1
00:00:00,030 --> 00:00:04,040
[ocean sounds] [music throughout]

2
00:00:04,060 --> 00:00:08,240
Narrator: Cape Cod, MA is known for its beautiful beaches.

3
00:00:08,260 --> 00:00:12,390
This scenic landscape is also home

4
00:00:12,410 --> 00:00:16,410
to one of the most frequent marine mammal stranding sites in the world.

5
00:00:24,600 --> 00:00:20,510
[dolphin breathing]

6
00:00:24,620 --> 00:00:28,730
these animals to strand.

7
00:00:28,750 --> 00:00:32,940
What has been proven is that a quick and efficient response in these moments

8
00:00:32,960 --> 00:00:35,320
is a matter of life and death.

9
00:00:35,320 --> 00:00:39,340
Katie Moore: If we can get there quickly and provide supportive care they have a much better prognosis

10
00:00:39,340 --> 00:00:40,960
in terms of survival.

11
00:00:40,960 --> 00:00:44,380
Narrator: Katie Moore works on the front lines, as the Deputy Vice President of Conservation and Animal Welfa

12
00:00:44,500 --> 00:00:48,760
Conservation and Animal Welfare at the International Fund for Animal Welfare.

13
00:00:49,420 --> 00:00:53,460

Through Moore’s fine-tuned rescue efforts, she has increased the survival rate

14
00:00:53,470 --> 00:00:57,560
from 14% to 75%, but the question remains:

15
00:00:57,580 --> 00:01:01,260
Could it be possible to predict, rather than

16
00:01:01,260 --> 00:01:03,800
react to, these events?

17
00:01:03,880 --> 00:01:08,920
Katie Moore: If we develop an algorithm that pieces together the different variables

18
00:01:09,060 --> 00:01:13,120
that may be causing mass strandings or driving driving them,

19
00:01:13,280 --> 00:01:16,520
we'd have the ability to then prevent them.

20
00:01:16,520 --> 00:01:21,820
We can have teams out on the shore, looking for animals in those hotspots, knowing that all those variables

21
00:01:21,980 --> 00:01:26,300
have come together, and this is the likely point in time where we are likely to see it.

22
00:01:26,330 --> 00:01:30,380
We can also have teams ready to respond, so that if they do strand, we are there that much faster,

23
00:01:30,400 --> 00:01:33,200
and more animals will survive the event.

24
00:01:33,200 --> 00:01:40,160
Narrator: In Cape Cod, the annual number of stranded animals ranges from less than 10 to over 200.

25
00:01:40,480 --> 00:01:43,640
Some of the most affected species include

26
00:01:43,640 --> 00:01:46,940
pilot whales and whitesided dolphins,

27
00:01:46,950 --> 00:01:51,050
creatures that are typically found in deeper water, rather than along the coast.

28
00:01:51,070 --> 00:01:55,110
The ongoing search for answers began 400 miles

29
00:01:55,130 --> 00:01:59,220
away at the Bureau of Ocean Energy Management in Sterling, VA.

30
00:01:59,240 --> 00:02:03,410
There, fellow marine biologist Desray Reeb had some initial thoughts on

31
00:02:03,420 --> 00:02:06,620
triggers for these events.

32
00:02:06,620 --> 00:02:10,440
Desray Reeb: For the large proportion of these strandings the animals

33
00:02:10,440 --> 00:02:15,540
are across the ages, in pretty good health, and there's no really

34
00:02:15,740 --> 00:02:19,900
immediate evidence as to why they actually strand.

35
00:02:19,920 --> 00:02:23,800
[water sound] Narrator: Geomagnetic perception,

36
00:02:23,800 --> 00:02:27,020
the ability to navigate using Earth’s magnetic field,

37
00:02:27,020 --> 00:02:30,460
is a feature thought to exist in marine mammals.

38
00:02:30,460 --> 00:02:34,360

Could changes in the magnetic field confuse the animals?

39
00:02:34,440 --> 00:02:39,460
All the way down to the sea floor,
Sensors like magnetometers can detect changes

40
00:02:39,460 --> 00:02:44,960
in Earth's magnetic field - called geomagnetic pulses or storms -

41
00:02:44,980 --> 00:02:49,780
One cause of such changes is activity from the sun known as space weather.

42
00:02:49,780 --> 00:02:54,100
Desray Reeb: Geomagnetic perception is one of the theories.

43
00:02:54,100 --> 00:02:57,180
I thought, well, hmmm...if a magnetometer

44
00:02:57,200 --> 00:03:01,020
can pick it up, maybe the animals actually can pick it up.

45
00:03:01,020 --> 00:03:05,040
Dr. Reeb brought her hypothesis to Antti Pulkkinen, Research Astrophysicist

46
00:03:05,040 --> 00:03:10,280
from the Heliophysics department at NASA’s Goddard Space Flight Center in Greenbelt, MD.

47
00:03:10,280 --> 00:03:13,560
Antti Pulkkinen: The coolest thing was we realized

48
00:03:13,580 --> 00:03:17,660
that nobody had really taken a cold, hard data science analysis look at this problem

49
00:03:17,680 --> 00:03:21,760
Narrator: By combining Katie’s records

50
00:03:21,780 --> 00:03:25,880
on marine mammal strandings in Cape Cod and Antti’s records of the changes in Earth’s magnetic field,

51
00:03:25,900 --> 00:03:29,970
the team of researchers had a starting point.

52
00:03:29,990 --> 00:03:34,080
Katie Moore: What we are trying to look at here was if there was a potential driver or

53
00:03:34,100 --> 00:03:38,230
relationship or correlation between the occurrence of mass strandings

54
00:03:38,240 --> 00:03:40,240
and any solar activity.

55
00:03:40,240 --> 00:03:46,320
Antti Pulkkinen: So, the data we have correlated or analyzed so far is information about local geomagnetic con

56
00:03:46,420 --> 00:03:50,580
We have long data records from geophysical observatories

57
00:03:50,580 --> 00:03:54,120
of the local geomagnetic field variations

58
00:03:54,120 --> 00:03:56,840
and marine mammal strandings.

59
00:03:56,840 --> 00:04:01,000
Narrator: When the team analyzed all the data, they found that measurements from the the same

60
00:04:01,000 --> 00:04:03,000
time period or random time periods

61
00:04:03,000 --> 00:04:07,080
produced similar results, meaning that there is no obvious

62
00:04:07,100 --> 00:04:11,260
relationship between geomagnetic changes and stranding in Cape Cod.

63

00:04:11,280 --> 00:04:15,420
If space weather wasn’t the trigger, what could be?

64
00:04:15,440 --> 00:04:19,540
Desray Reeb: The easy fix correlation between the geomagnetic pulse

65
00:04:19,560 --> 00:04:23,710
and “Ohh! A stranding!” doesn't seem to be very

66
00:04:23,730 --> 00:04:27,780
evident, but what it does show is that there are multiple variables

67
00:04:27,800 --> 00:04:31,890
involved in this equation. The geomagnetic storms could

68
00:04:31,910 --> 00:04:35,990
be one very small part of it - significant still - but

69
00:04:36,010 --> 00:04:40,210
it looks like there are multiple oceanographic and environmental elements

70
00:04:40,230 --> 00:04:44,290
Narrator: The scientists considered what other variables

71
00:04:44,310 --> 00:04:48,340
may exist in the air or water that could change animal behavior.

72
00:04:48,360 --> 00:04:52,470
Tides or winds could be disruptive.

73
00:04:52,480 --> 00:04:56,520
Ocean color - measurements of the water’s chemical and particle content -

74
00:04:56,520 --> 00:04:59,380
could reflect changes in the food chain.

75
00:04:59,380 --> 00:05:02,480
Perhaps sea surface temperature

76
00:05:02,480 --> 00:05:04,720
was a factor too.

77
00:05:04,730 --> 00:05:08,740
With the help of data from NASA Earth Science missions, they could also explore these possibilities.

78
00:05:08,760 --> 00:05:12,860
[Antti talks to team]

79
00:05:12,880 --> 00:05:17,000
Narrator: With more data in hand, it was time to expand the team.

80
00:05:17,020 --> 00:05:21,100
They recruited statisticians, and the expertise of NASA Earth Science

81
00:05:21,120 --> 00:05:25,220
data analyst and oceanographer Erdem Karaköylü.

82
00:05:25,240 --> 00:05:29,290
Erdem Karaköylü: A data set, no matter its shape or content, it always

83
00:05:29,300 --> 00:05:31,260
has a story to tell.

84
00:05:31,260 --> 00:05:36,240
Trying to figure out how the different data are connected

85
00:05:36,240 --> 00:05:39,660
requires a wide diversity of stills and background knowledge.

86
00:05:39,940 --> 00:05:42,800
Katie Moore: For example, I'll be explaining

87
00:05:42,800 --> 00:05:45,740
how a mass stranding how we respond to try and understand why

88

00:05:45,760 --> 00:05:49,850
we are presenting the data in a certain way, and my colleagues from NASA will look at me and ask

89
00:05:49,870 --> 00:05:53,970
questions that I wouldn't think to ask, because I take for granted my understanding, and they are coming

90
00:05:53,980 --> 00:05:56,920
at it from a totally new angle with no background.

91
00:05:56,920 --> 00:06:01,020
Narrator: The group hopes to combine these data sets in a way that reveals a pattern, allowing them to predict

92
00:06:01,020 --> 00:06:05,900
the likelihood and location of mass strandings before they happen.

93
00:06:05,900 --> 00:06:09,940
Desray Reeb: We've really just slowly peeled the first layer of this onion back.

94
00:06:10,400 --> 00:06:13,800
I think there is so many more layers

95
00:06:13,800 --> 00:06:16,940
that still need to be addressed and looked at.

96
00:06:16,940 --> 00:06:22,680
I hope that we can actually find additional collaborators and funding partners to really bring all the data

97
00:06:22,800 --> 00:06:26,860
that is really available to really give this the study

98
00:06:26,860 --> 00:06:29,580
and the scrutiny that it deserves.

99
00:06:29,580 --> 00:06:35,140
Antti Pulkkinen: And we are also going to make all these data sets available to the entire scientific community,

100
00:06:35,180 --> 00:06:39,280
so that we can utilize the entire scientific community to attack and approach this problem.

101
00:06:39,280 --> 00:06:42,080
and approach this problem.

102
00:06:42,080 --> 00:06:47,400
Narrator: The project’s legacy rests not only in a predictive tool, but also as an example

103
00:06:47,560 --> 00:06:50,020
for collaborative research moving forward.

104
00:06:50,020 --> 00:06:54,980
Erdem Karaköylü: I think that there will be other things to take and run with,

105
00:06:55,040 --> 00:06:59,600
get new ideas, maybe add more data. I'm hoping also that it will be a model

106
00:06:59,780 --> 00:07:05,840
for how projects can then be open to the wider public.

107
00:07:06,000 --> 00:07:08,660
[rescue volunteers talking]

108
00:07:08,660 --> 00:07:12,180
Narrator: With the potential for an even broader collaboration ahead,

109
00:07:12,190 --> 00:07:16,380
Katie's rescue team is optimistic that they will gain a deeper

110
00:07:16,400 --> 00:07:20,460
understanding of strandings - and ultimately - save more lives.

111
00:07:20,480 --> 00:07:24,640
Katie Moore: The ability to release animals after they have stranded is tremendous.

112
00:07:24,660 --> 00:07:29,200
When we do that, that's the best feeling in the world after all that hard work.

113

00:07:29,200 --> 00:07:32,820
Desray: those questions that seem unanswerable,

114
00:07:32,840 --> 00:07:37,010
if you give them time, and support,

115
00:07:37,030 --> 00:07:41,090
and effort, and put people on them, we can do amazing things.

116
00:07:41,110 --> 00:07:45,190
[music]

117
00:07:45,200 --> 00:07:48,240
[water sounds]

118
00:07:48,240 --> 00:07:53,200
learn more at www.nasa.gov/beachings

119
00:07:53,360 --> 00:07:56,920
special thanks to International Fund for Animal Welfare.

120
00:07:57,140 --> 00:08:00,040
All marine mammal stranding activities are conducted by

121
00:08:00,080 --> 00:08:02,400
International Fund for Animal Welfare under a permit agreement

122
00:08:02,400 --> 00:08:04,880
with the National Oceanic and Atmospheric Administration.

123
00:08:04,980 --> 00:08:08,280
special thanks to Bureau of Ocean Energy Management

124
00:08:08,280 --> 00:08:12,340
[tone] NASA Heliophysics