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AUTHOR Lee, Richard S.
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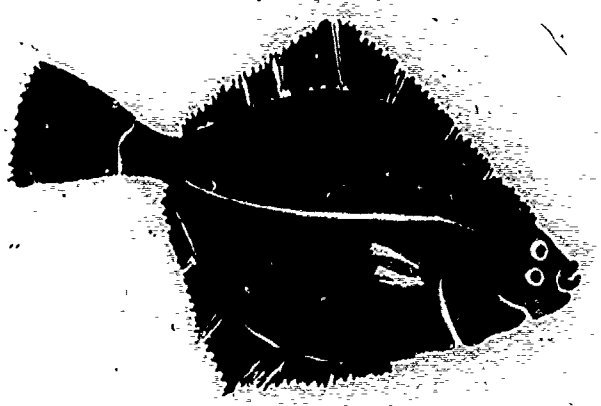
ABSTRACT

This document describes cameras, film, and methods useful for indoor or outdoor photography of aquatic and marine subjects. (SL)

MARINE ADVISORY PROGRAM
COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF ALASKA
ANCHORAGE, ALASKA 99504

CLOSE-UP PHOTOGRAPHY
for the
MARINE SCIENCE CLASSROOM



by

Richard S. Lee

Marine Science Curriculum Aid No. 3
Sea Grant Report 76-14

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TABLE OF CONTENTS

INTRODUCTION

Alaskan students have shown a tremendous interest in marine science despite the prevalent lack of visual teaching aids and the difficulty of planning field trips because of capricious weather. This publication seeks to aid teachers in developing their own collections of photographic materials for classroom use.

Underwater photography has become a relatively simple hobby and a tool for many teachers and students in the lower 48 states. Alaskan teachers, however, are faced with many problems that make this method of collecting teaching materials impractical or difficult. Severe weather, poor underwater visibility, and the lack of skill or enthusiasm for cold water diving all legislate a different approach.

Photography of intertidal organisms, either under natural conditions or in classroom aquaria, allows the teacher to build a file of photographs for later teaching projects. These photographs also can serve as reference collection, allowing the school to avoid the wasteful (in terms of space and natural resources) practice of maintaining study collections of local flora and fauna preserved in formalin.

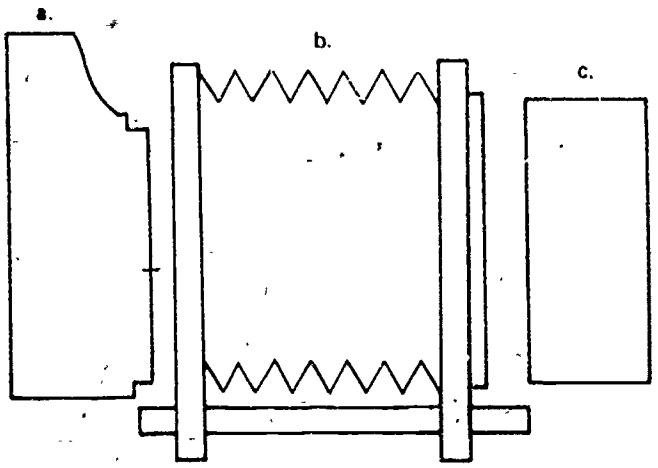


Figure 1. Disassembled single-lens reflex camera showing bellows and lens placement. a. camera body b. bellows unit c. lens.

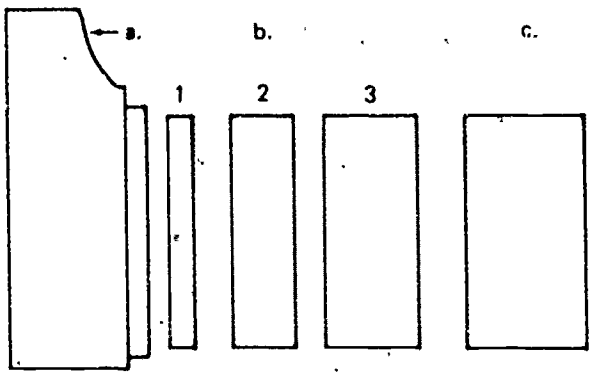


Figure 2. Dissasembled single-lens reflex camera showing extension tubes and lens placement. a. camera body b. (1,2,3,) extension tubes c. lens.

CAMERAS

This publication presupposes that teachers will have access to a 35-mm camera, preferably one with variable focusing and an internal (built-in) exposure meter. A description of three different possibilities follows.

Single-lens reflex camera with interchangeable lenses

A single-lens reflex with interchangeable lenses is the most popular type of camera for this kind of photography, and can be used in several ways. Assuming the use of an internal exposure meter, the exposure is automatically monitored regardless of the lens or combination of lenses. The average (50-55 mm) lens can be focused as close as 24-36 inches, which is adequate for pictures of large organisms and scenic shots, but, unmodified, will not give satisfactory results for close-up work. The most sophisticated modification is the substitution of a close-focusing, or *macro* lens, which allows the photographer to focus from infinity down to 4-8 inches, depending on the brand of lens. In most cases life size reproduction can be attained at close range. A macro lens, however, is an expensive piece of equipment.

Three less expensive alternatives are available. The first involves an extension bellows (Figure 1), which is placed between the camera and the lens. For maximum sharpness and magnification, the lens may be mounted in reversed position. The advantage of this system is that it allows greater magnification (up to four-times life size with a normal lens), and it is somewhat cheaper than a macro lens. The disadvantages are that: (a) the bellows is a rather fragile unit; (b) it is awkward, and therefore it is usually necessary to use it or a tripod; (c) the bellows cuts down the amount of light reaching the film quite drastically, thus making it necessary to use high speed films and low shutter speeds or strobe lights; and (d) the expense is still rather great.

The second alternative involves the use of a set of extension tubes (Figure 2). These are similar to the bellows unit but are rigid. While they allow relatively great magnification, they lack the ability to change magnification over a continuous range. As with the bellows unit, the extension tube extinguishes an appreciable amount of light before it reaches the film.

The cheapest and most practical alternative is the use of diopter lenses. These lenses normally come in sets of three (+1, +2, +3 diopters) and, like light filters, screw onto the front of the lens. Used singly or in combination with a normal (50-55mm) lens, they allow the photographer to focus to about half size - this is adequate for most purposes. They are easy to use and relatively inexpensive. The disadvantages of diopters are that they are (a) easy to lose or scratch; (b) do not produce as sharp an image as the other systems because they introduce an extra layer of glass into the path of light; and (c) do not give as great a range of magnification.

Fixed (non-interchangeable) lens reflex cameras

Fixed (non-interchangeable) lens reflex cameras require the use of supplementary diopter lenses which may be used singly or in combination. These screw onto the front of the normal lens in the same way as a filter. When ordering diopter lenses, state the brand of camera and the lens model so the lens will fit properly.

Rangefinder cameras

Rangefinder cameras used with a diopter lens make it necessary to build a set of wire focusing frames according to the dimensions given in the table. Since the frame is slightly larger than the field of view, it will not appear in the picture.

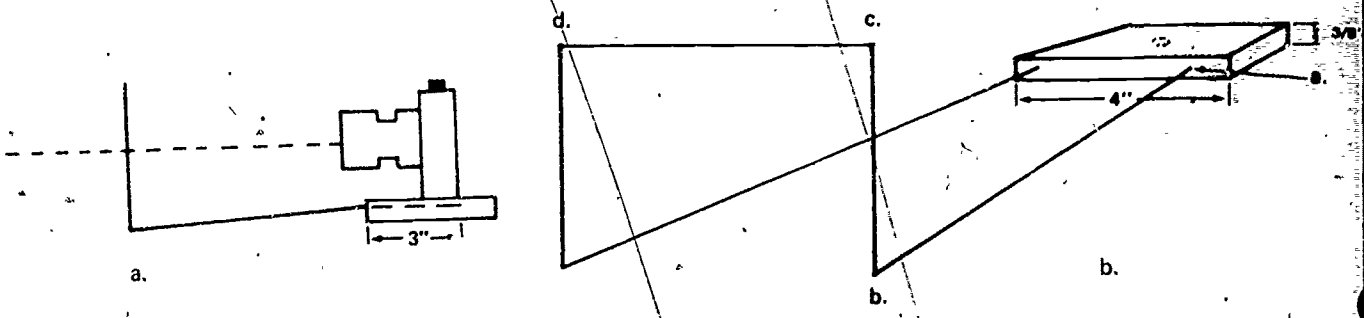


Figure 3. Design of close-frame for 35 mm rangefinder camera. a. side view b. front view. See table for dimensions for different lenses.

Dimensions (inches) of Close-up Focusing Frames (see Figure 3) for 35 mm Rangefinder Camera

Close-up Lenses	Camera Lenses 50 mm			44-46 mm		38-40 mm	
	ab	bc	cd	bd	cd	bc	cd
+2	19.50	19.50	14	10	15	11.50	17
+3	13	6	9	6.75	10	7.25	10.75
+4	9.50	4	7	5	7.50	5.50	7.75
+5	8	3.75	5	4	6	4.25	6.25
+6	6.50	3.25	4.75	3.50	5	3.50	5

Figure 3 illustrates the shape of the wire frame, which is mounted on a board 3/8 inch thick, 4 inches wide and as long as the camera body. Add three inches to each bottom wire to allow attachment to the board though two 3-inch-long drilled holes in the front of the board. A third hole should be drilled in the center of the mounting board to allow mounting with a tripod screw in such a position that the subject to lens distance is equal to leg a-b in Figure 3.

In focusing with the diopter lens in place, the main lens should be set at infinity, and exposures should be read with a hand-held meter at the location of the camera.

FILM

Color film

Two alternatives exist - transparency (positive) and print (negative) film. For most teaching purposes transparency (slide) films produce better results at lower cost. Low speed films (ASA 25-64) generally yield better results for reproduction than do high speed films (ASA 160-500) because of the better grain structure and truer colors. Low speed films, however, have the disadvantage of not being able to function in low-light situations. Supplementary lights, such as strobes or photofloods (see section on lighting) are needed.

Black and white film

Black and white photographs do not lend themselves to classroom use as well as color transparencies. Furthermore, unless the photographer does his own processing, or has custom processing done, the results are likely to be disappointing. However, for special purposes, such as displays or publications, a medium to high speed (ASA 100-300) black and white film will prove most versatile.

OUTDOOR PHOTORAPHY

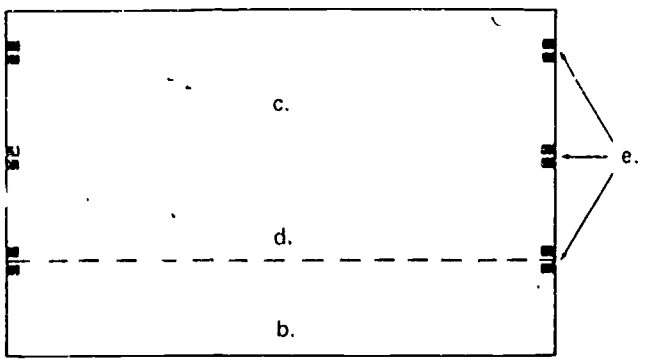
Photographs taken in natural situations always have greater appeal, but intertidal photography, particularly in Alaskan waters, is fraught with hazards. Salt water is especially damaging to photographic gear: exposure to even slight salt spray is detrimental. For best protection, cameras should be carried in sealable plastic bags when not actually in use. Waves and tide demand attention and awareness. Many photographers and beachcombers have found themselves dashed by a wave or stranded by a rapidly incoming tide while concentrating on their subject.

Many animals live in situations that make photography difficult at best. Some of these may be captured and moved to a location where it is more feasible to photograph them. *Remember to replace your subjects as gently as possible as soon as you are finished. When working with members of the underrock communities, it is essential that any rocks you move be replaced in their original position in order to prevent the animals from drying out.*

AQUARIUM PHOTOGRAPHY

Since most of the swimming animals would look very unnatural if photographed out of the water, use of aquaria offers a workable solution. For most purposes, a small (10-, 15-, or at the most, 20-gallon) tank is best. For rather active animals, such as small fishes, a simple means of controlling the back and forth movement is necessary. One of the simplest methods is to place pairs of tabs of aquarium sealer on each side of the tank at 1-, 2-, 3-, and 4-inch intervals. These, when hardened, form supports for a pane of window glass, confining the specimen in a forward chamber and providing suitable background material in rear chamber (Figure 4).

For those teachers without aquaria, it is not a difficult task to build one of glass, plexiglass, or of a plywood and glass combination. (Aquarium building is the subject of Curriculum Aid #2.)



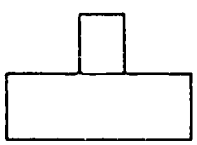


Figure 4. a. camera
b. forward chamber
c. rear chamber
d. window glass
e. aquarium sealer tabs
f. front of tank

LIGHTING

Balanced lighting is difficult to achieve without artificial light of some sort. However, outdoor lighting may be used in conjunction with white reflector cards to give adequate results. The white card should be placed so that it reflects the sunlight toward the shadowed areas, thus softening the shadows.

Photoflood lights

Two types of artificial lighting may be used. The first is a pair of photoflood lights on stands, preferably run off a single switch. These should be placed on either side of the camera at an angle of about 45° to the front wall of the tank so that the light is not reflected back into the lens (Figure 5). Unfortunately, photofloods generate a great deal of heat which could damage or kill your specimens so these lights should be used with caution. For special effects, back and/or top lights of lower intensity may be placed behind and/or above the tank.

Exposures may be calculated directly either from a hand-held or built-in meter. Remember to use indoor film when using photoflood lamps, since tungsten lights have a different color temperature than that of sunlight.

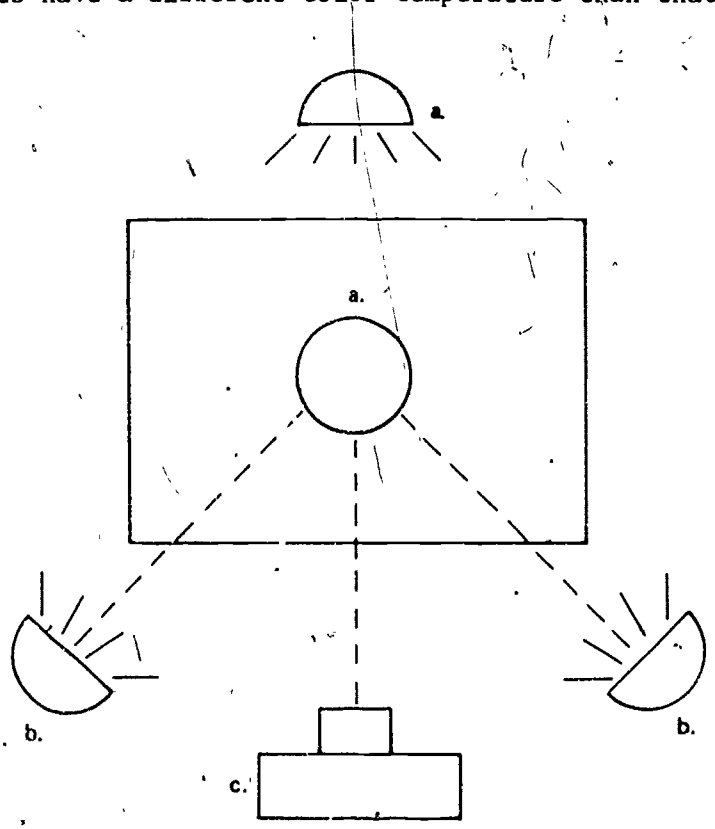


Figure 5.

a. optional overhead lights — angle b a b + 90°

b. necessary lights — angle b a c = 45°

c. camera — angle c a b + 45°

Strobe lights

A slightly more expensive and slightly more complex approach to the lighting problem is through the use of two strobe lights, placed in the same position as the photofloods in Figure 5. The advantages of strobes are (a) they do not create heat; (b) their period of peak flash is very quick (usually 1/1000 of a second) so that almost all motion is frozen; and (c) outdoor film may be used since the color temperature of strobes is balanced to match sunlight. Strobes need not be expensive and, with some experimentation, the proper strobe-to-tank distances can be matched with the proper stops on your camera so that consistently good results may be attained.

RESULTS AND THEIR USE IN THE CLASSROOM

To obtain good results your *equipment must be in good working order* -- clean and protected from salt spray and dust. Elaborate cameras are not necessary. It is far easier to take good pictures of any sort with a simple camera that you are used to than with an unfamiliar or complicated one.

The second prerequisite is *good record keeping*. This is especially important when working with strobe lights and photofloods. The pertinent data to be recorded is (a) the lens to subject distance; (b) light to subject distance; (c) the number and angle of lights; (d) shutter speed; (e) lens aperture (f stop); and (f) any other miscellaneous notes. While this practice may seem tedious at first, it is well worth the effort. It develops a consistency of quality by allowing you to analyze each exposure and to make adjustments in technique for later shots.

There are many photo filing systems and it is difficult to single out one or two that would suit general needs. Large slide file boxes arranged by subject (e.g., fishes, mollusks, echinoderms, marine plants) work well for most people. Most Alaskan teachers will, no doubt, want to concentrate on their particular region in order to assemble a set of slides meaningful to their students.

Identification of your subject is a real problem unless you have great familiarity with marine life. For most purposes the common name and some basic information about the animal are important. For example: where was this organism found; how is it adapted to its habitat; and what are its biological relationships? These questions can be used as springboards for discussion of natural history, adaptation/natural selection, and taxonomy. These pictures can help give the students an awareness of the tremendous diversity and wealth of life. They can also show the non-commercial resources which exist in the region and how these resources may be used.

When you find and photograph an organism which you cannot identify, two paths are open to you. Either preserve the animal and save it until you can enlist the aid of a university or state biologist or, if your photographs are clear, send a copy of the picture to the Marine Advisory Program and we will try to identify it for you

GLOSSARY

color temperature -- a means of expressing the spectral energy distribution -- measured in on the absolute scale (or Kelvin) scale, or expressed as *mireds* (1 mired = 10 /color temperature in ^{o}K).

diopter lens -- supplementary lens which, when added on the front of the normal lens allows closer focusing and greater magnification.

exposure meter -- an instrument for calculating the correct lens opening and shutter speed combination.

macro lens -- a lens capable of focusing to close ranges, usu. 8-4 inch, yield reproduction rations of 1:2 (1/2x) to 1:1 (1x).

photoflood -- an extremely high intensity incandescent light balanced for *indoor* color film.

rangefinder camera -- camera with an accessory optical focusing and coupled to the lens.

single lens reflex -- a camera which by means of prisms and mirrors allows the photographer to focus directly through the lens.

strobe -- an electronic flash unit whose illumination is provided the discharge of a high voltage electric current in a tube filled with one of the rare gas elements, usually either krypton or xenon.

variable focusing -- ability of lens to selectively focus on near to far subjects.

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