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DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

[RR0810000, 15XR0680A1, RY.1541CH20.1430001]

Announcement of Requirements and Registration for a Prize Competition Seeking: *New Concepts for Remote Fish Detection.*

AGENCY: Bureau of Reclamation, Interior.

ACTION: Notice.

SUMMARY: The Bureau of Reclamation, in collaboration with other Federal agencies (U.S. Geological Survey, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration-National Marine Fisheries Service, and U.S. Army Corps of Engineers) are announcing a prize competition looking for detailed concepts for the next generation of fish tracking methods, beyond what is available and in the literature today. Emphasis is on accurate tracking of many fish, ease of use, longevity, and low cost.

DATES: Listed below are the specific dates pertaining to this prize competition:

1. Submission period begins on [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER].
2. Submission period ends on [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].
3. Judging period ends on [INSERT DATE 90 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

4. Winners announced by [INSERT DATE 104 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: The *New Concepts for Remote Fish Detection* Prize Competition will be posted on the following crowd-sourcing platforms where Solvers can register for this prize competition:

1. The Water Pavilion located at the InnoCentive Challenge Center:

<https://www.innocentive.com/ar/challenge/browse>.

2. U.S. Federal Government Challenge Platform: *www.Challenge.gov*.

3. The Nature Open Innovation Pavilion at

<http://www.nature.com/openinnovation/index.html>.

4. The Scientific American Citizen Science Center at

<http://www.scientificamerican.com/citizen-science/>.

InnoCentive, Inc. is administering this challenge under a challenge support services contract with the Bureau of Reclamation. These websites will re-direct the Solver community to the InnoCentive Challenge Center as the administrator for this prize competition. Additional details for this prize competition, including the Challenge Agreement specific for this prize competition, can be accessed through any of these prize competition web addresses. The Challenge Agreement contains more details of the prize competition rules and terms that Solvers must agree with to be eligible to compete.

FOR FURTHER INFORMATION CONTACT: Challenge Manager: Dr. Levi Brekke, Chief, Research and Development, Bureau of Reclamation, (303) 445-2494, *lbrekke@usbr.gov*; Mr. Chuck Hennig, (303) 445-2134, *chennig@usbr.gov*.

SUPPLEMENTARY INFORMATION: The Bureau of Reclamation is announcing the

following prize competition in compliance with 15 U.S. Code 3719, Prize Competitions. The ability to track individual or groups of fish is central to efforts to recover threatened and endangered fish species, and to reduce impacts to at-risk species. Reliable, affordable detection and tracking provides vital information about how many fish are present, where and why mortality occurs, and where and why species thrive. This enables fish recovery program managers to pursue targeted and more effective actions that can reduce mortality rates, improve habitat, and increase survival rates while continuing to meet the mission of the agency—delivery of water and power in the case of Reclamation. A successful solution will significantly reduce costs and dramatically increase the effectiveness and efficiency of various fish recovery efforts led by Federal, state, local, and/or other organizations.

CHALLENGE SUMMARY: There are a number of methods in use today to track fish. Common electronic methods include use of acoustic tags, radio-telemetry tags, and passive integrated transponder (PIT) tags. Different technologies have pros and cons. Tags accurate over long distances are often costly and need to be surgically implanted in the fish. Low cost tags have long lifetimes, but work over short distances and signals are subject to electromagnetic interference, which may result in no or inaccurate detections. Since there is no universal or “best” method, the option that best meets the specific needs of the fish tracking program objectives is typically selected (e.g. accuracy, lifetime of the study, working environments, species being tagged, number of and size of fish, available funding, etc.). Current methods rely on capture and handling of fish to implant or attach tags, with subsequent recaptures or resightings involving elaborate capture or corralling methods, which can be complex, costly, and stressful to the fish.

The goal of this Challenge is to generate new concepts for tracking fish that advance technologies that meet fish recovery program management needs at a reasonable cost. A solution is being pursued through a prize competition because the Bureau of Reclamation and the collaborating Federal agencies view it beneficial to seek innovative solutions from those beyond the usual sources of potential solvers and experts that commonly work in the fish recovery management domain. We find ourselves often wondering if somebody, somewhere may know a better way of tracking and monitoring fish for our purposes than the methods we currently use. The prize competition approach enables us to reach a new source of potential Solvers to generate new and timely solutions that would not likely be accomplished by standard contractual methods.

This is an Ideation Challenge, which has the following unique features:

- There is a guaranteed award. The awards will be paid to the best submission(s) as solely determined by the Bureau of Reclamation (The Seeker). The total payout will be \$20,000, with at least one award being no smaller than \$5,000 and no award being smaller than \$2,500.

- ALL INTELLECTUAL PROPERTY RIGHTS, IF ANY, IN THE IDEA OR CONCEPT DEMONSTRATED BY THE PROPOSED SOLUTION WILL REMAIN WITH THE SOLVER. UPON SUBMISSION OF A PROPOSED SOLUTION TO THIS CHALLENGE, EACH SOLVER AGREES TO GRANT TO THE SEEKER A ROYALTY-FREE, PERPETUAL, IRREVOCABLE, NON-EXCLUSIVE LICENSE TO USE BY OR ON-BEHALF OF THE U.S. FEDERAL GOVERNMENT ANY INFORMATION INCLUDED IN THIS PROPOSAL IN ANY FORUM, OR SUBSEQUENT EFFORTS TO FURTHER DEVELOP THE CONCEPT INTO A

VIABLE SOLUTION AND TO ALLOW OTHERS TO DO SO.
NOTWITHSTANDING GRANTING THE SEEKER A PERPETUAL, NON-
EXCLUSIVE LICENSE FOR THE PROPOSED SOLUTION, THE SOLVER RETAINS
OWNERSHIP OF THE IDEA OR CONCEPT DEMONSTRATED BY THE
PROPOSED SOLUTION.

- The Seeker believes there might be a potential for future collaboration with awarded Solver(s), although such collaboration is not guaranteed. The Seeker may also encourage Solver(s) to further develop and test their winning submissions through subsequent round(s) of competition. Solvers should make it clear if they have the ability for subsequent design and development phases and would be willing to consider future collaborations and/or subsequent competitions.

BACKGROUND: The Bureau of Reclamation and other Federal and non-Federal resource managers require the ability to identify and monitor fish and other aquatic animals. Fish, in particular, use different habitats, from small streams to deep fast-flowing rivers, and large lakes and oceans. A common challenge faced by fish recovery managers is the need to monitor movements of free-swimming individual fish without repeated capture and handling.

Telemetry systems currently used to detect and/or track individual fish include PIT tag systems (or radio frequency identification) and two types of active (battery powered) systems: radio tag and acoustic tag.

- PIT tag systems are limited to detecting fish at short distances (generally < 40 inches for 12 mm tags) and they require antennas that must withstand large hydraulic forces. These systems transmit and receive very rapidly (e.g. 10-25 milliseconds,

depending on the system), which means that they are able to detect fish traveling quickly (i.e., > 40 feet/second) through or over stationary antennas in dams, fish ladders, canals, and streams. PIT tags are relatively inexpensive (~ \$2.00/fish) and can be inserted in fish as small as 2 inches in length. Because PIT tags do not have a battery and are glass-encapsulated, they can function and persist throughout the lifetime of long-lived fish (10-100 years or more).

- Radio and acoustic telemetry systems have the ability to detect fish over large distances (100 feet-1 mile), but transmitters are expensive (> \$150 each) and most but not all require surgical procedures to implant. The battery within the telemetry system determines both their size and lifetime. Transmission rate is a function of technology—some acoustic tags transmit unique codes in < 0.1 seconds, while others take close to 10 seconds. Radio tags typically transmit codes of 0.2 seconds duration. The duration of codes, combined with battery size and power output, limit the life expectancy of the tag. This, combined with the greater broadcast range, can make it difficult to observe rapid or fine-scale fish movements using these tags. In addition, radio and acoustic tags are generally limited by environmental conditions, e.g., water depth of tag location, salinity, ambient noise from entrained air bubbles, sediment in water, and other water quality conditions.

Information is easily found on the internet concerning state of the art fish tagging techniques. A few references are provided in the prize competition posting for your information; however, please realize this is what is known today, and that the Seeker is looking for new ideas and mechanisms beyond the known literature.

THE CHALLENGE: New technology is needed to enable resource managers to

address important problems at a reasonable cost. Our Challenge is to find the next fish monitoring and tracking system. The Solver is not limited to the mechanical and physical systems described above. The answer could be biological, chemical, physical, mechanical, etc.

A successful solution significantly reduces costs and dramatically increases the effectiveness and efficiency of fish detecting and tracking efforts. For the sake of clarity and simplicity, we will designate the rainbow trout (*Oncorhynchus mykiss*) as the representative fish species for this Challenge. If the Solvers need to make assumptions about a generalized fish, they can use data for this particular representative fish, which can be found on the internet.

The question is not, “How do we track a single fish for its lifetime”, but “How do we track thousands of individually identifiable fish for extended periods of time cheaply and effectively”. Note that there are many criteria that need to be considered for tracking fish such as:

- Lifetime of a tag or device (longer is better)
- Size and invasiveness (smaller is better)
- Detection distance (longer is better)
- Quality of detection (high accuracy and high speed is better)
- Cost (low is better)

Solvers need not meet every technical requirement with one new concept.

Concepts that meet some requirements, but not all, will still be eligible for competing for an award. New and novel approaches to the tracking of individual identifiable aquatic organisms will be given special consideration.

Things to avoid:

1. The Seeker is not interested in marginal improvements to current fish tagging techniques such as PIT tags, acoustic and radio tags as well as other known marking methods, but novel and major improvement in any of these would be of interest.

2. The Seeker is not looking for a review article on fish tagging. Only new methods/techniques/technology will be considered that are not currently in use for fish tagging.

Submissions should try to meet the following Technical Requirements:

1. The best device/method/technique would be able to:
 - a. Be used for freshwater fish as small as 4 inches in total length (if a physical tag is used, it must be less than 5% of the fish's body weight).
 - b. Detect and identify individual fish from a minimum of 30 feet away from detector device throughout the entire water column (up to 30 feet in depth or laterally).
 - c. Detect and identify rapidly moving individual fish with detection efficiency >95%, even when in a school or assemblage of like or different species that may or may not be similarly tagged or marked.
 - d. Be used on a large scale (e.g., if tags used, should be able to tag > 1,000 fish/day using two people) and scalable to use in a field setting where fish would be marked after capture from rafts, small boats, or from banks of water bodies in remote field locations.
 - e. Reduce capturing or handling of fish to an original marking or tagging event.
2. The system should not modify the behavior, physiology, genetic, phenotypic, growth, survival, or edibility of the fish of interest, or other fish and aquatic animals near

the fish of interest.

3. Detection devices should not be susceptible to normal electromagnetic interference, which would include overhead power lines, turbine motors such as those found at dams, water pumps, outboard and inboard motors, transformers, etc.

4. The method must have performance characteristics as good as or better than existing 12-mm PIT tags and existing active acoustic and radio tags. These performance characteristics are:

a. Shedding rates are $< 5\%$.

b. Durability is defined as capable of being dropped from a height of 4 feet and submersible to a water depth over 300 feet without damage.

c. Longevity > 10 years while in service, but should be > 50 years.

The following are not required for an award but would be “nice to have”.

5. The detection device should be portable (i.e., < 50 pounds) and capable to be operated by one person.

6. Detection devices should not be susceptible to any electromagnetic interference.

7. If tags are used (one device per fish), they should be capable of mass production to meet demand at a reasonable cost and show promise for future miniaturization.

8. The method is capable of successfully identifying individual fish in both freshwater and seawater.

9. The method is capable of detecting and identifying individual fish from a minimum of 100 feet away from the detector device throughout the entire water column

(up to 100 feet in depth or laterally).

10. The solution is capable of identifying fish as small as 2 inches in total length, and if a physical tag is used, it should be no more than 2% of the fish's body weight.

PROJECT DELIVERABLES: This is an Ideation Challenge that requires only a written proposal to be submitted. At least one solution will be deemed the winner.

The submission should include:

1. Detailed description of a fish tracking method that is unknown in the literature today. The method or system should minimize handling and recapture of fish.

2. Rationale for why the processes/material can meet the Technical Requirements listed in the Challenge description. Note: a general concept is needed, but is not considered a solution by itself. The Solver must describe with a high level of technical detail how the system would meet or not meet each of the "must have" and "nice to have" attributes described above. The Solver should expect that their submittal will be reviewed by experts in the field of telemetry, biology, and multiple fields of engineering. Examples and literature references of where similar techniques are used will be helpful as evidence.

3. A list of equipment and material required. Discussion should include lifetime of any equipment; size and invasiveness to the fish; detection speed, accuracy, and distance; and estimated costs.

4. Details of any process associated with the tracking system (e.g., tagging fish, setting up detectors, etc.) and the time and effort required to accomplish tasks.

5. The Solver needs to describe how deployable and workable the system would be under a wide variety of environmental conditions including water depths, turbidity,

salinity, velocities, and turbulence such as those found in small to large streams in the western United States.

Submitted proposals should not include any personal identifying information or any information the Solvers do not want to make public or consider as their Intellectual Property they do not want to share.

JUDGING: After the Challenge deadline, the Seeker will evaluate the submissions and make a decision with regards to the winning solution(s). All Solvers that submitted a proposal will be notified on the status of their submissions. However, no detailed evaluation of individual submissions will be provided. Decisions by the Seeker cannot be contested.

Submitted solutions will be evaluated by a Judging Panel composed of scientists, engineers, and telemetry experts. The Judging Panel will also have consultation access to technical experts outside of their expertise, as determined necessary, to evaluate specific submissions. The Judging Panel will assess the merits of the solution by the degree that they meet the Technical Requirements listed in the Challenge description, by the potential utility (i.e., adaptability, scalability, readiness for development), and by originality (i.e., novel extension of current knowledge).

ELIGIBILITY RULES: To be able to win a prize under this competition, an individual or entity must:

1. Agree to the rules of the competition (15 U.S. Code § 3719(g)(1));
2. Be an entity that is incorporated in and maintains a primary place of business in the United States, or (b) in the case of an individual, a citizen or permanent resident of the United States (15 U.S. Code § 3719(g)(3));

3. Not be a Federal entity or Federal employee acting within the scope of their employment; (15 U.S. Code § 3719(g)(4));

4. Assume risks and waive claims against the Federal Government and its related entities (15 U.S. Code § 3719(i)(1)(B)); and,

5. Not use Federal facilities, or consult with Federal employees during the competition unless the facilities and employees are made available to all individuals and entities participating in the competition on an equitable basis.

The following individuals or entities are not eligible regardless of whether they meet the criteria set forth above:

1. Any individual who employs an evaluator on the Judging Panel or otherwise has a material business relationship or affiliation with any Judge.

2. Any individual who is a member of any Judge's immediate family or household.

3. The Seeker, participating organizations, and any advertising agency, contractor or other individual or organization involved with the design, production, promotion, execution, or distribution of the prize competition; all employees, representatives and agents thereof; and all members of the immediate family or household of any such individual, employee, representative, or agent.

4. Any individual or entity that uses Federal funds to develop the proposed solution now or any time in the past, unless such use is consistent with the grant award, or other applicable Federal funds awarding document. NOTE: Submissions that propose to improve or adapt existing federally funded technologies for the solution sought in this prize competition are eligible.

CONSULTATION: Fish recovery program managers and technical specialists from across the Bureau of Reclamation, U.S. Geological Survey, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration-National Marine Fisheries Service, and U.S. Army Corps of Engineers were consulted in identifying and selecting the topic of this prize competition. Direct and indirect input from various stakeholders and partners associated with the fish recovery program efforts by these agencies were also considered. In addition, the Bureau of Reclamation maintains an open invitation to the public to suggest prize competition topics at www.usbr.gov/research/challenges.

PUBLIC DISCLOSURE: InnoCentive, Inc. is administering this challenge under a challenge support services contract with the Bureau of Reclamation. Participation is conditioned on providing the data required on InnoCentive's online registration form. Personal data will be processed in accordance with InnoCentive's Privacy Policy which can be located at <http://www.innocentive.com/privacy.php>. Before including your address, phone number, e-mail address, or other personal identifying information in your proposal, you should be aware that the Seeker is under no obligation to withhold such information from public disclosure, and it may be made publicly available at any time. Neither InnoCentive nor the Seeker is responsible for human error, theft, destruction, or damage to proposed solutions, or other factors beyond its reasonable control. Solver assumes any and all risks and waives any and all claims against the Seeker and its related entities, except in the case of willful misconduct, for any injury, death, damage, or loss of property, revenue, or profits, whether direct, indirect, or consequential, arising from

participation in this competition, whether the injury, death, damage, or loss arises through negligence or otherwise.

Dated: June 10, 2015. _____

Dr. Levi Brekke,
Chief, Research and Development.

[FR Doc. 2015-18157 Filed: 7/24/2015 08:45 am; Publication Date: 7/27/2015]