

*"An important scientific innovation rarely makes its way by gradually winning over and converting its opponents: it rarely happens that Saul becomes Paul. What does happen is that its opponents gradually die out, and that the growing generation is familiarised with the ideas from the beginning."*

-- Max Planck

As a scientist and inventor, the above quote is my favorite among quotes by scientists. In my 35+ years of academic and scientific experience, Planck's observation has been proven over and over again.

Here we go again...

We would like to thank the Council for the effort expended in generating this solicitation. It was "yeomen's work", no doubt. We believe that all of the interested parties would agree that the Council, the ISRP, the project sponsors and the proposed project's partners were under considerable time pressure. Time "crunches" can lead to oversight and cutting corners. We acknowledge that we may have "cut some corners" of our own in an effort to submit a timely proposal that met all the Council's requirements. It appears that the ISRP may have felt the need to do so, as well. While we won't argue that we should have had both our proposals (The Natural Tag –TNT and Automated Scale Image Analysis- ASIA) ranked in the highest categories, "unranked" – without merit for consideration - seems "odd". If this were our opinion alone, it might simply be a matter of sour grapes on our part. However, several, objective, uninterested parties have read our proposals and the reviews, and agree that the reviews these proposals received were at best "odd". Herein we will address the issues the ISRP has raised in criticism of our proposals. The ISRP's comments are italicized, our response follows immediately.

Automated Scale Image Analysis:

*1) The project is innovative in that it applies a technology developed using National Science Foundation funding to Columbia River salmon populations. However the ISRP concludes that agencies and the sponsors on their own initiative could undertake this proof-of-concept work, as the technology has already been developed.*

This criticism seems "odd".

All of the "Agencies and their sponsors" could undertake ALL of the various research projects proposed under this solicitation completely and without ANY assistance from the BPA. Maybe the ISRP was in a hurry, and that wasn't exactly what they meant in writing this comment. Still, we can't 'divine' what their thoughts might have been so we are forced to address what they actually wrote. On one hand, the ISRP states that this is "proof-of-concept" work. (Isn't that what this solicitation was supposed to be?) In the same sentence, they state that the "technology has already been developed". Besides the contradiction, this criticism is just as applicable to the proposals the ISRP rated highly. Furthermore, while the technology behind ASIA *has* been

developed, (it was our understanding that this solicitation was NOT to be for basic research), so have almost all of the technologies proposed in response to this solicitation. ASIA's applicability to the Columbia River has not been demonstrated. Contrary to the ISRP's assertions, (and clearly stated in the document provided in the proposal), one cannot simply pick up the ASIA hardware and go to a new locale and commence work, producing management quality data. Exactly as is required with current, more expensive and time consuming genetic stock ID protocols, a baseline must be established. The stocks of interest in the Columbia basin are considerably closer in geographic proximity, and just as in genetic stock ID, the closer the geographic proximity, the greater the difficulty in separating stocks. The work proposed by us was to determine the geographic proximity limits within the Columbia basin to establish the baseline, then put ASIA into the field for both in-season management and historical scale analysis simply to demonstrate speed, high throughput and improved statistical rigor through larger sample sizes. The following sentence is extracted verbatim from our proposal: **Machine-derived (ASIA) stock ID accuracy can be very good (above 90%), but has to be quantified on a case-by-case basis depending on the samples available and the geographic separation of the stocks in question.**

*2) The technical and scientific background in the proposal is insufficient, i.e., one short paragraph that refers to information in an attachment.*

This criticism is one of the particularly "odd" ones. To suggest that there was only *one short paragraph* is disingenuous at best. The *attachment* which the ISRP apparently chose not to read was a 12-page document. That attachment notwithstanding, there was considerably more scientific background provided than *one short paragraph*. We would add that given the page limits within which we – and all project sponsors - were trying to fit all the relevant scientific information, forced us to make choices. The apparently unread attachment was the same scientific document that was submitted to and approved by the National Science Foundation when proof of concept on the technology was completed. We chose to include this already accepted document that contained not only the scientific background and description, but also the outstanding results, in one attachment within the space limits we and all project sponsors were facing. The Council is encouraged to examine (no need to read the whole document unless you want to), the proposal, including what we submitted as the attachment - and determine for itself if the above comment is consistent with what was provided in the proposal. We note that other proposals used hyper links and other attachment materials to provide better background materials. We simply put ours as an attachment knowing it contained all the information, technical descriptions, scientific detail and results that scientists would be interested in to evaluate an emerging technology. The only information that we did not include – and that we will not provide – are the proprietary algorithms and methods we use behind the scenes to collect and generate the highly accurate results of our high throughput scale analysis.

*3) No problem is identified.*

In retrospect, considering the burden the ISRP was under, it would have been wiser of us to preface each of what we assumed were obvious problems, with the phrase "The problem is...". Nonetheless, as instructed in the rules of the proposal solicitation, our proposal outlined several

points (with specific documents, basin and subbasin plans and page numbers) where collecting scales or the need to do better stock identification assessment was desired by managers and biologists. It was assumed (clearly we assumed wrong here), that by citing these desires we did not need to reiterate the problems that managers and scientists were facing when they put their subbasin plans together. Consistent with every scale project, and the need to cost effectively collect and process scientifically significant data, is the underlying need to improve upon those processes. It was assumed that by having mainstem and sub-basin plan drafters, managers and biologists calling for more data collection or the desire to improve upon collection techniques in stock identification was the underlying desire to more effectively process that data, including higher throughput and automation at affordable rates. In addition, the mainstem plan and many sub-basin plans specifically state an objective is to collect better data and share that data across user-defined groups, including stock ID information.

Specifically we will quote from our proposal: **ASIA is capable of providing age, and in some cases, stock ID for no less than 5000 fish (500 acetates) per day compared to an experienced human's rate of about 100 fish (10 acetates) per day.** While this statement was not made by prefacing it with "The problem is", we assumed incorrectly that providing a minimum of a 50-fold increase in throughput per day, with its attendant 50-fold decrease in cost, was a solution to a "problem". This is particularly true as it relates to the specific goals outlined in several sub-basin plans delineating the need to collect and process better stock ID data. Extracting the relevant problem from those sub-basin plans were an integral part of our proposal, as was required by the original solicitation (Section 5: Relationship to Other Projects and Section 6: Objectives). In addition, as stated in the proposal: **It is important to note that in a machine-based process such as ASIA, there is no subjectivity, and no between or within-reader variability.** Again we assumed that scientifically experienced reviewers would appreciate the significance of eliminating "subjectivity" and "between reader and within reader variability". Subjectivity and undesirable variability are ubiquitous "problems" that transcend the Columbia basin. ASIA *eliminates* those "problems".

We are certain, as we are sure the Council is as well, that the people responsible for collecting, analyzing and processing scale cards see a very clear and unambiguous benefit in higher throughput and automation. We urge the Council to call our project partners (listed in Section 1 under contacts) directly and determine for themselves if ASIA doesn't address a real "problem". We spent a significant amount of time discussing this issue with the managers responsible for scale aging and stock ID and putting this proposal together with their input. We did not simply put their names down on paper "hoping" they would one day use ASIA. Rather, they are partners in this endeavor and we believe they would like to see what long term benefits can be applied to the entire Columbia Basin system through both better data collection and cost savings.

*4) The project's goals (increase speed and improve the accuracy of ageing fish scales or, in some case stock identification) are not directly linked to the goals and objectives of Columbia River subbasin plans and regional programs.*

Again, maybe haste caused the ISRP to write something other than what they meant exactly, because this statement will be surprising news to the five state governmental and Tribal partners

joining us in this proposal. Relying not on our own subjectivity to defend this comment, we outlined specific sub-basin plans and pages where scale and stock identification problems were outlined and lamented (see sections 5 and 6 of AISA proposal). Even ignoring the specific language contained in several sub-basin plans about this problem and the desire to see better data, it is "odd" to hear the scientists of the ISRP assert that increasing throughput and sample size of any project by at least 50-fold or reducing costs by 50-fold, (while also allowing real-time, in-season management) and eliminating within and between reader variability as well as subjectivity, *are not directly linked to the goals and objectives of Columbia River subbasin plans and regional programs*. However, we acknowledge that we are not the arbiters of what is, and is not, directly linked to the goals and objectives of the Columbia River basin and regional programs – it is our understanding that it is the Council that is in large part responsible for those decisions. We can only go by what was printed and published in those plans and referenced in our proposal (per the solicitation instructions). We submit to the Council that specifically addressing a need identified by managers and sub-basin planners while also increasing speed, reducing cost, improving statistical rigor and deploying an exciting and emerging technology in the system are exactly why this solicitation was put out. It is also why we responded, with input from our state and Tribal partners, to the solicitation with our proposal.

*5) The project objectives are stated as tasks, e.g., "collect and scan enough scale cards" and "demonstrate the automated throughput" rather than as desired outcomes.*

This, we are afraid is simply a semantic issue. It is our perception that an "objective" in a scientific proposal, is something that *can* be accomplished; not something one *hopes* to accomplish. Of course one could hope that it would only take one scale from one fish to correctly age all the fish in the world and identify each and every one to its exact stock. That however, we all understand, is unlikely. What we *can* be *certain* of, as an *accomplishable objective* (as opposed to wishful thinking), is to collect and scan a sufficient number of scale cards to *determine* requisite baselines for each salmon stock (just as genetic stock ID labs must continuously do). Once such baselines are established (literally within a matter of days of scanning the requisite number of scale cards) we would use those baselines against further scale samples in very high volumes for managers to either perform historical trend analysis or to perform near real time in-season management. "*Desired outcomes*" we consider wishful thinking, the results of which **cannot be quantified** other than in a "pass/fail" form. The objectives we listed are tangible, testable, and quantifiable goals that we believe are more meaningful than "we hope to" *objectives*. We also hoped that by breaking down the *objectives* into "*tasks*" we could better convey that a task must be performed to reach the desired objective, so the two cannot be de-linked.

*6) There is no explanation in the proposal's methods section of how automated scanning of scale acetates can be used to perform "stock identification" function or task.*

Here we find another “odd” criticism. Without considering our proposal at all, those proposals using genetics methods or hydroacoustics methods, or any other similarly advanced technology, did not have to explain genetic methods, or hydroacoustics methods. However, *we* are criticized for not having done so. Second, and more importantly, the attachment we provided contained more than sufficient scientific detail to comprehend the process. Maybe in their haste, the reviewers only scanned the attachment. Third, this proposal had a finite limit on size (15 pages). It is impossible to provide detailed tutorials on pattern analysis and recognition (disciplines, by the way, more developed than genetic stock ID) and still remain within the size constraints of the solicitation. For us, (and we *do* understand, for all other project sponsors, too), it was a matter of having to select what was included in the proposal and what was not. Before we (willingly) accept responsibility for making the wrong guess on what a reviewer might want, we would think that it is a reasonable assumption on our part that our proposal gets a thorough examination. This seems especially true if the proposal is being classified not even worthy of ranking. To do this the ISRP, or the Council, or both, should review the entire proposal – including the scientific methods and results contained in our attachment that was the result of our NSF approved proof of concept. As stated earlier, the only information that we did not include – and that we will not provide – are the proprietary algorithms and methods we use behind the scenes to collect and generate the highly accurate results of our high throughput scale analysis.

*7) The explanation of the statistical confidence in the aging of the fish form automated reading of the scales is not very clear.*

We accept this feedback constructively and will use it to improve our reporting in the future. We were relying on our experience that other reviewers familiar with the statistics of pattern recognition and analysis have not found the explanations in our documentation “unclear”. We understand that it is unlikely that any of the ISRP reviewers are familiar with the statistics and technical elements of Image Analysis and Pattern Recognition. We acknowledge that that is a burden we must bear when trying to bring a new technology to Natural Resource Management. We do not find the ISRP’s discomfort here “odd”. Nonetheless, we do feel it is appropriate to address the criticism.

[PAUL – don’t you think we should attempt to explain for the Council laymen what our numbers mean in relation to the old system???)

*8) The sponsor’ CVs do not include any reports or publications of their previous work.*

We didn’t realize that the weight of the CV would be a determining criterion. After all, this solicitation was intended to seek out new and innovative technology – the operative word being “*new*”.. As such, there aren’t any publications regarding this specific subject because it’s new. That’s the nature of innovative, paradigm-changing technologies. CVs with long lists of publications unrelated to the matter at hand, filled with “fluff” to increase “weight” are not Biopar’s “style”. This “burden” we acknowledge is self-inflicted. It, however, is a philosophical issue, not one that we feel should be a matter of consideration when reviewing a proposal for

“New and Innovative Science Projects”. We submit that the proposal’s scientific design stands on its own merits. Perhaps the ISRP would prefer that we had included lists of publications dealing with image analysis, pattern recognition, algorithm development, and database management techniques or other similar scholarly works – but would they have actually pulled the papers, read the submission and tried to familiarize themselves with the detailed specific and highly mathematical under workings of these issues in grading our submission? We do not think so – partly because that is not really their job, but also because they did not have the time to do so with all of the submissions they received. But we believe the real results of the will be borne out in the final work product we provide to our state and Tribal partners, not in the litany of papers or articles someone has published in the past

*9) Information transfer involves reports, public databases, and public presentations, but would be improved by scientific peer-reviewed publication of results.*

This is once again, a semantic issue. It is our opinion, that the request in the solicitation regarding “Information Transfer” was most appropriately addressed by those elements *within our control to accomplish*. Publication of the results of this work in a peer-reviewed journal, while highly desirable, is *completely* outside our, or any other project sponsor’s, ability to control. We felt, and continue to feel, that putting down what we **hope might** happen, is at best, wishful thinking and has no place in a rigorous proposal. No other project sponsor can guarantee they will get published, and we are happy to have our outcomes published in peer-review journals. We did *not* shut the door to that or exclude that in any way. However, what we *can* control is lecturing on the results, making the data available for public data bases in the region to use and working with our project sponsors (states and Tribes) to assist them in disseminating the information as well. We would ask the Council to consider if this is not an appropriate response to the inquiry about “Information Transfer”, and that the ISRP’s above criticism is misplaced.

*10) The inclusion of a lawyer as a co-principal investigator on this project is not adequately justified.*

Here is a comment that is not only “odd”, but highly inappropriate. Most significantly, combined with the above “odd” comments, it strongly suggests that the reviewer(s) were less than objective in their consideration of this proposal. First, the ISRP does not get to choose whom we have as business partners. More importantly, if the reviewers had read the CVs with an objective eye, they would have seen that Mr. Stiefel was trained as a Chemical Engineer, otherwise referred to in industry as a Process Engineer. For the benefit of those unfamiliar with this technical discipline, chemical/process engineers are trained in the design and maintenance of chemical and physical processes for large-scale manufacture or processing. It requires detailed understanding of processes, creativity in application and invention and solid math skills. We would hope that it would be clear to the most casual observer that ASIA is nothing if not *process*. In addition, for the benefit of any lawyers sitting on the Council, we did not discount Mr. Stiefel’s involvement with us simply because he took the time and effort to go to law school. While some in society view

law degrees as being a hindrance to being an otherwise productive citizen, we do not take that view. Rather, we welcomed Mr. Stiefel's legal training as further evidence of his ability to process large quantities of information, think in a highly rigorous way and otherwise bring an elevated level of thinking to our array of projects and products. Beyond this we cannot fathom why the ISRP would feel it appropriate to comment in this manner, especially given Mr. Stiefel's training as an engineer.

## Summary

We encourage the Council to contact our project sponsors listed in our proposal to discuss their desire to see this cost effective and innovative technology deployed. They are the professionals who deal with salmon stock and scale card issues on a regular basis. They are scientifically trained and they understand the importance ASIA has to making their jobs easier, saving money and to getting better science done in the name of resource management and salmon recovery. They would not have agreed to let their names be added to our proposal, or to work with us on this project, if they felt this project lacked merit or that our "lawyer" was getting in the way.

In summary, we grant and acknowledge that the ISRP team had many projects to sift through with little time for the task. Nonetheless, other disinterested third-parties agree that the reviews to both Biopar submission (ASIA and TNT) were replete with "odd" criticisms and in one instance (in BOTH proposals), inappropriate comments. We are not asking for a "new" review by the Council. We would simply ask the Council to read the proposals, **not** for scientific merit, but rather to ascertain for themselves if the reviews provided by the ISRP of our two proposals provided the Council with the assistance they desired in determining the best proposals to recommend to BPA for funding.

Thank you for your time and efforts.

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