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Dr. David VanderZwaag

Shelley Denny

Amber Giles

David Dow

Mitch Feigenbaum

See next page for additional authors

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American Eel: A Symposium. Session Two

Authors

Dr. David VanderZwaag, Shelley Denny, Amber Giles, David Dow, Mitch Feigenbaum, and Genna Carey

**AMERICAN EEL: A SYMPOSIUM
SESSION TWO: SOCIO-ECONOMIC PANEL**

Moderator:

Dr. David VanderZwaag¹

Panelists:

Shelley Denny²

Amber Giles³

David Dow⁴

Mitch Feigenbaum⁵

Genna Carey⁶

This panel focuses on the socio-economic and cultural significance of American eels. The discussion covers an overview of eel fisheries, socio-economic uses, international eel markets, dominance of Asian aquaculture, and the role of the American eel for aquaculture seed stock and for the consumption market.

David VanderZwaag:

We will have four presentations with five speakers. The first presentation will be giving [Canadian] First Nations' perspectives on the . . . importance of [American eel fisheries and the status of indigenous knowledge] and management We have two presenters. First is Shelley Denny, Director of Aquatic Research and Stewardship, Unama'ki Institute of Natural Resources. She is from Eskasoni, Nova Scotia. . . . Our second presenter will be Amber Giles. She will talk from a Maliseet Nation Conservation Council perspective.

**INCORPORATING FIRST NATION PERSPECTIVES IN EEL SCIENCE, SPECIES AT RISK AND
MANAGEMENT**

Amber Giles:

Good morning. First of all I would like to acknowledge Passamaquoddy Territory and thank the Passamaquoddy People for allowing us to be on their territory and hosting this meeting. We have already been sort of introduced. My name is Amber Giles with the Maliseet Nation conservation Council and this is Shelley Denny of UINR. Today we are going to be talking about incorporating First Nations' Perspectives in Eel Science and Species at Risk and Management. First we are going to be giving you an overview of what is an indigenous perspective and how can it be incorporated into Science and Management for Species at Risk. Shelley and I are here on

¹ Professor and Canada Research Chair in Ocean Law and Governance, Marine & Environmental Law Institute, Dalhousie University.

² Director of Aquatic Research and Stewardship, Unama'ki Institute of Natural Resources.

³ Environmental Technician, Maliseet Nation Conservative Council.

⁴ Ocean Policy Coordinator for Chief Moore of the Passamaquoddy Tribe.

⁵ Director, American Eel Sustainability Association.

⁶ Committee Chair, Canadian Committee for a Sustainable Eel Fishery, Inc.

behalf of our Nations, the Wolastoq Nation (or, the Maliseet Nation) and the Mi'kmaq Nation. They are two separate Nations. Our territories are shown here on the map.

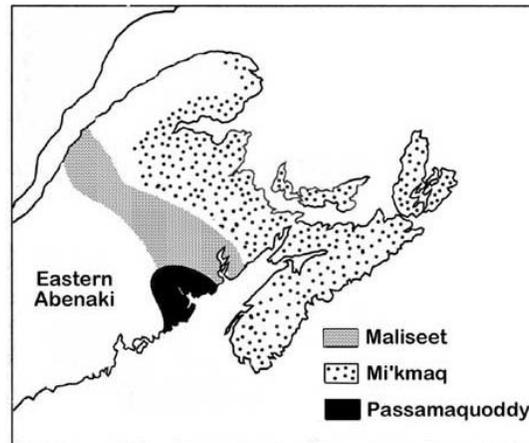


Figure 1. Distribution of Aboriginal Nations in the Maritimes.⁷

The Mi'kmaq Nation is shown in the dotted area and the Maliseet Nation is shown in the grey. And you will see here that we do not have the Canadian-U.S. border indicated on the map. Because we have a saying, “the border crossed us, we didn’t cross the border.” Both of our Nations are part of the Wabanaki Confederacy which is our traditional governing system. Our knowledge systems are really place-based. So our creation stories talk about how we came from our territory. They literally say “we came from the trees and the rocks.” We have been in our territories since time immemorial. Our names for ourselves really represent how connected to our territory we are. The Wabanaki, for example, translates to “People of the Dawn.” And Wolastoqiyik, which is the name for my Nation, what we call ourselves, is the “People of the Beautiful River,” or what you might know as the St. John River.

Shelley Denny:

While each Nation is different in their beliefs, there are commonalities among all First Nations. There are multiple ways of knowing and we do value our indigenous knowledge, but we also value the scientific inquiry and information. We believe that Mother Earth is borrowed from future generations and that we are here for a limited time but that we must be able to protect Mother Earth for generations to come. We believe in the values of respect, relationship, reciprocity, and responsibility. We do respect the eel as an individual. Our relationship to the eel is based on our use of the eel and how we are dependent on the eel for survival. But also too, you cannot exist without Mother Earth and without being in that relationship, so it is clearly important. Reciprocity, we need to be able to give back, not just take; we cannot just take the eel, we must give something back. And also responsibility, we carry a great sense of responsibility for the eel and so we are always aware that we have to do something, we have to help and that is part of our responsibility as human people. And also the equality of life. We are only one part of the ecosystem. We have to realize that there are other things that depend on it, not just humans.

⁷ *Living Lightly on Land and Water*, BAY OF FUNDY ECOSYSTEM PARTNERSHIP (2003) available at http://bofep.org/native_resource.html.

Amber Giles:

I have been carrying around this term “Indigenous Knowledge Systems” (IKS). Some of you might be familiar with Traditional Ecological Knowledge or Aboriginal Traditional Knowledge, but what I have been sort of moving towards this term, “Indigenous Knowledge System.” And this conceptual model is something that I developed during my research with the Fish-WIKS research project, which stands for Fish and Western Indigenous Knowledge System. It sort of illustrates how knowledge is held within the system. Our knowledge is transmitted between people. In a Western knowledge system it might be through the written word, where in an IKS our knowledge is transmitted through stories and song, it is an oral tradition. Our knowledge system includes how our knowledge is valued, our beliefs, how our knowledge adapts over time. While we have traditional knowledge, we are in a contemporary society so our knowledge adapts over time. How we practice our knowledge, and I think that you will see that illustrated as we go through our presentation of how our [IKS] is really practiced to our advantage and our relationship with the eel. We have a couple terms, M’sit no’komaq, which means “all my relations.” That really illustrates how we see ourselves in our environment, the ones that swim and the ones that fly and the two-legged and the four-legged are relations. There is not a sort of hierarchy in our belief system. Netukulimk is a concept that some people sort of have translated to “sustainability” but it sort of is more than that it is to “avoid not having enough” and do to do that you have to save some for the generations to come. You “take only what you need,” and we practice these beliefs when we are fishing for eels.

Shelley Denny:

The significance of eel has been documented – it is quite common to pull-up a file or research document that records the uses. But first and foremost, it is food for our people. We depend on it for certain feasts, offerings, and pow-wows. There is a ceremonial component to it. Eels are known for their calming and relaxing ability once it is consumed so sometimes people do request them as a last meal before they do transition to the spirit world. It is medicinal. We do use the skins for sprains, for stabilizing bones, arthritis. The oils have been used for ear aches and also it is a good fat. It has been known to be put into baby bottles because it gives them the extra nutrition, the fat, and it just helps to develop a taste for eels as they grow older. But it is a good food source and it is something that has sustained our people for a long time. It is also used for art. Some people will wrap their bows in eel skins and has been known to be used for ties in hair.

Amber Giles:

Fishing for eels provides us with more than just a food. It provides us with a variety of opportunities. It enables us to carry out our cultural obligations. It allows us to transmit knowledge inter-generationally. When young kids join their grandfathers or uncles fishing, they are allowed to get that information from the older generations.

Shelley Denney:

Or aunts.

Amber Giles:

Or aunties, yeah, it is one of those things. *[Laughter.]* Also it lets us practice our generosity. When people go out fishing they will catch maybe a dozen eels but all of those eels will not remain in their household. They will be given to their aunties or their grandmas or their neighbor down the road. It also allows us to cultivate our kinship in our communities. Also, there are a number of words used specifically for eeling. If we are not able to eel anymore, we will lose that language related to the practice. It also allows us to establish and keep our relationship with eels. If we are not able to eel like some of our communities in the Maliseet territory, we lose that relation. It is part of our cultural identity. We have had this relationship for millennia with eels and by losing that, it is a part of who we are, and we risk losing that.

Shelley Denny:

We do participate in the eel fisheries and participate for food, social, and ceremonial reasons; we fish for food and ceremony. But, we also have Commercial licenses in Nova Scotia but these are not owned by individuals but by rather by the communities themselves. . . . They tend to be under-utilized or not utilized at all because they are noticing that when they do fish for eels commercially, then there is less left to fish for food. They often choose to have the food fishing, rather than commercial. We do have one elver license. One community in Breton has a license.

Amber Giles:

In the Maliseet Territory, we also have food, social, and ceremonial fishery. It is not used as much as in New Breton, for example, because we do not have as many eels in our territory. Also we do have a floating commercial communal eel license that floats between three communities but it is not used every year. We do not have any elver licenses in our territory.

Shelley Denny:

In terms of science and our Indigenous Knowledge Systems, our knowledge is qualitative. It is based on observation, interaction, and it is also intergenerational. To try and fit our science into an assessment model, for example, is not going to work because it is not based on the same type of information. But we do know where to find eels and where not to find them; when to catch eels and when not to catch them; what they feed on and where; how eel movements coincide with natural cues; how to co-exist with eels. But, most importantly, we are noticing now that it is taking more time to get food on our table. And that commercial fishing does impact food fishing. Our knowledge that we have is relevant and practical for what we need. So is all eel science relevant and practical?

Who are we kidding? We do not manage eels, we manage ourselves. I think that our integration of the belief-knowledge-action system, you cannot really separate what we know from what we do and what we believe. In the Indigenous context it is all one. In the Western system, knowledge is here, science is here and there are many rules on how to interact. We have that integration of what we know and what we believe. Many of the values that we do have are a shared resource. We know we are not the only people that depend on eels; there are other animals and

other fisheries that go on. . . . It is about definite sustainability, not just for us but for other animals as well. Respect, relationship, reciprocity, and responsibility.

Some of the specifics of these are no-brainers really – it is very common. We do rotate fishing areas and we tend not to harvest the same area over and over again so there is that time to allow Mother Earth to replenish. That is not only eels that is a lot of other fisheries and other hunting practices, as well. A lot of what we do is not just for fishing it is natural resource people management. We tend to keep what you catch when spearing which is really important in winter fishing because there is a tendency to get smaller eels that we do not normally get because our spears are two different types for winter eeling and summer eeling that we are able to get the smaller eels during the winter. If that happens, we keep the eels because if we put them back in, they are not going to survive, and that is waste. We limit catch, we take what we need. When we go eeling we go for maybe a dozen eels and that is shared among three homes or three families so we are fortunate in some ways that we do not have to get them all at once. We take them when we need them. And also reduce waste. We do not like to see eels wasted. We practice this and teach our people not to waste; if you are not going to use them, if you are not going to eat them, do not fish for them.

Amber Giles:

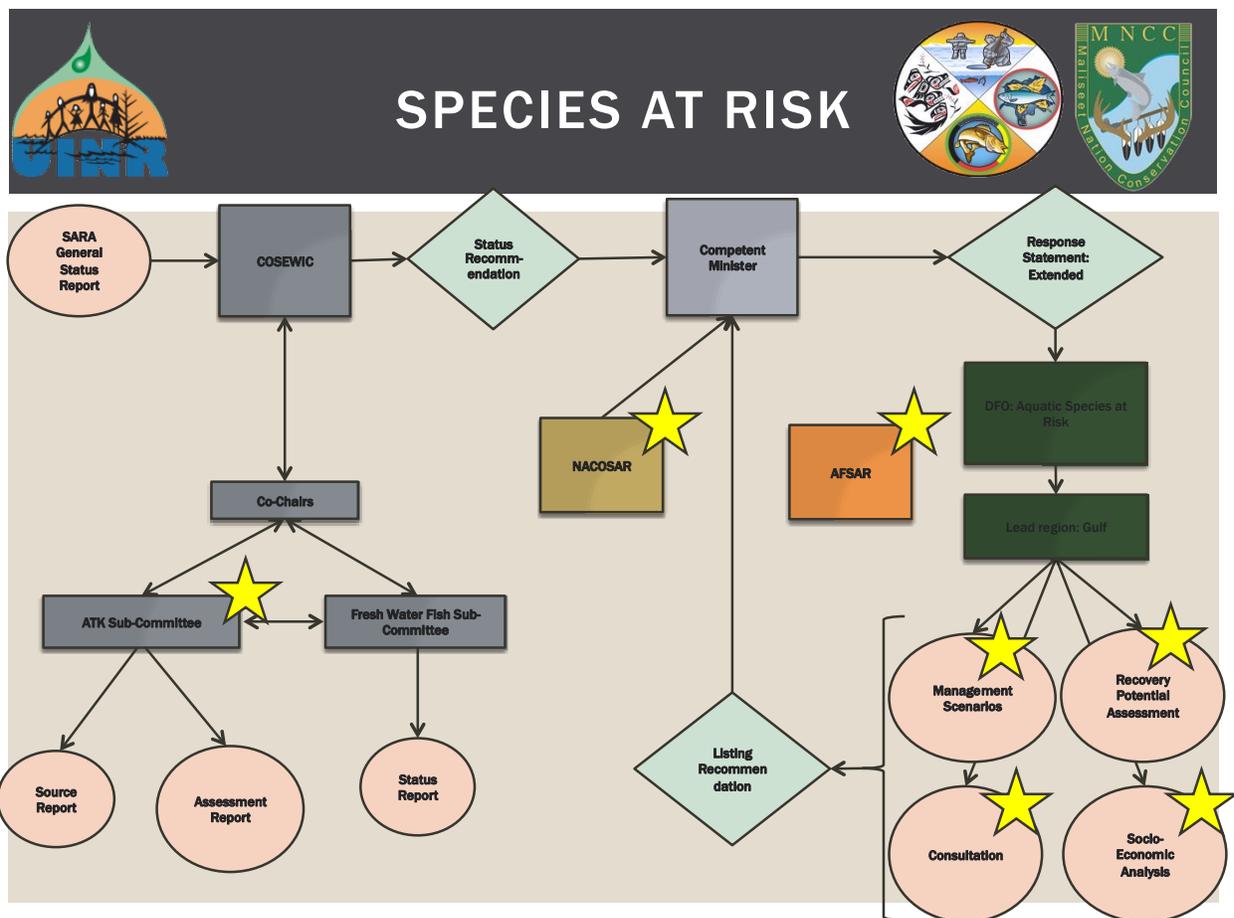


Figure 2. Canadian Species at Risk Listing Process

This flow chart [in Figure 2] is again from my research project and it illustrates how the species at risk listing process works in Canada, specifically for an aquatic species and the extended listing process like the American eel is undergoing right now. Dr. Cairns has given us an overview so I will briefly explain it and explain what the stars mean. The listing process comes through COSEWIC and comes into the subcommittee then they write reports and make a recommendation to the minister and then it goes into DFO, they make a bunch of reports, and then it comes back to the minister. All of these stars represent opportunities for Indigenous Knowledge Systems to be further incorporated into this process. Right now, there is some limited capabilities. For example, in the Aboriginal Traditional Knowledge Subcommittee, the funding that they have right now only allows them to essentially do a Google Search of indigenous knowledge. As we know, we have an oral tradition, so it sort of seems ridiculous that when our knowledge system is transmitted orally, that they have to do a Google Search to incorporate our knowledge. I hope that through our presentation so far we have showed that indigenous people have a breadth of information, of long-term information on eels. So incorporating our knowledge into this sort of system will be beneficial for all of us and for management and for our conservation efforts on eels.

We decided to include this to show that our world views sometimes can cause tensions. For example, in Nova Scotia right now, the minimum legal limit for eels is 35 centimeters. Our People feel that that is a very small eel and our summer spears will not even catch an eel that small.

Shelley [Denny] alluded to the difference between summer and winter spearing. In the summertime, when we go spearing we go at night time from a boat and we have a lantern that is at the front of the boat so that you can see the eels that you are spearing. If somebody sees a small eel they will decide not to go for it and they will wait for a bigger one. So 35 centimeters is small for us. But in the wintertime, we go on the ice and we cut a whole and you have to sort of make a circular motion. You get what you get and you cannot see because they are buried in the mud. Shelley [Denny] alluded to that sometimes the non-native fishermen will put the smaller eels back, where our fishermen find that is disrespectful to the eel and that creates tensions on the ice. I have heard stories about fights almost breaking out between native and non-native fishermen based on these sort of rules that are known among non-native fishermen versus native fishermen. Also there have been conflicts between who decides that eels can be taken for science experiments. So we have heard stories of scientists being allocated two hundred eels in territories where people have not had a relationship with their eels for fifty-plus years. You can imagine how people who have lost that relationship with that species that has been so iconic in their tradition and they see people taking them just for the sake of science that it would cause some tension.

Shelley Denny:

Moving forward we would like to see Indigenous Knowledge Systems be valued with wider application to management. So do not think of Aboriginal Traditional Knowledge or Indigenous Knowledge as something to fit into science, think of the wider applications that they have. I was pleased to hear about governance and working internationally and locally. We do need to work collaboratively with the First Nations, scientists, management, and policy. We tend to not work so much with industry because we have limited industry involvement. So our rights kind of give us the privilege of having different consultation systems evolve in Nova Scotia. So we do need to develop better information and more relevant practical knowledge to improve management and we need to develop that policy for collaboration. All of that does exist but does not seem to be working well with eels – it just seems to be something that is organized by people who are

interested. And that is great, that is what we need, we need to start doing that. We do need some framework for inclusion of Aboriginal people. In Nova Scotia, we have a process for that but in other areas there is not a process. We also need those funding opportunities for interdisciplinary studies because that's bringing all of those views together. We also need to use sciences as a tool for evaluating those management measures; are they working, what we can do, what is working and what is not, where and why.

That is pretty much it. Wela'lioq.

Amber Giles:

Woliwon.

David VanderZwaag:

Thank you, Shelley and Amber, for that excellent presentation and overview raising issues of how to better incorporate Indigenous Knowledge Systems [The topic could warrant] a separate conference, [and perhaps there] should [be] a follow-up conference on that topic. Our next presenter [will] be looking at the Passamaquoddy Tribe's [interest in American eel fisheries and related traditional knowledge and management issues.] David Dow is Ocean Policy Coordinator for Chief Moore of the Passamaquoddy Tribe.

FIRST NATION PERSPECTIVE ON AMERICAN EEL FISHERIES

David Dow, on behalf of Chief Moore:

Chief Moore is a man of few words and what I have been asked to convey will allow me to be quite brief. First off, he sends his greetings and welcome. He wants you to know how much he supports the work that goes on here. This is incredibly important. The nature of this animal and its extensive range and complicated life history. There is considerable effort on the part of the Science and Policy makers in trying to get it right. Chief Moore, it goes without saying, thank you to our Mi'kmaq and Maliseet friends for the good take on the cultural importance of this particular animal to Native People. But Chief Moore would like to see this, along with all other species, not just be sustained, but to thrive. He said make it clear that thriving and the ability of an animal, human, or eel, or salmon, or lobster, requires certain considerations. First and foremost, those animals have to have an appropriate habitat that is cared for, and are looked after, nurtured. It has to have a favorable environment that can be suitable for what it needs. So, given that we need those things and given the complicated nature of this particular animal, in order for it to be bountiful, we are going to have to be conscious of that habitat and what we have done to it and what we need to do to restore it. Be mindful of the environment and the variables that are out there both oceanographic and land-based and how we look at this and incorporate this and view our understanding of this animal in light of its life history, all aspects of it. He wanted me to be sure to pass that on. This is a very large question that has a great body of information that needs to be considered and worked on to move forward for this animal to thrive.

Beyond any question, Chief Moore considers the Passamaquoddy People as having a responsibility in ensuring that the animal thrives and are committed to do their part in having that happen. He has also often expressed to me that quite often less is more. You do not take what you

do not need, as we have heard earlier. You respect what you have taken and respect the dignity. In that vein, Chief Moore is the primary author of the Passamaquoddy Fisheries Management Plan which is seen by many tribal people on the East Coast as a model for bringing together modern science and ancient science in some way that is meaningful and has cultural significance but also adopts some of the modern methods of science in putting together a strategy that makes sense in conserving the animals and how we conduct fisheries.

Very briefly regarding eels, of course the history goes back for thousands of years. So the Passamaquoddy People have been involved in different life stages of that animal, whether that be yellow eels or silver eels in modern times, now, elvers. And harvesting and utilizing that species at all stages. But, given today's markets and today's needs, sustainability versus thriving, the Management Plan that the Tribe has adopted has called for quite restrictive elver harvest based on quotas, based on methods, and based on areas. There is virtually a ban now in place on any commercial taking of adult eels by Passamaquoddy People. Very, very minor taking of adult eels; one per family member and in very limited ceremonial takings. But there is a virtual ban on the taking of adult eels by the Passamaquoddy Fisheries Management Plan of eels.

There is great concern, we hear, of course, there has been substantial controversy about harvesting glass eels and rightfully so. How much, what is, the variables that we are dealing with that I hear from Dr. McCleave and these others that are almost overwhelming when we look at what we have to deal with and what we have to understand how much is enough or where do we say what was so . . . here. So we need to act conservatively if we are going to continue to adapt these capture efforts. The other thing that I need to mention that Barry mentioned in his presentation, the Passamaquoddy are actively pursuing, have an interest in learning more about the potential for eel aquaculture, not only for market reasons but for potential enhancement or restoration purposes as well. There is a feasibility study that is nearly complete that should be complete in early November regarding efforts going forward regarding eel aquaculture. Of course eels are situated to conduct an activity such as that given their vast activity in saltwater and on fresh water as well. There is potential there but there is much to be learned before we go forward.

With that I think I have spoken to the best that I can on behalf of Chief Moore. Again, welcome. Keep up the good work. I am sure there will be a great deal of good that will come through this collaboration and Chief Moore welcomes that. Thank you.

David VanderZwaag:

Thank you, David. Our next presenter will be Mitch Feigenbaum. Mitch is Director of the American Eel Sustainability Association. I Googled Mitch's name [a few] times in preparation for this workshop and there were an [amazing number] of industry connections. So, Mitch, you might want to say a few words about your involvement with the commercial fisheries as well.

DESCRIPTION OF COMMERCIAL EEL FISHERIES IN NORTH AMERICA

Mitch Feigenbaum:

. . . I am known for my association with Commercial side of eel fishery. I am a principle shareholder of two companies – one in Canada called Southshore Trading, and one in Pennsylvania in the U.S. called Delaware Valley Fish. The two companies are engaged in the trade of American eel really in all the different life stages of the eel. The companies are completely integrated. Really,

we manage as one, our client base is one, we participate in regulatory affairs with one single voice. In the last few years we have been working with our fellow shareholders in Canada with a group called Canadian Committee for Sustainable Eel Fishery. You will hear from Genna Carey about that shortly. But in the U.S. we have also created a sustainability group called the American Eel Sustainability Association. That group has been advocating a responsible position for the eel fishery. We view most of our work with that group as being one directed towards the fisherman and educating fishermen about the importance of management and cooperation with the authorities and trying to view the relationship between industry, stakeholders, and regulators and government and science as being necessary and should be, preferably, a collaborative one as opposed to an oppositional one because we really are in this together. Because now, for the first time really in a long time, pretty much all the commercial eel fisheries in North America are somewhat quota based, we feel more strongly than ever that there is no one with a greater interest in sustainability than the commercial participants in the fishery. I want to be clear that our company in the U.S., Delaware Valley Fish, is a forty-five year old company and is now being worked on by the fourth generation by our families to be involved in this business. So, we are very serious about the long-term interests and the goals that everyone else shares here in terms of sustainability. Please . . . do not hold it against me the fact that I have commercial interests. This is what inspires me and really inspires my life is the eel business, and what inspires the eel business is the availability of eels, hopefully forever. So with that, my presentation is going to be kind of lighthearted today. I was asked to just talk about the worldwide market or industry for eels, and that is what I am going to do.

I want to point out that the eel does have a great history in North America and of course that history begins with the First Nation Peoples and part of that history and cultural knowledge of eels was shared with the settlers. It has been asserted by James Prozac, who wrote the book “Eels,” that at the first Thanksgiving, eel was part of the menu. One of the writers for the *New York Times* created this video⁸ It is very entertaining. It was accompanied by an editorial in the *New York Times* about the importance of eel and the writer’s desire to promote more visibility for eel.

. . . The book, “The American Anglers Guide,” is a classic book about fisheries in the U.S. published in the mid-1800s. It describes fishing for eels so we do know that there was a significant eel fishery in the settler population in the U.S. as well as in Canada for quite a long time.

I can describe how we fish for eel and associate it with some of the history.

⁸ A *Thanksgiving Eel*, NEW YORK TIMES (2012), <https://vimeo.com/56726619>.



Figure 3. Historical Weir Fishery.

[Figure 3] is a weir, where the river is diverted to a catch point and you see in this etching what appears to be some Native Americans fishing for, spearing eels at the end of the weir.



Figure 4. Modern Weir Fishery.

[Figure 4 is] a picture of a modern weir on the Delaware River that a lot of you may be familiar with, and you can see the essential stacking of stones to create a giant “V” funnel into the catch basin that really has not changed that vastly for so many years. Weir fisheries do not really exist anymore on the U.S. side of things. There is one exception, the State of New York is permitted to maintain a certain number of weir licenses on the upper stretches of the Delaware River. These weirs have a profound connection to the Native Population that we actually do not even know how old the weirs are, that is how old they are. But a gentleman in New York State who operates the biggest weir, claims to have learned about eel fishing and weir fishing as a young man from Native Americans from that area and claims that his weir is on the same spot and uses many of the same rocks that would have been used hundreds and hundreds of years ago.

Most eel fishing takes place with baited traps. This is an antique baited trap that you can see in this old etching men fishing somewhere using these types of pots.

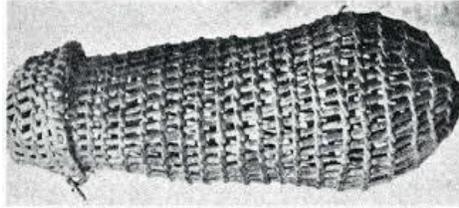


FIG. 67—Bait-pot used with eel-pots set in open water. Length, 10½ in

Figure 5. Historical Fishing Methods—Bait Pot.

[Figure 5] is what the eel pot looks like in the modern fishery but it is essentially unchanged. It is either one or a series of funnels going into a baited trap that the eel can come in, squeeze its way through the narrowing funnel but can never find its way back out. That is what you call a good haul.

Historically there was also a Fyke Net Fishery. Fyke Nets come in many different designs but the essential element of a Fyke Net is similar to a weir in that you are targeting eels on the move; you are not using bait to attract the eel, you are trying to track their migratory movements and set your traps in a way as to catch them. A lot of people associate the Fyke Nets with the silver eel fishery. But in fact, the Fyke Net is widely used during the spring and summer throughout Canada to target yellow eels. Fishermen just have a very good knowledge of where the eels are moving between different locations in the river.



Figure 6. Modern Fyke Net Fishery; Glass Eels.

The glass eel Fyke Net is in the modern fishery. [Figure 6 shows] the same general concept – you have a central hop and then you have either one or multiple leaders where the eels on their migratory route hit the leader and then get funneled. I am showing you the tool of the modern glass eel fishery: dip nets. We use Fyke Nets and dip nets in the glass eel fishery. Of course, historically, we know that the spearing of eels has been a major method of catching eels. It was practiced not only by Native Americans, Native Canadians, but also early settlers.

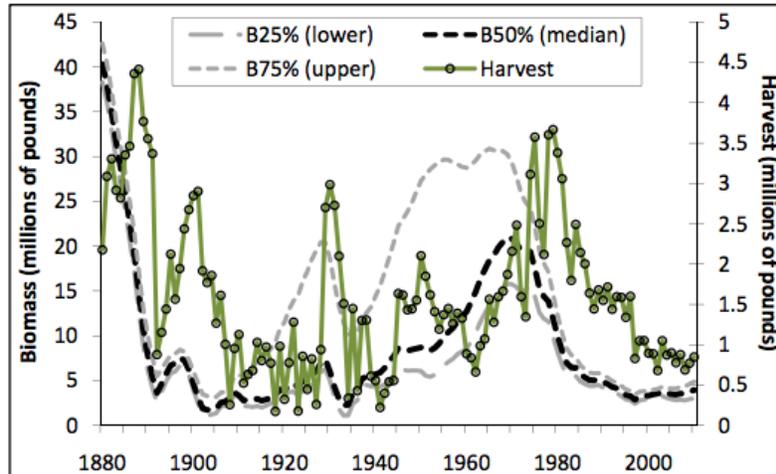


Figure 7. U.S. Commercial Eel Landings.⁹

[Figure 7] shows a little about the historical perspective. . . . Focus on the green line, which presumably represents the harvests. Here, I do not know where the ASMFC [Technical Committee] got the numbers, and I think these numbers have been challenged, but we do know that there was a serious eel fishery at the turn of the century. We know from records on the Sasquahanah River, for instance, that on that river alone at the turn of the century they were harvesting more eels than maybe the entire country harvested this year. Being that we are not going to have a very good year because of economic conditions. I think these numbers are considered questionable in the early stages but from the early 1950s on we have very good statistics and it is fairly well known that eel fisheries really grew in the 1970s, peaked in the 1980s, and has declined very much since then.

Touching on a point Barry [Costa-Pierce] made, there is no doubt in my mind that this line is the result of aquaculture. During this time, the aquaculture of eels grew in Europe which is the single biggest market for North American eels and has always been the biggest market for North American eels since the 1960s at least. During the 1970s and into the 1980s as European eel farming proliferated, the export and demand for wild eels from North America in Europe has just shrunk. . . .

⁹ ATLANTIC STATES MARINE FISHERIES COMMISSION, AMERICAN EEL BENCHMARK STOCK ASSESSMENT (MAY 2012).

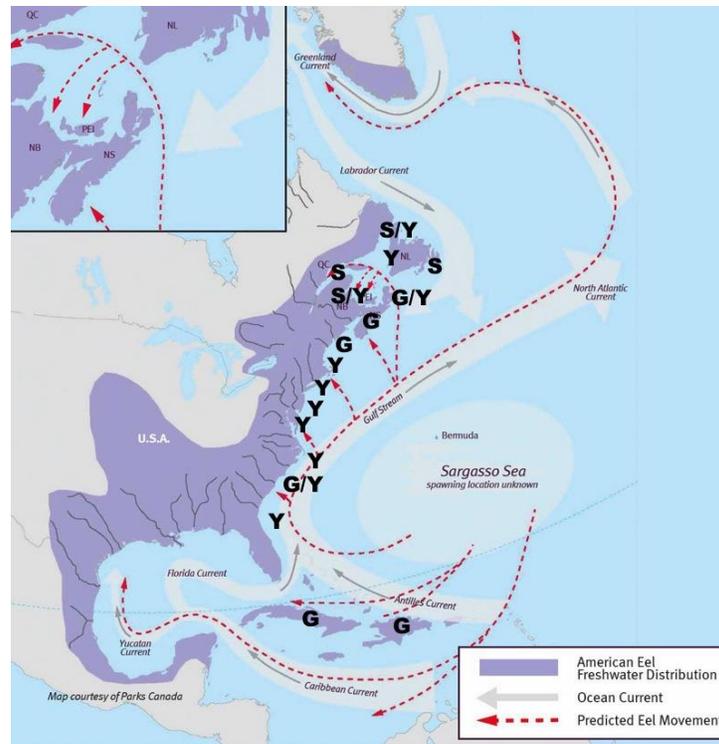


Figure 8. Location of Major Eel Fisheries in North America.

[Figure 8] is the location of major eel fisheries in North America. It is not very scientific and some of it has been covered. We know that in Northern Newfoundland there is both silver and yellow eel fisheries. On the West Coast of Newfoundland there is pretty much just a yellow eel fishery. But the rest of Newfoundland, especially the area called the Avalon Peninsula is actually very similar to the traditional fishery in Quebec; it is an all silver eel fishery. Eels that are harvested by commercial fishermen in the Eastern part of Newfoundland are going to be very similar to what you would see in Quebec; all females, all big, and the numbers there are pretty good. There is not so many people fishing for eels in such a remote location but the numbers have been stable over the last ten years that I have been involved in the business. We know that the eels coming out of the Great Lakes and on the St. Lawrence, of course are predominately silver eels. In the Maritimes and the Gulf of St. Lawrence of the Maritimes, fishing is for both silver and yellow. But when you get into the coast that is where we have the glass eel fisheries. We have the yellow eel fishery in Cape Breton, as well as the glass eel fishery. But I have to say that the yellow eel fishery that did exist here in Nova Scotia is pretty much gone. And that goes to Barry's point that the diversion of the resource from the river to aquaculture is sometimes, if there is effective management, and I believe in our region we have had effective management, there can be a zero-sum game. The proliferation of this glass eel fishery came in a series of steps that correspond with the reduction of the yellow eel fishery. This was not just random. Our managers in Nova Scotia-Fundy region have recognized that they could not allow the glass eel fishery to grow and increase and have flexibility unless it was accompanied by corresponding reductions from the yellow eel fishery.

Maine really went through a similar process. In both cases, a little bit more informally, but it has become more formal over the years in that Maine, which was really the heart of America's biggest silver eel fishery at one time, now does not exist anymore. This also corresponded with the rise of the glass eel fishery. So it was these fisheries that are the result of the economic and science

trade-offs – it has not just happened randomly. The rest of the mid-Atlantic is almost exclusively devoted to the harvest of yellow eel. ASMFC in its recent Addendum Four basically banned the targeting of silver eels. An American eel fisherman in the U.S. is still allowed to catch the silver eel but he is not allowed to use a Fyke net or a weir or any other device . . . that has no bait in it and is actually targeting silver eels. So as a by-catch it is okay but you cannot target them and in fact that reflects the practice anyway. There really is no silver eel fishery in the U.S. ever since the Maine fishery dropped out. Again, I did mention the one exception on the Delaware River. South Carolina has one glass eel fishery; it is almost de minimis but it is worth acknowledging. . . . I am keeping my comments limited to what is happening Haiti and Cuba, other than to say that everyone's concerns about the proliferation of the glass eel fisheries in those regions are well-founded. . . .

So, where are the worldwide markets for eels? There are markets for eels in much of the world. In Spain and the Netherlands you see smoked eels. In Korea, they eat barbecued eels. In England, of course they have a very famous tradition of jellied eels. . . . And, of course, the world's biggest consumer of eels, although this is rapidly changing, but traditionally, by far would have been the Japanese. The Japanese are eating the eel almost exclusively in the form of unagi kabayaki. . . . When you go to a sushi bar, if you eat eels, you are eating unagi kabayaki, whether it is served on skewers, or piece of nigiri sushi, it all started with this package which came from that processing line. Basically, the Japanese invented this method, they can filet the eel while it is still alive very efficiently and turn it into this product about an hour later. Fresh eels are very popular in Europe but not so much in the U.S. In the Chinese culture they eat the eels in stir-fry. If you look closely, you can learn a very fundamental difference between consumption of eels in the Asian world versus non-Asian world. In the Asian world the skin is always part of what the consumer is eating; in the Western world it is almost never a part of it. In northern Europe, most eels are smoked. This is where all those silver eels being caught in Lake Ontario and St. Lawrence for decades ended up; in German smoke shops, smoke houses. That business has been eviscerated by the emergence of eel farms. Every eel is the same shape and size. Modern smokeries in Europe are factories. They want to work with uniform material; wild eels are never uniform. So this is what has pretty much eliminated the silver eel fishing in North America. We see eels canned in Japan, China, Thailand and Portugal. In North America, a lot of eels are used for stripe bass bait. Almost always live eels however there are actually some fishermen of striped bass that like to use the dead eel, they can put it on a jig. This is probably 15% of American eel fisheries now. And then glass eels, they are actually eaten in Spain and Portugal. This is a Basque delicacy. . . . All those eels that perish in the glass eel trade end up here because they are really not very valuable for aquaculture if you are dead. This is really an ancient tradition, eating of glass eels is associated with certain Catholic rites. There are certain saints are honored with their own holidays and during the holidays it is the tradition to eat the glass eel. One thing that is interesting here, the Spanish glass eel consumption market has been pretty much devastated by the high price of glass eels over the last decade, creative businessmen in the Basque region have actually started making artificial glass eels out of surimi. But, of course we know that most of the glass eels are going from farming in Asia. . . .

Finally, eel farming is part of the future. . . . I just want to offer my agreement that any fish farming in North America in the future almost certainly would be based on RAS. That is assuming it takes place in the place where eels are caught: Maine, the Maritimes. There are a lot of us in the Maritimes who are interested in pursuing farming in the future but we are not just interested, we are doing it. We actually are doing research at Dalhousie University at the present time. We are

researching a whole lot of basics and some more advanced issues that I am not at liberty to get into. But for the basics we are learning about stocking densities, water temperature, feed analysis, and we are making really great progress. Frankly our research is substantial but it has been in second gear for quite some time because with the Endangered Species Review in the U.S. and the SARA review in Canada; obviously it is literally impossible to attract capital to this initiative without some regulatory certainty. . . . Hopefully this will be a good future and thanks to everyone for listening.

David VanderZwaag:

. . . Our final presenter on this panel is Genna Carey. She is a commercial harvester of American eel and elvers in Nova Scotia and is President [of the Canadian Committee] for a Sustainable Eel Fishery. She also helps operate a family business, Atlantic Elver Fishery, and harvests eels from around the Halifax region down to the South Shore of Nova Scotia.

SOCIO-ECONOMIC AND SCIENTIFIC CONTRIBUTIONS OF CANADIAN GLASS EEL HARVESTERS

Genna Carey:

Thanks, David. I am going to give you a little bit of a background on the Canadian Committee for a Sustainable Eel Fishery (CCSEF) and the things that we contribute to. We are relatively new as an organization. We were established in 2012. We are made up of all privately-operated glass eel harvesters in maritimes. There are nine of us altogether but on the Committee there are only eight. We all fish in Nova Scotia and New Brunswick, and in Canada that is where the fishery is operated. License holders have had a history of working together. We have been on the Scotia-Fundy Elver Advisory Committee since the beginning of the fishery. The difference between the two is that the Advisory Committee focuses on admin, policy, enforcement, science, and other licensing related activities. We meet once or twice a year. CCSEF was formed to address collaborative efforts to deal with all the listings, basically, that have come up in the last number of years. We meet, instead of twice a year, twice a month.

It is important to note that we have participated in research funding since the beginning so the first experimental license was in 1989. So it has been a while. A lot of you know a little about the elver fishery, but maybe not a lot, so I am going to tell you just a tiny bit. There are nine licenses, as I said. We all operate on a set quota, which is 900 kilos for a license holder. Each license holder is allowed to fish only licensed rivers and each river has a set quota as well. We have an overall quota and then a quota per river so that we do not take too much from any one place. The season depends on Mother Nature and sometimes she is kind and sometimes she is not. We start sometimes the end of March, if all of the snow and ice has melted and the water has warmed up to approximately 10 degrees. Sometimes, like last year, we do not get to start until the end of April because we have a lot of snow. The volumes fluctuate year to year. It is a fishery – it ebbs and flows, there are cycles.

This is just an overview of our Committee members, we all fish in Nova Scotia and New Brunswick but a lot of the operations are based in other places. Most of us are Nova Scotia/New Brunswick but we also have a company that operates out of Newfoundland and Quebec.

The purpose of CCSEF was to promote, encourage, and support a sustainable eel fishery in Canada. We all need, like Mitch [Feigenbaum] said, we need a sustainable fishery. It is nobody's

goal to deplete the stock so much that I do not have a job. That would not make any sense. We are promoting and supporting the viability and the conservation of eel stocks and eel habitat. We are promoting and supporting education, research, and knowledge relating to the above and obviously to advocate for all of the above.

We have three main projects supported by CCSEF: the East River Elver Abundance Study that started in 1996, the Silver Eel Study in Oakland Lake that started in 2009, and the Silver Eel Study on the East River that we started [in 2014]. Eel science in Canada has seen considerable funding loss over the last number of years. It is our goal as an organization to promote and maintain long-term data. We have made that commitment to fund it to make sure that it is there. This is a list of other research partnerships that we have had in the past.¹⁰ I am not going to go through them all I am going to talk about the three main studies just a little bit more.

The East River Elver Abundance Study was started in 1996 by Brian Jessop. He worked for the Department of Fisheries and Oceans Canada (DFO). When he retired, Dr. Rob Bradford took it over and maintained the study until 2005. At which time, sadly, funding ran out, DFO no longer had the resources to support it so there was a lapse in the study. Until 2008, at which time the license holders made a commitment of a three-year project that we would continue. Since that time, the three years have been up but we have committed to funding it indefinitely. As I mentioned, DFO was no longer running the study, so we had to look elsewhere. We contacted Bluenose Coastal Action Foundation to do the scientific and field work. They work in partnership with Dr. Rod Bradford to keep everything on track and logistical support from my company, Atlantic Elver Fishery, which basically means we get the boxes running and make sure the water does not stop. It is the longest running elver recruitment index and abundance study in North America. I have a graph coming up in a minute that shows that there is not really any trend; it goes up, it goes down . . . there is no upward or downward trend. It is important to note that, as David showed earlier, there was a lovely upward trend happening from 2011-2014 in which year we broke the previous year's record. I cannot say that that trend has continued this year, I guess we are back on the downswing and Mother Nature had other ideas. We had terrible weather, which is quite likely the reason for that. Also, the study counts, so basically it is on the river that we fish on. I fish downstream of the elver boxes so in the end they can take the data from everything that I have caught from downriver plus what has escaped me and gone into the boxes; they can add everything together to get more of a total number and also can make some inferences on how effective the fishery is. The current budget of this is in the range of \$34,000-\$40,000 annually. This is just a picture of the boxes. This one is the holding box, the one below is the ramp, the water is gravity fed through the top of the ramp and attracts the eels to come up so you can see it all working together. They swim up the ramp, get flushed into the holding box, and they are locked

¹⁰ JESSOP, ELVER FISHERY AND MANAGEMENT (1998); JESSOP, ELVER BIOLOGY IN THE BAY OF FUNDY AND ATLANTIC COAST OF NOVA SCOTIA (1998); JESSOP, ELVER BIOLOGY AND RUN CHARACTERISTICS, EAST RIVER, CHESTER, NOVA SCOTIA (2003); SOUTH SHORE TRADING - LIFECYCLE STUDY, EEL POND – MUSQUODOBOIT HARBOUR, NS (indexing of incoming glass eels and outgoing silver eels, and mark recapture of yellow eels); SOUTH SHORE TRADING - GLASS EEL SURVEY, MUSQUODOBOIT RIVER (to be expanded to include silver and yellow eels); JESSOP & KNIGHTS, EEL STATUS REPORT FOR CCSEF (2013); PUBLICATION OF PAPERS PRESENTED AT THE INTERNATIONAL EEL SYMPOSIUM OF THE AMERICAN FISHERIES SOCIETY - QUEBEC, 2004; DR. ROD BRADFORD ET AL., MIGRATION OF EELS THROUGH A MACROTIDAL ESTUARY AND BAY (2009).

in there until the lovely lady at the back of the room comes to collect them and do all of her analysis.

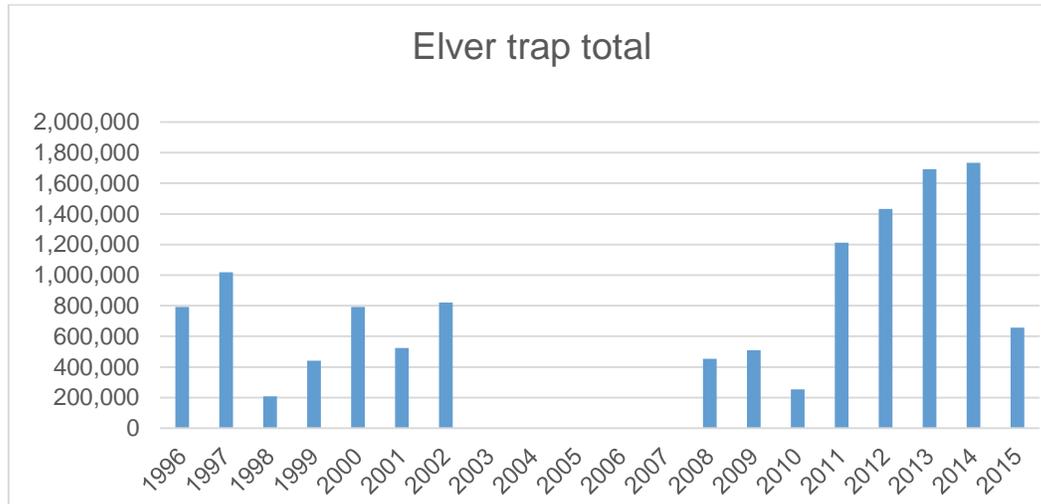


Figure 9. East River Abundance Study—Recruitment.

From 1996 until 2015, [Figure 9] just shows the trends. And this is the trap totals only; it does not have the commercial catch added to it.

The Silver Eel Study in Oakland Lake was established in 2009. Again, Bluenose Coastal Action Foundation does all of the field work and works in collaboration with Dr. Bradford from Department of Fisheries and Oceans. It is a mark-recapture study so they pot in the lake in the summertime to try and figure out the habitat, where the eels live, where they feed, what they do. They bait the pots, catch them, PIT tag them (Passive Integrated Transponder tags), and release them back into the lake. That portion of the project costs approximately \$12,000 annually. In the fall, the Oakland Lake is a pristine watershed. It has just kind of one entrance and outflow is perfect for this kind of thing. In the fall, they put the outflow recapture trap in. Basically, they just catch and scan the eels to see if we have caught them in the Lake, characterize their life stage, weight, length, all of that fun stuff. We share all of our data with anybody that is interested. The budget for that portion is \$16,000-\$18,000, annually. . . .

Finally, the last research project that we are involved in, or our three main ones anyway, is the Silver Eel Study at the East River. This is the same site that the elver index takes place on. We started last year and as any new study we had a few growing pains. It is again funded by CCSEF with support from Fisheries and Oceans Canada. It is a mark-recapture study. The East River tester has a few tributaries off of it so up at the higher points, at the head waters, they have set marking sites, there are three of them down the river where they all kind of converge we have a recapture site. They are tagging the eels up high, releasing them back in and seeing who we come up with at the recapture site. It is conducted during the fall months, weather dependent, because, as I mentioned we had growing pains last year, all the eels tend to migrate on the heaviest rainfall, in the middle of the night, at one time. That equals a lot of eels and a lot of rain. We lost a few traps, but I am happy to report we were far more prepared for that and Danielle spent a few good nights camping by the traps. They are measuring the biological characteristics and population estimates. Again, we share all of this data with interested parties. Our current budget for this is between \$22,000-\$24,000, annually.

Just before we move onto the next part, it is important to note that between those three studies alone, the glass eel harvesters are spending between \$84,000-\$94,000. And that is not to mention the other research studies that we partner with for donations of eels. Like I said, the other list was fairly long as well, so we are happy to help in the research department.

I am going to touch briefly on some of the socio-economic analysis of the industry. It is unfortunate that this [conference] did not happen a few months later or we did not start this a few months earlier because I would have a bit more to report to you. We are engaging a consulting company, Gardiner Pinfold Consultants Inc., to help us do an analysis of the elver fishery. They are going to review fishing efforts and revenues, operating and maintenance expenses, and financial performance. So we are just in the process now. Hopefully, we will have all of our information back to them by mid-November and they will have the completed to us by the end of the year. If anyone is interested, you can contact me in January and I can have some more information to share. The results are going to be used to provide response during the Species at Risk Act that is currently happening as we speak and ongoing. Corporate revenues are generated almost entirely through exporting. As Mitch [Feigenbaum] said, we do not have a local eel market. Maybe someday we will, but for now we do not. There are over 130 employees that work in the glass eel fishery. Yes, there may only be nine license holders but we each employ a number of people. These companies operate in primarily rural areas that are affected by economic downturns and low employment levels compared to, say, our cities. Many of our employees, I am happy to say, stick around for a long time. We have had one employee that has worked for us for almost twenty years. It is a seasonal business but they do receive a sufficient wage to support them through the rest of the year or to allow them to have their own business to run the rest of the year or work in other seasonal jobs. Local employment, as always, equals local spending. We have spinoffs: in order to run a business you need a vehicle, you need to buy fuel, you need to buy equipment, we all need to buy food because we are hungry, hungry fishermen. Along with that, we support the services in our community. We support the schools, the medical centers, the fire halls, and also many of the charities such as universities and other not-for-profits including marine science and related areas.

That pretty much brings me to the end of my presentation and this session. I think we can open it up to questions for all of the panel.

MODERATED DISCUSSION AND QUESTION & ANSWER PERIOD

Matthew Gollock:¹¹

I was wondering about the quotas in the U.S. and Canadian fisheries. Is it set on an annual basis and what kind of information goes into actually setting those quotas?

Mitch Feigenbaum:

The quota in the U.S. for glass eels was imposed for the first time only two years ago by the State of Maine. Maybe Mike [Waine] might want to weigh in or Gail [Wippelhauser]. But for the most part, it seems to be that the State of Maine looked at historical glass eel landings were in the 1970s, 1980s, and 1990s and before the “gold rush” or before the spike in 2011-2013. Basically,

¹¹ Chair of the IUCN Anguillid Eel Specialist Group, Zoological Society of London.

ASMFC, working with Maine, took the position that in order to be precautionary, they did not really want to see growth or a spike of that fishery so they imposed quotas that basically restored the fishery to somewhere in what was its historical average range. It is really no more scientific than that. I do not believe there was any biological data that was presented saying this much glass eel fishery is sustainable and this is not.

In Canada, the quotas in those nine license holders, they go back way beyond my time. Genna or Yvonne [Carey] might know more about what kind of analysis was done to go into those. They have only reduced in the last five-six years. Primarily, when the first Species at Risk Act analysis was done, all the regions in DFO were asked to impose new measures that were more conservative than prior measures. I think it was that all licences used to be 1,000 kilos with the opportunity if you reach 1 ton to petition for an additional 300 kilos. So the potential quota was actually 1,300 kilos but now it has actually been fixed at this 900 kilo number, although some are smaller, but most of the quota has the firm quota. In recent years, the movement now is, as Genna [Carey] mentioned, not only do we have an overall quota per license holder but within that license there are rules that say you can only take so much from each individual river. DFO has told us that that will be the continued focus of future regulations. They want to look at those individual river quotas more carefully and a lot of the work we are doing on the East River is telling us what is a more reasonable amount, depending on the size of the watershed and what the recruitment of eels is on an average basis over the years, what is the appropriate number to put in there.

Matthew Gollock:

So they are not reviewed annually? You have got a set quota and that is it?

Mitch Feigenbaum:

They are not reviewed annually. Well, in a way they are reviewed. As Genna [Carey] mentioned, we have annual meetings with DFO as part of the consultative process but there has only been the one set of major changes in 2000.

Genna Carey:

It is reviewed but it is not changed.

Laura Hussey-Bondt:¹²

I guess the point would be Mitch [Feigenbaum] is right; there was sort of a standard quota level set back in the beginning of the elver fishery. The way we are going recently is to more – there is the overall individual quota for the license holder, it is almost a double system. And then you have the caps by river. So actually catches by elver fisheries have been well below the total quota cap just because of the fact that you may have a couple of rivers that do really well but then other rivers that do not perform as well. So chances of meeting that overall cap are pretty low. The way that we have been going is, like I said before, that we were sort of a standard river cap on all rivers regardless of the size of the system or anything like that. We are moving towards, based on

¹² Senior Advisor, Fisheries and Oceans Canada.

the information from that East River Index, looking at scaling to watershed size and making different quotas based on the actual system. In terms of annual review, in a lot of the other fisheries that I manage, we are looking at annual, or at least biannual, stock assessments and changes in stocks and maybe modifying measures accordingly. With eels, we do not have that same kind of science process; we do not have that kind of information; we do not have population estimates, and the ability to look at mortality rates and how our management measures might be affecting those populations. Based on the information we have and trying to take a bit of a precautionary approach in this particular fishery with conservation concerns, we would review the quotas, I guess, if we had new information that would influence that but it is not like we have an annual scientific assessment process like we do in a lot of other fisheries where that would impact how we are setting those levels. So it is static but reviewed in the sense that we have yearly advisory meetings that we would look at any new information.

Martin Castonguay:¹³

I wonder if we know what the latest information is on Japanese efforts to close the life cycle – have they been able to bring costs down such as to make it economically feasible? I do not know if anyone can answer this.

Mitch Feigenbaum:

I know what I have read in the published literature that they are now on the second or even third generation of artificially reproduced eels. So it is clear that they have the knowledge of how to do it. It is a matter of figuring out the fee and coming to a fee formulation that . . . can be economical but I don't know anything more than that. I was in Japan two years ago and I had a visit to a facility where they are doing the work and the day before I was told I was not welcome. That suggests that they are making some progress. *[Laughter.]*

Matthew Gollock:

I was there last year and it is pretty much as Mitch was saying that they are on the second or third generation but they still get a lot of congenital deformities. So even when they are getting to the point of growing eels they are also very expensive to produce and because of the uniformity that is required for the factory production, they are not necessarily in good enough shape to be processed.

First Unidentified Male Voice:

They are still working on this.

Second Unidentified Male Voice:

¹³ Research Scientist, Department of Fisheries and Oceans.

In Europe there are at least two, maybe three labs that they have managed to get through at least one generation but it is very much behind where the Japanese are but they are getting somewhere with the European one as well.

Mitch Feigenbaum:

Just to complete the picture, in North America, Ken Olivera spawned the eels accidentally in his lab on a \$500 budget he said and now he does an annual contest for his freshman biology students where he spawns the eels and then challenges them, each one gets responsibility for a bucket and says “see how long you can keep them alive.” It is not very high-tech; I believe the record is 24 days.

Mike Waine:¹⁴

My question is about the survey funding, so are all the surveys that you talked about basically industry funded? Do you get grants from granting agencies or from government agencies?

Genna Carey:

It is mostly industry funded, yes. The East River Elver Index we get support from the Province of Nova Scotia Department of Agriculture, in some years. The Oakland Lake Survey, the very first year was funded through the Department of Environment.

Mitch Feigenbaum:

. . . My company is doing a complete life cycle survey of American eels and is actually on a watershed called Eel Pond. Perfectly named. In our case, unlike the other licenses in Canada, our license for Southshore Trading has a requirement that as a condition of having that license, we have to conduct this complete life cycle survey. We are now in our second year of measuring glass eels, the yellow eels, and the silver eels which are marked so we can identify how much we are recapturing. We have been doing that for two years. And then on the main stem of the Musquodoboit River we have also embarked on the same program so we have now created a second glass eel index for the Maritime Region through the Eel Pond Survey and that the Musquodoboit Survey will actually become a third glass eel index. We are very happy to hear that Maine is working with the technical committee, ASMFC, on their complete life cycle survey. So the more the better.

Mike Waine:

Mitch, can you go into a little more detail about – is there technical review of the life cycle survey you are talking about? Sort of the technical equivalent of the process we have.

Mitch Feigenbaum:

¹⁴ Senior Fishery Management Plan Coordinator, Atlantic States Marine Fisheries Commission.

Well the technical equivalent is where, as you have a [Technical Committee] that is reviewing Maine's proposal, we have Dr. Rob Bradford. I am not aware of who he collaborates with within the scientific bureaucracy of DFO but he is our point person and he approves the methodology and he has been very active. It is not like a rubber stamp.

Genna Carey:

. . . We do have a process within DFO. We have got sort of a framework review coming up next year scheduled, which would be the peer review of our framework for sort of eel science and eel assessment purposes. So, through that process we would be considering all the different science work, how it feeds in, what our process is for determining status, managing the price, that sort of thing. That does get reviewed on a regular basis usually every few years. So the work that is feeding into that would be part of that review.

Brooke Nodding:¹⁵

To mention in terms of U.S., the projects are mostly solo funded by the license holders as Genna mentioned. Depending on the year, I am able to leverage the funding through other options. So, there has been funding by provincial and federal government, as well as other registered charities or foundations . . . but it mostly has been solely licensed holders funding these programs. But there has been some other support from Environment Canada, DFO, Canadian Wildlife Federation, for example, who has funded portions of it.

Mike Waine:

Does that come from elver license fees?

Brooke Nodding:

No, that comes from their own business directly. They directly fund it.

Genna Carey:

It was a decision that we made to commit to research because it is so very important to our industry and it was not coming from anywhere else.

¹⁵ Executive Director, Bluenose Coastal Action Foundation.