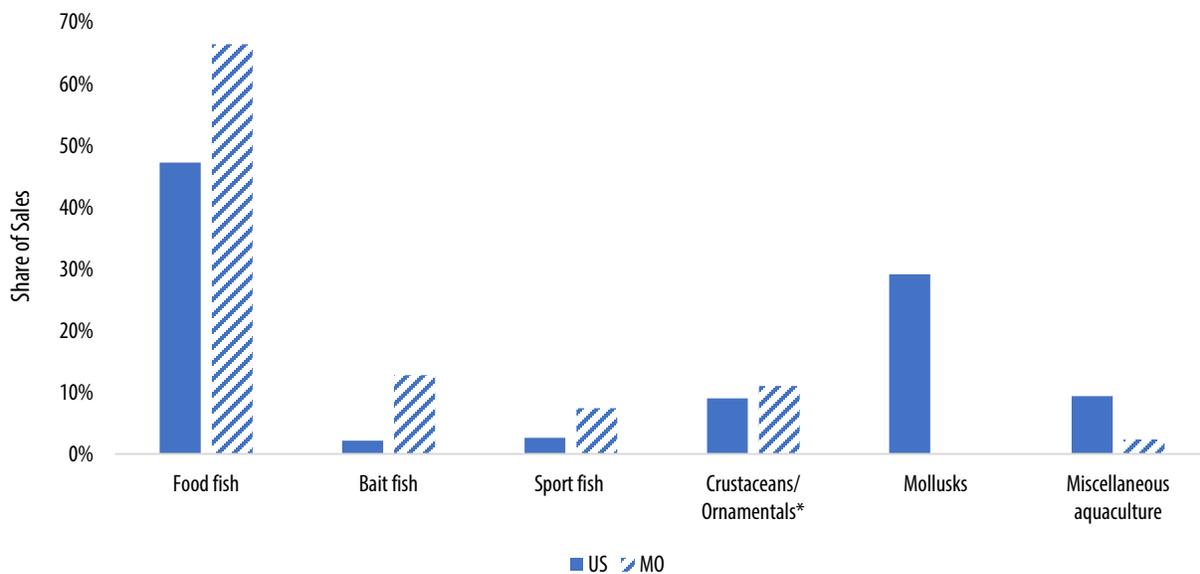
Missouri Aquaculture Marketing Study

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Summary

The U.S. Census of Aquaculture estimated \$1.5 billion in total sales accrued nationally to producers in 2018. Of all aquaculture sales, 47% originated from food fish sales. Following food fish were mollusks at 29% of all sales, miscellaneous aquaculture at 9%, crustaceans at 7%, sport fish and ornamentals at 3% each and bait fish at 2%. Missouri captured 1% of all U.S. aquaculture sales, according to the 2018 U.S. Census of Aquaculture. Missouri's industry exhibited 3% sales growth in nominal dollars from 2013 to 2018, but the growth did not keep up with inflation. Missouri generated 3% of all U.S. bait fish sales. In no other aquaculture category did the state achieve a market share this high. However, food fish more heavily contributed to the state's aquaculture sales — 66% of all sales; see Exhibit S.1. Food fish also saw the strongest growth in Missouri sales from 2013 to 2018; their sales increased by 36%.

Exhibit S.1. Share of 2018 Aquaculture Producer Sales by Category



* Crustaceans and ornamentals combined to address undisclosed data in Missouri.

Source: 2018 Census of Aquaculture, USDA National Agricultural Statistics Service

(nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/index.php)

Food Fish

The Missouri aquaculture producer survey conducted for this project found that 43% of responding Missouri aquaculture producers — nine of them — sold fish through food markets and 10%, or two producers, sold crustaceans through food markets. Producers serving food markets have an opportunity to

reach consumers who increasingly have added more seafood to their diets. NOAA Fisheries indicates per capita fishery products consumption increased from roughly 15 pounds per capita in the early 1990s to 19 pounds per capita in 2020. Fresh and frozen consumption drove the growth. Canned seafood consumption largely followed a downward trend. Recently, however, “tinned fish” has had interest from younger consumers and garnered social media buzz, and this momentum has led to some canned seafood product introductions with premium positioning and price points.

In terms of seafood consumption by species, shrimp was the top choice in 2020 at 5 pounds per capita. Salmon and canned tuna ranked second and third, respectively, for per capita consumption. Conducted in fall 2020 by the North Central Regional Aquaculture Center, a nationally representative survey found consumers had interest in buying rainbow trout, lake trout, Great Lakes whitefish, Pacific salmon, bass and Atlantic salmon if they were available.

Spending on fish and seafood averaged \$121 per consumer unit — a family or group living together — in 2011, but it increased to \$178 on average by 2021, according to Consumer Expenditure Surveys data from the U.S. Bureau of Labor Statistics. The following demographic characteristics were positively associated with greater fish and seafood expenditures: middle-aged, Asian, higher income and larger households. Those living in rural areas and the Midwest tended to report lower fish and seafood expenditures. In its Power of Seafood 2023 report, FMI-The Food Industry Association published sales data collected by IRI for multioutlet retailers, which include food stores, drug stores, mass retailers, Walmart, club stores other than Costco, dollar stores and military stores. In 2022, frozen seafood sales totaled \$7.1 billion, and fresh sales reached \$6.5 billion. The grocery department recorded \$2.7 billion in seafood sales. Frozen sales did well during the pandemic because these products store well and have an economical price point. Post-pandemic, frozen sales may normalize.

Factors motivating seafood consumption include taste, healthfulness and price. Some consumers also exhibit preferences for the seafood production or sourcing model used. Of the seafood consumers FMI-The Food Industry Association surveyed for its Power of Seafood 2023 research, 34% preferred wild-caught seafood, and 10% would only buy or eat wild-caught. Three in 10 had no preference, and 20% said they either preferred farm-raised or would only buy or eat farm-raised options. Responding consumers

had relatively low understanding of “aquaculture” and “indoor farm-raised” terms relative to understanding of “wild-caught” and “farm-raised.” Therefore, consumer education may be needed. U.S. seafood processors have been most likely to handle Alaska pollock, salmon and shrimp, and these processors commonly add value through preparing dressed, canned and filleted goods, according to processor data from NOAA Fisheries. Other opportunities to add value to fishery products include smoking fish, packaging seafood in platters or preparing seafood salads and other ready-to-eat foods. Short-staffed food service businesses may appreciate precut or preportioned products.

To sell seafood products, U.S. aquaculture producers rely on processors as buyers; 70% of food fish sales had processors as the first point of sale in 2018, according to Census of Aquaculture data. Live haulers or brokers and wholesale to other producers ranked second and third, respectively, in terms of points of first food fish sale for aquaculture producers. Producers interested in selling seafood products may consider reaching grocery stores, fish markets, restaurants or direct-to-consumer channels.

Seafood consumers have been slightly more likely to source seafood from market channels consistent with at-home consumption than away-from-home consumption, according to a 2020 article from *Nutrients* that detailed National Health and Nutrition Examination Survey data. Recently, retailers have stocked fewer seafood products — possibly due to supply chain issues or higher prices than consumers may be willing to pay. Retailers consider factors such as consumer preferences, price and freshness when making stocking decisions. To promote seafood goods, producers may consider timing promotions to seasons, such as the Chinese Lunar New Year and the winter holidays, when consumers often buy more seafood.

Bait Fish

Nationally, bait fish sales from aquaculture producers were \$32.8 million in 2018 and increased 11% in nominal dollars from 2013 — a 2% decline after adjusting for inflation. U.S. production is relatively concentrated. Arkansas contributed two-thirds of total bait fish sales in 2018. Missouri producers generated 3% of U.S. sales. Missouri is not known to ship live bait in-region to other states, according to a 2019 analysis conducted for the Mississippi River Basin Panel on Aquatic Nuisance Species.

Bait fish are sold for both recreational and commercial fishing purposes and as feeder fish for aquariums, zoos, private pond owners and wildlife management agencies. In 2018, 38% of all national first-point

sales went to live haulers and brokers, 19% went to businesses that stock recreational ponds, 17% went wholesale to other aquaculture producers and 15% went to retail outlets. The remaining 11% went directly to consumers, exports, government agencies or other buyers. In the U.S. bait fish marketplace, an estimated 40% to 50% of bait fish sold are wild-caught. Expenditures on live, cut and prepared bait were \$1.5 billion in 2020, and artificial bait sales were \$1.1 billion. Almost two-thirds of anglers use live bait, according to a 2020 national study by Southwick Associates. This study signaled potential concern about the future of the recreational fishing industry and bait market as fewer young people fish and more fishers choose artificial bait. Challenges also include fewer bait distributors in the northern Mississippi River basin and more convenience stores offering bait, which may lower customer service and satisfaction.

A few species dominate the bait fish market. They include golden shiners, fathead minnows and goldfish. These species also averaged the highest price per pound in the 2018 USDA Census of Aquaculture. Serious anglers may seek out specific species to attract their desired fish. Prices can vary widely depending on how bait is packaged and sold. Bait fish producers must meet specific size specifications to achieve different retail grades, and consistent delivery schedules — sometimes as often as twice a week — are important. To distribute product, bait fish producers may use 5-gallon buckets or fill a certain number of aerated compartments on a live hauler truck. Missouri-based bait dealers must register with the Missouri Department of Conservation, and the 153 registered businesses, as of April 2023, cluster in the Ozarks, mid-Missouri and St. Louis region. Very few producers add value to bait fish through processing.

Sport Fish

Missouri has a small share of a consolidating but growing U.S. sport fish industry. According to Census of Aquaculture data, the number of U.S. farms with sport fish sales declined slightly between 2013 and 2018. During this same period, total sport fish sales increased 51% after adjusting for inflation to an estimated \$39.3 million. At the time of the 2018 census, Missouri represented 3% of all sport fish farms and 1.5% of total U.S. sales. A 2021 report from the American Sportfishing Association found the state represented 2.2% of U.S. freshwater retail sport fishing sales. Sport fishing economic activity geographically concentrates in states with major waterbodies; examples include Texas, Florida, California, Michigan and Minnesota, according to the association's report. Sixteen (80%) of Missouri producers responding to this project's accompanying needs assessment survey said they sold fish for pond or sport stocking in 2022 — the most common product category.

Bass, specifically largemouth bass, dominate U.S. sport fish sales by total sales volume and number of producers as they are favored species among anglers. Trout, sunfish and catfish are also important species by number of farms and sales. Producers sell sport fish through multiple market channels; 54% of all fish were sold through recreational stocking or live haulers or brokers in 2018. Another 20% went to exports, and 14% were sold to retail outlets. Producers may offer delivery services to expand reach to customers.

An estimated 17% of the U.S. population fishes in an average year. Two-thirds of anglers fished 11 times or fewer in 2021, and half of these individuals fished three times or less, according to a national study from the Outdoor Foundation and Recreational Boating and Fishing Foundation. Freshwater fishing was preferred among respondents, and more than half expressed an interest to fish more often or start fishing.

Aquaculture producers can add sport fishing-related revenue streams by considering a farm's suitability for offering on-site fee-fishing experiences, which could be expanded to include guide services, lodging and other direct sales. Producers targeting pond stocking may think creatively about packaging products on a whole-pond basis, offering species bundles to appeal to a type of angler or supplementing fish sales with management recommendations or other services that establish a multiseason touchpoint with customers.

Ornamental Fish

A 2023-24 survey from the American Pet Products Association found an estimated 11.1 million U.S. households owned freshwater fish, and 2.2 million households owned saltwater fish. Within the broader U.S. pet industry, ornamental fish were a small niche. Based on the 2023-24 survey data, 12.8% of all pet owner households owned freshwater fish, and 2.5% of pet owner households had saltwater fish. Beyond identifying consumer preferences for freshwater fish, a lack of detailed species data exist.

Compared with other segments of the aquaculture industry, less information describes the size and composition of the U.S.-produced ornamental fish market. The 2018 Census of Aquaculture estimated that \$43.5 million in total ornamental fish sales accrued to producers, and nearly two-thirds of all sales were attributed to Florida producers. Notably, the U.S. was the largest ornamental fish importer in 2021. U.S. imports were valued at an estimated \$74.9 million — nearly one-fifth of all ornamental fish imports. The top countries supplying imports to the U.S. were Singapore, Sri Lanka and the Philippines.

Consumer interest in ornamental fish ownership grew during the pandemic. An estimated 14% of respondents acquired a pet at the time, according to data from a 2021-22 survey from the American Pet Products Association. In 2022, some reports indicated unfilled orders and low stocks. Some consumers

value novel species and colors. Knowing how to clean and maintain aquariums can concern fish owners. Given this information, producers may be able to add value to their ornamental fish sales by offering unique species or colors and providing fish care and maintenance guidance.

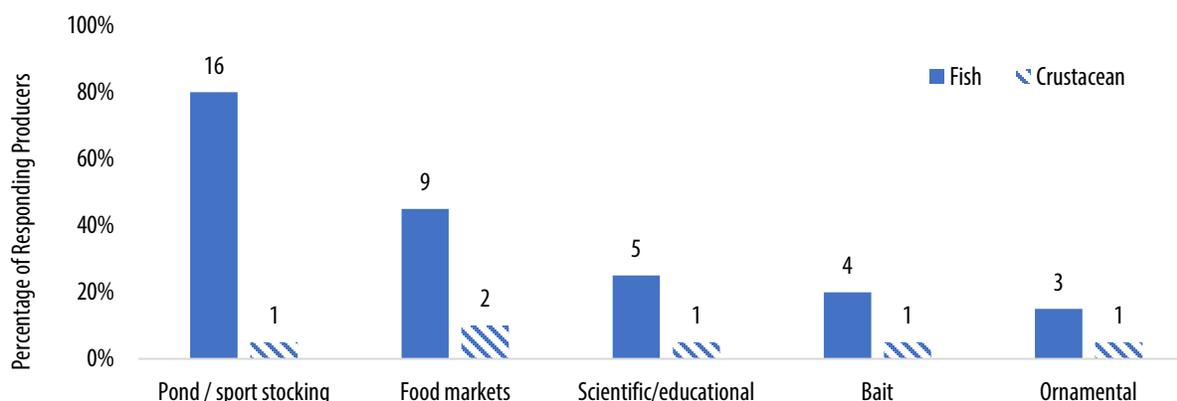
Producers in the ornamental fish market captured 33% of all 2018 sales directly from retailers, according to the Census of Aquaculture. Sales to live haulers and brokers and wholesale sales to other producers were other important distribution channels. In 2018, 15% of ornamental fish sales were made directly to consumers by U.S. aquaculture producers — a larger direct-to-consumer share than the shares observed in the food fish, bait fish or sport fish markets.

1. Food Fish and Seafood

1.1. Missouri Aquaculture Landscape

The Missouri aquaculture producer survey conducted for this project found that 43% of responding Missouri aquaculture producers — nine of them — sold fish through food markets and 10%, or two producers, sold crustaceans through food markets. For responding producers, food markets were the second most utilized market after pond stocking. Exhibit 1.1.1 presents the number of responding Missouri aquaculture producers who indicated they served various product markets.

Exhibit 1.1.1. Markets for Aquaculture Products Sold by Missouri Producers, 2022

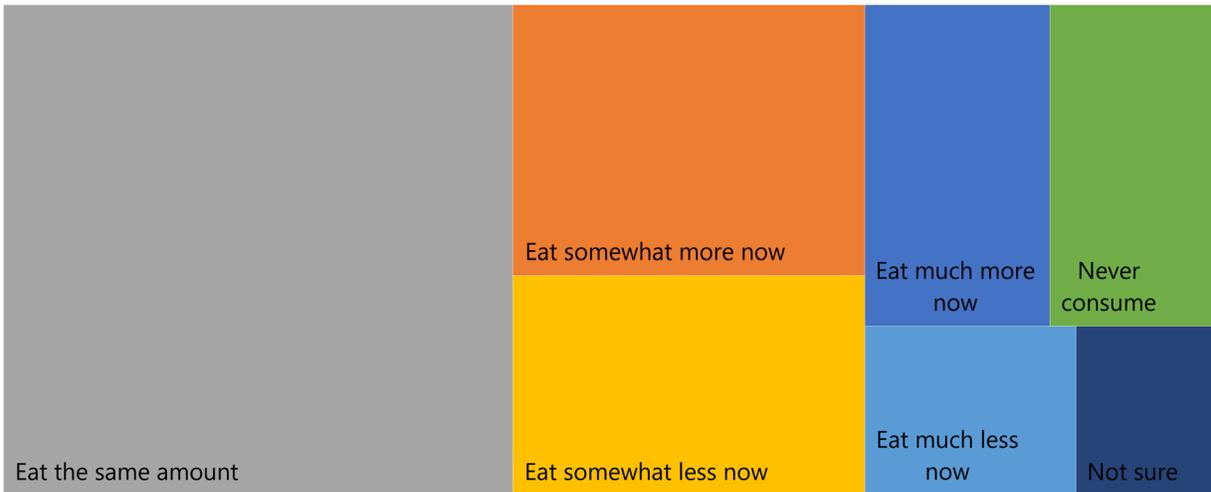


Source: University of Missouri Aquaculture Producer Survey, 2022

1.2. Seafood Consumption and Purchase Behavior

Consumers have been more likely to increase seafood consumption in recent years than decrease seafood consumption. Annually, the International Food Information Council Foundation surveys American adults to understand consumer perspectives about health and food. In the 2022 survey, 26% of consumers surveyed said they were eating much more or somewhat more seafood than in the previous 12 months. Therefore, seafood ranked third — only behind protein from whole-plant sources and poultry/eggs — as a protein source being consumed much more or somewhat more. Exhibit 1.2.1 also illustrates that 19% of consumers said they were eating somewhat less or much less seafood. Note, 9% of consumers said they never consume seafood, and for 42% of consumers, their seafood consumption hadn't changed in the previous year ([foodinsight.org/2022-food-and-health-survey](https://www.foodinsight.org/2022-food-and-health-survey)).

Exhibit 1.2.1. Americans’ Self-Reported Change in Seafood Consumption as a Protein Source, 2021 to 2022



Source: International Food Information Council (foodinsight.org/2022-food-and-health-survey)

Consumers responding to a 2020 survey administered by the Marine Stewardship Council and GlobeScan reported similar behaviors. Of the 4,170 seafood consumers from North American who responded, a third said they were eating more fish and seafood compared with five years ago. Top factors driving the consumption increase were the healthfulness of fish and interest in displacing red meat in diets. One-fifth of consumers had reduced their fish and seafood consumption — due to factors such as fish being expensive, concerns about declining fish populations and concerns about how fishing affects the ocean. For roughly half of consumers, their fish and seafood consumption had not changed significantly (msc.org/docs/default-source/default-document-library/for-business/rise-of-the-conscious-food-consumer---north-america-webinar-slides.pdf?sfvrsn=f32d573_4).

The pandemic led to some first-time seafood purchases. In 2021, the Alaska Seafood Marketing Institute collaborated with Datassential to release findings from a survey of 400 “general consumers” — individuals not categorized as affluent but had purchased salmon and at least one other seafood product for at-home consumption during a three-month time. Of those who responded, a quarter first purchased seafood during the pandemic (alaskaseafood.org/wp-content/uploads/Datassential-Retail-Research-Final_2.pdf).

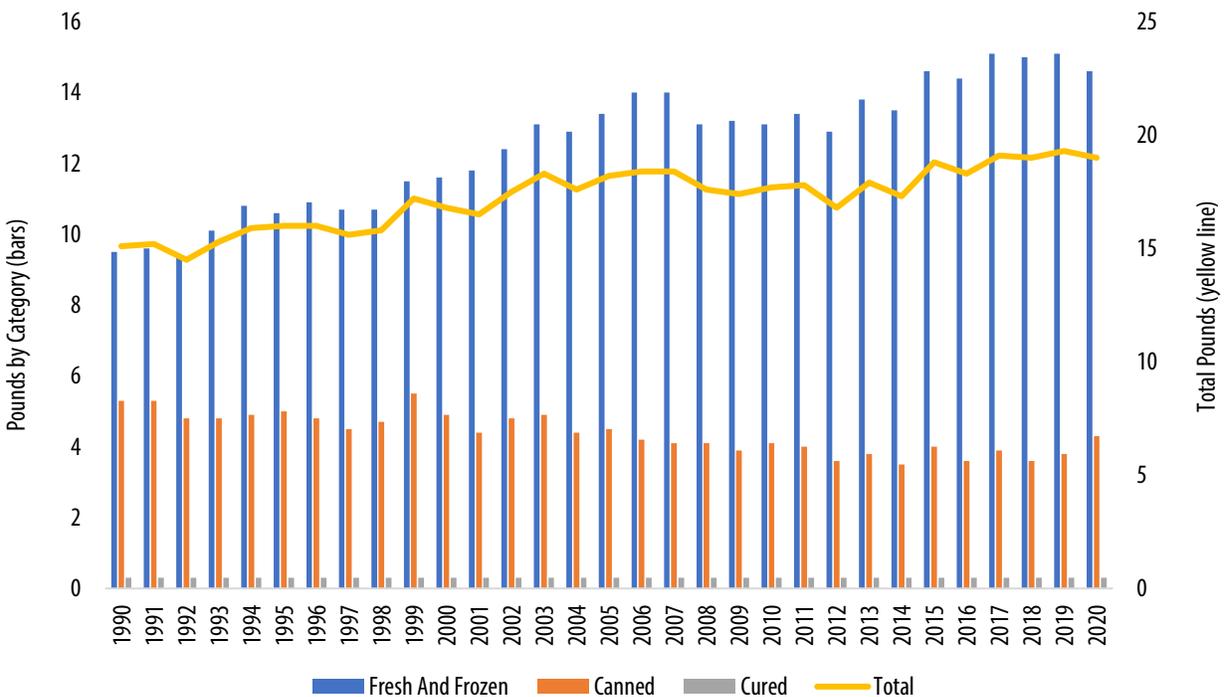
Per Capita Consumption

Annually, NOAA Fisheries approximates fishery product consumption per capita for its Fisheries of the United States report. To compute these values, it accounts for domestic catch, imports and exports and divides total estimated domestic consumption by the U.S. population on July 1. Using this method,

NOAA Fisheries estimated that fishery products per capita consumption totaled 19 pounds in 2020 — slightly less than the record 19.3 pounds per capita recorded in 2019. Exhibit 1.2.2 illustrates growth in per capita consumption between 1990 and 2020. Fresh and frozen consumption drove this growth, and cured consumption was stagnant (fisheries.noaa.gov/foss).

Canned consumption largely followed a downward trend; however, that trend began to reverse in recent years. Consumption grew between 2018 and 2020. The expansion in 2020 likely stemmed from the pandemic prompting consumers to choose more shelf-stable products because supply chains issues limited availability of other animal proteins (fisheries.noaa.gov/foss).

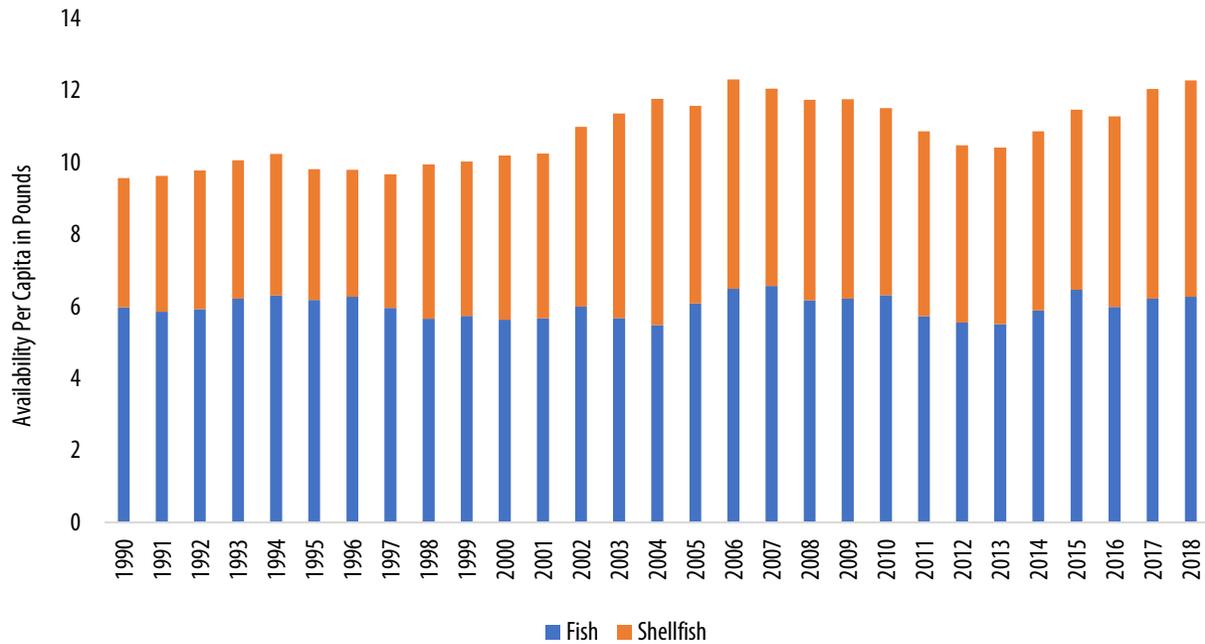
Exhibit 1.2.2. Fishery Products Per Capita Consumption, 1990 to 2020



Source: NOAA Fisheries (fisheries.noaa.gov/foss)

Food availability data from USDA’s Economic Research Service provide additional perspective about seafood consumption. This dataset breaks down per capita availability — a proxy for consumption — between fish and shellfish. During the early 1990s, fresh and frozen fish consumption exceeded fresh and frozen shellfish consumption. Exhibit 1.2.3 show shellfish consumption grew in more recent years while fish consumption remained steady. By 2018, shellfish had captured a 49% share of fresh and frozen fish and shellfish consumption (ers.usda.gov/data-products/food-availability-per-capita-data-system).

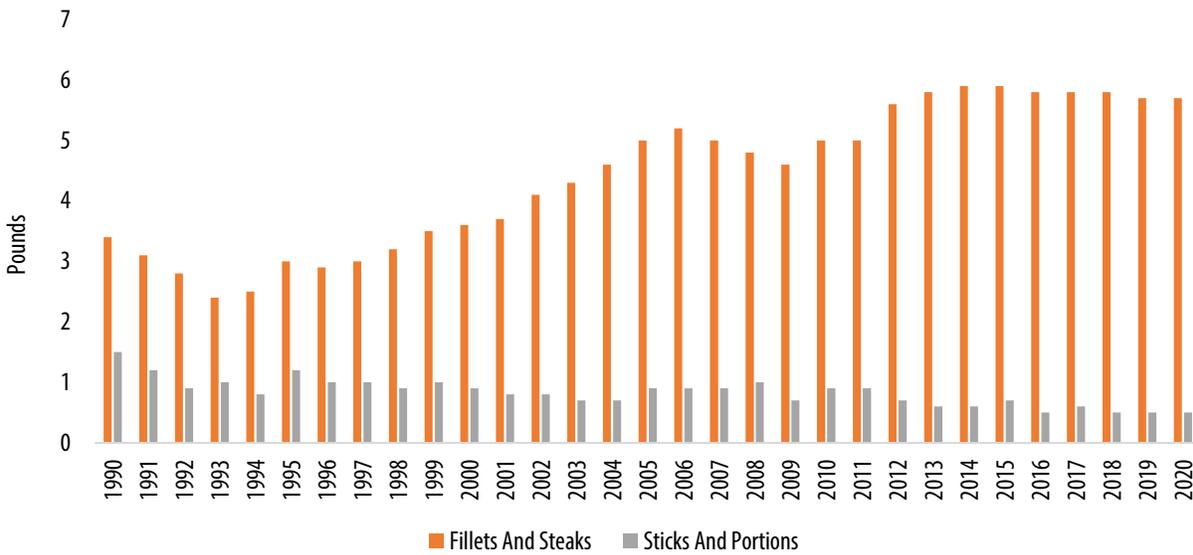
Exhibit 1.2.3. Fresh and Frozen Fish and Shellfish Per Capita Availability, 1990 to 2018



Source: USDA Economic Research Service (ers.usda.gov/data-products/food-availability-per-capita-data-system)

To further explore product preferences, NOAA Fisheries reports per capita consumption estimates for two fishery products: 1) fillets and steaks and 2) sticks and portions. Exhibit 1.2.4 details per capita consumption estimates for these product formats from 1990 to 2020. Fillets and steaks had higher per capita consumption, which grew over time from roughly 3 pounds in the early 1990s to more than 5.5 pounds in recent years. On the other hand, sticks and portions consumption per capita declined by two-thirds. In 1990, sticks and portions consumption was 1.5 pounds per capita, and it declined to roughly half a pound in recent years (fisheries.noaa.gov/foss).

Exhibit 1.2.4. Per Capita Consumption by Product Format, 1990 to 2020



Source: NOAA Fisheries ([fisheries.noaa.gov/foss](https://www.fisheries.noaa.gov/foss))

Annually, the National Fisheries Institute ranks consumption per capita for the top 10 seafood species consumed. Collectively, the top 10 species represented 77% of total seafood consumed by U.S. consumers in 2020. Exhibit 1.2.5 lists those most-consumed seafood species for 2020. Shrimp led the list. Per capita, its consumption averaged 5 pounds. At 2.83 pounds per capita, salmon ranked as the fish species with the highest consumption per capita. Canned tuna followed salmon and ranked as the third most-consumed seafood species per capita ([aboutseafood.com/about/top-ten-list-for-seafood-consumption](https://www.aboutseafood.com/about/top-ten-list-for-seafood-consumption)).

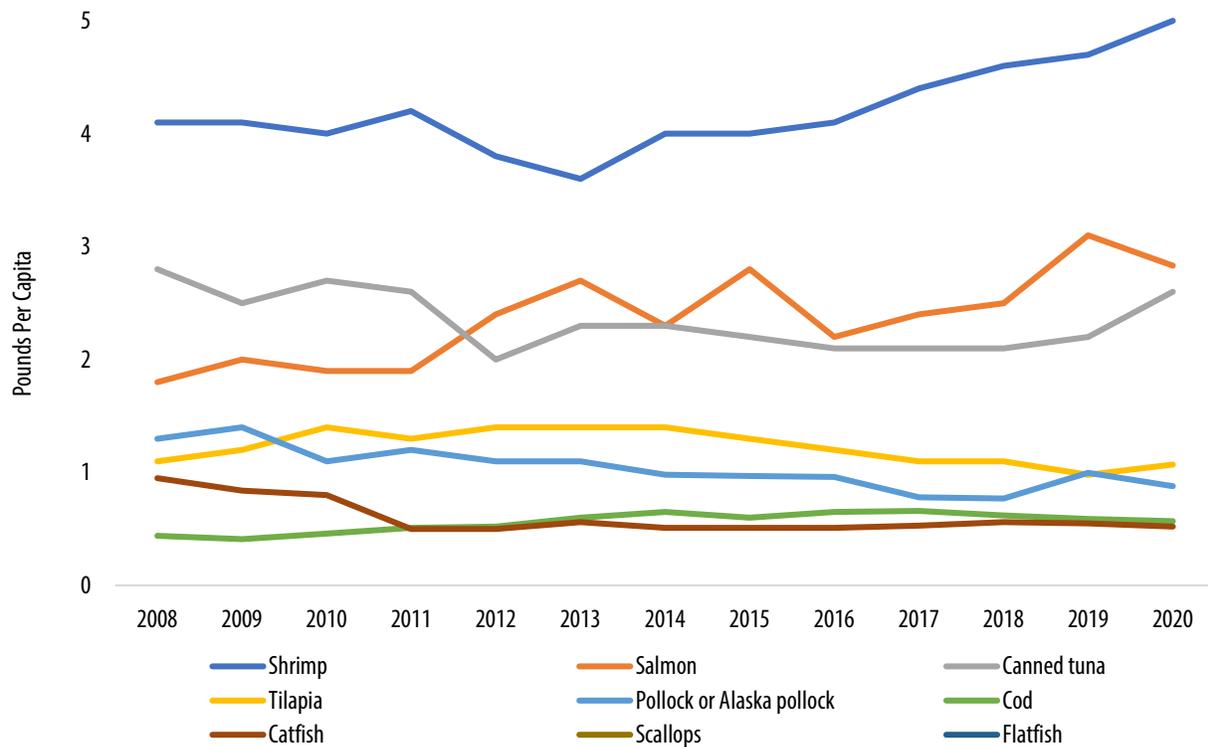
Exhibit 1.2.5. Top 10 Seafood Species Consumed by Pounds Per Capita, 2020

| Species | Pounds per capita |
|----------------|-------------------|
| Shrimp | 5.00 |
| Salmon | 2.83 |
| Canned tuna | 2.60 |
| Tilapia | 1.07 |
| Alaska pollock | 0.88 |
| Cod | 0.57 |
| Crab | 0.52 |
| Catfish | 0.52 |
| Pangasius | 0.39 |
| Scallops | 0.22 |

Source: National Fisheries Institute ([aboutseafood.com/about/top-ten-list-for-seafood-consumption](https://www.aboutseafood.com/about/top-ten-list-for-seafood-consumption))

Exhibit 1.2.6 summarizes how consumption per capita has changed for several commonly consumed species since 2008. Throughout the 13-year period, shrimp ranked in the top position. Its consumption also demonstrated consistent growth since 2015. Canned tuna ranked second for consumption per capita early during the observed period, but in more recent years, salmon consumption per capita topped canned tuna consumption (aboutseafood.com/about/top-ten-list-for-seafood-consumption).

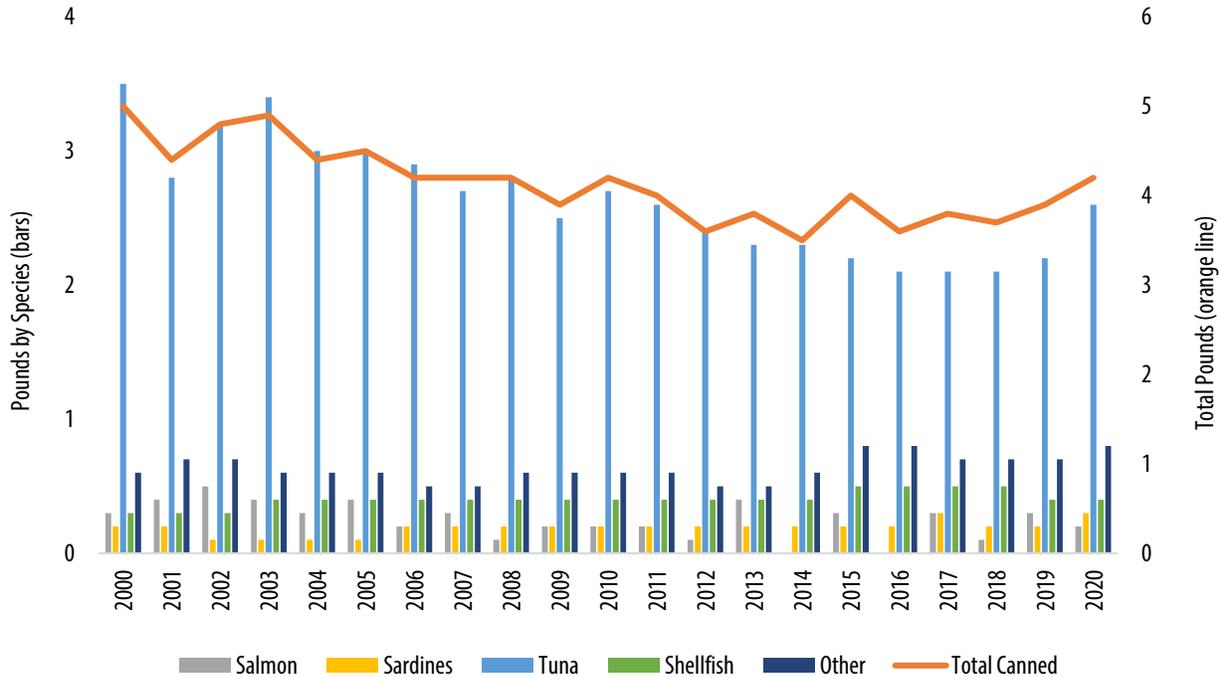
Exhibit 1.2.6. Consumption Per Capita Trend for Most Consumed Seafood Species, 2008 to 2020



Source: National Fisheries Institute (aboutseafood.com/about/top-ten-list-for-seafood-consumption)

From a canned product perspective, Exhibit 1.2.7 illustrates that changes in total per capita consumption have largely mirrored consumption trends for canned tuna — the most commonly consumed canned seafood or fish product. From 2000 to 2020, canned salmon and canned shellfish also experienced declines in per capita consumption. However, per capita consumption trended up for canned sardines and other fish and seafood products (fisheries.noaa.gov/foss).

Exhibit 1.2.7. Canned Fish and Seafood Consumption by Species, 2000 to 2020



Source: NOAA Fisheries (fisheries.noaa.gov/foss)

Expenditures

The U.S. Bureau of Labor Statistics conducts Consumer Expenditure Surveys, which are federal household surveys meant to measure changes in spending for multiple household expenses including food, housing, health care, education and entertainment. Data for fish and seafood suggest strong expenditure growth from 2011 to 2021.

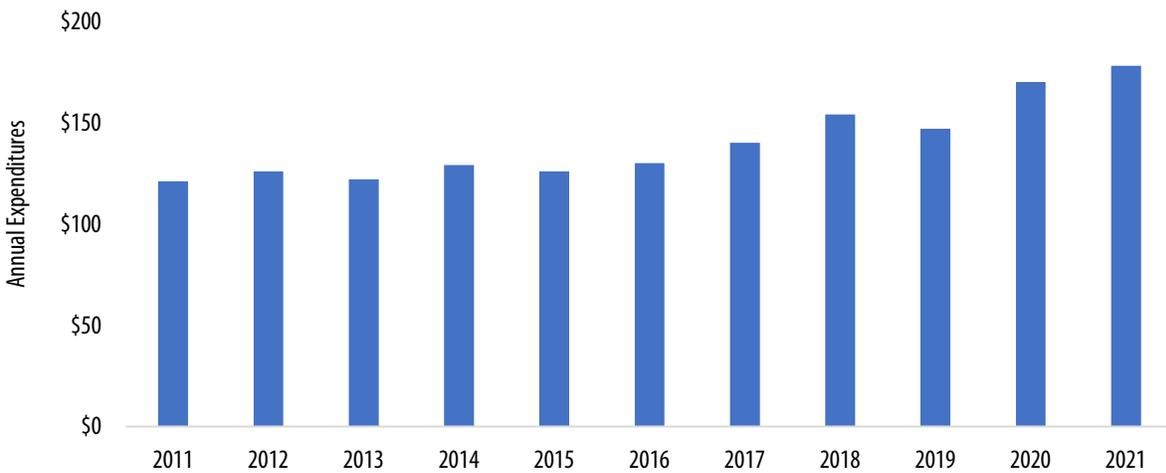
Definitions Used in Consumer Expenditure Survey Reports

Consumer unit: household members related by blood, marriage, adoption or other legal means; someone living alone, sharing a household or rooming in a home, hotel, motel or other lodging; or two people who live together and share expenditure decisions

Reference unit: person in a consumer unit who owns, rents, co-owns or co-rents the dwelling

Exhibit 1.2.8 indicates annual fish and seafood expenditures averaged \$121 for all consumer units surveyed in 2011. Expenditures increased to \$178 on average by 2021 (bls.gov/cex/data.htm).

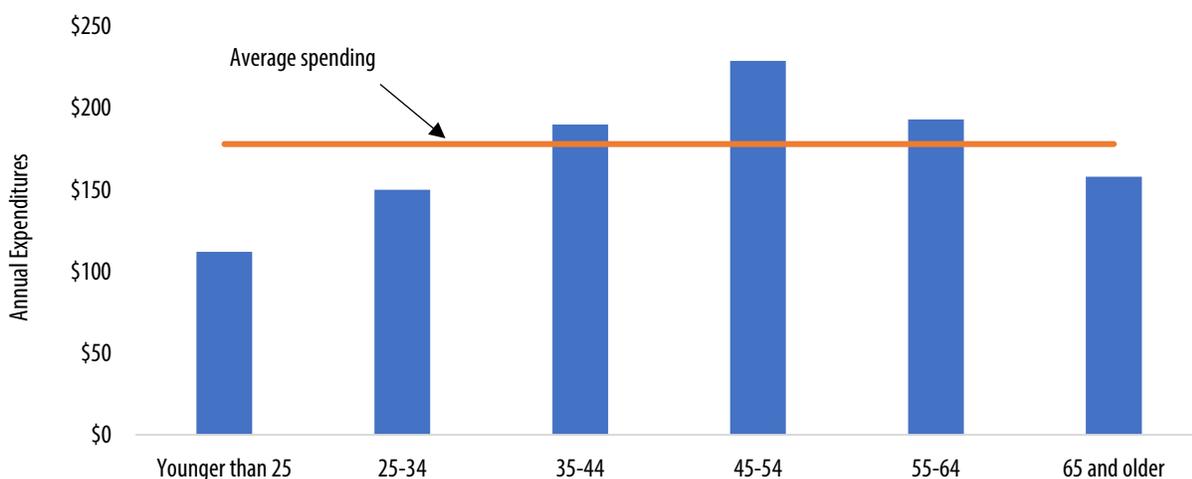
Exhibit 1.2.8. Annual Fish and Seafood Expenditures by Consumer Unit, 2011-21



Source: Consumer Expenditure Survey, U.S. Bureau of Labor Statistics (bls.gov/cex/data.htm)

The Consumer Expenditure Survey data also break down how fish and seafood expenditures vary according to multiple demographic characteristics. Aquaculture producers and other fish and seafood marketers can use this information to identify audiences most interested in purchasing the types of products they raise. By age, consumer units, which are similar to households, with a middle-age reference person — the individual who owns or rents the consumer unit’s dwelling — reported greater fish and seafood expenditures in 2021. See Exhibit 1.2.9. Households with a reference person between 35 years old and 64 years old spent more on fish and seafood in 2021 than the overall \$178 average. Expenditures peaked in households with a reference person who was a 45- to 54-year-old (bls.gov/cex/data.htm).

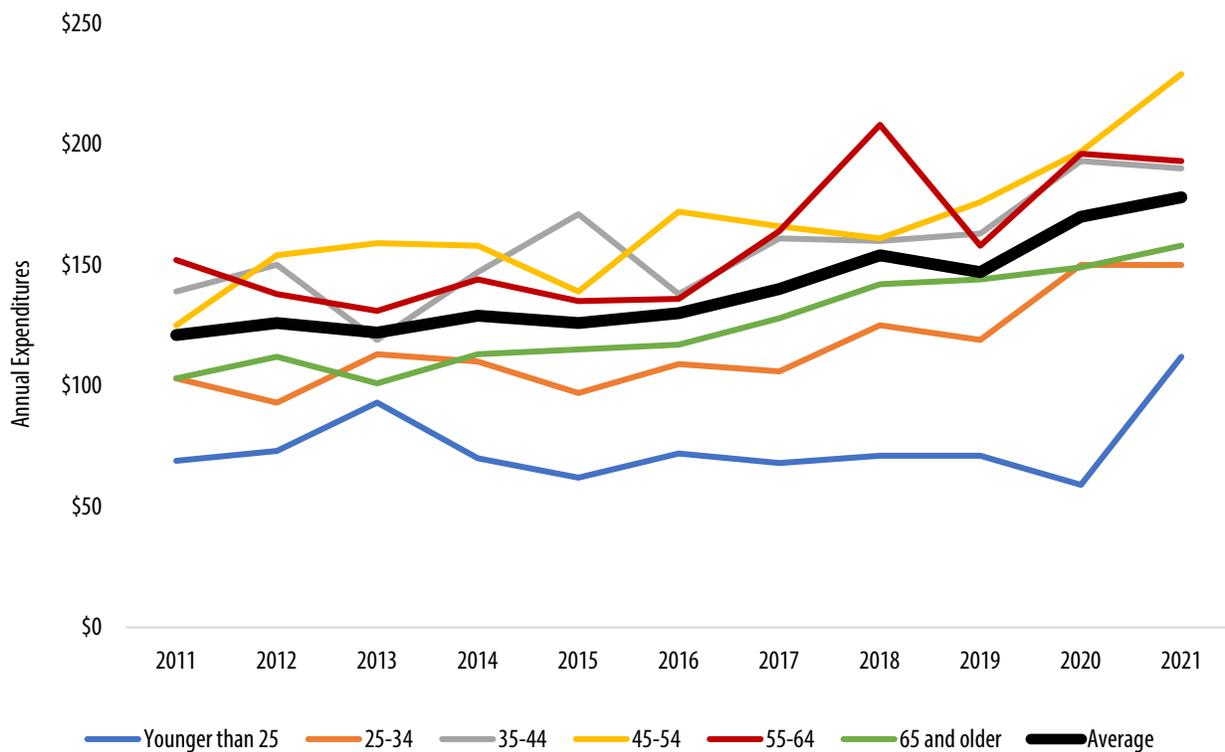
Exhibit 1.2.9. Fish and Seafood Expenditures by Age of a Consumer Unit’s Reference Person, 2021



Source: Consumer Expenditure Survey, U.S. Bureau of Labor Statistics (bls.gov/cex/data.htm)

Examining this highest spending consumer unit, Exhibit 1.2.10 illustrates the increase in annual expenditures among the 45- to 54-year-old reference person category since 2011. In 2011, households with a reference person in the 45- to 54-year-old category spent roughly the average for fish and seafood. Fish and seafood expenditures attributed to this age group increased rather sharply from 2018 to 2021. These data suggest the strength of Gen X consumers for the seafood market, another age group that has demonstrated stronger growth is the younger than 25 demographic (bls.gov/cex/data.htm).

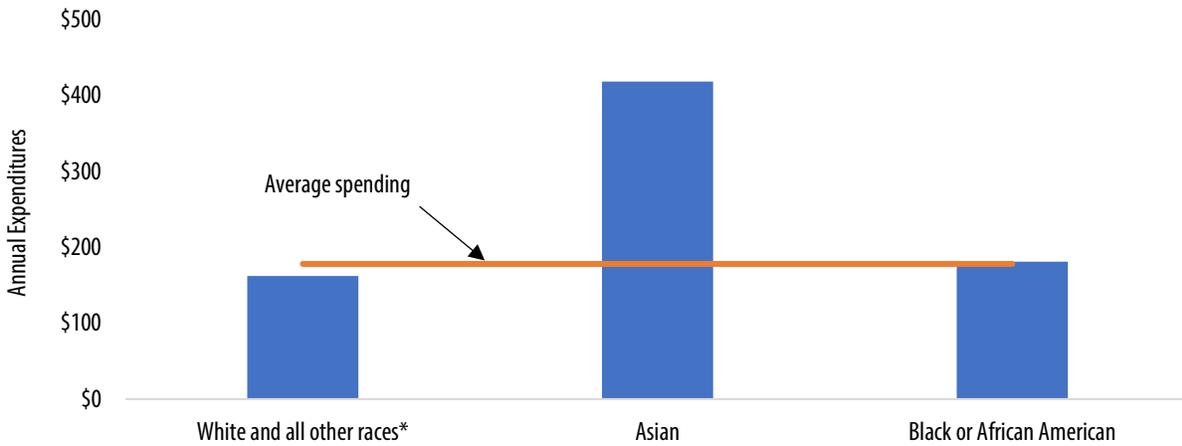
Exhibit 1.2.10. Trend in Fish and Seafood Expenditures by Age of a Consumer Unit’s Reference Person, 2011-21



Source: Consumer Expenditure Survey, U.S. Bureau of Labor Statistics (bls.gov/cex/data.htm)

Fish and seafood expenditures varied significantly in 2021 based on a consumer unit’s reference person’s race. Compared with overall fish and seafood expenditures that averaged \$178 per consumer unit in 2021, consumer units with Asian reference people spent roughly 2.35 times more as shown in Exhibit 1.2.11. Consumer units with Black or African American reference people reported expenditures that slightly — by \$3 annually — exceeded the average in 2021. Consumer units with reference people who identified as white, more than one race or another race trailed in terms of their fish and seafood expenditures. They spent \$16 per year less than the overall average (bls.gov/cex/data.htm).

Exhibit 1.2.11. Fish and Seafood Expenditures by Consumer Unit's Race, 2021

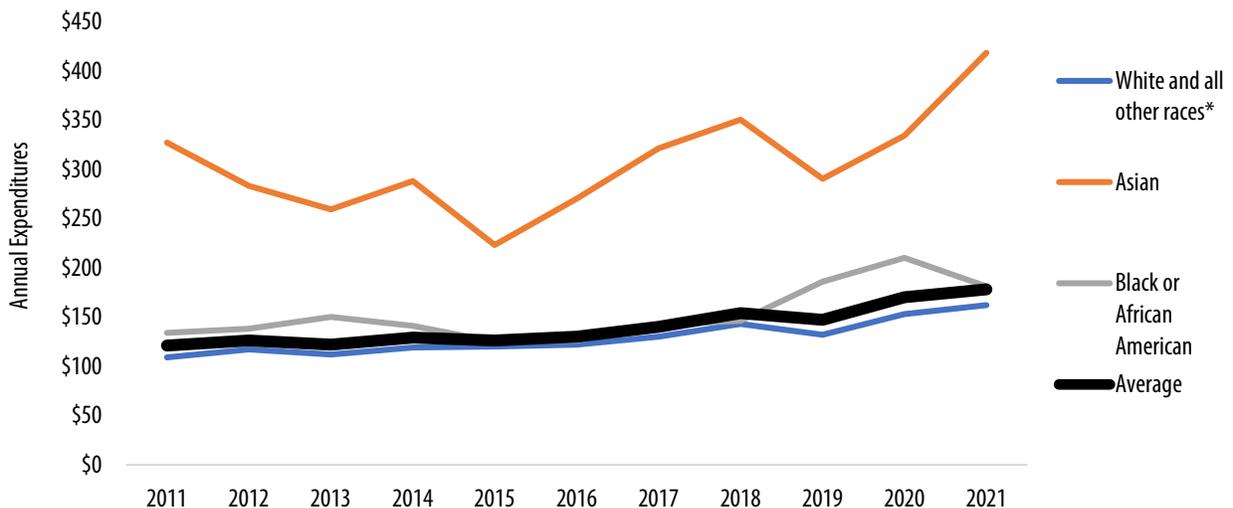


* “All other races” includes Native Hawaiian or other Pacific Islander, American Indian or Alaska Native and respondents who reported more than one race.

Source: Consumer Expenditure Survey, U.S. Bureau of Labor Statistics (bls.gov/cex/data.htm)

Fish and seafood expenditures for most racial groups have trended with overall average expenditures — as shown in Exhibit 1.2.12. From 2011 to 2021, consumer units with an Asian reference person consistently spent more than the average. This group’s expenditures, however, did experience some volatility. During the observed period, fish and seafood expenditures among consumer units with an Asian reference person averaged a low at \$223 annually in 2015 — still nearly \$100 more than overall average expenditures that year — and a high at \$418 annually in 2021 (bls.gov/cex/data.htm).

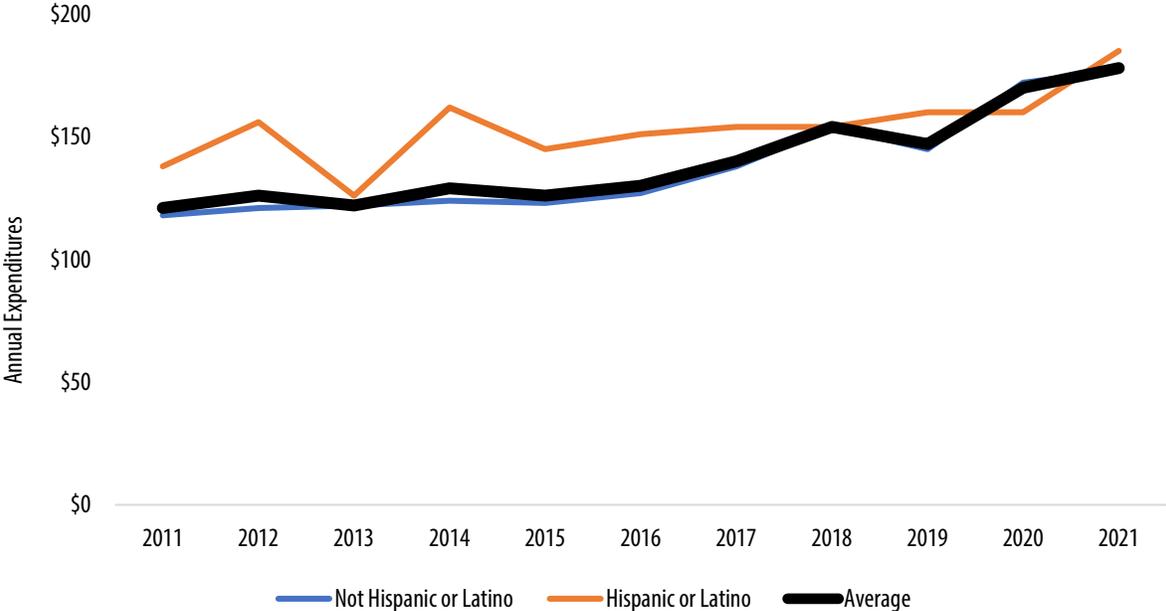
Exhibit 1.2.12. Trend in Fish and Seafood Expenditures by Race of Consumer Unit's Reference Person, 2011-21



Source: Consumer Expenditure Survey, U.S. Bureau of Labor Statistics (bls.gov/cex/data.htm)

From an ethnicity perspective, consumer units with a reference person who was Hispanic or Latino tended to spend more on fish and seafood early in the 2011-to-2021 period. Exhibit 1.2.13 illustrates this relationship stopped being relatively consistent in 2018. Since then, this group has recorded fish and seafood expenditures that deviate relatively slightly from the overall average. Those deviations have been in both directions, too — somewhat higher spending in some years and somewhat lower spending in others. From 2011 to 2021, consumers units with a non-Hispanic or -Latino reference person reported fish and seafood expenditures that nearly mirrored overall average expenditures (bls.gov/cex/data.htm).

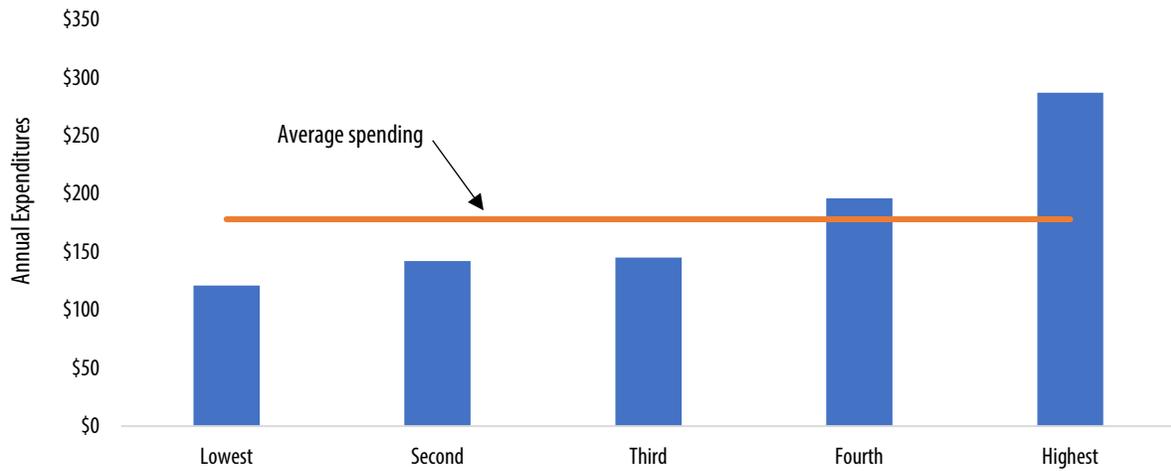
Exhibit 1.2.13. Trend in Fish and Seafood Expenditures by Ethnicity of Consumer Unit’s Reference Person, 2011-21



Source: Consumer Expenditure Survey, U.S. Bureau of Labor Statistics (bls.gov/cex/data.htm)

Exhibit 1.2.14 illustrates how income shaped fish and seafood expenditures in 2021. For the income analysis, the U.S. Bureau of Labor Statistics divided consumer units into quintiles based on income before taxes. Consumer units in the lowest quintile — those that earned the least income before taxes — spent the least on fish and seafood. The second and third quintiles had similar fish and seafood expenditures. The two quintiles with the highest income before taxes averaged more fish and seafood expenditures than the overall average. The highest income quintile’s expenditures averaged \$287, which was roughly 1.6 times the average expenditures reported by all consumer units (bls.gov/cex/data.htm).

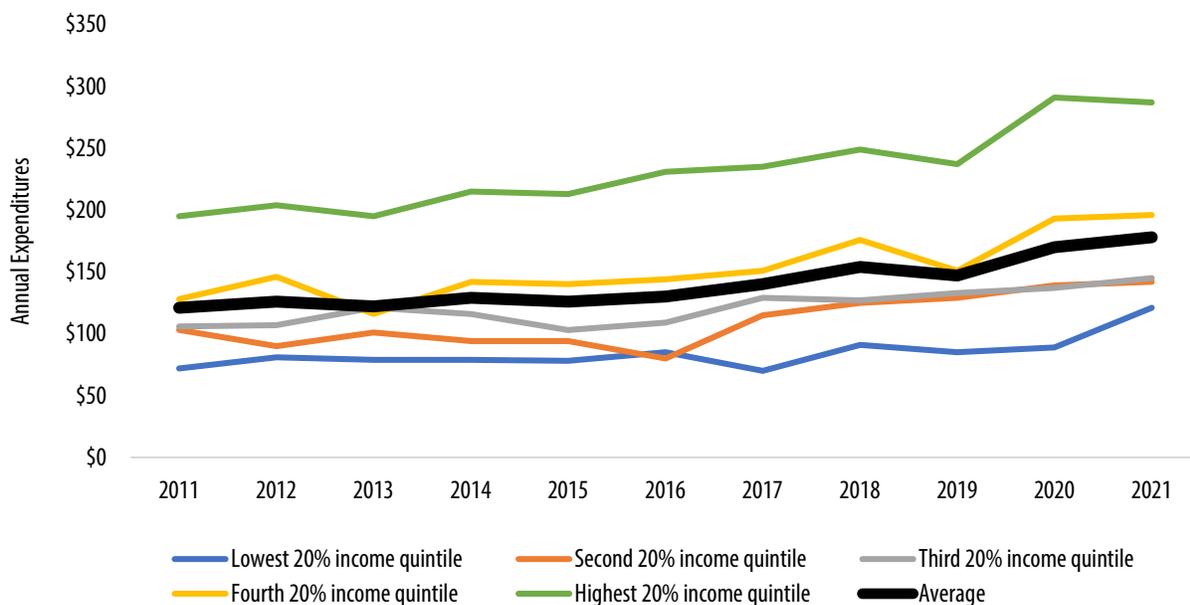
Exhibit 1.2.14. Fish and Seafood Expenditures by Consumer Unit Income Before Taxes, 2021



Source: Consumer Expenditure Survey, U.S. Bureau of Labor Statistics (bls.gov/cex/data.htm)

Between 2011 and 2021, consumer units ranked in the top quintile for income before taxes increased fish and seafood expenditures more quickly on average than all consumer units. See Exhibit 1.2.15. The difference between average annual expenditures and the highest quintile’s average annual expenditures totaled \$74 in 2011. It increased to \$109 in 2021. Note that the second and third quintiles had similar fish and seafood annual expenditures from 2018 to 2021 (bls.gov/cex/data.htm).

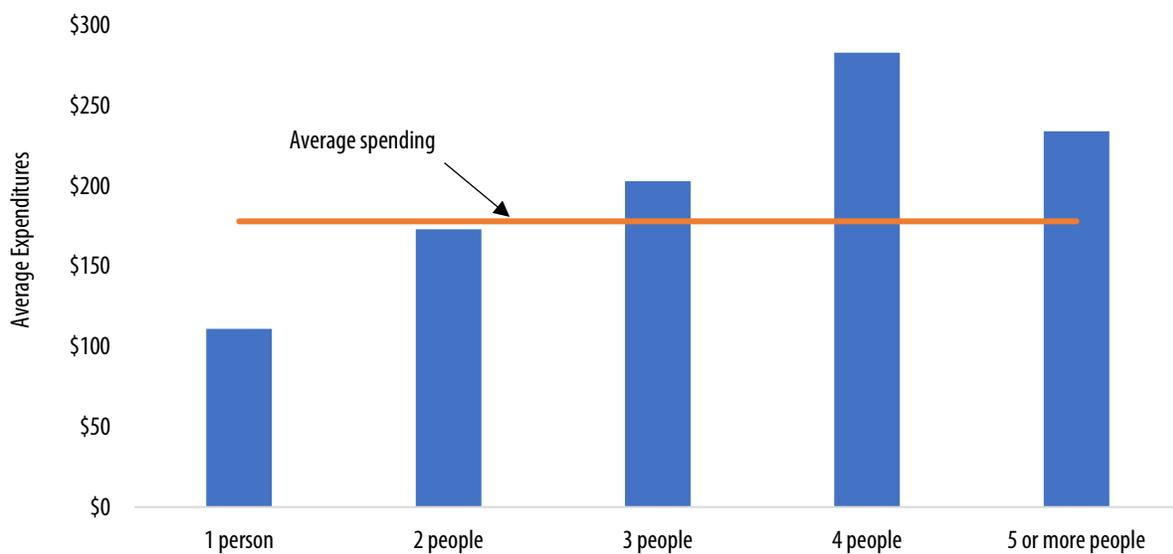
Exhibit 1.2.15. Trend in Fish and Seafood Expenditures by Consumer Unit Income Before Taxes, 2011-21



Source: Consumer Expenditure Survey, U.S. Bureau of Labor Statistics (bls.gov/cex/data.htm)

Household size has had a positive relationship on fish and seafood expenditures to a degree. Exhibit 1.2.16 illustrates that consumer units with four people spent more for fish and seafood products than any other consumer unit size classification in 2021. One-person consumer units spent the least overall. However, on a per-person basis, the one-person consumer units had the greatest annual expenditures on average — \$111 for one-person consumer units compared with \$71 for four-person consumer units (bls.gov/cex/data.htm). Therefore, consumers living alone may consume fish and seafood more often, or they may choose fish and seafood options that carry a more premium price.

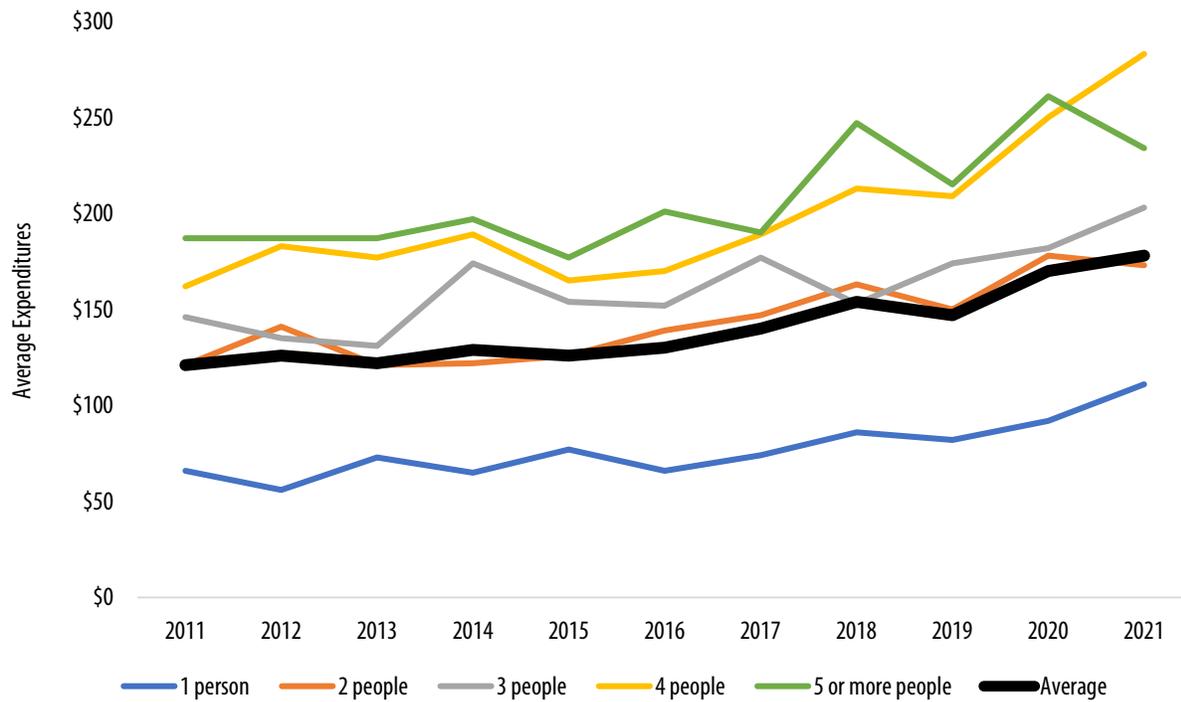
Exhibit 1.2.16. Fish and Seafood Expenditures by Consumer Unit Size, 2021



Source: Consumer Expenditure Survey, U.S. Bureau of Labor Statistics (bls.gov/cex/data.htm)

Fish and seafood spending among four-person consumer units topped spending compared with the other groups for the first time in 2021. See Exhibit 1.2.17. Consumer units with at least five people recorded greater fish and seafood expenditures in the other years between 2011 and 2021, though the spending differences between the two groups were relatively negligible during several years (bls.gov/cex/data.htm).

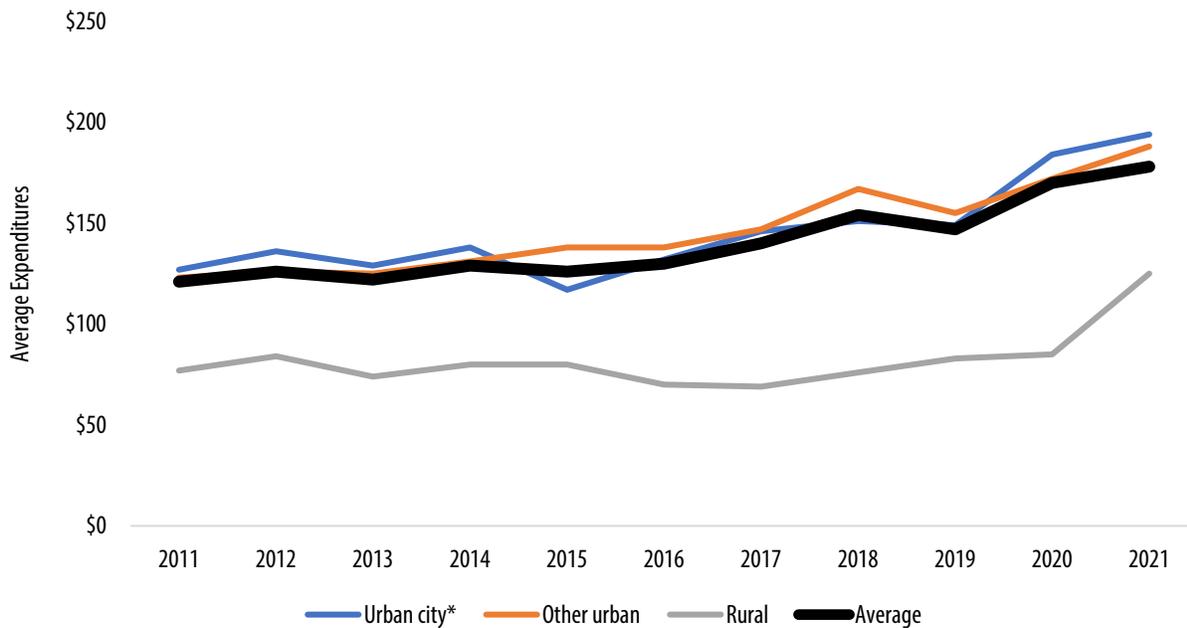
Exhibit 1.2.17. Trend in Fish and Seafood Expenditures by Consumer Unit Size, 2011-21



Source: Consumer Expenditure Survey, U.S. Bureau of Labor Statistics (bls.gov/cex/data.htm)

Consumer units living in rural areas spent less on fish and seafood products than their urban counterparts in 2021. Expenditures reported by urban consumer units — those living in central or principal city locations and other urban designations — exceeded the overall average. Rural consumer units spent \$125 on average compared with the \$178 overall average in 2021. From 2011 to 2021, consumer units living in rural areas consistently had lower fish and seafood expenditures than the overall average. The difference hit a peak in 2018 but later narrowed. See Exhibit 1.2.18. During this same time, urban consumer units averaged spending that hovered near overall average fish and seafood expenditures (bls.gov/cex/data.htm).

Exhibit 1.2.18. Trend in Fish and Seafood Expenditures by Urban and Rural Consumer Units, 2011-21

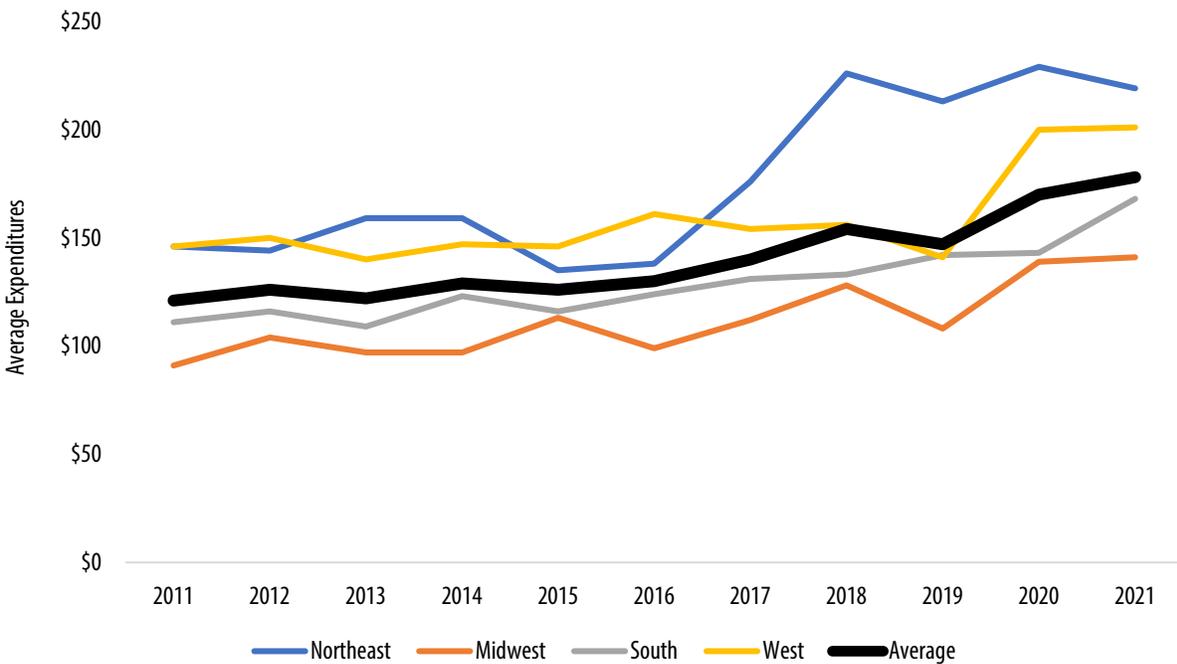


* City classifications were “central city” from 2011-20 and principal city in 2021.

Source: Consumer Expenditure Survey, U.S. Bureau of Labor Statistics (bls.gov/cex/data.htm)

Compared with consumer units in other regions, Midwest consumer units consistently had lower fish and seafood expenditures between 2011 and 2021. In 2021, fish and seafood expenditures among Midwest consumer units averaged \$141 compared with the \$178 overall average. Consumer units living in the Midwest and South both trailed overall average fish expenditures from 2011 to 2021; however, spending among South consumer units tended to track more closely with the overall average. Exhibit 1.2.19 illustrates that Northeast consumer units emerged as the biggest fish and seafood spenders on average in 2017. Expenditures reported by Northeast consumer units continued to be strong in later years. Consumer units living in the West picked up spending in 2020 (bls.gov/cex/data.htm).

Exhibit 1.2.19. Trend in Fish and Seafood Expenditures by Consumer Unit Geography, 2011-21



Source: Consumer Expenditure Survey, U.S. Bureau of Labor Statistics (bls.gov/cex/data.htm)

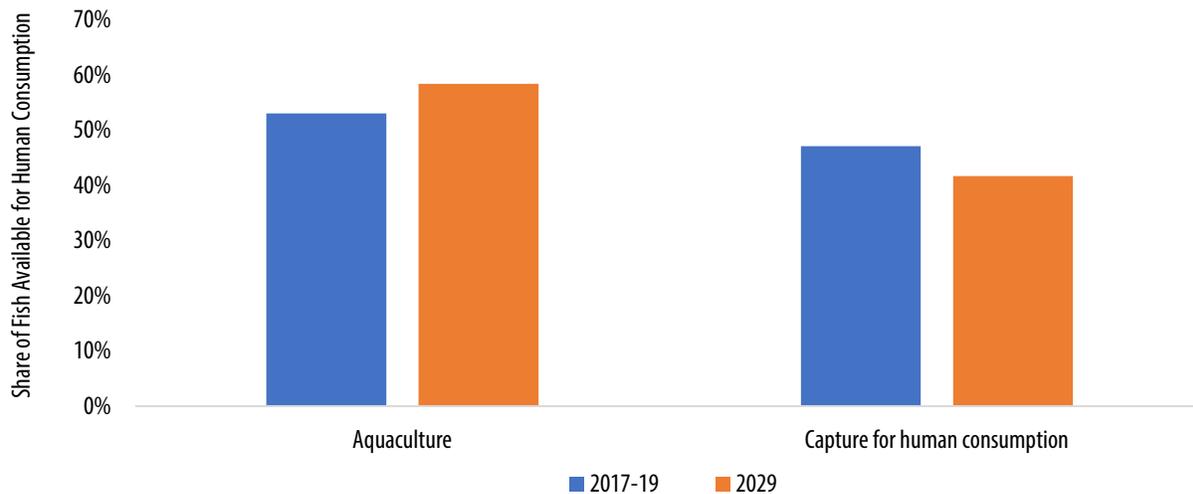
Outlook

Per capita fish consumption has room to grow, according to projections released in 2020 from the Organization for Economic Cooperation and Development (OECD) and Food and Agriculture Organization (FAO) of the United Nations. In live weight equivalent, worldwide fish consumption per capita averaged 44.97 pounds from 2017-19. OECD and FAO estimate a 2.21-pound increase by 2029 (oecd-ilibrary.org/agriculture-and-food/oecd-fao-agricultural-outlook-2020-2029_1112c23b-en).

In North America, OECD and FAO project fish consumption to increase by 0.89 pounds between 2017-19 and 2029. Therefore, it estimates consumption per capita to exceed 50 pounds by 2029. In 2029, OECD and FAO forecast food uses to capture 90% of all fish production (oecd-ilibrary.org/agriculture-and-food/oecd-fao-agricultural-outlook-2020-2029_1112c23b-en).

Aquaculture producers supplied 53% of the global fish available for human consumption during 2017-19. In their 2029 outlook, OECD and FAO estimate aquaculture to grow in importance. See Exhibit 1.2.20. By 2029, they estimate 58% of the fish available for human consumption will originate from aquaculture (oecd-ilibrary.org/agriculture-and-food/oecd-fao-agricultural-outlook-2020-2029_1112c23b-en).

Exhibit 1.2.20. Origin of Fish Globally Available for Human Consumption



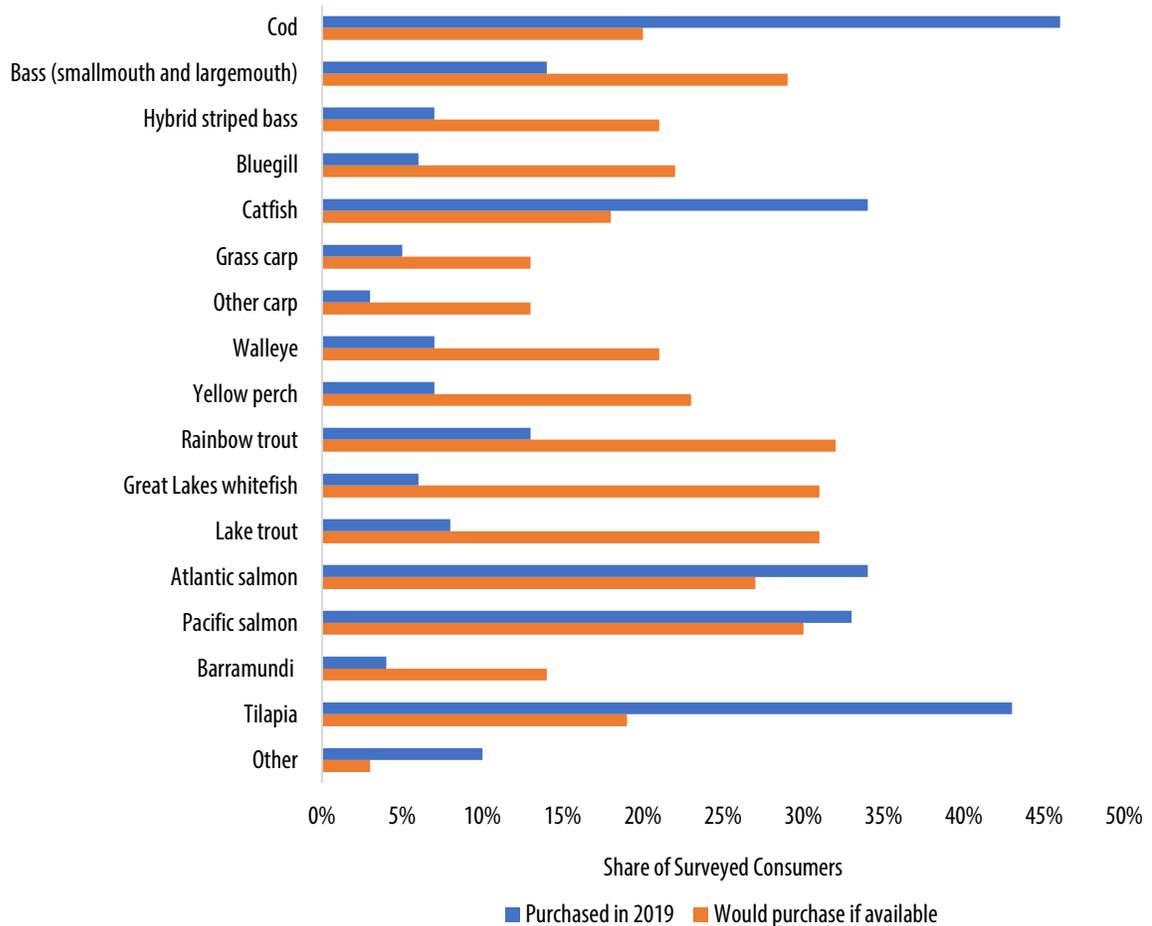
Source: Organization for Economic Cooperation and Development and Food and Agriculture Organization of the United Nations (oecd-ilibrary.org/agriculture-and-food/oecd-fao-agricultural-outlook-2020-2029_1112c23b-en)

Purchase Behavior

A nationally representative survey conducted in fall 2020 dives deeper into U.S. consumers' fish purchases and preferences. Funded by a USDA National Institute of Food and Agriculture grant to the North Central Regional Aquaculture Center, the survey found responding consumers were most likely to have purchased cod and tilapia in 2019; 46% and 43%, respectively, bought these species. Roughly one-third had purchased Atlantic salmon, catfish and Pacific salmon. A much smaller share of consumers had purchased other fish species named in the survey. Exhibit 1.2.21 contrasts 2019 purchase behavior data with reported interest in various fish species. Consumers indicated the most interest in buying rainbow trout, lake trout, Great Lakes whitefish, Pacific salmon, bass and Atlantic salmon if they were available (choicesmagazine.org/choices-magazine/theme-articles/the-economics-of-us-aquaculture/go-fish-us-seafood-consumers-seek-freshness-information-safety-and-health-benefits).

Great Lakes whitefish and lake trout had the greatest differences between 2019 purchase behavior and purchase interest. For both, 31% of consumers said they would buy these fish if available. Only 6% and 8%, respectively, purchased these fish in 2019. Other species with at least a 14-percentage-point gap between purchase interest and 2019 purchase behavior were rainbow trout, yellow perch, bluegill, smallmouth and largemouth bass, walleye and hybrid striped bass. They represent opportunities to fill unmet demand (choicesmagazine.org/choices-magazine/theme-articles/the-economics-of-us-aquaculture/go-fish-us-seafood-consumers-seek-freshness-information-safety-and-health-benefits).

Exhibit 1.2.21. U.S. Consumers' Fish Purchase Behavior and Interest by Species



Source: Choices (choicesmagazine.org/choices-magazine/theme-articles/the-economics-of-us-aquaculture/go-fish-us-seafood-consumers-seek-freshness-information-safety-and-health-benefits)

When purchasing fresh and frozen fish, consumers gravitate toward fillets, according to a nationally representative survey conducted in fall 2020. See Exhibit 1.2.22. The survey, which the USDA National Institute of Food and Agriculture funded through a North Central Regional Aquaculture Center grant, found nearly half of consumers had purchased fillets as either fresh or frozen products. Closer to one-quarter had bought whole fish, prepared fresh fish or breaded frozen fish. Marinated and seasoned fillets are prepared fresh fish examples. Breaded frozen products include fish sticks and breaded fillets. Fewer consumers had purchased live, smoked or shelf-stable fish (choicesmagazine.org/choices-magazine/theme-articles/the-economics-of-us-aquaculture/go-fish-us-seafood-consumers-seek-freshness-information-safety-and-health-benefits).

Exhibit 1.2.22. Fish Purchase Preferences by Product Format

| | | Share of consumers |
|-------------------------------------|----------|--------------------|
| Fresh | Whole | 28.0% |
| | Fillets | 48.0% |
| | Prepared | 24.0% |
| Frozen | Whole | 27.0% |
| | Fillets | 49.0% |
| | Breaded | 24.0% |
| Live | | 2.2% |
| Smoked | | 2.4% |
| Shelf-stable (cans, pouches) | | 1.7% |

Source: Choices (choicesmagazine.org/choices-magazine/theme-articles/the-economics-of-us-aquaculture/go-fish-us-seafood-consumers-seek-freshness-information-safety-and-health-benefits)

For shellfish and mollusks, consumers responding to the North Central Regional Aquaculture Center survey reported a greater likelihood of choosing fresh instead of frozen whole options. See Exhibit 1.2.23. When purchasing shellfish tails, consumers were slightly more likely to buy frozen product. Mollusks buyers were more likely to have experience with purchasing live and value-added (e.g., smoked, canned) products than shellfish buyers. Note, of all 1,416 consumers surveyed, 77% had purchased shellfish, and 37% had purchased mollusks (choicesmagazine.org/choices-magazine/theme-articles/the-economics-of-us-aquaculture/go-fish-us-seafood-consumers-seek-freshness-information-safety-and-health-benefits).

Exhibit 1.2.23. Shellfish and Mollusks Purchase Preferences by Product Format

| | | Shellfish | Mollusks |
|-------------------------------------|-------|-----------|----------|
| Fresh | Whole | 69.0% | 42.0% |
| | Tails | 31.0% | – |
| Frozen | Whole | 61.0% | 36.0% |
| | Tails | 39.0% | – |
| Live | | 3.8% | 10.0% |
| Smoked | | 2.9% | 7.0% |
| Shelf-stable (cans, pouches) | | 2.4% | 6.0% |

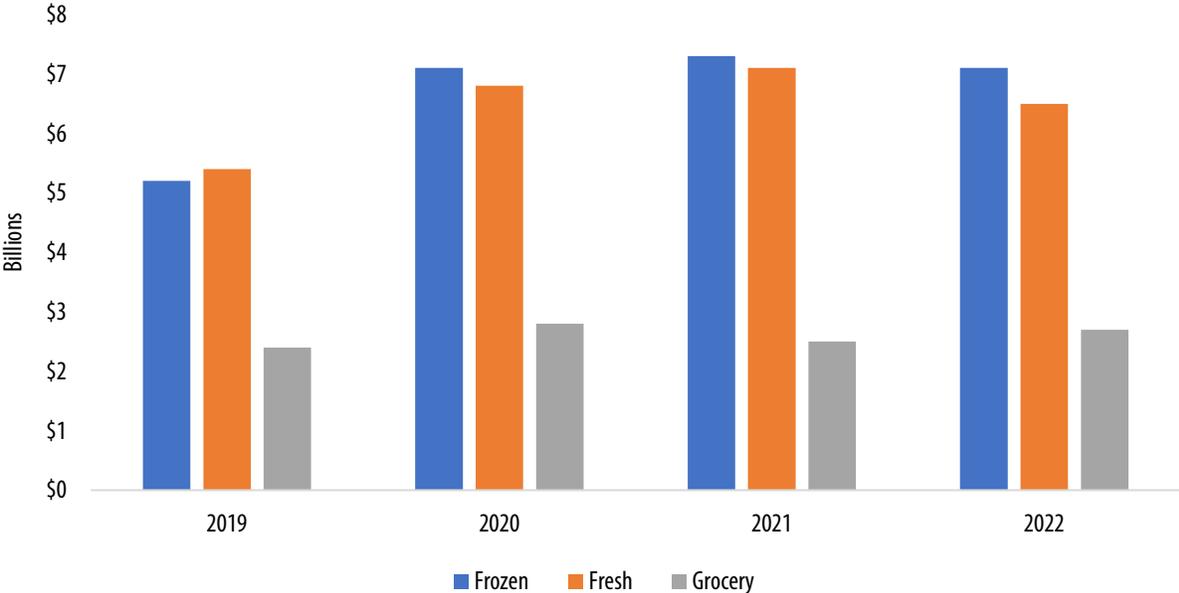
Source: Choices (choicesmagazine.org/choices-magazine/theme-articles/the-economics-of-us-aquaculture/go-fish-us-seafood-consumers-seek-freshness-information-safety-and-health-benefits)

1.3. Seafood Sales

Within a retail store, the frozen and fresh departments tend to generate most seafood sales; however, the grocery department also contributes through sales of seafood packaged in cans and pouches. Exhibit 1.3.1

presents U.S. seafood dollar sales by department for 2019 to 2022. FMI, the Food Industry Association, published these sales totals from IRI in its Power of Seafood 2023 report. As noted, frozen and fresh departments provided 43.6% and 42% of seafood dollar sales. The grocery department contributed 16.6% of total dollar sales. Between 2021 and 2022, total seafood dollar sales dropped by 3.6%. Fresh dollar sales declined by 8.5%, and the frozen category posted a 2.7% reduction in dollar sales. The grocery category’s dollar sales improved by 8% (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023).

Exhibit 1.3.1. U.S. Seafood Dollar Sales by Department, 2019 to 2022*

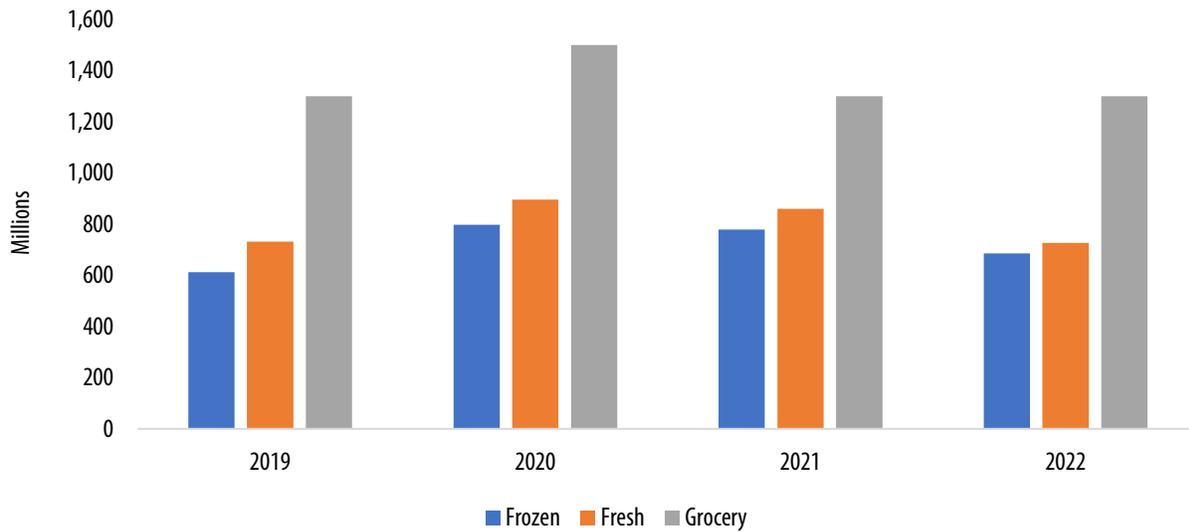


* Data reported for multioutlet retailers, which include food stores, drug stores, mass retailers, Walmart, club stores other than Costco, dollar stores and military stores.

Source: IRI via Power of Seafood 2023, FMI-The Food Industry Association (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023)

In terms of U.S. seafood unit sales, Exhibit 1.3.2 summarizes frozen, fresh and grocery trends from 2019 to 2022, based on IRI data cited in the Power of Seafood 2023 report released by FMI-The Food Industry Association. Grocery seafood unit sales surpassed fresh and frozen unit sales. Between 2021 and 2022, the grocery category showed no change in unit sales; therefore, price inflation fueled the change in dollar sales growth shown in Exhibit 1.3.1. Unit sales for fresh and frozen seafood sales declined more from 2021 to 2022 than dollar sales — a 15.6% unit sales decline for fresh seafood and 11.9% unit sales decline for frozen seafood (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023).

Exhibit 1.3.2. U.S. Seafood Unit Sales by Department, 2019 to 2022*



* Data reported for multioutlet retailers, which include food stores, drug stores, mass retailers, Walmart, club stores other than Costco, dollar stores and military stores.

Source: IRI via Power of Seafood 2023, FMI-The Food Industry Association
(fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023)

Fresh Seafood

Exhibit 1.3.3 summarizes more detailed U.S. sales activity for fresh seafood. During the first two quarters of 2022, just three fresh seafood product categories experienced dollar sales improvements: seafood salads, salmon and smoked salmon. Salmon topped sales of all other product categories in August 2022 and still posted 8% and 9.1% sales growth in the first quarter and second quarter, respectively. A smaller product category, seafood salads had sales totaling \$11 million in August 2022, but it had notable sales growth in the first half of 2022 — 25% in the first quarter and 13.9% in the second quarter. When comparing August 2021 and August 2022 sales figures, seafood salads and salmon were the only two product categories to have increased their dollar sales. With respect to volume sales, all categories but crab had less volume move in August 2021 than in August 2022. Crab volume sales increased very slightly by 0.9% (iriworldwide.com/IRI/media/Library/IRI-Frozen-Update-Oct-2022.pdf).

In the August data, note many categories had poorer volume sales changes than dollar sales changes from 2021 to 2022. This indicates strengthening seafood product prices. Instead of paying even higher prices for seafood, consumers may choose other animal proteins, such as meat or poultry, and abandon a seafood purchase altogether (supermarketnews.com/seafood/why-supermarket-seafood-purchasing-dropping). Consumer hesitancy to pay higher prices results in retailers tightening their seafood selection and

avoiding products not likely to sell as well. In December 2022, an IRI representative noted high prices had led retailers to no longer stock fresh fish such as tuna and swordfish. Eventually, stores may have more interest in stocking these products when the price point better aligns with willingness to pay. Novel options in a store stimulate interest (supermarketnews.com/seafood/brighter-forecast-seafood-pricing).

Exhibit 1.3.3. U.S. Multioutlet Retailers’ Fresh Seafood Sales Summary, 2022*

| | Q1 22 | Q2 22 | August 2022 (millions) | Dollar sales change versus year ago | Volume sales change versus year ago |
|----------------------------|--------------|---------------|---------------------------|--|--|
| Salmon | 8.0% | 9.1% | \$206 | 8.0% | -2.0% |
| Crab | -31.0% | -34.2% | \$76 | -12.8% | 0.9% |
| Shrimp | -12.0% | -17.7% | \$62 | -15.4% | -22.4% |
| Lobster | -18.0% | -28.6% | \$27 | -6.9% | -6.2% |
| Catfish | -16.0% | -9.6% | \$16 | -17.1% | -25.2% |
| Cod | -3.0% | -0.5% | \$15 | -4.0% | -18.3% |
| Tilapia | -20.0% | -17.0% | \$14 | -20.3% | -39.7% |
| Seafood salads | 25.0% | 13.9% | \$11 | 9.5% | -5.7% |
| Smoked salmon | 0.3% | 0.9% | \$8 | -0.5% | -6.6% |
| Seafood cakes | -3.0% | -12.6% | \$8 | -15.3% | -19.1% |
| Total fresh seafood | -9.0% | -11.7% | \$504 | -6.1% | -12.9% |

* Data reported for multioutlet retailers, which include food stores, drug stores, mass retailers, Walmart, club stores other than Costco, dollar stores and military stores.

Source: IRI (iriworldwide.com/IRI/media/Library/IRI-Seafood-Update-Aug-2022.pdf)

Frozen Seafood

U.S. frozen seafood sales saw single-digit dollar sales declines during the first two quarters of 2022 — -3% in the first quarter and -2.5% in the second quarter, according to IRI. See Exhibit 1.3.4. By product category, the dollar sales reduction was most significant for frozen cooked shrimp. Relative to a year earlier, frozen cooked shrimp’s dollar sales had declined by 6.9% in August 2022. Volume sales experienced a greater reduction — 17.2%. In volume terms, frozen fish sales improved by 4.5% in August 2022 relative to a year earlier. This was the only category to report sales growth (iriworldwide.com/IRI/media/Library/IRI-Frozen-Update-Oct-2022.pdf).

Exhibit 1.3.4. U.S. Multioutlet Retailers' Frozen Seafood Sales Summary, 2022*

| | Q1 22 | Q2 22 | August 2022 (millions) | Dollar sales change versus year ago | Volume sales change versus year ago |
|-----------------------------|--------------|--------------|---------------------------|--|--|
| Frozen fish | -0.3% | 0.3% | \$245 | -2.2% | 4.5% |
| Frozen raw shrimp | -1.6% | -2.7% | \$162 | -3.1% | -9.5% |
| Frozen cooked shrimp | -9.0% | -11.0% | \$122 | -6.9% | -17.2% |
| Total frozen seafood | -3.0% | -2.5% | \$530 | -3.6% | -3.9% |

* Data reported for multioutlet retailers, which include food stores, drug stores, mass retailers, Walmart, club stores other than Costco, dollar stores and military stores.

Source: IRI (iriworldwide.com/IRI/media/Library/IRI-Seafood-Update-Aug-2022.pdf)

During the COVID-19 pandemic, sales of frozen products including seafood performed well. FMI-The Food Industry Association reported that frozen seafood had a 73% penetration rate in U.S. households during 2020. Only about half of households purchased fresh seafood at the time (supermarketnews.com/seafood/frozen-seafood-sales-heat). Post-pandemic, frozen sales will likely return to pre-pandemic levels (seafoodsource.com/whitepapers/innovation-millennials-driving-big-changes).

Freezing seafood requires technologies, such as plate freezers, belt-freezers, tunnel freezers, individual quick-freeze equipment and flash-freezing methods. Product formats that have sold well include frozen seafood sold in large packages and seafood, such as shrimp, snapper, mahi and shellfish, incorporated into frozen meals (seafoodsource.com/whitepapers/innovation-millennials-driving-big-changes).

Frozen seafood products had pandemic-era sales strength because they store well. Plus, frozen seafood has availability throughout the year and often costs less (supermarketnews.com/seafood/frozen-seafood-sales-heat). Online shoppers have a greater likelihood of buying frozen items, including seafood (seafoodsource.com/whitepapers/innovation-millennials-driving-big-changes). Other contributors to frozen seafood interest include demand for ready-to-eat, ready-to-cook and healthy foods (divcomplatform.s3.amazonaws.com/www.seafoodsource.com/images/7bbbc4e2014b2305810f1dfd62b8e721.pdf). Some foodservice firms opt for frozen seafood as a strategy to minimize food waste (provisioneronline.com/articles/112144-2022-seafood-report-the-breakthrough-continues).

To succeed with frozen seafood sales, marketers should emphasize the frozen product's healthfulness. Seafood that undergoes flash-freezing shortly after it's caught has well-preserved nutrients, flavor, texture and quality (supermarketnews.com/seafood/frozen-seafood-sales-heat). According to a 2021 survey of U.S. consumers, Deloitte found younger consumers — 18- to 34-year-olds — are more likely than older consumers — those who are at least 55 years old — to view frozen seafood as a product that's just as good

or better than fresh seafood (www2.deloitte.com/us/en/insights/industry/retail-distribution/future-of-fresh-food-sales/future-of-food-survey.html). Frozen foods also resonate with consumers because they are perceived as authentic — for example, require fewer artificial ingredients — and safe to eat (seafoodsource.com/whitepapers/innovation-millennials-driving-big-changes).

Ambient Seafood

Sold in cans or pouches, ambient seafood offers a shelf-stable alternative to fresh and frozen seafood products. IRI reports that inflationary times tend to prompt an uptick in ambient seafood sales. Exhibit 1.3.5 illustrates how sales changed from August 2021 to August 2022. Total ambient dollar sales grew by 5.3%. Unit and volume sales posted -4.2% and -3.7% changes, respectively. Despite the drop in unit and volume sales, the ambient category largely performed better than total fresh and total frozen seafood sales. Fresh seafood sales changed by -6.1% in dollar terms, -14% in unit terms and -12.9% in volume terms. Regarding the frozen seafood category, sales changes were -3.6% in dollar terms, -13.6% in unit terms and -3.9% in volume terms (iriworldwide.com/IRI/media/Library/IRI-Seafood-Update-Aug-2022.pdf).

All three species for which IRI reports ambient seafood sales experienced unit and volume sales declines from August 2021 to August 2022, and the “all other” group also had fewer unit and volume sales in August 2021 than in August 2022. Clams and the “all other” groups posted the steepest declines. Tuna unit and volume sales decreased the least. All subcategories had at least marginal dollar sales growth — led by tuna with 6.8% dollar sales growth from August 2021 to August 2022 (iriworldwide.com/IRI/media/Library/IRI-Seafood-Update-Aug-2022.pdf).

Exhibit 1.3.5. U.S. Multioutlet Retailers’ Ambient Seafood Sales Summary, August 2022*

| | August 2022 (millions) | Dollar sales change versus year ago | Unit sales change versus year ago | Volume sales change versus year ago |
|------------------------------|-----------------------------------|--|--|--|
| Ambient tuna | \$162 | 6.8% | -2.6% | -2.7% |
| Ambient all other | \$28 | 0.4% | -11.7% | -9.0% |
| Ambient salmon | \$20 | 0.7% | -6.9% | -4.3% |
| Ambient clams | \$3 | 2.3% | -11.7% | -13.0% |
| Ambient seafood total | \$213 | 5.3% | -4.2% | -3.7% |

* Data reported for multioutlet retailers, which include food stores, drug stores, mass retailers, Walmart, club stores other than Costco, dollar stores and military stores.

Source: IRI (iriworldwide.com/IRI/media/Library/IRI-Seafood-Update-Aug-2022.pdf)

Euromonitor International data cited by The Wall Street Journal indicate 2022 sales strength for canned seafood. Euromonitor reports that canned sales totaled \$2.7 billion, which was 9% growth. Factors

driving the growth included product launches, interest from younger consumers and social media buzz. On TikTok, users have added the #tinnedfish hashtag to product reviews and recommendations. To encourage more social conversation about canned seafood products, some brands have engaged social media influencers ([wsj.com/articles/the-latest-tiktok-star-is-canned-tuna-11673878559](https://www.wsj.com/articles/the-latest-tiktok-star-is-canned-tuna-11673878559)). An 2023 seafood outlook published The National Provisioner included an expert's projection that tinned seafood would become more widely available in retail outlets (provisioneronline.com/articles/114299-seafood-report-2023-supply-challenges-and-market-opportunities).

Some new canned seafood products have premium positioning and price points — as much as \$20 per unit. For example, Wildfish offers flavored canned fish, and to keep up with demand, it has acquired more production space and equipment. Seafood used in Wildfish products originates from Alaska, where it's also smoked and hand-packed ([wsj.com/articles/the-latest-tiktok-star-is-canned-tuna-11673878559](https://www.wsj.com/articles/the-latest-tiktok-star-is-canned-tuna-11673878559)). Scout packages and sells high-quality seafood, including Atlantic Canadian lobster and dill-seasoned rainbow trout, in cans. With a desire “to expand the canned seafood market beyond tuna,” according to a Food Business News story, Scout has stocked its products in specialty U.S. and Canadian retailers. As of October 2022, it planned to reach into national and regional retail stores during 2023 (foodbusinessnews.net/articles/22475-packaged-seafood-producer-raises-4-million-in-funding).

Seasonality

To an extent, seasonality shapes seafood sales. The following discussion highlights several seasons known for seafood consumption. Celebrated in January or February, the **Chinese Lunar New Year** brings together families, who often make fish or seafood meals part of the holiday's tradition. Some serve “whole fish” — one that has had no cutting or chopping. The whole fish signifies ending one year and beginning another with a food — fish — that represents abundance, well-being and prosperity. Other fish dishes prepared to recognize the holiday include basin meals, which use a single pot to stew shrimp, prawn, scallop, abalone and other fish; rice cake soup made using a broth from anchovies and kelp; and prosperity salad often made using salmon, snails or crab (msc.org/what-you-can-do/eat-sustainable-seafood/festive-seafood-dishes-for-the-chinese-lunar-new-year).

Lent, the period between Ash Wednesday and Easter, leads to a boost in fish sales. During this time, many Catholics choose meatless meals on Fridays, and they often decide to consume seafood instead. A February 2021 story from *Restaurant Hospitality* reported that an estimated 14% of Americans during Lent choose to not eat meat on Fridays. Also, Lent represents a time to launch new seafood products given consumers regularly seeking seafood options. Of the seafood dishes that restaurants debuted in

2020, more than half were introduced during the first quarter (restaurant-hospitality.com/limited-service/seafood-draw-during-lent-even-during-pandemic). These behaviors have a measurable effect on seafood sales. According to data reported by *The Counter* in March 2021, restaurants' seafood sales during Lent increase by 20% (thecounter.org/fish-sandwiches-new-chicken-lent-popeyes-arbys).

Seafood marketers often see a boost in value-added sales during the **winter holidays** (supermarketperimeter.com/articles/8945-seafood-industry-has-fresh-offerings-for-the-holidays). Some families serve seafood on Christmas Eve as part of the Feast of the Seven Fishes tradition. Originating from Italian-Americans, the feast typically involves serving at least seven dishes made using different types of seafood (usatoday.com/story/life/food-dining/2022/12/23/feast-seven-fishes-seafood-recipes-italian-chef/10925155002). New Year's Eve represents another celebration where hosts serve seafood to their guests (seafoodsource.com). To attract customers, some seafood marketers invest in holiday-season promotions. For example, Pacific Seafood, an Oregon-based firm that harvests, processes and distributes various seafood products, ran a 12 Days of Fishmas program in 2022. For 12 days, the company revealed a special promotion, recipe or downloadable activity (pacificseafood.com/fishmas).

1.4. Marketing Considerations

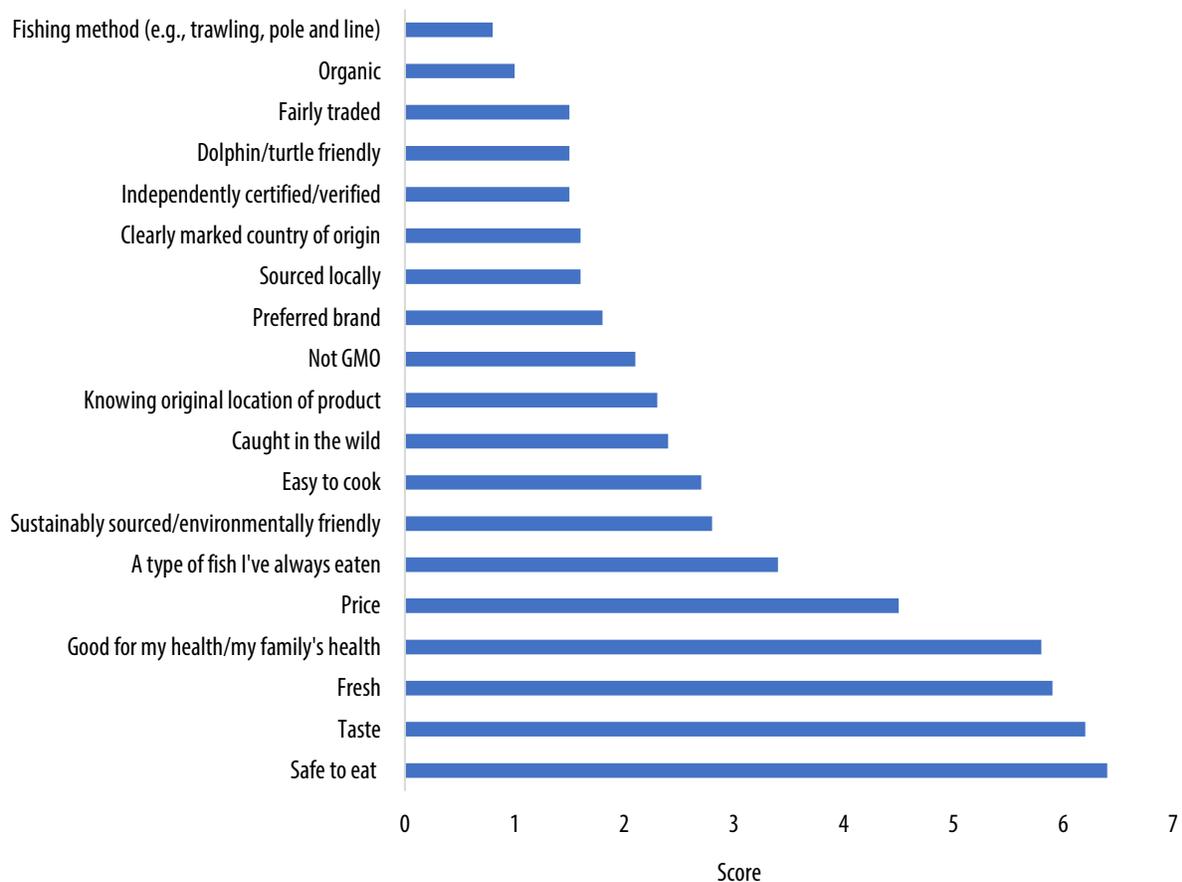
To succeed with selling seafood products, firms must assemble a marketing mix compelling to seafood consumers. The following discussion highlights product, promotional, pricing and placement considerations for seafood marketers.

Purchase Drivers

For North American seafood consumers, the top four considerations shaping their purchase decisions are safety, taste, freshness and healthfulness, according to a 2022 survey from the Marine Stewardship Council and GlobeScan. See Exhibit 1.4.1. Price ranked fifth in importance. Ranking sixth, “a type of fish I've always eaten” suggests some consumers choose seafood products based on familiarity. The survey collected input from more than 5,700 consumers in North America, and it asked seafood consumers to select the five considerations most important to their seafood purchases. The six top purchase drivers all tie to factors conventionally viewed as purchase motivators. According to consumers, the most important sustainability-focused factor was “sustainably sourced/environmentally friendly,” which ranked seventh overall (msc.org/docs/default-source/default-document-library/for-business/changing-food-choices---msc-globescan-webinar-slides-n-america-2022.pdf?sfvrsn=43d9e075_5).

Although the “local” characteristic didn’t rank particularly high as a purchase consideration in this survey, local sourcing does present some supply chain advantages. Of the seafood consumed in the U.S., 80% to 85% is shipped from other countries. The logistical lead times and product seasonality involved in seafood markets means supply and demand can be difficult to match (provisioneronline.com/articles/114299-seafood-report-2023-supply-challenges-and-market-opportunities).

Exhibit 1.4.1. Fish Purchase Considerations Cited by North American Seafood Consumers, 2020*



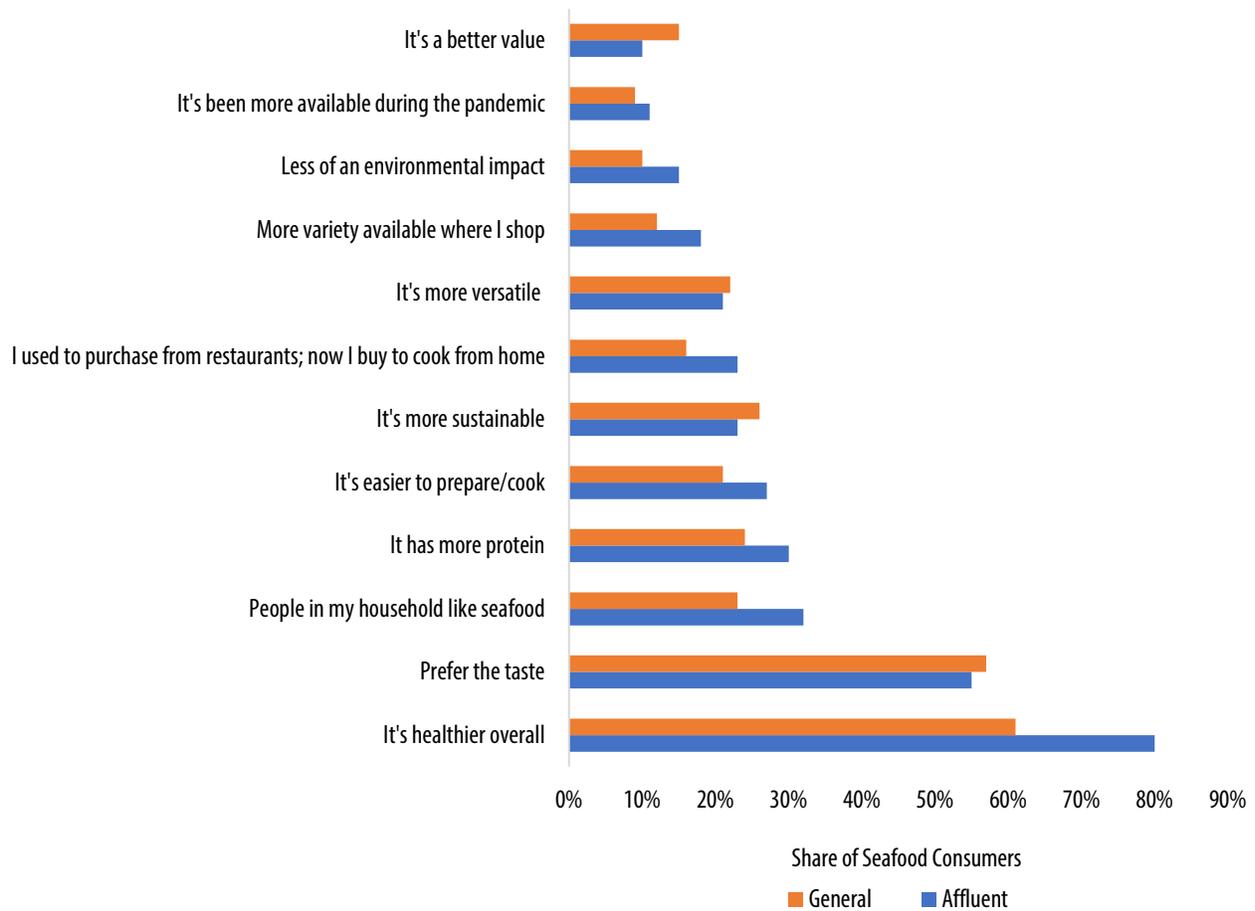
* Greater score indicates stronger purchase consideration or motivator

Source: Marine Stewardship Council and GlobeScan (msc.org/docs/default-source/default-document-library/for-business/changing-food-choices---msc-globescan-webinar-slides-n-america-2022.pdf?sfvrsn=43d9e075_5)

As indicated in the Marine Stewardship Council and GlobeScan research, consumers view healthfulness as an important purchase consideration. Protein represents one nutrient found in seafood. The Alaska Seafood Marketing Institute collaborated with Datassential to conduct a nationally representative online survey of consumers who had purchased salmon and another seafood product for at-home consumption within a three-month period, and the survey inquired why the participating consumers would choose

seafood relative to other proteins. Published in 2021, the survey findings represent input from two groups of consumers: 600 affluent consumers and 400 general consumers. The affluent consumers were 25- to 75-year-olds who had earned a college degree and recorded at least \$100,000 in household income. Exhibit 1.4.2 summarizes why affluent and general consumers decided to choose seafood instead of other proteins. For both groups, two factors most influenced their decisions: overall healthfulness and taste preferences. Affluent consumers voiced particular favor for seafood’s nutritional profile (alaskaseafood.org/wp-content/uploads/Datassential-Retail-Research-Final_2.pdf).

Exhibit 1.4.2. Reasons Seafood Consumers Choose Seafoods Instead of Other Proteins

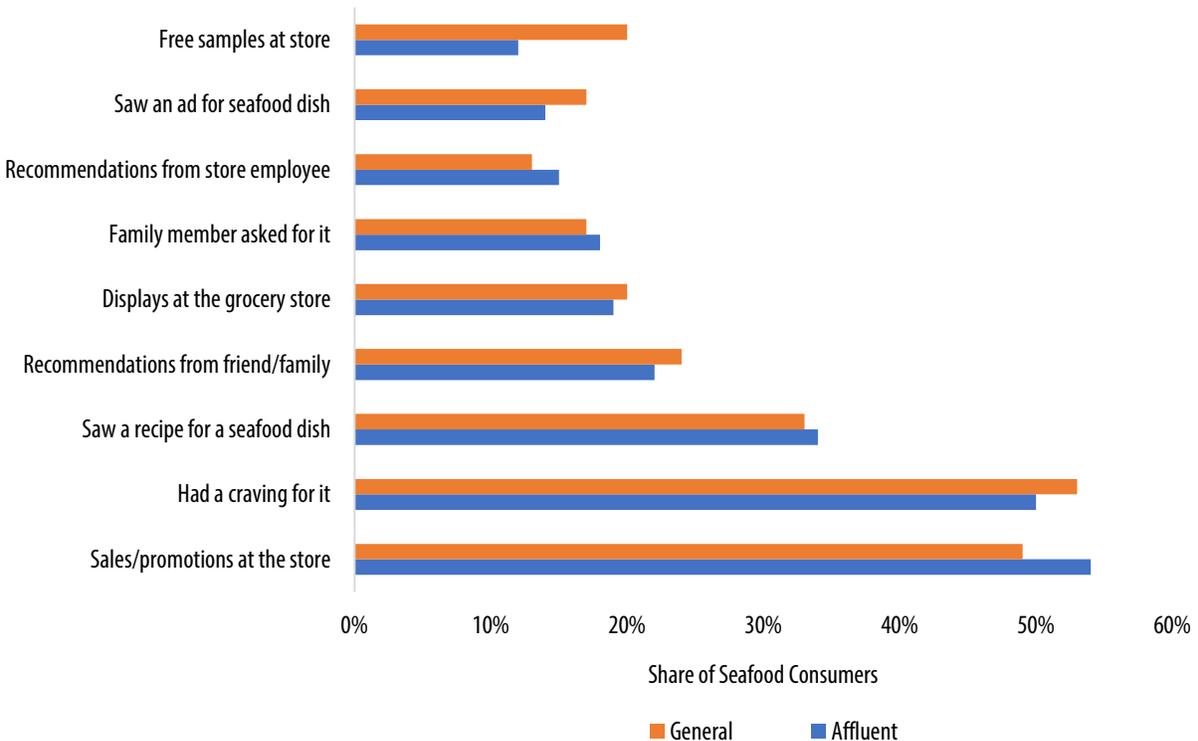


Source: Alaska Seafood Marketing Institute and Datassential (alaskaseafood.org/wp-content/uploads/Datassential-Retail-Research-Final_2.pdf)

The survey research from the Alaska Seafood Marketing Institute and Datassential also explored seafood purchase motivators among affluent and general seafood consumers. Exhibit 1.4.3 presents the results. For both groups, store sales or promotions and cravings commonly stimulate seafood purchases. Roughly

half of affluent and general consumers noted these two factors as purchase motivators. Affluent and general consumers in most cases had similar sentiments about seafood purchase motivators. The factor producing the greatest difference in response was free samples. One-fifth of general consumers said they viewed free samples as a purchase motivator, but just 12% of affluent consumers agreed (alaskaseafood.org/wp-content/uploads/Datassential-Retail-Research-Final_2.pdf).

Exhibit 1.4.3. Seafood Purchase Motivators Cited by Seafood Consumers

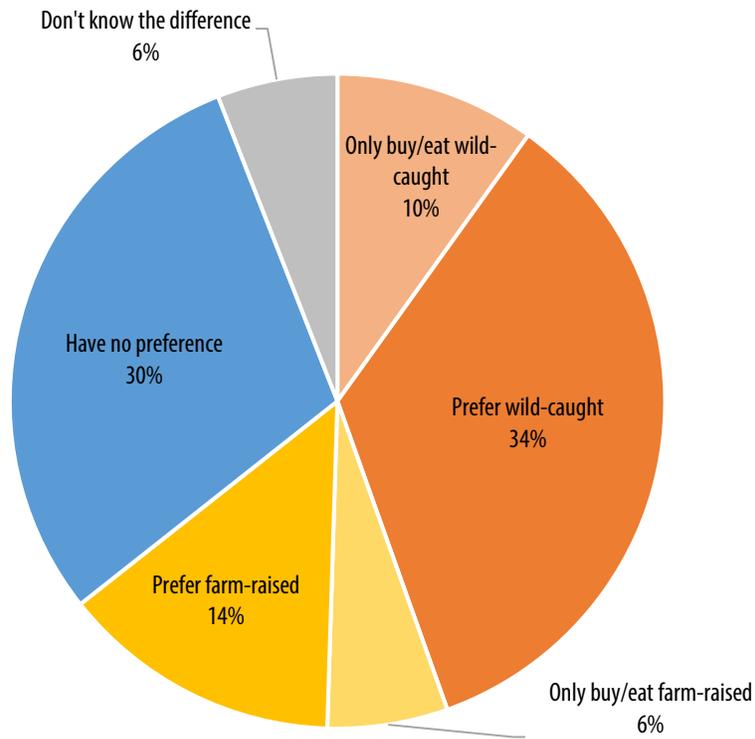


Source: Alaska Seafood Marketing Institute and Datassential (alaskaseafood.org/wp-content/uploads/Datassential-Retail-Research-Final_2.pdf)

Respondents participating in the 2023 Power of Seafood survey research conducted by FMI-The Food Industry Association indicated a greater preference for wild-caught seafood than farm-raised. Note, conducted in November 2022, the nationally representative survey collected input from 2,006 U.S. adults who shop for groceries. Exhibit 1.4.4 indicates 45% of seafood consumers participating in the survey research said they either prefer or only buy and eat wild-caught seafood. Just 20% said they prefer or only buy and eat farm-raised seafood. Nearly one-third reported no preference for wild-caught or farm-raised seafood (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023).

Survey findings published in the Power of Seafood 2023 indicate that farm-raised and wild-caught preferences vary by age and household characteristics. Gen Z and millennials show more preference for farm-raised seafood, but Gen X and boomer consumers tend to prefer wild-caught options. The farm-raised preference tends to be more common among seafood consumers who have children (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023).

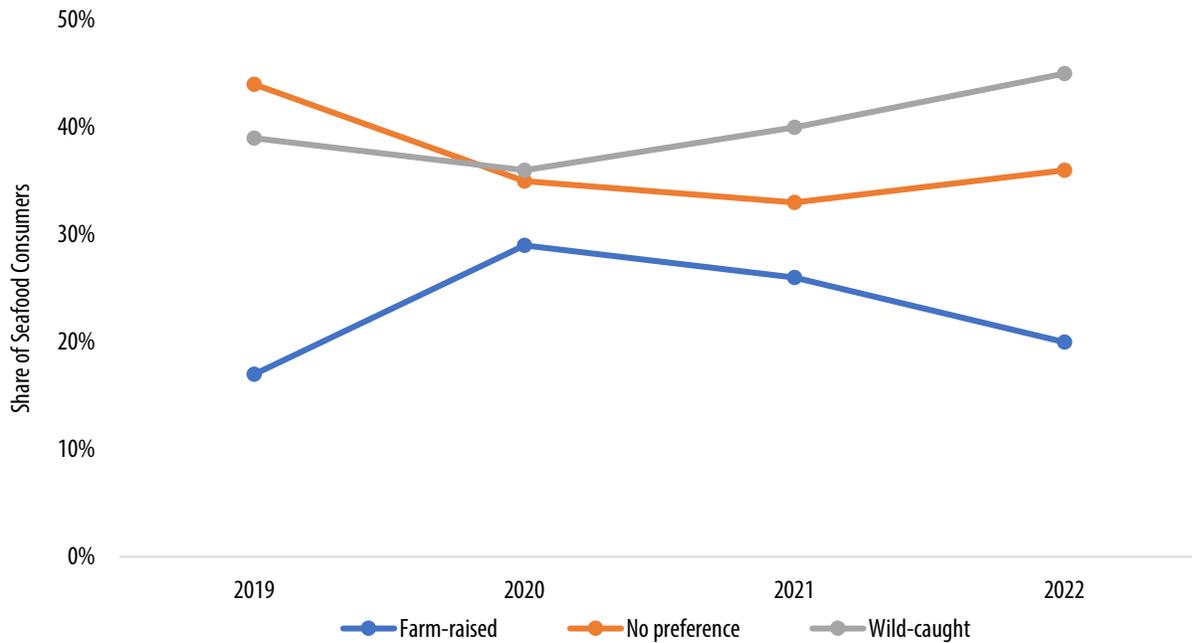
Exhibit 1.4.4. Production or Sourcing Model Preferences Among Seafood Consumers, 2022



Source: Power of Seafood 2023, FMI-The Food Industry Association (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023)

Based on data reported in the FMI Power of Seafood 2023, Exhibit 1.4.5 displays a four-year trend in seafood production model preferences. From 2020 to 2022, seafood consumers increased preferences for wild-caught seafood. The share of seafood consumers reporting farm-raised preferences declined from 29% in 2020 to 20% in 2022 (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023).

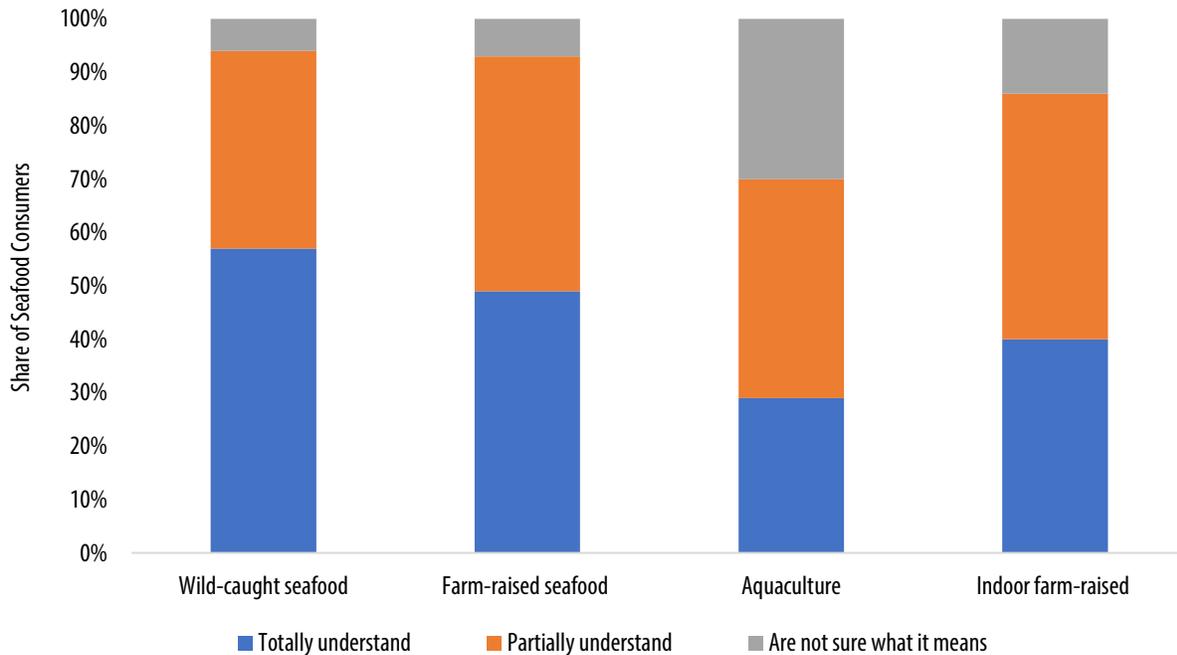
Exhibit 1.4.5. Trend in Seafood Production Model Preferences, 2019 to 2022



Source: Power of Seafood 2023, FMI-The Food Industry Association
(fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023)

Seafood consumers participating in FMI’s Power of Seafood 2023 survey indicated they had relatively good understanding of wild-caught and farm-raised terms used to market seafood. All but 6% and 7% of participating seafood consumers said they had total or partial understanding of these terms. Of the four terms assessed, “aquaculture” had the lowest reported understanding. Exhibit 1.4.6 compares understanding level of all four terms. Among seafood consumers, less than one-third said they totally understood what “aquaculture” means, and 30% said they were unsure about the term’s meaning. With respect to the “indoor farm-raised” term, 14% didn’t know the term’s meaning. Four in 10 seafood consumers totally understood its meaning, and close to half said they partially understood the “indoor farm-raised” term (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023).

Exhibit 1.4.6. Understanding of Production Model Terminology Among Seafood Consumers



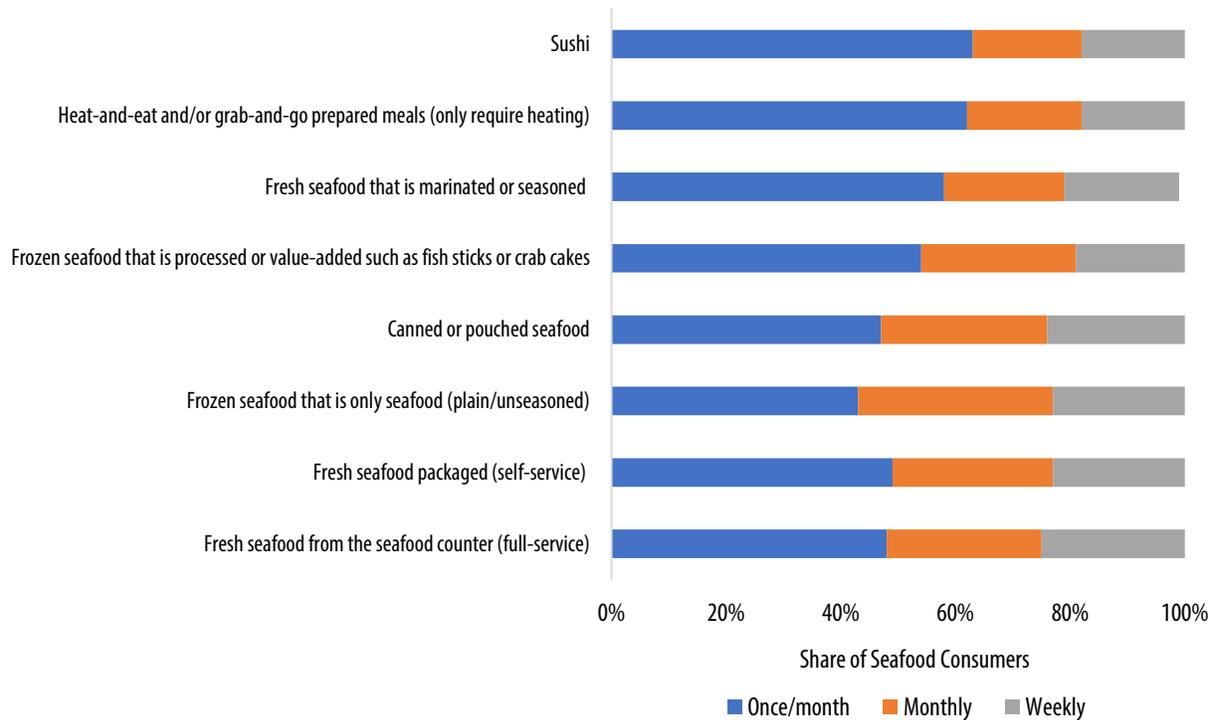
Source: Power of Seafood 2023, FMI-The Food Industry Association (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023)

Value-Added Opportunities

Value-added products generate about 20% of seafood sales, according to IRI data. Therefore, the value-added category has been about twice as important to encouraging sales revenue for seafood as it has been for meat (provisioneronline.com/articles/112144-2022-seafood-report-the-breakthrough-continues).

In its Power of Seafood 2023 report, FMI detailed the extent to which consumers purchase value-added products and other seafood. As shown in Exhibit 1.4.7, 46% of consumers said they buy frozen processed or value-added seafood at least monthly. Fresh marinated or seasoned products find themselves in 41% of shoppers’ carts at least monthly. Respondents were slightly less likely to purchase heat-and-eat/grab-and-go products (38%) and sushi (37%) at least monthly (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023). Consumers who lack cooking skills or confidence may particularly appreciate value-added seafood. Also, for consumers who want to enjoy a high-quality product but can’t afford higher restaurant prices, value-added seafood presents a solution (provisioneronline.com/articles/114299-seafood-report-2023-supply-challenges-and-market-opportunities).

Exhibit 1.4.7. Frequency of Consumers Purchasing Seafood Products at Retail



Source: Power of Seafood 2023, FMI-The Food Industry Association
fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023

For non-seafood consumers, value-added goods may serve as a gateway to seafood product trial. Among the non-seafood consumers who responded to FMI’s Power of Seafood 2023 survey, 47% said they would be very or somewhat likely to purchase partially or full prepared seafood items from the grocery store. The same share said they were very or somewhat likely to buy processed or value-added goods such as fish sticks or crab cakes (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023).

Examples of value-added products that are ready to eat or ready to cook include smoked fish, seafood cakes, seafood salads or fresh fish on a cedar plank for grilling — an activity with growth potential considering many consumers invested in grills or smokers during the pandemic (seafoodsource.com/news/foodservice-retail/seafood-meets-grill-gsmc-analysts-pick-top-2022-trends). Other value-added products include boiled shellfish, seafood platters, bacon-wrapped shrimp and shrimp kabobs (supermarketperimeter.com/articles/8945-seafood-industry-has-fresh-offerings-for-the-holidays). Prepared seafood represents a substitute to rotisserie or fried chicken — standard offerings in some stores (seafoodsource.com/news/foodservice-retail/seafood-meets-grill-gsmc-analysts-pick-top-2022-trends). Another value-added trend influencing the seafood marketplace is dry aging. This method will remove

water and yield a more tender final product. Other benefits associated with dry aging include flavor concentration, extended shelf life and fish skins crisping up better during cooking (provisioneronline.com/articles/114299-seafood-report-2023-supply-challenges-and-market-opportunities).

Not only do value-added products deliver on consumer-level demands, but they also may benefit other value chain stakeholders. For example, food service businesses grappling with staffing and developing supply chains have had growing interest in precut or preportioned products, which can save on preparation time, standardize products and reduce food waste. Other value-added products increasingly considered by food service operators, such higher education institutions and hospitality businesses, include those that are marinated or have added spices or stuffing (provisioneronline.com/articles/114299-seafood-report-2023-supply-challenges-and-market-opportunities).

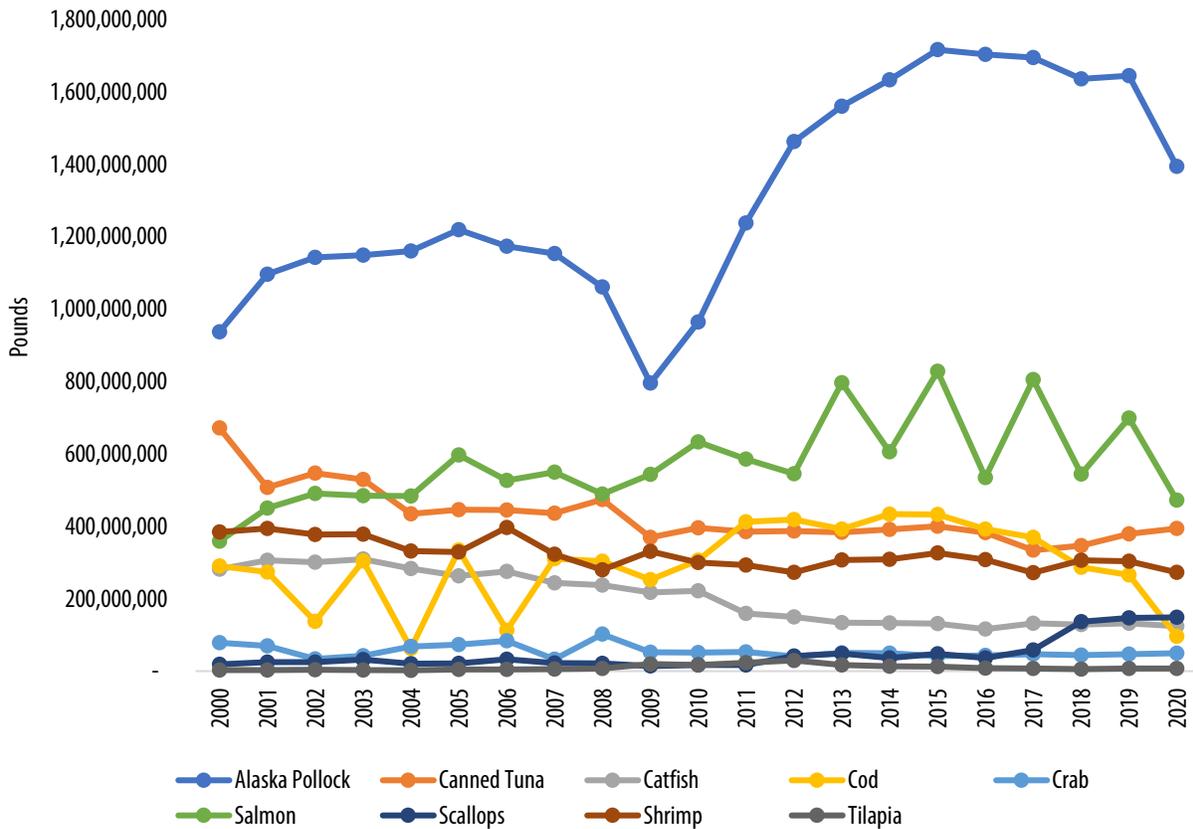
Introduced by Trident Seafoods, Protein Noodles show how innovation has led to new value-added opportunities for seafood. The high-protein noodles use pollock surimi as an ingredient, and they enable consumers who exclude gluten from their diets to enjoy dishes made with noodles

(alaskajournal.com/2018-11-28/fish-factor-trident-takes-symphony-honors-pollock-based-noodle).

Clean Eat Kitchen, a firm offering direct-to-consumer meal plans and prep, added the noodles to its keto-friendly product lineup in 2021 (prnewswire.com/news-releases/clean-eatz-kitchen-introduces-keto-friendly-alaskan-pollock-noodles-301289480.html).

U.S. seafood processors annually respond to a survey, and the responses — released by NOAA Fisheries — suggest the extent to which processors employ workers and generate processed seafood goods. For 2000 to 2020, Exhibit 1.4.8 presents the trend in processed seafood product volumes. Throughout the two-decade observation period, Alaska pollock ranked first for volume processed in the U.S. Substantial processed Alaska pollock volume growth occurred between 2009 and the early 2010s. Ranking second, third and fourth were salmon, canned tuna and shrimp, respectively. Most of the salmon processed in recent years originated from three species: pink, sockeye and Atlantic. With respect to U.S. shrimp processing, roughly 37% of the processed volume in 2020 tied to breaded products. “Other” uses represented the balance of shrimp processed (fisheries.noaa.gov/foss).

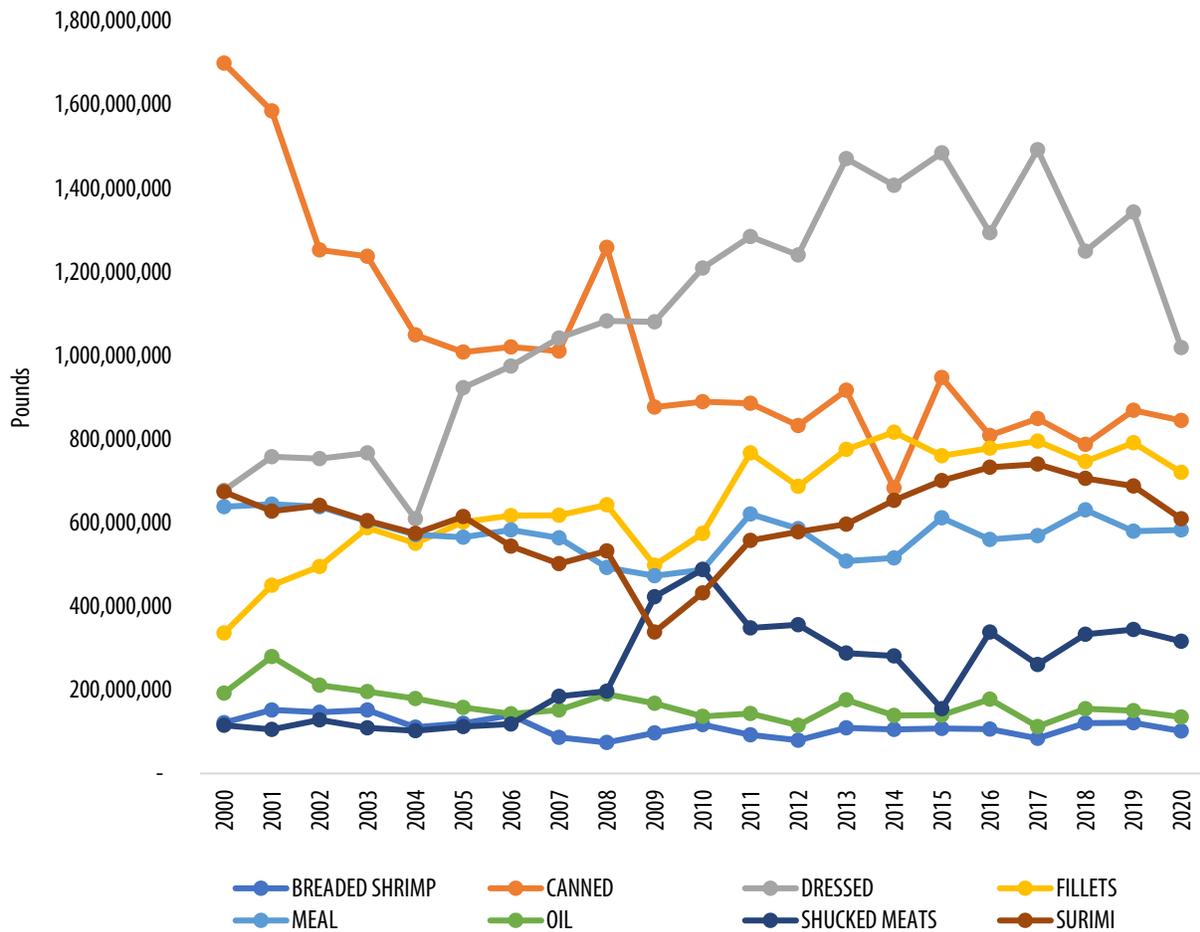
Exhibit 1.4.8. Top U.S. Processed Seafood Species



Source: NOAA Fisheries ([fisheries.noaa.gov/foss](https://www.fisheries.noaa.gov/foss))

Seafood processors in the U.S. convert raw material into various product formats. Exhibit 1.4.9 presents the volume of product formats processed between 2000 and 2020. “Dressed” products had the most processed seafood product volume since 2009. In recent years, the dressed volume had some year-over-year volatility; however, it largely followed a downward trend from the mid-2010s to 2020. U.S. processors also reported canned, fillets, surimi and meal as products processed at significant volumes in recent years — more than 500 million pounds in 2020. Shucked meats followed these formats in terms of product volume. Formats such as cakes and patties, smoked, steaks, chowders and fish sticks have been relatively minor contributors to U.S. processed seafood product volume ([fisheries.noaa.gov/foss](https://www.fisheries.noaa.gov/foss)).

Exhibit 1.4.9. Top Product Formats of U.S. Processed Seafood

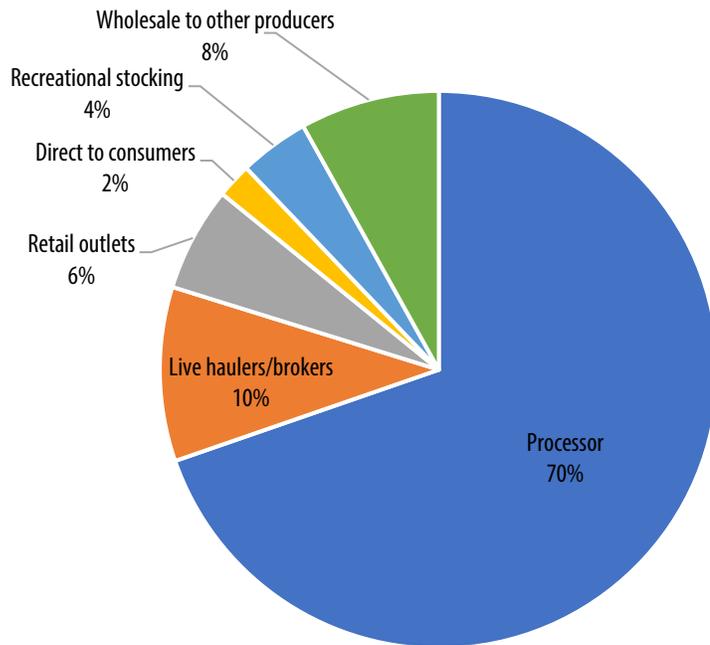


Source: NOAA Fisheries (fisheries.noaa.gov/foss)

Market Channels

Aquaculture producers may consider multiple market channels for the fish and seafood products they raise. Those responding to the 2018 Census of Aquaculture administered by USDA indicated the market channels that represented points of first sale for their products. See Exhibit 1.4.10. For food fish, aquaculture producers relied heavily on processors as the point of first sale. More than two-thirds of food fish sales originated from processors as the point of first sale. For producers pursuing processor sales, proximity to a processor would likely be important. Live haulers or brokers and wholesale transactions to other producers ranked second and third, respectively, for being points of first sale for food fish producers. These two market channels captured 10% and 8% of food fish sales, respectively (nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0021_0022.pdf).

Exhibit 1.4.10. Share of Aquaculture Producers' Food Fish Sales by Points of First Sale



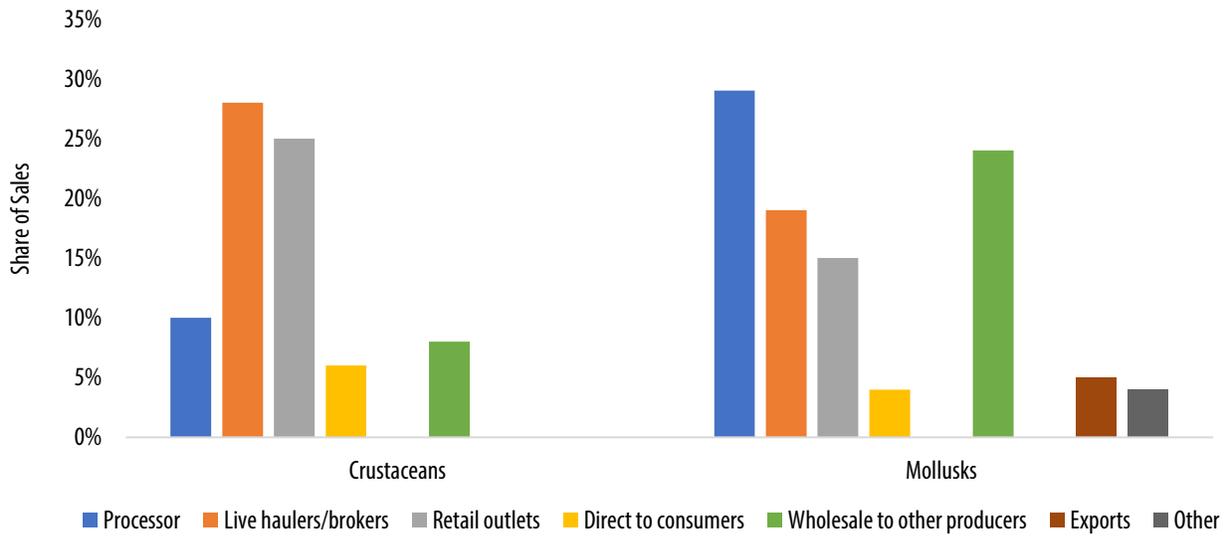
Source: USDA Census of Aquaculture 2018

nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0021_0022.pdf

On average, producers who sold crustaceans and mollusks relied less on any one point of first sale for their aquaculture products. Exhibit 1.4.11 breaks down the percentage of sales provided to varying points of first sale. Live haulers or brokers and retail outlets were the two points of first sale that captured the greatest shares of crustacean sales. Slightly more than half of mollusk sales originated collectively from two points of first sale: processors and wholesale transactions to other products

nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0021_0022.pdf.

Exhibit 1.4.11. Share of Aquaculture Producers' Crustacean or Mollusks Sales by Points of First Sale



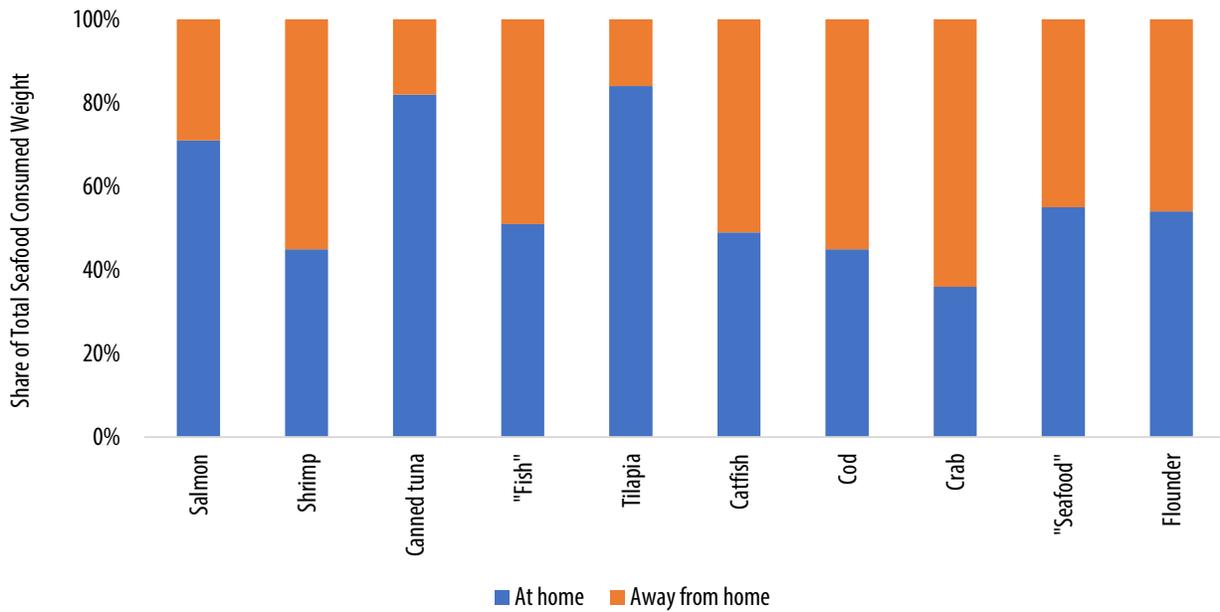
Source: USDA Census of Aquaculture 2018

nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0021_0022.pdf

When choosing appropriate market channels, producers should consider consumer behavior. Seafood consumers have been slightly more likely to source seafood from market channels consistent with at-home consumption than away-from-home consumption, according to a 2020 article from *Nutrients* that detailed National Health and Nutrition Examination Survey (NHANES) data. At-home consumption represented 63% of all seafood eaten. However, seafood expenditures have been greater for away-from-home consumption — 65% of total expenditures compared with 35% for at-home seafood expenditures (ncbi.nlm.nih.gov/pmc/articles/PMC7353403/pdf/nutrients-12-01810.pdf).

In the NHANES survey data, seafood consumption choices varied depending on whether U.S. adults ate meals at home or away from home. By weight, more than 80% of tilapia and canned tuna were eaten at home. Of total salmon eaten, 71% was part of at-home meals. See Exhibit 1.4.12. Nearly two-thirds of crab meat was consumed in away-from-home meals. Respondents also ate more shrimp and cod away from home than at home (ncbi.nlm.nih.gov/pmc/articles/PMC7353403/pdf/nutrients-12-01810.pdf).

Exhibit 1.4.12. Weight of Seafood Products Consumed At Home or Away From Home by NHANES Participants



Source: National Health and Nutrition Examination Survey via Nutrients
ncbi.nlm.nih.gov/pmc/articles/PMC7353403/pdf/nutrients-12-01810.pdf

Exhibit 1.4.13 illustrates that participating NHANES respondents sourced more than half of their seafood meals at stores during the observed period. They consumed most of those store-bought meals (88%) at home. Restaurants represented the other significant channel from which NHANES participants sourced seafood meals. Nearly one-third of seafood meals originated from restaurants. Of those, 75% were consumed in restaurants instead of at home. Gifts and several other sources (e.g., self-caught fish, institutional food) contributed less significantly to total seafood meals consumed by U.S. adults (ncbi.nlm.nih.gov/pmc/articles/PMC7353403/pdf/nutrients-12-01810.pdf).

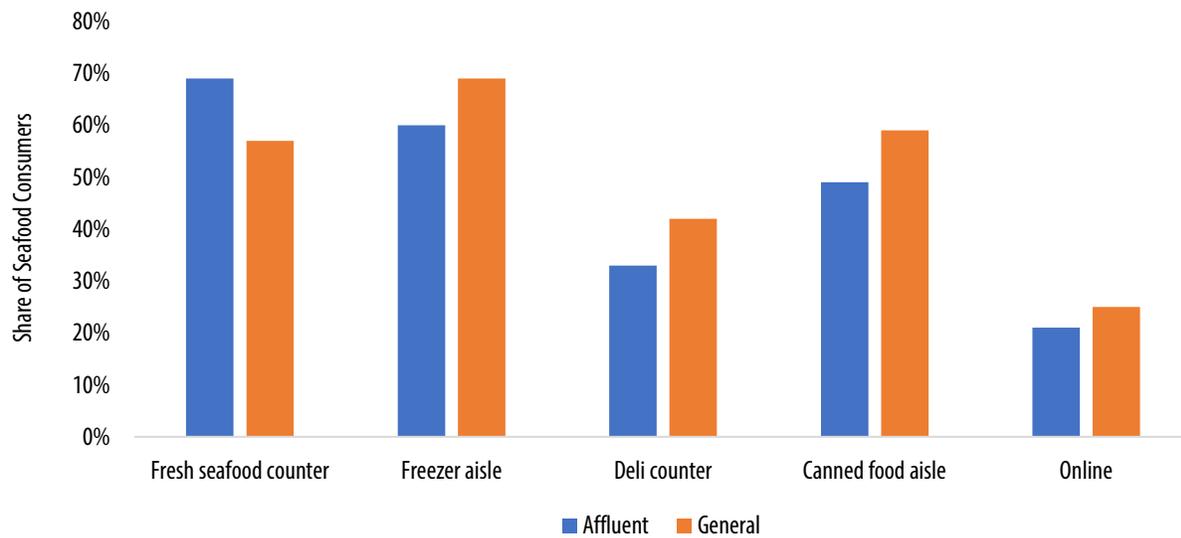
Exhibit 1.4.13. Source of Seafood Meals Consumed by NHANES Participants



Source: National Health and Nutrition Examination Survey via Nutrients (ncbi.nlm.nih.gov/pmc/articles/PMC7353403/pdf/nutrients-12-01810.pdf)

Within a store, consumers may purchase seafood products from multiple departments. Exhibit 1.4.14 presents the areas from where affluent and general seafood consumers — those participating in the Alaska Seafood Marketing Institute and Datassential study, which had results published in 2021 — said they purchased seafood at least once a month. Affluent consumers most commonly shopped at the fresh seafood counter and freezer aisle. General consumers tended to purchase seafood from the freezer aisle, canned food aisle and fresh seafood counter. Compared with affluent consumers, general consumers also were slightly more likely to buy seafood from the deli counter and online (alaskaseafood.org/wp-content/uploads/Datassential-Retail-Research-Final_2.pdf).

Exhibit 1.4.14. Grocery Store Areas Where Seafood Consumers Buy Seafood at Least Monthly

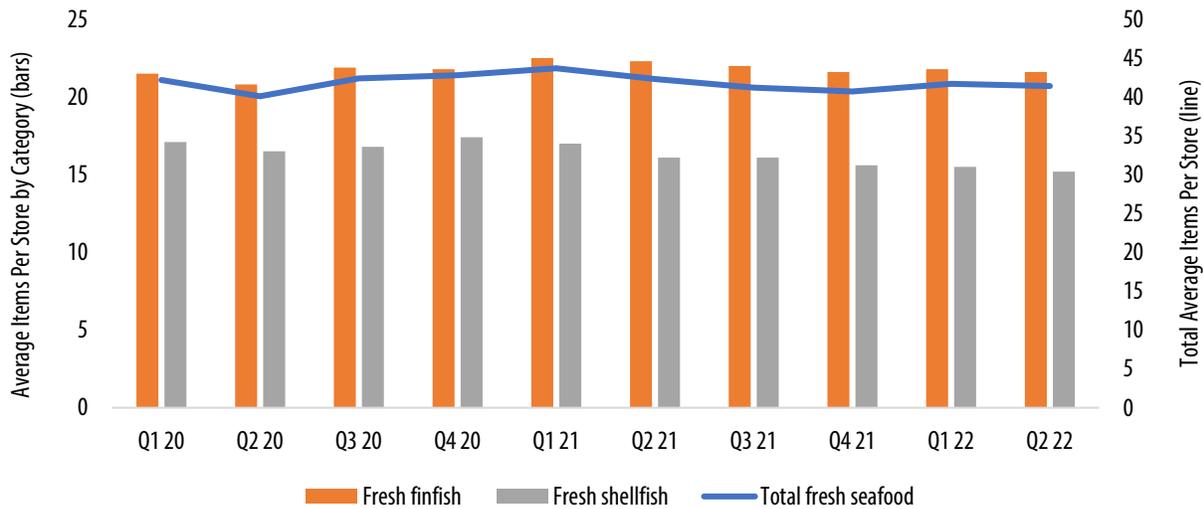


Source: Alaska Seafood Marketing Institute and Datassential (alaskaseafood.org/wp-content/uploads/Datassential-Retail-Research-Final_2.pdf)

IRI, a market research firm, tracks seafood product availability in stores. In recent quarters, retailers stocked between 40 and 44 fresh seafood products on average, according to data for multioutlet (MULO) retailers, which include those selling food and drugs; those categorized as mass, club, dollar or military stores; and Walmart. Note, Costco is excluded from the club store category (iriworldwide.com/IRI/media/Library/IRI-Seafood-Update-Aug-2022.pdf).

Exhibit 1.4.15 charts the trend in average items per store. Retailers have tended to stock more fresh finfish than shellfish. During the observed period, the number of fresh shellfish items declined — from 17.6 in first-quarter 2021 to 15.5 in second-quarter 2022. Fresh finfish also had a slight downward trend in products stocked — 22.5 in first-quarter 2021 to 21.1 in second-quarter 2022 (iriworldwide.com/IRI/media/Library/IRI-Seafood-Update-Aug-2022.pdf). Supply chain issues may have contributed to retailers having fewer seafood products to offer (nationalfisherman.com/us-seafood-sales-plunge-as-inflation-continues-to-bite). For unfamiliar seafood products priced at higher levels, particularly during inflationary times, retailers may choose to not stock those products altogether. This response stems from retailers anticipating that consumers may balk at higher prices and leave more product on the store shelf. Ultimately, the retailer may then have more spoilage-related losses to absorb (supermarketnews.com/seafood/why-supermarket-seafood-purchasing-dropping).

Exhibit 1.4.15. Average Fresh Seafood Products Stocked Per Retailer, 2020 to 2022



Source: IRI (iriworldwide.com/IRI/media/Library/IRI-Seafood-Update-Aug-2022.pdf)

An October 2022 report from IRI summarized the frozen seafood assortment found in retailers recently. On average, multioutlet retailers — those including food and grocery stores, drug stores, mass merchandisers, Walmart, club stores other than Costco, dollar stores and military stores — stocked 63 frozen seafood items. Compared with October 2021, retailers had reduced their frozen seafood products by 4.3%. However, the frozen product count average in October 2022 was 0.6% greater than in 2019 (iriworldwide.com/IRI/media/Library/IRI-Frozen-Update-Oct-2022.pdf).

Despite the slight downtick in retailers’ seafood assortment, U.S. fish and seafood marketers have introduced new products. Relatively fewer new product launches occurred in late 2020, but 2021 saw an increase, according to Innova Market Insights. Of the new fish and seafood products launched, Innova noted several themes. Product features exhibited by new products have included high protein content; omega-3 levels; and claims pertaining to wild-caught, local and sustainable sourcing. Convenience has been another product development priority, and product taste — in particular, traditional, ethnic and exotic flavors and recipes — have also driven fish and seafood product development (provisioneronline.com/articles/112144-2022-seafood-report-the-breakthrough-continues).

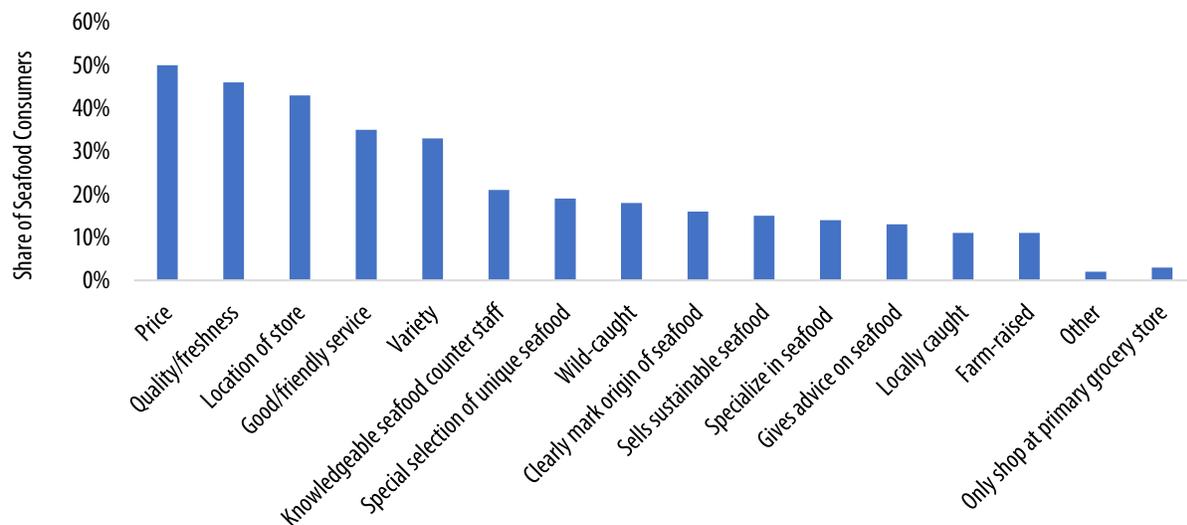
When retailers decide what products to stock, they consider multiple factors. Those include consumer preferences, product availability, price and freshness. Stores may justify stocking fresh products if they feel certain they can move high volumes. Items sold at lower volumes may be better suited for the freezer case (supermarketnews.com/seafood/here-s-how-be-savvy-seafood-stocker).

Grocery Stores

Depending on the grocery store, seafood products may appear in a fresh seafood counter, canned foods aisle, frozen case or snack foods department. BrandSpark surveyed more than 10,000 consumers who shop for groceries about the retailers they trust for fresh seafood purchases. IntraFish published the top 10 retailers in January 2023. HEB, Publix and Wegmans ranked as the top three retailers. Kroger, Price Chopper and Whole Foods Markets also appeared on the list at fourth, fifth and ninth, respectively, and have Missouri store locations (intrafish.com/markets/new-survey-shows-which-retailers-americans-trust-most-when-purchasing-fresh-seafood/2-1-1383438).

Consumers surveyed for the Power of Seafood 2023, which FMI-The Food Industry Association released in March 2023, named traditional grocery stores (35%), supercenters or discount stores (25%) and club stores (12%) as their primary seafood stores. They also identified price, quality or freshness and store location as the top three factors they consider when selecting a “primary seafood store.” Exhibit 1.4.16 details the other factors contributing to consumers’ choice of primary seafood store. Economic conditions likely explain why consumers ranked price in the top position for the first time. Price was slightly more important for occasional seafood consumers compared with frequent seafood consumers. Frequent seafood consumers found factors such as knowledgeable seafood counter staff, special selection of unique seafood and wild-caught product availability as more important than consumers who eat seafood only occasionally (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023).

Exhibit 1.4.16. Factors Consumers Consider When Choosing a Primary Seafood Store



Source: Power of Seafood 2023, FMI-The Food Industry Association (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023)

In March 2023, the project team visited St. Louis-area grocery stores to assess available seafood supplies. The stops included Asian markets, specialty grocers and local supermarkets. The following summaries share the seafood selections available at these stores and other observations.

- The two **Asian markets** had a wide seafood selection: live seafood, fresh seafood sold on ice, frozen boxed and branded seafood and frozen unbranded seafood. Live options included lobster, eel, crab, crawfish, striped bass, catfish and tilapia. Sold as fresh whole fish, the on-ice selection featured widely consumed species, such as tilapia, striped bass and shrimp, and less commonly available species, such as flounder, cuttlefish, croaker, red drum, rockfish and milk fish. For some species sold fresh on ice, signage described that fish had been wild-caught. Frozen cases had diverse fish species and preparations. Shrimp was commonly packaged in branded boxes, and some brands placed the “farm-raised” label on their packaging. Frozen unbranded seafood was available in multiple forms, including whole, nugget and fillet. The Asian markets also carried a wide assortment of fish and meat balls to use in soups or hot pot preparations. Species included in fish balls included pollock, cuttlefish, octopus, milk fish and simulated lobster. Some fish balls were packaged in branded bags, but consumers could also “mix and match” from a bulk freezer.
- At their seafood counters, **specialty grocers** (e.g., Whole Foods, Starrs, Straub’s, Fresh Thyme) primarily carried filleted fish and value-added preparations. Counters stocked fresh products such as salmon, red snapper, haddock, grouper, cod, tilapia, catfish, halibut, sea bass, yellowfin tuna, sole, trout and walleye. These were a combination of farm-raised and wild-caught selections. One sales associate indicated a general lack of education about farm-raised options, and another mentioned salmon as a particularly popular fish among the store’s shoppers. The fresh seafood counters had few whole fish, but trout and branzini were two whole fish available. The value-added options included ready-to-eat and ready-to-cook products. Grilled shrimp, baked tilapia, seafood salads, breaded shrimp, cod cakes, crab cakes, Creole crawfish cakes and scallop-shrimp cakes were among the ready-to-eat seafood available from specialty grocers. Ready-to-cook products included stuffed salmon fillets, crab cakes, bacon-wrapped sea scallops and marinated salmon. Packaged products in the fresh case included caviar, smoked salmon and seafood salads.
- **Local supermarkets** (e.g., Dierbergs, Fields Foods, Schnucks) had diverse products available from their seafood departments. The selections included salmon, snow crab, cod, shrimp, tilapia, swai, scallops, trout and lobster. In most cases, the fish stocked at counters had been filleted, but whole dressed rainbow trout was available at one location. Signage indicated that some products had been previously frozen, and some stores had clear labels to indicate seafood had been farm-raised or wild-caught. Counters also featured some value-added items, such as salmon burgers, stuffed salmon, salmon sausage, marinated fish fillets, seafood spreads or dips. Dierbergs also offers a

“seafood cooked free” service for shoppers. Local grocery stores also had a variety of branded, packaged seafood products — some value-added (e.g., breaded) and fresh and frozen options.

Fish Markets

Tightly focused on seafood products, fish markets may provide items not accessible from other retailers. Exhibit 1.4.17 lists fish markets operating in Missouri or those nearby that may serve Missouri customers.

Exhibit 1.4.17. Missouri and Nearby Fish Markets

| Name | City | State | Products | Description |
|--|-------------|--------------|---|--|
| Beasley Fish (beasleyfish.com) | Grafton | Illinois | Fresh river-caught fish, farm-raised fish and hot fish | Operates a fresh fish market; sells frozen items |
| Coral Reef Seafood (facebook.com/coralreefseafood) | Osage Beach | Missouri | Fresh and frozen seafood | Family-owned and -operated retail and wholesale fish market |
| Fabulous Fish Company (fabulousfishco.com) | Bridgeton | Missouri | More than 40 fresh seafood varieties; hundreds of frozen varieties; examples include crab, fin fish, lobster, salmon, shellfish, shrimp | Sells to restaurants and gourmet food purveyors; operates an e-commerce store; offers delivery in Illinois and Missouri |
| Murdock’s Fresh Fish and Seafood (murdocksseafood.com) | Kansas City | Missouri | Examples include whole fish, fillets and nuggets; crab legs; shrimp; lobster tails; crawdads; scallops | Neighborhood market offering fresh fish and seafood and grocery items |
| Ozark’s Ocean (ozarkfishseafood.com) | Stanton | Missouri | Selection includes halibut, swordfish, black sea bass, cod, haddock, pollock, striped bass, crab cakes, crab legs, oysters, lobster, salmon burgers, scallops, shrimp | Authorized Red’s Best dealer in central and east central Missouri; delivers frozen product to residential and commercial customers |
| Upstream Fish Company (upstreamfish.com) | Camdenton | Missouri | Shipping options include seafood dips, smoked salmon, crab cakes, crab and shrimp boil, carryout options include ready-to-eat cod, coco shrimp, garlic shrimp | Offers a shipping menu, carryout menu and DoorDash delivery |

Restaurants

As noted in the NHANES data cited earlier, Americans purchase roughly one-third of the seafood meals they consume from restaurants (ncbi.nlm.nih.gov/pmc/articles/PMC7353403/pdf/nutrients-12-01810.pdf). In January 2023, SeafoodSource published a restaurant outlook. It highlights multiple factors that will shape seafood performance at restaurants. One is strong demand for dining away from home. However, inflationary pressure may challenge seafood dishes, which already feature higher prices than some alternatives. For seafood that consumers feel less confident to prepare at home, consumers may be more inclined to continue choosing those options at restaurants if they perceive the price to be reasonable (seafoodsource.com/news/foodservice-retail/mixed-forecast-for-2023-us-restaurant-seafood-sales). As

mentioned earlier, some food service buyers purchase frozen seafood as a strategy to minimize food waste (provisioneronline.com/articles/112144-2022-seafood-report-the-breakthrough-continues).

Data from FMI-The Food Industry Association's 2023 Power of Seafood research pinpoints seafood species that consumers prefer to choose at restaurants versus cook on their own. The respondents showed a preference for restaurants preparing species that cost more or have more involved preparation needs. Examples include lobster; crab; premium fish such as snapper or sea bass; and mussels, clams, scallops or oysters. Consumers felt comfortable preparing shrimp, fresh salmon, cod, pollock, tilapia, trout, haddock and fresh tuna (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023). Datassential has tracked more salmon belly, black sea bass, langoustine and blackened fish appearing on restaurant menus. In 2022, Technomic reported the three species with the greatest increase in menu appearance were sturgeon, rock shrimp and haddock. According to the National Restaurant Association, charcuterie boards have also had strong performance (seafoodsource.com/news/foodservice-retail/mixed-forecast-for-2023-us-restaurant-seafood-sales). Another food service trend gaining steam involves purchasing whole fish and finding uses for nontraditional components — for example, stews from fish cheeks or collars (provisioneronline.com/articles/112144-2022-seafood-report-the-breakthrough-continues).

Limited- and full-service restaurants most commonly fry seafood. However, menus have increasingly featured newer products such as seafood bowls and tacos. In terms of popular flavors to complement seafood dishes, a 2023 seafood outlook from The National Provisioner mentioned citrus and Asian flavors (e.g., sweet soy, spicy mayo and sweet chili) (provisioneronline.com/articles/114299-seafood-report-2023-supply-challenges-and-market-opportunities). The National Restaurant Association identified Southeast Asian and Caribbean flavors as those trending in 2023 (seafoodsource.com/news/foodservice-retail/mixed-forecast-for-2023-us-restaurant-seafood-sales).

Direct-to-Consumer

The pandemic motivated many seafood sellers to consider direct-to-consumer marketing channels as food service buyers reduced their orders (seafoodsource.com/news/supply-trade/seafood-companies-large-and-small-adding-direct-to-consumer-sales). In many cases, direct-to-consumer models incorporate an online or e-commerce component, but the models adopted by seafood marketers do have some nuances. A 2022 report from Future of Fish categorized direct-to-consumer models in four categories: grassroots, membership, fishmonger 2.0 and online brand+. Exhibit 1.4.18 summarizes their features, which vary according to reliance on e-commerce, extent of fisher or producer involvement in order fulfillment and type of products handled (futureoffish.org/wp-content/uploads/2022/03/D2C-Report-2022_v5.pdf).

Exhibit 1.4.18. Direct-to-Consumer Seafood Sales Models

| Model | Description | Producer or fisher role | Products |
|-----------------------|--|---|--|
| Grassroots | Hyperlocal model involves selling to nearby consumers through dockside stands, door-to-door sales or online transactions; online maps or directories give sellers visibility | Fisher or producer completes sale or works with third-party logistics company | Catch of the day; minimally processed fish; some value-added products |
| Membership | Serve customer-members through community-supported fisheries that provide a share of catch or allow buyer to choose products, subscription seafood boxes or meal kits featuring seafood ingredients; online maps or directories give sellers visibility; e-commerce sites support sales; see Sitka Salmon Shares as an example | Community-supported fisheries often fulfill sales; otherwise, an intermediary often facilitates sales from fisher to consumer | Fresh products typical from community-supported fisheries; frozen products typical from seafood boxes or meal kits |
| Fishmonger 2.0 | Combines e-commerce sales and home delivery with offline sales options at brick-and-mortar stores, pop-ups or kiosks, which allow customers to have in-person brand and product interactions; the physical stores may serve as online sales fulfillment sites | “Fishmonger” serves as an intermediary between fishers and consumers; sometimes, logistics partners provide support | Fresh or frozen seafood; value-added seafood; other products |
| Online brand+ | Digitally focused firms or traditional business-to-business seafood companies (e.g., processors, distributors) sell online; no physical store; mainly handle individual orders but may offer “limited” subscriptions; company distributes product or partners with logistics firm to deliver to buyers; True Fin and PureFish are examples | Multiple fishers or producers provide product to stock in online stores | Fresh, frozen and processed seafood |

Source: Future of Fish (futureoffish.org/wp-content/uploads/2022/03/D2C-Report-2022_v5.pdf)

As noted in the Future of Fish publication, online tools have emerged to build awareness of direct-to-consumer seafood marketers. **Local Catch Network** follows this model. It connects seafood harvesters and seafood businesses to consumers through its Seafood Finder tool. The network lists seafood marketers who sell through various direct-to-consumer channels: seafood boxes, dock pick-up, farmers market, retail outlets, roadside stands and wholesale sales. These marketers list freshwater fish, marine fish, shellfish and other specialty seafood in the tool. For a seafood harvester or business to join the network, it must meet several expectations. Those include aligning with the network’s core values; expressing a willingness to share knowledge and resources within the network; selling through direct-to-consumer channels, which include restaurants and institutions; and supporting anti-racist, food justice or food sovereignty activities. Find more information at localcatch.org. The following are two examples of businesses with Local Catch Network listings.

- **Schoolhouse Fish Co.** operates its own e-commerce shop stocked with gift card options, smoked coho and apparel. It also distributes fish through fish clubs located throughout the country,

including one in Columbia, Missouri. A club forms when a local “captain” recruits a “crew” to order at least 80 pounds to 100 pounds of seafood products. It may place as many as five seasonal shipments, but the business recommends new clubs to place no more than two orders in a year. To recognize captains for arranging orders, they receive free fish — 10 pounds. Schoolhouse Fish Co. then ships product to participating clubs via Alaska Air, and captains retrieve the shipments from the airport (schoolhousefish.com). The business plans the bulk offerings each month, and the types of seafood included vary (docs.google.com/forms/d/e/1FAIpQLSeL3Kg7sL-d88BsWSzFnSsVX2n6CdDLdr-raU2tRCccb-nD0w/viewform).

- **Sitka Salmon Shares** provides seafood packages to consumers who are subscriber-members. The products included in a box rotate monthly to feature fresh, seasonal options. On its website, Sitka Salmon Shares features its seafood sourcing partners. In March 2023, member-subscribers had three main box choices: seafood box at \$139, premium seafood box at \$159 and salmon box at \$129. Each box provides 4.5 pounds of product. The online market also offered 3-pound options for coho salmon, albacore tuna, Pacific cod and salmon burgers. For consumers interested in a trial, Sitka Salmon offers an intro box. Priced at \$99, the intro box includes two fish species. In addition to receiving boxed seafood, Sitka Salmon subscriber-members also gain access to recipes, culinary tips, culinary classes and a private Facebook group (sitkasalmonshares.com).

Some state-level programs have emerged to build demand for seafood caught or raised by in-state seafood businesses. They incorporate technology to different degrees to boost seafood business awareness and sales. The following summaries highlight three such programs in Alaska, Louisiana and Rhode Island.

- Provided by the Alaska Seafood Marketing Institute, a new **Alaska Seafood Online Marketplace** enables seafood suppliers to make their products visible to industry buyers and home cooks. Suppliers and industry buyers have the option to register for the site, and consumers may search the supplier directory to identify businesses that fulfill direct-to-consumer sales. The searchable directory enables consumers to filter suppliers by several characteristics, including whether a supplier has received sustainability-related certifications and owns processing plants (alaskaseafood.org/resources/marketplace). The Alaska Seafood Marketing Institute also provides direct marketing information for Alaska seafood businesses. Released three times a year, the Alaska Seafood Direct Marketer Toolkit, which is distributed via email and posted online, summarizes available resources (alaskaseafood.org/resources/?keyword=direct+marketer+toolkit).
- Louisiana has introduced a regional program meant to encourage more direct-to-consumer sales of seafood produced in the state. Named **Louisiana Direct Seafood**, the initiative divides the state’s southernmost area into four regions. Using an online tool, consumers may choose a region

and load seafood products and fishers available nearby. The site also includes e-commerce functionality, and it lists several products available for sale. The Louisiana State University Ag Center and Louisiana Sea Grant administer the program, which receives funding from the Louisiana Office of Community Development and Gulf States Marine Fisheries Council. More information is available at louisianadirectseafood.com.

- Rhode Island’s Department of Environmental Management directs consumers to two online tools to identify seafood from commercial fishermen. The **Local Seafood Finder in Rhode Island** maps locations for lobstermen, fishermen with direct-to-consumer sales and seafood markets. The website also links to other resources such as the Rhode Island Oyster Trail. Rhode Island also urges consumers to use the **FishLine** app (dem.ri.gov/riseafood/buy.php). FishLine serves as a directory of seafood suppliers throughout the world. At no cost, fishermen, seafood markets, farmers markets, restaurants and cafes and community-supported fisheries may list products on the site. Consumers may access the information from a phone app or website (apps.apple.com/us/app/fishline-local-seafood-finder/id602986493).

The following websites serve as four other direct-to-consumer examples. All rely on e-commerce.

- **ChopLocal** offers an e-commerce option for farms and butcher shops. Self-described as “an online farmers market,” the website maps nearby farms and butcher shops that sell products such as beef, pork, chicken, turkey and seafood. It then allows consumers to complete transactions online. The product can be picked up at the farm or shop or shipped to a consumer’s home. ChopLocal lists two farmers or butchers marketing seafood. Based in Maine, Fisherman’s Net sells products such as fresh Maine lobster, frozen steamed brown crab and live Jonah crab on the site. Based in Iowa, Midland Co. produces Pacific white shrimp in a recirculating aquaculture system. On ChopLocal, Midland Co. has a waitlist for its fresh shrimp (chopllocal.com).
- **E-Fish** operates as an online market to facilitate direct-to-consumer sales for fish harvesters. The website manages the transaction, but the “harvester direct” model means the harvester takes responsibility for packing and shipping in-season product. The business features harvesters listed on the site, and the website enables consumers to choose product sourced from four regions in the U.S.: East Coast, West Coast, Alaska and Gulf Coast. The site lists wild-caught and farm-raised products. Fresh, frozen and live options are available (e-fish.com).
- **Fish Fixe** provides customers with two purchase formats: one-time orders or recurring shipments. Each shipment includes 16 portions weighing 6 ounces each. The customer may choose the portions included in a box or allow Fish Fixe to make the selections, but options available do vary by season. Fish Fixe distributes frozen fish sourced from suppliers who catch fish in the wild or

raise fish in farms. In March 2023, the company listed these farm-raised selections: Norwegian salmon, ocean-raised cobia and freshwater rainbow trout. All aquaculture suppliers must have Best Aquaculture Practices and Aquaculture Stewardship Council certification (fishfixe.com).

- **WalleyeDirect.com** markets fish including walleye, perch, bluegill, crappie and trout. The business, which operates a distribution facility in Nebraska, sources many fish from Canada. Farms in Idaho or Canada supply rainbow trout to WalleyeDirect.com, and the business imports lutefisk from Norway. Many fillets available on the website have been processed using individually quick-frozen technology. Other products are vacuum-packaged (walleyedirect.com).

Note, despite the pivot seafood marketers have made to sell their products online, relatively few seafood consumers have converted to buying their seafood online, according to consumer research published in FMI's Power of Seafood 2023 report. In 2022, FMI found one-third of seafood consumers said they bought seafood online compared with 38% who said they purchased seafood online in 2021. Of seafood consumers who shop online for seafood products, they on average buy 45% of their seafood online. The most commonly fresh or frozen seafood products purchased online in 2022 were fresh salmon (44%), cooked shrimp (36%), fresh tuna (35%), raw shrimp (34%), crabs (33%), other fish (32%) and lobster (30%) (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023).

In its 2022 report, Future of Fish identified several key points for seafood marketers to consider as they seek to make direct-to-consumer sales. The following list summarizes several of these points:

- Direct-to-consumer sellers should incorporate data management systems into their operations. They can use data for purposes such as anticipating inventory needs, marketing strategically to customers and tracking food safety.
- Historically, retailers and restaurants have added value to seafood not only by linking sellers and consumers but also by providing some processing services. To provide a ready-to-eat or ready-to-prepare product in a direct-to-consumer channel, other entities must have the skills and resources to perform the necessary processing activities.
- Some direct-to-consumer models, such as subscription boxes or in-person sales, may acquaint consumers with new types of seafood and encourage them to try different types. This opens an opportunity to deliver more diverse options and possibly drive more seafood consumption.
- Traditional seafood sellers, such as grocery stores, hotels, restaurants and caterers, and new direct-to-consumer entrants create a more competitive selling environment.
- To compete, direct-to-consumer seafood businesses must invest in branding.

Packaging

Increasingly, seafood marketers have used packaging technologies already introduced to the meat and poultry categories. Examples include modified atmosphere packaging, active packaging and intelligent packaging. The former two control the in-the-package environment to promote product quality for a longer time. Intelligent packaging indicates the packaged product's condition (supermarketnews.com/seafood/right-packaging-adds-seafood-s-appeal).

For fillets, buyers tend to prefer vacuum packaging

(divcomplatform.s3.amazonaws.com/www.seafoodsource.com/images/7bbbc4e2014b2305810f1dfd62b8e721.pdf). Putting seafood in vacuum-sealed packaging tends to preserve freshness, flavor and product appearance (provisioneronline.com/articles/112144-2022-seafood-report-the-breakthrough-continues).

Typically made from plastic, vacuum packaging can take at least 100 years to break down. Researchers have explored an alternative that blends conventional plastic with bio-resin made from corn and yams. The bio-resin, which helps the packaging to decompose in 20 years, represents 20% of the blend (divcomplatform.s3.amazonaws.com/www.seafoodsource.com/images/7bbbc4e2014b2305810f1dfd62b8e721.pdf). Sustainable packaging opens an opportunity for fish and seafood marketers to add value to their products, according to Innova Market Insights. Packaging materials made with plant-based components or without BPA are examples (provisioneronline.com/articles/112144-2022-seafood-report-the-breakthrough-continues). Other plastic alternatives for seafood packaging applications include paper, paperboard and metal (supermarketnews.com/seafood/right-packaging-adds-seafood-s-appeal).

Promotion

In some cases, **educating shoppers** about seafood and how to cook it may stimulate interest and sales. Quoted in a December 2022 story from Supermarket News, an IRI representative described that younger consumers, including millennials, may need seafood preparation education before they're willing to make the investment in a relatively expensive seafood item

(supermarketnews.com/seafood/brighter-forecast-seafood-pricing). To help seafood marketers design promotional programs, FMI-The Food Industry Association and Seafood Nutrition Partnership developed a **communications calendar**. By month, the calendar provides ideas about educational and promotional messages to share with potential buyers. For example, the calendar suggests sharing

Seafood Storytellers Collective

For seafood businesses, the Seafood Storytellers Collective serves as an online community that provides access to marketing-related training, coaching and insights. Materials available to members educate about topics such as online marketing and content creation, and members have an opportunity to network with peers: seasidewithemily.ck.page/dd69d44f18

nutrition-focused content in January — a point when consumers may be setting their nutrition goals for the year (seafoodnutrition.org/resources/retail).

Cross-promotion may also encourage seafood sales. Consumers often need help visualizing how a seafood product becomes part of a meal. Therefore, creating a display or recipe that features complementary ingredients may support meal planning. When designing a cross-promotional program, selecting frequently purchased seafood items, such as salmon and shrimp, can maximize the program's effectiveness (supermarketnews.com/seafood/shoppers-have-seafood-meal-prep-fatigue-here-s-how-beat-it).

Groups throughout the U.S. organize **annual seafood cook-offs** to spark interest in creatively preparing seafood dishes. Each cook-off event takes a slightly different approach to building seafood demand. For example, Oregon's Port of Newport has hosted a wild seafood cook-off open to commercial fishing vessels. The winning team would receive \$10,000, and the event has a charitable element by donating proceeds to local organizations (portofnewport.com/2022-seafood-cookoff-info). Sea Grant Rhode Island has co-sponsored a cook-off event open to high school students. Using local seafood, students develop their own dishes, and Newport Restaurant Group adds winning recipes to restaurant menus (seagrant.gso.uri.edu/seafood-cookoff). The Great American Seafood Cook-Off, which the Louisiana Seafood Promotion and Marketing Board has hosted since 2004, welcomes chefs who win state cook-offs (louisianaseafood.com/great-american-seafood-cook). A 4-H edition of the competition allows young people from the southeastern U.S. to gain seafood preparation skills and learn about seafood itself. Since 2010, the 4-H seafood cook-off has co-located with the Great American Seafood Cook-Off (lsuagcenter.com/profiles/jmorgan/articles/page1660076311324).

Part of seafood consumption behaviors stem from **cultural traditions**. Seafood boils provide an example of how consumers throughout the U.S. enjoy a similar experience — group dining — but often use seafood products historically available in their local areas. Also known as a Lowcountry boil, Frogmore stew made from shrimp, sausage and corn has cultural significance in the southeast U.S. along the East Coast. New England lobster boils or clambakes add potatoes and corn to the featured seafood, but Mid-Atlantic tradition involves steaming crabs. In the Great Lakes region, fish boils include whitefish, onions and potatoes. Texas seafood boils often use blue crab and shrimp. Crawfish boils, shrimp boils and crab boils are common in Louisiana, depending on the season (seattletimes.com/life/food-drink/all-american-seafood-boils-communal-eating-at-its-best). Developing a locally relevant seafood tradition may create an opportunity to build seafood demand and attract tourists who want to participate.

Several **aquaculture certification programs** are available to producers who want to distinguish their products from others. To participate, producers must pay the relevant fees and meet standards, which vary by program but often relate to environmental stewardship and food and antibiotic use. Other guidelines may include hiring an outside firm to conduct initial and annual onsite audits. An audit serves as evidence that a producer adheres to certification expectations (edis.ifas.ufl.edu/publication/FA233). Aquaculture producers may consider the following certification programs as opportunities.

- Aquaculture Stewardship Council:* Certification from the Aquaculture Stewardship Council (ASC) indicates that a product has met all of the program standards, which address topics such as water quality, feed sourcing, animal welfare and worker treatment. All certification standards are posted online. The program offers certification to feed mills, farms and chain of custody entities. For farms, the process will take roughly 4.5 months. The certification process involves farms working with an accredited conformity assessment body (CAB) to fulfill an on-site audit, a draft audit report being made publicly available on the ASC website to allow public comment and the CAB deciding whether to certify the farm. Certified farms may place the ASC logo on product packaging — as long as the packaging also includes corresponding claim language to explain the claim’s meaning. The logo’s only available after signing a license (asc-aqua.org).



Logo use from the Aquaculture Stewardship Council’s Instagram account

- Best Aquaculture Practices:* Part of the Global Seafood Alliance, Best Aquaculture Practices (BAP) offers certification services at each value chain step. Open to hatcheries, aquaculture farms, feed and processing plants, the program stresses traceability and four other tenets: environmental responsibility, animal health and welfare, food safety and social accountability. It sets standards for factors such as stocking density, humane slaughter, transportation conditions, antibiotic use, employee wages and hours, feed use and water quality. You can find the specific standards online. To prepare for certification, businesses may enroll in the BAP Improvers Program, which offers



Logo iterations from the Best Aquaculture Practices website

technical assistance focused on ensuring businesses have done the work required to receive the certification. After applying to the program, the certification process takes 150 days to 180 days. Worldwide, more than 3,000 producers have received BAP certification (bapcertification.org).

- *GLOBALG.A.P.*: The aquaculture integrated farm assurance program from GLOBALG.A.P. applies to finfish, crustaceans, mollusks and seaweed. Inclusive of multiple production principles and criteria, the program sets expectations for food safety; animal health and welfare; environmental sustainability; worker well-being; social practice; and legal, management and traceability. Individual producers and producer groups who raise aquaculture in any type of production system may pursue the certification. Certification principles and criteria are available online. An independent, accredited certifier, which the producer may choose, will annually audit participating operations on 226 principles. Producers who comply with all principles labeled as “major musts” and 95% of “minor musts” will receive a one-year certification.



Logo from the GLOBALG.A.P. certified aquaculture consumer label for products guide

Registered trainers may help you with preparing for certification (globalgap.org/uk_en/for-producers/globalg.a.p./integrated-farm-assurance-ifa/aquaculture).

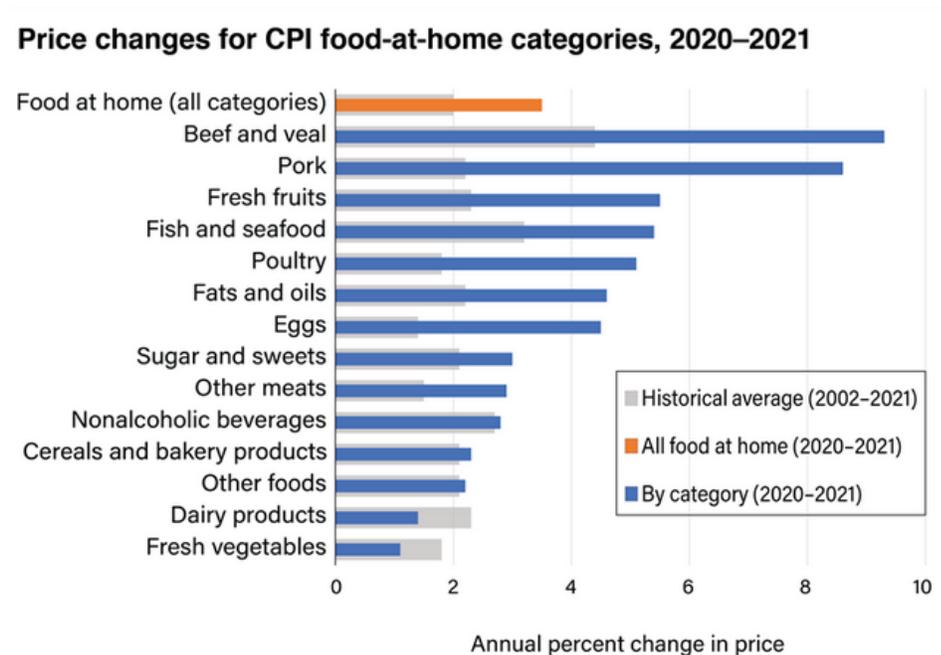
- *USDA Process Verified*: As of February 2023, the USDA Process Verified online database listed no aquaculture products using the label (ams.usda.gov/services/auditing/process-verified-programs).

In its Power of Seafood 2023 report, FMI-The Food Industry Association reported consumer awareness of four seafood certifications and ratings, and it reported the extent to which these certifications or ratings affect purchase or consumption likelihood. Frequent and occasional seafood consumers had the greatest familiarity with the Fair Trade certified label. Slightly more than one-third of frequent seafood consumers — those who consume seafood at least twice a week — said they were familiar with the Aquaculture Stewardship Council and Best Aquaculture Practices programs. Among occasional seafood consumers — those who consume seafood as often as once a week — roughly one-fifth said they were familiar with these programs. In terms of how these programs affect purchase or consumption decisions, 36% and 41% of frequent seafood consumers said the Aquaculture Stewardship Council and Best Aquaculture Practices programs, respectively, majorly impact their seafood purchases or consumption. These two programs major affected seafood purchase or consumption decisions for roughly one-quarter of occasional seafood consumers (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023).

Pricing

From 2020 to 2021, fish and seafood food price inflation exceeded the long-term average from 2002 to 2021, according to a USDA Economic Research Service analysis that used U.S. Bureau of Labor Statistics data. Exhibit 1.4.19 illustrates that fish and seafood food prices increased by more than 5% from 2020 to 2021. Of the food product categories tracked, fish and seafood ranked fourth — behind beef and veal, pork and fresh fruits — for price appreciation between 2020 and 2021 (ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=76961). The National Provisioner reported prices for many seafood products had largely retreated by late 2022. Three factors encouraged this price movement: lower ocean shipping costs, more adequate available supply and stabilized demand. Demurrage fees, detention fees and transportation costs had appreciated, however (provisioneronline.com/articles/114299-seafood-report-2023-supply-challenges-and-market-opportunities).

Exhibit 1.4.19. At-Home Food Price Inflation Trends, 2020-21



Note: CPI = Consumer Price Index.

Source: USDA, Economic Research Service using U.S. Department of Labor, Bureau of Labor Statistics Consumer Price Index data.

For non-seafood consumers participating in the Power of Seafood 2023 research — conducted by FMI-The Food Industry Association — cost ranked as the most impactful reason for not purchasing or eating seafood. Nearly half said seafood cost had a major effect on them not purchasing or eating seafood, and

25% said cost had a minor effect. Cost also ranked as the top factor that non-seafood consumers said might prompt them to try seafood. Two-thirds identified “good/sale price” as a potential motivator for seafood trial (fmi.org/forms/store/ProductFormPublic/power-of-seafood-2023).

At retail, stores may seek out products of varying price points. If a high price per pound may discourage consumers, then retailers may choose to sell the product at a price per portion (supermarketnews.com/seafood/why-supermarket-seafood-purchasing-dropping).

As mentioned previously, the project team traveled to St. Louis, Missouri, during spring 2023 to observe seafood product availability and pricing in various retail outlets. Exhibit 1.4.20 reports average prices for several species by type of retailer: Asian market, specialty grocer or local supermarket. In Asian markets, live bass and tilapia carried a premium relative to fresh or previously frozen options – almost twice as much for the live fish. Larger shrimp had price premiums compared with smaller shrimp, which are sold in counts. Average shrimp prices charged by local supermarkets and specialty grocers were comparable, and Asian markets tended to price shrimp at lower levels. The value-added shrimp products were priced higher than most shrimp counts, except for the largest shrimp. Comparing tilapia and trout, the trout tended to average a higher price. Average prices for fresh tilapia were somewhat similar in specialty grocers and local supermarkets, and fresh cuts were priced higher than the frozen alternative. Value-added tilapia product prices were more varied between specialty grocers and local supermarkets. In the trout category, fresh fish carried a higher price than frozen or previously frozen fish. No value-added trout pricing was available to observe.

Exhibit 1.4.20. Seafood Product Pricing, St. Louis Area, Spring 2023

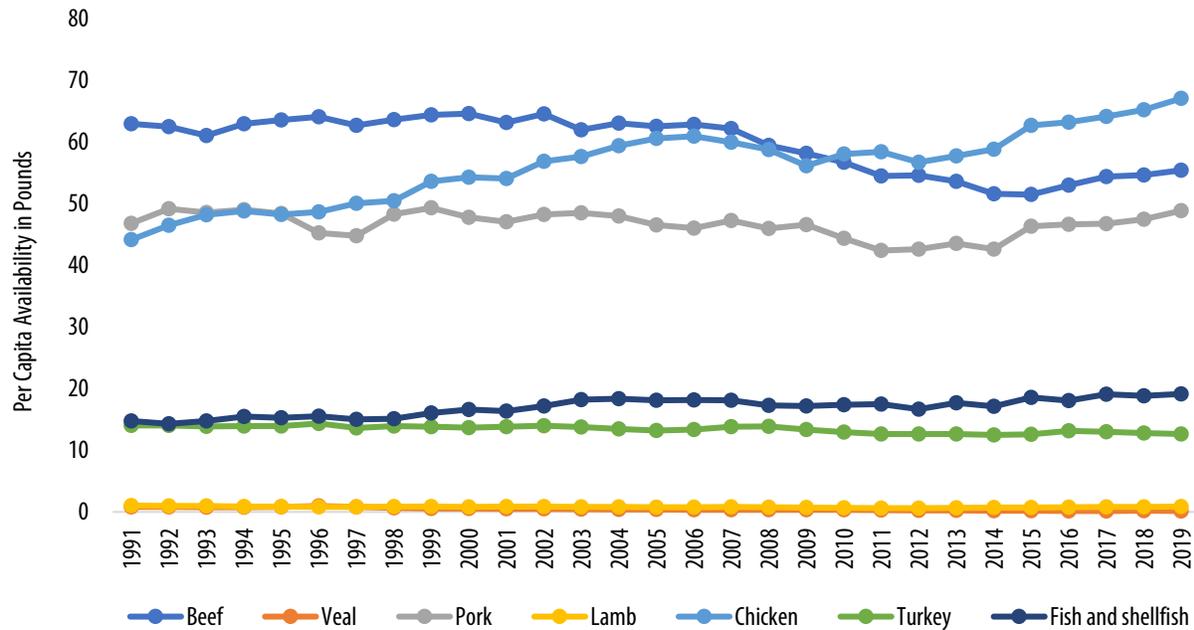
| Species | Product format | Retailer type | Price per pound | Number of price observations |
|----------------|-------------------|-------------------|-----------------|------------------------------|
| Bass | Live | Asian market | \$11.99 | 2 |
| | Fresh | Asian market | \$6.99 | 2 |
| | Previously frozen | Asian market | \$5.99 | 1 |
| | Fresh* | Specialty grocer | \$49.99 | 1 |
| Shrimp | 30/40 count | Asian market | \$6.16 | 3 |
| | 20/30 count | Asian market | \$8.32 | 3 |
| | Other | Asian market | \$5.50 | 1 |
| | 20/30 count | Specialty grocer | \$12.79 | 1 |
| | 10/20 count | Specialty grocer | \$18.32 | 3 |
| | Other | Specialty grocer | \$13.85 | 5 |
| | Value-added | Specialty grocer | \$17.49 | 5 |
| | 30/40 count | Local supermarket | \$12.66 | 3 |
| | 20/30 count | Local supermarket | \$15.09 | 3 |
| | 10/20 count | Local supermarket | \$19.65 | 5 |
| | Value-added | Local supermarket | \$17.49 | 4 |
| Tilapia | Live | Asian market | \$6.99 | 1 |
| | Fresh | Asian market | \$3.74 | 2 |
| | Previously frozen | Asian market | \$3.99 | 1 |
| | Fresh | Specialty grocer | \$9.32 | 3 |
| | Frozen | Specialty grocer | \$5.99 | 1 |
| | Value-added | Specialty grocer | \$18.74 | 4 |
| | Fresh | Local supermarket | \$9.24 | 2 |
| | Value-added | Local supermarket | \$14.40 | 7 |
| Trout | Previously frozen | Asian market | \$5.24 | 2 |
| | Fresh | Specialty grocer | \$16.99 | 3 |
| | Fresh | Local supermarket | \$13.79 | 5 |
| | Frozen | Local supermarket | \$8.49 | 1 |

* Imported wild sea bass

Competition

Within the animal protein category, fish and shellfish products face competition from meat and poultry. By species, the USDA Economic Research Service reports per capita availability data annually. The availability data serves as a proxy for consumption. Exhibit 1.4.21 illustrates chicken, beef and pork have led in per capita availability since 1991. Chicken took the top spot in the early 2010s and pushed beef into the second-ranking position. Fish and shellfish have ranked fourth since the 1990s. Although fish and shellfish per capita availability grew subtly since 1991, it's dwarfed by consumption of the “big three” proteins (ers.usda.gov/data-products/food-availability-per-capita-data-system).

Exhibit 1.4.21. Per Capita Animal Protein Availability, Boneless Weight, 1991 to 2019



Source: USDA Economic Research Service (ers.usda.gov/data-products/food-availability-per-capita-data-system)

The competitive set for seafood has expanded beyond other animal proteins. The Good Food Institute reported that 120 companies in 2021 had projects underway to develop alternative seafood products. Three-quarters of those companies had plans to create plant-based alternatives, but several were using cultivation and fermentation techniques. Of the 120, 41 had headquarters and production platforms in North America. Plant-based seafood sales have been relatively limited. According to market researcher SPINS, they totaled \$13.9 million in 2021 — a 42% increase relative to 2019 — and represented just 0.1% of total seafood sales. Of the sales made in 2021, three-quarters originated from plant-based fish (gfi.org/wp-content/uploads/2022/04/2021-Alternative-Seafood-Industry-Update.pdf).

A consumer survey conducted by Good Food Institute and Kelton Global found that 62% of respondents felt familiar with plant-based seafood — less than the 87%, 82% and 74% who felt familiar with plant-based beef, chicken and pork, respectively. The survey collected input from 2,500 18- to 65-year-olds who lived in the U.S. and roughly mirrored the U.S. population in terms of gender, age and regional demographics. Of those responding, 14% identified as “alternative seafood enthusiasts” because they found alternative seafood attractive and indicated they would very likely purchase these products in the future. Relative to the other respondents, these “enthusiasts” were more likely to be male, live in the Northeast, identify as Hispanic, reside in a large city and earn a higher household income (gfi.org/wp-content/uploads/2021/04/Choosing-alternative-seafood.pdf).

2. Bait Fish

2.1. Missouri Aquaculture Landscape

Of the 20 Missouri aquaculture producers who responded to this project’s survey, four sold bait fish in 2022, and one also sold crustaceans through bait markets. All four producers had diversified businesses and sold goods through other markets including ornamental markets, sport markets and food markets. The 2018 Census of Aquaculture reported 11 producers sold baitfish in Missouri, an increase from six in 2013. It estimated Missouri’s bait fish producers had \$982,000 in total sales and used 202 surface acres of water for bait fish production. Seven producers sold fathead minnows; three sold goldfish, golden shiners and other bait fish; and two sold crawfish. Most sales estimates were withheld to protect respondent confidentiality. Fathead minnows contributed 29% of total Missouri bait fish sales, and goldfish sales were minor as shown in Exhibit 2.1.1. In neighboring Arkansas, which led U.S. bait fish production with 68% of all sales in 2018, golden shiners accounted for 61% of total bait fish sales followed by fathead minnows at 35%. Nationally, golden shiners represented 50% of bait sales followed by fathead minnows (39%), suckers (4%), goldfish (3.5%), other baitfish (2%) crawfish (<1%) and other shiners (<1%).

Exhibit 2.1.1. Summary of Missouri Baitfish Producers and Sales by Species, 2018

| | | Arkansas | Missouri | U.S. |
|--|-----------------|----------|----------|----------|
| Total farms | | 29 | 11 | 168 |
| Total sales (\$1,000) | | \$22,159 | \$982 | \$32,778 |
| Water surface acres used to produce baitfish | | 17,973 | 202 | 24,450 |
| Crawfish (bait) | Farms | 3 | 2 | 31 |
| | Sales (\$1,000) | \$6 | (D) | \$209 |
| Fathead minnows | Farms | 21 | 7 | 114 |
| | Sales (\$1,000) | \$7,771 | \$281 | \$12,802 |
| Goldfish (feeder and bait) | Farms | 17 | 3 | 35 |
| | Sales (\$1,000) | \$845 | \$4 | \$1,162 |
| Golden shiners | Farms | 22 | 3 | 67 |
| | Sales (\$1,000) | \$13,537 | (D) | \$16,385 |
| Other shiners | Farms | - | - | 9 |
| | Sales (\$1,000) | - | - | \$203 |
| Suckers | Farms | - | - | 18 |
| | Sales (\$1,000) | - | - | \$1,363 |
| Other baitfish | Farms | - | 3 | 23 |
| | Sales (\$1,000) | - | (D) | \$654 |

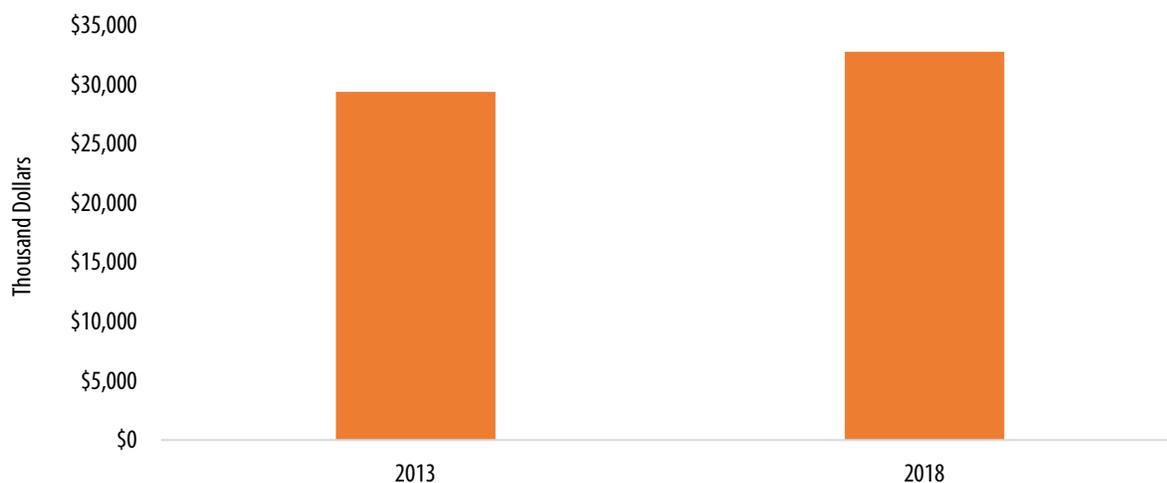
Source: 2018 Census of Aquaculture Table 16, USDA National Agricultural Statistics Service

https://nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0016_0016.pdf

2.2. Sales Trends

In the 2018 Census of Aquaculture, USDA collected responses from 168 farms. Collectively, these producers indicated their bait fish sales totaled nearly \$32.8 million. Exhibit 2.2.1 compares bait fish sales data from 2013 and 2018. Between these two years, aquaculture producers increased bait fish sales by more than 11% (nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/index.php). Adjusting for inflation suggests sales declined by 2%.

Exhibit 2.2.1. U.S. Aquaculture Producers' Bait Fish Sales



Source: 2018 Census of Aquaculture, USDA National Agricultural Statistics Service

(nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/index.php)

Of the total dollar sales recorded, Missouri aquaculture producers captured a 3% share. Top states for bait fish sales were Arkansas, Ohio, Wisconsin, and Minnesota

(nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/index.php). Live bait fish markets are relatively localized. Of the 28 states in the Mississippi River Basin, five— Arkansas, Minnesota, North Dakota, South Dakota and Wisconsin — are known to export live aquatic bait to states within the region, according to a 2019 pathway analysis conducted for the Mississippi River Basin Panel on Aquatic Nuisance Species (glc.org/wp-content/uploads/Live-Bait-Pathway-Report-Final-Report-June-14.pdf).

Two types of bait fish serve different markets. First, recreational anglers and commercial fishing companies use bait to catch fish. Anglers use bait fish when fishing for crappie, catfish, walleye and largemouth bass. Second, bait can be sold as feeder fish, which aquariums and zoos purchase to feed fish

and other animals (encyclopediaofarkansas.net/entries/baitfish-industry-3641). Other markets for feeder fish include private pond owners and wildlife management agencies seeking food for predator fish that they raise (glc.org/wp-content/uploads/Live-Bait-Pathway-Report-Final-Report-June-14.pdf).

Prepared for the Mississippi River Basin Panel on Aquatic Nuisance Species in 2019, a live aquatic bait pathway analysis report evaluated the extent to which bait fish raised in key states are directed to the feeder fish or bait markets. The following points highlight uses of major bait fish species produced by Arkansas farms, which contribute significantly to the U.S. bait fish industry. The pathway analysis found that Arkansas suppliers provide half of Mississippi River Basin states with most bait fish they use (glc.org/wp-content/uploads/Live-Bait-Pathway-Report-Final-Report-June-14.pdf).

- **Golden shiners:** Of the Arkansas-raised golden shiners, most are sold as bait fish. Some production volume goes to feeder fish or pond management markets.
- **Fathead minnows:** Feeder fish buyers procure 15% to 20% of Arkansas-produced fathead minnows. For individual producers, feeder fish may represent a larger share of sales.
- **Goldfish:** Many goldfish — an estimated 85% to 90% — are sold as feeder fish. However, goldfish measuring 2 inches to 4.5 inches may also be used to catch catfish. On farms that produce ornamental goldfish, culled fish may be sold through the bait market. Bait shops don't as reliably stock black salties — goldfish that lack gold coloring — but these fish can be used as bait to catch catfish or striped bass.
- **Hybrid bluegill:** These fish predominantly find use as stocking fish and bait fish. As live or cut bait, hybrid bluegill can be used to catch catfish.

To further explore bait sales, the annual “Sportfishing in America” report details spending by U.S. anglers. The U.S. Fish and Wildlife Service provided funding for preparing the report, which Southwick Associates produced for the American Sportfishing Association. Exhibit 2.2.2 summarizes bait-related spending included in the 2020 report. Spending on live, cut and prepared bait topped \$1.5 billion — 3.1% of total angler expenditures. The artificial bait category, which also includes lures and flies, captured a 2.2% share of total expenditures. Its sales exceeded \$1.1 billion (asafishing.org/wp-content/uploads/2021/11/Sportfishing-in-America-Economic-Report-March-2021.pdf). Note, not all bait fish sold in the U.S. originate from farm production. Wild-caught bait fish represent between 40% and 50% of annual bait fish sales (encyclopediaofarkansas.net/entries/baitfish-industry-3641).

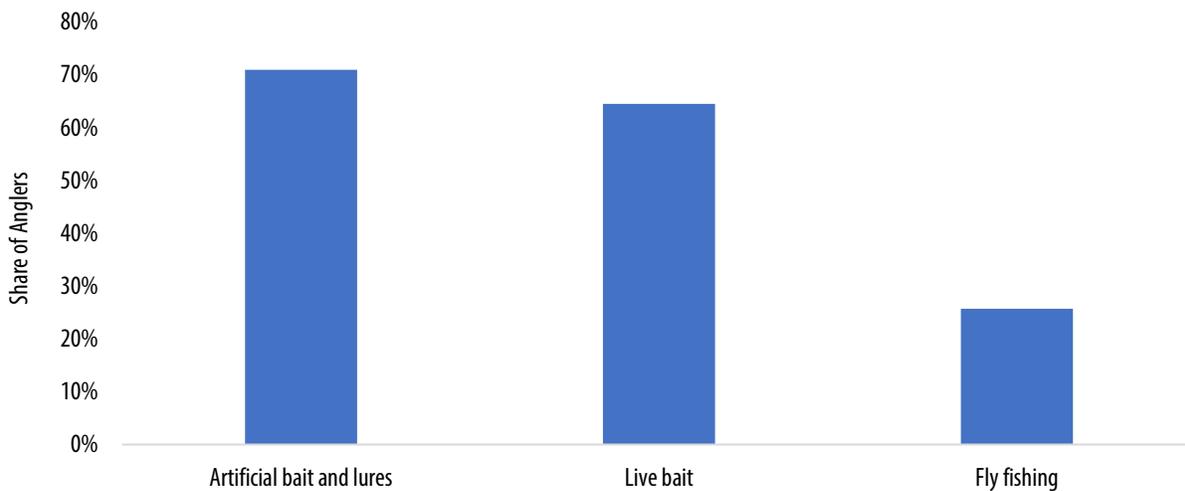
Exhibit 2.2.2. U.S. Angler Expenditures for Bait-Related Items

| Category | Spending | Share |
|----------------------------------|------------------|-------|
| Bait (live, cut, prepared) | \$1,562,852,171 | 3.1% |
| Lures, flies and artificial bait | \$1,110,875,707 | 2.2% |
| Total U.S. angler expenditures | \$51,226,258,721 | 100% |

Source: Sportfishing in America report, 2020 (asafishing.org/wp-content/uploads/2021/11/Sportfishing-in-America-Economic-Report-March-2021.pdf)

In July 2020, Southwick Associates released a study meant to segment anglers into groups to understand how their fishing behaviors and motivations varied. The average angler more likely purchased lures and bait than other types of fishing equipment in a year. Lures and bait had been purchased in the previous year by more than 80% of anglers. Exhibit 2.2.3 reports the share of study participants who said they use various types of bait each year. Nearly 71% said they use artificial bait. Roughly two-thirds use live bait. Fly fishing was less common (southwickassociates.com/angler-consumer-segmentation).

Exhibit 2.2.3. Types of Baits and Lures Used by Average Anglers in a Year



Source: Southwick Associates (southwickassociates.com/angler-consumer-segmentation)

Waterway owners or managers may restrict anglers from using live bait. The Missouri Department of Conservation posts special waterbody regulations on its website, and in some cases, these restrictions prohibit natural bait. For example, at multiple sites denoted as Blue Ribbon Trout Areas, the department allows anglers to use flies and artificial lures but not soft plastic bait, natural bait or scented bait. The department has seasonal bait restrictions in other cases. At several trout fishing locations, a catch-and-release season runs from November through January, and anglers may only use flies, artificial lures and unscented soft plastic baits (mdc.mo.gov/fishing/regulations/special-waterbody-regulations). Live bait is

also not allowed at many properties managed by the National Park Service, which states the live bait may lead to non-native or invasive species entering waterways ([nps.gov/subjects/fishing/responsible-fishing.htm](https://www.nps.gov/subjects/fishing/responsible-fishing.htm)). These rules have the potential to shape bait purchases. Other factors affecting bait sales include weather conditions, which influence whether anglers choose to fish or partake in other activities. Economic conditions also play a role. Therefore, balancing supply and demand may create challenges for bait fish producers (agmrc.org/commodities-products/aquaculture/aquaculture-fin-fish-species/baitfish).

To an extent, fishing circumstances and environments may dictate whether live or artificial bait produces the best outcomes for anglers. Live bait reliably attracts fish, though bait preferences do vary somewhat by species. Catfish and panfish species such as bluegill and crappie tend to be drawn to live bait. Bass and walleye, however, show a preference for well-presented artificial bait. Bass also will bite at live bait. Less experienced fishers may gravitate toward live bait because mastering artificial lure use takes practice, and lures are an investment. Fishing conditions also tend to dictate whether live or artificial bait will optimize fishing results. A column published by Curated suggests using live bait when you fish in a new or highly fished area and want to test whether fish are available. Another use case is when fishers experience clear weather and feel like fish could be timid after seeing the line or people on the banks (curated.com/journal/459000/when-to-use-live-bait-vs-artificial-lures).

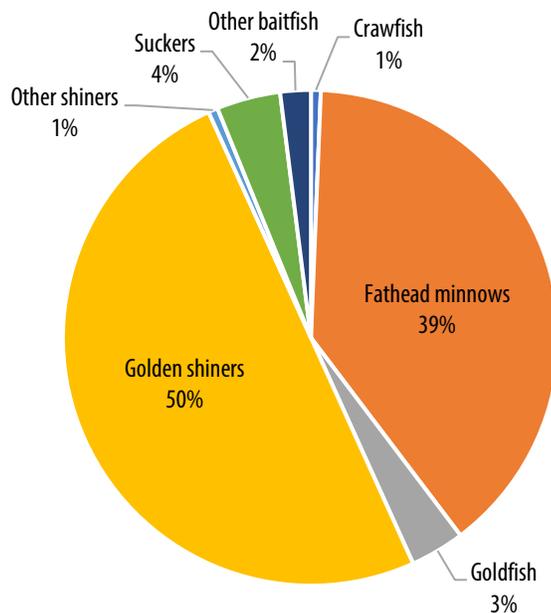
For anglers who choose to use live bait, they may purchase it from a vendor or harvest their own. Missouri posts live bait regulations on its website. These regulations include several components. For example, they permit individuals to catch live bait using traps, dip nets, throw nets, poles and lines or seines. However, fishers must observe daily limits and length limits, and they may not use game fish; game fish parts; or live common carp, grass carp, bighead carp or silver carp as live bait. Find the full regulation summary at mdc.mo.gov/fishing/regulations/live-bait-regulations. In some areas, wild-sourced bait fish populations have declined and ultimately led to shortages. Reasons for the weakening natural population include weather conditions leading to winter kills, drought, warm temperatures and invasive species limiting access to waters where bait fish live and grow. An August 2022 story from Minnesota Public Radio described grant-funded research focused on raising bait fish in different production models to offset the drop in natural bait fish populations and shorten the grow-out process. Interest has also emerged to combine bait fish production with greenhouse-based produce production — a type of aquaponics system (mprnews.org/story/2022/08/04/research-aims-to-address-bait-fish-shortage). Between 2017 and 2021, Minnesota, which doesn't allow minnow imports, experienced a 25% drop in its live bait harvest. Due to the shortage, minnow prices have roughly doubled, and fewer minnow dealers operate (startribune.com/fish-bait-minnows-shortage-minnesota-dnr-fishing-opener-live-bait/600267377/).

Winter kill in North Dakota has reduced the live bait supply there, too (inforum.com/live-bait-shortage-impacts-more-than-just-fishermen).

Sales by Species

In 2018, aquaculture producers traced half of their bait fish sales to golden shiners. Fathead minnows represented 39% of sales. Exhibit 2.2.4 contrasts sales market share for these two species and five other bait fish categories. Suckers and goldfish ranked third and fourth, respectively. Other species and crayfish followed (nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/index.php).

Exhibit 2.2.4. Bait Fish Dollar Sales Share by Species



Source: 2018 Census of Aquaculture, USDA National Agricultural Statistics Service (nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/index.php)

According to the Agricultural Marketing Resource Center, golden shiners, fathead minnows and goldfish tend to perform well because they typically accept manufactured feed, do well in captivity, tolerate handling and transport and pose minimal risk for adverse impacts (agmrc.org/commodities-products/aquaculture/aquaculture-fin-fish-species/baitfish).

Market Trends

The 2019 live aquatic bait pathway analysis prepared for the Mississippi River Basin Panel on Aquatic Nuisance Species included feedback from interviews conducted with industry representatives. The report

highlighted these four trends that respondents noted observing in the Mississippi River Basin region (glc.org/wp-content/uploads/Live-Bait-Pathway-Report-Final-Report-June-14.pdf):

1. **Among young people, fishing has declined as an activity.** When the number of anglers decreases, bait fish marketers have a smaller potential market to reach.
2. **Convenience stores have increasingly handled more bait sales.** Staff at these stores may lack knowledge needed to care for fish and provide high-quality service to bait shoppers. Not as many traditional bait shops are open for business, so that has contributed to the shift toward more convenience store sales.
3. **Particularly in northern states within the Mississippi River Basin region, fewer bait distributors now operate.** This means distribution footprints have grown. Several factors have triggered this change. They include the difficulty involved in operating a distribution business and the regulatory compliance requirements.
4. **Increasingly, fishers choose artificial bait.** This competition has reduced live aquatic bait sales.

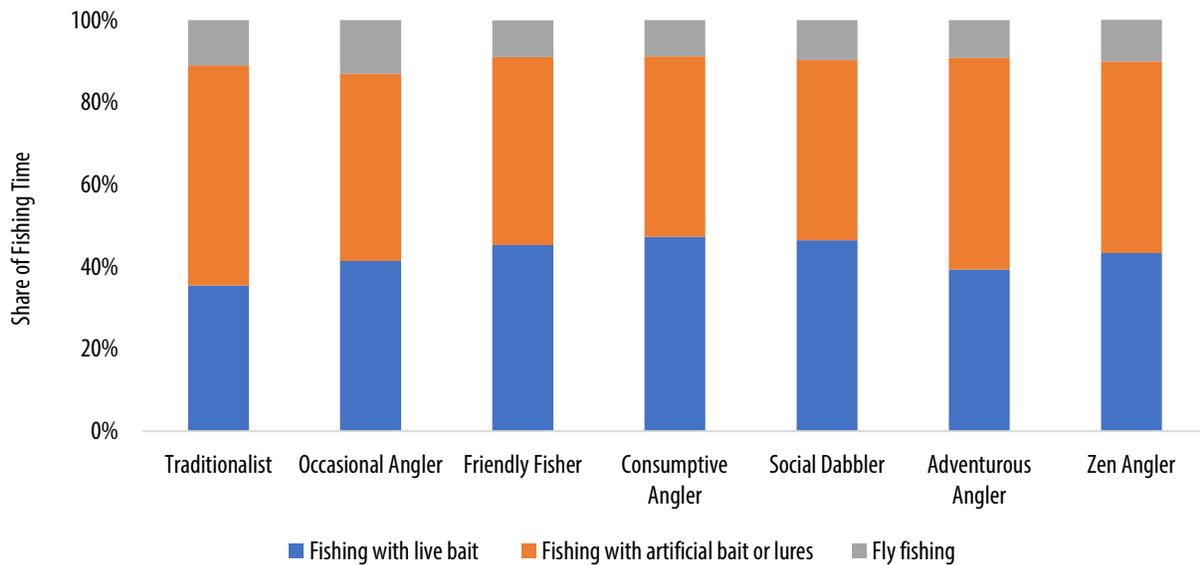
2.3. Marketing Considerations

Baitfish producers tend to develop long-term customer relationships. As a result, new entrants must find a way to carve out market share for themselves and develop a loyal customer base (store.extension.iastate.edu/product/Introduction-to-Aquaculture-in-the-North-Central-Region). The following discussion shares information that bait fish producers may use to market their fish.

Purchase Considerations

Bait choice varies by type of angler. In July 2020, Southwick Associates published a study that segmented anglers into seven groups based on their fishing behaviors and motivations. As a percentage of time spent fishing, Exhibit 2.3.1 summarizes bait and fishing technique use for these angler segments in a typical year. Two groups reported fishing with live bait more than with artificial bait or lures: consumptive anglers and social dabblers. These anglers spent 47.3% and 46.4% of their time, respectively, using live bait. The margin between live bait use and artificial bait or lure use was thin — within 5 percentage points — for friendly fishers, Zen anglers and occasional anglers. Traditionalists and adventurous anglers were the two groups with the greatest inclination to use artificial bait or lures instead of live bait when fishing (southwickassociates.com/wp-content/uploads/downloads/2020/08/ASA-Angler-Personas-Technical-Report-8-31-20.pdf).

Exhibit 2.3.1. Types of Baits and Lures Used Next Year or Typical Year by Angler Persona*



* n=3,142 for traditionalists; n=999 for occasional anglers; n=907 for friendly fishers; n=1,130 for consumptive anglers; n=691 for social dabblers; n=2,397 for adventurous anglers; n=1,206 for Zen anglers

Source: Southwick Associates (southwickassociates.com/wp-content/uploads/downloads/2020/08/ASA-Angler-Personas-Technical-Report-8-31-20.pdf)

The following summaries provide more information about the five market segments most likely to use live bait. Marketing to them may present opportunities to increase live bait use (southwickassociates.com/wp-content/uploads/downloads/2020/08/ASA-Angler-Personas-Technical-Report-8-31-20.pdf).

- **Consumptive anglers:** These anglers, which represent 12% of all anglers, primarily fish to catch food, carry on tradition and connect with an outdoor activity. They fish relatively frequently compared with most other segments. Consumptive anglers spend relatively little on fishing equipment and tackle. They tend to only purchase the basics.
- **Social dabblers:** When fishing, these anglers want to connect with family or friends. The social dabblers are a young, educated segment. They represent 12% of all anglers, but they have low fishing participation, and they spend relatively little on fishing equipment.
- **Friendly fishers:** Representing 16% of all anglers, friendly fishers want to fish to connect with family or friends, spend time outdoors and get away and relax. For this segment, family obligations and relaxing at home compete with fishing for time. Friendly fishers also tend to be fairly affluent, but they spend relatively little on items used for fishing.
- **Zen anglers:** The opportunity to get away and relax primarily motivates Zen anglers to fish. They represent a relatively large share of anglers at 18%. This segment tends to be older than others,

and they describe themselves as relatively advanced fishers. They are not an affluent group, but they show willingness to spend on fishing equipment.

- **Occasional anglers:** A segment self-described as not overly experienced with fishing, the occasional anglers ranked low in their plans to fish in the next year. Representing 13% of fishers, they cited relaxing at home and work obligations as activities they viewed as competing for time they could otherwise spend fishing. The challenge presented by fishing encourages occasional anglers to fish, and some may want to catch a trophy fish or targeted species.

Buyers typically look for bait that meets size standards. Therefore, producers grade bait fish into categories, and each category has size criteria. Exhibit 2.3.2 summarizes grades for bait species sold in Missouri, based on the 2019 live aquatic bait pathway analysis completed for the Missouri River Basin Panel on Aquatic Nuisance Species. To grade bait fish, producers tend to use vertical drag graders or floating box graders (glc.org/wp-content/uploads/Live-Bait-Pathway-Report-Final-Report-June-14.pdf).

Exhibit 2.3.2. Typical Number of Bait Fish Grades Available in Wholesale and Retail Markets

| Category | Wholesale grades available | Retail grades available | Grade size range |
|-------------------|----------------------------|-------------------------|------------------------------------|
| Golden shiners | As many as 6 | 2 to 4 | 1.5 inches to larger than 4 inches |
| Fathead minnows | As many as 4 | 1 to 2 | 1 inch to 3.5 inches |
| Rosy reds | 2 | 1 | 1 inch to 3.5 inches |
| Goldfish | -- | -- | 2 inches to 4.5 inches |
| Black salties | -- | -- | 2 inches to 5 inches |
| Hybrid bluegill | -- | -- | 3 inches to 5 inches |
| Ribbon leech | 2 | 4 or 5 | 50 per pound to 300 per pound |
| Horse leech | 2 | 4 or 5 | 50 per pound to 300 per pound |
| Northern crayfish | -- | -- | 1.5 inches to 3 inches |

Source: 2019 Live Aquatic Bait Pathway Analysis, Mississippi River Basin

(glc.org/wp-content/uploads/Live-Bait-Pathway-Report-Final-Report-June-14.pdf)

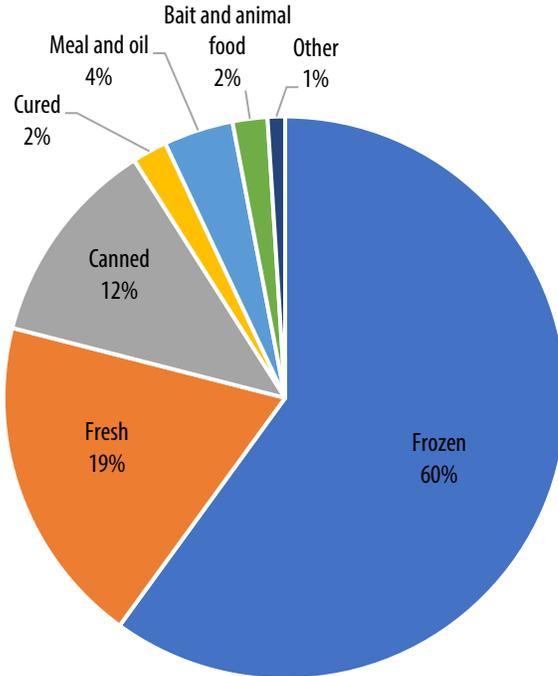
Meeting buyers' needs is critical to establishing a bait fish market presence. Offering a consistent supply and regular deliveries — sometimes as often as twice weekly — may help to attract small-scale buyers to begin purchasing bait fish. By providing a variety of bait fish species, producers may help buyers to offer diverse options to their customers. Dealers may particularly appreciate accessing multiple species to resell to customers who have different needs and product interests (agmrc.org/commodities-products/aquaculture/aquaculture-fin-fish-species/baitfish).

Handling leftover live bait may represent one reason that fishers choose alternative baits. Releasing bait into fishing waters has the potential to introduce aquatic invasive species and possible pathogens these fish may carry. Most states don't allow anglers to discard unused bait fish into waterways. However, published research suggest 20% to 65% compliance is typical. University of Minnesota researchers recently surveyed fishing license holders by mail about bait fish use in 2019, and they conducted an on-site survey at water bodies to collect more information about fishing behaviors. With respect to the mail survey, roughly 20% of those who had purchased live bait said they released the bait into water, but approximately half (52%) said they properly disposed the unused bait. Nearly one-quarter said they gave away unused bait, and just 14% said they used all live bait purchased their fishing trips. Age affected likelihood of releasing bait into water. Young respondents more often released live bait. Those who did report releasing live bait said they did so for multiple reasons, including it being convenient and contributing to the environment by providing food to larger fish and supplying bait fish to waterways (afspubs.onlinelibrary.wiley.com/doi/full/10.1002/nafm.10747).

Value-Added Opportunities

Of the fish processed annually, little is used for bait or animal food applications. Bait and animal food represented just 2% of processed fisheries product value in 2020. Exhibit 2.3.3 reports the share of 2020 processed product value stemming from multiple categories. Note, this chart reflects data for fisheries products made using domestically caught and imported fish. Edible fisheries products — the categories labeled as frozen, fresh, canned and cured — captured a 93% share of processed product value. All industrial products — meal and oil, bait and animal food and other categories — were minor contributors. As a reference, processed fisheries product value totaled an estimated \$11.2 billion in 2020 (media.fisheries.noaa.gov/2022-05/Fisheries-of-the-United-States-2020-Report-FINAL.pdf).

Exhibit 2.3.3. Processed Fisheries Product Value by Product Category, 2020



Source: 2020 Fisheries of the United States (media.fisheries.noaa.gov/2022-05/Fisheries-of-the-United-States-2020-Report-FINAL.pdf)

To preserve bait, suppliers may use methods such as curing, freezing or other processing. The preparation will vary depending on the bait material. Located in Snohomish, Washington, Triangle Bait and Tackle lists preserved bait options that it offers on its website: trianglebaitandtackle.com/the-store. These examples suggest the variety of preserved bait available to fishers. Maine-based Harmon Brook Farm offers frozen, salted and processed and preserved bait, which offers a long-lasting frozen option that shares many live fish features. The processed and preserved bait fish also may undergo multiple freezing and thawing processes without losing its integrity (harmonbrookfarm.com).

The 2019 live aquatic bait pathway analysis produced for the Mississippi River Basin Panel on Aquatic Nuisance Species lists aquatic frozen and preserved bait sold in the Mississippi River Basin. The following list highlights the species used as frozen and preserved bait widely throughout the region (glc.org/wp-content/uploads/Live-Bait-Pathway-Report-Final-Report-June-14.pdf).

- Shad: whole, sides and guts
- Skipjack herring
- Cisco
- Smelt

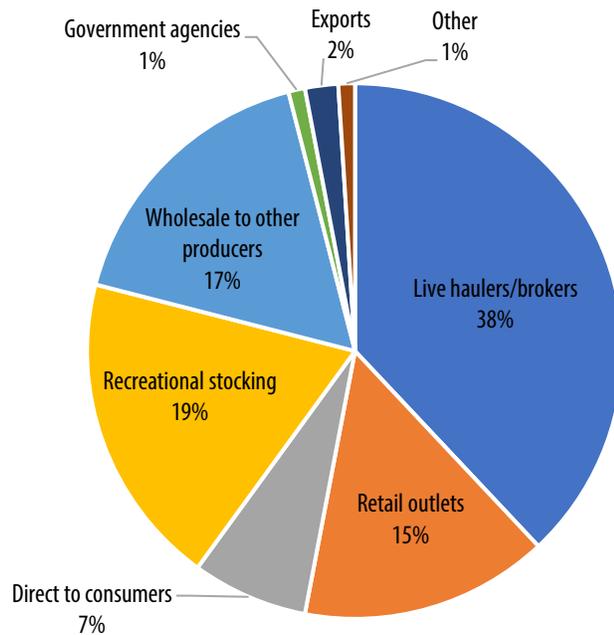
- Emerald shiners
- Bighead carp fillets
- Mooneye
- Saltwater shrimp
- American eels
- Salmon eggs
- Brown trout eggs
- Crayfish

Market Channels

Aquaculture producers who sell bait fish rely on a diverse mix of buyers. USDA conducted the latest Census of Aquaculture in 2018, and responding producers indicated that live haulers or brokers ranked first as a point of first sale for bait fish products. Live haulers or brokers tied to 38% of bait fish sales. Exhibit 2.3.4 illustrates that three other market channels notably contributed to bait fish sales, based on census results. Recreational stocking represented the point of first sale for 19% of bait fish sales. Wholesale to other producers and retail outlets followed at 17% of sales and 15% of sales, respectively (nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0021_0022.pdf).

Hauling trucks used to transport bait fish typically can handle 4,400 pounds to 5,500 pounds per load. These trucks feature small insulated, aerated compartments — as many as 44 compartments per truck. If water must be cooled, then haulers use ice. Semi-trailers and straight trucks could also move bait fish shipments. In some cases, distributors that purchase bait fish in the Mississippi River Basin may store bait fish at a distribution facility until orders are ready to be fulfilled (glc.org/wp-content/uploads/Live-Bait-Pathway-Report-Final-Report-June-14.pdf).

Exhibit 2.3.4. Share of Aquaculture Producers' Bait Fish Sales by Points of First Sale



Source: USDA Census of Aquaculture 2018

https://nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0021_0022.pdf

In its fishing participation and equipment purchases study conducted in 2017, Southwick Associates assessed where anglers tend to buy fishing gear and equipment. Among freshwater anglers, they most frequently purchased baits and lures from brick-and-mortar establishments, but a small share indicated buying product online. Brick-and-mortar stores contributing the most to bait and lure sales were outdoor specialty shops and local shops. The top websites for buying baits and lures were Amazon and eBay (asafishing.org/wp-content/uploads/2019/06/Trade-Insights-Report-2018.pdf).

Annually, bait dealers — any person or entity that sells live bait — must register with the Missouri Department of Conservation (mdc.mo.gov/fishing/regulations/live-bait-dealer-regulations). The department includes a map and directory of the registered businesses online: mdc.mo.gov/fishing/where-fish/live-bait-dealers. As of April 2023, the department listed 153 live bait dealers in the online directory. Exhibit 2.3.5 maps the dealers' locations. As shown, dealers operate throughout Missouri. However, businesses noticeably cluster near the Ozarks, mid-Missouri and the St. Louis region. Dealers included in this map represent possible markets for Missouri baitfish producers.

Exhibit 2.3.5. Missouri Live Bait Dealers, April 2023



Source: Missouri Department of Conservation (mdc.mo.gov/fishing/where-fish/live-bait-dealers)

Live bait dealers must adhere to Missouri law. They may only sell baitfish that has been procured legally and named in the state’s approved aquatic species list: mdc.mo.gov/fishing/regulations/approved-aquatic-species-list. Dealers must not sell live bait caught from waters of the state — unless a licensed commercial fisher caught the bait in commercial waters (mdc.mo.gov/fishing/regulations/live-bait-dealer-regulations).

A May 2020 story from Wide Open Spaces shared a distribution strategy to facilitate more direct-to-consumer bait sales — bait trucks that follow the food truck model. Stocked with bait and fishing equipment, these trucks could park in high-traffic areas that may lack ready access to other convenient live bait sources (wideopenspaces.com/fishing-business-idea-bait-trucks-that-are-run-like-food-trucks).

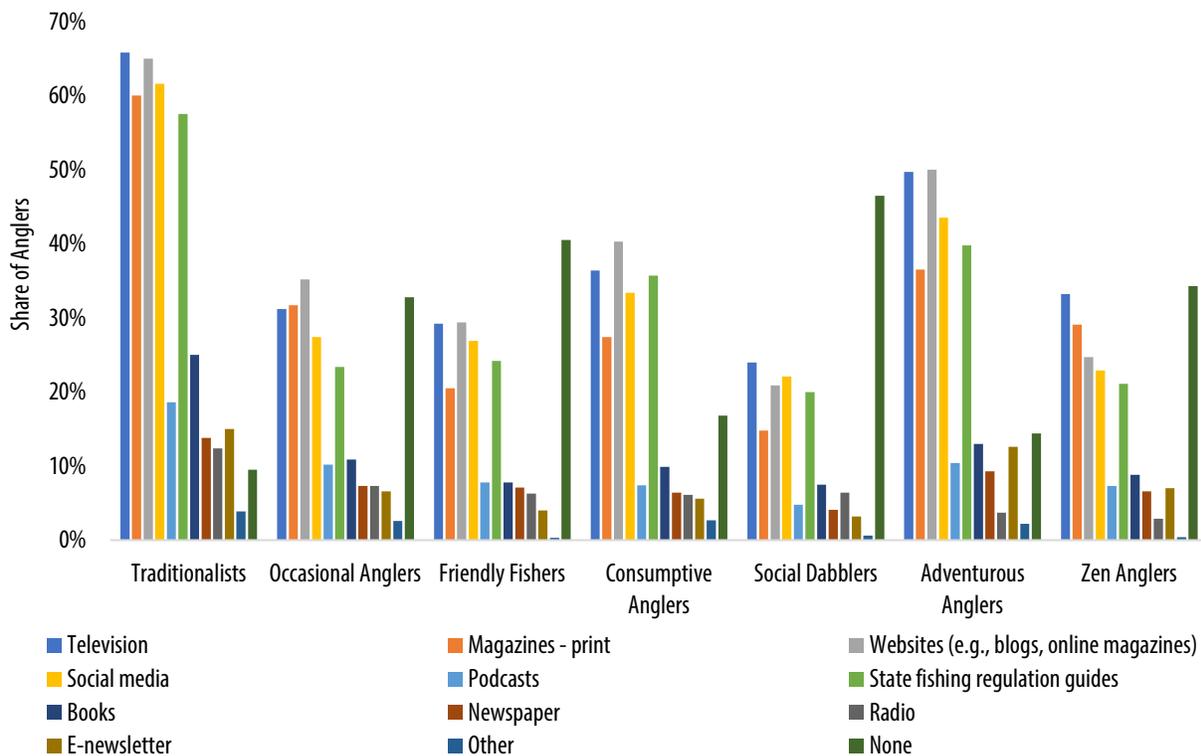
Packaging

When selling to bait shops, producers typically load and unload bait fish using 5-gallon buckets. Marked with 1-gallon increments, the buckets allow sellers to gauge weight of the fish they sell. The industry in the Mississippi River Basin assumes 1 gallon of fish totals 8 pounds. Producers catch bait fish with nets, allow water to drain and then fill buckets. After delivering to a bait shop, using 5-gallon buckets helps to track load size (glc.org/wp-content/uploads/Live-Bait-Pathway-Report-Final-Report-June-14.pdf).

Promotion

The Southwick Associates angler segmentation research published in July 2020 provides insights into media use among the seven persona categories. For each category, Exhibit 2.3.6 highlights the types of fishing-related entertainment that anglers had consumed in the year preceding their participation in the research. Based on these findings, disseminating marketing messages or information through fishing-related entertainment sources would most likely reach traditionalists, adventurous anglers and consumptive anglers. At least 80% of these categories — 90% for traditionalists — had used at least one medium to access fishing-related entertainment. Of the 10 media provided as choices, anglers regardless of persona indicated they were most likely to have used television, websites and social media to access fishing-related entertainment (southwickassociates.com/wp-content/uploads/downloads/2020/08/ASA-Angler-Personas-Technical-Report-8-31-20.pdf). When planning their marketing communication efforts, bait marketers may consider prioritizing the media that anglers tend to more broadly use.

Exhibit 2.3.6. Fishing-Related Entertainment Consumed in Previous Year by Angler Persona*



* n=752 for traditionalists; n=225 for occasional anglers; n=153 for friendly fishers; n=230 for consumptive anglers; n=125 for social dabblers; n=468 for adventurous anglers; n=242 for Zen anglers

Source: Southwick Associates (southwickassociates.com/wp-content/uploads/downloads/2020/08/ASA-Angler-Personas-Technical-Report-8-31-20.pdf)

Pricing

The price of bait fish vary based on species and size as well as market channel. Buyers can search online for specialized products and compare prices posted by individual businesses. Others may choose to purchase at the nearest bait retailer. The 2018 Census of Aquaculture indicated the average U.S. bait fish producer reported \$195,000 in total baitfish sales, a 10% increase over the 2013 average. Most states have too few bait fish farms to release sales information. Missouri ranked fifth among reporting states with sales averaging \$89,000, a 43% decrease from 2013. By comparison, Arkansas — the leading baitfish producer in the U.S. — reported average sales of \$764,000, which was a 4% decline from 2013.

The 2018 U.S. Census of Aquaculture provided national average price estimates for six major types of baitfish; see Exhibit 2.3.7. Golden shiners, a species raised by an estimated 67 farms nationally, commanded the highest prices; they averaged \$4.25 per pound. The next highest priced baitfish was the fathead minnow at \$4.04 per pound followed by goldfish at \$3.55 per pound.

Exhibit 2.3.7. U.S. Average Baitfish Prices, 2018

| Species | Farms | Number sold (1,000) | Live weight (1,000 pounds) | Number per pound | Total sales (\$1,000) | Avg. price/ pound (dollars) |
|----------------------------|--------------|--------------------------------|---------------------------------------|-----------------------------|----------------------------------|--|
| Crawfish (bait) | 31 | 1,851 | 108 | 17.2 | \$209 | \$1.94 |
| Fathead minnows | 114 | 666,054 | 3,170 | 210.1 | \$12,802 | \$4.04 |
| Goldfish (feeder and bait) | 35 | 25,534 | 328 | 77.9 | \$1,162 | \$3.55 |
| Golden shiners | 67 | 465,838 | 3,852 | 120.9 | \$16,385 | \$4.25 |
| Other shiners | 9 | 14,297 | 84 | 169.4 | \$203 | \$2.40 |
| Suckers | 18 | 24,395 | 490 | 49.8 | \$1,363 | \$2.78 |
| Other baitfish | 23 | (X) | (X) | (X) | \$654 | (X) |
| Baitfish, total | 168 | | | | \$32,778 | |

Source: USDA Census of Aquaculture 2018, Table 4

nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0004_0005.pdf

3. Sport Fish

3.1. Missouri Aquaculture Landscape

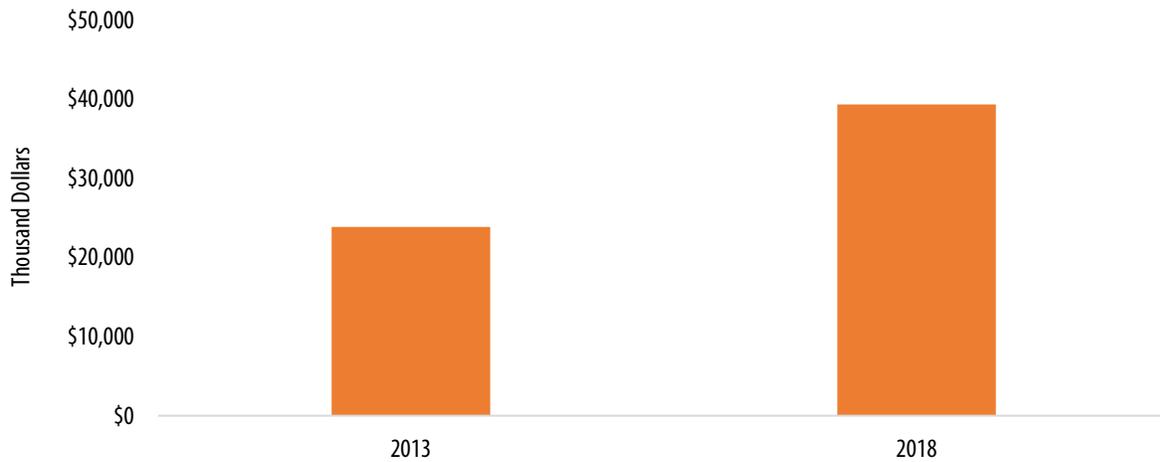
In the 2022 survey of Missouri aquaculture producers, 16 of the 20 responding producers (80%) indicated they sold fish for pond or sport fish stocking — the most common product category noted from that survey. Sport fish refers to fish caught through recreational activity. Different species are known to be savvier about taking bait, and stronger fish may pull harder once hooked. These species are often sought by sport anglers. The survey grouped pond stocking and sport fish together into a single product category. In addition, one respondent sold crustaceans in this category. Seven of the 16 respondents that sold fish for pond or sport fish stocking also sold fish through food markets, and these respondents had more diverse operations with 11.3 species on average compared with 5.9 species on average among the nine producers who sold to stocking markets but not food markets.

Among the six producers who only sold fish to pond or sport stocking markets, the species they most commonly raised included bluegill (5 producers), black crappie (4), channel catfish (4), fathead minnow (4), largemouth bass (4), redear sunfish (4) and grass carp (3). Of the six producers solely focused on pond or sport stocking markets, five made 99% or more of their sales direct to consumers.

3.2. Sales Trends

In 2018, 264 farms in the U.S. recorded sport fish sales — a decline from 282 farms making sport fish sales in 2013. For U.S. farms, Exhibit 3.2.1 illustrates the sport fish dollar sales change from 2013 to 2018. Despite the number of sport fish farms constricting during this period, sport fish dollar sales strengthened. Sales totaled nearly \$24 million in 2013 but grew to exceed \$39 million in 2018 (nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/index.php).

Exhibit 3.2.1. U.S. Aquaculture Producers' Sport Fish Sales



Source: 2018 Census of Aquaculture, USDA National Agricultural Statistics Service

nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/index.php

Comparing the Missouri and U.S. sport fish industries, Missouri had 3% of all U.S. farms that reported sport fish sales in 2018. However, Missouri-recorded sport fish sales represented just 1.5% of total U.S. dollar sales. Looking at sport fish dollar sales, the states capturing the greatest market share in 2018 were Arkansas, 34.8% share of U.S. sport fish sales; California, 24.3% share; and Illinois, 7.3% share. These three states had the greatest share of operations recording sport fish sales in 2018: Ohio, 11% of sport fish operations; Arkansas, 7.6% of operations; and Texas, 7.6% of operations

nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/index.php.

According to the USDA Census of Aquaculture, the eight Missouri farms that reported sport fish sales in 2018 most commonly sold largemouth bass. Half sold largemouth bass. Three farms in Missouri indicated they had crappie sales, and three documented that they had sunfish, which includes redear sunfish, bluegill and other sunfish species, sales. Walleye, smallmouth bass, muskellunge and other species were less commonly sold from Missouri farms

nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/index.php).

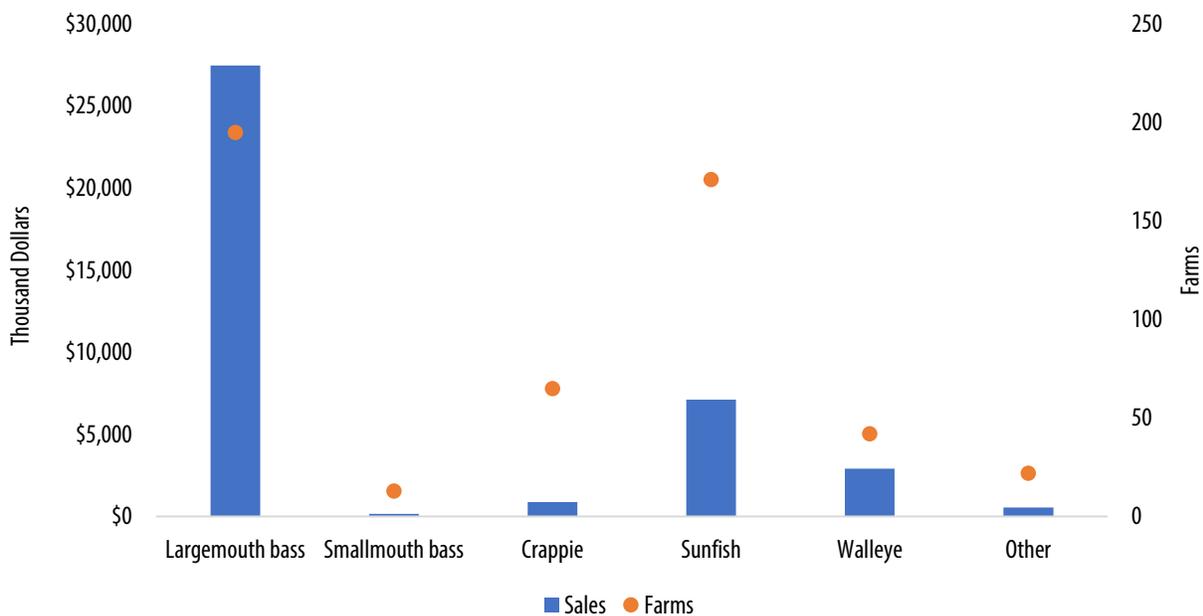
For species other than catfish and trout, the USDA Census of Aquaculture also reports sport fish farms and dollar sales. In 2018, sport fish sales were greatest for largemouth bass, sunfish and walleye. Of total sport fish sales recorded in 2018, largemouth bass captured a 70% share. See Exhibit 3.2.2, and note that these totals include multiple types of fish or fish products sold by species: food or market-size fish, stockers, fingerlings or fry, broodfish and eggs. With respect to farm count by species, more farms

reported largemouth bass sales than sales of other sport fish species

(nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/index.php).

Catfish and trout sales are collected separately on the Census of Aquaculture survey, and sales are not segregated for sport fish or food fish sales, which prohibits comparison to other sport species. In 2018, the U.S. had an estimated 531 catfish farms with \$366.8 million in sales and 334 trout farms with \$116.7 million in sales. The Census of Aquaculture reported 2% of catfish sales, \$7.75 million from 55 farms, were for catfish stockers and 7% of trout sales, \$8.3 million across 158 farms, were for trout stockers. These estimates may undercount the total production of both species that targets pond or sport stocking.

Exhibit 3.2.2. U.S. Aquaculture Producers’ Sport Fish Sales and Farms by Species, 2018

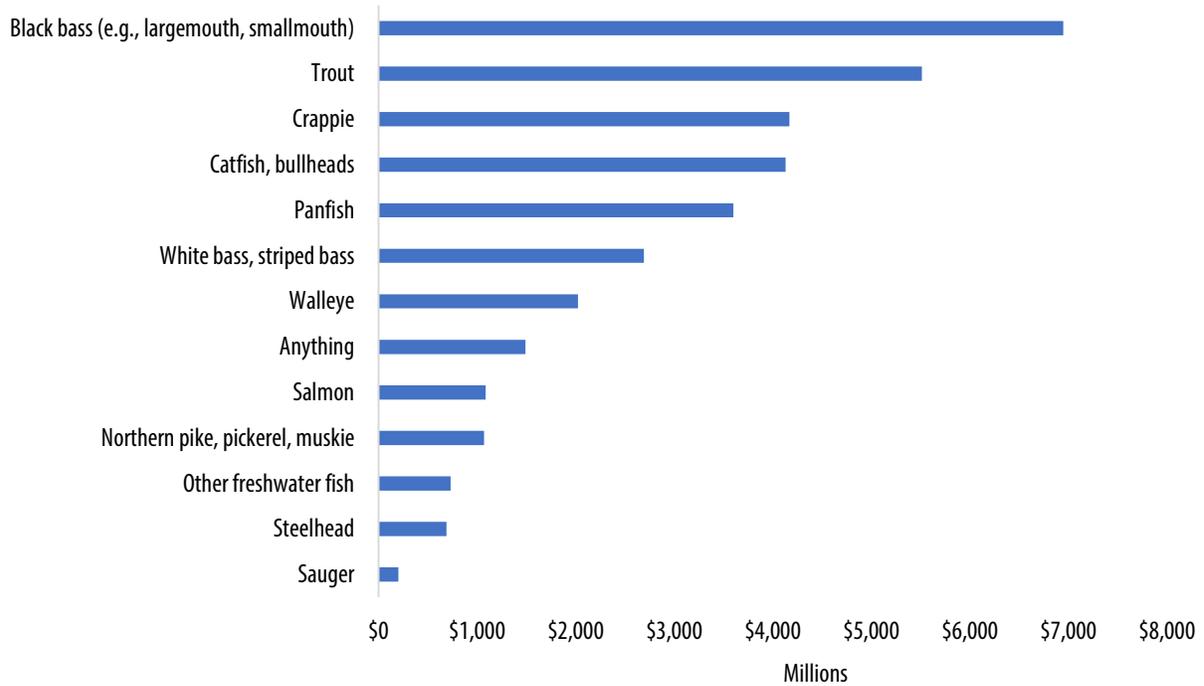


Source: 2018 Census of Aquaculture, USDA National Agricultural Statistics Service

(nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/index.php)

Sport fishing anglers may catch farm-raised or wild fish. The Census of Aquaculture data are limited to tracking activity for farm-raised sport fish. The American Sportfishing Association worked with Southwick Associates to produce a sport fish economic impact report for 2020. The report details estimated retail sales by state and expense line item. Exhibit 3.2.3 presents the retail sales data shared by freshwater species. The two sport fish species generating the greatest retail sales were black bass — a category that includes largemouth, smallmouth and spotted bass — and trout. Crappie and bullhead catfish followed ([asafishing.org/wp-content/uploads/2021/11/Sportfishing-in-America-Economic-Report-March-2021.pdf](https://safishing.org/wp-content/uploads/2021/11/Sportfishing-in-America-Economic-Report-March-2021.pdf)).

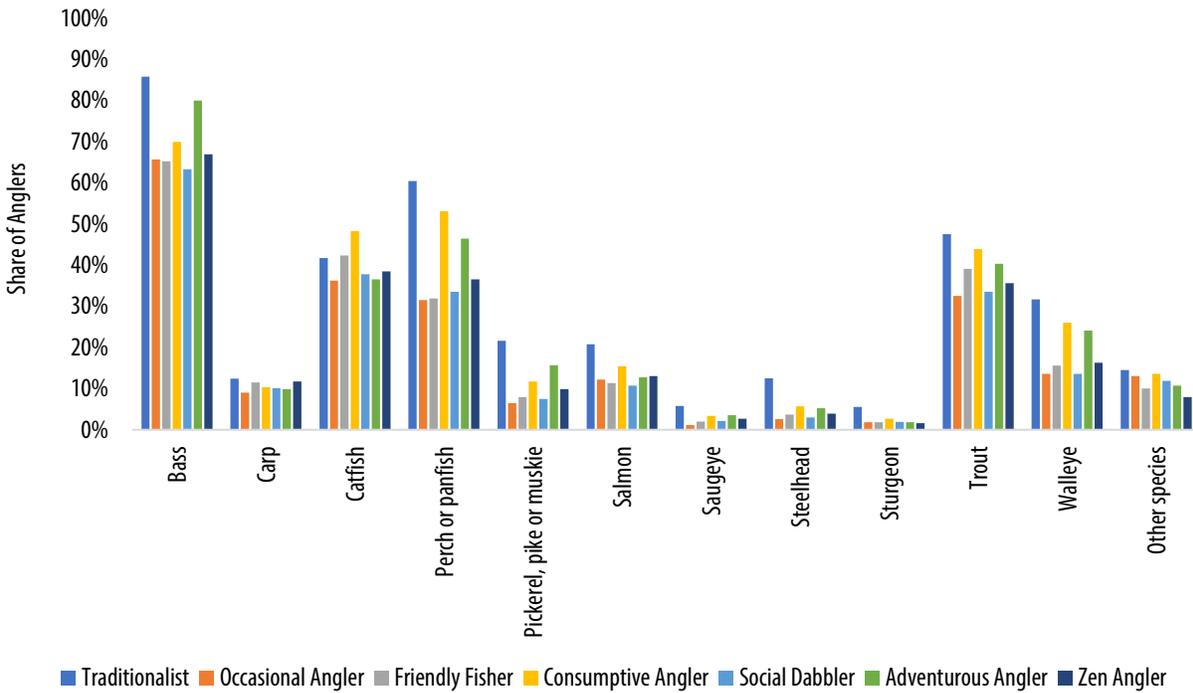
Exhibit 3.2.3. U.S. Sport Fishing Retail Sales by Freshwater Species



Source: Sportfishing in America report, 2020 (asafishing.org/wp-content/uploads/2021/11/Sportfishing-in-America-Economic-Report-March-2021.pdf)

As an alternative to using retail sales data to identify species most likely to draw fee fishing or pond stocking buyers, refer to the freshwater species preferences data in Exhibit 3.2.4. These species preferences were published by Southwick Associates in a July 2020 report. The publication describes fishing behaviors and preferences for seven personas — groups that share similar characteristics. All seven named bass as one of the three top freshwater species they target. Other freshwater species most commonly targeted by anglers were perch or panfish, catfish and trout (southwickassociates.com/wp-content/uploads/downloads/2020/08/ASA-Angler-Personas-Technical-Report-8-31-20.pdf). When choosing species to stock at a fee-fishing site or sell to others for pond stocking purposes, these species may attract the most interest and drive the most sales.

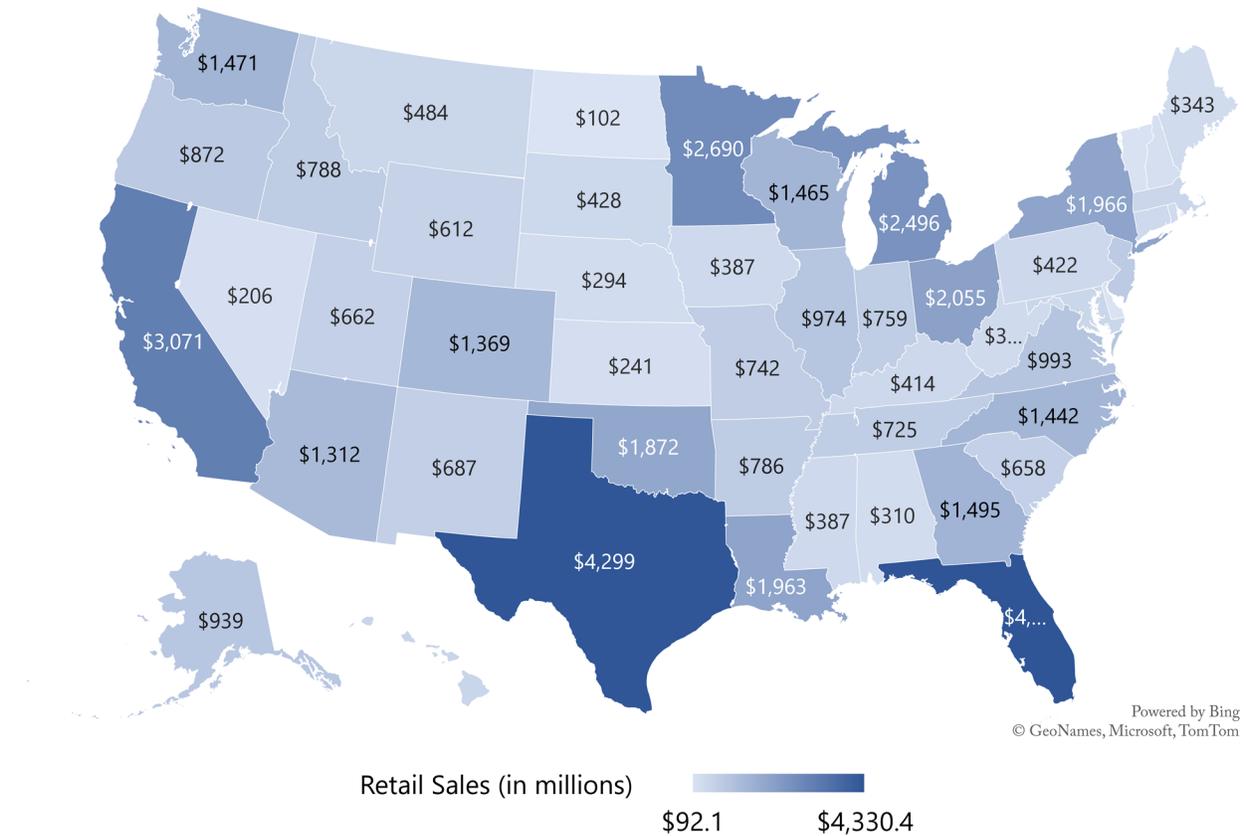
Exhibit 3.2.4. U.S. Freshwater Species Targeted by Angler Persona



Source: Southwick Associates (southwickassociates.com/wp-content/uploads/downloads/2020/08/ASA-Angler-Personas-Technical-Report-8-31-20.pdf)

By state, Exhibit 3.2.5 breaks down total — freshwater and saltwater — sport fishing retail sales as reported in a 2020 sport fishing economic impact report. Missouri captured a 1.4% share of U.S. total retail sales. States where retail sales concentrated were located along major waterbodies — the Atlantic and Pacific oceans, Gulf of Mexico and Great Lakes. Looking exclusively at freshwater sport fishing, Missouri still captured a relatively small share — 2.2% of U.S. freshwater retail sales (asafishing.org/wp-content/uploads/2021/11/Sportfishing-in-America-Economic-Report-March-2021.pdf). These sales totals suggest where fishing tends to be part of the local culture or attract visitors interested in fishing.

Exhibit 3.2.5. Sport Fishing Retail Sales by State



Source: Sportfishing in America report, 2020 (asafishing.org/wp-content/uploads/2021/11/Sportfishing-in-America-Economic-Report-March-2021.pdf)

To engage in the sport fish market, aquaculture producers may open their own ponds for fee fishing or sell fish for pond stocking — either directly to consumers or other buyers (e.g., municipalities, subdivisions) that stock ponds and lakes. Exhibit 3.2.6 breaks down sport fish sales by species and fish maturity or size. A majority, 80%, of largemouth bass sales originated from food- or market-size fish. No other species had the same extent of market-size fish sales. One-third of smallmouth bass sales stemmed from stocker sales. Stocker, fingerling or fry sizes contributed most to crappie, sunfish and walleye sales (nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0021_0022.pdf).

Note, some fee-fishing operations stock market-ready fish, so visitors have an opportunity to catch and keep fish they can consume or feel accomplished by catching larger fish. However, if a pond or lake owner is less concerned about immediate reward, then purchasing smaller fish that grow and mature on site is an alternative. According to the Missouri Department of Conservation, choosing fingerlings has multiple

benefits. Those include accessing fish at a lower cost, encouraging uniformly sized fish and facilitating a better fishing experience as pond and lake owners may be in a position to stock more fingerlings than full-grown fish (mdc.mo.gov/magazines/conservationist/2007-05/private-pond-stocking).

Exhibit 3.2.6. Sport Fish Dollar Sales by Species and Maturity or Size, Thousand Dollars, 2018

| Species | Food or market size | Stockers | Fingerlings or fry | Broodfish | Total |
|------------------|---------------------|----------|--------------------|-----------|----------|
| Largemouth bass | \$21,876 | \$2,319 | \$3,178 | \$86 | \$27,458 |
| Smallmouth bass | (D) | \$55 | (D) | (D) | \$156 |
| Crappie | (D) | \$225 | \$610 | (D) | \$869 |
| Sunfish | (D) | \$1,484 | \$5,382 | (D) | \$7,116 |
| Walleye | \$258 | \$469 | \$2,188 | - | \$2,915 |
| Other sport fish | (D) | (D) | \$281 | - | \$554 |

* Muskellunge and northern pike data withheld.

Source: USDA Census of Aquaculture 2018

(nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0021_0022.pdf)

The following summaries highlight sales opportunities related to fee fishing and pond stocking.

Fee Fishing

In this scenario, private landowners or businesses allow consumers to enjoy fishing experiences on properties they manage (agmrc.org/commodities-products/agritourism/fee-and-lease-pond-fishing-profile). This pay-to-fish model has also been labeled as pay lakes or fish-out ponds

(aquaculture.ca.uky.edu/sites/aquaculture.ca.uky.edu/files/managing_kentucky_fee_fishing_operations.pdf).

Note, inviting the public to a fishing property does carry risk. Individuals who participate in a fee-fishing experience or lease fishing privileges should sign an agreement that includes a “hold harmless” provision. Plus, to offer further risk protection, landowners should check that they have the appropriate insurance coverage (extension.okstate.edu/fact-sheets/development-and-management-of-fishing-leases.html).

Typically, landowners create fee-fishing opportunities at smaller water bodies — those that measure 1 surface acre to 3 surface acres — because they are easier to stock than larger ponds and lakes. Species stocked in fee-fishing ponds vary by climate. Examples include catfish, hybrid sunfish, bass, crappie, rainbow trout and walleye. Three scenarios describe common fee-fishing revenue streams: the landowner charges a daily fee per visitor, visitors pay for fish they catch and keep, or the cost to participate blends fee-per-day and catch-and-keep models. (agmrc.org/commodities-products/agritourism/fee-and-lease-pond-fishing-profile). Fee-fishing operations tend to follow a “catch and keep” or “catch and release”

philosophy. Some businesses prefer a “catch and keep” model because fish that are caught and then released may have a low chance of survival. Smoke Hole Outfitters — a Cabins, West Virginia, lodge that offers fishing services at its trout pond — follows a hybrid model. It doesn’t allow visitors to release any trout back to the pond. For customers who choose not to keep the fish, however, Smoke Hole Outfitters allows for releasing trout in a stream (smokeholeoutfitters.com/catch-and-keep-trout-pond.htm).

Leases represent a pay-to-fish alternative to fee fishing. In this model, landowners and sport fishers engage in short- or long-term leases. The short-term option — a lease by day, weekend or week — may work best for operators who enjoy interfacing with consumers and providing value-added experiences. Location plays a role in determining the best type of lease for a property. Properties near populated areas may do well with short-term leases. Sometimes, a hunting lease is extended to include fishing privileges, and access to fishing waters increases the lease’s value. However, for consumers only interested in fishing, standalone leases for fishing permissions are another possibility, especially in areas where public fishing areas tend to feel crowded or fewer fishing areas are available. Compared with public fishing venues, a lease provides a degree of exclusivity and puts less strain on the stocked fish inventory. Possible species to stock in a leased waterbody include largemouth bass, channel catfish, blue catfish, sunfish, crappie and rainbow trout (extension.okstate.edu/fact-sheets/development-and-management-of-fishing-leases.html).

If aquaculture producers would like to participate in the fee-fishing space but not operate fee-fishing sites on their own properties, then supplying fish to other fee-fishing businesses is a possibility. Depending on traffic through fee-fishing operations and catch sizes, these businesses may need to regularly restock their inventory. In some cases, the fee-fishing operations maintain their own tanks to haul fish, so they can access fish shipments as needed (extension.umd.edu/sites/extension.umd.edu/files/2021-03/FS754_DyppingFeeFishingEnt.pdf). Others may purchase fish from live haulers who make regular deliveries. Depending on activity at their properties, fee-fishing businesses may require weekly shipments — often scheduled on Thursdays or Fridays to prepare for upcoming weekend visitors (aquaculture.ca.uky.edu/sites/aquaculture.ca.uky.edu/files/managing_kentucky_fee_fishing_operations.pdf).

Exhibit 3.2.7 presents total U.S. angler spending for multiple categories related to accessing fishing sites or fishing permissions. Published in the Sportfishing in America report for 2020, these spending data suggest where anglers tend to concentrate expenses and, therefore, what fishing access models tend to be most popular. Looking at land use fees, anglers in total spent more on private land use fees than public land use fees. Therefore, consumers may show a preference for fishing at private sites, or some public areas may not charge as much or at all. Fishing licenses, tags and permits represented the most significant

costs of the expense lines shown. Collectively, these costs were nearly 5% of total angler expenditures. Note the relatively small contribution of land leases to total angler expenditures. Expenditures on land leases were limited compared with purchased land expenditures (asafishing.org/wp-content/uploads/2021/11/Sportfishing-in-America-Economic-Report-March-2021.pdf)

Exhibit 3.2.7. U.S. Angler Expenditures for Fishing Access and Permission

| Category | Spending | Share |
|--|------------------|-------|
| Public land use fees | \$314,401,137 | 0.61% |
| Private land use fees | \$508,575,516 | 0.99% |
| Fishing licenses | \$1,336,510,136 | 2.61% |
| Tags, permits and other special licenses | \$1,092,138,014 | 2.13% |
| Land purchased for fishing | \$646,184,519 | 1.26% |
| Land leased for fishing | \$53,214,765 | 0.10% |
| Total | \$51,226,258,721 | 100% |

Source: Sportfishing in America report, 2020 (asafishing.org/wp-content/uploads/2021/11/Sportfishing-in-America-Economic-Report-March-2021.pdf)

Pond Stocking

Compared with other states, Missouri has many small impoundments on private lands. It has more than 300,000 privately owned ponds and lakes. Opportunity exists to sell fish to landowners who manage these small bodies of water (mdc.mo.gov/magazines/conservationist/2007-05/private-pond-stocking).

When stocking ponds, landowners may choose from several species, which the following list describes (mdc.mo.gov/magazines/conservationist/2007-05/private-pond-stocking).

- A predatory fish, **largemouth bass** work well in stocked ponds. They eat small fish, frogs, crawfish and insects. Largemouth bass will fight, so they create a sport fishing challenge.
- As omnivores, **bluegill** consume microscopic plants, insects, snails, crayfish and small fish. Largemouth bass will eat bluegill, but natural reproduction tends to sustain the bluegill population within a pond. Among anglers, bluegill also are popular to catch and cook.
- Young **channel catfish** are part of largemouth bass diets, so pond and lake owners often need to restock these fish every two years to three years. They consume crayfish, fish or commercial feed.
- To do well in a pond, **crappie** need clear water and aquatic vegetation, which requires management. Additionally, adult crappie must be removed periodically. Otherwise, this fish species will reproduce to the point that the water becomes crowded, and the fish don't grow well.
- If a pond needs vegetation control, then **grass carp** represent a possible option. However, these long-lived fish can overeat and remove all vegetation and cause water to become muddy.

- Related to bluegill, **redeer sunfish** eat snails, and their young can be part of largemouth bass diets.

The Missouri Department of Conservation published a list of Missouri fish producers in 2020:

mdc.mo.gov/sites/default/files/2020-05/FishProducers.pdf. All businesses named in this list sell at least bass, bluegill or channel catfish. Other species sold by in-state fish producers featured in this list were fathead minnows, grass carp, hybrid sunfish and redear sunfish. Referencing this list suggests the extent of in-state supplier competition for sport fish species. The University of Kentucky cautions against stocking several species in small ponds: crappie, hybrid sunfish, gizzard shad, golden shiners, bullhead catfish and yellow perch. They may lead to overpopulation issues and prompt pond and lake owners to remove unwanted fish by draining a waterbody or chemically treating it (exclusives.ca.uky.edu/2021/anr/stocking-recreational-fish-ponds).

Markets for fish used to stock ponds may be categorized in different ways. On one hand, these markets vary according to how long the pond structure has been in place and its condition. Properties may have a newly constructed pond or lake, a pond or lake that hasn't supported fish reproducing or a water body that has experienced fish kills (mdc.mo.gov/magazines/conservationist/2007-05/private-pond-stocking). Supplemental stocking may occur in ponds and lakes that already have a fish population, but the manager perceives additional stocking needs. For example, individuals interested in raising large sport fish such as largemouth bass and crappie may have a need to stock more feeder fish, or they may decide to add a new species over time. Alternatively, supplemental stocking may allow pond managers to choose a species to target a specific pest problem, such as overgrown aquatic plants or parasites. For buyers interested in supplementing existing ponds or lakes with fish, the fish themselves represent a product for aquaculture producers to offer. However, the restocking decision may require expertise or other support, such as using electrofishing boats to gauge existing populations. In such cases, the aquaculture producer could package that expertise as a service that could represent a new revenue stream or enhance the value of products being sold (arkansasonline.com/news/2023/jun/03/time-to-stock-ponds-says-uapb-specialist).

As an alternative to defining the pond stocking market opportunity, consider the pond or lake's location. For example, subdivisions may install neighborhood ponds to encourage residents to build community and offer a venue for residents to connect with fishing as an outdoor activity. Cities may install stormwater basins to control runoff. These structures could be stocked (iowadnr.gov/Portals/idnr/uploads/fish/files/Community_Fishing_Program.pdf). Some sources caution against consuming fish raised in stormwater basins because they may have absorbed harmful contaminants, pollutants or toxins present in the stormwater. However, stormwater basin managers may

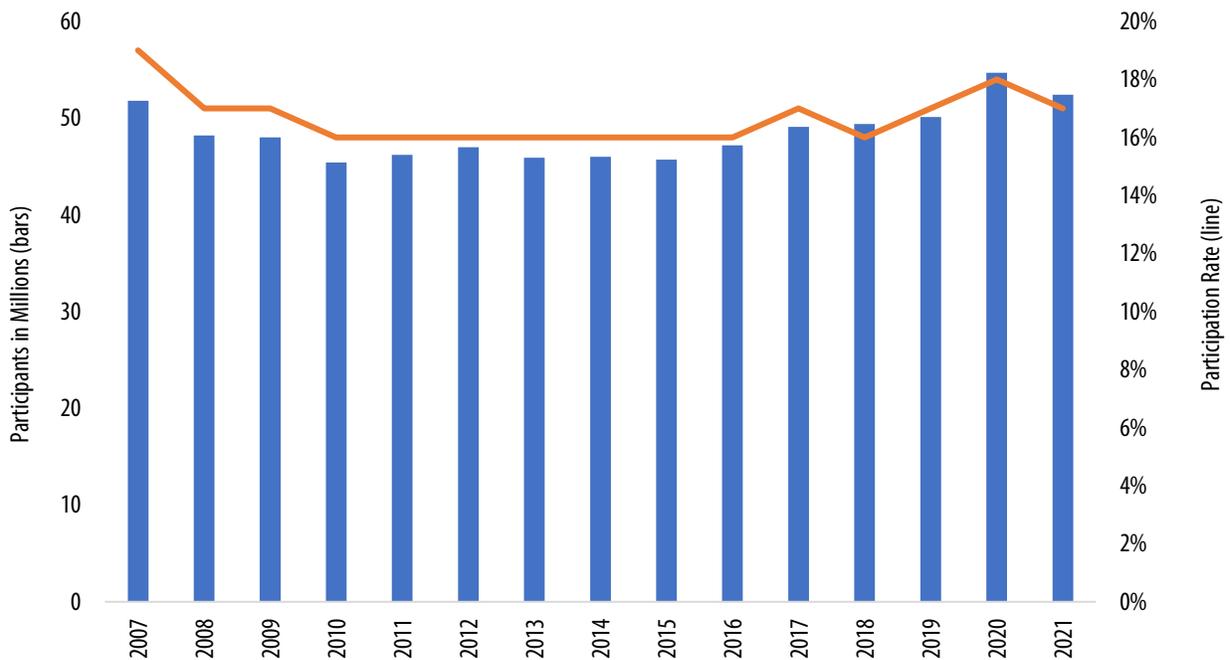
lean on the fish to consume aquatic plant materials, small fish and invertebrates. The fish could also be prey for birds that communities would like to attract (clemsont.edu/extension/water/stormwater-ponds/problem-solving/stocking-harvesting.html).

A third consideration is understanding who will fish in a pond or lake. Hybrid bluegill and channel catfish work well if serving families with children. Catfish may also be a desirable food fish for individuals who want to raise their own fish to eat. Individuals interested in raising trophy-sized fish may prefer bass and must understand the management required for bass to grow to a large size (extension.okstate.edu/fact-sheets/improve-fishing-in-your-pond.html).

3.3. Marketing Considerations

If marketing sport fish through fee-fishing or pond stocking arrangements that necessitate direct-to-consumer sales, then understanding the consumers most likely to spend time and money on fishing will inform how to choose a target audience. Of the U.S. population that's at least 6 years old, 17% fished at least once during 2017, according to the 2022 Special Report on Fishing from the Outdoor Foundation and Recreational Boating and Fishing Foundation. Based on a nationwide study administered by Sports Marketing Surveys USA, the report highlights the fishing participation rate and number of fishers since 2007. The study involved conducting 18,000 online interviews with U.S. residents who were at least 6 years old. The data show the participation rate changed little from 2007 to 2021. See Exhibit 3.3.1. The start of the COVID-19 pandemic contributed to a slight uptick in the participation rate, which increased from 17% in 2019 to 18% in 2020 but receded to 17% in 2021 (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf).

Exhibit 3.3.1. Trend in U.S. Fishing Participation Among 6-Year-Old and Older Population, 2007-21



Source: Outdoor Foundation and Recreational Boating and Fishing Foundation

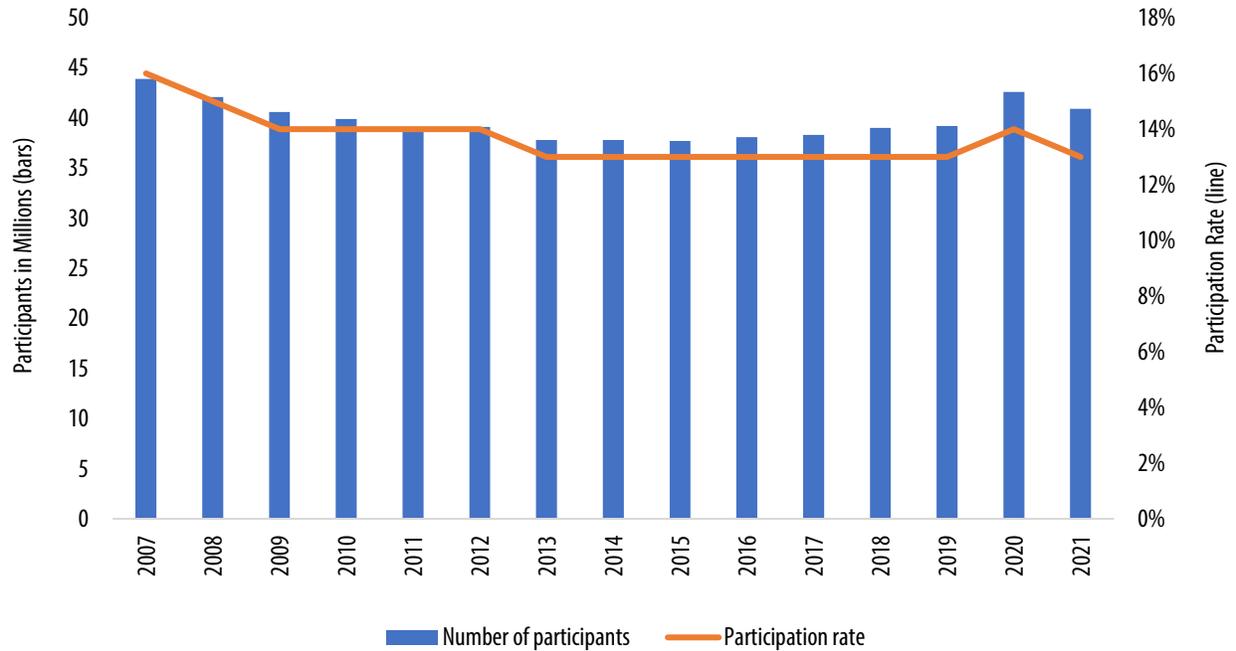
takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf

Fishing participation data from 2021 illustrate that fishers tended to be male (63% of participants) and white (79% of participants). In terms of age, the smallest share of fishing participants were 13- to 24-year-olds. Other age categories had similar representation. In terms of income level, 28% of participants reported income to total at least \$100,000, and 22% said their income ranged from \$25,000 to \$49,999. With respect to educational attainment, individuals who had completed as many as three years of high school or post-graduate studies were least likely to have fished in 2021. Individuals identifying with other educational levels were more evenly represented among fishing participants. Children in a household positively affected fishing participation — 14% for households with no children compared with 20% and 23% among households with children of different ages (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf).

A majority of individuals participating in the research — 62% — said they preferred freshwater-only fishing; 10% said they preferred freshwater fishing and saltwater fishing; 4% preferred fly fishing and freshwater fishing; and 3% preferred fly fishing, freshwater fishing and saltwater fishing. Exhibit 3.3.2 illustrates how the freshwater fishing participation rate and number of participants changed from 2007 to 2021. The participation rate was slightly stronger early in the observed period — for example, 16% in

2007 — than later in the observed period — 13% in 2021 (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf).

Exhibit 3.3.2. Trend in U.S. Freshwater Fishing Participation, 2007-21



Source: Outdoor Foundation and Recreational Boating and Fishing Foundation (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf)

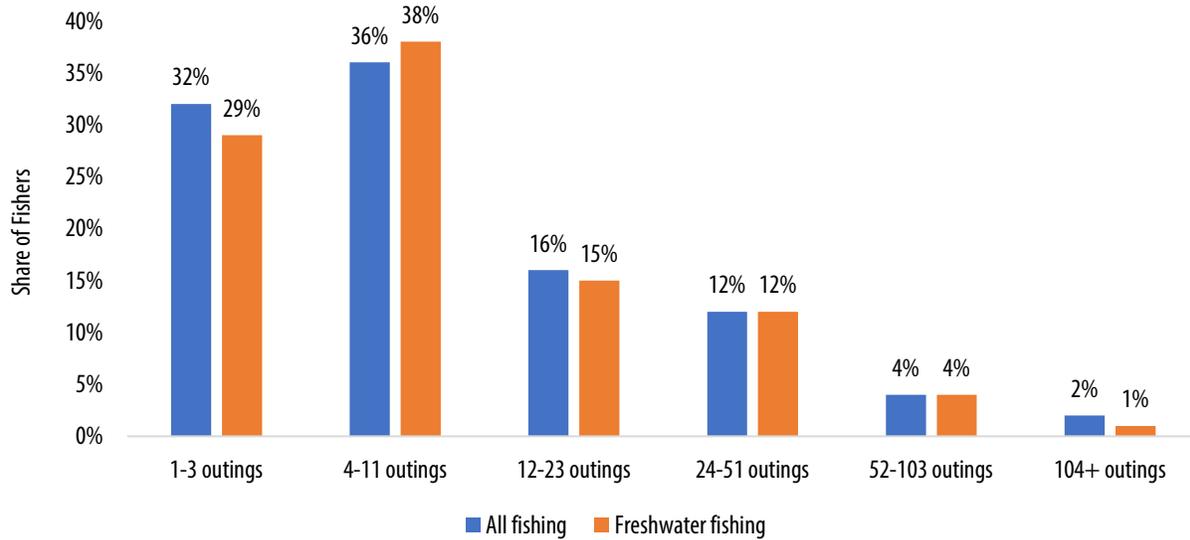
One-third of anglers in 2021 took one to three fishing trips. Another third fished four times to 11 times. Just more than one-quarter of individuals who fished in 2021 took 12 fishing outings to 51 fishing outings, and 6% reported more than one fishing outing per week (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf).

The research from the Outdoor Foundation and Recreational Boating and Fishing Foundation probed to better understand whether survey participants had the opportunity to fish as often as they'd like or whether they had interest in fishing more often. More than half said they would like to fish more often or would like to start fishing if they didn't fish currently (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf).

Compared with all fishers, freshwater fishers in 2021 were slightly more likely to take a moderate number of fishing outings. See Exhibit 3.3.3. Of freshwater fishers, 38% said they had four to 11 fishing outings

in 2021 compared with 36% of all fishers, and 29% had one to three fishing outings in 2021 compared with 32% of all fishers (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf).

Exhibit 3.3.3. Annual Fishing Outings by All Fishers and Freshwater Fishers, 2021



Source: Outdoor Foundation and Recreational Boating and Fishing Foundation (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf)

Purchase Considerations

The following discussion outlines more factors that may shape consumer purchase decisions related to fee-fishing experiences and pond stocking.

Fee Fishing Consumer Purchase Considerations

As illustrated in Exhibit 3.3.4, the research from the Outdoor Foundation and Recreational Boating and Fishing Foundation identified crowded fishing spots as the top obstacle to enjoying fishing (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf). Therefore, fee-fishing venues must invest in crowd control to deliver a positive experience for visitors. When forming a schedule, try to anticipate slow periods, but offer enough open times to avoid overcrowding. Maintaining a consistent schedule may help to make a fee-fishing operation feel more reliable. A Maryland Cooperative Extension publication also suggests night fishing as a novel option to offer, but it warns that nighttime fishing may lead to an uptick in theft (https://extension.umd.edu/sites/extension.umd.edu/files/2021-03/FS754_DyppingFeeFishingEnt.pdf).

The second most cited obstacle to fishing enjoyment involved not catching fish as hoped. Well-stocked ponds and lakes excite fishers because the high stocking may lead to a greater chance to catch fish. Outdoor pests and weather conditions ranked third as an obstacle to enjoying fishing.

Exhibit 3.3.4. Obstacles of Fishing Enjoyment

| Rank | Obstacles of enjoyment |
|------|---|
| 1 | The fishing spots were crowded. |
| 2 | Not catching any fish |
| 3 | Being outdoors (e.g., bugs, heat, cold weather) |
| 4 | The lakes and rivers weren't very clean |
| 5 | The expense (e.g., equipment, bait, supplies) |
| 6 | Baiting the hooks or taking the fish off the hook |
| 7 | Not having the right equipment |
| 8 | The hassle |
| 9 | Lack of knowledge |
| 10 | Don't like to touch fish/worms |

Source: Outdoor Foundation and Recreational Boating and Fishing Foundation

(takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf)

Published in July 2020, the angler persona research from Southwick Associates evaluated the factors that different types of fishers think are important when they choose a fishing site. Exhibit 3.3.5 summarizes how site characteristic preferences vary by the seven angler segments. Reinforcing the Outdoor Foundation and Recreational Boating and Fishing Foundation research findings, lack of crowds and abundance of fish consistently ranked as important factors for anglers — regardless of persona group. Other factors at least moderately important to most or all personas included easy to access, opportunity to catch big fish, scenic beauty, short travel distance and water quality (southwickassociates.com/wp-content/uploads/downloads/2020/08/ASA-Angler-Personas-Technical-Report-8-31-20.pdf).

Although the fish may drive consumers to ponds and lakes, fee-fishing participants often expect an overall recreational experience that extends beyond catching fish. For example, participants may value a natural setting (agmrc.org/commodities-products/agritourism/fee-and-lease-pond-fishing-profile). Ponds or lakes with an irregular shape may provide a more secluded or natural setting for visitors (aquaculture.ca.uky.edu/sites/aquaculture.ca.uky.edu/files/managing_kentucky_fee_fishing_operations.pdf). Sites that locate near good-quality roads and offer access to basic services such as electricity, water and cellphone reception may attract larger crowds (agmrc.org/commodities-products/agritourism/fee-and-lease-pond-fishing-profile). Properties should also offer parking options to meet visitors' needs (aquaculture.ca.uky.edu/sites/aquaculture.ca.uky.edu/files/managing_kentucky_fee_fishing_operations.pdf). A

brief from the Agricultural Marketing Resource Center outlines other strategies to develop popular fee-fishing sites: keep restrooms clean, provide seating, offer shaded areas and discourage noisiness (agmrc.org/commodities-products/agritourism/fee-and-lease-pond-fishing-profile).

Drawing from these findings, aquaculture producers should carefully consider their pond location's ability to serve anglers. Producers that are closer to other fishing opportunities, other tourist and recreational destinations, metropolitan areas and locations with better road access and higher scenic beauty may more easily attract anglers. Many of these factors are outside of a producer's control. However, producers can improve the on-site experience for anglers by managing their on-farm scenic beauty, pond stocking rates, bookings, water quality and other factors described in the exhibit.

Exhibit 3.3.5. Important Factors to Consider When Choosing a Fishing Site, Share of Anglers by Persona

| | Traditionalist | Occasional Angler | Friendly Fisher | Consumptive Angler | Social Dabbler | Adventurous Angler | Zen Angler |
|--|----------------|-------------------|-----------------|--------------------|----------------|--------------------|------------|
| Abundance of fish | 36 | 25 | 27 | 27 | 24 | 33 | 22 |
| Amenities (e.g., bathrooms, parking) | 6 | 8 | 9 | 13 | 16 | 7 | 14 |
| Diversity of species | 16 | 9 | 7 | 7 | 9 | 12 | 10 |
| Easy to access | 20 | 26 | 25 | 24 | 34 | 27 | 28 |
| Education programs offered | 1 | 2 | 2 | 0 | 1 | 0 | 0 |
| Familiar site/I have access or permission | 24 | 15 | 22 | 29 | 31 | 16 | 18 |
| Lack of crowds | 23 | 27 | 38 | 34 | 30 | 30 | 34 |
| Learning of positive fishing information | 14 | 9 | 7 | 9 | 6 | 10 | 4 |
| New site/going somewhere different | 15 | 9 | 5 | 6 | 3 | 18 | 9 |
| No access fees | 11 | 15 | 17 | 19 | 16 | 15 | 18 |
| Opportunity to catch big fish | 39 | 20 | 16 | 23 | 13 | 35 | 21 |
| Other activities (e.g., playground) nearby | 0 | 4 | 6 | 1 | 6 | 3 | 2 |
| People on site to help | 3 | 2 | 2 | 5 | 8 | 3 | 3 |
| Regular fish stocking | 5 | 8 | 3 | 9 | 6 | 6 | 5 |
| Safety | 15 | 18 | 13 | 11 | 18 | 14 | 15 |
| Scenic beauty | 23 | 16 | 36 | 21 | 20 | 17 | 27 |
| Shorter travel distance/close to home | 20 | 16 | 25 | 23 | 20 | 22 | 18 |
| Water quality/conditions | 21 | 19 | 25 | 23 | 16 | 23 | 27 |

Created with Datawrapper

* n=693 for traditionalists; n=231 for occasional anglers; n=168 for friendly fishers; n=186 for consumptive anglers; n=122 for social dabblers; n=474 for adventurous anglers; n=247 for Zen anglers

Dark blue shading indicates 30% or more of respondents in a persona category selected a factor (relatively high priority). Light blue shading indicates a factor was valued by 20% to 29% of respondents in a persona category.

Source: Southwick Associates (southwickassociates.com/wp-content/uploads/downloads/2020/08/ASA-Angler-Personas-Technical-Report-8-31-20.pdf)

Pond Stocking Consumer Purchase Considerations

A Mississippi State University Extension publication outlines multiple considerations for buyers to take into account as they evaluate whether to purchase from a given fish supplier. For aquaculture producers, providing information related to these considerations or offering a service to address them may trigger customers to buy from one supplier instead of another. One consideration is a fish warranty. Buyers may look for a short-term warranty to protect their fish purchases. Suppliers may offer one to attract customers and demonstrate their own faith in their product. A second consideration is references and Better Business Bureau listings. Touting positive testimonials and displaying business credentials could encourage customers to buy (extension.msstate.edu/content/selecting-supplier).

The Tennessee Wildlife Resources Agency outlines further questions for buyers to consider. Those include clarifying the size of fish available. Articulating the size at purchase and the ultimate size of these fish may help pond owners know what to anticipate from a particular species. Pond owners may also want assurance that fish you sell would not be considered exotic or unwanted and pose a problem if they enter into other waterways. Buyers may also inquire about where you sourced the fish if you didn't raise the fish yourself. Understanding the origin may help the pond owner troubleshoot if the fish begin to demonstrate any problems. More sophisticated or experienced pond managers may expect a producer to provide information about fish genetics and how well a given strain will acclimate to a particular environment (tn.gov/content/tn/twra/fishing/small-lake-management.html#management).

Delivery options may also dictate purchase decision. Some farms offer delivery. Its availability and the associated cost may vary according to order size and the buyer's proximity to the farm's location. Because pond stocking requires balancing the waterbody's ecosystem, pond owners — particularly those new to managing aquatic species — may require recommendations and advice to succeed.

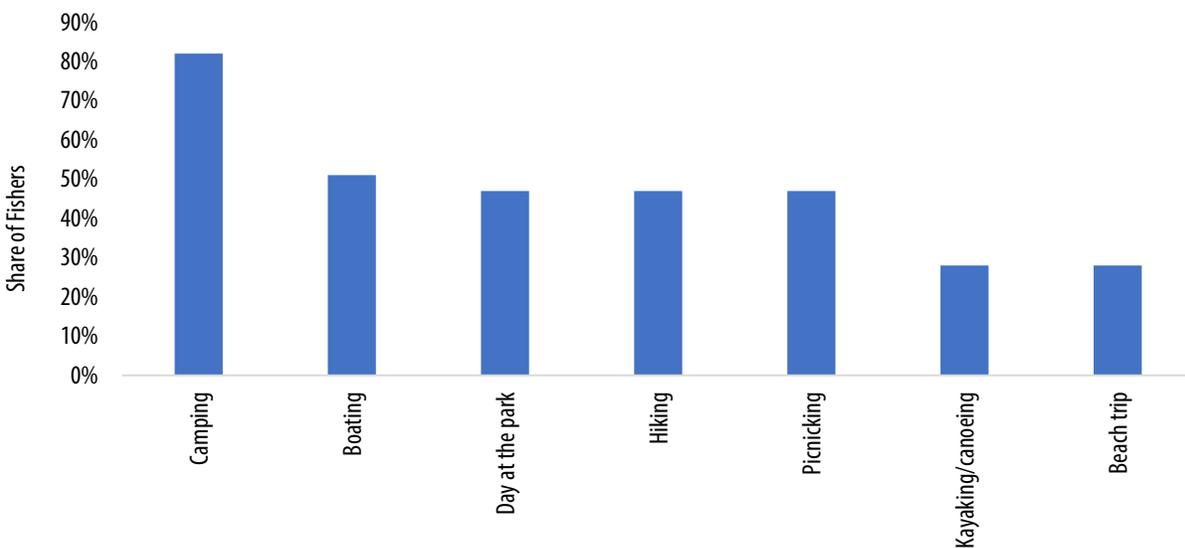
Value-Added Opportunities

Fee-fishing sites have several value-added opportunities to consider. Businesses may view value-added products and services not only as opportunities to create new revenue streams but also as offerings that may trigger customers to visit. One option is to combine fishing with other activities in a single venue. Data from Outdoor Foundation and Recreational Boating and Fishing Foundation illustrate the opportunity to combine fishing with other activities. For 72% of fishers participating in the foundations' research, fishing motivated the outing and represented the main activity. However, some also combine fishing with other outdoor activities. Exhibit 3.3.6 presents the share who said they did other activities. Camping ranked as the top complementary activity. Boating, spending time at a park, hiking and

picnicking also were popular activities to do on a fishing trip (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf). For anglers who want to stay overnight but not camp outside, renting a cabin or other accommodations may attract visitors.

Other revenue-generating opportunities include marketing fish already caught, selling bait and tackle and stocking other outdoor supplies such as sunscreen and band-aids (agmrc.org/commodities-products/agritourism/fee-and-lease-pond-fishing-profile). If an operation chooses to lease or rent equipment instead of only sell it, then charging a security deposit may discourage damage to rented items. Offering concessions, such as candy, drinks and food, could add a revenue stream and encourage visitors to stay on the property. If a fee-fishing business allows visitors to keep fish they catch, then a fish cleaning service, which charges a fee per pound, would help consumers with preparing fish for cooking at home (aquaculture.ca.uky.edu/sites/aquaculture.ca.uky.edu/files/managing_kentucky_fee_fishing_operations.pdf). Operations that allow catch-and-keep fishing and stock trophy-sized fish may consider pairing the fishing activity with a taxidermy service that allows successful anglers to prepare a prized catch for mounting and display. Catch-and-release businesses alternatively may connect visitors to taxidermists who can recreate a trophy-size catch for display (news.minnesota.publicradio.org/features/2005/05/12_postt_replicafish).

Exhibit 3.3.6. Other Outdoor Activities Fishers Do on Fishing Trips



Source: Outdoor Foundation and Recreational Boating and Fishing Foundation (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf)

Individuals and families represent one fee-fishing market segment. However, accommodating groups also has potential. Entities such as schools, youth organizations, senior centers and churches may consider

planning fishing field trips or experiences for the people they serve (agmrc.org/commodities-products/agritourism/fee-and-lease-pond-fishing-profile). Just 17% of fishers participating in the Outdoor Foundation and Recreational Boating and Fishing Foundation research said they typically take solo fishing trips. Four of five fishers said they fish in groups of two people to five people. A small segment — 4% — fishes in groups of at least six people. In terms of typical fishing group composition, just more than half of fishing participants said they only fish with adults, and 48% typically fish with adults and children or only children (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf). Designing value-added products, services or experiences for groups may lead to more visits from angler groups.

If leasing a waterbody for fishing purposes, then possible value-added experiences include connecting lessees with a fishing guide, providing a boat to use and offering on-site lodging. Fishing tackle, meals or other supplies also serve as other amenities to consider offering to fishing lessees (extension.okstate.edu/fact-sheets/development-and-management-of-fishing-leases.html).

For consumers interested in stocking ponds, aquaculture producers may consider providing added value through consultation services. Pond and lake owners may receive help with maintaining a well-balanced fish population — a particular challenge for small waterbodies, according to the University of Kentucky (exclusives.ca.uky.edu/2021/anr/stocking-recreational-fish-ponds). One-on-one consulting may teach property owners how to maintain ponds, implement a management plan, troubleshoot problems and sustain a healthy ecosystem. A spring 2020 story from Texas A&M AgriLife Extension breaks down pond development into a multiyear process. The following list summarizes steps involved. Consulting services could include educating property owners about these steps or executing steps for property owners (agrilifetoday.tamu.edu/2020/04/08/when-stocking-ponds-with-fish-stick-to-the-process).

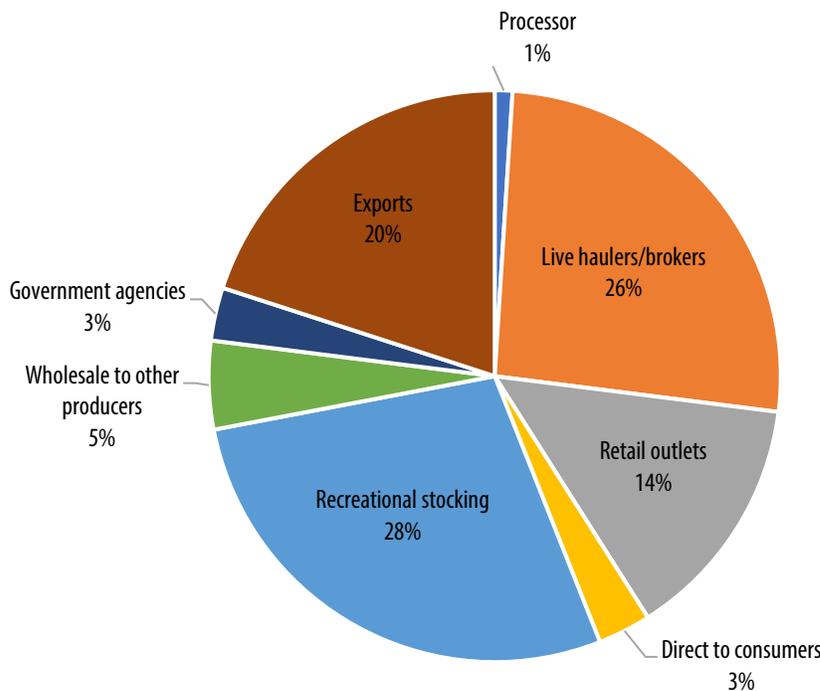
- Test pond water to determine whether the water requires a pH adjustment or fertilizer to encourage phytoplankton growth.
- Stock small bait fish (e.g., fathead minnows) that other fish will use as a food source, and allow their population to grow.
- Add larger bait fish (e.g., bluegill, redear sunfish) to the pond environment.
- Populate the pond with sportfish in the appropriate proportions relative to the bait fish present.
- Introduce structures made from wood or rocks that will attract fish and offer cover.
- Manage vegetation growing in a pond.

Assistance with a waterbody’s mechanical components may emerge as a value-added opportunity. For example, pond and lake owners may choose to add a fountain or aerator to encourage oxygen levels, but they may need help with buying the correct system and installing it. The following two operations serve as examples that have pursued this path. Cassidy Fish Farm, an Indiana business that sells stocking fish, markets aerator kits (cassidyfishfarm.com). Based in West Union, Iowa, the Jim Frey Fish Hatchery sells aerators it has designed to oxygenate the water, protect against water stagnation and keep water open during cold weather (jimfreyfishhatchery.com).

Market Channels

In the sport fish marketplace, recreational stocking and live haulers or brokers ranked first and second, respectively, for generating sport fish sales as points of first sale. This is according to sales data aquaculture producers reported in the 2018 Census of Aquaculture administered by USDA. Exhibit 3.3.7 communicates that recreational stocking represented the point of first sale for 28% of sport fish sales. Live haulers or brokers followed at 26% of sales. Exports, 20% of sales, and retail outlets, 14% of sales, also made sizable contributions to aquaculture producers’ sport fish sales, according to the census (nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0021_0022.pdf).

Exhibit 3.3.7. Share of Aquaculture Producers’ Sport Fish Sales by Points of First Sale



Source: USDA Census of Aquaculture 2018

(nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0021_0022.pdf)

For aquaculture producers selling fish for pond stocking directly to consumers, “fish days” held at retail locations such as feed or farm supply stores represents one distribution option. Held seasonally — particularly during the spring and fall — fish day events generally require preorders, so fish suppliers will know the appropriate quantities to transport to a location. The buyers then pick up their fish at a designated time. Typically, buyers bring water and containers for hauling the fish back to the water bodies they plan to stock. Farm & Home Supply, which has two Missouri locations, serves as an example of an operation that has hosted fish days. See the protocol this business follows for its fish days at farmandhomesupply.com/fish-days-booking.

As an alternative to fish days, sport fish marketers may haul fish to customers’ ponds. Customers who prefer to avoid the delivery and stocking charge may instead opt for picking up the fish themselves — if an operation allows on-farm pickup (extension.msstate.edu/publications/sport-fish-suppliers-and-stocking-guidelines-for-stocking-ms-ponds).

Packaging

The need for packaging will vary according to a producer’s business model. If selling fish for pond stocking purposes, then supplies needed to package fish for delivery include bags, oxygen and vessels for holding the bags or containing fish. The additional containers are important for species such as channel catfish that don’t transport well within bags. If hauling fish at relatively long distances, then aerators can help to keep oxygen levels high enough to meet fish needs (extension.msstate.edu/publications/sport-fish-suppliers-and-stocking-guidelines-for-stocking-ms-ponds).

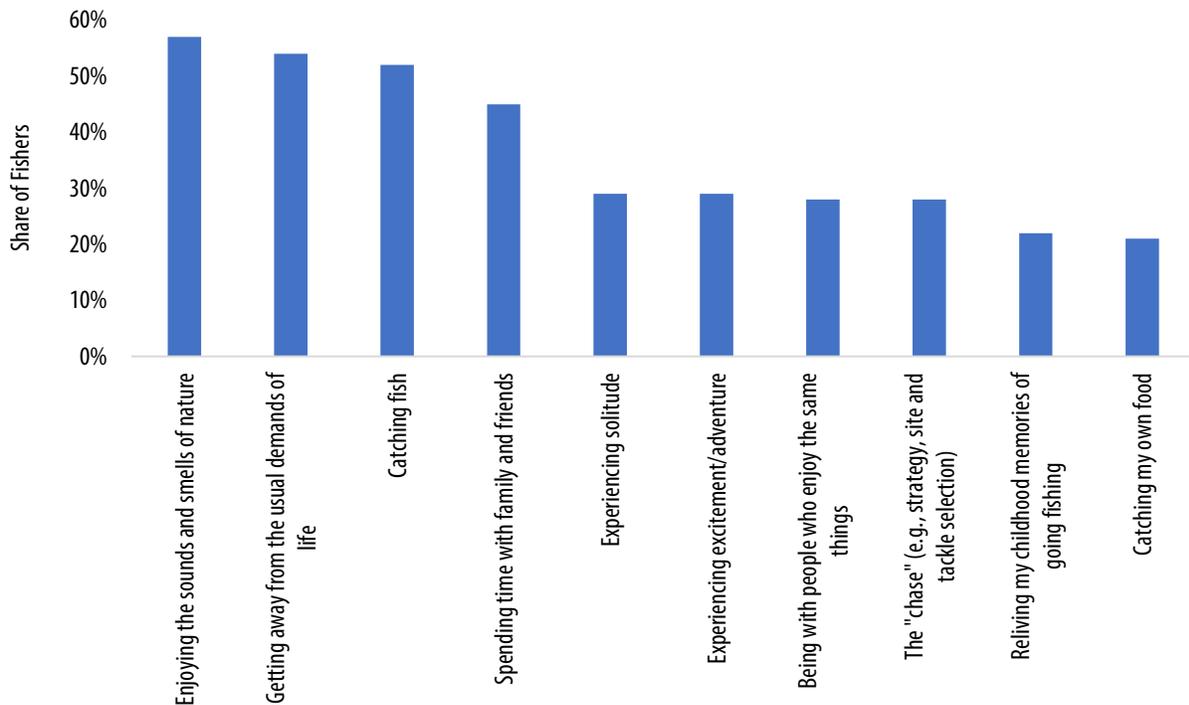
A fee-fishing operation may also require basic packaging investments. As an example, Big Brown Fish & Pay Lakes in Effort, Pennsylvania, provides buckets for visitors to store their catch while they continue to fish. When filled with cool water or ice, the buckets offer the right environment for maintaining fish freshness. At checkout, the operation weighs fish and then bags them to help consumers transport the fish home. Additionally, the business clearly describes these packaging details and other information for visitors on its website (bigbrownfish.com/fish-lakes). Other businesses may consider publishing similar information, so visitors know what to expect. They also may look to provide the needed packaging (e.g., buckets, bags) or explain that visitors must bring their own.

Promotion

The research from the Outdoor Foundation and Recreational Boating and Fishing Foundation outlines what fishers most enjoy about the activity. Exhibit 3.3.8 shares the top 10 benefits that fishers cited.

More than half of fishers identified these reasons as the best things about fishing: enjoying the sounds and smells of nature, getting away from the usual demands of life and catching fish (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf). Addressing these themes in promotional messaging tied to marketing a fee-fishing experience or selling fish to stock ponds may help prospective buyers picture the benefits of a purchase.

Exhibit 3.3.8. Most Cited “Best Things” about Fishing

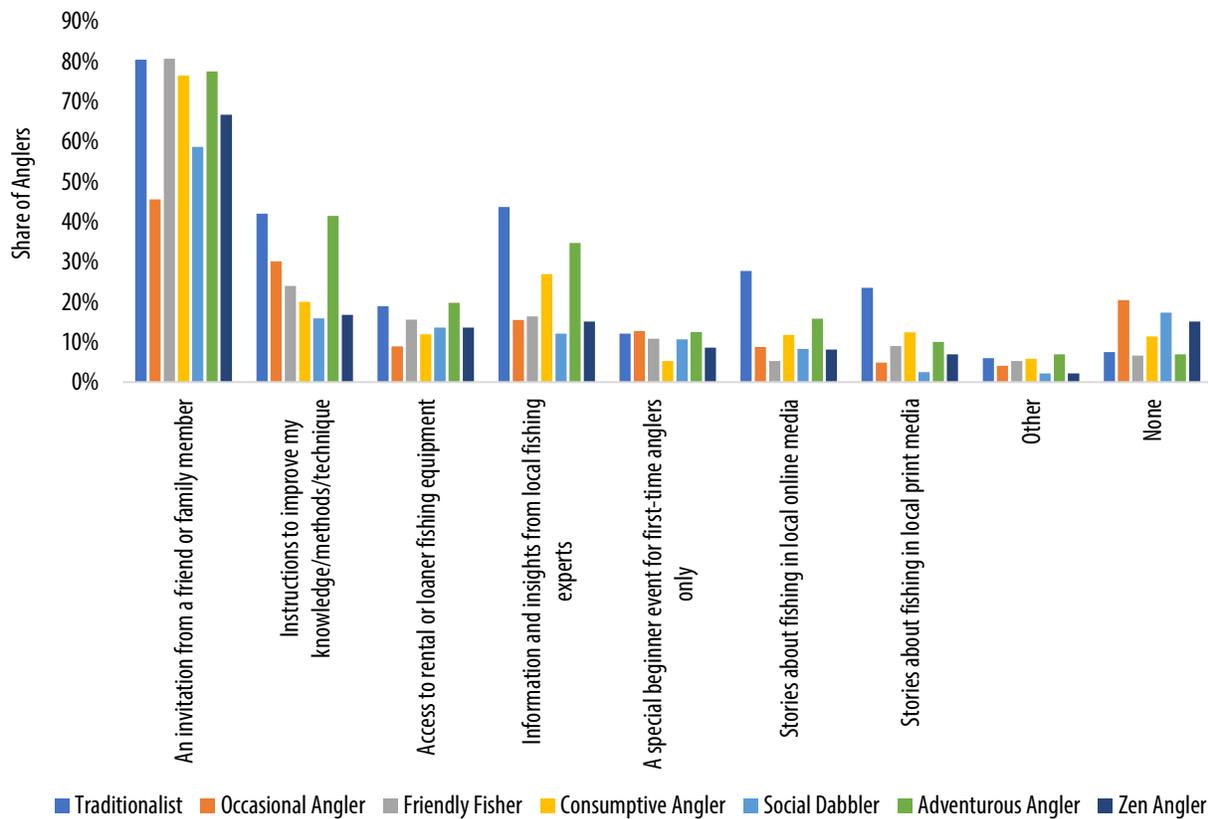


Source: Outdoor Foundation and Recreational Boating and Fishing Foundation (takemefishing.org/getmedia/155fcbd1-716a-41e5-ad5b-1450b76b9162/2022-Special-Report-on-Fishing.pdf)

In its angler personas research, Southwick Associates probed participants to identify factors that would motivate them to fish more often. For fee-fishing businesses, these motivators may present opportunities for developing promotional programs that encourage return visits. Producers selling fish for pond stocking purposes may communicate these messages to trigger pond or lake owners to make stocking decisions. Exhibit 3.3.9 presents the personas research results. For all seven segments, “an invitation from a friend or family member” ranked as the top factor that would encourage more frequent fishing experiences. For four of the seven segments, “instructions to improve my knowledge/methods/technique” ranked as the second most-cited factor to encourage more frequent fishing. “Information and insights from local fishing experts” ranked second among traditionalists and consumptive anglers (southwickassociates.com/wp-

<content/uploads/downloads/2020/08/ASA-Angler-Personas-Technical-Report-8-31-20.pdf>). These findings underscore how personal connections drive fishing experiences. Developing and promoting referral programs, group fishing discounts and team fishing events could possibly lead to customers inviting friends and family to fee-fishing operations. Those who receive invitations may then return the favor and invite others to fish. For pond stocking businesses, communicating the stocking decision as a vehicle for making memories with family and friends or providing access to information and expertise related to fishing and pond or lake management could be other strategies to promote pond stocking products and services.

Exhibit 3.3.9. Factors That Might Encourage Anglers to Fish More Often



* n=673 for traditionalists; n=187 for occasional anglers; n=149 for friendly fishers; n=219 for consumptive anglers; n=144 for social dabblers; n=474 for adventurous anglers; n=244 for Zen anglers

Source: Southwick Associates (southwickassociates.com/wp-content/uploads/downloads/2020/08/ASA-Angler-Personas-Technical-Report-8-31-20.pdf)

Fee Fishing

Events tied to fishing experiences create an opportunity to attract anglers. Designed to reach inexperienced anglers and spark a passion for the sport, fishing derbies provide an opportunity to introduce families to fishing or attract event-sized traffic to fishing venues. At a derby, participants will have a chance to fish, but some events also incorporate other programming such as educational presentations, demonstrations and instruction (extension.msstate.edu/publications/what-fishing-derby). Small ponds and lakes work well as fishing derby sites. The bank at a site should provide good access to the water's edge. Several steps can help to make the event safe and accessible. Those include making fishing spaces open to individuals with disabilities, positioning parking away from foot traffic, installing railings or fences to keep participants away from potentially dangerous areas and preparing for medical emergencies (extension.msstate.edu/publications/selecting-site-for-fishing-derby). In some cases, derbies have a friendly competition component. They may award prizes for number of fish caught or length of all fish caught (extension.msstate.edu/publications/basis-for-competition-fishing-derbies). If organizing a fishing derby, then refer to this Mississippi State University Extension publication for a month-by-month guide to planning activities: extension.msstate.edu/publications/planning-and-organizing-fishing-derby. Water bodies managed by municipalities or other public agencies are popular venues for fishing derbies. However, privately owned ponds and lakes may consider organizing these events themselves or leasing their spaces to outside groups interested in hosting derbies.

To reach experienced anglers through events, fee-fishing businesses may consider hosting a fishing tournament or rodeo (extension.msstate.edu/publications/what-fishing-derby). Tournaments typically charge an entry fee, set specific guidelines to dictate the competition and award prizes to the winners. Sometimes, organizers guarantee a certain number of prizes per a certain number of entries. In some cases, nonprofits or community organizations choose to host fishing tournaments as fundraisers, or companies may look for venues to host team-building events for their employees. These audiences may consider fee-fishing venues as tournament sites. Alternatively, the fee-fishing business could work with a sports club to organize a tournament or host one independently.

Pricing

The prices set for fish sold for pond stocking or fee-fishing experiences vary significantly based on multiple factors. This section provides examples of the revenue streams and pricing approaches used by existing businesses offering these products and services. Missouri producers may consider adapting these models to their own businesses.

Fee Fishing

When designing a price schedule for a fee-fishing operation, the following points explain different options to consider and tradeoffs to various pricing models. A Maryland Cooperative Extension fact sheet and University of Kentucky publication highlighted several of the following considerations (extension.umd.edu/sites/extension.umd.edu/files/2021-03/FS754_DvpingFeeFishingEnt.pdf and aquaculture.ca.uky.edu/sites/aquaculture.ca.uky.edu/files/managing_kentucky_fee_fishing_operations.pdf).

- If charging a low entry fee, then the entrance itself may not drive revenue for the business. However, businesses may add higher fees for keeping fish to offset the low entry fees. Fee-fishing businesses that allow visitors to purchase fish they catch will need to set a price — often one that’s assessed per pound — for these kept fish and hire labor to weigh fish and complete these transactions. Fish sales records can be used to track inventory levels.
- For businesses that charge a relatively high entry fee, the fee itself may have more value if it includes more than just entry. As an example, the fee may package entry and keeping one fish.
- In a catch-and-release model, the entry fee will need to accommodate possible losses that stem from released fish that don’t live because of catch stress. Fee-fishing operations that do follow a catch-and-release model do experience losses from fish death.
- To drive participation among specific market segments, consider offering targeted discounts, such as those for senior citizens or school groups.
- Offering season passes would allow fee-fishing businesses to capture revenue at the beginning of the season. The season pass model may also create long-term customers if passholders visit the venue multiple times and create positive memories or traditions tied to the venue.

Exhibit 3.3.10 summarizes a few revenue models and associated fees set by U.S. fee-fishing operations. Typically open on evenings and weekends, fee-fishing businesses or pay ponds often stock trout in their ponds and lakes open to the public. Other species commonly available from a fee-fishing experience include bass and catfish. Some businesses, particularly those with catch-and-release fishing, charge an entry fee. In some cases, operations require visitors to keep and buy the fish they catch, and they charge a fee per pound of fish. Sometimes, they levy extra fees for providing additional services such as cleaning and filleting caught fish or renting boats. Contests (e.g., biggest fish of the month, tagged fish, end-of-season fish-off) may also draw participants to fee-fishing sites.

Exhibit 3.3.10. Sample Revenue Streams and Pricing for Sample Fee-Fishing Businesses

| Business | Location | Sample revenue streams | Pricing (as of summer 2023) |
|---|---------------------------|---|--|
| Big Brown Fish & Pay Lakes | Cresco, Pennsylvania | Entrance fee; fee per pound of live weight fish caught for trout and largemouth bass | \$4 regular entrance, \$3 senior entrance and free kids younger than 12; \$7.75 per pound for trout and \$13.75 per pound for largemouth bass |
| Blue Water Catfish Farm | Eagleville, Tennessee | Catch-and-release catfish fishing; observer fees; take-home fish; tournament entries | \$20 for 13-year-olds and older and \$15 for 12-year-olds and younger for catch-and-release fishing; observers pay \$5 per person; \$3 per pound for take-home fish; \$25 per tournament entry |
| Broken Poles Catfish Pond | Ballard, West Virginia | Tournament entry fees; slot fishing to receive prize money if catching fish of a certain weight; fun fishing fee per pole | \$32 per pole for Friday/Saturday tournaments, \$20 per pole for Sunday tournaments, \$10 per pole for Wednesday tournaments; slot fishing at \$16 per pole for four-hour ticket, \$20 per pole for six-hour ticket, \$24 per pole for eight- or 12-hour ticket; \$12 per pole for fun fishing |
| Capt-n Cliff's Pay Lake | Beckley, West Virginia | Tournaments and fun fishing; cabin rental available; trout and catfish | \$35 tournament entry with one pole, \$10 for additional two poles and \$5 jackpot; \$15 fun fishing; trout catch-and-keep at \$26 and keep five |
| Kirkendoll Pay Pond | Oceana, West Virginia | Fun fishing with two-pole limit, may keep fish weighing no more than 6 lb. at \$2.75 per pound; tag fishing; catch-and-release tournaments; brown catfish and channel catfish | Fun fishing entry priced at \$15 for adults, \$10 for 7- to 12-year-olds and free for kids who have one pole and participate with a paying adult; \$30 for tournament entry with one pole and \$5 for an extra pole; \$2 to \$3 for fish tags where those who catch a tagged fish win half the pot |
| Moby Dick's Private Pond Fishing | Cedar Creek, Texas | Hourly fishing rate to catch bass, blue catfish, channel catfish, perch, crappie; fishing mini lessons, full-service fishing, kids birthday party package | Group rate is \$15 per person per hour for the first two hours and then \$5 per person for additional hours; individual fishing is \$10 per hour |
| Montebello Resort | Montebello, Virginia | Fee per pound of rainbow trout caught | \$6.25 to \$6.95 per pound caught |
| Mountain Springs Trout Park | Highlandville, Missouri | Fee per pound of live trout, which is gutted, gilled and packed on ice; catch and release; event rentals for birthday parties, weddings, receptions, reunions; trout fillets and smoked trout | \$8.95 per pound live weight for catch-and-keep trout; \$35 per hour per pole for catch-and-release fishing; \$20 per guest for birthday party rentals; \$500 full-day event rental; \$250 half-day event rental; \$2 per trout for skin-on, boneless fillet; \$18.95 per pound for smoked trout |
| Rutland Farms Fishing | Tifton, Georgia | Fee per person; catch-and-release bass; 30-fish total for bream, crappie and catfish combined | \$20 per person for full day; \$10 per person for half day; Kids 12 and younger are free |
| Santa Ana River Lakes | Anaheim, California | Entry fee for adults, seniors and kids and fish limits; day, mid-day and overnight sessions; trout, catfish, tilapia, bass, crappie, bluegill, sturgeon, carp | Adult rates are \$35 for day sessions with five-fish limit, \$41 for mid-day sessions with seven-fish limit and \$67 for overnight sessions with 10-fish limit and free camping; senior and kid rates discounted from adult rate |
| Spring Valley Trout Farm | Dexter, Michigan | Entrance fee; fee per pound of rainbow trout and channel catfish caught | \$5 entrance per person; \$8.99 rainbow trout per pound plus \$0.40 cleaning fee per fish; \$7.89 channel catfish per pound plus \$0.60 cleaning fee per fish; \$0.30 de-boning fee per fish |
| Springside Trout Farm | New Holland, Pennsylvania | Fee for caught trout; catch-and-release fly fishing fee | Caught trout charged at \$5.75 per pound; \$1 filleting fee per fish; fly fishing fee at \$10 per hour or \$30 per day |
| Trout Haven Fishing Pond | Estes Park, Colorado | Trout catch and clean | \$1.35 per inch of catch \$1 cleaning fee per fish |

Pond Stocking

When selling fish intended for pond stocking, aquaculture producers may charge customers a fee per fish, pound, gallon or set quantity. Smaller fish stocked as feeder fish — examples include shiners and minnows — are sometimes sold by the pound or gallon, or they may sell in large increments, such as 1,000 fish. Commonly, popular sport fish species will be sold by the fish or in a set quantity, such as 100 fish or 1,000 fish. The price charged will vary by species. In some cases, producers offer multiple sizes of fish, and to communicate their size, they post the fish length in inches. The price then differs according to fish size. Larger fish carry the higher price points. The more expensive options include prized sport fish, such as bass, and grass carp.

To help guide pond and lake managers through determining how to stock their ponds, some aquaculture producers who sell fish for pond stocking purposes create stocking packages. The packages are meant to yield a well-balanced population in a pond or lake. Exhibit 3.3.11 summarizes some packages available from aquaculture producers and their pricing. For example, Arkansas-based Stock My Pond offers four package options scaled to meet half-acre and 1-acre pond sizes. Packages include bluegill, hybrid bluegill, redear sunfish, largemouth bass, crappie and minnows, and in both sizes, customers have the choice to add catfish to their packages. Depending on the package size, the business may offer free delivery (stockmypond.com). Based in Montour, Iowa, North Star Fish Hatchery offers two starter packages and another package to add to ponds after the initial stocking year (northstarfishhatchery.com). Jones Fish Lake Management uses descriptive names — besides only the size of a pond or lake — to title its variety of pond stocking packages. The names help prospective buyers to picture the purpose or benefit of a package (e.g., trophy bass, angler's choice). Then, buyers may select the appropriate package size according to their pond or lake size. Often, the business quotes package sizes for ponds that measure one-quarter acre to three acres. Note, two packages have similar names. The fingerling alternatives provide smaller fish than the premier packages (jonesfish.com). Not listed in the table, Blyzo Fish Farm lists multiple stocking packages on its website. Based in Leon, Iowa, the farm's standard stocking packages are similar to those available from the farms listed in Exhibit 3.3.11. Additionally, it markets several multiple-season packages designed for large ponds or lakes, fall forage packages and specialty packages. With a multiple-season package, buyers receive the first fish in the spring. Then, during the following three fall seasons, buyers stock their waterbodies with supplemental fish. Agreeing to a multiple-season package yields a 5% to 10% discount, depending on pond or lake size (blyzofishfarm.com).

Exhibit 3.3.11. 2023 Pricing for Sample Pond Stocking Packages

| Business | Location | Package name and contents | Price [^] |
|-----------------------------|------------------|---|--------------------|
| Blueview Outdoors | Racine, Ohio | ¼ Acre Pond: 25 largemouth bass, 50 bluegill, 25 hybrid bluegill, 25 redear sunfish, 25 yellow perch, 400 fathead minnows, 2 grass carp plus 7.5% sales tax | \$295 |
| | | ½ Acre Pond: 50 largemouth bass, 100 bluegill, 50 hybrid bluegill, 50 redear sunfish, 50 yellow perch, 800 fathead minnows, 4 grass carp plus 7.5% sales tax | \$540 |
| | | ¾ Acre Pond: 75 largemouth bass, 150 bluegill, 75 hybrid bluegill, 75 redear sunfish, 75 yellow perch, 1,200 fathead minnows, 6 grass carp plus 7.5% sales tax | \$785 |
| | | 1 Acre Pond: 100 largemouth bass, 200 bluegill, 100 hybrid bluegill, 100 redear sunfish, 100 yellow perch, 1,600 fathead minnows, 8 grass carp plus 7.5% sales tax | \$1,033 |
| | | Sportsman 1 Acre Package: 100 largemouth bass (varying size), 200 bluegill, 50 hybrid bluegill, 50 black crappie, 100 redear sunfish, 100 yellow perch, 50 channel catfish, 2,000 pounds fathead minnows, 8 grass carp | \$1,245 |
| Jones Fish Lake Management* | Cincinnati, Ohio | Angler's Choice Fingerling Stocking Package, ¼ Acre: 10 lb. fathead minnows, 5 lb. golden shiner minnows, 30 largemouth bass, 15 hybrid striped bass, 100 bluegill sunfish, 50 hybrid bluegill, 50 redear sunfish, 30 channel catfish, 2 triploid grass carp | \$660.08 |
| | | Angler's Choice Premier Stocking Package, ¼ Acre: 10 lb. fathead minnows, 5 lb. golden shiner minnows, 25 largemouth bass, 15 hybrid striped bass, 100 bluegill sunfish, 50 hybrid bluegill, 50 redear sunfish, 30 channel catfish, 2 triploid grass carp | \$1,167.63 |
| | | Supplemental Forage Fish Stocking, ¼ Acre: 20 lb. fathead minnows, 10 lb. golden shiner minnows | \$464.70 |
| | | Trophy Bass Stocking Package, ¼ Acre: 20 lb. fathead minnows, 20 lb. golden shiner minnows, 25 largemouth bass, 400 bluegill sunfish, 200 redear sunfish | \$2,450.85 |
| | | Swimming Fingerling Stocking Package, ¼ Acre: 15 lb. fathead minnows, 10 lb. golden shiner minnows, 35 largemouth bass, 15 hybrid striped bass, 100 mosquitofish, 200 redear sunfish, 20 channel catfish, 2 triploid grass carp | \$966.53 |
| | | Swimming Premier Stocking Package, ¼ Acre: 15 lb. fathead minnows, 10 lb. golden shiner minnows, 30 largemouth bass, 15 hybrid striped bass, 100 mosquitofish, 275 redear sunfish, 20 channel catfish, 2 triploid grass carp | \$1,800.83 |
| North Star Fish Hatchery | Montour, Iowa | Base Stocking: 300 bluegill, 100 largemouth bass, 100 channel catfish, 6 grass carp | \$495 |
| | | Sportsman Stocking: 200 bluegill, 100 channel catfish, 100 hybrid bluegill, 6 grass carp, 100 redear, 1 gallon minnows, 100 largemouth bass | \$685 |
| | | Year-Later for Ponds 2 Acres or Smaller: 150 black crappie, 100 yellow perch, 50 walleye | \$325 |
| Stock My Pond** | Lonoke, Arkansas | Half Acre Without Catfish: 375 bluegill, 50 red ear, 50 hybrid bluegill, 100 largemouth bass, 50 crappie, 5 lb. minnows plus delivery cost | \$625 |
| | | Half Acre With Catfish: 375 bluegill, 50 red ear, 50 hybrid bluegill, 100 largemouth bass, 50 crappie, 5 lb. minnows, 150 catfish plus delivery cost | \$675 |
| | | Acre Without Catfish: 750 bluegill, 100 red ear, 100 hybrid bluegill, 200 largemouth bass, 100 crappie, 10 lb. minnows plus free delivery | \$1,099 |
| | | Acre With Catfish: 750 bluegill, 100 red ear, 100 hybrid bluegill, 200 largemouth bass, 100 crappie, 10 lb. minnows, 300 catfish plus free delivery | \$1,199 |

[^] As of summer 2023

* Packages available for ponds of varying sizes; one-quarter acre package shown as example

** Pricing for Missouri customers quoted

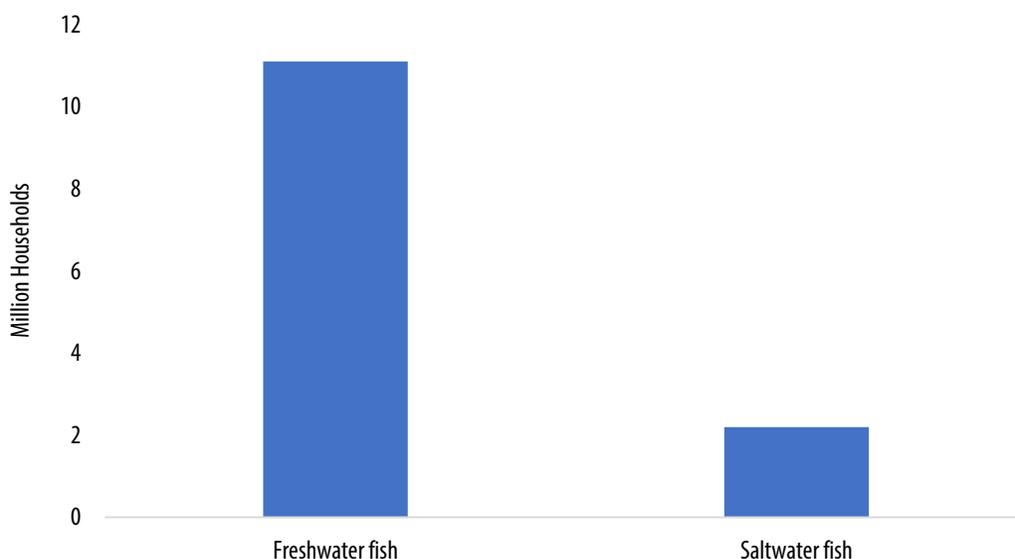
4. Ornamental Fish

4.1. Sales Trends

The Missouri ornamental aquaculture industry has an estimated at five or fewer active businesses. For this reason, this report omits Missouri-specific information collected from the 2022 aquaculture producer survey and focuses instead on summarizing national sales trends. In its 2023-24 National Pet Owners Survey, the American Pet Products Association found that 11.1 million households in the U.S. owned freshwater fish. Exhibit 4.1.1 illustrates that fewer households, 2.2 million, reported owning saltwater fish. The survey results estimated that 86.9 million households owned a pet. Therefore, 12.8% of American pet owners had freshwater fish, and 2.5% owned saltwater fish (americanpetproducts.org/press_industrytrends.asp).

Fish ownership tends to be particularly common among Generation Z — the generation that follows millennials in age. Consumers from this generation also tend to be more likely to own other small pets, including birds and reptiles, according to the generational pet ownership report that the American Pet Products Association released in 2022 (petfoodprocessing.net/articles/15660-appa-releases-generational-report-on-pet-ownership-purchasing-trends).

Exhibit 4.1.1. U.S. Households Owning Fish, According to 2023-24 Pet Owners Survey

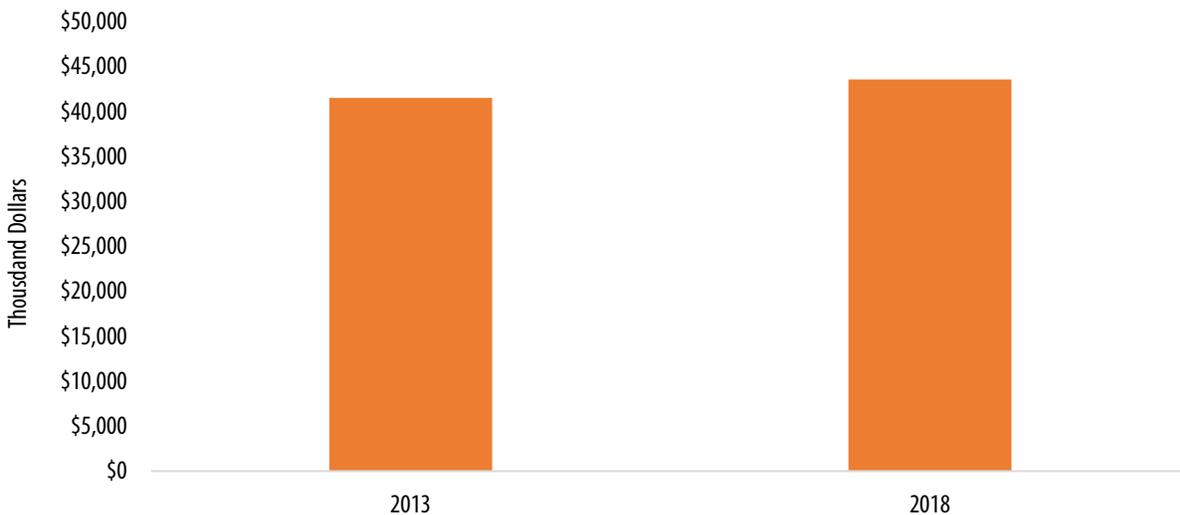


Source: American Pet Products Association (americanpetproducts.org/press_industrytrends.asp)

Value and Volume

Data from the U.S. Census of Aquaculture indicate the trend in domestically produced ornamental fish sales. Exhibit 4.1.2 visualizes the change in U.S. aquaculture producers' ornamental fish dollar sales from 2013 to 2018. Between these two years, ornamental fish dollar sales increased by 4.9%; they grew from \$41.5 million in 2013 to nearly \$43.5 million in 2018. The number of farms selling ornamentals declined 8% during this period to 263 operations in 2018. Of aquaculture producers in all states, Florida producers contributed most to these sales. When considering dollar sales, Florida producers captured approximately two-thirds of the domestic ornamental fish market in both years. Statewide sales estimates were not disclosed for Missouri or 20 other states with low numbers of producers to protect respondent anonymity (nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0017_0017.pdf).

Exhibit 4.1.2. Dollar Sales of U.S.-Produced Ornamental Fish



Source: USDA Census of Aquaculture, 2018

(nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0017_0017.pdf)

In addition to using domestically produced ornamental fish, the U.S. market also relies on ornamental fish imports, and compared with all other countries, it ranked first for ornamental fish imports in 2021. At a 19.1% share of all ornamental fish imports, the U.S. imported ornamental fish valued at roughly \$74.9 million that year. Countries supplying ornamental fish that the U.S. imports include Singapore, Sri Lanka and the Philippines. Collectively, 44% of the U.S. imports originated from these three countries in 2021 (oec.world/en/profile/hs/ornamental-fish).

Species by Species

To gauge sales by species, U.S. Census of Aquaculture data in Exhibit 4.2.3 summarize sales of several species or species categories in 2013 and 2018. Freshwater species sales exceeded saltwater species sales. The saltwater category recorded a 20% share in 2018

(nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0017_0017.pdf).

Often, producers raise freshwater species, and marine species originate from the wild

(edis.ifas.ufl.edu/publication/FA224). Within the freshwater category, U.S. producers recorded more

sales of egg-laying than live-bearing species. In 2018, egg-laying sales were more than seven times greater

(nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0017_0017.pdf).

Egg-laying species include angelfish, neon tetras and zebra danios. Live-bearing species include mollies, swordtails and guppies (thefishsite.com/articles/an-introduction-to-ornamental-aquaculture-part-ii).

Exhibit 4.1.3. Dollar Sales of U.S.-Produced Ornamental Fish by Species or Species Category, in Thousands

| Species or species category | 2013 | 2018 |
|------------------------------------|-----------------|-----------------|
| Freshwater egg layers | \$16,076 | \$17,709 |
| Freshwater live bearers | \$2,927 | \$2,300 |
| Goldfish | \$4,136 | (D) |
| Koi | \$6,898 | \$8,141 |
| Saltwater | \$10,323 | \$8,857 |
| Other ornamental | \$1,124 | (D) |
| Total | \$41,485 | \$43,534 |

Source: USDA Census of Aquaculture, 2018

(nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0017_0017.pdf)

Exhibit 4.1.3 lists two specific species: koi and goldfish. Koi represented nearly 19% of the dollar sales recorded in 2018, and the census report didn't disclose the goldfish sales total

(nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0017_0017.pdf). A

type of carp, koi sales have benefited from growing interest in water gardening, and consumers looking to add koi to their gardens or landscapes tend to show the most interest in springtime purchases. Outlets such as pet stores, discount chains and garden centers may stock koi fish. Depending on whether koi are considered pond quality or show quality, their price can vary dramatically. Note, consumers may also use some goldfish varieties in water gardening applications, too (agmrc.org/commodities-products/aquaculture/aquaculture-fin-fish-species/koi-carp).

A July 2022 story from Pet Product News described increasing popularity for freshwater species at the time. One freshwater aquatic species that tended to pique consumers' interest was shrimp

(petproductnews.com/current-issue/demand-for-aquatic-livestock-surges-despite-rising-prices-other-headwinds/article_ce6990ae-ee51-11ec-9fb5-ef811aab40e4.html). A year earlier in July 2021, the publication reported that consumers had particular interest in “oddball” freshwater fish species. Examples included cory catfish, unique angelfish, gobies and cichlids. Aquatic plants were also highly demanded. At the same time, consumers felt less interested in experimenting with unique saltwater species (petproductnews.com/current-issue/aquatic-stores-face-freshwater-fish-supply-shortages/article_5af2629c-d50f-11eb-96c6-bb02ed697e32.html).

Factors Driving Change

Generally, the COVID-19 pandemic triggered American consumers to add more pets to their households. In its 2021-22 National Pet Owners Survey, the American Pet Products Association found that 14% of the pet owners and nonowners who participated in the research said they acquired a new pandemic-time pet. Of the pet owners who had added saltwater fish to their households, 60% attributed the change in saltwater fish ownership to the pandemic. For new freshwater fish owners, 34% said the pandemic played a role in them acquiring the new fish (americanpetproducts.org/Uploads/NPOS/21-22_BusinessandFinance.pdf). The pandemic triggered some concerns about ornamental fish supply. Retail establishments in July 2022 reported some challenges with keeping fish in stock (petproductnews.com/current-issue/demand-for-aquatic-livestock-surges-despite-rising-prices-other-headwinds/article_ce6990ae-ee51-11ec-9fb5-ef811aab40e4.html).

4.2. Marketing Considerations

The following considerations may shape how ornamental aquatic species producers approach marketing fish to consumers and intermediary buyers.

Purchase Considerations

The Centers for Disease Control and Prevention have a “Healthy Pets, Healthy People” program to inform U.S. households about how to incorporate pets safely into their homes. The agency lists a variety of considerations — mostly focused on health — that consumers should note when selecting fish. Those include the following points (cdc.gov/healthypets/pets/fish.html).

- Choose fish that will thrive in the aquarium setup you plan to use, and make sure the number of fish you plan to keep will fit comfortably in the aquarium space available.
- If selecting multiple species to stock in a single tank, then double-check that they will do well in the same environment.

- Observe whether a fish swims actively and normally. Only purchase fish that meet these criteria.
- Avoid picking fish stocked in a tank with unhealthy or dead fish.
- Prioritize selecting fish that have good color; no bumps; intact fins; and scales with a smooth, sleek and shiny appearance.

In some cases, consumers may hold preferences for fish raised in certain areas. The American Veterinary Medical Association urges consumers to inquire about where fish originated while they evaluate their options. With respect to sustainability, some ornamental fish producers have committed to sourcing ornamentals in such a way to minimize disturbance to wild fish. Consumers may share those same values (avma.org/resources/pet-owners/petcare/selecting-pet-fish).

Other reasons may contribute to consumers viewing fish as well-suited pets for their particular situations. For example, allergy sufferers who want to experience pet ownership may look to purchase and care for fish. The color variety provided by different fish species can add to the interest. Observing fish may also provide stress relief benefits (avma.org/resources/pet-owners/petcare/selecting-pet-fish). When marketing ornamental fish to consumers, these factors could be possibilities to emphasize in messaging.

Packaged Facts released a report focused on fish, small mammals, reptiles, amphibians and birds in 2021. According to research with Americans who own these types of pets, several factors motivated them to keep these types of pets. The enjoyment stemming from watching and observing these animals was a motivator for 65% of these owners. They also reported simply loving these pets, enjoying the interactions with these pets and appreciating the liveliness and companionship these animals contribute (petproductnews.com/news/ownership-of-fish-small-animals-and-herptiles-hits-10-year-high/article_6a482024-0a84-11ec-a7bf-1fe838c1ae6a.html).

In June 2022, Pet Product News reported on the trend toward consumers buying and maintaining nano aquariums, which are small tanks that may require less time for upkeep. Kits that simplify the setup for nano tanks have been particularly popular. Some beginners may want to start with a nano aquarium to learn how to best manage a tank. However, more experienced aquarium owners may also use nano tanks — sometimes more than one nano tank per person, too. Demand for this tank configuration, limited availability of tank components and shipping problems constrained the supply of nano aquariums during the pandemic (petproductnews.com/trends/sleek-and-modern-nano-tanks-are-sparking-new-interest-in-the-hobby/article_8ccda3fc-e1bc-11ec-a6be-b7ec7e7f76a9.html). Consumers who use nano tanks will want to choose species that work well in the smaller aquarium environment.

Value-Added Opportunities

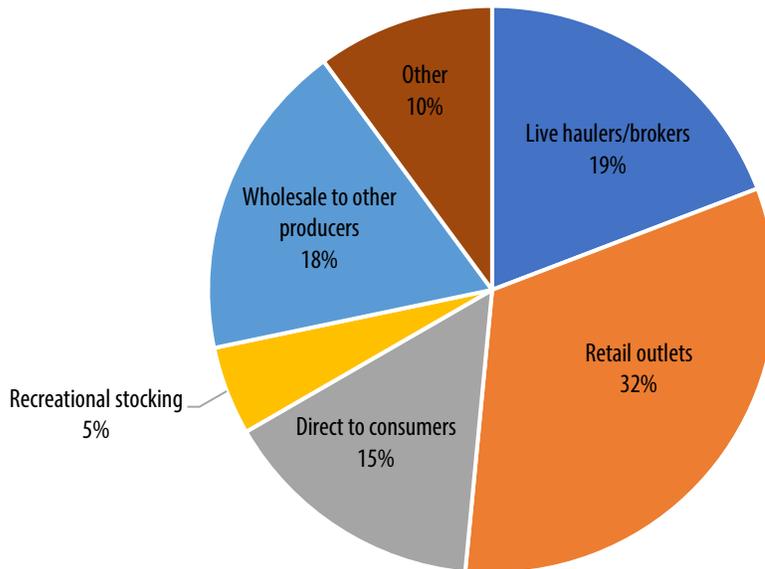
The pet market overall has trended toward premiumization in recent years — a willingness to treat and spend on animals in the household. Premium products considered by pet owners include natural foods and sustainable, design-forward habitats and toys. In a 2021 report, Packaged Facts reported that 33% of pet owners it surveyed at the time had increased their pet-related spending in the preceding year. A minor share, 4%, had decreased spending (petproductnews.com/news/ownership-of-fish-small-animals-and-herptiles-hits-10-year-high/article_6a482024-0a84-11ec-a7bf-1fe838c1ae6a.html). Given the acceptance of premium pet products, consumers may be willing to consider value-added ornamental fish goods.

One value-added opportunity involves educating new ornamental fish hobbyists about how to manage the ecosystems in their aquariums. A September 2021 story from Pet Age described how 28% of consumers new to keeping fish don't continue this activity after one year. Challenges driving first-time fish owners to stop pursuing this hobby include not understanding how to maintain water quality and the tank's appearance. Namely, water clarity and algae growth are two common issues (petage.com/understand-what-motivates-aquatic-hobbyists-to-better-serve-them-fish-aquarists-trends). Equipping ornamental fish hobbyists with the information needed to care for fish and their habitats may give them more confidence, encourage them to keep their fish and lead to developing long-term customers who will demand more fish as their aquarium investments grow.

Market Channels

With respect to ornamental fish, retail outlets represented the most important point of first sale from a sales perspective. They generated 32% of ornamental fish sales, according to the 2018 Census of Aquaculture administered by USDA and listed in Exhibit 4.2.1. Live haulers or brokers and wholesale to other producers ranked second and third, respectively, based on contributions as points of first sale for ornamental fish. Compared with all other aquaculture products evaluated in the survey, ornamental fish derived the greatest share of sales — 15% — from direct-to-consumer transactions (nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0021_0022.pdf).

Exhibit 4.2.1. Share of Aquaculture Producers' Ornamental Fish Sales by Points of First Sale



Source: U.S. Census of Aquaculture 2018

https://nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0021_0022.pdf

If selling to retailers, then understanding these businesses' needs can help aquaculture producers move product. Pet stores tend to appreciate variety and unique species that incentivize consumers to visit their establishments to find novel fish (petproductnews.com/current-issue/demand-for-aquatic-livestock-surges-despite-rising-prices-other-headwinds/article_ce6990ae-ee51-11ec-9fb5-ef811aab40e4.html).

Color is another factor to consider. A January 2018 story from Pet Age described color as a trend in the freshwater fish market (petage.com/differentiation-is-key-in-the-freshwater-category). Also, because of consumers buying more pet products online, retailers may not stock as many "dry goods" as they have in the past or may not sell as many of these products given the competition with online providers. For brick-and-mortar stores, accessing and marketing high-quality live product may be the niche they have the greatest opportunity to pursue (petproductnews.com/current-issue/demand-for-aquatic-livestock-surges-despite-rising-prices-other-headwinds/article_ce6990ae-ee51-11ec-9fb5-ef811aab40e4.html). Brick-and-mortar stores generated more than 80% of freshwater fish purchases tracked in the 2016 American Pet Products Association pet owner survey (petage.com/differentiation-is-key-in-the-freshwater-category).

Promotion

If selling directly to consumers, then engaging with aquarium societies may provide an opportunity to connect directly with individuals passionate about ornamental fish. At least two of these organizations exist in Missouri. Serving the western side of the state, the Heart of America Aquarium Society of Kansas

City hosts monthly meetings with guest speaker presentations. Its website also mentions auctions and swaps as other programming, and the organization has an online forum available to aquarium hobbyists (kcfishclub.org). The Missouri Aquarium Society meets in St. Louis. It also hosts meetings, swaps and auctions, and on its website, the organization describes its focus on “keeping and breeding of tropical and marine fish or other aquatic life” (missouriaquariumsociety.com).

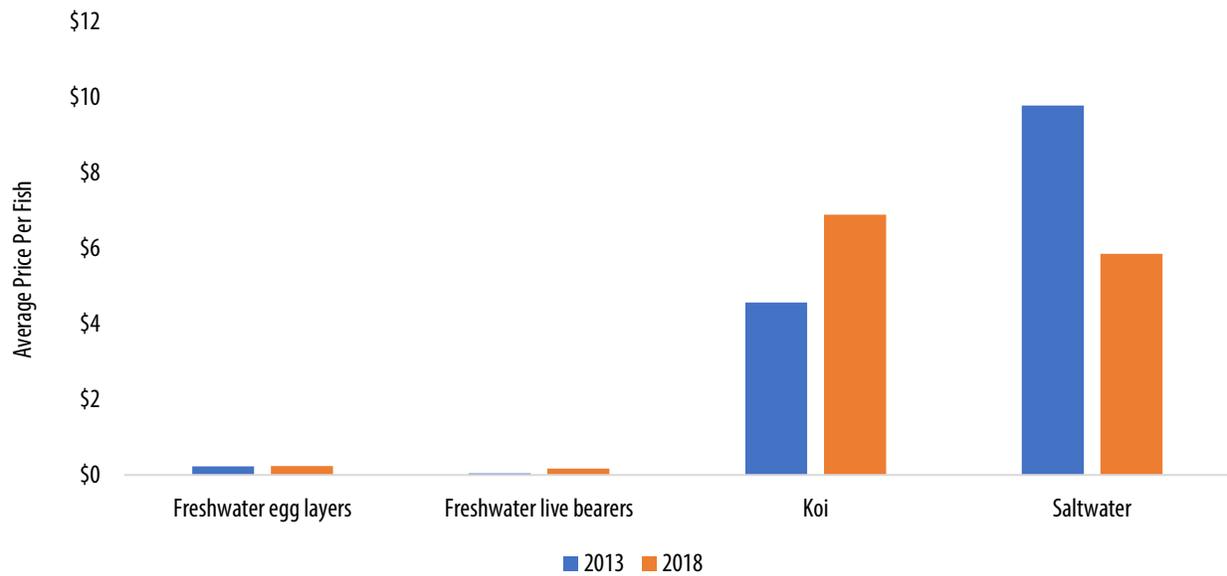
The Aquarium Hobbyist Magazine also serves as a channel to communicate with individuals who are ornamental fish enthusiasts. Published quarterly, the magazine includes stories about aquarium trends, and it accepts advertisements. The magazine also sponsors nonprofit aquarium clubs. Members of sponsored clubs can receive the magazine, and the clubs can use the magazine to share information and other messages with the aquarium hobbyist community. The Missouri Aquarium Society is one of the clubs sponsored by Aquarium Hobbyist Magazine (aquariumhobbyistmagazine.com).

Hobbyists interested in keeping ornamental fish — in particular, those who are new to the hobby — may appreciate guidance and ideas about how to assemble a neat display. Therefore, retailers look to create interesting displays to help with brainstorming and planning (petproductnews.com/current-issue/demand-for-aquatic-livestock-surges-despite-rising-prices-other-headwinds/article_ce6990ac-ee51-11ec-9fb5-ef811aab40e4.html). If working with retailers, then supplying display ideas may be an opportunity to add value to ornamental fish sales. If selling directly to consumers, then offering display ideas to a particular target customer may help to encourage ornamental fish sales.

Pricing

For species or species categories with an adequate number of records, the U.S. Census of Aquaculture reports the average price per ornamental fish. Exhibit 4.2.2 shares the data for 2013 and 2018. As illustrated, saltwater species tend to command a higher price per fish than many freshwater species. However, the price per saltwater fish did decline by 40% between these two years. In 2018, koi averaged a higher price per fish than saltwater fish, and koi prices increased on average from 2013 to 2018. Koi prices grew by 51%. Within the two combined freshwater species categories, freshwater egg layers have commanded a higher price than freshwater live bearers. However, the live bearer prices increased in 2018 and were only \$0.07 less per fish on average than egg layer prices. Note, goldfish data were reported in 2013 when prices averaged \$0.05 per fish. Those data were withheld from reporting in 2018 (nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0017_0017.pdf).

Exhibit 4.2.2. Average U.S. Price Per Fish for Ornamental Species



Source: U.S. Census of Aquaculture 2018

(nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/aqua_1_0017_0017.pdf)