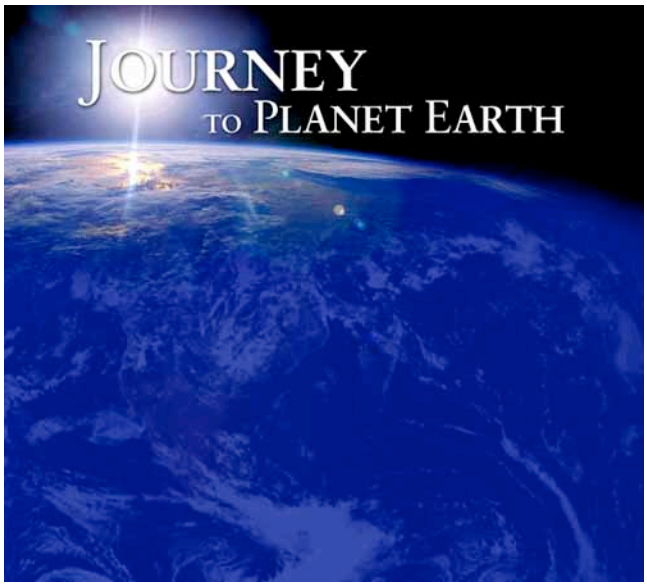

Journey to Planet Earth

Transcript for Episode 14:
DISPATCHES FROM THE GULF

Complete Version

Journey to Planet Earth is produced by

Screenscope, Inc.
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CHRIS REDDY

I got a phone call from a friend of mine who works for the government and he said, "You have to get involved in this spill."

MATT DAMON

It happened on April 20th 2010 – 41 miles off the coast of Louisiana.

CHRIS REDDY

Woods Hole Oceanographic Institution

It's going to change your career. It's going to define every part of the rest of your life. You have to get in the game and get down here.

MATT DAMON

Tragically – the explosion killed 11 – and changed the lives of millions living near the Gulf coast – as well as hundreds of scientists who responded to the crisis.

CHRIS REDDY

I was as close to the well as any scientist could be. This cauldron of oil that's flying out of the bottom of the ocean floor.

MATT DAMON

Four weeks after the BP Deepwater Horizon disaster – oil hit the Louisiana coast.

WAYNE KELLER

Port Commission – Grand Isle, Louisiana

The first few days of the major impact, it was – it was – mind-boggling.

Everybody just could not believe how much oil was on the beaches.

MATT DAMON

In an effort to breakup as much oil as possible, almost two million gallons of dispersants were sprayed onto the surface of the water and directly into the escaping oil. By the time the well was capped – 87 days after the blowout – hundreds of communities and millions of people were affected.

ROBERT CRAFT

Mayor – Gulf Shores, Alabama

We smell fumes from oil. Is it safe to stay here and breathe? Can we get in the water? Can we walk on the beach?

TRACIE SEMPIER

Mississippi-Alabama Sea Grant Consortium

People were looking for answers and I think that was a very difficult time because we were still trying to research and uncover what had truly happened.

DAVE HOLLANDER
University of South Florida
This was a really a catastrophic disaster, but it was – from a scientific point of view – this is an incredible opportunity to really understand how the ocean responds… how the system really functions.

STEVE MURAWSKI
University of South Florida
What ran through my mind first was let's go out and get some base-line data. At least have some measurements about what was there before the oil.

DEAN GRUBBS
Florida State University
When I heard about the oil spill and I realized that the blowout occurred at 1500 meters deep, I knew that we didn't have any baseline data for the large fishes in that area.

MATT DAMON
To discover what happened – scientists from around the world turned their attention to the Gulf of Mexico.

DAVE HOLLANDER
A whole research community has developed.

CHENG LI
It's composed of engineers. It's composed of chemists, biologists.

HANK ASHBAUGH
Tulane University
We all get to work on pieces of this very big puzzle.

STEVE MURAWSKI
We're trying to see if we can come up with new, unique methods to understand the oil pollution process.

JOSEPH KATZ
Johns Hopkins University
In controlled experiments that we perform in the laboratory, we try to answer these questions.

MANDY JOYE
Every dive I've seen something new that I didn't know before. We discovered processes and organisms and microorganisms that are new to science.

MANDY JOYE
University of Georgia

I mean good grief, how incredible is that? That your job is to discover things that no one has ever seen before.

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. Stories that speak directly to a nation still recovering from the largest oil spill in U.S. history.

DISPATCHES FROM THE GULF

CREW MEMBER

Stay clear of the ground wire.

CAPTAIN BAUMEISTER

Go ahead and light up the bow thruster.

CREW MEMBER

Good.

A Film By
Marilyn & Hal Weiner

Narrated By
Matt Damon

Dispatch #1: The Journey Begins

MATT DAMON

The Weatherbird II is on the second leg of a two-week cruise. At 115 feet, it's one of the better-equipped research vessels working the waters of the Gulf of Mexico. Its current mission is to collect and analyze fish and soil samples near the site of the Deepwater Horizon oil spill.

DAVE HOLLANDER

And that'll be up in the site DSH 10, which is at a depth of 1500 meters.

MATT DAMON

Dave Hollander and Steve Murawski are leading a team of oceanographers from the University of South Florida. Working closely with the ship's captain, Brendon Baumeister – they've spent weeks developing their itinerary.

STEVE MURAWSKI
We're really interested in the fish all along the area north of the Deepwater Horizon.

MATT DAMON
Because time aboard the Weatherbird is limited and expensive, their plan is to divide into two teams and work around the clock.

BRENDON BAUMEISTER
Okay. That'll put us in a few hours behind. So it looks like we'll probably arrive to the first fishing site like mid-afternoon tomorrow.

MATT DAMON
Running behind schedule and with the clock ticking – the team is facing one other time-related problem. Though the spill happened six years ago, Gulf coast communities are still pressing scientists for more information – more answers about the environmental impact of Deepwater Horizon.

Dispatch #2
What's At Stake?

MATT DAMON
If you travel south – through the back-country of Louisiana – eventually you'll arrive at a point where the land begins to join the Gulf of Mexico. And then it soon becomes obvious – in this part of the world, everything and everyone is tied to the rhythms of the sea, including shrimpers like Donald Dardar.

DONALD DARDAR
I've been shrimping for over 40 years now. My dad was a shrimper and his dad was… Well they were shrimpers and crabbers and trappers.

DAVID CHAUVIN
David Chauvin's Seafood Company
Shrimping has been in my family for four generations. It's all we've ever done and the way we've always supported our families and made a living.

TIMOTHY LUKE
It's wonderful – I mean you're your own boss and you don't have nobody to answer for.

MATT DAMON
For crabber Timothy Luke and thousands of other watermen working the waters of the Gulf – the oil spill changed everything.

DAVID CHAUVIN
It's just scary how one little pipe in the middle of the Gulf could change so many lives and, and rearrange things in a way that you could have never imagined.

MATT DAMON
What's at stake is not only a way of life – it's the future of one of the most biologically fertile regions in the world – a place whose waters provide 40% of the commercial seafood caught in the lower 48 States.

The Gulf's coastal wetlands and marshes are home to thousands of species of plants and animals – and its beaches help support a hundred billion-dollar tourist industry. But after 87 days of oil spewing into the Gulf, the beaches and salt marshes were hit hard – hundreds of thousands of marine animals and birds died.

ROBERT CRAFT
Mayor – Gulf Shores, Alabama
All of our tourists left, everybody evacuated, basically left – didn't want to be here. A lot of just unanswered questions created a lot of fear and concern.

MATT DAMON
Fear and concern – empty beaches — unanswered questions. Caught in the middle of a public debate was the scientific community.

STEVE MURAWSKI
Our role is primarily to look at the weight of evidence of what we've got and then come up with the most reasonable explanation for the different things that we're actually seeing.

MATT DAMON
And what the public saw were oil slicks covering 65,000 square miles of the Gulf – stretching from the salt marshes of central Louisiana, across Mississippi and Alabama, into the Florida panhandle.

Dispatch #3
The Mud and Blood Cruise

MATT DAMON
The Weatherbird motored through the night putting the research team back on schedule. Traditionally, every scientific cruise is given a nickname. This one is called "The Mud and Blood Cruise."

Steve Murawski's team is getting ready to catch fish. Though working in the field is never easy – August can be particularly brutal. It's 8 am and the temperature is approaching 100 degrees Fahrenheit. It will be a very long day.

STEVE MURAWSKI

What you're seeing is a long-line fishing operation. We're setting out five miles of baited hooks. There's 500 hooks on that set.

MATT DAMON

Their equipment is similar to what the commercial fishing fleet uses – except for one key difference.

STEVE MURAWSKI

At the beginning and end of each long line sets, we put this recorder on. And what it is a pressure and temperature recorder. This is the recorder—you can see it's quite small. It also has a clock in it, so it tells us exactly when we set it out and when we retrieved it.

MATT DAMON

To help with long-lining, Tia Clark and Jorge Hernandez joined the crew. When not working aboard the Weatherbird, they are – in fact – commercial fishermen.

STEVE MURAWSKI

We're trying to catch a representative sample of the fish community in this particular location off Southwest Pass Louisiana, but we fished all over the Gulf. And we fished almost 200 different locations.

MATT DAMON

The team's ultimate goal is to track the recovery and health of fish.

STEVE MURAWSKI

This is a very confusing place because if you look around us there's a tremendous number of oil facilities.

MATT DAMON

The numbers are staggering: 4,000 gas and oil platforms – 25,000 miles of active pipelines and 22,000 natural oil seeps – all contributing to an oil-soaked underwater environment.

STEVE MURAWSKI

And so we're trying to basically disentangle the Deepwater Horizon effect from all the other background and so that's why continued studies of this is so important.

MATT DAMON

For some, this is a rare moment of down time – until the lines are ready to be pulled in. That's when the field work really begins – but only if there are fish on the other end of the line. The team will know in about two hours.

Not very far from the Weatherbird, a smaller and faster vessel is also in search of fish. However, the scientists aboard do not use baited hooks to find their prey.

Dispatch #4
It Gets Complicated

MATT DAMON

Oceanographers, Will Patterson and Joe Tarnecki, are about to launch an ROV – a remotely operated robotic device with cameras and data collecting sensors.

WILL PATTERSON

There are 27 sites here that we've been studying now for about a decade. So we had a long time series of data before the oil spill and now we've been revisiting them since the spill.

So Joe will fly it from inside.

Got it?

JOE TARNECKI

Got it.

JOE TARNECKI

Our ROV is in the water at 10:05:41.

All right, we're at about 100 feet now.

WILL PATTERSON

How you doing Joe?

JOE TARNECKI

Just approaching the bottom now.

WILL PATTERSON

Look at that. Look at that. Yeah, cool. It's a big stingray.

JOE TARNECKI

That's a big ray.

JOE TARNECKI

What kind is that, Will? Is that a southern?

WILL PATTERSON

I didn't see the front of it.

JOE TARNECKI

I think it's southern.

WILL PATTERSON

Probably a southern.

JOE TARNECKI

It looks pretty here today. We should get some good footage.

MATT DAMON

One of the perks of being an oceanographer is having a front row view of an extraordinary world of diversity. But the team's primary mission is to study the impact of oil and dispersants on both natural and artificial reef habitats.

WILL PATTERSON

There's a red snapper.

And we just scaled him with our lasers.

MATT DAMON

When the ROV is close enough, Joe aims two parallel laser beams at the fish. Called scaling – it's how the team determines the length of reef fish.

WILL PATTERSON

The lasers that we have are set at 10 centimeters apart. That's about 4 inches. So when we go back we can grab frames…

…of the video. We can measure the distance between the two red dots and then get an estimate of the true length of the fish.

That's important because for many of these fish that we have on these coastal reefs, they're small young fish, less than ten years old.

And for many of these species we can estimate their age from their length. We can also estimate the weight of the fish.

JOE TARNECKI

It's a great way for us to gain information about the fish without having to bring them up to the surface and potentially killing them.

MATT DAMON

After the oil spill, the team discovered that the population of the reef fish community dramatically decreased. But they also found that within a few years their numbers rebounded to pre-spill levels. Yet there were profound changes. On average, the fish were now smaller and weighted less than before the spill.

WILL PATTERSON

Well there's lots of different ways to think about impact of oil. So one thing that we've been looking at is growth rates and we've seen in the years after the spill that for a few of these species for which we have quite a bit of information that they are smaller at age than they were before the spill. So just because their numbers are similar to what they were doesn't mean that there's no chronic impacts in the system.

MATT DAMON

But then Patterson and Tarnecki's work got a bit more complicated.

JOE TARNECKI

We had another issue dating back to 2010–2011 with the emergence of lionfish. There's a lionfish. These guys are invasive exotics. They showed up a few years ago here in our area of the Gulf of Mexico.

WILL PATTERSON

It's unknown actual the ultimate source, whether it was a hobbyist that dumped their aquaria, or whether it was a facility that released lionfish. But they were here because of the aquarium trade.

Among fishes – lionfish are the most successful marine invaders that have been documented. They are very voracious predators and their numbers have grown exponentially in four years.

MATT DAMON

The team made one other discovery. The red snapper were competing for exactly the same food as the lionfish. This created an unexpected problem.

WILL PATTERSON

We did some work last year where we tagged red snapper with acoustic pingers and then mapped their distribution and what we found is that the red snapper stayed farther away from reefs with lionfish. So it costs more energy for the red snapper to try to find a meal – so there can be these indirect effects.

MATT DAMON

The aggressive and territorial nature of lionfish – compounded by an already oil contaminated habitat – presented a major challenge to one of the most important fisheries in the Gulf. For the team aboard the Weatherbird – lionfish add another layer of complexity to their red snapper research.

Dispatch #5
This Is Fishery Science

STEVE MURAWSKI

Here we go.

MATT DAMON

The first four hooks come up empty, but Murawski is still confident.

STEVE MURAWSKI

Generally, we'll catch about 50 or so on a 500-foot string, so nine out of 10 should be empty. You can see that there's no bait left. That's a good sign. That means the fish are at it.

Oh, Red Snapper. Come on, Chris, you can get him. You can get him! All right.

Oh, a double! Oh, that's a nice one.

MATT DAMON

It doesn't take long before the deck of the Weatherbird is covered with red snapper.

STEVE MURAWSKI

From the animals that you see coming up we're taking about a dozen different tissues, body parts. They include things like the inner ear stones of the red snapper so we can determine their age. We're taking liver samples, bile samples, muscle samples, and in some cases spleen, liver, heart, and brain.

AMY WALLACE

Forty-eight.

MATT DAMON

Susan Snyder is a graduate student at the University of South Florida.

SUSAN SNYDER

I work with the bottom trawling fish that we're catching here, looking at their present day exposure to oil and any long-term accumulation in their tissues. We take the bile to look at any exposure within the past couple of days to oil compounds and then we take other tissues like muscle and liver to get the long term accumulation of oil in the tissues.

STEVE MURAWSKI

We know we're killing animals, but the point is in order to do these kinds of studies we have to do this. There's no other way to do this with photographics or anything. This is, this is basically fishery science.

AMY WALLACE

This is a male.

MATT DAMON

Amy Wallace is a Ph.D. candidate – also at the University of South Florida.

AMY WALLACE

To study fish around the time of the oil spill you need to be able to tell what they're eating. Were they in the area of the oil spill at the time of the oil spill and if so how did they change and move after that. I'm taking muscle and eye lenses and otoliths from the fish. This is an otolith. It's the ear stone and when we break open their heads, this is what we're looking for.

Once you preserve them, you get back to the lab. This is where you're generating your data.

Today, I've been cutting otoliths on the isomet saw to cut out the center section so that I can get the most material from the otolith. And then at that point I'm going to…

…put it under the microscope, which will give me the fish's true age.

What's great about this job is what you see. It's being out here on the water and being able to see things. Not just the snapper and the fish that we pull in. You just never know besides what you're working on – what you're going to see. Whether it's on the line or off the line.

STEVE MURAWSKI
Oh, oh look at him. Look at him. Look at him. He's after him. He's a big shark there. See, he's got him. He's got him. That's a Blacktip.

MATT DAMON
The team also gathers information about sharks to share with other scientists.

AMY WALLACE
I'm taking some fin clips of the sharks for some of the species for Dean Grubbs at FSU.

MATT DAMON
Whenever possible, they return the sharks to the Gulf.

STEVE MURAWSKI
That was an outstanding haul. We got a lot of red snapper. That'll give us a number of things. First of all, a really good look at the contamination levels of tissues, the blood. But also, we're trying to form the age composition of the population. So with so many red snapper, we can see which ones are the 3s, 4s, 5s and 6-year olds and what level of abundance.

So what we're going to learn from this is basically what the levels of contamination are. Some of the fish are quite contaminated and they remain contaminated and they are among the highest contaminated ever seen. And some of the other fish the contamination levels have dropped significantly. Like red snapper and you know that's a good thing.

The problem comes in when you actually have exposure to toxic chemicals. It results in things like liver cancer and you know long-term genetic changes and other things that may affect the long-term viability of this population.

MATT DAMON
And that is exactly what scientists at the University of Miami are looking at – the genetic impact of oil on fish.

Dispatch #6
Failing Hearts

MATT DAMON

This is a larva of a Mahi-Mahi. Take a closer look – this is what the failing heart of a fish looks like.

The story of that larva begins here – where the Gulf Stream nears the shores of Miami, Florida.

This morning a team of scientists are going fishing. They're after Mahi-Mahi. Their goal is to replenish breeding stock necessary for their research.

MARTIN GROSELL
University of Miami

We cannot do the work without the brood stock and what we're looking for is basically young adult animals that are sexually mature, but not too big to handle. As I say, it all starts here, that is what we're doing today and the target is to collect one or two males, bulls as we call them, and then a handful or perhaps more cows.

We are now, I'd say, maybe 15 miles off shore of Miami. And we're probably in about 1200 feet of water.

This time of year we look for birds. Any excitement by birds here typically means that there's a school of Mahi or other predatory fish that's pushing baitfish to the surface. If we see birds that are kind of excited about something in the area we will run right up and will start fishing that area.

CREW MEMBER #1

You're gonna wind a little bit. Get their head up. He's gonna kind of jump. Jump a bit. Okay, hold it. Right there.

Now, go, go, go.

CREW MEMBER #2

Right behind you, John, is another one.

JOHN STIEGLITZ

Right there?

CREW MEMBER #2

At four o'clock.

JOHN STIEGLITZ
University of Miami

So the Mahi you'll notice they have a yellowish-greenish appearance when they come out of the water. It's because they're stressed; they've been fighting against the hook. So we get them into the tank as soon as possible. And in order to help them recover quickly, we pump pure oxygen into the water. And it really helps speed that recovery process as well as keep them alive so that we can get them back to those land-based tanks and spawn them in captivity.

MARTIN GROSELL

So what we have now probably is at least one bull and four or five cows that are in good condition. But we can't be sure that all these fish make it, so what we are hoping to do is get another one or two confirmed bulls and whatever cows we will catch with that. So we're gonna push through for another batch of fish and hopefully that will get us what we need.

We've discovered a number of things that are somewhat alarming or concerning, including impaired swimming ability of these animals when they're exposed to very, very low concentrations of oil. The big question is obviously, what was the cumulative impact of these exposures on the early life stages and the adults where we see some lethal effects on swim performance.

MATT DAMON

It doesn't take long before they find another school of Mahi-Mahi. When the team catches enough fish, they head for home. As soon as they dock, the scientists begin the process of transferring the Mahi-Mahi from the on-board holding tank to a carrying sling.

A relay team will bring each fish to a nearby holding tank on the university campus. Their goal is to get the fish back into water in less than a minute. The objective is to maintain a stress-free and healthy environment for the fish so they'll feed and spawn naturally while in captivity.

JOHN STIEGLITZ

What we see here these fish are about four months old. We feed them about twice a day to satiation. We try and replicate what they eat in the wild and provide them with a balanced, nutritional diet. This is probably the one place in the world where you'll be able to see Mahi-Mahi this many of them in captivity.

MARTIN GROSELL

What you can see here is that they are ferocious feeders, which is why we are getting some of the very, very high growth rates that we find in these animals. Up to about 30% growth rate per day in these animals, which is about as high as it gets for any animal or any fish in captivity.

JOHN STIEGLITZ

We also sample the tissue frequently and compare that against tissue from wild fish to make sure that the body composition really matches that so because in terms of the experiments we want really want to make sure that these are good examples of fish you would find in the wild.

MATT DAMON

In a few days, the newly captured fish will begin to spawn. Their embryos and off-spring will be used in two separate studies.

MARTIN GROSELL

One of the things that we're focusing on in particular is the ability of these animals to swim at sustained high aerobic activity.

MATT DAMON

Just a few steps from the spawning tanks, the Mahi-Mahi are tested for endurance.

MARTIN GROSELL

In here, we have a swim tunnel, which is basically a treadmill for fish…

…where we can also monitor the metabolic rate while we are looking at their swim performance.

The equivalent would be if you place me on a treadmill and…

…you exhaust me or exercise me. My cardiac problems would manifest themselves in poor performance on this treadmill.

And we can do it the exact same thing with Mahi-Mahi and other fish species in the lab.

The bottom line though is that Mahi-Mahi exposed to oil in certain concentrations during certain life stages are not able to swim as well as unexposed animals.

And swimming performance is critical obviously for capturing prey, therefore being able to ingest food and also critical for being able to avoid predation – avoid larger animals.

MATT DAMON

In a second study, the team discovered yet another serious problem.

ED MAGER

University of Miami

So what I'm doing right now is looking at larval Mahi-Mahi, specifically at their hearts. And the reason why we're doing that is because we know that one of the primary targets of oil toxicity is the heart.

The larvae that we have here today, we got from the experimental hatchery that we have across the street from our campus.

We find that with oil exposures to Mahi-Mahi…

…they have specific impacts to the heart…

…and also have impacts on their survival at later stages of life and the capacity of which they need their hearts to sustain high aerobic function.

MARTIN GROSELL

But I think one of the critical things that we've learned from the work and that one of the things that we're following up on is that in addition to the obvious effects of mortality during exposure to high concentrations of oils. We have subtle effects that you cannot see with the naked eye.

You have to dig deeper and apply more sophisticated techniques to reveal these subtle effects.

Dispatch #7
Lessons From The Past

MATT DAMON

Surrounded by rugged mountains and the frigid waters of Prince William Sound is the picturesque fishing village of Cordova, Alaska. This is a place teeming with wildlife. Supported by a thriving herring fishery – not very long ago Cordova was among the top ten fishing ports in the United States. But all that was before disaster struck in 1989.

MALE ANCHOR #1

It's being called the worst oil spill ever in Alaska. The super tanker Exxon Valdez, loaded with nearly 53 million gallons of oil, ran aground off the Port of Valdez…

FEMALE ANCHOR #1

One of America's most magnificent water ways is blackened and befouled tonight by the biggest oil spill in American history…

MALE ANCHOR #2

An oil tanker smashed into a reef near Valdez, Alaska today causing the worst oil spill since the Alaska pipeline opened 12 years ago.

MATT DAMON

Ultimately, about eleven million gallons of crude leaked from the Exxon Valdez oil tanker – devastating nearly everything in its path.

Among the few bright spots was the herring fishery. Everyone thought Cordova was spared. And in fact, the fishery did reasonably well for the next four years – until something totally unexpected happened.

MALE REPORTER #1

The fishing village of Cordova was hard hit. A mainstay of the local economy, the herring catch disappeared.

MALE REPORTER #2

Fishermen from Cordova, Alaska say that lingering effects from the oil spill have caused a sharp decline in herring.

MATT DAMON

Four years after Exxon Valdez – the herring fishery suddenly collapsed.

FRANK HERNANDEZ
University of Southern Mississippi

That's something we would call a latent effect. That there wasn't any evidence of a potential disaster immediately, but in the years that followed the spill it became evident that there were some impacts.

STEVE MURAWSKI

We need to be cognizant that sometimes these events take a while to work their way through the ecosystem. Many of these animals are long lived. It takes a number of years for – you know baby fish to recruit to the spawning populations.

DAVE HOLLANDER

Larval fish are much more susceptible to contaminant chemistry and contaminant exposure than are adults.

Subsequently, if larval fish and even juvenile fish are more severely impacted by contaminant exposure then, as they become adults, those populations suffered dramatically.

FRANK HERNANDEZ

Adult fishes, they are able to swim away from a potentially a damaging or a threatening situation. But again larval fishes and particularly eggs are planktonics so they are going to be wherever they were spawned or released by the adults. And if that was in the oil then they were definitely going to be impacted at the time.

MATT DAMON

So why should we care about an eleven million gallon oil leak that happened in Alaska 27 years ago – when today, the Gulf Coast states are still coping with the aftermath of a more recent 200 million gallon oil leak?

STEVE MURAWSKI

I think the biggest issue that we have in terms of learning from Exxon Valdez is to expect the unexpected.

For example, in the years that we've been sampling since the Deepwater Horizon event, we've seen relatively poor production of juvenile red snapper. Now is that just natural vagaries of the stock? Is there something to this in terms of a response to potential for oil pollution? We don't know. What we can do is monitor those stocks and see if there's some kind of correlation. So we need to have a healthy skepticism about early declarations of no harm.

Dispatch #8
Where Did The Oil Go?

MATT DAMON

To the causal observer, it's hard to believe that the world's ninth largest body of water is still under stress. The flotilla of boats surrounding the BP blowout site is gone – and oil exploration has resumed in the Gulf. Tourists have returned to pristine beaches, commercial and recreational fishing boats are again working the waters of the Gulf, and the seafood is safe to eat.

So what happened to over 200 million gallons of leaked oil? Government scientists estimate that 25% was burned or siphoned off. 23% reached the salt marshes and beaches or stayed in the water. And 52% evaporated into the air or was dispersed. But it was the use of dispersants that quickly caught the attention of the news media.

FEMALE ANCHOR #2

Deadly mix. Did the chemicals used to break-up that oil in the Gulf do more harm than good?

FEMALE REPORTER #1

Little is known about the affects of these chemicals applied in such great amounts.

FEMALE ANCHOR #3

The EPA insists dispersants are biodegradable, but many locals worry that their community could become another Love Canal.

TONY KENNON

Mayor – Orange Beach, Alabama

I just don't know that anyone can say today whether dispersants was a good choice or a bad choice. It may have probably or may have been the lesser of evils. Only time will tell did the dispersants actually have a long-term effect on our ecology and environment, or not.

MATT DAMON
Scientists at John Hopkins University are developing innovative ways to see how dispersants interact with the ocean.

JOSEPH KATZ
We have some unique facilities that enable us to simulate oceanic conditions in a very controlled laboratory set up.

JOSEPH KATZ
Johns Hopkins University
This information then will go into large-scale field models that actually try to predict the fate of oil.

CHENG LI
Johns Hopkins University
Essentially, I built the wave tank from scratch, which is 20 feet long wave tank and it can generate from non-breaking waves to very violent breaking waves. And it's amazing.

MATT DAMON
The wave tank enables scientists to study exactly how naturally breaking waves split oil slicks into small droplets. But when dispersants are added to the oil slick – high-speed cameras capture the interaction. The result is remarkable. The oil is broken up into microscopic droplets, which mitigates many of the adverse effects of an oil spill.

DAVID MURPHY
Johns Hopkins University
The Deepwater Horizon event was the first oil spill in which they actually went down with a submarine and injected dispersant into the oil ducts coming out of the earth. And so we're trying to simulate that process looking at how that dispersant breaks the oil up into very small droplets. When you have an oil well blowout at the bottom of the ocean, you almost have this cloud or this smokestack of oil that's rising from the bottom of the ocean. And as it rises, it gets swept by the current. And so I built a towing tank to try and simulate that process. So we're looking at how that dispersant breaks the oil up into very small droplets and then looking at how those droplets rise much more slowly and how that interaction changes the structure of the plume. And that ultimately affects where the oil goes.

JOSEPH KATZ
What happens after an oil spill? How fast the oil disperses, how much of the oil is going to end up in the marshes, how much the oil will settle to the bottom?

We need to answer those questions. Otherwise we don't really have tools to predict and then we don't really know what kind of tools do we need to develop to mitigate the adverse effect of oil.

MATT DAMON

Despite the use of dispersants, about 47 million gallons of Deepwater Horizon oil reached land or stayed in the water. Its impact poses a lingering question that scientists are still trying to answer. Chris Reddy and his colleagues from the Woods Hole Oceanographic Institution have been filling in some of the blanks.

Dispatch #9
Ginger Snap Cookies

CHRIS REDDY

My whole career has been studying oil spills, and at the end of the day I think about oil as a bunch of different molecules and I'm interested in where all those molecules go and how Mother Nature attacks them.

I try to go out and collect as many different oiled samples and try to figure out who's winning this war of nature versus oil.

I'm supposed to be a chemical oceanographer. People think I travel all over the world sea faring. I just rented a car, drove 45 minutes, pulled up on a beach and I'm going to be doing my field work within 100 feet of the parking lot.

We're going to start looking for samples. They have a little orange glow to them – about as big as a ginger snap cookie. So from a distance you could almost think it's this, but it's not. That's a shell. That's a sample from the Deepwater Horizon right here. That's one. That's not.

If you were walking on this beach, I don't think you would know this was from Deepwater Horizon. I'm going to pick it up, put in a jar. So it'll come back to my lab up in Cape Cod and I'll do some initial studies to get a feeling for what's going on and then I'll send a portion of this down to Tallahassee – the high field magnetic lab with my colleague Ryan Rogers.

RYAN ROGERS
Florida State University

I am an analytical chemist, but I do petroleum analytical chemistry. Chris Reddy and myself have been working with the pre-blowout samples that were collected from the pool of oil that's way below the surface. And we analyze the petroleum – essentially we create a library of everything that was in the oil before it went into the Gulf of Mexico.

CHRIS REDDY

The high field magnetic lab uses an instrument that has a magnet that's 20 times stronger than an MRI. So if you think about how we can study human bodies with an MRI, think about how we can study the chemistry of the oil with an instrument that can interrogate 20 times stronger.

RYAN ROGERS

Through Chris's efforts of collecting samples when they wash ashore on the beach, what we've been able to do is watch sunlight and bacteria chewing them up.

CHRIS REDDY

What I have been seeing more recently – that a lot of the oil compounds that we would have thought would have lasted a decade maybe only lasted about a year. The sun and has done a remarkable job of breaking down these oil molecules much, much faster than I would have thought. And to me has added a whole new appreciation about how powerful the sun can be breaking down oil in the environment. You know we still find oil on some beaches, but it's very trace amounts. And you know we know there are some oil and salt marshes in Louisiana, but after that it's really hard to figure out whether or not there's any you know identifiable oil. And so obviously you have to keep looking.

Dispatch #10
Holy Cow Moments

MATT DAMON

Like Chris Reddy, Mandy Joye is also looking for answers. She's an oceanographer from the University of Georgia. Her team of researchers studies the environment in the most remote parts of the Gulf of Mexico.

MANDY JOYE

It's different too in that the little beads at 600 were larger. These are little tiny like tar ball size.

MATT DAMON

Places where oil seeps naturally from vast pools of petroleum locked deep beneath the sea floor.

MANDY JOYE

I'm a microbial geochemist. That means that I study microorganisms, the little tiny organisms that you need a microscope to visualize. You can think of them as these little microbial worker bees that live in the ocean and they carry out critical processes that make the ocean function and keep the ocean healthy.

MATT DAMON

Over the years, Joye has visited numerous sites where animals have adapted to an oily existence – places where microscopic organisms eat tiny droplets of oil.

MANDY JOYE

These natural seeps are incredibly diverse and the teeming with life. Every single dive is filled with "wow's" and "ah-ha's" and "holy cows" and "can you believe that?" Oh my God – look at this – look at that!

MATT DAMON

But ever since Deepwater Horizon, she has experienced very few "holy cow" moments.

MANDY JOYE

It's a lot of dead worms and debris from the water column.

MATT DAMON

In 2010, Joye and her team were aboard the research vessel Atlantis several months after the blowout. Operated by the Woods Hole Oceanographic Institution, the Atlantis is one of the most sophisticated research vessels afloat. The ship's hangar carries a unique vehicle. A manned submersible called the Alvin – famous for its voyages in the deep ocean – including the exploration of the Titanic.

For this cruise, the Alvin will take Joye to the bottom of the Gulf – to a location just over 5,000 feet deep and two miles from the site of the oil spill. Her goal is to visually confirm what the team's remotely operated equipment discovered. Instead of rising to the surface, a significant amount of oil now blankets vast areas of the ocean floor.

All who board the Alvin remove anything that might scratch the surface of the submarine and take off their shoes leaving them on the catwalk. It's a reminder of those working thousands of feet below.

Diving to bone crushing depths and frigid temperatures introduces inherent risks on every dive.

MANDY JOYE

But I've never been afraid because these guys – the ship's crew and the Alvin crew – they're excellent at what they do. And you feel perfectly safe in their hands.

MATT DAMON

After a final visual inspection, the dive begins. It will take the Alvin about one and half hours to reach the site. Once there, Joye will have an unparalleled look at the ocean floor. It's not a pretty sight.

The Alvin's ultraviolet camera is turned on. Wherever there's oil, the sediment fluoresces an eerie green.

MANDY JOYE

The bad "aha moment" was when we really started looking hard at some of the animals. We saw oiled and dead corals. We saw oiled and dead sea fans. All the filter-feeding organisms were clearly impacted by the sedimented oil.

A sea fan that's a few feet tall can be five hundred years old and happily surviving and is now covered in brown slime and is dead. These organisms who filter feed and who are not selective filters – feeders. They're not gonna spit the oil out. They're gonna just filter whatever comes past them. They're being damaged. We saw two crabs both of which had the darken carapaces and they all were just covered in these barnacles. And when we brought that crab up, we picked some of the barnacles off and looked at them under the microscope. And their guts were filled with this orangey, oily look residue. That to me was a very just sort of somber message.

MATT DAMON

The dive to the bottom of the Gulf confirmed Joye's worst fears. She found oil – and lots of it. Since the oil spill in 2010, Joye has made 17 such dives to the floor of the Gulf. And along the way a question she is often asked is simply this – nearly six years after the blowout – what is the state of the Gulf?

MANDY JOYE

The answer is we don't know fully yet. I think in many aspects the Gulf is certainly resilient and it has responded incredibly to this very, very large and significant perturbation. But I do believe that there are things that we don't know the answer to yet.

Dispatch #11
Tracking Contamination

MATT DAMON

Back on the Weatherbird, long-lining for red snapper is over for the day – and the mud team of the "Mud and Blood Cruise" has taken over the main deck. David Hollander and his researchers are launching a device that collects sediment samples from the sea floor.

DAVE HOLLANDER

What we have here is the multi-corer. This is the device for taking sediment cores from the ocean basin. It goes very deep. We can also take cores in a much shallower environment like we are here. There's eight cores around a central column. And this central core actually penetrates into the sea floor and then when we pick it up with the winch it actually closes both the caps on the upper and lower side.

MATT DAMON

The team's investigation was motivated by the earlier and unexpected discovery that as much as 10% of Deepwater Horizon oil now covers vast areas of the sea floor.

DAVE HOLLANDER

You got it?

WINCH OPERATOR

Ready to roll.

DAVE HOLLANDER

So why are we doing both sediment coring and fishing on the same cruise, which is sort of unorthodox? By us taking sediment cores in the same locations as we do the fishing we are able to relate the evolution of contaminants over time in the sediments – to the changes that we see in the fish.

It should take about 10 minutes to get down and about ten minutes to get back.

All right; we're in.

What we're trying to do is track the vectors of contamination. How it goes from the sediments into the fish. And then how long it takes for the sediments to recover, the contamination to decrease, and see how that parallels the contamination in the fish.

CREW MEMBER

All right. This was a long course.

DAVE HOLLANDER

Success.

MATT DAMON

The core sampling operation was successful. Each of the core tubes is filled with sediment.

DAVE HOLLANDER

So what we do now is remove the cores from the multi corer. We make a decision about what cores are going to be distributed to what scientific groups.

ISABEL ROMERO
University of South Florida

This is a sediment core that we just collected. It's a fresh core. And what we're going to do right now, we're going to split it in half so we can see inside and we can take pictures and have a record visually of how the layers look in the sediment core.

PATRICK SCHWING
University of South Florida

Inside each one of the tubes this is the best visual representation of what we get in each one. Just by seeing the changes in color, we can get a really good idea of how the oxygen depletion is occurring as you go down core.

It also gives us a really good idea of when certain events happened in the core before we even date it or do any other further analyses. So just a visual inspection in any geology is really helpful.

DAVE HOLLANDER

What this is essentially is a record of history or you can view it as a history book where you can peel back the layers or turn the pages back in the history of the Gulf of Mexico. So this could be anywhere from a couple of hundred years to present – each layer denoting a certain time. The Deepwater Horizon is going to be the upper most window of time that is accumulated in this sediment core.

This is very, very fine clay. Very organic rich mud. We're going to analyze it for chemistry.

MATT DAMON

When the Weatherbird returns to Panama City – all of the samples and data collected during the two-week Mud and Blood Cruise are carefully off-loaded and brought to the University of South Florida in St. Petersburg. That's where the process of discovery continues.

MALE LAB ASSISTANT

All right, you ready?

FEMALE LAB ASSISTANT

Yep.

PATRICK SCHWING

This is the carbon dioxide coming from the sample into the mass spectrometer.

ISABEL ROMERO

This is the reference gas for the nitrogen. Those are great picks actually.

DAVE HOLLANDER

The chemical techniques that we use – are essentially doing forensics on the events that are associated with the oil. How the oil evolved in the system and ultimately its impacts, its consequences, and its fate.

MATT DAMON

Murawski and Hollander's team discovered that oil contamination transferred from tiny creatures – that managed to survive in the oiled sediment – to small fish that feed on those organisms – and then the contamination simply moved up the food chain until it reaches larger fish like the red snapper. But there is also some good news.

STEVE MURAWSKI

The fish are fine. Unless people are eating things like gall bladders there should be absolutely no difficulty in terms of meeting public health standards you know for fish muscle – fish flesh. So people should be confident that they're not eating tainted fish.

DAVE HOLLANDER

Our focus now is the impacts of sedimentary oil and that was surely a discovery that was unexpected. It was one of the unexpected consequences of the blowout.

Dispatch #12
Final Thoughts

MATT DAMON

Today, the scientific community is working together to push the boundaries of what we need to known about oil spills and what we still need to discover. Yet in the end – there are simply no easy answers – no quick fixes.

DAVID CHAUVIN

It was never, ever a thought that it would be possible to have to get out of this business. You was born in it. You knew you were going to be raised in it, and you was probably going to going to die living in, in this business. The fear is what if this ever happens again? How many oil spills can the Gulf take before it starts having a more of a negative effect than what this one's already had?

DAVE HOLLANDER

As exploration moves further off shore to deeper environments, these deep-sea blowouts or any subsurface blowout of an oil well is the new breed of oil spills.

STEVE MURAWSKI

What we're finding is that in many cases those wells are going to be over two miles deep. Much of that deep-water area remains totally unexplored. There are many new species to be discovered. It's really on us to try to do as much as we can to try to understand and protect those animals that are likely to be highly vulnerable to these kinds of issues.

MANDY JOYE

You've got be a science communicator. You've got to be a science advocate. You've got to be a science educator and you've got to go outside the classroom. And you've got to work with kids. And you've got to work with adults. And you've got to teach them about how the ocean and the earth's system is changing.

MATT DAMON

In a world that is 70% ocean and inter-connected by an increasing demand for energy, we cannot ignore the reality that the search for oil is a major economic issue of the 21st century.

ROBERT CRAFT

If it ever a light bulb went off in all of our mind it was our economy is totally dependent on a clean safe useable environment. So that was the lesson that we learned and to this day that is still our biggest concern.

MATT DAMON

This presents the scientific community with an enormous challenge – to help find 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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On-Camera Interviews

AMY WALLACE
I've always been in love with the ocean. I have always wanted to work with it and be around it.

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.

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On-Camera Interviews

SARAH MUFFELMAN
I've always loved the outdoors and was interested in science and animals.

DAVID MURPHY
I used to work on my science projects with my, with my dad and we used to build some pretty fun contraptions.

Titles

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On-Camera Interviews

DAVE HOLLANDER
It should be noted I was a surfer and a surf rat when I was growing up. So this was a logical transition for me.

MANDY JOYE
My father used to joke that the question I always asked when I was a little kid – when I was walking along the beach – is where the water came from that filled my footprints.

[Underwriters Bed]

UNDERWRITING NARRATOR
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