Department of Environmental Conservation
Division of Environmental Health
Tsunami Marine Debris Status Report for Calendar Year 2012
Prepared February 2013

Background

Marine debris has impacted otherwise pristine beaches in Alaska for decades. Non- profit organizations such as Gulf of Alaska Keeper (GoAK), Island Charters, Island Trails Network, Sitka Sound Science Center, the Center for Alaskan Coastal Studies, and others have used federal funding, volunteers and other resources to clean up debris from a number of Alaska beaches including various locations of Southeast Alaska, along the outer coast of the Kenai Peninsula and Kodiak Island, and numerous islands in Prince William Sound.

Comparisons between the amounts of marine debris found on these beaches before and after the March 2011 Tohoku earthquake and tsunami are evidence of an estimated ten-fold increase in the amount of marine debris. The nature of this additional debris is consistent with it having originated from the tsunami. Immediately after the tsunami, debris was concentrated in large fields and rafts of mixed debris. These concentrations were large enough to be seen in low-resolution satellite imagery. However, by mid-April 2011, the debris had dispersed to the point that it could no longer be detected by the sensors available. After April 2011, the debris was dispersed throughout the North Pacific Ocean and as early a December 2011, tsunami-generated marine debris began arriving on Alaska's coastline, as it continues to do, and is expected to continue for several years to come.

In July 2012, Governor of Alaska Sean Parnell issued Administrative Order No. 263, tasking a group of his cabinet members with coordinating Alaska's response to this growing concern. This effort is led by the Alaska Department of Environmental Conservation (ADEC).

The scale and size of Alaska's shorelines made a specific estimate of the quantity of tsunami-generated marine debris or "normal" marine debris impossible, but it was clear that tsunami-generated marine debris had become a component of marine debris on beaches in Alaska. In response to the need to determine the debris density and composition, the ADEC funded an aerial survey, targeted to collect consistent imagery and data in the Gulf of Alaska region. Airborne Technologies, Inc (ATI), a Wasilla-based survey company with extensive experience surveying marine debris, executed the survey, and conducted the post processing, using a protocol previously developed by ATI specifically for aerial shoreline marine debris surveys in Alaska. The original survey area was targeted to cover the outer coast shoreline from Dixon Entrance in Southeast Alaska as far as Cold Bay on the Alaska Peninsula, including the Gulf of Alaska facing side of the Kodiak archipelago. However, weather conditions limited survey operations and forced reallocation, shifting the survey area to end at Hallo Bay. The result of the survey was over 8,000 individual high resolution still photographs, each geo-referenced to the point in space and time where the image was taken. Each image was reviewed by the same analyst, who assigned the image specific keywords from a set vocabulary, as well as a qualitative debris rating. Images ranged from a rating of 0 for no debris sighted, to a 5 for the heaviest debris density.

Concurrently, NOAA and other groups were conducting shoreline monitoring, recording debris densities and composition using consistent protocols in order to measure changes in debris trends both

geographically and over time. Preliminary results at locations where baseline data existed for comparison demonstrated a marked increase in the density of high-floating debris, including plastics and Styrofoam. Taken together, the shoreline monitoring and the aerial survey data shows that there are significantly greater amounts of marine debris on the shorelines within the Gulf of Alaska, which includes debris generated by the Japan tsunami.

Observations of the Amount, Location and Composition of Tsunami-Generated Marine Debris **in Alaska:**

The ATI aerial survey and GoAK field reports show a significant increase in the volume of the marine debris on the outer coasts of the Kenai Peninsula and islands in Prince William Sound in 2012. This debris includes a large volume of high windage items (more exposed to winds along the surface of the ocean) including buoys, floats, Styrofoam and urethane products, and smaller household items.

Evidence that significant portions of this marine debris may have originated with the March 2011 tsunami includes the presence of:

- Oyster buoys that have been identified as being used extensively in the coastal areas of Japan, and which have not been observed on beaches in Alaska before 2012, at least in any significant number;
- Rigid urethane insulation that is typically used for insulation and sound-deadening purposes in construction in Japan, and which was not prevalent on Alaska beaches before 2012;
- Numerous objects commonly used by households in Japan (a few small household freezers and refrigerators and numerous smaller items such as bottles, jugs and other plastic items), again in greater quantities and variety than observed on Alaska beaches in the past; and
- Numerous pieces of white Styrofoam, which in large part may be from the breakdown of the oyster buoys described above, as well as from warehouses in Japan.

The survey and field reports also show that this same type of marine debris continues to arrive on Alaska's coast. This is evidenced by formation of new debris "lines" in many areas along the coast. As lines of debris get pushed by wind and surges further up the beach, new debris lines form in the lower surf zone. The survey and reports show many instances of debris being carried by water and wind into upland areas, including instances of Styrofoam and oyster buoys as far as one-quarter to one-half mile inland (or more).

The southern boundary of Prince William Sound (PWS) contains a number of islands. The outer coasts of several of these islands (notably Montague, Hinchinbrook and Kayak Islands) have "collector beaches" oriented towards the Gulf of Alaska so that they tend to collect more of the marine debris than other beaches. Historically, very little of marine debris has made it around these islands and into Prince William Sound. However, observations this summer show tsunami-generated marine debris is now making its way between Montague and Hinchinbrook Islands and into the Sound.

Tsunami-generated marine debris has washed ashore in Alaska since December 2011, far sooner than the early modeling efforts indicated. Models by both NOAA and the Government of Japan indicate that tsunami-generated marine debris will continue to reach Alaskan shores throughout the next several years.

Estimations in the Increase of the Amount of Tsunami-Generated Marine Debris at Specific Locations:

GoAK is in its sixth season of gathering marine debris accumulation data from monitoring plots in PWS, and at Gore Point at the southwesterly tip of the Kenai Peninsula. The data included in the attached charts is from two monitoring sites on Gore Point and two from PWS.

Non-beverage bottles, beverage bottles, hard plastic fishing floats (including the large plastic oyster farm floats), buckets and plastic drums were the high-windage objects selected for this comparison. Non-beverage bottles include a sub-set of "cleansers" including shampoos, dish soaps, detergents, bleach and other such items. Also included in non-beverage bottles but not listed separately are things such as condiment bottles and other plastic bottles.

The beverage bottle category is further broken into Western Pacific (bottles with Asia-Pacific labels), Eastern Pacific (bottles with English labels), and unidentified (bottles with no labels or identifying marks). Because of their unfamiliar shapes, it is suspected that most of the unidentified bottles are Western Pacific, but that determination hasn't been completed.

The Plastic Drum category includes 5-gallon Japanese fuel drums and other 5-gallon size drums used for everything from water to chemicals.

The category of debris titled "combined rope and line fragments", was selected as a control because that debris type has minimal windage, is transported mainly by current, and thus unlikely to have originated from the Japanese tsunami. As expected, the amount of line and rope fragments was essentially unchanged from 2011 to 2012, but each of the other categories of marine debris increased substantially.

Concerns Relating to Tsunami Marine Debris:

There is no current forecast of the total amount of tsunami-generated marine debris that may ultimately impact Alaska beaches or any definitive list of the types of marine debris that will arrive. We do know the general composition of what was swept away from Japan's towns and mariculture areas, and the debris we are seeing now is consistent with those items. It is not possible at this time to say what all of the risks are associated with this marine debris.

Current concerns include: potential toxicity of components of the marine debris; the breaking up and disbursement of marine debris, potential impacts of the smaller pieces of Styrofoam and urethane on marine and terrestrial life; smothering of sensitive areas by the debris; ability of local landfills to accept large quantities of marine debris; risks to clean up crews and "beachcombers" posed by remoteness of beaches, weather, sea conditions and wildlife; and the risk of potential large floating debris items to navigation.

Marine Debris Cleanup General Considerations:

Each cleanup project has its own specific physical conditions and parameters. Cleanup areas can vary in distance from the nearest port. Some other considerations include:

- whether or not sites can be accessed by road
- whether beaches are amenable to the use of support vehicles
- whether beaches can be accessed by boats safely and efficiently or if helicopter or airplane access is necessary
- whether debris can be removed by landing craft or if helicopter support will be necessary
- whether nearby shelter is available for cleanup support vessels
- whether crew should be housed on boats or on temporary camps on beaches
- whether disposal sites are readily available or will the debris need to be shipped long distance
- whether there are species of concern or critical habitat issue that must be addressed

Beaches have individually distinct topography that can strongly influence cleanup efforts. Beach gradient and length are important factors. Do they have gentle or steep beaches? Do they have long uninterrupted stretches that crews can easily walk or is the coast punctuated by pocket beaches interrupted by steep rocky impassable headlands that require cleanup workers to be transported around by vessel?

If beaches are fronted by reef and rocks, landing on them will be difficult and dangerous. Some beaches are susceptible to nearly continuous surf and often rip tides, both of which make beach landing precarious. Beach structure, such as whether the beach is sandy or boulder covered, has a large impact on cleanup effort. Beach holding structure such as boulders, drift logs, brush and heavy grass also impact cleanup effort. Beaches with large log jams and boulder fields can be exceedingly difficult and dangerous to work on. Some beaches are essentially barrier dunes with estuaries and lakes immediately behind them that tend to catch large quantities of marine debris. Those wetland areas are difficult and expensive to clean, plus they may pose cleanup permit problems.

Some beaches are heavily influenced by prevailing winds and tides. On high-energy beaches, debris is likely to buried or entwined in logs and brush. Low-gradient beaches exposed to Gulf of Alaska storms may have debris scattered up to a half a mile inland depending on the type of growth immediately behind the beach. Forests will capture the debris closer to the beach, but grass covered or tundra inlands may allow the debris to blow far inland.

The amount and composition of debris varies remarkably beach to beach. Debris can range from large derelict vessels to the tiniest piece of crushed plastic to hazardous chemicals. Non-indigenous (invasive) species may be associated with marine debris. Lines and nets can be intertwined in logs and boulders, or buried deeply in beach substrate. Large items may be too heavy and costly to remove. Hazardous chemicals will need to be removed by trained remediation personnel. Some items such as crushed Styrofoam and other plastic will likely be too small to efficiently remove.

Human aspects of cleanups include consideration of the ownership of the proposed cleanup area, whether qualified cleanup workers are available, concerns about safely sheltering workers in the field on extended cleanup projects, workers compensation and other payroll considerations such as overtime and Davis Bacon payroll requirements (if hiring hourly wage crew instead of sub-contracting with individual operators), and the availability of cleanup equipment and funding to pay for cleanup work.

There is also the concern about the presence of bears and other dangerous terrestrial animals in some areas. Evidence of bear presence is commonly seen.

Landfills in Kodiak and other places are already refusing to take tsunami marine debris. Concerns include the landfill's ability (or willingness) to accept solid waste from outside the area authorized by utility regulators. Some communities have also expressed concerns about accommodating the volume of tsunami generated marine debris in the limited space of their landfills. Barging marine debris to Washington state is a possibility, but more expensive. A workgroup is looking into disposal methods, including Styrofoam densifiers to reduce the volume, making disposal or re-use easier.

Weather is the single biggest uncontrollable variable. Bad weather can quickly prevent any work from occurring. Cleanup work can rapidly become dangerous when storms hit. Vessels are at risk underway and at anchor in the storms that are common in the Gulf of Alaska.

Recent Costs of Tsunami Marine Debris Cleanup:

Tsunami marine debris collection, storage and disposal will be a major expense as evidenced by costs experienced this summer. Daily costs for current marine debris cleanup efforts on Prince William Sound and Kenai Peninsula beaches have ranged between $6,500 and $7,500 for an eight-person crew and three vessels (medium-sized landing craft, crew quarters vessels, and smaller boat/skiff).

Helicopters are needed to sling loads from inaccessible locations inaccessible by boat at a cost of over $2,000 an hour. Ferry time (to and from the remote sites) must also be paid. Large landing crafts lease for $4,000-$6,000 a day, and require days to both load and unload, plus transportation time to and from the remote coastlines.

A 2012 Gore Point beach cleanup (East Beach is one-third mile long and North Beach is approximately 1.5 miles long), took 1,584 man hours, at a projected cost of $65,000-75,000.

Two 40-yard construction dumpsters were filled during the 2012 Gore Point cleanup, from just under two miles of total shoreline. The cost to transport and dispose of the contents of each 40-yard dumpster is over $1,000.

A project on the southwest end of Montague Island, originally planned for 12 days, was extended to 17 days due to difficulties with getting landing craft to the project (a 200 mile roundtrip from port), which required three additional runs to the site to continue consolidating and removing all collected debris. Approximately 14 miles of beach was cleaned, at a total cost of $110,000

In September 2012, approximately 25 miles of selected beaches were cleaned inside Prince William Sound, at a cost of $49,000. These beaches had been cleaned earlier in the spring, and were 'swept' for only high-windage tsunami-generated debris during the 10-day cleanup.

Just two locations, Kayak Island and Montague Island, known collector beaches, together measure over 90 linear miles of beach, and they are wider than the beaches at Gore Point. Alaska has hundreds of smaller beaches, equally inaccessible, and thousands of miles of coastline, all in similar condition.

In summary, removal of marine debris from Alaska's coastline is frequently/usually extremely cost-intensive based on the logistical challenges and high costs of mobilization, deployment, operations, debris removal, and debris disposal. The exact cost per any unit of cleanup (distance of ground, or weight of debris removed) is highly variable based on the shoreline to be cleaned, as well as the operational realities at the time of the cleanup (weather delays or other impacts, equipment malfunctions, accidents or medical emergencies, etc)

Planning and Prioritization Workshop:

The exact amount of resources that will be available for cleanup of tsunami or non-tsunami debris within the Gulf of Alaska region is still unknown as of the time of this writing (February 2013). This means that a coordinated prioritization effort is important in order to cooperatively determine the best method to allocate resources for debris removal activities.

In order to address these needs, NOAA and ADEC began working together to plan and facilitate a workshop to discuss and prioritize marine debris removal operations during the 2013 field season. The January 2013 workshop participants included land and living resource managers from Federal, State, and Native organizations, as well as NGO's active in the marine debris community.

The primary goals of the workshop were to:

- Prioritize shoreline areas for debris removal – Begin the process of comparatively prioritizing shoreline on a consensus basis, utilizing the information the marine debris community gathered about debris depositions during the 2012 field season combined with existing knowledge and input on debris impacts and the feasibility of cleanup operations. This prioritization was not intended to be prescriptive, but rather to provide a common foundation for decision making on debris cleanup actions that can be built off of or adjusted as more information becomes available and the situation changes.
- Outline the needs and next steps for HAZMAT, Invasive Species and large debris object reporting, handling and restriction protocols and processes.
- Identify data gaps and next steps to be taken by the group, as well as key stakeholders that should be engaged in the future.

In preparation for the workshop, NOAA worked with ADEC and ATI to translate the results of the aerial survey into an intuitive online display, showing the relative density of debris using color coded line segments. These were derived by creating an overall flight path from the locations of the individual photographs. This derived flight path was then divided into 5 mile segments, which were color-coded based on the average rating of photos within that segment. This information was uploaded into an online map display, and distributed to workshop attendees in advance of the workshop for orientation, review and comment.

In order to provide a common starting point for communication and discussion, the shoreline within the survey area was divided into a total of 44 individual segments, generally ranging from 35-70 air-miles in length. It was understood that the segments were too large for comprehensive action or detailed

comparison, and would need to be sub-prioritized for later action and active field operation planning. Rather, these were designed as a foundation for comparative prioritization and discussion.

In order to standardize and organize inputs on the relative priority of shoreline areas, an initial rubric was drafted, built around the shoreline segmentation. For each shoreline segment, the overall priority was designed to be defined by a combination of debris density, foreseeable impact and logistical feasibility.

- Density - The average rating of debris density was taken from the ADEC/ATI aerial survey, which ranged from 0.2 to 3.4 (on a 0 to 5 scale). This number was the average rating of all photos within the defined segments.
- Impact - Based on pre-workshop input from resource managers, the impact rating was divided into four sub-categories each to be rated based on a qualitative scale of 0-5 by resource management agencies with relevant jurisdiction for the segment under discussion. These segments are defined roughly below:

    1. Biological Impacts – Impacts to living species
    2. Habitat Impacts – Impacts to availability or function of habitat
    3. Socio-Economic Impacts – Impacts to commercial productivity or use of the area
    4. Cultural Impacts – Impacts to historical sites or culturally sensitive use of the shoreline area
- Feasibility - Logistical feasibility was designed to be assessed based on the combination of factors, including the shoreline accessibility, distance from port, and availability of disposal options.

The group discussed and agreed that while the resource picture is unclear, it appeared unlikely at the time of the meeting that funding would be available to remove debris from more than a very small percentage of the overall area surveyed. Because of this, and the need for more immediate operational prioritization at a rough scale, the prioritization was divided into an immediate focus on high density areas, with a later focus on more in-depth analysis and prioritization of other areas.

Prioritization was completed for nine total segments, with the agreement that others would be revisited by smaller focused groups based on additional analysis and integration of staff with more localized expertise. The segments were graded based on density combined with biological, habitat, socio-economic and cultural impacts. For each segment, the group worked through the scoring rubric, and their resulting ranks are listed below, in geographical order:

1. Cape Muzon to Suemez Island
2. Baker, Noyes, Lulu, San Fernando and Western Prince of Wales Islands
3. Kruzof Island
4. Cape Yakataga to Kayak Island
5. Kayak Island
6. Outer Hinchinbrook
7. Outer Montague
8. Outer Island to Gore Point (including Gore Point)
9. Shuyak and North Afognak Islands (to Pillar Cape)

These prioritized locations will be the focus of debris removal efforts during the 2013 field season (May – September).

Funding:

Government of Japan: The Government of Japan made a $5 million dollar gift to the United States, which has been entrusted to NOOA to appropriately distribute to the five affected states and two territories. DEC has signed an MOA with NOAA, outlining the broad details of how and for what purpose the funds will be expended. The next step, which DEC is actively working on, is to produce a proposed Statement of Work (SOW) for NOOA's review and approval. Initial SOW submissions by each state will result in a $250,000 award, which Alaska will in turn use to issue contracts for tsunami-generated marine debris removal or survey efforts. The bulk of the $5 million will be held in reserve by NOAA, and will be released to the states based on subsequent submissions of Statements of Work. These SOW's will be carefully reviewed by NOAA and approved on the basis of greatest need. This approach benefits Alaska.

Alaska has already clearly demonstrated that the amount of tsunami debris is significant, our coastline is vast, and logistical access to conduct removal activities is difficult and expensive. We plan to submit two Statements of Work to NOAA in March and April, one for $250,000, and one for $750,000, with intent to award contracts for debris removal during the 2013 field season (May – September).

Federal Funding for Tsunami Debris Removal: As the agency responsible for marine debris management in the United States, NOAA advertises grant opportunities for communities and NGO's, in amounts ranging from $15,000 to $150,000. NOAA has not received any additional funding to deal with the increased quantity of tsunami-generated marine debris.

However, in 2012, NOAA, at the urging of Congress, 'swept' their budget and made available $50.0 to each the five affected states, specifically for tsunami debris removal. ADEC contracted with Gulf of Alaska Keeper for a cleanup in Prince William Sound that was completed in October 2012.

The State of Alaska, and the other affected states, continue to support Congressional delegations to approve federal funding for tsunami-generated debris removal. Alaska's delegation has been very engaged, understands the depth of the problem, and is deeply concerned.

State Funding: The State of Alaska does not have a marine debris program, and therefore, no funding for marine debris removal. However, in June 2012, an aerial survey contract for $200.0 was funded by the Department of Environmental Conservation, as it was deemed critical to assess the extent of the tsunami debris impact on Alaskan shores. Tsunami debris coordination efforts by affected state departments has been funded through each agency's operating budgets

Prior to the Japanese tsunami, the Exxon Valdez Oil Spill (EVOS) Trustee Council granted $1.1 million for marine debris cleanup in Prince William Sound. Now, the majority of the contractor's efforts are devoted to removing tsunami-generated marine debris.