DeSylva for encouragement in planning this long-term study. O. L. Austin, Jr. provided valuable criticisms as a referee. Laurie Farber, Darrell Ford, Robert Gochfeld, and Carl Safina participated in the fieldwork.—MICHAEL GOCHFELD, *N. J. State Department of Health, Box 1540, Trenton, NJ 08625.* Received 28 March 1979, accepted 23 July 1979.

A Laparotomy Technique for Nestling Birds.—Laparotomy has been used frequently to study avian reproductive cycles and to identify sex in monomorphic species, although details of technique are infrequently reported (Risser, 1971; Lawson and Kittle, 1973). The procedure has usually been used only on adult birds; to my knowledge only Howe (1976) has reported laparotomizing nestlings, and he was unsuccessful with birds under 12 days old. As part of a study of reproductive strategies of Red-winged Blackbirds (*Agelaius phoeniceus*), it became desirable to identify the sex of much younger nestlings. This proved to be possible as early as the day after hatching with the laparotomy technique described here, which I have used on over 700 nestling Red-wings, mostly 1–3 days old. Mean weights at these ages ranged from 6.3 g for day 1 birds to 12.7 g for day 3 females, and 14.2 g for day 3 males.

Each bird was anesthetized in a wide-mouthed 350-cc jar containing a cotton ball moistened with 0.5–1 ml of methoxyflurane (Metofane; Pitman-Moore Inc., Washington Crossing, NJ), an inhalant that is safer and more effective than ether (Gandal, 1969). Exposure of 1.5–2 min was found to induce an adequate and safe level of anesthesia. Young nestlings (but not older ones) tended to breathe irregularly in the anesthetic jar, often stopping temporarily. Perhaps because of this, the depth of anesthesia attained was variable, and sometimes a longer exposure was required. The frequency with which it was necessary to refresh the anesthetic was also variable; in the long run, I anesthetized roughly 10 birds per ml of methoxyflurane.

The small size of the nestlings necessitated using a 9× dissecting microscope, which in turn necessitated carefully positioning the bird with the sagittal plane horizontal so that the gonad could be viewed vertically. This was accomplished by securing the bird, left side up, to a small plexiglass sheet with three pieces of lightweight adhesive tape, one extending the right leg ventrally, one extending the left leg caudally, and one holding the thorax in place and keeping the left wing out of the way.

An initial incision about 3–5 mm long was made in the skin anterior to the left thigh, and the bird was placed on the stage of the microscope. Using fine-pointed watchmaker's forceps, I then made a small puncture in the intercostal muscles near the tip of the uncinate process just ventral to the anterolateral margin of the kidney, which is visible through the muscles. This site is typically in the first intercostal region that is entirely clear of the lung, which is usually the last intercostal region. It was usually necessary to retract the sartorius muscle slightly in order to expose the site, especially in older birds. It is essential to locate the puncture exactly to avoid damage to the kidney and to minimize damage to the underlying abdominal air sac.

I inserted a pair of fine, blunt, curved forceps into the intercostal incision, enlarging it sufficiently to admit a second pair of similar forceps. By probing alternately with these two forceps, underlying organs could be pushed away from the ventral face of the kidney. In very young nestlings, the abdominal air sac is tightly pressed against the kidney and must be separated from it carefully; in birds several days old this is more easily done. Most young birds had a large thin-walled sac of clear amber fluid immediately ventral to the kidney, and it was usually necessary to rupture the membrane and drain some of the fluid by inserting tightly twisted pieces of gauze bandage into the incision. The fluid appears to be associated with the yolk sac and may be the remnant of an extraembryonic fluid. It disappears (from the gonadal region, at least) by the time birds are several days old.

Finally, the gut and spleen were pushed aside sufficiently to expose the gonad, which could be found in the middle of a triangular frame of landmarks composed dorsally of the kidney, ventrally of the superior mesenteric artery, and posteriorly of the anterior end of an intestinal loop. The gonad can be identified without necessarily probing deeply enough to expose the latter landmarks, but when there is any doubt the artery is an

especially valuable reference point. Ovaries of nestlings lack the granular appearance of adult ovaries, but are distinguishable in being larger than testes and flattened against the kidney. Testes are ellipsoid as in adults, and stand distinctly separate from the kidney.

Most operations were completed within 3–6 min of the induction of anesthesia. The outer incision was closed with a liquid skin adhesive (New-Skin; New-Skin Co., Cody, WY), which accelerated healing when it remained in place but often peeled off too rapidly; best results were obtained with a very thin application, and by keeping the bird restrained, except for the left leg, until the adhesive dried. Young nestlings tended to cool off during the operation and were placed on a heating pad during recovery. It was difficult to judge alertness of very young birds, but most were capable of movements immediately after the operation, and gaping was not unusual within several minutes. Most nestlings healed completely or had only a small scab by fledging (approximately day 9–10), and some healed much sooner. No serious negative effect on growth was noted in most individuals.

The most common complication was renal hemorrhage, but in only a few cases was it so severe as to prevent the completion of the operation or to lead to noticeable ill effects later. It could be minimized by careful use of the forceps, especially by confining probing motions to the longitudinal axis as much as possible. It is difficult to avoid damaging the air sac, and such damage may lead to subcutaneous emphysema. Although unsightly, the bubble is not obviously uncomfortable or harmful to the bird, and it eventually disappears (cf., Risser, 1971).

I usually removed an entire brood from a nest at once. Usually all could be brought to the lab, laparotomized, and returned to the nest within 1–1.5 hr. Very few broods were abandoned, mostly following prolonged absences, and in fact a few times I found the mother brooding the empty nest upon my return.

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LITERATURE CITED

GANDAL, C. P. 1969. Surgical techniques and anesthesia. *In* Diseases of Cage and Aviary Birds. M. L. Petrak (ed.), p. 217–231. Philadelphia, Lea & Febiger.

HOWE, H. F. 1976. Egg size, hatching asynchrony, sex, and brood reduction in the Common Grackle. *Ecology,* **57:** 1195–1207.

LAWSON, P. T., AND E. L. KITTLE. 1973. Sex determination in birds of prey by laparotomy. *Raptor Res. News,* **5:** 132–135.

RISSER, A. C., JR. 1971. A technique for performing laparotomy on small birds. *Condor,* **73:** 376–379.

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Nest-shifting by a Dowitcher.—The shifting of eggs or nest sites as a result of disturbance during incubation is an unusual event. The most spectacularly documented case involved a Pileated Woodpecker (*Dryocopus pileatus*) that was photographed carrying its eggs from a damaged nest cavity. Further details are not available, but the eggs apparently failed to hatch (Truslow, *Nat. Geogr.,* **130:** 882–884). Although nest-shifting might seem a simpler task for ground-nesting birds, there are remarkably few reports (e.g., *Coragyps atratus*: Thompson, "A New Dictionary of Birds," p. 523, 1964; *Caprimulgus carolinensis*: Ferguson, *Wilson Bull.,* **79:** 452–453, 1967). Most of the shorebirds that I have studied (e.g., *Micropalama himantopus*: Jehl, *Wilson Bull.,* **85:** 114–147, 1973) are highly resistant to disturbance and continue to incubate even though the adults have been trapped and banded early in incubation and the nest sites visited daily during the entire period. Yet, there are limits of disturbance that cannot be transgressed.

On 27 June 1967, I found a Short-billed Dowitcher (*Limnodromus griseus*) nest containing four slightly pipped eggs atop a small sedge hummock at Churchill, Manitoba. Early on 6 July, I erected a blind 20 ft from the nest and late that day moved it to