INCREASING THE KNOWLEDGE BASE: *ECOLOGICAL THREATS POSED BY THE MOST PERSISTENT ITEMS OF TRASH*

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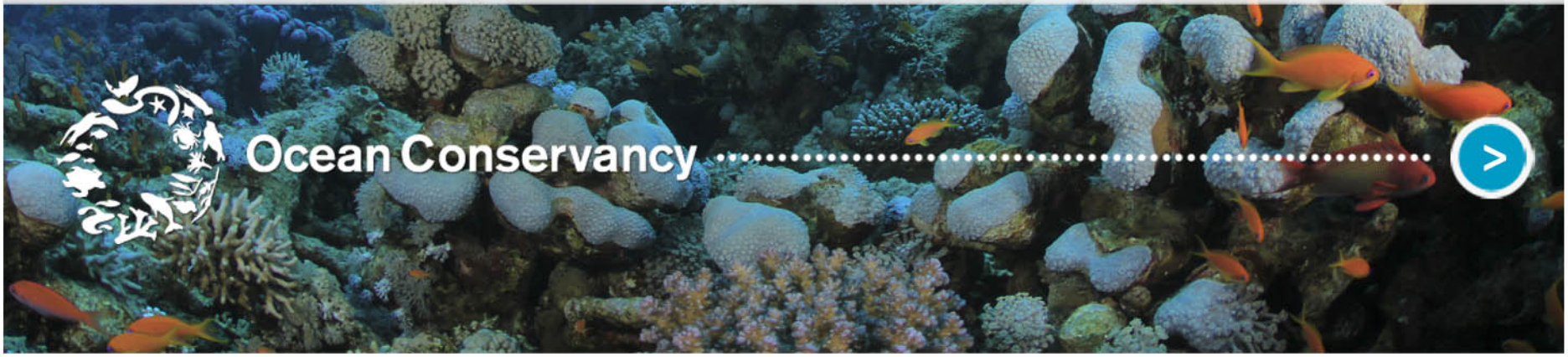

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LEADERS
FOR TRASH FREE SEAS

"By the end of the event I saw the headphones put away and students interacting and laughing with the adults. And, perhaps best of all, I saw a real understanding in them about the problem of marine debris and an interest in being part of the solution.

MARCIA TAYLOR, ST. CROIX, USVI COORDINATOR (UNIVERSITY OF THE VIRGIN ISLANDS)

"A few years ago, I had a nine-year-old who gave up his birthday party to be able to volunteer for the Cleanup. He believed so much in a clean environment and felt so good taking part that the next year he asked his friends to donate to Ocean Conservancy instead of buying birthday presents for him!"

LORI HERR, PENNSYLVANIA COORDINATOR (VERIZON TELECOMPIONEERS)

"The first International Coastal Cleanup I took part in—as a volunteer in 1994—hooked me! I loved the data collection. It makes our impact last beyond the day of the Cleanup and helps us understand more about the 'hand behind the litter.'"

KATIE REGISTER, VIRGINIA COORDINATOR (CLEAN VIRGINIA WATERWAYS)

"On September 11, 2001, we had American flags at all 30 zones, and the turnout was one of the largest we ever experienced. We had the support of all corporate sponsors, state agencies, zone captains, and volunteers. It was one of those things that gave people a positive opportunity to express themselves during this time of uncertainty and turmoil for our country."

SPENCER RYAN, ALABAMA (ALABAMA PALS)

"I think that my most meaningful experience was when I saw the volunteers arriving at the beach the second year that I organized the Cleanup, as we went from a small group of 114 in 2004 to more than 1,000 in 2005."

ALEJANDRA LOPEZ DE ROMAN, MEXICO (CLUB REGATAS CORONA, A.C.)

"It is so moving to see entire families at the end of the Cleanup, proud of their hard work and happy to have shared time together in service."

LIZA GONZALEZ, NICARAGUA (PASO PACIFICO)

"In 2008 there was something in the air—a spirit of service, of public engagement, a desire to give back—and our volunteer numbers were outstanding. It was great to see so many come out and care for the Great Lakes."

FRANCES CANONIZADO, ILLINOIS AND INDIANA COORDINATOR (ALLIANCE FOR THE GREAT LAKES)

"We thoroughly enjoyed the collaborations between jet skiers, kayakers, divers, and beach lovers. It was great to know people with different interests have one thing in common: the protection of our fragile environment."

ALAN W.K. TAN, BRUNEI COORDINATOR (BEACH BUNCH)

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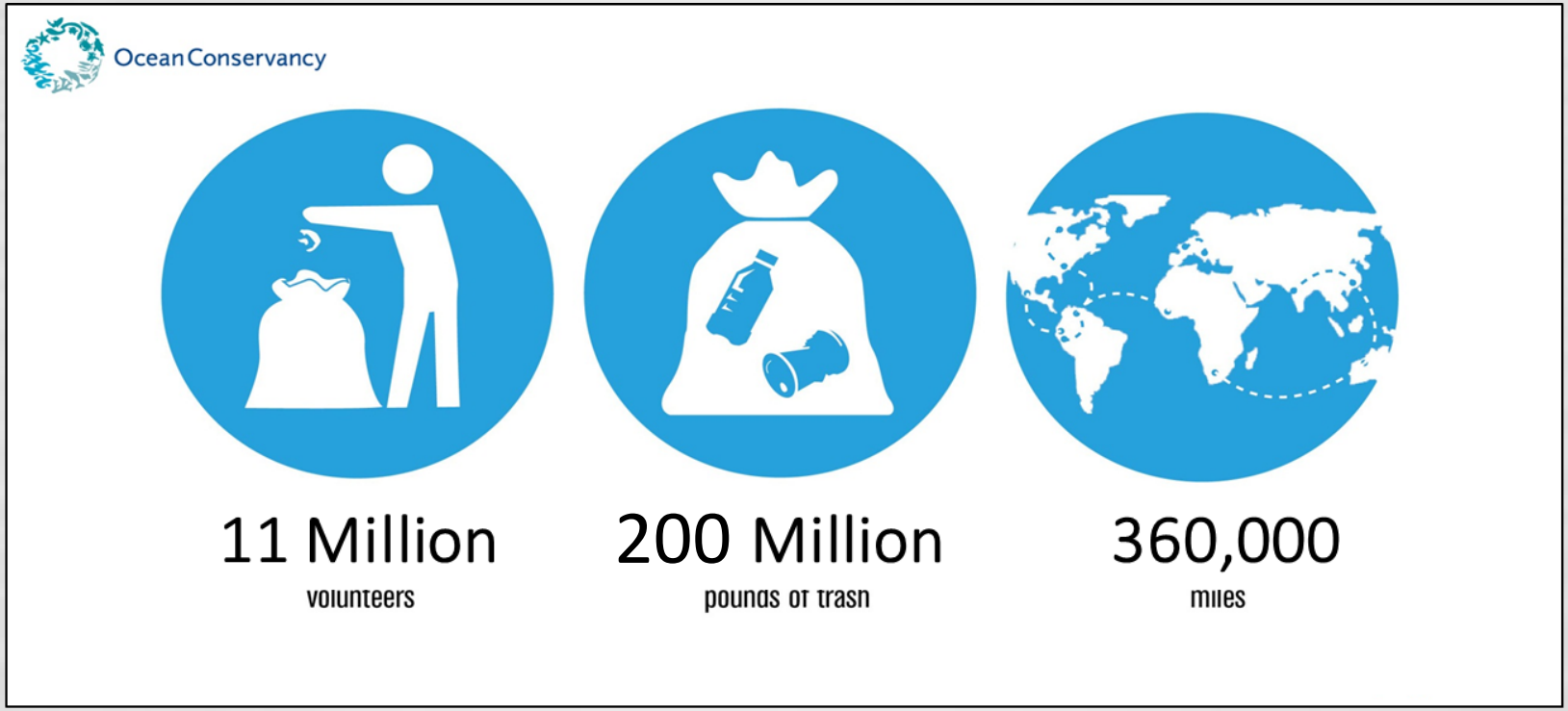

30
YEARS

153
COUNTRIES

215 Million
ITEMS COLLECTED

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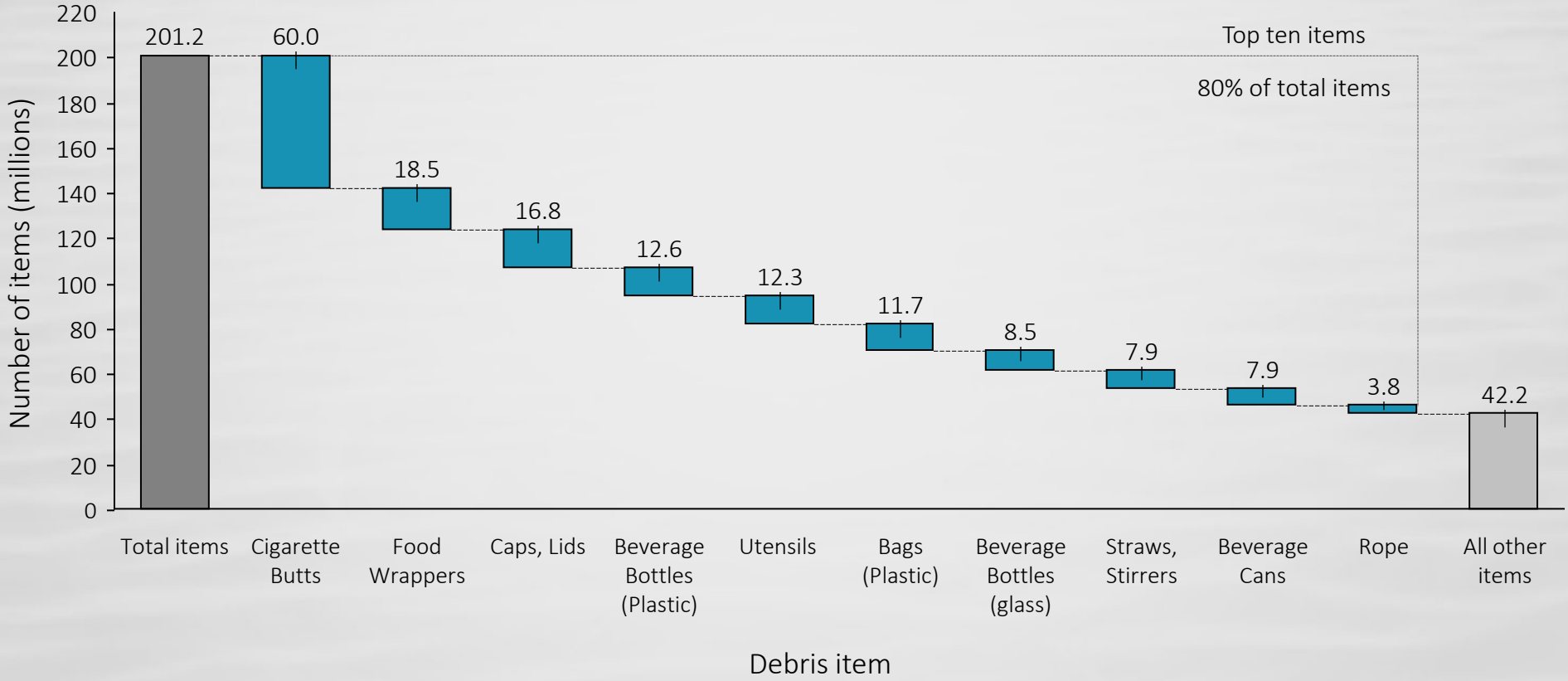
MOST PERSISTENT ITEMS OF DEBRIS

International Coastal Cleanup: 1986-2013



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DOES ABUNDANCE = ECOLOGICAL IMPACT?

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RESEARCH QUESTION

- Which debris item(s) pose the greatest ecological threat to marine wildlife, considering the product of their severity and specificity?

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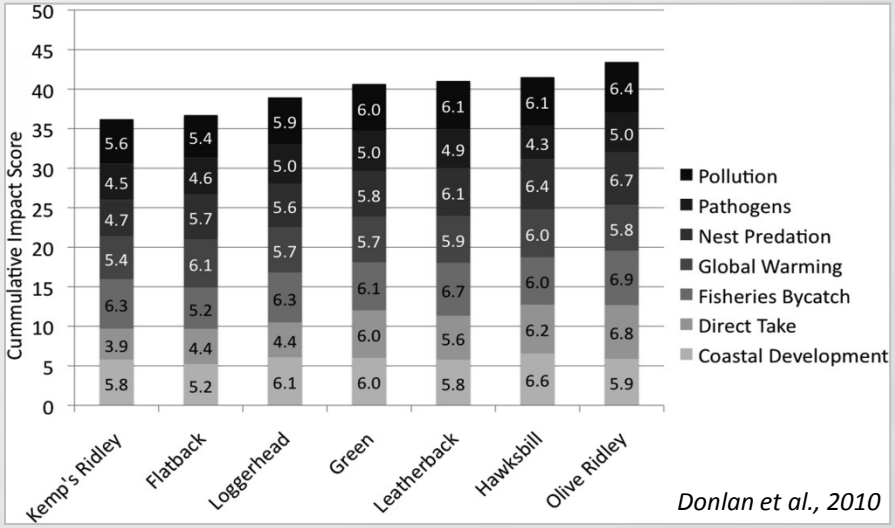
INVOKING EXPERT ELICITATION

- Used for several decades in social sciences and risk assessment
- Widely used in conservation for data poor systems
- Can guide environmental management and expedite species recover plans



Donlan et al., 2010

SOURCE: Kerr, 1996; Garthwaaite et al., 2006; Martin et al., 2012; Kuhnert et al., 2010; Jellinek et al., 2014; Donlan et al., 2010

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THREAT CRITERIA + ASSESSMENT MATRIX

SEVERITY

If a single, individual animal within the taxon experiences the threat, what is the impact of the interaction?

4 = Very High: individual animal **dies**.
3 = High: individual animal **may die**
2 = Medium: individual animal suffers **nonlethal impact**
1 = Low: **no impact** to the individual animal

SPECIFICITY

For a group of animals impacted by the product, what fraction do you expect to experience an interaction?

4 = Very High: 76-100% of animals
3 = High: 51-75% of animals
2 = Medium: 26-50% of animals
1 = Low: Less than 25% of animals

SEVERITY	Taxa: Marine Mammals		
OCEAN TRASH PRODUCT	***Entanglement threat***	***Physical Ingestion***	***Chemical Ingestion***
Balloons	1	2	2
Beverage bottle caps	1	2	2
Beverage cans	1	2	1
Cigarette butts	1	2	2
Cups and plates	1	2	2
Fishing buoys, traps and pots	4	3	1
Fishing line (monofilament)	3	3	1
Fishing nets	3	3	1
Food packaging/wrappers	2	2	2
Glass beverage bottles	1	2	1
Hard plastic containers (detergent bottles, etc.)	1	2	3
Other expanded polystyrene packaging	1	2	2
Paper bags	1	1	1
Plastic bags	1	3	2
Plastic beverage bottles	1	2	2
Plastic food and beverage lids	1	2	2
Plastic utensils	1	2	2
Straws and stirrers	1	2	2
Takeout/away food containers	1	2	2
Unidentifiable plastic fragments	1	2	2

SOURCE: WWF, 2007; Bird Life Int'l.

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SURVEY INSTRUMENT

- Twelve question internet-based survey
  - Expert profile
  - Threat assessment
  - Token offered for completion
- Distributed to 6 international list servers:
  - MARMAM
  - IUCN-DCMC
  - International Coastal Cleanup
  - CTURTLE
  - Scuttlebutt
  - Pacific Seabirds Group

- *Average response time just under 45 minutes*
- *Response time ranged between 16 min. and 2 hrs.*

SOURCE: Dillman, 2000; WWF, 2007; IUCN/Birdlife International

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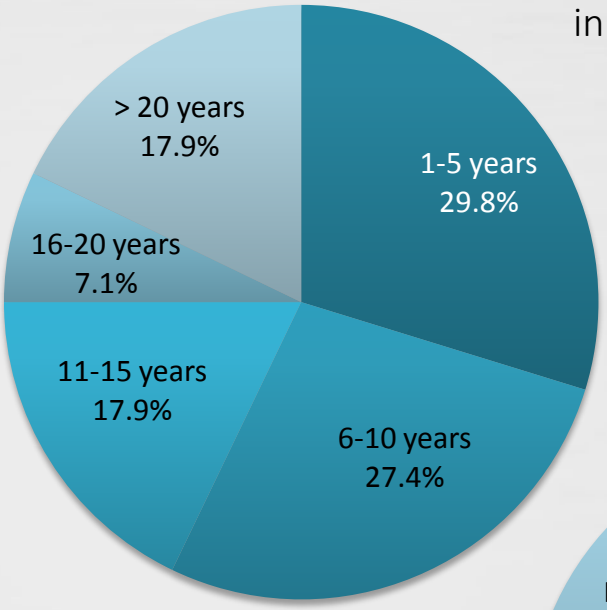
RESPONDENT DEMOGRAPHICS

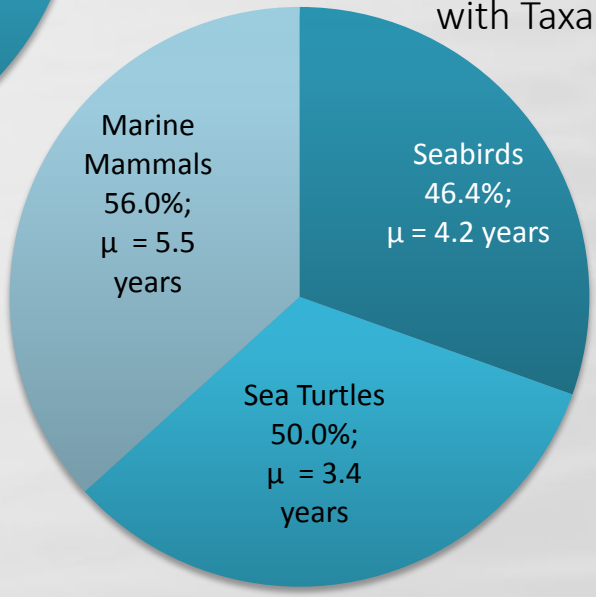
FIELD OF EXPERTISE	
Conservation biology	12
Marine Mammal biology	12
Advocacy/Conservation	10
Marine ecology	9
Education	8
Marine pollution	7
Biology	5
Ecology	4
Fisheries	4
Policy and management	3
Behavioral ecology	1
Biogeography	1
Coastal management policy	1
Ecosystem biology	1
Ecotoxicology	1
Landscape ecology	1
Oceanography	1
Toxicology	1
Veterinary health	1
Zoology	1
Completed Surveys	84/282

Years of Experience Working in Field of Study



18 countries represented

Years of Experience Working with Taxa



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PREDICT EXPECTED IMPACTS TO TAXA FROM 20 MOST COMMON ITEMS

SEVERITY	
Lethal interaction	
Potentially lethal interaction	
Nonlethal interaction	
No effect	

SPECIFICITY	
76 – 100% of animals	
51 – 75% of animals	
26 – 50% of animals	
Less than 25% of animals	

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EXPECTED IMPACTS: ENTANGLEMENT

Item of Debris	Birds		Turtles		Marine Mammals	
	Specificity	Severity	Specificity	Severity	Specificity	Severity
Balloons						
Beverage bottle caps						
Beverage cans						
Cigarette butts						
Cups and plates						
Fishing buoys, traps and pots						
Fishing line (monofilament)						
Fishing nets						
Food packaging/wrappers						
Glass beverage bottles						
Hard plastic containers						
Other EPS Packaging						
Paper bags						
Plastic bags						
Plastic beverage bottles						
Plastic Food and Beverage Lids						
Plastic utensils						
Straws and Stirrers						
Takeout/away food containers						
Unidentifiable plastic fragments						

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EXPECTED IMPACTS: INGESTION

Item of Debris	Birds		Turtles		Marine Mammals	
	Specificity	Severity	Specificity	Severity	Specificity	Severity
Balloons						
Beverage bottle caps						
Beverage cans						
Cigarette butts						
Cups and plates						
Fishing buoys, traps and pots						
Fishing line (monofilament)						
Fishing nets						
Food packaging/wrappers						
Glass beverage bottles						
Hard plastic containers						
Other EPS Packaging						
Paper bags						
Plastic bags						
Plastic beverage bottles						
Plastic Food and Beverage Lids						
Plastic utensils						
Straws and Stirrers						
Takeout/away food containers						
Unidentifiable plastic fragments						

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EXPECTED IMPACTS: CONTAMINATION

Item of Debris	Birds		Turtles		Marine Mammals	
	Specificity	Severity	Specificity	Severity	Specificity	Severity
Balloons						
Beverage bottle caps						
Beverage cans						
Cigarette butts						
Cups and plates						
Fishing buoys, traps and pots						
Fishing line (monofilament)						
Fishing nets						
Food packaging/wrappers						
Glass beverage bottles						
Hard plastic containers						
Other EPS Packaging						
Paper bags						
Plastic bags						
Plastic beverage bottles						
Plastic Food and Beverage Lids						
Plastic utensils						
Straws and Stirrers						
Takeout/away food containers						
Unidentifiable plastic fragments						

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FIRST-EVER DEBRIS THREAT RANK ORDER

Table 2
Rankings of marine debris items by their expected impact on marine animals. Item ID corresponds to numbers in Fig. 3, and order in Fig. 2. Rankings are based on most severe expected impacts across the three impact mechanisms. Mean rank is the arithmetic mean of these scores across the taxa.

Item ID	Item name	Rank of expected impact			
		Mean	Bird	Turtle	Mammal
6	Buoys/traps/pots	1	1	1	1
7	Monofilament	2.3	3	2	2
8	Fishing nets	2.7	2	3	3
14	Plastic bags	5.7	4	9	4
17	Plastic utensils	5.7	7	4	6
1	Balloons	6.7	8	5	7
4	Butts	7.3	5	12	5
2	Caps	7.7	9	6	8
9	Food packaging	8.7	10	7	9
12	Other EPS Packaging	9.7	11	8	10
11	Hard plastic cont.	11.3	6	13	15
16	Plastic Food Lids	11.3	13	10	11
18	Straws/Stirrers	12.3	14	11	12
19	Takeout containers	15.3	15	18	13
3	Cans	15.7	17	14	16
15	Beverage bottles	16	12	17	19
20	Unidentified Plastic Fragment	16.3	16	19	14
5	Cups&plates	16.7	18	15	17
10	Glass bottles	17.7	19	16	18
13	Paper bags	20	20	20	20

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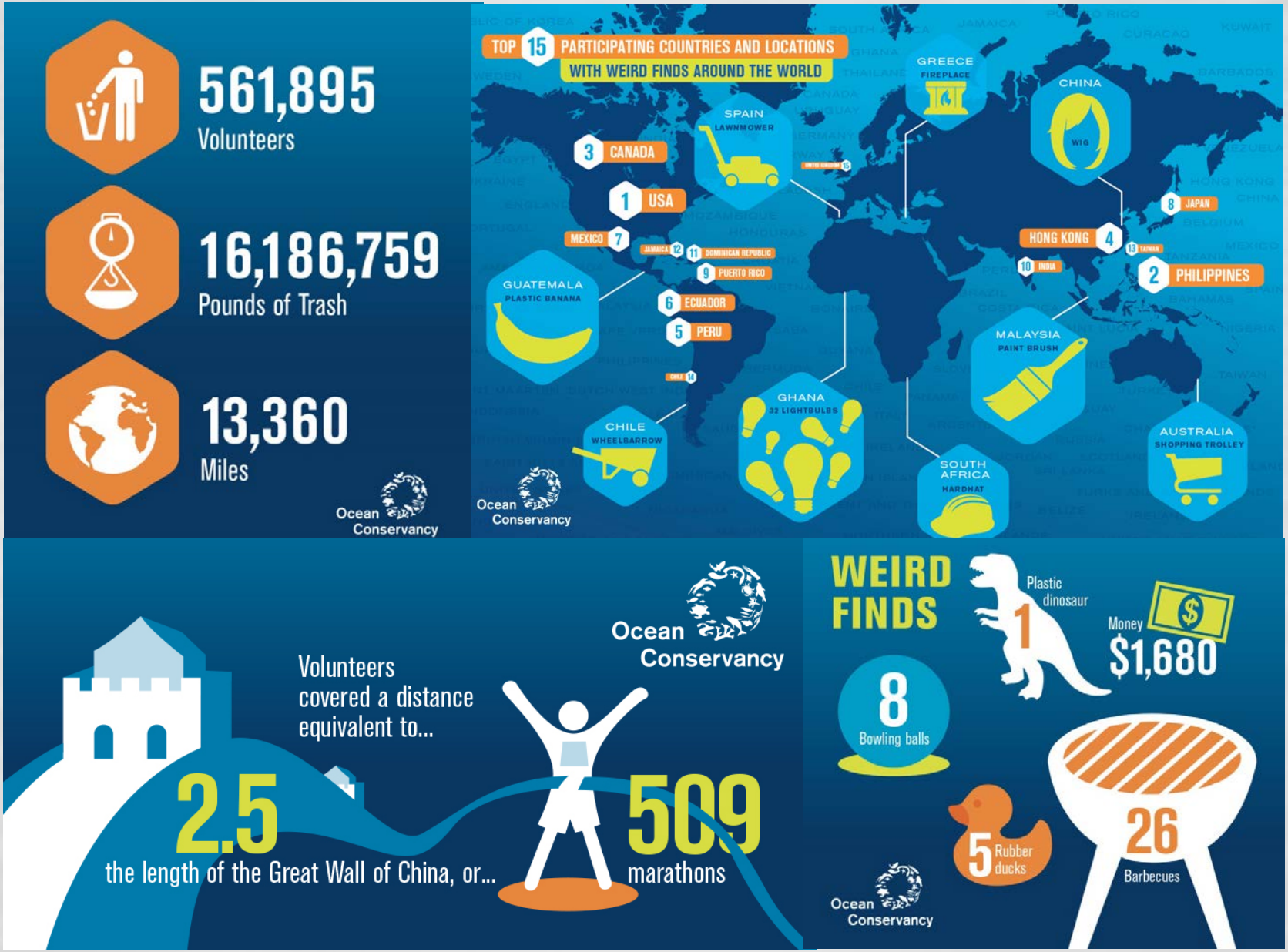

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IMPLICATIONS AND NEXT STEPS

- ✓ Increased attention needed to reduce the threat of derelict fishing gear
- ✓ Policy attention on plastic bags is scientifically warranted
- ✓ Holistic approach necessary; product-by-product approaches alone will not suffice
- ➢ Mitigation strategies:
  - Calculate total threat/beach
  - Prioritize cleanups to maximize conservation impact
- ➢ Incorporate threat findings into risk analysis frame

GLOBAL GHOST GEAR INITIATIVE

TRASH FREE SEAS® ALLIANCE

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THANK YOU, QUESTIONS?

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Wilcox, C., Mallos, N.J., Rodriguez, A.G., Leonard, G.H., Hardesty, B.D. (2016). Using expert elicitation to estimate the impacts of plastic pollution on marine wildlife. *Marine Policy,* 65: 107-114.

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END

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