

IS THE U.S. MUSSEL AQUACULTURE INDUSTRY GROWING?

ABSTRACT

- This presentation shows overall U.S. mussel aquaculture production trends and farmgate values.
- U.S. aquaculture data are available from 1983 to 2019.
- Values beyond 2019 are predicted using econometric models developed by Dr. Posadas.
- Annual production is expected to rise during the next decade.
- Recessions disrupted domestic production and markets of farmed mussels.
- Annual farmgate values are projected to rise during the next decade.

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ACKNOWLEDGEMENT

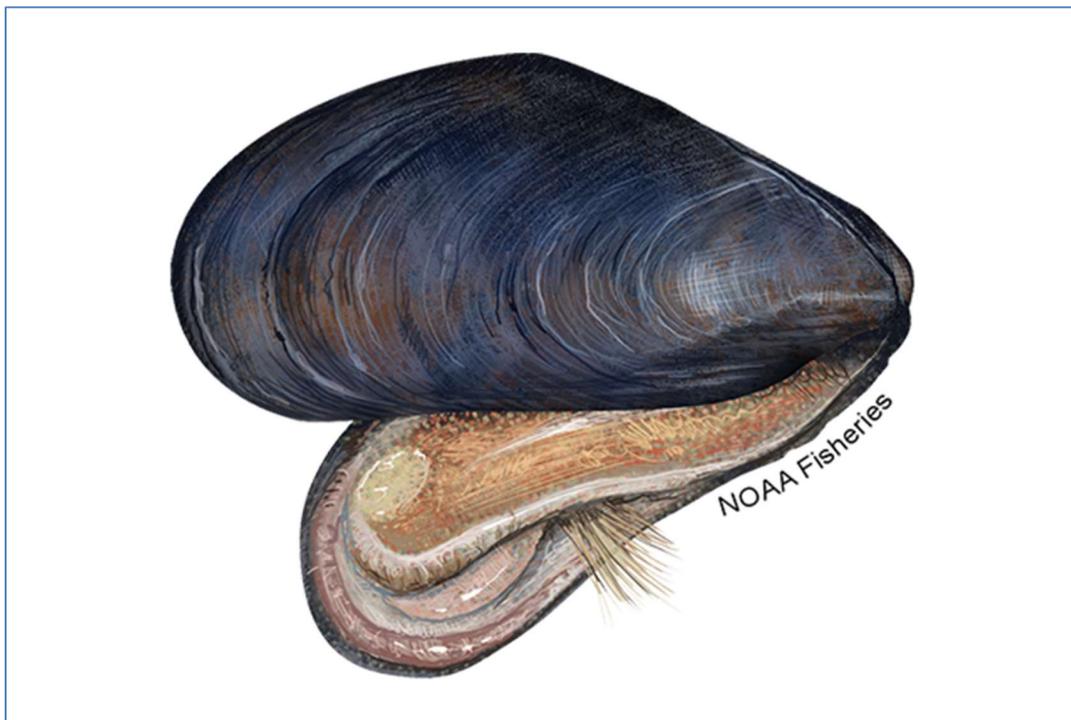
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U.S. MUSSEL FARMS

- More than 30 farms are growing blue mussels in the U.S. ([2018 Census of Aquaculture](#)).
- Mussels are farmed mainly in Washington, California, Maine, and Rhode Island. Blue mussels are economically and environmentally important filter-feeding bivalves.

BLUE MUSSELS

- Source: <https://www.fisheries.noaa.gov/species/blue-mussel>.



- They are commonly harvested for food worldwide from wild and farmed sources.
- Range from 2 to 4 inches at maturity, though it can grow up to 8 inches.
- The shell is black, blue-black, or brown, tear-drop shaped, and has concentric lines marking the outside; the inner shell is white.
- The 'beard' is the byssal threads allowing the mussel to attach to the substrate.

- Are of the shellfish family. Like oysters, clams, and scallops, they are bivalve mollusks and have a hinged shells.
- Adults are sessile—they stay in one place—and inhabit both intertidal and subtidal areas.
- Have fast growth rates and high reproduction rates.
- First mature as males, then later develop female reproductive capabilities.
- Each female can produce between 50 and 200 million eggs during spawning.

LET US START OUR MODELING EFFORT!

- The Food and Agriculture Organization (FAO) data on national aquaculture production are reported in **tons** and converted into **pounds per year**.
- The FAO data on national aquaculture farmgate values are reported in **dollars per year**.
- Farmgate prices are imputed from the farmgate values and pounds of live weight.
- U.S. aquaculture data are available from **1984 to 2019**.
- Values beyond 2019 are predicted using econometric models developed by Dr. Posadas.

U.S. AQUACULTURE ECONOMIC MODELS

- The Ordinary Least Squares (OLS) models of U.S. aquaculture consisted of the following dependent variables:
 - Aquaculture production (lb/yr)
 - Deflated farmgate value (\$/yr)
- The OLS models of U.S. aquaculture were estimated using the robust variance procedure of STATA-16.
- The variation inflation factor was calculated to detect the possible presence of multicollinearity.
- The marginal impacts of disaster events were computed using the margins procedure.

U.S AQUACULTURE PRODUCTION ECONOMIC MODEL

- The OLS model of U.S aquaculture production (lb/yr) assumed that annual production could be explained by the following:
 - year and year-squared

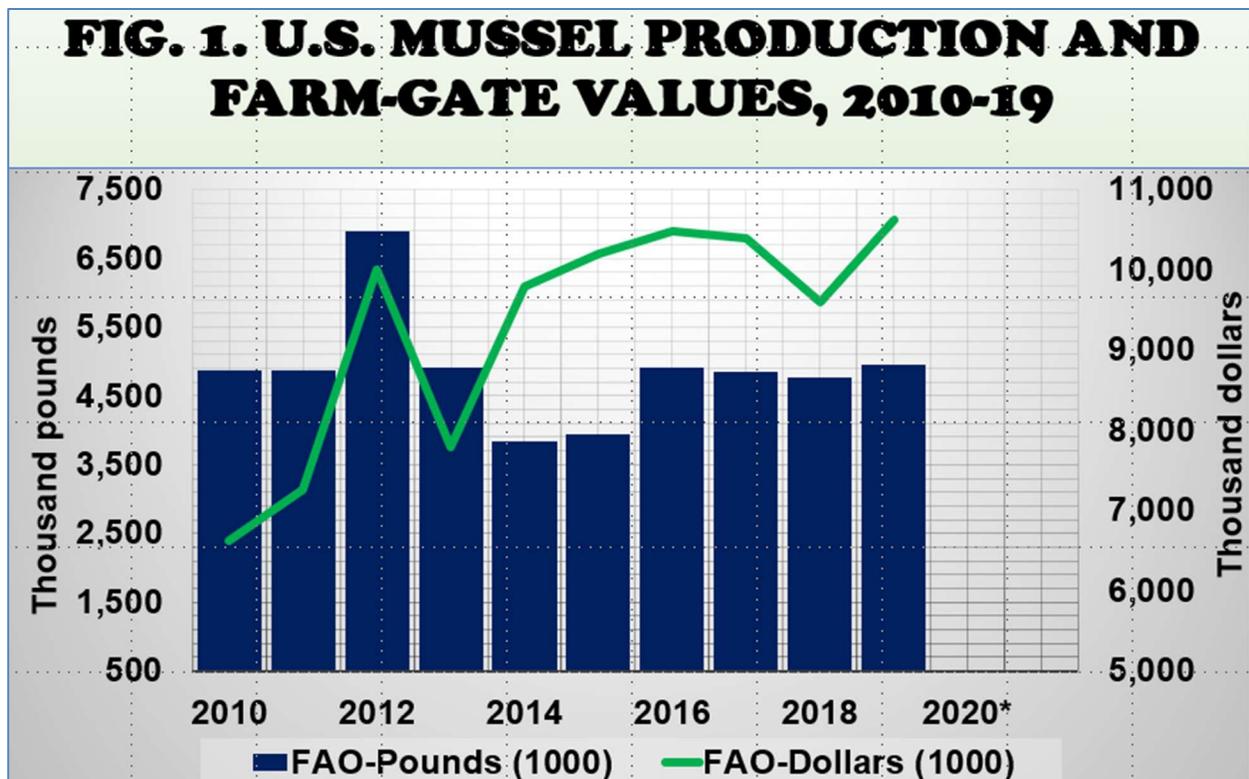
- recession (1 or 0) and trade war (1 or 0)
- growth in per capita disposable income (%)
- other variables

U.S. AQUACULTURE FARMGATE VALUE ECONOMIC MODEL

- The OLS model of U.S. aquaculture farmgate value (\$/yr) assumed that annual production could be explained by the following:
 - year and year-squared
 - recession (1 or 0) and trade war (1 or 0)
 - aquaculture production (lb/yr)
 - growth in per capita disposable income (%)
 - other variables

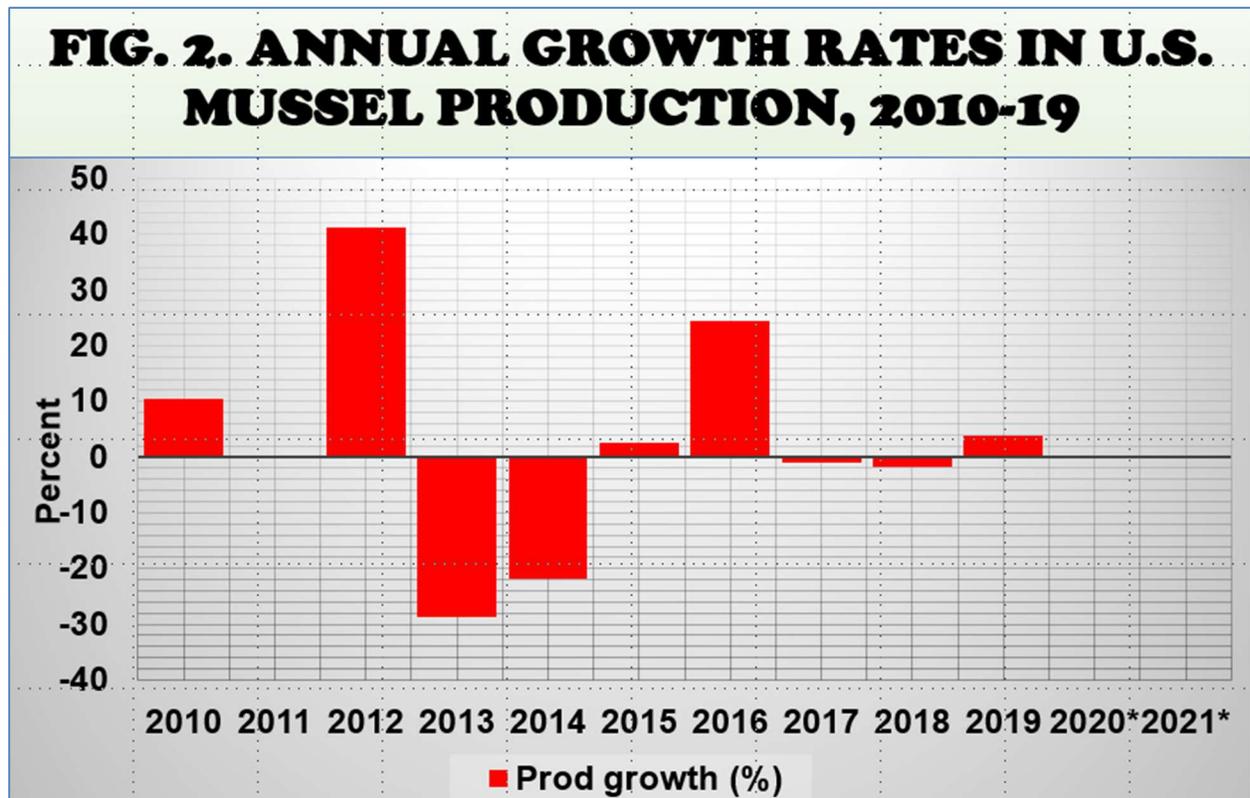
U.S. MUSSEL AQUACULTURE, 2010-19

- Production (lb/yr)
- Farm-gate values (\$/yr)
- Imputed farmgate prices (\$/lb)
- Data were compiled from the Food and Agriculture Organization (FAO) website.



U.S. MUSSEL PRODUCTION AND FARMGATE VALUES, 2010-19

- FAO-Pounds (1000) is the annual blue mussel production in pounds, as reported by FAO.
- FAO-Dollars (1000) is the annual blue mussel farmgate values in dollars, as reported by FAO.
- Annual production since 2014 averaged **4.5 million pounds** (Fig. 1).
- Annual farmgate value since 2014 averaged **\$10.1 million**.

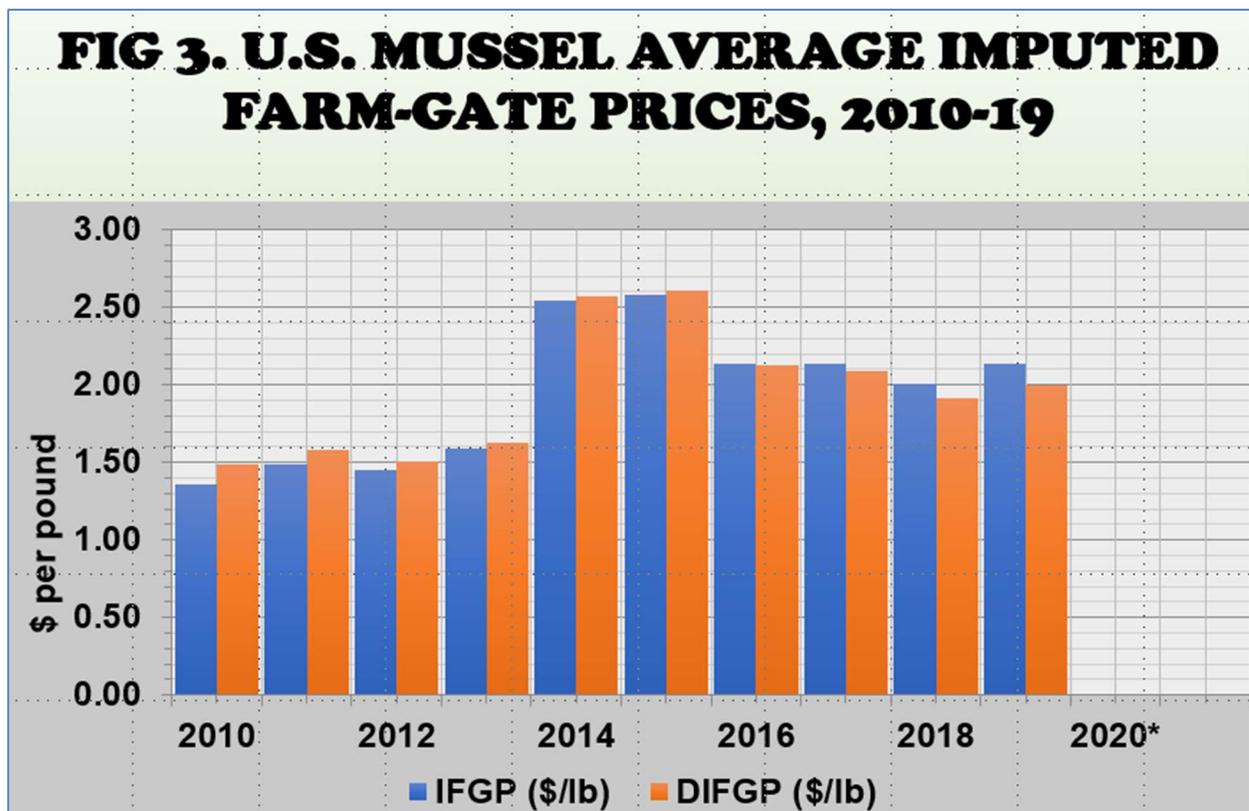


ANNUAL GROWTH RATES IN U.S. MUSSEL PRODUCTION, 2010-19

- Production growth is the annual growth rate in blue mussel production in percent.
- The annual production growth rate since 2014 averaged **1.08 percent** (Fig. 2).
- The annual deflated farmgate value growth rate since 2014 averaged **4.17 percent**.

U.S. MUSSEL AVERAGE FARMGATE PRICES, 2010-19

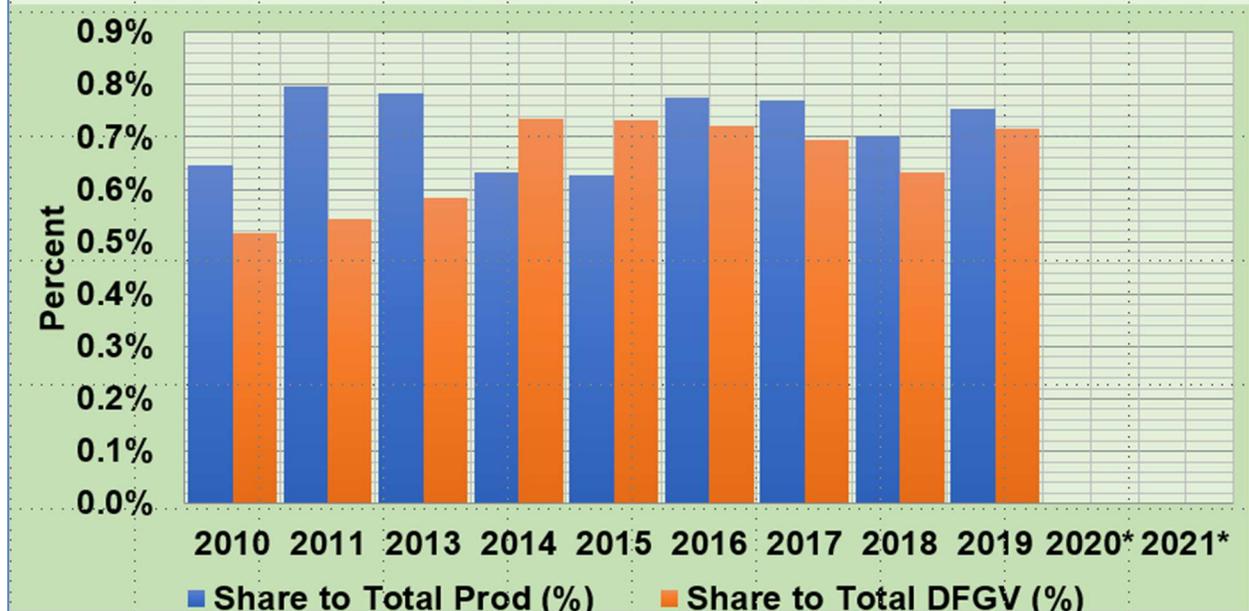
- Urner Barry Comtell reports wholesale mussel prices in dollars per pound.
- The imputed farmgate price (IFGP) is expressed in dollars per pound.
- The deflated imputed farmgate price (DIFGP) is IFGP divided by the consumer price index.
- The imputed farmgate price (IFGP) since 2014 averaged **\$2.26 per pound** (Fig. 3).



SHARE OF MUSSEL TO TOTAL AQUACULTURE PRODUCTION AND FARMGATE VALUE

- Share to total is the percent contribution of mussel production or farmgate value to total U.S. aquaculture production or farmgate value.
- Share to total U.S. aquaculture production of mussel production since 2014 averaged **0.71 percent** (Fig. 4).
- Share to total U.S. farmgate value of mussel aquaculture since 2014 averaged **0.70 percent**.

FIG. 4. SHARE OF MUSSEL TO TOTAL AQUACULTURE PRODUCTION AND FARM-GATE VALUE



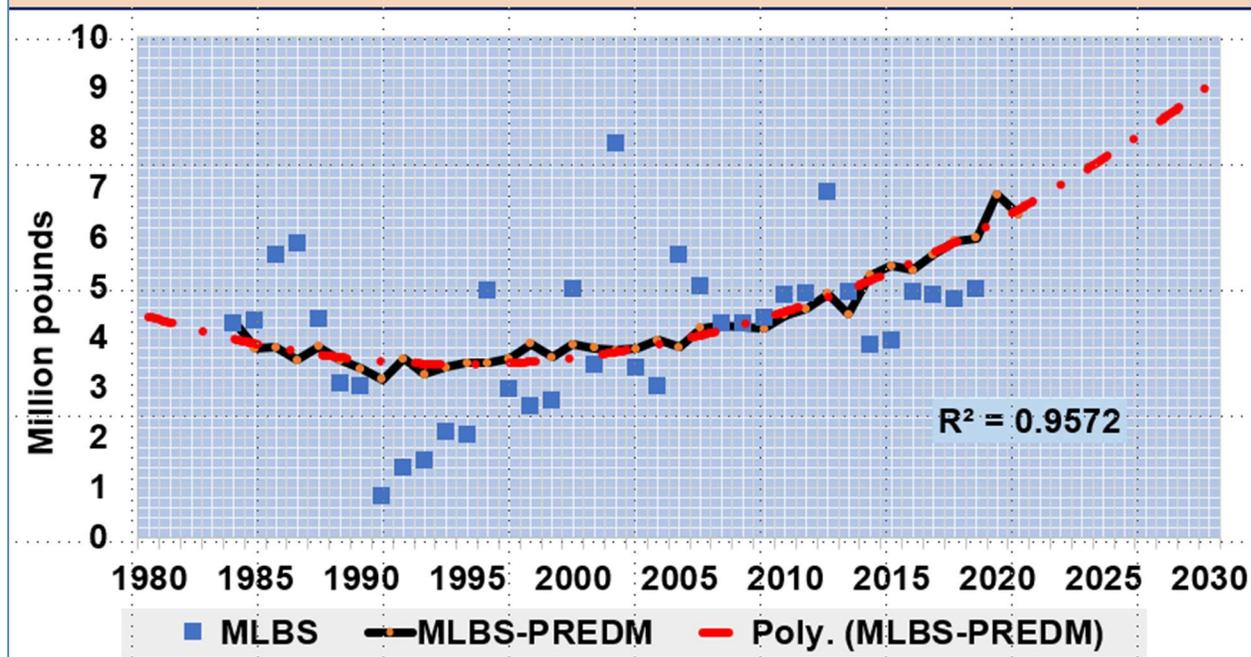
U.S. MUSSEL AQUACULTURE, 1983 TO 2021

- Production (lb/yr)
- Farm-gate values (\$/yr)
- Imputed farmgate prices (\$/lb)
- Data from 1984 to 2019 were compiled from the FAO Aquaculture website.
- Values from 2020 to 2021 were predicted using econometric models developed by Dr. Posadas.

U.S. MUSSEL AQUACULTURE PRODUCTION BEYOND 2019

- The estimated OLS equation of aquaculture production explained **19 percent** of the variations in annual production.
- Time is not a significant determinant of annual production.
- Recession is not a significant determinant of annual production.
- The per capita disposable income growth is a positive but insignificant determinant of annual production.

FIG. 5. U.S. MUSSEL AQUACULTURE PRODUCTION BEYOND 2019



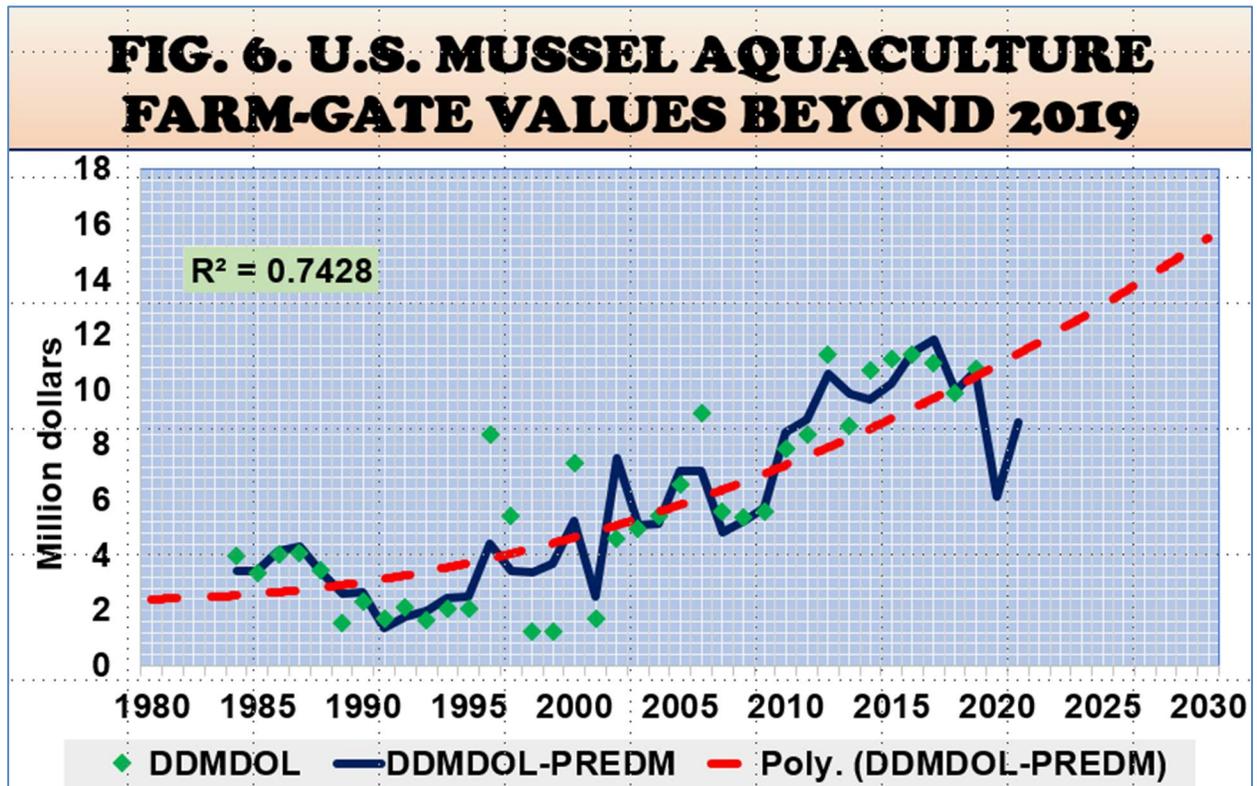
ESTIMATING LONG-TERM AQUACULTURE PRODUCTION FROM 2020 TO 2030

- Fig. 5 shows the three time-series data on annual production.
- The blue dots show the actual FAO data on annual production up to 2019.
- The black curve portrays the OLS-estimated annual production up to 2021.
- The red-dotted curve represents the Excel-generated polynomial trend for annual production up to 2030.
- Overall, annual production is expected to rise during the next decade.

U.S. MUSSEL AQUACULTURE DEFLATED FARMGATE VALUES BEYOND 2019

- The estimated OLS equation of clam aquaculture production explained **86 percent** of the variations in annual farmgate values.
- Time is a significant determinant of annual farmgate values.
- Recession is a negative and significant determinant of annual farmgate values.

- The trade war is a negative and significant determinant of annual farmgate values.
- Annual production is a positive and significant determinant of farmgate yearly values.

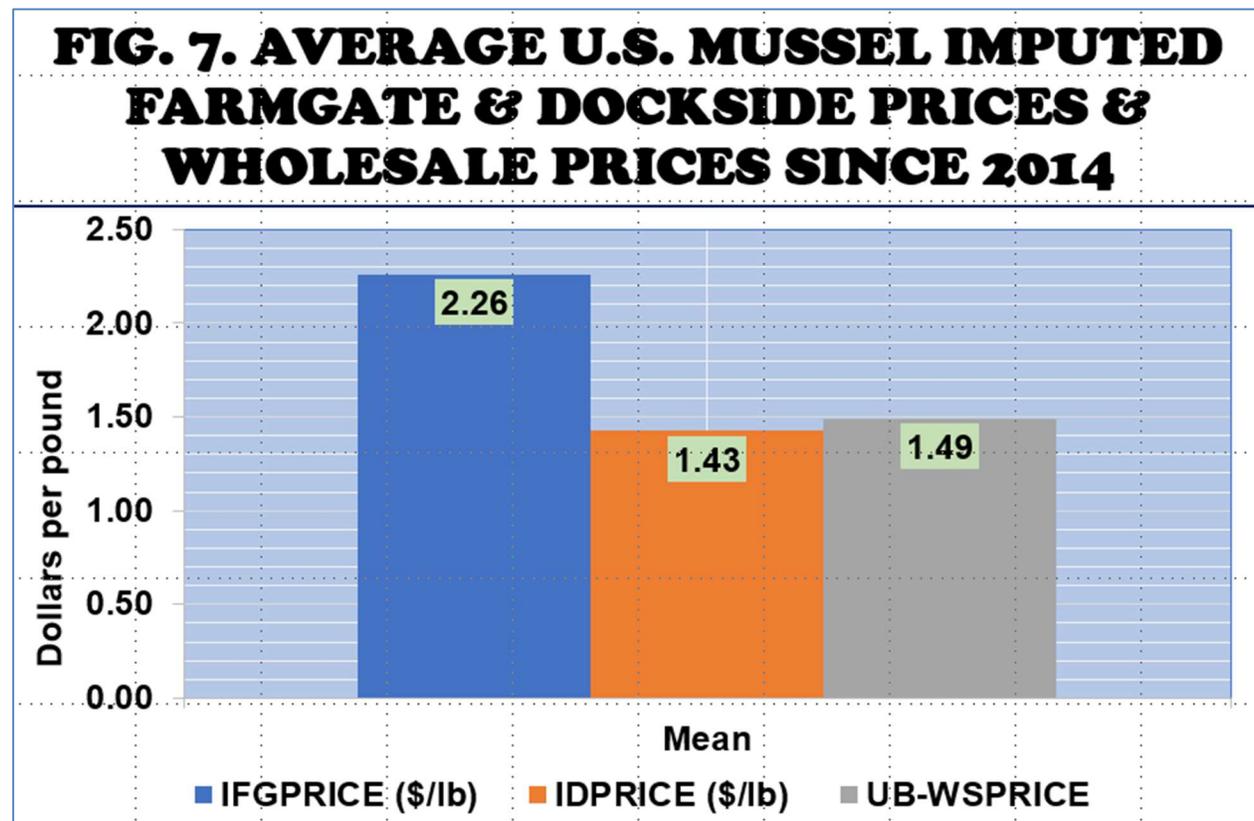


ESTIMATING LONG-TERM AQUACULTURE DEFLATED FARMGATE VALUES FROM 2020 TO 2030

- Fig. 6 shows the three time-series data on annual farmgate values.
- The green dots show the actual FAO data on annual farmgate values up to 2019.
- The black curve portrays the OLS-estimated annual farmgate values up to 2021.
- The red-dotted curve represents the Excel-generated polynomial trend for annual farmgate values up to 2030.
- Overall, annual farmgate values are expected to rise during the next decade.

MARGINAL IMPACTS OF RECESSIONS

- Recessions caused the deflated farmgate values to decline from **\$0.98 to \$3.17 million per year**.
- Trade wars caused the deflated farmgate values to decline from **\$0.83 to \$3.92 million per year**.
- A million-pound expansion in annual production would raise the farmgate value from **\$0.11 to \$1.11 million per year**.



U.S. MUSSEL IMPUTED PRICES SINCE 2014

- Fig. 7 shows three average prices of mussels in the U.S. at the dockside, farmgate and wholesale markets.
- The blue bar shows imputed farmgate prices (IFGPRICE) using the FAO data, averaging \$2.26 per pound.
- The orange bar portrays imputed dockside prices (IDPRICE) using the actual NOAA data, averaging \$1.43 per pound.

- The grey bar represents the wholesale price (UB-WSPRICE) provided by Urner Barry Comtell, averaging \$1.49 per pound.
- Overall, imputed farmgate prices are higher than imputed dockside prices and wholesale prices.

SUMMARY AND IMPLICATIONS

- Annual production is anticipated to rise during the next decade.
- Recessions disrupted domestic production and markets of farmed mussels.
- Annual farmgate values are projected to rise during the next decade.

MY ECONOMIC OUTREACH ON CLAMS

- Posadas, B.C. 2022a. Is the U.S. Mussel Aquaculture Industry Growing? HME Outreach. MSU-CREC, Biloxi, MS. Virtual presentation.
<https://www.youtube.com/user/bposadas>.
- Posadas, B.C. 2022b. Is the U.S. Mussel Aquaculture Industry Growing? Mississippi MarketMaker Newsletter, Vol. 12, No. 12. December 14, 2022.
<http://extension.msstate.edu/newsletters/mississippi-marketmaker>.