Juneau Area Commercial Fisheries Byproduct as a Biodiesel Feedstock: Energetic and Economic Analyses of Potential Collection Methods

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INTRODUCTION

Overview

Net economic and energetic analyses of commonly produced biofuels must account for the energy inputs and lifecycle impacts involved with the production of the biofuel "feedstock." Biodiesel feedstocks, including soybean and canola, are often grown from seed, which requires high energy inputs throughout the plants' growth cycles as well as lifecycle impacts that range from land use to fertilizer flows in the environment. In contrast, fishing industry waste is an existing byproduct that requires no additional energy inputs, and has no feedstock-related lifecycle impacts—until the point of collection. In other words, whether or not Fishermen's Daughters Ecofuels (FDE) chooses to utilize fisheries waste as a biodiesel feedstock, the byproduct will still be produced.

At the point of byproduct collection, however, additional resources are required to transfer fish offal from the feedstock sources (processing plants and terminal salmon hatcheries) to one or more feedstock stabilization and biodiesel production facilities. We calculated and evaluated the energetic and economic costs associated with the basic collection of fisheries byproduct in the Juneau area in the cost analyses outlined here. **The goal of these analyses was to compare potential feedstock collection methods and to ultimately identify the most cost-effective and energy-efficient mode by which to collect Juneau area byproduct that is spread out spatially and temporally.**

We wish to build upon what we learned in our previous byproduct availability research through these economic and energetic cost analyses. What we now know about the spatial and temporal availability of the biodiesel feedstock (seafood waste), as well as about the accessibility of the feedstock sources and the unique properties and stabilization requirements of the feedstock, has informed our cost analyses in critically important ways. This evaluation of the costs involved with the collection of fisheries byproduct will take us one step closer to determining whether biodiesel production from Juneau area fisheries waste is a feasible endeavor from both economic and energetic standpoints.

Juneau Area Commercial Fisheries Byproduct

Spatial Availability

In our analysis of Juneau area commercial fisheries byproduct availability, we studied seafood company discharge records, as well as interviewed representatives from seven of the eight biodiesel feedstock sources, in the Juneau area. We referred to the seafood processing plants,

terminal salmon hatcheries and the single direct marketing salmon company comprised of several individual fishermen as Sites A, B, C, D, E, F, G and H, and learned these feedstock sources annually generate at least 12 million pounds of byproduct that are currently not utilized.

Sites A, B, C, D, E, F and G represent consolidated sources of biodiesel feedstock (seafood waste). In fact, we even referred to Sites A, D, E and F as "feedstock hotspots" because of the large volumes of feedstock consolidated at these onshore processing facilities. However, Site H referred to a diffuse source of biodiesel feedstock: a small amount of salmon byproduct spread out among several fishermen who work with the same direct marketing firm. We did not consider the waste generated at Site H in these cost analyses because the firm's representative said it's impossible for individual fishermen to store their byproduct (mostly heads and viscera) aboard their boats for even a few hours prior to a tender vessel coming to the fishing grounds to retrieve the waste. Limited, chilled storage capacity precludes individual fishermen from safely holding byproduct for any appreciable amount of time. Ultimately, then, we considered the collection of byproduct from seven feedstock sources (A, B, C, D, E, F and G) in our economic and energetic cost analyses.

Temporal Availability

As discussed in our byproduct availability report, the vast majority of Juneau area byproduct is generated by the seven feedstock sources from June through September, with a peak in July and August. Figure 1 below clearly demonstrates how the amount of byproduct to be collected on a daily basis varies dramatically between "High Season" and "Low Season" for six of the seven feedstock sources. This seasonal variation in maximum daily byproduct was an important factor for which we accounted in our cost analyses.

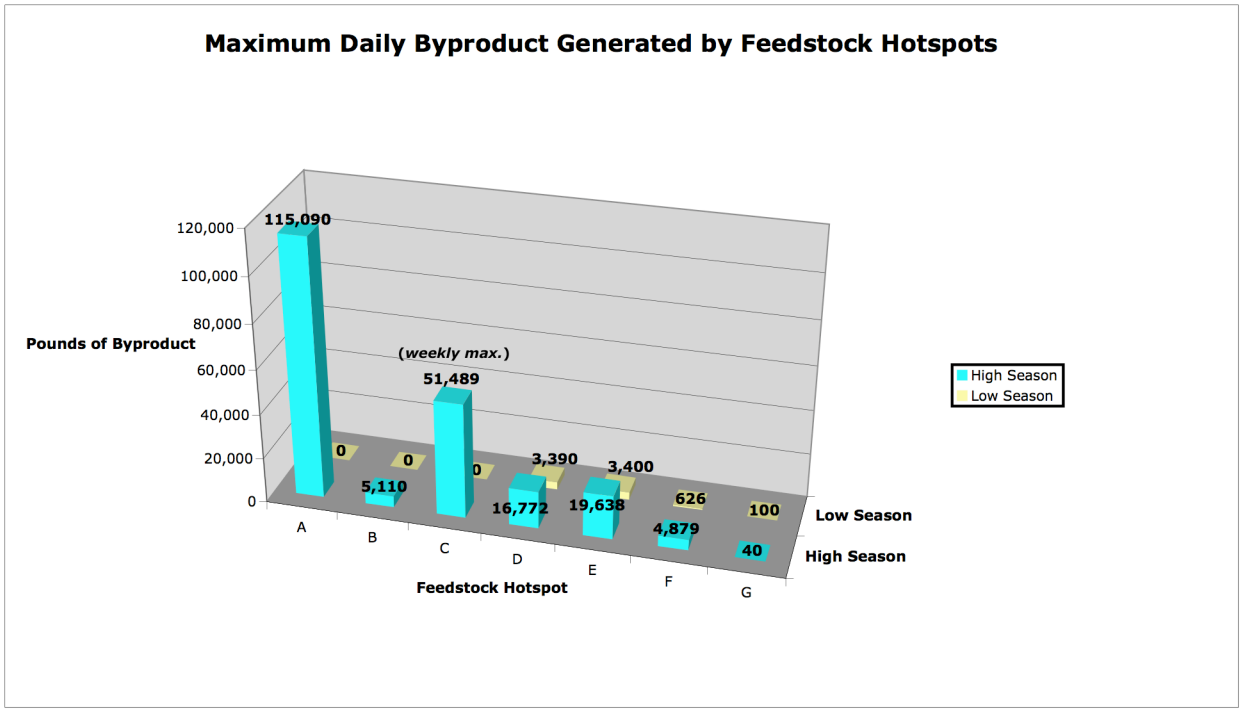

Figure 1. Maximum daily pounds of fisheries byproduct generated at seven feedstock sources during High Season and Low Season.

Accessibility and Transportation
Our interviews with byproduct suppliers indicated that a combination of land and water transportation is necessary to collect all fisheries waste in the Juneau area. A vast majority of the land-based feedstock collection can occur with modified milk trucks, a flatbed, polyethylene totes and simple piping and/or pumps. FDE proposes the use of milk trucks to pump ground waste from feedstock sources on the Juneau road system, and the transport of this byproduct to a facility for further processing and biodiesel production. While truck costs and fuel expenditures are considered in these analyses, because of the short distances required for its use, piping is considered a minimal cost and, thus, is not addressed in our calculations. Water-based feedstock collection, or sites that necessitate a combination of land and water collection, require the daily lease use of small, medium and/or large tenders, depending on waste volume to be collected.

As mentioned earlier, we ruled out byproduct collection from individual fishermen on the fishing grounds as a feasible collection method. The feedstock sources considered in these analyses include only consolidated sources of byproduct. Similarly, we have determined that neither feedstock stabilization nor biodiesel production can occur during byproduct collection; this processing of the feedstock must occur at a stationary facility. The extraction of oil from fisheries byproduct and the conversion of this oil to biodiesel (including the necessary settling of the fuel prior to final washing) takes more than 24 hours, while maximum transportation times during byproduct collection are only eight to twelve hours. **Therefore, our analyses consider the energetic and economic costs of transporting byproduct by land and/or by water to a stationary feedstock stabilization and biodiesel production facility (or facilities).**

Stabilization
Finally, the potential byproduct collection methods we've identified to analyze have been informed by FDE's work with consultants in Finland and by our experimental work with ground salmon waste in the lab. In Europe, the discharge of seafood offal into local waters is strictly prohibited; thus, coastal nations including Finland have devised innovative ways to handle fisheries byproduct. FDE's guided tours in Finland of a fish waste stabilization facility, a fish oil biodiesel production facility and plants where organic waste (including fisheries byproduct) are converted to compost and to biogas (methane) were enlightening. Additionally, our own hands-on work to stabilize salmon byproduct at a small scale also provided us with valuable information. We discuss some of what we learned from our Finnish consultants and through our own research in a future report focused on salmon oil as a biodiesel feedstock. We include here those findings that directly relate to these analyses focused on cost-effective byproduct collection.

To slow the deterioration of fish protein and oil due to uncontrolled autolytic (enzymatic) and microbial decomposition, it's necessary to grind fisheries byproduct as finely as possible as soon as possible. (In accordance with the law, all Juneau area seafood processing facilities and terminal salmon hatcheries considered in this study grind byproduct to less than 0.5 inches before discharging the waste into the sea). Enzymatic and microbial decomposition are vital factors to address for odor and oil yield/quality decline rapidly. Ground byproduct should be stored on ice or in refrigerated seawater (RSW) in order to slow decomposition as much as possible en route to a byproduct stabilization facility for further processing. Furthermore,

ground fisheries waste is ideally stabilized ("ensiled" with a strong acid or rendered—"wet reduction"—at high heat) within 30 hours of seafood processing and the byproduct generation.

The initial grinding of the byproduct, and the resulting increase in surface area of the waste, makes the enzymes in the viscera more available and speeds the liquefaction process. If the autolytic decomposition of the waste is then controlled within 30 hours of byproduct generation, ultimate oil yield and quality (and nutritive content of the protein solids) is dramatically enhanced. One way to control decomposition of the waste (and unpleasant odors), and to thereby stabilize the byproduct, is to ensile the material with the addition of formic acid to the ground waste in mixing tanks. The acid both acts as an antimicrobial agent to counter bacterial production and drives down the pH of the fish offal. At an ideal pH of 3.5-4.0, proteins become soluble enough that the byproduct autolyzes without spoiling. Within a week, proteins and bone sink to the bottom of the mixing tank and oil rises to the surface. This acidified waste, or "silage," can be stored at room temperature for up to three months prior to further processing. A second, much more common way to stabilize ground fish offal is to render the waste at high heat (>160-180˚ F for at least twenty minutes) to break down the cellular structure of byproduct. The heated slurry is then separated into oil, presscake/fishmeal (largely protein) and stickwater with the use of machinery that includes at least one liquid press, decanter and centrifuge.

Ensiling is often the stabilization method of choice for smaller amounts of byproduct (<50,000 lbs./day); whereas, rendering is often the chosen stabilization method for larger amounts of byproduct (≥50,000 lbs./day). Ensiling is employed in several European countries as a means to extract the majority of [unclarified, lower quality] oil from byproduct prior to processing the liquid silage into fertilizer without committing to the energy, equipment and space requirements of a wet reduction rendering facility. Ensiling for the purpose of rudimentary oil extraction and silage production requires the addition of formic acid at a concentration of 3-3.5%. In Europe, ensiling is also used as a storage technique; byproduct is stabilized for up to three months until it can be combined with larger amounts of waste for high heat rendering and separation into clarified, high quality oil and fishmeal. Ensiling for the purpose of storage requires the addition of formic acid at a concentration of at least1.5-2.5%.

We will discuss whether we propose the stabilization of Juneau area byproduct, post-collection, via ensiling and/or high heat rendering in our subsequent report on salmon oil as a biodiesel feedstock. We mention these descriptions of stabilization techniques here in order to, first, highlight the importance of fast, proper byproduct collection. Second, we also need to explain why we ruled out, from the outset, one collection method that might seem like the obvious, best choice. More than two-thirds of Juneau area byproduct is produced in just three months at remote Site A, just over 100 miles from downtown Juneau. We initially assumed we would consider ensiling the waste at this remote feedstock source for up to three months before transporting the oil and silage to a Juneau-based byproduct stabilization and biodiesel production facility at the end of High Season. However, this proposal appears to be cost-prohibitive and logistically not feasible.

Formic acid is approximately $30 per gallon. Thus, to ensile all of Site A's waste (approximately 8.5 million pounds) at a minimum formic acid concentration of 1.5% would cost $510,000, exclusive of the additional and substantial equipment and supply costs, including large

mixing tanks. Furthermore, our experiments with ground fish waste in the lab demonstrated that, even when offal was ground to less than 0.25 inches, and the waste and formic acid were thoroughly mixed by machine, very little oil was released and an extremely unpleasant odor resulted when we added formic acid at a 1.5% concentration. We found, to adequately control microbial growth and bad odors, as well as release a reasonable amount of oil, the addition of formic acid at a concentration of at least 3% is required. Ensiling all of Site A's waste with a 3% acid concentration would cost just over $1 millon, again exclusive of additional equipment and supply costs. When we considered that these estimates of $510,000 and $1 million to ensile Site A's byproduct are costs *in addition to* the eventual economic and energetic costs of rendering the silage to additional, high quality oil and fishmeal, we decided to rule out the option of collecting all of Site A's [ensiled] byproduct at the end of High Season in Juneau.

Potential Byproduct Collection Methods

Based on the spatial and temporal availability of the fisheries byproduct, as well as the transportation and stabilization requirements of the waste, we have developed three potential methods by which to collect this biodiesel feedstock. Ultimately, these possible methods reflect our desire to determine whether it's most feasible to (1) daily collect all byproduct for stabilization in downtown Juneau, or (2) daily collect all byproduct for stabilization at the source of the largest amount of waste, Site A, or (3) daily collect all byproduct generated in the City and Borough of Juneau for stabilization in downtown Juneau AND daily collect only Site A's byproduct for stabilization at Site A. It is the following byproduct collection methods outlined below, "JNU", "A" and "TWO," that we evaluate for cost-effectiveness and energy-efficiency in our economic and energetic cost analyses:

(1) JNU: All byproduct from seven feedstock sources (A-G) is transported on a daily basis to a land-based, waterfront facility on the Juneau road system that is approximately two miles south of downtown Juneau (and directly adjacent to an area known as the "Rock Dump"). [Byproduct will be immediately stabilized at this facility (ensiled or rendered) in preparation for eventual biodiesel production].

(2) A: All byproduct from seven feedstock sources (A-G) is transported on a daily basis to Site A, the source of the vast majority of Juneau area byproduct that is located approximately 107 miles from the proposed Juneau byproduct stabilization and biodiesel production facility. [Byproduct will be immediately rendered (wet reduction) at a waterfront or floating plant adjacent to Site A's existing processing facilities in preparation for eventual biodiesel production].

(3) TWO: Byproduct from six feedstock sources (B-G) in the City and Borough of Juneau is transported on a daily basis to a land-based, waterfront facility on the Juneau road system for immediate stabilization. Meanwhile, byproduct from feedstock source A is pumped on a daily basis to a waterfront or floating byproduct stabilization facility that is adjacent to Site A's existing processing facilities.

METHODS

Evaluation of Byproduct Collection Methods

Table 1 below summarizes the equipment and collection protocol requirements of the three potential collection methods (JNU, A and TWO) for each feedstock source. When we analyzed the economic and energetic costs of these collection methods, our calculations were based on the collection requirements listed below and on our specific assumptions about these requirements. These assumptions are detailed in our descriptions of the economic and energetic costs analyses directly following the table.

Table 1. Equipment required for each byproduct collection method during High Season and Low Season.

Feedstock Source	High Season			Low Season		
	JNU	A	TWO	JNU	A	TWO
A	2 Large Tenders Daily	No Transport Needed	No Transport Needed	N/A	N/A	N/A
B	1 Small Tender Daily	2 Small Tenders Daily	1 Small Tender Daily	N/A	N/A	N/A
C	1 Medium Tender Weekly (transport whole salmon *sans* roe in slush ice, grind at plant)	1 Medium Tender Weekly (transport whole salmon *sans* roe in slush ice, grind at plant)	1 Medium Tender Weekly (transport whole salmon *sans* roe in slush ice, grind at plant)	N/A	N/A	N/A
D	1 Milk Truck Daily	1 Milk Truck Daily & Combine with Byproduct from E & F aboard 2 Medium Tenders Daily	1 Milk Truck Daily	1 Milk Truck Daily (no collection in Jan. & Dec.)	1 Milk Truck Daily & 2 Medium Tenders Daily	1 Milk Truck Daily (no collection in Jan. & Dec.)
E	1 Milk Truck Daily	1 Milk Truck Daily & Combine with Byproduct from D & F aboard 2 Medium Tenders Daily	1 Milk Truck Daily	1 Milk Truck Daily (no collection in Jan. & Dec.)	1 Milk Truck Daily & Combine with Byproduct from D aboard Medium Tender Daily	1 Milk Truck Daily (no collection in Jan. & Dec.)
F	1 Milk Truck Daily	2 Medium Tenders Daily (Collect Byproduct from D & E and Transport to A)	1 Milk Truck Daily	N/A	N/A	N/A
G	2 Flat Bed-Loads Annually (G holds in freezer until collection)	2 Flat Bed-Loads Annually & Combine with Byproduct from D, E & F aboard Medium Tender (G holds in freezer until collection)	2 Flat Bed-Loads Annually (G holds in freezer until collection)	N/A	N/A	N/A

Economic Analysis

Our economic analysis examined the costs associated with the three potential collection methods from the point of discharge at processing sites to the point of delivery at a stabilization facility. The following are the assumptions we made for the purpose of this analysis, as well our energetic analysis:

Feedstock Locations, Accessibility and Availability

1. A critical characteristic of each feedstock source is whether the facility is accessible by land only, by water only, or by both land and water. The accessibility of each feedstock source allowed us to determine proper driving distances and proper modes of transportation required by each of the three collection methods. For example, a feedstock source that is not accessible by water requires that byproduct be driven by truck to the nearest dock before being transported by vessel to a byproduct stabilization facility that is accessible only by water.

2. Based on the waste-flow data calculated in the feedstock availability portion of this study, the three potential byproduct collection methods reflect feedstock availability by day and by month. We considered mid-June through mid-September to be "High Season" (92 days) and the rest of the year [excluding December and January altogether] to be "Low Season" (211 days).

Feedstock Properties

1. While no further processing of the byproduct is required prior to collection, we recognized the state of the waste (ground versus not ground) when identifying collection procedures for each feedstock source.

2. We incorporated the speed of byproduct degradation into the three collection methods to ensure that, whenever possible, waste is delivered to a stabilization facility within 30 hours of collection.

3. We assumed the density of the [mostly salmon] byproduct is 7.8 pounds per gallon. Because the byproduct is approximately 70-80% water, we chose a figure between the density of water (8 pounds per gallon) and the density of salmon oil (7.7 pounds per gallon).

Equipment, Labor and Operating Costs

1. The table below highlights the tender vessel assumptions we included in our analyses.

Table 2. Characteristics of small, medium and large tender vessels.

TENDERS	Capacity	Lease/day*	Gallons/hr.	Miles/hr.
Tender-large capacity	270,000 lbs.	$3,100	16	9
Tender-medium capacity	85,000 lbs.	$1,550	12	9
Tender-small capacity	6,000 lbs.	$500	8	9

*Includes captain, one crew member and ice

2. We considered labor costs to be $15 per hour. We assumed 40-hour work weeks are needed during the High Season and 20-hour work weeks are needed in the Low Season to collect fisheries byproduct.

3. We assumed each milk truck has a 4,000-gallon (~30,000-pound) capacity, achieves 14 miles per gallon and is priced at $25,000. We applied a down payment of $2,500 to each truck with 8% interest, and this resulted in a monthly payment of $465 for each truck.

4. We included a price of $3.00 per gallon for #1 (highway) diesel and a price of $2,50 per gallon for #2 (marine) diesel. We estimated the final biodiesel sale price to be $3.35 per gallon.

5. We calculated the volume of biodiesel produced from a given mass of byproduct in the same way in these analyses as we did in our earlier evaluation of byproduct availability. We assumed that 10% of a given amount of fisheries byproduct is oil. To convert this mass of oil into a volume of oil, we divided the oil mass figure by the density of salmon oil: 7.7 lbs./gal. Finally, we conservatively assumed that 75% of this oil volume would be successfully converted to biodiesel.

6. We deemed the costs of ancillary equipment such as plastic tubing and small pumps required to collect byproduct by various methods to be minimal as compared to tender, milk truck, labor and fuel costs. Because small equipment and supply costs are not likely to affect final cost comparisons of byproduct collection options, we assigned these smaller costs a value of $0 for this analysis.

Energetic Analysis

In our energetic analysis, we compared the British Thermal Units (BTU) required to collect byproduct according to each of the three collection methods with the total BTU we estimate will be contained in the final biodiesel product. The table below depicts the energy estimates for the three fuel products we used in this analysis.

Table 3. British Thermal Units per gallon in three types of fuel.

Fuel Type	Estimated BTU/gallon
#1 Diesel (Highway)	125,000
#2 Diesel (Marine)	130,000
Biodiesel	118,000

RESULTS

Economic Analysis

Most Viable Collection Option

The economic analysis of the three possible collection methods demonstrated definitively that options JNU and A are not feasible at this time. Collecting all byproduct in Juneau prior to processing resulted in a collection cost that is 2.2 times greater than the projected revenue from resulting biodiesel (assuming a biodiesel sale price of $3.35/gallon). Similarly, collecting all byproduct at Site A resulted in a collection cost that is 1.6 times greater than the projected revenue from resulting biodiesel. While the final revenue from processing the byproduct will likely be much higher than that derived solely from biodiesel, due to the production of other products from the waste that is not converted to biodiesel, this high collection cost to revenue ratio is deemed unacceptable for a viable business model.

Final byproduct collection costs for the third collection method, TWO, only accounted for 37% of the projected revenue from biodiesel sales**. Collection method TWO provides for the delivery of byproduct to both the Juneau processing plant, as well as to a facility adjacent to Site A, for immediate stabilization (ensiling and/or rendering). From an economic standpoint, collection method TWO is the most feasible collection method for Juneau area fisheries byproduct.**

Site-by-Site Evaluation is Critical

A detailed look at the individual feedstock sources in collection option TWO revealed the need to analyze processing sites individually in order to more closely compare collection costs versus final biodiesel revenue generated. Because collection methods JNU and A were already ruled out, only collection method TWO is discussed here. As the following figure demonstrates,

collection costs for several sites are greater than the projected biodiesel revenue generated from those sites.

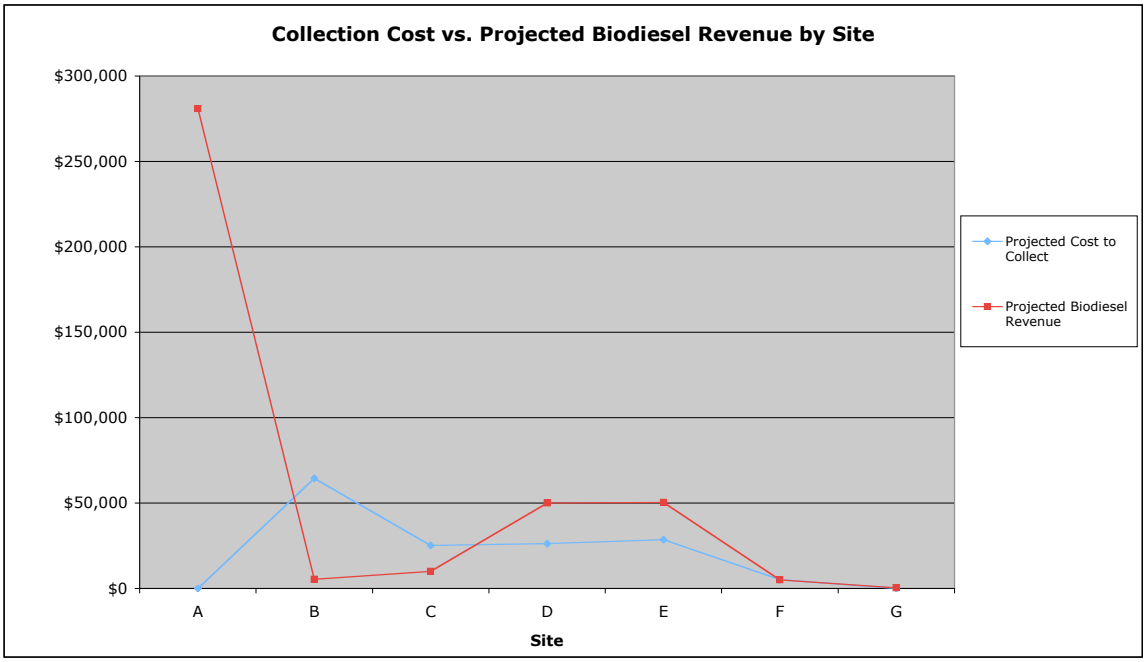

Figure 2. Byproduct collection cost versus projected biodiesel revenue generated at each feedstock source.

Site B is quite remote from both proposed collection sites (Juneau and Site A) and is not connected by road to either location. Site B also generates a small amount of byproduct relative to the overall total pounds of offal identified in this study (1%). While other processing sites generate less waste than this, collection costs relative to pounds of byproduct collected are highest at Site B. When Site B is removed from the analysis, collection option TWO becomes even more desirable, with collection costs at 21% of overall projected biodiesel revenue. Site C also requires collection by water (a more expensive option than land) and only produces 2% of the overall total pounds of waste in this study. When Sites B and C are removed from the analysis, option TWO collection costs total only15% of overall projected biodiesel revenue.

While removal of Sites B and C represent a significant reduction in byproduct collection costs, their removal from the analysis only represents an overall projected biodiesel revenue reduction of 4%.

A third site, Site F, requires collection costs that virtually equal the final anticipated biodiesel revenue from that site. While this fact alone could eliminate Site F from further consideration in this study, secondary products from the byproduct (after oil extraction and subsequent biodiesel production) are likely to yield total revenue from Site F's byproduct that is higher than collection costs. Thus, at this stage in the analysis, we have chosen to include Site F in order to evaluate its potential for positive revenue generation later in this study.

Table 4. Byproduct collection costs and projected biodiesel revenue for selected feedstock sources, according to collection method TWO.

Total Byproduct, Collection Costs and Biodiesel Revenue for Selected Sites				
Site (Feedstock Source)	**Total Annual Byproduct (lbs.)**	**Percent of Overall Byproduct Total** ***(including eliminated sites)***	**Projected Byproduct Collection Costs**	**Projected Biodiesel Revenue**
A	8,498,229	70%	Minimal	$277,296
D	1,509,801	12%	$26,282	$49,265
E	1,523,941	13%	$28,489	$49,726
F	152,726	1%	$5,131	$4,983
G	12,000	<1%	$63	$392
TOTAL	11,696,697	96%	$59,965	$381,662

As highlighted in the above table, the collection of 11,696,697 pounds of fisheries byproduct from five feedstock sources (A, D, E, F and G) according to collection method TWO will cost $59,965. Because we estimate 11,696,697 lbs. of byproduct will yield 113,929 gallons of biodiesel, the cost to collect the biodiesel feedstock is $0.53 for every gallon of biodiesel produced.

Energetic Analysis

While all collection methods utilized less BTU than that projected to be contained in the resulting biodiesel, collection method TWO resulted in significantly less BTU utilized than methods JNU or A. Due to our findings in the economic analysis, we compared all three collection methods with and without feedstock sources B and C in our energetic analysis, as well.

Table 5. A comparison of the energy required to collect byproduct by each of the three potential collection methods versus the energy in the final biodiesel product.

Energy Utilized in Byproduct Collection Versus Energy in Final Biodiesel Product				
Collection Method	**Energy required for collection at all sites (BTU)**	**Energy for collection / energy in final biodiesel product**	**Energy required for collection at all sites, except Sites B and C (BTU)**	**Energy for collection / energy in final biodiesel product (w/o Sites B and C)**
JNU	10,499,257,143	75%	9,296,422,857	68%
A	10,524,459,286	75%	5,836,139,286	43%
TWO	**1,313,977,143**	**9%**	**111,142,857**	**1%**

As the above table illustrates, collection method TWO is the preferred method of waste collection from an energetic standpoint. The energy expended to collect byproduct from seven feedstock sources is only 9% of the energy in the biodiesel produced. Additionally, eliminating Sites B and C reduces the amount of energy required to collect byproduct in relation to the energy contained in the final biodiesel product to just1%.

DISCUSSION

We calculate the cost to collect fisheries byproduct from five biodiesel feedstock sources via collection method TWO is $0.53 for every gallon of biodiesel produced and is, therefore, approximately 15% of the total expected revenue generated by biodiesel sales. Similarly, the energy required to collect byproduct from these five sites is just 1% of the energy contained in the biodiesel ultimately produced. **Such low economic and energetic cost figures are encouraging, and lead us to now closely examine the other costs, in addition to collection, of the fish oil biodiesel feedstock cost.**

A biodiesel feedstock normally accounts for approximately 75% of biodiesel production costs. If we can continue to obtain fisheries byproduct virtually for free from feedstock sources, (1) collection, (2) stabilization (rendering and/or ensiling, including oil extraction) and (3) storage of the feedstock constitute the total cost of the this biodiesel feedstock. **Thus, as long as byproduct stabilization and storage costs can be kept below 60% of final biodiesel revenue**

figures (less than $2.00 per gallon of biodiesel produced), collection method TWO may result in positive final revenue figures for biodiesel sales alone. Moreover, the additional revenue streams from byproduct processing into secondary products, including such items as fishmeal, fertilizer and/or biogas, should confirm that the collection, stabilization and storage of fisheries byproduct via collection method TWO will be a profitable venture.

In the final phase of our research, we will evaluate the economic and biochemical viability of Juneau area fisheries byproduct (mostly salmon) as a biodiesel feedstock. We will calculate the approximate stabilization and storage costs of the feedstock, as well as examine the costs and benefits of the possible co-products that can be produced from fish waste in conjunction with biodiesel. Such analyses, in addition to an accounting of the costs and logistics involved in actual biodiesel production from fisheries byproduct [that has been collected, stabilized and stored] will allow us to ultimately determine whether or not biodiesel production from Juneau area waste fish oil is a feasible endeavor.