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Results of Fishing Net Collection and Recycling Projects in Four Northwest Ports

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RESULTS OF FISHING NET COLLECTION AND
RECYCLING PROJECTS IN FOUR NORTHWEST PORTS

by

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Pacific States Marine Fisheries Commission

May 1995

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INTRODUCTION

Between February 1991 and June 1992, the Pacific States Marine Fisheries Commission (PSMFC) conducted a gill net recycling program supported by a \$23,000 grant from the National Marine Fisheries Service and about \$4,500 from DuPont's Fiber Division. The PSMFC worked with port officials, community-based coordinators, and members of the fishing industry to set up and promote the use of net recycling facilities in three areas in Washington and one in Alaska. As a result, fishermen brought 47,000 lb of old nylon netting to the collection sites. Collected nets were transported to a recycler in Washington state to be baled, stored, and marketed. The nets were sold to a plastics broker and recycled into bicycle seats in Taiwan.

As the first net recycling effort conducted in the United States, the program has taught some important lessons on community collection and shipment logistics and has shown that nylon net collection and recycling can be made economically viable and self-sustaining in the Pacific region. Higher prices and contracts are now being offered by recycling brokers who want the nets on an on-going basis.

Accordingly gill net collection programs are continuing and expanding in Alaska (with and without grant support), and the feasibility of a collection effort in the Columbia River area is currently being studied. These recycling efforts will now expand to also collect seine net which is made from a different type of nylon.

Coverage of net recycling efforts in trade journals such as Plastics News has elicited interest from plastics recyclers in the southeastern United States who may contact fishing groups regarding net collection in that area.

This report describes the collection and promotion efforts in Bellingham, Seattle, and Anacortes, Washington, and in Cordova, Alaska. It discusses shipping, transportation, and marketing considerations. It then provides a list of questions that will help others analyze the merits and feasibility of setting up a similar program in their region and how to anticipate and avoid problems.

The marine debris and net recycling work of the Commission was supported by the National Marine Fisheries Service through Saltonstall-Kennedy (S-K) grant funds. S-K funds, generated by taxes placed on foreign fishing-related products, are dedicated to projects that assist America's commercial fishing industry and meet industry-established priorities.

BACKGROUND

Concern over the growing use and disposal of plastics at sea and in the resultant environmental impacts led to the ratification of MARPOL Annex V. This international treaty became effective on December 31, 1988 and has now been signed by 41 countries. Through this law the at-sea disposal of any plastic item is prohibited and the disposal of other types of refuse is restricted, depending on distance from shore. Further, ports, processing plants, and other vessel docking areas are obligated to accept and properly dispose of the refuse being brought back to shore.

Since 1988 the PSMFC has worked to encourage the West Coast fishermen's understanding of the impacts of marine debris and compliance with the law. The PSMFC has also worked with ports to assure that they provide convenient refuse containers for fishermen and has encouraged and instigated port recycling programs to help ports keep their costs down (as such costs can be passed back to the fishermen). As part of these port waste collection and recycling efforts, areas for the collection of used nets were often designated, and these nets made available to the public. While some of these nets (the trawl and seine nets) became sought after by fishermen, residents and tourists alike (for net repair, decoration, gardens, baseball fields, erosion control, etc.), it became apparent that used gill nets (made of monofilament line and multistranded monofilament lines) were much more abundant but generally undesirable and unsafe for re-use (they catch too easily on everything).

The PSMFC discovered that gill nets were not being discarded at sea and were not creating a marine debris problem; however, they were creating a land-based disposal headache. Gill net fisheries for Pacific salmon (Oncorhynchus sp.) and Pacific herring (Clupea pallasii) are common in many areas in Alaska and in Washington's Puget Sound. These nets vary in length, depth, and mesh size, with the webbing in Alaska weighing anywhere between 30 and 70 lb and the webbing in the Puget Sound weighing between 65 and 420 lb, with an average weight of about 300 lb. This webbing is rarely discarded in its entirety; generally 85-100 lb of webbing at a time may be replaced.

Depending on the area, nets last from a year to a few years. It is estimated, on the basis of the amount of new net sold, that anywhere between 500,000 and 1 million lb of nylon gill net webbing (the mesh part) are discarded in Washington and Alaska's landfills each year. Fishermen and ports frequently received complaints from landfill operators when they tried to dispose of their used nets, as the webbing becomes entangled in the earth moving or baling equipment and causes equipment failures. In some places, fishermen were burning their nets to get rid of them -- a dangerous practice.

Research conducted by the Polymer Processing Institute on the feasibility of recycling used net showed that old nylon gill nets were not badly degraded after exposure to sea conditions and would lend themselves to reprocessing into other items. Our study of the market showed that nylon was potentially a valuable recyclable commodity.

The PSMFC initiated a gill net collection effort in Bellingham and Anacortes, Washington, in 1989 and 1990 in collaboration with those ports. It resulted in the collection of about 14,000 lb of gill net material. While this represented a large volume to be diverted from the landfill, it was an inadequate amount for marketing (40,000 lb needed).

Initially, the collection system was labor intensive and expensive. Wooden and plastic bins known as fish totes (the boxes into which fish and ice are loaded at fish processing plants) were utilized for net collection. These bins generally make convenient recycling containers as they are designed for forklift handling. However, older wooden bins, which were often the ones donated by the fish companies, had nails, splinters, and cracks which caught on the net and made loading and unloading difficult. The first collection of nets from these sites was coordinated with the help of student volunteers from Bellingham's Huxley College environmental center. These volunteers loaded nets from fish totes and old discarded nets that had been piled around the port into large (5' x 3' x 3') reinforced cardboard boxes provided by the recycler. These boxes (known as gaylords in the recycling industry) have wooden pallet bottoms for easy forklift moving. They were loaded onto a flatbed and trucked to Burlington, Washington (about one-half hour from Anacortes; 1-hour from Bellingham). Subsequent to the initial effort, upon a call from the ports, the recycler would come and pick up the full totes of nets, exchanging them with empty ones. However the system was inefficient--the totes would fill up quickly, requiring frequent servicing even though, by weight, quantities were small. Because of the uncertain markets for the nylon nets, the recycler would not have picked up, baled, and stored the materials had these costs not been reimbursed through the Commission's grant.

A more organized and focused collection effort was needed to make net recycling feasible and self-sustaining. This report notes the work done between February 1991 and June 1992 to realize that goal. While this report deals with gill net recycling, and most of this program's effort was concentrated on that, it should be noted that time was also spent to try to locate recyclers interested in the high-density polyethylene (HDPE) trawl nets and polypropylene line originating from the Bering Sea areas of Dutch Harbor and Unalaska. Such efforts generated little interest, though one recycler offered to pay \$.01/lb for the material--a price which did not make the

transport and labor costs worthwhile, even though for this market and price, it might have been possible to leave some of the rubber roller gear attached (though the metal chains would have had to be removed). Efforts are continuing to find a secondary use for this material.

PROJECT DESCRIPTION AND METHODS

Project Sites

To assure an adequate volume of nets for marketing, it was clear that additional sites and better promotion of the program were necessary. In addition to the sites at Squalicum Harbor, Bellingham, and Cap Sante Marina, Anacortes, a collection site was designated with the support of port managers at Fishermen's Terminal, Seattle. A net collection site was also established in Cordova, Alaska.

All four of these areas have significant gill net fishing fleets. In 1991, there were 1,125 gill net fishing permits issued in the Puget Sound area. Many of these permit holders fish out of the Seattle, Bellingham, and Anacortes ports or the surrounding communities. These port areas in Washington were also chosen because many fishermen and tender vessel operators (the vessels that pick up fish from the gillnet fishermen and deliver them to shore-based fish plants) take their vessels to Alaska to work. Since at season's end these vessels return to their Washington ports, it was anticipated that vessels could transport used net from various remote Alaskan sites to these central locations.

The Cordova gill net fishing fleet is also large. There were 528 gill net fishing permits in Cordova in 1991. Approximately 200 of these permits are owned by Cordova residents, 100 are owned by Washington residents, and the rest by fishermen from other Alaskan areas.

Net Collection Facilities

To assure the net recycling program's continuity, it was apparent that the collection systems initially established in Bellingham and Anacortes needed to be improved to make them logistically simpler and more economically efficient. A system that minimized handling and transport time was needed.

To assure adequate net collection capacity, a used 20 ft end-loading shipping container was located near the docks in areas where fishermen work on their nets in both Bellingham and Seattle. These used containers were obtained from a shipping company at one-half to one-third the cost of a new container. Anacortes (being close to Burlington where the nets are collected and baled) continued to collect nets in fishing totes.

In Cordova, Alaska, a net collection system was set up and actively promoted with the help of enthusiastic local coordinators, volunteers, and fishermen. It consisted of donated

fish totes with net recycling signs at each of the dock access ramps, collection bins at each of the fish processing plants, and a central collection site established at a city-owned storage site, where nets were piled on top of tarps donated by the local hardware stores. Fishermen were encouraged to place small net pieces and scraps in the bins at the docks and fish plants, but to bring large pieces and entire nets to the collection site.

Vinyl signs with adhesive backing were designed and ordered for posting on the containers or on sign boards placed adjacent to the bins and containers. The signs were white with black and red lettering and read, "Recycle Gillnet Clean Web Only!", and feature the three arrow recycling emblem. They were ordered in two sizes, 13" x 16" and 24" x 30". Small (5" x 6") white decals with red lettering were also printed for placement on the port's trash bin: "Please Don't Put Web Here! Recycle It!".

Net Consolidation and Transport

In Anacortes, Washington, where anywhere between 3 and 7 wooden fish bins (totes) were used to collect nets, nets were placed in the bins by the fishermen. When no more bin space was available, the port officials would call the recycling company, Skagit River Steel & Recycling, to arrange to have the bins picked up. The recycling company brought a flatbed truck and some empty totes to leave at the port in exchange for the ones full of nets. The port used their forklift to load the totes onto the truck. Sometimes these net pick-ups could be coordinated with the pick-up of the large scrap metal bin the recycling company had provided the port, saving on transport costs for the net materials.

In Bellingham a 20 ft end-loading shipping container (20' x 8' x 8') replaced the plastic fish totes at the net collection site. The container was located in the same place where the totes had been to minimize confusion. Fishermen brought their nets to the container to load them in--either using their own pick-ups to haul large pieces and nets, or renting the port's forklift to move them. To assure efficient loading of the container and good compaction, a port maintenance supervisor devised a clever and effective ramrod device: a long, heavy-duty steel pipe with a piece of thick steel plating welded to one end. The pipe fit over the prongs of the forklift and the ramrod was used to stuff nets farther back into the container and to pile them up high (by raising and lowering the fork arms). By using this device, the amount and weight of nets that could fit into a container were increased. One container loaded this way contained over 12,000 lb of net. When the container was full, the port officials called Skagit River Steel & Recycling and arranged to have the container picked up. The recycler brought a flatbed truck and the container was loaded onto the truck using

the port's large forklift. The container was emptied at the recycler's yard and returned to the collection site.

In Seattle, the 20 ft collection container was located in the net repair yard adjacent to the docks. Fishermen loaded scraps of net and old nets into the container. To date, the container has not been filled to the point of needing pick-up. When it becomes full, the port officials will call the recycler to have it picked up.

In Cordova, net handling was more complicated. Net collection totes were not located in one place, but rather scattered throughout the harbor and at the fish processing plants. Additionally, nets were piled in the storage area. These nets needed to be consolidated for shipping efficiency and easier handling. The collection system was established in the spring of 1991 and the first net consolidation and shipment effort was in October 1991. In support of the program, the City of Cordova purchased 45 large nylon net bags. These squarish bags normally hold new net web, and when full measure about 4 ft wide and 3 ft high and can hold about 300 lb. They are reinforced with straps, which allow the full bags to be easily lifted by forklift. A volunteer work day was scheduled to get the nets ready for shipping. Seven adults and a few children spent about 5 hours stuffing the nets into these bags while assuring quality control (removing non-nylon lines and gear). These bags were picked up from the various collection sites by city employees using a forklift and the city's flatbed truck. The truck brought the net bags to the shipping company's dock (Sea Land, Inc.), where they were then loaded and stacked into a 40 ft extra-high container (40' x 8' x 8'10") using the forklift services donated by a local fuel company. The full net bags just barely fit into the container, precluding the original idea of shipping bales of aluminum and cardboard alongside to help offset transport costs. Instead, a separate 40 ft container full of bales of aluminum, cardboard, and white goods (appliances) was also sent to Skagit River Steel & Recycling in Burlington, Washington.

Sea Land transported these shipping containers at cost (about \$750 for each container) to their docks in Tacoma, Washington. The containers were then transported overland to the recycler's operation.

A more detailed description of the net recycling effort prepared by the Cordova net recycling coordinator is included in Appendix I.

Net Characteristics, Quality Control, and Handling

As with all recycling efforts, it was critical to have materials reasonably clean and properly prepared, as some materials can not be recycled with others or because contaminants drive the price of the commodity down or cause its rejection. In the case of our net recycling effort, because there was no experience with markets or the tolerances these markets might have for contaminants, there was no room for error. Only net that was clean (i.e., no fish remains and few weeds) was eligible for recycling; additionally only the nylon webbing material was to be baled and marketed (i.e., all other material needed to be removed from the nets).

Gill nets, when they are ready to be fished, consist of webbing material suspended between a floating corkline and a weighted lead line. In some areas a polypropylene line, known as a weed line, is attached below the cork line to catch floating kelp and seaweed before they can foul the net. The recycling effort was focused on collecting only the nylon web material. Because the cork line and the lead line are expensive, they are almost always stripped off the unwanted old webbing to be attached to the new webbing. However, weed lines are generally not cut off when a net is ready to be discarded, as this line wears down with use and is inexpensive. This polypropylene is an unwanted contaminant for nylon recycling purposes. It has quite different physical properties than nylon (e.g., it melts at a much lower temperature), and it breaks down after prolonged exposure to sea conditions, making it unattractive for recycling.

Press articles, signs, and word of mouth were used to inform fishermen that all gear including weed lines were to be removed from the webbing before being left for recycling, and that the nets needed to be clean. Cutting a weed line off a net takes only a few minutes. Though there was no problem with fish or weed contamination and most of the fishermen responded to our pleas to remove the weed line, some nets with weed lines found their way to the collection areas. Before baling, the recycling center's staff removed any remaining lines (and in one case, after the shipment load of nets from Cordova arrived, three fishermen spent a day helping to complete the net stripping). However, this is costly, both in time and labor, and detracts from the material's potential value and the interest the recycler has in it.

The nets were baled using a commercial cardboard baler. Using this baler and its steel conveyor belt took a little practice, but it was not difficult once figured out. Because netting material tended to snag easily on the conveyor's fastening screws, the recycler determined that nets should be heaped in piles in the center of the belt and not allowed to hang over the sides. It was also important to keep an eye on the

hopper and not overload it because the cutting device at the top could not cut off too much net at once. The net material compressed very well. The finished bales measured 42" x 48" x 30" and weighed 1,100-1,500 lb, a good density.

Because the recycler's facilities were undergoing improvements, the bales were stored outside on unpaved ground. Therefore the nets that were shipped were slightly sandy and moist. Though there was no penalty applied on this shipment, it was important to keep the nets as clean and dry as possible with subsequent shipments. Bales of net were later set on a concrete floor and covered with tarps to keep them dry.

Of concern initially in the project was the information from net manufacturers that gill nets were made from two different types of nylon resin (known as nylon 6 and nylon 6,6). These resins are indistinguishable visually, but they have quite different melt points and chemical characteristics for reprocessing purposes. In order to solve this problem, Oregon State University's mechanical engineering department was contracted to develop and calibrate a device that could be used for quick field testing of the nylon nets to separate them by resin type (it is set above the melt point for one type of resin, but below the other). Net fibers are placed in the heat gun slot for 15-20 seconds. If the net is nylon 6, the fibers will break apart or separate; they won't if they are nylon 6,6.

Two different systems for using the heat gun were considered--one that would test, separate, and label the nets on site before shipment to the recycler, or alternatively the recycler would do the separating before the nets were baled. In testing the device and verifying the results with test samples provided to the Polymer Processing Institute, it was found that all monofilament nylon gill nets used on the West Coast are made from the nylon 6 resin, though a small percentage of the twine used to "hang" the nets (put on the cork lines, lead lines, and weed lines) is nylon 6,6. Seine nets on the other hand were found to be made of the nylon 6,6 resin. In the future, the heat gun will be used periodically to randomly test nets to assure that nylon 6 remains the resin of choice for gill net manufacturers. Nylon 6,6 is significantly more expensive and it is likely to remain so.

As this project ended, new markets for the seine netting emerged, and the recycler decided that they would also accept and bale these nets. Because seine nets look significantly different from gill nets, there is no problem in collecting these nets together, as long as they are baled separately. Information will be provided to the fishermen to let them know that seine net web is also being accepted and that all gear must be removed. New signs will also be designed for posting on the containers, noting that the container is for recycling both gill and seine net web.

Fishermen Awareness and Community Support

Methods used to make fishermen aware of the program were passive in the Washington ports and more active in Cordova.

In the Washington ports, awareness of the program by fishermen resulted mostly from the prominent location of the collection containers with their posted signs. Additionally, notices were posted in the port offices and in the supply stores where new nets were sold. Letters and notices for posting were also mailed to Washington-based fish processing companies with operations throughout Alaska. The letters asked the company to let their tender operators and fishermen know of the net recycling program and the location and availability of the recycling containers for their used nets. Occasional articles in the general press or fishing publications also served to increase awareness.

In Cordova, a small community of about 3,000 residents, awareness was raised through both active one-on-one conversations about the program and signage and press coverage. Fishermen and community awareness and involvement were heightened by one-on-one informal conversations begun during the exploratory phase of the program in late spring and early summer of 1991. Fishermen and net menders were asked about the quantity of nets available, their thoughts on the need for such a program, and how it could be set up. Managers of fish processing plants were asked about the amount of old nets they ended up having to deal with at season's end and if they would be willing to make net collection bins available at their docks. The City was queried about their experiences with nets at the landfill operation, the quantities being disposed of, and their willingness to support the project.

Once it was decided to implement a collection program, awareness and support were increased by asking for donations for materials from each of the hardware stores, printing articles in the newspaper, posting notices in the fish canneries and on town bulletin boards, and placing signs and bins at each of the docks.

Because of the number of people who had been asked for their comments, ideas, and support by members of the community, the net project was quickly perceived and referred to by the community as "our project", an attitude which fostered the support and cooperation we enjoyed.

Marketing Efforts

Methods used to find markets at first seemed to be straightforward, but later proved to be quite labor intensive. The first marketing work done was to track down the company recycling Berkeley monofilament fishing line--a company in Georgia known as

Hale Manufacturing. This company mixes nylon 6 with glass fibers to make gun stocks and pulleys for exercise machines. A contact there explained that they could not utilize nylon 6,6, and were not interested in the nets, but mentioned that once the nylon 6 nets were able to be separated to recontact them.

To find markets, the Directory of U.S. and Canadian Scrap Plastics Processors and Buyers published by Resource Recycling, Inc. of Portland, Oregon, was searched. The directory lists firms and the types of materials they deal with and the form in which the material would be accepted (e.g., whole, ground, shredded, or baled), and if they would accept materials which were either byproducts of other manufacturing or commercial operations or post-consumer materials (i.e., been through people's homes, such as milk jugs, margarine containers, etc.). A letter outlining the net materials that we had available was sent out to all companies indicating an interest in whole or baled nylon materials of post-commercial/post-consumer origin.

Though this letter indicated that the nets were mixed nylon 6 and nylon 6,6 and plastic buyer's were unfamiliar with the fishing industry and the nets used, about 15 responses were received. Those responding asked for samples and more details about the plastic's characteristic melt flow rate and other information. Information on flow rates was available through the characterization and testing done by the Polymer Processing Institute. After sending samples and information, no further interest or purchase offers were received. Even after it was found that the gill nets were solely of nylon 6 resin and a new letter sent out to nylon recyclers listed in the directory, little additional interest was generated.

After recontacting Hale Manufacturing with the information about the nylon 6 content of West Coast gill nets and discussing transportation costs and considerations, we were provided with the name of a West Coast nylon buyer that dealt with Pacific Rim markets (E.J. Wright and Associates of San Jose, California). Nets were purchased by the company and sent to a Taiwanese company which used them as a feedstock for producing bicycle seats.

Subsequent to this first successful marketing, two articles in plastic trade magazines and a contact provided by the Society for the Plastics Industry turned up other plastics brokers interested in purchasing future container loads and offering at least double the initial price received.

RESULTS AND DISCUSSION

Quantities and Sources of Nets

Just over 47,000 lb of nets were collected, baled, marketed, shipped, and reprocessed into bicycle seats as a result of this program. On-going collection programs are now in place in Anacortes, Bellingham, and Seattle, Washington, and in Cordova, Alaska.

Of the 35,000 lb of nets collected in Washington, the most came from the Bellingham area. A few tons came from the Anacortes area, and little from the Seattle area. In 1990, 14,000 lb were collected from Bellingham and Anacortes in the net recycling efforts. The 1990 collections were added to the 21,000 lb collected from these areas during the course of this project. Approximately 12,000 lb were collected in Cordova.

Container Location and Project Support

The 20 ft container in Bellingham proved to be a popular and convenient drop-off point and companies such as Redden Net, which sell new nets and supplies to fishermen, helped promote the program through word of mouth, and by posting of notices. The port staff were actively involved with the program through communication to fishermen and by their work at the container, which included using the ramrod device to assure the nets were well compacted into the containers and keeping the site clean. In Anacortes the program was not actively promoted and the bins not so prominently located or visible, though notices were posted in the harbor office and most of the local fishermen were aware of the recycling program. In Seattle, the program was too newly established when many of the tender vessels returned from Alaska's Bristol Bay and Southeast Alaska fisheries to have allowed for the coordination of their hauling of fishermen's unwanted nets for recycling. Therefore the container collected nets and net scraps primarily from Seattle-based fishermen. It was prominently and conveniently placed in the net repair area adjacent to the port offices and docks. We expect this location to be an effective drop-off spot for nets from other sites in Alaska.

Thanks to the enthusiastic and well thought-out local coordination efforts in Cordova, the net recycling effort received an outpouring of fishermen, city, and community support. It became, in the words of the net recycling coordinator, "a golden project." This support was evidenced by generous donations of services, materials, and volunteer time, the collection of 12,000 lb of used net in less than 5 months' time, with absolutely no net being disposed of in the trash bins once

the program was set up. Even more telling was the fact that no garbage was put into the open net recycling containers even when the adjacent trash dumpsters were overflowing. Additionally this program generated much community pride. Usually, school coloring contests receive a marginal student response--however, a picture showing gill net fishermen at work, with a net recycling bin pictured front center, was colored and entered by most all students in grades one through four.

Because the Cordova net collection program has various collection sites and depends on volunteer labor to consolidate nets, it is likely to be more vulnerable to disruption should grant funding end. Trying to assure continuity of the program was a major goal throughout the program. To this end, the recycling coordinator has worked to streamline this program. The bins are now lined with net bags, so that the fishermen themselves can stuff the nets into the bags, and emptying the totes simply requires a few people lifting the net bag onto a truck and taking it out to the central collection site. Also the coordinator has been working to get City or port cooperation to regularly empty the recycling bins that are in the harbor and to get the fish canneries to keep their recycling bins emptied by bringing the nets to the collection area. So far the plan has been unsuccessful; however, the president of the local fishermen's union is working to get fishermen to "Adopt a Tote"--taking charge of keeping one of the bins emptied and in place. Currently, most bins have been adopted.

Down the line, it is hoped that used nets will be seen by the City as a valuable commodity and that they will realize the benefit of baling, storing, and marketing the nets themselves (see below). If this becomes the case, net pick-up will likely become a routine part of the City's waste handling tasks such as cardboard collection.

Net Reprocessing

The container of nets collected and baled by Skagit River Steel & Recycling in Burlington, Washington, was marketed to the plastic broker E.J. Wright and Associates of San Jose, California, and its affiliate company in Hong Kong, which sold the nets to a small factory near Kioshiung, Taiwan. This company uses nets as a feedstock for producing bicycle seats. This factory also recycles nets from Japanese and Soviet fishing operations, using 80,000-100,000 lb/month. The factory reports that they have been recycling Japanese nets for about 15 years.

Nets are dried in the sun if necessary. They are then chopped and melted down. Black dye is added to the nets as they melt. The molten material is then placed into extrusion molds to form bicycle seats. Apparently another nearby factory can also

use the net materials to make black umbrella handles and other umbrella parts.

Other secondary products that can potentially be made from recycled nets include office chair wheels, phone casings, combs, brushes, zippers, carpets, exercise machine pulleys, and gun stocks.

Economic Feasibility of Net Recycling

Feasibility--From the Recycler's Perspective

The container of nets was sold at \$.06/lb from the docks in Seattle (i.e., the container had to be trucked from Burlington, Washington to Seattle, Washington), resulting in income of about \$.055/lb to the recycler or about \$2,585. Costs to the recycler for trucking, baling, postage for sending out samples, phone expenses, and supplies such as gloves and knives to cut line off nets, totalled \$2,500. Therefore, at the market price received, net recycling would not be profitable as an unsubsidized commodity unless labor and transport costs could be minimized. Such steps as maximum compaction of the nets in the 20 ft shipping containers in Bellingham and Seattle, placement of a 20 ft container in Anacortes, getting the fishermen or net recycling volunteers to remove weed line and persuading the City of Cordova to bale the nets before shipping, might make the project more lucrative.

Subsequent to the first shipment, other plastic brokers have become interested in the material and have offered higher prices (in the range of \$0.12- \$0.14/lb) and even a contract. At this price (which still appears as if it could rise higher), nylon gill net recycling appears to be attractive to the recycler.

In February 1992, a container load of about 12,000 lb of compacted nets was retrieved from Bellingham. The nets were subsequently baled. These nets had little weed line on them and were generally clean. Costs to the recycler totaled \$115.00 for trucking and about \$400.00 for labor, or about \$.043/lb. Assuming a price of about \$.12/lb, profit would be at about \$.077/lb, if quality remains high. This is a good profit in an industry accustomed to a few cents per pound profit on other plastic commodities.

Sea Land, Inc. shipped Cordova's first load of unbaled nets to their docks in Tacoma, Washington, at cost (\$750). The container then was trucked to the recycler in Burlington, Washington, at a cost of about \$250 for a total transportation cost of about \$1,000. If the nets were cleaned of line before shipping, labor costs for baling the 12,000 lb of nets would run about \$400. At \$.12/lb, 12,000 lbs of nets are worth \$1,440.

Therefore the recycler would only break-even under that scenario and net recycling would not be economical unless the City of

Cordova was paying for the transport costs or "piggybacking" other valuable recyclables in the same container.

Feasibility--From the Community Perspective

When thinking about economics from the community's point of view, one needs to think about avoided costs. Recycling can be cost-effective if one thinks about the benefits of extending the life of an existing landfill and delaying the need to site a new one. However, many communities, though acknowledging these realities, still are adverse to spending money for recycling. Only short-term deferred or avoided costs tend to be reflected in city priorities and line item budget approvals.

In places such as Bellingham, Seattle, and Anacortes, garbage disposal costs are charged by volume, with rates in the \$50-70/cubic yard range (soon rising to about \$90/cubic yard), thus making recycling attractive. Where recycling is free, or offered at a much reduced rate, incentives are built into the system. The net recycling program offered the ports a simple and relatively labor-free means of keeping bulky nets out of the dumpsters and off the port's trash bill. Given the high container weight achieved in Bellingham using the ramrod device and the usually clean nets received from that site, it is unlikely that the port would be charged for container pick-ups and it's conceivable, depending on the market, that the port could even be paid a penny or two per pound for the materials, helping to offset the port's labor costs and encouraging them to maintain high compaction and quality. At \$.01/lb, the port would receive \$120.00 for filling the container with 12,000 lb of nets.

Unfortunately, from the standpoint of promoting recycling, most communities in Alaska do not charge specifically for garbage disposal. In many communities, there is no charge for garbage pick-up from homes and businesses, nor are residents charged for disposal at the city dump (these costs are recovered from the city's tax base). In these communities, it is more difficult to get people to recycle (at least those who might recycle if there were an economic incentive) and more difficult to make clear to the city decision makers that recycling saves money, especially when all that city council members can see is that they need to find \$1,000 in their budget for paying to send a container of recyclables south. When this is the case, making net recycling's viability means assuring little or no out-of-pocket expenses to the city. This can be achieved by increasing the efficiency of the shipping efforts--that is, increasing the weight (and value) of nets that fit in the container by baling and/or adding other commodities (such as bales of aluminum cans or barrels full of copper pipe or other scrap metal) to the container to make it

more valuable. (Cordova has a baler they now use to consolidate garbage, cardboard, and aluminum.) These options are being explored.

The best financial option for Cordova, if they can find the storage space, is to bale and store the nets, until they can fill a shipping container and have it shipped directly to markets without having to first send it to Washington. This would likely make net recycling a revenue generator, despite the increased labor needed for baling, as long as quality control was maintained. It is estimated that about 500 nets weighing an average of 70 lb each, or a total of 35,000 lb, are discarded each year in Cordova. Therefore baled nets would need to be stored over a year (to get at least 40,000 lb). Because space at the bale site is at a premium, Cordova is looking into purchasing a used shipping container so that baled nets could be kept clean and dry and out of the way.

Media Attention

Articles and information about Cordova's successful community collection effort appeared not only in the local paper but were picked up by other Alaska-based media. A writer from National Geographic Magazine, having seen the article in Alaska Magazine, contacted the project for more information. However, to date, no action has been taken. A press release stating that the nets were being made into bicycle seats was picked up by various papers and trade journals.

SUMMARY

This net recycling project set up a system for the collection and transport of used nylon gill net from one Alaskan and three Washington fishing communities to a central location for baling and storing the nets until a container load could be gathered. The program resulted in the marketing and shipment of 47,000 lb of nets to a small factory in Taiwan where the nets were melted down and formed into bicycle seats.

At current market conditions, gill net recycling appears to be economically self-sustainable for the ports of Seattle, Anacortes, and Bellingham, Washington. It is uncertain if the ports can get paid for the materials at these prices, but they will not have to pay to get rid of the materials either. In Cordova, Alaska, because shipping costs are high, the current collection and shipment system will require the City to pay some transport costs to have the nets recycled. However, by baling the nets in Cordova, net recycling could be accomplished with no cost outlay and could become a revenue generator through direct marketing.

The success of net recycling in other communities will depend on the quantities of old net available, their value and proximity to markets, and the ability to streamline and simplify the collection and handling systems.

Interested parties should contact the author at 503-765-2229 for further information/details.

APPENDIX I

THOUGHTS FROM CORDOVA NET RECYCLING COORDINATOR
Prepared by Linden O'Toole, November 1991

We learned as we went along here in Cordova, since we were the first community to implement a recycling program in Alaska. Some things worked wonderfully, others didn't.

Early on in the process, we held a brainstorming meeting and thought up a lot of possible ways to do things. This was a good way to get started. Some of the ideas had to be modified as we learned more, but it really got the project moving to have the meeting and come up with a list of what to DO next.

Another thing that had to be done immediately was to designate a central collection site where we could collect and store the web. I met with the Cordova City Manager, Harbor Master, and Public Works Administrator. They all thought that recycling web was a wonderful idea, and within two days the city planner accompanied me to walk the perimeter of a city-owned industrial lot which the City designated for our use free of charge. In dealing with the city, it was helpful to discuss the effects of discarded web on the city's baler and landfill equipment (it breaks them).

Once a main collection site has been obtained, I suggest that people get some tarps to put on the ground under the web. We failed to do this at first, and collected a lot of rocks and sticks along with the web. We had one large tarp donated by the local hardware store, and purchased a second from them at a discount. The collection area may also need to have signs to designate "Gillnet", "Seine", "Lines", etc. Since there are no buildings at our collection site, we are making signs out of discounted plywood on donated two by fours painted with donated paint and stood up in a donated 5-gallon "kelp" bucket filled with cement donated by the construction company (leftovers). We tried not to ask for too much from one business, and every single item that we requested for a discount or donation was granted. It is important to publicly acknowledge and thank those who donate materials and services. Since our program began before the grants came through, we also relied entirely on volunteer efforts. Even when the grant money is there to pay for the coordinator's time, there are plenty of people in the community willing to help out.

Next in our program, I went back to meet with city officials about the possibility of collecting the web at convenient locations and taking it to the main collection area. The Public Works Administrator felt too stretched to help with this, but I was able to get the Harbor Master to agree to have his staff place empty recycling totes at the tops of the five ramps leading

down to the harbor's docks. Through canneries and friends of the recycling "committee", we were donated about ten old fish totes (approximately 5' x 5' x 2'). We placed these at the heads of the ramps next to the dumpsters also located there. The totes were labeled with the large "Recycle Gillnet--Clean Web Only" signs. A wonderful way we found to mount these was to use a band saw to cut up "tote liners" to use as sign backing. We were given a couple of these "tote liners" at one of the processing plants. They are white plastic sheets about 1/4" thick that are 5' x 5' (intended to be placed in the bottom of the fish totes). We then used a drill to secure the signs to a 4 ft length of 2" x 4" post and screwed the post to the outside of the tote. This put the sign up near eye level.

Emptying the web from these totes turned out to be a challenge. They are too heavy to lift by hand, and because we had cracked, old totes, the web stuck into the cracks. The city did not want to "handle" the web so much, so they bought 45 gill net bags to place inside the totes. These bags were well labeled (by us) with large recycling symbols. The stencil was cut out of the plastic tote liner, and we used about 7 cans of spray paint. Our bags have two sides painted in fluorescent orange and pink. I would perhaps recommend the color red, as the fluorescent colors are actually not very visible in photographs or at a distance. We felt that it would be important to label the bags well so that fishermen wouldn't be tempted to remove them from the collection totes. We have not yet used the net bags in the totes. They were purchased after the 1991 fishing season, and were used to transport the web down to Burlington, WA. They will be returned to us after the recycler removes the web down there for baling. Hopefully, the fishermen will be able to deposit their web directly into the net bags in the totes at the top of the ramps at the harbor, and the City will simply take the bags to the main collection site to await shipment via van to Burlington.

Another idea that came up was to label dumpsters in the harbor (and around town) that commonly receive web with small stickers that say "Don't Put Web Here--Please Recycle It."

I met with the manager and yard boss of each of the four fish processing plants in Cordova, as well as managers of net companies and other facilities where net work is done in Cordova. I explained our programs, and obtained cooperation from each one. At each facility, collection totes were labeled, and each fish processor agreed to transport the web to the main collection site. They didn't actually follow through with this agreement very well...we ended up emptying the web ourselves. At least they collected it, though. Maybe next year I will be more persistent in getting them to bring the web to the site. There will be more web next year, because the program will be in place

for the entire pre-season and all of the fishing season, rather than the late start we got last year.

Once the collection system is in place, it is important to let people know about the program. We put fliers up all over town...at all the canneries, net loft, stores, the post office, fisherman's union, etc. It explained where to take the web (encourage people to take it to the MAIN collection area), and how to prepare it (i.e., strip off the lines). It also had my name and phone number for people to be able to ask further questions or volunteer to help. For further outreach, I contacted the newspapers, and did radio interviews. I met with the high school ecology club to get them involved, and also got the cooperation of the local fishermen's union (Cordova District Fishermen United, CDFU).

We ended up with a few lines (leadlines and corklines) in our pile, which I feel is okay. I think it is important to emphasize that people should REUSE materials at the collection sites as well as recycle them. I had a couple of people call me to see if they could piece together a subsistence net--I said YES!

In Cordova we had a community work day for volunteers to come down and stuff the web in the pile into net bags. It was really fun and productive, and gave us another chance to educate the community about the project with media coverage. The story was picked up by several state-wide publications (Anchorage Daily News, Alaska Commercial Fisherman, Alaska Magazine, etc.). This helps to get people in other fishing villages inspired to start recycling web, and builds support for the program state-wide.

As far as other recyclables, the net project was great in Cordova. Working closely with the city government enabled us to coordinate the shipment of baled cardboard and aluminum and old appliances to the recycling center in Burlington. We obtained a reduced rate for a Sea Land van to barge the web down (at a price approximately equal to their cost). Then, they agreed to allow the city to fill a second van with their recyclables to go to the same destination at the same price. In fact, we got the City to agree to pay for shipping the web with the extra proceeds from its baled aluminum.. The City also helped us tremendously by providing a 5-person crew with flatbed truck, and two forklifts to go around town and collect all the web bags at remote sites (like the harbor and canneries). They moved these bags and the bags at the main collection site over to the facility where the van was loaded. A local business donated the time and equipment to actually load the bags of web into the van.

One idea that we hope to implement here next year is to place aluminum can recycling barrels next to the web totes and garbage dumpsters at the top of the harbor ramps. We have had some cans in our totes... no doubt because an enthusiastic

recycler didn't want to put it into the dumpster. We have such a barrel downtown--it is a 55-gallon drum with a flat removable lid which has only a 6" round hole cut in the center. The barrel is well labeled "aluminum only."

The net recycling project in Cordova has been amazingly well-received by all segments of our community. Everyone seems to be enthusiastic about it. It has been both rewarding, and FUN to work on this "golden project".

VOLUNTEERS IN THE CORDOVA NET RECYCLING PROJECT
Prepared by Linden O'Toole, December 1991

The net recycling project in Cordova began with volunteer efforts. I was a volunteer, and donated my time because I was so enthusiastic about the idea of recycling the nets. Our group was small at first--there were only three of us at our first meeting. At this meeting, we brainstormed on how to set the program into motion, and came up with lists of tasks which needed to be accomplished.

In talking to friends and acquaintances about the project, a few people offered to help out, and I followed through by asking for their assistance when I had specific things to be done. A good idea would be to keep a "volunteer list" with names and phone numbers of people who agree to be "on call" when help is needed.

A good way to ease into the project would be to invite people to a meeting. This meeting could be advertised with flyers put up in appropriate places, and/or an announcement in the newspaper or even a public service announcement on the local radio station. One part of the meeting could be to brainstorm tasks and solicit volunteers to be in charge of and/or work on each one. The meeting would also be a great place to get the volunteers to sign up on the "on call" list.

At the end of our fishing season in Cordova, we had a "community workday" for the net recycling project. We advertised in the paper and with flyers and on the T.V. scanner (provides information on local happenings). A wonderful group of enthusiastic helpers showed up, and we had a fun and productive afternoon of filling net bags with web.

Other resources in the community are the various "clubs" which are already organized, and may be looking for "good deed" projects to participate in. We worked with the high school ecology club. Other possibilities would be the scouts, athletic teams, bands, even adult clubs such as the Elks or Moose. We

also received support from the fishermen's union, and the Sea Grant Marine Advisory Program.

It has been my experience that fishing net recycling is such a popular concept that many people are willing to support it by volunteering a little time and energy to help make it possible.

APPENDIX II

POINTS TO CONSIDER ON STARTING A NET RECYCLING PROGRAM

Though fishing communities and their ports vary and logistical support needs will differ somewhat, answering the following questions will help to decide if a net recycling project is viable and how it might be set up and operated. The Cordova Net Recycling Coordinator's report contained in Appendix I will provide additional insight.

Questions to Ask About Net Use, Composition and Turnover
(Ask fishermen, fishing groups, net sellers and menders, and Sea Grant Marine Advisors)

What kind of nets are used in the area?
 How many fishermen use each type of net?
 What is the webbing made of?
 Is an entire net often thrown out, or are worn-out pieces replaced in parts?
 How much is thrown out (by weight) generally and how often? (The amount of new webbing sold may give some indication of turn-over)
 What other gear is on the net and is this gear usually all removed when the nets are ready to be thrown away?
 If the gear isn't removed is it difficult and does it take a long time to remove it?
 What is the gear made of and does it have any value? (For example gill net floats cost \$1.00 each new, and \$0.60 used.)
 Where are nets generally disposed of?
 Are there piles of old nets anywhere (in gear lockers?)
 Are old nets used by fishermen and residents for other purposes? That is do people use nets for decoration, playing fields, gardens, erosion control etc.?

Consider:

Unless you can find a nearby plastics manufacturer (an end user), your area will likely need to generate at minimum, 40,000 lb of net material before marketing becomes viable (this much material is needed to fill a container van for efficient shipping).

Alternatively, an interested recycler could consolidate net materials from a broader region if the net materials were valuable enough in themselves (nylon) to make transport worthwhile, or if these nets could be "piggybacked" with other valuable commodities such as aluminum or scrap metal that the

recycler is interested in so that transport costs to the port could be avoided.

If the amount of used nets generated is not large enough to warrant recycling, then consider a collection and re-use program, which makes nets available to the public. Nets will find a longer useful life, and the program will generate a very positive relationship and interaction between fishermen, the port, and the public. This collection program can be as simple as a bin with a prominent sign saying, "Free Net." Though word will likely spread by word of mouth, the port or fishing group can also type up a short public service announcement about the availability of the nets and the specific location of the bin and periodically provide it to local radio stations and the newspapers.

Questions to Ask About Garbage and Recycling Services
(Ask municipal waste handlers, local recyclers, the state's solid waste division, and trucking/shipping companies):

What materials are now collected or accepted for recycling in the area?

Who does the recycling, where are they located, and what equipment do they have on hand to densify or process the materials (i.e., is there a baler, chopper, shredder, pelletizer, etc.)?

Would the shredding or pelletizing equipment be able to handle this fibrous net material? (High-density polyethylene net material is typical fiber grade or film-grade material.)

Is any plastic product now being recycled? What secondary product is this material made into and where is this processing done?

What is the going rate per pound for a container load of the type of plastic your nets are made of? (Plastics News reports the value of recycled plastics on a weekly basis)

Would materials likely be trucked or shipped to markets? If they were to be shipped, where would they likely be shipped from and how far is that from you?

How much does it cost to dispose of a cubic yard of garbage?

How is garbage disposed of now? (Landfill, balefill, incinerator)

Do nets cause any unusual disposal problems?

Consider:

Is the net material a valuable commodity or one that is presently being recycled in the area?

Would the available machinery be able to densify the nets?

Is net recycling, even if one needed to pay some collection or transport fees, attractive compared to waste disposal costs?

Could collection and recycling of other commodities at the port (e.g., aluminum cans, scrap metal, cardboard), help generate revenue for net recycling or reduce costs so that "extra" money

is available to pay some transport costs for nets and other recyclables?

Questions Regarding Net Collection Logistics
(Ask fishermen, fish processing companies, port officials, Sea Grant Marine Advisors)

Is (are) there a central location(s) where fishermen work on their nets? Who owns or manages the property?

If a collection container were provided would fishermen be likely to use it?

If gear isn't normally removed from the nets, is the gear valuable to the recycler or able to be left attached? If not, would fishermen cooperate in removing their gear or who would be likely to do so?

Who would promote the program among the fishermen? How would it be promoted? Who will make and post notices and signs?

Would the property owner allow a collection container to be set out?

Who will empty the container when it is full? Is the bin large enough so that frequent servicing is not necessary? How would the nets be removed from the container? Where will they be brought to? How will they be handled, where will they be stored, what will happen to them?

Consider:

Once the program is set up is it likely to continue? How complicated is the system? Does it require frequent attention? Is it dependent on volunteers? Is the volunteer organization a well organized, experienced one and is their motivation for involvement strong (i.e., is there a public relations, financial, or strong environmental benefit?) What will happen if there is personnel turnover? How dependable is the recycler? Is there a commitment to a long-term relationship with the port and fishermen, despite fluctuations in market price?

APPENDIX III

PROJECT EXPENDITURES

Funding for the project came from a National Marine Fisheries Service Saltonstall-Kennedy grant of \$23,000 and from \$4,500 provided by the DuPont Company Fiber Division. The costs presented here are approximate:

PROJECT MANAGEMENT	\$10,450
TELEPHONE	\$ 550
SIGNAGE	\$ 1,000
CONTRACT WORK*	\$ 8,600
COLLECTION CONTAINERS	\$ 1,300
TRAVEL	\$ 1,500
ADMINISTRATIVE SERVICES	\$ 3,450
OTHER**	\$ 650

	\$27,500

* CONTRACT LABOR includes:

Cordova net recycling system set-up and coordination;
 Recycler's services to haul containers from Bellingham and
 Anacortes, preparing and baling nets, and arranging shipping;
 Design of heat gun for net separation;
 Net characterization work done by the Polymer Processing
 Institute.

** OTHER includes:

Fishing show participation
 Postage and supplies

APPENDIX IV

CONTACT LIST FOR RECYCLING COORDINATORS AND PORTS

Fran Recht

P.O. Box 221, Depoe Bay, OR 97341
(503) 765-2229

Steve Hendrickson

Skagit River Steel & Recycling
P.O. Box 376, Burlington, WA 98233
(206) 757-6096

Leah Gray

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Kerry Beebe

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Ed Wackerman

P.O. Box 1203, Haines, AK 99827
(907) 766-2840

Laurie Schellenberger

P.O. Box 408, Anacortes, WA 98221
(206) 293-4273

Kayrene Gilbertson

206 E. Sunnyside Road, Cathlamet, WA 98612
(206) 849-4421

George Keeney

City of King Cove
P.O. Box 37, King Cove, AK 99612
(907) 497-2298

Peter Branson
P.O. Box 2073, Wrangell, AK 99929
(907) 874-3645

Jayne Sontag
P.O. Box 2353, Valdez, AK 99686
(907) 835-3775

CONTAINER LOCATIONS

Ross Perry or Greg Money
Fishermen's Terminal, Seattle, WA
(206) 728-3395

Marc Bishop or Don Baker
Squalicum Harbor, Bellingham, WA
(206) 676-2500

Dale Fowler or Whitney Haag
Cap' Sante Marina, Anacortes, WA
(206) 293-0694