Menhaden Tagging and Recovery: Part II—Recovery of Internal Ferromagnetic Tags Used to Mark Menhaden, Genus *Brevoortia*

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ABSTRACT

Plate and rotating grate magnets installed in various locations in reduction plants effectively recover internal ferromagnetic tags used to mark menhaden. Tag recovery efficiency rates for large (adult) tags range from 14 to 97 percent with a mean of 64 percent and for small (juvenile) tags range from 5 to 86 percent with a mean of 39 percent. Magnet installations do not interfere with the reduction operation, but facilitate it by removing scrap metal.

INTRODUCTION

Since Rounsefell and Dahlgren (1933) demonstrated the use of magnets for recovering metallic tags in herring, many scientists have successfully used this method of recovering tags from industrial fish, i.e., species converted to meal, oil, and condensed solubles (Fry, 1937; Fridricksson and Aasen, 1950; Stevenson, 1955; Aasen, Andersen, Gulland, Madsen, and Sahrhage, 1961; Klima and Bayliff, 1961). In addition to magnets, electronic detectors have been used to detect tagged fish among thousands of fish landed (Dahlgren, 1936; Stevenson, 1955; Parker, 1972). These recoveries provide the same information as magnet recoveries, such as migration patterns and mortality rates, and in addition permit the determination of: growth rates, validity of aging techniques, best tag injection location, and time for tag incisions to heal. However, the low efficiency and high cost of detector systems limit their use.

This paper describes the recovery of internal ferromagnetic tags from menhaden plants by magnets. Two sizes of tags are recovered: a large tag, 14.0 × 3.0 × 0.5 mm, used in adult menhaden and a small tag, 7.0 × 2.5 × 0.4 mm, used in juvenile menhaden.

PROCESSING PROCEDURE

At least 96 percent of the menhaden landed annually are processed by reduction plants (Reintjes, 1969). About two dozen plants are active each year along the Atlantic and Gulf coasts of the United States and convert millions of menhaden daily to meal, oil, and condensed solubles.

As the catch is unloaded, it is weighed automatically before being transferred to the plant by a drag line or screw conveyor. In the plant, fish are temporarily stored in a raw box or are carried directly to a steam cooker. Cooked menhaden enter a screw press which produces a liquor and press cake. The liquor is separated into oil and stickwater by centrifuging or settling, and the stickwater is evaporated to condensed solubles. The press cake is conveyed through a rotating dryer to a scrap shed for storage. Later, scrap is either shipped in bulk or ground into meal before shipping.

MAGNET INSTALLATIONS

All companies install magnets to reduce metallic contaminants in the product and prevent damage to equipment. Most companies have two-pole plate magnets in chutes conveying material to grinders, and some plants have drum magnets turning the terminal end of conveyor belts. Electromagnets are also used in some plants.

In addition to company-owned magnets, we installed a variety of magnets at various locations in the plants to increase tag recovery efficiency and minimize the delay between processing and recovery. In drag lines and chutes we installed two-pole and four-pole plate magnets (Figure 1). The pulling power of these magnets (304.8 mm long) at a distance of 50.8 mm for a standard test piece of 76.2 × 25.4 × 3.2 mm cold-rolled steel was 141.8 g and 106.3 g. More recent installations of plate magnets have been of the two-pole type with a pulling power of 510.3 g. In many plants where scrap drops from conveyors, we installed rotating grate magnets (Figure 2). These grates are cylindrical with several magnetic bars, 25.4 mm in diameter, spaced 76.2 mm apart. The cylinders are rotated with electric motors at 12 rpm. We abandoned stationary grate magnets after initial tests because they often became clogged. Magnet installations do not in-

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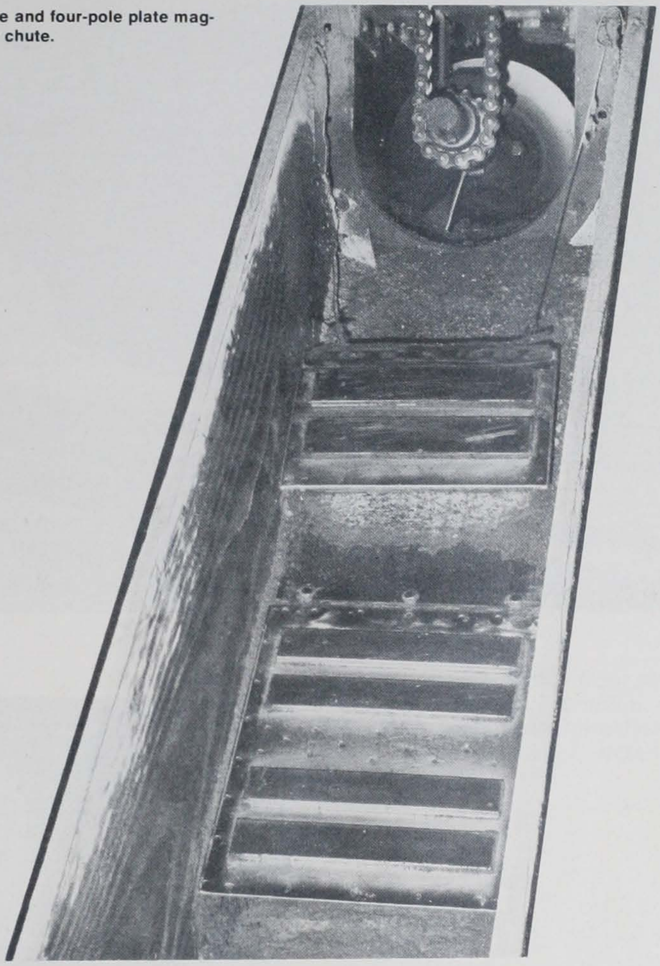

Figure 1.—Two-pole and four-pole plate magnets in a conveyor chute.

terfere with the reduction operation, but facilitate it by removing scrap metal.

All magnet installations have been designated as primary or secondary locations based on the length of delay between the time of landings and passage of fish scrap over the magnets. Primary installations, between the dryer and scrap shed, search scrap the day fish are landed, except during heavy landings when fish must be stored for a day or two in raw boxes. Secondary installations, usually in the scrap shed just ahead of the grinders, search scrap at irregular intervals, sometimes months after fish are landed.

TAG RECOVERY

Magnets are usually cleaned daily. To facilitate cleaning, some magnets are attached with hinges and a latch (Figure 3). Others are covered with a metal plate quipped with a handle, permitting all material to be lifted at once (Figure 4). Metal and fish scrap are scraped into buckets and the magnet number (identifying the plant and magnet location) and date are recorded. The material is spread on the floor and a magnetic sweeper is passed over it several times to concentrate the metal (Figure 5). The metal is searched by hand for tags (Figure 6). If there is a large quantity of scrap metal, the bulk of it is separated from the tags with sieves (Figure 7). Recovered tags are sealed in small envelopes identified by magnet number and date. Later, the tags are taped to forms on which all recovery information is transferred. The forms are checked and sent to computer processing. Tens of thousands of tags are recovered annually (Coston, 1971).

EFFICIENCY TESTS

Tests are conducted weekly throughout the fishing season to monitor magnet and plant tag recovery efficiencies under various conditions. From these tests we evaluate magnet installations and estimate the number of field tags entering the plants. Magnet installation efficiency is determined by scattering 100 tags in the scrap just before it passes

Figure 2.—A rotating grate magnet removes metal from scrap as the scrap drops from a conveyor.

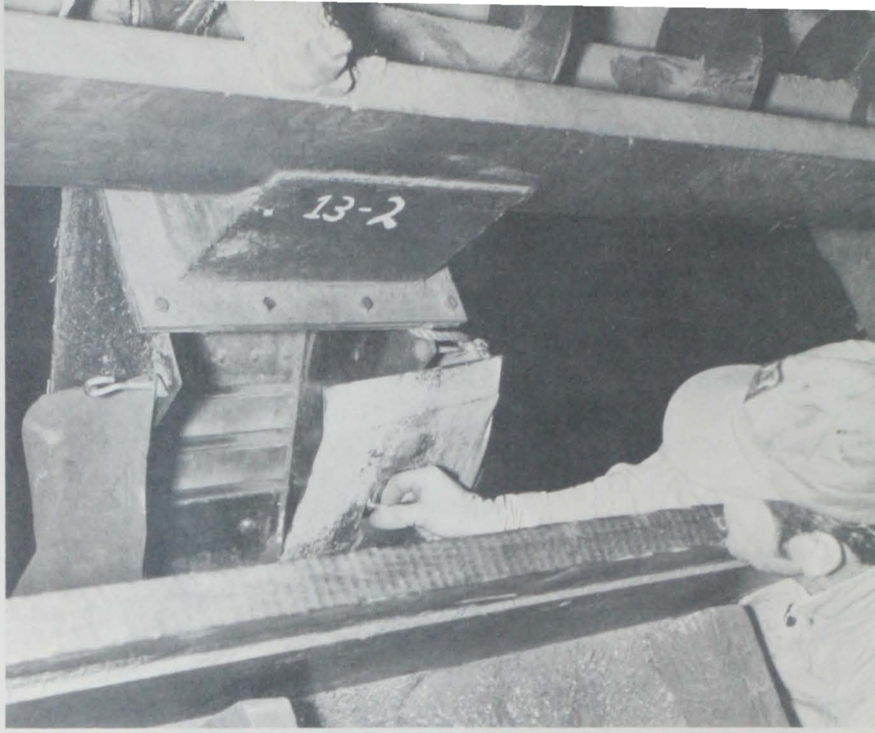

Figure 3 (above).—Hinged magnets facilitate cleaning.

Figure 4 (top right).—A metallic magnet cover with a handle permits all material to be lifted at once.

Figure 5 (below).—Metal and fish scrap are separated with a magnetic sweeper.

Figure 6 (center right).—Metal is searched by hand for tags.

Figure 7 (bottom right).—Sieves help separate scrap metal and tags.

over the magnets. The percent of test tags recovered on the magnets is a measure of the efficiency of the installation. Tag recovery efficiency at a plant is determined by distributing 100 tagged fish in the hold of a fishing vessel, in the conveyor system between dock and plant, or in raw boxes. Because of the delay between primary and secondary installation recoveries, weekly plant tag recovery efficiency is determined from test tags recovered on primary installations only. Seasonal tag recovery efficiencies are based on both primary and secondary recoveries. Test tag and field recoveries are recorded alike.

Magnet installation efficiencies for large tags range from 18 to 100 percent with a mean of 71 percent; seasonal recovery efficiencies range from 14 to 97 percent with a mean of 64 percent. No tests of magnetic installation efficiencies were conducted with small tags since these tags were not developed until our third year of tagging. Seasonal recovery efficiencies for small tags range from 5 to 86 percent with a mean of 39 percent. In some plants large numbers of tags are lost in cookers and dryers in addition to losses through magnet inefficiency.

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