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DEVELOPMENT OF A PROTOTYPE VIDEO-BASED FISHERIES ASSESSMENT UNIT

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Development of A Prototype Video-Based Fisheries Assessment Unit[1]

Daniel A. Isermann
Minnesota Department of Natural Resources, Division of Fisheries and Wildlife
1601 Minnesota Drive, Brainerd, MN 56401

Thomas S. Jones and Kit Nelson
Minnesota Department of Natural Resources, Division of Fisheries and Wildlife
1200 Minnesota Avenue South, Aitkin, MN 56431

and Gerold C. Grant
Oregon Dept. of Fish and Wildlife, NE Region Fish Research
Eastern Oregon University, 203 Badgley Hall, 1 University Blvd., La Grande, OR 97850

Abstract- We assessed the field performance of a prototype video-based fisheries assessment unit for potential use in surveying fish populations. The unit consisted of three video cameras housed within waterproof chambers extending from a rectangular aluminum frame that was placed on the lake bottom to collect video images of fish. Infrared lights were attached to the frame to capture images at night. Cameras were connected to floating buoy housing a power supply and transmitters that conveyed video images to receivers on shore. Three separate trials demonstrated that most of the camera unit components functioned properly under field conditions and we successfully captured numerous images of sunfish *Lepomis* spp. Difficulties were encountered with one of the cameras (poor image quality) and the light timer did not function properly. Deployment of the camera was cumbersome due the size of the buoy and the need for divers when deploying the unit in deeper water. Future use of the prototype will require that issues with light operation and problems with the top camera be resolved. Furthermore, methods of directing fish to the cameras must be devised in order to maximize encounter rates and obtain measurements.

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Video technology has been used in a variety of fishery assessments (Hinch and Collins 1991; Hatch et al. 1994; Grant et al. 2004; Daum 2005). Video cameras have been frequently used to enumerate fish during migration events (Hatch et al. 1994; Haro and Kynard 1997; Daum 2005), monitor fish behavior or habitat use (Hinch and Collins 1991; Shardlow 2004; Standen et al. 2004), and to assess selectivity of sampling gears (Grant et al. 2004). Conceptually, video-monitoring systems can collect information remotely with relatively low effort. Many of the techniques currently used to sample fish populations (i. e., gill nets, trawls, trap nets) are both physically demanding and require multiple personnel. Development of an effective video-based sampling approach could provide a relatively easy way to collect information on fish populations. Our objective was to field test a prototype video-based fisheries assessment unit for potential use in surveying fish populations.

Methods

The superstructure of the camera unit consisted of a rectangular aluminum frame (1.2 x 0.9 m) connected to a buoy by a series of cables (Figure 1, photo A). The aluminum frame was open at the bottom and fitted with two 1.2-m sections of angle iron that allowed the frame to sit upright (Figure 1, photo A and B). Three cameras (GENWAC model GW-902H) were housed within cylindrical waterproof chambers made of aluminum pipe extending from the rectangular frame (Figure 2, photo A); camera locations are noted in Figure 1 (photo B). The frame was also fitted with infrared lights (locations in Figure 1, photo B) for use in obtaining footage at night. The buoy (Enviro Flotation Module, Apprise Technologies, Inc.) housed a circuit board (Figure 2, photo B) connected to a 12-volt battery. The circuit board included a timer for the lights and a transmitter box, which conveyed video images recorded by all three cameras to a battery of three receivers (one for each camera) positioned on shore. Receivers (Video-Comm Technologies, model TC-2403a) were attached to a digital video recorder (Pelco® DX3009-060), which was in turn connected to a television monitor so that images could be viewed during testing.

We tested the prototype camera unit on three separate occasions. During August 2004, the camera unit was deployed during daylight hours in Hammal Lake, a 156-ha mesotrophic lake with relatively high water clarity located in Aitkin County, Minnesota. A second test of the camera unit was attempted on Round Lake, a 256-ha mesotrophic lake also located in Aitkin County during August 2004. This second test was designed to evaluate the camera unit's performance under darkness; hence, the unit was deployed during evening hours and the light timer was set so that the infrared lights mounted on the frame would turn on at sunset. In both cases, electrical power for operating shore equipment was obtained through cooperating lake homeowners. The frame and buoy were deployed from a boat powered by an outboard motor. Two divers were used to deploy the frame while a third worker remained in the boat to activate controls in the buoy (power, light timer, etc.) and for safety purposes. The camera frame was set on the bottom in approximately 1.8 m of water and the buoy was tethered to two anchors to prevent drifting. The camera unit was positioned within 100 m of the receivers on shore to ensure transmission of images captured by the cameras.

In July 2005, the camera unit was again deployed in Hammal Lake to obtain more footage and to assess whether previously encountered problems were resolved. In this instance, the camera was directly deployed from the boat (no diving needed) in approximately 1.2 m of water.

Results

Most of the camera unit components functioned properly during our daylight tests on Hammal Lake during 2004 and 2005. Images from all three cameras were successfully transmitted to the digital video recorders on shore. We successfully captured numerous images of sunfish *Lepomis* spp. with the two side cameras; however, the camera mounted at

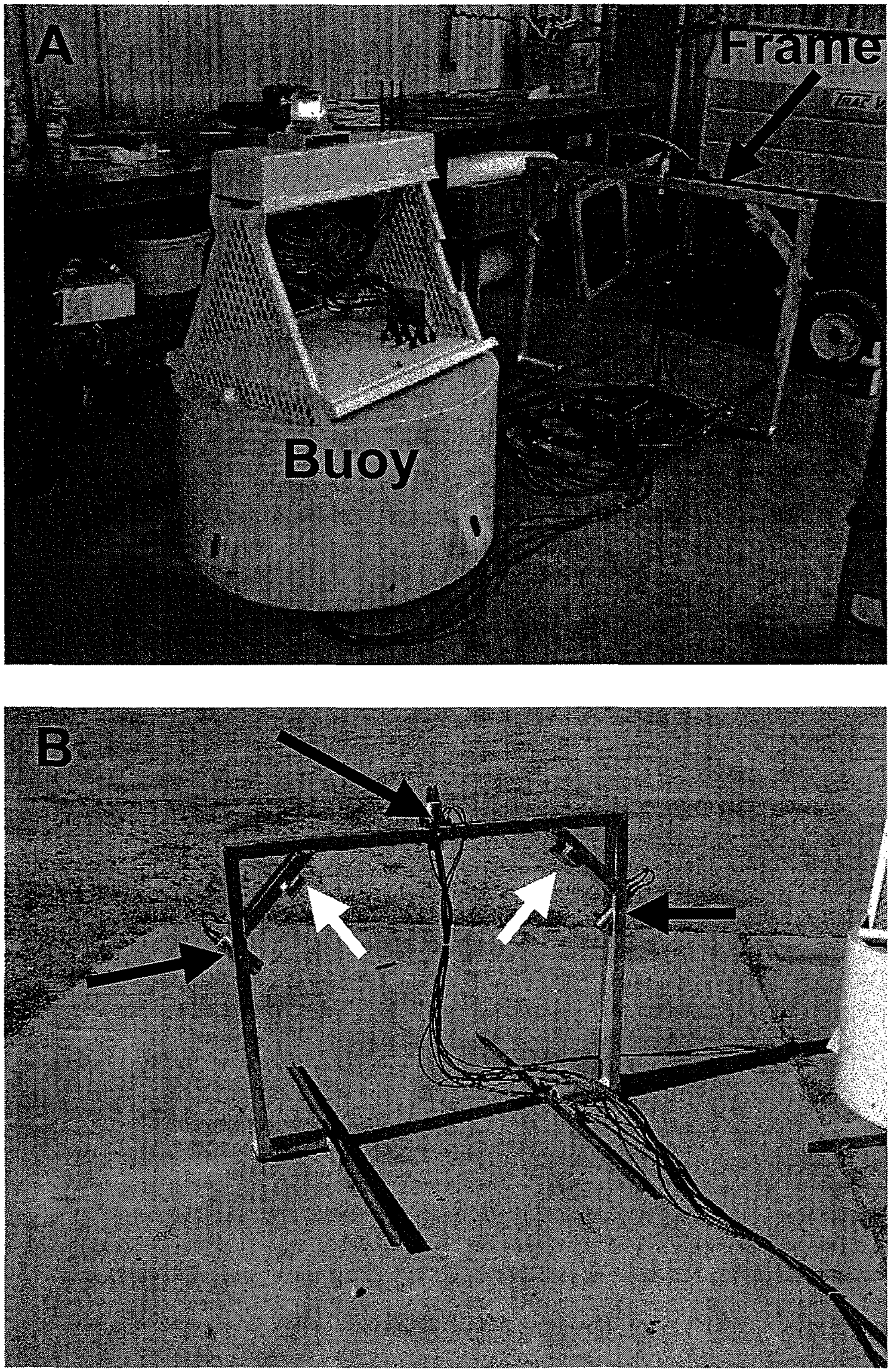

Figure 1. Photos of the entire camera unit (photo A) and a detailed view of the aluminum frame that was deployed underwater (photo B). Camera locations are denoted by black arrows; location of infrared lights are denoted by white arrows.

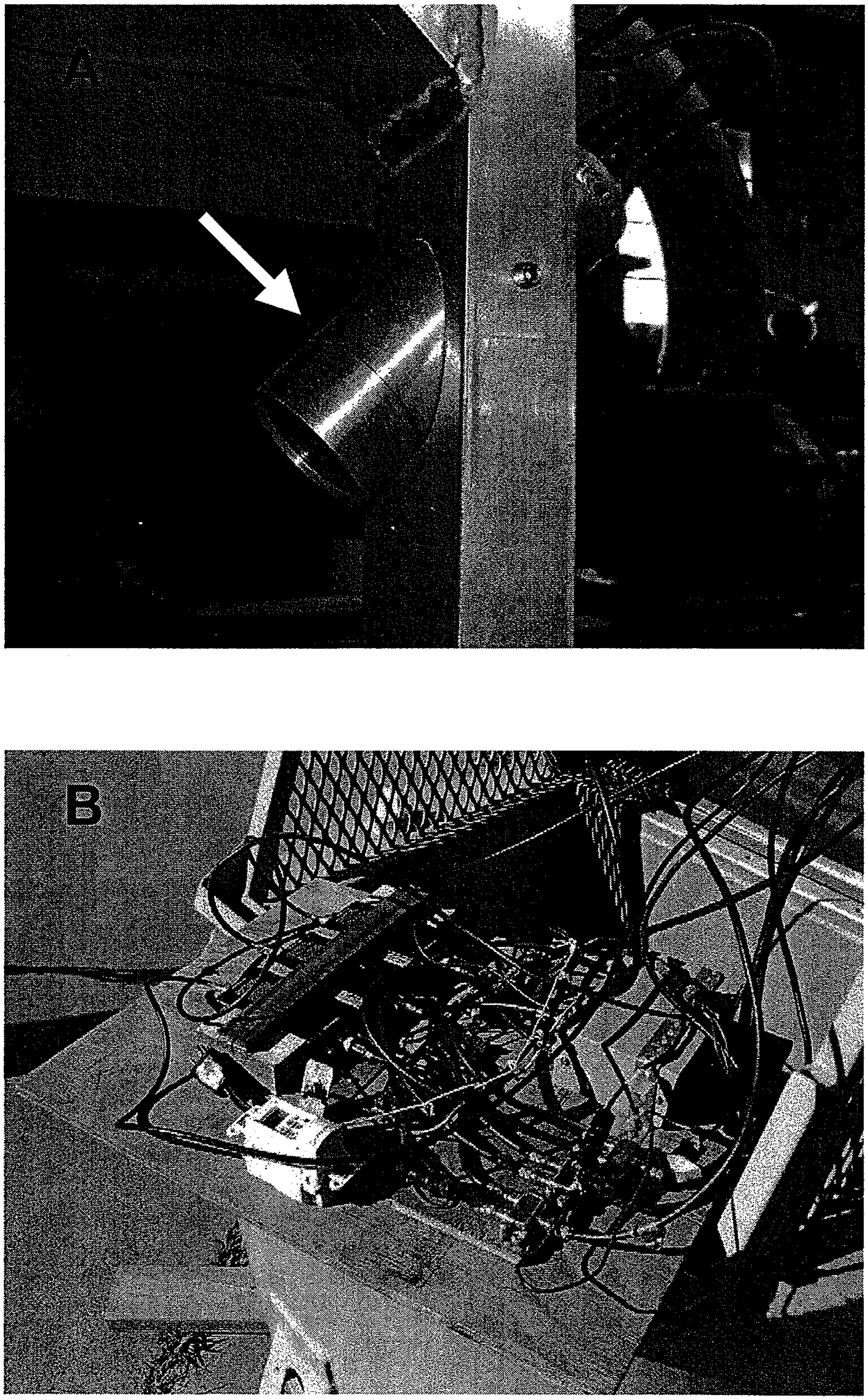

Figure 2. Photo of one of the waterproof chambers used to house cameras (photo A) and a photo of the circuit board housed within the buoy (photo B).

the top of the aluminum frame provided poor image quality that appeared to result from overexposure (i. e., footage had a washed-out or white appearance) occurring after the camera frame was submersed in a lake environment. This explanation was further supported by the fact the top camera functioned perfectly when not submerged or when submerged in a bucket of water. Our test of the camera unit on Round Lake was not successful as the lights failed to turn on at sunset as instructed by the timer. Subsequent trials in the lab demonstrated that the lights were functional but the timer did not always operate properly. Digital video footage is available to anyone that may be interested in developing this technology.

Discussion

Our tests of the prototype camera unit demonstrated that the design was functional and that most of the components operated successfully when the unit was deployed in a lake environment. We were able to capture clear images of fish on the two side cameras. Deployment of the camera unit was cumbersome, mostly due to the size of the buoy and the fact divers were required for setting the trap in deeper water. The effort required to deploy the camera was still far less than required to set and retrieve a series of nets. Future use of the prototype will require that issues with light operation and problems with the top camera be resolved. Furthermore, methods of directing fish to the cameras must be devised in order to maximize encounter rates and obtain measurements.

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Donald L. Pereira, Fisheries Research Supervisor
Paul J. Wingate, Fish and Wildlife Research Manager

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