

National Fish and Wildlife Foundation

Fishing for Energy 2018 - Submit Final Programmatic Report (New Metrics)

Grantee Organization: University of Hawaii

Project Title: Derelict Fishing Gear Removal from Shallow Coral Reef Environments within Papahānaumokuākea (HI)

<b>Project Period</b>	7/01/2018 - 3/31/2019
<b>Project Location</b>	Staging and de-staging will occur from the docks at the NOAA PIFSC in Honolulu. Marine debris removals will take place in the Papahānaumokuākea Marine National Monument including the Northwestern Hawaii Islands and atolls.
<b>Description (from Proposal)</b>	Execute a large-scale derelict fishing gear removal effort from the remote islands and atolls within the Papahānaumokuākea Marine National Monument. Project will reduce the impacts of derelict fishing gear to critical habitats for more than 7,000 marine and avian species, and dispose up to 50 metric tons of removed derelict fishing gear.
<b>Project Summary (from Proposal)</b>	
<b>Project Status and Accomplishments</b>	<p>A team of nineteen scientists and technicians from the Joint Institute for Marine and Atmospheric Research (JIMAR), working with the NOAA Pacific Islands Fisheries Science Center (PIFSC), completed a forty-one day mission with three main components, to conduct a major marine debris removal field mission in the Northwestern Hawaiian Islands (NWHI) within the Papahānaumokuākea Marine National Monument (PMNM). The field mission began on September 19th, 2018, at the NOAA/PIFSC dock on Ford Island on board the NOAA Ship Oscar Elton Sette, transiting to Pearl and Hermes Atoll for aerial (using a small unmanned aerial system; sUAS) and subsequent removal of marine debris and derelict fishing gear (DFG) from September 19 to October 11. Over the period October 4-23, project staff conducted swim and tow surveys around Midway Atoll, and fifteen divers removed DFG and other debris from reef systems and shorelines. The chartered vessel M/V Imua was then used to transit and remove DFG and other plastic debris from Kure Atoll, Pearl and Hermes Atoll, Lisianski Island, Laysan Island, and French Frigate Shoals. Finally, the team arrived back at Ford Island on October 29th, 2018. This extensive effort resulted in the removal of over 82 tons (164,013 lbs) of marine debris (primarily derelict fishing gear) from the shallow water (within 30 ft depth) coral reef environments and shorelines of Pearl and Hermes Atoll, Midway Atoll, Kure Atoll, Lisianski Island, Laysan Island, and French Frigate Shoals. A total of 3.99 km<sup>2</sup> (987 acres) of habitat were completely cleaned and restored. Of that area, 3.58 km<sup>2</sup> (885 acres) were of coral reef area and 0.41 km<sup>2</sup> (102 acres) were of shoreline. 906 people were directly reached through outreach and education opportunities.</p> <p>The field mission and subsequent data analysis have been completed. The work of the project is planned to be synthesized with previous efforts over the last several years into a publication.</p>
<b>Lessons Learned</b>	<p>Existing in-water survey and removal methods for derelict fishing gear remained the most successful approach to remove debris. Initial qualitative reviews of sUAS aerial survey footage showed the ability to detect unfouled buoyant derelict fishing nets, however nets fouled with algae growth and nets below the surface were more difficult to detect from the air. In terms of operational effectiveness, it would have been difficult to use aerial footing in real-time to inform survey operations due to high evening workload during the mission limiting the time in the field to review the footage collected. Steps would need to be taken to streamline image download, georeferencing, and visual review in order to use aerial footage on a daily basis. Additional work needs to be done to experiment with optimal flight altitude and detection bands (Red-green-blue vs. near-infrared vs. multi-spectral). Swim surveys and tow-board surveys remained the most successful in-water survey method for identifying derelict fishing nets effectively.</p> <p>Due to projected reduction of sea days aboard the NOAA ships for the management and conservation of the Papahānaumokuākea Marine National Monument, chartered vessels are a practical solution for large-scale marine debris removal operations in the Northwestern Hawaiian Islands. This year's marine debris removal mission successfully utilized a chartered vessel for the first time since 2007.</p> <p>Innovative net cutting and hauling techniques should be explored. The most time consuming part of derelict fishing net removal lies in cutting large net conglomerates into manageable (~400 lbs) pieces to haul manually into the inflatable boats. More research should be conducted on innovative tools or creative solutions to effectively roll the nets into the deck space of the boats. Various knives, pneumatic tools, saws, and winches should be explored to increase efficiency.</p>

## Activities and Outcomes

### **Funding Strategy: Habitat Restoration**

Metric: FFE - Land, wetland restoration - Acres restored

Required: Optional

Description: Please use this metric to indicate the square miles cleared of derelict gear.

<b>Starting Value</b>	0.00 Acres restored
<b>Value To Date</b>	987.00 Acres restored
<b>Target value</b>	990.00 Acres restored

Note: Of the total acreage restored, 551 acres of coral reef were surveyed, cleaned and restored at Pearl and Hermes Atoll, 334 acres of coral reef area were surveyed, cleaned and restored at Midway Atoll, and 102 acres of shoreline were surveyed, cleaned, and restored at Midway Atoll. By definition, restoration around the coral reef indicates the entire reef area was cleaned and freed of all derelict fishing gear and nets. When restoring shoreline acres, the area was cleared and freed of all plastic and rubber debris fragments larger than 10cm. Metal, glass and other debris deemed hazardous to removal operations were not surveyed or removed.

### **Funding Strategy: Habitat Restoration**

Metric: FFE - Marine - # lbs of marine debris removed

Required: Recommended

Description: Enter the number of pounds of marine debris that has been removed from the environment and properly disposed of.

<b>Starting Value</b>	0.00 # lbs of marine debris removed
<b>Value To Date</b>	164013.00 # lbs of marine debris removed
<b>Target value</b>	100000.00 # lbs of marine debris removed

Note: Of the 164,013 lbs of marine debris removed 58,334 lbs were pulled from the coral reefs environments and another 105,679 lbs were taken from the shorelines. More specifically, 51,504 lbs were removed from the reefs of Pearl and Hermes Atoll, 6,830 lbs from the reefs of Midway Atoll, 56,410 lbs from the shorelines of Midway Atoll, 13,248 lbs from the shorelines of Pearl and Hermes Atoll, 9,374 lbs from the shorelines of Kure Atoll, 15,697 lbs from the shorelines of Lisianski Island, 8,203 lbs from the shorelines of Laysan Island, and 2,747 lbs from the shorelines of French Frigate Shoals. Only derelict fishing gear (primarily nets) was extracted from the coral reef environments, whereas derelict fishing gear, plastic, rubber, and other debris were removed from all shorelines.

### **Funding Strategy: Capacity, Outreach, Incentives**

Metric: FFE - Outreach/ Education/ Technical Assistance - # people reached

Required: Optional

Description: This would be the actual goal for individuals that would receive the message which is likely fewer than the total visitation number.

<b>Starting Value</b>	0.00 # people reached
<b>Value To Date</b>	906.00 # people reached
<b>Target value</b>	500.00 # people reached

Note: Of the people directly reached, 601 people were contacted pre-field mission, 30

people during the field mission, and 275 post mission. This included presentations at Palama Settlement Summer Enrichment Program (42 people), Waikiki Aquarium Family Night (60 people), Maunawili Elementary School (155 people), Waianae Intermediate School (90 people), Mililani High School (30 people), Kaaawa Elementary (57 people), Hookele Elementary School (167 people), Mililani High School (another 30 people), Environmental Issues Panel (75 people), Le Jardin Academy (8 people), Lanakila Elementary (85 people), and the Papahānaumokuākea Reserve Advisory Council Meeting (60 people). Millions of the public were reached through the CBS "60 Minutes" feature piece, 13 online blog posts on the NOAA Fisheries website, local television news pieces covering the outreach event at the NOAA facility, interviews with Hawaii Business Magazine, Millenium Recycling, and Sharecare, as well as through various social media.

- 1. Summary of Accomplishments - In 4-5 sentences, provide a brief summary of the project's key accomplishments and outcomes that were observed or measured. This can be duplicative of the summary provided in the reporting "field" or you can provide more detail here.**

A team of 19 scientists from the Joint Institute for Marine and Atmospheric Research (JIMAR) and the NOAA Pacific Islands Fisheries Science Center (PIFSC) completed a 41-day, 3-part, marine debris removal field mission in the Northwestern Hawaiian Islands (NWHI) within the Papahānaumokuākea Marine National Monument (PMNM), from September 19 to October 29, 2018. The 3-part mission began and ended in Honolulu, HI, and took place aboard the NOAA ship R/V *Oscar Elton Sette* and chartered vessel M/V *Imua* with a shore-based mission at Midway Atoll in between. This mission resulted in the removal of over 82 tons (164,013 lbs) of marine debris (primarily derelict fishing gear) from the shallow water (<30 ft) coral reef environments and shorelines of Pearl and Hermes Atoll, Midway Atoll, Kure Atoll, Lisianski Island, Laysan Island, and French Frigate Shoals. 3.58 km<sup>2</sup> (885 acres) of coral reef area and 0.41 km<sup>2</sup> (102 acres) of shoreline was completely cleaned of debris and restored.

## **2. Project Activities and Outcomes**

- a. Activities - Describe the primary activities conducted during this grant and explain any discrepancies between the activities conducted from those that were proposed**

Primary activities proposed for this grant included:

- 1. Mission Planning:** Plan a 3-part, 47-day field mission to survey and remove marine debris from the Northwestern Hawaiian Islands within Papahānaumokuākea Marine National Monument using two different vessels with a mid-mission ship swap at Midway Atoll.
- 2. Survey and Removal of Marine Debris:** Conduct in-water, shoreline, and aerial survey and removal operations for marine debris at various islands and atolls within the Northwestern Hawaiian Islands. The goal was to remove 100,000 lbs of marine debris and restore 990 acres of habitat.
- 3. Marine Debris Disposal:** Transport all marine debris removed from the reefs and shorelines of the islands and atolls within the Northwestern Hawaiian Islands and dispose of it properly using Hawaii's Nets-to-Energy Program in Honolulu, HI.
- 4. Outreach and Education:** Conduct regular outreach and education events at local schools prior to the start of the field mission, continue to report out during the mission via blogs (JIMAR and NOAA Fisheries website) and Story Map, conduct a final media/PR event at culmination of field effort, and publish a funder's booklet to be used for future outreach and education events. The goal was to reach 500 people through our outreach and education efforts.

Details of the primary activities conducted during the field mission:

- 1. NOAA Ship R/V *Oscar Elton Sette*: September 19 - October 11, 2018**
  - a. Objective:** In-water survey and removal of derelict fishing gear (DFG) from Pearl and Hermes Atoll.
    - i. Over the course of 10 operational days, a team of 17 divers, 1 small unmanned aerial systems (sUAS) pilot, and 1 data manager surveyed the lagoon of Pearl and**

Hermes Atoll and removed a total of 23,362 kg (51,504 lbs) of DFG from the shallow reefs and restored 2.23 km<sup>2</sup> (551 acres) of coral reef area.

- ii. 2.23 km<sup>2</sup> of reef was surveyed, cleaned and restored (1.99 km<sup>2</sup> via snorkel methods and 0.24 km<sup>2</sup> via towed-diver methods).
- iii. A total of 66 photomosaics were collected at select sites to quantitatively measure the negative impacts of derelict fishing nets on scleractinian coral and benthic community composition. 3m x 3m mosaics were collected at 21 net-impact/DFG removal sites and 24 control sites. At each of the 21 net-impact sites, a mosaic was captured of the net impacting the reef, and of the reef after net removal.
- iv. 10 sUAS flights were completed to collect mapping-quality imagery at 60m altitude. Of the 10 flights, 9 were successful, and 8 collected imagery with pixel resolution of <10cm. The goal was to map 0.5 km<sup>2</sup> per flight. In total, 3.39 km<sup>2</sup> of coral reef environment was mapped in 3.7 hours of flight time.
- v. 6 derelict fishing nets were located, left in place, and tagged with satellite tracking buoys for the purpose of measuring movement within an atoll. These nets were at minimum 75% buoyant and have a minimum in-water volume of 0.5 m<sup>3</sup>.

2. Midway Atoll: October 4-23, 2018

- a. Objective: In-water and shoreline survey and removal of DFG, plastics, and other debris at Midway Atoll.
  - i. Over the course of 14 operational days, 4 days were spent conducting in-water (tow and swim) surveys, and 10 days were spent conducting shoreline surveys. 15 divers removed a total of 28,685 kg. (63,240 lbs.) of marine debris, restoring 1.35 km<sup>2</sup> (334 acres) of coral reef area and 0.41 km<sup>2</sup> (102 acres) of shoreline.
  - ii. 6 back-reef survey polygons (0.25 km<sup>2</sup> each) were randomly selected and surveyed, resulting in 0.90 km<sup>2</sup> of shallow coral reef area surveyed, cleaned and restored via tow-board methods and 1,558 kg (3,435 lbs) of DFG removed.
  - iii. 0.45 km<sup>2</sup> were surveyed, cleaned and restored via swim methods along the fringing reef, resulting in 1,540 kg (3,395 lbs) of DFG removed.
  - iv. 23 shoreline survey segments (300 m each) were surveyed and cleaned on Eastern and Spit Islands, resulting in 0.14 km<sup>2</sup> of shoreline cleaned and restored. 0.11 km<sup>2</sup> was surveyed on Eastern Island resulting in a removal of 9,722 kg (21,433 lbs) and 0.03 km<sup>2</sup> on Spit Island resulting in a removal of 2,190 kg (4,828 lbs) of marine debris. These surveys resulted in a total of 11,912 kg (26,261 lbs) removed.
  - v. 0.27 km<sup>2</sup> of shoreline on Sand Island was cleaned and restored, resulting in a total of 13,627 kg (30,041 lbs) of marine debris removed.

3. Chartered Ship M/V Imua: October 13-29, 2018

- a. Objective: Shoreline survey and removal of DFG, plastics, and other debris at Kure Atoll, Pearl and Hermes Atoll, Lisianski Island, Laysan Island, and French Frigate Shoals.
  - i. Over the course of 12 operational days, 1 day was spent at Kure Atoll, 3 days were spent at Pearl and Hermes Atoll, 3 days were spent at Lisianski Island, 3

- days were spent at Laysan Island, and 2 days were spent at French Frigate Shoals. 9 field staff removed a total of 22,348 kg (49,269 lbs) of marine debris.
- ii. 4,252 kg (9,374 lbs) of DFG, plastic and other debris were removed from the shoreline of Kure Atoll. In addition, an 18' Japan Tsunami Marine Debris small boat was removed from the shoreline and disposed of properly in Honolulu, HI.
  - iii. 6,009 kg (13,248 lbs) of DFG, plastic, and other debris were removed from the shoreline of Pearl and Hermes Atoll.
  - iv. 7,120 kg (15,697 lbs) of DFG, plastic, and other debris were removed from the shoreline of Lisianski Island.
  - v. 3,721 kg (8,203 lbs) of DFG, plastic, and other debris were removed from the shoreline of Laysan Island.
  - vi. 1,246 kg (2,747 lbs) of DFG, plastic, and other debris were removed from the shoreline at French Frigate Shoals. In addition, our staff were tasked with conducting the first assessment of damage at Tern and East Islands following Hurricane Walaka.

Discrepancies between the activities proposed versus the activities conducted:

1. Mission Planning: A 3-part, 47-day, 36 operational days field mission was proposed and a 3-part, 41-day, 36 operational days field mission was executed.
  - a. NOAA Ship R/V *Oscar Elton Sette*: A 30-day, 18 operational days mission was proposed. Due to loss of sea days from ship's mechanical failures pre-mission, the project's allocated days at sea was reduced from 30 to 23 days. In the 23 days at sea, the project was able to complete 10 days of operation (reduction of 8 operational days).
  - b. Midway Atoll: An 8-day, 6 operational days mission was proposed. Due to loss at sea days on the NOAA R/V *Oscar Elton Sette*, management decided to extend and maximize the field effort (more days and more staff) at Midway Atoll. A 20-day, 14 operational days shore-based mission was executed and yielded massive results (addition of 8 operational days).
  - c. Chartered Ship M/V *Imua*: A 16-day, 12 operational days mission was proposed. A 17-day, 12 operational days mission was executed.
2. Survey and Removal of Marine Debris: Activities proposed through this grant were in-water, shoreline, and aerial survey and removal operations for marine debris at various islands and atolls within the Northwestern Hawaiian Islands. All survey and removal activities proposed were successfully executed. The goal was to remove 100,000 lbs of marine debris and restore 990 acres. The project was able to remove 164,013 lbs of marine debris and restore a total of 987 acres (885 coral reef area and 102 shoreline).
3. Marine Debris Disposal: The goal of this project was to transport and dispose of all marine debris removed from the reef and shorelines through Hawaii's Nets-to-Energy Program in Honolulu, HI. All derelict fishing nets were properly disposed of through Hawaii's Nets-to-Energy Program. Ocean plastics were sorted and recycled through various channels (outreach and education events, school artwork, partnerships with plastic recyclers) prior to disposal of the remainder through Hawaii's Nets-to-Energy Program.
4. Outreach and Education: This proposal had a goal of conducting outreach at schools, writing blogs, posting and updating a photo journal, and conducting a final media event to highlight the

efforts of the mission. Of those activities, all were completed or are in the process of completion. Six outreach and education events were conducted at local elementary, intermediate, and high schools prior to the start of the field mission. 14 blogs were written and published online throughout the mission. An ArcGIS Story Map was published and updated throughout the mission. A media event with three local schools was conducted at the end of the project, involving marine debris education, sorting, and artwork. A funder's booklet is currently in the process of publication and should be available by October 1, 2019.

**b. Outcomes - Describe progress towards achieving the project outcomes as proposed, and briefly explain any discrepancies between your results compared to what was anticipated. Provide any further information (such as unexpected outcomes) important for understanding project activities and outcome results.**

The project outcomes proposed through this grant were to 1) improve the condition of shallow coral reefs and shoreline habitats within the Papahānaumokuākea Marine National Monument through the removal of marine debris and 2) to test the feasibility of using small unmanned aerial systems (sUAS) to detect in-water derelict fishing nets.

1. Improving the condition of shallow coral reefs and shorelines habitats within PMNM:

Successfully meeting this outcome meant to:

- a. Mitigate and reduce the entanglement hazard for protected wildlife, including the critically endangered Hawaiian monk seals, threatened green sea turtles, and other marine wildlife. This outcome was completed through the removal of 50,612 kg. (111,581 lbs) of derelict fishing nets. Of the total 50 metric tons of net removed, 27,270 kg. (60,121 lbs) were removed in-water from coral reef environments and 23,342 kg. (51,461 lbs) were removed from the shoreline.
- b. Mitigate and reduce the ingestion of hazardous shoreline plastics by avian wildlife. This outcome was completed through the removal of 23,783 kg. (52,432 lbs) of plastic and other marine debris from the shoreline of Pearl and Hermes Atoll, Midway Atoll, Kure Atoll, Lisianski Island, Laysan Island, and French Frigate Shoals. A total area of 0.41 km<sup>2</sup> (102 acres) was swept clean of all marine debris <10 cm and restored.
- c. Mitigate and reduce the threat of derelict fishing gear to living corals. This outcome was completed through the removal of 23,342 kg. (51,461 lbs) of derelict fishing net from shallow coral reef environments at Pearl and Hermes Atoll and Midway Atoll. A total of 3.58 km<sup>2</sup> (885 acres) of coral reef area was cleaned and restored.

2. Testing feasibility of using small unmanned aerial systems (sUAS) to detect in-water nets:

- a. Project outcomes from this study are unavailable at this time because imagery has yet to be analyzed. However, a qualitative assessment of these activities can be found in the 'lessons learned' section.

Discrepancies between the project results compared to what was anticipated:

The project metrics tracked throughout this project were 1) pounds of marine debris removed, 2) acres of coral reef habitat and shoreline cleared of marine debris, and 3) number of people reached through outreach and education events.

1. **Metric #1:** 100,000 lbs of marine debris removed: This mission successfully exceeded its goal of 100,000 lbs of debris removed and removed a total of 164,013 lbs.
  2. **Metric #2:** 990 acres of coral reef habitat and shoreline cleared of marine debris: This mission fell just shy of its goal of 990 acres cleared of marine debris, and completely restored a total of 987 acres. Many more km of shoreline was cleared of only derelict fishing gear and other entanglement hazards, which were not tracked.
  3. **Metric #3:** 500 people will be reached through outreach and education events: This mission successfully exceeded its goal of reaching 500 people directly by reaching 906 people. Indirectly, through its CBS 60 Minutes segment, local television news pieces, printed article pieces, web-based articles, blogs, and social media, millions of others have been reached.
- 3. Lessons Learned - Describe the key lessons learned from this project, such as the least and most effective conservation practices or notable aspects of the project's methods, monitoring, or results. How could other conservation organizations adapt similar strategies to build upon some of these key lessons about what worked best and what did not?**

Key lessons learned (what worked best and what did not):

1. Current traditional in-water survey and removal methods for derelict fishing gear remained most successful during this mission. Initial qualitative review of sUAS aerial survey footage showed the ability to detect unfouled buoyant derelict fishing nets supported with plastic buoys and floats, however, nets fouled with algae growth and nets below the surface were more difficult to spot from the air. Without dedicated funding to quantitatively analyze this imagery, no data to support this is available at this time. In terms of operational effectiveness, it would have been difficult to use aerial footing in real-time to inform survey operations due to high evening workload during the mission. Steps would need to be taken to streamline the image download, georeferencing and visual review process in order to use them practically on a daily basis. Additional work needs to be done to experiment with optimal flight altitude and detection band (Red-green-blue vs. near-infrared vs. multi-spectral). Swim surveys and tow-board surveys remained the most successful in-water survey method (started in 1999) for identifying derelict fishing nets effectively.
  2. Chartered vessels are a practical and feasible solution for large-scale marine debris removal operations in the Northwestern Hawaiian Islands. This year's marine debris removal mission utilized a chartered vessel for the first time since 2007. Due to projected reduction of sea days aboard the NOAA ships for the management and conservation of the Papahānaumokuākea Marine National Monument, chartered vessels likely remain the only option.
  3. Innovative net cutting and hauling techniques should be explored. The most time consuming part of derelict fishing net removal lies in cutting large net conglomerates into manageable pieces (~400 lbs) to haul manually into the inflatable boats. More research should be conducted on innovative tools or creative solutions on how to effectively roll the nets into the deck space of the boats. Various knives, pneumatic tools, saws, and winches should be explored to boost efficiency.
- 4. Dissemination - Briefly identify any dissemination of project results and/or lessons learned to external audiences, such as the public or other conservation organizations. Specifically, outline any management uptake and/or actions resulting from the project and describe the direct impacts of any capacity building activities.**

During this project period, the JIMAR/NOAA PIFSC Marine Debris Project conducted several outreach events, interviews, and presentations to directly reach 906 people. Through television pieces, printed articles, web-based articles, blogs, and social media, millions of others may have been reached. The list of events, interviews, and presentations are detailed below.

1. Outreach pre-mission:

- a. Interview, CBS 60 Minutes at Midway Atoll, June 20-22, 2018 (aired January 3, 2019): 11.1 million viewers/week
- b. Presentation, Palama Settlement Summer Enrichment Program, June 27, 2018: 42 students
- c. Event, Waikiki Aquarium Family Night, August 31, 2018: 60 people
- d. Presentation, Maunawili Elementary School (3rd-5th grade students), September 10, 2018: 155 students
- e. Presentation, Waianae Intermediate School (8th grade students), September 10, 2018: 90 students
- f. Presentation, Mililani High School (9th-12th grade students), September 10, 2018: 30 students
- g. Presentation, Ka'a'awa Elementary School (4th-6th grade students), September 12, 2018: 57 students
- h. Presentation, Ho'okele Elementary School, September 12, 2018: 167 students

2. Outreach throughout mission:

- a. Blogs: 13 blogs posted on NOAA Fisheries website, 1 blog posted on JIMAR website, 1 blog NOAA Pacific Islands Fisheries Science Center website: no data available on audience
- b. Ask a scientist (live question and answer), Mililani High School: 30 students
- c. Social Media: Twitter, Instagram, and Facebook were used by NOAA PIFSC, NOAA Marine Debris Program, NOAA Papahānaumokuākea Marine National Monument, and NOAA Fisheries to broadcast updates throughout the field mission: no data available on audience

3. Outreach post-mission:

- a. Event, Debris sorting and education at NOAA IRC Facility, November 2, 2018: 30 students from Mililani High School
- b. Event, Media day/PR, debris sorting and education at NOAA IRC Facility, November 9, 2018: 14 students from Iolani Middle School, 3 students from Le Jardin Academy, KHON2 Hawaii News Now (TV), Honolulu Star Advertiser (Newspaper/Web-content), Civil Beat (Web-content)
- c. Interview, Millenium Recycling (South Dakota), January 22, 2019: no data available on audience
- d. Interview, Hawaii Business Magazine, in press: 65,000 print readers/month
- e. Presentation, Environmental Issues Panel. January 22, 2019: 75 students and parents
- f. Interview, Sharecare web-article, February 5, 2019: 5.4 million viewers/month
- g. Interview, Le Jardin Academy (7th grade students): 2 students
- h. Interview, Le Jardin Academy (5th grade students): 6 students

- i. Presentation, Lanakila Elementary School (5th grade students): 85 students
- j. Presentation, Papahānaumokuākea Reserve Advisory Council Meeting, March 20, 2019: 60 people

**5. Project Documents - Include in your final programmatic report, the following:**

**a. 2-10 representative photos from the project. Photos need to have a minimum resolution of 300 dpi. For each uploaded photo, provide credit and brief description below.**

- i. Photo 1: The Marine Debris team works together to haul in a large net at Midway Atoll (credit: Steven Gnam, JIMAR/NOAA PIFSC)
- ii. Photo 2: A Marine Debris diver carefully cuts the net free from the reef at Pearl and Hermes Atoll (credit: Steven Gnam, JIMAR/NOAA PIFSC)
- iii. Photo 3: The Marine Debris team works together to haul in a large net at Pearl and Hermes Atoll (credit: Steven Gnam, JIMAR/NOAA PIFSC)
- iv. Photo 4: Marine Debris divers work to remove a net from the reef at Pearl and Hermes Atoll (credit: Steven Gnam, JIMAR/NOAA PIFSC)
- v. Photo 5: As the Marine Debris diver peels back the net from the impacted reef, you can see visible coral bleaching and scarring (credit: Steven Gnam, JIMAR/NOAA PIFSC)
- vi. Photo 6: Marine Debris divers work to remove a net from the reef at Pearl and Hermes Atoll (credit: Steven Gnam, JIMAR/NOAA PIFSC)
- vii. Photo 7: A critically endangered Hawaiian monk seal plays with a derelict fishing net (credit: Steven Gnam, JIMAR/NOAA PIFSC)
- viii. Photo 8: Comparisons of sUAS (small unmanned aerial system) imagery vs. conventional satellite imagery (World View 2) of a patch reef at Pearl and Hermes Atoll (credit: Josh Levy, University of Hawaii Applied Research Lab)
- ix. Photo 9: Aerial image of the NOAA ship R/V Oscar Elton Sette craning off a small boat's haul of derelict fishing net for the day (credit: Steven Gnam, JIMAR/NOAA PIFSC)
- x. Photo 10: A Marine Debris team member weighing a net and adding it to the pile at Midway Atoll (credit: Steven Gnam, JIMAR/NOAA PIFSC)

*\*More photos can be made available upon request.*

**b. Report publications, Power Point (or other) presentations, GIS data, brochures, videos, outreach tools, press releases, media coverage.**

- 1. <https://vimeo.com/315334060/19b82bb6c8> - Video to be released publically May 22, 2019
- 2. <https://www.cbsnews.com/news/the-great-pacific-garbage-patch-cleaning-up-the-plastic-in-the-ocean-60-minutes/> - CBS 60 Minutes - TV series and web-based article
- 3. <https://www.fisheries.noaa.gov/feature-story/removal-and-research-marine-debris-team-strikes-again> - NOAA Fisheries Blog #1

4. <https://www.fisheries.noaa.gov/science-blog/photo-journal-taking-out-trash> - NOAA Fisheries Blog #2
5. <https://www.fisheries.noaa.gov/science-blog/meet-marine-debris-team> - NOAA Fisheries Blog #3
6. <https://www.fisheries.noaa.gov/science-blog/training-training-training-marine-debris-mission> - NOAA Fisheries Blog #4
7. <https://www.fisheries.noaa.gov/science-blog/marine-debris-training-continued-surf-zone-rescues-net-monsters-and-flipping-boats> - NOAA Fisheries Blog #5
8. <https://www.fisheries.noaa.gov/science-blog/cleaning-marine-debris-pearl-and-hermes-atoll-its-not-always-sunny-paradise> - NOAA Fisheries Blog #6
9. <https://www.fisheries.noaa.gov/science-blog/mission-possible-stormy-seas-and-marine-debris> - NOAA Fisheries Blog #7
10. <https://www.fisheries.noaa.gov/science-blog/midway-marine-debris-finding-our-land-legs> - NOAA Fisheries Blog #8
11. <https://www.fisheries.noaa.gov/science-blog/midway-furious-five-rid-land-and-sea-marine-debris> - NOAA Fisheries Blog #9
12. <https://www.fisheries.noaa.gov/science-blog/leaving-jet-plane-marine-debris-removal-midway-atoll-comes-end> - NOAA Fisheries Blog #10
13. <https://www.fisheries.noaa.gov/science-blog/imua-going-forward-island-island-clean-marine-debris> - NOAA Fisheries Blog #11
14. <https://www.fisheries.noaa.gov/science-blog/were-back-marine-debris-team-returns> - NOAA Fisheries Blog #12
15. <https://www.fisheries.noaa.gov/feature-story/protecting-paradise-marine-debris-team-does-heavy-lifting> - NOAA Fisheries Blog #13
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**c. Any project deliverables per the terms of your grant agreement**