

Otter Kelp Research 7:35 min

Narrator

Some people have trouble figuring out where the Central Coast is. The people who live and work up here know exactly where it is. It's that stretch of exposed coastline between the northern end of Vancouver Island and the southern tip of Haida Gwaii. And it's an amazing part of Planet Earth.

The Central Coast has traditionally been a hard place to do science because there's nothing up here in the way of infrastructure to support the work. But that's all changed now. We've established a research station at Hakai on Calvert Island right in the middle of the Central Coast.

We now have several established science programs at Hakai. But until now we've had nothing on the rugged outer shores. On that landscape of archipelagoes, reefs, channels, bays, and beaches that stretches north from Hakai. It's the world of rocky shores, kelp forests, sea otters.

So, I'm thrilled to be starting work for the Solomon Lab this summer, embarking on a major initiative on the landscape that so epitomizes the Central Coast we know so well and love so much.

Dr. ANNE SALOMON Marine Ecologist, Simon Fraser University MaPP Marine Advisory Committee

Kelp forests are one of the most productive ecosystems on the planet. Home to a remarkable diversity of marine life. These liquid forests provide a plethora of resources and drive ecosystems processes that coastal people have relied on for millennia. Yet these underwater forests are highly susceptible to overgrazing by sea urchins -- universally the most important temperate reef herbivore capable of controlling the distribution, diversity, and productivity of entire kelp forest ecosystems. Any force that alters their numbers can bring these rich ecosystems to tipping points that when crossed can fundamentally restructure marine processes and resources.

For example, sea urchin numbers are heavily influenced by the presence of sea otters. So when the historic fur trade eliminated these predators from most of North America's high latitude coastlines, this caused a cascade of effect that rippled across ecosystems, driving rocky reefs to switch from kelp forests to urchin barrens.

Today, along the outer shores of BC's Central Coast, sea otters are recovering and expanding their range. What remains unclear is when, how, and to what degree these kelp forest tipping points will occur.

This summer we have begun to explore these questions, establishing study sites from the McMullen Island group all the way down to the south Calvert Island. At these sites we're measuring the variation in sea otter foraging behavior, rocky reef fish assemblages, and sub tidal invertebrates and kelp communities.

There's so much to explore and this is just the beginning!

Bear Research 5:00 min

DOUGLAS NEASLOSS Kitasoo Band Council & Kitasoo/Xai'Xais Integrated Resource Authority Stewardship Director

The Province came up with these Grizzly Bear Habitat maps, and I looked at their maps, and none of these maps had areas where there was Grizzly Bear habitat on the islands. So, we said, "Well, um, we know there's bears on those islands. I've been watching those bears for, ah, the last 5-6 years." So I phoned the Province and I told them there's Grizzly Bears there, and they said I'm not a scientist, I'm a biologist, and that I had no credibility in the scientific community.

That one walks this way, so that's a totally different bear. It's just the cub.

That's the mother right there, sniffing the camera. So, I knew that I had to develop a relationship with economic institutions, and try and find the resources to get out there and fund some projects, so that we can get out there and ground truth it.

My name's Christina Service. I'm a graduate student at the University of Victoria, the Rain Coast Hakai Lab.

I am Margaret, and I'm a field technician with the Spirit Bear Research Foundation as well as a research assistant with the Hakai Rain Coast Lab at the University of Victoria.

Christina Service, Graduate student at the University of Victoria

So when we first come out here in the spring, early May. We set up these barbed wire corrals, so we basically build a barbed wire fence, and then build a pile with sticks and moss and lots of woody debris. Meant to mimic a kill, then we use a non-reward bait, and create a really nasty, nasty smell on that pile to attract those bears in. And it's non-reward in the sense there's no calories involved, so the bears aren't getting habituated, but it does draw them in.

WILLIAM HOUSTY Chair, Heiltsuk Integrated Resource Management Department

Either they go underneath the wire, or they go over top of the wire and leave hair from their legs or their belly, and we can go and collect that hair, and in that hair possesses the genetic code that's unique to every individual bear.

Christina Service, Graduate student at the University of Victoria

We can run different hormone techniques to see what sort of nutritional stress these bears are under. For males, how much testosterone they had in last year of hair growth. And for females, whether or not they're pregnant, sort of the same hormones that are in us in humans as mammals. We can also look to see how much salmon they ate the previous year. And what proportion of their diet that was, and also, just, we know that this is an individual bear now, and if we detect an individual here in Watson Bay, we can also see if it's moving around the territory and how it's moving across seasons and across years.

Jennifer Walkus, Wuikinuxv Nation

What we wanted to do, is we wanted to make sure that we're collecting our data in the same way, because if we're collecting our data in the same way, then we can look for patterns

between territories. So that E=everybody has access to a lot more information than we would if we only did our own project.

Megan Moody, Stewardship Director, Nuxalk Nation

Science is basically adding to those arguments that we already have as aboriginal people.

WILLIAM HOUSTY Chair, Heiltsuk Integrated Resource Management Department

We've all had an understanding of bears and had a feel for what it's like to live with them. But to have that whole science side of it, the whole genetics piece to it really adds a lot of weight to it, and gives us a lot of, what some people might call "sound science."

Jennifer Walkus, Wuikinuxv Nation

They base their "how many bears they're allowed to kill in a year" on what they believe are the current population dynamics. But if they've changed sufficiently to change the bear's behavior, then there's something out of balance out there. And considering how dependent they are on the fish and the fish stocks are falling all over the place, then I can't see how those population estimates can be correct.

Megan Moody, Stewardship Director, Nuxalk Nation The scary part for me about the hunting and killing of bears is that we really don't know how many are there. I mean, generally, we know deforestation, climate change, declining salmon runs are all impacting the bear. I would rather protect them and have them here for thousands of years to come, rather than pretend we know, what, what is going on and allow the needless killing of them.

Herring Research 21:00 min

Charlie Mason

Hereditary Chief, Kitasoo/Xais'Xais Nation

This time the year is the start of our harvest season. The start of our harvest season usually starts with herring eggs. When the herring move into the "beach" to spawn we wait, watch, watch and as soon the start spawning we set up our poles, tie up one end to the beach, one end to an anchor out at sea and we fill out our poles with trees and put that kind of tree to the pole and leave it there for about 3-4 days to let the herring spawn on it. When it gets thick enough like that we pick it up to take home and we peel it and put it away.

Alejandro Frid

Science Coordinator, Central Coast Indigenous Resource Alliance

Herring is just a really key species. Not only from a cultural perspective, but from a whole ecosystem perspective. I mean, it feeds, you know, whales, salmon, I mean, feeds terrestrial mammals like wolves, and bears have come down during spawn. And then culturally, I mean, it's just tremendously important.

Karen Meyer, Producer, Great Bear Sea

These ones, can you eat the kelp with it?

Ruth Robinson

Yeah

Karen Meyer, Producer, Great Bear Sea

Do you eat it like this? Oh, wow! Delicious!

Title:

**THE SPAWN IS ON
PACIFIC HERRING AND THE GREAT BEAR SEA**

Karen Meyer, Producer, Great Bear Sea

Hi, I'm Karen Meyer, producer of the *Great Bear Sea* documentary. We're here on the Central Coast of British Columbia to witness the spectacle of the herring spawn and to meet with First Nations and scientists who are working together to save the herring.

What are herring. When do they come here? When do you see them?

Charlie Mason

Hereditary Chief, Kitasoo/Xais'Xais Nation

Well they are basically here all year around, but they just go to a certain spot to spawn. Like Kitasoo Bay is one of them. Also through the pass here. Years ago they used to spawn right down on the end of the island, all the way up to the top end of the island. That was years ago. There are things that happened, where they stopped spawning here, but the herring are still there, eh? Always around Easter time that they move in until they're ready to lay their eggs, you know, mill around the bay by the thousands. Go by the tonnage.

We got the sea lions out feeding, humpback whales out feeding, the cormorants, the eagles, the ravens, all along the beach waiting, waiting in the trees, watching, so it's a big change for them. Every one of them, they would grab a herring, eat it, go back grab another one, grab another one. So that's part of what we call a "harvest season." That's the start of it.

Markus Thompson

Masters of Resource in Environmental Management

Simon Fraser University

If you go out to KITASOO Bay during the spawn, you can see hundreds of sea lions, dozens of whales, and hundreds of eagles, the amount of wildlife out there is astounding. So the herring are a vital source of energy for the entire ecosystem, including the local First Nation population. And so, that's where my interest lies, is that it is a key part of the ecosystem, and if we don't treat it properly, if we don't fish it responsibly, then it has massive consequences. Not only on the people, but on the ecosystem.

Karen Meyer, Producer, Great Bear Sea

Markus and his team are collaborating with Central Coast First Nations to look at recent changes in the behavior of herring. Collaborative research such as this builds on First Nations traditional knowledge and the tools science can provide.

Markus Thompson

Masters of Resource in Environmental Management

Simon Fraser University

Where my project comes in is in Bella Bella, the spawn kelp fishermen, have been noticing over the past few years really deep spawns. Now herring typically spawn in the shallow, the intertidal, you can often see it on the shoreline at low tide.

But they have been noticing spawns that are as deep as 30 or 40 meters below the surface. And that's really uncharacteristic. It's not something that researchers or local fisherman have seen before. And, there are a number of reasons why this might be happening. And there are a number of consequences that could result in that.

Ernie Mason

KITASOO/XAI'XAIS Nation

Up in the shallow you got the surface current, where you know everything's moving back and forth, and you know that the sperm is fertilizing eggs. Whereas at 100 feet, you don't have as much current, you don't have the swells, so how much of those eggs are getting fertilized. How much of the them actually survive, anyway, right. That's one of the unknowns, I would say.

Markus Thompson

Masters of Resource in Environmental Management

Simon Fraser University

It could be temperature induced, so it could be a result of recent climate change or El Niño. We have warmer water in here now, and the herring may be diving deeper to find the colder water that they're accustomed to. It could also be a result of large aggregations of predators. If you have a large amount of predation on the surface, then the herring may dive deep to get away from the predation.

And, for the same reason, they might be doing that with vessel traffic. So that's another hypothesis.

Dan Okamoto

Postdoctoral Researcher, Simon Fraser University

And one of the challenges that we're facing right now is there's a lot we don't know about Pacific Herring in terms of how they move, how they behave as...are they one huge population? Or are they all very small pockets of populations that operate independently. Because we don't know a lot of those things, the assumptions about how we think herring populations operate, have very strong impacts on the kind of risks that are imposed by fishing. And so we use a combination of field methods and mathematical modeling to try to understand those tradeoffs between do we take a lot of fish and leave just a little? Or do we leave a lot and just take a little? And how do we allocate how the fishery use is executed in space and time. There is different kinds of people that use herring for different reasons and how do we balance the tradeoffs, the needs of those different kinds of people, and the ecosystem?

Charlie Mason

Hereditary Chief, Kitasoo/Xais'Xais Nation

Over time when it starts tipping, it gets to the time when it tips over and that's when they sort connect this with the herring. Because the herring tip over to spawn. That's the term they use. When they go into the kelp they spawn on their sides - that's when they watch the moon tipping over, coincides with the herring when they spawn they tip over onto their sides to spawn. That's one of the ways they connect, not having no calendar, having no type of GPS, it's just nature.

Markus Thompson

***Masters of Resource in Environmental Management
Simon Fraser University***

Herring typically live up to about nine years. And they'll spend their winters at really deep depths out in Hecate Strait, and offshore. When the spawning season comes around, they'll start swimming into these areas of the coastline and there are different locations that they'll return to. The same spots every year to spawn. It's remarkable how accurate the timing is. So for the last three or four years in Kitasoo Bay, herring have spawned starting on roughly about March 28, and that's exactly what happened this year. So, it's a really interesting phenomenon. Before they spawn, you can go out there and all the wildlife has showed up because they're expecting it.

Alejandro Frid

Science Coordinator, Central Coast Indigenous Resource Alliance

So there's three types of herring fisheries in this part of the world. The first one is the commercial roe fishery. And this is very industrial. They catch the fish before they spawn to extract the roe. So they're catching reproductive adults and they're killing them.

We also have what's called a commercial spawn on kelp operation, they're collecting only the herring eggs. But this is done in two ways. Some First Nations they do it what's called open ponding. So they're just setting the lines where herring are going to spawn, as in the food fishery. But just on a much larger scale.

And the other approach is to have the equivalent of basically a fish pen, in which they catch herring with the seine net, adult, put them into the pen, and they provide the kelp for them to spawn, and they wait for them to spawn, and once they spawn, they release the adults and collect the eggs on the kelp.

For their own food use and in a cultural context, First Nations go to spawning areas, prior to spawn, and they set hemlock boughs or kelp on lines at the bottom and then the herring come and spawn and the eggs collect on the hemlock boughs or the kelp, and they pull that up, and they're covered with eggs, and that gets distributed in the community. There's the very strong cultural context to it, as well as tremendous nutritional value to that food.

And in their view, which is completely consistent with scientific studies, says that if we harvest just the eggs, rather than the adults that are about to reproduce, which is what the commercial fishery does, you have a much lower impact on the population.

Ruth Robinson

This is how they make it, they put rocks on there to keep it tucked under water.

Karen Meyer, Producer, Great Bear Sea

oh that's a rock

Ruth Robinson

yeah, they tie a rock on there.

Markus Thompson

***Masters of Resource in Environmental Management
Simon Fraser University***

A lot of these ideas that we were considering have largely been fueled by local people here. So they're here year round. They've lived here for their entire lives, and they have observed these changes over time. So they're telling us where they're observing this happening, and giving us ideas of why it might be happening. And it's that collaboration with us, Simon Fraser University and the Central Coast Indigenous Resource Alliance and the people here in the community that is allowing this project to happen. The local people are really key to this because we have to travel to some really remote areas out on the outer coast to find these areas, and to find where the herring are spawning, where they might be spawning deep. The local knowledge of where to go, how to find these places, and when we can go and cannot go.

For example, today it seems calm in here, but out where our experiment site is it's blowing 30 knots. And it would be impossible to get any work done. So it was the locals who gave me that information, and it's the reason that I've got a shore day today.

Ernie Mason

Kitasoo/Xai'Xais Nation

We're blowing 25 south east, won't be as bad, but if it's 25 north west, it blows right in the bay, stacks up the waves, when the tide was coming out you get big chop not as much fun.

Alejandro Frid

Science Coordinator, Central Coast Indigenous Resource Alliance

So Wednesday the forecast looks better. It's 10 to 20 going to light, and then it's crazy. It's light, light, light after that. So maybe we just

Markus Thompson

Masters of Resource in Environmental Management

Simon Fraser University

Tomorrow we're going to head out into Kitasoo Bay, and we're going to set up an experiment to test how depth effects herring eggs. And to do this we're going to place eggs that we harvest from the natural spawn to three different depths in the bay. So we're going to put them at 30 meters, at 15 meters, and at 3 meters. To do this we going to have to have two dive crews out there. One dive crew is gonna be harvesting while the other dive crew is collecting the stuff from harvesters and putting it into these pre-constructed frames, and those frames will be lowered from the surface to the bottom, and we will collect those eggs at different intervals. So, I collect them just before they hatch, and then I preserve them, bring them back to the lab and I can examine them with a microscope and see how well they survived. If a lot of them have died. And we'll also have temperature, salinity and dissolved oxygen loggers on those systems.

Dan Okamoto

Postdoctoral Researcher, Simon Fraser University

Studying fish is like studying trees, except they're invisible, and they move," and not only are herring like that, but also studying herring is like studying the vast majority of the ecosystem. Right?

So there's all these interacting pieces that we have a very limited understanding of. And yet, human intervention is such that we'd like to try to simplify things so that we can manage it well. But in reality, management means considering all those different tradeoffs between all the different players in the system. And that's something we're just starting to touch the tip of the iceberg of, in the sense that we have data on some of these things, but we don't really understand how they interact. And how they're going to change in response to the impending stresses of climate change.

Clark Robinson Sr.

Hereditary Chief, Kitasoo/Xais'Xais Nation

We had a lot of strong winds hitting out there, but, we ran into rough water. We made it through there, everybody managed to get their stuff in, what they needed to get in. But what we brought in there is not enough for the whole community.

With the same amount of trees, I set, which was 12 in one area, would fill this whole bulk grid up, every bin would have been full if it turned out good. But, three boats that were there this morning only had two bins, like you see in mine. Charlie probably got two bins, the other boat had two bins, where we usually come in with four or five bins each, that's enough for the whole village to come down and take their share for the winter. But we're gonna have to run out again tomorrow to go try and set up again. Reset, the trees to see if we get enough for the village. But, I doubt it. But right now we're just chasing the spawn that could be moving. Usually the elders tell us when the spawn is in one area, it gonna stay there, but once it gets disturbed by everything. I told my son on the way in, four things bothering the spawn: The first one there was the whales. There was probably about a dozen humpback whales in there. Then you got about three or four pods of sea lions. Then you have the fisherman that's out there doing the

draw of kelp, and then you've got us. Four things bothering the herring. So that's probably the reason why it didn't turn out as well. But maybe the stocks are weak, too. That could be another thing we just gotta look at it, and then talk about it amongst ourselves and see what went wrong and what we could do a little bit better next year, I guess.

Alejandro Frid

Science Coordinator, Central Coast Indigenous Resource Alliance

What's rather exciting about all this work that I'm involved in is that it's not someone with an academic background like me coming into a place and bringing my own ideas, and just making my own moves, and making decisions as if I knew any better. It's about listening to people, have been living in place for many generations, have a very long-term perspective, who have an intimate relationship with their resources that nourished them culturally and as well economically, nutritionally, and saying, "Hey! We're noticing these changes. We understand a lot of this from our own perspective, but what can you as a scientist bring to round out our understanding better?" And that's a very enriching experience because it's the synergy of the old traditions and all of their wisdom. And new tools that science can contribute. It just complements our understanding as well. And it's very gratifying where that requests for scientific research comes from the First Nations themselves.

Clark Robinson Sr.

Hereditary Chief, Kitasoo/Xais'Xais Nation

Make sure to respect the area, not to ruin it for the future. Make sure that we have enough goin' around there, all of them. Not to overtake. Not to waste. Not to be disrespectful to any of the animals. They're all there to feed as well as we're gonna feed ourselves. Make sure that we're looked after well with whatever we have left there for the herring.

Alejandro Frid

Science Coordinator, Central Coast Indigenous Resource Alliance

So what different First Nations are trying to set up are areas that are exclusive for their harvest of herring eggs So, they're zoning areas that they want to keep just for their own harvest of eggs, and they're saying when there's enough herring coast-wide we can consider commercial roe herring fisheries to open outside those areas. But there has to be a minimum threshold of abundance.

We're trying to achieve a positive and collaborative relationship with the Department of Fisheries and Oceans, in which they contribute their substantial scientific expertise, we contribute scientific expertise and indigenous knowledge and indigenous laws and come up with a co-management structure that promotes access to this very important resource by First Nations, but also that promotes the conservation of herring in the whole ecosystem. If that is achieved that we can contribute to improved management so that other non-indigenous fishers can access herring as well.

Karen Meyer, Producer, Great Bear Sea

In addition to herring recent collaborative research with First Nations and Universities includes kelp and otters, bears and salmon, crab, rockfish and birds.

Doug Neasloss

Chief Councillor, Kitasoo Band Council & Resource Stewardship Director, Kitasoo/Xai'Xais Nation

We don't want to be one of those people that say, "We used to have salmon here, we used to have halibut, we used to have herring, we used to have eulachon," that's not something we want to do. We want to be very proactive. We're prepared to do whatever it takes to make sure we protect these resources and make sure things are done in a sustainable way. We're working on marine planning with the province of British Columbia, so we've getting involved with processes like MaPP, we're doing a lot of science work, incorporating a lot of our traditional ecological knowledge, in term of the management. Because we want to protect those. You want to make sure that people have the opportunity to still harvest those resources in the future. So I think just being able to be a part of the decision making, I think will hopefully bring better sustainability to our coast.

Cumulative Effects 20 min

Karen Meyer, Producer, The Great Bear Sea

We're here on the North Coast of British Columbia standing alongside the Skeena River estuary. This region is facing some of the largest proposed developments in North America and this week we'll be talking to people who are taking a groundbreaking new approach of how we look at the potential impacts. So rather than looking at one project by one project by one project they are looking at the cumulative effects of how all these projects may have an impact on both the ecosystem and the people who live here.

Rina Gemeinhardt

Environment, Lands and Referrals, Kitsumkalum First Nation

Kitsumkalum territory goes from Terrace all along the Skeena, over to the coast. It used to always be, forestry and fisheries, and maybe some tourism. People would come and fish on the Skeena. And all of a sudden from all directions, we are being inundated by pipelines to feed liquefied natural gas plants. With that all of a sudden came other things as well, like a refinery, somebody's talking about. Huge mega projects in wind power.

Nicole Wallace

Consulting Biologist, Kitsumkalum First Nation

We've got, at this point, five facility projects, and two major pipelines coming into that area. And even if just one project goes through, you know, we are talking 6,000 people to come into a very small area to construction over five years for a facility. You know, different workers, sets of workers. Another 3,000 or so for pipeline, 6 for facility, and that's just one. There's five proposed out on the coast of Rupert, there's another three in Kitimat at this point, it's that scale. And people just need to try to wrap their head around that scale of things.

Rina Gemeinhardt

Environment, Lands and Referrals, Kitsumkalum First Nation

Right now, there's no holistic approach to any, anything really. Be it socio-economic, or environmental. Nothing is looked at as a package. A holistic package. So cumulative effects, I think, is a tool to come up with: "How does this system, a holistic system, gets impacted? And how can we measure it? And how can we make sure that we know going into the new project what is going to happen, cumulatively?"

Nicole Wallace

Consulting Biologist, Kitsumkalum First Nation

And then there's all the other factors to consider. I mean, we've sort of focused just on the projects, and their effects, but the other things in cumulative effects. There's those things that are extraneous, like climate change, which is a big one. And, it can't be sort of left out either.

Rina Gemeinhardt

Environment, Lands and Referrals, Kitsumkalum First Nation

It's all a steep learning curve. What we're finding is not only are we completely inundated and unprepared for the onslaught of projects, we find that the federal and provincial government are unprepared. They did not organize themselves in a way that they could address mega-

situations like this. How can we all get together and talk about these things? Look at all the environmental issues we need to talk about. The economic issues. The social issues.

Nicole Wallace

Consulting Biologist, Kitsumkalum First Nation

So some of the initiatives that we've been participating in include the federal, we're talking about, it's called "Cumulative Effects Monitoring Initiative." It's being led by Environment Canada and Climate Change. We've pulled together some of the federal family – Fisheries and Oceans Canada, Natural Resource Canada. And then at this point it's been, not limited, but included the Tsimshian Nations. So those that have interest on the coast. That's Kitselas First Nation, Kitsumkalum First Nation, Metlakatla, Lax Kw'alaams, and Gitga'ata and Kitkatla.

Taylor Zeeg

Advisor, Cumulative Effects Management Initiative

Metlakatla Stewardship Society

Basically, cumulative effects are the combined effects of past, present, and future activities on the things that people care about. In our case it's what the Metlakatla membership cares about. So the starting point for us was going through a process to understand the priorities of the membership given the development context within the territory.

One of the Metlakatla priorities is, we called it "food, social, and ceremonial activity." We loosely define that as hunting, fishing, gathering, social events, cooking, eating. So it's a broad spectrum of things. And trying to understand to what degree people are participating in these activities. And is that level of participation being negatively or positively affected by the development activity that we're seeing in the area.

So, that would have been something that sort of fits in the cultural category, but in the case of at least Metlakatla First Nations it has implications for health, economy, and social well-being as well.

Metlakatlas always taken economic development very seriously, but it's always been said "never at the expense of stewardship." So there's all this stuff happening and the environmental assessment process tends to be focused on a single project. There wasn't, it's not well suited to address the relationship amongst different projects and the effects that can result. That's where Cumulative Effects more steps in.

David Leask Jr.

Land and Marine Implementation Manager, Metlakatla Stewardship Society

We're starting to gather the baseline. Trying to get a better picture about what state the entire zone is in, in terms of a holistic view.

We're at one of the clam gardens in Metlakatla pass here. The wall is about 2 feet under the water right now. But what it is exposing here right now is the terrace behind it. They did testing on it, carbon dating, and this one was one that was abandoned 2000 years ago. The forest looks natural back there but there is a village in there.

So we zoned this area as a Special Management Area in our marine use plan. An area that we as Metlakatla people want to fully manage. As Metlakatla people we did not just want protection in the area, we want full stewardship and management authority out there so that we could create our own opportunities out of these areas and kind of manage them holistically and not just viewing them as a or conservancy but as an active stewardship area where we enhancing, revitalizing, we're educating and we're creating opportunity for our people here.

Taylor Zeeg

Advisor, Cumulative Effects Management Initiative

Metlakatla Stewardship Society

Ideally what you want to have in place for the cumulative effects management system is that you know your tolerances ahead of time. And so, when a new project comes along, is it bumping up against that tolerance? Or is there lots of room within that? So, limits and tolerances, and knowing that ahead of time, that's what makes it different. And, then, if a project comes along, and starts to impact something beyond that tolerance, well, that's a whole conversation you need to have about mitigate, avoid, manage, or offset. And it's an opportunity for decision makers to get really engaged with good information.

Caroline Butler

Heritage Research Coordinator, Gitxaala Environmental Monitoring

So working with community members and working in collaboration with other nations, we have identified a long list of values. Gitxaala people harvest probably close to 100 different species from the territory. So, we've identified species of concern. We've identified critical habitats. We've identified cultural values. And, it's a case now of creating the indicators for being able to monitor those values and the impacts on them.

So, wake, for example. The community members have a lot of concern about the impacts of a wake from tanker traffic. So, harvesters out in a small speedboat, what that means to their safety, what that means to their gear, what it means to the species on the beach, the clam beds, what it means to boats on the beach, and people on beach. What it means to the marine archeological sites, the coastal archeological sites. So looking at the speed of the vessels and the size of the wake, the consistency of those impacts over time as the traffic increases, and how that can be managed, or mitigated, or stopped.

Bruce Watkinson

Marine Program Coordinator, Gitxaala Environmental Monitoring

It's very easy for one project to come in, and Mr. Industry to say, "Oh, we're not going to have an effect on the environment. We're not gonna have effect on your culture. We're not gonna have effect on your social values."

Well, when they start having two, or three, or four, or five of these projects, the additive effect, the cumulative effect, of those projects, it needs to be examined. Both in a short-term perspective and, more importantly, I think, in a long-term perspective. What effects are these projects, as a group as a whole, what effect are they having on our environment and our resources? And our culture.

First Nations want to take the lead on this. We think we have a plan in place to start addressing this. And we have talked to the provincial government. We have put objectives and implementable items into the MAPP plan.

We're working as individual First Nations. We're working collectively with our neighbors to deal with LNG, to deal with marine shipping, to deal with all those issues like safety, wake, underwater noise, protected habitats, anchorages, invasive species. We're dealing with those in other arenas, and that include the federal government. We've had as recently as a month ago, we've had some really good conversations with ministries – Environment Canada, Transport Canada – and promises from ministers to work with First Nations on addressing some of these issues. Including continuation of the moratorium on crude oil shipment in British Columbia waters.

David Leask Jr.

Land and Marine Implementation Manager, Metlakatla Stewardship Society

So this is one of our other village sites. It's one that was abandoned during the time of European contact. So it's kind of a recreational beach and our graveyard is here. It's kind of sensitive in that regard. There's quite a bit of erosion on this side, so we like to come here and monitor the beach once in a while if there's any artifacts or even potentially human remains because this whole thing was a graveyard so we had gravestones that had been eroded out of the shell midden up here.

We have a couple of places in Metakatla pass where erosion is happening, it seems like quite rapidly. So the cultural remain is the shell mitten. Most of the things we find are things like broken tools but we're also finding a lot of animal and fish bones.

But the other thing with all these developments is that the pass is one of the only ways in and out of Price Rupert harbor. So just boat traffic alone, whether we're talking about industrial traffic or recreational traffic, it's all going to go up. So we have more people here and more wake, more wash, that's gonna disturb this even more and make this erosion happen faster.

We'd like to at least understand what's going on here before that pressure comes. But yeah, the main thing is that vessel traffic will have the biggest effect on this.

Nicole Wallace

Consulting Biologist, Kitsumkalum First Nation

Probably of the biggest one that comes up from First Nations' perspective is access. Access to the resources. Access to getting to their fishing spots. Getting to the vegetation or marine vegetation harvesting areas. Cockles, clams. You know, are we gonna still be able to get to those places? This comes down to First Nations governance. It's, you know, this is where we traditionally went. This is our spot. You know, you can't tell us: "Well, you could probably go next door if you like. This isn't the place anymore." That's not the way it works. You know, "Somebody else has that spot," and then we have to ask permission, and now suddenly there's a

change in our status around that. So, there's a lot more to it, than: "Here, go over there," sort of thing. So access is probably one of the bigger ones.

Caroline Butler

Heritage Research Coordinator, Gitxaala Environmental Monitoring

So, we have an LNG project that's proposed. Have a trestle over an eel grass bed where there are juvenile salmon and crab. We have another project proposed in an area where there are 50 archeological sites. And then we'll have tankers coming through in the commercial fishing grounds where people make a living, so there are multiple potential impacts to people's experience of the territory, their ability to harvest resources, their ability to make a living.

Our office has done climate change research that's already showing the sensitivity of particular species, such as seaweed, to climatic shifts and change, and to add other forms of impacts on top of what's already happening is a concern to people. Some of these species are very sensitive. Herring is extremely sensitive to noise. Gitxaala people always managed noise impacts in herring spawn areas, and so adding tankers to the territory makes a big difference in terms of the underwater acoustics. So that's a key concern as we approach the cumulative effects monitoring.

So right now people can go out in a small speedboat and they may not see another vessel while they're out harvesting in their territory. Or they may only see the odd fishing boat. But they're going to go out in those small speedboats and be dodging tankers down Principe Channel if the projects are approved. That changes the experience of your territory. It changes the experience of learning about harvesting from your uncle, if that's what you're doing. So those impacts could be huge on the way people experience their place in the world. And their ability to actually put fishing nets across the channel, or their ability to pull their boat up on the beach and dig clams. And those are harder to measure, but we're looking for ways to do that because those are changes to Gitxaala lifestyle and culture that are as major as the air quality concerns and the impacts on herring spawn as well.

Taylor Zeeg

Advisor, Cumulative Effects Management Initiative

Metlakatla Stewardship Society

These are the things that make people's lives work living, I think. If they have access to good food, and a healthy Butter clam population, and the ability to fish for Chinook, and their kids can go to school and have high school completion rates that are acceptable, that just makes for a good life.

The main point of cumulative effects is to maintain the condition of things people care about, in good condition. And, if the arrow starts going in the wrong direction, what it's supposed to do through management regime is inflect the arrow, turn it in a different direction. So, if it's going into a "danger zone," we'll call it, there should be a management regime in place associated with that zone. So that's the whole point of cumulative effects is try to keep things in the "good" zone. The happy zone.

Bruce Watkinson

Marine Program Coordinator, Gitxaala Environmental Monitoring

Some of the questions I grapple with, that keep me awake at nights is, you know, are very basic questions. You know, how much is too much? You know, how much industrial development can this area take? And where is the proper places for some of this development? You know, we have proposals that are, in the Skeena estuary, right, and Skeena River is a world-renowned river, and there's still, ah. It's the second-largest salmon-producing river in British Columbia. It's very important to our culture, to our people for economic reasons. And so, some of the questions are "Why are these LNG facilities so close?" "Why are they located within Skeena estuary?" "How much is too much?" "How much development can this area handle?" "How much is too much for our people?"

On the same hand, we wonder "What are the economic opportunities for our people, our younger people?"

Caroline Butler

Heritage Research Coordinator, Gitxaala Environmental Monitoring

This is a really important time. And it's an important time for everyone to be really diligent about what happens here. There's been a lot of change here, and a lot of impacts over the last 150 years, but people have been able to maintain their way of life, and protect their territory, and protect their culture, but this is a different level of threat. So, it's really important to plan it well, and trace out all the potential impacts, and some of them are more clear. Like clear out the eel grass. There are very clear, ecological impacts to that loss of habitat. But, what's more difficult to trace out, but equally important, is to understand how the population increase, the rise in the price of housing, the increased traffic, the size of the wake down Principe Channel, what that means to how people feel about their territory. How they are able to manage the resources.

Taylor Zeeg

**Advisor, Cumulative Effects Management Initiative
Metlakatla Stewardship Society**

So key to us is the management of cumulative effects. And put it right in our word. Right in our title. So it's about setting up a program. Not a project, a program to manage cumulative effects. So it goes on and on and on, it never stops. It just becomes part of the way our resource and environmental management is done. It's a new era. And there's all these opportunities to do a better job of stewardship in the face of all the development activity that's going on.

Bruce Watkinson

Marine Program Coordinator, Gitxaala Environmental Monitoring

We might not get this chance to enter into benefit agreements with companies again. So, there's a large responsibility for our nation to make sure that these agreements do have long-term benefits for our people. But at the same time, do not go over the line in terms of compromising our culture, our social values, and our environment.

Eel Grass 8:20min

Narrator

In about three feet of water and down to twenty to twenty-five feet or so are the eelgrass beds, where they haven't been dredged up in the past. Eelgrass beds function as nursery grounds for many commercial fish, including King Salmon. The Opalescent Nudibranch is only one of many sea slugs who permanently dwell in the eelgrass.

Eelgrass beds are home to a wealth of marine life. They are an incredibly important habitat. In this rich environment, mating comes natural and when spring comes along, packages of eggs soon litter the eelgrass.

Giant pink starfish patrol eel grass for food.

English soles don't just have fun in front of my camera. They have learned that plankton gathers in front of my video lights. Easy pickings.

Migratory waterfowl often gather in small flocks, or even larger numbers, to feed on the rich bounty of eelgrass meadows. They store energy before flying north again. Here Surf scooters, common goldeneyes, and buffleheads take turns filling their bellies. They feed on snails, small crabs, and other crustaceans.

Pacific herring feed on zooplankton in the offshore environment. They are of tremendous importance to the marine food chain. In early spring they take to the shore and move into sheltered bays. After congregating in deeper channels, herring move into sub or even into tidal waters to spawn. Submerged vegetation, especially eelgrass, is the preferred spawning habitat. Herring spawning events attract large numbers of predators, which like to feed on the fatty fish and their nutritious eggs.

These cormorants are diving for herring, which have just spawned.

Baby Island is well known for its Harbor Seals hauling out there. But they don't only rest on land. They also relax just idling through the eelgrass beds. I dive with a reed breather, which is completely noiseless and makes no bubbles.

Harbor Seals have been hunted by men for centuries. They are cautious around us. But if I just sit on the bottom and wait, I become irresistible to them. And soon I feel that tug on my fin. Then I can move freely as if one of them. Every Harbor Seal has a personality, and diving with them my way, you soon learn to know their characters. Where which seal likes to go, and how it reacts to you, and the other seals.

Diving at night yields yet a completely different picture of Holmes Harbor. In the shallow water on the way to the eelgrass beds, I get pounded by smells, blinded by my video lights. A staggering amount of fish. While some fish have wedged themselves into my dive gear, this soft smelt gradually got used to my lights.

Juvenile King Salmon or Chinook hunt at night for the bounty of the nursery grounds. Yes, I have seen many young Chinook getting bigger by the day. They need these eelgrass beds. And this one in front of my home is a magnificent one.

Young Chinook on the night prow, also have to be aware of larger predators. Spiny Dogfish come up from the depth at night. And while they're probably out for smelt, a juvenile Chinook will not be safe.

Pacific Market Squid show up in late summer. Some forage above the eelgrass. Others come to mate. It is a spectacle to watch these agile mollusks move through the water. They definitely appear very alien to me. They communicate with color flashes across their skin. Here white ones are out hunting, and colored ones are displaying for a mate.

Delicate comb jellies. A large, predatory worm. A stinging Lion's Mane grows to six feet across. It is the largest jellyfish in the world, and when fishing, its tentacle load may stretch to hundred feet in length.

Tube-snouts seek for cover in the eelgrass. An Alabaster Nudibranch is out on the prow. Juvenile Rock Fish and Perches catch krill, fatally attracted to my underwater lights.

In some areas eelgrass beds have completely disappeared. I cannot stress more the importance of keeping these eelgrass beds intact. This is where many fish – commercial and otherwise – survive young age.

To me Hooded Nudibranchs are some of the weirdest, not-from-this-world looking citizens of the eelgrass community. Reminiscent of a delicate underwater Venus Flytrap, these strange Nudibranchs actively herd plankton into their mouths. Opening and closing the large hood, they also use the ring of tentacles to caress their prey in the right direction. With up to seven inches long, Hooded Nudibranchs are also one of the bigger sea slugs of the Salish Sea. They often come in small, or even larger, groups and Three-Spined Sticklebacks sometimes use the opportunity to steal trapped food out of the hood of the Nudibranch. And when a Hooded Nudibranch thinks it needs a better hunting ground, it simply dislodges from the eelgrass blade and swims to a better location, hopefully. Hooded Nudibranchs swimming really look like out from this world. Sea Angel-like things, currents to relocate themselves.

Clam Gardens 1:45 min

**Dr. ANNE SALOMON Marine Ecologist, Simon Fraser University
MaPP Marine Advisory Committee**

We are here on Quadra Island, in Waitt Bay, and in this bay alone right here, there are 49 clam gardens. Clam Gardens are prehistoric rock walls that people made in ancient times to, we think, increase the productivity of clams. And, what you can see right here is one of the rock walls. So if you look at the dark strip in the water, that's the rock wall. So, people rolled, as we hear from elders, rolled rocks down to the edge of the water at low tide to make these walls. And here we are at high water, high tide, so you can see the clam garden's flooded. So the clams right now have their siphons out, and they're filtering phytoplankton from the water, but it's this clam garden structure that creates like a terrace, and what we're doing here today is we're picking up an experiment where we're actually measuring the growth rates of the clams to ask "Do you get faster-growing clams and more clams in clam gardens than non-clam gardens?" So really how did people actually perform these ancient forms of mariculture?

We have all these little baby clams that are in a mesh bag that my student Amy and colleagues carefully put little tags on, little vinyl tags, that have numbers on them. And, we've got the length and width and weight of these tagged clams, which we are now going to retrieve to see if they grew any bigger, and if they weigh any heavier.