

Price Indices for Shrimp Imports and Gulf of Mexico Shrimp Landings by Size and Season

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Price Indices for Shrimp Imports and Gulf of Mexico Shrimp Landings by Size and Season

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This write-up pertains to the following file:

[SHR_priceIndx_SEFSC_6023_20240710.xlsx](#)

Introduction

This working paper describes the method used to produce final shrimp price indices for SEDAR87. While all data elements and most method details were discussed and documented as part of the SEDAR87 Data Workshop, the Assessment’s modelling process required further refinements of the shrimp price indices. This type of adjustment was anticipated by the Economics and Social Science data workgroup and noted in the final Data Workshop Report: “The workgroup noted that while they could endorse the data sources/information in general, not all decisions can be made independent of the specifics of the final stock assessment models chosen and the purpose and method for including economic data. Further, the economic data will often not match the data/model resolution across many or even all of the stock assessment’s dimensions. Economic data is more aggregate, often at an annual, overall fishery resolution [Page 87].”

Two changes of resolution were made to the previously described development of price indices. The primary change is the creation of three individual indices for the different SEDAR87 size categories, rather than producing a single, size-adjusted price index. The second change to the indices is the inclusion of a seasonal time step, based on aggregated monthly resolution of the underlying data, rather than just an annual one.

Finally, as the decision to develop the shrimp price indices was made during the Data Workshop, no self-standing working paper on price indices was created at the time, and the relevant write-up can only be found in the Data Workshop Report (Chapter 5). This working paper rectifies that and focuses solely on the method used to create the final price indices. For an extensive discussion on and broad recommendations for shrimp price indices, including the explanations and justification for the method below, please see Section 5.3.5 Shrimp Price Indices in the Data Workshop Report (attached as Appendix 1 for simplicity).

Method

During the SEDAR87 data workshop, two possible indices were identified: A GOM shrimp price index and a shrimp import price index (or global price index). These price indices are derivatives of the GOM shrimp landings data (SEDAR87-DW-06) and shrimp import data (SEDAR87-DW-10) provided and documented by the SEFSC Fisheries Statistics Division. However, the focus on price index creation was deemed within the expertise of the economics and social sciences workgroup.

Import Data

To update the import price index, monthly, worldwide import data, from 1972 through 2023, for any “shrimp” product, were downloaded from the NMFS S&T’s One-Stop Shop (<https://www.fisheries.noaa.gov/foss>) on July 7, 2024. These data are ultimately collected by U.S. Customs and Border Protection.

Import pounds and value of all “SHELL-ON FROZEN” shrimp categories were summed to three seasonal levels (January-April: JFMA, May-August: MJJA, and September-December: SOND) and three size groups for each year. Note, that the categories of frozen, shell-on shrimp have changed and expanded over time: From a single “FRESH/FROZEN” category in 1972; replaced by just “FROZEN” from 1989 to 1990; itself replaced by 9 size categories by 1991 (partially in 1990); starting in 2012 frozen, shell-on shrimp were further subdivided into “COLD-WATER” or “WARM-WATER” shrimp; and, finally, by 2022 (starting in 2021) warm water shrimp were further subdivided into “FARMED” and “WILD.” The three size groups were defined with Large encompassing the size categories <15, 15/20, 21/25, and 26/30 of count of shrimp per lb, i.e., all shrimp larger than 31 count per lb; Medium encompassing 31/40, 41/50, and 51/70; and Small consisting of 61/70 and >70. Note, a small deviation from the SEDAR sizes (>61 tails per pound instead of >67 tails per pound) was made to increase the volume (lbs, revenue) within the Small category, as imports skew toward larger shrimp.

The total landings and value (revenue) from the various frozen, shell-on categories were then collapsed to just Large, Medium, and Small shrimp by season and by year shrimp starting, consistently, in 1991.

GOM Landings Data

To update the GOM shrimp price index, the GOM landings data, as updated June 11, 2024, were used (file: SHR_com_land_6022_20240611C.xlsx; tab: all_data_C). While these data already contain the correct SEDAR87 seasons and size categories, landings and value still have to be aggregated across state, data source, species, area fished, and grade (head-on vs. tails). The landings and revenue for the GOM shrimp fishery by Season and by Size categories are available from JFMA 1960 through SOND 2022.

Data for Inflation Adjustment

Due to the introduction of a seasonal time step, the index used for inflation adjustment of nominal dollar values must also be at the seasonal resolution. To update the analysis, the implicit price deflator for the gross domestic product was downloaded from the U.S. Bureau of Economic Analysis on July 7, 2024 at a quarterly time step. This index was recommended for SEDAR87 to adjust nominal dollar values from different years into constant (or current) dollars (see also SEDAR87-DW-08 and/or the Data Workshop Report).

The quarterly time step of the inflation adjustment index was aligned with seasonal trimesters in the following manner: Quarter 1 (Q1) to Season JFMA, (Q2+Q3)/2 to MJJA, and Q4 to SOND.

Result

The three data sets were combined, and the shrimp values (revenues) were inflation adjusted into Fourth Quarter of 2022 U.S. dollars by Season, Size, and Year for both imported shrimp and for GOM shrimp landings. The data were further eye-balled to discover any problematic entries.

Finally, 8 price indices were calculated by dividing inflation adjusted revenue by lbs; for the Large, Medium, Small, and Total shrimp price for imports and for the GOM fishery, each.

The final file, SHR_priceIndx_SEFSC_6023_20240710.xlsx, contains the 8 trimester time step price indices as well as the underlying revenue and landings data. The underlying data allows the analyst to consolidate individual time periods, if necessitated by gaps in other data, and still derive the proper price index level for the consolidated period [by summing revenue and landings across the cells to be consolidated and then dividing the sum of revenue by the sum of landings]. The file also contains the three figures below that need to be enlarged for closer study.

Figure 1 shows total import and the total GOM shrimp price indices with their respective 5-year moving averages. While global shrimp price is the long-term driving force of these price developments, the GOM price index has a longer history. The latter also shows much more seasonal fluctuation, which can be tentatively explained as seasonal shifts in species, regions, and sizes within the GOM annual landings (more on that below). The five-year moving average shows that the GOM shrimp fishery peaked in the early 1980s at around \$9 on average per lb of shrimp (in 2022/Q4 dollars), and has generally trended downward since (though with plateaus and temporary reversals, i.e., fluctuations); dropping under \$4 per lb in recent years. The import prices have generally been higher, on average, due to the fact that small shrimp are less likely to be imported, i.e., imports are on average larger shrimp.

Figure 1: Shrimp Import Price Indices by Shrimp Size Category and Total

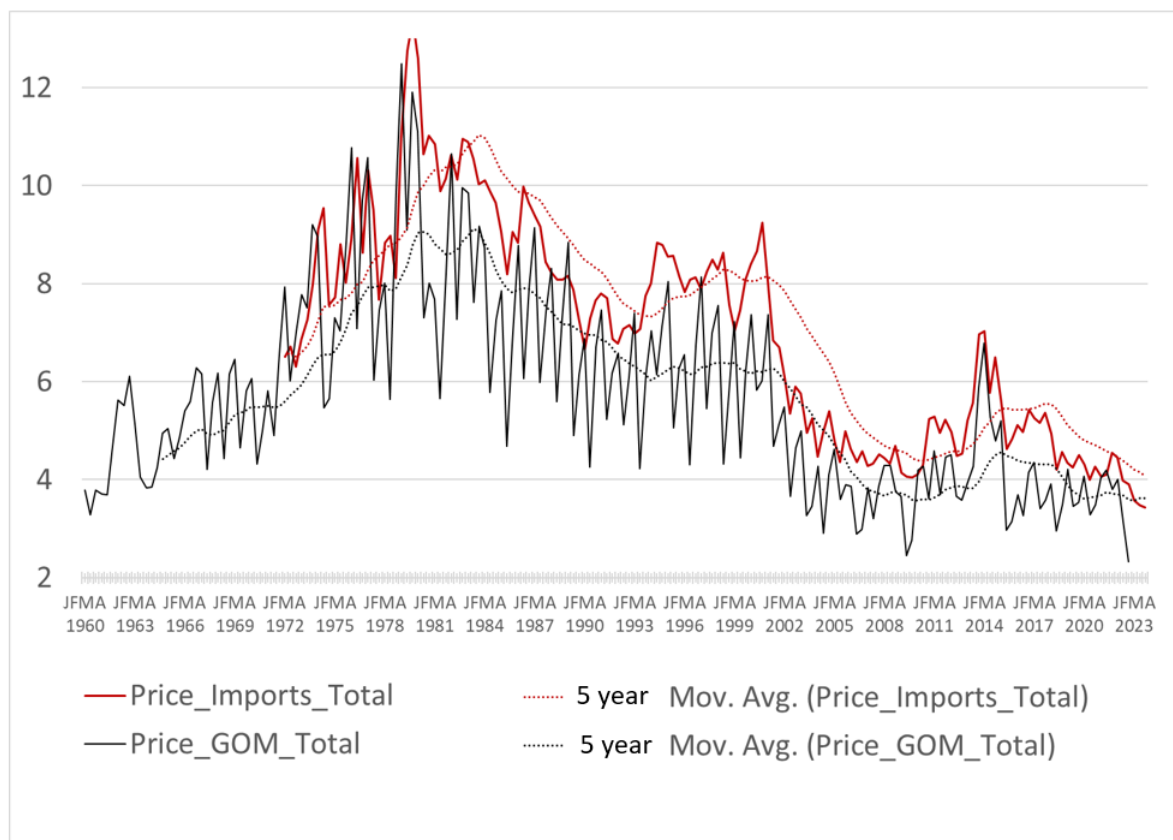


Figure 2: Shrimp Import Price Indices by Shrimp Size Category and Total

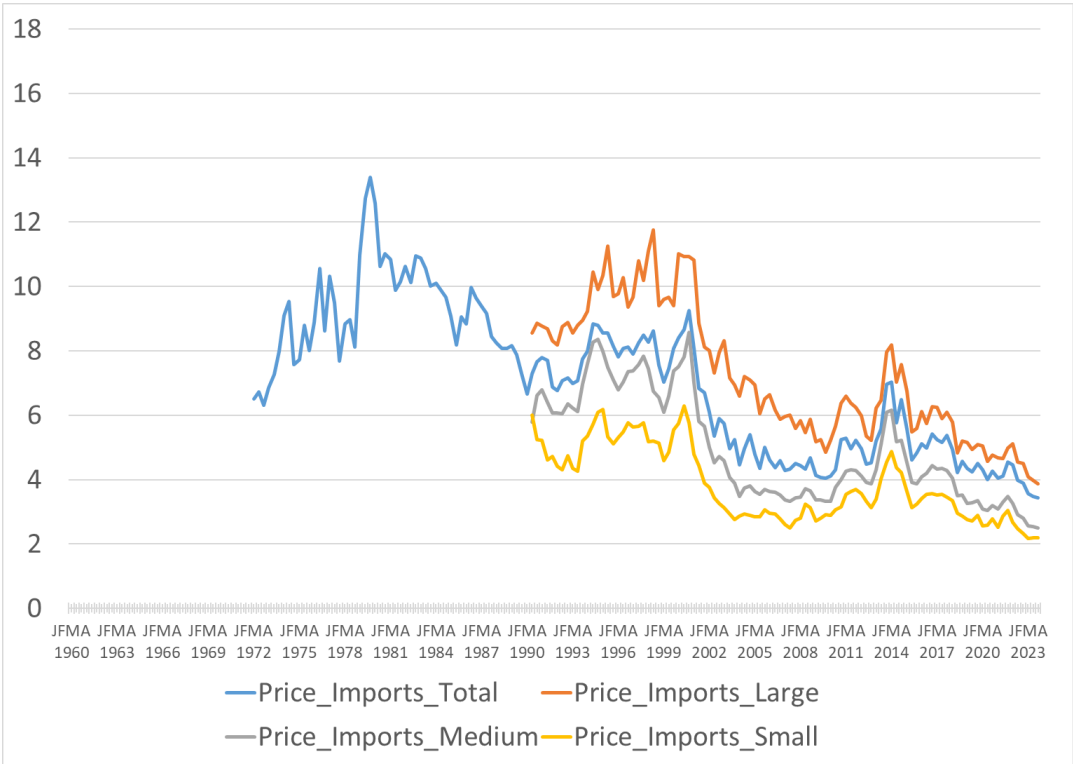


Figure 3: GOM Shrimp Landings Price Indices by Shrimp Size Category and Total

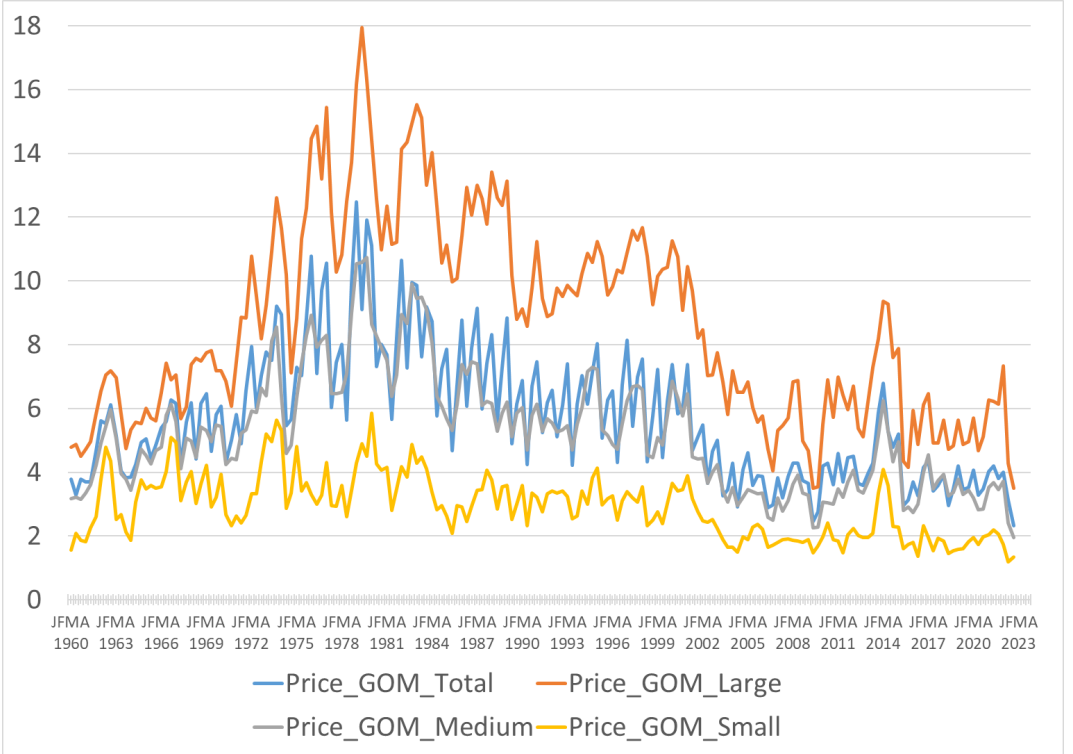


Figure 2 and 3 show the price indices for different sized shrimp (and the one for the total). For imports, the size-based price indices can only be generated starting in 1991. It is important to state the obvious: The price for a pound of large shrimp has been and still is a multiple of the price of small shrimp. Though it can be seen that this difference has been compressed over time. It should be further noted that while imports and GOM landings of medium and especially large shrimp seem to generally get a similar price, the two price indices for small shrimp are quite different. This is likely because the two small groups measure different shrimp! Small shrimp are the least imported size category and tend toward the larger sizes of small. Further, to have enough volume in the small import category, the upper bound of small was also defined a bit larger than for GOM shrimp. But the dominate driver is still likely the Louisiana shrimp fishery, which harvest very small “baby Gulf” shrimp of the sort that are minimally imported to the US, if at all.

Note in Figure 3 that the strong seasonal signal in the total GOM shrimp price index (blue squiggly line) is not nearly as strong in the size-based indices, i.e., the subcomponents of the very seasonal data are themselves not as seasonal. Generally, total/average GOM prices are lowest in the MJJA trimester/season, while prices peak in JFMA. The implication is that there must be non-proportionality of how the size-based prices translate into the overall price. More research is needed, but based on eyeballing the data no single explanation suffices. There is somewhat of a higher proportion of small shrimp in MJJA, but that effect alone does not suffice. There might also be shifts across species, e.g., pink shrimp get a small premium and peak at other times. Or, as MJJA are the peak landings months in the GOM overall, the seasonality might also be a market supply effect (a shrimp “glut” leading to lower prices). Such seasonal component would be independent of the global price. While these ideas are speculation, the contrast between strong seasonality overall and less of it at the size-based index level tentatively argues for using the size-based indices if GOM shrimp price indices are used.

A final note, the strong seasonality is not present in the import price data. This is not surprising, as the imported frozen, shell-on shrimp are very “shelf stable” (in a freezer) and there is a lot of storage capacity in the US. Beyond that, the lead and lag times between the dates associated with imports in the custom data and the imported shrimp’s arrival “in the US market,” and the “equivalency” to ex-vessel, GOM-harvested shrimp is hard to determine and mostly unknown (say, at monthly resolution).

In conclusion, the U.S. price for shrimp is the primary driver of economic decisions by producers, i.e., production decisions by GOM shrimp vessels such as if to shrimp, how long to shrimp, where to shrimp, etc., and hence it is central to explaining/understanding effort---and by extension abundance and catch per unit effort---in this fishery. Ultimately, it is the interplay of global and U.S. consumer demand for shrimp and global shrimp supply that sets the U.S. price for shrimp. While the import price leads and drives the ex-vessel prices received by GOM harvesters over a time scale of a year to decades, the GOM shrimp prices further reflects local and regional-level developments, especially at a monthly or multi-month time scale. Also, the price for the largest shrimp can be many multiples of the price for the smallest, and an overall mean price obscures seasonal fluctuations specific to size classes. Hence this working paper recommends using size specific shrimp price indices derived from GOM-landings at a trimester time step in the EDM models.

References

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Liese, C. 2023. General Economic Measures for Fuel Price Trend, Inflation Adjustment, and Discounting. SEDAR87-DW-08. SEDAR, North Charleston, SC. 6 pp.

Lowther, Alan. 2023. Shrimp Import Data. SEDAR87-DW-10. SEDAR, North Charleston, SC. 2 pp.

SEDAR. 2024. SEDAR 87 – Gulf of Mexico White, Pink, and Brown Shrimp – SECTION II: Data Workshop Report. August 2024. SEDAR, North Charleston, SC. 94 pp.

Appendix 1 (Section 5.3.5 Shrimp Price Indices from the Data Workshop Report)

September 2024

Gulf of Mexico White, Pink, and Brown Shrimp

measures are usually *outcomes* of the fishery rather than drivers. Hence it is not clear to the group if or how these economic metrics would be integrated into a stock assessment model. An example, though deemed not very likely by the group, could be the inclusion of a lagged fishery profit measure, i.e., assuming that last year's (average) profit influences fishing behavior the following year. Another example might be claims payments related to the DWH oil spill, though the fishery aggregate/average nature of the results obscures the huge variation within the fleet, i.e., the measure would be average payments per vessel per year, but some vessels received large payouts while many received nothing. The workgroup felt that it was premature to determine if and how these data/results might support the stock assessment and hence recommends keeping them for now. More details are provided in the working paper (SEDAR87-DW-07).

Data file: shr_econ_SSRG_0619_08182023 - formatted for printing_discussion.csv

5.3.5 Shrimp Price Indices

The workgroup was tasked with deriving a GOM shrimp price index and a shrimp import price index (or global price index) during the SEDAR87 data workshop. The price indices are entirely derivative of the dealer landings (SEDAR87-DW-06) and import data (SEDAR87-DW-10) provided and documented by the SEFSC Fisheries Statistics Division. However, the focus on price index creation was deemed within the expertise of the economics and social sciences workgroup.

The discussion focused initially on the central role of prices in our decentralized or market economy. In a decentralized economy, the fluctuation of prices serves as the critical signal that coordinates all economic activity, conceptually allocating scarce resources to their most efficient/valuable use. As such, the price of shrimp is the principal variable that drives shrimping effort, though, ultimately, it is the interplay of consumer demand for shrimp and global supply that sets the price.

While the shrimp price (in a given market) drives the fishery, two caveats were discussed. The first is the delineation of the shrimp market. Most of the shrimp consumed in the U.S. is imported, as domestic landings measure in 100+ millions of lbs while imports reflect many billions of lbs of shrimp biomass (imported in various product forms). As such shrimp imports dwarf the production in the GOM shrimp fishery. Published research (Asche et al. 2012) shows the GOM shrimp market is integrated with, and a "price taker" from, the global market. As a result, it is expected that the import shrimp price leads the GOM shrimp price, which in turn drives GOM shrimp effort. That said, segments of the GOM shrimp fishery, e.g., pink shrimp, sell to more local markets and could (also) be driven by more local price developments. A GOM shrimp price index can be derived from ex-vessel prices of GOM landings. Such an index is "closer to the fishery" and might contain the effects of more local and regional drivers, e.g., local product scarcity or glut (warehouse fire or capacity constraint).

A second caveat is that prices, resulting from the interaction of a myriad of independent supply and demand decisions, reflect or summarize *all* the information available to market participants. As such it is usually not possible to further identify the specific factors that drive prices, unless they are very dominant or persistent over time. Similarly, it is not possible to say, on a decadal scale, if the global shrimp price drop led to an increase in shrimp volume or vice versa, as these processes (supply, demand, and price) continuously interact (feedback), shaping the market together. In the case of shrimp, a once high-priced, scarce, luxury product generated profit, and

thereby attracted interest and investment, which led to increased production, including the development of shrimp farms. As additional, lower-cost-of-production shrimp entered the global market, shrimp prices dropped, and (greatly) expanded the demand and hence the market for shrimp.

Another very important aspect of shrimp prices in particular is that the per pound price varies substantially for different shrimp size categories, i.e., larger shrimp demand a premium over smaller shrimp. The price for the largest shrimp can be many multiples of the price for the smallest. So while today, shrimp is traded as a commodity, this commodity is split into differently priced categories. It should be noted that the spread across shrimp prices has declined somewhat over the last decades as shrimp farmers can control the size of shrimp produced. In comparison, the specific species of shrimp has little to no impact on the price.

As eluded to earlier, two data sources could be used to generate shrimp price indices for SEDAR87. A GOM shrimp price index can be derived from ex-vessel prices of GOM landings reported by the dealers, and an import/global market price of shrimp index can be derived from import data ultimately collected by U.S. Customs and Border Protection (CBP). The GOM landings data provided the species information and only two shrimp product forms represent the vast majority of GOM landings, frozen heads-on shrimp (whole shrimp) and frozen heads-off shrimp ("tails"). The date of the dealer record corresponds roughly with the month the shrimp were caught, and these landings clearly correspond to the harvested biomass of the GOM shrimp fishery.

In contrast, the import data generally does not specify the shrimp species but does provide size categories for the frozen (plain) shrimp product form category (since 1990). Only in the last two years has CBP differentiated between wild-caught and farmed shrimp (since 2021). Further, the different "product forms" of imports---ranging from whole, frozen to heads-off/tails all the way to cooked, breaded, canned, etc.---obscure the weight of the actual shrimp input and hence the original biomass (from worldwide shrimp fisheries and aquaculture production). This makes measuring a standardized "volume of shrimp imports" difficult. Further, the variety of product forms also complicates the use of the import price data as the price reflects the overall value of the product, and it is impossible to determine which part of the price reflects the value added from the actual shrimp input (vs., e.g., the value added by bread crumbs and the act of breading).

That said, the amount of shrimp imported in simple, frozen forms is huge. Given these vast product flows, if the purpose of a price index is to integrate shrimp price fluctuations and trends into the stock assessment, using a subset of the import data is acceptable, e.g., volume or average price by year of frozen, heads-off shrimp. We could combine frozen heads-on and heads-off product using NMFS conversion factors, but given the lack of species information some approximation error is introduced.

The workgroup agreed that developing a price index is not trivial and depends a lot on its intended use. The workgroup agreed that more research is needed on prices and price indices on the dealer landings data, as everyone's experience dates back a decade or more, if any. The dealer data have undergone significant changes in that time, as has the fishery. On the other hand, the group agreed that a full research project would exceed the scope of this SEDAR (and take too long), and to stick to simple and proven methods. In light of that, it was decided that the index derived from the dealer data should mirror the one based on the import data. This decision also eliminates providing species-specific price indices (using the dealer data).

It was further discussed to what extent size should be incorporated into the index production. For instance, it would be possible to produce price indices for different size categories, but no use for such indices was found at the time. A straight average across all the applicable landings or imports, i.e., ignoring size categories, represents the actual prices paid and received in the specific year---and hence is an important measure---yet it suffers from distortions from shifting market shares of different shrimp sizes. Given that the focus of a price index is as a possible driver of effort, the workgroup decided that a size-adjusted price index would be most appropriate. The actual size categories are given in the import data. A size-adjusted price index is produced by weighted-averaging across prices by size and where the weights are kept constant, similar to how the consumer price index is calculated using a fixed market basket of goods and services over time. The weights might be the series' average (over time) share of market for each size category. The group agreed on the methodology needed for generating price indices, and recommended using the average size distribution across the time series as the weights in the size-adjusted price indices.

Finally, it should be noted that all the GOM and import shrimp price data is nominal data and will need to be inflation adjusted before use in most analysis. Hence the price indices data provided to this SEDAR have been inflation adjusted using the GDP implicit price deflator. Any forward-looking analysis would not need inflation adjustment as dollar values will be hypothetical and can be based on the "current" price level. Note though, for other reasons, future dollar values will need to be discounted for most analysis.

In summary, given the previous discussion, the workgroup recommends using the size-adjusted import price index in any regression where a proxy for the primary driver of effort on the demand side is needed. The workgroup notes that if deemed useful or necessary for the stock assessment further indices can be generated from the data already submitted to this SEDAR. Such indices could differentiate by species (only for the GOM dealer data, though), by size category, e.g., large-medium-small, or by season or month. It was noted though that frozen imports have a very long shelf life and are routinely stored making assignment to a specific time period difficult.

5.4 QUALITATIVE INFORMATION

Apart from quantitative economic data provided for SEDAR 87 modeling efforts, economic and social science information can assist in understanding and validating developments, specifically trends, breaks, and outliers, in the quantitative data during the assessment process. The GOM shrimp fishery has been substantially influenced and changed by many global and local developments, including globalization/world trade and the extensive farming of shrimp, fuel price fluctuations, hurricanes, and the DWH oil spill. The workgroup discussed and documents many of these developments in the fishery and finalized a working paper (SEDAR87-DW-15), for the benefit of the assessment scientists and others not intricately familiar with the more recent history of the fishery. The working paper is primarily focused on developments since 2000, though some of the trends discussed have been in effect for longer. After many rounds of review and revision, the final version of the working paper was endorsed by all workgroup members and submitted to SEDAR87 on November 29, 2023.

This comment received from a shrimper on a 2007 economic survey creatively sums up the problems facing the Gulf of Mexico shrimp fishery since 2000 and especially during the 2006-2008 period which led to rapid industry consolidation and, possibly, again today (in 2023).