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Floating mist nets: a technique for capturing birds in flooded habitat

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ABSTRACT. The banding of birds is essential for detailed demographic studies of avian populations. Mist nets are a widely used, effective method of capturing birds for banding, but are difficult to use under certain conditions. While conducting a demographic study of Southwestern Willow Flycatchers (*Empidonax traillii extimus*), rising reservoir levels flooded large tracts of flycatcher breeding habitat making traditional mist netting techniques impossible to use. In response, we devised a technique for capturing birds over deep water using mist nets suspended between poles kept afloat on compact buoys. In 2005, we used this technique to safely capture 17 Willow Flycatchers that could not have been captured by any other means, and over 40 additional passerines were incidentally captured with no injuries occurring. This versatile apparatus was simple to build and employ, and capture success was similar to that over dry land.

Key words: banding techniques, floating mist nets, flooded habitat, Willow Flycatcher, *Empidonax traillii*

The capture of birds is important for research and conservation efforts, and the marking and subsequent monitoring of individuals is necessary for understanding survivorship, movement, behavior and other aspects of a bird's biology and ecology (DeSante 1992, Nichols and Kaiser 1999, White and Burnham 1999). Of the many methods for capturing birds, mist nets have long been a successful tool for capturing passerines, and the only effective method of capturing many species (Bub 1978). Mist nets are typically used in areas where an adequate net lane (a gap in the vegetation) can be made, and where firm ground allows for vertical poles to be free standing. When these conditions cannot be met, the use of mist nets is difficult or impossible, constraining the effectiveness of research in certain habitats.

A long-term demographic study on the endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*) at Roosevelt Lake, Arizona, has relied on mist netting as the only effective method to capture flycatchers. In 2005, our flycatcher research site was flooded, with approximately half of the Roosevelt Lake flycatcher population breeding in deeply flooded riparian habitat which was accessible only by boat, and mostly impenetrable to anything larger than a canoe. Because traditional mist-netting techniques were ineffective, an alternative method of deploying mist nets was needed to continue banding flycatchers in this flooded woodland. A search of the literature revealed only two papers describing potentially useful techniques, but each had significant drawbacks for our particular situation. The first technique (Wilson and Allan 1996) involved erecting a short net within a jon boat, that could then be positioned in open habitat to target-net territorial birds. Although this technique would work well in certain areas, the requirement of a wide boat precludes netting in dense habitat, and the length of typical boats would limit the length of the net to 2.6 m. The second technique (Kaiser et al. 1995) involved attaching mist nets to poles floated on rafts 3.6 m in diameter. This latter technique was used successfully to capture Marbled Murrelets (*Brachyramphus marmoratus*), and allowed for long nets, but is impractical for use in dense habitat given the size of the rafts needed to ensure stability of the nets. Our needs for a highly portable technique that would allow various length nets to be deployed in dense, flooded vegetation forced us to develop an alternative method of deploying mist nets. We devised a technique using mist nets suspended between poles kept afloat on compact buoys. These stable buoys are simple to construct and erect, and can be used in a variety of circumstances including in dense habitats. This technique can be tended by canoe or motorboat and has proven to be safe and effective.

METHODS

Study area. All work was conducted at Roosevelt Lake (33˚ 42'N, 11˚ 07'W, 654 m elev.), Arizona, as part of a long-term demographic study of the Southwestern Willow Flycatcher. A long-term drought, beginning in 1996, caused the lake level to fall, allowing large tracts of riparian habitat to develop in the exposed portion of the lake bed, with flycatchers colonizing this young riparian habitat. The exceptionally wet winter of 2004-2005 caused Roosevelt Lake to rise over 25 vertical meters, inundating most of the flycatcher's breeding habitat. Although much of the habitat was completely inundated, large areas were only partially submerged, with flycatchers occupying the emergent canopy. The flooded flycatcher habitat within the reservoir was composed of dense tamarisk (*Tamarix ramosissima*) and willow (*Salix goodingii*) stands with a small cottonwood (*Populus spp*.) component. The areas occupied by flycatchers had water depths of 1 - 10 m, with 3 – 10 m of canopy emergent above the surface of the water. A few areas occupied by flycatchers could be reached by motorboat, but most were only accessible

via canoe or kayak due to dense vegetation. The surface of the lake was generally calm, but windy days and boat traffic generated waves up to 0.5 m high in the areas we worked.

Equipment. A canoe and two mist net buoys are the only pieces of additional equipment necessary to adapt a traditional mist net setup to use on the water (Fig. 1). The buoys can be built with just a few hours of labor and supplies found at most hardware stores. The only necessary tools are a drill, a hacksaw, a set of wrenches, and a pocket knife.

Each buoy is composed of an appropriately-sized floatation block, a length of aluminum conduit into which the mist net poles are dropped, and a sufficient weight which is suspended beneath the flotation block to keep the buoy and pole upright. The heavier the weight used and the farther the weight is attached from the floatation the more stable the buoys will be, resulting in an easier net setup. The dimensions we present result in a stable net which could safely capture even large birds (up to about 1 kg) with no risk of tipping.

We used 5-cm thick sheets of Styrofoam insulation cut into 20 cm x 20 cm squares (appropriately sized blocks of Styrofoam can be substituted, if available). For each buoy, we glued seven of these squares together with Styrofoam craft glue to make a 20 cm (W) x 20 cm (D) x 35 cm (H) floatation block. To increase durability, we wrapped the block with duct tape to form a protective skin around the Styrofoam. We inserted a 1.5 m long x 23 mm diameter aluminum electrical conduit through the center of the floatation block, leaving 50 cm of conduit above the block and 65 cm below the block (different diameter conduit can be used depending on diameter of mist net pole). We drilled holes just above and below the block through which 76

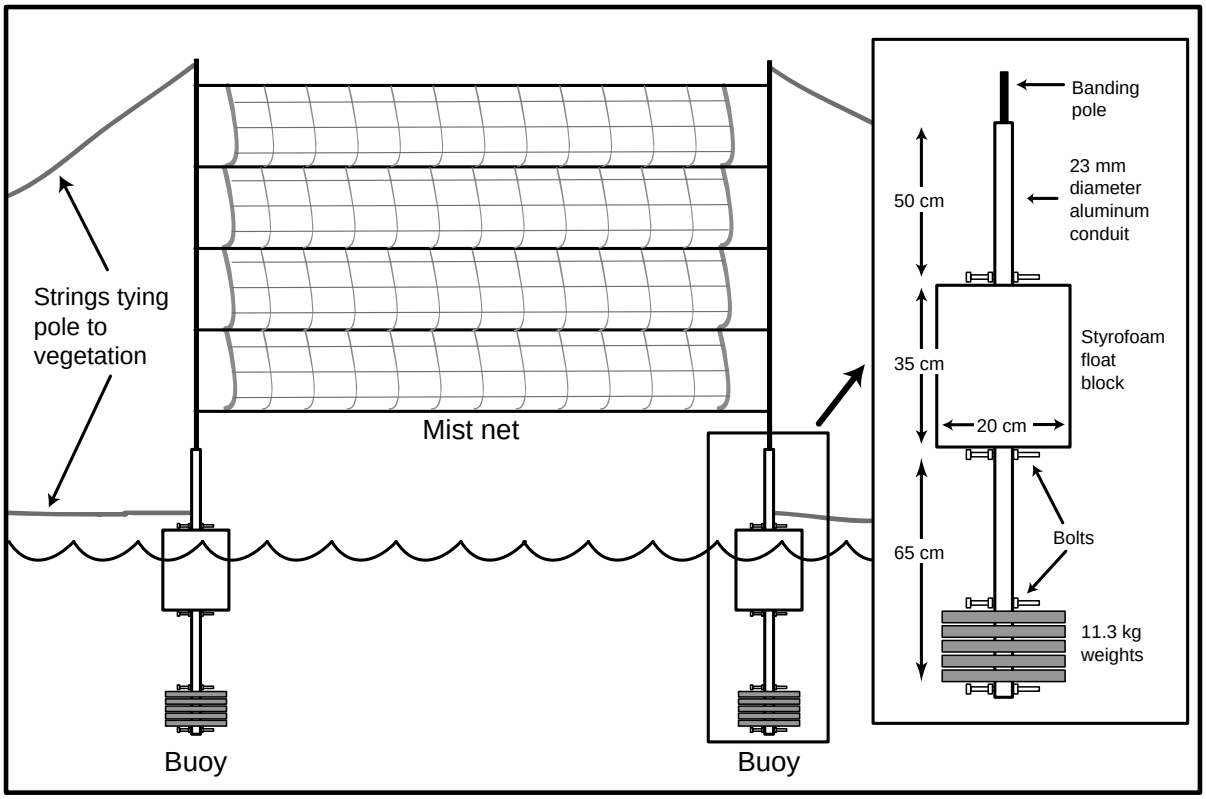

Figure 1. Schematic of floating mist net setup, with inset detailing the construction of a buoy. A mist net is stretched between poles supported by the buoys and anchored by tying the buoys and poles to vegetation or anchors.

mm x 6 mm carriage bolts were inserted and bolted in to keep the block from sliding up or down. Using bolts as described above, we attached 11.3 kg of metal gym weights at the bottom end of the conduit. We used gym weights, purchased from a sporting goods store, primarily to enable adjustments in the size and position of the weight until we arrived at the ideal dimensions. A less expensive alternative would be 11.3 kg of concrete poured into a mold and allowed to set around the bottom end of the conduit, though this would slightly increase the bulk of the buoys.

Deployment. While many kinds of boat can be used to deploy this technique, we typically used Old Town "Guide" ™ canoes that are 4.5 m long and 94 cm wide, with a fairly stable hull design. These could be paddled into dense vegetation and were sufficiently stable to stand up in and work from. Narrower models of canoes may lack sufficient stability. Although a single person could employ this system, we always worked in pairs as this was safer and more practical, especially when extracting birds.

First, a net lane was chosen. In the dense habitat where we worked, this usually involved tying back vegetation to create a net lane. Depending on the length of net lane available, we used standard 12 m, 6 m, and 2.6 m length mist nets. A buoy was dropped into the water at one end of the net lane and tied at approximately water level back to vegetation. Then a mist net pole was inserted into the conduit and tied near the top back to nearby vegetation. The trammel loops at one end of the net were attached to the pole and one person paddled the canoe down the net lane while the other person fed the net out. When the net was fully extended, the paddler either "anchored" the canoe by holding nearby vegetation or continued paddling to hold the canoe in place so that the net remained taught with the first pole. The other person dropped the second buoy into the water, attached the second end of the net to a pole that was inserted into the second buoy's conduit and tied this second buoy setup back at the top and bottom, in the same way the first end was tied back. Finally, the net was opened and strings were adjusted to ensure proper net tension.

When a passive netting approach was taken, multiple nets were set up and tended by a pair of banders. More often, we targeted specific individuals using conspecific vocalizations played over speakers hung in trees (Sogge et al. 2001). Speakers could be easily attached to branches using rubber bands, and speaker wires were stretched out to a CD player in the canoe which was hidden in the trees several meters from the net.

Once a bird was captured, the banders would lower the net if necessary and paddle the canoe over to the bird. With the canoe positioned under the bird, one bander would kneel down in the bottom of the canoe and stabilize it, either by holding vegetation or using paddle strokes as necessary. The second bander could then extract the bird from a sitting position (if the net was lowered enough), but it was generally easier to stand and extract the bird as would be done on land. With a partner steadying the canoe, maintaining balance required little effort and full attention could be given to extracting the bird from the net.

RESULTS AND DISCUSSION

This technique proved to be highly effective and safe, with capture success similar to on-land capture efforts and no injuries occurring. Over the course of the 2005 breeding season, we use this technique to capture 17 Willow Flycatchers that could not have been captured by any other apparent means. In addition, over 40 non-flycatchers were incidentally captured and safely extracted from these floating mist nets. We found this technique to be quite versatile. It worked

well for target netting specific birds with playback, and for passive netting efforts with multiple nets open at once. This technique worked equally well with 2.6 m, 6 m, and 12 m length mist nets, and equipment was kept to a minimum making the system readily transportable by canoe. Most importantly, the nets could be erected in dense, flooded habitat.

A general level of comfort in canoes and moderate practice improves the ease of using this technique, and the process was successfully accomplished by 12 different banders in 2005, each with varying levels of boat experience. The time required for net setup varied, but 15 min was typical after a moderate level of proficiency was achieved.

We took several precautions to maintain the safety of the birds when using this technique. The buoys were highly stable and there was no risk of the net tipping over, even if a large bird was captured or a tie-back failed. However, to ensure that all captured birds would be held well above the water, we kept the net's bottom trammel-line at least 70 cm above the water, and kept the net under sufficient tension to prevent trammel lines from sliding down the poles. Also, the top of the conduit functioned as a stop in case the trammels were to inadvertently slide down the pole. Particular care was taken while extracting birds from the net. We always worked in pairs to allow one person to control and balance the canoe while the other devoted their full attention to the netted bird.

Our technique worked well in relatively calm, flooded woodlands, but several considerations need to be addressed if this method is to be used in more open water. Although the pole/buoy configuration is free standing, it is necessary to tie each buoy and net pole back to a stationary object to keep the net under proper tension. In flooded habitat this is rarely an issue, but in open water anchors would need to be employed to anchor the net, such as the ones used by Kaiser et al. (1995). Another issue is wind-driven waves and boat wakes that tend to sway the net enough to make it more visible to birds. In conditions we encountered, the net never moved enough to be a hazard to entrapped birds, but we felt the increased visibility of a moving net reduced our capture success, and could entangle the net in vegetation if used in a narrow net lane. We minimized this issue by avoiding netting in strong winds or during times of heavy boat traffic (i.e., weekends and holidays when recreational boating was highest). In situations where prevalent water conditions are not as calm, netting activities should be limited to periods of low light conditions to reduce the likelihood of birds seeing the swaying net.

This technique is applicable to a wide variety of study areas including flooded bottomland forest, mangrove swamps, marshland, and open water. Although we used this technique to capture passerines, with little or no modification it could also be used to capture larger birds as well as bats.

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LITERATURE CITED

BUB, H. 1978. Bird trapping and bird banding: A handbook for trapping methods all over the world. Cornell University Press.

DESANTE, D. F. 1992. Monitoring avian productivity and survivorship (MAPS): a sharp, rather than blunt technique for monitoring and assessing landbird populations. In: Wildlife 2001: populations. (D. R. McCullough and R. H. Barrett, eds.), pp. 511-512. Elsevier Applied Science, London, UK.

KAISER, G. W., A. E. DUROCHER, S. CRAWFORD, M. J. GILL, AND I. A. MANLEY. 1995. A capture technique for Marbled Murrelets in coastal inlets. Journal of Field Ornithology 66:321-333.

NICHOLS, J. D., AND A. KAISER. 1999. Quantitative studies of bird movement: a methodological review. Bird Study 46:S289-289.

SOGGE, M. K., J. C. OWEN, E. H. PAXTON, S. M. LANGRIDGE, AND T. J. KORONKIEWICZ. 2001. A targeted mist net capture technique for the Willow Flycatcher. Western Birds 32:167-172.

WHITE, G. C., AND K. P. BURNHAM. 1999. Program MARK: survival estimation from populations of marked animals. Bird Study 46:S120-138.

WILSON, R. R., AND R. S ALLAN. 1996. Mist netting from a boat in forested wetlands. Journal of Field Ornithology 67:82-85.