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Seafood Purchasing Behavior in the U.S. during the Early Recovery Period from the COVID-19 Pandemic

Mustafa Selcuk Uzmanoglu^{1,2,*}, Shraddha Hegde³, Carole Engle⁴, Jonathan van Senten¹, Ganesh Kumar⁵ and Madan Dey⁶ 

¹ Virginia Seafood AREC, Virginia Polytechnic Institute and State University, Hampton, VA 23669, USA; jvansenten@vt.edu

² Vocational School of Technical Sciences, Marmara University, Mehmet Genc Campus, Kartal 34865, Istanbul, Turkey

³ Department of Rangeland, Wildlife and Fisheries Management, Texas A&M University, College Station, TX 77843, USA; shraddha@tamu.edu

⁴ Engle-Stone Aquatic LLC, Strasburg, VA 22657, USA; cengle8523@gmail.com

⁵ Delta Research and Extension Center, Thad Cochran National Warmwater Aquaculture Center, Mississippi State University, Stoneville, MS 38776, USA; gkk27@msstate.edu

⁶ Department of Agricultural Sciences, Texas State University, San Marcos, TX 78666, USA; mmd120@txstate.edu

* Correspondence: selcuk.uzmanoglu@gmail.com or suzmanoglu@marmara.edu.tr

Abstract: This study examined seafood consumption during the early period of economic recovery following the COVID-19 pandemic. Specifically, surveys of U.S. consumers compared seafood purchasing behavior of the first two quarters of 2021 (Q1, 1 January through 31 March 2021, and Q2, 1 April through 30 June 2021) with those of 2020. Each survey included 100 seafood consumer respondents in each of the 20 U.S. metropolitan market areas. Following data cleaning, there were 1885 valid responses for Q1-2021 and 1940 for Q2-2021. A majority (57%) of respondents had received at least one dose of the COVID-19 vaccine before March 2021 and 70% had received at least one dose as of June 2021. Regardless of vaccination status, few respondents (6% to 9.5% for food generally and 4% to 6.5% for seafood) reported changes in seafood consumption. Seafood consumption away from home increased significantly in Q1-2021 as compared to 2020 and continued to increase but to a lesser degree in Q2-2021. Demographic differences were found in shopping behaviors by age, education, income, and gender, but not by ethnic group. Generally, higher-income females with higher education tended to purchase more seafood. Respondents reported increased numbers of shopping trips per year in Q1-2021 as compared to 2020, which continued into Q2-2021 for general food, but shopping trips for seafood decreased as compared to 2020. The frequency of takeout purchases (times/year) of prepared meals for home consumption of seafood decreased during Q1 from 2020 and remained at that level in Q2-2021, but home delivery purchases of prepared meals of seafood increased during this period. Approximately 50–55% of respondents reported no change in overall seafood consumption levels, while 28% noted an increase in seafood consumption compared to pre-pandemic periods, a significant increase from the 19% who had reported doing so pre-pandemic. In contrast, those reporting a decrease declined from 31% to 17% in comparison to pre-pandemic levels. Seafood consumption in the U.S. remained stable and recovered in early 2021, with a preference for dining out. Consumer behaviors varied by age, income, education, and gender, but not by ethnicity. These changes were primarily driven by access, availability, and income, indicating the need for further research on long-term consumption patterns. This study found apparent stability of seafood consumption by U.S. consumers, which recovered from pandemic consumption levels in early 2021, and there was little change in seafood consumption, frequency, or the types of seafood consumed. Vaccination status did not appear to affect seafood consumption.

Keywords: seafood purchases; early pandemic period; shopping behavior; consumer behavior; seafood markets



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Key Contribution: This study found apparent stability of seafood consumption by U.S. consumers, which recovered from pandemic consumption levels in early 2021. Respondents reported little change in overall (when at-home and away-from-home consumption was combined) consumption or frequency of seafood consumption in this study. There also was little change in the types of seafood chosen for consumption by many respondents, with no change over time in the most often eaten seafood. This was also true regardless of vaccination status.

1. Introduction

The COVID-19 pandemic was unprecedented as a public health crisis but also as an unparalleled shock to the U.S. economy. Vaccines for COVID-19 began to become available in December 2020 but were not widely available until the first quarter of 2021, following which economic restrictions began to be eased and the economy entered a recovery phase. Understanding the effects on seafood purchasing behavior in the U.S. throughout the lengthy recovery period is important for seafood suppliers and buyers to continue to adjust to the dynamic, uncertain post-pandemic market conditions.

Effects on purchasing behavior during periods of severe economic shocks have not been well studied for general food purchases or, specifically, for seafood. Purchasing behaviors in economic downturns vary by location and socio-demographic factors [1], but food purchases are not always affected as severely because food is an essential good [2]. Consumer spending may be affected more by the length of the shock and the extent of its effect on household income than by other factors [3]. Recovery of spending patterns may occur more slowly than initial reductions in spending [4].

The nature of a crisis affects consumer responses, but the COVID-19 pandemic and economic shutdowns were unprecedented in modern economic history. Early studies on effects of the COVID-19 pandemic focused largely on supply effects. For example, [5] found that 90% of U.S. aquaculture farms experienced impacts from the economic shutdowns. The ensuing loss of revenue was substantial when restaurants closed because of the shelter-at-home orders, creating critical cash flow deficits that deepened with the length of the pandemic-induced shutdowns [6]. The aquaculture industry faced significant production and marketing challenges due to the COVID-19 crisis. The restrictions imposed by pandemic lockdowns, both domestically and internationally, along with disruptions in transportation and travel, resulted in a decreased ability to market aquaculture products effectively [7]. Consumption displacement occurred as a result of mobility restrictions, reduced income, and the overall need to reduce consumption [8,9]. Several studies conducted during the pandemic and economic shutdowns predicted that the changed consumer behaviors identified during the pandemic would endure after the pandemic had ended, especially the change to increased online sales [10,11]. Morales (2021) showed significant increases in online sales that were driven primarily by younger consumers and claimed that online sales would likely continue to increase going forward [12]. By contrast, however, Tudoran et al. (2024) found that 67% of customers discontinued their online grocery shopping within a year of the pandemic [13].

Fewer studies have examined changes in seafood consumer behavior either during the pandemic or through the recovery period. Those that did revealed variability across countries. In the U.S., the early effects of COVID-19 on seafood consumption showed a substantial (70%) decline in consumer demand for seafood from restaurants [14], similar to that reported in China, especially for high-value marine species consumed in restaurants [15]. In Bangladesh, fish consumption also decreased severely during the pandemic [16]. The collapse of the tourism industry in the Galapagos Islands, Ecuador, combined with pandemic-induced closures of restaurants hotels and cruises, severely reduced seafood demand [17]. In Brazil, however, more than half of those surveyed reported no change in fish consumption during the pandemic [18]. In France, the trend of purchasing pre-packaged fish was amplified during the pandemic, but fresh shellfish consumption

at home did not change significantly during the pandemic [19]. In Indonesia, seafood consumption decreased during the pandemic, primarily because of its higher cost, and to a lesser extent, the reduced availability of seafood [20]. The perceived risk associated with wild freshwater fish negatively affected purchase frequency, with some consumers altering their perceptions of risks associated with wild freshwater fish [21]. Australians consumed beef and chicken for more than two meals per week, in contrast to pork, lamb, and seafood, which were consumed once a week. During the pandemic, consumption across all meat types, including seafood, increased [22]. In the U.S., changes in seafood purchasing behavior in 2020 as compared to 2019 largely mirrored the availability of seafood with decreased away-from-home consumption when restaurants closed but were also affected by changes in consumer income throughout the pandemic [23]. Shrimp consumption in the U.S. increased from July 2020 to June 2021 as compared to the lockdown phase of March to June 2020 [24]. Given the lack of studies generally on consumer behaviors during severe shocks and the recovery period, this study evaluated U.S. seafood consumer behavior during the first half of the 2021 recovery period and compared that behavior with 2020, the first year following the outbreak of COVID-19.

The general and seafood-specific news media have reported increased preparation of seafood at home following the pandemic [25–27]. These reports have fueled speculation that overall consumption of seafood in the U.S. had increased following the pandemic. Such reports have not been verified in research studies, and it is important to understand whether seafood consumers in the U.S., one of the largest seafood markets in the world, increased following the pandemic.

This study aimed to measure evolving changes in how, when, and where consumers purchased seafood during the first half of the 2021 pandemic recovery period (quarters 1 and 2 of 2021). The specific objectives of this study were to determine whether seafood consumption and shopping behaviors changed during the first half of 2021 (Q1 and Q2-2021) as compared with those of 2020 and whether those changes differed among socio-demographic groups. This study fills research gaps related to detailed assessment of consumer seafood purchases in one of the largest seafood markets in the world (U.S.) during the early pandemic recovery period when vaccines became available and the shelter-at-home orders ended. A key question addressed by this study is whether U.S. seafood consumption patterns returned to pre-pandemic levels within months (the early recovery period) or whether the pandemic resulted in longer-lasting consumption patterns of seafood.

2. Materials and Methods

Two online surveys were conducted in the first half of 2021 using the Qualtrics platform. An online format was used because of the very high cost of in-person interviews. Telephone surveys require very short and simple questions that would not have met the needs of this study, and response rates for telephone surveys have been low [28]. Finally, many consumers have become more comfortable with online formats following the pandemic. Participants were recruited by Qualtrics panel services from member referrals, targeted e-mails, website intercepts, and social media. Qualtrics uses IP addresses to avoid duplication and to ensure validity. Demographic targets established by the project research team were used by Qualtrics to filter and select participants. The overall study design followed [29], with a screener question used to identify seafood consumers.

The Q1-2021 survey asked respondents questions about general food and seafood consumption and shopping behaviors from 1 January 2021 through 31 March 2021, and the Q2-2021 survey queried respondents about consumption and shopping from 1 April 2021 to 30 June 2021. The two surveys were designed and implemented to compare seafood consumption and shopping behaviors with the 2020 results of [23]. Twenty market areas (with a high degree of social and economic integration) were included in the study based on recommendations from the Industry Advisory and Extension Committees involved in the project. These areas were Atlanta, Baltimore/Washington D.C., Boston, Charlotte,

Chicago, Dallas, Denver, Houston, Jackson, Las Vegas, Los Angeles, Memphis, Miami, New Orleans, New York, Raleigh/Durham, Salt Lake City, San Francisco, Seattle, and St. Louis. Following review and approval by the Virginia Tech University Human Research Protection Program (IRB No. 20–766), the Q1-2021 survey was pre-tested, launched on 23 April 2021, and closed on 4 July 2021; the Q2-2021 survey was launched on 17 August 2021 and closed 8 September 2021. The survey questions requested respondents to report responses for the Q1-2021 period (1 January 2021 through 31 March 2021) and the Q2-2021 period (1 April 2021 through 30 June 2021).

The questionnaire developed included questions about vaccination status because COVID-19 vaccines had become widely available in the early part of 2021. Both surveys gathered data on seafood consumption at home and away from home. Questions related to at-home consumption included those on the frequency and quantity of seafood purchases, costs per shopping trip, and whether groceries were bought in store or online. Additional inquiries examined the frequency of orders for takeout and home delivery of prepared meals. Questions on away-from-home consumption focused on the frequency of meals consumed away from home, menu pricing points, and the specific seafood products consumed most frequently. Surveys further inquired into consumer difficulties, such as time constraints and the cost of seafood.

The total number of usable responses following data cleaning was 1,906 in the 2020 survey, 1885 in Q1-2021, and 1940 in Q2-2021. Descriptive statistics (means \pm standard deviations) were used to compare shopping behaviors for at-home and away-from-home consumption and food expenditures. The data were separated into responses related to general food intake and seafood consumption to examine whether shopping behaviors for seafood were similar to or differed from those for general food consumption. Responses were tabulated on (1) percentage of groceries purchased in supermarkets/grocery stores, ordered online for home delivery, or purchased from other sources, such as farmers' markets, food hubs, or caught from the wild; (2) frequency of grocery shopping; (3) expenditures per shopping trip; and (4) away-from-home consumption. The percentage of meals consumed away from home, typical menu prices of entrées, and the type of eating establishment (i.e., chain or small restaurant) were also sought. Several open-ended questions were posed to elicit reasons for changes in consumption and purchase behavior. Responses were cross-tabulated by socio-demographic characteristics of age, educational level, income, gender, and ethnicity.

Data were disaggregated between responses related to general food consumption and seafood and between the 2020, Q1-2021, and Q2-2021 surveys. The effects of the demographic categories of age, education, income, gender, and ethnicity were examined using a two-way ANOVA. Tukey's test was used as a post hoc analysis when ANOVA results were significantly different ($p \leq 0.05$). Although a single, defined panel of respondents would have been preferable for repeated monitoring over time, available funding was not sufficient to accommodate a single, long-term panel.

3. Results

3.1. Respondent Characteristics

Household size, age, and income distribution percentages were similar to those of the national average in the Q1 and Q2-2021 surveys and the 2020 survey of [23], except for slightly lower percentages of respondents < 20 years of age and also of the lowest income category (<USD30,000) (Table 1). Relatively more women participated in the Q1-2021 and Q2-2021 surveys than the national average and the 2020 survey. All three surveys (Q1-2021, Q2-2021, and 2020) tended to have a somewhat greater percentage of white respondents and a lower percentage of Hispanic respondents than the national average. In the 2020 survey, the percentage of respondents with a 4-year or more education in Q1 and Q2-2021 was greater than the national average, and the percentage with a high school education and below was lower than the national average.

Table 1. Demographic characteristics of the respondents (n = 1908 for the 2020 survey, n = 1885 for Q1 (2021), and n = 1940 for Q2 (2021)).

Response Categories	2020 Survey	Q1 (2021)	Q2 (2021)	National Average ^a
Household size				
Household	2.6 ± 1.2	2.4 ± 1.2	2.6 ± 1.3	2.5
Adults ^b	2.1 ± 1.0	2.1 ± 1.0	2.2 ± 1.1	2.0
Age				
<20 years	1%	2%	2%	8%
20 to 29 years	10%	10%	19%	18%
30 to 39 years	20%	15%	21%	17%
40 to 49 years	23%	13%	16%	16%
50 to 59 years	14%	12%	11%	13%
60 to 69 years	18%	24%	16%	14%
70+	14%	23%	15%	14%
Income (2020)				
<USD30,000	17%	19%	23%	24%
USD30,000 to USD49,999	14%	18%	21%	17%
USD50,000 to USD99,999	32%	35%	34%	30%
USD100,000 to USD149,999	21%	18%	14%	15%
USD150,000 to USD199,999	8%	6%	5%	7%
USD200,000+	7%	4%	3%	8%
Gender				
Female	50%	61%	61%	51%
Male	50%	39%	39%	49%
Ethnicity				
Caucasians	80%	80%	67%	61%
African Americans	9%	9%	18%	12%
Hispanic	4%	4%	6%	18%
Asian	5%	4%	6%	6%
Other	2%	3%	4%	4%
Education				
Some high school	1%	1%	2%	12%
High school graduate	10%	13%	17%	27%
Some college	15%	18%	20%	20%
2-year associate degree ^c	10%	12%	14%	8%
4-year college degree	31%	33%	27%	20%
Advanced college degree	33%	23%	20%	12%

^a Source: Census Bureau (2019–2020). Percentages may be less than 100 due to rounding. ^b Twelve years and older. ^c Trade, technical, vocational degree.

3.2. Changes in Overall Consumption of Seafood over Time

Half (50%) of the respondents reported that their consumption of seafood had not changed as a result of the pandemic in the 2020 survey (Table 2). The percentage of respondents reporting no change in seafood consumption from the previous quarter increased to 62% and 55% in Q1-2021 and Q2-2021, respectively. The percentage of respondents that reported decreased seafood consumption in response to the pandemic, however, decreased from 31% in the 2020 survey to 13% and 17% in the Q1-2021 and Q2-2021 surveys, respectively, while the percentage of respondents reporting increased consumption of seafood increased to 25% and 28%, respectively, in Q1-2021 and Q2-2021.

Table 2. Overall consumption of fish (fresh and saltwater) and shellfish from the previous term.

Response Categories	2020 Survey	Q1 (2021)	Q2 (2021)
Stayed the same	50%	62%	55%
Decreased	31%	13%	17%
Increased	19%	25%	28%

3.3. Most Often Eaten Types of Seafood

The top 10 most often eaten seafood types in the Q1-2021 and Q2-2021 surveys were similar to those reported in the 2020 survey and included salmon, shrimp, cod/haddock, tuna, tilapia, catfish, and lobster (Figure 1), similar to other reports of the top-purchased species in the U.S. [30–32]. Differences were that the 2020 survey showed crappie and trout in the top ten, whereas flatfish and shellfish appeared among the top ten in the Q1-2021 and Q2-2021 surveys. Studies of anglers in the U.S. showed that during COVID-19, anglers took more fishing trips than they had previously [33,34]. In addition, fishing license sales in the U.S. increased by 12.8% from 2019 to 2020 [35]. Crappie and trout consumption in 2020 likely reflected increased angling for wild-caught fish for consumption during the pandemic.

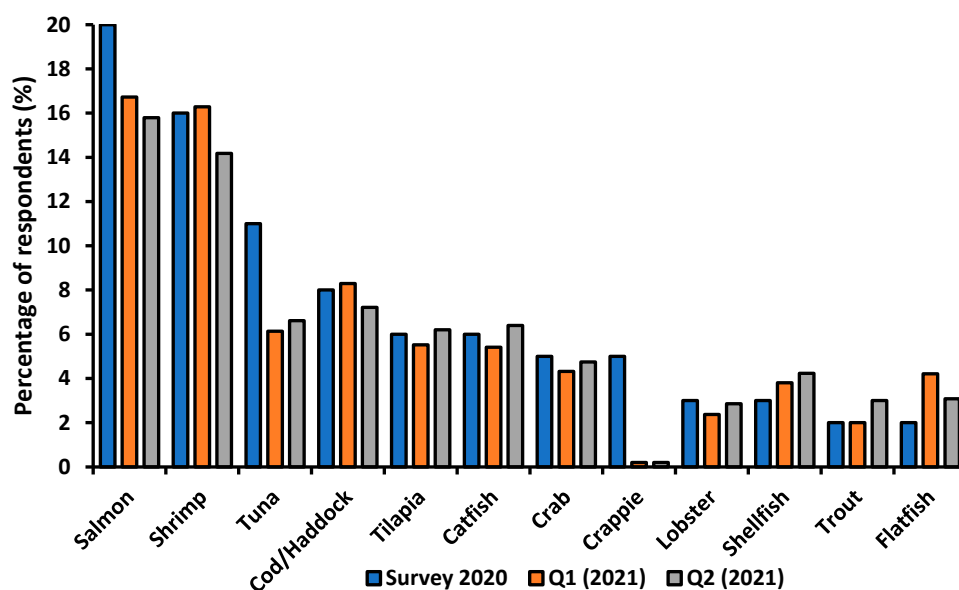


Figure 1. Percentage of respondents who reported their top three most often eaten seafood species by species.

3.4. Vaccination Status and Changes in Food Consumption

The majority of respondents reported having been vaccinated; 57% had had at least one dose of the vaccine before March 2021 and 70% before June 2021 (Table 3). Regardless of vaccination status, low percentages of respondents (4% to 6.5%) reported changing their seafood consumption habits in either quarter of 2021 as compared to the previous quarter. Of those who did report a change in seafood consumption, most (58% each in Q1-2021 and Q2-2021) reported an increase in seafood consumption. Thus, the increased consumption of seafood in Q1- and Q2-2021 appears to indicate that seafood consumption had recovered from the pandemic effects in which 31% of respondents had decreased seafood consumption.

Table 3. Vaccination status and changes in food consumption of the respondents, presented with row percentages.

Response Categories	Q1 (2021)		Q2 (2021)	
	Yes	No	Yes	No
Were you vaccinated for COVID-19	57%	43%	70%	30%
Did you change general food consumption as compared to the previous quarter?	6%	94%	9.5%	90.5%
Did you change fish and shellfish consumption as compared to the previous quarter?	4%	96%	6.5%	93.5%

3.5. Where Food Was Eaten or Obtained

Table 4 compares the percentages of meals that were prepared at home, eaten away from home, ordered as takeout, and delivered to home as a prepared meal. The percentage of meals prepared at home increased significantly from 2020 to Q1-2021 and decreased in Q2-2021 to less than that in 2020. Seafood meals also increased significantly from 2020 to Q1-2021 but returned to 2020 levels in Q2-2021. Meals eaten away from home increased significantly from 2020 to Q2-2021 and in Q1-2021 for seafood, remaining at that level in Q2-2021. The frequency of takeout orders of prepared meals increased significantly across the three surveys for both general and seafood meals. Home delivery of prepared meals decreased significantly from 2020 to Q1-2021 but returned to 2020 levels in Q2-2021, whereas the percentage of seafood meals delivered to homes only increased in Q2-2021 as compared to 2020 and Q1-2021.

Table 4. Percentage of meals prepared at home, eaten away from home, takeout, or delivered to the home. Statistically different values ($p \leq 0.05$) are indicated by different letters in each row.

Response Categories	General Food			Seafood			<i>p</i> -Values	
	2020 Survey	Q1 (2021)	Q2 (2021)	2020 Survey	2020 Survey	Q1 (2021)	Q2 (2021)	Surveys
	% (mean \pm SD)							
Prepared at home	70 \pm 29bc	75 \pm 25a	67 \pm 29d	66 \pm 36d	72 \pm 35b	68 \pm 35cd	<0.0001	<0.0001
Eaten away from home	8 \pm 14c	10 \pm 16bc	11 \pm 16b	10 \pm 21b	19 \pm 29a	21 \pm 29a	<0.0001	<0.0001
Takeout	11 \pm 14d	14 \pm 17c	17 \pm 18b	12 \pm 21cd	18 \pm 27b	21 \pm 27a	<0.0001	<0.0001
Delivered to home, prepared meal	9 \pm 15ab	8 \pm 16c	11 \pm 17ab	9 \pm 17bc	9 \pm 19abc	12 \pm 20a	<0.0001	<0.0001
Other	1 \pm 5c	4 \pm 14bc	5 \pm 16ab	2 \pm 12bc	5 \pm 18ab	8 \pm 22a	<0.0001	<0.0001

By age group, older respondents (>50 years of age) prepared significantly more seafood meals at home and ordered significantly fewer takeout and home-delivered meals than did younger respondents in all three surveys but ate seafood meals away from home with similar frequencies (Table 5). The percentage of seafood meals prepared at home did not differ over time for either age group. Meals eaten away from home increased significantly from 2020 to Q1-2021 for both age groups but continued to increase in Q2-2021, but only for older respondents. Meals ordered as takeout increased from 2020 to Q1-2021 but remained constant in Q2-2021 for both age groups, as did home-delivered meals, but only for younger respondents. The percentage of home-delivered meals remained at a low level over time for older respondents.

Table 5. Percentage of meals prepared at home, eaten away from home, takeout, or delivered to home for seafood by age group effects. Statistically different values ($p \leq 0.05$) are indicated by different letters in each row.

Response Categories	Age < 50 Years			Age > 50 years		
	2020 Survey	Q1 (2021)	Q2 (2021)	2020 Survey	Q1 (2021)	Q2 (2021)
	% (mean \pm SD)					
Prepared at home	61 \pm 34b	65 \pm 35b	60 \pm 35b	72 \pm 36a	75 \pm 35a	75 \pm 34a
Eaten away from home	10 \pm 17c	18 \pm 26b	19 \pm 24b	11 \pm 25c	19 \pm 31b	24 \pm 33a
Takeout	14 \pm 19b	23 \pm 24a	25 \pm 27a	10 \pm 22c	16 \pm 28b	17 \pm 28b
Delivered to home, prepared meal	14 \pm 18b	17 \pm 23a	15 \pm 20ab	4 \pm 13c	4 \pm 14c	6 \pm 19c
Other	2 \pm 11b	10 \pm 26a	9 \pm 22a	2 \pm 14b	1 \pm 2b	6 \pm 22ab

The educational level of the respondents significantly affected the percentage of seafood meals purchased at home, away from home, and by takeout orders in 2020 but not in Q1 or Q2-2021 (Table S1: Percentage of meals prepared at home, eaten away from home, take-out, or delivered to home of seafood by education effects.). Respondents with 4 years of college or more prepared significantly fewer meals at home, ate out more often, and ordered more home-delivered meals in 2020 than those with <4 years of college. Nevertheless, those with less education did not change percentages of meals prepared at home over time, but those with greater education increased meal preparation at home in Q1-2021 but returned to 2020 levels in Q2-2021. Adjustments to meals eaten away from home only occurred in Q1 from 2020, with increases for both groups. Orders of takeout meals increased from 2020 to Q1-2021 and then remained the same for both groups. No adjustments were made over time in percentages of home-delivered meals for either educational group.

Income levels significantly affected where food was eaten or obtained across the three surveys (Table S2: Percentage of meals prepared at home, eaten away from home, take-out, or delivered to home of seafood by income effects.). Respondents with less than USD100 K of income prepared significantly more seafood meals at home in 2020 and Q1-2021 but the same in Q2-2021. Meals eaten away from home and ordered as takeout did not differ between income groups over time. Home-delivered meals, however, were greater for higher-income respondents than lower-income respondents in 2020 and Q1-2021, but not in Q2-2021. Over time, lower-income respondents prepared more seafood meals at home in Q1-2021 than in 2020 but returned to 2020 levels in Q2-2021. Higher-income respondents, however, did not change the percentage of home-prepared meals over time. Meals eaten away from home and ordered as takeout increased from 2020 to Q1-2021 and remained the same in Q2-2021 for both income groups.

By gender, females prepared more seafood meals at home than males in 2020, but not during Q1-2021 or Q2-2021; there was no difference due to gender in meals eaten away from home or takeout meals (Table S3: Percentage of meals prepared at home, eaten away from home, take-out, or delivered to home of seafood by gender effects.). Males ordered more home-delivered meals than females in 2020 and Q1-2021, but there was no difference in Q2-2021. Males increased meal preparation at home from 2020 to Q1-2021 and remained the same in Q2-2021, but female respondents showed no difference in meal preparation at home in 2020 and either quarter in 2021. Both males and females increased the percentage of meals eaten away from home from 2020 to Q1-2021, and this remained the same in Q2-2021. Neither gender showed differences over time in percentages of ordering home-delivered meals. Female respondents ordered more takeout meals in Q1-2021 and Q2-2021 than in 2020, but there was no significant difference over time in takeout meals ordered by males.

There were no differences in where meals were eaten by ethnicity. Detailed results of the statistical analyses comparing ethnicity effects are available in the Supplementary Materials (Table S4: Percentage of meals prepared at home, eaten away from home, take-out, or delivered to home of seafood by ethnicity effects.).

3.6. Purchases for at-Home Preparation and Consumption

Supermarket/grocery store purchases increased from 2020 into Q1-2021 and decreased significantly in Q2-2021 but did not return to 2020 levels (Figure 2). Online purchases of groceries decreased from 2020 to Q1-2021 and remained at that level in Q2-2021. Purchases at farmers' markets/food hubs and other venues increased significantly from 2020 to Q1-2021 and remained at similar levels in Q2-2021.



Figure 2. Percentage of groceries for at-home preparation purchased at supermarkets, online, or at other venues in 2020, Q1, and Q2 (2021). Statistically different values ($p \leq 0.05$) are indicated by different letters in market outlet groups.

Older shoppers (>50 years of age) purchased more groceries at supermarkets, ordered fewer groceries online, and shopped less at farmers’ markets/food hubs than younger shoppers (<50 years of age) over time (Table 6). Respondents in both age categories increased purchases at supermarkets in Q1-2021 as compared to 2020 and remained at that level in Q2-2021. Online orders of groceries did not change significantly over time for either age category. Purchases at farmers’ markets and food hubs changed over time for the younger respondents, but there was no change for older respondents.

Table 6. Age effects on general food purchases of groceries for at-home preparation at supermarkets, online, or at other venues in the 2020 survey, Q1, and Q2 (2021). Statistically different values ($p \leq 0.05$) are indicated by different letters in each row.

Response Categories	Age < 50 years			Age > 50 years		
	2020 Survey	Q1 (2021)	Q2 (2021)	2020 Survey	Q1 (2021)	Q2 (2021)
	% (mean ± SD)					
Supermarkets/grocery stores ^a	53 ± 38d	72 ± 35c	71 ± 35c	78 ± 34b	85 ± 32a	84 ± 32a
Groceries ordered online for home delivery ^b	38 ± 34ab	42 ± 59a	35 ± 51b	17 ± 30c	14 ± 35c	18 ± 40c
Farmers’ markets and food hubs	5 ± 10c	16 ± 33a	12 ± 23b	2 ± 7de	1 ± 7e	3 ± 15d
Other	4 ± 9cd	14 ± 33a	10 ± 25b	3 ± 12d	2 ± 12d	3 ± 17d

^a Includes Costco and Walmart. ^b Includes submarkets, hypermarkets, Amazon, and farm websites.

Respondents with less than 4 years of college purchased food more often from supermarkets and less often online or at farmers’ markets/food hubs than those with 4-year college degrees (Table 7). Adjustments to food purchases for respondents in both educational categories occurred primarily from the 2020 survey to Q1-2021. Lower-income respondents purchased more food in supermarkets and less online and at farmers’ markets/food hubs than did higher-income respondents in all three surveys (Table 8). Over time, all respondents increased purchases at supermarkets and at farmers’ markets/food hubs. Higher-income respondents reduced online orders of groceries, whereas there was no significant difference in online grocery purchases over time by lower-income respondents.

Table 7. Education effects on general food purchases of groceries for at-home preparation at supermarkets, online, or at other venues in the 2020 survey, Q1, and Q2 (2021). Statistically different values ($p \leq 0.05$) are indicated by different letters in each row.

Response Categories	<4-yr College			4-yr College +		
	2020 Survey	Q1 (2021)	Q2 (2021)	2020 Survey	Q1 (2021)	Q2 (2021)
	% (mean ± SD)					
Supermarkets/grocery stores ^a	77 ± 34c	83 ± 35a	77 ± 35c	57 ± 39d	78 ± 33b	77 ± 34b
Groceries ordered online for home delivery ^b	19 ± 32d	17 ± 41d	24 ± 43c	34 ± 34a	27 ± 49b	29 ± 51b
Farmers' markets and food hubs	1 ± 7e	5 ± 21c	6 ± 17c	5 ± 10d	6 ± 20bc	9 ± 23a
Other	3 ± 12d	5 ± 23b	6 ± 18b	4 ± 10c	6 ± 20a	8 ± 24a

^a Includes Costco and Walmart. ^b Includes submarkets, hypermarkets, Amazon, and farm websites.

Table 8. Income effects on general food purchases of groceries for at-home at supermarkets, online, or at other venues in the 2020 survey, Q1, and Q2 (2021). Statistically different values ($p \leq 0.05$) are indicated by different letters in each row.

Response Categories	Income < USD100,000			Income > USD100,000		
	2020 Survey	Q1 (2021)	Q2 (2021)	2020 Survey	Q1 (2021)	Q2 (2021)
	% (mean ± SD)					
Supermarkets/grocery stores ^a	72 ± 37d	82 ± 33a	77 ± 34b	51 ± 37e	76 ± 35c	76 ± 35c
Groceries ordered online for home delivery ^b	23 ± 33c	20 ± 43cd	24 ± 41c	38 ± 33a	31 ± 52b	34 ± 65ab
Farmers' markets and food hubs	2 ± 8f	4 ± 18e	6 ± 15c	6 ± 9d	10 ± 25b	13 ± 31a
Other	3 ± 11e	4 ± 20de	5 ± 15d	4 ± 9c	9 ± 24b	13 ± 35a

^a Includes Costco and Walmart. ^b Includes submarkets, hypermarkets, Amazon, and farm websites.

Female respondents purchased more food generally at supermarkets in 2020 than did males, but the increased purchases by males in Q1-2021 and Q2-2021 were not significantly different than females in those quarters (Table 9). Online grocery purchases by males decreased from 2020 to Q1-2021 and remained at that level in Q2-2021, but there were no differences over time in online grocery orders by females. Female respondents purchased food significantly more often at farmer's markets/food hubs in Q1-2021 than in 2020, but there were no differences for males.

Table 9. Gender effects on general food purchases of groceries for at-home preparation at supermarkets, online, or at other venues in the 2020 survey, Q1, and Q2 (2021). Statistically different values ($p \leq 0.05$) are indicated by different letters in each row.

Response Categories	Male			Female		
	2020 Survey	Q1 (2021)	Q2 (2021)	2020 Survey	Q1 (2021)	Q2 (2021)
	% (mean ± SD)					
Supermarkets/grocery stores ^a	53 ± 38d	79 ± 34ab	76 ± 34b	76 ± 35bc	81 ± 34a	77 ± 35b
Groceries ordered online for home delivery ^b	37 ± 33a	26 ± 49bc	31 ± 56b	21 ± 33c	22 ± 45c	24 ± 41c
Farmers' markets and food hubs	6 ± 10bc	7 ± 21ab	10 ± 23a	2 ± 7d	5 ± 20c	6 ± 18c
Other	5 ± 11b	7 ± 21ab	9 ± 26a	2 ± 10d	5 ± 22bc	5 ± 18c

^a Includes Costco and Walmart. ^b Includes submarkets, hypermarkets, Amazon, and farm websites.

There were no statistically significant differences in where respondents purchased groceries by ethnicity. Detailed results of the statistical analyses comparing ethnicity effects are available in the Supplementary Materials (Table S5: Percentage of seafood purchases for

at-home preparation at supermarkets, online or at other venues by various ethnic groups in Survey 2020, Q1 and Q2 (2021).).

Respondents reported increased numbers of shopping trips per year in Q1-2021 as compared to 2020, which continued into Q2-2021, but there was no difference in the number of shopping trips per year for seafood over time (Figure 3a). There was little difference in the weighted average of expenditures per shopping trip among the 2020, Q1-2021, and Q2-2021 surveys for general food purchases or seafood (Figure 3b). Patterns of shopping frequency by demographic category did not change from those in 2020 (Table S6: Grocery shopping for at-home preparation and expenditures per shopping trip for general groceries and for seafood.). In all three surveys, (1) older respondents shopped less frequently for seafood than did younger respondents; (2) respondents with greater education and higher incomes shopped more frequently for seafood than those with less education or lower incomes; (3) male respondents shopped more frequently for seafood than females; (4) younger respondents and those with higher incomes spent more on seafood per trip than did older respondents and those with lower incomes; (5) and male respondents spent more on seafood per trip than did females.

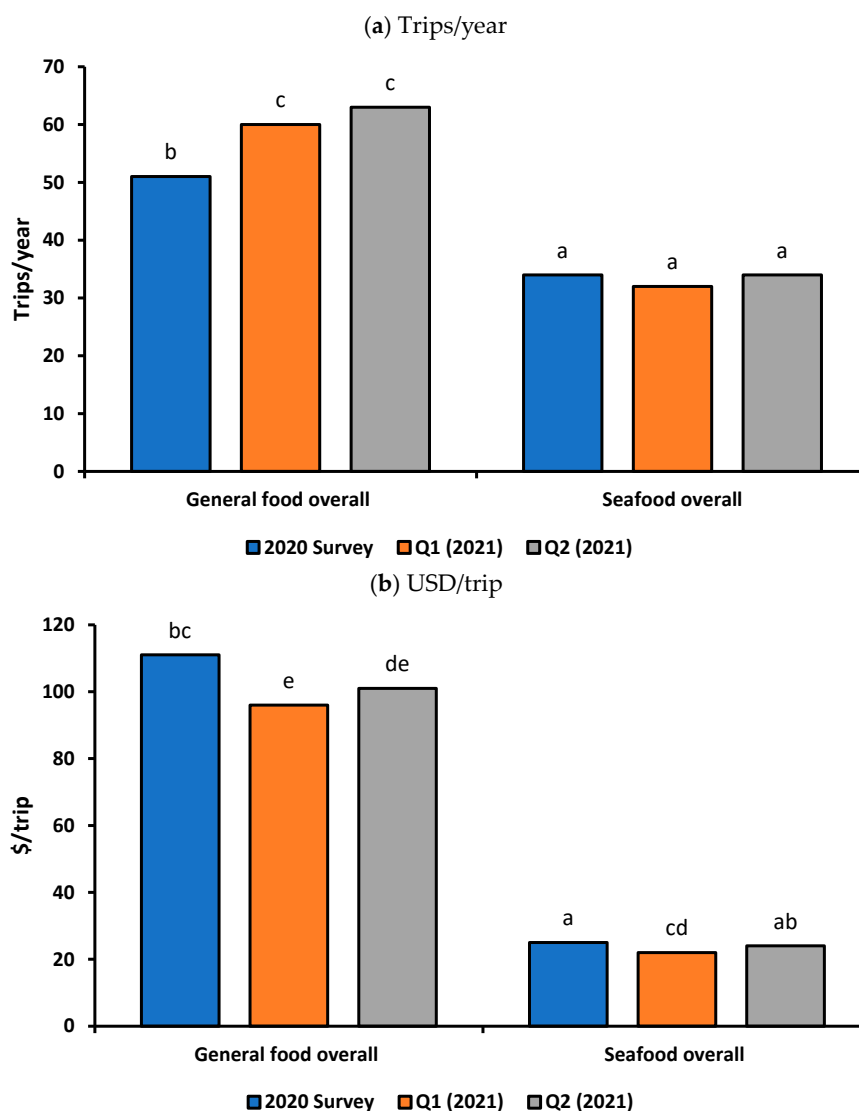


Figure 3. Grocery shopping for at-home preparation and expenditures per shopping trip for general groceries and seafood by (a) trips/year and (b) USD/trip. Statistically different values ($p \leq 0.05$) are indicated by different letters in each bar.

3.7. Shopping for Prepared Food for at-Home Consumption

The frequency of takeout purchases (times/year) of prepared meals for home consumption of seafood decreased from 2020 to Q1-2021 and remained at that level in Q2-2021 (Figure 4). Younger respondents, those with higher education and income, and male respondents ordered more seafood takeout meals than did older respondents, those with lower educational levels and incomes, and female respondents in all three surveys (Table S7: Frequency of shopping for prepared food for consumption at home.).

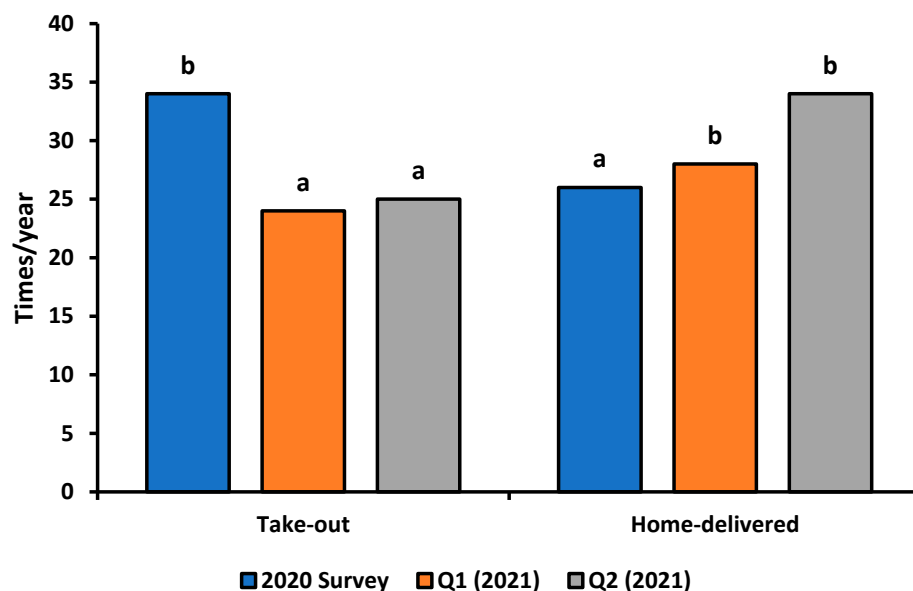


Figure 4. Frequency of seafood shopping for prepared food for consumption at home. Statistically different values ($p \leq 0.05$) are indicated by different letters in each delivery category. Takeout and home delivered were analyzed separately.

Home delivery purchases of prepared meals of seafood generally increased from the 2020 through the Q1-2021 and Q2-2021 surveys. Younger respondents, those with higher education and income, and male respondents ordered more seafood home-delivered meals than did older respondents, those with lower educational levels and incomes, and female respondents in all three surveys (Table S7: Frequency of shopping for prepared food for consumption at home.).

Figure 5 shows the frequency distribution of percentages of respondents who reported dinner entrée prices in various ranges for away-from-home meals generally and specifically for seafood. The most often reported menu prices for food generally decreased from USD 20 to USD 29.99 in the 2020 survey to USD 10 to USD 19.99 in the Q1-2021 and Q2-2021 surveys. For seafood, however, the most frequently reported menu price remained the same across the three surveys. Detailed results by demographic categories are available in the Supplementary Materials (Table S8: Typical dinner entrée prices.).

The majority of general meals eaten away from home at the onset of the pandemic were consumed in chain restaurants (40%) followed by local restaurants (38%) in the 2020 survey (Table 10). In Q1-2021 and Q2-2021, meals eaten away from home decreased in chain (31% and 30%) and local restaurants (32% and 28%), respectively. For seafood, however, greater percentages of meals were consumed at local restaurants (51%, 64%, 59%) across the three surveys, respectively, than at chain restaurants (41%, 28%, and 33%, respectively). The greater consumption of seafood in local restaurants remained high in Q2-2021.

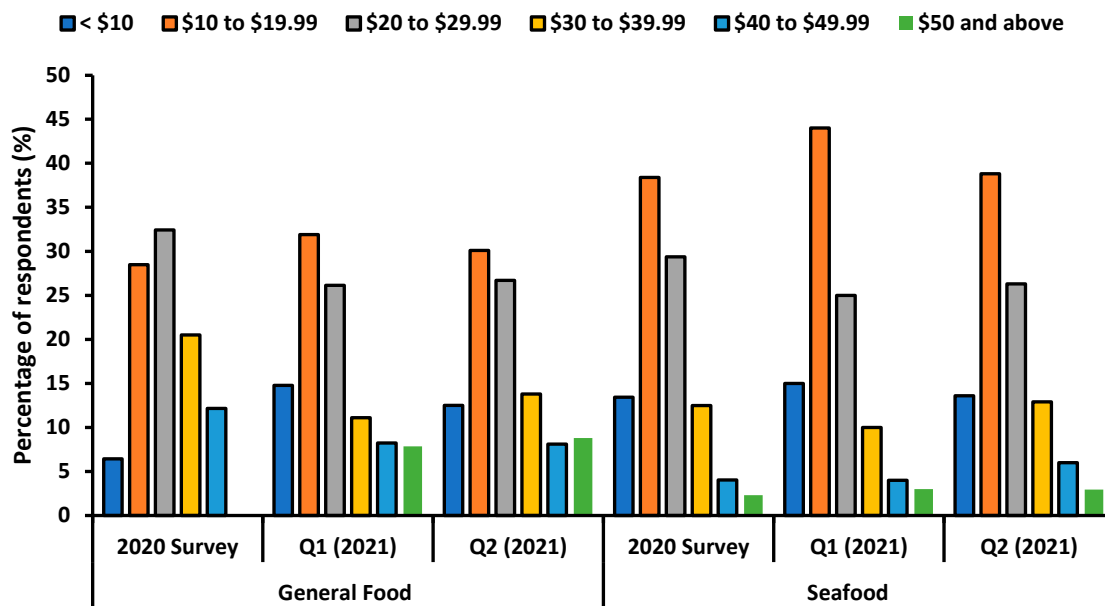


Figure 5. Percentage of responses of menu prices paid for seafood dinner entrées.

Table 10. Percentage of meals eaten away from home by eating establishment (chain, local, others).

Response Categories	General Food			Seafood		
	2020 Survey	Q1 (2021)	Q2 (2021)	2020 Survey	Q1 (2021)	Q2 (2021)
Chain restaurant	40%	30%	30%	41%	28%	33%
Local restaurant	38%	31%	28%	51%	64%	59%
Other	22%	39%	42%	8%	8%	8%

4. Discussion

Studies on consuming seafood products in times of crisis are insufficient. Studies have generally focused on the marketing of seafood and consumer preferences, but very few studies have focused on consumer behavior as related to seafood purchases. The COVID-19 pandemic differed from other crises in that it was a global event. This study presents the results of follow-up surveys to that of [23] to examine seafood shopping behaviors in the early months of the recovery period from the COVID-19 pandemic. Most studies on consumer behaviors related to the pandemic were conducted during the pandemic and shelter-at-home mandates, with few questioning whether the shopping behavioral changes during the pandemic continued once the shutdowns were lifted and vaccines became widely available. This study fills this research gap by focusing on the early recovery period when vaccines became available to better understand whether consumer shopping behaviors during the pandemic persisted or returned to pre-pandemic levels during the early months of the recovery. This current study is one of the few to corroborate results of Tudoran et al. (2024) [13], who similarly focused on time periods after the pandemic, finding that two-thirds of all consumers discontinued their online grocery shopping within a year of the pandemic, refuting the many claims that the increased online grocery purchases would continue after the pandemic.

This study focused specifically on seafood purchasing behaviors rather than general food purchases. Respondents reported little change in consumption or frequency of seafood consumption. There also was little change in the types of seafood chosen for consumption by many respondents, with no change over time in the most often eaten seafood. Overall, seafood consumer purchasing behavior returned to pre-pandemic behaviors as the economic restrictions were lifted. The apparent stability of seafood consumption by U.S. consumers is a key result of this study.

Vaccination status did not affect either general food or seafood consumption. The availability of vaccines, accompanied by the relaxation of shelter-at-home and business shutdown orders, resulted in resumption of shopping and food consumption activities, as has been reported elsewhere. A 2021 study of Chinese residents revealed that fish and seafood consumption increased among fully or partially vaccinated consumers [36]. Vaccination appeared to alleviate safety-related concerns and encouraged a return to away-from-home seafood meals.

Findings of this study were consistent with annual food away-from-home expenditures of U.S. households, which decreased by 33% in 2020 compared to the previous year and increased by 28% in 2021 compared to 2020. In 2022, away-from-home expenditures reached pre-COVID-19 levels [37]. In contrast to preferences for eating out at chain restaurants generally, seafood consumers in this series of surveys preferred to eat seafood at local restaurants. The percentage of consumers who preferred to eat seafood at local restaurants increased from 51% in the 2020 survey to 64% and 59% in the Q1-2021 and Q2-2021 surveys. Follow-up studies are needed to evaluate whether that preference has continued or if it has returned to pre-pandemic levels. Such information is critical for seafood marketers, especially because local restaurants tend to be higher-priced, specialty types of restaurants [38].

There have been a number of reports of increased preparation of seafood at home following the pandemic [25–27]. According to the Bureau of Labor Statistics (BLS), average annual food at-home expenditures of U.S. households increased by an average of 6% in 2020 compared to 2019 and 2021 compared to 2020 [39]. Data from our series of consumer surveys, however, do not support the BLS report's findings. Home preparation of food generally and also of seafood was reported to have returned to previous levels, and respondents reported returning to eating seafood primarily away from home once again. Additional follow-up studies are needed to determine whether this trend has continued since 2021. If so, extension and outreach programs need to understand that the low levels of seafood preparation at home may not be driven simply by lack of custom or experience but by other factors, such as age, price, gender, or education [29]. Those who prepared more seafood meals at home were older, had a lower income and less education, and were female respondents in all surveys. Those who purchased prepared seafood meals for home delivery tended to be younger, male, and had higher income and higher education in all surveys. Given that seafood generally is a higher priced food, efforts to increase home preparation may need to focus more on those with higher incomes and education. Male respondents also prepared more seafood at home than did females. The frequency of takeout orders decreased over time, but the frequency of home-delivered meals increased for seafood in all three surveys.

Online sales of many goods have generally increased over time. Food purchases generally and seafood, in particular, however, appeared to have returned to previous pre-pandemic levels in our surveys. Respondents generally reported more frequent purchases in supermarkets and less frequent orders of groceries online as the recovery progressed. Online grocery shopping sales in the U.S. were USD 62 billion in 2019 and USD 96 billion in 2020. In 2021, online grocery shopping increased to USD 113 billion [40]. In Spain, from 2019 to 2020, the relative increase in purchases was significantly higher online as compared with purchases at specific store locations [41]. During the COVID-19 pandemic, online grocery shopping became more popular in the UK. Consumers more often preferred online grocery shopping to physical stores because of safety, convenience, and government restrictions [42].

This analysis identified some effects of age, income, educational level, and gender on seafood shopping behaviors, consistent with findings of other studies, such as those of [18,30,43–45]. Respondents in older age and lower-income groups prepared more meals at home. High-income respondents and those with higher educational levels tended to eat more seafood. Interestingly, however, very few differences were found in this study across ethnic groups, in contrast to findings of other studies [29,46]. The lack of

differences among ethnic groups in this study likely has more to do with the broader effects of changes in availability of seafood supplies, reduced access to seafood, and lost income during the pandemic. Ethnic differences in seafood preferences may have more to do with general preferences for species, product forms, and preferred shopping venues, whereas the adjustments to the COVID-19 pandemic had more to do with access, availability, and income effects on various groups.

Results of this study are specific to the time immediately following the peak pandemic period. Given the macroeconomic changes in 2023–2024 that resulted in high inflation rates in most countries, additional studies are needed to evaluate the effects of high food and other costs of living on seafood consumption.

A limitation of this study was that it was not possible to examine effects of varying regional preferences for seafood. Various studies have documented regional preferences, especially for species preferences [32,38,47–50]. Nevertheless, the overall results point to limited changes in consumer preferences. Many of the differences in shopping behaviors and patterns in this study reflected access to and availability of seafood in addition to changes in income during the pandemic and throughout the recovery. Study results are limited to those of the set of respondents who tended to have higher-than-average educational and income levels. The restriction of the study to seafood consumers through the use of an initial screener question may have resulted in higher-than-average incomes and educational levels in the study, or it may reflect some degree of bias in the respondent set. Other studies [23,29,30] have shown that higher-income consumers tended to eat more seafood. Alternatively, results may be skewed in that higher-income consumers were less affected by the economic hardships suffered by lower-income consumers. The respondent set also largely under-represented Hispanic consumers (4% of respondents compared to 18% of the U.S. population). Additional research is needed, particularly on seafood consumption and preferences among the U.S. Hispanic population, which is the fastest-growing ethnic group in the U.S. Responses were based on recall, which may have introduced some degree of bias; we further did not have access to data that would have allowed us to validate responses against actual purchase and consumption data.

5. Conclusions

The COVID-19 pandemic and subsequent economic shutdowns created unusual challenges in the form of access to food from supply chain disruptions, sudden loss of income to many consumers, and health issues. This study surveyed U.S. consumers during the pandemic and then twice during the first six months of the 2021 recovery period. Results generally suggested that seafood consumption is relatively stable in the U.S. and had largely recovered in the first six months of 2021. Results do not support frequent reports of increased home preparation of seafood but rather that consumers returned to preferences for eating seafood away from home in early 2021. Consumer shopping behaviors differed by age, income, educational level, and gender, but generally not ethnicity. The majority of changes in consumer shopping behaviors for seafood were driven primarily by access, availability, and income effects. This study found apparent stability of seafood consumption by U.S. consumers, which recovered from pandemic consumption levels in early 2021. Respondents reported little change in frequency of seafood consumption and the types of seafood chosen for consumption by many respondents, and there was no change over time in the most often eaten seafood, regardless of vaccination status. Further research is needed in the latter months of the 2021 recovery to further evaluate whether the apparent stability found in this study has continued. This study corroborates findings from other studies that found that away-from-home expenditures had returned to pre-pandemic levels [36]. Of particular interest would be research to identify whether the preferences for eating seafood in local, rather than chain, restaurants have continued post-pandemic. Additional studies are needed to further evaluate seafood purchasing behaviors under other economic stressors, including 2023–2024 inflationary effects, on costs of living.

Supplementary Materials: The following supporting information can be downloaded at <https://www.mdpi.com/article/10.3390/fishes9090348/s1>, Table S1: Percentage of meals prepared at home, eaten away from home, take-out, or delivered to home of seafood by education effects. Table S2: Percentage of meals prepared at home, eaten away from home, take-out, or delivered to home of seafood by income effects. Table S3: Percentage of meals prepared at home, eaten away from home, take-out, or delivered to home of seafood by gender effects. Table S4: Percentage of meals prepared at home, eaten away from home, take-out, or delivered to home of seafood by ethnicity effects. Table S5: Percentage of seafood purchases for at-home preparation at supermarkets, online or at other venues by various ethnic groups in Survey 2020, Q1 and Q2 (2021). Table S6: Grocery shopping for at-home preparation and expenditures per shopping trip for general groceries and for seafood. Table S7: Frequency of shopping for prepared food for consumption at home. Table S8: Typical dinner entrée prices.

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