INDEPENDENT ECONOMIC ANALYSIS BOARD MEETING NOTES

DECEMBER 12, 2012

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| **Members Present** | **Members Absent** | **Guests** |
| Roger Mann |  | Tony Grover |
| Dan Huppert |  | Jim Ruff |
| Bill Jaeger |  | Richard Golden |
| Junjie Wu |  | Tom Karier |
| Noelwah Netusil |  | Peter Cogswell |
|  |  | Phil Rockefeller |
|  |  | Mark Jones |

1. ***Greetings and Introductions***.

IEAB Chair Roger Mann welcomed everyone to the quarterly meeting of the Independent Economic Analysis Board, held in Portland, Oregon on 12/12/2012. The following is a summary (not a verbatim transcript) of the topics discussed and decisions made at this meeting. Anyone with questions or comments about these notes should contact Tony Grover at 503-222-5161.

Mann led a review of today’s agenda and of the notes from the IEAB’s September 25 meeting. The amended notes were unanimously approved. Mann clarified the IEAB governance discussion at the September meeting by noting that the group had not discussed the IEAB vice-chairmanship; he moved that Jaeger be asked to continue as vice-chair. This motion was seconded and unanimously approved.

1. ***Discussion of Fish Tagging Economics***.

Mann began by saying that, as the group begins to consider the modeling effort required for this analysis, that they endeavor to ensure that modeled fish tagging costs reflect, as closely as possible, actual historical costs. Golden, from BPA, led a presentation titled “BPA Fish Tagging Costs 2012.” He noted that, about a year ago, when the Fish Tagging Forum began, he began to dig into PISCES to gather information about what BPA pays each year for fish tagging. He noted that there are five major types of tags used in the Columbia River Basin:

* Coded-wire tags (CWT)
* Passive integrated transponder (PIT)
* Genetic projects
* Radio tags
* Acoustic tags

Golden’s presentation touched on the following major topics:

* BPA-funded coded-wire tag projects
* CWT overview – insertion, scanning/recovery, decoding, data recovered (release group, where released, when released, where recovered)
* FY’12 BPA CWT tasks and costs—21 total projects in the following areas: tag insertion ($2.4 million), tag retrieval ($2.7 million), decoding (~$500,000), analysis ($1.032 million), total ($6.653 million).
* CWT recovery rate (overall): 0.35 percent. Insertion cost: about 19 cents per fish. Cost per tag recovered: about $10.
* CWT are used primarily in coho, Chinook, sockeye and redband trout (very few steelhead)
* PIT tags: used to gather data on run forecasts, smolt performance/physiology, BiOp compliance, habitat restoration effectiveness, smolt transport survival and other parameters.
* PIT tags are unique to each fish (rather than batches of fish, as is the case with CWT) and can be detected multiple times (rather than once only, as is the case with CWT). PIT tags can therefore provide researchers a much greater depth and variety of data on topics including age and physiology at, and location of, release, diet, passage timing etc.
* Unexpected discoveries from PIT tag data include the fact that in some cases, steelhead pass one or two dams upstream before returning downstream to their natal stream.
* The immense body of PIT tag data can be extensively mined to answer specific questions, now and in the future. PIT tag data has an incredible range of management uses, Grover noted.
* Multiple (redundant) detection systems at the dams significantly increase PIT tag detection rates.
* Juvenile PIT tag losses average about 2 percent vs. 3.7 percent for CWT. However, PIT tag loss in adult fish is about 18 percent vs. 7.8 percent for CWT.
* One PIT tag from the Columbia Basin was recovered in New Zealand (from a sea bird)
* FY 2012 BPA PIT tag costs: 76 total projects: tag insertion ($9.628 million), detection and data management ($7.351 million), analysis ($3.104 million), total ($20.083 million).
* PIT tags are used in many species, including Chinook, sockeye, steelhead, coho, white sturgeon, westslope cutthroat trout, smallmouth bass, northern pike, pikeminnow, lake trout, rainbow and redband trout, bull trout, burbot, northern whitefish and lamprey.
* BPA-funded genetic projects: used to develop Parental-Based Tagging (PBT) and Genetic Stock Index (GSI) databases; useful to relative reproductive success projects. It’s a hugely interesting emerging technology, but we’re still working out how best to use it, Grover observed. There is no “tag” per se; the fish itself is the tag. DNA is taken from a scale or fin clip. In 2012, BPA funded sampling and analysis tasks. Some believe that, some day, genetic information will replace CWT.
* Smolt-to-adult returns are a critical measure of success, but there are currently five different commonly-used definitions of the term, and experts cannot agree on how it should be measured.
* FY 2012 BPA genetic tagging tasks and costs: 14 total projects: sampling ($818,000), analysis ($4.783 million), total ($5.6 million). Species from which genetic samples are taken and analyzed include Chinook, sockeye, coho, steelhead,and redband. The number of fish sampled is unknown at this time, so cost-per-fish information is lacking, but the number of fish sampled is increasing every year.
* Genetic technology is evolving extremely rapidly. Some available Columbia Basin samples date from the late 1980s.
* FY 2012 BPA Radio tagging tasks and costs: 11 total projects: tag insertion ($480,000), detection ($1.097 million), analysis ($266,000), total ($1.84 million).
* BPA-funded acoustic tag projects: ocean/estuary migration etc.
* FY 2012 BPA acoustic tagging costs: five projects: tag insertion ($125,000), detection ($436,000), analysis ($390,000), total ($952,000).
* Acoustic tags have a battery life of only 30-40 days, but provide valuable information about fish movement. A high degree of sophistication is required to interpret the data.
* Acoustic tag data cannot be aggregated – individual tag data only.
* Primarily used by the Corps of Engineer to measure juvenile fish passage survival through various routes of dam passage. Costs roughly $5 million per dam.
* Radio and acoustic tagging are not routinely done, but are used for specific studies only. From the perspective of the Fish Tagging Forum, radio and acoustic tagging are a separate question from coded-wire, PIT and genetic tagging.
* Other FY 2012 tagging projects: hatchery operations, for example.
* Costs: 10 total projects: tag insertion ($385,000), detection ($84,000), analysis ($749,000), total ($1.2 million). Tag types include otoliths, fin rays, scales, calcien marks, floy, spaghetti, jaw tags used on steelhead, rainbow trout, sturgeon, pikeminnow, others.
* **Total FY 2012 BPA tagging costs: $36,349,519**.

Our main task for the next month or so is to come to agreement about the cost information and how to use it, Mann observed. What percentage of fish returning to the Columbia Basin have coded-wire tags? Netusil asked. About 10 percent of the total hatchery production receives coded-wire tags; about 140 million hatchery fish were released in 2011; about 2 percent of those fish return, Grover replied. Wu asked whether researchers have considered placing more emphasis on recovery, rather than increased tag numbers. Yes, they have, Golden replied.

Wu asked whether there is information that is obtained via CWT research that is not possible to obtain via PIT tag research. Grover replied that CWT data is especially useful for harvest-related questions; the type of information you need depends on your management focus. Grover noted that the Fish Tagging Forum is tasked to answer two key questions: program effectiveness and cost effectiveness. The point is that it doesn’t matter if you can do something cheaply, if it doesn’t answer the critical questions you’re tasked to answer, Grover said.

After a brief discussion, the group agreed to exclude radio and acoustic tagging from its cost benefit analysis, and to focus its analysis on CWT, PIT and genetic tagging.

Grover said that, at its January 7 meeting, the FTF will confirm that the majority of its analysis and discussion will focus on coded wire, PIT and genetic tagging. The key thing is to start with the critical management questions that must be answered, Wu observed – that’s what will answer the question of how available funding should be allocated. What makes that a challenge, analytically, is developing measures of effectiveness, fixed costs vs. variable costs, and interdependencies such as selective harvest. The overlap between the various technologies, their activities and infrastructure – trailers, screw traps, weirs etc. – is another complicating factor, Mann observed -- Some of that infrastructure is even used for non-tagging purposes. That makes it difficult to develop a true picture of the costs, or to parse out those costs from the global cost structure, Grover agreed. Another question that the FTF will be addressing is the lack of a global strategy for the PIT tagging program overall, Grover noted – at the moment, to some extent, it’s a little chaotic, and resembles a home-brewing industry, because there are so many small independent operators out there.

The group devoted a few minutes of discussion to the intricacies of parsing out the true costs of each tagging technology. Some of the key points of this discussion included:

* Potential ways to identify and quantify the various elements of detection, handling and analysis used with the various tagging technologies
* Ultimately, the IEAB would like to develop cost estimates for each technology that are consistent with what the databases show, Mann observed. Golden said he will help as much as he can.

Next, Jaeger moved on to the modeling work he has developed in support of the IEAB’s fish tagging economic analysis. Highlights of his presentation included:

* An overview of the algebraic structure of the linear programming model he has developed
* Similar to a transportation model that shows the distribution of goods from one point to another, using various modes of transportation
* Essentially, the model is designed to show how to minimize the cost to satisfy demand (minimum number of fish marked or detected that are required at a given location)
* Jaeger demonstrated the model, using a simple hypothetical example, measuring marking fish, carryover, flow conservation, cost factors and other parameters. Ultimately, the model demonstrated the optimal number of fish to be tagged at a given “point of delivery” in order to obtain the desired number of detections at the point of return (SAR).
* Jaeger demonstrated a second model, this one in the GAMS integrated development environment. It developed comparative results for Chinook and steelhead, using Pit vs. coded wire tags, for eight “points of delivery.” This model demonstrated the possibility of comparing the desirability of coded wire vs. PIT technology in order to achieve the desired outcome (in terms of meeting detection goals at a given point of detection) at the lowest cost. In response to a question, Jaeger said the objective function of this model is cost.
* The models may ultimately be useful in answering the question, “What is the incremental cost to BPA of attempting to answer a given question, or satisfy a management objective, proposed by another group?”

The group discussed Jaeger’s model, offering a variety of clarifying questions and comments. In response to a question, Jaeger said the model will not explicitly factor in non-linear costs. The key is to carefully develop the cost functions first, Mann observed. The group discussed how time will be factored into the model, given the fact that it could be several years before a fish returns to its stream of origin. Jaeger replied that levelized costs would be the simplest way to incorporate that factor. Huppert observed that, while a given fish may take several years to return to its natal stream or hatchery, every year, fish from other cohorts return , so levelized or annualized costs probably make sense.

Can the model look at how much effort is devoted to tagging vs. detection? Wu asked, observing that if detection efficiency can be increased, it may be possible to tag fewer fish. One way to address that might be through high, medium and low levels of effort for a given activity, Jaeger replied. For a given management question, and a given tag technology, what is the optimum level of effort in detection, is essentially the question we would need to answer, Jaeger said; however, there are nuances as to how that increased detection rate is achieved, which complicates that analysis. Improved spillway detection would allow us to tag a lot fewer fish, which would increase the power of the test while decreasing handling and mortality, Ruff observed. There are really two questions – given the status quo, what is the optimal configuration of level of effort and technology to answer the management question at hand, and second, what potential innovations, such as improved spillway PIT tag detection, offer the greatest potential improvements in cost effectiveness, Jaeger noted.

Again, I think we should focus initially on developing detailed cost functions, and that will guide the next steps in this effort, Mann observed. He thanked Golden and Jaeger for their presentations, noting that he can now see a potential path through the complexities of this analysis.

The discussion turned to the data that will be required to produce valid modeling results, including detailed and accurate cost information, a list of the specific management requirements/objectives each tagging technology needs to answer, the number of fish that need to be tagged in order to achieve required confidence intervals at various points of detection, survival and detection estimates by reach and route of passage, and other factors.

Mann suggested that it may make sense to structure the model results by ecologically significant unit (ESU), such as Snake River Fall Chinook, Snake River sockeye and Upper Columbia steelhead. We can ask the subject matter experts if that’s an adequately-detailed approach, or whether we need to break it down further, to the population level within each ESU, Grover observed. It was agreed to model each of the dams, and to develop aggregate results for the tributaries. Most management objectives are built around ESUs and populations, Mann added, so that type of modeling approach makes sense. It may be feasible to start by modeling by ESU, and then ask the FTF whether it would be beneficial to extend the modeling to a few tributaries, to see whether the results by ESU can comfortably be extrapolated to that more localized area or population, Grover suggested.

Mann suggested that the BiOp Reasonable and Prudent Alternatives may provide some of the data Jaeger will need in his modeling, such as performance standards by dam and reach. He said he, Jaeger, Grover and Ruff will continue to discuss these issues, in order to clarify how to proceed.

1. ***Discussion of Invasive Mussel Update Task***.

This is a proposal on potential new work related to invasive mussels, expanding on the IEAB’s analysis of a couple of years ago, Mann said. The purpose of this agenda item is to discuss what additional work is desired, and what may be possible, in terms of an expansion of the IEAB’s original analysis.

Karier said the IEAB’s initial report was extremely valuable, and has been cited frequently with respect to mussel-related risk. There is a lot of activity in the region centered around invasive mussels. One key question is, is the region spending enough on prevention, given what’s at stake? A second issue is allocation – are the parties that are at risk from mussels sharing equally in the cost of prevention? We were thinking it might be possible, if we had a clear idea of the expense of a good prevention program vs. the risk, to develop a formula for allocating funding, Karier said. What is the dollar risk to the FCRPS, for example, from mussels? Municipal water supplies that draw water from the Columbia, irrigators, non-Bonneville utilities such as Idaho Power and the Mid-Columbia PUDs, and state boating and recreation interests are all possible contributors, Karier said. Industrial water users, such as pulp and paper mills, are another potential stakeholder, Ruff observed.

If the IEAB was willing to review and update the information in its original report, it may be possible to significantly refine the wide range of potential costs identified in the original mussel report, Karier said. He noted that the Corps and Bureau of Reclamation are developing risk assessments at each dam, and although those assessments may not include cost information, they may still provide detailed impact/level of effort estimates.

In response to a question, Rockefeller noted that British Columbia is very interested in participating in any regional mussel prevention strategy. He added that many entities in the Northwest are simply not aware of the risk they may face from mussels in the future. Building an economic approach will be the way we make our case to the stakeholders, he said, and will provide a basis for building a more robust prevention strategy.

Jones said that, from BPA’s perspective, the longer we can keep mussels away, the better – that gives researchers more time to develop potential technological solutions. Prevention, outreach and education have been very effective so far, and we would like to expand funding for those efforts, as well as R&D efforts. We need a greater understanding about where we’re vulnerable to mussel concentration, given water chemistry, temperature and velocity at various places in the system, Jones said; that research is ongoing. USBR has done some recent works on levels of risk for various facilities which may be useful, he said. Jones said he will follow up in the Northwest Hydro Operators’ Forum to discuss the potential for higher levels of utility funding and involvement in the mussel prevention/R&D work.

For the IEAB, the scope of work depends on how much new information is available, Karier said – if there isn’t a lot of new data available, it may be a relatively quick project. Mann said that, in his view, the most difficult to quantify, but potentially largest, cost associated with a mussel invasion is the environmental cost. Especially in the Snake River, where calcium conditions appear to be more favorable, the fish agencies will not let BPA and the Corps off the hook, in terms of their responsibilities to fish – they will require them to do everything in their power to help fish survive. Ruff noted that, based on the experience in the Great Lakes, once a mussel infestation takes hold, there is no effective eradication method. Karier agreed that ecological impact is a looming cloud over the region – no one knows, at this point, how large it really is. It would be horrific, given the huge investment we’ve made in these fish, to lose more of them to an invasive species. With that in mind, Karier said, I think if we can more precisely quantify the potential infrastructure costs, that will give us a significant tool in helping the other stakeholders understand what is truly at stake with this issue. I would add that there is a significant amount of information available as to how mussels alter the aquatic environment once they take hold, from the research that has been done in the Great Lakes, Rockefeller added – that would give us qualitative data, even if we don’t yet have good quantitative data. Ruff noted that results from the Portland State University research into what areas of the Columbia Basin may be most at risk from mussels will be available in February, adding that, from what he understands, this research has produced some very surprising results. Clearly, we need to spend whatever we have to spend to keep mussels out of the Columbia Basin, Grover said.

Ruff suggested that it would make sense for the region to get the necessary permits in place, in advance, to allow the region to quickly implement eradication actions, such as reservoir drawdown, which has been extremely effective in some areas.

Mann said that it does appear that there is, or soon will be, some relevant new data that could be incorporated into an update of the IEAB’s mussel report – the PSU work, and the Corps’ vulnerability assessments, at least for the lower three Columbia River projects. In response to a question, Jones said BPA is willing to support Corps vulnerability assessments at additional projects, but there is a matching funds requirement that the Corps has had difficulty meeting. Grover reiterated that the region’s focus needs to be on building an effective mussel prevention program. Ruff noted that he and other Council staff are working with the state enforcement agencies to update the map of current inspection stations, by early next year. That will allow us to develop recommendations about what additional inspection/prevention efforts are needed, and how much they will cost, Ruff said. Montana and Oregon would appear to have the biggest holes, at this point, he added.

Mann said he will draft a task that will allow the IEAB to investigate what new data may be available to inform the IEAB’s analysis, and to begin to develop a tighter range of potential cost estimates for all of the stakeholders identified by Karier. The IEAB can then review that potential task with the goal of presenting at the Council’s January meeting. Grover suggested that it may also make sense to make this a joint project with the ISAB, in order to facilitate the evaluation of potential environmental costs and impacts; Mann agreed. It may also make sense to consider a phased approach, Grover added; those environmental impacts could be the focus of phase two.

1. ***Future Meetings and Other Items***.

The next quarterly IEAB meeting (a phone meeting) was set for Thursday, March 7 from 9 am to noon. Meeting summary prepared by Jeff Kuechle, NWPPC contractor.

These minutes are an accurate and complete summary of the matters discussed and conclusions reached at the Independent Economic Analysis Board meeting held on December 12, 2012.

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 Roger Mann, Chair

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