Controls for Moisture in Shrimp

NFI Shrimp School (virtual) November 2020 Steve Otwell

History for Moisture Controls

1979 – GRAS status noted for sodium tripolyphosphates (STP) with proposal for maximum limits allowed plus required labeling for seafood(21CFR184.1810)

Use not to exceed *GMP* results with a maximum level, *as served*, of 0.5% for *fish products*…

Proposed limit was withdrawn due to confusion….

- distinguishing natural levels of phosphate from additions
- how to apply for ‘as served’
- definitions for ‘Fish Products vs. Fresh Fish’

History for Moisture Controls

1989 – FDA emphasizes Compliance Policy Guide

Water in Food Products (current CPG 555.875)

[Water] is a normal component of many foods and is essential in preparation and processing …

However …

… ‘sufficient water to prepare’ does not comply;

… no water added to product with standard of identity unless prior established;

… scallops adulterated if water added directly or in the form of melt ice.

History for Moisture Controls

1992 – FDA Industry Advisory

Declaration of Ingredients in Shrimp

Salt, STP and other phosphate compounds added to shrimp during processing either by direct application, spraying, immersing, or other methods, must be declared in the ingredient statement.

1993 – Industry attempt for **Temporary Marketing Permit** with STP controls for Breaded Shrimp never completed

History for Moisture Controls

1993 – Sea Scallop industries conducted studies to help explain changes in moisture content through necessary GMPs

… 80% limit for scallops was initially accepted and later withdrawn;

1994 – Based on studies to explain moisture and weigh gains associated with STP use during processing of Pacific Shrimp (cold water), FDA concluded ‘the use of STP serves as a technically effective processing aid, in that it increases the meat yield in a manner exempt from ingredient labeling…’

History for Moisture Controls

1995 thru 2020 (25 years) –

- Markets continue to question Source & Content

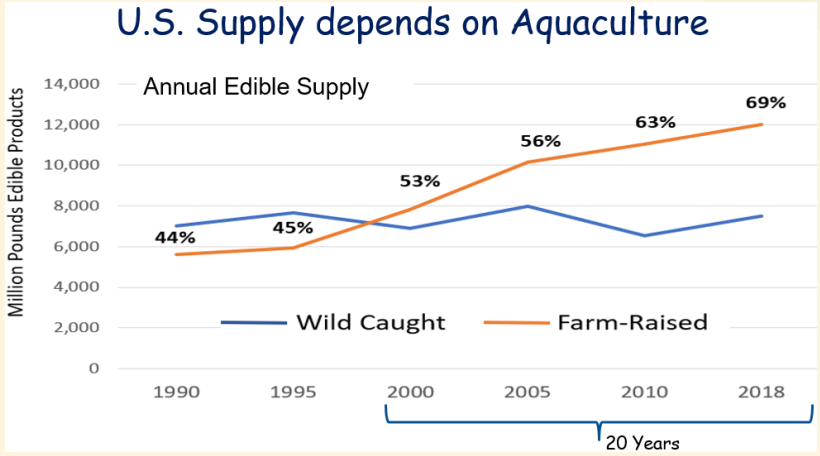
  Prefer “Clean Labels & Chem-Free”

- Moisture Debate relies on interpretations for no labeling 😕 … Processing aids
  … Phosphate-free blends

History for Moisture Controls

1995 thru 2020 (25 years) –

- Historical change in shrimp supply (Imported & Farm-raised)



- Regulatory focus on seafood safety (HACCP and Traceability)

Moisture is not a significant food safety issue

PREVAILING STRUGGLE

Some commercial indifference in the current supplier driven economy for shrimp

Regulatory hesitation due to appropriate priorities for food safety relative to available enforcement budget, and required time and access to primary sources and processing (international)

Failure to recognize real consequences during necessary practices for conversion of invertebrate animal into edible food

Lack of reliable evidence for compliance

NFI Response

Industry Guidance
Best Practices
Addressing Seafood Fraud

BETTER SEAFOOD BOARD
Task Force and NFI Members

It is unlikely that any of the components of a phosphate or non-phosphate blend designed for moisture retention purposes would meet the regulatory requirements that allow for an exemption of labeling.

1. MRA's have a functional or technical effect in the finished product
2. Some ingredients in MRA blends contribute significantly to increase the sodium content of the product

Either point would disqualify the ingredient as an incidental additive.

Lingering Issues for Consideration

1. No science, regulatory or industry-based agreement for the 'expected' moisture content in warm water *Penaeid* shrimp during the conversion of the invertebrate animals into edible food through necessary harvest and processing methods, to include GAPs, GVPs and GMPs.

2. Commercial and science-based experience clearly indicate, relative to established GAPs, GVPs and GMPs, that the expected moisture content in shrimp can be similar, and also differ, for products with or without intentional exposure to moisture retentions agents (MRAs), substances or additives.

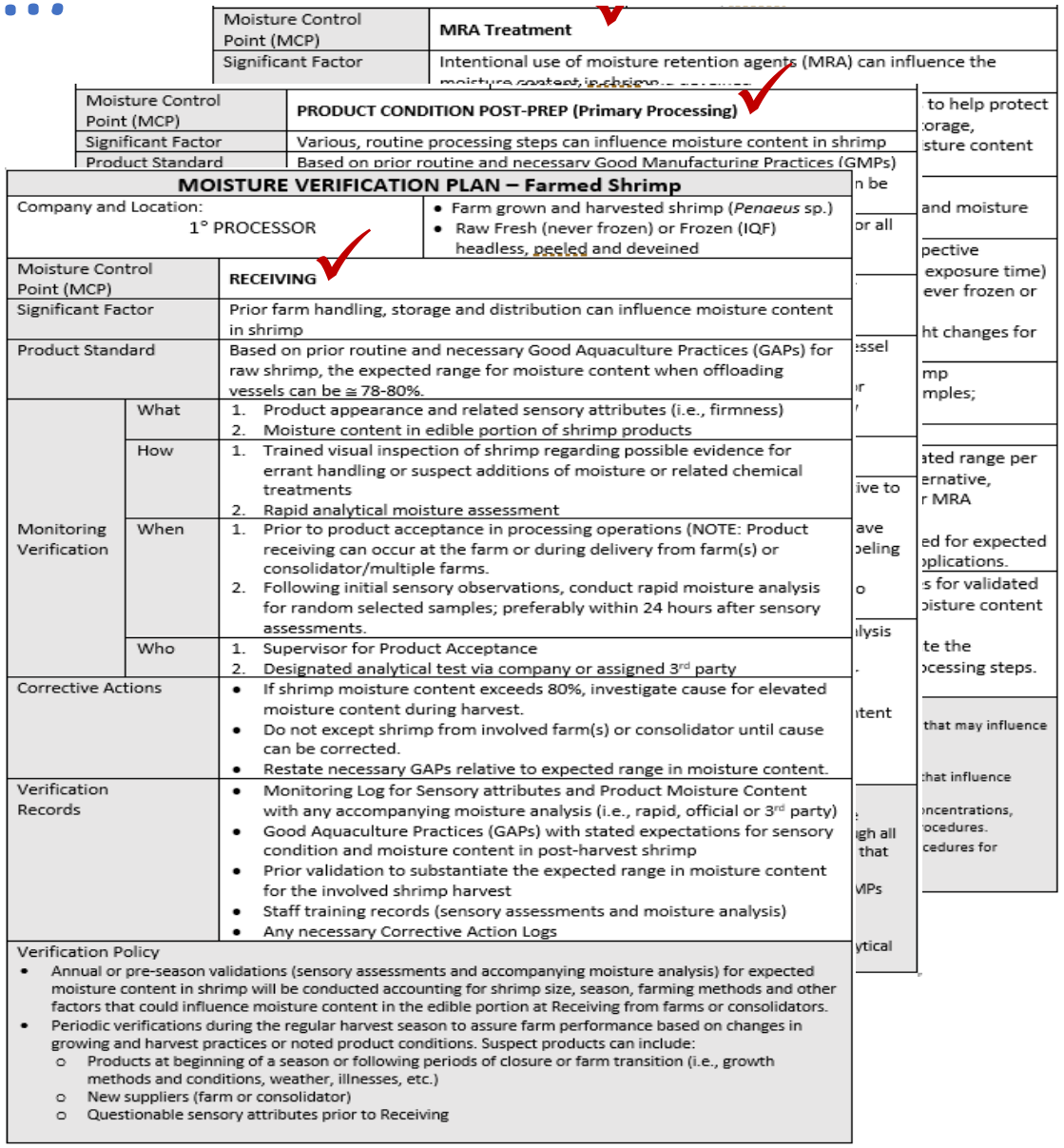
3. Additional evidence is need to guide and verify responsible practices.

Proposal for Response…

Moisture Verification Plan

… the lacking evidence

Moisture Control Points



Moisture Control Point (MCP)	MRA Treatment
Significant Factor	Intentional use of moisture retention agents (MRA) can influence the

Moisture Control Point (MCP)	PRODUCT CONDITION POST-PREP (Primary Processing)
Significant Factor	Various, routine processing steps can influence moisture content in shrimp
Product Standard	Based on prior routine and necessary Good Manufacturing Practices (GMPs)

MOISTURE VERIFICATION PLAN – Farmed Shrimp

Company and Location: 1° PROCESSOR		• Farm grown and harvested shrimp (*Penaeus* sp.) • Raw Fresh (never frozen) or Frozen (IQF) headless, peeled and deveined
Moisture Control Point (MCP)		RECEIVING
Significant Factor		Prior farm handling, storage and distribution can influence moisture content in shrimp
Product Standard		Based on prior routine and necessary Good Aquaculture Practices (GAPs) for raw shrimp, the expected range for moisture content when offloading vessels can be ≅ 78-80%.
Monitoring Verification	What	1. Product appearance and related sensory attributes (i.e., firmness) 2. Moisture content in edible portion of shrimp products
	How	1. Trained visual inspection of shrimp regarding possible evidence for errant handling or suspect additions of moisture or related chemical treatments 2. Rapid analytical moisture assessment
	When	1. Prior to product acceptance in processing operations (NOTE: Product receiving can occur at the farm or during delivery from farm(s) or consolidator/multiple farms. 2. Following initial sensory observations, conduct rapid moisture analysis for random selected samples; preferably within 24 hours after sensory assessments.
	Who	1. Supervisor for Product Acceptance 2. Designated analytical test via company or assigned 3rd party
Corrective Actions		• If shrimp moisture content exceeds 80%, investigate cause for elevated moisture content during harvest. • Do not except shrimp from involved farm(s) or consolidator until cause can be corrected. • Restate necessary GAPs relative to expected range in moisture content.
Verification Records		• Monitoring Log for Sensory attributes and Product Moisture Content with any accompanying moisture analysis (i.e., rapid, official or 3rd party) • Good Aquaculture Practices (GAPs) with stated expectations for sensory condition and moisture content in post-harvest shrimp • Prior validation to substantiate the expected range in moisture content for the involved shrimp harvest • Staff training records (sensory assessments and moisture analysis) • Any necessary Corrective Action Logs

Verification Policy

- Annual or pre-season validations (sensory assessments and accompanying moisture analysis) for expected moisture content in shrimp will be conducted accounting for shrimp size, season, farming methods and other factors that could influence moisture content in the edible portion at Receiving from farms or consolidators.
- Periodic verifications during the regular harvest season to assure farm performance based on changes in growing and harvest practices or noted product conditions. Suspect products can include:
  - Products at beginning of a season or following periods of closure or farm transition (i.e., growth methods and conditions, weather, illnesses, etc.)
  - New suppliers (farm or consolidator)
  - Questionable sensory attributes prior to Receiving

Moisture Verification Plans (MVPs)

PURPOSE

Develop and maintain evidence and guidance for the expected moisture content in the edible portion of shrimp relative to GVPs, GAPs and GMPs that are necessary to convert the whole, live invertebrate animal into an edible food product.

GVPs

Good Vessel Practices

GAPs

Good Aquaculture Practices

GMPs

Good Manufacturing Practices

Moisture Verification Plans (MVPs)

APPROACH

- Not mandated or required program, but remains consistent with pertinent regulatory mandates for food safety and economic integrity

- Market driven with regulatory compliance

- Based on proven HACCP concepts and practice; Includes –
  - Identified Controls Points (MCPs),
  - Monitoring,
  - Corrective Actions,
  - Verifications,
  - and respective Records

MVP Farm-Raised Shrimp

PROCESS ANALYSIS WORKSHEET for MOISTURE VERIFICATIONS – Farm Shrimp

Firm Name and Location: *<list company name>*

1° Processor
(receiving shrimp from farms)

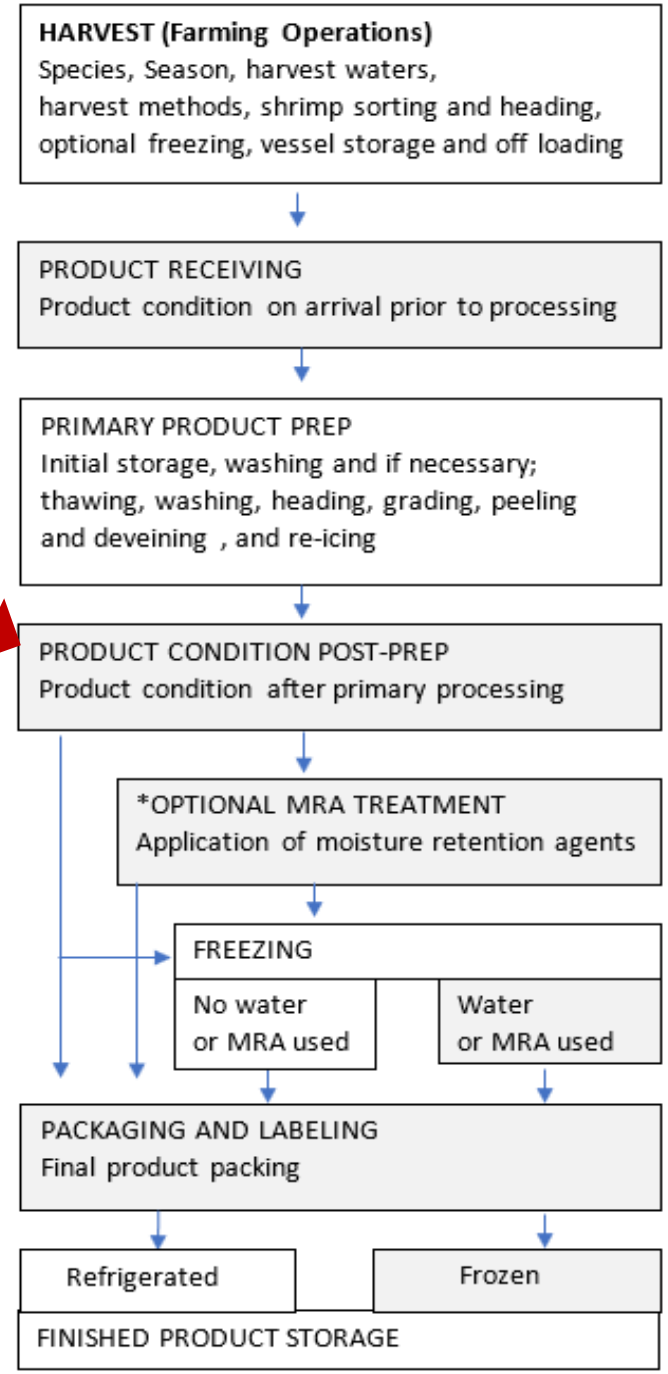
Product Description: Farm Grown and Harvested Shrimp (*Penaeus* sp.)

Preparation and Storage & Distribution: Raw Fresh(never frozen) or Frozen (IQF) headless, peeled and deveined

Distribution and Intended Use: Available for processors, retail operations, food serv
with intentions to be cooked prior to consumption

(1) **Processing Steps**	(2) List all potential **factors** that can influence product moisture content	(3) Is the potential factor **significant** (could increase or decrease moisture content) at this step? **(Yes or No)**	(4) **Justify the decision** in column 3	(5) **Control measure(s)** that can be applied to control significant changes in moisture content	Is this step a **Moisture Control Point? (Yes or No)**
Harvest (Farm)	Species	Yes	Based on traditional and validated practice, these factors will not significantly alter the moisture content in the Penaeid shrimp during harvest from open or enclosed farming operations. Expected range for initial post-harvest moisture content (≅ 77-79%) can be influenced by shrimp species, size, feeding, growth stage (molting), growing waters (i.e., salinity and temperature) and product form (head-on or removed).	Good Aquaculture Practices (GAPs) are discussed with all approved farming operations and crew: Plus, product conditions are subject to monitoring at Receiving.	
	Season	Yes			
	Harvest Waters	Yes			
	Harvest Methods	Yes			
	Shrimp sorting; (heading optional)	Yes			
	Farm Storage (Iced)	Yes	Although the shrimp head and body shell provide some barriers to prevent changes in the moisture content in the edible portions, prolonged storage in ice slushes could slightly increase moisture content, particularly for headless shrimp (cephalothorax hand removed on vessel).		No
	Brining or Plate Freezing	Yes	Use of cold brining freezing systems must be properly maintained and applied to prevent prolonged exposure to elevated salt solutions that can result in addition of sodium in shrimp and possible shrimp dehydration.		
	Farm Storage (Frozen)	No	Duration in frozen storage while controlled by farming operations will not significantly alter product moisture content.		No
	Product Delivery and Transport	Yes	Although the shrimp head and body shell provide some barriers to prevent changes in the moisture content in the edible portions, prolonged exposure in ice slushes could slightly increase moisture content, particularly for headless shrimp.	Harvest advisories are discussed with all approved farming operations and crew, and transit conditions can be monitored prior to Receiving. Plus, product conditions are subject to monitoring at Receiving	No

Moisture Control Points



MVP – Process Analysis

PROCESS ANALYSIS WORKSHEET for MOISTURE VERIFICATIONS – Farm Shrimp

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(receiving shrimp from farms)

Product Description: Farm Grown and Harvested Shrimp (*Penaeus* sp.)

Preparation and Storage & Distribution: Raw Fresh(never frozen) or Frozen (IQF) headless, peeled and deveined

Distribution and Intended Use: Available for processors, retail operations, food service and consumers with intentions to be cooked prior to consumption

Moisture Control Points

(1) **Processing Steps** ✓	(2) List all potential **factors** that can influence product moisture content ✓	(3) Is the potential factor **significant** (could increase or decrease moisture content) at this step? **(Yes or No)** ✓	(4) ✓ **Justify the decision** in column 3	(5) ✓ **Control measure(s)** that can be applied to control significant changes in moisture content	(6) Is this step a **Moisture Control Point? (Yes or No)**
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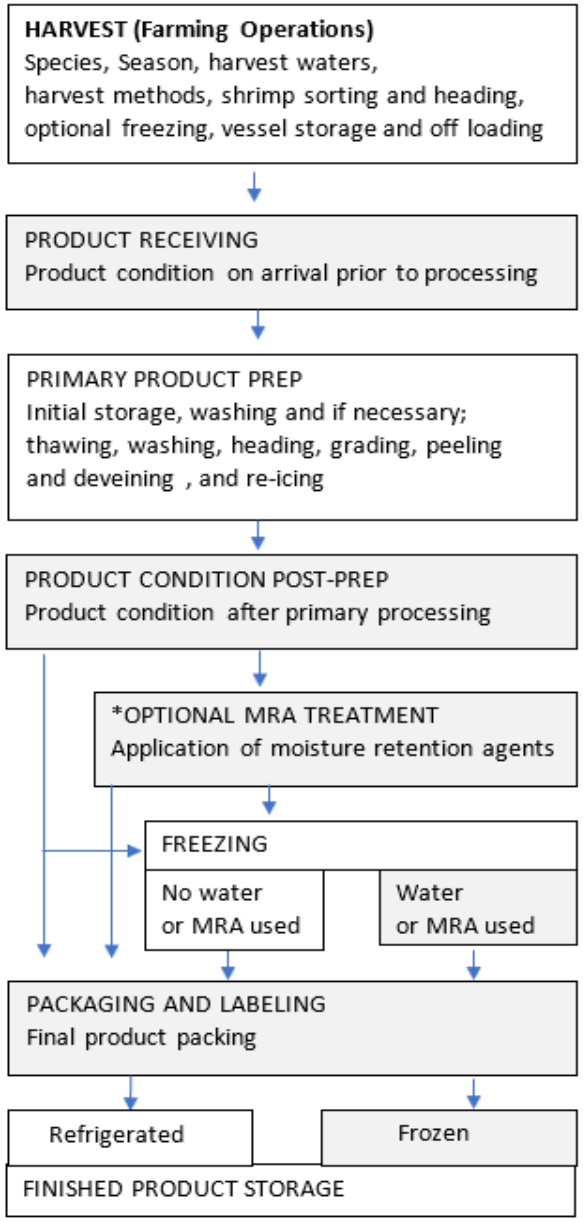
	Season	Yes			
	Harvest Waters	Yes			
	Harvest Methods	Yes			
	Shrimp sorting:	..			

PROCESS ANALYSIS accounts for all steps from Harvest thru final Product Storage

Moisture Control Points

Product Receiving	Product condition on arrival at processing operations	Yes	Potential exposure to ice slushes and/or errant brining freezing could slightly alter moisture content in shrimp	All incoming raw shrimp, both fresh (never frozen) or prior farm frozen can be subject to standard analytical measures for moisture content; expected moisture content at Receiving can range from ≅ 78-80%; if no prior use of MRAs**.	Yes
Primary Product Prep	Initial frozen storage for prior frozen shrimp	No	Initial, temporary frozen storage should not significantly alter moisture content in prior frozen shrimp.		No
	Initial refrigeration in primary cooler including ice	Yes	Shrimp can be exposed to water during the accumulative time in these processing steps such that it is possible to slightly influence moisture content in the products.	Standard Good Manufacturing Procedures (GMPs) will prevent or limit prolonged exposure to processing waters. Plus, the product conditions post-processing are subject to monitoring at 'Product Condition Post-Prep'	No
	Thawing (if required)	Yes			
	Washing	Yes			
	Heading (remove cephalothorax; if required)	Yes			
	Grading	Yes			
	Peeling (remove body shell; if required)	Yes			
	Deveining and Cutting (if required)	Yes			
	Re-icing (if required)	Yes			
Product Condition Post-Prep	Product condition after primary processing (Product Prep)	Yes	Potential accumulative exposure to water through the various primary processing steps could slightly alter the moisture content in shrimp	Following all primary processing steps, the raw shrimp can be subject to standard analytical measures for moisture content; expected moisture content can range for shrimp with shell-on ≅ 78 to 80% or peeled ≅ 80 to 82%.	Yes
Optional MRA* Treatment	Application of moisture retention agents to retain moisture in shrimp	Yes	**IF used,** MRA treatments can influence the moisture content in raw shrimp	Monitoring use of validated MRA applications for the various shrimp sizes and product forms (headless or peeled raw shrimp) should indicate an expected range ≅ 80-84% moisture content. Labeling required	Yes

Declare 'expected' moisture contents based on MVP



EXPECTED MOISTURE CONTENTS

≅ 78-80%

≅ 78-80% Shell-on

≅ 80-82% Peeled

≅ 80-84%

≅ 80-84%

Based on prior steps

Not to exceed 1.0% loss

Moisture Control Points

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Moisture Control Points

- Specific stage or step in processing
- Reason for Product Standard

- Monitoring
  (What, How, When and Who)

- Corrective Actions (if necessary)

- Verification Records

- Verification Policy
  (includes reference to GVPs, GAPs and GMPs)

MOISTURE VERIFICATION PLAN – Farmed Shrimp		
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Moisture Verification Plans (MVPs)

FEATURES

- Flow diagram from Harvest thru final Product Storage
- Process Analysis to identify Moisture Control Points (MCPs)
- Moisture Verification Plan to set expected levels, monitoring controls, corrective actions and records
- Terminology & Support Documents

Moisture Verification Plans (MVPs)

Terminology & Support Documents

PRODUCT:
Warm water Penaeid shrimp to include species within the genera for *Penaeus, Farafantepenaeus, Fenneropenaeus, Litopenaeus and Parapenaeus* that are either vessel harvested from wild resources or farmed production in aquaculture operations.

PRODUCT FORMS (Edible):
Various product forms can include - whole shrimp (head and body shell intact), headless shrimp (cephalothorax removed), peeled shrimp (head and body shell removed); deveined shrimp (digestive track and organs removed); AND all prior product forms in various product states (i.e., raw or cooked as never frozen (refrigerated) or frozen products).

MVP Terminology & Support Documents

≅ symbol for ‘approximately equal to’ used to represent the expected moisture content in the edible portion of the shrimp based on prior experience, good practices, prior validations and periodic verifications. The symbol recognizes a range in moisture content mindful of natural consequences due to shrimp (species, size, growth rates, etc.), harvest or production waters (temperature, salinity, pH, etc.), and processing waters (hardness, alkalinity, etc.).

Added Water or Water Added, relative to the Moisture Verification Plan, means any amount of water that is ‘intentionally’ added to elevate or retain the moisture content in shrimp through identified handling and processing procedures or steps.

Batch is a designation for the same portion of shrimp designated during processing operations. In some situations, depending on volume or weight of product, a batch can be an entire ‘Lot’ of shrimp.

Consolidator is a person or company that collects and delivers shrimp from single or multiple vessels or farms.

MVP Terminology & Support Documents

Expected Moisture is the total moisture content in the edible portion of the shrimp that has been validated to occur during current GVPs, GAPs and GMPs that are necessary to convert shrimp in original animal form (live invertebrates) into an edible food product.

Good Practices include established commercial procedures and guidelines that have been developed through commercial practice and respective regulations that are necessary and required to convert an original live shrimp (invertebrate animal) into an edible food product. The practices can include:

GVPs – Good Vessel Practices for commercial shrimp harvest.
GAPs – Good Aquaculture Practices for commercial farming operations.
GMPs – Good Manufacturing Practices including commercial guidance and regulatory mandates (i.e., CFR Part 117/FDA) for processing operations.

Moisture Control Point (MCP) is a particular point, procedures or step during seafood processing at which controls can be applied and/or monitored to assure the expected moisture content in the shrimp products at the respective stage of processing.

MVP Terminology & Support Documents

Third Party (3rd Party) refers to a 'competent' person, private company or government authority, other than an original producer or processor, that provides advice and verifications for expected moisture content in shrimp products through respective production, harvest, supply and/or processing which can be accompanied by oversight for corrective actions, GVPs, GAPs and GMPs.

Validation is a verification conducted prior to or as necessary to provide scientific and technically based information to determine the expected moisture content in shrimp products subject to established GVPs, GAPs and GMPs used to convert shrimp in original animal form (live invertebrates) into an edible food product.

Verification includes routine monitoring procedures that can include sensory and analytical assessments that are used periodically or as necessary to assure the expected moisture content for shrimp through various processing operations, procedures or steps including final finished products.

Water Addition, relative to moisture content in shrimp, is a specified commercial practice, procedures or processing steps that are actively applied or conducted with intended purpose to influence the elevation and/or retention of moisture in shrimp food products.

Give MVP a chance.

It offers a responsible and reasonable means to break the commercial and regulatory inertia !