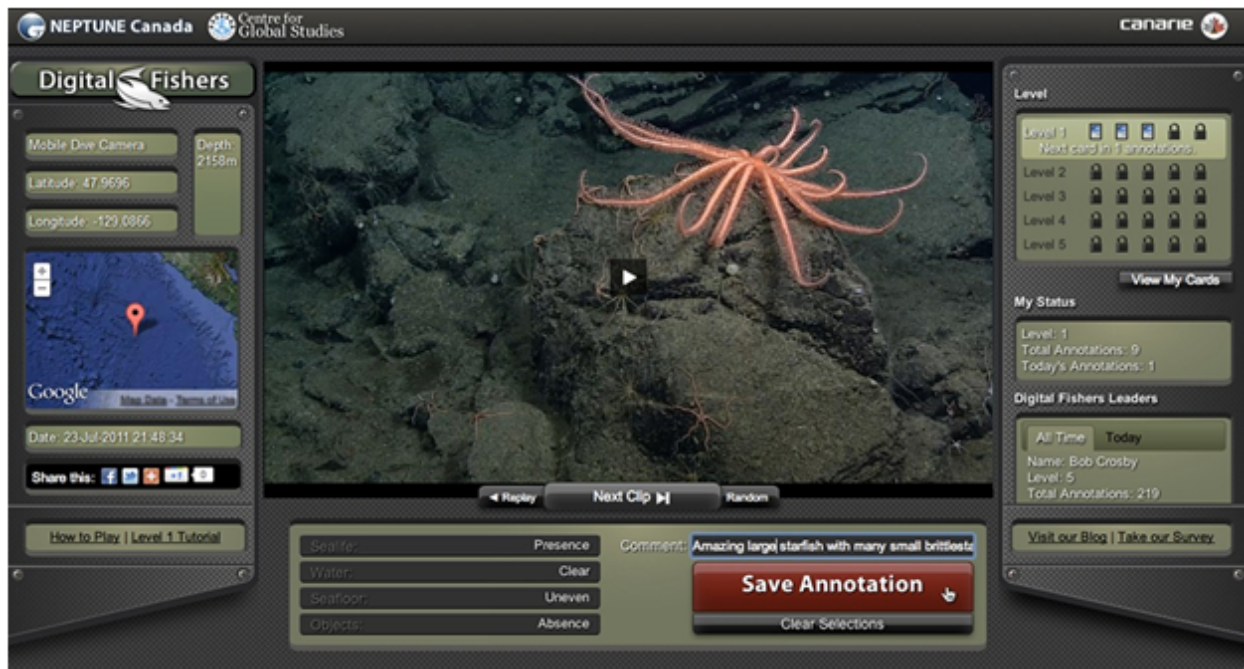


Digital Fishers



Evaluation Report:

A Summary Report to CANARIE Inc.

December 15, 2011



Centre for Global Studies

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[Digital Fishers](#) is a joint project of [NEPTUNE Canada](#) and the [Centre for Global Studies \(CfGS\)](#) at the [University of Victoria](#).

The project archive and engagement platform can be found at <http://www.digitalfishers.net>

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Digital Fishers: Evaluation

Executive Summary

Conclusion in brief

The CANARIE investment in the Digital Fishers (DF) component of its NEP-67 grant to NEPTUNE Canada was intended to build a capacity within Oceans 2.0 to support ongoing interaction with a growing Internet-based community interested in contributing to scientific research into oceans issues. At the end of the initial capacity-building phase of the Digital Fishers initiative, the evidence suggests that the CANARIE decision to undertake that investment was well-founded. The development of Digital Fishers has both created a capacity to support ongoing oceans research within Oceans 2.0 and built a foundation for a number of very promising future activities that might also extend the high-capacity “big-pipe” CANARIE system into a range of important distributed applications. Among the benefits of this initial investment by CANARIE Inc is the potential to build - through both formal education and informal citizen engagement - a widening community of interest supportive of ongoing public investment in scientific research into oceans issues.

Introduction

As noted in the main project report, the Digital Fishers initiative is a joint project of NEPTUNE Canada and the Centre for Global Studies (CfGS) at the University of Victoria. The involvement of CfGS was led by co-investigator Dr. Rod Dobell and Research Co-ordinator Jodie Walsh, with additional support from eBriefings.ca. The features and specifications for the Digital Fishers system as deployed at the end of the NEP-67 contract period were described earlier in that report. This executive summary offers a preliminary retrospective assessment of the Digital Fishers system as of the end of the capacity-building phase of the Digital Fishers initiative, with an appraisal also of possibilities for building fruitfully on this initial investment. A full discussion of this evaluation activity is the subject of the following report.

In the following document an introductory section describes the background and activities undertaken during the course of the project, and provides the rationale for the crowdsourcing approach proposed in the original application for support of this project. Subsequent sections confirm the project objectives and describe the purpose and methods for our evaluation, proposed indicators of effectiveness and a presentation of the data gathered to date in order to assess effectiveness. These data form the basis for a preliminary appraisal of the extent of achievement of project purposes, as well as the foundation upon which to rest recommendations for improvement in the Digital Fishers system and future tracking of performance. It concludes with recommendations that emerge from this exercise and point towards future possible developments. In this executive summary we simply offer a brief summary of key points.

Digital Fishers: Origin, purpose, background - design and development

Readers of this report will be well aware that NEPTUNE Canada is about strengthening future oceans-related research through building and operating the world's largest cabled seafloor observatory, off the west coast of Vancouver Island, British Columbia. The network, which extends across the Juan de Fuca plate, gathers live data from a constellation of instruments deployed in a broad spectrum of undersea environments. Data are transmitted via high-speed fibre optic communications from the seafloor to an innovative data archival system at the University of Victoria. This system provides free Internet access to an immense wealth of data, both live and archived throughout the life of this planned 25-year project.

Much of the data collected through the NEPTUNE Canada seafloor array is recorded as numerical observations (e.g., conductivity, temperature, depth, current meters, bottom pressure sensors, chemical and gas sensors for measuring carbon dioxide, oxygen, methane, nitrates, etc. - the list is extensive). In the massively high volume of the Ocean Networks Canada systems (comprised of the VENUS and NEPTUNE Canada cabled sea-floor observatories), data such as these are best analyzed through machine computational methods. However, where inputs are not so easily decipherable by traditional computer analytical methods (e.g., camera imagery, full-motion video and audio signals), two alternative approaches are distinguished:

- Development and training of software agents that can be taught to interpret these data, and
- Applying human intelligence and reasoning directly through human-based analysis and observation.

In both these instances, the common approach to analyzing these data has been to assign trained personnel to accomplish these tasks - whether to assess the data or problem directly, or - where feasible - to provide rules and vocabulary through iterative interpretations in order to increase the accuracy of software agents. This approach - employing highly-skilled personnel drawing on formal training and technical expertise to undertake routine data analysis and software training tasks - can represent an inefficient use of scarce and valuable resources if the tasks are particularly simple and numerous. In the extreme, the massive volume of observations and measurements flowing into the system may simply overwhelm any effort by scientists to extract relevant data or useful information.

The Digital Fishers component of the NEP-67 "Data from the Deep, Judgment from the Crowd" project focuses on the application of science-oriented crowdsourcing, or Web2.0-enabled citizen-science, to the special problem of interpreting and annotating the large volume of visual and audio data streaming in from the seafloor observatory.

"Crowdsourcing" is a term coined in 2006 to describe the process of taking a task traditionally performed by a scientist or expert staff person and allocating it to a large and dispersed set of volunteers, using the Internet as the medium for communicating the request for volunteers, allocating the tasks, and collecting the results. A related term, "citizen science" describes scientific projects or programs in which volunteers with little or no training perform tasks such as observation, measurement or computation. Volunteer crowdsourcing examples usually include tasks that:

- are comprised of a large number of discrete, simple, human-based interpretation tasks or computations, usually drawing on tacit human skills not easily codified;

- require very little time on the part of the volunteer to learn how to complete the task, and actually complete one instance of the task;
- give the volunteer a sense of accomplishment and of having contributed to a large, complex project through a very simple, short interaction.

Two further brief comments on terminology are needed. First, it is important to avoid confusion around the simple word “user” in the text that follows. As is emphasized at several points in the following report, the goal of the Digital Fishers project is to contribute to the mission of NEPTUNE Canada, its companion VENUS network, and Ocean Networks Canada more generally. That mission is primarily to serve scientific research communities, but also other governmental and non-governmental groups and individuals pursuing scientific questions, by offering ready internet access to a growing and trustworthy database. These research users seek access to VENUS and NEPTUNE Canada databases and analytical capacities (and possibly to data from other networks in the future) through the Oceans 2.0 interface. In other contexts, “users” refers to the Internet-based volunteers who view video segments and add annotations, where each individual user is referred to as a “Digital Fisher”. We generally seek to distinguish between “users of the database” (research users) and “users of the interface” (volunteer “players” of the Digital Fishers game). (Educators drawing on both the database and the interface to create learning opportunities represent an intermediate class of “user”.)

Second, it is helpful here to draw on a distinction used in work on program evaluation, namely between “effectiveness” or “summative” evaluation seeking to determine the extent to which a program has achieved or is achieving the purposes for which it was undertaken, and “formative” evaluation attempting to identify further developments or improved procedures through which goals or purposes not yet achieved may be more effectively pursued. This terminology is employed occasionally in this summary, and more extensively in the full report.

Project Activities

For evaluation purposes, we may think of the work on Digital Fishers as an investment project aimed at the creation, over an initial 2-year period, of a capacity to support subsequent ongoing crowdsourcing and “citizen science” activities directed toward both more effective scientific research and increased public understanding of oceans issues.

In this case, funding from CANARIE Inc. financed part of the work of the CfGS team (Dobell and Walsh, supported by eBriefings.ca) and the DMAS team over the two-year period of the capacity-building phase of the project. Together with the in-kind contributions represented by the *pro-bono* work of Dobell, the provision of indirect and overhead services by CfGS and DMAS, and access to the pre-existing Internet population from which the Digital Fishers volunteer “players” were to be drawn as a scientific resource, these inputs resulted in the successful completion of capacity-building design and development activities leading to full deployment in “perpetual beta” mode of the Digital Fishers system by the end of 2011.

Following this launch (analogous to the opening of flood gates following completion of a dam-building project), a period of ongoing operational activities has been initiated. In this case those activities entail principally the serving of strategically-selected videos to the users of the Digital Fishers interface, the capture and storage of annotations submitted by Internet-based participants viewing these video clips and exercising

their pattern recognition capabilities as members of the Digital Fishers crowd, and ongoing efforts to build that crowd through direct promotion and the animation of citizen science engagement activities. Provision for analytical tracking of performance attributes in all these respects has been developed and will provide a basis for ongoing monitoring, as illustrated in this report.

Evidently, undertaking a summative evaluation of the investment project, aimed at appraising, in some sense, the present value of the ongoing net benefits (net of ongoing operational costs) as against the present value of the cumulative investment expenditures, is not feasible at the beginning of the period in which ongoing operational activities begin and the value of ongoing flows might be estimated. Thus any effectiveness evaluation at this stage must be limited to a canvas of user satisfaction with the Digital Fishers system and its perceived potential, focusing on the initial reaction of a range of representative players and potential research users of the Digital Fishers system to the current form of that system. More importantly at this stage, a formative evaluation can be directed toward identification of desirable improvements in the system and promising directions for specific future developments.

A brief summary of the evidence

In the following document, a body of relevant evidence is described, offering a limited range of data bearing on user satisfaction and perceived effectiveness of the Digital Fishers interface and supporting system, and a wider range of comment on possible improvements and further development.

In summary, the results from usability tests and focus group discussions suggest that the design and development work has succeeded in building a user-friendly and persuasive vehicle that offers substantial potential for tapping into the resource represented by the cognitive capacity of the crowd for purposes of enhancing the DMAS database to strengthen capacities for scientific research within Oceans 2.0. Particular points to note include the degree of satisfaction expressed by test groups of players in the usability of the interface, and the confidence expressed in small focus groups of research users in the potential of the system, as participation builds, to serve ongoing research purposes. With respect to the specific objectives of the initiative, confidence was expressed that, as the issues of quality assurance and cognitive consistency are progressively addressed, the process of annotations to achieve an enhanced DMAS database within Oceans 2.0 can make a significant contribution to fundamental scientific research. (Nevertheless, fragmentary results from peer reviews undertaken by the Citizen Science Alliance in connection with an application for financial support to enable deployment of Digital Fishers under the Zooniverse citizen science umbrella - while generally supportive - indicate that further development is essential to strengthen confidence in the contribution of Digital Fishers to oceans research and support of science users.)

Two distinct elements must be addressed in responding to this last reservation. First, the case for ongoing use for formal scientific purposes by research users of Oceans 2.0, resting on confidence in the quality and replicability of crowdsourced annotations, must be directly strengthened. Second, continuing support for interaction with informal citizen science users must be assured. Such interaction, resting on a more active engagement platform accessible from the Digital Fishers interface, with the participation of scientists or students responsive to the needs of those informal users, is essential both to promote greater interest and involvement among Digital Fishers players and to encourage the citizen science enterprise more generally. Strikingly, in focus groups and classroom settings, educators—a body of users not explicitly identified in the

initial project proposals—expressed particular enthusiasm with respect to education and training possibilities, through either formal curriculum development or informal activities.

Thus, an appraisal of the extent to which the design and development work on the Digital Fishers system achieved the initial goals of the project can be summarized by noting that development of the system to the point of full deployment through Oceans 2.0 was completed within the contract period and within the agreed budget, with satisfactory - indeed encouraging - results in both user (player) testing and focus groups of research users, as well as in unexpectedly enthusiastic endorsement of potential applications in classroom and educational contexts. Despite this, there has not yet been sufficient experience with the system to build any evidence-based direct appraisal of the quality and reliability of the crowd-sourced annotations contributing to the enhanced database.

Further, discussions and outreach activities to date suggest confidence that a number of further developments can prove very fruitful in promoting increased awareness of, and engagement in discussion of, oceans issues and in the building of a broader constituency recognizing the need for increased scientific research and support of government investment and community involvement in work on such issues.

Looking forward

Experience with construction of the Digital Fishers system has led to considerable learning about potential future use and further development. Indeed, as the work has proceeded, it has become clear that the contribution of Digital Fishers to enhancement of the database serving scientific research purposes is only part of a general process of extending research activities from structured formal practices to more inclusive and informal social processes drawing on local observation and experience as well as formal expertise. Further, this trend toward more inclusive and participatory processes is also reflected, of course, in increasing social demand for and expectation of more substantial public involvement in science-based public decisions. Recognition of this trend toward more open processes in gathering, interpreting and using scientific evidence leads in turn to recognition that the value of the Digital Fishers system may lie substantially in its contribution to greater public awareness of oceans issues, increasing public support for research into such issues and more informed public involvement in related decision processes. Further, use of the system offers considerable promise in education programs as well as in support of citizen science initiatives that broaden research activities from formal academic research to include informal involvement of interested amateur volunteers through increasingly accessible collaborative workspaces. The “formative evaluation” section of this report explores in more detail the possibilities for further development of the Digital Fishers system.

Conclusion

Design and development of the Digital Fishers system has achieved the goal of deployment of an effective user-friendly interface meeting initial tests of user satisfaction. As a result of learning through the development process, some unexpected potential applications have been identified and a substantial menu of further development work, both short term and longer, has been developed. The Digital Fishers initiative is promising and should be pursued actively in order to build the scale of participation that will assure the reliability and value of the crowdsourcing process as an essential component in drawing usable information from the overload of observations and deluge of data in which the Oceans 2.0 science enterprise may otherwise drown.

1. Introduction

Digital Fishers is a joint project of NEPTUNE Canada and the Centre for Global Studies (CfGS). The involvement of CfGS was led by co-investigator Dr. Rod Dobell and Research Co-ordinator Jodie Walsh, with additional support from eBriefings.ca. This report provides a retrospective assessment of the capacity building phase of the Digital Fishers project, with also a review of possibilities for building on this initial investment.

This introductory section describes the background and activities undertaken during the course of the project to date, and provides the rationale for the crowdsourcing approach adopted. Subsequent sections describe the purpose and methods for our evaluation, the project objectives, proposed indicators of effectiveness and a presentation of the data gathered in order to assess effectiveness. This data forms the basis of a preliminary summative comment, as well as the foundation upon which to sketch a formative evaluation. We conclude with recommendations that emerge from this exercise and point towards a number of very promising future (possible) developments.

Digital Fishers: Origin, purpose, background - design and development

NEPTUNE Canada is about the scientific revolution emerging from the building and operating of the world's largest cabled seafloor observatory off the west coast of Vancouver Island, British Columbia. The network, which extends across the Juan de Fuca plate, gathers live data from a constellation of instruments deployed in a broad spectrum of undersea environments. Data are transmitted via high-speed fibre optic communications from the seafloor to an innovative data archival system at the University of Victoria. This system provides free Internet access to an immense wealth of data, both live and archived throughout the life of this planned 25-year project.

Much of the data collected through the NEPTUNE Canada seafloor array is recorded as numerical observations that are best analyzed through machine computational methods (e.g., conductivity, temperature, depth, current meters, bottom pressure sensors, chemical and gas sensors for measuring carbon dioxide, oxygen, methane, nitrates, etc. - the list is extensive). However, where inputs are not-so-easily decipherable by traditional computer analytical methods (e.g., camera imagery, full-motion video and audio signals), two alternative approaches are distinguished:

- Development and training of software agents that can learn to interpret these data, and
- Applying human intelligence and reasoning directly through human-based analysis and observation.

In both these instances, the common approach to analyzing these data has been to assign trained personnel to accomplish these tasks - whether to assess the data or problem directly, or - where feasible - to provide rules and vocabulary through iterative interpretations in order to increase the accuracy of software agents. This approach - employing highly-skilled personnel to undertake routine data analysis and software training tasks - can represent an inefficient use of scarce and valuable resources if the tasks are particularly simple and numerous.

The Digital Fishers component of the "Data from the Deep, Judgment from the Crowd" project (funded by CANARIE Inc.) focuses on the application of science-oriented crowdsourcing, or Web2.0-enabled citizen-science, to the special problem of how to effectively assess the large volume of video data that is streaming

in from the seafloor observatory - data which is still largely undecipherable by current machine computation methods - without wasting highly-skilled, scientifically-trained human resources in repetitive tasks that require very little training. We take our inspiration from previous crowdsourcing / citizen science exercises such as NASA Clickworkers.¹

NASA Clickworkers was an experiment to see if public volunteers acting as citizen scientists, each working for a few minutes here and there, could do routine science analysis that would normally be done by a fully-trained scientist or graduate student. Users were asked to mark craters on maps of Mars, classify craters that have already been marked, or search the Mars landscape for "honeycomb" terrain. In its first six months of operation, more than 85,000 users visited the site with many contributing to the effort, making more than 1.9 million entries. An analysis of the quality of markings showed "that the automatically-computed consensus of a large number of clickworkers is virtually indistinguishable from the inputs of a geologist with years of experience in identifying Mars craters." The Clickworkers project was a particularly clear example of how a complex professional task that requires a number of highly trained individuals on full-time salaries can be reorganized so as to be performed by tens of thousands of volunteers in increments so small and simple that the tasks could be performed on a much lower budget. The low budget would be devoted to coordinating the volunteer effort. However, the raw human capital needed would be contributed for free.

Crowdsourcing is a term coined in 2006 to describe the process of taking a task traditionally performed by an employee and allocating it to a large and dispersed set of volunteers, using the Internet as the medium for communicating the request for volunteers, allocating the task, and collecting the results. Citizen science describes scientific projects or programs in which volunteers with little or no training perform tasks such as observation, measurement or computation. Volunteer crowdsourcing examples usually include tasks that:

- are comprised of a large number of discrete, simple human-based computations.
- require very little time on the part of the volunteer to learn how to complete the task, and actually complete one instance of the task.
- give the volunteer a sense of accomplishment and of having contributed to a large complex project through a very simple, short interaction.

The Digital Fishers approach is to use crowdsourcing in order to apply volunteer labour as a first pass effort. Digital Fishers is designed to enlist crowds of anonymous Internet participants in the tagging and annotation of video clips flowing from the VENUS and NEPTUNE Canada seafloor observatories. The overall goal of this CANARIE Inc. funded project was to use the power of crowdsourcing to help filter and annotate the large volume of video data being collected from the Ocean Networks Canada seafloor observatories.

Digital Fishers is a web-based system that enlists volunteers to come to the project website, watch a short 15 second segment of video, and then apply descriptive tags to that video image using the interface annotation system. For each video that's "annotated", the player receives a point. Points contribute to the earning of "collector cards", and for each five cards collected the player advances to the next level. There are five levels in the Digital Fishers game, and each level presents the player with an increasingly sophisticated

¹ The original Clickworkers site is no longer on-line, but the Internet Archive project has a cached version at <http://web.archive.org/web/20090730053153/http://clickworkers.arc.nasa.gov/top>. Further information on the Clickworkers experiment is available from Kanefsky, B., N. G. Barlow and V. C. Gulick (2001) "Can distributed volunteers accomplish massive data analysis tasks?" *Lunar and Planetary Science XXXII*, available at <http://www.lpi.usra.edu/meetings/lpsc2001/pdf/1272.pdf>

annotation system. If a player finds the annotation system too complicated at higher levels, they have the option of playing at a lower level - though they will continue to earn points (so, for example, their efforts will still be reflected on the leader-board), these points will not lead to the further accumulation of collector cards if they choose to play at a lower level than the one they've attained.

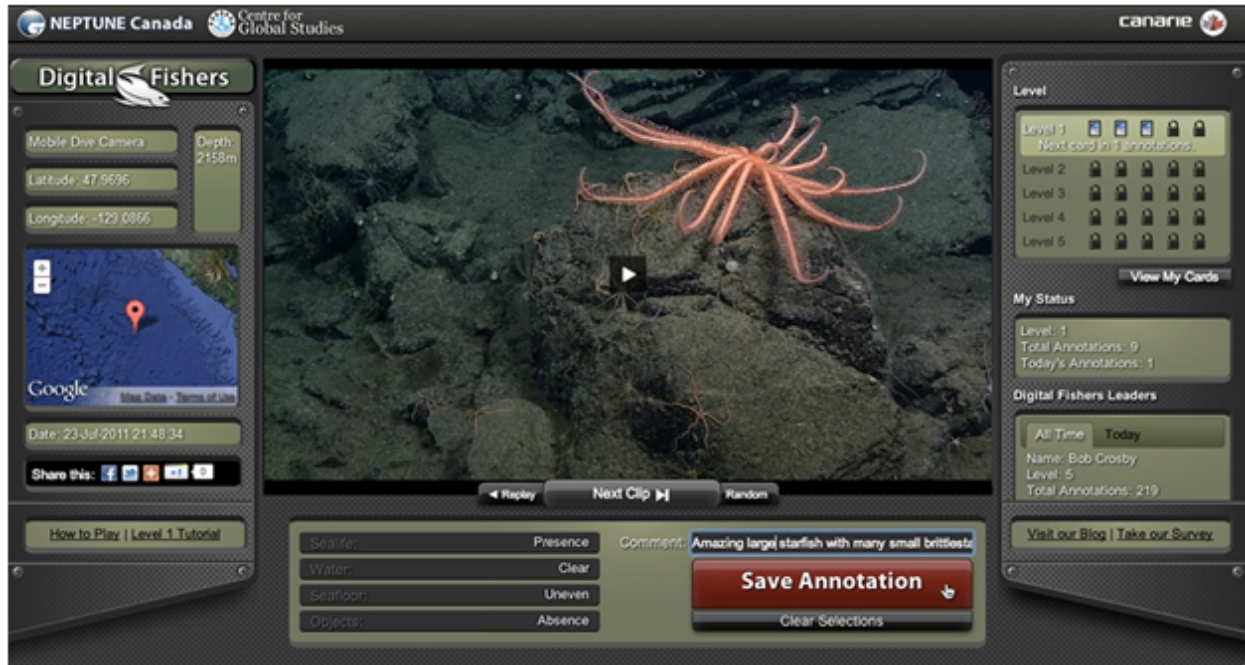


Figure 1: The Digital Fishers Interface available at <http://DigitalFishers.com>

Project activities

The Digital Fishers project began in the fall of 2009 following the awarding of a contract from CANARIE Inc. (the full project proposal is at http://digitalfishers.net/wp-content/uploads/2010/02/SoW_1.1.pdf). The project envisioned the use of crowdsourcing to engage large numbers of volunteers to provide a feedback loop from the database through the collective mind of the crowd and back to the data base to offer enhanced content and value added for purposes of the scientific community. This approach would seek to tap the cognitive surplus of large numbers of dispersed volunteers to improve the value of the data to the scientific community and, subsequently, the quality of the evidence provided by the scientific community as a basis for public deliberation. A parallel objective was to use the social networking activities that are central to a successful crowdsourcing strategy to build interest and awareness of the VENUS / NEPTUNE Canada cabled sea-floor observatories, and oceans issues more generally.

In January 2010, an interface design and specifications report was delivered by CfGS to the DMAS team within NEPTUNE Canada (a copy of this report is available at http://www.digitalfishers.net/wp-content/uploads/2010/03/Phase_1_Report_1.0_Ir.pdf). This report presented user interface (UI) and user experience (UX) design recommendations, wireframes and use cases to inform and guide the development of a beta version of the Digital Fishers crowdsourcing platform. The central message underlying the report focussed on the volunteer Digital Fishers as the drivers of this project, who must be understood to be a scarce and

valuable resource that need to be attracted and retained in order for this project to meet its objectives. In order to frame the approach advocated in that report, CfGS adopted a business case perspective that views the Digital Fishers system as a business providing a service (the UI/UX) to its clients (the volunteer Digital Fishers). In return, those clients provide the system with its currency: the attention and effort of the users.

Following the receipt of that report, the DMAS team developed an initial beta version of the Digital Fishers interface. An intuitive and attractive web interface was deployed in limited release in March 2011 that allowed volunteer Internet-based users the ability to view short segments of NEPTUNE Canada video imagery and apply human reasoning, processing and computations that are then usable by the NEPTUNE Canada science community.

During the development of the Digital Fishers prototype and beta version, CfGS led a discussion of related user management, privacy, human research ethics and information security concerns related to the development and deployment of Digital Fishers. This document provided a basis for moving forward on issues of privacy, security, user management and human research ethics in a coordinated way across all Oceans 2.0 websites. The development of an appropriate Privacy Policy and Terms of Use Statement for the purposes of the NEPTUNE Canada and Digital Fishers sites also informed the application for approval by the University of Victoria's Human Research Ethics Board of the Digital Fishers component. (The application submitted to that Board is included in that full report, which was submitted in July 2010 by CfGS to NEPTUNE Canada, and is available here: <http://digitalfishers.net/wp-content/uploads/2010/02/Report-1.3.pdf>.)

Formal usability testing on the beta version Digital Fishers interface was undertaken in March - May of 2011 as part of the CfGS responsibility for providing heuristic evaluation and usability testing of the beta version of Digital Fishers. The purpose of this testing and subsequent recommendations to NEPTUNE Canada was to enhance the contribution of the Digital Fishers system to the overall project objectives. That report represents the summary compilation of a number of interim reports that had previously been delivered to NEPTUNE Canada, principally a heuristic evaluation report delivered March 24 2011, an informal briefing to the Digital Fishers software development team on May 18 2011, and a "Usability Testing - Quick Findings Report" delivered May 25 2011 (much of the content of which is included in the formal usability report submitted on June 15 2011; a copy of that report is available at <http://digitalfishers.net/wp-content/uploads/2011/10/Digital-Fishers-Usability-Testing-Summary-Report-to-NEPTUNE-Jul-15-2011.pdf>.)

Following revisions to the interface based on this usability testing, operational deployment occurred in limited release in July 2011 with additional revisions through the July-September period as informed by ongoing user feedback. Continuing interaction between the CfGS and DMAS teams led to the release of an enhanced version on December 15 2011 (accessible through <http://www.digitalfishers.com>).

Outreach

During the period of the above-noted project activity, project team members also engaged in related outreach activities in order to promote the coming full release of the Digital Fishers interface and to engage academic colleagues in discussions surrounding some of the conceptual models underlying the Digital Fishers project.

The project team presented an early beta version of the Digital Fishers interface at the annual NEPTUNE Canada workshop in June 2011. Also in June 2011, Project Co-Investigator Dr. Rod Dobell gave a presentation on the topic of “Techniques, Tools and Toys in the 21st Century” to the 2011 International Conference of the Aquatic Ecosystem Health and Management Society. A copy of this presentation is available at <http://digitalfishers.net/wp-content/uploads/2011/12/AEHMS-REVISED-July-21-2011.pdf>.

The project team, represented by Dr. Dobell and Research Coordinator Ms. Jodie Walsh, also gave a presentation at the Salish Sea Ecosystem Conference in October 2011 and demonstrated the Digital Fishers system in the associated “Data Fair”. That presentation is available at http://digitalfishers.net/wp-content/uploads/2011/12/o8Proceedings_Dobell.pdf.

Jodie Walsh and project assistant Jessica Nephin worked to bring the Digital Fishers experience to the attention of K-12 teachers in the Victoria school systems. As part of that effort, they worked with 30 students from Monterey Middle School in a school computer lab to guide students through the interface.

Lastly, the Director of NEPTUNE Canada, Dr. Kate Moran, gave a lecture at the 2011 TEDxVancouver conference and, in addition to focussing on the work of NEPTUNE Canada, highlighted the Digital Fishers project, leading to a noticeable increase in traffic to the project website at <http://www.digitalfishers.net>.

2. Evaluation Purpose and Methods

The purpose of this evaluation report is to provide a preliminary assessment of the extent to which this first capacity-building phase of the Digital Fishers project - i.e., the present Digital Fisher interface and middleware for capturing the user annotations, the user-base and the infrastructure and social network which supports continued promotion and maintenance of that user base - succeeds in achieving the objectives of the project, and what improvements might be made in the future to enhance performance and increase the extent to which the objectives are achieved.

An important basic distinction in evaluation types is between formative and summative evaluation. A *summative evaluation* involves the systematic assessment of the worth or merit of some project or undertaking. We also engage in a *formative evaluation* in order to provide useful feedback about the project and point towards potentially valuable future developments. Formative evaluations strengthen or improve the project being evaluated. Summative evaluations, in contrast, examine the effects or outcomes of the project. Dobell and Zussman² recommend that we distinguish between formative evaluations as an aid to improving programs - i.e., “monitoring and feedback activities which enable managers to improve performance by adjusting operations and redesigning programs” (p. 415), addressing the question: “how can this program be made better?” (p. 422) - and summative evaluations as retrospective judgements - “comprehensive assessments of the degree of success achieved by programs” (p. 416) addressing the question “how well are we responding to the problem?” (p. 422). This distinction is adopted here.

Through this evaluation exercise, our aim was to assess to what extent the present Digital Fishers interface succeeds in achieving the objectives of the project, and what improvements might be made in the future to enhance performance and increase the extent to which objectives are achieved. As the evaluation was led by CfGS, a key participant in the project, the reader is alerted to the inherent challenges presented when a party to a project also serves as the evaluator. Our summative evaluation is also severely handicapped by a lack of data to date with respect to the use of the Digital Fishers system. While the participation of the evaluation team throughout the Digital Fishers project limits the objectivity of the summative evaluation of the project, however, this close involvement in the project has, we believe, provided us with an invaluable perspective with respect to the formative evaluation.

Evaluation methods

As noted, this report involves both a preliminary, abridged, summative evaluation and a formative evaluation, with the emphasis on the latter. In planning for both, we identified a number of sources of evidence necessary to support these complementary appraisals.

Usability testing was not explicitly an evaluation activity (having occurred following the release of beta version of Digital Fishers during the period March - May 2011), but insights derived from that work have informed the evaluation process. Those results do bear, in a preliminary way, on the general question of client satisfaction.

² Dobell, Rodney A. and David Zussman (1981) “An evaluation system for government: If politics is theatre, then evaluation is (mostly) art.” *Canadian Public Administration*. 24(3): 404-427

Focus groups were an important method of collecting information for program evaluation purposes, using carefully designed questions in the context of group interviews. Information and insights from the group participants and the group as a whole are derived from the interaction between the moderator and the group, as well as the interactions among focus group members.

Three focus groups (and one related school demonstration) were conducted in November 2011, and also served to assess user satisfaction with the Digital Fishers system. Rod Dobell, Justin Longo, Jessica Nephin, and Jodie Walsh designed the questions and were key facilitators of these events. Justin Longo acted as moderator for all of the focus group discussions.

A **user survey** was also deployed during the evaluation phase as a vehicle for interested users to provide feedback on the Digital Fishers system, their experience interacting with the interface and their reactions to the concepts underlying the project. This survey is available at <http://app.fluidsurveys.com/s/df-exit-survey/>.

Outreach and engagement activities provided an opportunity to gauge reactions to underlying conceptual models as well as to collect informal feedback on the ongoing development of the Digital Fishers system.

While there has been limited use of the Digital Fishers system, and consequently a very limited number of user annotations, we have still been able to prepare a limited but illustrative **analysis of annotations** collected to date in the Digital Fishers database. More importantly, the framework for ongoing information extraction from that data has been established through this work as illustrated below (see section 5).

Again subject to limited user exposure, we have access to **website analytics data** to gauge traffic and undertake some preliminary analysis about user characteristics.

Lastly, through our discussions with the Citizen Science Alliance and our application for consideration as a Zooniverse project, we have received preliminary **peer review** of our work to date.

3. Digital Fishers Project Objectives and Logic Model

As noted earlier, one goal of the Digital Fishers project was the creation of a crowdsourcing platform that could engage large numbers of Internet-based volunteers to provide a feedback loop from the database through the collective mind of the crowd and back to the database to offer enhanced content and value added in support of the scientific community. The following conceptual diagram, from the original project proposal, helps to illustrate the relationship between the flow of data from the instrumentation through the filter of crowdsourcing in support of enhanced understanding.

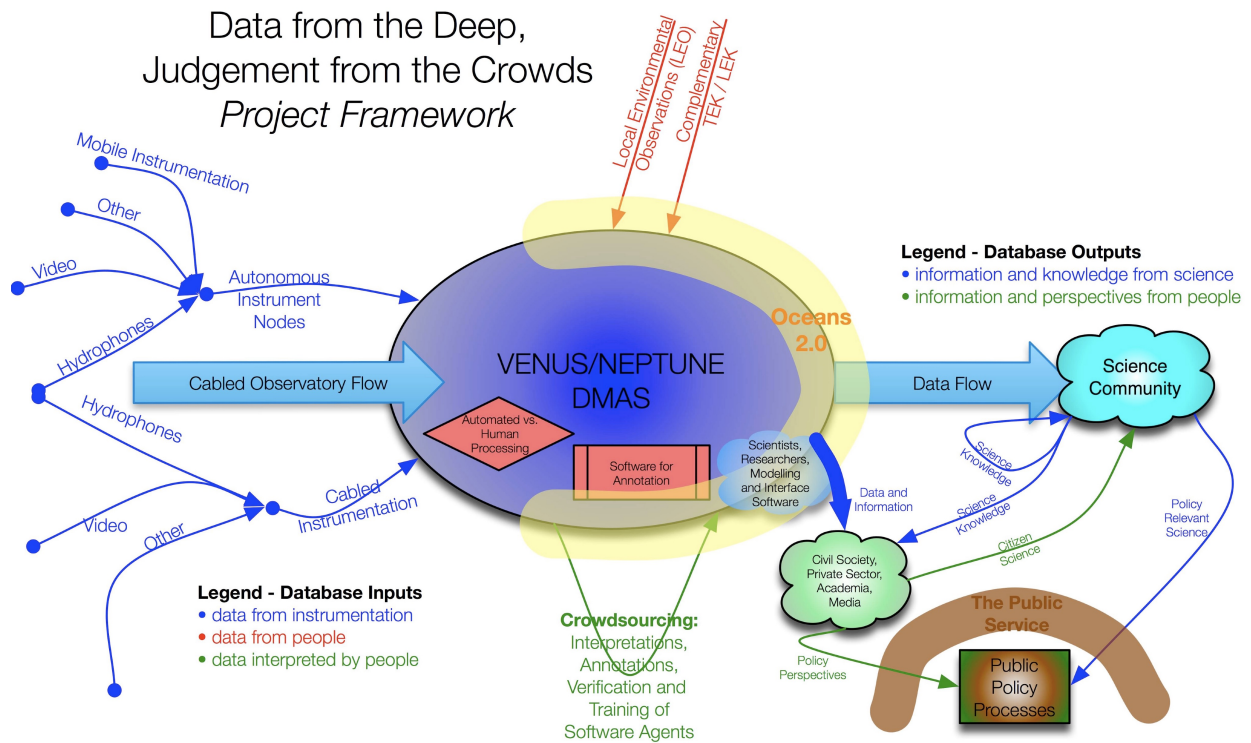


Figure 2: Digital Fishers Project Conceptual Model

There are several dimensions to the articulation of explicit objectives, and hence alternative indicators to measure the degree of success or characterize performance.

The initial purpose was seen as enlisting large numbers of participants to tag as much as possible of the video clips accumulating in the DMAS archives, so that any research scientist or other user seeking access to this accumulating database through Oceans 2.0 could undertake an efficient search based on these tags to assemble the most promising sample from this massive database in order to pursue specific research topics.

But there is also a slightly different use, based on the idea that “inside” scientists might structure the selection of videos to be served up by the system to the internet to permit exploitation of the resource represented by the crowd for purposes of expediting the specific research projects addressed by these “inside” scientists. In effect, a custom-selected flow of videos could be exposed to the human scrutiny made possible by the Digital Fishers interface. We refer to this concept as “mission-based activities” in which a

scientist is able to direct the attention of the Digital Fishers crowd towards particular videos of interest, focussing those volunteers to look for specific items or organisms.

Indeed, as the system develops, one could imagine the capacity for DMAS to support not just custom-designed “mission oriented projects”, and not just for research scientists registered through Oceans 2.0, but also to support citizen scientists progressing through Digital Fishers to a level of expertise that would permit them to participate more directly themselves in a collaborative platform facilitated through Oceans 2.0.

Thus there is a supplementary purpose (or even “joint product”) that arises as a result of the Digital Fishers experience leading some participants to wish to move on from higher levels of Digital Fishers to some more individual involvement in marine science or oceans issues. This might be accomplished through “graduation” from Digital Fishers to participation in various NEPTUNE or VENUS related collaborative workspaces. Or it might occur simply as a result of greater awareness of threats to marine resources or interest in oceans issues leading to increased involvement in other government-sponsored or community-based activities. So we need to think about appropriate measures to use in gauging to what extent any of these (somewhat different) purposes that have emerged as the learning has developed through the capacity building phase can be achieved.

The learning experience achieved as a result of progress through the ranks of Digital Fishers (enriched cards, for example), or teaching objectives through classroom presentations and discussion (assignments to develop new or more specialized cards for collection, for example) might make significant contributions to social goals of greater awareness and engagement by broader communities of young people (as well as older users pursuing an interest as distinct from an education).

Project objectives

Objective 1: To draw in participants from the Internet to provide credible annotations and tags to video clips to enhance the DMAS database for scientific and ancillary use. Two principal modes of scientific use are: first, through serving of selected video to Internet participants, to achieve tagging of video selected in advance by scientists as relevant to a particular research topic; second, through annotation of the general database to facilitate more efficient search by unknown future researchers accessing the database through Oceans 2. (To the extent that Oceans 2.0 increasingly permits researchers to specify research procedures or experiments they wish to conduct through Oceans 2.0, one can foresee these two different approaches above merging into the first approach, with outside researchers specifying criteria for the video they wish served to meet their needs through future tagging, rather than simply searching on past tagging.) Note that this database is not just of benefit to “marine scientists”, but to anyone wishing to explore and draw on the Oceans 2.0 environment (e.g., a K-12 teacher could use it to find videos of particular interest, by searching the database for tags of interest and then directly linking to the 15-second video annotated with that tag).

Objective 2: Although Objective 1 remains the primary purpose for which the Digital Fishers crowdsourcing was proposed, increasing attention also attaches to a supplementary objective, namely to build awareness of oceans and marine issues on the part of a broader population, and to increase engagement of broader populations in monitoring and reporting activities and development of action to address issues identified. (Possibilities for recruiting participants to more substantial research through recruitment into collaborative work groups or other initiatives may prove significant.) Curriculum enrichment and increased student

engagement through classroom experience and development of underlying tutorials may be seen as part of this objective, or developed as a distinct objective.

With respect to the first objective, of course, issues of accuracy or scientific quality arise, whereas questions of user satisfaction, user experience, and user confidence in results are important for the second objective.

In order to reach the project goal of involving large numbers of participants in the Digital Fishers endeavour, an intuitive and attractive web interface, complementary middleware applications and a database for storing the crowdsourced annotations has been built. This “Digital Fishers system” gives volunteer Internet-based users the ability to view short segments of NEPTUNE Canada video imagery and apply human reasoning, processing and computations that are then stored alongside the video metadata. The intention is that these annotated video segments are of added value for the NEPTUNE Canada science community.

In addition to providing the basic functionality of easily viewing and annotating NEPTUNE Canada video data, the Digital Fishers interface faces a second challenge - that of persuading volunteer participants to engage with the Digital Fishers process across multiple iterations and long time periods. With a view to those two challenges - to be simultaneously functional and engaging - this usability testing process sought to determine how well the Digital Fishers system met those objectives and where improvements could be identified.

Logic model

A logic model is an evaluation tool that provides a way of illustrating a program graphically, using a flow chart metaphor to link the pre-project situation to the intended outcomes and impacts of the project, through a causal chain of project objectives, inputs, activities and outputs. As a model, its purpose is to conceptually illustrate the rationale behind the project. It shows the relationships between the resources invested (inputs), the activities carried out, the resulting direct consequences (outputs) and the longer-term or ultimate benefits expected (outcomes).

Digital Fishers as an investment project

For evaluation purposes, we must think of the work on Digital Fishers as an investment project aimed at the creation, over an initial 2-year period, of a capacity to support a subsequent ongoing crowdsourcing activity directed toward more effective scientific research and increased public understanding of oceans issues.

In this case, funding from CANARIE financed part of the work of the CfGS team (Walsh, supported by eBriefings.ca) and the DMAS team over the two-year period of the capacity-building phase of the project. Together with the in-kind financing provided through the work of Dobell, the provision of indirect and overhead costs by CfGS and DMAS, and access to the pre-existing internet population from which the Digital Fishers crowd can be drawn as a scientific resource, these inputs resulted in the successful completion of capacity-building design and development activities leading to full deployment in beta test mode of the Digital Fishers system at the end of 2011.

Following this launch, a period of ongoing operational activities has been initiated. In this case those activities entail principally the serving of strategically selected videos to a Digital Fishers interface, the capture and storage of annotations submitted by Internet-based participants exercising their pattern recognition capabilities as part of the Digital Fishers crowd while viewing those videos, and ongoing efforts to build that

crowd through the animation of citizen science activities. In addition, a capacity for strategic selection of video to be served for specific research purposes and subsequent search of the annotated video data base, as well as provision for analytical tracking of performance attributes in all these respects, will be exercised.

Evidently, undertaking a summative evaluation of the investment project, aimed at appraising the present value of the ongoing net benefits (net of ongoing operational costs) as against the present value of the cumulative investment expenditures is not feasible at the beginning of the period in which ongoing operational activities begin and the value of ongoing flows can only begin to be estimated. Instead, as explained elsewhere in this report, the focus must be on the initial reaction of a range of representative potential users of the Digital Fishers system to the current form of that system, and on a formative evaluation directed toward identification of desirable improvements in the system and promising directions for specific future developments.

In order to carry out more summative appraisals in the future, on the basis of extended operational experience with the system, it is desirable to identify the anticipated short term outputs and longer term, more fundamental but less tangible outcomes flowing from ongoing use of the Digital Fishers system in scientific and social context. That is attempted in the following diagram.

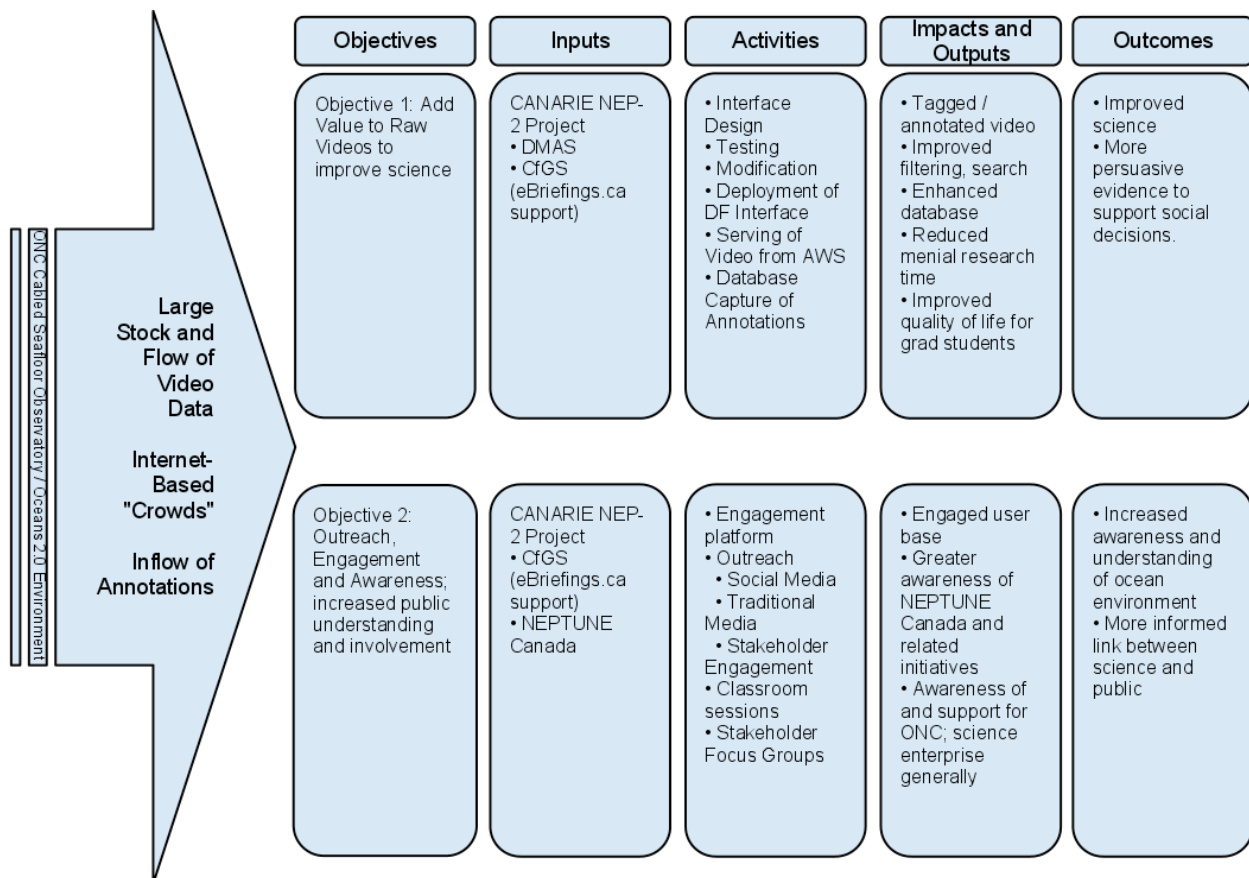


Figure 3: Digital Fishers Project Evaluation Logic Model

4. Effectiveness Indicators

An indicator describes or points to an issue or condition, and is designed to show how well a system is functioning. The characteristics of useful indicators include being:

- Relevant
- Easy to understand
- Reliable, and
- Based on evidence

Indicators can be useful as proxies or substitutes for measuring conditions that are so complex that there is no direct measurement. For instance, it is hard to measure the “effect of engagement on awareness and understanding of the ocean environment” due to a number of different aspects that influence that engagement, how “awareness” is appropriately measured, what constitutes “understanding” and what tangible results can be said to be attributable to that chain.

For objective 1, improved support for scientific research through an enhanced database complemented with user annotations and tags, the crucial consideration is the scale and value of annotations to assist in efficient search by scientists, researchers and other interested database users, whether formally within the Oceans Networks Canada group or more broadly amongst the community of scientists and interested clients of the Oceans 2.0 and DMAS environments. The reliability and usability of the metadata developed through Digital Fishers will hinge on the accuracy (not necessarily precision, although the precision and discrimination of tags is expected to increase as participants move through the levels of DF) of the annotations offered.

In this respect, we focus on two perspectives from which we gathered evidence: feedback from the intended users of the database; and the content in that database accumulated during the pre-release beta development phase:

What do database users think?

To get at the perspectives of potential users of the database, we convened three separate focus groups involving representatives of the science community, a group of experts in marine video annotation, and educators. We also gathered more informally feedback from interested parties at two conference events, as well as through a web-based survey of users which included a section for potential users of the database. Lastly, we benefitted from a preliminary and limited peer review of the project plan.

From this evidence base, we present data in the following section that is intended to indicate whether the project has met or is contributing to its objectives. These include questions such as:

- Do scientists and experts believe that the user-contributed annotations will be useful in their work?
- Do scientists and experts trust the annotations of anonymous users?
- What level and detail of annotation is reasonable to expect of anonymous users?
- Are non-expert anonymous users able to usefully add value to the video data using the interface?
- Do non-expert users of the database see the potential of using the database of annotations, and its link to annotated video, as a potential aid in educational and related settings?
- Can the Digital Fishers system potentially serve as a professional video annotation tool?

What do actual “Digital Fishers” add to the database?

Through a close analysis of the user annotations contributed to the database to date, we were able to assess what users contributed in terms of annotations. Central questions addressed from this perspective include:

- What annotations do users add, assessed by category of annotation and level of the user?
- How accurate are user annotations compared to the annotations of a marine classification expert?
- To what degree do the annotations of “the crowd” gravitate towards agreement; i.e., is the concept of “the wisdom of crowds” revealed in the annotations accumulated to date?

For objective 2 - increased public awareness, understanding and involvement in oceans studies through outreach and engagement, more general indicators of increased awareness, interest and involvement were identified, as were indicators of the extent to which interested communities see benefit in the Digital Fishers tool as a platform for engaging others in their own work. In this respect, we focus on two perspectives:

- from the intended users of the Digital Fishers interface - whether as an individual interacting with the Digital Fishers platform or as a group facilitator (e.g., a teacher) using the tool as a mechanism for engaging others in the subject; and
- from the actual users of the Digital Fishers interface during the pre-release beta development phase.

What do intended users think?

To understand the perspectives of potential users of the Digital Fishers system, we relied on an educator’s focus group and our web-based survey of users. From this evidence base, we present data in the following section that is intended to indicate whether the project has the potential to meet this second objective. From the perspective of the individual user, the indicators are focussed on the following questions:

- Do users find the interface intuitive and engaging?
- Do users believe they are able to make valuable contributions through the Digital Fishers interface?
- What motivates users to participate in the Digital Fishers system?
- What tangential aspects of the Digital Fishers system - e.g., gamification, learning - appeal to users?
- Do users intend to return after their activity, and do they intend to promote the tool to others?

From the perspective of using the tool as a mechanism to engage others in its use (i.e., the facilitator’s or educator’s perspective), the indicators are focussed on the following questions:

- Do facilitators and educators find the interface intuitive and engaging?
- Do they find it flexible and robust enough to use in a facilitated setting?
- Do they see the need for additional material (e.g., curriculum) to make effective use of the tool?

What do actual “Digital Fishers” do when on site?

Through a close analysis of the user activity measured through contribution to the database and through website analytics analysis, we were able to assess what users did during their activity as Digital Fishers.

Central questions addressed from this perspective include:

- How many users were involved?
- How many annotations were made?
- How did the user’s level affect their activity?
- What general profile characteristics of users can be derived?

5. Data

In this evaluation process, we developed tools to collect a range of data and identified a number of sources of evidence necessary to support this evaluation.

Usability testing

Our first observation from **usability testing** was that test participants were enthusiastic about the interface and were impressed with the functionality of the Digital Fishers environment. In addition, the testers appreciated the underlying objective of the project in providing Internet-based volunteers an opportunity to contribute to the NEPTUNE Canada science mission. All testers indicated in the post-test questionnaire that they would participate as a volunteer Digital Fisher in future when the site went live.

The test results point towards five central conclusions that are supported across all participants: a “landing page” was superfluous to the user experience and could be discarded; a functional map on the main interface was helpful in terms of orienting the user to the real-world context of the project; an intuitive annotation system should be the central focus of further interface development; there is a balance to be struck between a simple, intuitive interface and one that is robust enough to support the underlying science objective; and gamification, though helpful, requires significant thought and design considerations.

Focus groups

The following is a brief summary of the central observations emerging from each **focus group**. Greater detail can be found in Appendix 1.

1. Archipelago Marine Research Ltd. Focus Group - November 24th, 2011

The experts were mainly enthusiastic about the use of crowdsourcing in the professional environment. There was caution about the use of a detailed annotation system beyond level 3 and suggested further work on quality control measures would increase their trust in the annotations. They saw value in having this system as a first pass filtering of video for projects not involving issues of confidentiality (such as DFO projects), they liked the idea of using the crowd as a filter when looking for rare species or rare events related to their environmental monitoring work.

2. Science Focus Group - November 30th, 2011

This group was enthusiastic about the engagement aspect of the project and interested in ways to use the crowdsourcing tool to fit their needs. There was some apprehension as to the reliability of the crowd and there were suggested solutions for quality control. Quality was also a main topic of conversation regarding the vocabulary associated with the annotation choices as they relate to the crowd and how they are useful as a common standard for dissemination amongst the scientific community.

3. Educators Focus Group - November 30th, 2011

The educators all responded very positively to Digital Fishers and the potential the tool has to engage students and be relevant as a classroom resource. Some of the recommendations included: having more contextualization around the experience; the wish for a greater ability to “share” with classmates or friends through social media³; the potential in the cards as an educational tool and an engagement tool through the

³ A social networking sharing function was added to the December 2011 release version of Digital Fishers.

linking of a Mobile Application; and the need for supplementary marine curriculum resources in the classroom. It was evident that while there was substantial enthusiasm for the potential, further work would be needed to focus on supplemental curriculum materials.

Demonstrations

Outreach and engagement activities provided an opportunity to gauge reactions to our underlying conceptual models as well as to collect informal feedback on the ongoing development of the Digital Fishers system. See appendix 1 for details on these activities.

User feedback

A **user survey** was also deployed during the evaluation phase to provide a vehicle for interested users to provide feedback on the Digital Fishers system their experience interacting with the interface, and their reactions to the concepts underlying the project. This survey is available at <http://app.fluidsurveys.com/s/df-exit-survey/>.

Please tell us what you thought about the Digital Fishers system

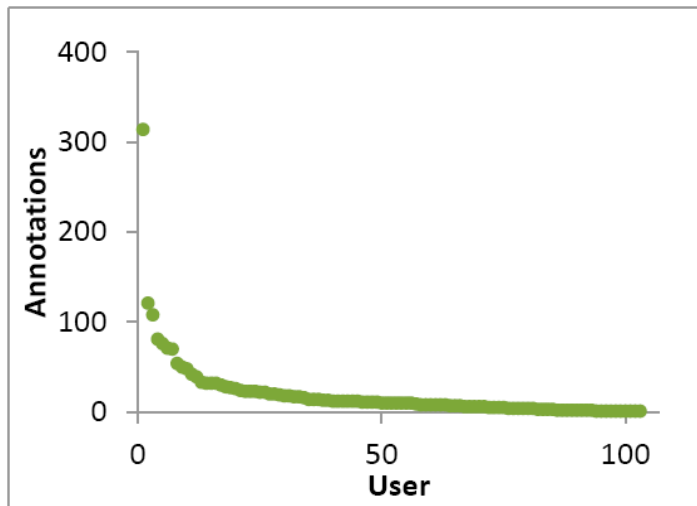
	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree	Total
The videos were interesting	0 (0%)	2 (5%)	5 (12%)	12 (29%)	11 (26%)	12 (29%)	42
There were no glitches or problems with the system	9 (21%)	6 (14%)	7 (17%)	4 (10%)	7 (17%)	9 (21%)	42
The video clips were too short	4 (11%)	10 (26%)	6 (16%)	12 (32%)	1 (3%)	5 (13%)	38
The map was helpful	0 (0%)	1 (2%)	6 (15%)	10 (25%)	17 (42%)	6 (15%)	40
The tutorial was helpful	0 (0%)	5 (13%)	7 (18%)	6 (15%)	16 (41%)	5 (13%)	39
I liked the cards	1 (2%)	1 (2%)	8 (20%)	8 (20%)	15 (38%)	7 (18%)	40
The "how to play" pop-up was helpful	0 (0%)	2 (5%)	7 (19%)	8 (22%)	15 (41%)	5 (14%)	37
The video clips were too long	13 (32%)	16 (39%)	6 (15%)	4 (10%)	1 (2%)	1 (2%)	41
I like the interface	0 (0%)	5 (13%)	3 (8%)	9 (24%)	16 (42%)	5 (13%)	38
It was easy to annotate the videos	0 (0%)	4 (10%)	5 (12%)	9 (22%)	14 (34%)	9 (22%)	41
I found it easy to get started	1 (2%)	4 (10%)	8 (20%)	4 (10%)	14 (35%)	9 (22%)	40
The higher levels were too difficult	8 (22%)	12 (32%)	8 (22%)	6 (16%)	1 (3%)	2 (5%)	37

Figure 4:A table from the user survey

Evidence from annotations

While there has been limited use of the Digital Fishers system, and consequently a limited number of user annotations, we have still been able to prepare a preliminary analysis of annotations collected to date in the Digital Fishers database. More importantly, the framework for ongoing information extraction from that data has been established through this work.

From a high level, for the six month period that Digital Fishers was in limited beta release, 103 users made a total of 2040 annotations.⁴ One simple measure emerging from this is that users made on average about 20 annotations each.



But to speak of an “average”, or mean number of annotations per user, in these systems is usually misleading as they typically exhibit a “long tail” distribution with a small number of high-output users making many contributions each, with large numbers of users making very small per-user contributions. Early results from Digital Fishers have begun to reveal this long-tail, a typical characteristic of unconstrained social systems, which can be seen in figure 3.

Figure 5: The number of total Annotations per User. Each user ranked in order of the number of annotations they recorded up to 02/12/2011.

As users make more annotations in Digital Fishers, they progress through the system’s five levels. Not surprisingly, the database shows more users at level 1, and decreasing numbers of users at higher levels. In line with that observation, most of the annotations came from users at level 1, with decreasing numbers of annotations at each user level (see figure 4).

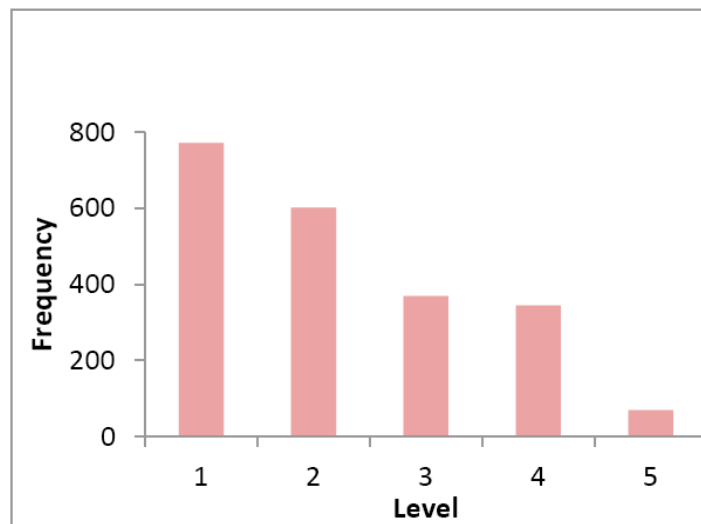
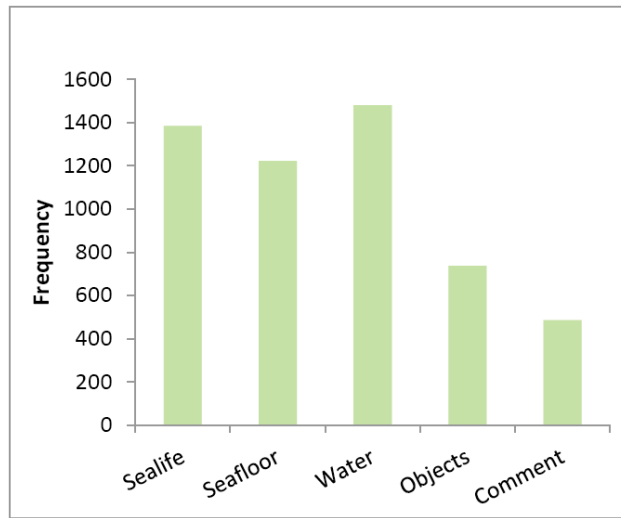


Figure 6: The number of Annotations per Level.

Digital Fishers were able to make observations across five categories in each annotation, with a minimum of one observation per annotation. However, the average number of observations per annotation shows no

⁴ All data is reported as of December 2 2011. All graphs can be found in Appendix 2.

discernible pattern across the levels, with level 1 users contributing approximately 2.75 observations per annotation and level 5 users contributing just over 2.



With respect to the number of observations across each of the five categories, “sealife”, “seafloor” and “water” received roughly the same number of annotations. Not surprisingly (since there are fewer “objects” in the videos not captured by the above three categories), “objects” received far less and “comments” (i.e., the ability of users to provide free text commentary via a text box) less still. This final observation points, perhaps to the power of the annotation system in allowing users a low-effort means of providing feedback, and not requiring users to enter text-based annotations (figure 5).

Figure 7: The number of observations in each category over all levels.

One of the central challenges in the Digital Fishers system is in understanding the correspondence between what the user sees and how they use the available annotation choices to communicate that through the system. Also, since users advance to higher levels based on the number of annotations they make, but are not subject to testing or evaluation of their abilities as they progress through those levels, there is currently no basis for claiming that higher level users have greater abilities than lower level users.

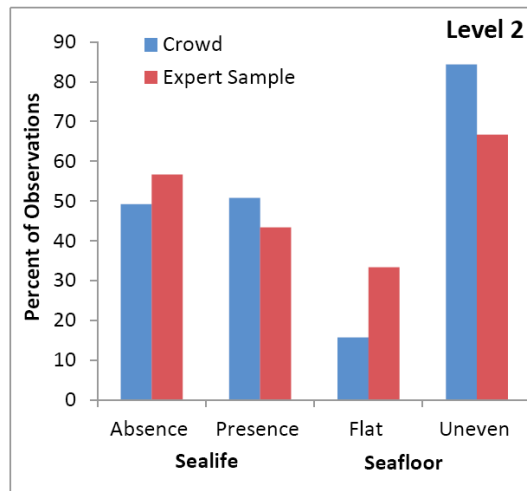


Figure 8: Comparing Level 2 Users to an Expert

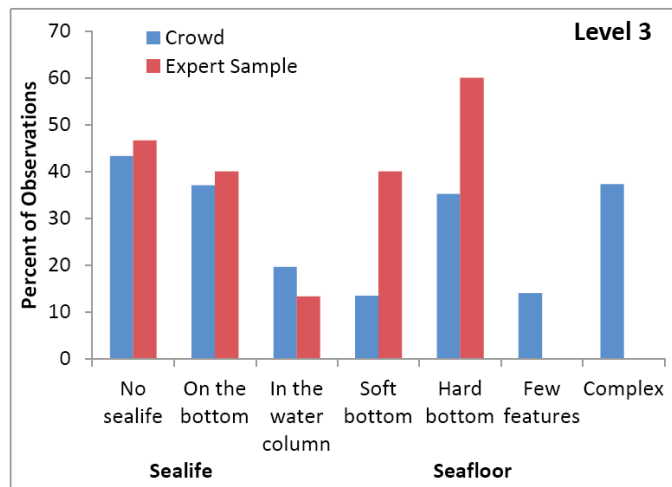


Figure 9: Comparing Level 3 Users to an Expert

In order to evaluate the “accuracy” of user annotations, an ex-post assessment of user accuracy was performed using a small sample of video clips. Figures 6 and 7, above, represent the percentage of observations in a limited number of categories, compared as between “the crowd” (or the anonymous

annotations accumulated during the beta test phase to date) and an “expert” (represented by a sample of 30 15-second video clips analyzed by a graduate student versed in underwater video analysis).

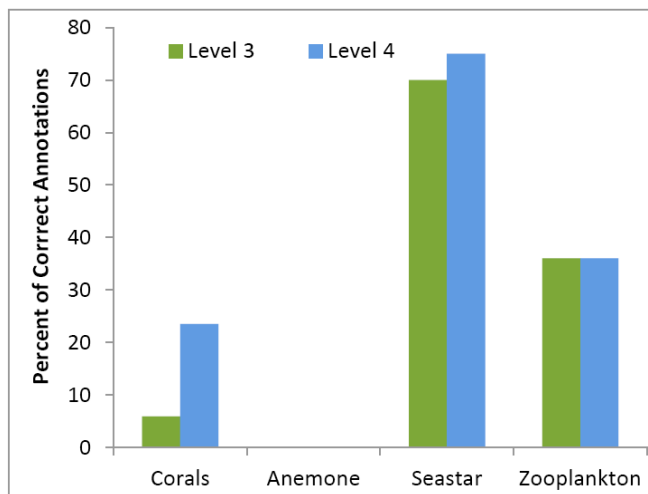
The relatively large discrepancies in the seafloor category (figure 6) may stem not from the difficulty of the novice user to grasp the task at hand, but from vague categories such as “few features” and “complex” and the deficient illustrations in the tutorial that describe them.

Crowdsourcing analysis

To date, there were only 54 annotations for “Sealife” where multiple annotations have been gathered at the same point in time (for the same 15-second video clip). Most of these annotations were only associated with one other annotation for the same clip. The largest number of annotations per clip was a “crowd” of 7. Multiple annotations per clip by one single user were removed, in order to assess the accuracy of the crowd and not the return accuracy of a single user. Annotations were marked as “Agree” if they matched the other annotation(s) for the clip and were marked as “Differ” if the annotation differed from the consensus of the crowd. **Our analysis found that 81% of annotations agreed and only 19% differed from the crowds’ judgment.** This approach did not evaluate the correct annotation (i.e., video clips were not watched to determine which users were right) but judged annotations solely on their agreement with the crowd.

Accuracy by level

Annotations were evaluated based on the accuracy of the observation. Sealife level 3 and level 4 were used in this analysis because they share categories (level 5 could not be used because of the limited number of



users). The sealife category was chosen because it is less subjective than water and seafloor which are subject to gradation. The sealife categories (Corals, Anemone, Seastar and Zooplankton) were chosen for their consistency between level 3 and 4 and the large number of annotations to date. Due to the large amount of annotations for zooplankton, the evaluation was performed on a random sample selected from each level.

Figure 10: The percent of correct annotations by category for level 3 and level 4.

Tracking of participation

Again subject to limited user exposure, we have access to **website analytics data** to gauge traffic patterns and undertake some preliminary analysis about user characteristics (see Appendix 3). In looking at this data from the NEPTUNE Workshop in June 2011 to the present, we can see an increase in the Digital Fishers user base. There are also traffic spikes following the Salish Sea Ecosystem Conference (October 2011) and focus groups and demonstrations in November 2011. The figures in Appendix 3 show not only the steady expansion of the user base, but also how the engagement has spread across the globe (e.g., user location tracking shows how project presentations in Scotland and Italy increased traffic from European visitors).

Peer review

Lastly, through our discussions with the Citizen Science Alliance and our application for consideration as a Zooniverse project, we have received preliminary **peer review** of our work to date. The Zooniverse is a Citizen Science Alliance (CSA) initiative and “the Internet’s largest online citizen science website”. The CSA mission “is to create online citizen science projects to involve the public in academic research” as a “response to the flood of data facing researchers in many fields.” Following the launch of Galaxy Zoo (the first Zooniverse project), volunteer citizen scientists did in a few months an amount of work that could have taken a graduate student 3½ years. Their second version, Galaxy Zoo 2, collected 60 million classifications of spiral nebulae and other images from a variety of telescopes in just over a year. The Zooniverse has been operating since 2007 with partners from around the world. Their base of citizens across the disciplines allows them to market new projects directly to almost 500,000 people.

The overall goal of the CSA is to host citizen scientists from a broad range of disciplines. The CSA announced its first public call for projects in July 2011. Full details are available on the proposal homepage <http://www.citizensciencealliance.org/proposals.html>. The Zooniverse / Citizen Science Alliance umbrella offered the Digital Fishers project a potential solution to the key implementation challenge: how to attract large number of volunteers to engage with the project in order to meet both our objectives of developing a reliable data-set to be effectively and efficiently searched by the research community and of increasing awareness and interest in marine issues. Partnering with the Citizen Science Alliance in order to place Digital Fishers within the Zooniverse umbrella would give the project access to a very large user base and significantly raise the profile of the project, and Oceans 2.0 more generally.

The Citizen Science Alliance’s main priority for this first round of funding is for projects which:

- Produce high impact research
- Serve as case studies for citizen science in new areas of research

The proposal (available online <http://digitalfishers.net/wp-content/uploads/2011/12/CSA-Questionnaire-Digital-Fishers.pdf>) was sent on July 19, 2011 to Arfon Smith, Technical Director of the Citizen Science Alliance for a partnership with the CSA and funding for the integration of the interface under the Zooniverse umbrella. Although the Digital Fishers project was unsuccessful in this round of proposals for a partnership with Zooniverse and hosting and implementation through their platform, the feedback through the peer review process and the overall comments from the project manager, David Weiner, were illustrative of the uncertainty around the science case. As considerations are made for the ongoing Digital Fishers work, this assessment will help to inform future proposals and considerations.

In an initial proposal, we suggested Claude Nozeres as a referee. Mr. Nozeres' review was positive overall, but included the following comments (excerpts from full review):

I am however somewhat unclear as to how they (NEPTUNE Canada) are to make the data or the data systems (i.e., the video annotation system) available for searching or adapting for users in case of expanded projects elsewhere. A major challenge in biology is trying to come up with media and metadata standards that can be used beyond a specific, big project; if they have come up with a solution, many others may be eager to follow. It would help if they were more explicit

about the data standards in use for video. While I believe they have done some conference presentations, I have not yet found any publications about the video systems in use, or the Digital Fisher interface.

Even as I am excited by the concept and the quality of the current implementation, I am hesitant regarding the science value derived from the project at the NEPTUNE network. While interesting events will undoubtedly be observed, it may be important not to oversell to the public participants regarding the science value of their observations from fixed sites. Folks accustomed to Nat. Geo may find "hours" of "nothing" somewhat of a turnoff. Certainly we may chance to find out new things not previously seen or known, but directed projects, such as tagging moving animals and experiments may be more likely to produce scientific findings. In the end, the annotated footage may simply be interesting, but not produce any "real payoff"--of course, this remains to be seen, and I wish all the best for everyone involved in this project.

6. Summative Evaluation

The purpose of this summative evaluation is to provide a preliminary assessment of the extent to which this first capacity-building phase of the Digital Fishers project succeeded in building a system that has the potential to achieve the objectives of the project. To reiterate, the project objectives were:

- **Objective 1:** To have interface users add value to the raw video data through annotations, and
- **Objective 2:** To increase understanding and awareness of NEPTUNE Canada sciences and the marine environment.

From an “outputs” perspective, Digital Fishers has achieved success: a fully functional version of the Digital Fishers interface (<http://dmas.uvic.ca/DigitalFishers>) was released to coincide with the project completion in December 2011, and outreach activities have been undertaken and the ongoing project engagement platform (<http://digitalfishers.net>) remains active. The interface has met with a generally favorable response from users - both users of the database and users of the interface.

Measuring outcomes and impacts in project evaluation is always more challenging than measuring activity and outputs, and it is especially challenging in this case given the short period of operational deployment we have upon which to derive evidence. With a limited period of pre-release beta version user activity upon which to base our evaluation, the data (presented above in section 5) is limited and our analysis is necessarily preliminary and suggestive only. We note, however, that in accumulating some of this evidence (i.e., the “evidence from annotations” reported above) we have constructed a framework for ongoing evaluation of the user contributions that can be easily and frequently updated over time.

Objective 1: Adding value to the raw video data

For objective 1, this summative evaluation focusses on the degree to which the platform that has been created is functional, supports users and shows promise to continue progressing towards its objective. While the crucial consideration is the scale and value of annotations as an aid to scientists, researchers and other interested database users, at this early stage we have focussed on two perspectives:

- from the intended users of the database, measuring what they think about Digital Fishers. This involves a qualitative assessment of our conceptual model - i.e., that crowdsourcing is a useful means by which to have anonymous Internet-based volunteers add value to raw video imagery by supplying annotations - based on feedback from potential database users as to whether crowdsourced annotations are of value to the science enterprise; and
- on the content in that database, accumulated during the pre-release beta development phase, we quantitatively measured what these early users actually did in order to determine whether the Digital Fishers interface adequately facilitates the crowdsourcing of annotations.

What did database users think?

From the evidence base accumulated (see section 5), the following observations are summarized:

- Scientists and experts understand and generally support the potential value of the crowdsourcing conceptual model in this project, and appreciate that in certain applications the user-supplied annotations believe that the user-contributed annotations will be useful in their work.
- However, when it comes to whether the science or specialist user would trust those annotations, concerns about quality control of the annotations remain, and there was particular concern about the challenge of ameliorating the divide between what non-expert users can do and what is valuable to scientists. This issue of the language interface between what the non-expert sees, what annotation choices are available to them and what annotation labels are useful to practicing scientists is a key challenge remaining in this project (see section 7, formative evaluation).
- We appreciate the comments received in the peer review and additional feedback from the CSA / Zooniverse team. We note that the Digital Fishers project needs to put significant effort into strengthening the science case for the project.
- With respect to the levels through which users progress, coupled with the increasingly complex annotation vocabulary available to users and building on the language interface challenge noted above, expert users felt that the appropriate level and detail of annotations that is reasonable to expect of non-expert users is around level 3 or below.
- The value of having the non-expert crowd annotate raw video was seen by non-science users of the database as valuable in helping them to locate videos of interest quickly (i.e., annotation as filtering tool).
- There was preliminary interest on the part of expert users in the value in considering whether Digital Fishers could be adapted for use as a professional video annotation tool, and for exploring the potential for paid crowdsourcing approaches (e.g., Amazon Mechanical Turk). However, the ability to evaluate annotator's capabilities with built-in quality control features would be crucial.

What did actual “Digital Fishers” add to the database?

Through a close analysis of the user annotations contributed to the database to date, two important observations emerged:

- An ex-post evaluation of user accuracy revealed fairly strong correspondence between crowd annotations and expert annotations, with some discrepancy possibly related to the annotation vocabulary, the influence of the tutorial system and the challenge of linking scientific concepts and non-expert perspectives.
- Our analysis found that 81% of annotations agreed and 19% differed from the crowds' judgment. This suggests that the concept of “the wisdom of crowds” was revealed in the annotations accumulated to date.

Objective 2: Building awareness through user engagement

For objective 2, we focus on the extent to which the Digital Fishers platform serves as an effective engagement platform such that a sufficient future user base can be built over time. With limited opportunity to test this platform with significant numbers of users, we focus on two perspectives:

- from the intended users of the Digital Fishers interface, we assess the extent to which the interface is seen as having the potential as an engagement tool; and
- from the actual users of the Digital Fishers interface active during the pre-release beta development phase, we assess the initial experience of users in their interaction with the site.

What do intended users think?

Based principally on the educator's focus group and our web-based survey of users, the following insights emerge:

- Users found the interface intuitive and engaging, with focus group participants enthusiastic about the project accomplishments to date.
- Users noted that they felt the interface did give them sufficient scope to make what they considered useful annotations, but found that at higher levels their confidence in their abilities diminished if they lacked specific expertise in marine science. This again speaks to the challenge of building an annotation language system that effectively bridges between the non-expert and expert realms.
- The gamification aspects were generally appreciated by respondents as useful tools to maintain interest and engagement.
- Educators saw great potential for using Digital Fishers as an educational tool, but cautioned that K-12 teachers would require supplemental curriculum materials in order to effectively take advantage of the interface.
- Users generally responded in the affirmative when asked if they would recommend Digital Fishers with others.

What do actual "Digital Fishers" do when on site?

Through a close analysis of the user activity measured through contribution to the database and through website analytics analysis, we were able to assess what users did during their activity as Digital Fishers:

- Over 100 users of the interface were involved.
- Over 2000 total annotations were made, with an average of 20 annotations per user arrayed along a classic long tail distribution.
- With respect to characteristics of the annotations, no discernible patterns of significance could be detected at this preliminary stage.
- With respect to the characteristics of users, one observation of note is that conference presentations seemed to generate the most noticeable spikes in activity throughout the beta test period.

In summary, at this preliminary stage with limited data upon which to draw, we are confident in concluding that the Digital Fishers project has made a strong start in working towards its objectives. However, there remains great scope for additional work in order to address some of the concerns identified and further strengthen the desired outcomes of the project.

7. Formative Evaluation

Our objective in this section of the evaluation is aimed at providing useful feedback about the project and to point towards potentially valuable future developments, with the aim of strengthening or improving the Digital Fishers system in future. Here we draw on the insights revealed through the focus groups, through our outreach activities and other sources of evidence, as well as through the evaluation team's deep integration with the project development. Our direct experience with the construction of the Digital Fishers system has led to considerable learning about potential future use and further development. While the participation of the evaluation team throughout the Digital Fishers project limits the objectivity of our summative evaluation, it is through this close involvement in the project that we have been able to bring a participant observation perspective to this component which, we believe, strengthens our approach.

Indeed, as the work has proceeded, it has become clear that the contribution of the Digital Fishers system to enhancement of the database serving scientific research purposes is only part of a general process of extending research activities from structured formal practices to more inclusive and informal social processes drawing on local observation and experience as well as formal expertise. Further, this trend toward more inclusive and participatory processes is also reflected in increasing social demand for and expectation of more substantial public involvement in science-based public decisions. Recognition of this trend toward more open processes in gathering, interpreting and using scientific evidence leads in turn to recognition that the value of the Digital Fishers system may lie substantially in its contribution to greater public awareness of oceans issues, increasing public support for research into such issues and more informed public involvement in related decision processes. Further, use of the system offers considerable promise in curriculum design and education programs as well as in support of citizen science initiatives that broaden research activities from simply formal academic research to include informal involvement of interested amateur volunteers through increasingly accessible collaborative workspaces.

The following list of observations and areas of focus are listed in what we believe to be descending order of importance, with the first items being what we would characterize as very important for the continued enhancement of the Digital Fishers system and the ability to move directly meet the core objectives of the original project. Note, however, that this ordering does not necessarily translate directly into an operational approach or identification of program requirements.

The citizen science / science interface

The core challenge that has emerged in this project has been revealed in the interface between the marine science mission that is the foundation of the Digital Fishers project and the citizen science objective that is its inspiration. This tension - between what the non-expert, Internet-based anonymous player can usefully and reasonably be expected to do, and what the scientist user of the database of annotated videos will trust and find useful - is revealed in the numerous design and implementation compromises that are required in building a robust and complex interface like Digital Fishers.

In the preliminary design recommendations delivered in January 2010, the central message was that the volunteer Digital Fishers that are the drivers of this project must be understood to be a scarce and valuable resource that need to be attracted and retained in order for this project to meet its objectives. From this flowed a user-centric design perspective that influenced the design of Digital Fishers. Concepts like a simple,

intuitive interface, gamification of the experience, and the use of language that was oriented towards the non-expert user were central in that process (potential further developments along these lines are explored later in this section).

However, we would often return to the key question underlying this entire project: what will science users of the annotated videos find useful and trustworthy? Often, the objective of making the experience engaging for participants was at odds with capturing annotations that would be useful for scientists. Whereas the novice Digital Fishers player might be content with tagging a video clip as containing a fish, identification of the specific species would be of greater use to the research user.

The challenges inherent in bridging this language interface expose deep epistemological and practical concerns that have yet to be resolved. We do not underestimate the significance of this challenge; we simply note the need to address the issue of scientific vocabulary in annotations and the need for cognitive interoperability between the perception of the video imagery by non-expert players and the needs of research users. Future development will require focused effort to bridge the language of the player to the language of the science research user.

Mission-based approaches

Digital Fishers is generally thought of as a mechanism for filtering and annotating the entire catalogue of NEPTUNE Canada video, and asking users of the interface (the “players”) to remark on anything of interest. Another way to think of the crowd of Internet-based volunteers is to consider their efforts, directed through the Digital Fishers interface, as similar to any other instrument on the NEPTUNE Canada array that can be specifically calibrated, aimed, placed or used for a precise purpose. If a research user could use the Digital Fishers system and its attendant volunteers for a specific “mission” - directing the crowd to look for a particular organism or phenomenon, for example, or pre-selecting a sub-set of video clips for consideration - the research user can benefit by being able to draw upon the focussed attention of the crowd for some defined period of time. In addition, the users of the interface can benefit by being more explicitly drawn into the scientific process and better understand the direct connection between their efforts and the work of the researcher. This “mission-based approach” has yielded positive results in the Zooniverse context, and - we believe - could be useful in Digital Fishers. Should such a procedure be of interest in the Digital Fishers context, Ocean Networks Canada would need to develop procedures for the approval of such missions in order to ration this additional “instrument” and to ensure that targeted research missions do not have a detrimental effect on the users of the interface and their affinity for the project.

This capacity might be extended to provide an opportunity for science users to feed their own video stock into Digital Fishers in order to tap into utilization of the Digital Fishers crowd. (Such a process would be analogous to a DMAS service offering application of customer algorithms to deliver analytical results rather than raw data.) Exercising this capacity is likely to generate a greater volume of more carefully considered annotations.

Quality control

There is currently no quality control mechanisms built into the Digital Fishers system for automatically determining the reliability or expertise of individual players. The simple leveling / game play function awards

points for a player's activity and advances players through the game's levels without regard to the accuracy or value of their observations. It is quite possible for a volunteer user of the database to offer facetious annotations bearing no relationship to what is actually contained in the video clips, and still progress rapidly to the status of Level 5.

We have considered three approaches to maintaining some control over the quality of the annotations:

1. **“Averaging” the crowd’s consensus:** one of the benefits of a crowdsourcing approach to filtering data is that mis-identification should not matter if a video clip is viewed by multiple players independently. If, for example, 20 players view a 15-second clip and 15 identify the clip as containing a pelagic fish, 3 a benthic fish and 2 identify nothing, it might be a reasonable assumption to conclude that the clip contains a pelagic fish. Under this approach, we can be indifferent to the general reliability of a particular player and instead focus on the reliability of the crowd. It is possible to link the two, however: if an individual player demonstrates “agreement” with the consensus labeling (unknown to them) emerging from multiple annotations, they can be rewarded for matching others and thus have their reputation enhanced (e.g., by advances through the levels, or having a reputation badge applied to their status).
2. **“Testing” the individual user:** a direct method for reputation management and rewarding “skilled” Digital Fishers could involve assigning points for accurate identification of pre-screened video clips in which the system has specific expectations of what annotations should be returned (alternatively, the system could deduct points for incorrect responses). Such an approach would help to ensure that players at higher levels are increasing their knowledge and that their annotations are more accurate than players at lower levels.
3. **“Crowdtruthing” the crowdsourced annotations:** If Digital Fishers had two additional interface elements - one would allow users to search for previously annotated video based on some criteria of interest (e.g., “show me halibut”), and when they view that video, another interface element would allow them to comment on it (e.g., recommend, favourite, stars, thumbs up/down, text comment, correct the annotation) - the Digital Fishers system could use the crowd to evaluate whether previous annotations were useful.

Building the crowd

Crowdsourcing activities initiated through Digital Fishers might be seen as offering a range of joint products, exploiting economies of scope resting on three basic assets:

- the Oceans 2.0 database and interface;
- the Digital Fishers system as one component of the Oceans 2.0 interface; and
- the crowd of Internet users of the Digital Fishers system.

Drawing on these assets, Digital Fishers offers services to the following clients:

- formal research users by enhancing the database accessible to them;
- informal research users (citizen scientists) by means of the Digital Fishers engagement platform, blog and other collaborative activities (noting that the distinction between these categories of formal research expertise and informal understanding is becoming increasingly blurred); and

- to formal educational activities and informal learning by enhancement of the content and tutorial support within the Digital Fishers interface.

Fundamental to all these services is the expansion of participation in the Digital Fishers crowd, both through increasing numbers (building the pool of players) and through extended involvement by individual players (lengthening the period of engagement). Fundamental to such increasing participation, in turn, are measures to make the Digital Fishers game more widely known and accessible, and more interesting or engaging. The following categories each address ways in which the crowd of Digital Fishers can be built over time.

UI / UX enhancement

The Digital Fishers development team made impressive strides in producing the release version of Digital Fishers. However, time and resource constraints meant that a number of hoped-for interface elements and user-experience features were not incorporated in the December 2011 release version (see the list of potential enhancements in Appendix 5). Key areas for consideration include modification of the annotation system (with the possibility of combining the location of the annotation system with the video itself), enhancements to the game system and additions to the user interface (such as user-controlled sound to enhance the experience of immersion in the interface's research submarine metaphor). Four sub-categories of the user experience environment are discussed below.

Pre-filtering of served video

One of the challenges in building an engaged crowd of volunteers lies in an undeniable truth of the NEPTUNE Canada video archive: there is a high likelihood that a user will see an uninteresting video, especially if they are expecting highly edited video productions aimed as much at entertaining the viewer as at educating them. We imagine two possible approaches to ensuring a Digital Fisher player sees more videos of interest and less "nothing":

1. "Stopping rule": if, after multiple independent views, the consensus annotation of players points towards the absence of anything of note, a statistical stopping rule could remove that video from further consideration. Thus, over time, less interesting videos would be removed from the pool of videos being served out to future Digital Fishers.
2. "Software Agents": as video interpretation software agents improve in sophistication, videos with little motion or without any discernible features could be removed from consideration.

Registration / anonymous annotation

The current deployment of Digital Fishers requires that a user register in the Oceans 2.0 environment before contributing as a player. We note that there is no authentication process attached to this registration (i.e., a user can submit false credentials - including a non-existent email address), thus making technically-anonymous registration possible. Also, preliminary user feedback and some evidence showing steep attrition between interest shown in the Digital Fishers project and actual follow-through to the interface point to substantial concerns that some users have to completing the registration process. Given that, we wonder whether the bar presented by the registration process is necessary and whether anonymous play could be allowed.

Enhanced gamification

We also note the great potential that exists for enriching the game through enhanced rewards and incentives based on performance, improved social networking linkages, and extended possibilities for inter-player competition. One possible “reward” could see the possibility of “graduation” from the Digital Fishers game to increased privileges within Oceans 2.0 and more direct interaction with NEPTUNE Canada.

Integration with Oceans 2.0

There exist additional opportunities to develop increased movement from the crowd of players to the community of citizen scientists through enhanced linkage between the players and the Digital Fishers engagement platform at digitalfishers.net and within Oceans 2.0. There exists great potential for developing collaborative workspaces that build upon the knowledge gained in the Digital Fishers system and progressively open-up participation in these platforms as players progress through Digital Fishers levels.

Curriculum development

The first motivation for the Digital Fishers project was articulated in objective 1: providing a mechanism for “the crowd” to add value to the NEPTUNE Canada video archive, with the idea of engagement and awareness-building (objective 2) a secondary concern. What was revealed in our evaluation activities - especially in the focus groups and other informal feedback - was the enormous potential that Digital Fishers might have as an educational tool. Our educators focus group (and our science focus group, to the extent that those practicing scientists also had a teaching role as well) were enthusiastic about the potential value of using the Digital Fishers system - both the interface end and the database end - in support of teaching activities.

Attached to this enthusiasm, however, was an emphasis on the need to develop supplemental curriculum materials to support teachers in their use of the tool. Without such support, teachers do not often have the capacity to learn how the tool works and to develop lesson plans and learning activities that can fully take advantage of the education possibilities. Curriculum enrichment would involve the development of manuals and materials supplemental to the interface, as well as educational supports built-into the interface, e.g., an expansion and development of the on-board tutorials currently available to the Digital Fishers player.

There also exists the possibility of building student enthusiasm for the Digital Fishers game by blending the virtual world with the real world through the production and distribution of physical printed cards (which could be distributed through educational settings or museum kiosk deployments, for example - see below), and providing an online mechanism for the trading of virtual cards. The educational link inherent in the ability to trade collector cards could extend, conceivably, to the development of ecosystem dynamics and food web concepts for organizing card collections according to scientific criteria.

In addition to curriculum development, teachers would benefit from several design enhancements and administrator functions such as group control, the ability to select specific videos to be shown to specified users, and enhanced database search and filtering functions.

Alternative deployment platforms

In order to reach as many potential Digital Fishers as possible, and expand the range of audiences exposed to the project, Digital Fishers should investigate alternative deployment environments. Beyond its initial deployment in a web browser environment, other platforms of opportunity for engaging additional and alternative contributors should be considered and explored. These include developing interfaces for various game ecosystems (principally for Facebook, though other opportunities should be explored such as gaming consoles like the XBox 360) and taking advantage of the revolutionary development in mobile platforms.

In addition, opportunities to consider the development of standalone kiosks in public spaces such as museums should be investigated. Lastly, the potential for linking the virtual collector card with printed collector cards has the potential for bridging the online system with the tangible world and generating additional exposure for the Digital Fishers system and NEPTUNE Canada generally.

Lastly, discussions regarding deployment under the Zooniverse umbrella should be re-started with the Citizen Science Alliance.

Commercialization and beyond

Preliminary discussions with our expert focus group pointed to the potential for developing a variant of Digital Fishers as a professional video annotation tool, or for real-time monitoring (subject to concerns about agenda bias). These possibilities should be followed up on in the near future.

Drawing additional and new networks into the Ocean Networks Canada constellation - for example, a Salish Sea network of autonomous clusters in coastal, tribal or First Nations communities or schools - could be explored, as could the deployment of a circumpolar network of cabled seafloor observatories.

Lastly, there is the possibility of developing programs for First Nations vocabulary recapture based on the Digital Fishers tutorial images, with the aim of assigning First Nations vocabulary and associated video and audio clips to images.

8. Conclusion

Conclusions

Design and development of the Digital Fishers system has achieved the goal of deployment of an effective user-friendly interface meeting initial tests of user satisfaction. As a result of learning through the development process, some unexpected potential applications have been identified and a substantial menu of further development work, both short term and longer, has been sketched.

The Digital Fishers initiative is promising and should be pursued actively. The potential pay-off from further development, building on this initial investment, is significant. Crowdsourcing has the potential of actively engaging citizen scientists in the mission of NEPTUNE Canada and building a constituency of active participants knowledgeable and concerned about the ocean environment. Crowdsourcing can also serve to build the scale of participation that will ensure the reliability and value of this approach. The alternative, in the absence of machine processing approaches and the continued deluge of data, suggests a future in which the Oceans 2.0 science enterprise might otherwise drown.

Appendix 1: Outreach Activities

NEPTUNE Canada Demonstration June 2-4, 2011 Overview: The NEPTUNE Canada annual workshop was the first appearance of Digital Fishers outside the DMAS environment. The workshop is a forum for existing and new researchers to discuss the present status of the undersea network, communicate research results, and define future directions. Justin Longo and Rod Dobell entered a poster for display and Justin Longo and Jodie Walsh demonstrated at the data fair. The handout and poster are available at this link <http://digitalfishers.net/wp-content/uploads/2011/12/DF-2-Pager-Updated-Nov.-10-2011.pdf>. Researchers were interested and curious about the science-oriented crowdsourcing/citizen science as a whole, but had comments on what they would like to see in correlation to the video data and how this could help them with their research. Also, the educational potential was recognized by Bamfield Marine Sciences Centre. Some examples of the discussions included:

- Researchers wanted to see the size of organisms - would be nice to have a grid overlay
- Researchers wanted to have a correlation of weather, light, spatial distortion, refraction
- Researchers thought it would be advantageous to have more data to go with depth, latitude and longitude more reference e.g., bathymetry
- Interested in project oriented videos from a timescale or yearly evaluation of an area
- Interest from a representative from the Department of Fisheries and Oceans; he commented on its potential to serve out a variety of videos through the interface not necessarily restricted to NEPTUNE Canada videos

AEHMS - Aquatic Ecosystem Health and Management Society June 15, 2011 Overview: The Aquatic Ecosystem Health and Management Society (AEHMS) promotes the understanding, remediation and conservation of the world's aquatic ecosystems through its ongoing series of conferences and publications. Dr. Rod Dobell participated in AEHMS X focussing on Digital Fishers as part of his presentation, "Techniques, Tools and Toys in the 21st Century: Web-enabled Platforms for Citizen Science and Civic Engagement in Integrated Coastal and Marine Spatial Planning." The presentation is available at this link: <http://digitalfishers.net/wp-content/uploads/2011/12/AEHMS-REVISED-July-21-2011.pdf>

Salish Sea Ecosystem Conference Data Fair October 23, 2011 Overview: The 2011 Salish Sea Ecosystem Conference was held October 25 to 27, 2011 at the Sheraton Wall Centre in Vancouver, British Columbia. This event brought together a diverse group of government officials, community leaders, First Nations and tribal members, environmental managers, scientists and academics to learn from each other about the state and threats to our shared ecosystem. Many connections were made with people locally and in Washington on both the Digital Fishers project and more generally NEPTUNE and VENUS - see blog post on <http://sea-media.org/mediaitems/201111/digital-fishers-science-g> Posters and presentations will be available on the website salishseaconference.org for all participants. Dr. Dobell's presentation ("Digital Fishers in the Salish Sea: Cutting Edge Science for Inclusive Public Policy") is available at http://digitalfishers.net/wp-content/uploads/2011/12/o8Proceedings_Dobell.pdf

TedX Vancouver: Dr. Kate Moran, Director, NEPTUNE Canada included Digital Fishers as part of her presentation November 12, 2011 Overview: TEDxVancouver is part of the TEDx family of events. TEDx is a program of local, self-organized meetings that bring people together to share a TED-like experience. The

following comment came from Stacy Ashton, Executive Director, Community Volunteer Connections: “I was inspired by your TedX talk yesterday. I run Community Volunteer Connections, a volunteer centre in Coquitlam. It’s part of our job to tell people about unique and exciting ways they can volunteer ... thank you again for such a fascinating look at connecting the oceans to the Internet – it’s an amazing project!” Ms. Ashton’s blog post is available at: <http://www.volunteerconnections.net/blog/blog-post/community-volunteer-connections-blog/2011/11/23/volunteering-for-science-%28and-fun%29>

Monterey Middle School Demonstration November 24th, 2011 Overview: Jessica Nephin and Jodie Walsh presented to a grade 7 class at Monterey Elementary in the computer lab. Prior to playing Digital Fishers, the children were led through a slide show and brief overview of NEPTUNE Canada, the concept of crowdsourcing and citizen science. They then had 30 minutes to play Digital Fishers. There was a lot of enthusiasm in the room for some of the creatures that they saw and they were very interested in the hydrothermal vents shown in the video clips. Some challenges included registering for Oceans 2.0 and learning how to use the tutorials as a resource for annotations. There was an interesting comment was from one student who was confused about presence and absence of “sealife”. He said, “there is always “sealife” present like zoo-plankton, bacteria etc.” Both the students and the teacher found the word “annotation” a challenge. Some students were unsure when to save their annotation. Overall they had fun with the treasure hunt of finding different types of sea life, cards, etc. A few users moved quickly through the first level and advanced to level 2.

Appendix 2: Focus Group Details

Focus groups were an important method of collecting information for program evaluation purposes, using carefully designed questions in the context of group interviews. Information and insights from the group participants and the group as a whole are derived from the interaction between the moderator and the group, as well as the interaction between focus group members.

These three focus groups (and one related school demonstration) were conducted in November 2011, and also served to assess user satisfaction with the Digital Fishers system. Rod Dobell, Justin Longo, Jessica Nephin, and Jodie Walsh designed the questions and were key facilitators of these events. Justin Longo acted as moderator for all of the focus group discussions.

Participants were recruited by email through local contacts, university research interests, and partner affiliates. Focus group times were arranged through a Doodle calendar and direct email contact. Once confirmed, participant's were given a brief overview of the project and asked to spend 10-15 minutes playing Digital Fishers prior to attending the session. These groups and participants were chosen for their diverse perspectives and expertise. As the final version of Digital Fishers was still in production and not available outside of the NC local area network infrastructure, the groups focused on the version available online. Questions and demonstrations were specifically designed to bring out the interest and expertise of each group. Justin Longo moderated the sessions and guided the participants through the main questions with support from Jodie Walsh and Jessica Nephin. Demonstrations of the interface and the database query functionality were conducted by Jodie Walsh and Jessica Nephin.

1. Expert Focus Group: Archipelago Marine Research Ltd. - November 24th, 2011

Background:

The expertise of the Archipelago Marine Research Ltd. group was chosen because they routinely perform video analysis of imagery for a number of different purposes. Types of imagery review and data entry software and the data structures vary by project. Imagery review at Archipelago includes the following:

- Review of ROV survey imagery for the purposes of classifying habitat, enumerating fish and invertebrates and also measuring fish and invertebrates when required by the client.
- Review of underwater imagery collected using a towed camera system (SIMS) for habitat classification work.
- Review of areal imagery for coastal inventory and mapping.
- Review of electronic fishery monitoring (EM) imagery for enumerating fishery catches, and monitoring fisher compliance to regulations.

Data resulting from any imagery review are generally entered into a data file using a standardized structure and codes. These data are also accompanied by comments to document outside of the box observations. For some projects they design the data structure and coding and translate to a client's codes or structure if necessary. For other projects, the client may prescribe the data formats to be used.

Participants:

1. Jen Paton: Sea Observer Programs Operations Manager (Participates in DFO Inshore rockfish ROV surveys and imagery analysis)
2. Robyn Andrew: Electronic Fishery Monitoring Data Manager (Coordinates EM data processing and imagery review)
3. Scott Buchanan: Responsible for oversight of all of the fishery observer programs and helps coordinate ROV surveys and imagery review as well as some EM fishery monitoring projects
4. Andrew Fedoruk: Manager, Technical Services Division
5. Brian Emmett: Co-founder, Vice President, and Senior Advisor Research and Program Development

Questions

1. One aim of Digital Fishers is to filter a vast and increasing collection of largely analyzed sea-floor videos through the addition of tags (annotations) by Digital Fishers users who may vary from inexperienced beginner to expert in the field. This “filter” would serve primarily to tag sections of video where nothing (which we define as no organism) is present.
 - Which level do you think is a reasonable starting point for a first time user or imagery analyst? What can we reasonably expect a novice to do?
 - How confident would you be in restricting your analysis to sections of video that were filtered by a pool of Digital Fisher users?
 - Would your confidence in public annotations increase as the number of users making annotations increases?
 - Do you think this presence/absence approach is valuable?
2. We are trying to strike a balance between a simple interface (akin to data entry software) for the benefit of Digital Fisher users and a high level of detail in the resulting database for the benefit of research scientists.
 - Which, if any, categories in the interface do you find particularly useful?
 - Which, if any, categories in the interface do you find redundant?
 - Which, if any, categories in the interface may be possible sources of confusion for the user? Possible sticking points?
 - What is the finest level of taxonomic and size detail you extract from sea-floor video imagery, in terms of species identification and habitat classification, and how would it compare with Digital Fishers level 5.

3. Digital Fishers currently has no formal evaluation in place to determine the accuracy of user annotations. We rely on the principle of crowd sourcing as a measure of quality control.
 - In what ways do you measure quality control of video imagery analysis (do you do performance evaluation on analysts' work)? For example the use of confidence tags and ID/classification guides. Does the absence of a quality control / evaluation system in Digital Fishers concern you?
 - Do you feel that the complexity of the interface, at higher Digital Fisher levels, could detract from the quality or accuracy of the resulting annotations? Does your confidence in the annotations made decrease at higher levels?
 - Do you think an additional tag, marking the level of confidence of the user would be useful in quality control?
 - Do you currently have a system in place to measure confidence in your identifications / classifications during image analysis? If so, how is it structured?
4. Could you see a potential use for this kind of data in your work or industry? Is level 5 a potentially useful professional video annotation system?
5. Could you imagine crowdsourcing (either free or paid) some of the work you do?

Main Findings:

The experts were mainly enthusiastic about the use of crowdsourcing in the professional environment. There was caution about the use of a detailed annotation system beyond level 3 and suggested further work on quality control measures would increase their trust in the annotations. They saw value in having this system as a first pass filtering of video for projects not involving issues of confidentiality (such as DFO projects), they liked the idea of using the crowd as a filter when looking for rare species or rare events which relates to their environmental monitoring work.

Confidence in public annotations:

- They were more comfortable with a 20+ pool of annotations to draw on rather than a singular user, and thought that this could increase the accuracy of annotations to a reasonable level
- Confidence would depend on how challenging the task (level) was.

Binary presence/absence approach:

- They saw value in the presence/absence approach but for their purposes would have used this in a more specific way i.e., presence/absence of fish on a hook or presence/absence of a certain species/grouping.

Annotation categorization:

- They pointed out that there were sources of confusion with common names (such as spider crab and tanner crab)
- These are possible sources of confusion as the interpretation of a common names may change from place to place. This issue arises more generally as a concern with the need to bridge language and

vocabulary as between the science users or the database of annotations and the non-expert Digital Fishers as users of the interface.

- They emphasized the importance of the tutorial in playing a key role in standardizing the annotations made and suggested a forced tutorial pop-up when advancing to each level.

Taxonomic detail:

- They annotate generally to the genus level (which could be thought as a level 6) but also when possible to the species level (level 7).

Quality control measures:

- The absence of quality control was an issue for them.
- They were concerned with users that may not even attempt to annotate correctly and wanted to see a means of evaluating performance.
- Their methods of quality control are direct assessment,. They annotate to the level of certainty (ie genus as opposed to species) and flag items to be sent to an expert in the field.
- What are too difficult to ID Complexity of the interface and accuracy: It was pointed out that level 3 was the highest level they would have confidence in a non-expert making annotation. Level 4 and 5 may be too challenging for non-experts resulting in low quality annotations. (There was even some question of whether certain sealife tags such as coral in level 3 were too difficult to annotate for)

Confidence:

- They felt the user probably does not have the ability to judge their own confidence. A confidence ID may become a measure of user confidence as a person not user confidence in their annotation.

Current practice to measure confidence in classifications:

- If Marine Archipelago were not confident with their identifications when tagging video, they would “flag” it to be sent to an expert for further identification or revert to a simpler identification. i.e. class vs. genus.

Potential / Level 5:

- Level 5, may be too simplistic, due to the lack of scientific names or IITIS codes.
- There are also many descriptors at level 5 that are at the family or order level, they usually annotate to the genus or species level.

Could you imagine crowdsourcing (either free or paid) some of the work you do?

- For projects not involving issues of confidentiality (such as DFO projects), they liked the idea of using the crowd as a filter when looking for rare species or rare events which relates to their environmental monitoring work.
- They were confident in using crowd-sourcing as a filter, if the task of filtering was a simple one. Especially where the filter is used to reduce the pool of video clips for the expert to view later.

Other notes:

- They brought up the interesting idea of allowing expert users to jump directly to level 4 or 5, this way we are more likely to engage our most valuable users. The idea of a test during / post registration was one idea on how to implement this.

2. Science Focus Group - November 30th, 2011

Background

The expertise of this science focus group were elicited because they could be the primary users of the annotated data, they routinely perform video analysis of video imagery, they come from diverse backgrounds, and they have an understanding of the NEPTUNE Canada observatory. For purposes of evaluation of the citizen science approach with the Digital Fishers interface, it is important to understand whether the scientific community finds value in the annotated database and confidence in the annotations and how successfully current features addresses their research needs and if there are ways we can improve confidence and promote use.

Attendees:

1. Dr. Ken Denman: Chief Scientist, VENUS Coastal Network, University of Victoria
2. Maeva Gauthier: MSc Student, School of Earth and Ocean Sciences, University of Victoria
3. Françoise Gervais: Research Assistant (imagery analysis), NEPTUNE Canada, University of Victoria
4. Jonathan Rose: Research Assistant (imagery analysis)⁵, VENUS Coastal Network, University of Victoria
5. Rod Dobell: Senior Associate, Centre for Global Studies, University of Victoria
6. Justin Longo: Senior Associate, eBriefings.ca
7. Jessica Nephin: Research Assistant, Digital Fishers Project, University of Victoria
8. Jodie Walsh: Research Coordinator, University of Victoria.

Questions

1. Filtering: Can “Nothing was there” or “Nothing Interesting Present” be a valuable question to ask at the end of a 15 second clip? Nothing can be a subjective term however in this case, do you feel comfortable assuming that a Digital Fishers viewer can confidently assess the presence/ absence of larger epifauna? If so, would this be useful to you?
2. Quality Control: Do you feel the complexity of the annotations detracts from their quality?
3. Mission-Based Activities
 - The annotations change from level to level. This creates a complex database with many different variables describing the same object/species. This could potentially cause problems in the mission based approach where data is compiled on one specific topic. Can you see the existing variables working for a mission based approach? Would you like to have control over the categories and variables for “your” mission based project?

⁵ Jonathan Rose also brought in comments from a colleague.

- Do you think the mission based approach would lead to an increase in annotation quality, by simplifying and constraining the choices and by adding an aspect of direct involvement? Direct involvement could be emphasized by providing information about the mission based project and its success, do you think this is realistic?

4. Overall: **Can you see a potential use for this kind of data in your research? Could you imagine crowdsourcing (either free or paid) some of the work you do?**

Main Findings:

This group was enthusiastic about the engagement aspect of the project and interested in ways to use the crowdsourcing tool to fit their needs. An example was offered of a researcher who divided up his video analysis on YouTube in order to use volunteers to sift through more video than he had time to do on his own. There was some apprehension on the reliability of the crowd and suggested solutions for quality control. Quality was also a main topic of conversation regarding the vocabulary associated with the annotation choices as they relate to the crowd and how they are useful as a common standard for dispersal among the scientific community.

Filtering:

- The question of a binary filter brought up the issue that the phrasing would have to be carefully worded as someone's "Nothing was there" or "Nothing Interesting Present" is subjective to the background and personality of the viewer.
- When we talked about the "mission approach" the idea of a clean binary question seemed useful. For example, "trawl marks" or "no trawl marks".

Quality Control:

- The majority of the discussion was on ways that the annotated data would be more reliable.
- Concerns ranged from having too much detail in the annotation categories increasing the risk of error.
- Substantive discussion regarding the challenge of using a language that is accessible to the crowd and a useful/current standard for marine science users.
- Suggestions for improvements to the quality control included:
 - forced tutorials that users would complete in order to annotate at a higher level
 - emphasis on education
 - ability to rate other annotations and see the level or score of another player
 - ability to annotate on the video screen providing an x and y axis point
 - keep annotations general

Mission-Based Activities:

- Consensus that different research initiatives could be a valuable tool.
- More quality with specific questions (yes or no / presence or absence) could be served out to the crowd with simple responses.
- Ideas included:
 - research on trawl marks, limpid presence, tube worm surveys

- there was some recognition that a broader research initiative could include time series research of a specific environment.
- It was also pointed out that this mission approach could serve as a way to build awareness around specific research or focus.

Other:

- The researchers had an appreciation for the engagement opportunities that the tool provides
- Some felt more compelled to annotate because of the gamification structure i.e., cards, leveling and all time leader statistics.
- They remarked that they felt that there was a good balance between science and game.

3. Educators Focus Group - November 30th, 2011**Background**

Information from the usability testing, the NEPTUNE Canada workshop, and the Salish Sea Eco-system Conference pointed to the potential with Digital Fishers as an engagement platform especially in regards to its educational function. The expertise of the educators were chosen because of their diverse perspectives including curriculum instruction, interest in marine science and/or technology in the classrooms, and broad perspective of the current educational system.

Attendees:

1. Jeff Hopkins: School District 64, Superintendent
2. Mijung Kim: Department of Curriculum and Instruction, University of Victoria, Science Education
3. Dr. Leslee G Francis Pelton: Department of Curriculum and Instruction, Technology in Education, University of Victoria, created Math Tappers Climate App
4. Tim Pelton: Department of Curriculum and Instruction, Technology in Education, University of Victoria, created Math Tappers Climate App
5. Steven Toleikis: School District 61, Grade 5 teacher, KnowledgeQuest website developer, and curriculum developer
6. Rod Dobell: Senior Associate, Centre for Global Studies, University of Victoria
7. Justin Longo: Senior Associate, eBriefings.ca
8. Jessica Nephin: Research Assistant, Digital Fishers Project, University of Victoria
9. Jodie Walsh: Research Coordinator, University of Victoria

Questions:

1. Engaging: Can you comment on the “game” aspect of Digital Fishers?
2. Pedagogical:
 - Do you see this fitting in the curriculum? (Prescribed learning outcomes for any all grade levels.)

- What additional learning materials if any would be needed?
 - Do you see the cards as a tutorial device?
3. Groups:
- Would a group function on the interface be helpful in managing activity?
 - What functionality would you like to see in terms of classroom groups? What would you like to report on or evaluate your students on?
4. Registration: You have all logged in using the NEPTUNE registration process. Do you see any issues with this registration and log in in the schools?
- 5. Do you see the educational potential in your classroom?**

Main Findings:

The educators all responded very positively to Digital Fishers and the potential the tool has to engage students and be relevant as a classroom resource. This enthusiasm was prevalent in both the regrets that were sent from those who were unable to attend the focus group session, during the evening session, and in subsequent discussions. Some of the recommendations included have more contextualizing around the experience, the wish for a greater ability to “share” with classmates or friends through social media, the potential in the cards as an educational tool and an engagement tool through the linking of a Mobile Application, and the definite need for marine resources in the classroom. It was evident that while there was substantial enthusiasm for the potential, further work would be needed to focus on supplemental curriculum materials.

Engaging and Pedagogical aspect:

- Curriculum and supplemental materials were a large component of the discussion especially because of the lack of oceanographic resource materials for the classroom. A comment was made that teachers need science to be accessible to them (so they can become comfortable teaching the material) and that Digital Fishers could help bridge this gap. There was also a recognition that the abundance of resources on space made it easier for teachers to provide instruction; however, there are currently very few resources on the ocean sciences. Suggestions included:
 - use of the cards to build virtual food webs
 - use a screen capture to create a comic book, story, or video essay
 - keep track of the locations you have been - create a log or participate in mapping the sea bed (Google Maps was an example of this)
 - need for a mechanism for project based learning
 - potential use of Digital Fishers as a way to log mandatory volunteer hours
 - kids research their own questions by viewing the videos, creating their own hypothesis, and using the annotations on the NEPTUNE Canada database to inform their conclusions
- There is potential to promote further engagement and interaction with other educators including suggestions for the use of online platforms (i.e., wikis, blogs etc.) to promote a collaborative

community of practice connected to Digital Fishers as a way of sharing supplemental material, sending ideas, having champions, rating lesson plans etc.

- Need to be iPad compatible as teachers are moving towards using these in the classroom
- Suggestion to be connected outside of the interface including the ability with sharing the interface in a variety of ways through Web 2.0 features as a way to promote learning and engagement. Examples include email, image screen capture, link to video, sharing and trading of cards through mobile application, tweeting of interesting videos or cards achieved, include top 10 videos shared on the interface
- This group wanted more contextualization of the experience including:
 - Understanding how they were contributing to science
 - Understanding what the current objective or “research question” (we are currently calling this the “mission”)
 - Understanding what the current clips related to
 - Understanding what the career potential is in ocean sciences, underwater video analysis etc.
 - Making the experience richer by adding a sound feature as a dimension of experiential learning - some examples included whale sounds, sounds collected from hydrothermal vents, or submarine sounds to get the virtual feeling of an overall underwater experience
 - Making the experience more participatory through the ability to click what you are annotating on the screen

Group function:

- They liked the idea of a group function as a way to have administrative privileges, monitor the classroom experience, track student progress and statistics, and provide classroom specific assessment

Other:

- The issue of registration did not seem like a problem as they could easily get around user names by having the kids sign in with a group name

Appendix 3: Evidence from Annotations

Digital Fishers User Statistics

Total number of annotations = 2040 Dec 2, 2011

Note: 2626 total annotations including those by DF/DMAS users (22% of total annotations)

Total number of Users = 103 Dec 2, 2011

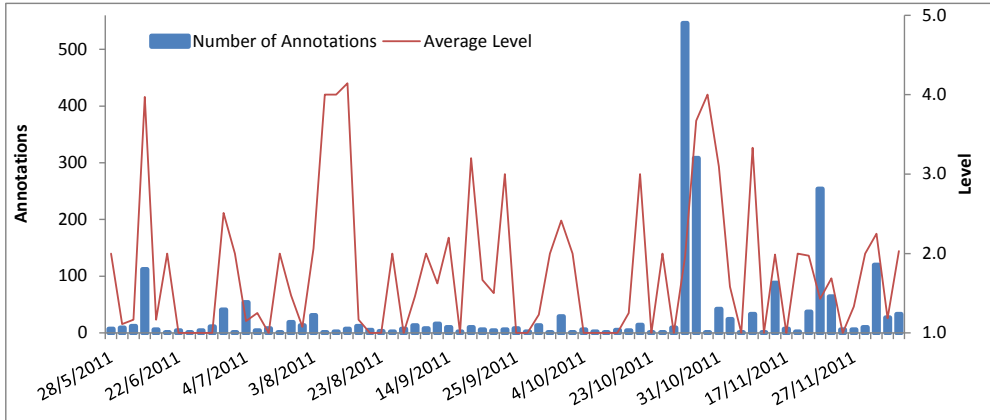


Figure 1: The number of **Annotations per Day** from 28/05/2011 to 02/12/2011 (only plotting days when annotations were made). The average level represents the average level that annotations were recorded from that day.

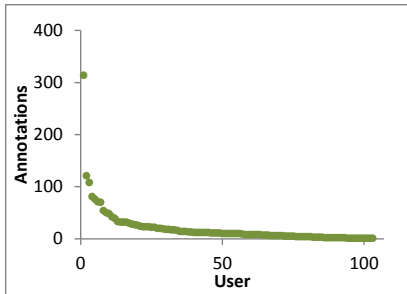


Figure 2: The number of total **Annotations per User**. Each user ranked in order of the number of annotations they recorded up to 02/12/2011.

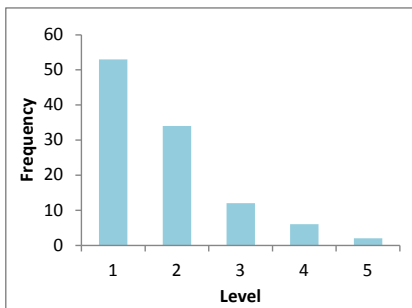


Figure 3: The number of **Users per Level**. Total number of users up to date is 103.

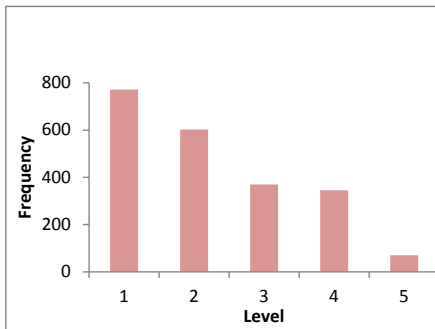


Figure 4: The number of **Annotations per Level**. You may expect in the future to have more annotations at higher levels due to the level requirements however at this early stage the number of annotations per level is highly influenced by the number of users per level (Figure 3)

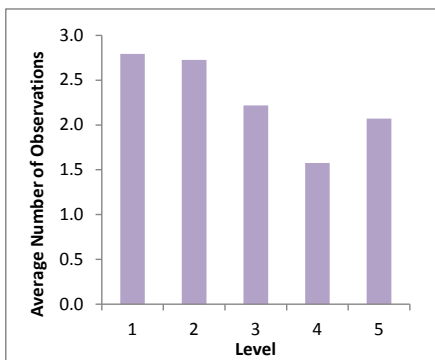


Figure 5: The average number of **Observations per Annotation** at each level. The total number of observations possible per annotation is 5.

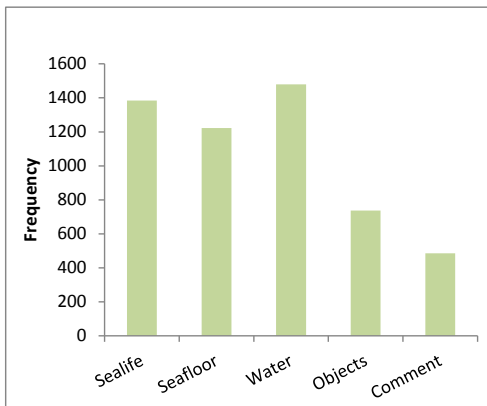


Figure 6: The number of **Observations in each Category** over all levels.

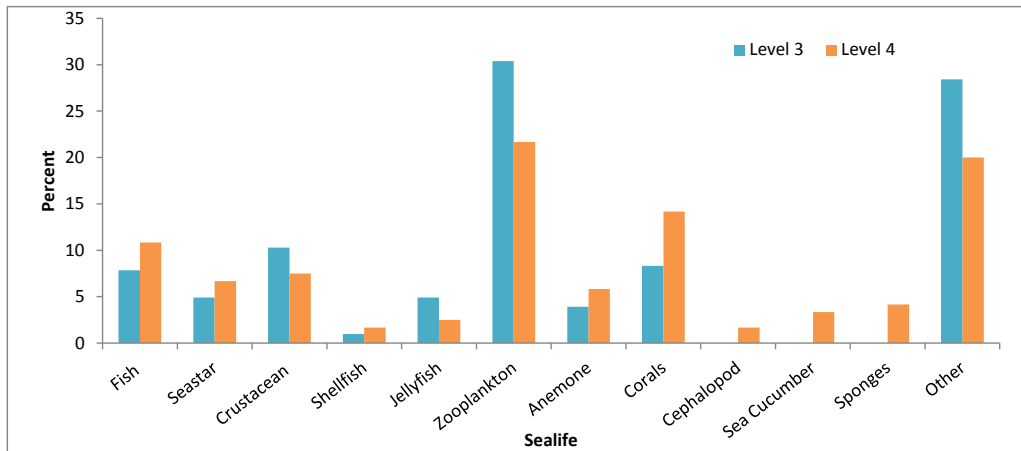


Figure 7: The percent of **Sealife Observations by Category** for level 3 and level 4. Some categories in level 4 were condensed to facilitate comparison with level 3, for example, pelagic fish and benthic fish became fish. Level 4 categories: Cephalopod, Sea Cucumber and Sponges have no comparable categories in level 3.

Evaluation of User Accuracy

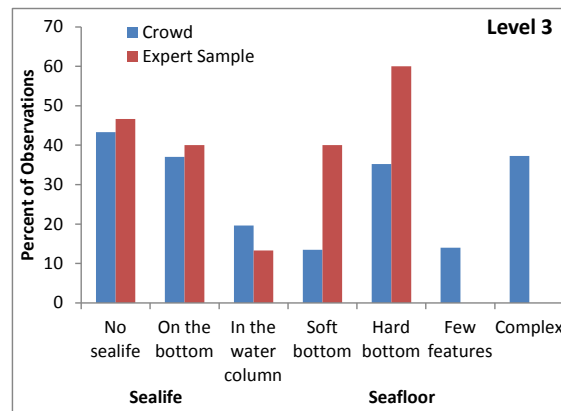
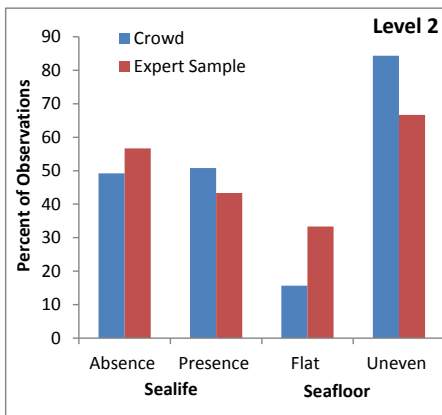


Figure 8 and 9: Represent the percent of the **Observations in each Category** for level 2 and level 3, respectively. The crowd represents the total observations in that category to date (02/12/2011) and the expert sample represents a 30 video clip sample analyzed by a graduate student versed in underwater video analysis. The relatively large discrepancies in the seafloor category may stem not from the difficulty of the novice user to grasp the task at hand, but from vague, abstruse categories such as few features and complex and the deficient illustrations in the tutorial that describe them. The apparent discrepancy, in both sealife and seafloor categories, may be caused in part by real differences due to fluctuations in ROPOS dives over time that steam into Digital Fishers because annotations by the expert where not completed over the same time period as the majority of the crowds' annotations.

Crowdsourcing Analysis

To date, there were only 54 annotations for 'Sealife' where multiple annotations have been gathered at the same point in time (for the same video 'clip'). Most of these annotations were only associated with one other annotation for the same clip. The largest number of annotations per clip was a crowd of 7. Multiple annotations per clip by one single user were removed, in order to assess the accuracy of the crowd and not the return accuracy of a single user. Annotations were marked as 'Agree' if they matched the other annotation(s) for the clip and were marked as 'Differ' if the annotation differed from the consensus of the crowd. I found that **81% of annotations agreed** and only **19% differed** from the crowds' judgment. This approach did not evaluate the correct annotation (video clips were not watched to determine which users were right) but judged annotations solely on their agreement with the crowd.

Accuracy by Level

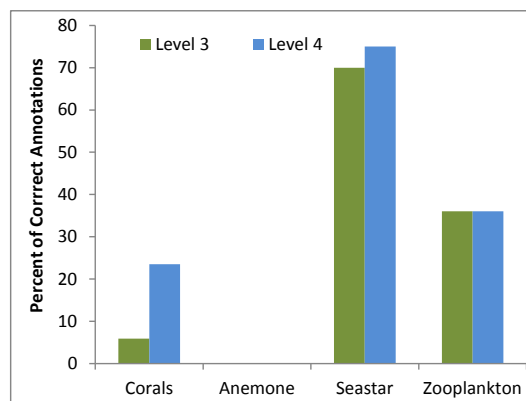
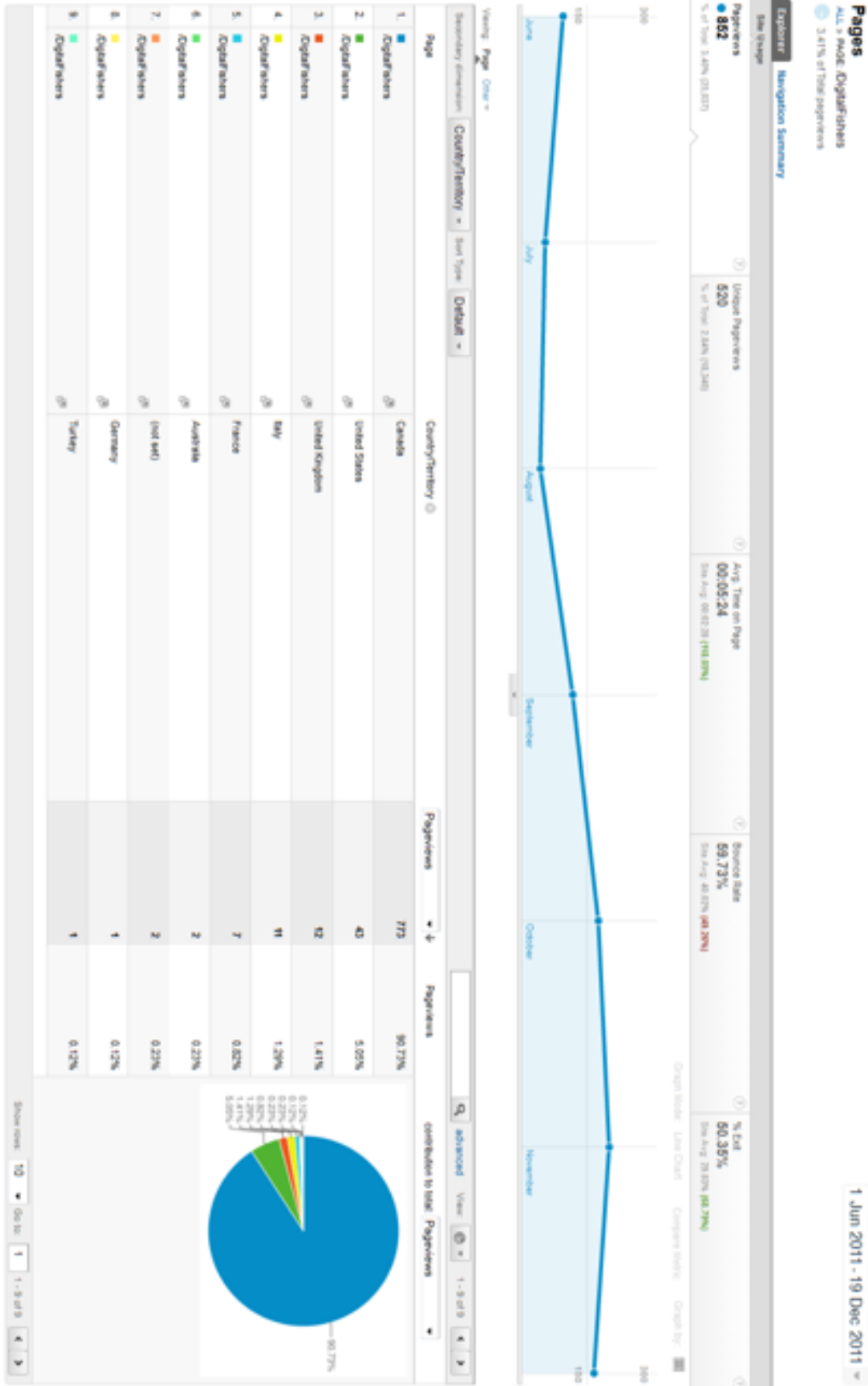


Figure 10: The percent of **Correct Annotations by Category** for level 3 and level 4. Annotations were evaluated based on the accuracy of the observation. Sealife level 3 and level 4 were used in this analysis because they share categories. Level 5 could not be used because of the limited number of users. The sealife category was chosen because it is less subjective than water and seafloor which are subject to gradation. The sealife categories (Corals, Anemone, Seastar and Zooplankton) were chosen for their consistency between level 3 and 4 and the large number of annotations to date. Due to the large amount of annotations for zooplankton, the evaluation was performed on a random sample selected from each level.

Appendix 4: Website Analytics







Viewing Page 2/20

Showing 20 of 42

Page	City	Requesters	Single Requesters	Avg Time on Page	Source Rate	% Exit
21	Requesters	Requesters	2	00:00:00	100.00%	100.00%
22	Requesters	Requesters	2	00:24:26	0.00%	50.00%
23	Requesters	Requesters	2	00:00:00	100.00%	100.00%
24	Requesters	Requesters	2	00:00:53	0.00%	50.00%
25	Requesters	Requesters	2	00:00:16	0.00%	50.00%
26	Requesters	Requesters	2	00:00:46	0.00%	50.00%
27	Requesters	Requesters	2	00:00:00	0.00%	100.00%
28	Requesters	Requesters	2	00:00:00	0.00%	100.00%
29	Requesters	Requesters	2	00:00:00	100.00%	100.00%
30	Requesters	Requesters	2	00:00:00	0.00%	100.00%

Showing 10 of 21

Viewing Page 3/20

Showing 20 of 42

Page	City	Requesters	Single Requesters	Avg Time on Page	Source Rate	% Exit
31	Requesters	Requesters	2	00:00:00	0.00%	100.00%
32	Requesters	Requesters	2	00:00:00	100.00%	100.00%
33	Requesters	Requesters	2	00:00:00	0.00%	100.00%
34	Requesters	Requesters	2	00:00:14	0.00%	0.00%
35	Requesters	Requesters	2	00:00:00	0.00%	100.00%
36	Requesters	Requesters	2	00:00:00	0.00%	100.00%
37	Requesters	Requesters	2	00:00:00	0.00%	100.00%
38	Requesters	Requesters	2	00:23:16	0.00%	0.00%
39	Requesters	Requesters	2	00:00:00	0.00%	100.00%
40	Requesters	Requesters	2	00:00:00	0.00%	100.00%

Showing 10 of 21

Viewing Page 4/20

Showing 20 of 42

Page	City	Requesters	Single Requesters	Avg Time on Page	Source Rate	% Exit
41	Requesters	Requesters	2	00:00:00	0.00%	100.00%
42	Requesters	Requesters	2	00:00:00	100.00%	100.00%

Showing 10 of 13

Appendix 5: User Survey



Summary Report

(Completion rate: 70.18%)




Age

The 52 response(s) to this question can be found in the appendix.














Gender

Response	Chart	Percentage	Count
Female		37%	19
Male		63%	33
Total Responses			52

[country] Where do you live?

Response	Chart	Percentage	Count
Canada		94%	47
United States		6%	3
United Kingdom		0%	0
Total Responses			50

[province] What province?

Response	Chart	Percentage	Count
Alberta		0%	0
British Columbia		93%	42
Manitoba		0%	0
New Brunswick		0%	0
Newfoundland and Labrador		0%	0
Northwest Territories		0%	0
Nova Scotia		0%	0
Nunavut		0%	0
Ontario		4%	2
Prince Edward Island		0%	0
Quebec		0%	0
Saskatchewan		2%	1
Yukon		0%	0
Total Responses			45

Highest Education Level Attained

Response	Chart	Percentage	Count
No formal schooling completed		0%	0
I'm currently in elementary school		0%	0
Elementary School		6%	3
Middle School		53%	25
High School		4%	2
College Diploma		0%	0
Professional Certificate		4%	2
University Degree		15%	7
Post-graduate Degree		17%	8
Total Responses			47

[inschool] Are you currently a student?

Response	Chart	Percentage	Count
Yes		66%	33
No		34%	17
Total Responses			50

[studying] If yes, what level of education are you pursuing?

Response	Chart	Percentage	Count
Elementary School		0%	0
Middle School		82%	27
High School		0%	0
College Diploma		3%	1
Professional Certificate		0%	0
University Degree		3%	1
Post-graduate Degree		3%	1
Other		9%	3
Total Responses			33

How Often Do You ...

	Never	Once a month	Once a week	Daily	Total
Send and receive email?	6 (13%)	7 (15%)	8 (17%)	26 (55%)	47
Send and receive sms / text messages?	21 (46%)	6 (13%)	7 (15%)	12 (26%)	46
Use a mobile smartphone (iPhone)?	28 (61%)	3 (7%)	4 (9%)	11 (24%)	46
Use a mobile device (e.g., iPad)?	21 (46%)	2 (4%)	7 (15%)	16 (35%)	46
Write on your own blog?	32 (71%)	6 (13%)	6 (13%)	1 (2%)	45
Use Twitter or other microblog?	38 (83%)	1 (2%)	3 (7%)	4 (9%)	46
Use Facebook / Google+ / LinkedIn or other social networking service?	19 (41%)	3 (7%)	4 (9%)	20 (43%)	46

[fan] Have you joined online projects like Digital Fishers before? (e.g.: SETI, Zooniverse, Stardust@Home, Wikipedia)

Response	Chart	Percentage	Count
Never - This is my first time.		68%	32
One or two - I like to take part when I can.		23%	11
Several - I am an online citizen science fanatic.		9%	4
Total Responses			47

[fav] Do you have a project that you consider a favourite?

The 5 response(s) to this question can be found in the appendix.

[favs] Do you have some projects that you consider favourites?

The 3 response(s) to this question can be found in the appendix.

How did you find out about Digital Fishers?

Response	Chart	Percentage	Count
At school		61%	28
At work		7%	3
From a friend / family member		7%	3
From a colleague		9%	4
On Twitter		4%	2
On Facebook		2%	1
Other web formats - e.g., science blogs		2%	1
Search engine		2%	1
NEPTUNE Canada website		17%	8
Zooniverse / Citizen Science Alliance		0%	0
scienceforcitizens.net		0%	0
Link from another web site		2%	1
Traditional media		20%	9
Museum exhibits/kiosks		0%	0
At a conference (which one?)		2%	1
Other		13%	6
Total Responses			46

Why are you a Digital Fisher?

Response	Chart	Percentage	Count
Interested in marine science		30%	13
Interested in science in general		32%	14
Interested in making a contribution to real science		32%	14
I like to play the game		18%	8
Specific interest in this project		20%	9
I would like to use Digital Fishers for instructional purposes		0%	0
A school assignment		34%	15
Curiosity		25%	11
Have free time		7%	3
Other - please specify:		20%	9
Total Responses			44

In a few words, can you tell us what your particular interests are -- e.g., fish, marine plants, sediments or sea floor, fishing, the environment, SpongeBob SquarePants, computer games.

The 33 response(s) to this question can be found in the appendix.

Please tell us what you thought about the Digital Fishers system

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree	Total
The videos were interesting	0 (0%)	2 (5%)	5 (12%)	12 (29%)	11 (26%)	12 (29%)	42
There were no glitches or problems with the system	9 (21%)	6 (14%)	7 (17%)	4 (10%)	7 (17%)	9 (21%)	42
The video clips were too short	4 (11%)	10 (26%)	6 (16%)	12 (32%)	1 (3%)	5 (13%)	38
The map was helpful	0 (0%)	1 (2%)	6 (15%)	10 (25%)	17 (42%)	6 (15%)	40
The tutorial was helpful	0 (0%)	5 (13%)	7 (18%)	6 (15%)	16 (41%)	5 (13%)	39
I liked the cards	1 (2%)	1 (2%)	8 (20%)	8 (20%)	15 (38%)	7 (18%)	40
The "how to play" pop-up was helpful	0 (0%)	2 (5%)	7 (19%)	8 (22%)	15 (41%)	5 (14%)	37
The video clips were too long	13 (32%)	16 (39%)	6 (15%)	4 (10%)	1 (2%)	1 (2%)	41
I like the interface	0 (0%)	5 (13%)	3 (8%)	9 (24%)	16 (42%)	5 (13%)	38
It was easy to annotate the videos	0 (0%)	4 (10%)	5 (12%)	9 (22%)	14 (34%)	9 (22%)	41
I found it easy to get started	1 (2%)	4 (10%)	8 (20%)	4 (10%)	14 (35%)	9 (22%)	40
The higher levels were too difficult	8 (22%)	12 (32%)	8 (22%)	6 (16%)	1 (3%)	2 (5%)	37

If you have additional comments that weren't captured in the above questions, or any other comments you want to pass along, please let us know.

The 21 response(s) to this question can be found in the appendix.

Please tell us about your experience as a Digital Fisher

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree	Total
I like the idea of collecting cards and moving through the levels	4 (10%)	3 (7%)	2 (5%)	9 (22%)	17 (41%)	6 (15%)	41
It was interesting watching and annotating the videos	1 (2%)	3 (7%)	2 (5%)	7 (17%)	15 (37%)	13 (32%)	41
It was easy to move up through the levels	1 (2%)	5 (12%)	3 (7%)	9 (22%)	17 (41%)	6 (15%)	41

If you have additional comments that weren't captured in the above questions, or any other comments you want to pass along, please let us know.

The 10 response(s) to this question can be found in the appendix.

These questions are about your perceptions about the science value of the Digital Fishers project

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree	Total
I see the potential and possible use of the Digital Fishers project in my own research or work	7 (21%)	5 (15%)	5 (15%)	8 (24%)	8 (24%)	1 (3%)	34
I felt like I was making a valuable science contribution	2 (5%)	1 (3%)	4 (11%)	13 (34%)	14 (37%)	4 (11%)	38
I'm confident that I made accurate annotations	1 (3%)	1 (3%)	5 (14%)	16 (43%)	11 (30%)	3 (8%)	37
I was less certain about my annotations at higher levels	33 (85%)	12 (31%)	3 (9%)	9 (26%)	7 (20%)	7 (20%)	35
The categories or menus were not clear for scientific research purposes	34 (85%)	12 (31%)	0 (0%)	4 (12%)	13 (38%)	11 (32%)	34

If you have additional comments that weren't captured in the above questions, or any other comments you want to share, please let us know.

The 10 response(s) to this question can be found in the appendix.

[return] Will you be comfortable using Digital Fishers to tag more video?

Response	Percentage	Count
Yes	85%	33
No	15%	6
Total Responses		39

[noreturn] If no, is there anything else you would like to share?

The 3 response(s) to this question can be found in the appendix.

[yesreturn] Would you recommend Digital Fishers to your friends and colleagues?

The 29 response(s) to this question can be found in the appendix.

[sat] Overall, how satisfied are you with your Digital Fishers experience?

Response	Percentage	Count
Very Satisfied	31%	12
Satisfied	59%	23
Unsatisfied	10%	4
Very Unsatisfied	0%	0
Total Responses		39

[unsat] Was there anything specific that you didn't like?

The 1 response(s) to this question can be found in the appendix.

If you have additional comments that weren't captured in this survey, please include them here.

The 8 response(s) to this question can be found in the appendix.

Appendix

Age |

#	Response
1.	14
2.	34
3.	11
4.	12
5.	12
6.	12
7.	12
8.	12
9.	12
10.	12
11.	12
12.	11
13.	12
14.	12
15.	12
16.	12
17.	12
18.	12
19.	60
20.	12
21.	12
22.	12
23.	12
24.	12
25.	11
26.	12
27.	12
28.	12
29.	12
30.	12
31.	12
32.	12

[fav] Do you have a project that you consider a favourite? |

#	Response
1.	NO
2.	NO
3.	EteRNA
4.	wikipedia
5.	I enjoyed SETI

[favs] Do you have some projects that you consider favourites? |

#	Response
1.	glogster
2.	gloster
3.	Zooniverse

In a few words, can you tell us what your particular interests are -- e.g., fish, marine plants, sediments or sea floor, fishing, the environment, SpongeBob SquarePants, computer games. |

#	Response
1.	fish and sealife in general.
2.	gaming and sports
3.	computer games/ animals/ art/ softball
4.	Spongebob SquarePants computer games
5.	I enjoy computer games
6.	Computer Games
7.	I like to draw and learn about history
8.	Video games, biking, Socals Studies, food and mw3
9.	I am interested in dogs, ipod touches, basketball, soccer, dogdeball, and facebook
10.	i like to play sports and vid games
11.	i like to draw
12.	I am interested in sports and animals
13.	water
14.	i dont know?
15.	soccer, drawing, reading, hanging out with my friends
16.	I have always liked marine life and it was ausome to see it up close
17.	I don't know
18.	Computer Games
19.	ipod touch facebook dogs etc
20.	Helping more of the public realize that the ocean is a major part of their ecosystem, and giving them opportunities to see what's below the surface. I produce a nonprofit TV series about our Northwest waters, see more at SEA-Inside.org
21.	I am interested in what lives in the waters surrounding my home on Vancouver Island.
22.	Intertidal ecology, marine ecology, citizen science and crowd-sourcing, climate change.
23.	I am interested in the types of marine plants, fish, crustaceans that I see in the clips.
24.	Have BSc (Biology/Botany and MSc (Medical Genetics); interest in previously unreported life forms of all kinds; interested in increasing knowledge of undersea;
25.	marine life, sea floor (particularly changes in the sea floor)
26.	fish, marine life, ocean changes, pollution, sea industries, cameras, internet communications, visual arts, blogging,

27.	biology
28.	marine life, sea floor characteristics, plate tectonics, geology, environment marine archeology
29.	marine biology dabbler, especially invertebrates docent at Vancouver Aquarium
30.	Fish
31.	The environment
32.	marine biology, geology, environment, tectonic action, oceanography
33.	Automated data acquisition systems, particularly video data, especially classification problems.

If you have additional comments that weren't captured in the above questions, or any other comments you want to pass along, please let us know. |

#	Response
1.	no
2.	NO I DON'T
3.	I enjoyed that it seemed like a race to make the most annotations. I think it would be the most fun playing in a group.
4.	The videos were out of focus and really slow. I had to push pause and then start to every video.
5.	i cant find any sea life
6.	The only thing that was wrong with mine is that the whole screen wasn't showing on the computer, half of it was cut off the screen, also some of the videos of water moving back and forth.
7.	I kind of like it because i got to see rocks and coral.
8.	You should make the videos more interesting and make a kids version that is easier and more fun for younger people.
9.	too slow
10.	I'd like to hear more about the project's evolution and feedback. There are of course other organizations collecting video that could benefit from such a cool technology.
11.	This is just Bob Crosby testing that your survey worked!
12.	It would be very helpful if you could annotate/"tag" more than one sub-category in each category, e.g. being able to choose "fish" and also "crustacean" if they're both in the video... sometimes I saw 4-5 different taxa and just had to choose one, which seems arbitrary: I would guess users are most likely to pick the biggest animal they see, skewing data toward fish, seastars, etc. Same applies to substrate: sometimes there is both soft and hard substrate in the video. Would also be useful to provide specific examples of NEPTUNE equipment... I couldn't decide if pipes were your equipment or being used for other projects, or not related to ocean studies at all.
13.	I have indicated that I don't like the cards much because, while recognising that they are older renditions would prefer that they were actual, modern pictures so that they are better learning aids and would help to give me greater confidence that my comments are accurate. Also, while I completely understand that you cannot spend time "holding hands" with your Digital fishers, some feedback as to the usefulness of my comments would be appreciated. It would also help to have the differences between "mud" and "sediment" explained.
14.	When there is particulate matter or ??? in evidence in the video, there is no consistent way to report the current flow of these objects. Is the computer reporting the direction of water flow or should the Digital Fisher report this as an observation???
	If the current flow is to be reported, Fishers should use the top as N and left side as W in order to be consistent/ John
15.	Finding the starting point for the game was a real challenge. Took me five pages on your site and three trips through google. You're going to lose people if it isn't blatantly obvious and super easy.

- | | |
|-----|---|
| 16. | I could not see any videos or use the interface with my iPad2. Does it require Flash? |
| 17. | I stumbled on a clip that is over an hour long (so fsr, it is still running) Apparently the camera was recording during the retraction back to its docking station and beyond. not much to see in the mid zone. Intend to write more on this when I visit the blog if possible |
| 18. | I'd like to be able to return to the previous clip, as there was sometimes more clarity as to what I had been seeing once the next clip came along.
I'd like to know how many clips there are, and how many people viewed the same clips as me, and what their annotations were. |
| 19. | Is the location that the "Fishers" use always fixed? I would welcome the opportunity to 'explore' more than one location. |
| 20. | It would be nice if there were a way to extrapolate sizes or distances. I.E. is the convergence point of the laser "sights" on the dive cam a certain distance from the camera? Or can you deduce from the ratio of the distance between the 2 points of contact of the light with an object to the remaining length of the laser lines or the distance to the frame of the picture? What is the size of the claws to use in a comparison? Or some way that I cannot guess? |
| 21. | Some comments on the design of the GUI for Digital Fisheries - it has some minor issues.
1. I would like to see scoring controls based on radio buttons that keep the same settings as the previous clip. Having to click the category and then select the response gets tedious, especially when it's the same for a lot of clips.
2. Having some sort of motion detection to select clips of interest would also make it more interesting.
3. When the marine life information card comes up, the clip continues to play behind it so I cannot see what happens, then I need to replay the clip. |

If you have additional comments that weren't captured in the above questions, or any other comments you want to pass along, please let us know. |

#	Response
1.	no
2.	NO NO
3.	still cant find any sea life
4.	idk?
5.	Some of the videos were a little bit boring just because it was water moving.
6.	bye
7.	I really haven't gotten very far level-wise yet. I do realize that many people respond well to opportunities to compete with themselves and/or with others. But my interest is more academic.
8.	Sorry about the "diagreess" but I was not able to get the interface to work.
9.	A reference guide would be helpful in distinguishing flora and fauna
10.	The "Leader" buttons are covered up by the "visit our blog" and "take the survey" unless you Use the "F11" button. (At least they are on my laptop). It would be helpful if you could continue to access the tutorials for the levels you have already passed. I can not always remember the names of marine life or other features later on. My computer locked up a couple of times. Seems o.k. now. Over all I think this is a great idea and I suspect that kids will love it.

If you have additional comments that weren't captured in the above questions, or any other comments you want to pass along, please let us know. |

#	Response
1.	no
2.	NO NO
3.	I felt like people care more about making the most annotations than making proper ones.
4.	i give up
5.	idk?
6.	I would prefer to answer "not applicable" to points 3 and 4 above. Also, though it may be covered in upcoming questions, I would like to mention that I found often that the tutorials would call things by different names than were actually available on the drop-down annotation menu. I found this caused me some confusion when it came to annotating, especially at the higher levels.
7.	My annotations did not capture all aspects of the video. See previous comment, re: being able to annotate for more than one sub-category/taxa.

- | |
|--|
| 8. Observation of current flow.....see previous comments |
| 9. Same |
| 10. Too many questions ;) |

[noreturn] If no, is there a reason why not? |

#	Response
1.	No i just dont have time in the day
2.	I DONT KNOW!!!!!!!!!!!!!!
3.	because i didnt like it

[yesreturn] Would you recommend this to your friends and colleagues? |

#	Response
1.	yes i would
2.	no
3.	Maybe.
4.	yes
5.	yes.
6.	Yes, I would!
7.	probaly not
8.	yes I would.
9.	Yes, it was very interesting!!!
10.	yes
11.	Maybe
12.	maybe maybe not
13.	NO
14.	yes, see my review at SEA-Media.org
15.	Yes, I would and have.
16.	yes
17.	Sure, but with many scientists/researchers among my friends and colleagues, they may be frustrated with the time needed to get to higher levels and not being able to annotate for everything they see.
18.	Oh yes, I am talking bout this to everyone I meet - Indeed am in danger of becoming a fisher-bore!
19.	If interested
20.	yes
21.	Yes, if I knew it would work for them.
22.	Yes
23.	yes
24.	yes - to some
25.	Yes, my daughters
26.	Absolutely
27.	yes
28.	Already have to a freind whose wife is a teacher.
29.	Yes!

[unsat] Was there anything specific that you didn't like? |

#	Response
1.	I wish you would put some indication of system requirements on your front end, so that those of us for whom it will not work can save our effort.

If you have additional comments that weren't captured in this survey, please include them here. |

#	Response
1.	no
2.	You should make it a kid's version too because sometimes it was difficult to understand.
3.	i want to find some sea life
4.	Keep up the good work, and if you have a newsletter, please add my name and email to it: "John F. Williams"
5.	smack my elected officials (figuratively) and remind them that citizens will work for free, if given the chance. smack them again and remind them that science isn't a thing, it's a process and bloody useful one at that then help them up and thank them for their time Thanks to all of you for your public service. Just because you're pulling in a salary, doesn't mean it isn't a service. Thank you
6.	Great project. I hope I can find a way to participate. Looks fascinating.
7.	Re: annotations I had difficulty distinguishing between "soft" bottom and "mud" bottom
8.	The survey is way too long.

Appendix 6: Open JIRA Tickets

1. **FIXED FOR DEC 2011**DMASEX-167 - Geometric progression - Should note here that older annotations can no longer be queried (can this be fixed?) [See example 1 below](#) -i think the ID number (primary key) orders them
2. DMASEX-165 - New User Pop up - How to play instructions - still needs graphics
3. DMASEX-160 - Move player controls - We had agreed to go with this for Sept.22 - but to fix the scrubber bar for Oct 15 (internal 184)
4. **FIXING FOR DEC 2011**DMASEX-159 - Video How2Play - Once a stable interface is developed we need to redo this video
5. DMASEX-163 - Rethink the annotation system - rethinking the annotation system ie NASA example on Zooniverse. Take a look as it will give you a good indication of what we are thinking with this <https://www.zooniverse.org/lab/neemo>. [See example 2 below](#)
6. **FIXED FOR DEC 2011**DMASEX-168 - Add Digital Fishers user survey button and link to engagement platform (this is especially important as we progress with evaluation) [See example 3 below](#)
7. DMAS 7051 - Add "not visible" option to Seafloor selector on Digital Fishers - currently says "no comment"
8. REQS 247 - Addition of level 0 including addition of larger marine mammal cards - Also documented as DMAS 7053
9. REQS 251 - Combine Landing Page
10. **FIXED FOR DEC 2011**REQS 295 - fix Black screen at end of video
11. **FIXED FOR DEC 2011**REQS 241 - User Levelling choice and flexibility to play at multiple levels
12. Query function - Murray had documented some searchable difficulties, Ron noted:[The links from the Annotations page that were supposed to open a specific dive in SeaTube were not working since no Dives occurred during the date associated with the Annotations. I'm not sure how the invalid date was captured but since the Annotations in question were created by Bob Crosby I am assuming it was either a bug that has been fixed or part of testing.](#)
13. **FIXED FOR DEC 2011**DMASEX-188 Improve annotation search table: Query function - capture time of annotation
14. Best user experience function - detection of bandwidth
15. REQS-301 - Landing page (what to do with)
16. 242 - Addition of Audio was listed as a priority #4 if there was time
17. **FIXED FOR DEC 2011**Tutorial for level 5 water quality to make sure it matches the annotation choices
18. "no comment" sticking on the annotation selection box rather than select
19. VENUS videos
20. Serve out specific videos
21. 15 seconds vs. 1 single point of time annotation
22. **FIXED** Jessica access to Jira
23. Group functions
24. **FIXED FOR DEC 2011**DMASEX-187 digitalfishers.net link When log in from registration goes to <http://dmas.uvic.ca/home> screen - there are no references to Digital Fishers so this is a deterrent for a new user
25. **FIXED** Digital Fishers 5 not working
26. Special pop up to tell you to annotate or question if you didn't see anything there or would like to go back and replay to add annotation
27. Under Annotations Search - call the Resource Type Digital Fishers rather than Device Data - if anyone starts to look at this side of things it is very difficult to know where to find your own annotations etc.

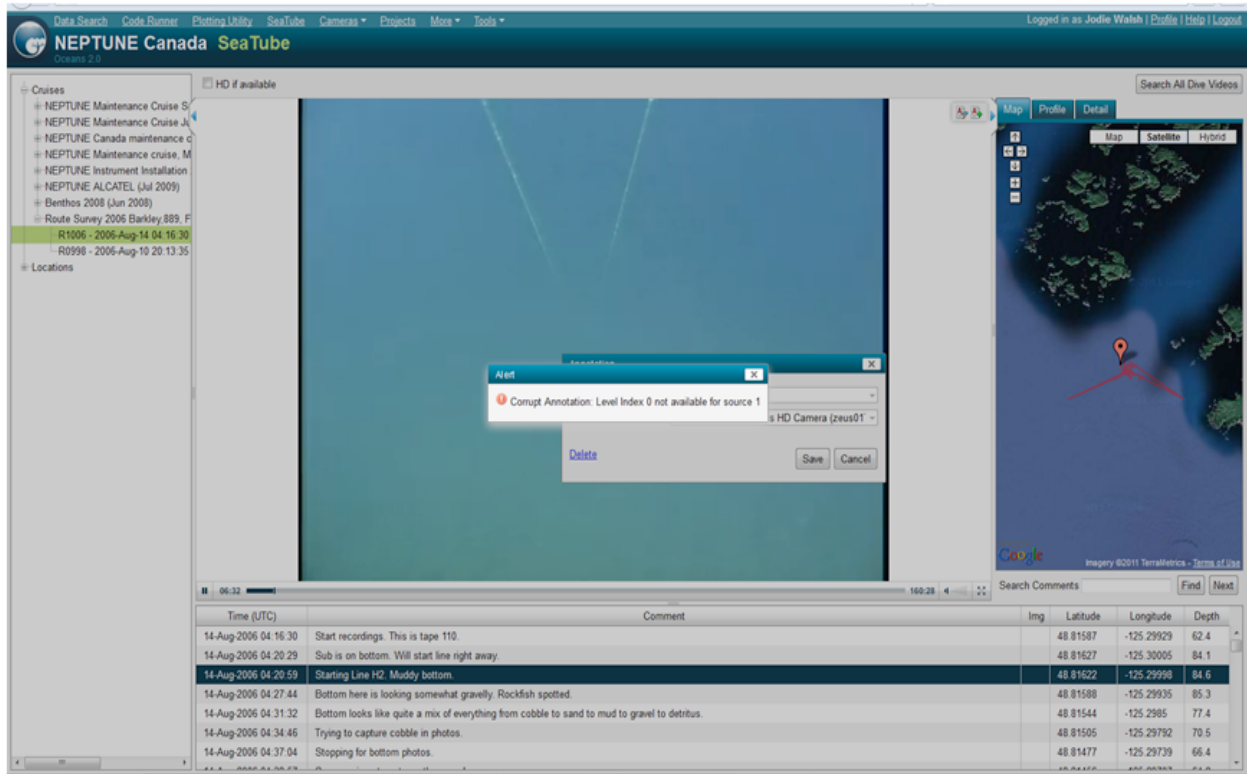
Ex. 1 DMASEX-167 - Geometric progression - Should note here that older annotations can no longer be queried (can this be fixed?) See image below

In the Query annotation side

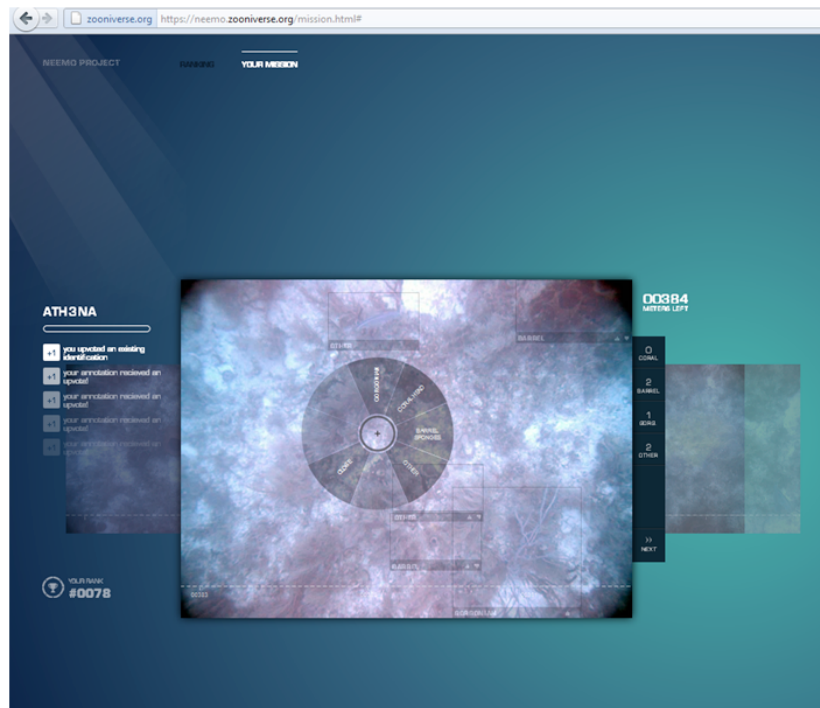
The screenshot displays the NEPTUNE Canada Annotations Search web application. A prominent error message is shown in a blue alert box at the top: "Alert Corrupt Annotation: Level Index 0 not available for source 1". Below the alert, the search interface is visible, including filters for Resource Type, Date, and Owner. A table of annotations is shown below the filters, with columns for ID, Resource Type, Resource Name, Start Date (UTC), End Date (UTC), Flagged, and Shared. The table contains several rows of data, all with a Start Date of 14-Aug-2006. An 'Alert' dialog box is also visible over the table, displaying the same error message.

ID	Resource Type	Resource Name	Start Date (UTC)	End Date (UTC)	Flagged	Shared
17552	Device Data	Insite Pacific Zeus Plus HD Camera (zeus017) Commissioning as of 201107 (1001)	14-Aug-2006 04:22:30	14-Aug-2006 04:22:45	false	false
17554	Device Data	Insite Pacific Zeus Plus HD Camera (zeus017) Commissioning as of 201107 (1001)	14-Aug-2006 04:22:29	14-Aug-2006 04:22:29	false	false
17555	Device Data	Insite Pacific Zeus Plus HD Camera (zeus017) Commissioning as of 201107 (1001)	14-Aug-2006 04:22:29	14-Aug-2006 04:22:29	false	false
17556	Device Data	Insite Pacific Zeus Plus HD Camera (zeus017) Commissioning as of 201107 (1001)	14-Aug-2006 04:22:29	14-Aug-2006 04:22:29	false	false
17557	Device Data	Insite Pacific Zeus Plus HD Camera (zeus017) Commissioning as of 201107 (1001)	14-Aug-2006 04:22:29	14-Aug-2006 04:22:29	false	false
17558	Device Data	Insite Pacific Zeus Plus HD Camera (zeus017) Commissioning as of 201107 (1001)	14-Aug-2006 04:22:29	14-Aug-2006 04:22:29	false	false
17559	Device Data	Insite Pacific Zeus Plus HD Camera (zeus017) Commissioning as of 201107 (1001)	14-Aug-2006 04:22:29	14-Aug-2006 04:22:29	false	false
17560	Device Data	Insite Pacific Zeus Plus HD Camera (zeus017) Commissioning as of 201107 (1001)	14-Aug-2006 04:22:29	14-Aug-2006 04:22:29	false	false

On the SeaTube side



Ex 2 DMASEX-163 - Rethink the annotation system - rethinking the annotation system ie NASA example on Zooniverse. Take a look as it will give you a good indication of what we are thinking with this <https://www.zooniverse.org/lab/neemo>.



Ex.3 DMASEX-168 - Add Digital Fishers user survey button and link to engagement platform (this is especially important as we progress with evaluation) See example 2 below

