



# **BioNovations Inc.**

*Traystor® Crate Closed-Loop  
Live Seafood Holding Systems*

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## *Traystor® Crate Closed-Loop Live Seafood Holding Systems.*

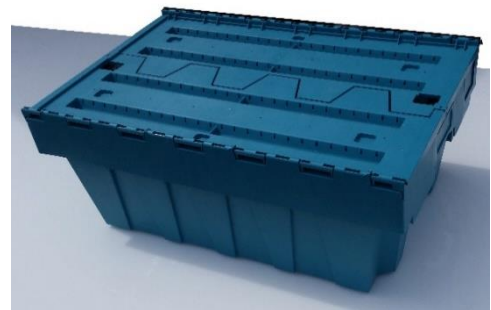
### BIONOVATIONS OVERVIEW

BioNovations manufactures technologically advanced systems designed for handling, holding, and transporting live seafood. Our core business is providing solutions for the live seafood industry that are safe, reliable, and sustainable at all points along the supply chain. Our systems allow fresh live seafood to be distributed globally with greatly reduced mortality and shipping costs, so that the aquaculture and seafood industries can achieve its fullest value potential

Product design at BioNovations is guided by our deep understanding of live seafood. We have designed our Traystor® Systems to replicate the natural conditions and cycles found in the aquatic ecosystem of each species. Our focus has been on both existing product improvement and proof of concept for new applications. This has resulted in numerous proprietary systems and components, such as the Traystor® Crate, Live Seafood Transport and Container Systems, particle filters, protein skimmers, and biofilters. These developments resulted in an innovative second generation of systems called the Traystor® Crate Systems, which are among the most efficient and sustainable currently available in the seafood industry.

### TRAYSTOR® CRATE FEATURES:

- Dimensions : 32" x 20¼" x 12¼" (L x W x H)
- Lightweight and strong: ~100-115 lbs. capacity
- Stacked 7 high to save floor space: ~154 lbs./ft<sup>2</sup>
- Nested together when empty: 15 crates/stack
- Engineered for even water flow and oxygenation
- Made of food-grade polypropylene and meets all the HACCP, CE, and FDA requirements
- Lightweight, strong, and recyclable at end of use



## TRAYSTOR® CRATE

The Traystor® Crate was specifically designed for the seafood industry and has several major advantages over traditional crates.

Firstly, the crates have two specialized lids that have a rim around their outer edge to trap the water falling from above. The water is directed towards two troughs in each lid, which serve to deliver a shower of small droplets of water by means gravity inside of the crate.



Secondly, there are specially engineered vents along the full length on both sides of the Traystor® Crate that allow air to flow through the crate, creating an air column between the bottom of the lids and the top of the water column. The small droplets created by the lids, increase the exposed surface area of water allowing for substantial oxygenation of the system



water in each crate before going down through the entire water column that continually keeps the product submerged. This ensures the live seafood in bottom crate receives as much oxygen as the top crate even at very low flowrates. The small water droplets also give each crate the ability to transfer energy by convection, therefore making it possible to use air evaporators for the main source of cooling, which are much more energy efficient than saltwater chillers barrels (evaporators). The use of air evaporators keeps the entire room cold therefore the water in the bottom crate is the same temperature as the top crate, and more importantly, cool air holds more oxygen than warm, helping with oxygen being absorbed throughout the system.

Thirdly, the end walls of the Traystor® Crate contain innovative weir plates, which draw water, ammonia, and other waste excreted by the product off the bottom of the crate and direct it down to the crate below by means of internal channels. This allows the crates to hold 9" of water to keep the live animals completely submerged while forcing the clean oxygenated water down through the animals towards the weir plate openings at the bottom of the crate. The water in each crate is completely exchanged every two minutes, keeping the submerged seafood in cold oxidized water reducing the lobster metabolic rate and level of activity. The low velocity cold water exchange rate in each Traystor® Crate is the highest in the industry and helps reduce the oxygen consumption and ammonia production of the live animals. This system is more energy efficient because of the small power requirement to pump the small volume of water.



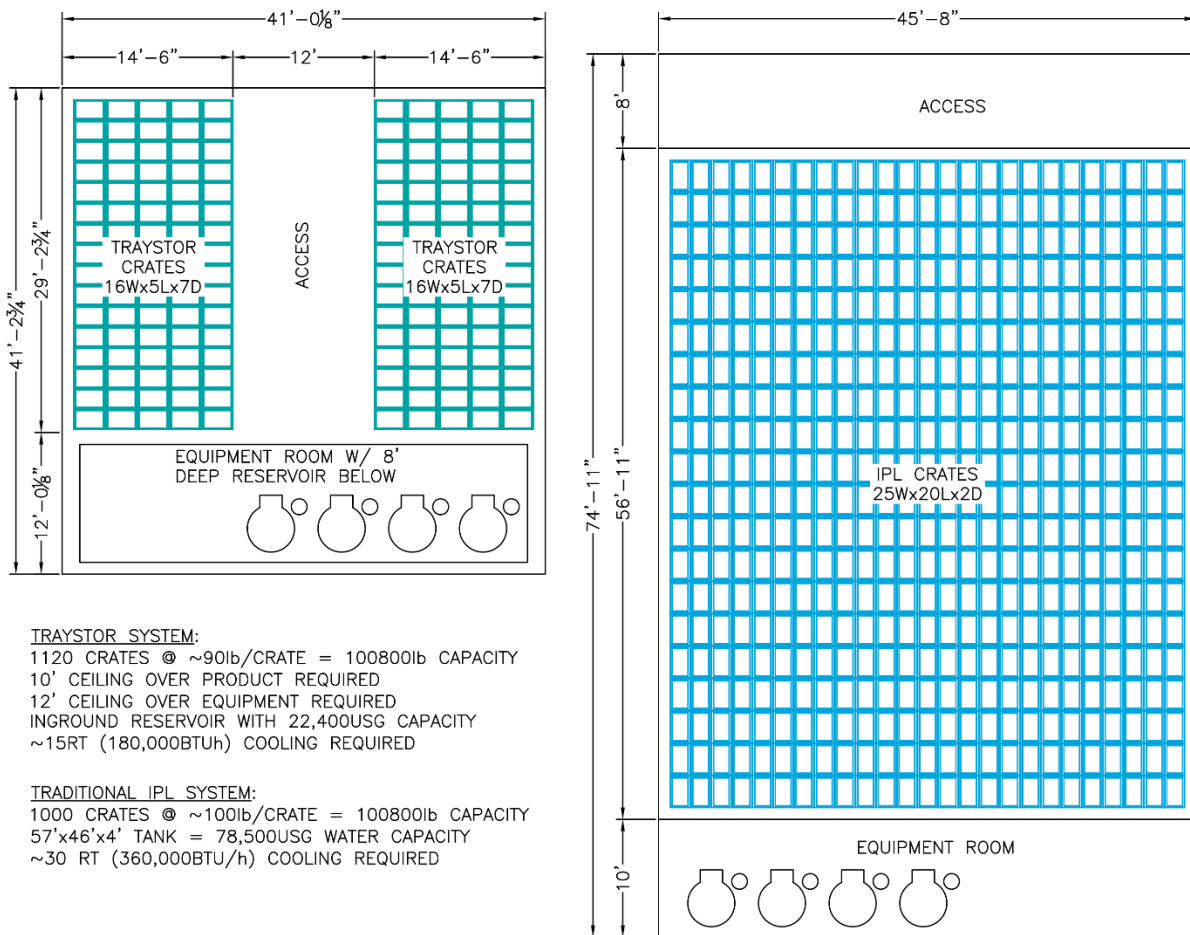
## TRAYSTOR® CRATE HOLDING SYSTEMS

The Traystor® Crate was designed and developed by BioNovations and is the keystone of our supply chain solutions by providing the link between our Fishing Boat Live Wells, Live Seafood Holding Systems, and Live Seafood Transport Systems. BioNovations' holding systems are currently being used for short-term and long-term holding, as well as wet storage and depuration of various species of live seafood and are designed to maximize product payload while minimizing water and energy requirements. The Traystor® Crate Systems are engineered for operation in environmentally controlled rooms with Closed-Loop and Semi-Open Systems allowing for the lowest carbon footprint in the industry.



An environmentally controlled room is all that is needed to facilitate a BioNovations Traystor® Crate Holding System, as all plumbing is above-floor and included in the design of the system. This allows the holding system to be easily installed into pre-existing rooms in warehouses, restaurants, and holding facilities, etc. without the need for new buildings, significant renovations, or additional construction. Stacks of BioNovations Traystor® Crates are placed over a food-grade catch basin (above or in-floor reservoir), or within a large food-grade plastic tank, such as the Traystor® II tank (3500 lbs per Traystor® II tank). Our innovative Manifold Water Delivery System (MWDS) delivers a steady flow of clean, cold, oxygenated seawater to the top of each stack and the water cascades from crate to crate through specially engineered

vents and water flow channels to allow even circulation and oxygenation throughout the entire crate while retaining water, effectively making the crate the holding system itself. Through internal channels, the circulating water continually removes all ammonia and other waste excreted by the product. The water is collected in the catch basin as it exits the bottom crate and a recirculation pump is utilized to return the water to the Integrated Water Treatment System (IWTS) to maintain optimal quality and temperature. The IWTS is composed of activated carbon filtration, particle filtration, protein filtration, biological filtration, and titanium chiller barrels, with optional UV filtration available. Our Traystor® Crate Holding Systems allow for the control of both the air and water temperature separately, making them the most energy efficient and sustainable system on the market.

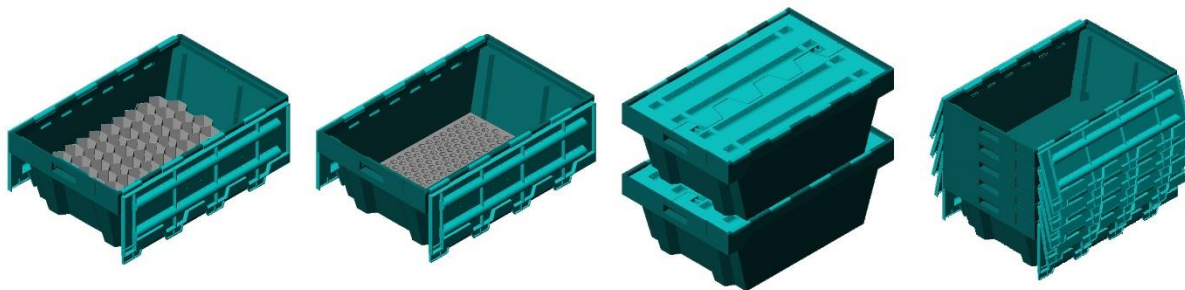


When comparing to traditional semi-open ponds, the Traystor® Crate Holding System reduces the cooling requirement by 50% and the water requirements by over 70%. By stacking the product vertically, the Traystor® Crate System can hold the same volume of live product as conventional ponds (with IPL crates stacked two deep) in half of the floor space (surface area).

## LIVE SEAFOOD IN THE TRAYSTOR® CRATE

The primary cause of degradation and mortality of live seafood is stress. The most common issues are emersion, excess handling, poor water quality and temperature control (due to outdated and insufficient infrastructure), exposure to heavy metals, pesticides, viruses, bacteria, etc., as well as proximity to other seafood (packing density). By developing a system which works to mitigate these stress inducing factors, BioNovations strives to provide suppliers with the facilities necessary to maintain the highest product quality possible. This maximizes consumer satisfaction and ultimately increases supplier profitability by ensuring the health, freshness, and taste of the live product while reducing handling, mortality rates, packaging costs, and thereby increasing the overall market value of the seafood and providing transparency to the industry.

Our patented Traystor® Crate technology was developed for use with our specially designed Traystor® Crate Inserts, which come in a range of sizes and shapes to accommodate various species and size grades and can hold approximately 100 lbs of product. Once the crates are stacked seven high, they provide a product capacity of approximately 154 lbs/ft<sup>2</sup>/stack. The Traystor® Crate is more efficient than conventional stacks of both the industry standard tote at 95 lbs/ft<sup>2</sup> and the IPL Cascade Tray at 94 lbs/ft<sup>2</sup> for holding live lobster in stacks 7ft high. The lobster inserts separate the live animals into individual compartments arranged in a honeycomb design to maximize the payload within, while keeping the animals in a vertical orientation and displacing most of the water within the crate. This allows for easy quality control as every animal is visible when the lid is open and significantly reduces handling and stress to the live seafood as the hexagonal compartments hold each individual lobster firmly in place, protecting it from being crushed, punctured, jostled around, or damaged in any other way that may occur throughout its journey from catch to plate. The inserts eliminate agonistic



and cannibalistic behavior, as well as prevent abrasions on lobsters that can cause blemishes which can lead to the development of shell disease. The inserts also allow the metabolic rates of the live lobster to be maintained at a low, healthy level by holding them in place. This optimizes the use of storage space within the crate allowing for the smallest volume of water to

lobster ratio in the industry, helping to make the system more energy efficient. Once live product is removed from the Traystor® Crate, the plastic insert can be easily removed, collapsed, and placed flat back in the crate so that another identical crate can be nested and stacked inside.

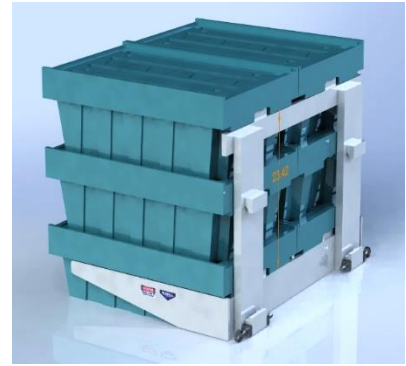
Additionally, the Traystor® Crate was engineered so that it could also be used in the wet storage and depuration of bivalves. By placing a false bottom inside the crate, it provides the live bivalves with the proper water circulation and product spacing required for controlled relaying and depuration as required by regulations under the Shellfish Sanitation Program in different countries. Also, the facility can be designed so that the wet storage area can be split into multiple smaller zones, allowing the operator to run as little or as much volume as is required making the system more economical to operate. The Traystor® Crate has an exact tare weight with slots for individual barcodes/RFID tags for traceability and efficient inventory control.

### ADVANTAGES:

- Can be kept for months at a time with no loss of quality, significantly extending the shelf-life after harvest
- Sales ready inventory for weather events and seasonal closures
- Allows for consistent supply and saves time by reduced handling, while giving the ability to fulfill smaller retail orders
- Harvest the shellfish when the time is right instead of harvesting to fill orders before they are fully matured
- Consistent taste, quality, and size
- Qualifies for the Nova Scotia Live Lobster Quality Certification Program
- Can be split into zones allowing the operator to run as little or as much volume as is required, making the system more economical to operate during the off-season
- Can be expanded to any size to grow with your business
- Engineered to use gravity water drops wherever possible to minimize and/or eliminate water pumps, degassers, and air blowers

This system enables the seafood industry to effectively hold live product throughout the entire year in any location around the world. Unlike traditional semi-open systems, the closed-loop Traystor® Crate System does not need to be near fresh seawater as natural or artificial seawater can be used, and water levels can be easily maintained with artificial seawater. The storage area can be split into multiple zones of any size and the operation then scaled to meet the demand as product stock levels fluctuate throughout the year. By controlling temperatures and reducing toxins, the health and vitality of the seafood is maximized by minimizing stress to ensure the highest possible economical return.

To further simplify operations, BioNovations offers a specialized forklift attachment and pallet jack to handle the Traystor® Crates. This eliminates the need for pallets and makes it easy to move the fully loaded or empty crates around. The forklift attachment comes either as a single or double attachment that can lift a stack one or two wide, from one to seven crates high (i.e., up to 14 crates can be moved at one time). The pallet jack can lift a single crate or a single stack of seven, allowing one person to easily perform the loading/unloading of the system.



## MANAGING FOOD SAFETY RISKS

Measures must be taken to manage food safety risks, such as controlling the risk of *Escherichia coli* (*E. coli*), *Vibrio parahaemolyticus* (*Vp*) and other viruses, bacteria, and pathogens in live bivalves being prepared for raw consumption. BioNovations accomplishes this by adding high intensity Ultraviolet Filtration (UV) and a high water flowrate to the Integrated Water Treatment System (IWTS). The IWTS is engineered to operate at very low temperatures and high salinities to further inhibit the growth of unwanted organisms.

## COMPANY OVERVIEW

BioNovations manufactures technologically advanced systems designed for handling, holding, and transporting live seafood. We are a locally owned and operated company based out of Antigonish, Nova Scotia, Canada. Our core business is providing solutions for the live seafood industry that are safe, reliable, and sustainable at all points along the supply chain. Our systems allow fresh live seafood to be distributed globally with greatly reduced mortality and shipping costs, so that the seafood industry can achieve its fullest value potential. Additionally, our systems are adaptable to a wide variety of aquaculture uses which is a fast-growing industry worldwide.

BioNovations Traystor® brand of products minimize stress from catch to plate ensuring the health, freshness, and taste of the live product while reducing handling, mortality rates, packaging costs, and thereby increasing the overall market value of the seafood and providing transparency to the industry.

BioNovations holding systems have lower water and energy requirements than traditional holding facilities, are more efficient and environmentally sustainable, and are designed to allow for easy expansion as your business grows. Whether you are a big or small operation, buyer, distributor, or retailer, if you deal with live seafood products BioNovations has a product that can be of benefit to you.