Extension of "You Are What You Eat":

Activity 8.2c and High School

"Tracking Albatross and Tracking Trash"

Science skills
- Organizing
- Interpreting
- communicating

Concepts
- Black-footed Albatross fly long distances to search for food
- Research is needed to answer questions about where they go because they are an endangered species
- Scientists use satellite telemetry to study their movement patterns
- During their journeys across the North Pacific they can encounter and eat plastic
- Black-footed Albatross are an endangered species; one of the primary factors affecting their status is by-catch associated with longline fishing
- Science plays a key role in providing important information for the conservation of the Black-footed Albatross and other endangered and threatened species

California Science Content Standards

9e. Construct graphs from data

Objectives
- Students map locations of Black-footed Albatross on a map of the North Pacific and determine overlap with the "eastern plastic garbage patch" documented by Agalita Marine Research Foundation (AMRF)
- Students understand the critical need for plastic pollution prevention

Time to complete: one class period

Mode of instruction: Teacher led mapping activity: Black-footed Albatross satellite tracking location data (latitude and longitude), and mapping location of "eastern garbage patch" on map of North Pacific Ocean

Materials: Map of North Pacific Ocean, Black-footed Albatross location data (latitude and longitude), coordinates of the "Eastern Garbage Patch", and Albatross Mapping Activity Summary Sheet

Preparation: photocopy maps and latitude/longitude data sheets for two albatross

Background
Build on lessons learned from **Activity 8.2a and 8.2b**. Advances in technology provide important tools to increase our understanding about ocean habitats and seabirds' use of these habitats and can identify potential interactions with threats far from land. Scientists use satellite telemetry to increase our understanding of long-distance ocean migrators. Satellite transmitters are placed on backs of albatross (http://www.oikonos.org/projects/albatross_taginfo.htm) and Argos satellites (http://www.argosinc.com/mission_and_organization.htm) that orbit our planet receive signals from tags, and then relay this information to ground receiving stations that process the data. Research is needed on the Black-footed Albatross because it is listed by the International Union for the Conservation of Nature as endangered, largely due to by-catch from longline fisheries, but also other threats such as plastic ingestion. Science plays a key role in seabird conservation by providing resource managers the important information about biology, ecology, and movement patterns required for effective management and protection. Algalita Marine Research Foundation documented the location of the "eastern garbage patch" and estimated there was ½ lb. of garbage per 100m^2 of sea surface in the North Pacific Ocean. Data from the study on Black-footed Albatross is included to complete the mapping activity.

Outline
Before class – photocopy maps and data sheets

During class
1. Lead class discussion about how scientists study seabirds that are far from land e.g. use of satellite telemetry
2. Help students locate and map location of tagging site at Cordell Bank National Marine Sanctuary
3. Demonstrate how to plot points of Latitude and Longitude on a map
4. Lead class to make predictions where they think Black-footed Albatross would go after leaving the tagging location at Cordell Bank National Marine Sanctuary
5. Divide students into groups for mapping activity or have students work independently
6. Create an encircled point at each location and label each point with each day
7. Summarize mapping activity

Activity
1. Divide class into groups (or have students work independently)
2. Distribute map of North Pacific Ocean
3. Label National Marine Sanctuaries (NMS) as follows: along west coast from north to south label Olympic Coast NMS, Cordell Bank NMS, Gulf of the Farallones NMS, Monterey Bay NMS, Channel Islands NMS, Hawaiian Islands Humpback Whale NMS, and Northwestern Hawaiian Islands NMS (proposed)
4. Review how to map latitude/longitude
5. Label tagging location – Cordell Bank National Marine Sanctuary
6. Brainstorm with students: "As a scientist, what questions would you want to know the answers to?"
7. Map points of latitude/longitude of selected Black-footed Albatross on North Pacific Ocean map; encircle points and label with the date for each bird

8. Use Albatross Mapping Activity Summary Sheet and calculate the following for each bird: total number days of tracking; average number of kilometers per day (#km/#days)
9. Map location of "eastern garbage patch"
10. For each bird, determine total number days spent in garbage patch; proportion time spent in garbage patch (# days in patch/total # days)

Results and reflection

1. Determine which birds spent the greatest amount of time in the garbage patch and would thus be likely to encounter (and possibly ingest) plastic
2. Discuss patterns of tracklines and possible reasons of their occurrence in specific locations e.g. garbage zone

Conclusions

Humans are responsible for plastic marine debris that seabirds ingest.
The continuing escalation of plastic marine debris warrants actions on many levels. At the local level, we can all do our part in preventing plastic debris from becoming part of the "eastern garbage patch" by being vigilant in keeping plastic from entering rivers and streams that flow into the ocean and that can then get transported around the planet via ocean currents.

Extensions and applications

1. Investigate why garbage accumulates in the central Pacific:
   http://oceancurrents.rsmas.miami.edu
   http://seawifs.gsfc.nasa.gov/OCEAN_PLANET/HTML/oceanography_currents_2.html

2. Investigate plastic and marine debris:
   www.plasticdebris.org
   www.marine-litter.gpa.unefp.org
   www.earthresource.org/campaigns/capp/capp-overview
   www.beachcombers.org

3. Use the following website to measure how far the albatross traveled during different legs of its journey in miles or kilometers:
   http://jan.ucc.nau.edu/~cvm/latlongdist.html

Adapted from: "Fishing for a Living: How do we know what Albatrosses eat?" developed by Cordell Bank National Marine Sanctuary and Oikonos - Ecosystem Knowledge

Further references:

1. Investigate longline fishing by-catch:
   www.abcbirds.org/policy/seabird_report.PDFwww.wsg.washington.esdu/publications/online/execsummary.pdf

www.wpcouncil.org

2. Investigate Oikonos Black-footed Albatross research:
   http://www.oikonos.org/projects/albatross.htm

3. Investigate Algalita Marine Research Foundation:
   http://www.algalita.org

4. Learn more about Cordell Bank National Marine Sanctuary:
   http://www.cordellbank.noaa.gov

5. Satellite telemetry:
   http://www.oikonos.org/projects/albatross_taginfo.htm
   http://www.argosinc.com/mission_and_organization.htm

6. "Eye of the Albatross" by Carl Safina

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Albatross Mapping Activity Summary Sheet

1) Approximate coordinates for "Eastern Garbage Patch" (EGP)
   Pers.com C. Moore, Agalita Marine Research Foundation
   30º N to 42º N; 155 Wº to 135º W

2) Total # kilometers traveled for albatross #36337: 47,180 km

3) Total # kilometers traveled for albatross #36339: 47,144 km

4) Albatross #36337
   a. Total number days tracked_____
   b. Average # km per day_____
   c. Total number days spent in "EGP"_____
   d. Proportion time spent in "EGP" (#days in patch/total # days tracked) _____

5) Albatross #36339
   a. Total number days tracked_____
   b. Average # km per day_____
   c. Total number days spent in "EGP"_____
   d. Proportion time spent in "EGP" (#days in patch/total # days tracked) _____

Questions:

1) Which bird would more likely encounter (and possibly ingest) plastic? Why?_____
   _____

2) Describe patterns of tracklines and possible reasons for observed patterns

_____
_____
_____
_____
_____

Black-footed Albatross Mapping Activity
Albatross #36337 - 2004 Location DATA

Data Source: Satellite telemetry research (http://www.oikonos.org/projects/albatross.htm)

START Satellite Telemetry Tracking

DATE	TIME	LAT (N)	LONG (W)	
8/9/2004		38.026	123.466	Remained in ~this location for 9 days
8/18/2004	0200	36.955	123.360	
8/19/2004	0400	35.367	125.584	Remained in ~ this location for 5 days
8/24/2004		33.708	125.651	Remained in ~ this location for 5 days
8/29/2004	0000	33.326	124.339	
8/31/2004	0000	34.525	124.879	
9/1/2004	0000	35.516	123.869	
9/2/2004	1200	36.032	121.956	
9/3/2004	0000	34.433	124.819	
9/4/2004	0000	32.917	128.725	
9/5/2004	0200	33.192	134.768	
9/5/2004	0400	33.346	135.124	
9/6/2004	2300	36.056	139.703	
9/7/2004	2200	37.216	141.335	
9/8/2004	2300	37.132	141.363	
9/9/2004	2200	37.091	141.410	
9/10/2004	2200	39.094	141.697	
9/11/2004	2300	39.521	140.741	
9/12/2004	2300	41.569	138.286	
9/13/2004	2300	41.343	134.397	
9/14/2004	0000	41.302	134.054	
9/14/2004	1000	40.943	131.313	
9/14/2004	1900	40.343	129.468	
9/15/2004	1200	40.268	128.035	
9/16/2004	0000	40.097	126.544	
9/16/2004	1500	40.008	124.260	
9/17/2004	0100	38.869	124.208	
9/18/2004	0000	35.970	126.114	
9/20/2004	1000	34.440	126.586	

END Satellite Telemetry Tracking

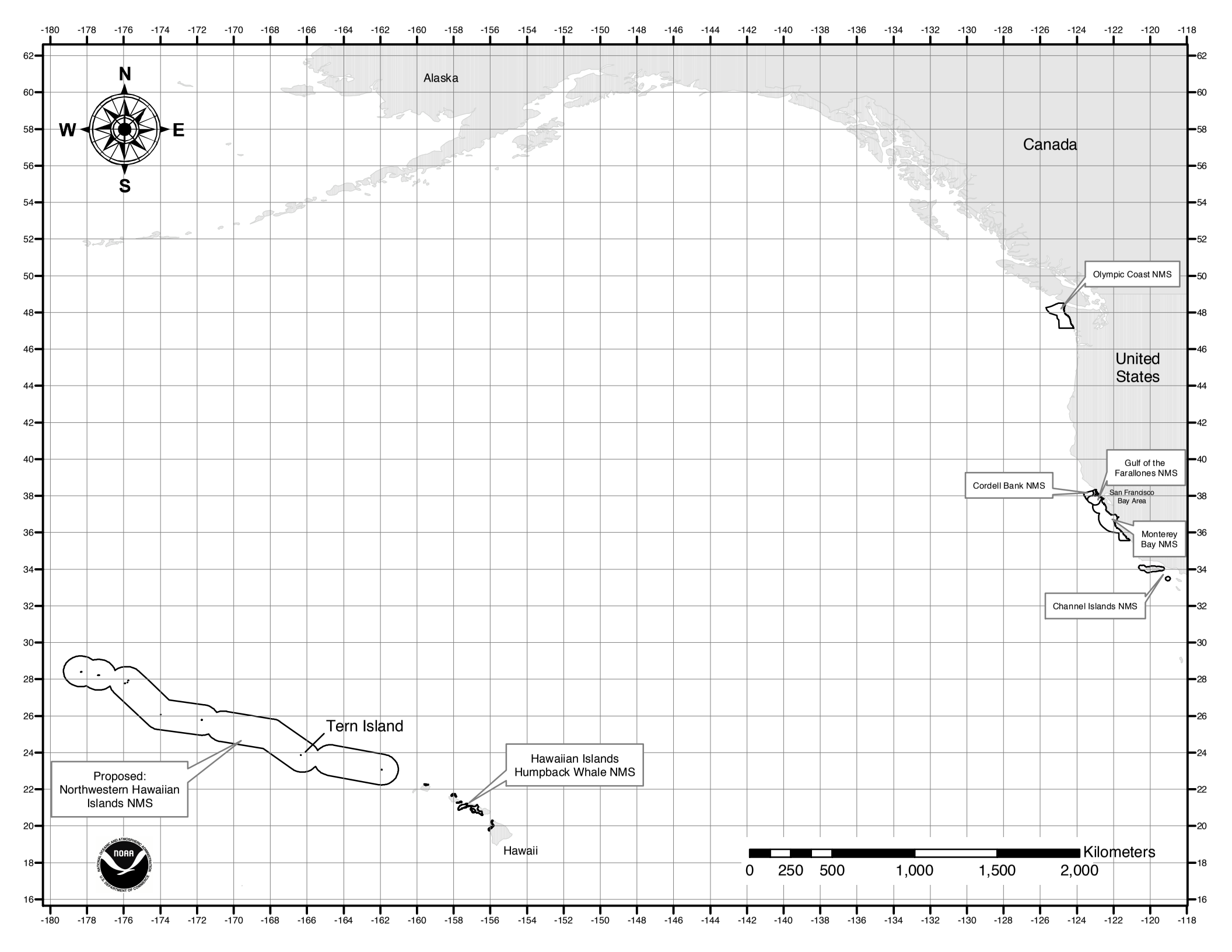
Black-footed Albatross Mapping Activity
Albatross #36339 - 2004 Location DATA

Data Source: Satellite telemetry research (http://www.oikonos.org/projects/albatross.htm)

START Satellite Telemetry Tracking

DATE	TIME	LAT (N)	LONG (W)	
8/9/2004	1300	38.013	123.528	Remained off central CA for ~18 days
8/26/2004	1500	36.970	124.042	
8/27/2004	1500	34.083	127.632	
8/28/2004	1500	33.614	130.807	
8/29/2004	1400	33.964	133.720	
8/30/2004	2200	34.476	135.560	
8/31/2004	1200	34.592	136.100	
9/1/2004	1200	35.223	137.562	
9/2/2004	1200	36.985	140.591	
9/3/2004	1200	39.717	143.532	
9/4/2004	1200	40.769	144.025	
9/5/2004	1100	41.501	145.936	
9/6/2004	1100	41.324	146.226	
9/7/2004	0000	43.222	146.921	
9/8/2004	0900	44.372	145.844	
9/9/2004	0000	45.025	148.339	
9/10/2004	0100	44.008	153.991	
9/11/2004	1200	41.156	154.912	
9/12/2004	1200	41.706	151.906	
9/13/2004	1200	41.628	147.829	
9/14/2004	1300	42.054	145.733	
9/15/2004	1300	41.920	144.759	
9/16/2004	1400	42.706	143.104	
9/17/2004	1200	40.795	144.349	
9/18/2004	1200	39.501	147.162	
9/19/2004	1200	38.462	147.098	
9/20/2004	1200	37.879	148.400	
9/21/2004	1200	38.258	148.795	
9/22/2004	1200	39.415	148.879	
9/23/2004	1300	41.385	150.961	
9/24/2004	1400	41.866	147.908	
9/25/2004	1100	41.523	148.499	
9/26/2004	0400	44.322	150.214	
9/27/2004	0400	48.010	149.962	
9/28/2004	0400	45.108	154.396	
9/29/2004	0400	41.186	159.585	
9/30/2004	0400	35.886	161.947	
9/30/2004	2300	36.114	158.448	
10/1/2004	1300	35.472	155.140	
10/1/2004	1400	35.338	154.766	
10/2/2004	1100	34.291	154.054	
10/3/2004	900	33.544	151.141	

END Satellite Telemetry Tracking


N
W
E
S
Alaska
Canada
United States
Olympic Coast NMS
Gulf of the Farallones NMS
Cordell Bank NMS
San Francisco Bay Area
Monterey Bay NMS
Channel Islands NMS
Tern Island
Proposed: Northwestern Hawaiian Islands NMS
Hawaiian Islands Humpback Whale NMS
Hawaii
Kilometers
0 250 500 1,000 1,500 2,000