# VALUE CHAIN ANALYSIS

## of Great Lakes Fish Byproducts for 100% Utilization

April 2025

TFC Inc.

Prepared for

GREAT LAKES ST. LAWRENCE GOVERNORS & PREMIERS

Photo credit: Bill Savage

Photo credit: Bill Savage

# EXECUTIVE SUMMARY

Generating approximately $420 million (CAD) annually, the commercial fishery in the Great Lakes is an important economic driver for the Great Lakes St. Lawrence region. Aquaculture production and fish processing of species harvested outside the region further contribute to the region's fish economy. The opportunity to increase the returns and economic opportunities from the region's fish economy is substantial, as traditionally only 40% of the 35 million pounds of fish that are commercially landed (the filet) is sold into the market. The remaining 60% of byproducts for these fish and those raised in aquaculture or processed in the region largely remains unused and often requires a fee for disposal. This waste represents a missed opportunity for economic growth, and overall value added to the region.

Through ongoing work, several existing value streams for fish byproducts have been identified that are easily accessible in the region. These include:

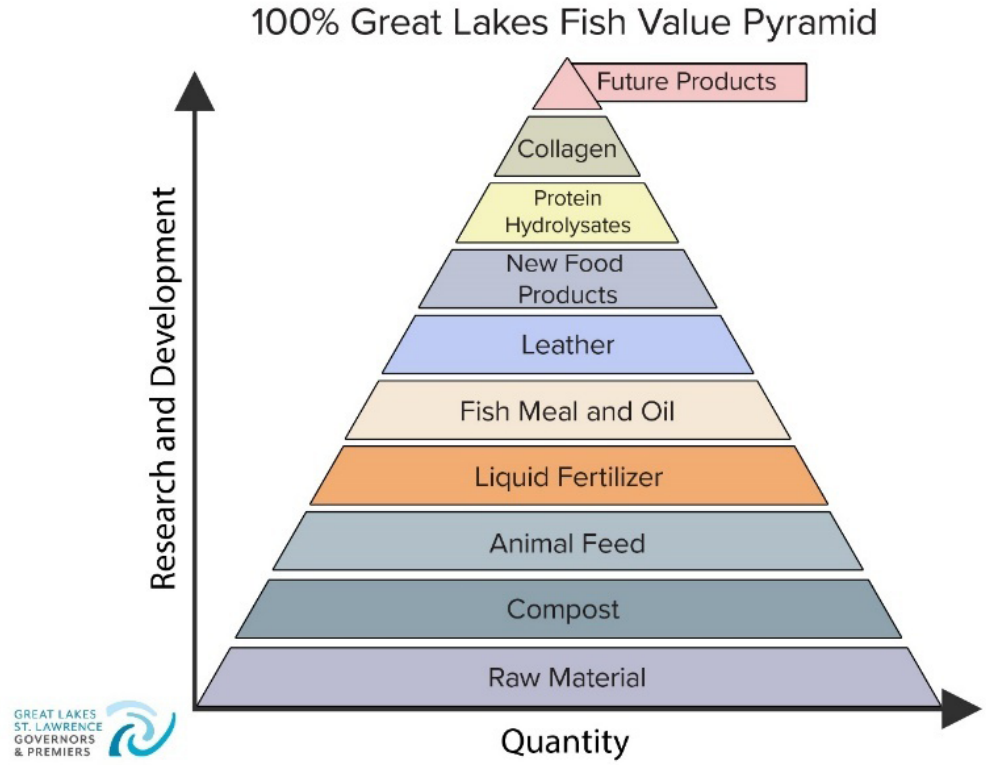
- fertilizer,
- compost, and
- pet food and treats.

As a short term/immediate solution, value chains such as fertilizer and composting exist locally in most areas. These value chains can be incorporated quickly; however, they do not generate high rates of return. Some forms of pet food/treats may be more profitable. Regardless, it is important to consider other potential future value chains to fully explore the opportunities that they can present.

Fish byproduct value chains hold high potential for sustainable economic development within the Great Lakes region. Larger and more profitable value chains, such as gelatin and collagen as well as fish meal and oil, could present the most viable and scalable pathways but material must either be transported long distances to existing facilities or a new plant would have to be constructed in the Great Lakes region. Higher-value chains like medical applications show promise but require significant investment, innovation and/or coordination between industry to be profitable. They also require much more research and development before being viable in the region. Aquaculture systems, with their ability to offer standardized, clean, and consistent raw material, in tandem with commercial

harvest and other processing, could be key to succeeding in many of these opportunities. The value pyramid (Figure 1) identifies the most to least profitable value chains.

**Figure 1.** Fish Value Pyramid from least profitable (bottom) to most profitable (top).




## Key Takeaways

- Disposing of fish waste is a cost. Turning this waste into revenue by, for example, freezing frames/skins instead of discarding can open new doors for partnerships and profits.
- Processors will need to decide between lower-margin, easily accessible value chains or more complicated but potentially higher margin value chains.
- Certain value chains like bait can be accessed easily and quickly if demand exists.
- Fish byproducts are increasingly in demand as a greater number of industries recognize their usefulness.
- High margin value chains such as fish meal and oil can present challenges such as global competition from a few large corporate entities, however, these value chains show potential.
- Collagen and gelatin markets are growing fast but have high startup costs and require specialized equipment/partnerships to get started.
- Establishing relationships with developing industries now could prove to be useful for when these industries begin to scale up production.
- The activation of these value chains will require a concerted marketing effort, as lack of consumer knowledge of fish products (ex. fish leather, fish-based collagen) is a major obstacle in the development.

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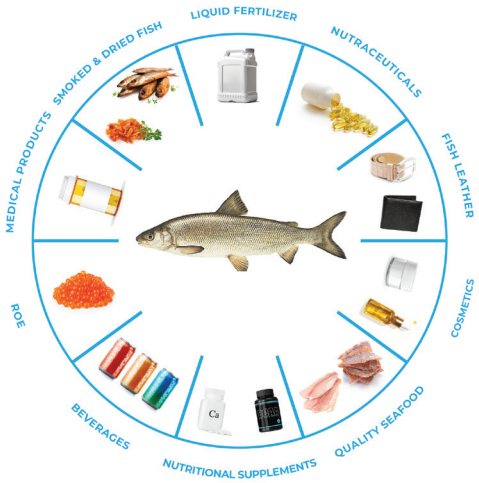
# INTRODUCTION




TriNav Fisheries Consultants, Inc. was engaged by the Conference of Great Lakes St. Lawrence Governors and Premiers (GSGP) as part of the 100% Great Lakes Fish initiative to conduct a comprehensive analysis of potential value chains—specifically, gelatin and collagen, fish meal and oil, fishing bait, fish leather, and potential biomedical applications using fish byproducts sourced from the Great Lakes region in the US and Canada. A summary of each industry is presented in Table 1 (Pages 2-3). The goal of the project is to highlight how 100% of the commercially and recreationally caught fish, fish raised in aquaculture, and processed in the Great Lakes region can be utilized to maximize economic and environmental benefit.

A 100% Great Lakes fish strategy presents significant opportunities for the Great Lakes St. Lawrence region to fully optimize fish utilization, boost economic returns, create jobs, and support the growth of rural economies. This report is a value chain analysis that discusses opportunities to collaborate with existing producers both inside and outside the Great Lakes region, identifies any barriers such as transportation costs, explores engagement with regional companies not currently involved in fish-related ventures but active in adjacent markets, as well as identifies value chain gaps. This report is one part of a broader effort to implement a 100% Fish initiative in the Great Lakes region, inspired by the 100% Fish initiative in Iceland. Further analyses will be conducted in the coming months.

The 100% Great Lakes Fish project and this report are supported through a grant by the Great Lakes Fishery Trust (GLFT). The GLFT is an innovative funding source created to compensate residents of Michigan for the lost use and enjoyment of fisheries resources of Lake Michigan resulting from the operation of the Ludington Pumped Storage Plant. Since 1996, the GLFT has granted more than $83 million to enhance, protect, and rehabilitate Great Lakes fishery resources.  Grant monies have also been generously provided by the Great Lakes Fishery Commission, the Ontario Commercial Fisheries' Association, and the Acme Smoked Fish Foundation.

## Background

The Great Lakes fisheries, managed by Provincial, State, and Tribal agencies, represent a significant economic pillar for the region. The Great Lakes commercial, recreational, and tribal fisheries are valued at nearly $420 million (CAD) annually and support almost 3,000 jobs (according to the Great Lakes Fishery Commission). Each year roughly 35 million pounds of fish are harvested as part of the commercial fishery in these lakes. Of this, approximately 40% of the fish (the fillets) is sold in the market, while the other 60% has little to no demand and is either discarded at a financial loss, given away at a breakeven level, or rarely sold at a marginal revenue. This means that when accounting for species markets and utilization, approximately 18 million pounds of fish product generated by the commercial fishery is currently being disposed of without realizing any substantial economic return. The main commercial species for this report are lake whitefish, yellow perch, walleye, lake trout, and white sucker. The value chains can also be optimized for other fish in the Great Lakes, such as smelt and cisco, as well as fish produced by aquaculture or fish that are imported into the region for processing. A summary of raw material usage type and all value chains assessed in this report can be seen in  1 below. Note that all dollar amounts are presented in $CAD.

**Table 1**. Summary of Industry components including acceptable materials, volume capacities, and achievable prices.

| Product | Acceptable Raw Materials | Handling Requirements | Supply Chain Structure | Volume Capacity | Health, safety, monitoring requirements | Logistics | Players in Great Lakes region | Achievable Price (Processor to buyer) | Misc. |
|---|---|---|---|---|---|---|---|---|---|
| **Fishing Bait** | Frames and racks, heads. | Must be fresh or frozen. | Highly unstructured. Often direct from producer to harvesters in Atlantic Canada. | >70,000 tonnes annually for snow crab, lobster, halibut, etc. | Bait market is relatively unregulated. Some regulations do exist regarding the import of bait material from non-native species (such as herring from Iceland due to disease). | Refrigerated (reefer) trucks would be required to transport bait from the Great Lakes region to the Atlantic Coast. | N/A | $0.50/lb (CAD). | N/A |
| **Gelatin/ Collagen** | Skin, scales, fins, anything with connective tissue. | Requires washing, hydrolysis, and precise temperature control for extraction. Fresh is preferred. | Processor -> Intermediate Transporter -> Collagen producers -> Retail Markets | Small scale processing is possible, but large operations are more cost-effective. | CFIA/FDA regulations on food and pharmaceutical grade gelatin. There is strict microbial and heavy metal testing. | Requires specialized processing equipment, controlled drying, and refinement. | N/A | Finished price: $5,600-$10,000 (CAD)/ tonne for food-grade gelatin. | Growing demand for fish-based gelatin in halal/ kosher market.<br>Could be good value-added product from fish processing waste. |

(Table 1 cont.)

| Product | Acceptable Raw Materials | Handling Requirements | Supply Chain Structure | Volume Capacity | Health, safety, monitoring requirements | Logistics | Players in Great Lakes region | Achievable Price (Processor to buyer) | Misc |
|---|---|---|---|---|---|---|---|---|---|
| **Fish meal and Oil** | Heads, skins, viscera, etc. | May require freezing/storage for seasonal stability; mixed species accepted but affects oil yield. | Large international companies dominate global markets.<br>Processor -> Meal & Oil Producer -> End User<br>Note: Some processors operate as the meal and oil producer, selling the product direct to the end user. | Smallest viable plant processes 2 tonnes/hour, full-scale plants require 16 tonnes/day. | Compliance with food/feed safety standards; processing generates 'stick' water that needs to be evaporated or disposal/treatment. | May need freezer capacity for stockpiling in off-seasons, transportation costs impact feasibility.<br>May be some issues with collaboration from processors needed to achieve required scale. | Aquatic Protein LLC. | Finished price: Fish meal: $1,700-2,050 (CAD)/tonne (global), $1,800-2,050 (CAD)/tonne (Peru/Chile); Fish oil: $3,600/ton (CAD). | Possible collaboration with livestock processors; potential communal processing plant (~$3-5 million (CAD) investment). |
| **Fish Leather** | Skins. | Ideally no rips/tears and no leftover parts of fish.<br>Single species is generally easier to handle than mixed totes. | Processor -> Tannery -> Apparel Manufacturer -> Retail Outlets | Recommended volume of 10,000 pounds of fish skins should be sourced for industrial-scale production, with the potential to scale up based on demand. Artisanal production possible at any scale. | Generally fresh product works best compared to frozen.<br>Fresh product can spoil quickly so transportation and processing speed is essential. | Process is not overly lengthy, however employing persons with the skills to successfully tan the skins within the limits of new regulations is a challenge. | Fiskur Leather, Aquarian Leather—both artisanal. | $0.14-$0.49/lb (CAD) depending on species, size of skin, condition. | Aquaculture facilities may be well suited for this industry, as mono-species culture and controlled conditions result in a more consistent product. |
| **Medical** | Blood, scales, chitin, peptides. | Ideally no rips/tears and no leftover parts of fish.<br>Single species is generally easier to handle than mixed totes. | Unknown/undergoing R&D. | Very limited, currently niche, cutting edge market. Mostly in early development phase. | Biomedical products are subject to extremely strict regulations to ensure human health and safety. | Underdeveloped as industry is in its infancy. | N/A | N/A – Industry in research and development stage. | Many applications for biomedical are in R&D or have not moved to human trials and are still years away from market implementation. |

# OVERVIEW OF POTENTIAL VALUE CHAINS

Fish byproducts from the Great Lakes region remain largely underutilized, with many processors currently paying for disposal. This report evaluates potential value chains to transform these byproducts into valuable products.

Key value chains analyzed include bait, fish leather, gelatin and collagen, fish meal and oil, and potential biomedical applications. The analysis finds that:

- **Bait** provides moderate and relatively easy access opportunities but is somewhat constrained due to pricing challenges and competition.
- **Fish meal, fish oil, gelatin, and collagen** require high capital investment and stiff competition in global markets but can potentially provide substantial revenues.
- **Industrial-scale and artisanal fish leather and biomedical applications** are promising but face regulatory and logistical barriers.

While collagen and fish meal/oil products provide the most immediate economic benefits, other value chains may become viable with targeted investments and infrastructure improvements. The successful utilization of fish byproducts can contribute to increased profitability, waste reduction, and sustainability efforts for the Great Lakes commercial fishery, aquaculture operations, and fish processors with broader benefits for regional job creation and rural economic development.

Table 2 provides an overview of the advantages and disadvantages of various value chains for byproduct utilization.

**Table 2.** Advantages and disadvantages of each value chain as a potential user of fish byproducts.

| Industry | Advantages | Disadvantages |
|---|---|---|
| **Fishing Bait** | Moderate to significant margin potential.<br>High level of demand (but unknown for great lakes region).<br>Uncomplicated value chain. | Harvesters are very selective of bait types. Would require extensive testing to encourage widespread adoption by harvesters.<br>Potentially volatile market; recovery of mackerel and herring fisheries could greatly reduce interest in bait sourced from Great Lakes in Atlantic Canada. |
| **Gelatin and Collagen** | Growing consumer demand.<br>Can be used as value added product in different value chains and industries (much larger markets). | Consumers overwhelmingly prefer bovine collagen due to availability and cost.<br>Difficult market to access, production of fish collagen centered in Asia.<br>Collaboration within the area may not be supported. |
| **Fish meal** | Has a long shelf life, can be stored for long periods of time for when demand increases.<br>Cost can be lower than competitors due to raw material costs. | Processing is complex and establishing a facility in the area could be costly and take time for return on investment to be achieved.<br>Many large global competitors. |

| | | |
|---|---|---|
| **Fish Oil** | Great Lakes-derived product could be favorable alternative due to increasing concerns about the health of traditionally used species.<br><br>Long shelf life for long-term backup of product. | Processing is complex and expensive. Establishing a facility in the area will be capital-intensive and require raw material supply certainty.<br><br>Raw material may not have proper nutritional content to extract oil successfully. |
| **Fish Leather** | High-value end product.<br><br>Increasing consumer interest.<br><br>Lack of regional competitors.<br><br>New methods of environmentally friendly tanning show promise. | Niche industry with production primarily centered in Europe and Asia.<br><br>Current price received by processors is low with the exception of large fish such as sturgeon.<br><br>Limited industrial-scale production capacity in North America due to environmental regulations and market conditions.<br><br>Requires separation and storage of byproducts. |
| **Medical** | Potentially high value product.<br><br>Higher initial payment for material. | Niche, cutting-edge industry that has only recently begun to be developed.<br><br>Industry is likely only capable of accepting extremely limited volumes.<br><br>Byproducts must be in pristine condition. |

Table 3 provides a summary of the revenue and utilization potential from each value chain included in this report.

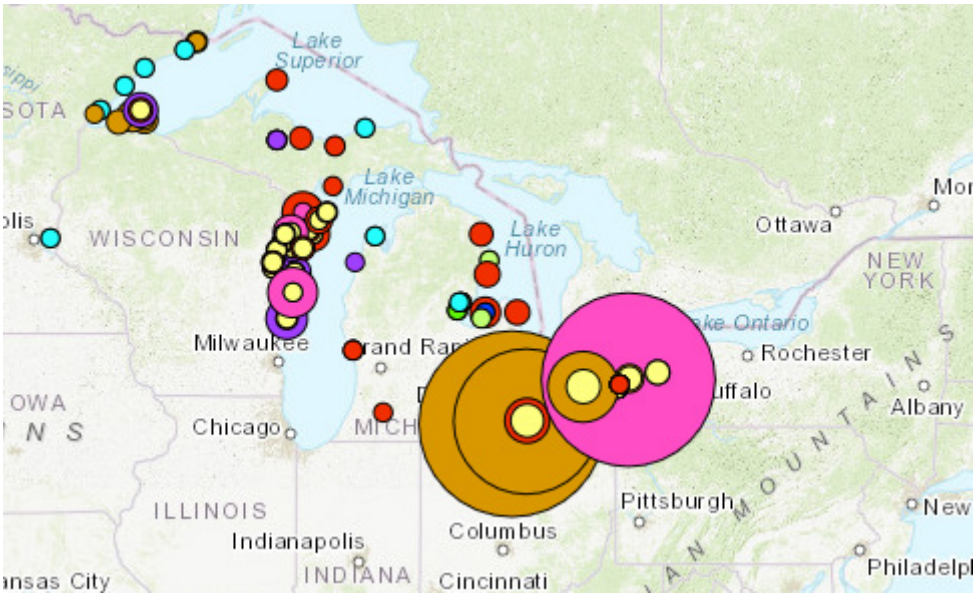
**Table 3**. Revenue and utilization potential of fish byproducts for each industry type (note: numbers have been rounded to one decimal).

| Industry | Currently achievable price received by processors ($/lb CAD) | Annual revenue at 10% utilization (1.8 million pounds) | Annual revenue at 50% utilization (9.0 million pounds) | Annual revenue at 100% utilization (18.0 million pounds) | Capacity for full utilization? |
|---|---|---|---|---|---|
| Fishing bait | 0.50* | $900,000 | $4,500,000 | $9,000,000 | Yes |
| Gelatin/Collagen | 0.35 | $630,000 | $3,150,000 | $6,300,000 | Partial |
| Fish Meal/Oil | 0.28 | $504,000 | $2,520,000 | $5,040,000 | Yes |
| Fish Leather | 0.14 | $252,000 | $1,260,000 | $2,520,000 | Partial |
| Biomedical | Unavailable | - | - | - | - |

*Note that this estimate is a projection based upon the assumption that a Great Lakes-sourced bait product is acceptable to harvesters. This is currently unproven and therefore this estimate should be considered speculative at this time.

Figure 2. identifies the theoretical availability of fish waste by port and species in the Great Lakes region.

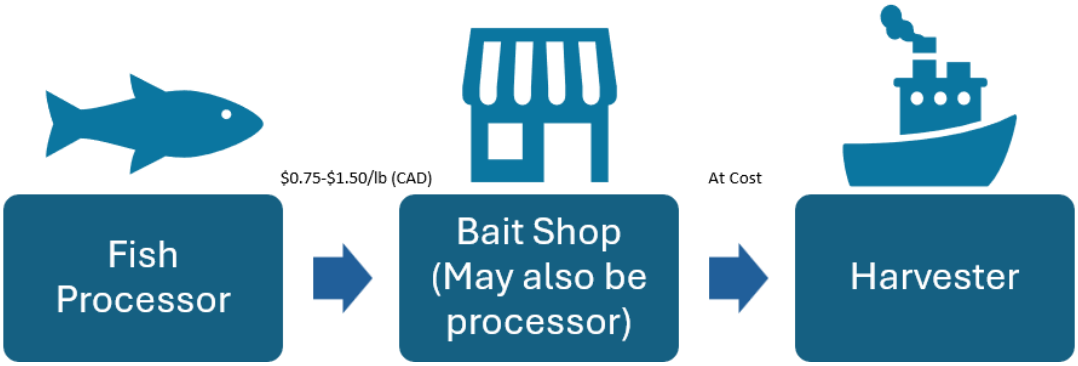
Figure 2. Map of Theoretical Byproduct Data from 3-year Average of Port Landings




## Fishing Bait

The value chain for fishing bait is relatively straightforward, driven by the demands of lobster and snow crab harvesters in Atlantic Canada and in the US. While some harvesters procure their own bait, the majority purchase bait from processing plants and/or lobster pounds to whom they sell their catch. Selling bait is typically offered as a service to encourage and retain business from harvesters. The processors acquire the bait material either from their own processing operations or by purchasing it from dedicated bait harvesters. Notably, harvesters have strong preferences for traditional bait species such as herring and mackerel. In recent years, however, harvesters have begun using the head and frames of redfish as an alternative due to the poor health of the traditional baitfish stocks. Bait price fluctuates and is typically sold for between $0.75-1.50 (CAD) per pound depending on the species and levels of demand. This price is for proven sources of bait, and harvesters would likely be unwilling to pay this amount for a novel, untested bait source such as bait comprised of Great Lakes species until proven to be successful. Processors generally sell bait to harvesters at near-cost, as it functions as a service to the harvesters (Figure 3).

**Figure 3.** Fishing bait Supply chain.



This value chain could potentially be accessed in several ways. Processors in the Great Lakes region could reach out directly to harvesters in the Atlantic Canadian/US lobster and crab industries and offer a prototype product for the harvester to utilize. Some lobster holding facilities and processing plants are also known to provide bait to harvesters and may have interest in a bait product. There are also several organizations that could be approached to generate a more industry-wide interest in Great Lakes-sourced bait, such as the Lobster Council of Canada. Additionally, the Government of Canada has a variety of initiatives and programs dedicated to improving the sustainability of the fisheries and offers grants for approved projects. This funding could potentially be utilized to fund the prototype and testing of the bait product sourced from the Great Lakes region, minimizing financial risks to both the processor and the harvester. If successful, the project could transition to a more traditional business arrangement.

**Image 1.** Redfish frames, typically used for lobster bait. Source: siceland.com

Byproducts from Great Lakes fisheries could be utilized in a similar manner as redfish in Atlantic Canada. However, extensive product testing would be required to demonstrate to crab and lobster harvesters that the performance of this new product is consistent with traditional baits such as herring and mackerel. There may also be strict regulations regarding the movement of specific fish species across international borders, specifically where concerns over disease or invasive species are involved. However, outside of import laws, the bait market is relatively unregulated in Canada.

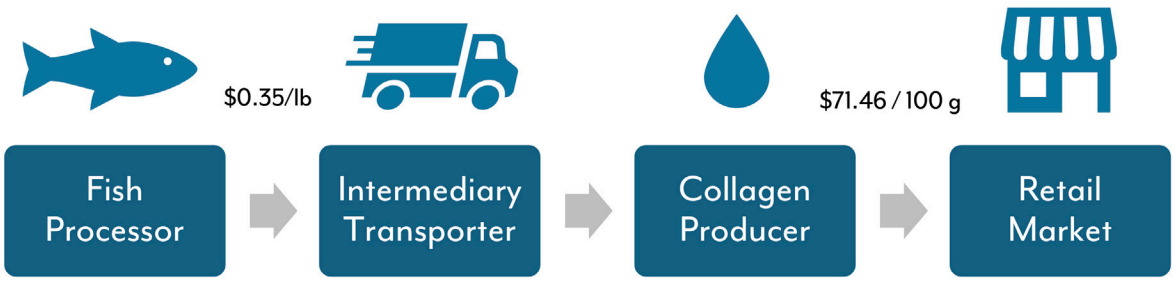
Bait can be created from byproducts in a variety of ways, including utilizing whole frames and heads or grinding the product for use in bait bags. The product must therefore be fresh or frozen prior to usage as bait, as harvesters will not accept spoiled product.

## Gelatin and Collagen

The gelatin and collagen value chain has potential to produce high margins from fish byproducts. The products are made by taking raw material and adding water with bacteriostatic or bactericidal treatment. Through enzymatic and chemical hydrolysis some byproducts such as acid and alkali are produced. After initial treatment, the product is dried, packaged, and transported for retail distribution.

Processors typically sell fish byproducts to collagen producers for approximately $0.35 (CAD) per pound. After further processing at specialized facilities, the value of collagen increases significantly, with retail prices reaching about $72 (CAD) per 100 grams (see Figure 4).

**Figure 4.** Gelatin and Collagen Supply chain.




In the Great Lakes region, gelatin production is dominated by animal-based sources: approximately 80% comes from pigskin and bovine hide, 15% from cattle hide splits, and just 5% from bones and fish. To successfully enter the value chain, processors need to encourage a market shift toward fish-based alternatives rather than relying exclusively on bovine sources. This shift can be supported by highlighting environmental and ethical advantages of fish collagen as an alternative, including its potential for utilizing waste from sustainable fisheries in a local area. Targeting Kosher and Halal markets could also help push the market toward fish-based collagen options.

Fish collagen startups could reduce capital costs by partnering with existing bovine processing facilities. Shared infrastructure—through retrofitting underutilized equipment or coordinating production cycles—would offer a lower-cost entry into the market and a pathway to building a new value chain within an established industry. Despite its profitability, the industry faces extremely high startup costs and significant barriers to entry. Many startups struggle due to the capital-intensive nature of production, regulatory compliance challenges, and intense market competition. Early-stage expenses—including raw material sourcing, enzymatic processing, and specialized equipment—often outweigh revenues, contributing to high failure rates.


**Image 2.** Collagen powder and packaged form of powder for retail purchase. Source: semixcollagen.com and customcollagen.com

Another major challenge in gelatin and hydrolysate production is the high rate of raw material loss during processing. Approximately 90% of the fish raw material is lost in extraction, resulting in relatively low yield per input. Additionally, specialized equipment is costly and difficult to obtain. Many companies retrofit existing food processing machinery, such as modified grinders, mixers, and filtration systems, to accommodate collagen and hydrolysate production instead of purchasing dedicated equipment, which can be cost-prohibitive.

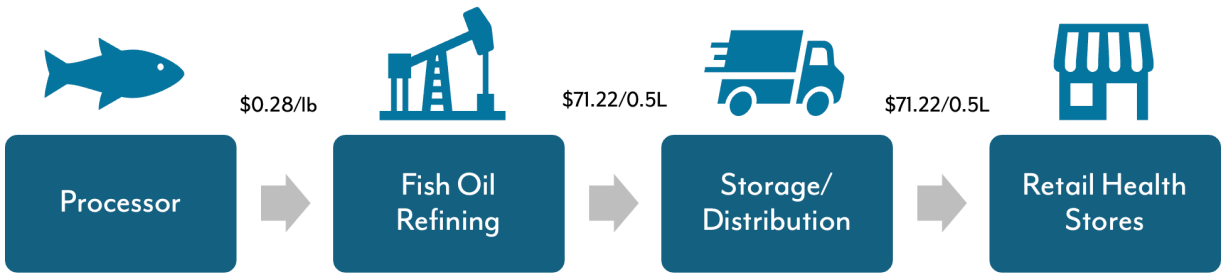
Bovine collagen remains dominant in the industry and the most cost-effective market option. Due to high initial startup costs, collaboration with existing processing plants should be initiated for test trials to determine market demand and pricing. Some existing companies such as H and A Canada process porcine and fish into gelatin, for example.

## Fish Meal and Oil

Fish meal and oil is a relatively simple value chain compared to some of the others. However, the steps that take place within the value chain are quite extensive and require large amounts of product, funding, and proper equipment to be successful. Processors typically sell byproducts to fish oil refining plants, or fish meal producers.

The fish oil refining process eliminates roughly 90% of the byproducts in the process, and the remaining 10% is turned into fish oil for retail purchase. Due to the high elimination of byproducts in the process, prices are around $140/L (CAD) depending on the end use of the oil. Oil made for human consumption generally receives higher prices due to stricter manufacturing standards and additional certifications. The oil can be shipped/sold at retail markets and health stores or stored for future distribution when byproduct supplies are low. Some processors operate as the meal and oil producer, selling the product direct to the end user. The value chain can be seen below in Figure 5 and Figure 6.

**Figure 5.** Fish oil supply chain.




Fish meal is a simpler process, with a shorter value chain and a less laborious extraction process. Byproducts are sold to the fish meal plants for roughly $0.10/lb (CAD) where they sort and grind it to produce fish meal. This meal can be packaged and sold directly to aquaculture facilities for around $1,800/tonne (CAD) depending on the size and quality of the feed. The shelf life of the feed is significantly less than the oil and is usually sold directly to large facilities or feed stores for a high turnover rate. This value chain can take a larger variety of byproducts, as the product is not used for human consumption and can be mixed with different species to alter the nutritional value of the blend. Fish meal can also be sold for use in pet food or treats, and for other purposes.

**Figure 6.** Fish meal supply chain.


To activate the value chain most efficiently, consistent raw material supply is critical, with a steady, year-round supply of fish byproducts necessary to ensure uninterrupted production. Stockpiling product through the fishing season can allow for added profits in the slower winter months when industry professionals may pay a premium for prod-

uct. Location also plays a vital role, with coastal regions offering good opportunities due to established processing facilities and byproduct generation.

In addition to raw material from the Great Lakes commercial and recreational fisheries, material generated by aquaculture producers could contribute a steady stream of mono species material. A stable supply source like Sapphire Springs, an aquaculture operation in Winnipeg, produces 1.4 million tonnes of byproducts annually, making aquaculture farms a viable candidate for stable raw material sourcing in the region. Raw material supply could also be sourced from recreational fisheries or processors working with fish imported into the region. There is also potential for collaborative partnerships with livestock, poultry, and pet food producers to enhance resource utilization and reduce costs. Collaboration with these partners could be an alternative entrance into the value chain and provide more successful relationships with industry professionals.

Market prices for fish oil fluctuate based on global demand. In October 2024, feed-grade fish oil dropped 20% to $3,600 (CAD) per tonne, while fish meal prices ranged between $1,800–$2,050 (CAD) per tonne. With favorable market conditions and a consistent supply, an investment in fish meal and oil production could achieve a 3-year return on investment (ROI). Separately, fish meal and oil processing generates 'stick' water, a protein-rich liquid that is typically discarded in ocean-based processing systems. In land-based facilities, this water must generally be treated for discharge or evaporated.

Entering the value chain as a new entity is difficult as the fish meal industry is dominated by international players in South America and Scandinavia, with Skretting being the largest producer in Canada. Smaller producers also generate significant revenue annually, though high-volume input requirements (at least 110,000 pounds of raw material per day) present a significant barrier for new entrants. Key challenges include traceability and ingredient consistency, with strict regulatory approval required, particularly from the Canadian Food Inspection Agency (CFIA).

**Image 3.** Fish meal and oil raw products made from sardines. Source: janathafishmeal.com

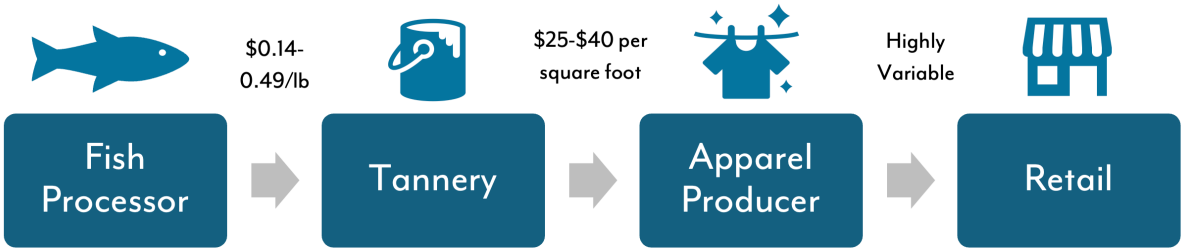
Another significant challenge in this industry is the seasonal inconsistency of raw material supply from wild fisheries, particularly during the winter months. The smallest identified facility capable of processing fish meal and oil operates at 2 tonnes/ hour. Full scale plants typically process 16 tonnes per day (10-20 million pounds a year) to make a profit. These volumes require a plant to operate for 8 hours a day, 5 days per week. This scale may be difficult to meet with current raw material supply from the Great Lakes commercial fisheries alone. As noted above, additional raw material could be provided by recreational fisheries, aquaculture producers, or fish processors. Smaller operations (2-3 days per week) or seasonal production could also be feasible with a lower revenue.

## Industrial-Scale Fish Leather

Fish leather is a niche but growing industry that presents long-term revenue potential, particularly for producers seeking to maximize the value of fish byproducts. While fish leather production has gained interest from major global fashion brands like Nike, Dior, and Prada, the North American industry remains underdeveloped due to low demand, limited processing capacity, and strict environmental regulations. Most commercial production currently takes place in Asia, Mexico, and parts of Europe, where tanneries are better established, supply chains are more robust and environmental regulations may be less stringent.

The supply chain is typically composed of four distinct stages (Figure 7). Typically, fish skins are bought for between $0.10-0.35/lb (CAD) from the processor by the tannery, which turns the skin into a usable leather. This leather is then sold to apparel producers, typically at between $25-40 (CAD) per square foot. Some specialty species, such as sturgeon, may sell for significantly more, approaching $100 (CAD) per square foot. Prices to retail outlets and to end users are extremely variable depending on the product type and leather quality.

**Figure 7.** Industrial fish leather value chain steps from processor to retail, with overall price changes between different processing steps.




Due to the limited presence of commercial tanneries, opportunities for collaboration in North America are scarce. North American-sourced fish skins are primarily exported to China, Mexico or Europe for the actual tanning process, before being shipped back to North America for transformation into finished leather goods. Alternatively, the product may be sold in the country where the tannery is located, though profitability is limited in Asia compared to Europe and North America.

The North American leather industry was heavily impacted by post-1970 environmental regulations, which led to the closure of many tanneries. As a result, there are few, if any, industrial scale leather operations in the Great Lakes region, and none currently handle fish material. However, there is one commercial fish tannery (Aquaborne) located in Sacramento, California, which has a capacity of 5,000 skins per month, and could potentially be a partner for companies in the Great Lakes region. Aquaborne has developed a novel, environmentally friendly method of producing fish leather, and produces a comparatively greater amount of leather per unit of input compared to traditional bovine tanning processes. In Norway, Norskin produces a large volume of fish leather from salmon. Currently Norskin only utilizes Norwegian farmed salmon, specifically broodstock. In addition to

**Image 4.** Assortment of sturgeon fish leather from an industrial fish leather plant. Source: https://theaquaborne.com/sturgeon

providing finished leathers, Norskin also sells semi-finished skins that have been pickled but not yet tanned, as well as the "crust", which is leather that has not been dyed.

There are also larger producers in Iceland, Mexico, and China capable of producing thousands of skins per week, however these tanneries frequently use Chromium, which can have substantial negative environmental impacts.

## Artisanal Fish Leather

Unlike many other fish byproduct value chains—such as fish meal, oil, or collagen—fish leather production is well-suited to small-scale, artisanal operations. Regional and local artisans can transform small quantities of fish skin into high-value, handmade goods, making it an attractive venture for small businesses and hobbyists. The initial start-up costs of an artisanal scale fish leather operation are low, less than $1,000 (CAD) total for tanning and sewing supplies. The primary limiting factor is the labor-intensive process of tanning the skins and creating a finished product such as a handbag. While industrial-scale operations may process over 5,000 skins per month, artisanal producers may only work with a few skins per month. Artisanal tanners typically purchase skins directly from the processor, tanning the skin and creating the finished good themselves (Figure 8). The artisanal tanner then sells direct to interested consumers, or to retail outlets featuring local goods. Examples of existing artisanal tanners include Fiskur Leather, which is located in Minnesota, and 7 Leagues Leather located on the west coast of Canada. Some artisanal apparel producers operating at a hobbyist scale do not engage in the tanning process and instead buy finished leather from other tanneries, typically from international sources.

**Figure 8.** Artisanal fish leather value chain steps from processor to retail, with overall price changes between different processing steps.


For fish processors, the achievable revenues from selling fish skins to artisanal producers are likely modest in the short-term. However, fish leather is increasingly in demand, and there has been interest in establishing training courses in fish leather production in the Great Lakes region. An increase in the number of local producers would represent a growing value opportunity for fish processors. One way to encourage the growth of this sector would be to provide skins for fish tanning classes, or to sponsor those classes. Though presently a niche market, the artisanal fish leather sector has the potential to evolve into a valuable, locally rooted revenue stream with relatively low barriers to entry and high cultural and environmental appeal.

**Image 5.** Artisan salmon leather handbag. Source: fiskurleather.com

## Medical Usage

While medical uses of fish material, including byproducts, have the potential to be highly profitable, the value chain remains in its infancy. The primary area of research development is centered around fish skins for bandages and grafts for wound care, and applications of fish blood for various serums, particularly related to medical imaging and diagnostics. While early results are encouraging, widespread adoption is unlikely in the short term. Progress depends on further clinical research and adoption by major medical institutions. There are also extremely restrictive regulations in the biomedical industry that hinder the activation of this potential value chain.

**Image 6.** Fish-based skin graft designed to specifically contour to the burn victim's hand. Source: kerecis.com

Material from wild caught fish is variable in quality and would likely not be preferred by medical institutions. To date, utilization of fish skins and blood for medical usage has been limited to products sourced from aquaculture operations due to consistency and quality control.

Regardless, there may be opportunities to provide byproducts to research institutions such as universities in the near future, but this would likely be sporadic in nature and require very limited volumes. A potential upside would be the possibility of funding in the form of research grants, minimizing financial risks.

# SUMMARY


There is a broad spectrum of emerging value chains for fish byproducts—from modest artisanal ventures to potentially high-value industrial applications--that could offer fish processors and aquaculture producers in the Great Lakes region new sources of revenue. Yet, infrastructure gaps and historically low demand have limited the ability to capitalize on these opportunities.

Consumer unfamiliarity and lack of awareness around fish-based alternatives—whether in leather goods, medical products, or wellness supplements—have created a cycle of underinvestment. Without clear demand, processors have had little incentive to develop the infrastructure and expertise needed to fully utilize their harvest.

However, international models like Iceland's 100% Fish Initiative have shown what is possible. In Iceland, strong collaboration between industries and strategic marketing campaigns helped build demand for sustainably sourced products from fish byproducts, spurring innovation and investment.

To replicate this success, entities in the Great Lakes region will need to:

- Pursue industry partnerships, especially with bait suppliers and the collagen and gelatin industries.
- Raise public awareness of new products, such as fish leather, through targeted marketing and storytelling.
- Explore joint ventures, including shared processing infrastructure like a fish meal and oil facility.
- Support artisanal and small-scale producers by donating materials for training and encouraging local entrepreneurship.

By developing multiple parallel value chains, the region can move toward more sustainable and fully utilized fisheries, ensuring that 100% of every fish caught is put to productive use, creating more jobs and supporting rural economic development.

Photo credit: Bill Savage

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