Canadian Technical Report of

Fisheries and Aquatic Sciences 1852

1992

A DURABLE ALL-SEASON MARKER FLOAT AND MOORING BUOY FOR LIMNOLOGICAL FIELD STUDIES

by

P. Campbell and A.G. Salki

Central and Arctic Region
Department of Fisheries and Oceans
Winnipeg, Manitoba R3T 2N6

This is the 45th Technical Report
from the Central and Arctic Region, Winnipeg

Cat. No. Fs 97-6/1852E ISSN 0706-6457

Correct citation for this publication is:

Campbell, P., and A.G. Salki. 1992. A durable all-season marker float and mooring buoy for limnological field studies. Can. Tech. Rep. Fish. Aquat. Sci. 1852: iv + 5 p.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Campbell, P., and A.G. Salki. 1992. A durable all-season marker float and mooring buoy for limnological field studies. Can. Tech. Rep. Fish. Aquat. Sci. 1852: iv + 5 p.

An ABS-pipe buoy for marking lake sampling stations is described. Materials cost is less than $10.00 Cdn per float. They are very resistant to damage and fouling and, once installed, require little maintenance. The floats can be left in place through all seasons, including winter.

Key words: buoyancy; floats; marker buoys, limnological equipment; lake.

RÉSUMÉ

Campbell, P., and A.G. Salki. 1992. A durable all-season marker float and mooring buoy for limnological field studies. Can. Tech. Rep. Fish. Aquat. Sci. 1852: iv + 5 p.

Une bouée constituée d'un tuyau d'ABS pour le marquage des stations lacustres d'échantillonnage est décrite. Le coût des matériaux est inférieur à 10.00 $ Can. par flotteur. Les bouées sont très résistantes aux dommages et à l'encrassement en plus de n'exiger que très peu d'entretien une fois installées. Les flotteurs peuvent être laissés en place toute l'année, même pendant l'hiver.

Mots clés: flottaison; flotteurs; bouées repères; équipement limnologique; lac.

INTRODUCTION

Most limnological studies require that samples be taken repeatedly from one or more fixed locations on a lake. Usually these locations are marked with an anchored buoy which may also provide mooring while sampling. We have found that conventional sandwich or round styrofoam floats left in situ are subject to high losses (30-50%). In summer, float anchor ropes are accidentally severed, and the styrofoam flotation material deteriorates (water saturation, UV radiation, boat collision, insect burrowing). In winter, particularly at freeze-up or ice-out, ice movement causes float displacement. Maintenance and replacement of the floats is time consuming and costly. As a solution to float loss from ice-entrapment, Davies (1984) developed a sealed aluminium pipe float that melts free of spring ice and retains its location in the lake following ice-out. This report describes a modification of the Davies float which is fabricated of more readily available ABS material, is less expensive, less prone to collision damage, and is more visible than the original model. Once installed, these maintenance-free markers can be left in position for many years.

MATERIALS AND METHODS

CONSTRUCTION

The float is made of 122 cm (4 ft) lengths of 40 mm (1-1/2 in) i.d. black, ABS drain pipe (Fig. 1). One end of the pipe is warmed with a heat gun, placed in a vice, and squeeze-sealed. A 9 mm (3/8 in) hole is drilled through the flattened bottom end to accommodate the anchor attachment rope. Normally, heating and squeezing is sufficient to effect a waterproof seal. However, to ensure leakage does not occur, ABS cement is brushed into the seam of the flattened end and into the inside of the drill hole.

One kilogram of ballast gravel is added through the open end and consolidated by gently shaking the upright pipe. The remaining void is filled with foam to provide back-up floatation should a leak develop. Approximately 100 ml (50 ml + 50 ml) of liquid 2-component foam (Vultafoam A & B, Fibreglass Canada) is poured into the pipe which is agitated gently to aid mixing. The exact amount of liquid components added should be adjusted to achieve a slight overflow of foam from the pipe end. Once the foam solidifies, the excess is removed with a small saw or knife. A 40 mm (1-1/2 in) ABS end cap is glued on the top end to seal the float. To adapt the float for mooring, a 6 mm (1/4 in) diameter hole is drilled through the end cap and a 25 mm x 9 mm x 100 mm (1 in x 3/8 in x 4 in) galvanized eye bolt threaded through it prior to gluing the cap onto the pipe end (Fig. 1). To prevent leakage, a dab of marine-grade silicone sealant is placed in the hole before threading the eyebolt through the end cap.

To increase float visibility, two or three strips of 25 mm (1 in) adhesive-backed fluorescent tape is pressed onto the upper part of the float just beneath the end cap.

INSTALLATION

Large rocks found on the shores of our study lakes were used for anchors. The pipe floats were tied to the anchors with 6 mm (1/4 in) polyester rope. Slack was left in the anchor rope sufficient to allow for fluctuating lake levels, for the possibility of the anchor sinking into a soft bottom, and to minimize stress on the float at the points of attachment.

RESULTS AND DISCUSSION

Materials used to construct the ABS-pipe float are readily available and inexpensive. Either model can be constructed for less than ten dollars ($10.00 Cdn.), exclusive of labour (Table 1).

The float orients perfectly upright (Fig. 2a, b) with approximately 20% (25 cm) above water. The ballasted design minimizes vertical or horizontal movement, even in blustery weather. The fluorescent tape enhances visibility and makes them easier to locate, even over considerable distances (in excess of 300 m on a clear day). Different colours of fluorescent tape can be used to code station types. For example, our zooplankton sampling sites located in the pelagic zone are coded green, whereas those in the littoral zone are red.

ABS-pipe floats are very robust. They have withstood direct collision from boats at high speed. Anchor lines are rarely, if ever, severed by boat propellers since attachment is approximately 1 m below water.

The ability of the ABS-pipe float to endure freeze-up, winter ice deepening, and spring ice movement is perhaps its most important feature. The anchor attachment is maintained below the ice layer, even at winter's end, due to the length of submerged pipe. Because they are black, the floats readily absorb solar radiation and transfer heat to the surrounding ice. With insolation levels increasing in late winter, a hole begins to melt around the float (Fig. 2c, d). when ice movement occurs in spring, the floats slip through the melted holes and remain intact and in place until ice disappears completely from the lake surface. In September 1990, 103 ABS-pipe floats were installed in 7 Lake Variation and Climate Change Study lakes in the Experimental Lakes Area (Campbell 1992). In May 1991, only one float was found to have moved or disappeared - a loss rate of only 1%. This high survival rate may be, in part, a function of the relatively small size of the study lakes (surface areas range from 16 to 27 ha, maximum depths from 4 to 21 m, McCullough and Campbell 1992) and may not be achievable in larger lakes. However, a larger float and heavier anchoring system patterned on this design could conceivably prove effective in large lakes.

ACKNOWLEDGMENTS

Ian Davies shared his technical know-how and advice. Donna Laroque typed the manuscript. Reviewers included M.A. Turner, C. Anema and I. Davies.

REFERENCES

Campbell, P. 1992. Lake variation and climate change study: ELA lakes 1986-1990. I. Study rationale and lake selection criteria. Can. Data Rep. Fish. Aquat. Sci.

Davies, I.J. 1984. Sampling aquatic insect emergence, p. 161-227. In J.A. Downing and F.H. Rigler (ed.). A manual on methods for the assessment of secondary productivity in freshwaters. Second edition. Blackwell Scientific, Oxford. (IBP Handbook 17).

McCullough, G.K., and P. Campbell. 1992. Lake variation and climate change study: ELA lakes 1986-1990. II. Basin physiography and lake morphology. Can. Data Rep. Fish. Aquat. Sci.

Table 1. List of materials to construct one ABS-pipe float, including estimated costs ($Cdn, 1990).

	Quantity	Components	Est. Cost ($Cdn)
1.	1	122-cm (4') x 40-mm (1 1/2") i.d. ABS drain pipe	3.06
2.	1	40-mm (1 1/2") ABS end cap	1.56
3.	1	60-cm (2') x 65-mm (1/4") polyester rope	0.14
4.	-	ABS-solvent cement	0.03
5.	100 mL (combined)	2-component polyurethane pour-foam	1.06
6.	1 kg	Gravel	0.02
7.	2	16-cm (6 1/2") x 2.5-cm (1") fluorescent, adhesive plastic tape	1.68
			7.55
Optional			
8.	1	25-mm x 9-mm x 100-mm (1 x 3/8 x 4) eye bolt	0.99
9.	2	7-mm (5/16) flat washers	0.10
10.	1	7-mm (5/16) or 9-mm (3/8) lock washer	0.05
11.	2	9-mm (3/8) hex nuts	0.33
12.	-	Marine-grade silicone sealant	0.08
			9.10

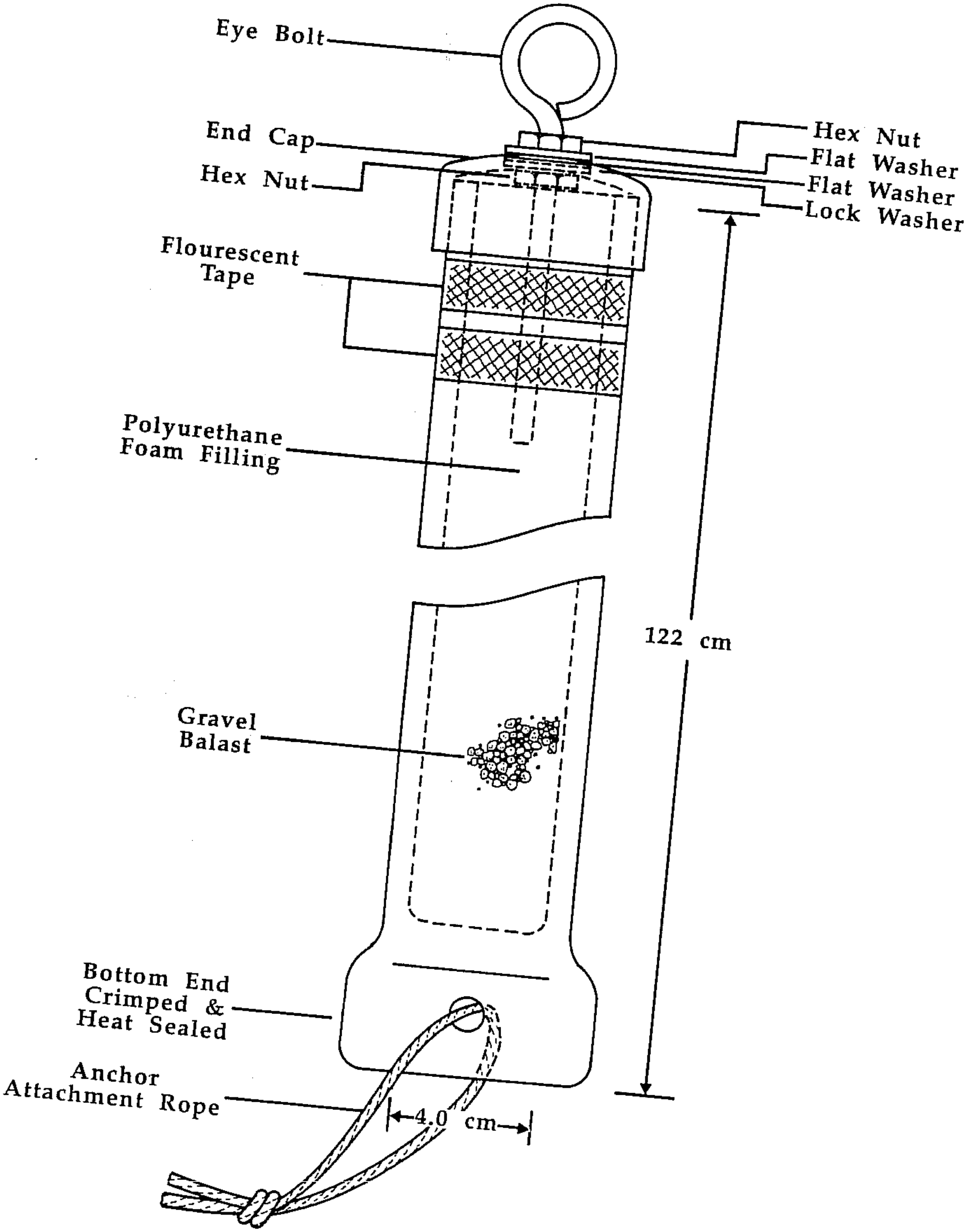

Fig. 1. Plan of the ABS-pipe float, including optional mooring bolt.

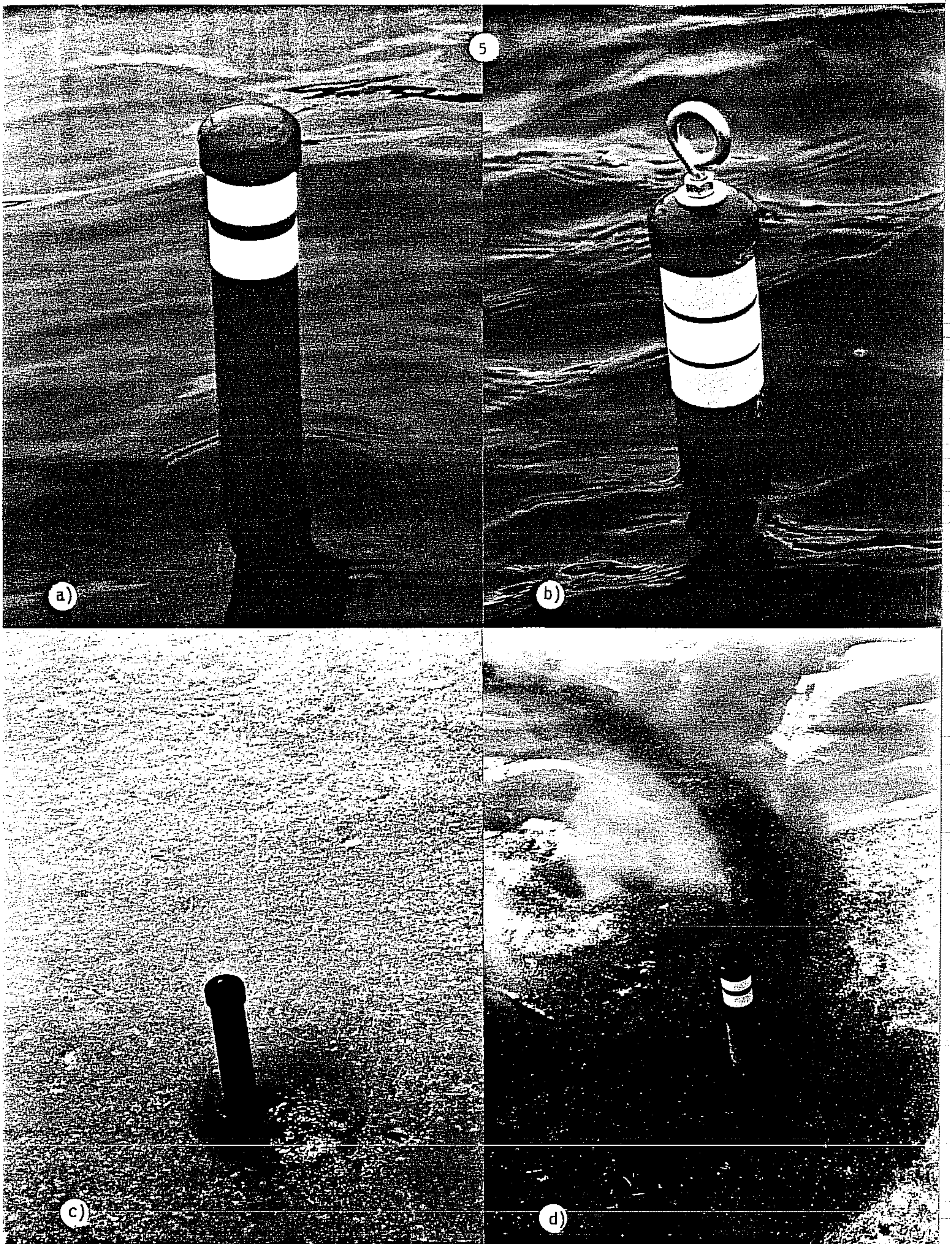

Fig. 2. Photographs of installed pipe floats. a) standard station marker float; b) station marker float, including mooring bolt; c) and d) views of floats melting free of surrounding ice (April 1991).