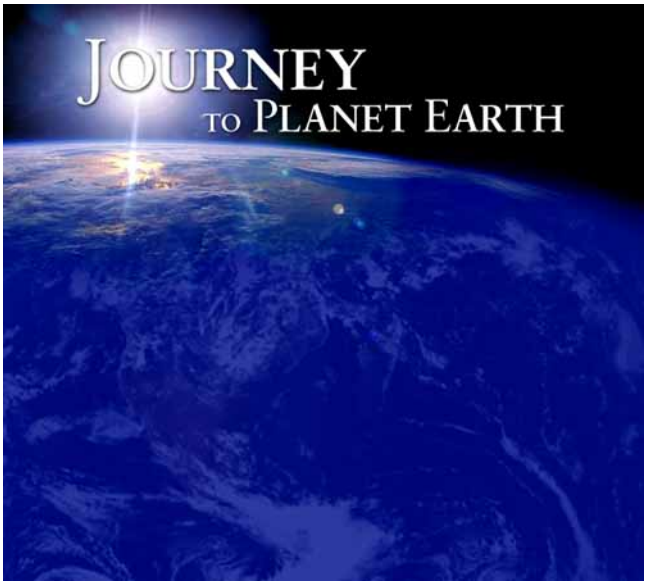

Journey to Planet Earth

Transcript for Episode 15:

DISPATCHES FROM THE GULF – 2:

Research • Innovation • Discovery

Complete Version

Journey to Planet Earth is produced by

Screenscope, Inc.
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Washington, DC 20016

MATT DAMON

On April 20, 2010 the United States experienced the largest offshore oil spill in its history. To discover the impact of the blowout scientists from around the world converged on the Gulf of Mexico.

ED OVERTON

It's one of the first oil spills where enough resources have been put aside to study it for ten years after the spill.

CYNTHIA SMITH

Why are so many dolphins in the Gulf of Mexico losing their young? Why are so many pregnancies failing?

KRISTEN DAHL

I'm using DNA bar coding to look at gut contents of unidentifiable fish. I guess I'm a fish detective.

ANTONIETTA QUIGG

This is really the first step in making the marine snow. When we started this, we didn't know it was going to work as well as it has worked.

MICHAEL SCHLÜTER

We have the ability to produce the same conditions in this laboratory that are in the deep sea. It's like sitting on the floor of the ocean and watching the droplets and bubbles that are rising under these extreme conditions.

ERIC D'ASARO

The purpose of our cruise here is to look at how oil might spread in a future oil spill.

TAMAY ÖZGÖKMEN

There will be two ships, three planes, and they need to be coordinated.

ERIC D'ASARO

We're going to get bounced around a little bit.

FEMALE CREW MEMBER

Let's go.

MALE CREW MEMBER

Two-thirty.

RACHAEL HEUER

Our research group studies the cardiac impacts of oil on fish, especially looking at the heart.

DEAN GRUBBS

This is what we live for, what we work for. All the time spent behind the computer. Biopsy. We only do that really so we can get out here. Look at her. She's gonna swim right off.

BRIAN HAUS

It's really exciting to see how all the pieces come together where all these different people are involved and all these, all these components.

MATT DAMON

Today – an international team of researchers are focused on the Gulf of Mexico. These are some of their stories – intimate portraits of research – innovation – discovery.

(Journey to Planet Earth Series Logo)

MATT DAMON

We begin here – about 60 miles south of New Orleans –as first light touches the salt marshes and shallow waters of Louisiana's Barataria Bay.

DISPATCHES FROM THE GULF – 2:
Research • Innovation • Discovery

MATT DAMON

Protected from the open waters of the Gulf of Mexico by a chain of barrier islands – 200 years ago these coves and bayous were home to marauding bands of pirates.

A Film By
Marilyn & Hal Weiner

MATT DAMON

Though the pirates are long gone the bay remains a popular stopover for tens of millions of migratory waterfowl.

Narrated By
Matt Damon

MATT DAMON

Its marshes and mangroves are fertile nesting grounds and nurseries for birds and fish.

Edited By
Jim McNamee

MATT DAMON

And despite being hit hard by the 2010 oil spill, these waters teem with hundreds of species of marine animals. This is also the permanent home for about 1,300 bottlenose dolphins. Though the acute health effects of the oil spill are over, a team of scientists is searching for answers to a surprising discovery.

Their investigation begins here – almost two thousand miles from the waters of Barataria Bay – at a military base in San Diego, California.

Dispatch # 1:
The World's Healthiest Dolphins

MATT DAMON

This is home to over 70 bottlenose dolphins that are part of the Navy Marine Mammal Program.

Trained to work in open waters – one of their missions is to use their sonar skills to detect enemy threats – like sea mines.

Cynthia Smith is Director of the National Marine Mammal Foundation. She and her team are responsible for the healthcare of the dolphins.

CYNTHIA SMITH

Everyday when we show up to work, we make sure that we're doing everything we can to provide them the best possible care. And part of that is this relationship that develops between our animal care experts and the animals.

What you're seeing here are my colleagues working one on one – a trainer with an animal on their daily physical exam.

ELAINE ALLEN
National Marine Mammal Foundation

Right now we're working with our youngest calf. She's about six weeks old and this is around the time when they start mouthing.

We try to take an opportunity at this point to put fish in their mouth so that it's nutritious and it's good for them.

Just like, us dolphins get bacteria in their mouths and on their teeth and to make sure that their teeth and gums are healthy, we brush their teeth daily.

And as you can see we try to make it as relaxing as possible.

MATT DAMON

But what exactly is the connection between the Navy dolphins and the dolphins of Barataria Bay?

Simply put, these are among the healthiest bottlenose dolphins in the world – a perfect control group for scientists to measure the impact of oil on the bottlenose dolphins of Barataria Bay.

FORREST GOMEZ

Hi lady, you ready?

MATT DAMON

Forrest Gomez is Deputy Director of Medicine.

FORREST GOMEZ

So remind me what her recent history has been.

MATT DAMON

Her care of the dolphins includes monitoring their reproductive health including periodic sonograms.

FORREST GOMEZ

Dolphins do tend to get pregnant more on the left side, which is why we always check the left first.

So far not too exciting but we'll check her again in a couple of weeks because you never know. And then we're also following her with blood work, watching her progesterone really closely.

CYNTHIA SMITH

Pretty much every day we've been training for what's happening in the Gulf of Mexico. Those dolphins have been affected by the Deepwater Horizon oil spill and the only way to really understand that is to study animals like this that are healthy and in good shape.

When we go to the Gulf of Mexico we're interested in why are so many dolphins losing their young? Why are so many pregnancies failing?

Dispatch #2:
Not So Healthy Dolphins

MATT DAMON

Three weeks later Cynthia Smith and her team from the navy dolphin program gather at a marina on Grand Isle, Louisiana – a slender barrier island protecting Barataria Bay.

They have joined a team of NOAA veterinarians, biologists and wildlife epidemiologists participating in a 10-day mission to evaluate the health of the local bottlenose dolphins.

CYNTHIA SMITH

We're already seeing health conditions that are concerning. We are also seeing pregnant dolphins, which is really important and good to document how those fetuses are doing and how the dams are doing.

ERIC ZOLMAN

Thanks everyone again, welcome to second Tuesday.

MATT DAMON

The morning briefing is lead by Eric Zolman, a biologist from the National Ocean Service in Charleston, South Carolina.

ERIC ZOLMAN

I think we're gonna try where we were last week. There's always plenty of dolphins – sometimes too many.

I'm the capture lead for this research project, which basically entails leading the project in the field when we're out on the boats, catching the dolphins. It's my decision which dolphins to concentrate on, which ones to target, and then which ones to ultimately set the net on, and safely handle and get them to the hands of the veterinarians and the trained staff who can then do the actual science of what we're doing out here.

MATT DAMON

Just after sunrise a fleet of eight small boats with nearly sixty scientists aboard – enter Barataria Bay. With temperatures expected to be in the mid-90s, it will be a very long, hot day on the water.

VOICE

Three of them.

MATT DAMON

It doesn't take long before dolphins surround the boats. These are year-round residents who rarely leave the bay. This is why they suffered during the two thousand and ten oil spill. Their feeding behavior was adapted to this specific area so when the oil entered the bay they stayed, rather than move into safer but unfamiliar waters.

ERIC ZOLMAN

What we're looking to get is small numbers: one, two, or three animals in workable waters, which is anything less than five feet in depth.

BOAT CAPTAIN

We got a blue tag with two or three animals coming your way, Eric.

ERIC ZOLMAN

If we find such a group we'll call in the catch boat with a 400-yard-long net on the back of his boat and we'll set a compass, basically just a big circle around those dolphins. We've got about 15 to 20 experienced animal handlers who'll then put it in the water and space them evenly around the compass and induce the animals to hit, ideally in a location that we choose.

The dolphin hits the net. Typically when they encounter that net they'll spin on their long axis, which wraps them up in the net, which is actually a good thing for us because that slows them down. We'll let the net do its work and then we get the handlers in there to support the animal and get them to the hands of the veterinarians and the trained staff who can then do the actual science of what we're doing out here.

MATT DAMON

Each dolphin receives a thorough examination – not unlike what was done back in San Diego. The major difference is that here, the goal is to discover any chronic health issues linked to oil exposure.

Because dolphins are mammals and breathe through their blowhole – monitoring their respiration will help the veterinarians decide whether their lungs are healthy or diseased.

Blood samples are drawn from tail fins to screen red and white blood cells and to check for any abnormalities with their immune system.

Biopsies are also taken for indications of problems with their reproductive hormones and the presence of pollutants.

The samples are immediately brought to the team's floating laboratory. A team of biologists analyzes and processes them. At the end of the day they are sent to scientists around the country for further analysis.

Occasionally the team captures a mother and her calf. When this happens the animals are positioned facing each other so they are never out of sight. This calms them down and allows the dolphins to verbally communicate with each other. The mother is on the right and her very vocal two-year old calf is on the left.

During a routine sonogram Cynthia Smith discovers that the mother, marked as YK5, is in the first trimester of pregnancy. To help the team track her location during the pregnancy they attach a satellite tag to her dorsal fin. Her calf also gets a full physical including dental x-rays. Before they're released mother and calf are weighed. This is the first time they have ever been separated. The calf is clearly unhappy. A few minutes later they are reunited and released.

During the two-week research mission the team examined 38 dolphins. Their preliminary findings are troubling – the scientists discovered that the dolphin population declined from 2,300 before the oil spill to 1,300 today. Many are underweight and in poor health. And

because their reproduction rate is low – 21% as opposed to 65% in the wild – Cynthia Smith worries about the future of this dolphin population.

CYNTHIA SMITH

Trans-generational issues are still a big question and that is something we're worried about. Are these dolphins going to pass reproductive failure issues on to their offspring?

MATT DAMON

About ten miles west of Grand Isle scientists from Louisiana State University are heading to one of their key research sites. The goal is to monitor the condition of Louisiana's marshes.

Dispatch #3:
Good News and Bad News

MATT DAMON

What they soon discover may also shed light on the health of the dolphins. Ed Overton is the lead scientist.

ED OVERTON

What happened to the coastal marshes after the spill occurred is a story of good news and bad news.

A beach is pretty solid grounds and so you can put heavy equipment on that beach and scrape the oil up and clean it up – and you haven't caused a great deal of ecological damage.

But when oil comes on a coastal marsh, the marsh is not very solid.

If you put heavy equipment on it tears up the marsh and it pushes the oil down into the marsh. One of the things you never ever want to do is let oil down below the surface. And so when it comes on a coastal marsh we can't easily clean it up.

MATT DAMON

The good news is that the marshes are recovering.

ED OVERTON

This area was covered with oil and now it's starting to return. There's essentially not a significant amount of oil still left on the surface.

However recently we've discovered that a significant amount has been buried along the beach. It looks like some of the oil flowed down at low tide into crab burrows and stuck there.

And so our current effort is focused on trying to find the buried oil and how much is there.

Once oil gets below the surface it stays down there. It doesn't get released all at once. It gets released a little bit at a time

MATT DAMON

And here's where things get a little complicated.

ED OVERTON

At the edge of the marsh, which you're' standing on now, is literally the nursery ground for the northern Gulf of Mexico fisheries. It's a protected area, for small minnows and other little critters.

MATT DAMON

But these marshes are also a favorite feeding ground for the bottlenose dolphins of Barataria Bay. This raises the question – could the slowly leaking oil along the edge of the marshes be a clue in the mystery of their failing reproductive health?

CYNTHIA SMITH

This story is going to play out for many years and it will take constant monitoring of these populations to really understand what was the long term impact of the spill on dolphins living in the gulf

MATT DAMON

Dolphins are not the only animals affected by the spill. At the epicenter of that story is a place we fondly call The Big Easy.

New Orleans is a city defined by Mardi Gras, jazz, and oysters – lots of oysters.

Dispatch #4:
Mardi Gras, Jazz, and Oysters

MATT DAMON

But during the stillness of early morning New Orleans looks and feels different – more like a sleepy southern town at least until you arrive at a small warehouse tucked away on a quiet street in the French Quarter. The P & J Oyster Company was founded in 1876 and is the oldest continuously operating oyster business in the United States.

In 2010 – just before the oil spill – P & J's workday usually began at 5am. Today things are different.

AL SUNSERI
P & J Oyster Company

We usually shuck on average maybe one day a week now.

We used to sell about 15 to 20,000 pounds of oysters in the shell a day that went to oyster bars in and around the country and we don't do that anymore.

We're trying to do our best to maintain our business and we don't want to see it go down under our tenure.

MATT DAMON

For over 150 years Louisiana was the nation's largest source of oysters. Thanks to a perfect combination of brackish and warm water – each day thousands of tons of oysters were harvested – loaded on to barges – and sent to New Orleans and on to cities around the country. By 2010, Louisiana supplied nearly 42 percent of the nation's oysters. But then the Deepwater Horizon blowout happened.

Emergency crews did everything possible to protect coastal beaches and marshes. To breakup as much oil as possible, dispersants were sprayed onto oil slicks on the surface of the water as well as directly into the escaping oil. After much debate massive amounts of fresh water from the Mississippi River were released into the Gulf.

At locations all along the lower Mississippi River giant valves and floodgates were opened – and for three weeks the Louisiana delta became a freshwater estuary. The hope was that the fresh water release would push the oil away from the coast.

But in the end nothing could stop the advancing oil. Ultimately, the oyster beds of Louisiana suffered a devastating blow – too much fresh water. The impact on eggs, sperm and larvae was deadly.

The impact on the economy of Louisiana's oystering communities was equally damaging. About 60 miles southeast of New Orleans, is the mostly African American fishing community of Pointe à la Hache.

Nearly all the oyster boats in the local marina are idle. Byron Encalade is President of the Louisiana Oystermen Association.

BYRON ENCALADE

After the spill went out there and found nothing but dead oysters.

This community is dead. It pushed it into poverty like we have never saw before. We have always prided ourselves as being recession proof in this community.

What's the road to recovery? Give us something.

We need the facts, regardless of what it is. We need facts and we need good science.

SEAN POWERS

You know that's a big question and that's the question that we're trying to explore.

Dispatch #5:
"We Need Facts"

MATT DAMON

Sean Powers is Professor and Chairman of Marine Sciences at the University of South Alabama. He and his colleague Meagan Schrandt are studying oyster reefs along the Gulf coast. One of their key missions is to discover why Louisiana oyster reefs haven't recovered.

Though this site in Alabama was untouched by the oil spill – it speaks volumes about the ecological importance of oyster reefs.

SEAN POWERS

So oysters everybody knows are valuable cause people like to eat them but that's just one of the values that oysters have. Oysters are much more important ecologically than most people understand.

One of the things oysters do is they stabilize the shoreline. These oysters will form a protective blanket around the marsh to make sure that wave energy doesn't erode that marsh away.

One of the things we know from the Deepwater Horizon in Louisiana was when this habitat was damaged by oil we saw more erosion of the shoreline.

Let's see if we can get the boat closer to the shoreline.

MATT DAMON

At a second research site, after first recording the water salinity and temperature, they randomly mark an area – and gather everything living on that part of the reef.

MEAGAN SCHRANDT

We're selecting about top 10 centimeters of material from the oyster reef. So everything that's within a quarter meter square

SEAN POWERS

We're ready to take our samples back to the lab and process these so we can get good counts of the number of live oysters associated with the oyster reef.

MATT DAMON

Once back at their laboratory – they sort everything gathered – by location, size, and species.

SEAN POWERS

My conclusion is that in 2010 something very bad happened to oyster populations in the central Gulf of Mexico. But one of the things that really strikes me is how long it's taken the oyster reefs to recover after the Deep Water Horizon oil spill. And that was the big

question for me. Because once you oil those habitats then you have a long-term legacy of the spill. Those habitats will take an enormous amount of time to come back and species that rely on those habitats will be injured for multiple, multiple years.

MATT DAMON

Like most research studies – data is the key to discovery. And as Sean Powers and Megan Schrandt continue to gather information another mystery is unfolding and it's happening in one of the most isolated places on Earth.

Dispatch #6:
Underwater Blizzards

MATT DAMON

The Gulf of Mexico contains a deep ocean galaxy of tiny animals some no bigger than a pinhead. Creatures like bacteria, algae, and jellyfish. It's a dazzling display of nature that exists in nearly every ocean of the world.

And then there's a phenomenon called marine snow when these creatures join with other small particles – like plants and animal wastes – to form sticky flakes slowly drifting downward through the water column. As it descends to the ocean's floor the marine snow picks up additional particles and grows larger until it becomes a major food source for animals – particularly for those living in the deep ocean. But what does this have to do with the Deepwater Horizon oil spill?

In 2010, while millions of gallons of oil poured into the Gulf, something very unexpected happened.

Wherever the currents took the oil – gently falling marine snow suddenly turned into a blizzard as it mixed with oil and dispersants. Left behind was an area of oiled sediments, about the size of Delaware, covering the floor of the Gulf of Mexico.

Research scientists at Texas A & M University in Galveston are investigating the interaction between marine snow, oil, and dispersants. Their first challenge was to create marine snow in the laboratory.

MATT DAMON

Uta Passow is a specialist in biological oceanography.

UTA PASSOW

Marine snow is really important because it's the only way food gets transported to the deep ocean. Plants can only grow at the surface of the ocean because only there is some light. And the other animals – living deeper down where it's dark – rely on this marine snow to bring food down to them.

MATT DAMON

Antonietta Quigg is a Professor of Marine Biology. She is the team's lead scientist.

ANTONIETTA QUIGG

So this is really the first step in making the marine snow. We mix the plankton with the oil or the oil plus the dispersant and then we give them 2 or 3 hours – sometimes it takes 6 to 7 hours.

It's really important in helping us to understand why we saw so much more marine snow formed after the spill.

Something that we haven't seen with other spill events that have occurred around the world.

MATT DAMON

Like most scientific studies there are rarely quick or easy answers. Finding the precise link between marine snow, oil, and dispersants and their impact on marine animals will require continued research and collaboration with other scientists.

Dispatch #7:
Secrets From The Deep

MATT DAMON

Not very far away, in Panama City Florida, Dean Grubbs, a world-renowned expert on the ecology of sharks is preparing for an 18-day research cruise.

He is joined by colleagues from Florida State University. The team's mission is to catch deep ocean fish living near the site of the 2010 blowout. Their goal is to create a baseline of information – as well as to discover the long-term impact on fish living in areas covered with oil carried by marine snow.

DEAN GRUBBS

When everyone realized that the spill occurred at about 5000 feet deep, the first question folks started asking was what lives down there, what organisms, what communities are actually being affected by this oil right now.

Okay, I updated the schedule.

MATT DAMON

Dean Grubbs and the vessel's captain go over the itinerary.

DEAN GRUBBS

That should get us in before midnight. Sounds good.

MATT DAMON

Twelve hours later they reach their first research site.

DEAN GRUBBS

We're getting ready to bait up. So on these sets we set 50 hooks and they range from little tiny ten aught hooks that take little tiny bait, up to a 16 aught hooks to take basically the whole side of a carcass. That allows us to basically catch everything from the smallest of the sharks up to up to the largest of sharks and big snake eels and that kind of thing all on the same set.

Let me know when you're ready Captain. All right, go on over.

So we're putting out our largest hooks first. These will be the last ones that we'll bring in. They're the ones that tend to catch the really big sharks. The 14-foot tiger sharks and 17-foot six gilled sharks and things like.

MATT DAMON

The team puts out a series of baited hooks. About two hours later they are ready to pull in the lines.

DEAN GRUBBS

Okay. I think we're ready Captain. Fish on.

Whenever we get a fish on we'll ID the fish – it'll get a specimen number from there if it's a shark then it will get its temperature taken and blood sample by Bianca for the stress physiology work and then it will get measured and weighed. John will take the liver and bile. Those are all the samples that will go for the toxicology work. It's a pretty streamlined process.

The ironic thing is we actually tried to get funding to do this exact kind of work to get base line data in preparation for a spill three years prior to the spill. There was no interest. And, and so we were behind the curve when the spill happened. No one knew what the what the effects may be or what animals may be affected and so that's why we actually sample all the way from just a few miles from the spill up to almost 300 miles away from the spill.

MATT DAMON

Despite the hour the team continues to set lines – haul in fish – and collect baseline data and toxicology samples. They will work through the night and into the morning. For oceanographers, these marathon sessions are often a time for reflection.

DEAN GRUBBS

When I was about 7 years old I caught a small Atlantic sharp-nosed shark and I told my parents I was going to be a marine biologist. I went through stages where I wanted to be a pro football player and a rock star but eventually I came back to being a marine biologist. That's the career path I chose.

See bubbles – have a critter coming – the thing of horror films. That's the giant snake eel. They're only found in the Gulf of Mexico. That big snake eel was only described in 1980.

Fish on. This one's even bigger. Yeah their only in the Gulf and mostly only over here where you got the Mississippi River plume and all the sediments of the Mississippi – that filthy sediments – that's what they like.

MATT DAMON

This is Dean Grubb's 15th cruise since the spill. The information he and his team gather is critical to discovering the long-term impact of oil on the health of deep ocean animals. John Whalen is a PhD student at the University of North Florida.

JOHN WHALEN

I'm going to look at molecules in their liver that increase in concentration after exposure to pollutants such as oil related products.

MATT DAMON

Bianca Prohaska is a PhD candidate studying biology at Florida State University.

BIANCA PROHASKA

I take the whole blood and I spin it down in the centrifuge and then I'm able to get the plasma, which separates from the red blood cells. And that's what I'm going to look at and see what reproductive condition fish are in.

MATT DAMON

And when all of the samples have been worked up and all the data is logged in, there are still chores to be done. On a small vessel with a limited budget and crew everyone chips in. No one is excused – no matter how many advanced degrees you have.

After going nearly 24 hours non-stop – some team members try to catch a few winks of sleep.

DEAN GRUBBS

We do keep a pretty intense schedule out here and get maybe 4 hours of – I don't call it sleep cause you're on a rolling ship.

For folks that aren't used to it, it can be pretty rough on them their very first trip but your body gets used to it.

MATT DAMON

But what happens next will really test the team's endurance and strength.

DEAN GRUBBS

We got a big fish. We got a big fish. Got a big six-gill shark coming.

MATT DAMON

Everyone rushes to the stern. It's extremely rare to see a live six-gilled shark.

DEAN GRUBBS

I bet she's a thousand pounds at least. We're going to test that winch.

She's almost too big for the stretcher.

MATT DAMON

This is one of the world's largest sharks and its appearance is similar to fossil sharks dating back roughly 200 million years.

DEAN GRUBBS

Go out with A-frame just a little bit for me. Think that'll hold? Okay, now up. Real slow; real slow. Keep coming up. You gotta do this fast guys. Okay, hold it; hold it. One, two, three. There we go. Now we're talking.

All right. Measurements.

A lot of people think about the dangers of dealing with these sharks and there are certainly dangers.

Joe, cattle fin has been bitten.

A rolling boat - rough seas – your working with scalpels and hypodermic needles taking blood samples and bile samples. Working on a deck of a research ship can be quite dangerous.

We try to get her in within about two to three minutes, but they're pretty tough animals.

MATT DAMON

They say that once you look into the eye of a six-gill, you'll never forget it.

DEAN GRUBBS

All right. Let's get her over board.

MATT DAMON

The team is now in a race to get the shark back in the water as soon as possible.

DEAN GRUBBS

Out with the A-frame. Go ahead and let her down a bit. Yeah, just about. Down. Okay, hold what you got. Look at her, she's gonna swim right off.

Yahoo!

MATT DAMON

For the next 18 days Dean Grubbs and his crew of scientists will endure harsh weather conditions – lack of sleep – and backbreaking work.

DEAN GRUBBS

For those of us who are field biologists this is this is what we this is what we live for, what we work for. All the time spent behind the computer writing grant proposals, analyzing data, writing papers and all that, all we only do that really so we can get out here on the boat and collect data at sea. I think to a normal person they think we're crazy wanting to come out here and stay up for hours on end you know on a rolling ship. You know doing things like watching line come out of the water. But this is like space exploration to fish biologists. Being able to do work in the deep sea like this and see potentially new species to science and a lot of different species that very few people have ever seen.

MATT DAMON

After years of gathering information about deep-ocean fish Dean Grubbs is cautiously optimistic.

DEAN GRUBBS

This has become the largest survey of deep water sharks ever conducted. What we've seen is that the toxicological effects of the oil actually kept ramping up for two and a half or three years after the spill and then started coming back down. I am cautiously optimistic that the effects of the spill were relatively short lived and moderate.

But these animals grow so slowly – they reproduce slowly – so it takes a long time for these effects to work their way up the food chain to these really slow growing animals. And I think it'll take at least ten years before we're able to see if they are really recovering.

MATT DAMON

Far from the deep waters of the gulf – thousands of other scientists are working together to fully understand the implications of the oil spill.

Dispatch #8:
Centers Of Innovation

MATT DAMON

And this is where their work usually begins – in research laboratories that are centers of innovation. It's where long hours are spent searching for answers – and making discoveries.

Rachael Heuer has a PhD in Marine Biology and Fisheries. She does her research at the University of Miami.

RACHAEL HEUER

Our research group studies the cardiac impacts of oil on the mahi-mahi, especially looking at the heart.

And where my research fits in is taking a look at the actual cells to get a better idea of what's going on.–We know that there's something that is causing the heart to have

problems with oil exposure. And the bottom line of my particular study, looking at the cells, just one cell at a time, is to understand why that's happening, to get a better idea of what mechanism is causing those impacts that we're seeing.

MATT DAMON

At times the team's investigation could be a scene out of a science fiction movie.

Here we see the still beating heart of a fish isolated from its body.

So what do you think – reality or science fiction?

You've probably already guessed this is cutting edge science.

Georgina Cox is a comparative cardiovascular physiologist and a member of the team studying Mahi-Mahi.

GEORGINA COX

I measure metrics of cardiovascular function to look at how the heart performs before oil exposure and after oil exposure.

What we've done is we've removed the heart from the animal and cannulated the inputs to the heart and the outputs of the heart.

So, now we've got control of everything going into the heart and everything coming out of the heart.

What's going into the heart right now is physiological saline. This simulates the blood that's in the fish.

So, basically the heart doesn't know that it's out of the animal.

Now we can measure how the heart is doing in terms of cardiovascular performance.

We expose fish to concentrations of oil that were actually measured in the Gulf of Mexico during the spill and then measure cardiovascular function.

We've shown that cardiovascular function is compromised, um, due to oil exposure.

MATT DAMON

The research team also uses a swim tunnel, which is basically a treadmill for fish, to monitor the metabolic rate and swim performance of Mahi-Mahi exposed to oil. The scientists discovered that when the fish are exposed to oil they don't swim as well as unexposed animals.

Martin Grosell is a Professor of Marine Biology and the team's lead scientist.

MARTIN GROSELL

We do know that swimming performance is critical for these animals to capture prey, to avoid predation, to perform migrations, and probably also for spawning activities. So the assumption here is that based on what we see in the laboratory with respect to heart function and swim performance, would translate to lower success in survival in the wild of these animals. Without this complete understanding we do not truly know what's going on and we do not truly know what are the most sensitive indicators of impact by an oil explosion.

MATT DAMON

Thousands of miles from the Gulf of Mexico is the picturesque town of Trondheim, Norway.

Dispatch #9:
European Partners

MATT DAMON

Here at SINTEF – the Foundation for Scientific and Industrial Research – scientists are collaborating with a team from Johns Hopkins University to develop better ways to ease the impact of future oil spills.

CJ BEEGLE-KRAUSE
SINTEF

After Deep Water Horizon I really questioned myself in terms of what did I need to learn in order to be a better responder in the future. So I brought my family here to Norway so that I could gain that expertise in what could I contribute in terms of developing tools and modeling capabilities.

The tower basin is where we do studies for droplet size so we can simulate a blow out on a small scale. Our hope is that we can in real time be able to monitor and potentially alter the droplet size distribution and that's important because the droplet size distribution determines how much of the oil stays in the subsurface versus how much reaches the surface.

EMLYN DAVIES
SINTEF

We learn something new every time we do an experiment. Small droplets are good because they rise slowly. A large droplet will be very buoyant and it will reach the sea surface quickly and you have a very thick oil slick, which is very difficult in some cases to clean up.

MATT DAMON

Norwegian scientists are not the only Europeans collaborating on oil spill studies.

Less than a thousand miles to the south – in Germany's second largest city – is the Hamburg University of Technology.

Here, scientists, in collaboration with colleagues from the University of South Florida, are also searching for new ways to understand the impact of oil spills.

Karen Malone is a Master in Mechanical Engineering. She is focusing on the Karen Malone is a future – when deep water spills may become more common as Gulf of Mexico oil exploration goes two or three miles below the surface.

KAREN MALONE

The experiments we are doing here are pretty unique and pretty new to the world of oil spill science because to-date we mainly had spills on the surface or in very shallow waters. This is deep water so in our experiments we are replicating the exact environmental conditions we're having down in the Gulf of Mexico.

MICHAEL SCHLÜTER
Hamburg University of Technology

It's like sitting on the floor of the ocean and watching the droplets and bubbles that are rising under these extreme conditions.

KAREN MALONE

This is the first time we have the possibility to replicate this in the lab and to really find out what is driving these processes.

MICHAEL SCHLÜTER

It's really a miracle that this oil spill brings people together from all over the world, independent of the language of the country where they are coming from.

MATT DAMON

And as new technologies continue to emerge, funding and collaboration between research laboratories becomes much more common.

Back along the Gulf Coast another team of scientists is about to launch an innovative and multifaceted experiment. They are preparing two research vessels for a month-long cruise to locations near the site of the 2010 oil spill. Their goal is to test new equipment designed to predict where the wind, waves and currents of the Gulf would take surface oil after a major blowout. If successful the information could improve the response to future oil spills – saving the coastal marshes or even the Barataria Bay dolphins from further harm.

Dispatch #10:
Tracking Ocean Currents

MATT DAMON

Eric D'Asaro is the chief scientist on the cruise.

ERIC D'ASARO

It's a little crazy but we've done this a lot of times. It'll just happen. People are all working at their sort of pace.

There are problems and then they try to solve them and I'm not terribly worried about it.

BRIAN HAUS
University of Miami

We got a lot of different teams coming together here at the last day. Everybody's here from the University of Washington, British Columbia, Scripps.

ERIC D'ASARO

The purpose of our cruise is to look at how oil might spread in a future oil spill. So where it goes, cause that really matters. People care whether it goes where they are and so knowing where it goes is a big deal cause if you don't know where the oil is going to go then it's hard to prepare people and set up the cleanup, things like that, which is why we are working on it.

MATT DAMON

Tamay Özgökmen is responsible for the entire operation.

TAMAY ÖZGOKMEN

It took us an entire year to prepare for this cruise, mainly because we didn't have the equipment needed to carry out the measurements.

MATT DAMON

The team has brought with them a new generation of a device called a drifter – a mechanism that floats with ocean currents while transmitting data like location, speed, and water temperature.

TAMAY ÖZGÖKMEN

This is a really, really great chance for us to push science forward.

If you don't have science to help you make quantitative decisions, then you have to essentially guess. A lot of things can go wrong. Probably the biggest problem is weather.

MATT DAMON

And that is exactly what happens.

WEATHERMAN

We've got this huge mass of weather in the Gulf we'll probably have gale force winds for a time so don't even think about boating tomorrow morning.

MATT DAMON

By the time the two research vessels reach their drifter deployment site the weather has turned.

ERIC D'ASARO

We've been deciding what to do about the weather and we're not going to risk it because there's too much potential for damaging equipment – meanwhile we can get some of our equipment tested and then just wait.

MATT DAMON

But then some good news – the weather forecast changes – by sunrise the seas will be much calmer. The team seizes the opportunity and starts assembling the drifters for a morning deployment. Brian Haus specializes in the use of satellites to track ocean currents.

BRIAN HAUS

These contain a GPS on this board so every five minutes it'll update its position to the satellite, which will send the data back to our server at the University of Miami.

In the end we're going to have to build 200 drifters. The other boat is going to be building 800.

MATT DAMON

The work continues through the night – even during times of heavy wind and rain.

And when the team does take a break it's not long before they're called back to work.

INTERCOM VOICE

Okay back deck boys, five minutes till lift-off.

GUILLAUME NOVELLI

Squalls coming through so it will be wet on the deck. Not the most comfortable, but it's workable.

MATT DAMON

By morning the skies are clear – but the seas are still rough. Deploying the drifters is still on hold.

At an airport near Gulf Shores, Alabama other members of the team are preparing to provide logistical support.

SPENCER NAPOR

There's no problem for us to fly today?

JEROEN MOLEMAKER

We will fly

SPENCER NAPOR

Excellent.

JEROEN MOLEMAKER

The plan is to fly. Look outside. How can you not fly on a day like this? There's great science to be had.

The boats are ready to do their large-scale deployment. What we are trying to do is give them a heads up on how the ocean looks like in that area.

MATT DAMON

Two hours later they fly over the research vessels and send an updated sea-surface report.

Though the seas are still rough they've calmed enough to deploy the drifters.

ERIC D'ASARO

First drifter deployment.

HELGA HUNTLEY

And go.

ERIC D'ASARO

Deploy drifter number two. We're throwing out drifters. So it's going well. We just have to keep going. It's a marathon, not a race.

HELGA HUNTLEY

I'm keeping track of when they're throwing the drifters in the water. I put down the drifter number and the way point number. The time they dropped it and the GPS location so they have some record as to when the drifters were launched.

VOICE

All right. Last one.

MATT DAMON

During the month-long cruise the research team deployed over a thousand drifters. Assisted by a wide variety of communication and data gathering tools, it's an experiment on a scale that has never been done before. The initial results are remarkable real-time visualizations of oceans currents that will ultimately lead to computer models that will help predict the movement of oil during future spills.

When all the information is analyzed and programmed – this unprecedented experiment will enhance our knowledge of ocean observations for years to come.

Dispatch #11:
Final Thoughts

MATT DAMON

Today, the scientific community is working together to push the boundaries of what they have learned about oil spills and what still needs to be discovered. Their efforts represent one of the most remarkable collaborations in the history of marine science.

ED OVERTON

We're learning a lot more about what happened to the oil, how much damage did it do, and its lingering effects on the environment.

ANTONIETTA QUIGG

The language of the biologist is slightly different from that of the chemist and so we've had to come together and learn how to interact and work together.

SEAN POWERS

We realized that we needed physical oceanographers to tell us where the oil was going. We needed biologists to tell us what the response of the animals was. We needed socio-economists to tell us what the public perception of it was and what the economic impacts of the damages that we were seeing.

BRIAN HAUS

It's been a great collaborative enterprise. We have dozens of scientists all trying to solve the same problems and all sharing in a way that I've never experienced before in my career.

MATT DAMON

In the end – there are no easy answers – no quick fixes. This presents both industry and the scientific community with an enormous challenge – the need to work together to strike the right balance between the search for new sources of energy and what nature can safely provide.

Though separated by distance and culture – for the more than seven billion people who draw sustenance from the resources of the world – there are common bonds – bonds that are renewed by each generation – bringing new ideas – new attitudes – new hope. Planet Earth – this is our home – this is where our journey of discovery must begin.

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[Tail Titles / Production Credits]

Titles	On-Camera Interviews
Series Host/Narrator MATT DAMON **Producer** MARILYN WEINER **Writer/Director** HAL WEINER **Editor** JIM MCNAMEE **Co-Producer** REBECCA HOWLAND **Science Advisor** CHUCK WILSON **Director of Photography** WILLIAM MILLS **Sound** JOHN NEU **Additional Photography** TORGEIR HELGESEN RISETH VINCENT SOMMER DAVID ULLOA HAL WEINER **Original Music** FRANK FERRUCCI CHRISTOPHER MANGUM **Series Science Advisor** THOMAS E. LOVEJOY **Series Editorial Advisors** BRUCE BABBITT BONNIE COHEN PETER HART ANDREW LIGHT ANNE SHIELDS	**CYNTHIA SMITH** I grew up on the Gulf coast and spent a great deal of time on the beach watching wild dolphins swim by. So that's really where the inspiration started. **MEAGAN SCHRANDT** I was fortunate enough to take a lot of trips to the beach when I was a kid. And my parents couldn't keep me out of the water or away from anything that moved in the water. So I've always sort of been interested in marine life in general. **MARTIN GROSELL** I was raised in a very rural area, very close to a pond. And I spent most of my waking hours in that pond netting out any aquatic organism I could get my hands on. And I was always fascinated by the ability of these animals to live in an environment – the water – where we cannot survive.

Titles	On-Camera Interviews
Social Media Outreach NORA ZELEVANSKY **Production Controller** VICTOR J. CALANDRA **Educational Materials Development** MARGARET PENNOCK **Assistant Editor** SAM SHELINE **Web Site Design** REVELATION CONCEPT **Post-Production Facilities** HENNINGER MEDIA SERVICES THERAPY STUDIOS **Special Thanks** JENNIFER ALLEN LUKAS BAASCH JEAN-MICHEL COUSTEAU - OCEAN FUTURES SOCIETY JIM KNOWLTON - OCEAN FUTURES SOCIETY LOUISIANA WILDLIFE AND FISHERIES COMMISSION ALVARO E. MIGOTTO – UNIVERSITY OF SÃO PAULO, BRAZIL MONTEREY BAY AQUARIUM RESEARCH INSTITUTE NATIONAL WILDLIFE FEDERATION NEW ORLEANS TOURISM MARKETING CORPORATION NOAA COLIN J. O'HARA OBSERVATOIRE OCEANOLOGIQUE DE VILLEFRANCHE-SUR-MER OCEANEERING INTERNATIONAL RESTORATION GULF COAST CHRISTIAN SARDET – PLANKTON CHRONICLES TARA OCEANS EXPEDITION US ARMY CORPS OF ENGINEERS – TULSA DISTRICT US DEPARTMENT OF DEFENSE	**BIANCA PROHASKA** As far back as I can remember, I've always been really interested in animals and I love the outdoors. I always went camping when I was little.

Titles	On-Camera Interviews
Additional Footage Courtesy of: Adventure Outpost, Fox 13 – Tampa Bay, North Carolina Coastal Federation, Pond5, Theodore Roosevelt Conservation Partnership, The Nature Conservancy, Videoblocks, and WFSU Public Media. Footage of Eastern Oysters is provided courtesy of UNC-TV. **Screenscope Acknowledges the Fair Use of Footage from:** ABC News, CBS News, NBC News, and other sources. This program was produced by Screenscope, which is solely responsible for its content. A SCREENSCOPE PRODUCTION 	**TAMAY ÖZGÖKMEN** The reason I got interested in science to begin with was because of the US space program and "Star Trek." Spock died! I was so upset!

(GoMRI Logo)

UNDERWRITING NARRATOR

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