

ANALYSIS AND RECOMMENDATIONS

Luke's Lobster

Greenhouse Gas Emissions from Lobster & Crab Products

A Council Fire Report

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Executive Summary

Luke's Lobster is a Maine-based, vertically integrated seafood company working toward a goal of achieving net zero carbon emissions associated with its business operations. To begin making progress on this ambitious goal, Island Institute, on behalf of and in partnership with Luke's, commissioned Council Fire to conduct an assessment of the greenhouse gas (GHG) emissions related to the production and sale of two of its primary seafood products, lobster and crab, with an eye toward identifying and reducing emissions. Because Luke's is involved at every step in the supply chain of its products, from buying and selling bait all the way to serving consumers in restaurants and retail, they have unique access to data on the emission-generating activities at each step. Per standard protocol, GHG emissions have been assessed in three categories: direct emissions (Scope 1), indirect emissions (Scope 2), and indirect emissions occurring upstream and downstream in the company value chain (Scope 3) using 2021 as the reporting year.

GHG emissions were determined by analyzing energy use in lobster and crab harvest, wharf operations and upstream transportation, processing, and in post-processing use in transportation, restaurant locations, and wholesale and retail sales. Results are summarized in the table that follows.¹ It should be noted that Scope 3 emissions are difficult to measure. Accordingly, many companies choose to not measure or pursue explicit reduction targets for these types of emissions. For those that do, it is quite common for the assessment to reveal that Scope 3 is the largest source of emissions. This is the case for Luke's as well. Given the company's commitment to driving sustainability into its own operations and the Maine lobster industry as a whole, Luke's has not shied away from the task of beginning to quantify and reduce as many aspects of Scope 3 emissions as can be reasonably addressed.

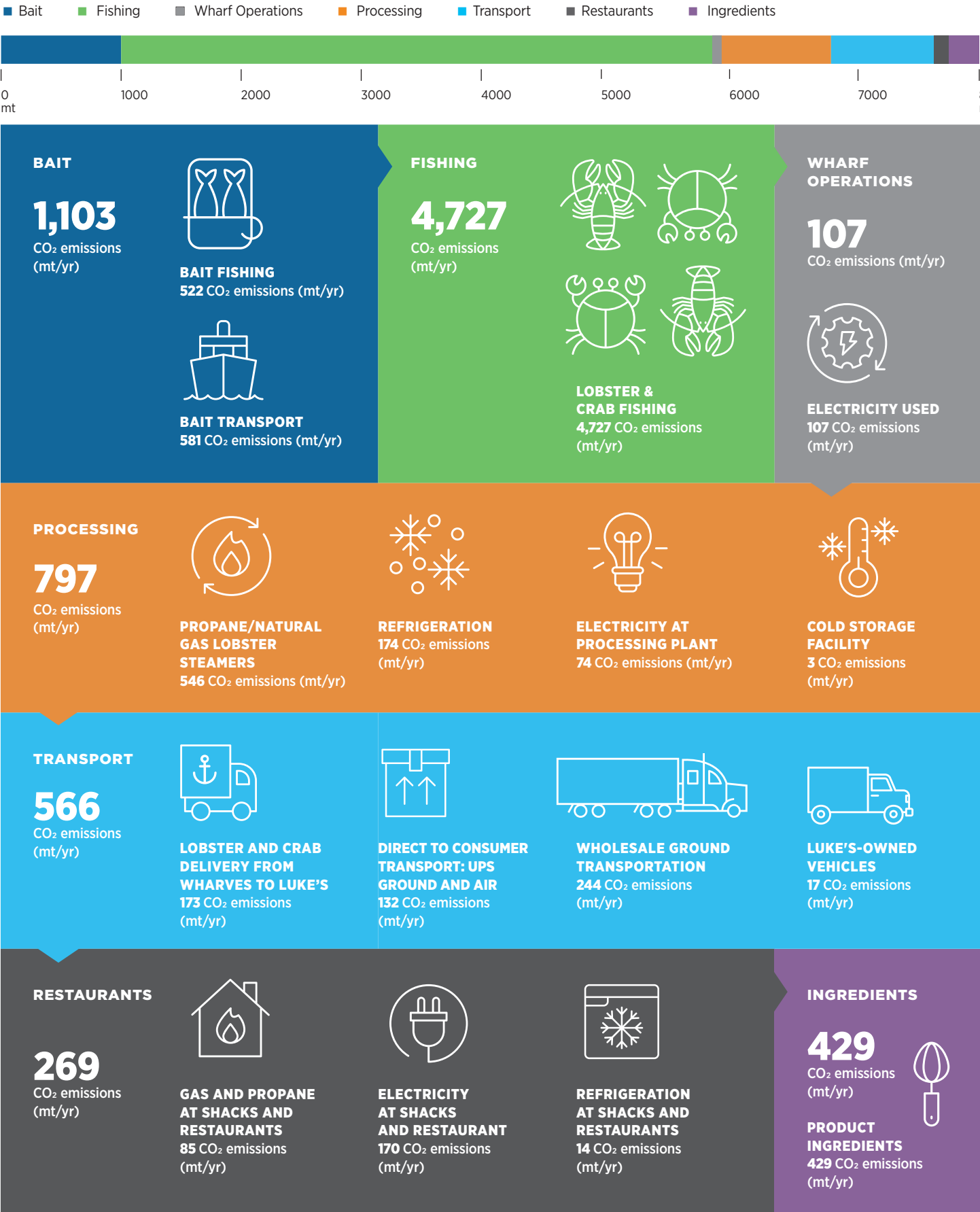
1. Additional details can be found in the Appendix - Table 25.

Table 1: Summary Emissions Table (All emissions reported in metric tons/reporting year)

Scope	Category or Type of Emissions	Operations Category Within Supply Chain	Total CO ₂ Equivalent Emissions (mt/yr)
1 Direct Emissions	Fugitive emissions (leakage, or discharge of gases or vapors)	Processing Restaurants Transport	190.18
1 Direct Emissions	Stationary combustion (emissions from heating, boilers, ovens, other non-movable equipment)	Processing Restaurants	2,660
1 Direct Emissions	Mobile combustion (emissions from the transportation of materials, products, waste)	Transport	14.81
2 Indirect Emissions from Purchased Electricity	Emissions from purchased electricity, all named locations	Transport	266.75
3 Upstream and Downstream Emissions	Category 1a: Purchased goods and services, emissions from bait fishing	Wharf Operating Restaurants Transport	521.55
3 Upstream and Downstream Emissions	Category 1a: Purchased goods and services, emissions from bait transport	Bait	581.31
3 Upstream and Downstream Emissions	Category 1b: Purchased goods and services, emissions from vessels used in lobster fishing	Bait	4,727.39
3 Upstream and Downstream Emissions	Category 1c: Emissions from electricity used at wharves	Fishing	84.52
3 Upstream and Downstream Emissions	Category 1d: Emissions from purchased ingredients	Wharf Operations	429.38
3 Upstream and Downstream Emissions	Category 3: Fuel- and energy-related activities not included in Scope 1 or Scope 2	Ingredients	2.52
3 Upstream and Downstream Emissions	Category 4: Emissions from upstream transport between wharves and Luke's properties for lobster and crab delivery	Processing	173.27
3 Upstream and Downstream Emissions	Category 5: Waste generated in operations	Transport	0
3 Upstream and Downstream Emissions	Category 9: Emissions from downstream air transport via UPS	Transport	131.86
3 Upstream and Downstream Emissions	Category 9: Emissions from downstream ground transport via UPS	Transport	0.27
3 Upstream and Downstream Emissions	Category 9: Emissions from non-UPS downstream transport	Transport	244.41
Total (mt/reporting year):			7,998.93

FIGURE 1 Total assessed emissions by operations category

Emissions from the Luke's Lobster Supply Chain for Lobster and Crab Products



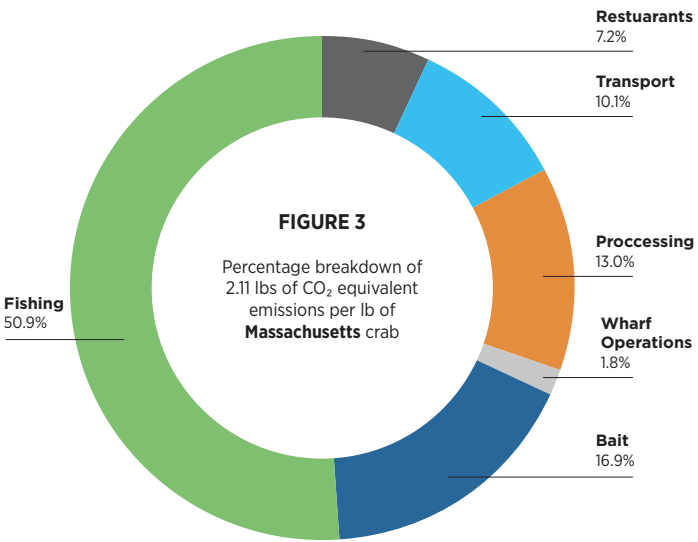
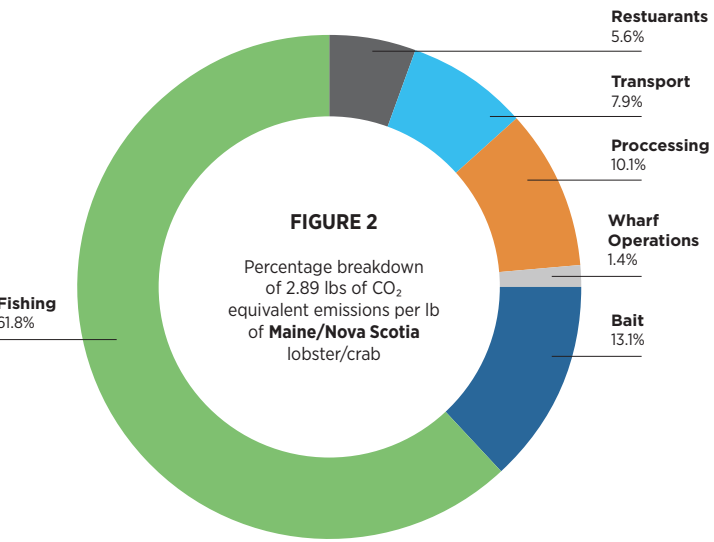
EMISSIONS PER POUND OF LOBSTER AND CRAB

An important figure in comparing the emissions of Luke’s products to other protein sources is the pounds of emissions per pound of lobster or crab. This calculation includes all of the operations categories above with the exception of additional ingredients (e.g. buns for lobster rolls), which are more appropriately allocated to final products rather than the overall lobster or crab average. The specific emissions of select Luke’s products, including all additional ingredients, are explored in the full report.

Nearly all of the crab that Luke’s purchases comes from vessels that exclusively fish crab in Massachusetts. Data show that this fishery is more efficient in fishing fuel usage, the largest source of emissions in the supply chain. As such, it is appropriate to consider the emissions per pound of Massachusetts crab separately from the emissions per pound of lobster/crab caught in the combined fishery in Maine and Nova Scotia, which is predominantly lobster but includes a small percentage of crab.

Emissions from the Luke’s supply chain for lobster (including Maine lobster, Nova Scotia lobster, and a small percentage of Maine crab caught in lobster pots) equates to 0.00131 metric tons, or 2.89 pounds, of emissions per pound of lobster. Emissions from the Luke’s supply chain for crab landed in Massachusetts equates to 0.000958 metric tons, or 2.11 pounds, of emissions per pound of crab. The percentage breakdown of these numbers by operations category are presented below.

These values indicate that Luke’s lobster and crab have a lower footprint than those available in the literature for other proteins such as beef (60 lbs emissions per lb of protein), lamb (24 lbs per lb), farmed prawns (12 lbs per lb), and pork (7 lbs per lb)². Published comparison studies have historically ranked crustaceans among the highest emissions proteins from wild-caught fisheries, with one study estimating 7.9 lbs of emissions per lb of protein³. These studies often consolidate findings from many different fisheries into broad categories such as “crustaceans” which is in stark contrast to Luke’s analysis here, which is based on a precise region, a network of known fishers, and the specificity of a single company’s operations. Thus, a true “apples to apples” comparison of this study does not exist as a reference point. Rather these global studies can be viewed as general benchmarks against which to consider Luke’s products from a relative and approximate standpoint.



2. Neufeld D. The Carbon Footprint of the Food Supply Chain. Visual Capitalist. 2020. <https://www.visualcapitalist.com/visualising-the-greenhouse-gas-impact-of-each-food/>
3. Parker, R.W.R., Blanchard, J.L., Gardner, C. et al. Fuel use and greenhouse gas emissions of world fisheries. Nature Climate Change 8, 333–337 (2018). <https://www.nature.com/articles/s41558-018-0117>

CONCLUSION AND RECOMMENDATIONS

The identification and quantification of the emissions associated with Luke's lobster and crab products has revealed opportunities for emissions reductions. Recommendations for pursuing those reductions are summarized below and elaborated upon in the final section of the report.

Lobster and Crab Harvest - Bait and Fuel Use

As demonstrated in the graphic above, the parts of the supply chain with the highest emissions and greatest opportunities for reduction include bait and fuel used for fishing—items over which Luke's has no direct control. What Luke's does have is a strong relationship with its suppliers, built on mutual understanding and respect. These unique connections can serve as the foundation for improvement, leveraging the recommendations below as a starting point:

Work with the lobster industry on the sources of emissions within their control and options for reduction.

► Fuel Use During Fishing Activities (Current Emissions 4,727 mt - Scope 3, Category 1b):

- In the near term, this means consideration of using biodiesel as an alternate fuel and potential modification of fishing practices to increase efficiency. Long-term solutions may include use of hybrid electric and electric-powered boats when they become feasible.

► Bait Selection (Current Emissions 1,103 mt - Scope 3, Category 1a and 1b):

- Promote to fishermen the value of using bait that is domestic, locally-sourced and/or a byproduct of another industry (i.e. discarded fish heads/racks or pig hide).
- Because Luke's is affiliated with a bait company, there is a unique opportunity to influence a significant source of its Scope 3 emissions. By selling bait that is sourced locally and/or a byproduct of another industry, they can put more low-emission bait products into the market and the fishing process.

Wharf Operations

Luke's is well positioned to use its established relationships with wharves to work collaboratively on initiatives that will reduce emissions from wharf operations. These recommendations will not only reduce Luke's GHG emissions but also stand to improve wharves' operational efficiency and reduce costs for suppliers.

► Purchased Electricity at Wharves

(Current Emissions 107 mt - Scope 2) Wharves operated by Luke's and Scope 3, Category 1c: all other wharves):

- Continue to work with wharves to explore switching wharf operations to renewable energy sources such as rooftop or on-premise solar installations, or solar power purchase agreements, and energy efficiency upgrades in all stages of production.

Processing

Because Luke's operates its own processing plant (SeaCo) and the company has direct control over some significant sources of Scope 1 and 2 emissions, processing represents a significant opportunity for emissions reductions. We offer the following recommendations to reduce emissions from processing:

► Natural Gas and Propane (Current Emissions 546 mt - Scope 1, Stationary Combustion):

- Explore options for switching to renewable natural gas (RNG) for high-emissions processing and steaming equipment when it becomes an option. Until, the company supplying gas to SeaCo, is "actively soliciting RNG program proposals to integrate with our system⁴". Luke's should remain in discussion with utility providers to stay abreast of the development of this program and to advocate for the advancement of RNG supply and credit programs.
- As processing appliances are in need of replacement, explore opportunities to switch from natural gas- and propane-fueled heat sources to low-energy-use electric options.
- Luke's has had early conversations with a wastewater consultant regarding the creation of a biodigestion system to turn processing waste into RNG on-site at SeaCo. This is likely to be a high dollar investment with a long development time but, if viable, one that should be pursued as a true and reliable source of RNG to power equipment that cannot easily be transitioned to electric, like lobster steamers.

4. [https://unitil.com/blog/what-renewable-natural-gas#:~:text=Renewable%20natural%20gas%20\(RNG\)%2C,and%20acts%20like%20natural%20gas.](https://unitil.com/blog/what-renewable-natural-gas#:~:text=Renewable%20natural%20gas%20(RNG)%2C,and%20acts%20like%20natural%20gas.)

► **Gases and Vapors from Appliances (Current Emissions 174 mt - Scope 1, Fugitive Emissions):**

- As appliances are in need of replacement, replace high GWP refrigerators, chillers, and air conditioning units with units that use low or lower GWP⁵ refrigerants.

► **Purchased Electricity (Current Emissions 74 mt - Scope 2, Purchased Electricity):**

- Luke's is already taking significant action to address purchased electricity emissions (Scope 2) by purchasing Renewable Energy Credits (RECs). Partial RECs reduced processing emissions this reporting year by 224 metric tons. Continuing purchasing these RECs throughout a full calendar year is expected to reduce this number to zero in future years.
- As electric appliances and equipment need to be replaced, choose the most energy-efficient replacement option available at that time.

Transport

Both upstream transport of lobster and crab and downstream transport of processed products offer opportunities for emissions reductions. While most aspects of transport are not directly within Luke's control, recommendations below outline ways to work with suppliers to pursue lower-emissions options.

► **Downstream Wholesale Distribution (Current Emissions 244 mt - Scope 3, Category 9):**

- Investigate ways of reducing downstream transport emissions through optimization of shipping schedules and exploring lower-carbon shipping options and/or offsets.

► **Upstream Transport (Current Emissions 173 mt - Scope 3, Category 4):**

- Work with wharves to establish a schedule for enhanced coordination in the transport of lobster and crab to Luke's, such that wharves along the same route transport products together. Concurrently or alternatively, work with wharves to replace transport vehicles with electric vehicles or more fuel-efficient vehicles.

► **Direct to Consumer Distribution (Current Emissions 132 mt - Scope 3, Category 9):**

- Luke's has committed to offsetting emissions from UPS shipments, so this reduction is already planned, but is not reflected in this report because the switch did not take place until 2022. This will represent an emissions reduction of approximately 132 tons. Additional methods of carbon neutral shipping and transport should be routinely explored as part of the ongoing operations optimization process.

► **Luke's-Owned Vehicles (Current Emissions 17 mt - Scope 1, Mobile Combustion and Scope 1, Fugitive Emissions):**

- With respect to Luke's own fleet of vehicles, consider selecting fully electric vehicles at the time of replacement. Consider the truck refrigeration units upon replacement, prioritizing low GWP refrigerants if possible.

Restaurants

Luke's restaurants and shacks represent a relatively small portion of the supply chain emissions, especially since RECs are being used to offset electricity usage at many locations. Still, more progress can be made with the purchase of additional RECs, switches to renewable energy sources, and utilization of more efficient equipment as replacements are required.

► **Restaurants/Shacks (Current Emissions 267 mt - Scopes 1 & 2):**

- All of the recommendations outlined for the SeaCo processing facility should be considered for each restaurant and shack location, albeit on a smaller scale. Transitioning all Luke's properties to RECs or renewables offers the opportunity to offset an additional 97 metric tons.

Ingredients

Product ingredients offer the opportunity for a variety of small, individual choices to add up to significant emissions reductions. By considering the inputs of each product and working collaboratively with ingredient suppliers, Luke's can further reduce its own footprint and encourage and inspire others to do the same.

► **Product Ingredients (Current Emissions 429 mt - Scope 3, Category 1d):**

- Inform partner manufacturers and ingredient suppliers of Luke's desire to source the lowest-emission ingredients possible and switch where viable.

5. <https://www.epa.gov/ghgemissions/understanding-global-warming-potentials>

Organization-Wide Opportunities

This product-level analysis represents an important first step in Luke's journey to achieving net zero emissions and has revealed additional operational improvements that would serve to further inform and empower the company's emissions reduction efforts.

- Some emissions estimates in this analysis have been calculated using proxy values due to the lack of available data. Developing and implementing a comprehensive emissions tracking program and protocols will provide additional data needed to further refine emissions measurement, thereby reducing uncertainty. This will also further enable the completion of Luke's stated desire to conduct a full organizational assessment.
- Complete a full organizational carbon emissions analysis. This report focuses on lobster and crab products and on certain scopes and categories of emissions. Estimates of emissions associated with one Luke's menu or grocery item are therefore not comprehensive, as certain emissions categories (for example employee commuting) are not included.
- The combination of more accurate calculations from more complete data sets and the comprehensive view offered by a full organizational assessment will allow Luke's to analyze where to best concentrate efforts for ongoing reduction efforts by revealing the relative value of all GHG emission-generating activities.

Caveats for the Broader Industry

Luke's Lobster and Island Institute intend for this study to be useful as a basis for others in their industry to have a general understanding of the footprint of their products. However, there are a few important points of differentiation between the Luke's supply chain, studied here, and that of others in the industry that must be accounted for when considering the carbon footprint of lobster and crab from the same regions but sourced through other companies.

- Downstream transportation makes up a relatively small proportion of the carbon emissions identified in this report. It is important to note that virtually all product generated in the supply chain studied here are used domestically. The analysis reflects the delivery of product to Luke's restaurants in the US, to wholesale distribution hubs for retail and wholesale, and overnight to its online market customers within the United States. Luke's engages in very little overnight air freight of live lobster. For other companies, shipping live lobster by overnight air freight is often a primary line of business with shipments traveling as far afield as China. These companies should note that studies have shown air freight emits an estimate of 0.0005 pounds of CO₂ equivalent per km traveled per pound shipped⁶. A flight from Boston to Shanghai, for example, would then add 5.87 pounds of emissions to each pound of lobster, roughly tripling the carbon footprint revealed in this study.
- Luke's purchases renewable energy credits to offset the Scope 2 emissions from every facility where they control their electric accounts. This report reflects Luke's having done so for 7 out of their 12 months of operation in 2021. This action reduced their carbon footprint from processing and restaurants by 0.15 pounds per pound of lobster sold. Generally speaking, this action is not a common practice in the lobster industry. Therefore, lobster sourced from companies not doing so will have higher Scope 2 emissions.

6. <https://blog.intekfreight-logistics.com/air-freight-vs-ocean-freight-carbon-footprint-environmental-impact>