

AFM 64-5

A I R F O R C E M A N U A L

Search and Rescue

SURVIVAL

DEPARTMENT OF THE AIR FORCE

AIR FORCE MANUAL

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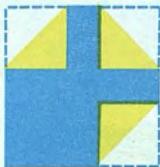
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PANEL SIGNALS

Survivors use liferaft sails to convey signals.

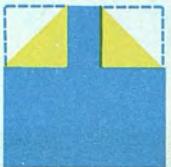
ON LAND AND AT SEA: Need medical attention.



ON LAND AND AT SEA: Need first aid supplies.



ON LAND: Need quinine or atabrine.
ON SEA: Need sun cover.



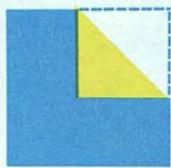
ON LAND: Need warm clothing.
AT SEA: Need exposure suit or clothing indicated.



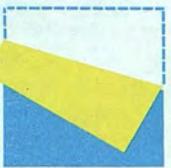
ON LAND AND AT SEA: Need food and water.



Have abandoned plane.
ON LAND: Walking in this direction.
AT SEA: Drifting.



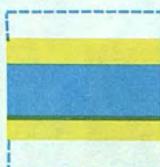
ON LAND: Need gas and oil, plane is flyable.



ON LAND AND AT SEA: Plane is flyable, need tools.



AT SEA: Need equipment as indicated. Signals follow.



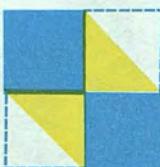
ON LAND: Indicate direction of nearest civilization.
AT SEA: Indicate direction of rescue craft.



ON LAND: Should we wait for rescue plane?
AT SEA: Notify rescue agency of my position.



ON LAND AND AT SEA: O. K. to land, arrow shows landing direction.



LAND AND SEA: Do not attempt landing.

STANDARD AIRCRAFT ACKNOWLEDGMENTS

MESSAGE RECEIVED AND UNDERSTOOD

Aircraft will indicate that ground signals
have been seen and understood by—



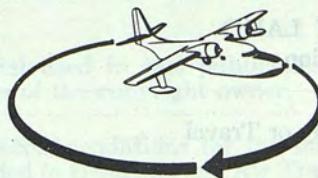
DAY OR MOONLIGHT: Rocking from side to side



NIGHT: Making green flashes with signal lamp

MESSAGE RECEIVED AND NOT UNDERSTOOD

Aircraft will indicate that ground signals
have been seen but not understood by—



DAY OR MOONLIGHT: Making a complete right hand circle



NIGHT: Making red flashes with signal lamp

Department of the Air Force
Washington 25, D.C.
1 February 1962

SEARCH AND RESCUE

SURVIVAL

The purpose of this manual is to aid and insure your survival and rescue regardless of geographic location or climatic condition. The manual tells you what to do, and when, where, and how to do it, whether your survival situation be in the Arctic, desert, or tropics—on land, sea, or ice. It recognizes your immediate and probable future problems and attempts to aid you in solving them. It describes the proper use of the equipment in your survival kit, and just as important, it will aid you in recognizing and using the natural resources at hand. This information, plus your will and desire to live, are necessary to insure your survival.

CONTENTS

	<i>Page</i>
SURVIVAL IN AREAS CONTAMINATED BY RADIATION	
Shelter	1
Food and Water	2
Clothing and Equipment	2
Health	2
SURVIVAL ON LAND	
Immediate Action	3
First Aid	4
Signaling	12
Decision to Stay or Travel	15

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	<i>Page</i>
SURVIVAL ON LAND (continued)	
Shelter	16
Fire-Making	21
Survival Weapons	25
Clothing	29
Health and Hazards	31
Water	36
Food	43
Animal	45
Plant	54
Preparation	62
Arctic	65
Desert	74
Tropical	78
Orientation	98
Direction Finding	98
Position Finding	104
Travel	120
Natives	128
SURVIVAL AT SEA	
Immediate Action	132
Signaling	136
Health	137
Water and Food	138
Survival Swimming	142
Seamanship	143
SURVIVAL ON SEA ICE	
Immediate Action	149
Decision to Stay or Travel	149
Shelter	149
Fire-Making	150
Food and Water	150
Travel	154

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Comments and recommendations for the improvement of this manual should be forwarded to Headquarters Air Training Command, Randolph Air Force Base, Texas.

SURVIVAL IN AREAS CONTAMINATED BY RADIATION

Under combat conditions when nuclear weapons have been employed, protection from the effects of residual radiation will be your immediate and most important task. Unless countermeasures are employed against this hazard when it exists, the techniques cited in the remainder of this manual will be of little value. Residual radiation is potentially lethal and must be dealt with as soon as you arrive on the ground.

Shelter

The most effective means of protection against penetrating gamma radiation is shelter. Attempt to locate a natural shelter which can be utilized with only minimal improvement. The location of the shelter should be determined in a very short time, (not more than five minutes), after arrival on the ground. Ideal locations are: caves, under overhanging rocks, deep defiles, under large downed logs, etc.

The shelter must be improved while taking advantage of the shielding it provides. On level ground, sweep the ground clean and lie down. Dig a slit trench from the prone position stacking the earth around the trench. A shielding cover (roof) should be considered only if materials are available to build it without undue exposure. A cover of parachute cloth, although it does not provide shielding, will prevent entry of particles into the shelter. It must be struck (shaken) frequently to remove the particles that have alighted on it.

Under marshy conditions or in areas of permafrost, sod blocks may have to be stacked on the surface to make a shelter.

The following thicknesses will provide ideal shielding if one is surrounded from all sides including the top to protect from "sky-shine"—the radiation scattered back by air molecules from radiation originating from fallout particles on the ground. However, a lesser amount of shielding may be life saving:

Earth	3 ft	Steel	1/2 ft
Rock or Concrete	2 ft	Snow	20 ft
Ice	5 ft		

Once you have entered the shelter, continue to work on it from the inside to make living in it more comfortable. The emphasis should be placed on obtaining as much comfort as possible, to allow for rest and increase recovery from radiation. Take steps to be as warm and dry as possible. Your parachute may be used as insulating material after it has been decontaminated by shaking and/or rinsing and drying.

DECAY OF THE RADIATION HAZARD. The radiation hazard dissipates fairly rapidly providing no new detonations add to the contamination. After seven (7) hours from the time of maximum contamination, only 1/10th of the hazard will remain. After forty-nine (49) hours from the time of maximum contamination, only 1/100th of the hazard will remain.

After two (2) weeks from the time of maximum contamination, only 1/1000th of the hazard will remain. If new contaminating events take place (more weapons delivered), the contamination will be renewed and you must wait out the decay of the fresh radioactive material. The shelter must be constantly occupied for a minimum of two hundred (200) hours after you estimate the last weapon has been delivered; longer if possible. You should not go outside the shelter except to satisfy a critical need for water. The shelter should be camouflaged and movement held to a minimum to preclude compromise of your position.

Food and Water

Processed foods (rations) will be safe to eat as long as containers are intact. The same will be true of any processed foods located in the area. Animal foods will be usable even when taken from an area contaminated by radiation. The animal must be carefully skinned and the heart, liver and kidneys discarded.

Plant foods are in general, safe to eat. Plants with the edible portion below ground are best. Smooth-surfaced plant foods that can be easily washed are next best. Rough-surfaced plant foods will be difficult to wash but may be used as a last resort. All plant foods should be peeled and the edibility test cited on page 54 applied.

Open water in an area that has received fallout may contain harmful particles. Water from an underground source, (spring, covered well, etc.), is your best supply. Water from other sources (lake, pond, rivers, streams, etc.) is next best. A filter can be made by digging a hole approximately one (1) foot from the bank of the water source. The water will seep into the hole where it may be collected for drinking. The water may be cloudy or even muddy but will settle out if allowed to remain still. This water should be purified from bacteria before drinking.

Clothing and Equipment

Keep your clothing on. This includes hat and gloves. This will prevent beta burns which will occur on exposed skin. Clothing and equipment should be decontaminated by shaking. Washing clothing in any available water will remove radioactive particles.

Health

Washing dust from exposed skin area will assist in preventing burns. Keep as warm and as dry as possible. If burns develop, treat as regular burns except that burned area should be washed.

SURVIVAL ON LAND

IMMEDIATE ACTION

General

Stay away from the airplane until the engines have cooled and spilled gas has evaporated.

Check injuries. Give first aid. Make the injured men comfortable. Be careful when removing casualties from the airplane, particularly men with injured backs and fractures.

Get out of the wind and rain. Throw up a temporary shelter. If you need a fire, start it at once. In cold weather, make hot drinks.

Get your emergency radio operating on schedule and have other signaling equipment handy.

Now relax and rest until you are over the shock of the crash. Leave extensive preparations and planning until later.

After you have rested, organize the camp. Appoint individuals to specific duties. Pool all food and equipment in charge of one man. Prepare a shelter to protect yourself from rain, hot sun, snow, wind, cold, or insects. Collect all possible fuel. Try to have at least a day's stock of fuel on hand. Look for a water supply. Look for animal and plant food.

Prepare signals so that you will be recognized from the air. (See section on *Signaling*, page 12.)

Start a log book. Include date and cause of crash; probable location; roster of personnel; inventory of food, water, and equipment; weather conditions; and other pertinent data.

Determine your position by the best means available, and include this position in your radio messages. If position is based on celestial observations, transmit the observations also.

If you have bailed out, try to make your way to the crashed plane. The rescuers can spot it from the air even when they cannot see a man.

Stay with the airplane unless your briefing instructions have been to the contrary. Do not leave the airplane unless you know that you are within easy walking distance of help. If you travel, leave a note giving planned route (except in hostile territory). Stick to your plan so rescuers can locate you.

You are the key man in the rescue. Help the search parties to find you and follow their instructions when they sight you. Don't collapse when you are sighted or when the rescue party arrives. They can use all the assistance you can give. Don't take chances which might result in injury. You will be easier to rescue if you are in one piece.

The following procedures will speed up your rescue:

Conserve power of electronic equipment. Use it according to procedures given in your briefing.

Sweep the horizon with your signal mirror at frequent intervals.

Read Signaling section of this manual, page 12, and follow procedures given there in communicating with rescuers.

Arctic

In winter, protection from cold is your immediate and constant problem. Keep dry, avoid snowblindness, check for frost bite.

To stay dry, keep snow out of your boots, gloves, and clothing; avoid open water. Overexertion causes perspiration which will freeze inside your clothing, thus decreasing effective insulation and increasing the chances of freezing. Always remove outer clothing when working or moving; when you stop, throw your outer garments over your shoulders or replace them to avoid chilling. If you have shelter at night, remove your underclothes and air them, or let them get cold and beat the frost out with a stick. *Keep hands and feet dry!*

Collect wood, gasoline, oil, heather, brush, or peat for fuel. Build a fire at a safe distance from the airplane and get under shelter (see pages 15-25).

If the airplane is flyable, drain oil; insulate wheels from ice with boughs or canvas; leave brakes off; remove battery and protect it from freezing.

If down in a glacier area, be on your guard against falling into crevasses when reconnoitering. Rope party together, preferably three men to a rope. As you walk, probe the snow in front of you with a pole or ice axe to detect crevasses covered by thin snow.

In summer, protect yourself against insects. Keep dry.

Desert

Water will be your biggest problem. Do not waste it. Keep your head and the back of your neck covered and get into shade as soon as possible to reduce sweating and loss of body water. Travel only at night. (See *Desert Travel*, page 126, for instructions on use of water.)

Tropics

Take shelter from rain, sun, and insects. Malaria-carrying mosquitoes and other insect pests are the immediate dangers of the tropics—protect yourself against bites.

Do not leave landing site without carefully blazing or marking your route. Use your compass. Know in what direction you are going.

FIRST AID

General

The most likely injuries will be cuts and bruises, fractures, concussion of the brain, internal injuries, and burns. Keep injured men lying down, unconscious men and those with head injuries, head down. Handle patients very carefully. Watch for symptoms of shock. Keep patients warm.

When there is no chance that an injured airman can be treated by medical personnel within a short period, the treatment rendered must be final treatment. *The primary aim will be to prevent loss of life and either to prepare the injured party for movement or to be less of a problem to his companions or to himself.*

You must be prepared to treat your own injuries. These injuries may be simple or in some cases so severe that death will result unless action is taken to preclude it. Simple, temporary treatment of injuries under these circumstances would be to no avail. You must be prepared to undertake strong measures to sustain life.

BLEEDING. Place sterile pad directly on wound and apply pressure by hand or by bandaging firmly.

Elevate the limb if bleeding does not stop.

Use a tourniquet only if limbs are badly crushed or if bleeding is not stopped by pressure bandage. Place the tourniquet on upper arm or leg between injury and heart. Under normal temperatures, tourniquets should be released every 15-20 minutes. If the extremity becomes cold and bluish in color, release the tourniquet more frequently. The release period should be for several seconds. In extremely cold temperatures, tourniquets should be released at more frequent intervals, and every effort should be made to keep the treatment area as warm as possible.

CONTROL OF BLEEDING. Serious bleeding must be controlled at once. In only a few minutes, life can ebb away and without the ability to replace the blood, the life is lost.

Direct pressure compresses will stop capillary and minor venous bleeding. Serious venous and arterial bleeding can also be stopped by pressure. Use of a tourniquet under these circumstances may sacrifice a



BLEEDING IN SCALP ABOVE THE EAR.
Light pressure in front of the middle ear.



BLEEDING ON OUTSIDE OR INSIDE OF HEAD.
Moderate pressure on neck about 3" below ear and 3" above collarbone — push artery against spine.



BLEEDING IN THE CHEEK.
Very light pressure in notch on under edge of jaw $\frac{2}{3}$ back from tip of chin.



BLEEDING IN THE LOWER ARM.
Strong pressure on inside of arm halfway between shoulder and elbow.



BLEEDING IN THE ARM.
Firm pressure behind the middle of collarbone — push artery against first rib.



BLEEDING ABOVE THE KNEE.
Strong pressure in groin with heel of hand — push artery against pelvic bone.

BLEEDING BELOW THE KNEE AND ELBOW.
Use tourniquet between crotch and knee.

How to stop bleeding

limb or if improperly applied may increase the bleeding. Application of strong pressure may be required until the seriously bleeding vessel can be tied off with thread or a fine string. If reasonably sure that the bleeder is in a given bit of tissue, the entire area can be tied off, thus stopping the bleeder. This may be done by using a large needle to pass into the tissue and around the area of severe bleeding and tying the entire mass securely.

CESSATION OF BREATHING. The best form of artificial respiration is the mouth-to-mouth type. It is the only technique which guarantees enough air exchange to revive the unconscious person, and allows the "operator" to insure that the airway is open. If there is an obstruction, air cannot enter the lungs regardless of the method of artificial respiration used.

There are three main causes for obstruction:

1. Liquid, false teeth, or other foreign matter in the mouth or throat.
2. Relaxation of the jaw. The tongue is attached to the jaw so that it falls backward and blocks the throat (called "swallowing the tongue").
3. Position of the neck. When the neck is bent forward so that the chin is near the chest, the throat becomes "kinked" and blocks the passage of air.

To correct any of the above conditions, place the patient on his back looking upwards and hold the lower jaw forward.

Procedure

1. Turn the victim on his back.
2. Clean the mouth, nose, and throat. If the mouth, nose, and throat appear clean, start exhaled-air artificial respiration immediately. If foreign matter such as vomitus or mucus is visible in the mouth, nose, and throat, wipe it away quickly with a cloth or by passing the index and middle fingers through the throat in a sweeping motion. (See Figure 1.)
3. Place the victim's head in the "sword-swallowing position." The head must be placed as far back as possible so that the front of the neck is stretched.
4. Hold the lower jaw up. (See Figure 2.) Approach the victim's head preferably from his left side. Insert the thumb of your left hand between the victim's teeth at the midline. Pull the lower jaw forcefully outward so that the lower teeth are further forward than the upper teeth. Hold the jaw in this position as long as the victim is unconscious. A piece of cloth may be wrapped around the thumb to prevent injury by the victim's teeth.



Figure 1



Figure 2

5. Close the nose. Close the victim's nose by compressing it between the thumb and forefinger of the right hand.
6. Blow air into the victim's open mouth with your open mouth with *airtight contact*. Blow rapidly and forcefully until the chest rises. (See Figure 3.)

7. Let air out of victim's lungs. After chest rises, quickly separate lip contact with the victim, and allow the victim to exhale by himself.

If the chest did not rise when you blew in, improve the support of the victim's air passageway, and blow more forcefully. Repeat the inflations of the lungs 12 to 20 times per minute. You'll find that you need to breathe slightly deeper and faster than usual in order to get enough air for yourself but don't worry about this point. Continue rhythmically without interruption until the victim starts breathing, or is obviously dead. A smooth rhythm is desirable, but split-second timing is not essential.

Special Considerations

If the victim *appears to be breathing to some degree*, keep his air passageway open until he awakens by maintaining the support of his lower jaw. If his tongue or fingernails are blue rather than pink, he is not breathing adequately and requires assistance.

Although the victim may appear to be breathing because of movement of his chest and abdomen, air may not be moving into his lungs due to complete obstruction of the air passageway from improper positioning of the head and jaw. For this reason, it is most important to determine whether or not there is any movement of air in and out of the mouth and nose by listening closely.

CHEST WOUNDS. Open chest wounds, through which air can be heard sucking, should be covered with a large dressing. Air entering the wound will collapse the lungs; consequently, the pad should be firmly applied at the moment of maximum exhalation, just before more air is sucked in. It should be firm enough to make a seal, but not tight enough to stop chest movement entirely.

SHOCK. All personnel are likely to suffer some shock after an emergency landing. Men in shock may have pale, cold skin; they may sweat, breathe rapidly, and have a weak pulse; they may be confused or unconscious.

Lay the patient down flat, with feet raised.

Keep him warm, but not overheated. If he is conscious and not injured internally, give him warm drinks; do not give alcohol.

If oxygen is available, give it to the patient.

If the patient is in severe pain from injury, give a morphine injection (syringe) according to directions on the container. (Always give the injection above the tourniquet, or on the uninjured extremity.)



Figure 3

Be reassuring and cheerful with men in shock.

EYE INJURY. Clean wound and eye by irrigating with clean water. Use atropine ointment or anti-biotic ointment such as penicillin, terramycin, etc., when available. Cover eye with clean dressing. Give aspirin for pain.

To remove a foreign body in the eye, first irrigate with clean water. If not successful, then wind sterile cotton on a match stick to make an applicator. Moisten with clean water and attempt to dislodge the foreign body by several gentle swipes over the affected area. If this is unsuccessful, make no further attempt to remove it but use atropine ointment and anti-biotics.

FRACTURES AND DISLOCATIONS. Handle injured men with care to avoid causing them more injury.

Don't remove clothing from a fractured limb. If a wound exists, cut away clothing and treat before splinting. Clothing is most easily cut at the seams.

Improvise splints from pieces of equipment or from a tight roll of clothing; pad with soft materials. The splint should be long enough to incorporate the joints above and below the fracture.

Give a morphine injection (syringe) for severe pain (except for head injuries).

Keep the patient lying quiet; don't move him.

The treatment of fractures is normally considered beyond the scope of first-aid; however, in the prolonged survival situation, the correction of bone deformities is necessary to hasten healing and to obtain the result that will allow the injured party to use the injured member. The best time for manipulation of a fracture is in the period immediately following the injury, before painful muscle spasm sets in. Traction should be applied until overriding fragments of bone are brought into line, (check by comparing with other limb). Then firmly immobilize the extremity.

An immobilization device must be improvised. This may be done by weaving together willow branches or other stable items to form a "splint-cast."

Gentle but firm traction is also applied to extremities to reduce dislocations.

If you are alone, the problem of treating fractures or dislocations is more complicated but not impossible, for traction can be applied by using gravity. The wrist or ankle end of the extremity can be tied to (or wedged into) a fork of a tree or similar point of firm fixation. The weight of the body is then allowed to exert the necessary counter-traction with the joint being manipulated until the dislocation (or fracture) is treated. Before beginning the procedure, necessary splinting materials must be collected and be readily available.

SPRAINS. Bandage and keep sprained part at rest. Application of local cold may prevent swelling. When swelling has decreased (in six to

eight hours) application of local heat will ease pain. Elevate the injured extremity.

If it is necessary to use the sprained limb, immobilize the injured area as much as possible with a splint or heavy wrapping. If no broken bones are involved, a sprained limb can be used to the limit that pain can permit.

To PREVENT INFECTION. Cut away clothing necessary to get at a wound. Don't touch a wound with fingers or dirty objects. Don't suck wounds, except snake bites.

Apply sterile dressing with firm pressure into wound. Tie firmly but not too tightly.

Keep wounded part at rest.

Iodine may be used to sterilize skin areas surrounding a wound but should not be poured directly into an open wound. Let iodine dry in air before applying bandage.

BURNS. One of the most frequent survival or aircraft emergency injuries is burns. Burns cause severe pain, often result in shock and infection, and offer an avenue for the loss of considerable body fluid and salts. The initial treatment is directed toward the relief of pain and prevention of infection. In survival, the closed method of treatment has certain advantages. Covering of the wound with a clean dressing of any type reduces the pain and the chances of infection. Further, such protection enhances mobility and performance of vital survival functions.

Maintenance of body fluids and salts is essential to the recovery from burns. The only way to administer fluids in survival is by mouth. You should therefore drink sufficient water in the early period following the burn damage and before nausea and vomiting starts.

Don't touch a burned part with fingers. Cover freely with *burn ointment*. Apply thick gauze pack; bandage firmly. Don't change bandage. If pain is severe, give a morphine injection. Keep the burned part at rest. Splints may sometimes be used to good advantage. If necessary to open blisters, use sterilized needle to pierce through the skin at the base of blister. Apply a sterile bandage after drainage.

Arctic

Keep injured men warm and dry. Put the patient in sleeping bag, provide shelter, and build a fire. Warm food and liquids are desirable for conscious patients. Avoid alcohol. Improvise heat packs by heating rocks, sand, metal, or dirt, and wrapping it in fabric. Place packs at the small of the back, between thighs, under armpits, on stomach, and on soles of feet, or as the patient requests. *Make sure not to burn the skin.*

FROSTBITE. Frostbite is the freezing of some part of the body. It is a constant hazard in sub-zero operations, especially when the wind is strong. As a rule, the first sensation of frostbite is numbness rather than pain. You can see the effects of frostbite, a grayish or yellow-white spot on the skin, before you can feel it.

Use the buddy system. Watch your buddy's face to see if any frozen spots show; and have him watch yours.

Get the frostbite casualty into a heated shelter if possible.

Warm the frozen part rapidly. Frozen parts should be thawed in water until soft, even though the treatment is painful. This treatment is most effective when the water is exactly 107°F, but water either cooler or warmer can be used. If warm water is not available, wrap the frozen part in blankets or clothing and apply improvised heat packs.

Use body heat to aid in thawing. Hold a bare, warm palm against frostbitten ears or parts of the face. Grasp a frostbitten wrist with a warm, bare hand. Hold frostbitten hands against the chest, under the armpits, or between the legs at the groin. Hold a frostbitten foot against a companion's stomach or between his thighs.

When frostbite is accompanied by breaks in the skin, apply sterile dressing. Do not use strong antiseptics such as tincture of iodine. Do not use powdered sulfa drugs in the wound.

Never forcibly remove frozen shoes and mittens. Place in lukewarm water until soft and then remove gently.

Never rub frostbite. You may tear frozen tissues and cause further tissue damage. Never apply snow or ice; that just increases the cold injury. For the same reason, never soak frozen limbs in kerosene or oil.

Do not try to thaw a frozen part by exercising. Exercise of frozen parts will increase tissue damage and is likely to break the skin. Do not stand or walk on frozen feet. You will only cause tissue damage.

IMMERSION FOOT (TRENCH FOOT). Immersion foot is a cold injury resulting from prolonged exposure to temperatures just above freezing. In the early stages of immersion foot, your feet and toes are pale and feel cold, numb, and stiff. Walking becomes difficult. If you do not take preventive action at this state, your feet will swell and become very painful. In extreme cases of immersion foot, your flesh dies, and amputation of the foot or of the leg may be necessary.

Because the early stages are not very painful, you must be constantly alert to prevent the development of immersion foot. To prevent this condition:

Keep your feet dry by wearing waterproof footgear and keeping your shelter dry.

Clean and dry your socks and shoes at every opportunity.

Dry your feet as soon as possible after getting them wet.

Warm them with your hands, apply foot powder, and put on dry socks.

When you must wear wet socks and shoes, exercise your feet continually by wiggling your toes and bending your ankles. When sleeping in a sitting position, warm your feet, put on dry socks, and elevate your legs as high as possible. Do not wear tight shoes.

Treat immersion foot by keeping the affected part dry and warm. If possible, keep the foot and leg in a horizontal position to increase circulation.

SEVERE CHILLING. If you are totally immersed in cold water for even a few minutes, your body temperature will drop. Long exposures to severe dry cold on land can also lower your body temperature. The only remedy

for this severe chilling is warming of the entire body. Warm by any means available. The preferred treatment is warming in a hot bath. Severe chilling may be accompanied by shock.

SNOWBLINDNESS. Symptoms of snowblindness are redness, burning, watering, or sandy feeling eyes, headaches, and poor vision.

Treat snowblindness by protecting the eyes from light and relieving the pain. Protect the eyes by staying in a dark shelter or by wearing a lightproof bandage. Relieve the pain by putting cold compresses on the eyes, if there is no danger of freezing, and by taking aspirin. Use no eye drops or ointment. Most cases will recover within 18 hours without medical treatment. The first attack of snowblindness makes the victim susceptible to others.

CARBON MONOXIDE POISONING. Carbon monoxide poisoning can be caused by a fire burning in an unventilated shelter. Usually there are no symptoms; unconsciousness and death may occur without previous warning. Sometimes, however, there may be pressure at the temples, headache, pounding pulse, drowsiness, and nausea. Treat by getting into fresh air at once; keep warm and at rest. If necessary, apply artificial respiration. Give oxygen, if available.

Desert

Exposure to the desert sun can be dangerous. It can cause three types of heat collapse.

HEAT CRAMPS. The first warning of heat exhaustion usually is cramps in leg or belly muscles. Keep the patient resting; give him salt dissolved in water.

HEAT EXHAUSTION. Patient is first flushed, then pale, sweats heavily, has moist, cool skin, may become delirious or unconscious.

Treat the patient by placing him in the shade flat on his back. *Give him salt dissolved in water*—two tablets to a canteen. Since he is cold, keep him wrapped up and give him warm drinks if available.

HEAT STROKE. Heat stroke may come on suddenly. The face is red, skin hot and dry. All sweating stops. There is severe headache; pulse is fast and strong. Unconsciousness may result.

Treat the patient by cooling him off. Loosen his clothing; lay him down flat, but off the ground, *in the shade*. Cool by saturating his clothes with water and by fanning. Do not give stimulants.

Tropics

WOUNDS. Even the smallest scratch can quickly become dangerously infected in the tropics. Promptly disinfect any wound.

SNAKEBITE. If you get bitten, immediately apply a tourniquet between the snakebite and the heart. Then make a cross-shaped cut about one-quarter inch deep through the fang marks and immediately apply suction over the bite—suck over a piece of rubber tissue, if available, or by mouth if there are no open sores in the mouth, and spit out poison immediately. Release tourniquet every 20 minutes for periods of 30 seconds. After a few hours (three or four), release the tourniquet for in-

creasing periods of time. Tourniquet treatment may be stopped when swelling or discoloration of bitten area has disappeared and release of tourniquet is not accompanied by an unusual ill feeling. *Don't give alcohol!*

SIGNALING

General

One man, a group of men, or even an airplane, is not too easy to spot from the air, especially when visibility is limited. Your emergency signaling equipment is designed to make you "bigger" and easier to find.

Your airplane radio or emergency radio is your best rescue aid. Try to make contact at once. Try to get a fix; if the radio is serviceable, you can transmit your position. When using the airplane radio, save the battery; try to get an engine or auxiliary generator to operate and charge the battery.

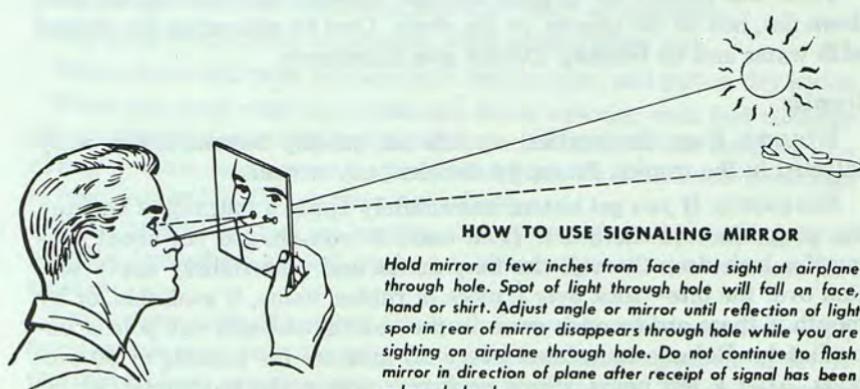
Use smoke by day, bright flame by night. Add engine oil, rags soaked in oil, or pieces of rubber (matting or electrical insulation) to make black smoke; add green leaves, moss, or a little water to send up billows of white smoke. Keep plenty of spare fuel on hand.

Signaling aids, such as flares and smoke grenades, must be kept dry. Use them only when friendly airplanes are sighted or heard.

Practice signaling with the mirror in kit. A mirror can be improvised from a ration tin by punching a hole in the center of lid. Keep the mirror clean. On hazy days, aircraft can see the flash of the mirror before survivors can see the aircraft; so flash the mirror in the direction of the plane when you hear it, even when you cannot see it.

Signal with a flashlight or the blinker signaling light of the emergency radio. If the airplane landing lights are intact and you can get an engine to run, remove the lights and extend them for signaling. But do not waste the battery—save it for the radio.

Place or wave the yellow-and-blue cloth signal panel in the open where it can be seen. Spread out parachutes. Make a pattern of orange-colored



I	II	X	F	V	K
1. Require doctor — serious injuries.	2. Require medical supplies.	3. Unable to proceed.	4. Require food and water.	5. Require firearms and ammunition.	6. Indicate direction to proceed.
↑	↗	↖	△	LL	L
7. Am proceeding in this direction.	8. Will attempt to take off.	9. Aircraft badly damaged.	10. Probably safe to land here.	11. All well.	12. Require fuel and oil.
N	Y	JL	W	□	!
13. No — negative.	14. Yes — affirmative.	15. Not understood.	16. Require engineer.	17. Require compass and map.	18. Require signal lamp.

Ground-air emergency code

Mae Wests. Line up cowl panels from engine nacelles upside down on airplane wings or ground; polish the inside surfaces—they make good reflectors. Arrange your ground signals in big geometric patterns rather than at random—they will attract more attention that way. The radio balloon or kite makes a good signal.

Use the fluorescent dye available in the life raft or Mae West kit for signaling on water or snow. Use it carefully, for a little goes a long way; use it only downwind for the fine dye will penetrate clothing or food. On rivers, throw it out into the current for a quick spread.

If you can climb a tall tree, hoist a large white or colored improvised flag on a pole lashed to the top.

Do everything you can to disturb the "natural" look of the ground. If you are down in grass and scrub lands, cut giant markers—an 8-12 foot wide circular path, 60-75 feet in diameter, is easily seen from the air. A trampled or burned grass pattern will show from the air.

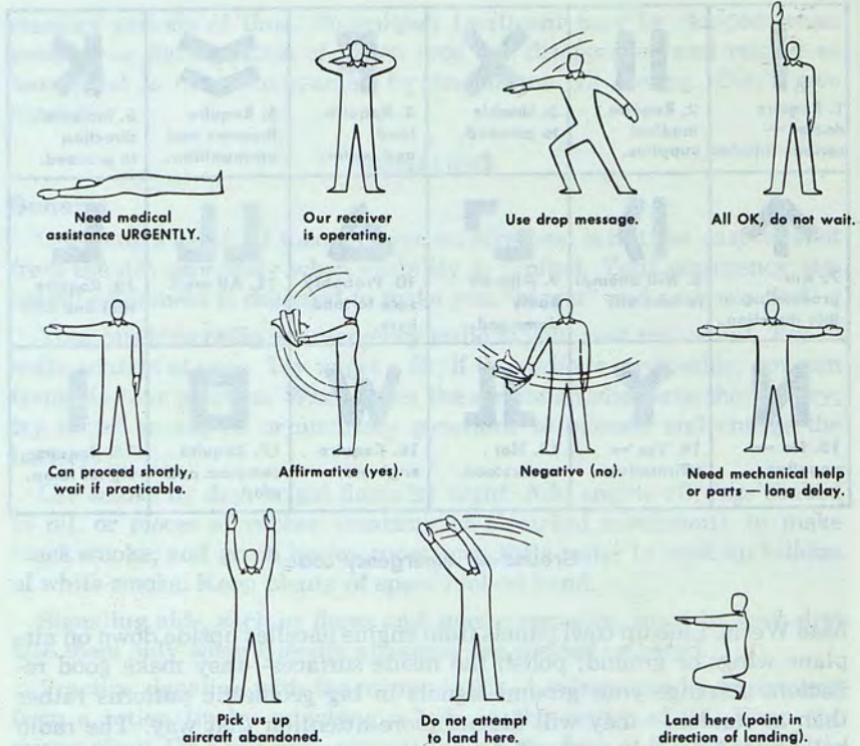
Arctic

Keep snow and frost off airplane surfaces to make a sharp contrast with the surroundings. Build your fire on a platform so it will not sink into snow. A standing spruce tree near timber line burns readily even when green. Build a "bird nest" of quickly inflammable material in the branches to insure a quick start.

Tramp out signals in snow. Fill them in with boughs, sod, moss, or fluorescent dye water.

In brush country, cut conspicuous patterns in vegetation.

In tundra, dig trenches, turn sod upside down at side of trench to widen signal.



Body signals

A parachute tepee stands out in the forest or on the tundra in summer, especially at night with a fire inside.

REMEMBER: Sound does not carry well through snow. If your entire party is in snow cave or igloo, you may not hear rescue aircraft. Keep someone on guard as spotter. Build the spotter a windbreak but don't roof it.

Desert

You can make a good improvised flare from a tin can filled with sand and soaked with gasoline. Light it with care. Add oil and pieces of rubber to make dense smoke for daytime signal. Burn gasoline or use other bright flame at night.

Dig trenches to form signals or line up rocks to throw shadow.

If there is any brush in the area, gather it in piles and have it ready to light.

Smoke fires and smoke grenades are best for use in daytime. Flares and bright flames are hard to see.

The mirror is a very good desert signal; practice using it.

Tropics

Set up your fires and other signals in natural clearings and along edges of streams, or make a clearing. Signals under dense jungle growth won't be seen.

DECISION: TO STAY AT THE AIRPLANE OR LEAVE

General

The best advice is to stay with the airplane and await rescue. Most rescues have been made when downed crews remained with the airplane. Leave the airplane only when:

You have been briefed to leave it.

You are certain of your position and know that you can reach shelter, food, and help with available equipment.

After waiting several days, you are convinced that rescue is not coming and you are equipped to travel.

Before making a decision, consider these important points:

ADVANTAGES OF STAYING WITH THE AIRPLANE. The airplane is easier to spot from the air than men traveling. Someone may have seen you come down and may be along to investigate.

The airplane or parts from it will provide you with shelter, signaling aids, and other equipment (use cowling for reflector signals, tubing for shelter framework, gasoline and oil for fires, generator for radio power).

You will avoid the hazards and difficulties of travel.

CHANCES FOR RESCUE. Your chances are good (1) if you have made radio contact; (2) if you have come down on course or near a traveled air route; (3) if weather and air observation conditions are good.

KNOWLEDGE OF LOCATION. You must know your location to decide intelligently whether to wait for rescue or to determine a destination and route if you undertake to travel out.

Try to locate your position by studying your maps, landmarks, and flight data, or by taking celestial observations.

CHOICE OF DESTINATION. Try to determine the nearest rescue point, the distance to it, the possible difficulties and hazards of travel, and the probable facilities and supplies at the destination.

CONDITION OF PERSONNEL. Consider your physical condition and that of the other men in the party and estimate your ability to endure travel. If there are injured men, try to get help. Send the best fitted men—two if possible. To travel alone is dangerous.

Before you make a decision, consider all the facts.

If you have decided to stay, then consider these problems:

Your health and body care; the sanitation of your camp. See page 31.

Your program for rest and shelter. See page 16.

Your water supplies. See page 36.

Your food problems. See page 43.

If you have decided to travel, then these are your problems:

Which direction? (See *Orientation*, page 98.)

What plan are you following?

What to take along? See page 120.

Arctic

Stay with the airplane, unless briefed to the contrary.

It may be advisable to move your camp a short distance from the airplane to where there is wood for fuel and shelter.

Except under unusual circumstances, only experienced northern travelers, with proper equipment, should attempt cross-country travel in winter (see page 124). If you leave the aircraft, leave markers to show direction.

Desert

The best advice generally is to stay with the airplane.

You'll last much longer without water by staying in the shade near the airplane rather than by exhausting yourself trying to walk out.

Travel only if you are sure you can walk to assistance *easily* and are absolutely certain you have enough water to make it. (See Desert Water Data Table on page 41.)

Tropics

If you come down in dense jungle where your airplane and signals can't be seen from the air, it is advisable to travel out.

You can get shelter, food, and water in the tropics.

Streams are plentiful in most places; they are often good routes to habitation.

With the proper equipment, care, and common sense, you should be able to travel successfully (see page 127).

SHELTER

General

In any area, you can improvise shelter from parts of your airplane and emergency equipment or from natural materials in the vicinity.

The kind of shelter you make depends on whether you need protection from rain, cold, heat, sunshine, or insects, and also whether your camp is only for a night or for many days. Practical shelters for all conditions are shown on the following pages.

Pick the location for your camp carefully. Try to be near fuel and water—especially water.

Don't make camp at the base of steep slopes or in areas where you run the risk of avalanches, floods, rockfalls, or battering by winds.

Arctic

IN THE SUMMER. You will need shelter against rain and insects. Choose a camp site near water but on high, dry ground if possible. Stay away

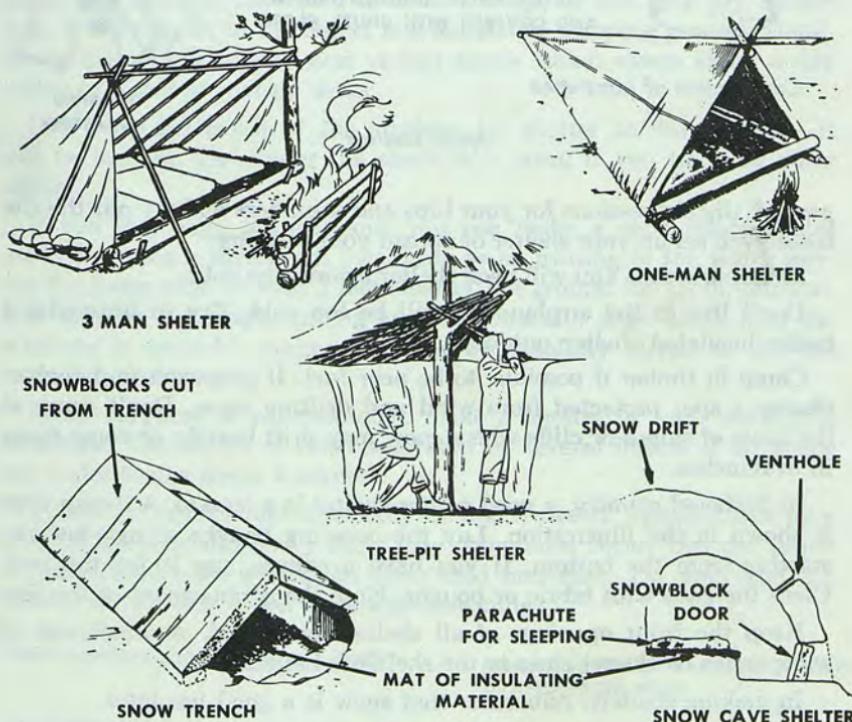
from thick woods as mosquitoes and flies will make your life miserable. A good camp site is a ridge top, cold lake shore, or a spot that gets an on-shore breeze.

If you stay with the airplane, use it for shelter. Cover openings with netting or parachute cloth to keep insects out. Do your cooking outside to avoid carbon monoxide poisoning. Make your fire at a safe distance from the plane.

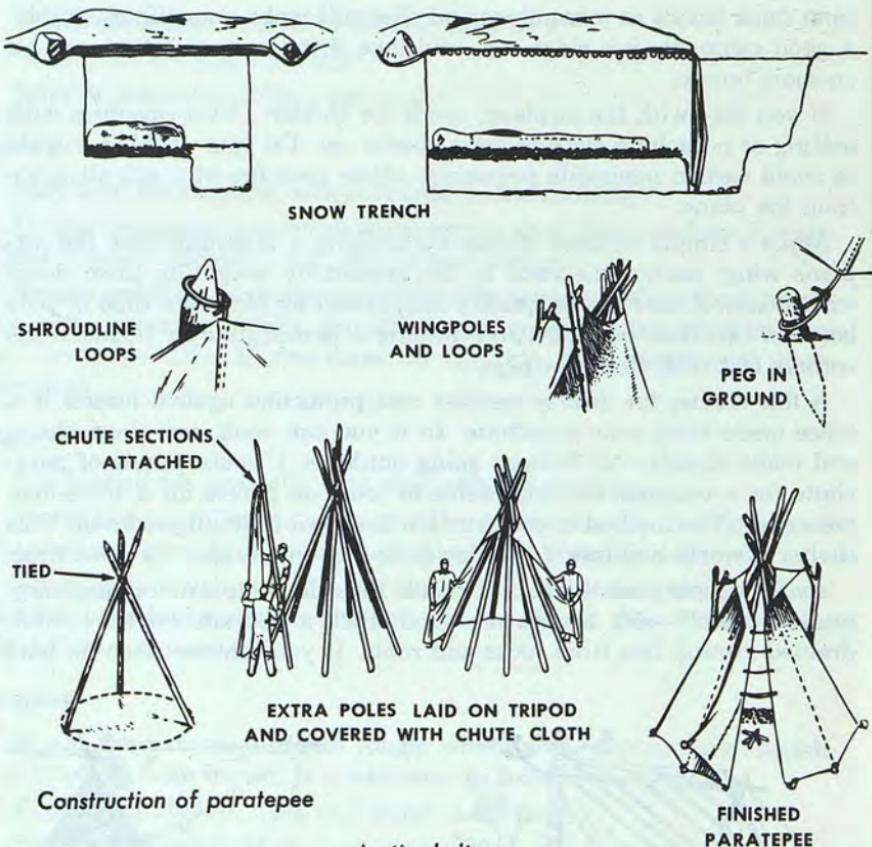
Make a simple outdoor shelter by hanging a tarpaulin over the airplane wing; anchor the ends to the ground by weighting them down with stones. A tent can be quickly improvised by placing a rope or pole between two trees or stakes and draping a parachute over it; make the corners fast with stones or pegs.

A fine shelter for drizzly weather and protection against insects is a tepee made from your parachute. In it you can cook, eat, sleep, dress, and make signals—all without going outdoors. Use six panels of parachute for a two-man shelter, twelve to fourteen panels for a three-man paratepee. The method of construction is shown in the illustration. This shelter is worth building if you decide to stay in one spot for some time.

Avoid sleeping on the bare ground. Provide some sort of insulation under yourself—soft boughs are good. Pick a bed site on level, well-drained ground free from rocks and roots. If you have to sleep on bare



Arctic shelters



Construction of paratepee

Arctic shelters

ground, dig depressions for your hips and shoulders and try out the site before you set up your shelter or spread your bedding.

IN THE WINTER. You will need shelter against the cold.

Don't live in the airplane—it will be too cold. Try to improvise a better insulated shelter outdoors.

Camp in timber if possible, to be near fuel. If you can't find timber, choose a spot protected from wind and drifting snow. Don't camp at the bases of slopes or cliffs where snow may drift heavily or come down in avalanches.

In timbered country, a good winter shelter is a lean-to. A 3-man type is shown in the illustration. Lay the covering boughs shingle-fashion, starting from the bottom. If you have a canvas, use it for the roof. Close the ends with fabric or boughs. Note the arrangement of the fire.

Keep the front openings of all shelters crosswind. A windbreak of snow or ice blocks set close to the shelter is helpful.

In making shelters, remember that snow is a good insulator.

In timberless country, make a simple snow cave or burrow by digging into the side of a snowdrift and lining the hole with grass, brush, or tarpaulin. Snow caves must be ventilated. If the snow isn't deep enough

to support a roof, dig a trench in a drift and roof it with snow blocks, tarpaulin, or other materials.

In wooded country make a tree-pit shelter if snow is deep enough. Enlarge the natural pit around a tree trunk and roof it with any available covering.

Reconnoiter for cabins and shelter houses. They are likely to be located along bigger streams, at river junctions, along blazed trails in thick, tall timber leeward of hills.

Prevent carbon monoxide poisoning by providing good ventilation in closed shelters in which a fire is burning.

Don't sleep directly on the snow. Provide insulation under your sleeping bag or body. Lay a thick bough bed in shingle-fashion, or use sea cushions, tarpaulins, or even an inverted and inflated rubber life raft if available.

Keep your sleeping bag clean, dry, and fluffed up to give maximum warmth. To dry the bag, turn it inside out, beat out frost, and warm it before the fire—but don't burn it. Wear only dry clothes to bed. Keep them loose. Turn over *with* rather than *in* the sleeping bag.

Desert

You will need shelter mostly from sun and heat. Use whatever natural shade you can find, such as a cave, rock ledge, or wall of a dry stream bed. A dry canyon in the desert is a dangerous camping ground; cloud-bursts may cause sudden and violent floods which sweep along a dry valley in a wall of roaring water.

Don't use the inside of the airplane for shelter in the daytime—it will be too hot. Get under the shade of a wing if you have no other shelter.

If you stay with the airplane, you can make a good shade-shelter easily by tying a spread-out parachute as an awning to the wing, leaving the lower edge at least 2 feet clear of the ground for air circulation. Use sections of airplane tubing for tent poles and pegs. Make sure the airplane is securely moored and the wing solidly guyed to prevent movement in a storm.

If the airplane is not available, make a shelter of your parachute as shown. Two layers of cloth separated by several inches of air space are cooler than a single thickness.

In winter months and especially at night, desert temperatures may drop to freezing and heavy rains may sometimes occur. Use the inside of the airplane for protection from cold and rain. Do your cooking outside to prevent carbon monoxide poisoning.

Desert shelters using parachute cloth



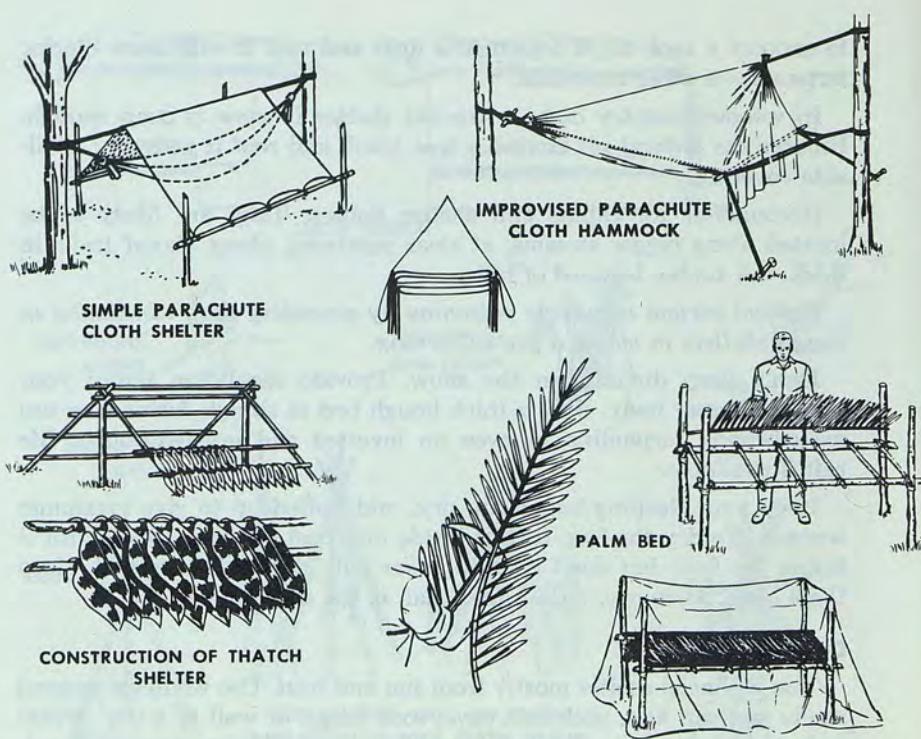
COLD WEATHER SHELTER

SHADE SHELTER



DOUBLE LAYER OF PARACHUTE CLOTH DRAPED FROM WING





Tropic shelters

Tropics

Try to pick a camp site on a knoll or high spot in an open place well back from swamps. You'll be bothered less by mosquitoes, the ground will be drier, and there will be more chance of a breeze.

Don't build a shelter under large trees or trees with dead limbs. They may fall and wreck your camp or hurt some one. Don't sleep or build a shelter under a coconut tree.

In the wet jungle forest, you will need shelter from dampness. If you stay with the airplane, use it for shelter. Try to make it mosquito-proof by covering openings with netting or parachute cloth.

The easiest improvised shelter is one made by draping a parachute or tarpaulin over a rope or vine stretched between two trees or by propping it up on poles.

A good rain shelter can be made by covering an "A"-type framework with a good thickness of palm or other broad leaves, pieces of bark, or mats of grass. Lay the thatch shingle-fashion with the tips of leaves pointing downward, starting from the bottom and working up, so the rain will shed off.

Dig a small drainage ditch just inside the eaves of your shelter and leading downhill—it will help keep the floor dry.

Don't sleep on the ground. Contact with the ground will chill you. Make a hammock from your parachute—it will keep you off the ground and discourage ants, spiders, leeches, scorpions, and other pests from getting to you. You can make a fair bed by covering a pile of brush

with layers of palm fronds or other broad leaves. A better bed can be made by building a frame of poles and covering the top with long, spineless palm leaves to a depth of 4 or 5 layers; cut the corner poles long enough to support a mosquito net.

In mountainous jungle the nights are cold. Get out of the wind. Make a fire a few feet from a cliff or against a log or rock pile, and build your shelter so that you get reflected heat; arrange the "reflector" so that the fire doesn't blow back at you.

FIRE-MAKING

General

You will need fire for warmth, for keeping dry, for signaling, for cooking, or for purifying water by boiling. Follow the tried and proved advice below.

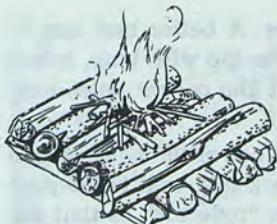
Don't build your fire too big. Small fires require less fuel and are easier to control; and their heat can be concentrated. In cold weather small fires arranged in a circle around an individual are much more effective than one large fire.

PREPARING FIREPLACE. Prepare the location of your fire carefully. Clear away leaves, twigs, moss, and dry grass, so that you don't start a grass or forest fire. If the ground is dry, scrape down to bare dirt. If the fire must be built on snow or ice or wet ground, build a platform of logs or flat stones.

To get the most warmth and to protect fire from wind, build it against a rock or wall of logs which will serve as a reflector to direct the heat into your shelter. Cooking fires should be walled in by logs or stones, not only to concentrate the heat but also to provide a platform for your cooking pot.

KINDLING AND FUEL. Most fuels cannot be started burning directly from a match. You will need some easily inflammable kindling to get your fire going. Good natural kindling materials are: thin sticks of dry wood, dry bark, wood shavings, palm leaves, twigs, loose ground-lying lichens, dead, upright grass straw, and ferns. If sticks are used for kindling, split them and cut long thin shavings; leave the shavings attached. Crumpled paper or empty waxed ration boxes are good kindling. Store kindling in shelter to keep dry. A little gasoline poured on the fuel before it is lighted will help it start burning. *Don't pour gasoline on a fire already started even if it is only smoldering.*

For fuel, use dry standing dead wood and dry dead branches. Dead wood is easy to split and break—pound it on a rock. The inside of fallen tree trunks and large branches may be dry even if the outside is wet; use the heart of the wood. Almost anywhere, you can find green wood that will burn, especially if finely split. In treeless areas, you can find other natural fuels, such as dry grass which you can twist into bunches, peat dry enough to burn (found at the top of undercut river banks), dried animal dung, animal fats, and sometimes even coal, oil shale, or oil sand lying on the surface. If you have not natural fuels,

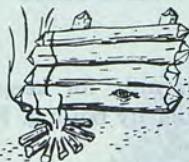


PLATFORM FOR COOKING

LOG PLATFORM FOR FIRE



BUILDING A PYRAMID FIRE



LOG REFLECTOR FOR FIRE



LIGHT YOUR FIRE
WITH A CANDLE

Fire-making

but if you are with the airplane, you can burn gasoline and lubricating oil or a mixture of both (see page 23).

FIRE-MAKING WITH MATCHES AND LIGHTER. Prepare fireplace. Get all your materials together before you try to start the fire. Make sure your matches, kindling, and fuel are dry. Have enough fuel on hand to keep fire going. Arrange small amount of kindling in low pyramid, close enough together so flames can lick from one piece to another. Leave a small opening for lighting.

Save matches by using a candle, if you have one, to light the fire. If you have no candle, use a "shave stick," or make a faggot of thin, dry twigs, tied loosely. Shield match from wind, and light candle or faggot. Apply lighted candle or faggot to lower windward side of kindling, shielding it from wind as you do so.

Small pieces of wood or other fuel can be laid gently on kindling before lighting or can be added after kindling begins to burn. Lay on smaller pieces first, adding larger pieces of fuel as fire takes hold. Don't smother fire by crushing down kindling with heavy wood. Don't make the fire too big. Don't waste fuel.

FIRE-MAKING WITH SPECIAL EQUIPMENT. If you have a fusee signal flare in your kit, light it by striking the self-contained flint and steel. Although it may mean wasting a signal, you can light a fire from the flame.

Some emergency kits contain small fire starters, cans of special fuels, windproof matches, and other aids.

FIRE-MAKING WITHOUT MATCHES. First, find or prepare one of the following kinds of tinder: very dry powdered wood, finely shredded drybark, or the shredded pith of a dead palm frond; lint from unravelled cloth, cotton, twine, rope, or first-aid gauze bandage, fuzzy or wooly

material scraped from plants; fine bird feathers or birds' nests; field-mouse nests, or fine wood dust produced by insects, often under bark of dead trees. Tinder must be bone-dry. You can make it burn more easily by adding a few drops of gasoline or by mixing in with powder taken from a cartridge. Once tinder is prepared, put some in a waterproof container for future use.

Once you have the tinder, light it in a place sheltered from the wind. Try the following methods.

FLINT AND STEEL. This is the easiest and most reliable way of making a fire without matches. Use the flint fastened to the bottom of your waterproof match case. If you have no flint, look for a piece of hard rock from which you can strike sparks. If it breaks or scars when struck with steel, throw it away and find another. Hold your hands close over the dry tinder; strike flat with a knife blade or other small piece of steel, with a sharp, scraping, downward motion so that the sparks fall in the center of the tinder. The addition of a few drops of gasoline before striking the flint will make the tinder flame up—for safety, keep your head to one side. When tinder begins to smolder, fan it gently into a flame. Then transfer blazing tinder to your kindling pile or add kindling gradually to the tinder.

BURNING GLASS. Any convex lens two inches or more in diameter can be used in bright sunlight to concentrate the sun's rays on the tinder and start it burning.

FRICITION. There are many methods of making fire by friction (bow and drill, fire plough, fire thong, etc.) but all require practice. If you are proficient in one of these methods, use it, but remember that flint and steel will give you the same results with less work.

ELECTRIC SPARK. If you are with the airplane and have a live storage battery, direct a spark onto the tinder by scratching the ends of wires together to produce an arc.

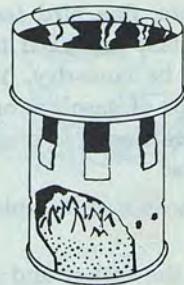
BURNING AIRPLANE FUEL. If you are with the airplane, you can improvise a stove to burn gasoline, lubricating oil, or a mixture of both. Place one to two inches of sand or fine gravel in the bottom of a can or other container and add gasoline. Be careful when lighting; the gas may explode at first. Make slots at the top of the can to let flame and smoke out, and punch holes just above the level of the sand to provide a draft. To make a fire burn longer, mix gasoline with oil. If you have no can, simply dig a hole in the ground, fill it with sand, pour on gasoline, and light; take care to protect your face and hands.

You can use lubricating oil for fuel with a wick arrangement. Make the wick of string, rope, rag, or even a cigarette, and rest it on the edge of a receptacle filled with oil. You can also soak rags, paper, wood, or other fuel in oil and throw them on your fire.

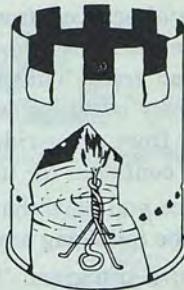
You can make a stove of any empty waxed ration carton by cutting off one end and punching a hole in each side near the unopened end. Stand carton on closed end; stuff empty sack loosely inside carton,



Striking knife on bottom of waterproof match box



Improvised stove using aviation fuel



Improvised stove using wick to burn oil or animal fat

leaving an end hanging over top; light this end—the stove will burn from top down and will boil more than a pint of water.

USEFUL HINTS. Don't waste your matches by trying to light a poorly prepared fire. Don't use matches for lighting cigarettes; get a light from your fire or use a burning lens. Don't build unnecessary fires; save your fuel. Practice primitive methods of making fires before all of your matches are gone.

Carry some dry tinder with you in a waterproof container. Expose it to the sun on dry days. Adding a little powdered charcoal will improve it. Collect good tinder wherever you find it.

Collect kindling along trail before you make camp. Keep firewood dry under shelter. Dry damp wood near fire so you can use it later. Save some of your best kindling and fuel for quick fire-making in the morning.

To split logs, whittle hardwood wedges and drive them into cracks in log with a rock or club; split wood burns more easily.

To make a fire last overnight, place large logs over it so that the fire will burn into the heart of the logs. When a good bed of coals has been formed, cover it lightly with ashes and then dry earth. In the morning the fire will still be smoldering.

Fire can be carried from one place to another in the form of a lighted punk, smoldering coconut husk, or slow-burning coals. When you want a new fire, fan the smoldering material into flame.

Don't waste fire-making materials. Use only what is necessary to start a fire and to keep it going for the purpose needed. Put out the fire when you leave the camp site.

Arctic

Don't build a fire under a snow-covered tree—snow may fall and put out the fire.

Low, dead, needle-bearing branches of standing spruce trees are good fuel. On the tundra wood is scarce. Look for any woody bush or shrub; burn roots as well as stems. Look for dry twigs in willow thickets, or for dry grasses. On the coasts, look for driftwood.

Animal fat and bones can be used as fuel. Put chunks of fat on a stick or bone framework or on top of a perforated can with a wick of greasy cloth or Sphagnum moss underneath, and light the wick. You can burn congealed oil in the same way.

A candle burning in a tin can makes a simple heater for your shelter.

In cold weather drain oil from the airplane and store it for fuel. If the temperature is not low enough to solidify the oil, leave it in the airplane and drain it off when needed.



Improvised stove using blubber

Desert

In some deserts fuel is extremely rare. Wherever you find plant growth, utilize all twigs, leaves, stems, and underground roots for burning. Dry animal dung, more commonly found along traveled routes, gives a very hot flame.

Tropics

Wood is plentiful—even if it is wet outside, the heart of dead wood will be dry enough to burn. You can also find dry wood hanging in the network of vines or lying on bushes.

In palm country, you can get good tinder by using the fibers at the bases of palm leaves. The insides of dry termite nests make good kindling.

Green leaves thrown on a fire make a smudge that will help keep off mosquitoes.

Keep spare wood dry by stowing it under your shelter. Dry out wet kindling and fuel near your fire for future use.

SURVIVAL WEAPONS

General

USE. The shotgun load has an effective range of 15 yards against birds and an effective range of 10 to 15 yards against small animals. Don't waste ammunition on long shots, especially long wing shots.

The survival rifle can kill at ranges over 200 yards but your chances of hitting game in a vital spot at ranges over 100 yards are very slight.

Remember, most big game is actually killed at ranges under 60 yards. Unless it is impossible to secure a clean kill by closer stalking, never attempt to kill by shooting over 100 yards. Make sure of your first shot, for it may be your last one at that particular animal—and your ammunition supply is what you are carrying.

Follow these rules when hunting:

Get as close as possible to the game before shooting.

Don't shoot rapid fire. One shot will do the job if aimed properly.

Fire from as steady a position as possible. Remember—survival rifles are light and any unsteadiness on your part due to exertion or excitement will set the barrel to trembling. The prone position is best for a steady shot, but sitting or kneeling positions may have to be used. Use a rest such as a log or stone for the barrel whenever you can; but put your hand between the rest and the gun barrel or the gun will shoot wild. Never fire offhand unless time prevents your taking another position.

Aim at a vital spot. The shoulder or chest is probably the best spot for medium and large game. Do not shoot unless a vital spot is open.

Do not trust your first shot even if game appears to have fallen dead. Reload immediately but keep your eye on the game.

Look for blood if game runs away after first shot. If blood is found, wait 30 minutes before following. Wounded game will lie down and stiffen if given time.

FIELD MAINTENANCE. Your survival weapons are built to withstand survival conditions, but they do require intelligent care if they are to function when you need them.

Keep your weapon clean. If possible, cover it when it's not in use. Keep the action, receiver walls, bolt and assembly, and especially the barrel clean and free from oil, dirt, snow, or mud. If the barrel is obstructed by mud, snow, or any foreign substance, clean it out before shooting. Never try to shoot out an obstruction. The barrel will burst.

Don't use your weapon as a club, hammer, or pry bar. It is a precision-made instrument on which your life may depend.

Don't over-oil your weapon. Only a few drops on moving parts are needed.

A piece of cloth on a string pulled through the barrel is a handy substitute for a ramrod and cleaning patch.

If you must give the barrel a thorough cleaning and have no powder solvent, pour boiling water through it from the breech. Mop up the excess water by pulling a cloth on a string through the barrel and the hot barrel will dry itself.

Arctic

During the winter, remove all lubricants and rust prevention compounds from your weapons. Strip them completely and clean all parts with a dry solvent. Use gasoline or lighter fluid. Normal lubricants thicken in cold weather and slow down the action. In cold weather, weapons function best when absolutely dry.

A major problem is to keep snow and ice out of the working parts, sights, and barrel. Even a small amount of ice or snow may disable your weapon, so careful handling is essential, especially in snow. Improvise muzzle and breech covers, and use them. Carry a small stick in your pocket to clean the sights and breech block.

Weapons sweat when they are brought from extreme cold into a heated shelter; and when they are taken out again into the cold, the

film of condensation freezes. This ice may seriously affect their operations; so leave them outdoors or store them in unheated shelters. If your shelter is not greatly warmer than the outside temperature, you may bring your weapons inside; but place them at or near floor level, where the temperature is lowest. When you take them into a heated shelter for cleaning, remove all the condensed moisture before cleaning. They may sweat for an hour.

If a part becomes frozen, do not force it. Warm it slightly, if possible, and move it gradually until unfrozen. If it cannot be warmed, try to remove all visible ice or snow and move it gradually until action is restored.

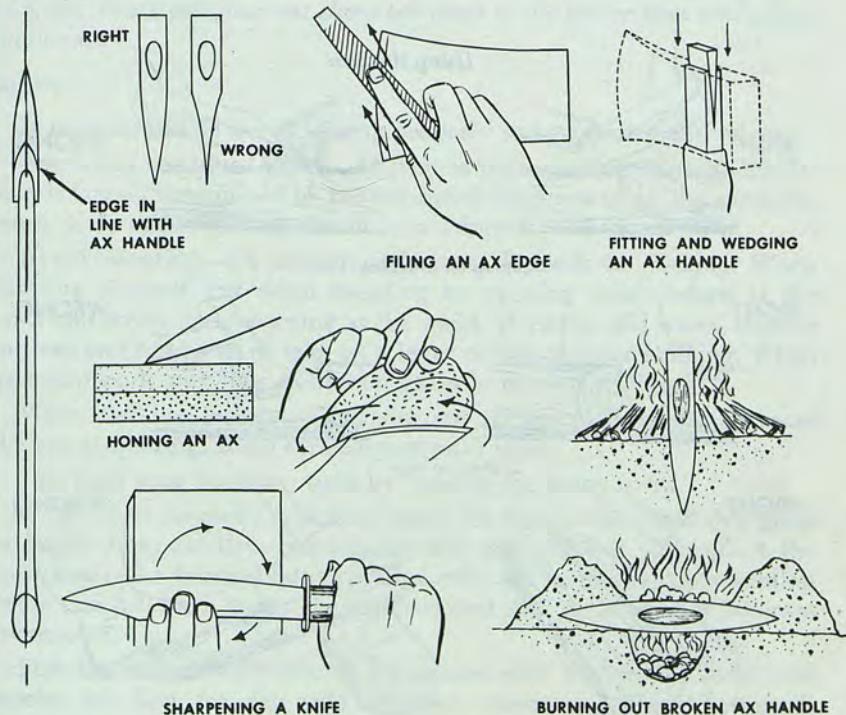
Before loading your weapon, always move the action back and forth a few times to insure that it is free and to check your ammunition.

If your weapon has a metal stock, pad it with tape or cloth, or pull a sock over it to protect your cheeks.

Axes and Knives

Your cutting tools are important aids to survival in any environment. For best results, use them and care for them properly.

When you use an ax, don't try to cut through a tree with one blow. Rhythm and aim are more important than force. Too much power behind a swing interferes with your aim. When the ax is swung properly, its weight will provide all the power you need.



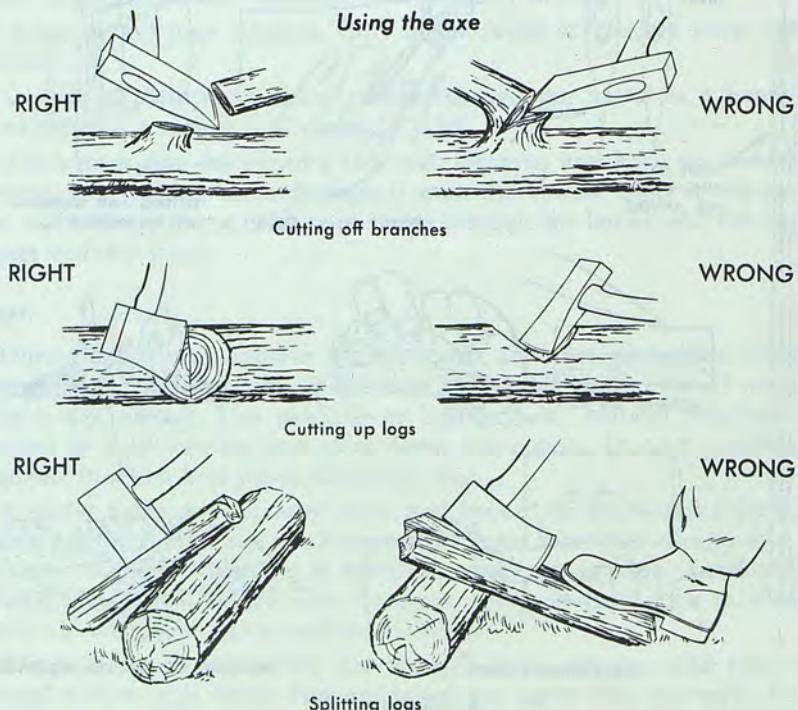
Before doing any chopping, clear away all obstructions. A branch, vine, or bush can deflect an ax onto your foot or leg. Remember—an ax can be a wicked weapon. The illustrations below show how to use it safely.

A broken handle is difficult to remove from the head of the ax. Usually the most convenient way is to burn it out. For a single-bit ax, bury the blade in the ground up to the handle, and build a fire over it. For a double-bit, dig a little trench, lay the middle of the ax over it, cover both bits with earth, and build the fire.

If you have to improvise a new handle, save time and trouble by making a straight handle instead of a curved one like the original. Use a young, straight hardwood without knots. Whittle it roughly into shape and finish it by shaving. Split the end of the handle that fits into the ax head. After it is fitted, pound a thin dry hardwood wedge into the split. Use the ax awhile, pound the wedge in again, then trim it off flush with the ax.

Your survival kit may include a file or a whetstone. If you haven't a sharpening tool, look for a natural whetstone. You will need it to sharpen your knives and axes.

Any sandstone will sharpen tools; but a gray, somewhat clayey sandstone gives better results than a pure quartz. You can recognize quartz instantly by scratching your knife blade with it—quartz is the only *common* mineral that will bite into steel, cutting a bright groove with every grain.



If you don't find sandstone, look for granite or any glittering, crystalline rock except marble. If you use granite, rub two pieces of the stone together until they are smooth before you use one as a grindstone.

Axes can be sharpened best by using both file and whetstone, but a stone alone will keep the ax usable. Use the file every few days, the whetstone after each using. Always push the file away from the blade, wetting the ax with water.

Put a finer edge on your ax with the whetstone. Move the stone with a circular motion, from the middle of the blade to the edge.

A snow knife can be sharpened with file alone. Other knives are sharpened with the whetstone alone. Hold the blade at a slight angle on the stone. Push the blade away from you. Sharpen the blade alternately. You can get a keener edge by gradually decreasing the pressure on the blade.

CLOTHING

General

Think twice before you discard any clothing. Clothing used properly can keep you cool as well as warm. It protects you also against sunburn, insects, pests, and scratches. It can be used for barter.

Try to keep your clothing clean and in repair. Clean clothes are better insulators than dirty clothes and they last longer.

Try to keep your clothing and shoes dry; use a drying rack in front of a fire. *Don't put your wet shoes too close to the fire or they will stiffen and crack.*

Arctic

It is important to wear clothing properly to keep warm and dry.

Insulation combined with body heat is the secret of warmth. Insulation is largely determined by the combined thickness of all the garments worn. Your outer clothing should be windproof.

Avoid sweating—it's dangerous because it leads to freezing. When exerting yourself, cut down sweating by opening your clothes at the neck and wrists and loosening at the waist. If you're still warm, remove mittens and headgear, or take off a layer or two of outer clothing. When you stop work, put your clothes on again to prevent chilling.

Wear clothing loosely. Tight fits cut off circulation and increase danger of freezing. Keep ears covered with scarf.

Don't get your boots too tight by wearing too many socks.

If you have no socks and your boots are big enough, stuff dry grass or kapok from airplane cushions around your feet—it will collect the frost and make fine insulation against cold. To maintain the insulation value you will have to dry the material and fluff it up when it becomes compacted.

Felt boots, mukluk boots, or moccasins with the proper socks and insoles are best for dry cold weather; shoepacs (rubber bottomed, leather-topped boots) are best for wet weather.

If you lose your boots or if your socks are wet and you have no spares, improvise footgear by wrapping parachute cloth or wing cover cloth lined with dry grass or kapok around your feet.

Keep your clothing as dry as possible. Brush snow from your clothes before you enter a shelter or go near a fire. Beat out frost before warming garments—dry them on a rack before the fire. Dry socks thoroughly. Don't get boots too near fire. Frozen boots or shoepacs are unmanageable.

Wear one or two pairs of wool mittens inside a windproof shell. Try to do everything with mittens on. If you have to remove mitts, warm your hands inside your clothes—once they get too cold you're in trouble.

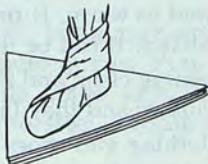
Wear sunglasses or improvise a pair to prevent snowblindness (see page 127).

Keep your clothing as clean as possible. Replace missing buttons and repair holes promptly.

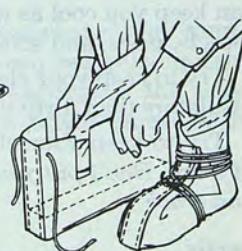
In strong wind or extreme cold, wrap yourself in your parachute and get behind shelter.



T-SHIRT USED AS FACE PROTECTION AGAINST SAND



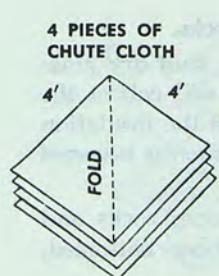
IMPROVISED FOOTGEAR



FACECLOTH



NECKCLOTH



4 PIECES OF CHUTE CLOTH



MAKING ARAB-TYPE HEADDRESS



Desert clothing

At night, arrange dry spare clothing loosely around your shoulders and hips—it will help keep you warm.

If you fall in water, roll in dry snow to blot up moisture. Roll, then brush off snow. Roll again, until all water is absorbed. Do not take off shoes until you are in shelter.

Desert

Wear clothing for protection against sunburn, heat, sand, and insects.

Keep your body and head covered during the daytime—you'll last longer on less water.

Wear long pants and shirts with sleeves rolled down. Keep them loose and flapping to stay cooler.

Wear a cloth neckpiece to cover the back of your neck from the sun. If you have no hat, make a headpiece like that worn by the Arabs, as illustrated. Your pilot chute is adaptable as a parasol for use in the desert; don't be too proud to use one. During dust storms, wear a covering for your mouth and nose; parachute cloth will do.

If you've lost your shoes or they wear out, make sandals as illustrated. See page 30.

Tropics

Keep your body covered to (1) prevent malaria-carrying mosquitoes and other pests from biting you; (2) protect your skin against infections caused by scratches from thorns or sharp grasses; (3) prevent sunburn in open country.

Wear long pants and shirts with sleeves rolled down. Tuck your pants in the tops of your socks and tie them securely, or improvise puttees of canvas or parachute cloth to keep out ticks and leeches.

Loosely worn clothes will keep you cooler.

Wear a mosquito headnet or tie an undershirt or tee shirt around your head. Wear it especially at dawn and dusk.

In open country or in high grass country, wear a neckcloth or improvised head covering for protection from sunburn and dust. (See illustration on page 30.) Move carefully through high grass; some sharp-edged grasses can cut your clothing to shreds.

If you lose your shoes or they wear out, you can improvise a practical pair of sandals by using the rubber side wall of a tire or a piece of bark for the soles, with parachute cloth or canvas for the uppers and heel straps.

Dry your clothing before nightfall to avoid discomfort from cold.

If you have an extra change of clothes, especially socks, keep them dry to replace wet clothing.

Wash clothing, especially socks, daily. Dirty clothes not only rot but may lead to skin diseases.

HEALTH AND HAZARDS

General

Keeping well is especially important when you are stranded on your own. Your physical condition will have a lot to do with your

coming out safely. Protection against heat and cold and knowledge of how to find water and food are important to your health. But there are more rules you should follow:

Save your strength. Avoid fatigue. Get enough sleep. Even if you can't sleep at first, lie down, relax, loosen up. Stop worrying; learn to take it easy. If you are doing hard work or walking, rest for ten minutes each hour.

Take care of your feet. Your feet are important, especially if you are going to walk. If your feet hurt, stop and take care of them; it will save you trouble later on. Examine your feet when you first stop, to see if there are any red spots or blisters. Apply adhesive tape smoothly on your skin where shoes rub. If you have a blister, pierce through the thick skin at its base with a sterilized needle or pin and press out the fluid. Clean the skin thoroughly before puncturing the blister. Apply sterile bandage after drainage.

Guard against skin infection. Your skin is the first line of defense against infection. Use an antiseptic on even the smallest scratch, cut, or insect bite. Keep your fingernails cut short to prevent infection from scratching. Cuts and scratches are apt to get seriously infected, especially in the tropics. A bad infection may hurt your chance of coming out safely.

Guard against intestinal sickness. Diarrhea and other intestinal sickness may be caused by change of water and food, contaminated water or spoiled food, excess fatigue, over-eating in hot weather, or using dirty dishes. Purify all water used for drinking, either by purification tablets or by boiling for one minute. Cook the plants you eat, or wash them carefully with purified water. Make a habit of personal cleanliness; wash your hands with soap and water, if possible, before eating. If one member of your group gets diarrhea, take special care to enforce measures for proper disposal of human waste and to insure cleanliness in handling food and water. Field treatment of diarrhea is necessarily limited. Rest and fast—except for drinking water—for 24 hours; then take only liquid foods such as soup and tea, and avoid sugars and starches. Keep up a large intake of water, with salt tablets. Eat several meals instead of one or two large ones.

Don't worry about lack of bowel movement; this will take care of itself in a few days.

Keep your body and clothing clean. You will feel better and keep free from skin infections and body parasites. Examine each other for external parasites.

Keep your camp clean. Dump garbage in a pit or in a spot away from camp where it will not blow about. Dig a latrine or designate a latrine area away from the camp water supply.

Arctic

The chief danger is freezing. Snowblindness and carbon monoxide poisoning are secondary dangers.

For protection against the cold, see the special instructions on clothing (page 29), shelter (page 16), and frostbite treatment (page 9). The important thing is to keep your face, ears, nose, wrists, hands, and feet warm and dry. Good circulation is important; don't restrict it by tight clothing. Avoid sweating. Keep out of the wind. Don't touch cold metal with your bare skin; you'll freeze to the metal and tear away the skin. If necessary, thaw by applying heat gently. Tape tool handles, gun triggers, and metal parts of eye glasses.

You will freeze only if the air is carrying away more heat than your body can generate. If you prevent the air from reaching your skin by wearing proper clothing and keeping your body in over-all heat balance, you won't freeze. Your whole body must be kept warm to maintain circulation to your hands and feet. Excessive loss of heat from any part of your body restricts circulation, leaving your extremities with poor blood flow and little heat. With no heat coming in, your hands and feet are liable to frostbite.

Protect yourself against carbon monoxide poisoning by seeing to it that your shelter has enough ventilation when a fire is burning.

You can get badly sunburned in the Arctic, even on foggy or light overcast days. Cover up in bright sunlight. Use sunburn ointment if you have it.

Snowblindness is caused by the exposure of the unprotected eye to glare on snow. It can occur even on cloudy days. You can prevent snowblindness by wearing dark glasses whenever you are exposed to glare. *Prevention is the best cure.* Don't wait until your eyes hurt to wear your glasses. A handy substitute for sun glasses is a piece of wood, leather, or other material, with narrow eye slits cut in it. This eye-shade is good in a blizzard because the slits can be kept clean by brushing them off; while glasses may become frosted over. For treatment of snowblindness, see page 11.

Mosquitoes and flies in the Arctic do not transmit diseases, but their numbers and constant activity during the long summer day are a nuisance, preventing rest or sleep. Keep your body completely covered, using headnet and gloves, and apply insect repellent when face, neck, or hands are exposed. In the absence of these protectives, use smudge fires or rest in insect-proof shelters. When walking or resting, keep to the higher ridges or along the sea shore. If possible, walk into the wind.

See if the natives are given to scratching; if so, they may be lousy. Avoid all contact with them; particularly avoid unclean bedding or quarters. Bathe and examine your body and clothes.

Tularemia is a plague-like disease of rodents, particularly of hares, rabbits, and squirrels; it may be transmitted to man by ticks or by handling infected animals, eating partially cooked and infected animals, and handling or drinking infected water. Avoid all rodents that are not active and healthy. Skin rodents with gloves and discard the hide. Cook them thoroughly.

Desert

Lack of water and exposure to sun and heat are the big hazards to health in the desert. You can overcome these problems and prolong your life by observing the special instructions on the use of water (page 40), clothing (page 31), shelter (page 19), and the prevention and treatment of heat exhaustion and heat stroke (page 11).

Sunburn can be dangerous. If you must be out in the sun, try not to expose your head or skin.

Wear sun glasses in the daytime. If you have no glasses, improvise an eye shade of cloth with slits; blacken the area around your eyes with soot. Even though the glare does not bother you, it will affect your ability to see objects at a distance and will retard your adaptation to night vision. If your eyes hurt and you have boric acid ointment, apply some to eyelids and corners of your eyes. Use a chapstick, if you have one, on lips and nostrils.

Avoid getting chilled at night. Keep your clothes buttoned up. Get under shelter.

Keep sand and sand fleas out of your shoes. Stop often to shake them out.

Mosquitoes near villages and oases are likely to carry malaria. Ticks and fleas are numerous in some areas. Protect yourself against them. (See instruction on page 31).

In some desert areas you may encounter spiders and scorpions. Shake out clothing and shoes before you put them on. Some deserts (in Africa and Asia) are inhabited by sand vipers—small poisonous snakes that hide in the sand. Heavy shoes give protection against them. Tread around your proposed camp site to locate any that may be hiding.

Tropics

Most stories about the animals, snakes, spiders, and nameless terrors of the jungle are pure bunk. You are probably safer from sudden death in the jungle than in most big cities. You probably will never see a poisonous snake or a large animal. What may scare you most are the howls, screams, and crashing sounds made by noisy monkeys, birds, night insects, and falling trees. The real dangers of the tropics are the insects, many of which pass on diseases and parasites.

Malaria may be your worst enemy. It is transmitted by mosquitoes, which are normally encountered from late afternoon until early morning. They may also bite in the shade during the day. Guard against bites. Camp away from swamps, on high land. Sleep under mosquito netting if you have it. Smear mud on your face as a protection against insects, especially when sleeping. Wear full clothing, especially at night; tuck your pants into the tops of your socks or shoes. Wear mosquito headnet and gloves if available. Rub mosquito repellent on your hands and all exposed skin. Take your anti-malaria tablets according to directions as long as the supply lasts; even if you are bitten by infected mosquitoes, you won't get sick for a month.

Ticks may be numerous, especially in grassy places; you may get dozens of them on your body. Strip to the skin once a day or oftener and inspect your body for ticks, leeches, bed bugs, and other pests. If there are several men in your group, examine each other. Brush ticks off clothing; flick them off the skin. If they get attached, cover them with a drop of iodine—they will let go. Heating them with a lighted cigarette will also make them let go, but don't burn your skin. Touch up the bite with iodine. Be careful when removing a tick—the head may stay in and start infection.

Fleas are common in dry, dusty buildings. Keep your trousers tucked into shoe tops. Female fleas will burrow under your toenails or into your skin, to lay eggs. Use a sterilized knife point to remove them; keep the cut clean. Mites will burrow in skin, often about the waist. Touch spots with iodine; avoid scratching all bites.

Leeches are most common in wet underbrush and during the wet season. You may pick them up from plants, the ground or water. They will get through your shoe eyelets or over your shoe tops. Flick them off with your knife or touch them with a pinch of salt.

Spiders, scorpions, and centipedes are often abundant, and some are large. Shake out your shoes, socks, and clothing; and inspect your bed morning and evening—especially for scorpions. A few spiders have poisonous bites, which may be as painful as a wasp sting. Black widow spiders are dangerous. The large spiders called "tarantula" rarely bite, but if you touch them, the short, hard hairs which cover them may come off and irritate the skin. This is also true of some moth wings.

The largest centipedes will sting if you touch them, and their sting is like that of a wasp. Avoid many-legged insects.

Scorpions are real pests, for they like to hide in clothing, bedding, or shoes; and they strike without being touched. They have poison glands in the large claws and tail; their sting can make you sick.

Stings of all these insects cause swelling and pain. Use cold compresses, mud, or coconut meat applied locally.

Chiggers, wasps, and wild bees are pests and may be serious. Chiggers, mites, and fleas bore under the skin and cause painful sores; but a drop of oil, resin, or pitch kills them. Treat ant, wasp, and bee stings with cold compresses. Don't camp near an ant hill or an ant trail. Use caution in climbing trees, for many types of biting ants live in branches and foliage of tropical trees. Mangrove swamps have hanging plants attached to the branches of the mangroves which are almost always inhabited by biting ants. Never walk barefoot—your shoes guard against crawling mites, ticks, cuts, and subsequent bacterial infection. When you are accidentally dunked or forced to wade in fresh waters suspected of being infested with fluke parasites, observe the following precautions: wring out your clothes; drain and dry your shoes; rub your body dry of all droplets. Apply insect repellent over exposed areas.

Poisonous snakes are less abundant than most people think. There is little danger of a bite, if you wear shoes, sleep off the ground, and watch where you put your hands. See page 11 for first aid.

The marine crocodile of the Indo-Australian region is very dangerous. It is abundant along the seashores, in coral reef areas as well as in salt water estuaries and in bays. Both crocodiles and alligators may be expected in any tropical waters. They prefer to lie on banks or float like logs with just their eyes above the water. Observe the greatest caution in fording deep streams, in bathing, and whenever you have occasion to be in or near the water, especially where crocodiles or alligators are evident. Do not attract them to you by thrashing in the water; avoid them at all times. When crossing a muddy stream, slide your feet instead of stepping freely, in order to avoid stepping on spiny fish. Do not grasp plants carelessly. Don't wade barefooted over reefs.

Watch out for poisonous, venomous, and ferocious fish; and for poisonous and irritating plants. (See pages 79-82, 54-58, and 72.)

WATER

General

Water will be one of your first and most important needs. Start looking for it immediately. You can get along for weeks without food, but you can't live long without water, especially in hot areas where you lose large quantities of water through sweating.

Even in cold areas your body needs 2 quarts of water a day to maintain efficiency. Any lower intake results in loss of efficiency. If you delay drinking, you will have to make it up later on.

Purify all water before drinking, either (1) by boiling for at least one minute; or (2) by using the water purification tablets in your first aid kit according to instructions; or (3) by adding 8 drops of 2½% solution of iodine to a quart (canteenful) of water and letting it stand for 10 minutes before drinking. Rainwater collected directly in clean containers or in plants is generally safe to drink without purifying.

Don't drink urine or sea water—the salt content is too high.

Ground Water

When no surface water is available, you may want to tap the earth's supply of ground water—rain or snow that has sunk into the earth instead of remaining on the surface to run off in streams and rivers. It sinks deep, leaving a thickness of dryer earth above.

Access to this water supply depends upon the kind of ground—whether it is rock or some loose material like clay, gravel, or sand.

ROCK. In rocky ground, look for springs and seepages. Limestones and lavas have more and larger springs than any other rocks. Springs of cold water are safest; warm water has been recently at the surface and is more likely to be polluted.

Limestones are soluble; and ground water etches out caverns in them—some large enough for you to explore and many just cracks, an inch or so high, that the water has enlarged. Look in these caverns, large and small, for springs. If you go into a large one beyond sight of the entrance, be careful—don't get lost.

Most lava rocks contain millions of bubble-holes; ground water may seep through them. Look for springs along the walls of valleys that cross the lava flow. Some flows have no bubbles but do have "organ pipe" joints—vertical cracks that part the rocks into columns a foot or more thick and 20 feet or more high. At the foot of these joints you may find water creeping out as seepage or pouring out in springs.

Look for seepage where a dry canyon cuts through a layer of porous sandstone.

Most common rocks, like granite, contain water only in irregular cracks. Look over the hillsides to see where the grass is lush and green. Then dig your ditch just at the base of the green zone and wait for water to seep into it.

LOOSE GROUND. Water is more abundant and easier to find in loose sediments than in rocks. Look for springs along valley floors or down along their sloping sides. The flat benches or terraces of land above river valleys usually yield springs or seepages along their bases even when the stream is dry.

Don't try to find water with a switch or a forked twig; and don't waste your time digging for water unless you have some sign that water is there. Dig in the floor of a valley under a steep slope, especially if the bluff is cut in a terrace; or dig out a lush green spot where a spring has been during the wet season.

Water moves slowly through clay, but many clays contain strips of sand which may yield springs. Look for a wet place on the surface of a clay bluff and try digging it out. Try wet spots at the foot of the bluff.

Along coasts you may find water in the dunes above the beach or even in the beach itself, well back from the high-tide line. Look in the hollows between sand dunes for visible water—or dig if the sand seems moist.

Arctic

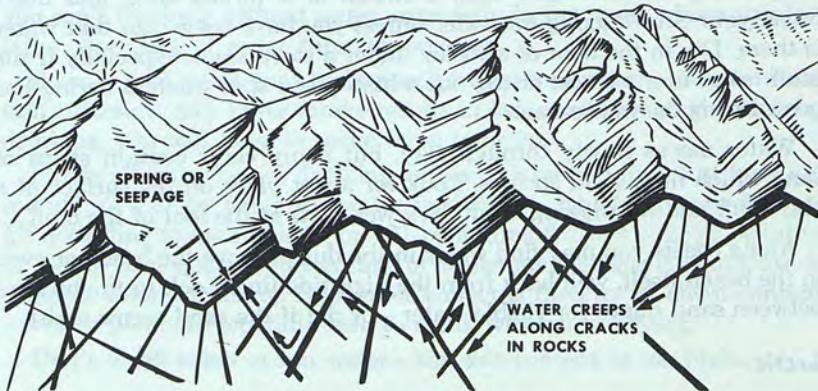
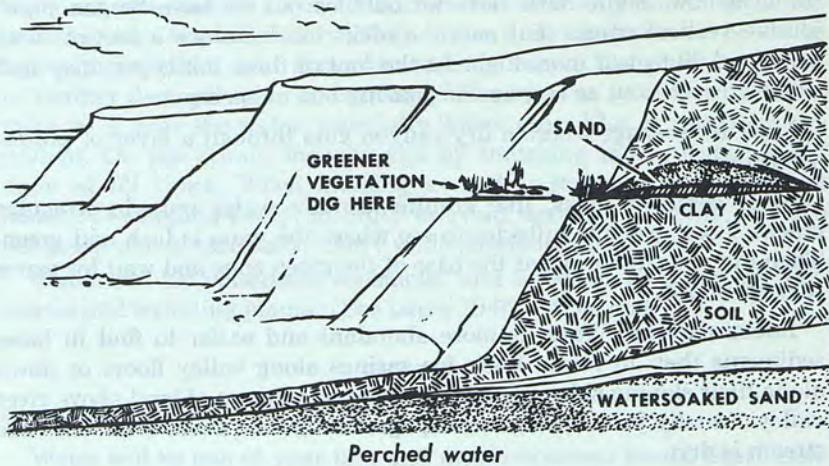
In the winter, ice and snow provide water but fuel is needed to melt them. Never waste fuel in melting snow or ice when drinkable water from other sources is available. In the summer there is plenty of water in lakes, streams, and ponds. Surface water on the tundra may have a brownish color, but it is drinkable.

Whenever possible, melt ice for water rather than snow—you get more water for the volume with less heat and time. If you melt snow by heating, put in a little snow at a time and compress it—or the pot will burn. If water is available, put a little in the bottom of the pot and add snow gradually.

If the sun is shining, you can melt snow on a dark tarpaulin, signal panel, flat rock, or any surface that will absorb the sun's heat. Arrange surface so that melt-water will drain into a hollow or container.

Use old sea ice for drinking water. It is bluish, has rounded corners, and is free from salt. New sea ice is gray, milky, and hard; don't drink it, because it is salty. Water in pools at the edges of ice floes is probably too

WHERE TO LOOK FOR WATER



Desert mountains of crystalline rock

salty to drink. Icebergs are good sources of fresh water and should be used if they can be approached safely.

If short on fuel, you can melt snow in your bare hands. It's best, however, to fill up on water at mealtime once you have melted ice or snow.

If fuel is plentiful, try to drink at least 2 quarts of hot tea or water daily instead of cold water or snow.

Desert

In the desert your life depends on your water supply. The following table shows how long you can survive on specific amounts of water at various temperatures.

In hot deserts, you need a minimum of a gallon of water per day. If you follow the rules and walk in the cool desert night, you can get about

WATER NEEDS
DAYS OF EXPECTED SURVIVAL IN THE DESERT
UNDER TWO CONDITIONS

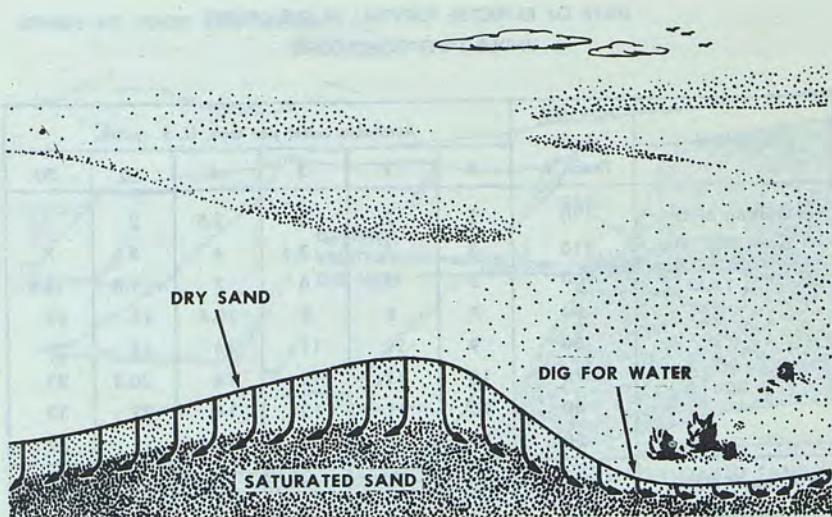
Condition	Max daily shade Temp °F	Available water per man, U. S. quarts					
		0	1	2	4	10	20
No walking at all	120	2	2	2	2.5	3	4.5
	110	3	3	3.5	4	5	7
	100	5	5.5	6	7	9.5	13.5
	90	7	8	9	10.5	15	23
	80	9	10	11	13	19	29
	70	10	11	12	14	20.5	32
	60	10	11	12	14	21	32
	50	10	11	12	14.5	21	32
Walking at night until exhausted and resting thereafter	120	1	2	2	2.5	3	
	110	2	2	2.5	3	3.5	
	100	3	3.5	3.5	4.5	5.5	
	90	5	5.5	5.5	6.5	8	
	80	7	7.5	8	9.5	11.5	
	70	7.5	8	9	10.5	13.5	
	60	8	8.5	9	11	14	
	50	8	8.5	9	11	14	

NOTE: This Table 17B, p. 279, *Physiology of Man in the Desert*, by E. F. Adolph and Associates, New York-London: Interscience Publishers, 1947. Survival time is not appreciably increased until available water is about four quarts, the amount necessary to maintain water balance for one day at high temperatures. Utilization of shade or saving a few degrees of temperature is as effective and as important in increasing survival time as water.

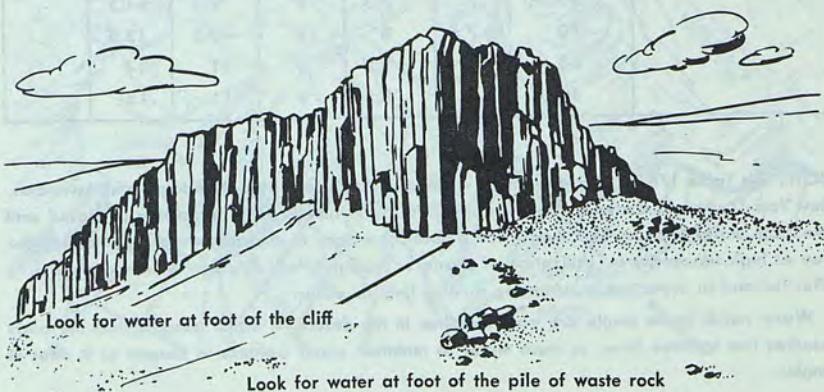
Water needs in the jungle are much less than in the desert. At equal temperatures the body requires two to three times as much water to maintain water balance in deserts as it does in jungles.

20 miles on that daily gallon. If you do your walking in daytime heat, you'll be lucky to get 10 miles to the gallon. Whether you sit out your desert survival or walk home, you'll need water.

The only way to conserve your water is to control your sweating. Drink water as you need it, but keep heat out of your body by keeping your clothes on. Clothing helps control sweating by not letting perspiration evaporate so fast that you get only part of its cooling effect. You may feel more comfortable in the desert without a shirt or pants, because your sweat evaporates fast. But it takes more sweat. Furthermore, you risk getting sunburned. Desert sun will burn even if you have a good coat of tan. Therefore wear a hat, use a neckcloth, and keep your clothes on. Light-colored clothing turns away the heat of the sun and keeps out the hot desert air. Keep in the shade as much as possible during the day.



Sand dunes

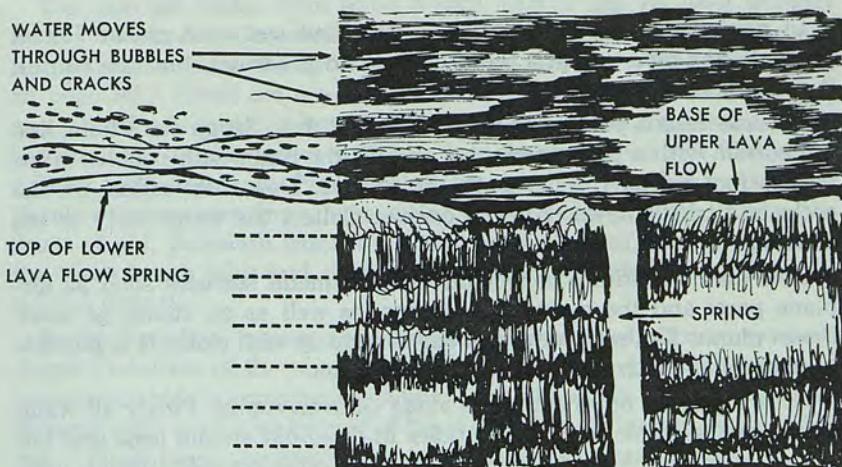


Columns of lava

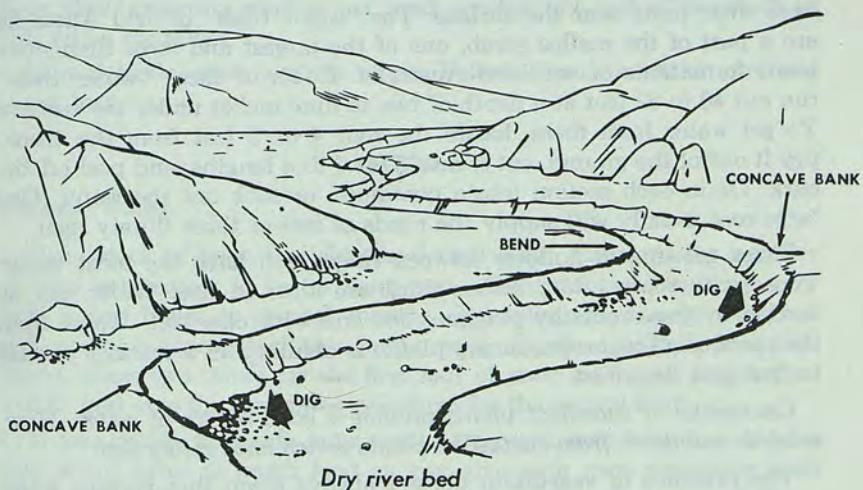
Desert natives keep their tents open on all sides to allow free circulation of air during the daytime. Sit up a few inches off the ground, if possible; do not lie on the ground. It can be 30° cooler a foot above the ground than it is right on the ground. That difference in temperature can save you a lot of sweat.

Slow motion is better than speed in hot deserts. Slow and steady does it. If you must move about in the heat, you'll last longer on less water if you take it easy. Take a lesson from the Arab—he is not *surviving* in the desert; he *lives* there and likes it. He isn't lazy, he's just living in slow motion; the way the desert makes him live.

If you have plenty of water—2 or 3 gallons a day—go ahead and work your head off if you want to, and drink as often as you like. In fact,



Porous lava (horizontal bedding)



you had better drink more and oftener than you think your thirst requires, if you want to stay healthy and efficient.

If you are looking for water along sandy beaches of desert lakes, dig a hole in the first depression behind the first sand dune. Stop digging when you hit wet sand. This first water is fresh or nearly so and is drinkable. If you dig deeper, you may strike salt water. If you find damp sand, dig a hole and wait for water to seep into it. In other places, pick the lowest point between sand dunes and dig down 3 to 6 feet. If sand becomes damp, keep digging until you hit water.

In a sand dune belt, search between the outermost dunes of the area, rather than in the middle.

In stony, desert country, look for dry stream beds. Dig at the lowest point on the outside of a bend in the stream channel.

In mud flats, during winter, you may find wet mud at the lowest point. Wring mud out in a piece of cloth to get water, but don't drink it if it is too salty or soapy-tasting.

In some deserts you may be able to collect dew. Scoop out a hole, line the bottom with a piece of canvas, and fill the basin with pebbles taken from a foot or more underneath the surface. Dew may collect on the rocks and trickle down onto the canvas. Collect the water early in the morning.

Dew may sometimes collect on exposed metal surfaces such as airplane parts and the covers of tin cans, as well as on stones or small desert plants. Drain the dew into cup or mop up with cloth. It is possible to mop up as much as a quart of dew an hour.

Look for water holes and wells along caravan routes. Purify all water from these sources. Small water holes in dried-out stream beds and low places, which are known to the natives, are often covered. Search carefully for them.

Water may be obtained from the roots of some desert plants that have their roots near the surface. The "water trees" of arid Australia are a part of the mallee scrub, one of the largest and most distinctive plant formations of southern Australia. Roots of these "water trees" run out 40 to 80 feet at a depth of two to nine inches under the surface. To get water from them, locate the root 4 or 5 feet from the trunk, pry it out of the ground, cut it into 2- or 3-foot lengths, and peel off the bark. Drain each section into a container, or suck out the water. One large root usually will supply the needs of two or three thirsty men.

Trees growing in hollows between ridges will have the most water. Those with roots 1 to 2 inches thick are ideal in size. Water can be carried in these roots by plugging one end with clay soil. Water from the roots of all water-producing plants is obtained in a manner similar to that just described.

Cactuslike or succulent plants provide a good source of water. However, *do not drink from cactuslike plants which have milky sap.*

The presence of vegetation doesn't always mean that surface water is available. But the actions of birds and animals give good clues for locating water. The sound of birds chirping in a semiarid brush country often means that water is near. Flocks of birds will circle over a water hole in very dry deserts. (Runways and trails of animals may lead to water.)

Tropics

You can get water that is almost clear from muddy streams or lakes by digging a hole in sandy soil 1 to 6 feet from the bank. Allow water to seep in, and then wait for the mud to settle.

Water from tropical streams, pools, springs, and swamps is safe to drink *only* after it has been purified. Some water may be discolored or turbid. It may be partially cleared by filtering through an improvised filter such as parachute cloth.

You can get water from some plants, and it can be used without further treatment. Coconuts contain refreshing water—the green, unripe coconuts about the size of a grapefruit are best. (See illustration on page 96.) Vines are often good sources. Choose a good-sized vine and cut off a 3- to 6-foot length. Make first cut at the top. Sharpen one end and hold a container or your mouth to the sharpened end. The water will be fresh and pure. Never drink from a vine that has milky sap. Bamboo stems sometimes have water in the hollow joints. Shake the stems of old, yellowish bamboo—if you hear a gurgling, cut a notch at the base of each joint and catch the water in a container. (See illustration on page 91.)

In the American tropics, the branches of large trees often support air plants (relatives of the pineapple) whose overlapping, thickly growing leaves may hold a considerable amount of rain water. Strain the water through cloth to eliminate most of the dirt and water insects. In climbing one of these trees, you may also find small frogs or snakes.

Collect rain water by digging a hole and lining it with a tarpaulin or a piece of canvas. Catch water from dripping trees by wrapping a clean cloth around a sloping tree, and arrange one end of the cloth to drip into a container.

Animal trails often lead to water. Follow them, but take care not to get lost.

FOOD

General Rules

1. Take stock of your available food and water. Estimate the number of days you expect to be on your own. (The pick-up time may vary from a few hours to several months, depending on the environment and available rescue facilities in the area. Divide available food into thirds; allow two-thirds for the first half of your estimated time before rescue, and save the remaining one-third for the second half.)
2. If you decide to divide your party, give each man traveling out for help about twice as much food as you give each man remaining with the airplane. In this way, the men resting at the airplane and those walking out will stay in about the same physical condition for about the same length of time, and the safety and rescue prospects of all will be increased.
3. If you have less than a quart of water daily, avoid dry, starchy, and highly flavored foods and meat. Keep in mind that eating increases thirst. Best foods to eat are those with high carbohydrate content, such as hard candy and fruit bars.
4. Every bit of work requires additional food and water; remember that the less you work, the less food and water you will need.
5. You can live many days without food if you have water. When water is no problem, drink more than your normal amount to keep fit.
6. Always be on the lookout for wild foods. Eat off the land whenever possible. Save your rations for emergencies.

7. Eat regularly, if possible; don't nibble! On limited rations, plan for one good meal daily; then sit down and make a feast of it. Two meals a day are preferable, especially if one of them is hot. If you are collecting wild foods, plan a hot meal. Cooking makes the food safer, more digestible, and more palatable. The time you spend cooking will give you a good rest period.

8. Native foods may be more appetizing if they are eaten by themselves. Mixing rations and native foods usually does not pay.

ENERGY REQUIREMENTS. You get your requirements from foods which contain:

CARBOHYDRATES. Mostly plant in origin—sugar, starches, cereals, and fruits. If your water supply is severely restricted, stick to these foods.

PROTEINS. Mostly animal in origin—meat, fish, eggs, milk, and cheese. Proteins are valuable fuels but their real importance is in maintaining and repairing body tissues. When you eat more of them than you need for maintenance, the extra amount is burned as fuel or converted to storage fat and carbohydrate. Your daily need is 3 ounces under all conditions; hard work does not require more. If your water supply is limited, do not eat large amounts of protein.

FATS. Partly plant—olive and cottonseed oil; partly animal—butter and lard. Except in very small amounts, fats are not essential for human nutrition. Although inefficient in comparison, fats provide more than twice as many calories per unit weight than do proteins or carbohydrates. Diets very high in fat cause digestive disturbances and often produce an acid condition (ketosis) that requires added water intake for elimination.

Prepared Foods

The food in your survival kit has been developed especially to provide you with proper sustenance in survival emergencies. When you eat it as directed on the package, it will keep you at maximum efficiency. You can eat it as it comes from the kit, without further preparation, alone, or with other foods. Save it for emergency use, if you can find enough other food at hand.

Wild Foods

Learn to overcome your prejudices. Foods that may not look good to eat are often part of the natives' regular diet. Wild foods are good foods, with high vitamin and mineral content. Fleshy-leaved plants make good salad greens; and fresh fruits provide fluid when water supplies are low. Eat enough to satisfy.

With a few exceptions, all animals are edible when freshly killed. Don't eat toads. Never risk your life with questionable sea food. Never eat fish with slimy gills, sunken eyes, flabby flesh or skin, or an unpleasant odor. If the flesh remains dented when you press your thumb against it, the fish is probably stale. For poisonous and venomous fish, see pages 79 and 80; for poisonous plants and mushrooms, see pages 55, 57, and 72.

Where to Look for Food

You should be able to find something to eat wherever you are. One of the best hunting grounds for survival food is along the sea coast, between the high and low water mark. Other likely spots are the area between the beach and a coral reef; the marshes, mud flats, or mangrove swamps where a river flows into the ocean or into a larger river; river banks, inland water holes, shores of ponds and lakes; margins of forests, natural meadows, protected mountain slopes, abandoned cultivated fields. Poorest hunting grounds are high mountain tops, dry ridges, and dense, continuous forest stands.

ANIMAL FOOD

Animal food will give you the most food value per pound. Anything that creeps, crawls, swims, or flies is a possible source of food. People eat grasshoppers, hairless caterpillars, wood-boring beetle larvae and pupae, ant eggs, and termites. Such insects are high in fat. You have probably eaten insects as contaminants in flour, corn meal, rice, beans, fruits, and greens of your daily food, and in stores in general.

HUNTING HINTS

Most warm-blooded, hairy animals are wary and hard to catch. To hunt them requires skill and patience. The best method for a beginner is "still hunting." Find a place where animals pass—a trail, watering place, or feeding ground. Hide nearby, always downwind so the animal can't smell you, and wait for game to come within range. Remain absolutely motionless. You can stalk an animal upwind by moving very slowly and noiselessly, keeping under cover as much as possible. Move only when the animal is feeding or looking the other way. Freeze when he looks your way.

The best time to hunt is in the very early morning or dusk. In your travels, keep alert for animal signs such as tracks, trampled underbrush, or droppings. On narrow trails be ready for game using same pathways.

Game is most plentiful and easiest found near water, in forest clearings, or along the edge of thickets. Many animals live in holes in the ground or in hollow trees. Poke a flexible stick into the hole to determine if it is inhabited. Use a stick to tease the animal into running out, but first close off other exits. Animals in hollow trees can be smoked out by a fire built at the base of the tree; be ready to club the animal as it comes out.

Night hunting or fishing is always good, since most animals move at night. Use a flashlight or make a torch to shine in the animals' eyes. They will be partly blinded by the light and you can get much closer than in the daytime. If you have no gun, try to kill the animals with a club or sharpened stick used as a spear. Eyes of spiders and insects are good reflectors, so don't be surprised if you "shine up" eyes and can't find the rest of the creature. Eyes of spiny lobsters on reefs

shine red. Remember that large animals when wounded or with their young can be dangerous. Be sure that the animal is dead.

Along river and lake shores, small, fresh-water turtles can often be found sunning themselves. If they dash into shallow water, you can still get them. Watch out for mouth and claws. Frogs and snakes also sun and feed along streams. Use two hands to catch a frog—one to attract it and keep it busy while you grab it with the other. All snakes, except sea snakes, are good to eat; use a long forked stick to catch them.

Both marine and dry-land lizards are edible. Use a baited noose or a fine fish-hook baited with a bright cloth lure, or use a slingshot or club.

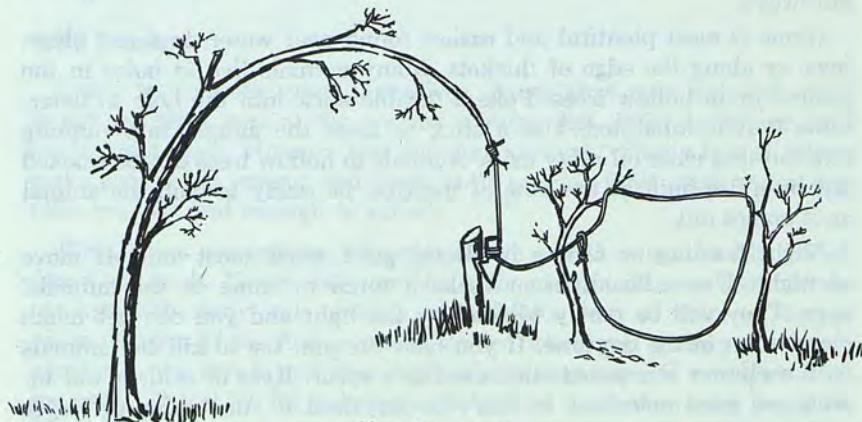
Never overlook small birds and their nests. All bird eggs are edible when fresh, even with embryos. Large wading birds, such as cranes and herons, often nest in mangrove rookeries or in high trees near water. Ducks, geese, and swans are to be expected in tundra areas. During the moulting season these birds can be clubbed. Sea birds along low coastlines frequently nest on sand bars or low sand island. Steep, rocky coasts are favorite rookeries for gulls, auks, murres, and cormorants. Catch your birds at night when they are roosting.

SNARES, TRAPS, AND DEADFALLS

Snaring of small game is useful during periods of food shortages, especially in the absence of firearms or during periods of imposed silence. Set your snares in game trails or frequently used runways, which you can recognize by fresh tracks and droppings.

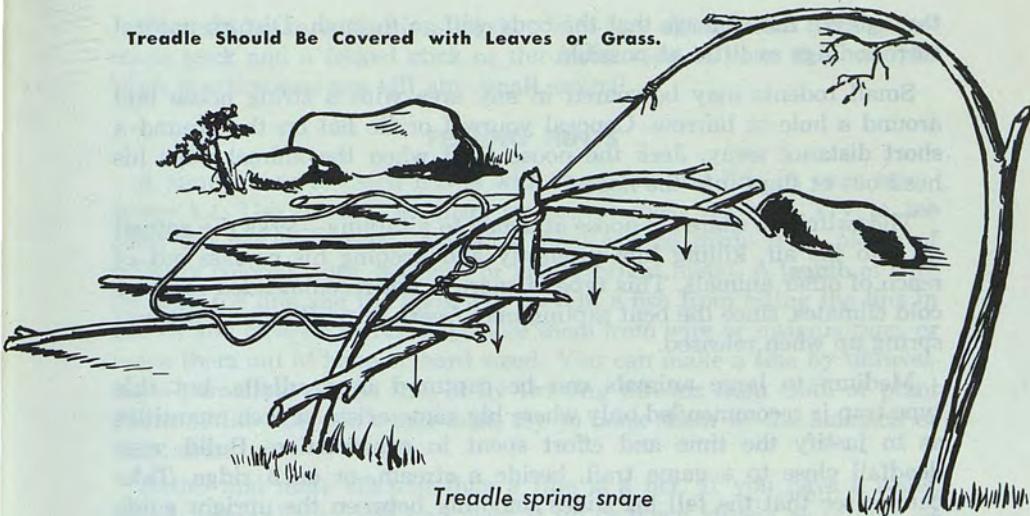
All snares and traps should be simple in construction and should be made after camp is completed but before darkness. Any spot used as a butchering place will attract other animals. It is a good place to watch for game during the next 24 hours. Use entrails for bait.

Place your traps where the trail is narrow. Arrange pickets, brush, or obstacles in such a manner as to force the animal to pass through the snare. Be sure that the loop is large enough for the head to pass

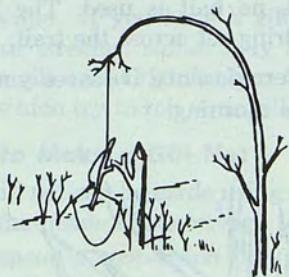


Hanging snare

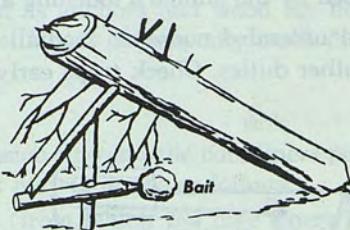
Treadle Should Be Covered with Leaves or Grass.



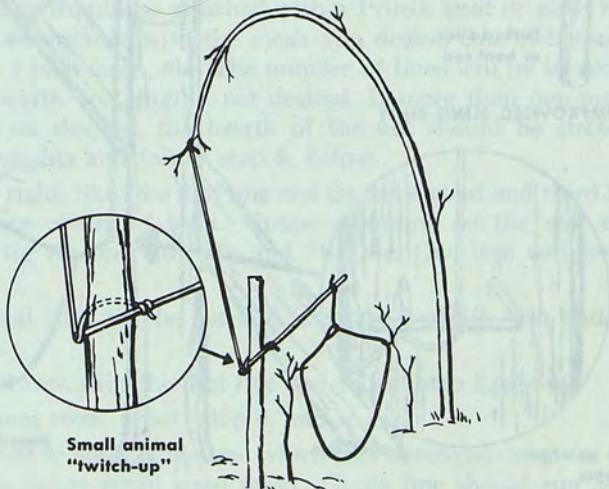
Treadle spring snare



"Twitch-up" snare



**Deadfall with
figure 4 trigger**



**Small animal
"twitch-up"**

Small animal traps and snares

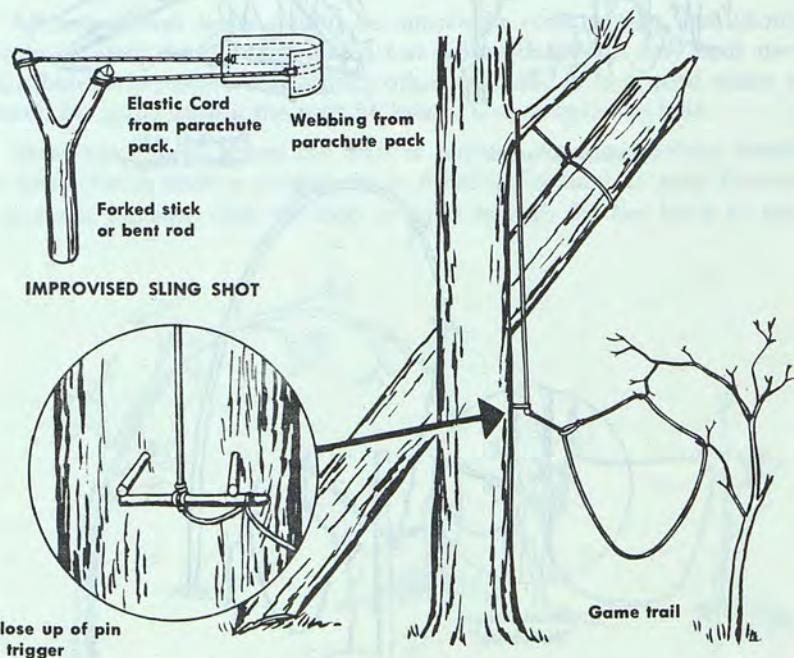
through but not so large that the body will go through. Disturb natural surroundings as little as possible.

Small rodents may be snared in any area with a string noose laid around a hole or burrow. Conceal yourself or lie flat on the ground a short distance away. Jerk the noose tight when the animal pops his head out or steps into the noose.

The twitch-up snare—a noose attached to a sapling—jerks the animal up into the air, killing him promptly and keeping his carcass out of reach of other animals. This type of snare is not recommended for very cold climates, since the bent sapling may freeze in position and will not spring up when released.

Medium to large animals can be captured in deadfalls, but this type trap is recommended only where big game exists in such quantities as to justify the time and effort spent in construction. Build your deadfall close to a game trail, beside a stream, or on a ridge. Take care to see that the fall log slides smoothly between the upright guide posts and that the bait is placed at a sufficient distance from the bottom log to insure time for the fall log to fall before the animal can withdraw its head. In a trip-spring deadfall, no bait is used. The log is tripped by the animal's touching a trip string set across the trail.

An untended noose or deadfall is preferred, since it leaves you free for other duties. Check traps early in the morning.



Deadfall and dragsnare in combination

You can make a simple slingshot with the elastic from your parachute pack and a forked stick or the metal rods in your tie-down kit. With practice you can kill any small animal.

FISHING HINTS

A simple way to catch fish is with the hook and line in your emergency kit. Use insects, shellfish, worms, or meat for bait. Try to see what the fish are eating. Artificial lures can be made from pieces of brightly colored cloth, feathers, or bits of bright metal. A length of wire between the line and the hook will prevent a fish from biting the line in two. If you have no hooks, improvise them from wire or insignia pins, or carve them out of bone or hard weed. You can make a line by unravelling a parachute shroud line or by twisting threads from cloth or plant fibers. If the fish won't take bait, try to hook them in the stomach as they swim by.

Better and more efficient than a line is a net. If you have a seine, attach poles at each end and work it up or down stream as rapidly as possible, moving stones and threshing the bottom or edges of the stream banks. Gather up the net quickly every few moments so the fish will not escape. If you have a gill net, use it in absolutely quiet water of lakes or streams; stones may be used as anchors and wood for floats; set the gill net at right angles to shore. It will occasionally catch diving birds which try to rob your gill net.

How to Make a Gill Net

A gill net can be made using suspension line and the core liners pulled from the inside of suspension lines. It may be made as follows:

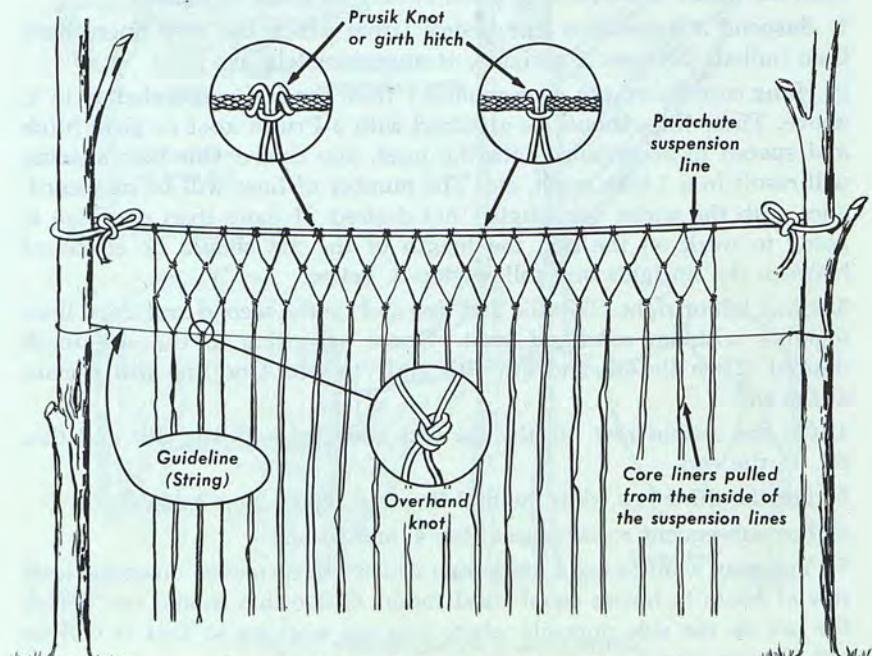
1. Suspend a suspension line casing (from which the core liners have been pulled) between 2 uprights, at approximately eye level.
2. Hang core liners (an even number) from the line suspended as in 1, above. These lines should be attached with a Prusik knot or girth hitch and spaced in accordance with the mesh you desire. One-inch spacing will result in a 1-inch mesh, etc. The number of lines will be in accordance with the width (or length) net desired. If more than one man is going to work on the net, the length of the net should be stretched between the uprights and follow step 8, below.
3. Start left or right. Skip the first line and tie the second and third lines together with an overhand knot. Space according to the size mesh desired. Then tie 4th and 5th, 6th and 7th, etc. One line will remain at the end.
4. On the second row, tie the 1st and 2nd, 3rd and 4th, 5th and 6th, etc. to the end.
5. For the third row, skip the first line and repeat step 3, above.
6. For subsequent rows, repeat step 4, and so on.
7. You may want to use a guide line which can be moved down for each row of knots to insure equal sized mesh. Guide line should run across the net on the side opposite where you are working so that it will be out of your way.

- When you have stretched the width between the uprights and approach ground level, move the net up by rolling it on a stick and continue until the net is the desired length.
- String a suspension line casing along the sides when net is completed to strengthen it and make setting of the net easier.

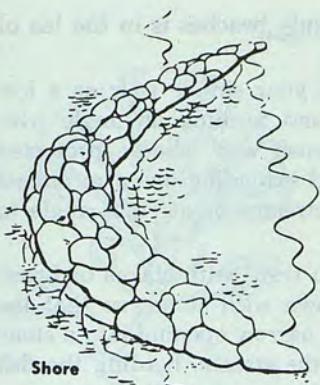
In fresh water, usually the deepest water is the best place to fish. In shallow streams the best places are pools below falls, at the foot of rapids, or behind rocks. The best time to fish is usually early morning or late evening. Sometimes fishing is best at night, especially if you have a light to attract the fish. Fish can sometimes be killed with the back side of a machete; or they can be speared with a sharpened stick. Before you give up, try fishing in all kinds of water and depths, at all times, and with all types of bait. There are a few safety rules to observe. Fish with the outgoing or low tide; watch out for slippery rocks; keep out of the surf.

Shrimp and prawns live on or near the sea bottom but may be lured to surface by light at night. Catch them with a hand net made from parachute cloth. Lobsters and crawfish are creeping forms found on the bottom in water 10-30 feet deep. Use lobster pots, a jig, or a baited hook, and lift your catch out of the water with a dip net. Crabs creep, climb, and burrow; they are easily caught in shallow water with a dip net or in traps baited with fish heads or animal guts.

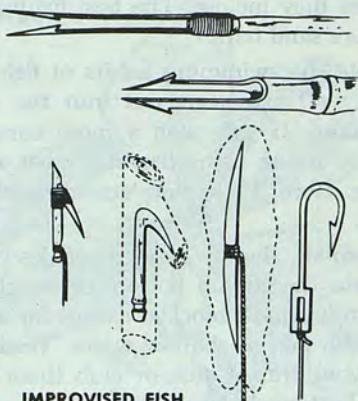
Fish traps or weirs are very useful for catching both fresh and salt water fish, especially those that move in schools. In lakes or large streams, fish tend to approach the banks and shallows in the morning and



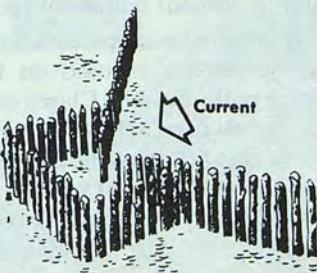
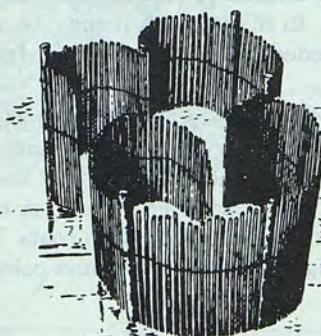
Gill Net, Overhand Knot Method



TIDAL FLAT FISH TRAP



IMPROVISED FISH HOOKS AND SPEARS



Maze-type fish traps

evening. Sea fish, traveling in large schools, regularly approach the shore with the incoming tide, often moving parallel to the shore and guided by obstructions in the water.

A fish trap is basically an inclosure with a blind opening where two fencelike walls extend out, like a funnel, from the entrance. The time and effort you put into building a fish trap should depend on your need for food and the length of time you plan to stay in one spot.

Pick your trap location at high tide; build at low tide. One to two hours of work should do the job. Consider your location and try to adapt natural features which will reduce your labors.

On rocky shores, use natural rock pools. On coral islands, use natural pools on the surface of reefs, by blocking openings as the tide recedes. Avoid "boilers" along surf. On sandy shores, use sand bars and the

ditches they inclose. The best fishing off sandy beaches is in the lea of offshore sand bars.

Note the swimming habits of fish. Build your simple weir as a low stone wall extending out into the water and forming an angle with the shore. If you plan a more complex brush weir, choose protected bays or inlets, using the narrowest area and extending one arm almost to the shore. Place nets across mouths of streams or at right angle to shore.

In small, shallow streams, make your fish traps with stakes or brush set into the stream bottom or weighted down with stones so that the stream is almost blocked except for a small, narrow opening into a stone or brush pen of shallow water. Wade into the stream, herding the fish into your trap. Catch or club them when they get into shallow water. Mud-bottomed streams can be trampled until roiled, then seined. The fish are blinded and cannot avoid the nets.

Look for fresh water crawfish, snails, and clams under rocks, logs, overhanging bushes, or in mud bottoms.

Fish may be confined in properly built inclosures and kept for days, since the incoming water keeps them fed. In many cases it may be advantageous to keep them alive until needed and thus assure a fresh supply without danger of spoilage.

Mangrove swamps are often good fishing grounds. At low tide, clusters of oysters are exposed on the mangrove "knees" or lower branches, along with mussels. Clams can be found in the mud at the base of trees. Crabs are very active among branches or roots and over mud. Fish can be caught at high tide. Snails are found on mud or clinging to roots. Do not eat shellfish that are not covered at high tide or those from a colony containing obviously diseased members.

PLANTS USED TO STUPIFY FISH

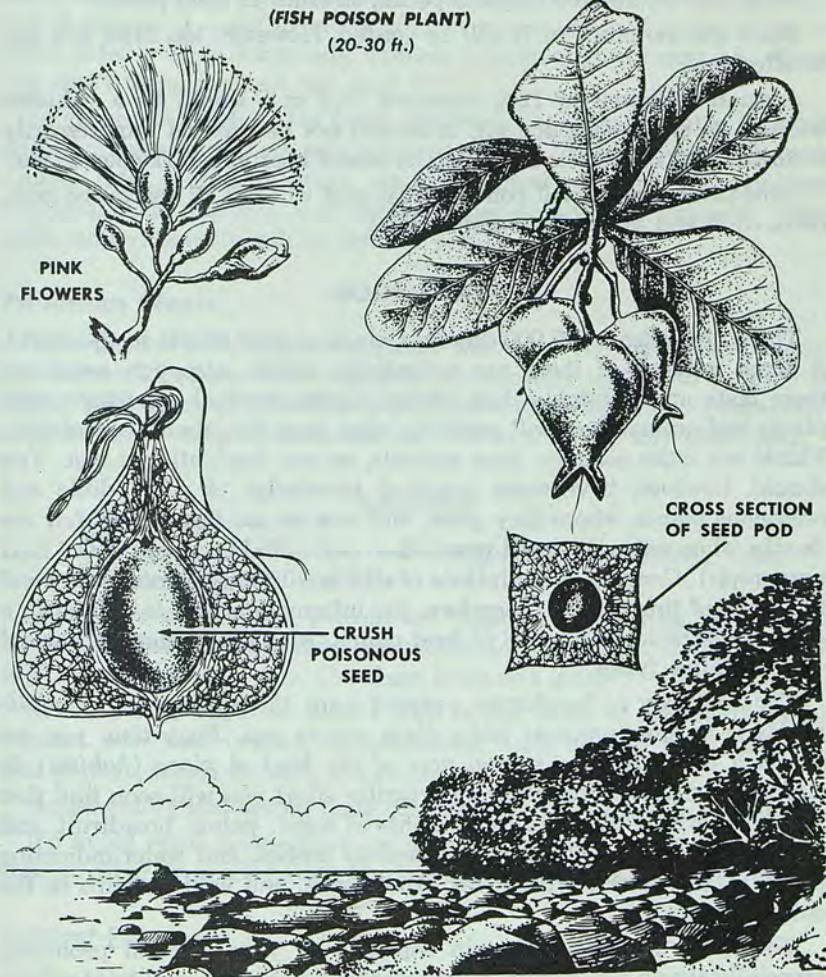
Throughout the warm regions of the world, there are various plants which the natives use for poisoning fish. The active poison in these plants is harmful only to cold blooded animals. Man can eat fish killed by this poison without any ill effects whatsoever. In the southwest Pacific, the seeds and bark from the barringtonia tree, illustrated on page 53, are commonly used as a source of fish poison. The barringtonia tree usually grows along the seashore. In southeast Asia, the derris plant is widely used as a source of fish poison. The derris plant, a large woody vine, is also used to produce a commercial fish poison called rotenone.

The most common method of using fish-poison plants is to macerate or crush the plant parts (most often the roots) and mix them in water. Drop large quantities of the crushed plants into pools or the headwaters of small streams containing fish. Within a short time, the fish will rise in a helpless state to the surface.

Commercial rotenone can be used in much the same manner as crushed derris roots. However, rotenone has no effect if dusted over the surface of a pond. It must be mixed to a chocolate-malted consistency with

(FISH POISON PLANT)

(20-30 ft.)



Barringtonia

a little water, and then distributed in the water. If the concentration is strong, it will take effect within 2 minutes in warm water, or it may take an hour in colder water. Fish sick enough to turn over on their backs will eventually die. An ounce of 12% rotenone will kill every fish for a half mile down a stream that is about 25 feet wide. After putting in the poison, follow slowly down stream and pick up the fish as they come to the surface, sink to the bottom, or swim crazily to the bank. A stick dam or obstruction will aid you in collecting fish as they float downstream.

A few facts to remember about the use of rotenone are:

It is very swift-acting in warm water at 70° F. and above.

It works more slowly in cold water, and is not practical in water below 50° or 55° F.

It can best be applied in small ponds, streams, or tidal pools.

Don't use too much or it will be wasted. However, too little will not be effective.

A small container of 12% rotenone (1-2 oz.) would be a valuable addition to any emergency kit. It should not be exposed unnecessarily to air or light. It will retain its toxicity best if kept in a dark-colored vial.

Lime thrown in a small pond or tidal pool will kill all fish in the pool. Burn coral and sea shells to obtain lime.

PLANT FOOD

There are at least 300,000 different kinds of wild plants in the world. A large number of them are potentially edible, although some are more tasty and palatable than others. Under survival conditions wild plants and animal food will probably alter your diet almost completely. Plants are more common than animals, so use them all you can. You should, however, have some practical knowledge of wild edible and poisonous plants, where they grow, and how to use them. Very few are deadly when eaten in small quantities (see edibility rules in the next paragraph). Complete descriptions of all the wild-food plants are beyond the scope of this manual; therefore, the information here is limited to a general discussion of classes of food plants, with illustrations of several representative types.

The best way to familiarize yourself with the appearance of edible plants is to have someone point them out to you. Each time you are shown a plant, make a mental note of the kind of place (habitat) in which you find it. Without any particular effort you will soon find that you are learning many kinds of plants at sight: palms, breadfruit, and plantains in the tropics; beans, succulent bushes, and water-indicating plants in the desert; blueberries, crowberries, and wild rhubarb in the cold regions.

You must use intelligence in coping with your survival problems, especially if you travel over widely dissimilar areas. Learn to recognize vegetation *patterns* in the tropics, deserts, and cold zones. The fact that you have learned about palms, beans, and wild rhubarb in one locality may pay you dividends if you are forced to survive in similar remote places. *Your greatest enemy under survival conditions will be the bacteria which cause spoilage and may infect your food and water under makeshift sanitary conditions.*

REASSURANCE AND WARNING

Edibility Rules

Never eat large quantities of a strange food without first testing it. Prepare a cooked sample, then take a mouthful, chew it, and hold it in your mouth for 5 minutes. If it still tastes good, go ahead and eat it. If the taste is disagreeable, don't eat it. Remember that olives are bitter and grapefruit is sour, so an unpleasant taste does not, in itself, neces-

sarily mean poison. But a burning, nauseating, or bitter taste is a warning of danger. *A small quantity of even poisonous food is not likely to prove fatal or even dangerous*, whereas a large quantity may be. (Does not apply to mushrooms, see page 57.)

In general it is safe to try foods that you observe being eaten by birds and mammals, but there are some exceptions. Food eaten by rodents (mice, rats, rabbits, beavers, squirrels, muskrats), or by monkeys, baboons, bears, racoons, and various other omnivorous animals (vegetable eaters) usually will be safe for you to try.

Poisonous Plants

As a general rule, poisonous plants are not a serious hazard, except on the rare occasion when you may accidentally walk into a patch of them. Your chances of eating a poisonous plant are rare. Frequently, only the seeds are poisonous, but use care in selecting any plant part.

CAUTION

Cook all plant foods when in doubt about their edibility. (See mushrooms pages 57 and 58.)

Except for mushrooms, poisons are removed by cooking. Most kinds of wild taro root, for instance, are poisonous when fresh, but after cooking they are perfectly safe. Use these hints as a guide:

Avoid eating untested plants with milky juice or letting the milk contact your skin (except the numerous kinds of wild figs, breadfruit and papaya, which are safe despite the milky juice).

Avoid eating plants that taste disagreeable (bitterness is a guide).

To avoid ergot poisoning from infected heads of cereals or grasses, discard all grain heads having black spurs in place of normal seed grains.

Contact Poisons

The relatively few plants that act as skin irritants all belong to the same natural family of plants as the poison ivy, poison sumac, and poison oak (cashew family). The plants of this family are trees or shrubs, usually with *resinous bark*. The leaves usually are alternate on the stem and divided into three segments, or pinnate (like the ribs of a feather). The fruit is usually one-seeded with an outer fleshy covering—similar to a cherry. *Some of these plants exude black ooze from fresh wounds.* The poisonous ingredient is the same, and the treatment is identical to that for persons coming into contact with poison ivy. In the moist tropics of southeast Asia the poisonous members of the cashew family are called *rengas*, and they are found as small or large trees.

Stinging Plants

You are no doubt familiar with nettles at home. The tree nettle and the cowhage in the tropics have stinging hairs, but generally these hairs are merely mechanical irritants and not poisonous.

HOW TO SELECT EDIBLE PLANTS

Plants, whether water or land types in arctic, desert, or tropical regions, furnish edible:

Fruits	Buds	Nuts
Seeds	Leaves	Stems
Bark	Flowers	Rootstalks
Tubers	Sap	Shoots
	Pods	Bulbs

All parts of some plants are edible, but for most kinds it is necessary to select the most palatable part, whether it be root or fruit, leaves or pods. Perhaps only the nuts will be edible.

STARCHY FOODS

Many plants store large quantities of edible starch in underground parts:

Tubers of the wild potato (mostly tropical American) with foliage similar to the cultivated varieties are edible. The tubers of other plants, such as the tropical yam (page 92) and water lily (page 61), are abundant in the tropics.

Rootstalks are found in thousands of plants, but only two examples of widely distributed types are illustrated; the fern (page 85) and the cattail (page 60). Also, in the tropics many of the commonest vegetables, such as the taro, manioc, and canna, come from rootstalks.

Bulbs are produced most commonly by members of the lily family, such as the true lily, onion, tulip, and daffodil. Many kinds of bulbs are edible. Tubes, rootstalks, and bulbs are a fine source of food because they are usually available throughout the year in most regions. In cold climates these underground storage organs can be found by digging where the dried plant stalks remain.

Stems of the sago palm, cycad, and certain other palms produce large quantities of edible starch in the trunk—enough to sustain life for several weeks.

Grains or seeds of millet, wildgrasses, wild rye, as well as many other grasses, are starchy and serve as excellent, staple food (illustration, page 93).

Fruits of the green banana (table), the plantain (cooking banana), and the breadfruit, all tropical, contain plenty of starch.

Preparation

All starchy food must be cooked, since raw starch is difficult to digest.

Starch is not extracted in the uncooked state from taros, yams, plantains, and breadfruit. They are boiled, steamed, roasted, or fried and are eaten plain, or, better, mixed with other wild food. The manioc is always cooked, because the bitter form is poisonous.

Starch is removed from sago palm, cycads, and other starch producing trunks by splitting the trunk and then pounding up the soft, whitish

inner parts with a pointed club. This pulp is washed with water and the white sago (pure starch) is drained into a container. It is washed a second time, and this may be used directly as flour. One trunk of the sago palm will supply a man's starch wants for many weeks.

(A cycad looks like a cross between a tree fern and a palm and is relatively common in southeast Asia and southwest Pacific.)

VEGETABLES

Vegetables are produced mostly from succulent leaves, pods, seeds, stems, and non-woody roots. Select young, tender kinds, but cook all vegetables particularly those in the tropics or those obtained from cultivated fields. In heavily populated regions, especially in Asia, human excrement is commonly used as fertilizer for food crops. Cooking will normally destroy all injurious intestinal parasites or bacteria.

Fruit which is bland or unsweet in flavor may be eaten as a vegetable. The tomato, sweet pepper, and eggplant are in this category.

MUSHROOMS AND OTHER FUNGI

Ninety-eight percent of the several hundred kinds of wild mushrooms (including most of the so-called toadstools) are edible. Mushrooms are found in all parts of the world growing on the ground or on dead trees and decaying wood. Mushrooms are rarely found on the arctic tundra. *Poisonous fungi cannot be detected by unpleasant taste or disagreeable odor.*

Kinds of Edible Fungi (Eaten as Meat Substitutes)

PUFFBALLS. Puffballs are white to brownish in color and almost round. In the edible stage, the interior is full of pure white "flesh." In this state, the puffball may be fried or be used as flavoring in stew or soup. Generally found on the ground in open meadows, the puffball is shown at D in the illustration on page 70.

MORELS, CORAL FUNGI, PORE FUNGI, CORAL HYDNUMS, AND CUP FUNGI. *All these are edible.* This group includes those with conical, honeycomb-like caps, those with a sponge-like look, and those that look like coral. These kinds are generally found in wooded areas on the ground or on dead trees. They are illustrated at B, C, D page 70; E, F, G, on page 71.

MUSHROOMS. The mushrooms (including toadstools) are the only fungi which have fish-like gills. They are illustrated on page 72 and at A on page 70. Mushrooms usually are found on the ground. In rare cases, they are found on decaying wood, in forests, or in meadow lands.

Distinguishing Edible from Poisonous Mushrooms

Color is not a reliable guide in deciding between poisonous and non-poisonous mushrooms. The poisonous kinds, mostly amanitas, have certain characteristics in common. (Study the illustration of poisonous kinds on page 72.) Poisonous mushrooms have a frill or ring (veil) around the upper part of the stem *plus* a cup (volva) at the base into

which the stem fits (usually just below ground level or covered with decaying leaves and sticks). Parts A-F (page 72) illustrate the different forms of the cup in poisonous mushrooms. Note carefully the differences between poisonous and edible kinds by comparing the illustrations on pages 70 and 72. *Edible mushrooms sometimes have the frill or ring, but never the cup.* Look out for poisonous mushrooms everywhere except in the arctic tundra, but in other areas the poisonous kinds frequently occur along the margin of woods (rarely in fields).

CAUTION

When picking young mushrooms, don't mistake them for young puffballs, which are edible but without gills and central stem. To be certain, cut the young "button" vertically and look for gills and cup. *If you find a poisonous kind (always with gills), cooking will not destroy the poisonous properties. Discard all suspected kinds from the start.*

FERNS

Three widely distributed types of ferns illustrate this group of food plants: (1) the bracken, (2) the polypody, and (3) the tree fern. See page 85.

Many related ferns are edible, *none are poisonous*. Edible kinds occur mainly in forested areas in the warm temperate and tropical regions. Some are only a few inches high; tree ferns up to 100 feet high are found in tropical areas from sea level to mountain slopes where there is heavy rainfall.

Desert ferns are usually small and tough. In the far north ferns are few and very small; look for edible kinds in moist, shady places.

What to Eat

The fiddleheads of all ferns are the curled, young succulent fronds which are good as cabbage or asparagus in food value. Practically all kinds of fiddleheads are covered with hair which makes them bitter. Remove hair by rubbing in water.

Preparation

If especially bitter, boil fiddleheads for ten minutes and then reboil in fresh water for 30 or 40 minutes. Wild bird eggs or meat may be cooked with the fiddleheads.

NUTS

Edible nuts, illustrated on page 84, are the most sustaining of all raw forest foods and are found throughout the world. Many American nut trees, such as oaks, hickories, hazelnuts, and beechnuts, are widely distributed throughout the North Temperate Zone. Others such as the coconut and cashew occur widely in the tropics. Familiarity with some

of the common North American nut trees will help you locate nut-bearing trees in other regions.

Several kinds of temperate evergreen trees, especially the pines, produce edible pine nuts. To remove the edible seeds, shake or break open the cones.

BARK

You may eat the inner bark from numerous trees raw or cooked. In famine areas people make flour from the inner bark of trees. The thin, green, outer bark and white, innermost bark are normally used for food, since brown bark ordinarily contains bitter tannin.

Among trees whose bark is used as sources of food are the poplars (including cottonwoods and aspens), birches, and willows. The inner bark and growing tips of a few species of pine, including the Scotch pine of northern Europe and Asia can also be used. Pine bark is especially valuable for vitamin C. The outer bark of these pines is scraped away and the inner bark stripped from the trunk and eaten fresh, dried, or cooked. It may also be pulverized into flour.

Bark is most palatable when newly formed in the spring. As food it will be most useful in the arctic regions, where food may be scarce, especially in winter. An infusion of the needles of evergreens may be boiled as tea.

GRASSES (GRAINS)

Grasses, illustrated on page 93, may serve as your most important single source of survival food, especially in the warmer parts of the world. Rice, millet, sorghum, maize, and several other cereals are extensively cultivated in the tropics; rye, wheat, oats are characteristic of the temperate regions. The young shoots of most bamboo may be cooked and eaten with safety, while sugar cane occurs growing wild in some tropical areas. Wild grasses, in general, have an abundance of seeds, which may be eaten boiled or roasted after you have separated the chaff from the seeds by rubbing.

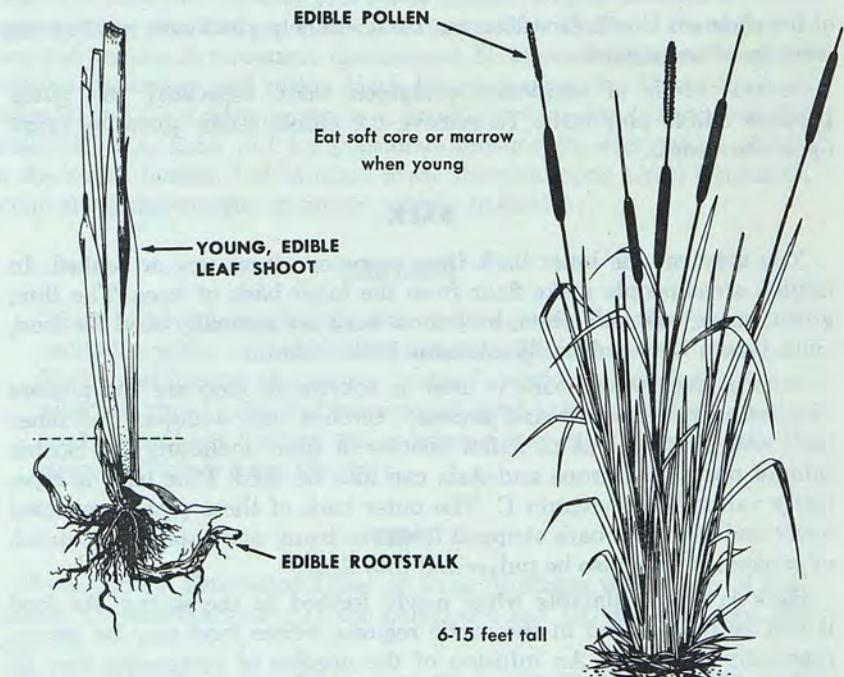
Preparation

No known grass is poisonous. If the kernels are still soft and do not have large stiff barbs attached, you may boil them for porridge.

To gather grass seeds place a cloth on the ground and beat the grass heads with sticks (winnowing). Many grasses pop like popcorn. Try them out by heating in a closed vessel.

WATER PLANTS

Plants that grow in very wet places along margins of rivers, lakes, and ponds, and those growing directly in water are of potential value as survival food. The succulent underground parts and stems are most frequently eaten. *Poisonous water plants are rare.* In temperate climates



Cattail

the water hemlock (page 73) is the most poisonous plant around marshes and ponds. In the tropics, the various members of the calla lily family often grow in very wet places with leaves that look like an arrowhead. Taro, jack-in-the-pulpit, calla lily, and sweet flag are members of the Arum family. To be eaten the members of this family must be cooked in frequent changes of water to destroy the irritant crystals in the stem.

Two kinds of marsh and water plants are the cattail or elephant grass and the water lily.

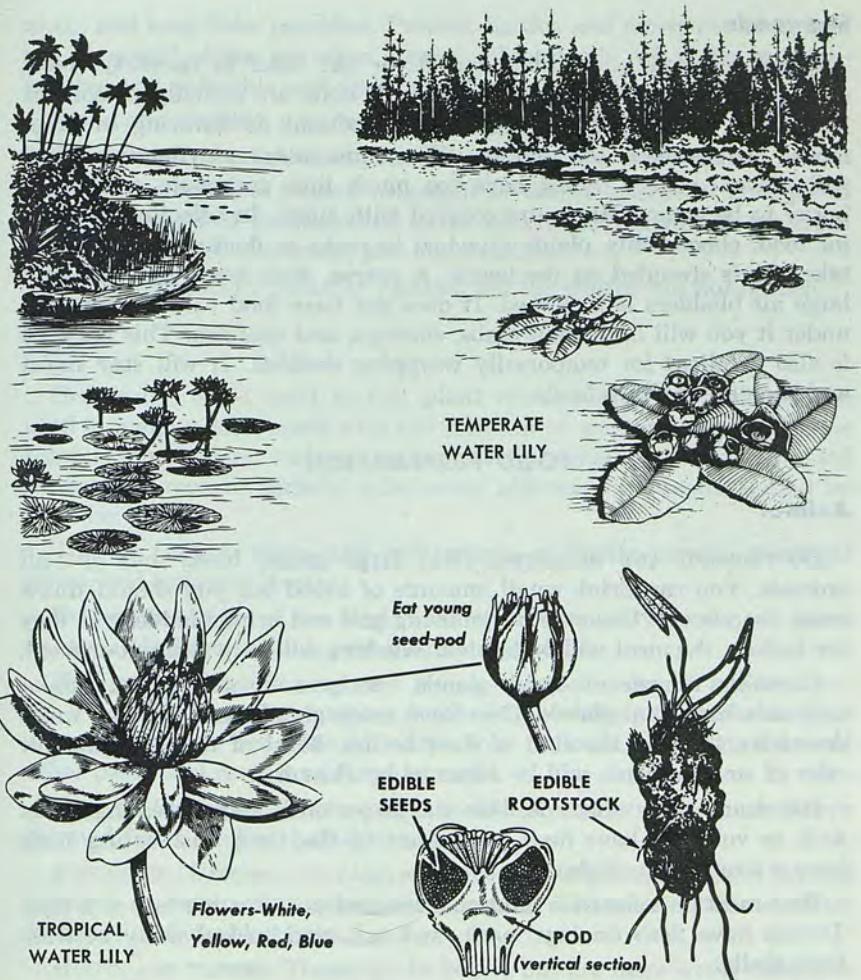
Cattail, Elephant Grass (*Typha*)

WHERE FOUND. World-wide except in tundra forested regions of the far north. Expect to find cattails in the more moist places in desert areas in all continents as well as the moist tropics and temperate zones of both hemispheres.

WHAT TO EAT. Edible young shoots that taste like asparagus. The rootstalks, without the outer covering, are eaten boiled or raw. While the plant is in flower, the yellow pollen is very abundant; this may be mixed with water into small cakes and steamed as a kind of bread.

Water Lilies (*Nymphaea* and *Nuphar*)

WHERE FOUND. Water lilies occur in all the continents, but principally in southern Asia, Africa, North and South America. Two main



Water lily

types occur: (1) temperate water lilies that produce enormous rootstalks and yellow or white flowers that float on the water surface; and (2) tropical water lilies that produce large edible tubers and flowers that are elevated above the water surface.

WHAT TO EAT. *Rootstalks or Tubers.* May be difficult to obtain because of deep water. The roots are starchy and therefore full of food if you can reach them. Eat either raw or boiled. Only one kind in South Africa is suspected of having poisonous properties; all others are perfectly safe.

Stems. May be cooked in a stew.

Young Seed Pod. May be sliced and eaten as a vegetable.

Seeds. May be bitter, but are very nourishing. May be parched and rubbed between stones as flour. The water lily is considered an important food article by native peoples in many parts of the world.

Seaweeds

Many seaweeds are edible, but never eat them in quantity; most seaweeds are violent purgatives, although none are actually poisonous. They may certainly be eaten in small portions as flavoring in other foods. All seaweeds are rich in iodine, minerals, and vitamins. They will prevent scurvy. Some have too much lime carbonate or are too horny to be eaten. Others are covered with slime. In selecting seaweed for food, choose only plants attached to rocks or floating free. Do not take plants stranded on the beach. A coarse, dark green seaweed with large air bladders is rockweed. It does not have food value but in and under it you will find small crabs, shrimps, and shellfish. This seaweed is also excellent for temporarily wrapping shellfish. It will stay moist and keep the shellfish fresh.

FOOD PREPARATION

Animal

BUTCHERING AND SKINNING. Skin large game; bleed and gut all animals. You can drink small amounts of blood but you should throw away the viscera. Use care in removing gall and urine bladders; if they are broken, the meat will be tainted. Washing will help clean your meat.

Carefully remove all musk glands. Badgers, civets, skunks, minks, and otter have anal glands. Deer have musk glands on their feet; musk deer have them in the skin of their bellies. Most of the objectionable odor of small rodents will be removed by skinning.

Bleed and draw all birds; skin the larger ones. Carrion-eating birds, such as vultures, have flesh unpleasant to the taste. Fish-eating birds have a strong, fish-oil flavor.

Best meat on a lizard is hind quarters and tail. Eat the legs of a frog. Turtles have flesh on legs, neck, and tail, and tucked away between their shells.

Skin all frogs and snakes. Remove and discard skin, head, and viscera.

CLEANING SHELL FOOD. Clams, oysters, mussels, crabs, and lobsters left in clean water overnight will clean themselves and save you the work. Note warning about mussels on page 68.

CLEANING AND SCALING FISH. Immediately after you land a fish, bleed it by cutting out the gills and large blood vessels that lie next to the backbone. Scale and wash the fish in clean water.

Small fish of the herring family can be eaten with a minimum of cleaning. Their scales are loose and drop off or can be washed off immediately after they are caught; the stomach and intestines can be flipped out with the thumb. These fish are oily, highly nutritious, and good—even raw.

COOKING. Cooking makes for a more enjoyable meal. All wild game, fresh water fish, clams, mussels, snails, and crawfish must be thoroughly cooked for safety. Mince tough mussels or large snails. Never eat raw or smoked fresh water fish; they are frequently contaminated with tape-

worm and lung fluke parasites. Parrots, hawks, and crows can be tough, but they will soften up when stewed. Plant foods are made more digestible and palatable and yield more food value after heating.

Salt water shellfish may be eaten raw but are safest when cooked.

Shark meat is edible except in the Arctic, but it must first be cut into small pieces and soaked overnight or boiled in several changes of water to get rid of the ammonia flavor which accumulates in the flesh. Shark meat is not poisonous, just unpalatable.

Turtle eggs can be boiled or roasted, but the whites will not harden.

Plant

Ordinarily, water used to boil plant roots, tubers, or seeds can be used to make a good broth with the addition of sea food or meat. In the tropics, some tubers, such as taro and manioc, must be soaked or boiled in water to remove harmful substances; afterward the water cannot be used for broth.

To give taste to stews, add wild onions, puffballs, morels, succulent stems, and leaves of plants.

To prepare seaweed for food, wash it in water, dry in sun on wood or stone platform, pound, and sprinkle over food.

Boiling, roasting, baking, and frying—in that order of preference—are efficient ways of preparing foods. Pit cooking or clambake style (oven) is slower but takes less attention, protects food from flies and other pests, and reveals no flame at night.

FRUITS. Succulent fruits are best boiled. Large, tough, or heavy skinned fruits are best baked or roasted.

POTHERBS (Greens). Boil leaves, stems, and buds until tender. Several changes of water with subsequent rinsing will help eliminate bitter juices or undesirable tastes.

ROOTS AND TUBERS. These can be boiled but are more easily baked or roasted.

NUTS. Most nuts can be eaten raw, but some such as acorns are better cooked. Acorns should be broken up, boiled with ashes from the fire to eliminate tannin, moulded into cakes, and then baked.

GRAINS AND SEEDS. Parch (roast) grains and seeds to make them more digestible and tasty.

SAP. The sap of plants containing sugar can be dehydrated to a syrup by boiling slowly for several hours to remove the water. (See illustration of coconut, page 96.)

MUSHROOMS. Thin, tender, juicy ones can be stewed slowly in 5-10 minutes. Thick, dry, tough caps and stems will require 30-40 minutes of stewing or may be fried crisp. Fresh caps may be broiled or baked on hot stones or on a greased iron, 2-4 minutes for a side.

Worms attack mushrooms and other edible fungi. Soak what you have picked in salt water for several hours and worms will rise to surface. Worms usually do not enter very young mushrooms.

CAUTION

Poisonous mushrooms are not safe to eat even after cooking.

Cooking without Utensils

ROASTING (in the coals of a fire). You can coat fish, potatoes, fresh water mussels, and many other foods large in size with a layer of mud or clay and roast them directly in the flames or coals of a fire. Loss of food by burning is thus reduced. You need not scale fish prepared in this way; peel off the skin with the baked clay when cooked.

STEAMING UNDER THE FIRE. Foods small in size, such as small bird eggs, fresh water snails, or any other shellfish, may be cooked in quantity in a pit beneath your fire. Fill a small, shallow pit with food, after lining it or wrapping the food in plant leaves, or cloth. Cover the pit with a $\frac{1}{4}$ - to $\frac{1}{2}$ -inch layer of sand or soil, and build your fire directly over it. After sufficient cooking, rake the fire away and recover the food.

STEAMING WITH HEATED STONES (clambake style). Heat a number of stones in a fire, then allow the fire to burn down to coals. Place such foods as fresh water mussels (in their shells) directly on and between the stones, and cover the whole with plant leaves, grass, or seaweed, and also with a layer of sand or soil. When thoroughly steamed in their own juices, clams, oysters, and mussels will show a gaping shell when uncovered; and you may eat the food without further preparation.

STONE BOILING. Take a big bowl with water and food. Add red-hot stones until the water boils. Cover for about an hour with big leaves, or until food is well done.

BAMBOO JOINTS. Bamboo joints are good pots. Heat them until they char.

PRESERVING EXCESS FOOD. Use a knapsack or better yet, a hand pack, to carry extra food. Wrap soft berries or fruits in leaves or sphagnum moss to keep them intact. Tie mushrooms together with a light string, to keep them from crushing. Carry shellfish, crabs, and shrimp in wet seaweed. Clean fish immediately; wash them well; carry them on a line over a pole.

Excess fish can be split (cut off the head and remove the backbone), spread apart, and cut thin. Then dry over smoke fires, spread on hot rocks, or hang from branches in the sun. If sea water is available, splash it on to salt the outside. Do not keep any sea food unless it is well dried and salted.

Meat can be preserved as dried "beef" or jerk meat, either over a slow fire or in the hot sun. Hang all drying meat high to keep it away from animals. Cover to prevent blow-fly infestation. If mold forms on the outside, brush or wash off before eating. In damp weather, smoked or air-dried meat must be redried to prevent molding.

To preserve cooked animal food, recook it once each day, especially in warm weather.

DRYING PLANT FOOD. Plant food can be dried by wind, air, sun, or fire with or without smoke. A combination of these can be used. The

main object is to get rid of the water. Plantains, bananas, breadfruit, tubers, leaves, berries, in fact most wild fruits, can be dried. Cut them into thin slices and place in the sun. A fire may be used if necessary.

If you find a lot of edible mushrooms or fungi, dry them in the sun or with a fire. They will keep indefinitely if kept dry.

ARCTIC AND SUBARCTIC

Animals

In the Arctic, the need for food will be your first consideration. In no part of the Arctic are native animals and plants a reliable source. Your chances for survival are best along the northeast coast of Asia, the northwest coast of Alaska, the Aleutians, and the northeast, southeast, and southwest coasts of Greenland, because sea food is more common there and gives you a dependable supply of food.

Depending on the time of year and place, your chances for obtaining animal food will vary considerably. Arctic shores are normally scraped clean of all animals and plants by winter ice. Inland animals are migratory. Watch for tracks, trails, or dung.

LARGE LAND GAME. Caribou and wild reindeer are migratory throughout northern Canada and Alaska. In northern Siberia they extend inland almost to 50° N. All move close to the sea or into the high mountains in summer. In winter they feed on the tundra (open, treeless plains). Caribou and reindeer are frequently infested with botfly larvae, which bore in the hide. They rarely penetrate into muscles and are not dangerous to man.

Moose in northern America and Asia, and elk in Asia are primarily animals of northern mixed forests. In winter both animals congregate in herds.

Musk ox may be found in northern Greenland and on the islands of the Canadian archipelago.

Mountain sheep and goats rarely descend into valleys except in severe winter; they are attracted to salt licks.

Bears are surly and dangerous. Wolves are curious, running in pairs or groups. Fox are solitary and are seen most frequently when mice and lemming are abundant.

SMALL LAND GAME. Tundra animals include rabbits, lemming, mice, ground squirrels, and fox. They may be trapped (see page 46) or shot, winter or summer, anywhere on the tundra. Most prefer some cover and can be found in shallow ravines, on north-facing slopes, or in groves of short willows. Ground squirrels and marmots hibernate in winter. In summer, ground squirrels are abundant along sandy banks of large streams. Marmots live in the mountains, among rocks, usually near the edge of a meadow, or in deep soil — much like woodchucks. To find the burrow in rocky areas, look for a large patch of orange-colored lichen on rocks. This plant grows best on animal or bird dung; and the marmot always seeks relief in the same spot, not far from his well-hidden entrance.

SEA ICE GAME. In the winter and spring, sea mammals — seals, walrus, polar bears — are found on the frozen pack ice and on floes in open water. Seals with claws on their flippers can make breathing holes and live relatively close to land. Those that cannot make breathing holes must live on the edge of the pack ice. Most are in groups, but the bearded seal is often found alone.

BIRDS. The breeding grounds of many birds are in the Arctic. In summer, ducks, geese, loons, and swans build their nests near ponds on the coastal plains or flats bordering lakes or rivers of the low tundra. A few ducks on a small pond usually indicate that setting birds may be found and flushed from the surrounding slopes. Swans and loons normally nest on small grassy islands in the lakes. Geese crowd together near large rivers or lakes. Smaller wading birds customarily fly from pond to pond. Grouse and ptarmigan are common in the swampy forest regions of Siberia.

Sea birds may be found on cliffs or small islands off the coast. Their nesting areas can often be located by their flights to and from their feeding grounds. Jaeger gulls are common over the tundra, frequently resting on higher hillocks. These birds, as well as ravens and owls, are useful for food.

In winter, owls and ptarmigan are the only birds available. Ptarmigan are seen in pairs or flocks, feeding along grassy or willow-covered slopes.

Hunting Hints

Winter hunting is best in the early morning. In summer, with almost continuous light, animals have very irregular moving habits. On the open tundra, select a high hill and scan the horizon for game. Summer heat haze will distort distant objects, and low ridges or brush will look like animals. In mountain country, hunting is best in and near mountain passes. Maintain a watch from a high place. When traveling, always be ready to shoot any animal which you may accidentally flush.

LARGE LAND GAME. Caribou or reindeer can be very curious, and you may attract them to you by waving a cloth and walking slowly toward them on all fours. Always approach from downwind.

Wolf can also be brought close by a four-legged pose. You may expect moose in heavy brush; they may charge you.

Mountain sheep and mountain goat can sometimes be surprised on high ridges. They are hard to approach, for they have keen eyesight. Stalk them quietly, moving only when they are feeding.

Musk ox leave broad cattlelike tracks and droppings. When alarmed, they will bunch together and remain in that position unless approached too closely; then one or more bulls may charge you. To kill, shoot in neck or shoulder.

Bears advertise their presence through great areas of torn-up sod where they have tried to dig up tubers or ground squirrels. If you hunt bear, don't shoot unless you are sure to kill; fire at the base of the ear, the neck, or just behind the shoulder. Wounded bears are extremely dangerous and should not be followed into cover.

SMALL LAND GAME. Rabbits often run in circles, returning to the same place from which they were frightened. If you shoot, aim for the head or you will not have much meat left. If the animal is running, whistle, and it may stop long enough for a shot. Snares are more efficient. Ground squirrels and marmots will run right by you if you get between them and their holes; club or stone them. They may also be trapped or shot.

SEA ICE GAME. Successful ice hunting depends upon proper reconnaissance and patient stalking. Seals are hard to approach. To shoot or spear seal, you must approach slowly and patiently on your stomach, with arms and legs close to your body. Advance only when the animal's head indicates that it is sleeping. A white camouflage suit helps. Keep downwind and avoid sudden moves. If you are hunting a bearded seal and it behaves as if it might move off, get up quickly and yell. The seal will be frightened enough to lie still and let you shoot or spear it. Always remember that where there are seal, there may be polar bears; and polar bears have been known to stalk and kill seal hunters.

The walrus and the bearded seal stay on floe ice. The seal is curious and can be attracted within gunshot. Walrus are indolent but at close quarters are dangerous. You must usually approach them by boat. Both seal and walrus should be killed on the ice so that their carcasses may be recovered easily.

The polar bear rarely comes on land. When it does, it is attracted by the smell of food caches or animal carcasses. It is a tireless, clever hunter with good sight and extraordinary sense of smell. Treat it with great caution.

BIRDS. To catch a nesting bird with a noose, attach cord or wire to a stick driven in the ground nearby and place it so that it will entangle the bird's foot. Where there are many birds, use long lines with many small nooses. If the birds are moulting, they may be run down and clubbed, speared, stoned, or shot with gun or slingshot.

Gulls and some other sea birds may be caught with a hook or a gorge and line. Bait the hook or gorge and let it float on a piece of wood; or stake it out on a beach.

Ptarmigan are easy to approach, though hard to find because so protectively colored in their winter and summer plumages; they may be killed with stones, a slingshot, or a long club.

SKINNING AND BUTCHERING. Skin all large game immediately, while the carcass is still warm. Roll the hide up before it freezes; cut the meat into proper portions and pile them separately, so that after they are frozen they may be handled as individual pieces. In summer, store them in ground ice holes, carefully protected from animals. Leave the fat on all animals except seals. Remove all of the seal fat you can, for it will turn rancid and spoil the meat except in very cold weather. If you do not have time for skinning, at least remove the entrails, musk glands, and genitals.

Butcher smaller animals as soon as possible. Until you can skin them, carry them on a string or stick, away from your body. Slit the

stomach, roll the skin backward as if you were removing a glove, and get rid of it.

COOKING OF MEAT. Cook all meat thoroughly. *Never* eat polar bear meat unless it has been thoroughly cooked — preferably after it has been cut into small pieces and boiled. Polar bear meat is always contaminated with the larvae of trichinosis. Don't eat polar bear liver; it is dangerous to man because of its high concentration of vitamin A. No small game, except marmots and porcupines, is very fat; add available fat when cooking.

SEA FOOD. The sea of the Arctic Basin and the shores adjoining it have few fish or shellfish useful for survival purposes. Arctic and tom cod, sculpin, and eelpout may be caught. The inland lakes and rivers of the surrounding coastal tundra generally have plenty of fish which are easy to catch during the warmer season.

In the North Pacific and in the North Atlantic extending slightly northward into the Arctic Sea, the coastal waters are rich in all sea foods. Varieties include all those mentioned on page 78 as well as one of the world's largest and meatiest crabs — the king crab. This crab may be caught on fish lines set in deep water, in the spring when it comes close inshore to breed.

Grayling, trout, ling (burbot), and white fish are common to the lakes, ponds, and the arctic coastal plain of North America and Asia. Many of the larger rivers have salmon and sturgeon.

Poisonous fish are rarer in the Arctic than in the tropics, but check the warnings on page 81. Some fish, such as sculpins, lay poisonous eggs; but eggs of the salmon, herring, or fresh water sturgeon are good eating. In arctic or subarctic areas, the black mussel may be poisonous at any season. If mussels are the only available food, select only those in deep inlets far from the coast. Remove the dark intestinal gland before eating. Mussel poison is as dangerous as strychnine. Beware of arctic shark meat, which is poisonous.

River snails or fresh water periwinkles are plentiful in the rivers, streams, and lakes of the northern coniferous forest. These snails may be pencil-point or globular in shape, 1-3 inches in length. Boil them in water and twist the meat out of the shell with a bent pin.

Fishing Hints

Winter fishing is possible through a hole in the ice or in open leads. To keep the hole open, cover it with skins or brush; then heap loose snow over the cover.

Shallow lakes freeze to the bottom along the margins, and fish tend to congregate in deeper pools. Locate the deepest part of the lake or pond before making a hole. Other good fishing grounds through ice are at lake outlets or where tributaries flow into a pond or stream. Ice is thinnest over rapids or small falls, or edges of deep-banked streams holding drifting snow. Open water is often marked by "smoke" or mist of vaporizing water.

Look for shell fish in muddy waters by feeling the bottom with hands or feet. In deep water, jab a sharp-pointed stick into the slit between the two halves of the shell. When the shells are closed, pull the shell-fish out of the water.

Edible Arctic-Subarctic Plants

North of the timber line, and when animal life is not plentiful, and even such food as mice, fish, and grubs are not available, you can still find plant food that will stave off starvation. By observing the feeding habits of birds and small mammals, you can often locate a source of food. When walking, gather food plants for use at your next camp. In the subarctic forests and on the tundra, many food plants are available in summer. In winter, when every source of food seems to fail, certain roots are available beneath the snow; and as a last resort there is still one source of plant food — the lichens (reindeer-moss).

Lichens are light green, gray, or bright-colored, leafless plants, which grow closely pressed to the ground or to rocks. The larger, shrubby forms may be used for food in an extreme emergency. Do not eat them raw. Crumble them into water and let the mass soak for several hours; then boil until it is reduced to a jelly-like consistency. This mass is starchy and may taste bitter, but it is not poisonous.

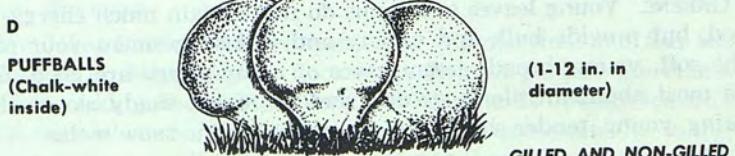
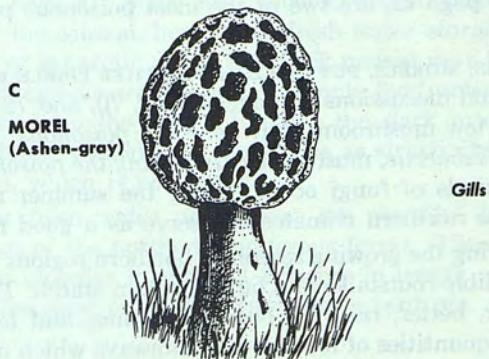
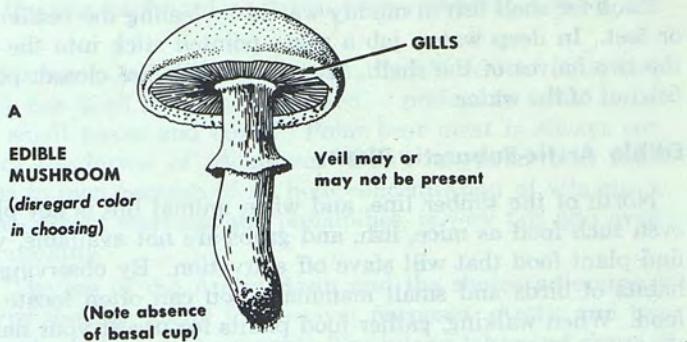
In arctic and subarctic regions, you may safely hunt and taste plant foods, with the assumption that less than a dozen are poisonous. The water hemlock, illustrated on page 73, and poisonous mushrooms, illustrated on page 72, are two of the most poisonous plants of the far north.

MUSHROOMS, MORELS, PUFFBALLS, AND OTHER EDIBLE FUNGI. Note the illustrations and discussions on pages 57, 58, 70, and 72. On the *tundra* you will find few mushrooms, but *none are poisonous*. In the forested regions of the *subarctic*, mushrooms (*including the poisonous kinds*) and many other kinds of fungi occur during the summer months. Mushrooms in these northern climates can serve as a good meat substitute.

ROOTS. During the growing season in northern regions many flowering plants with edible rootstalks and bulbs contain starch. Try to locate the right kinds or, better, raid the burrows of mice and lemmings. These animals store quantities of food in their runways which may be detected as softer and springier places than the surrounding tundra or meadow area. Dig along the burrow to the cache of roots. Muskrat houses — low mounds in swamps and shallow lakes — also contain stores of edible roots, especially in winter.

GREENS. Young leaves and stems do not contain much energy-giving food, but provide bulk and variety and will supplement your rations. The soft, young, broad, green leaves of many plants are good. Greens are most abundant along streams and on moist, shady slopes. In the spring, young, tender shoots appear soon after the snow melts.

BERRIES. Many types of berries are ripe from the middle of summer to autumn. Some persist on the bushes under the early snow and all are safe to eat. You can easily recognize berry bushes in the forest, but



Kinds of edible fungi

Usually found
on dead wood →



E

SULFURPOLYPORE

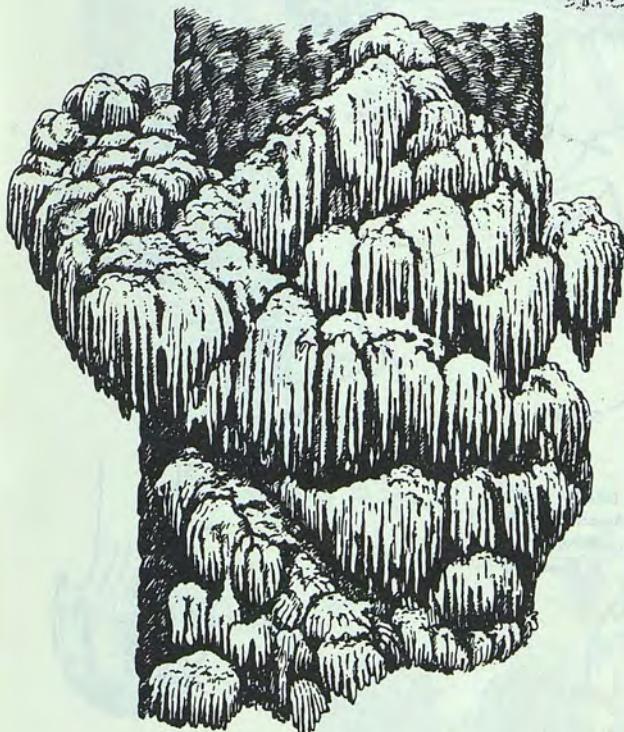
(2-4 in.)

(Bright yellow
to salmon pink)

F

CORAL FUNGUS

(White, orange, yellow,
pale violet, buff)
(2-6 in. high)



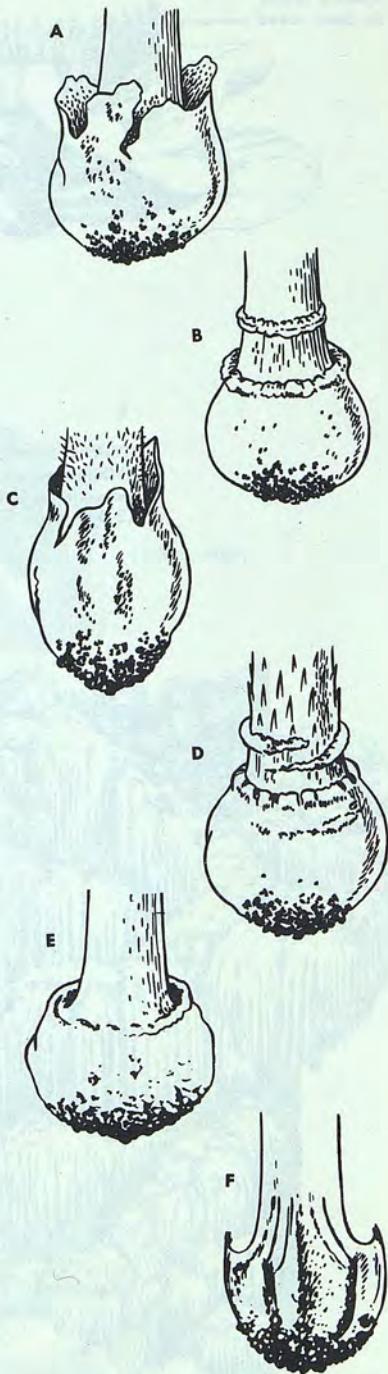
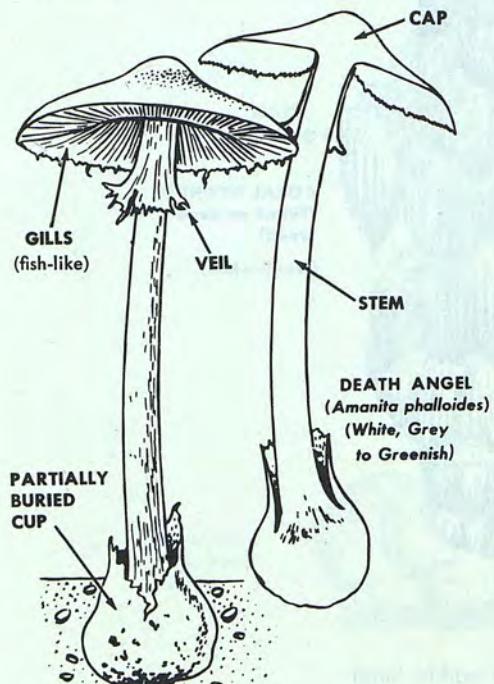
G

CORAL HYDNUM

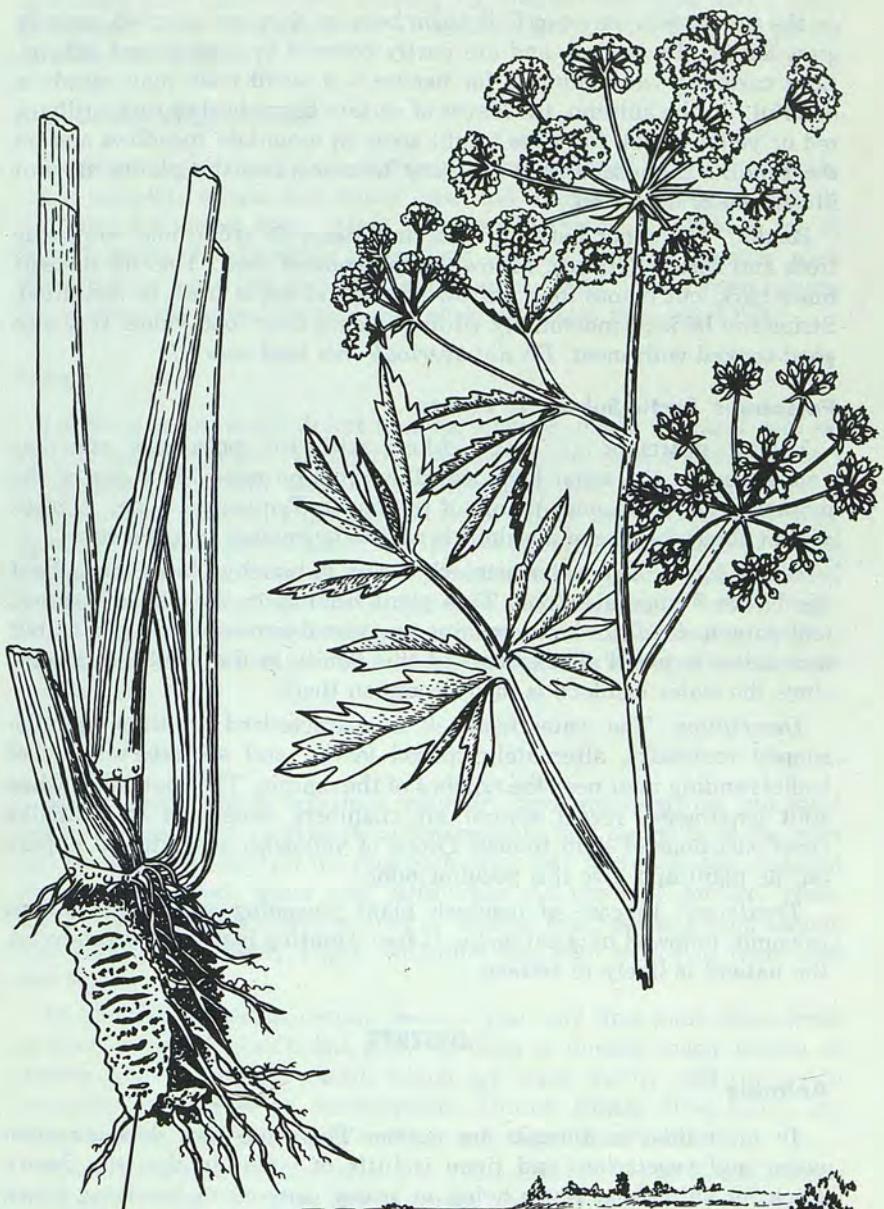
(Found on dead
wood)

(waxy white)

Kinds of edible fungi



Poisonous mushrooms (gilled)



ROOTSTALK
WITH AIR CHAMBERS



Water Hemlock (poisonous)

on the tundra you may overlook them because they are dwarfed, usually grow flat on the ground, and are partly covered by mosses and lichens. Look carefully when hunting for berries — a small bush may supply a handful. In the autumn, the leaves of certain berry bushes turn brilliant red or yellow. Look for these bright spots in mountain meadows and on the tundra. Because berries are easy to recognize, the plants are not illustrated or described.

BARKS. The inner bark of roots and stems of arctic and sub-arctic trees and shrubs (spruce, willow, birch) contain food. Peel off the soft inner bark, cut it into long narrow strips, and eat it fresh or sun-dried. Strips can be kept indefinitely without losing their food value. It is also good cooked with meat. *Do not overlook this food source!*

Poisonous Arctic-Subarctic Plants

WATER HEMLOCK (*Cicuta*). Along with the poisonous amanitas (mushrooms), the water hemlock, illustrated on page 73, is one of the most violently poisonous plants of the North Temperate Zone. A piece of root about the size of a walnut is said to be enough to kill a cow.

Where found. The water hemlock occurs in marshy places throughout the North Temperate Zone. This plant belongs to the parsley, carrot, and parsnip family, which contains many well-known edible plants, but it is better to avoid all members of this family in the northern regions, since the water hemlock is fairly common there.

Description. The water hemlock is characterized by thick spindle-shaped rootstalks, alternately spaced leaves, and secondary veins of leaflets ending in or near the notches of the margin. The rootstalks, when split lengthwise, reveal several air chambers, separated by platelike cross partitions of solid tissues. Drops of yellowish aromatic oil appear on the plant and give it a peculiar odor.

Treatment. In case of hemlock plant poisoning, cause the patient to vomit, followed by a cathartic. If free vomiting is promptly produced, the patient is likely to recover.

DESERTS

Animals

In most deserts, animals are scarce. Their presence depends upon water and vegetation, and there is little of either in the true desert. Look for animals at water holes, in grassy canyons or low-lying areas, dry river beds, where there is greater chance of moisture, or under rocks and in bushes. Animals are most commonly seen at dusk or early morning. Try kissing the back of your hand to make squealing sounds; you may attract birds. Sand grouse, ducks, bustards, pelicans, and even gulls have been seen over some desert lakes. Trap them in baited deadfalls or use a hook or gorge.

Most common animals are small rodents (rabbits, prairie dogs, rats), snakes, and lizards. They are generally found near brush or water and are your best and most reliable sources of food. Rodents may be caught

by finding their burrows and catching the animals with loop snare, trap, or deadfall when they come out at dusk or dawn. Look for land snails on rocks and bushes.

Preserving Excess Foods

In desert areas, meat from mature animals is wiped dry with a cloth, cut in arm-size strips, and buried raw and uncovered, without salt, in dry sand 6-8 inches deep. Meat prepared in this way will keep for at least 3 years. It resembles dried beef. Before cooking, natives soak the meat in water to soften it and remove sand. Meat from young animals can be stored in this way after the water is pressed out.

Plants

Locating water in all desert regions, whether torrid or frigid, will be your primary concern. Ordinarily, whenever you find water in desert areas, plant food will also be available. But, when standing water is not available, your only chance will be to utilize any plants there may be in the vicinity. Every desert has its own peculiar assortment of plants and the notable absence of man in most desert regions has decreased your chances of finding widely dispersed and commonly known vegetables and fruits. For instance, you can expect to find almost no American kind of desert plant on the deserts of the Old World. The converse is also true.

What to Eat

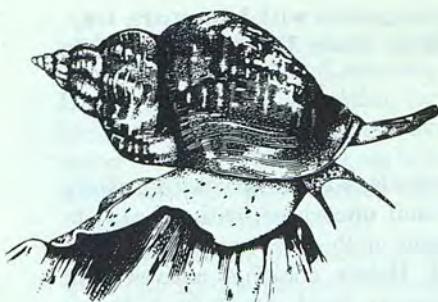
Many desert plants will look very dry and unappetizing, but start out by testing all the soft parts and digging to find the roots of the trees and shrubs. Then peel off the root bark. You may find some soft material that is edible, and water may drip from the cut root surface. Next, try all the soft parts above ground — flowers, fruit, seeds, young shoots, and bark. Thick fleshy plants will offer the best source of both food and water.

In the open desert at certain seasons you may find some grass seeds or bean bushes. These beans grow on trees or bushes, many known as *Acacia* trees in the old world, which are often thorny and similar to mesquite or catclaw in southwestern United States. The beans are usually bitter, but prolonged soaking will make them edible.

The prickly pear (a kind of cactus), native of North and South America, is now widely found in North Africa, the Near East, and Australian deserts. The fruits are edible. *Beware of cactus-like plants of the Old World with milky-juice — these are poisonous.*

CAUTION

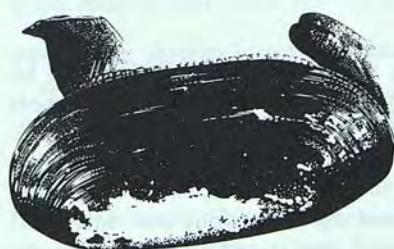
Avoid all desert plants with milky juice. They will cause much irritation to exposed skin surfaces. A white ooze running from a broken stem is a test.



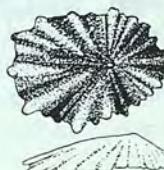
SNAIL



CHITON

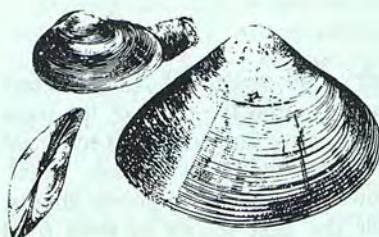


RAZOR CLAM

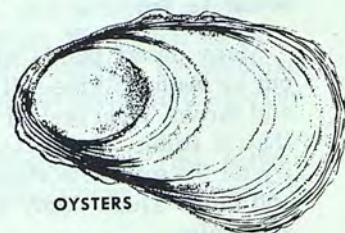


PERIWINKLES

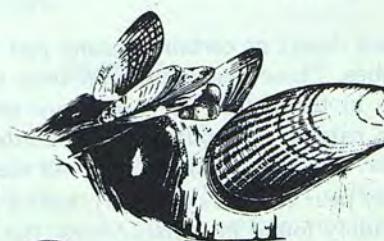
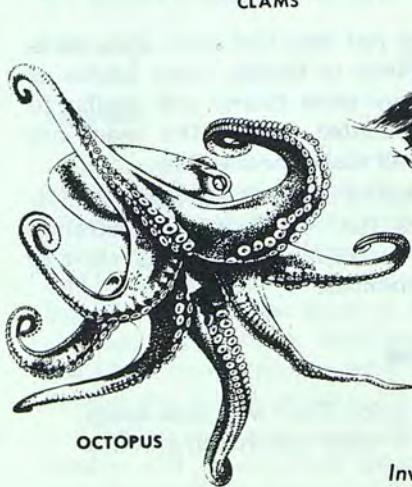
LIMPETS



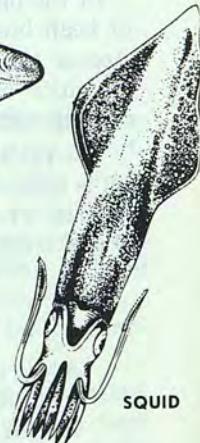
CLAMS



OYSTERS

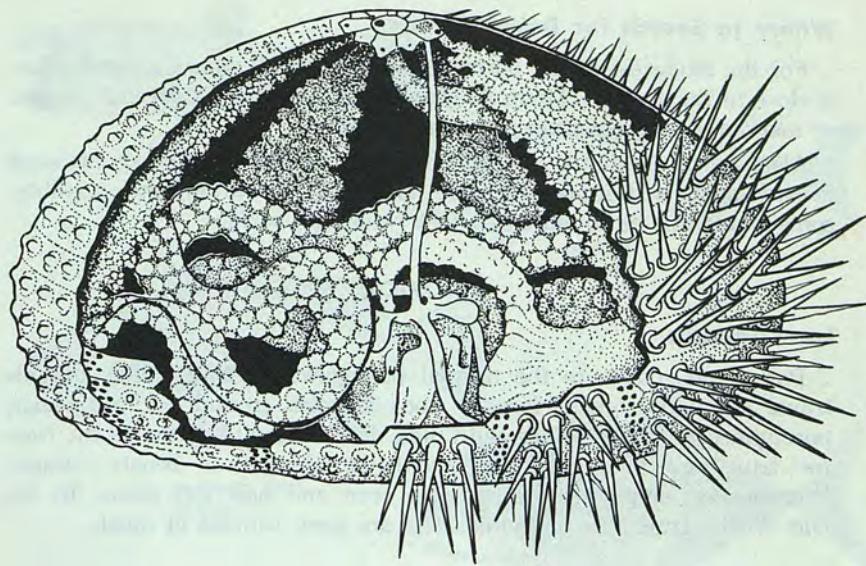


MUSSELS

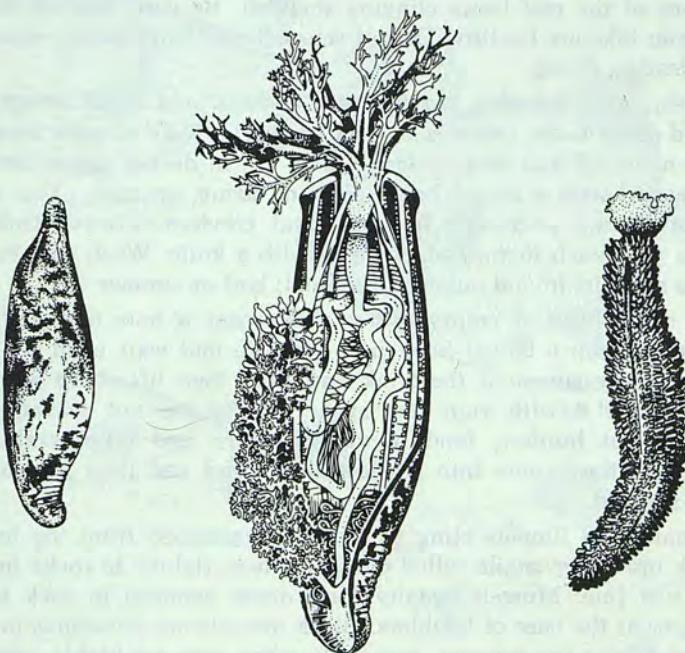


SQUID

Invertebrates



SEA URCHIN



SEA CUCUMBER

Invertebrates

Where to Search for Desert Plants

For the tenderest desert plants, search in places where ground water is close to the surface. There the vegetation will appear greener, larger, or markedly different from surrounding types.

Also search in dry river beds or other low areas. The damp sand in such spots will support a more abundant vegetation, and, possibly, some water will be found a few feet below the surface.

TROPICS

Land Animals

Paths and roads are the normal passageways along which animals travel through tropical forests. Look on the ground for hedgehogs, porcupines, pangolins, mice, wild pigs, deer, and wild cattle; in the trees for bats, squirrels, rats and monkeys. Dangerous beasts — tigers, rhinoceroses, elephants — are rarely seen and best left alone. In the Old World, fruit bats or flying foxes are good sources of meat.

Sea Food

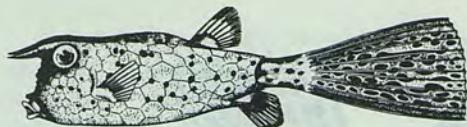
Coral rocks, along beaches or extending out into deeper water as reefs, provide the greatest amount of survival food. The more exposed surface of the reef bears clinging shellfish. Be sure that all the shellfish you take are healthy. Do not select them from colonies where some are dead or dying.

Fish, crabs, lobsters, crayfish, sea urchins, and small octopi can be poked out of holes, crevices, or rock pools. Be ready to spear them before they move off into deep water. If they are in deeper water, tease them shoreward with a baited hook, piece of string, or stick. You will find flowerlike sea anemones in pools and crevices. They shrink closed when you touch them. Detach them with a knife. Wash well to remove slime and dirt in and outside of animal; boil or simmer.

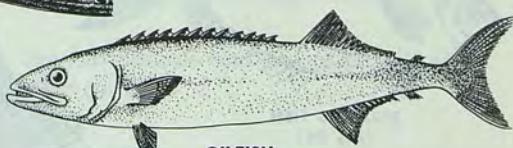
A small heap of empty oyster shells near a hole may indicate an octopus. Drop a baited hook into the hole and wait until the octopus has entirely surround the hook and line; then lift it up quickly. To kill, pierce it with your fish spear. Octopi are not scavengers, like sharks, but hunters, fond of spiny lobster and other crablike fish. At night they come into shallow water and can then be easily seen and speared.

Snails and limpets cling to rocks and seaweed from the low water mark up. Large snails called chitons adhere tightly to rocks just above the surf line. Mussels usually form dense colonies in rock pools, on logs, or at the base of boulders. Black mussels are poisonous in tropical zones during the summer, especially when seas are highly phosphorescent. See page 68.

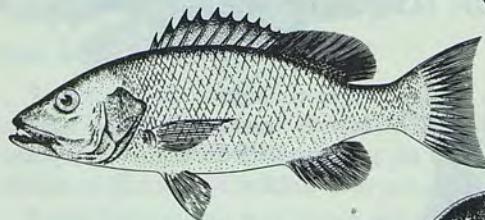
Sluggish sea cucumbers and conchs (large snails) live in deep water. The sea cucumber can and does shoot out his stomach when excited. Don't eat that; boil the animal and eat the five strips of muscle inside the body and the skin. It will make a gelatinous soup.



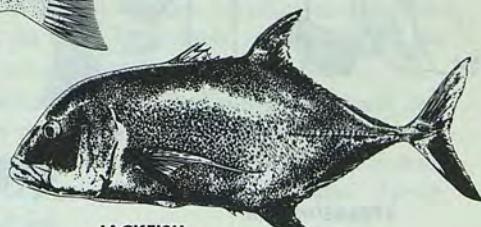
COWFISH
(6-12 IN.)



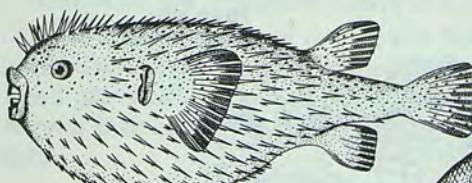
OILFISH
(3-5 FT.)



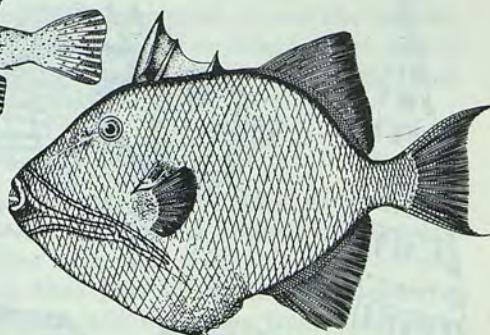
RED SNAPPER FISH
(2-3 FT.)



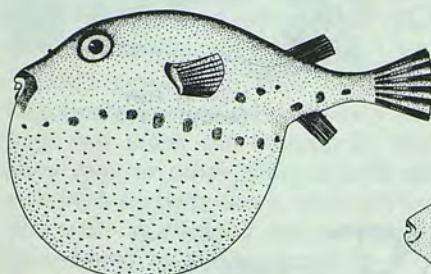
JACKFISH
(ABOUT 2 FT.)



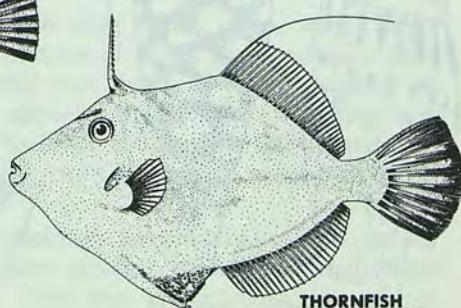
PORCUPINE FISH
(ABOUT 1 FT.)



TRIGGER FISH
(1-2 FT.)

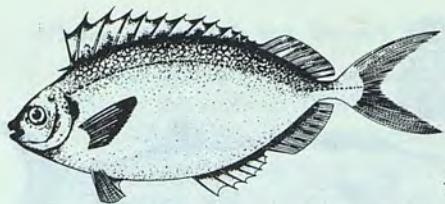


PUFFER FISH
(10-15 IN.)



THORNFISH
(ABOUT 1 FT.)

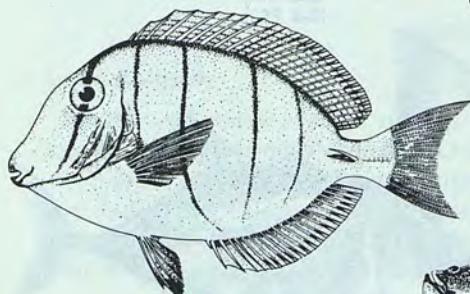
Fish with poisonous flesh



SIGANUS FISH
(4-6 IN.)



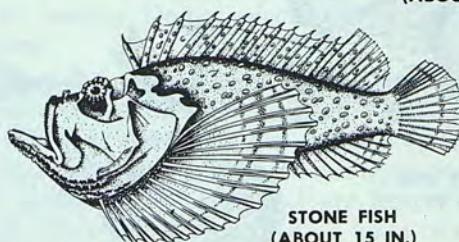
ZEBRA FISH
(10-30 IN.)



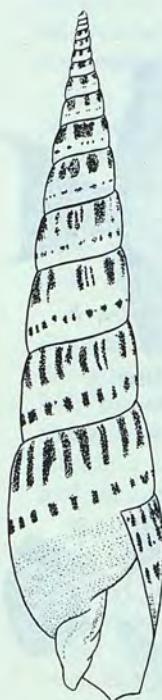
STURGEON FISH
(8-10 IN.)



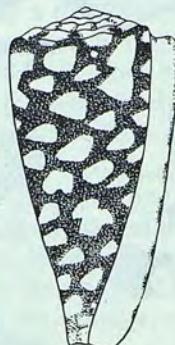
TOAD FISH
(ABOUT 1 FT.)



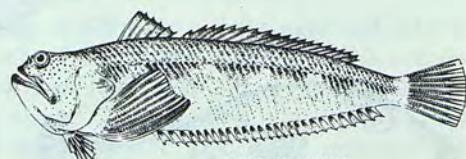
STONE FISH
(ABOUT 15 IN.)



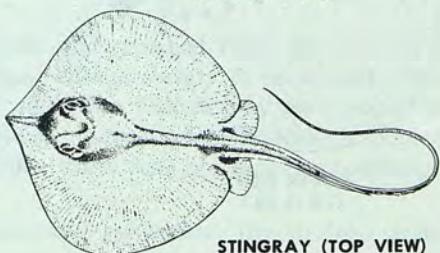
TEREBRA SHELL



CONE



WEEVER FISH
(ABOUT 1 FT.)



STINGRAY (TOP VIEW)

Venomous shells

Venomous fish

Safest fish to eat are those from the open sea or deep water beyond the reef. Silvery fishes, river eels, butterfly fishes, and flounders from bays and rivers are good to eat. Remember that fish caught in the tropics spoil quickly.

Land crabs are common on tropical islands and are often found in coconut groves. Use an open coconut for bait.

TROPICAL FISH

Fish with Poisonous Flesh

There are no simple rules for telling undesirable fish from the desirable ones. Often those considered edible in one locality may be unwholesome elsewhere, depending on the place, their food, or even the season of the year. Cooking does not destroy the poison.

Large barracudas can cause serious digestive illness; yet those less than 3 feet long have been eaten with safety. The oilfish has a white, flaky, rather tasty flesh which is very poisonous. This fish of the Southwest Pacific and all great sea eels should be carefully avoided. Never eat entrails or eggs of any tropical fish.

Undesirable fish have certain characteristics:

Almost all live in shallow waters of lagoons or reefs.

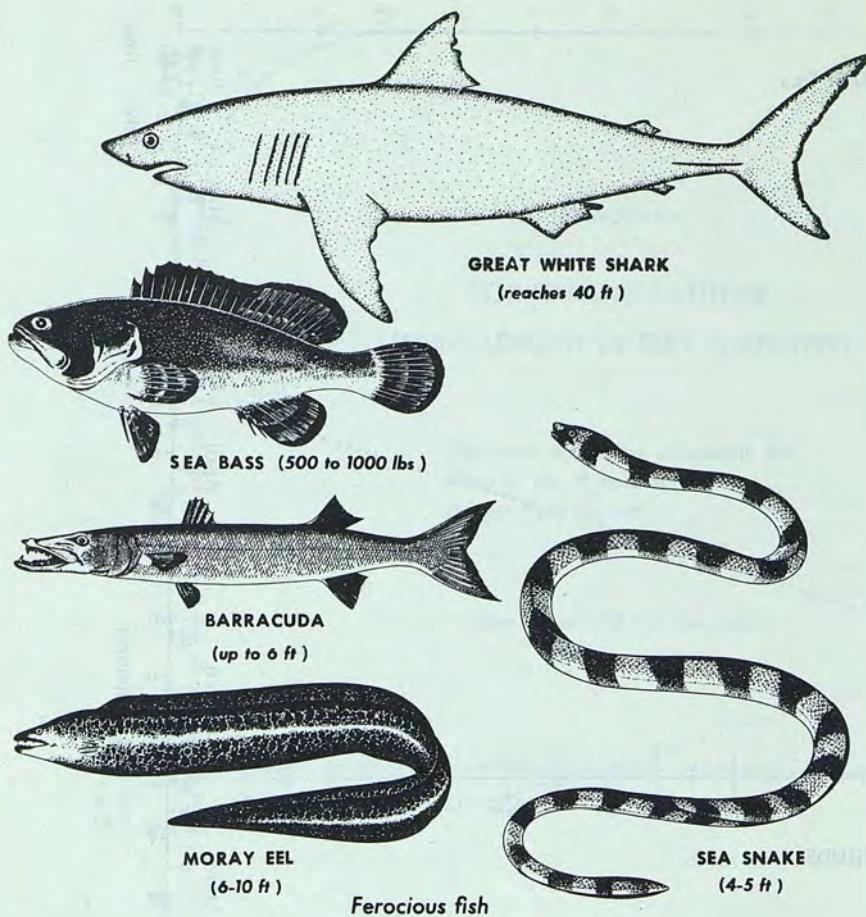
Almost all have round or box-like bodies with hard, shell-like skins covered with bony plates or spines. They have small, parrot-like mouths, small gill openings; and the belly fins are small or absent. Their names suggest their shapes — puller fish, file fish, globe fish, trigger fish, trunk fish.

Fish and Shellfish with Venomous Spines

Reefs are no place for bare feet. Coral, dead or alive, can cut them to ribbons. Seemingly harmless sponges and sea urchins can slip fine needles of lime or silica into your skin, and they will break off and fester. Don't dig them out; use lime juice, if available, to dissolve them. The almost invisible stonefish will not move from your path. It has 13 poisoned spines that will cause you agony and death. Treat as for snakebite (see page 11).

Don't probe with your hands into dark holes; use a stick. Don't step freely over muddy or sandy bottoms of rivers and seashores; slide your feet along the bottom. In this way you will avoid stepping on sting rays or other sharp-spined animals. If you step on a sting ray, you push its body down, giving it leverage to throw its tail up and stab you with its stinging spine. A sting ray's broken-off spine can be removed only by cutting it out.

Cone shell and long, slender, pointed terebra snails have poison teeth and can bite. Cone snails have smooth, colorful mottled shells with elongate, narrow openings. They live under rocks, in crevices of coral reefs, and along rocky shores of protected bays. They are shy and are most active at night. They have a long mouth and a snout or proboscis which is used to jab or inject their teeth. These teeth are



actually tiny hypodermic needles, with a tiny poison gland on the back end of each. This action is swift, producing acute pain, swelling, paralysis, blindness, and possible death in four hours. Avoid handling all cone snails.

Handle the big conchs with caution. These snails have razor-sharp trap doors, which they may suddenly jab out, puncturing your skin in their effort to get away. Don't use your hands to gather large abalones and clams. Pry them loose with bars or wedges; they will hold you if they clamp down on your fingers.

Ferocious Fish

In crossing deeper portions of a reef, check the reef edge shadows for sharks, barracudas, and moray eels. Morays are angry, vicious, and aggressive when disturbed. They hide in dark holes among the reefs.

In salt water estuaries, bays, or lagoons, man-eating sharks may come in very close to shore. Many sharks have attacked in shallow water on bathing beaches in the tropic seas. Barracudas have also made such attacks. Usually sharks four feet long and shorter are timid. Beware,

however, of all larger ones, including hammerheads. They are potentially dangerous. Not all sharks show fins above the water.

TROPICAL PLANTS

The tree-covered tropics offer the stranded survivor a large assortment of survival foods, but most people are quite unfamiliar with most kinds of tropical plants. We know the coconut, banana, pineapple, and citrus fruits in American markets, but there are literally hundreds more quite unknown in this country. How can we learn some of these? Several kinds of widely dispersed tropical fruits and vegetables are illustrated in this manual with supplementary information on how to detect other kinds of wild, edible tropical plants.

Poisonous plants will be met with in the tropics, but in no greater proportion to the non-poisonous kinds than in the United States.

Plant life above timber line in the high mountains of the tropics is similar in many respects to that in the far north and the arctic. If it is necessary to live off the land in such regions, proceed as if you were in the far north.

CAUTION

Always follow the edibility rules on page 54 when you are in doubt about tropical plants.

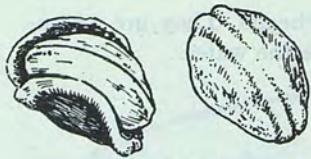
Where to Find Tropical Plant Foods

Tropical food plants will occur most abundantly in open forest clearings, abandoned by natives; along the seashore and margins of streams, and in swamps. The wet, dense jungles are the poorest place to look for survival food.

The best place to find food plants is an abandoned native garden. In many parts of the tropics, people live in small isolated villages and grow their food in nearby gardens or small clearings. If you find cultivated gardens in the forest, watch out for hostile natives who may be working or guarding the fields; find the trail that leads from the garden to the village. You may find yourself in enemy territory where you may want to take some food but avoid the owners.

Clearings and abandoned fields have generally been farmed, and cultivated forms of plants will persist long after fields have been abandoned. These places may occur along the shore and river banks or may be found in the interior of the country. Nearly all of the fruits found in gardens can be eaten.

Look first for fruits, nuts, or seeds. They can be used immediately for food. The tender end buds or starchy centers of some palm trunks, young bamboo shoots, roots of grasses, and the shoots and flower buds of the wild banana are all good sources of food. Ferns are usually abundant in the moist tropics and make good greens. Even when no food is available, the tender twigs of many plants may be chewed; most kinds have some food value.



ALMOND

(N. Africa, Asia)



BEECHNUT

(Europe, Asia)



WATER CHESTNUT

(Southeastern Asia)



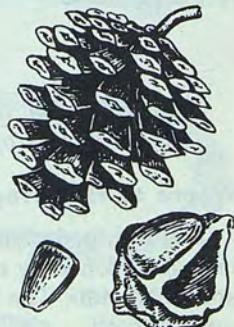
HAZELNUT

(N. America, Europe, Asia)



CASHEW NUT

(Tropical Regions)



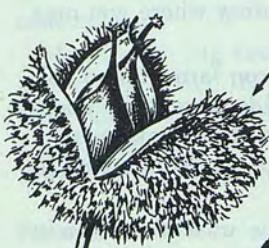
PINE NUTS

(Middle north latitudes)



OAK ACORNS

(Middle north latitudes)



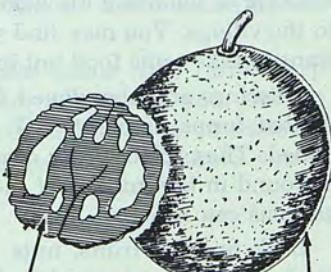
CHESTNUT

(N. America, Europe, Asia)



HUSK

NUT

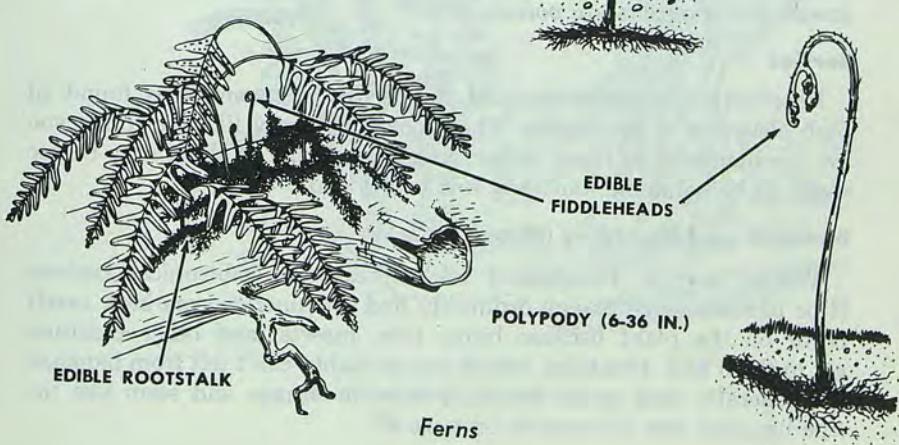
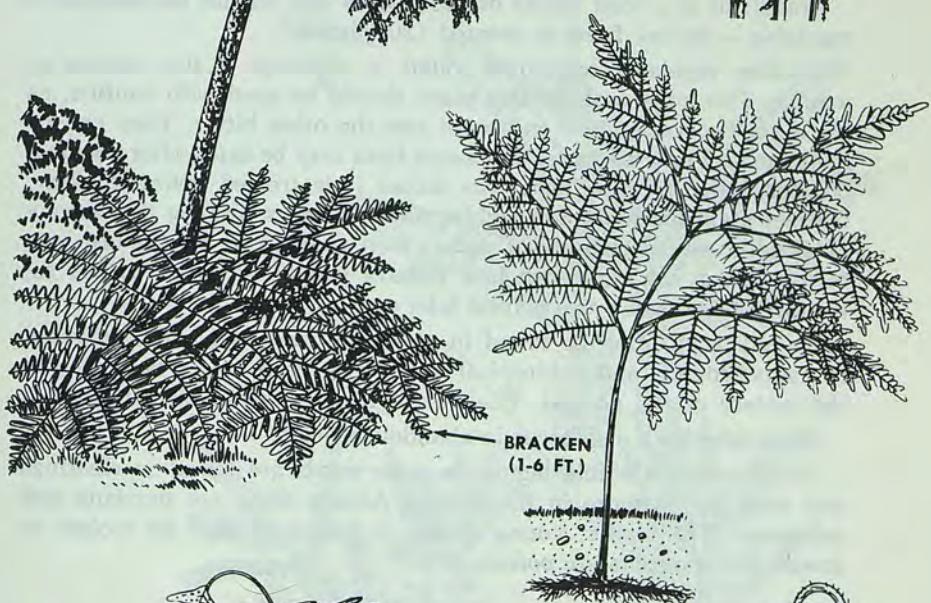
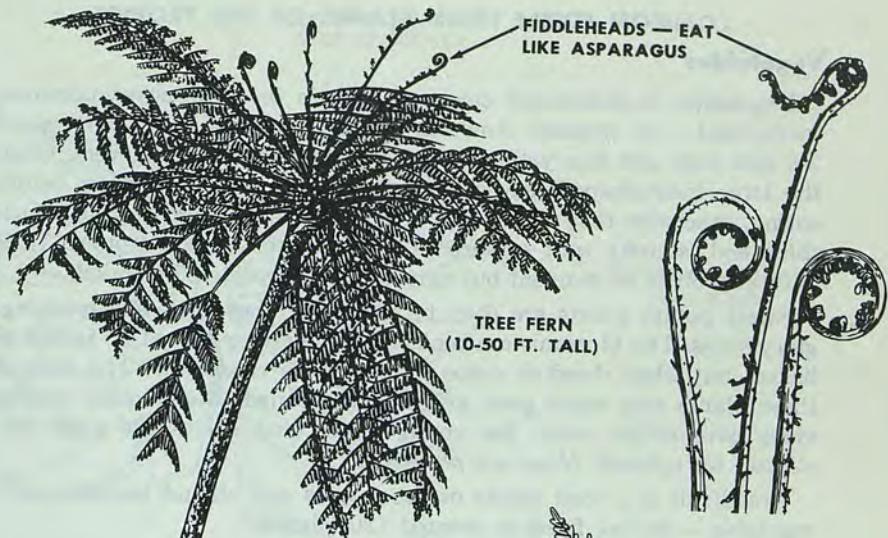


MEAT

WALNUT

(N. America, Europe, Asia)

Edible nuts



Ferns

COMMON EDIBLE FOOD PLANTS OF THE TROPICS

Vegetables

Vegetables in abandoned clearings include the taro, sweet potatoes, yams, and — in tropical America — wild tomatoes. The taro grows 2-3 feet high and has yellowish-green jack-in-the-pulpit flowers. Cook the large heart-shaped leaves well, preferably with lime juice, before eating, otherwise they will irritate your mouth and throat. The much thickened, starchy root of taro is the “potato” of the tropics. It is naturally bitter or pungent but may be baked, roasted, or boiled.

Sweet potato plants are easy to recognize; they look like morning-glory vines. The blossoms are pink. Sweet potatoes should be boiled or baked, but when dried in chips they may be eaten raw. The tops of these plants also make good greens when boiled. Many other similar vines have edible roots; the young shoots and leaves are good substitutes for spinach. *None are poisonous.*

Breadfruit is a food staple of the tropics and should be eaten as a vegetable — boiled, fried, or roasted (20 minutes).

Another vegetable sometimes found in clearings is the cassava or manioc. The large roots of this plant should be used with caution, as there are two varieties — one sweet and the other bitter. They can be distinguished only by taste. The sweet form may be eaten after cooking, but the bitter form is *poisonous* unless it is treated before cooking. Natives grate the roots thoroughly, washing and squeezing the starchy mass with several changes of water, then cooking it. If you are in a region where you can learn how cassava should be prepared, do so; the knowledge may prove helpful later on.

Peanuts may often be found in clearings, since they are cultivated in many tropical and subtropical areas. The peanuts are borne below the surface of the ground. Their seeds may be eaten raw or cooked.

Pineapples may also occur in abandoned fields.

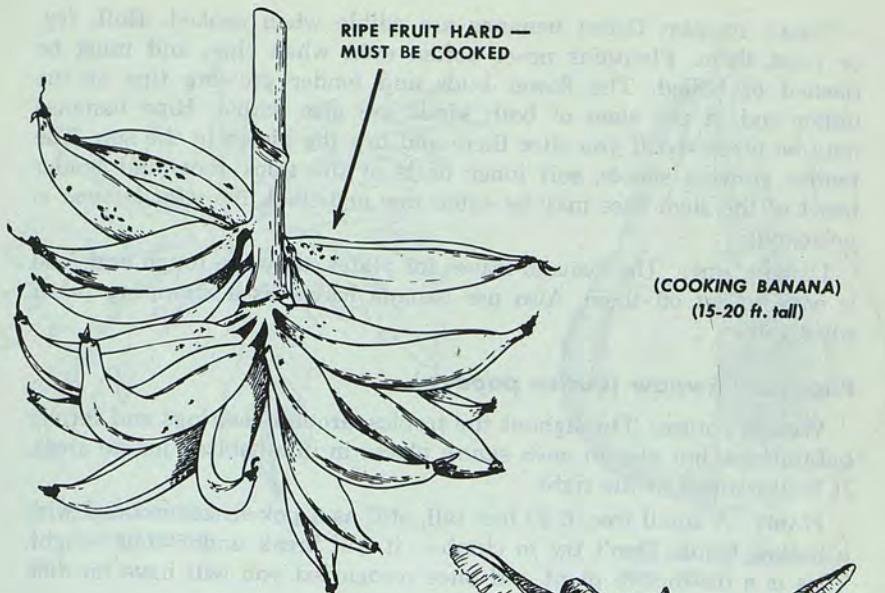
Many common edible temperate zone weeds are found in clearings and near the seashore in the tropics. Among these are purslane and pokeweed. The tender, young shoots of pokeweed may be cooked as greens, but the roots are *poisonous*.

Berries

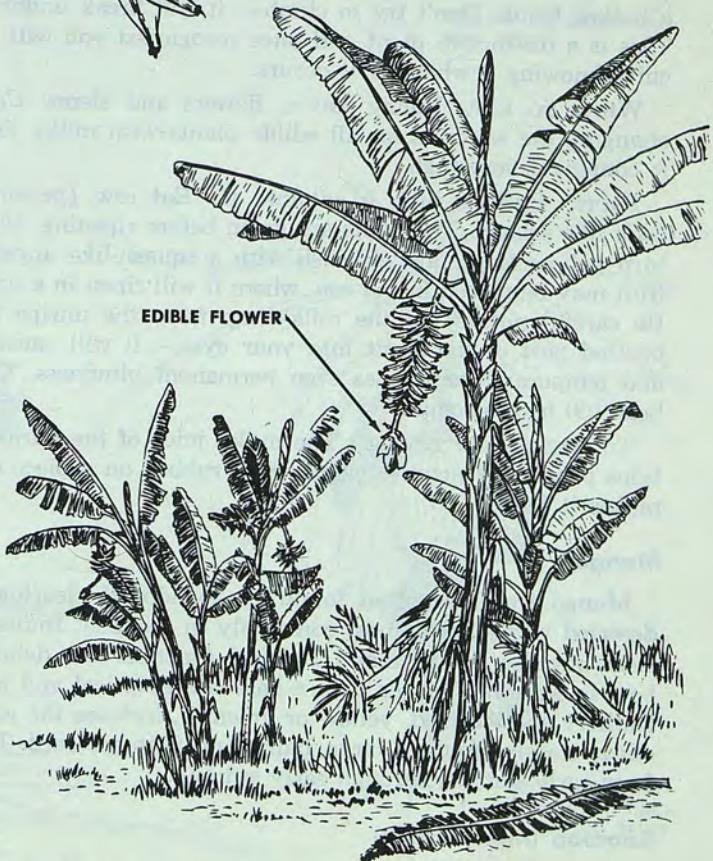
Raspberries, blackberries, and mulberries are sometimes found at high elevation in the tropics. They look sufficiently like the forms you are familiar with at home to be recognized. Some of them may be too seedy to be palatable, but they won’t hurt you.

Bananas and Plantains (*Musa*)

WHERE FOUND. Throughout all tropical and subtropical regions. Ripe bananas, such as you ordinarily find on American markets, rarely occur on the plant because birds, bats, insects, and other creatures get to them first. Plantains, which you probably can’t tell from bananas, are generally dark green, brown, yellow, or orange and seem like unripe bananas. See illustration on page 87.



(COOKING BANANA)
(15-20 ft. tall)



Plantain (cooking banana)

WHAT TO EAT. Green bananas are edible when cooked. Boil, fry, or roast them. Plantains never soften even when ripe, and must be roasted or boiled. The flower buds and tender growing tips at the upper end of the stem of both kinds are also edible. Ripe bananas may be preserved if you slice them and dry the pieces in the sun. The tender growing shoots, soft inner parts of the thick root, and tender heart of the stem base may be eaten raw or boiled. *No wild banana is poisonous.*

USEFUL HINT. Use banana leaves for plates, they are tough and food is easy to eat off them. Also use banana leaves as a wrapping paper substitute.

Papaya, Pawpaw (*Carica papaya*)

WHERE FOUND. Throughout the tropics, around clearings and former habitations, but also in *open sunny* places in uninhabited jungle areas. It is illustrated at the right.

HABIT. A small tree, 6-20 feet tall, stiff as a poker, soft wooded with a hollow trunk. Don't try to climb — it will break under your weight. This is a distinctive plant and once recognized you will have no difficulty knowing it wherever it occurs.

WHAT TO EAT. Young leaves, flowers and stems. *Cook* carefully, changing the water as for all edible plants with milky juices. Vitamin A content is very high.

FRUIT. Fruit is high in vitamin C. Eat raw (pepsin-flavored) or cook like squash. The fruits are green before ripening. When ripe they turn yellow or remain greenish with a squash-like appearance. Green fruit may be placed in the sun, where it will ripen in a very short time. Be careful not to get the milky sap from the unripe fruit or other bruised part of the plant into your eyes — it will cause intense pain and temporary, sometimes even permanent blindness. The plant may bear 100 fruit at once.

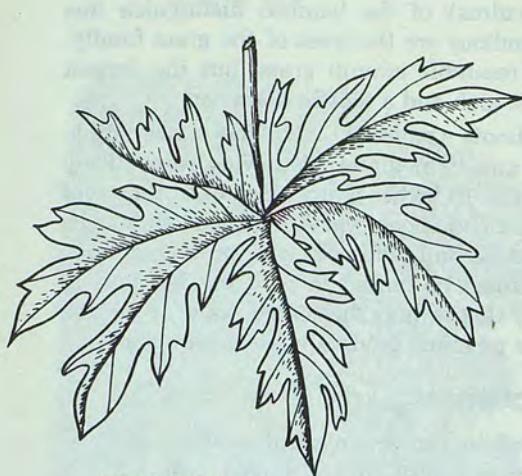
TO MAKE MEAT TENDER. The milky juice of the unripe papaya contains pepsin, an enzyme, which when rubbed on a piece of tough meat, makes it tender.

Mango

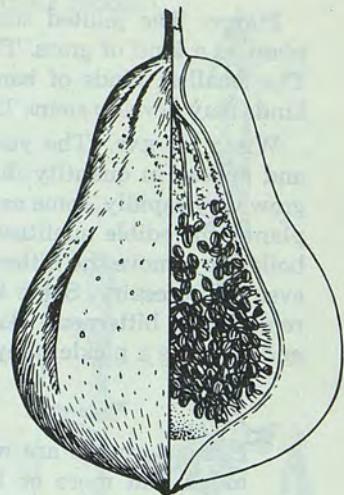
Mango trees are often found in abandoned clearings and around deserted village sites, most commonly in the East Indies and southern Asia, but also in Africa and Tropical America. The delicious fruit they bear is somewhat larger than a baseball, elliptical and rather flat. The leathery spotted rind, yellow or greenish, incloses the edible pulp that clings closely around a large, hairy, and flattened seed. The fruits ripen from early summer through early autumn.

Bamboo (Many kinds)

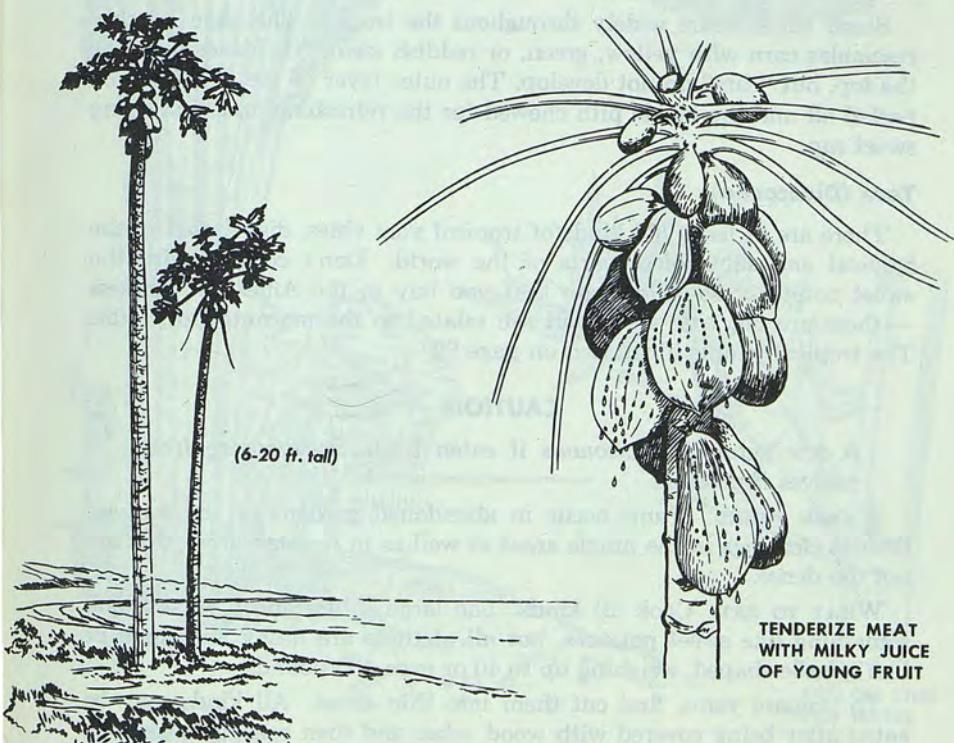
WHERE FOUND. Bamboos occur most abundantly in the moist temperate and tropical regions. Bamboos, illustrated on page 91, are predominantly forest plants.



COOK FOR GREENS
WHEN YOUNG



YELLOW OR GREENISH
RIPE FRUIT



(6-20 ft. tall)

TENDERIZE MEAT
WITH MILKY JUICE
OF YOUNG FRUIT

Papaya

HABIT. The jointed stems (culms) of the bamboo distinguish this plant as a kind of grass. The bamboos are the trees of the grass family. The smallest kinds of bamboo resemble swamp grass, but the largest kinds may develop stems 120 feet high and a foot in diameter.

WHAT TO EAT. The young shoots (page 91) of bamboo are edible and appear in quantity during and immediately following rains. They grow very rapidly, some as much as 15 inches a day. But like other wild plants, the edible qualities of bamboo shoots vary. All kinds should be boiled to remove the bitterness; a second boiling in a water change may even be necessary. Some kinds must be buried in mud for 3-4 days to remove the bitterness. Bamboo shoots may be salted, raw or boiled, and eaten as a pickle; they have as much food value as asparagus.

CAUTION

Bamboo shoots are wrapped in protective sheaths which are tough and more or less coated with tawny or red hairs. If eaten, these hairs cause much irritation to the throat. Remove these outer sheaths before eating bamboo shoots.

SEEDS. The grain of the flowering bamboo may be eaten. Pulverize and with a little water press into cakes or boil as you would rice.

Sugar Cane

Sugar cane occurs widely throughout the tropics. The cane roughly resembles corn with yellow, green, or reddish stems; its leaves are near the top, but "ears" do not develop. The outer layer of the stem may be peeled off and the inside pith chewed for the refreshing and nourishing sweet sap.

Yam (*Dioscorea*)

There are at least 700 kinds of tropical yam vines, distributed in the tropical and subtropical parts of the world. Don't confuse with the sweet potato or so-called yam that you buy in the American markets — these are not true yams, but are related to the morning-glory vine. The tropical yam is illustrated on page 92.

CAUTION

A few yams are *poisonous* if eaten fresh. Seek advice from natives if possible.

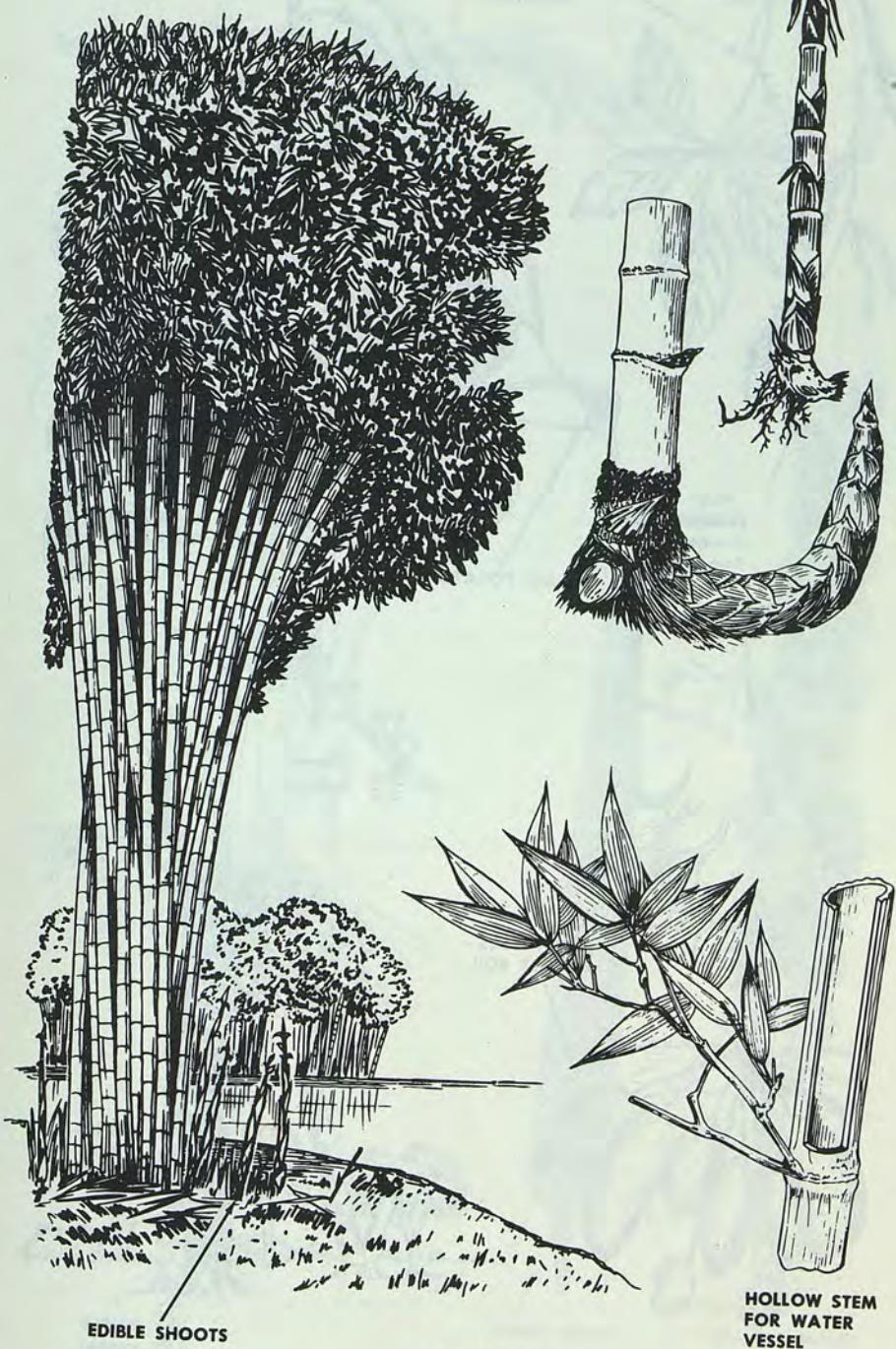
WHERE FOUND. Yams occur in abandoned gardens of the natives, besides clearings in the jungle areas as well as in forested areas that are not too dense.

WHAT TO EAT. Cook all kinds. The large subterranean tubers look something like sweet potatoes, but all of them are fleshy and more or less spindle-shaped, weighing up to 40 or even 100 pounds.

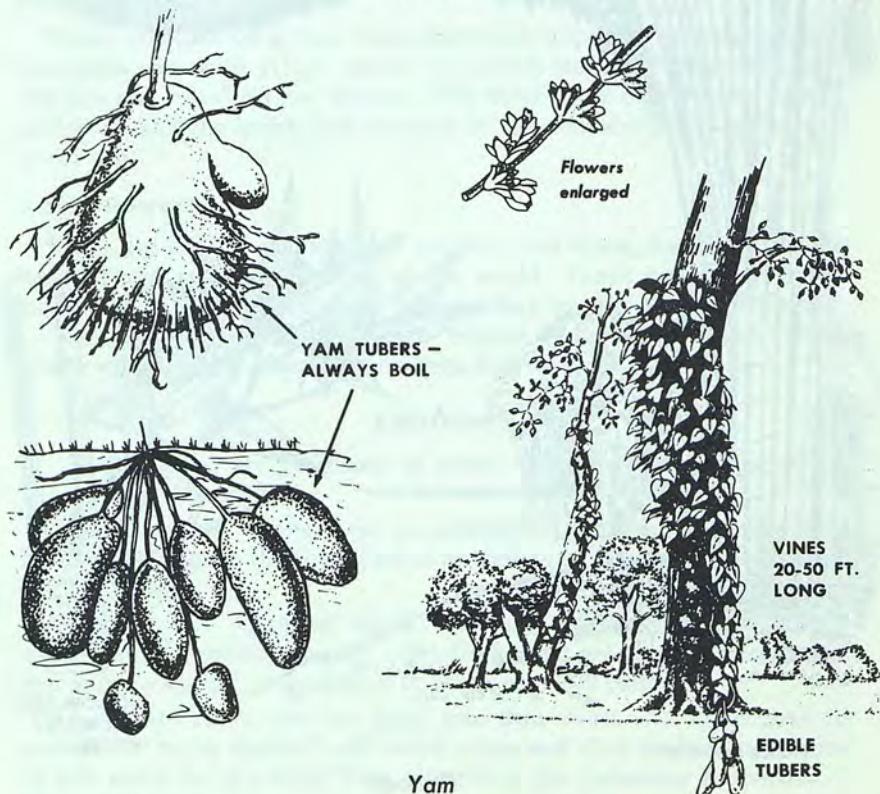
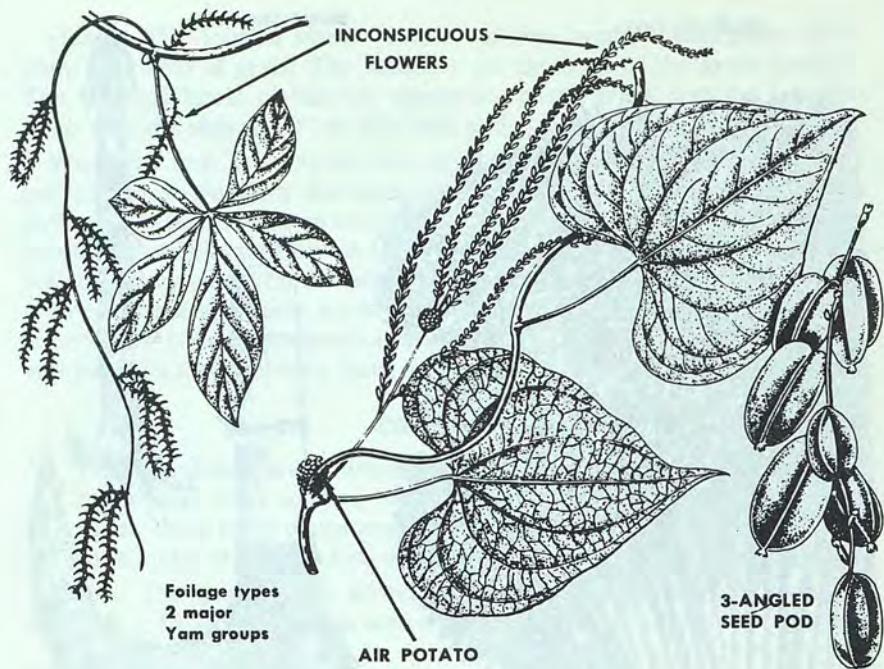
To prepare yams, first cut them into thin slices. All kinds may be eaten after being covered with wood ashes and then soaked in streams or salt water for 3-4 days. This gets rid of the *poisonous* properties of some wild kinds.

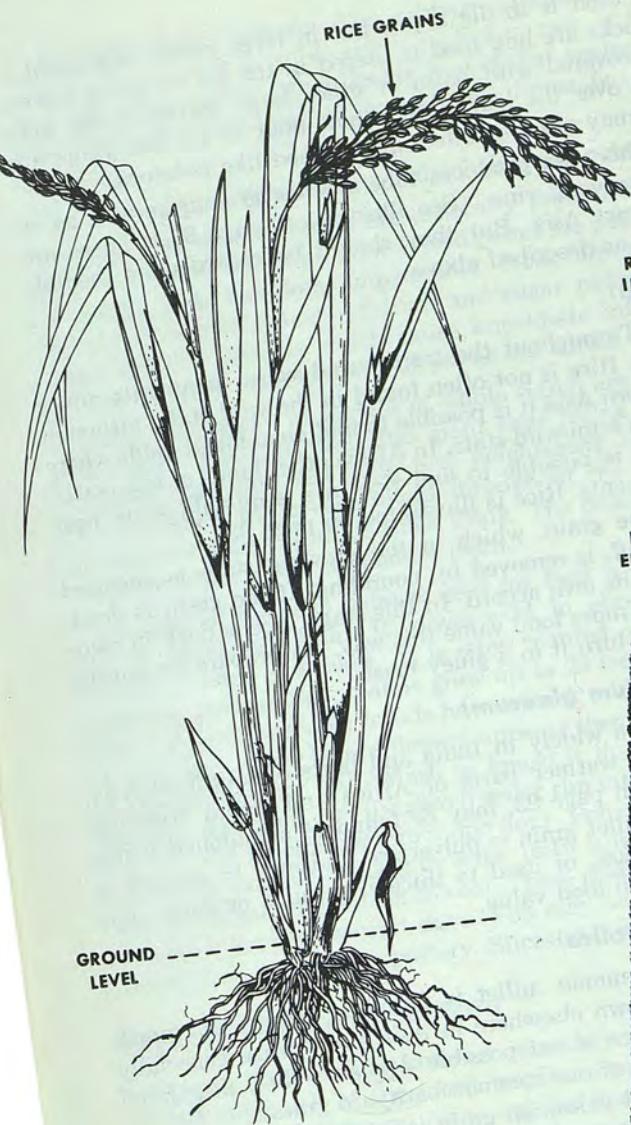
20-80 FT. TALL

EDIBLE SHOOTS



Bamboo





GROUND
LEVEL

RICE (3 ft.)

Distributed world-wide

HEADS WITH
EDIBLE GRAINS



PEARL MILLET
(3-6 ft.)



ITALIAN MILLET
(3-4 ft.)

The native method is to dig a pit, put in large rocks, and build a fire. When the rocks are hot, food is placed in the pit on green leaves, and the hole is covered with palm or other large leaves. Earth may also be mounded over the leaves. In a half hour or so, the yams are well done. Yams may also be boiled and mashed like potatoes.

AIR POTATO. This yam produces tubers below ground as well as on the stems of the growing vine. (See illustration, page 92.) These are common in southeast Asia. But they should be regarded as inedible until after soaking as described above.

Rice (*Oryza sativa*)

WHERE FOUND. Throughout the tropics and warm temperate zones of both hemispheres. Rice is not often found in the wild state, although in parts of southeastern Asia it is possible to find abandoned fields where rice has persisted in a semi-wild state. In Africa other kinds of rice occur. In South America it is possible to find rice in a semi-wild state near abandoned establishments. Rice is illustrated on page 93.

WHAT TO EAT. The grain, which in the growing state is enclosed between yellowish chaff, is removed by pounding. If the grain is dead-ripe, it will fall out of its own accord. In this stage, rice is dark in color and unpolished. It has more food value this way. To prepare for eating, steam it — boiling will turn it to a gluey mass.

Pearl Millet (*Pennisetum glaucum*)

WHERE FOUND. Grown widely in India and parts of southeast Asia, Arabia, Egypt, and the warmer parts of Africa and South America. This millet, illustrated on page 93, may be found in abandoned fields.

WHAT TO EAT. The millet grain is pulverized and may be cooked as porridge, pressed into cakes, or used to thicken a sauce or soup. The pearl millet is very high in food value.

Italian Millet (*Setaria italica*)

WHERE FOUND. The common millet is found in Korea and north China, but it is widely grown elsewhere in Asia and Africa, especially where the cultivation of rice is not possible. Italian millet, illustrated on page 93, is a form of one of our common barnyard grasses.

WHAT TO EAT. The small yellowish grain is produced in abundance on the seed-head. The grains pulverized and eaten as a porridge, or pressed into cakes, are very high in food value.

Palms

WHERE FOUND. At least 1,500 different kinds of palms are distributed throughout the tropical world. They grow in almost every conceivable habitat — seashore, swamp, desert, grassland, and jungle. Palms vary in size from a few feet to 100 feet tall. Some are climbers, such as the rattan palms. The palms assume many different forms, but generally they are easy to recognize. The leaves are of two main types: pinnate (like a feather), such as the date palm, or palmate (like a hand with webbed fingers), such as the fan or cabbage palm.

WHAT TO EAT. *Cabbage.* The cabbage (terminal bud) or growing point of most palms is edible either cooked or raw. It is located on the tip of the trunk, often rather deeply buried, but enclosed by the crown of leaves of sheathing bases of the leaf stem. Some, but not all, cabbages are bitter.

Sap. The sap of many palms is drinkable and nourishing.

Fruits. The nuts of palms are generally produced in clusters below the leafy crown. Nuts of all New World palms are edible, although many are woody and, therefore, unpalatable. *None are poisonous.* Nuts of several Old World palms—fishtail and sugar palms—contain microscopic stinging crystals which cause immediate intense pain if eaten. But the fruits of most Old World palms are edible, if not too woody.

Starch. Enormous quantities of edible starch are stored in the trunks of the sago, sugar, fishtail, and giant buri palms. These palms occur principally in southeast Asia and neighboring islands of Indonesia. Another plant, the cycad, found throughout the same area, produces quantities of starch from its thick trunk. The palm-like cycad looks like a cross between a tree fern and a palm.

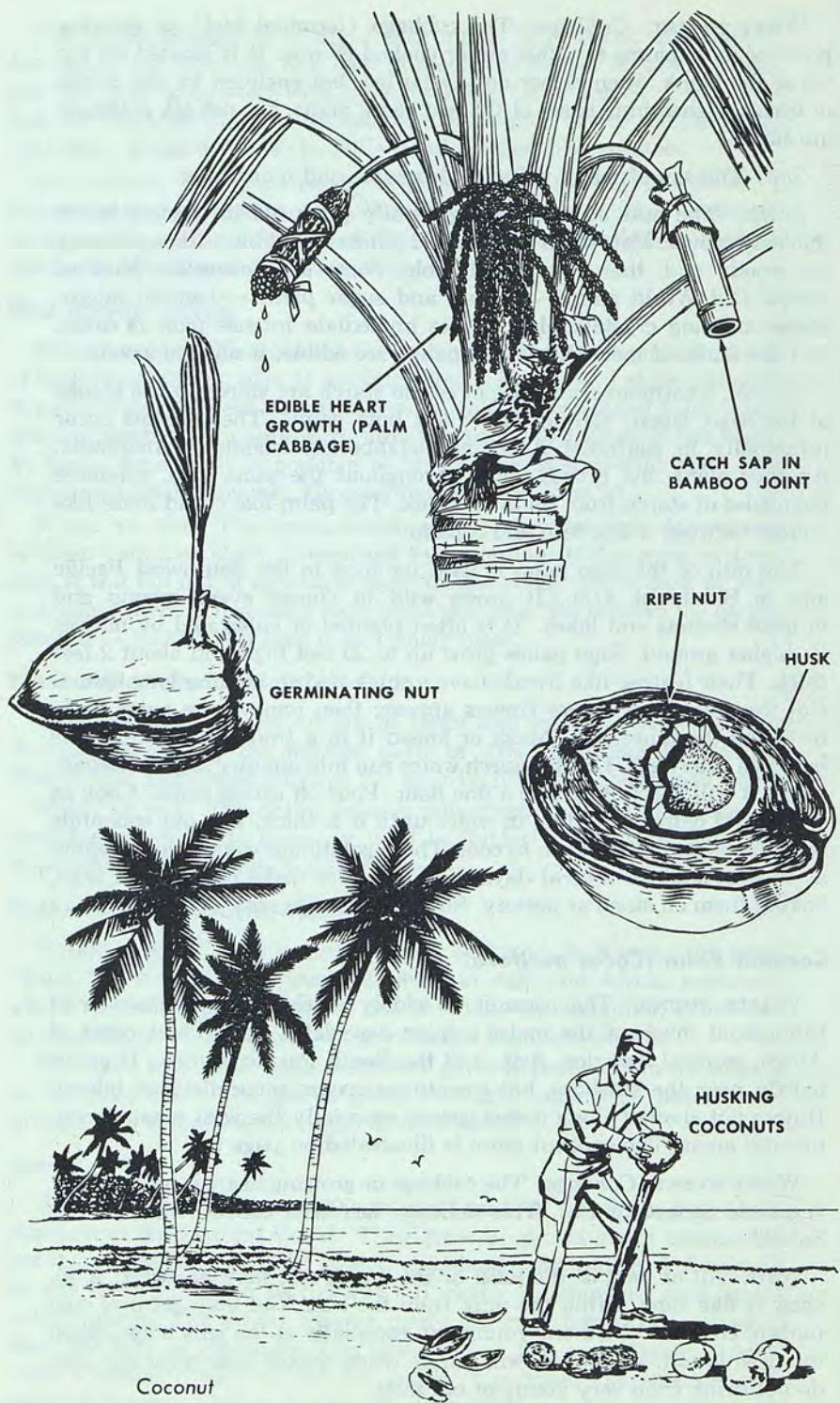
The pith of the sago palm is used for food in the Southwest Pacific and in Southeast Asia. It grows wild in almost every swamp and in most streams and lakes. It is often planted or cultivated by natives on higher ground. Sago palms grow up to 25 feet high and about 2 feet thick. Their feather-like fronds have a thick midrib bearing long spines. Cut the tree down before flowers appear; then remove the outer bark, revealing the inner pith. Mash or knead it in a trough made from the base of a sago stem. Let the starch water run into another sago container, where it will precipitate into a fine flour. Pour off excess water. Cook as you would oatmeal, boiling in water until it is thick. Dip out spoonfuls onto leaves and allow them to cool. These gelatinous cakes may be eaten at once or kept for several days. You may also make pancakes of sago, baking them on stone or pottery. Slices of the pith may be baked.

Coconut Palm (*Cocos nucifera*)

WHERE FOUND. The coconut is widely cultivated and grows wild throughout much of the moist tropics, especially on the east coast of Africa, tropical America, Asia, and the South Pacific islands. It grows mostly near the seashore, but sometimes occurs some distance inland. It does not abound along desert coasts, especially the west coast of continental areas. The coconut palm is illustrated on page 96.

WHAT TO EAT. *Cabbage.* The cabbage or growing heart is an excellent vegetable cooked or raw. This delicacy has been called "Millionaire's Salad."

Nuts. All or part of the husk of the young nut may be sweet; if so, chew it like cane. Drink the milk from the nut. You may get over two pints of cold fluid from one young nut, especially at the jelly stage, when the flesh is soft. A ripe nut will gurgle when shaken near your ear. But do not drink from very young or old nuts.



Grate or chop up the meat or flesh as it firms up; this makes it easier to digest.

Fallen nuts germinate where they lie. In these, both milk and meat are used up, but the cavity is filled with a spongy mass, called the bread. Eat this raw or toasted in a shell over the fire. It tastes good and is very sustaining. Eat the sprouts like celery.

CLIMBING THE COCONUT PALM. Coconuts grow in clusters near the top of the palm. The slim and slippery trunks are very difficult to climb. You may want to use a climbing bandage — a belt or rope a little longer than the circumference of the tree. Put it around the trunk, leaving enough room for your feet, and step on it with both feet. The loop on the other side of the trunk will support your weight. Reach up with your arms and grasp the trunk with both hands. Pull yourself on, doubling your knees and sliding the bandage up to a higher position with your feet. Straighten up, resting your weight on the bandage to get a new position. Repeat the process and you can climb to any height. The method depicted in the illustration of the coconut may also be used.

HUSKING COCONUTS. The nut is encased in a husk consisting of a smooth exterior and a matting of tough fibers. If you have a heavy knife or an ax, you need not remove the husk of the green coconut to get the liquid. Whittle off the husk at the free (not the stem) end to a crude point and then cut off the end and the top of the nut inside.

If you haven't a knife or a machete, use this procedure: Drive a stake 3 or 4 feet long into the ground so that it slants away at a right angle. The top of the stake should be given a crude wedge-shaped edge so that it will pierce the longitudinal fibers of the husk. Stand about a foot clear of the stake, judging the point of entry so that the stake will clear the nut within the husk. Then push the coconut downward firmly against the sharpened stake with your hands, giving the coconut a twisting motion to pry off a small portion of the husk. By repeating this process, you can remove the entire husk, from either green or mature nuts.

Once the nut is out of the husk, your problem is to break through the hard shell. To open a nut, hold it in one hand so that the eyes (at the stem end) are uppermost. Strike it sharply with a stone or with the point of a mature nut, just below each eye. The shell will crack and the top of the nut can be picked off without spilling the liquid. Poke out the eyes of a mature nut and drink the liquid. To break it open, place it on its side on the palm of your hand. In your other hand, grasp a stone and strike the middle of the nut, revolving it a quarter turn and striking it again. Continue to turn it, striking it each time, until it cracks in half.

COCONUT OIL. Coconut oil is a good preventive for sunburn as well as an aid in keeping off chiggers and other insects. It can also be used for cooking. You can get coconut oil easily by exposing the meat of the coconut to the sun. The oil will run more quickly if you grate or pound the meat before placing it in the sun. You can also get oil by heating the coconut meat over a slow fire. If you have any kind of cooking

pot or a section cut from a bamboo tree, you can boil coconut meat in water. When the mixture cools, the oil will rise to the top.

The natives of Oceania have discovered that coconut oil is a good preventive against salt water sores and bloating. Before going fishing on the reef, they smear their legs and feet with oil, which keeps their skin in good condition even though they stand in salt water for many hours.

ORIENTATION

An aircraft navigator carries a small suitcase full of instruments and tables to help him do his work. You can't carry all his gear, but you can use your watch, the sun, the stars, and the landscape to orient yourself. Under favorable conditions at sea, you can find latitude and longitude by simply noting the times of sunrise and sunset. On land and sea you can get direction from the sun and stars.

Whether you plan to stay in one place or to travel, you will want to know where you are. If you are traveling, you need to know what direction to take. If you are staying, you want to know your location so that you can radio the information to your rescuers. Your position report doesn't have to be accurate to the mile to be helpful; any data you can give will reduce the area to be searched.

DIRECTION FINDING

Direction from the Sun at Sunrise and Sunset

You can find north by observing the sun when it rises or sets. Table D shows the true azimuth (true bearing) of the rising sun and the relative bearing of the setting sun for all the months in the year in the Northern and Southern Hemispheres.

An example of how to find north from the rising sun is as follows: On January 26 your position is $50^{\circ}00' N$ and $165^{\circ}06' W$. Entering Table D at that date and under $50^{\circ} N$ latitude, you find the azimuth of the sun to be 120° . Since the sun is rising, you know that this is the true azimuth of the sun from north. Therefore, north will be to your left 120° when you are facing the sun.

To find north from the setting sun, consider the same problem as above. However, in this case, the azimuth of the sun is not the true azimuth. Instead, it is a relative bearing. Since the sun sets in the west, north must be to the right of the sun. Therefore, north will be 120° to your right when you face the sun.

Table D does not list every day of the year nor does it list every degree of longitude. If you want accuracy to within one degree of azimuth, you may have to interpolate between the values given in the table. However, for all practical purposes, using the closest day and the closest degree of latitude listed in the table will give you an azimuth which will enable you to hold your course. For example: If you are at 32° north latitude on the 13th of April, the azimuth of the rising sun

is actually $79^{\circ} 22'$; however, by entering the table with the closest day listed, 11 April, and the closest latitude, 30° , you get 81° as the azimuth of the rising sun. This value is accurate enough for field purposes.

Direction from Polaris

In the Northern Hemisphere one star, Polaris (the Pole Star), is never more than approximately 1° from the Celestial North Pole. In other words, the line from any observer in the Northern Hemisphere to the Pole Star is never more than one degree away from true north. We find the Pole Star by locating the Big Dipper or Cassiopea, two groups of stars which are very close to the Celestial North Pole. The two stars on the outer edge of the Big Dipper are called pointers, as they point almost directly to Polaris. If the pointers are obscured by clouds, Polaris can be identified by its relationship to the constellation Cassiopea. The illustration indicates the relation between the Big Dipper, Polaris, and Cassiopea.

The angular distance of Polaris from the meridian of the observer (the north-south line passing through the observer's position) can also be determined by the relative positions of Cassiopea and the Big Dipper. The illustration (page 100) shows positions of maximum error and minimum error of Polaris. For positions between these extremes, you can make a mental interpolation to find the angular distance of Polaris from the Celestial Pole.

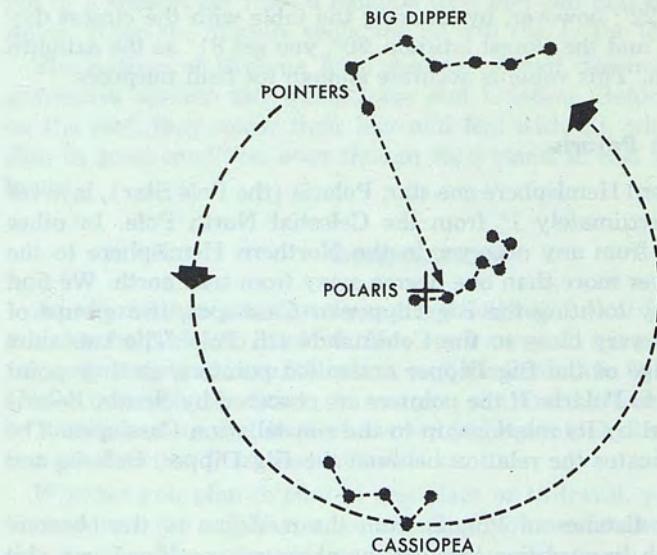
Direction from Orion

The constellation of Orion consists of seven stars. The three close together are called the Belt of Orion. The star through which the north-south line on the diagram passes is exactly on the Celestial Equator. No matter where on earth you are, this star rises due east of you and sets due west.

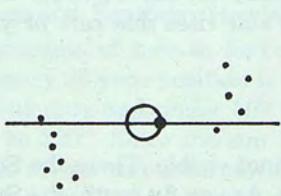
Direction from the Southern Cross

In the Southern Hemisphere Polaris is not visible. There the Southern Cross is the most distinctive constellation. As you fly south, the Southern Cross appears shortly before Polaris drops from sight astern. An imaginary line through the long axis of the Southern Cross or True Cross points toward the South Pole. The True Cross should not be confused with a larger cross nearby known as the False Cross, which is less bright although its stars are more widely spaced. The False Cross has a star in the center, making five stars in all, while the True Cross has only four. Two of these are among the brightest stars in the heavens; they are the stars on the southern and eastern arms. Those on the northern and western arms, while bright, are smaller.

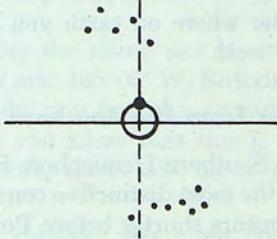
There is no star above the South Pole to correspond to Polaris above the North Pole. In fact, the point where such a star would be, if one existed, lies in a region devoid of stars. This point is so dark in comparison with the rest of the sky that it is known as the Coal Sack.



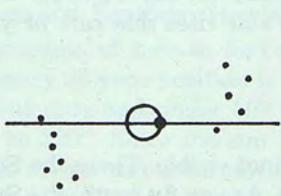
1. Polaris 1° west of meridian



2. Polaris on meridian



3. Polaris 1° east of meridian

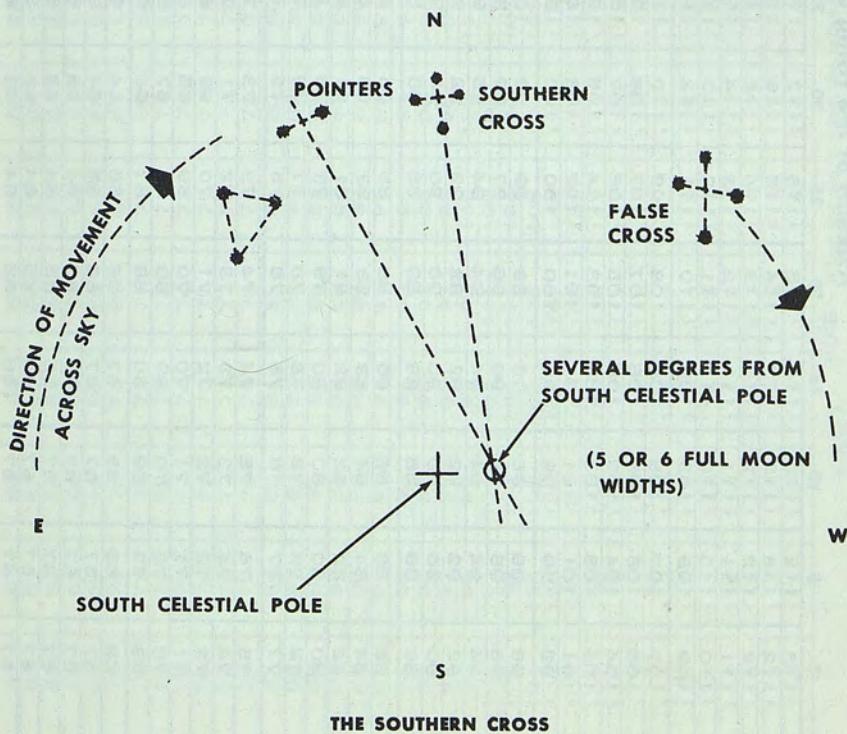
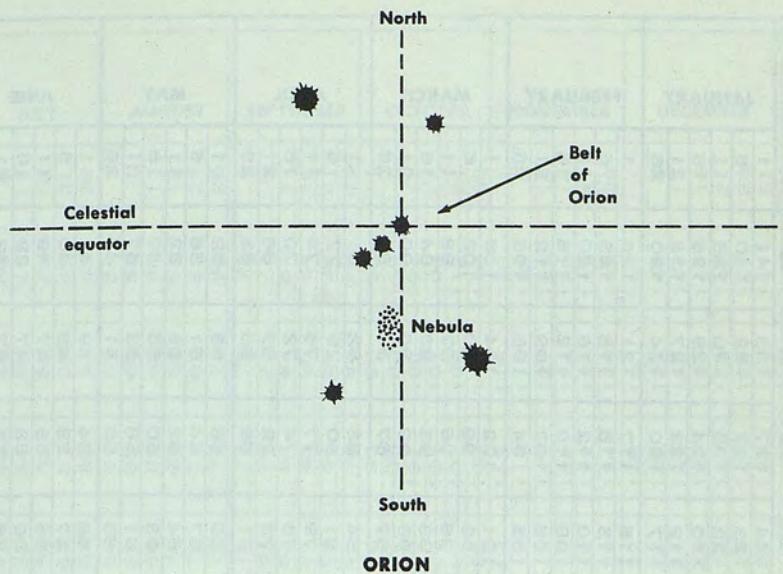


4. Polaris on meridian

Relationship of Polaris to the Big Dipper and Cassiopeia

The illustration on page 101 shows the True Cross and — to the west of it — the False Cross. Hold the page above your head for realism and note two very bright stars just to the east of the True Cross. With them and the True Cross as guides, you can locate the spot within the Coal Sack which is exactly above the South Pole.

First, extend an imaginary line along the long axis of the True Cross to the south. Join the two bright stars to the east of the Cross with an



Azimuth of the rising and setting sun													LATITUDE	DATE
0	5	10	15	20	25	30	35	40	45	50	55	60		
113	113	113	114	115	116	117	118	121	124	127	133	141	1	
112	113	113	113	114	115	116	118	120	123	127	132	140	6	
112	112	112	113	113	114	115	117	119	122	125	130	138	11	
111	111	111	112	112	113	114	116	118	120	124	129	136	16	
110	110	110	111	111	112	113	115	117	119	122	127	133	21	
109	109	109	109	110	111	112	113	115	117	120	124	130	26	
107	107	108	108	108	109	110	111	113	115	117	121	126	1	
106	106	106	106	106	107	107	108	109	111	113	115	118	23	6
104	104	105	105	105	106	107	108	109	110	112	116	120	11	
103	103	103	103	103	104	105	106	107	108	110	112	116	16	
101	101	101	101	101	102	102	103	104	105	107	109	112	21	
99	99	99	99	100	100	100	101	102	103	104	106	108	26	
98	98	98	98	99	99	99	100	100	101	102	104	106	1	
96	96	96	96	96	97	97	97	98	98	99	100	102	6	
94	94	94	94	94	94	95	95	95	96	96	97	98	11	
92	92	92	92	92	92	92	92	93	93	93	93	94	16	
90	90	90	90	90	90	90	90	90	90	90	90	90	21	
88	88	88	88	88	88	88	88	87	87	87	87	86	26	
86	86	86	86	85	85	85	84	84	83	82	81	81	1	
84	84	84	83	83	83	83	82	82	81	80	79	77	6	
82	82	82	82	81	81	81	80	80	79	77	76	74	11	
80	80	80	80	79	79	78	78	77	76	74	72	70	16	
78	78	78	78	78	77	76	76	75	73	72	69	66	21	
77	77	76	76	76	75	75	74	72	71	69	66	63	26	
75	75	75	74	74	73	73	72	70	69	66	63	59	1	
74	74	73	73	73	72	71	70	68	67	64	61	56	6	
72	72	72	72	71	70	69	68	67	64	62	58	52	11	
71	71	71	70	70	69	68	67	65	63	60	55	49	16	
70	70	70	69	69	68	67	65	63	61	58	53	47	21	
69	69	69	68	68	67	66	64	62	60	56	51	44	26	
68	68	68	67	66	66	64	63	61	58	54	49	41	1	
67	67	67	67	66	65	64	62	60	57	53	48	40	6	
67	67	67	66	65	64	63	62	59	56	53	47	39	11	
67	67	67	66	65	64	63	62	59	56	53	47	39	21	
67	67	67	66	65	64	63	62	59	56	53	47	39	26	

67	67	67	66	65	64	63	62	59	56	53	47	39	1	JULY
67	67	67	66	66	65	64	62	60	57	53	48	40	6	
68	68	68	67	66	65	64	63	61	58	54	49	41	11	
69	68	68	68	67	66	65	64	62	59	55	50	43	16	
69	69	69	69	68	67	66	65	63	60	57	52	45	21	
70	70	70	70	69	68	67	66	64	62	59	54	48	26	
72	72	72	71	71	70	69	68	66	64	61	57	51	1	
73	73	73	73	72	71	71	69	68	66	63	60	55	6	
75	75	74	74	74	73	72	71	70	68	66	63	58	11	
76	76	76	76	75	75	74	73	72	70	68	65	61	16	
78	78	77	77	77	76	76	75	74	72	71	68	65	21	
79	79	79	79	79	78	78	77	76	75	73	71	68	26	
82	82	82	81	81	81	80	80	79	78	77	75	73	1	
83	83	83	83	83	83	82	82	81	81	80	78	77	6	AUGUST
85	85	85	85	85	85	85	84	84	83	83	82	81	11	
87	87	87	87	87	87	87	86	86	86	85	85	84	16	
89	89	89	89	89	89	89	89	89	89	88	88	88	21	
91	91	91	91	91	91	91	91	91	91	92	92	92	26	
93	93	93	93	93	93	93	94	94	94	95	95	96	1	
95	95	95	95	95	96	96	96	97	97	98	99	100	6	
97	97	97	97	97	98	98	99	99	100	101	102	104	11	
99	99	99	99	99	100	100	101	101	102	104	105	108	16	
101	101	101	101	101	102	102	103	104	105	107	109	112	21	
102	102	103	103	103	104	104	105	106	108	109	112	115	26	
104	104	105	105	105	106	107	108	109	110	113	116	120	1	SEPTEMBER
106	106	106	107	107	108	109	110	111	111	115	119	123	6	
107	107	108	108	108	109	110	111	113	115	117	121	126	11	
109	109	109	109	110	111	112	113	115	117	120	124	130	16	
110	110	110	111	111	112	113	114	116	119	122	126	133	21	
111	111	111	112	112	113	114	116	118	120	124	128	135	26	
112	112	112	113	113	114	115	117	119	122	125	130	138	1	
112	112	113	113	114	115	116	118	120	123	126	132	140	6	
113	113	113	114	115	116	117	118	121	124	127	133	141	11	
113	113	113	114	115	116	117	118	121	124	127	133	141	16	
113	113	113	114	115	116	117	118	121	124	127	133	141	21	
113	113	113	114	115	116	117	118	121	124	127	133	141	26	
113	113	113	114	115	116	117	118	121	124	127	133	141	31	
Table I														

NOTE: When the sun is rising, the tabulated azimuth is reckoned from North to East.
 When the sun is setting, the tabulated azimuth is reckoned from North to West.

imaginary line. Bisect this line with one at right angles. The intersection of this line with the line through the Cross is approximately the point above the South Pole.

Compass Check

You can use the directions you obtain from sun and stars either directly or as checks on your compass. To check your compass, sight on the heavenly body you are using as a reference (Polaris or the sun) and note the magnetic azimuth of that body. The difference between this magnetic azimuth and the true azimuth of the body will be the magnetic variation at your position. Note this variation and check it with the variation given on your map. (For example: the magnetic azimuth of the sun at midday is 190° . The true azimuth is 180° . 190° minus 180° is 10° . The variation is 10° W. Subtract 10° from your magnetic azimuths to get true azimuth.) If the difference is less than 3° , check again before changing your map. If even a small difference is constant, adjust your map to correspond with your observations.

Checking magnetic variation can be very important to a man down in poorly mapped territory. Much of the earth's surface — especially the Arctic — has not been well mapped magnetically. Small local variations which would not trouble an airplane traveling 300 miles an hour can be of great concern to a man traveling 20 miles a day.

If you find a great discrepancy between the variation shown on your map and the variation you observe, first make sure that no iron or electrical fields are close to your compass. Iron may be present in the rocks around you, so look carefully to see whether varying the distance from compass to rock will change your compass reading.

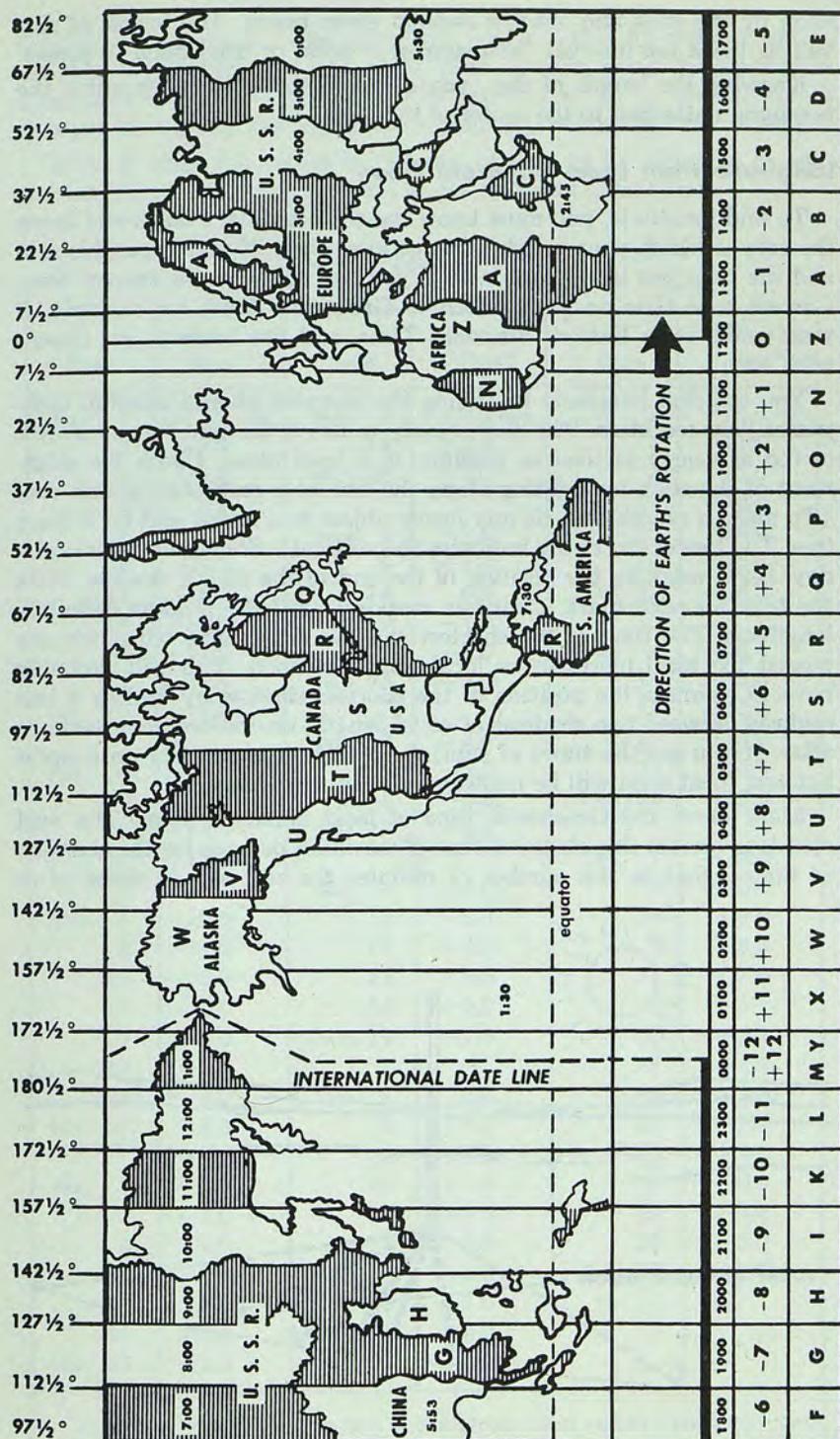
POSITION FINDING

Latitude by Length of Day

When you are in any latitude between 60° N and 60° S, you can determine your exact latitude within 30 nautical miles ($\frac{1}{2}^{\circ}$), if you know the length of the day within one minute. This is true throughout the year except for about 10 days before and 10 days after the equinoxes — approximately 11-31 March and 13 September - 2 October. During these two periods the day is approximately the same length at all latitudes. To time sunrise and sunset accurately, you must have a level horizon. A land horizon cannot be used.

Observations for Latitude

Find the length of the day from the instant the top of the sun first appears above the ocean horizon to the instant it disappears below the horizon. This instant is often marked by a green flash. Write down the times of sunrise and sunset. Don't count on remembering them. Note that only the length of day, counts in the determination of latitude; your watch may have an unknown error and yet serve to determine this factor. If you have only one water horizon, as on a seacoast, find local



noon by the stick and shadow method given below. The length of day will be twice the interval from sunrise to noon or from noon to sunset.

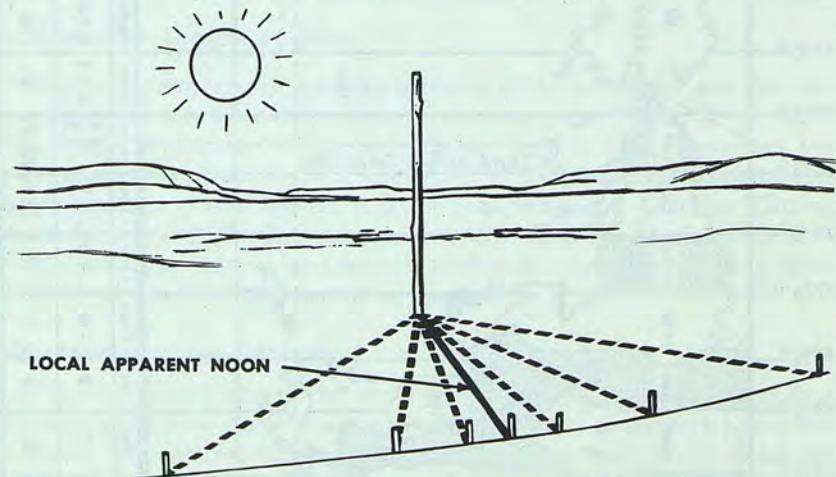
Knowing the length of day, you can find the latitude by using the nomogram attached to the center of the book.

Longitude from Local Apparent Noon

To find longitude, you must know the correct time. You should know the rate at which your watch gains or loses time. If you know this rate and the time you last set the watch, you can compute the correct time. Correct zone time on your watch to Greenwich time; for example, if your watch is on Eastern Standard Time, add five hours to get Greenwich time.

You can find longitude by timing the moment when a celestial body passes your meridian. The easiest body to use is the sun. Put up a stick or rod as nearly vertical as possible, in a level place. Check the alignment of the stick by sighting along the line of a makeshift plumb bob. (To make a plumb bob, tie any heavy object to a string and let it hang free. The line of the string indicates the vertical.) Sometime before midday, begin marking the position of the end of the stick's shadow. Note the time for each mark. Continue marking until the shadow definitely lengthens. The time of the shortest shadow is the time when the sun passed the local meridian or local apparent noon. You will probably have to estimate the position of the shortest shadow by finding a line midway between two shadows of equal length, one before noon and one after. If you get the times of sunrise and sunset accurately on a water horizon, local noon will be midway between these times.

Mark down the Greenwich time of local apparent noon. The next step is to correct this observed time of meridian passage for the equation of time — that is, the number of minutes the real sun is ahead of or



Stick-and-shadow method of determining local apparent noon

behind the mean sun. (The mean sun was invented by astronomers to simplify the problems of measuring time. It rolls along the equator at a constant rate of 15° per hour. The real sun is not so considerate; it changes its angular rate of travel around the earth with the seasons.)

Table B gives the values in minutes of time to be added to or subtracted from mean (watch) time to get apparent (sun) time.

Table B — Equation of time

Date	Eq. of Time*	Date	Eq. of Time*	Date	Eq. of Time*
Jan. 1	-3.5 min.	May 2	+3.0 min.	Oct. 1	+10.0 min.
2	-4.0	14	+3.8	4	+11.0
4	-5.0	May 28	+3.0	7	+12.0
7	-6.0			11	+13.0
9	-7.0	June 4	+2.0	15	+14.0
12	-8.0	9	+1.0	20	+15.0
14	-9.0	14	0.0	Oct. 27	+16.0
17	-10.0	19	-1.0		
20	-11.0	23	-2.0	Nov. 4	+16.4
24	-12.0	June 28	-3.0	11	+16.0
Jan. 28	-13.0			17	+15.0
		July 3	-4.0	22	+14.0
Feb. 4	-14.0	9	-5.0	25	+13.0
13	-14.3	18	-6.0	Nov. 28	+12.0
19	-14.0	July 27	-6.6		
Feb. 28	-13.0			Dec. 1	+11.0
		Aug. 4	-6.0	4	+10.0
Mar. 4	-12.0	12	-5.0	6	+9.0
8	-11.0	17	-4.0	9	+8.0
12	-10.0	22	-3.0	11	+7.0
16	-9.0	26	-2.0	13	+6.0
19	-8.0	Aug. 29	-1.0	15	+5.0
22	-7.0			17	+4.0
26	-6.0	Sep. 1	0.0	19	+3.0
Mar. 29	-5.0	5	+1.0	21	+2.0
		8	+2.0	23	+1.0
Apr. 1	-4.0	10	+3.0	25	0.0
5	-3.0	13	+4.0	27	-1.0
8	-2.0	16	+5.0	29	-2.0
12	-1.0	19	+6.0	Dec. 31	-3.0
16	0.0	22	+7.0		
20	+1.0	25	+8.0		
Apr. 25	+2.0	Sep. 28	+9.0		

*Add plus values to mean time and subtract minus values from mean time to get apparent time.

Now that you have the Greenwich time of local noon, you can find the difference of longitude between your position and Greenwich by converting the interval between 1200 Greenwich and your local noon from time to arc. Remember that 1 hour equals 15° of longitude, 4 minutes equal 1° of longitude, and 4 seconds equal $1'$ of longitude.

Example: Your watch is on Eastern Standard Time. It normally loses 30 seconds a day. You haven't set it for 4 days. You time local noon at 15:08 on your watch on 4 February.

Watch correction is 4×30 seconds or plus 2 minutes. Zone time correction is plus 5 hours. Greenwich time is 15:08 plus 2 minutes plus 5 hours or 20:10. The equation of time for 4 February is minus 14 minutes. Local noon is 20:10 minus 14 minutes or 19:56 Greenwich. Difference in time between Greenwich and your position is 19:56 minus 12:00 or 7:56. 7:56 of time equals 119° of longitude.

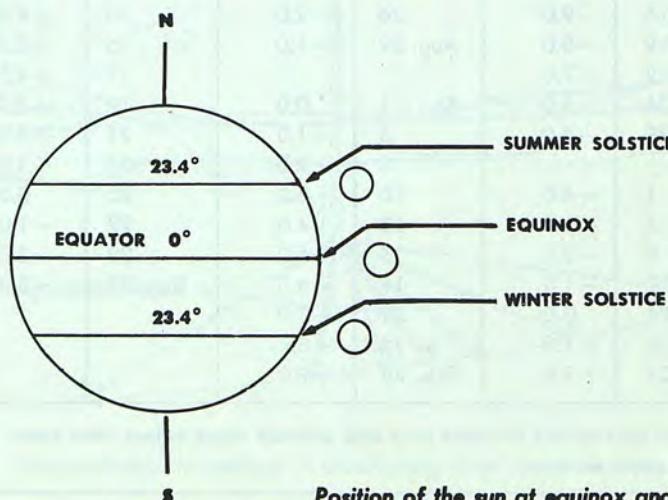
Since your local noon is later than Greenwich noon, you are west of Greenwich. Your longitude then is 119°W .

Direction from the Sun at Noon

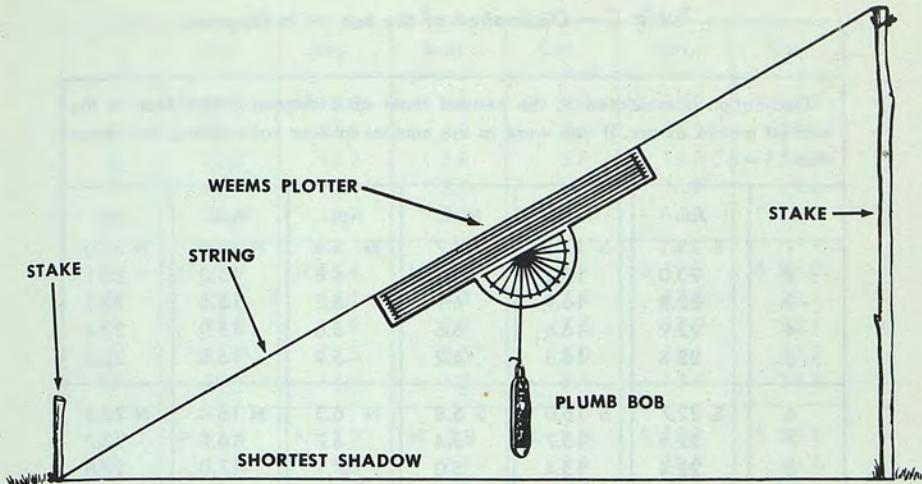
Determining local noon by the stick and shadow method will also give you direction. The line of the shortest shadow is also the line of the local meridian or north-south line. Whether the sun is north or south of you at midday will depend on your latitude. North of 23.4° N , the sun will always be due south at local noon; and the shadow will point north. South of 23.4° S , the sun will always be due north at local noon; and the shadow will point south. In the tropics the sun can be either north or south at noon, depending on the date, and your position.

Latitude by Noon Altitude of Sun

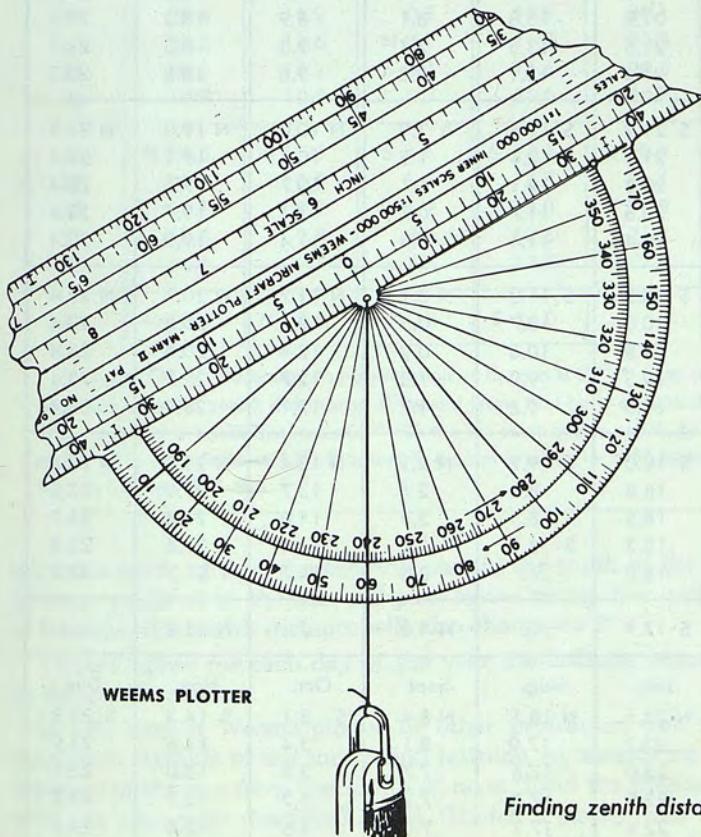
On any given day there is only one latitude on the earth where the sun will pass directly overhead or through the zenith at noon. In all



Position of the sun at equinox and solstice



Angular distance of sun from zenith



Finding zenith distance of the sun

Table C -- Declination of the sun — In Degrees

Declination is tabulated to the nearest tenth of a degree rather than to the nearest minute of arc. If you want to use minutes in your calculations, remember that $^{\circ}.1 = 6'$.						
	Jan.	Feb.	Mar.	Apr.	May	June
1	S 23.1	S 17.5	S 7.7	N 4.4	N 15.0	N 22.0
2	23.0	17.2	7.3	4.8	15.3	22.1
3	22.9	16.9	6.9	5.2	15.6	22.3
4	22.9	16.6	6.6	5.6	15.9	22.4
5	22.8	16.3	6.2	5.9	16.2	22.5
6	S 22.7	S 16.0	S 5.8	N 6.3	N 16.4	N 22.6
7	22.5	15.7	5.4	6.7	16.7	22.7
8	22.4	15.4	5.0	7.1	17.0	22.8
9	22.3	15.1	4.6	7.4	17.3	22.9
10	22.2	14.8	4.2	7.8	17.5	23.0
11	S 22.0	S 14.5	S 3.8	N 8.2	N 17.8	N 23.1
12	21.9	14.1	3.5	8.6	18.0	23.1
13	21.7	13.8	3.1	8.9	18.3	23.2
14	21.5	13.5	2.7	9.3	18.5	23.2
15	21.4	13.1	2.3	9.6	18.8	23.3
16	S 21.2	S 12.8	S 1.9	N 10.0	N 19.0	N 23.3
17	21.0	12.4	1.5	10.4	19.2	23.4
18	20.8	12.1	1.1	10.7	19.5	23.4
19	20.6	11.7	0.7	11.1	19.7	23.4
20	20.4	11.4	0.3	11.4	19.9	23.4
21	S 20.2	S 11.0	N 0.1	N 11.7	N 20.1	N 23.4
22	20.0	10.7	0.5	12.1	20.3	23.4
23	19.8	10.3	0.9	12.4	20.5	23.4
24	19.5	9.9	1.3	12.7	20.7	23.4
25	19.3	9.6	1.7	13.1	20.9	23.4
26	S 19.0	S 9.2	N 2.1	N 13.4	N 21.1	N 23.4
27	18.8	8.8	2.5	13.7	21.2	23.3
28	18.5	8.5	2.9	14.0	21.4	23.3
29	18.3	S 8.1	3.2	14.4	21.6	23.3
30	18.0	...	3.6	14.7	21.7	23.2
31	S 17.7	...	N 4.0	...	N 21.9	...
	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	N 23.1	N 18.1	N 8.4	S 3.1	S 14.3	S 21.8
2	23.1	17.9	8.1	3.4	14.6	21.9
3	23.0	17.6	7.7	3.8	15.0	22.1
4	22.9	17.3	7.3	4.2	15.3	22.2
5	22.8	17.1	7.0	4.6	15.6	22.3

	July	Aug.	Sept.	Oct.	Nov.	Dec.
6	N 22.7	N 16.8	N 6.6	S 5.0	S 15.9	S 22.5
7	22.6	16.5	6.2	5.4	16.2	22.6
8	22.5	16.3	5.8	5.7	16.5	22.7
9	22.4	16.0	5.5	6.1	16.8	22.8
10	22.3	15.7	5.1	6.5	17.1	22.9
11	N 22.2	N 15.4	N 4.7	S 6.9	S 17.3	S 23.0
12	22.0	15.1	4.3	7.3	17.6	23.1
13	21.9	14.8	3.9	7.6	17.9	23.1
14	21.7	14.5	3.6	8.0	18.1	23.2
15	21.6	14.2	3.2	8.4	18.4	23.3
16	N 21.4	N 13.9	N 2.8	S 8.8	S 18.7	S 23.3
17	21.3	13.5	2.4	9.1	18.9	23.3
18	21.1	13.2	2.0	9.5	19.1	23.4
19	20.9	12.9	1.6	9.9	19.4	23.4
20	20.7	12.6	1.2	10.2	19.6	23.4
21	N 20.5	N 12.2	N 0.8	S 10.6	S 19.8	S 23.4
22	20.4	11.9	0.5	10.9	20.1	23.4
23	20.2	11.6	N 0.1	11.3	20.3	23.4
24	20.0	11.2	S 0.3	11.6	20.5	23.4
25	19.7	10.9	0.7	12.0	20.7	23.4
26	N 19.5	N 10.5	S 1.1	S 12.3	S 20.9	S 23.4
27	19.3	10.2	1.5	12.7	21.1	23.3
28	19.1	9.8	1.9	13.0	21.3	23.3
29	18.8	9.5	2.3	13.3	21.4	23.3
30	18.6	9.1	S 2.7	13.7	S 21.6	23.2
31	N 18.4	N 8.8	...	S 14.0	...	S 23.1

Example: On 10 December the declination of the sun is $22^{\circ}.9$ S, so an observer who measures the zenith distance as 0° would know that he is at latitude $22^{\circ}.9$ S. If he measures a zenith distance of 5° with the sun south of this zenith, he is 5° north of $22^{\circ}.9$ S, or at latitude $17^{\circ}.9$ S; and if the sun is north, he is 5° south of $22^{\circ}.9$ S, or in latitude $27^{\circ}.9$ S.

latitudes north of this, the sun will pass to the south of the zenith; and in those south of it, the sun will pass to the north. For each 1° change of latitude, the zenith distance will also change by 1° .

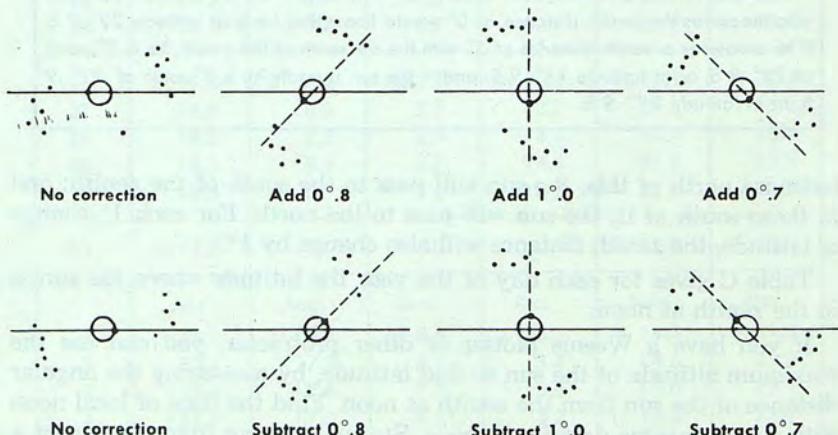
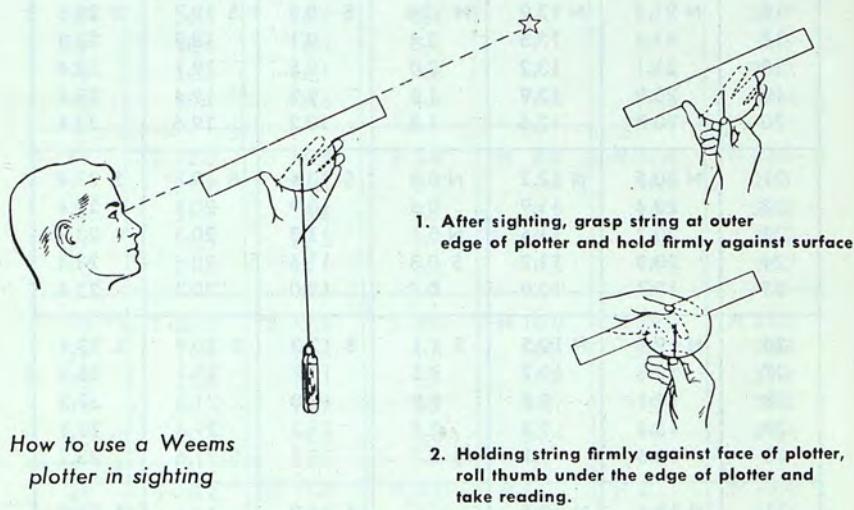
Table C gives for each day of the year the latitude where the sun is in the zenith at noon.

If you have a Weems plotter or other protractor, you can use the maximum altitude of the sun to find latitude, by measuring the angular distance of the sun from the zenith at noon. Find the time of local noon with the apparatus described above. Stretch a string from the top of a stick to the point where the end of the noon shadow rested; place your plotter along the string and drop a plumb line from the center of the

plotter. The intersection of the plumb line with the outer scale of the plotter shows the angular distance of the sun from your zenith.

Latitude from Polaris

You can find your latitude in the Northern Hemisphere north of 10° N by measuring the angular altitude of Polaris above the horizon. Attach a thin string or thread to the center hole of your plotter and attach a small weight to the lower end of the string. Sight along the edge of the plotter at Polaris (below), so that the string crosses the scale of the plotter on the 0° - 90° quadrant. Subtract the reading of the point where the string crosses the scale from 90° to get the altitude of Polaris. To this reading apply the correction given below illustration.



Correction for observed altitude of Polaris

The figures are drawn for angles of 0° , 45° and 90° between the vertical and the line through Cassiopeia and the Dipper. For intermediate positions the angle may be estimated and the correction taken from the following table.

Angle	Correction
0°	1.0°
10	1.0
20	0.9
30	0.9
40	0.8

Angle	Correction
50°	0.6°
60	0.5
70	0.3
80	0.2
90	0.0

Note that the correction changes very slowly near the time when the correction is greatest, and hence an error in estimation of the position has little effect at this time.

Use of Computers as Protractors

All hand computers used in flying operations may be used in lieu of weems plotters for navigation. A straight edge of some sort will be required for sighting and nearly all will require that you subtract the reading obtained from 90° .

Position Finding Using the Fishline Sextant

One of the oldest known means of establishing position is to measure the instant when an infinitely distant celestial body passes directly overhead. The celestial body is then at the instant of Meridian Transit.

The time that various celestial bodies will be over any point on the earth's surface has been established, and almanacs containing this calculated position of stars at any given time have been printed for centuries.

A simple system of determining Meridian Transit can be set up under survival conditions. The only pieces of equipment needed are:

1. A watch that is running and which was set on a time zone that you can convert to GMT by adding or subtracting the correct number of hours. (A watch already showing GMT is ideal.)
2. Approximately 20' of string.
3. The proper forms for computation. (Two 3-way swivels are very handy to assist in setting up the sextant. Nylon leader is ideal for constructing the triangle itself since it tends to be more visible under minimum light conditions.)

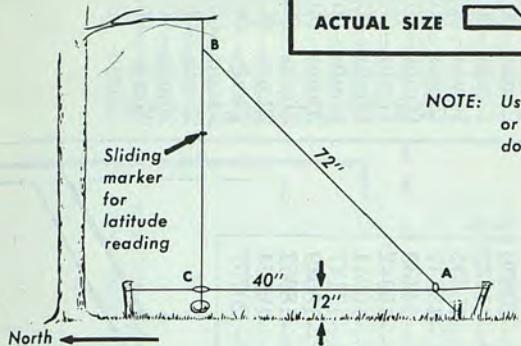
How To Set Up and Use the Fishline Sextant

1. Line AC should be horizontal, and about 40" long. Line AB should be about 72" long.

2. Angle at C should be a 90-degree angle, or as close to 90° as possible.
3. Line BC must hang through a ring used at point C without bending line BC or being restricted by the ring at point C.
4. Device is oriented by assuming a position which will allow you to place your eye at point A. Sight *through* at A at line BC and the North Star (Polaris). This is done in a manner similar to firing a rifle. Point A is the rear sight; line BC the front sight; and Polaris the target. (NOTE: You should set up the triangle in advance so that line AC runs roughly north and south, A at the South and C at the North. This pre-setting can be done with a magnetic compass.) Adjustments for a precise sighting will be required and may be made by manipulating the lines used to tie down the triangle at Point A. After adjusting, recheck line BC to insure it is not restricted at Ring C (Step 3, above). Continue to adjust until the sighting is accurate. Take note of the position of Polaris and the Big Dipper. If necessary, apply the correction as described in Table A.
5. *To fix longitude.* Lie down with your head under line AC (which will serve as a new rear sight). Move your body until you can bring line AB (a new front sight) into alignment with line AC without touching the string. From the Star Chart, select and identify a star (a new target) that will soon pass overhead from the east to the west. (If none is available from this position, get up and move to a new position where you can bring lines AB and BC in line from either a position at A or C and select a star that will pass from the east to the west across the sighting you take through *these* two lines.)
6. As the star passes the lines, note the time and enter on the computation sheet. *You must convert your watch time to GMT, before you can begin computation.*
7. *To fix latitude.* Immediately following the entry of the longitude data (star used & GMT), on the computation sheet, return to point A to make a latitude reading. Sighting as before, through line BC at Polaris, adjust sliding marker on line BC so that Polaris is viewed from point A just over the top of the sliding marker.
8. Attach line from point A to line BC at a point just over the sliding marker using the thinnest string available. (This may be done the following day if you are sure the marker will not move in the interim). This line should be taut but must not bend line BC. You may now get the sliding marker out of your way by sliding it down line BC.
9. Place point P of printed protractor at junction of line BC and line attached as in 8 above. Be sure arrow adjacent to protractor points up. Enter reading from the protractor (read off the line running to point A), in proper place under latitude determination on the computation sheet.
10. The computation itself may be completed at any time once the observations that were made have been recorded. (Check and recheck your arithmetic). The position fix resulting from this procedure will be accurate within approximately ten (10) miles if your sightings were made carefully and your GMT is accurate.

DIMENSIONS FOR NOTCHED STICK

ACTUAL SIZE



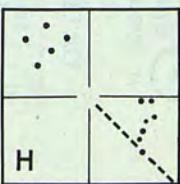
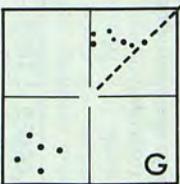
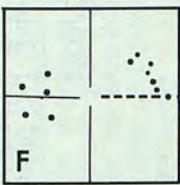
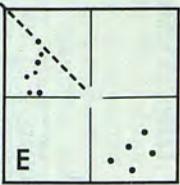
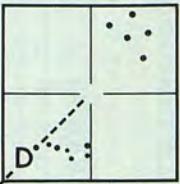
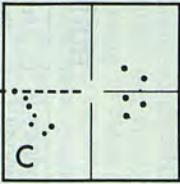
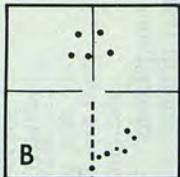
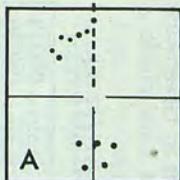
NOTE: Use stakes, rocks, snow or sod blocks to tie down at A and C.

Points A, B, and C are the intersection of the sides of the triangle.

TABLE A

Note the position of the constellations, Ursa Major (Big Dipper) and Cassiopeia, and consult the diagrams to the right of the page. Select the illustration which most closely resembles the appearance of the key constellations and apply the correction as indicated in the following descriptions. Polaris is located at the intersection of the vertical and horizontal dotted lines in each of the diagrams.

1. If positioning of constellations look like A or B, make no correction. Sight through center of swivel at point A toward line BC.
2. If positioning of constellations looks like C, insert the small stick through the center of the swivel at A to the center notch. Sight from the *left* end of the stick and align line BC with Polaris.
3. If position of the constellations looks like D or E, insert the small stick through the center of the swivel at A from the *right* side to the 1st notch. Sight from the *left* end of the stick and align BC with Polaris.
4. If position of the constellations looks like F, insert the small stick through the center of the swivel to the center notch. Sight from the *right* end of the stick and align BC with Polaris.
5. If position of the constellations looks like G or H, insert the small stick through the center of the swivel at point A from the *left* side to the first notch. Sight from the *right* end of the stick and align BC with Polaris.



A

Enter proper information
in space provided.

COMPUTATION SHEET
LONGITUDE DETERMINATION

Time of transit in Greenwich
mean time, 24 hour clock.

DATE.....

MONTH.....

YEAR 19.....

HOURS.....

MINUTES.....

1st—00059	16th—00946
2nd—00118	17th—01005
3rd—00177	18th—01065
4th—00237	19th—01124
5th—00296	20th—01183
6th—00355	21st—01242
7th—00414	22nd—01301
8th—00473	23rd—01360
9th—00532	24th—01420
10th—00591	25th—01479
11th—00650	26th—01538
12th—00709	27th—01597
13th—00769	28th—01656
14th—00828	29th—01715
15th—00887	30th—01774
	31st—01834

Jan—05918
Feb—07751
Mar—09407
Apr—11241
May—13015
Jun—14848
Jul—16622
Aug—18456
Sep—20289
Oct—00463
Nov—02296
Dec—04070

1961.....	00047
1962.....	00033
1963.....	00019
1964 (Jan-Feb).....	00005
1964 (Mar-Dec).....	00064
1965.....	00050
1966.....	00036
1967.....	00022
1968 (Jan-Feb).....	00008
1968 (Mar-Dec).....	00067
1969.....	00053
1970.....	00039
1971.....	00025

1hr—00902
2hr—01805
3hr—02707
4hr—03610
5hr—04512
6hr—05415
7hr—06317
8hr—07220
9hr—08122
10hr—09025
11hr—09927
12hr—10830
13hr—11732
14hr—12635
15hr—13537
16hr—14439
17hr—15342
18hr—16244
19hr—17147
20hr—18049
21hr—18952
22hr—19854
23hr—20757

1min—00015
2min—00030
3min—00045
4min—00060
5min—00075
6min—00090
7min—00105
8min—00120
9min—00135
10min—00150
11min—00165
12min—00180
13min—00196
14min—00211
15min—00226
16min—00241
17min—00256
18min—00271
19min—00286
20min—00301
21min—00316
22min—00331
23min—00346
24min—00361
25min—00376
26min—00391
27min—00406

TRANSIT	STAR	USED	#
# 1—21508	# 21—14660	# 37—08795	
# 3—21029	# 26—12509	# 42—06798	
# 9—18582	# 27—11684	# 46—05806	
# 10—17499	# 28—10997	# 49—04867	
# 12—16898	# 32—10018	# 51—03770	
# 16—16308	# 33—09556	# 53—03000	
# 18—15552	# 34—09212	# 56—00971	
# 20—14745			

STAR	CORRECTION	
# 1—	10'	#28—1° 48'
# 3—	8'	#32—1° 54'
# 9—	0'	#33—1° 56'
#10—	17'	#34—1° 56'
#12—	24'	#37—1° 56'
#16—	32'	#42—1° 44'
#18—	43'	#46—1° 33'
#20—	57'	#49—1° 19'
#21—	58'	#51—1° 2'
#26—1° 31'	#53—	49'
#27—1° 41'	#56—	20'

LATITUDE DETERMINATION

Enter reading from protractor

..... °'

(J)

Add (K) °'

Enter at (J) the correction for the star used in longitude computation. When added to the protractor reading, (K) is your latitude.

B

Enter below, proper value from each table as indicated.

Month

Date

Year

Star

Hours

Mins

28min—00421
29min—00436
30min—00451
31min—00466
32min—00481
33min—00496
34min—00511
35min—00526
36min—00541
37min—00557
38min—00572
39min—00587
40min—00602
41min—00617
42min—00632
43min—00647
44min—00662
45min—00677
46min—00692
47min—00707
48min—00722
49min—00737
50min—00752
51min—00767
52min—00782
53min—00797
54min—00802
55min—00817
56min—00832
57min—00847
58min—00862
59min—00877

C Add

(W)
(X)

SUB-
TRACT

(Y)

°

,

(Z)

D At (X) above, enter 00000,

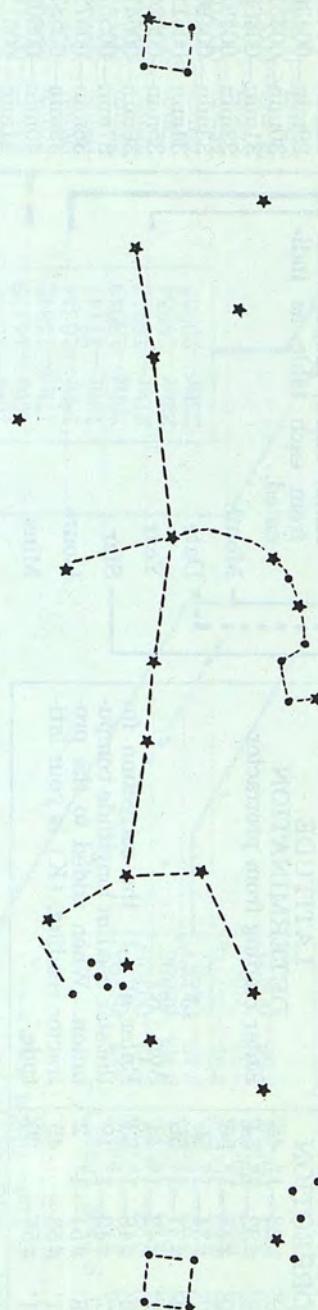
21600, 43200 or 64800
whichever is next smaller
than (W).

E To obtain value (Z) which will be your longitude, you must do one of the following:

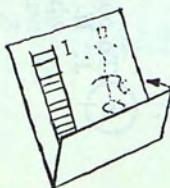
1. If (Y) is less than 10800, divide by 60. Carry the division to two (2) decimal places. The whole number will be degrees of *West* longitude. Round off the decimal remainder to one (1) number. (If second figure is five or over, add 1 to the first figure following the decimal; if less than 5, drop it.) Multiply the remaining figure by 6; the result will be minutes of *West* longitude.
2. If (Y) is between 10800 and 21600, subtract the figure from 21600. Divide the result by 60. The whole number will be degrees of *East* longitude. Round off as above. When figure following decimal has been multiplied by 6, the result will be minutes of *East* longitude.

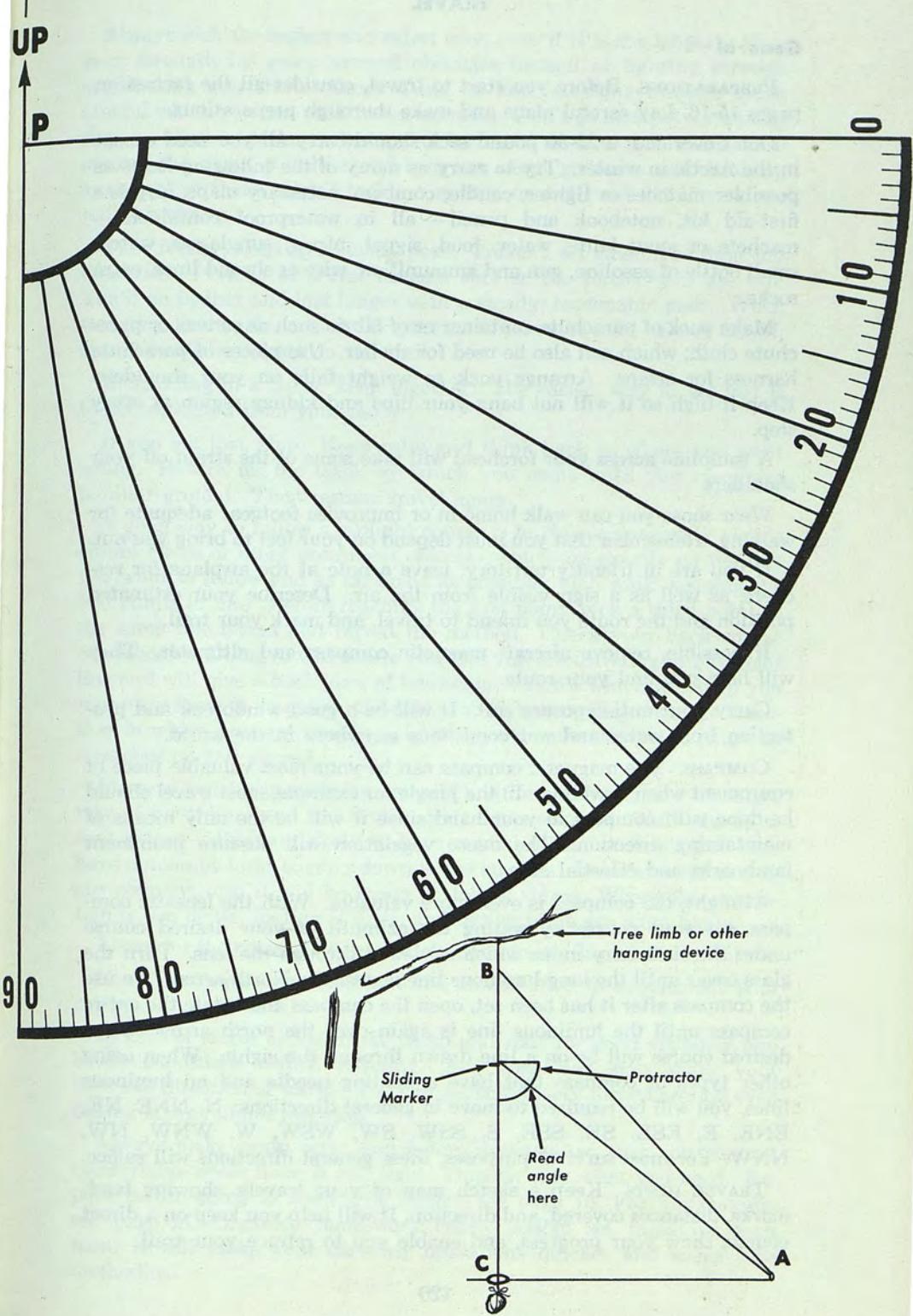
#1 — Alpheratz
#56 — Fomalhaut
#53 — Deneb
#51 — Altair
#49 — Vega
#46 — Rasalague
#42 — Antares
#37 — Arcturus
#34 — Alkaid
#32 — Alioth
#28 — Denebola
#27 — Dubhe
#26 — Regulus
#21 — Pollux
#20 — Procyon
#18 — Sirius
#16 — Betelgeux
#12 — Capella
#10 — Aldebaran
#9 — Marfak
#3 — Schedir
#56 — Fomalhaut

Stars move this
far in two hours



Fold up the bottom edge of this page to
star that will be passing over lines AB
and AC to identify star and obtain Star
number. See paragraph 5 of directions
on how to use longitude-latitude fixer.





General

PREPARATIONS. Before you start to travel, consider all the factors on pages 15-16. Lay careful plans and make thorough preparations.

Don't overload; a 25-30 pound sack should carry all you need except in the Arctic in winter. Try to carry as many of the following items as possible: matches or lighter, candle, compass, necessary maps, airplane first-aid kit, notebook and pencil — all in waterproof containers — machete or stout knife, water, food, signal mirror, sunglasses, watch, small bottle of gasoline, gun and ammunition, wire or shroud lines, extra socks.

Make pack of parachute container or of fabric such as canvas or parachute cloth, which can also be used for shelter. Use pieces of parachute harness for straps. Arrange pack so weight falls on your shoulders. Keep it high so it will not bang your hips and kidney region at every step.

A tumpline across your forehead will take some of the strain off your shoulders.

Wear shoes you can walk home in or improvise footgear adequate for walking. Remember that you must depend on your feet to bring you out.

If you are in friendly territory, leave a note at the airplane for rescuers, as well as a sign visible from the air. Describe your estimated position and the route you intend to travel, and mark your trail.

If possible, remove aircraft magnetic compass and altimeter. They will help you find your route.

Carry your anti-exposure suit. It will be a good windbreak and protection from water and wet conditions anywhere in the world.

COMPASS. The magnetic compass can be your most valuable piece of equipment when traveling. In the jungle for example, most travel should be done with compass in your hand since it will be the only means of maintaining direction. The dense vegetation will obscure prominent landmarks and celestial aids.

At night, the compass is even more valuable. With the lensatic compass, set your course by setting the azimuth of your desired course under the stationery index which is viewed through the lens. Turn the glass cover until the long luminous line is over the North arrow. To use the compass after it has been set, open the compass and rotate the entire compass until the luminous line is again over the north arrow. Your desired course will be on a line drawn through the sights. When using other types of compass that have a floating needle and no luminous lines, you will be required to move in general directions: N, NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW. For most survival purposes, these general directions will suffice.

TRAVEL HINTS. Keep a sketch map of your travels, showing landmarks, distances covered, and direction. It will help you keep on a direct course, show your progress, and enable you to retrace your trail.

Always pick the easiest and safest way, even if it is the longest. Save your strength by going around obstacles instead of fighting through or climbing over them. Don't spend an hour crashing through brush around which you can walk in ten minutes. Don't go straight up a steep slope — climb at a slant, zig-zagging back and forth to save energy. Go around the edges of gullies and canyons; don't go down and climb up again out of them. Don't tackle a swamp or wet mud flat if you can walk around it.

Take it easy; keep up a steady pace. Travel a set amount of time and then rest. Periods of travel become shorter the longer you are out. You'll go farther and last longer with a steady, reasonable pace. When traveling in a party, adjust the pace to the slowest man. Don't crowd; stay 8 to 10 feet apart on the trail.

If traveling in a party, keep together. The easiest way to get lost is to get separated from your party.

If you get lost, stop. Keep calm and think back to where you went wrong. Return on the track by which you came until you recognize familiar ground. Then resume travel again.

A good way to follow a straight course is to choose two easily visible points (trees or other prominent objects) which are exactly on the line you want to follow and as far apart as possible; then walk, keeping the two points in line. Before reaching the first point, pick a third point in the same line ahead and repeat the method. Check your back course occasionally. Doing so will assure you that you are traveling in a straight line and will give a back view of landscape features which will help you recognize them if you have to backtrack. When resting, face the direction in which you are traveling, or make a pointer of stones, twigs, or scratches on the ground.

Streams and trails made by animals and human beings are the highway of the tropics and the Arctic. Raft down streams. Walk the adjacent ridges — they are likely to have animal or human trails and may have numerous forks coming down to the streams. In hilly or mountainous country, also it will be easier to follow ridges. Where the vegetation is less dense, footing is drier, and native trails are more likely.

Listen for the noise of rivers or surf. Look for trails and shelter cabins.

Keep your eyes open for plant and animal food to supplement your rations.

In case of storm or fog, make camp and wait for good visibility and better conditions before traveling. Any time you stop, mark your trail and direction of travel. You can get completely turned around even during a five-minute rest stop.

Always make camp early and before darkness, so that you can get comfortable while there is still light. Unpack only what you need. Repack before going to sleep. For shelter, see page 16. For fire making, see page 21. Organize camp-work crews. Assign set tasks for each man; it will make your camping operations quicker and easier. Be methodical.

Cross streams with care. Carry a pole and test the bottom of the stream ahead so that you won't step into a hole. The first man to cross swift streams should be roped so that other members of the party can pull him out if he is swept off his feet. Once across, he can make the rope fast on the other bank to help the rest of the men across.

Avoid swamps and wet mud flats. If you come down in one, step on roots or bunches of grass. Avoid "slick spots." In soft mud, lie flat and travel on your belly. Anti-exposure suits are invaluable in this type of terrain. If you have a life raft, you may be able to make your way out through meandering water channels.

Traveling at night without a compass will present problems in maintaining direction. The stars will provide the best means of determining directions and the best star to use is the North Star (Polaris). Due to its polar location, it will always be a reliable indicator of direction. Be careful when using other stars and remember, all stars move from east to west during the night and you must compensate for this movement.

You may be required to estimate distance traveled and this is difficult to do for untrained personnel. It is best to be conservative when estimating distance. A good basic rule is that steady going over average terrain will cover about 1½ miles per hour. Variations in pace and terrain will change this rule and you will have to adjust your estimate accordingly.

RIVER TRAVEL. You will save strength, go faster, and make rations last longer by rafting down a stream wherever you can. Raft travel is normally slow; don't try to hurry.

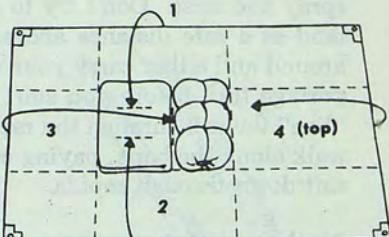
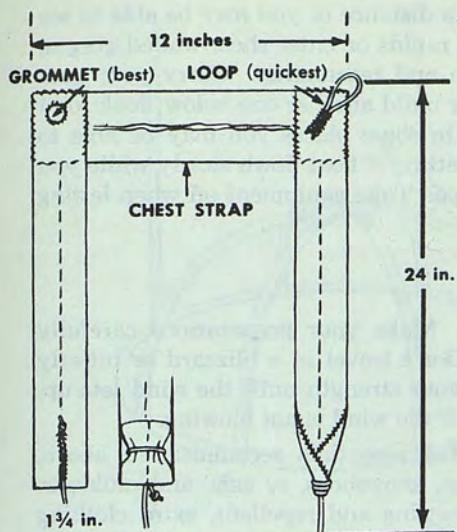
Life rafts can be used for fording or traveling over inland waters. The decision to use one depends on the weight of all the equipment you propose to take with you, and the nearness of waterways. If you use it with a sail, you may experience difficulty in keeping it on course. To reduce drifting, weight the front end with enough large stones so that it balances the weight in the rear. Rafts of sound, dry wood 5 to 7 feet wide may be made from logs 10 to 12 feet long and 6 to 8 inches in diameter. Bind them with wire, shroud lines, bark, or grass woven into a braid, or with pegs. Test the floating quality of each log. Large trees require too much effort and are frequently too heavy and unwieldy for rafts. Younger trees of desirable diameter grow on the edges of forests or on river bars.

A small, serviceable boat may be improvised by wrapping a tarpaulin around an oval framework of green saplings tied with shroud lines or vines. Lash all loose equipment to one item that will float in case of a spill.

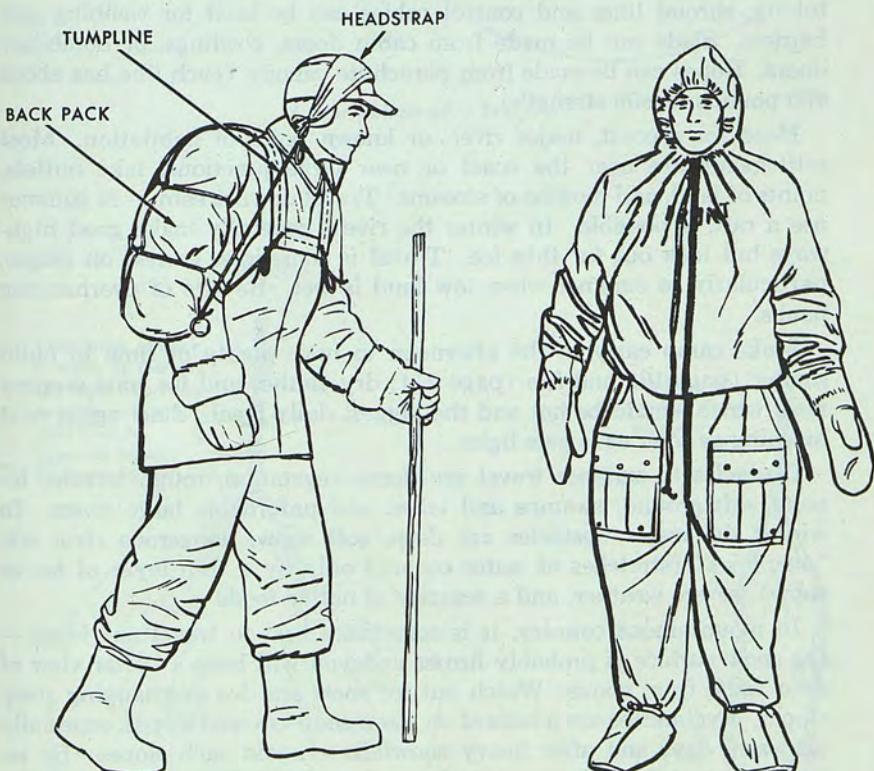
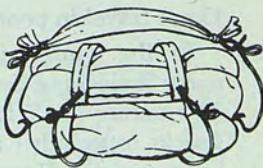
Rig up a cloth or brush shelter for protection from sun, cold, or rain, as required. Attach a 75-100 foot piece of wire, rope, or vine to the raft for tying it up or for letting it down small rapids.

Use a pole to move the raft in shallow water; in deeper water, use an improvised oar.

Travel rivers only when it is light. Keep near the shore so you can land in a hurry if necessary. If you are on the raft alone, don't go to sleep. Keep on the look-out for snags, rapids, and waterfalls. You can



TUMPLINE
ATTACHED TO
PACK



either hear rapids and waterfalls at a distance or you may be able to see spray and mist. Don't try to shoot rapids or enter sheer-walled gorges; land at a safe distance above them and reconnoiter. Carry your gear around and either carry your raft or build another one below; look for a portage trail before you start off. In some places you may be able to "line" the raft through the rapids, letting it float down slowly while you walk along the bank, paying out rope. Take equipment off when letting raft down through rapids.

Arctic

Travel in the Arctic is difficult. Make your preparations carefully and carry the proper equipment. Don't travel in a blizzard or bitterly cold wind — make camp and save your strength until the wind lets up. Don't travel in poor visibility, even if the wind is not blowing.

In the winter, in addition to the essentials recommended above, carry a sleeping bag, parka, mittens, snowshoes, or skis, and mukluks. In summer don't forget mosquito netting and repellent, extra clothing (socks especially) and shoepacs. Wear sunglasses when sun is high on snow surface. Keep feet dry, summer and winter.

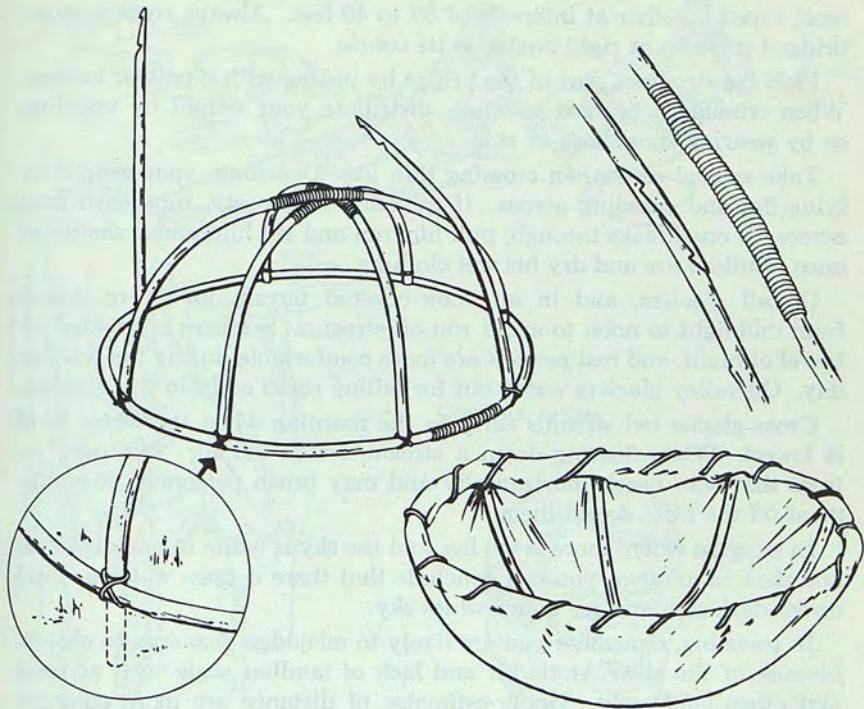
Improvise traveling aids. Make snowshoes from willow branches, airplane inspection plates, small metal panels, seat bottoms or metal tubing; shroud lines and control cables can be used for webbing and harness. Sleds can be made from cabin doors, cowlings, or bomb-bay doors. Ropes can be made from parachute canopy (each line has about 450 pounds tensile strength).

Head for a coast, major river, or known point of habitation. Most settlements are near the coast or near large junctions, lake outlets, points of land, and mouths of streams. Travel downstream — in summer use a raft, if possible. In winter the rivers generally make good highways but look out for thin ice. Travel is sometimes easiest on ridges, particularly in summer when low land is wet. Beware of overhanging banks.

Make camp early in the afternoon to have plenty of time to build shelter (page 16) and fire (page 21); dry clothes and fix your evening meal which should be hot and the biggest daily meal. Start again next morning as soon as it gets light.

Obstacles to summer travel are dense vegetation, rough terrain, insects, soft ground, swamps and lakes, and unfordable large rivers. In winter the major obstacles are deep, soft snow, dangerous river ice, "overflows" (stretches of water covered only by a thin layer of ice or snow), severe weather, and a scarcity of native foods.

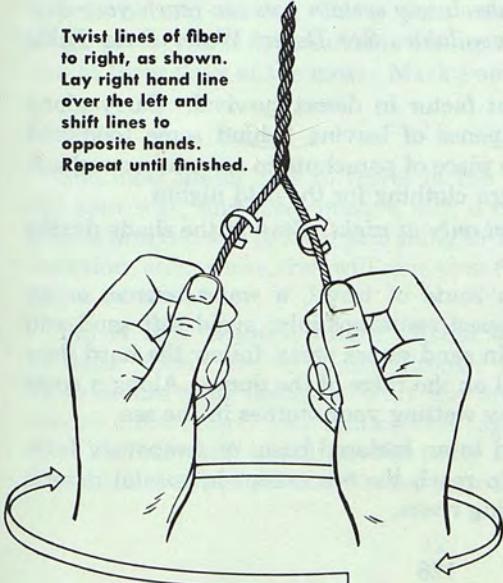
In mountainous country, it is sometimes best to travel on ridges — the snow surface is probably firmer and you will have a better view of your route from above. Watch out for snow and ice overhanging steep slopes. Avalanches are a hazard on steep snow-covered slopes, especially on warm days and after heavy snowfalls — avoid such slopes. Be especially careful on glaciers; watch out for crevasses (deep cracks in the ice) that may be covered by snow. Travel in groups of not fewer than 3



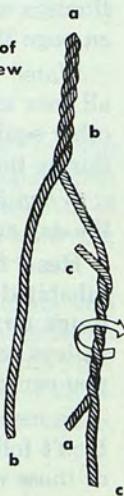
Construction of a bull boat

ANCHOR

Twist lines of fiber to right, as shown. Lay right hand line over the left and shift lines to opposite hands. Repeat until finished.



Methods of adding new material



Making a rope

men, roped together at intervals of 30 to 40 feet. Always cross a snow-bridged crevasse at right angles to its course.

Find the strongest part of the bridge by poking with a pole or ice-axe. When crossing a bridged crevasse, distribute your weight by crawling or by wearing snowshoes or skis.

Take special care when crossing thin ice. Distribute your weight by lying flat and crawling across. If traveling in a party, rope each man across. If one breaks through, pull him out and get him under shelter at once. Build a fire and dry his wet clothing.

On all glaciers, and in all snow-covered terrain in spring, travel from midnight to noon to avoid run-off streams. Surfaces are better for travel at night, and rest periods are more comfortable during the warmer day. On valley glaciers watch out for falling rocks early in the evening.

Cross glacier-fed streams early in the morning when the water level is lowest. When floating down a stream, watch out for "sweepers"—trees that lean nearly horizontally and may brush personnel or equipment off the raft. Avoid them.

In a region where there is sea ice, and the sky is white in one direction and dark in another, you can conclude that there is open water or land under dark sky, and ice under white sky.

In traveling, remember you are likely to misjudge distances to objects because of the clear Arctic air and lack of familiar scale such as trees and other landmarks. Under-estimates of distance are more common than over-estimates. Mirage is common in the Arctic.

When the sky is overcast and the ground is covered with snow, the lack of contrast makes it impossible to judge the nature of the terrain. In these conditions, men have walked over cliffs before they saw them. Do not travel in these "white out" conditions.

Desert

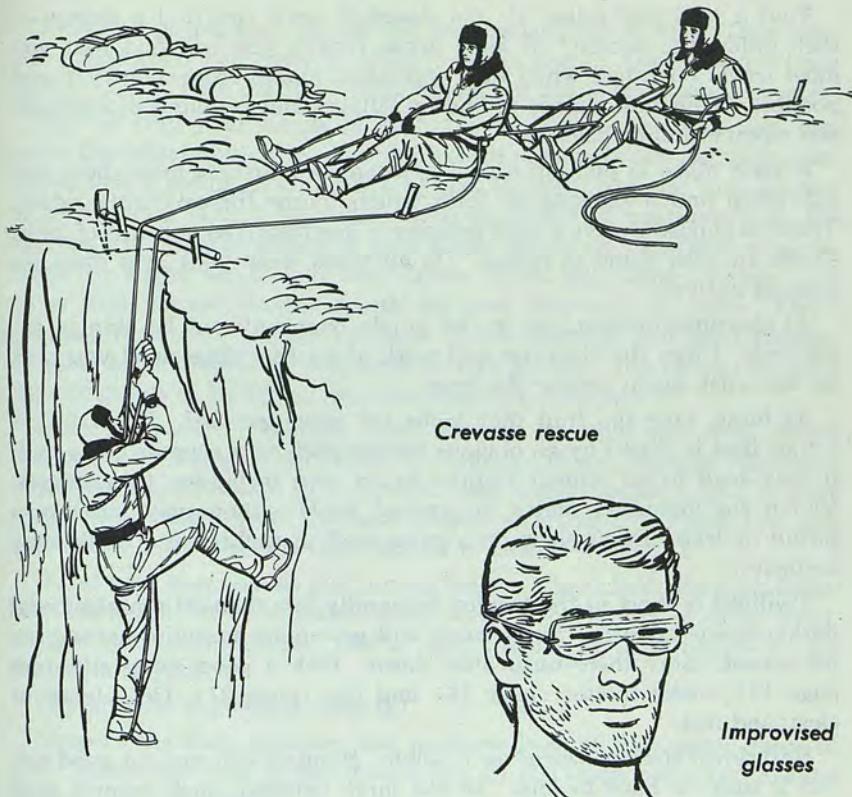
Don't travel unless you are absolutely certain you can reach your destination on the water supply available. See Desert Water Data Table on page 39.

Water is the most important factor in desert survival. Carry along all you can—even at the expense of leaving behind some food and other equipment. Take along a piece of parachute to serve as a sunshade during the day; carry some extra clothing for the cold nights.

When the days are hot, travel only at night. Stay in the shade during the day and rest; see page 19.

Head for a coast, a known route of travel, a water source, or an inhabited area. Follow the easiest route possible; avoid soft sand and rough terrain. Follow trails. In sand dunes areas, follow the hard floor valleys between dunes or travel on the ridge of the dunes. Along a coast you can conserve your sweat by wetting your clothes in the sea.

In most deserts, valleys lead to an inclosed basin or temporary lake. Don't follow streams hoping to reach the sea except in coastal deserts or those with large through-going rivers.



Crevasse rescue

**Improvised
glasses**

Take care of your feet. Clean the sand out of your shoes frequently. Distances in the desert will fool you—to play safe, multiply your estimates by three.

If a sandstorm comes up, sit or lie down or try to get into the lee of any natural shelter. Cover your mouth and nose with a piece of cloth, protect your eyes and stay put until the storm blows over, usually one to three days at the most. Mark your direction of travel.

Tropics

The most useful aids to travel in the tropics are a *machete*, to help cut your way, find food, make a raft; a *compass*, for maintaining direction; a *first aid kit*, to keep you going in the face of fever and the risk of infection; *stout shoes*, that will save your feet and enable you to walk out; and a *hammock*.

Travel only when it's light. Avoid obstacles such as thickets and swamps. Don't try to crash through thick jungle; push vegetation aside or use your machete. Part the brush to pass through, cut your way as a last resort. Don't climb over logs if you can walk around them. You not only will avoid injuries such as a sprained or broken ankle, bruises, and scratches but will save your strength as well.

Find a trail and follow it. Go downhill until you find a stream—then follow the stream. In some dense jungles you will find that you must travel on ridges when thin vegetation makes cross-country travel possible. Your best chance of finding villages and people is along trails and streams and on coasts.

A good place to pick up a trail is where two streams meet; here you will often find a crossing of trails which follow the adjoining ridges. There is almost always a trail crossing a low pass over a range of hills. Trails are also found at rapids. On all trails, keep your eyes open for signs of natives.

At clearings or openings in the jungle, you may not be able to see the trail. Cross the clearings and work along the edges until you pick up the track again among the trees.

At forks, take the trail that looks the most traveled. Don't follow a trail that is closed by an obvious barrier such as a rope or grass mat; it may lead to an animal trap or to an area forbidden to strangers. Watch for disturbed places on animal trails—they may indicate a pitfall or trap. Don't sleep on a game trail at night—the traffic may be heavy.

Twilight is short in the tropics (generally less than 30 minutes) and darkness sets in early. Make camp and get under mosquito netting before sunset. Stay there until after dawn. Pick a good camp site (see page 19); make shelter (page 16) and fire (page 21). Get plenty of sleep and rest.

Raft down streams whenever possible. Bamboo will make a good raft but it may be hard to find. To cut large bamboo, hack around stem below joint and then break. Soft, light wood, such as balsa, is easy to work and makes the best raft material.

If you are traveling on a river, land and make camp before dusk. Avoid the hazard of rising water resulting from violent rainstorms by pitching your camp on high ground well above the high-water mark (shown by mud line on trees). Moor your craft with a long line so that it will not be upset or pulled under as the water rises. Remove equipment from raft at night.

NATIVES

General

Let the natives contact you. With few exceptions, natives are friendly. They know the country, its trails, waterways, available food and drink, and the way back to civilization. They can be your best help; it all depends on the way you handle them.

Deal with the recognized headman or chief to get what you want. Ask for help; don't demand it.

The important thing in approaching natives is to show friendliness, courtesy, and patience. Don't act scared. Don't threaten or display a weapon. Don't make sudden movements. Don't give a native cause to fear you; fear makes him hostile. Smile frequently.

Primitive people may be shy and unapproachable at first. They may run away when you enter a village or meet them. Approach a village slowly. Don't rush matters. Stop where you are — sit down and relax.

Call or clap your hands to attract the native's attention. Let him make the initial approach. It is best to wait until only one native is near, rather than a group. A native will be glad to help a survivor who appears to be in need. Don't be afraid to be an object of amusement to the natives. Be ready to entertain with songs, games, or any tricks of cards, coins, or string which you may know. Rock salt, twist tobacco, and silver (not paper) money should be used discreetly in trade. Don't overpay a native. It leads to later embarrassment and even danger. Display proper identification, such as a U. S. flag. You can go far with sign language or by acting out your needs or questions.

Once the ice is broken, go ahead and ask for what you need. Some one may understand a few words of English. If not, use sign language; natives are accustomed to it because they communicate a lot by signs themselves. State your business simply and frankly. Once you win confidence, later dealings are a matter of common sense.

Treat your new friends like human beings. Don't look down on them. Don't laugh at them or make fun of them. Don't bully or drive them. People who violate these "don'ts" get a spear in their bellies or get knifed in their sleep.

If you make a promise, keep it.

Respect the local customs and manners even if they seem queer to you. Remember that to the natives you are the queer one. You are the stranger in their home.

Respect personal property. Always make some kind of payment for what you receive or take, but don't overpay.

Paper money is worthless in most places. Hard coin is good; in many places it has exchange value; in most places it has value as jewelry or trinkets. In isolated places, matches, tobacco, salt, razor blades, empty containers, or cloth may be worth more to the natives than any form of money.

Leave the native women alone at all times.

Respect privacy; don't go into a house unless you are invited. If you want to contact some one in a house, call or send a child in.

Certain areas may be taboo. They range from religious or sacred spots to diseased or danger areas. Certain animals must not be killed. Learn what the rules are and follow them.

If you have to live with natives for some time, do your share of entertaining them with tricks, games, songs, and dances. Be a good audience, too.

Don't take offense at pranks played on you; most primitive people are fond of practical jokes. If you're a victim, join in the fun; be a good sport.

Try to pick up at least a few words of the local language. The natives will like you for it and will help you learn if you show an interest.

Don't ask questions that can be answered by "yes" or "no." If you ask: "Does this trail go to the river?" — the native feels that is what you want to know and he will probably say "yes" to make you happy. Ask the question this way: "Which is the shortest way to the river?" Or: "How do you get to the river?" Or: "Where does this trail go?"

Learn all you can from the natives about woodcraft and getting food and drink. The knowledge will help you if you have to travel out on your own.

Take the natives' advice on local hazards; they know their country. Find out from friendly natives where there are hostile tribes. Frequently natives insist that distant tribes are hostile. They generally can be trusted only in their opinion of immediate neighbors.

Natives suffer from diseases which you can catch. Build a separate shelter, if you can. The natives will probably help you build one. Avoid physical contact *without seeming to do so*. If you can do it *without giving offense*, prepare your own food and drink. If you're asked why you boil water, explain that it's your own personal custom; and they will respect it.

Whatever you do, leave a good impression. Other men in the same fix may come along later. Make it easier for them.

Always be friendly, firm, patient, and honest. Be generous but not lavish. Be moderate.

Arctic

Natives are relatively few and all in North America and Greenland are friendly.

Eskimos live mostly along the coasts. Indians are found along streams and rivers in the interior.

Prospectors, trappers, and hunters are sparsely scattered.

The natives have little enough to eat. Don't take advantage of their hospitality. Eat their food sparingly. Offer payment when you leave.

Desert

Most permanent habitations are along the coasts or near water holes and oases. In most deserts, the inhabitants are nomadic herdsmen, but their sense of hospitality is very strong. A lone traveler can expect water, food, and shelter from any desert people.

Hostile parties may be met in southern Arabia. Some Arabs welcome distinguished visitors by firing into the air; don't confuse a noisy welcome for hostility.

The Mohammedans who live in the African and Middle East deserts are proud and independent people who take their religion seriously. Be especially careful not to offend them.

Tropics

Natives and habitation are found mostly along the coasts or along streams and trails.

If you take food from native gardens when no one is around, leave some payment.

If you use natives as guides, remember that most natives are familiar only with the local area where they live. As you move beyond this area, get new guides who live in and know the region in which you're traveling.

SURVIVAL AT SEA

IMMEDIATE ACTION

Check List

Stay clear of the airplane (out of gas-saturated waters) but in the vicinity until it sinks.

Search for missing men.

Salvage floating equipment; stow and secure all items and check rafts for inflation, leaks, and points of possible chafing. Bail out your raft. Be careful not to snag it with shoes or sharp objects.

In cold oceans, put on your exposure suit, if available. Rig a wind-break, spray shield, and canopy. If you are with others, huddle together; exercise regularly.

Check the physical condition of all aboard. Give first aid if necessary (see page 4). Take seasickness pills if available. Wash off gasoline from yourself.

If there is more than one raft, connect rafts with at least 25 feet of line. Connect rafts *only* at life line around outer periphery of raft. Unless the sea is very rough, shorten the line if you hear or see an airplane. Two or more rafts tied close together are easier to spot than scattered rafts.

Get the emergency radio into operation. Directions are on the equipment. Use emergency transceiver only when aircraft are known to be in the area. Prepare other signaling devices for instant use.

Keep compasses, watches, matches, and lighters dry. Place them in waterproof containers.

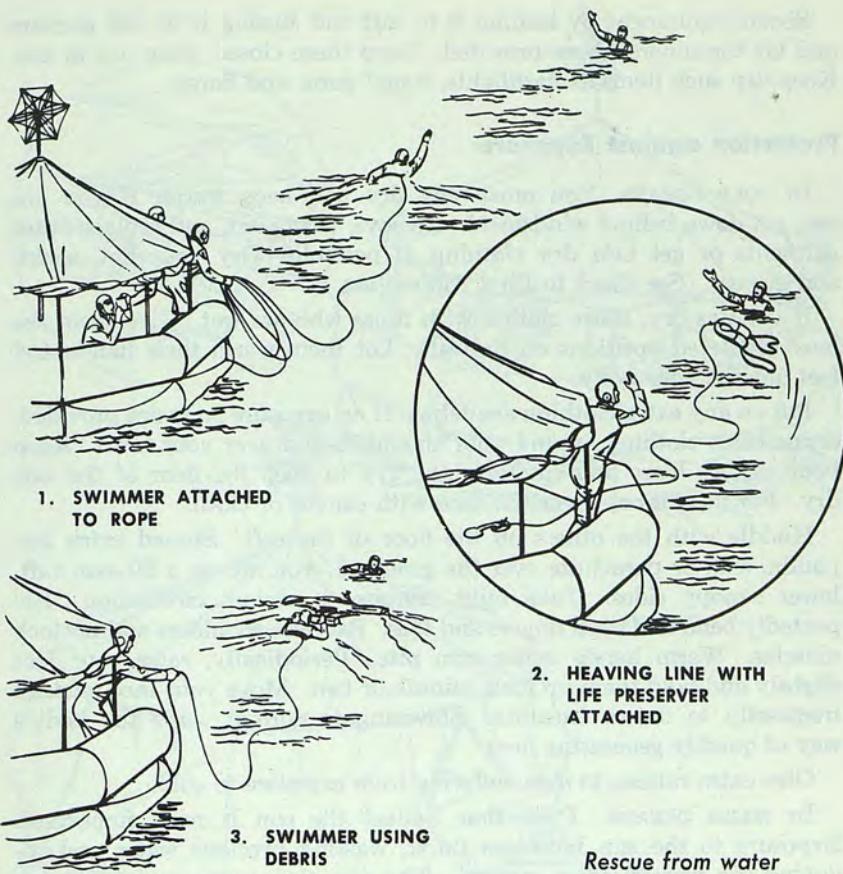
In warm oceans, rig sun shade and canopy. Keep your skin covered. Use sunburn cream and chapstick. Keep your sleeves rolled down and your socks pinned up or pulled up over trousers. Wear a hat and sunglasses.

Make a calm estimate of your situation and plan your course of action carefully.

Ration water and food; assign duties to the crew. Assign duties to crew only, if possible. Use canopy or paulins for catching and storing rainwater.

Keep a log. Record the navigator's last fix, time of ditching, names and physical condition of personnel, ration schedule, winds, weather, direction of swells, times of sunrise and sunset, and other navigation data. Inventory all equipment.

Keep calm. Save water and food by saving energy. Don't shout unnecessarily. Don't move around unnecessarily. Keep your sense of humor sharp; use it often. Remember that rescue at sea is a cooperative project. Search aircraft contacts are limited by the visibility of survivors. Increase your visibility by using all possible signaling devices.



Rescue from water

Keep your mirrors handy; use your radio whenever you can; use your signal panel and dye marker when you think an aircraft can see them.

Personnel

As soon as the rafts are assembled and tied, make a careful check of the physical condition of personnel. Give first aid to the injured.

Make a thorough search for missing men. Carefully patrol the entire area near the crash, especially in the direction toward which waves are moving. Look very carefully — some of the missing men may be unconscious and floating low in the water. If men are in the water and sharks are in the vicinity, use shark deterrent.

Equipment

Inspect all debris that comes from the airplane. Salvage all rations, canteens, thermos jugs, and other containers, parachutes, seat cushions, extra clothing, and maps. Don't overlook the tube containing the kite and balloons for emergency radio. Beware of sharp metal objects.

Secure equipment by lashing it to raft and storing it in raft pockets and kit containers where provided. Keep these closed when not in use. Keep dry such items as flashlights, signal guns, and flares.

Protection against Exposure

IN COLD OCEANS. You must stay dry and keep warm. If you are wet, get down behind windshield. Remove, wring out, and replace outer garments or get into dry clothing, if possible. Dry your hat, socks, and gloves. (See shock in First Aid section.)

If you are dry, share clothes with those who are wet. Give them the most sheltered positions on the raft. Let them warm their hands and feet against your body.

Put on any extra clothing available. If no exposure suits are provided, drape extra clothing around your shoulders and over your head. Keep your clothes loose and comfortable. Try to keep the floor of the raft dry. For insulation, cover the floor with canvas or cloth.

Huddle with the others on the floor of the raft. Spread extra tarpaulin, sail, or parachute over the group. If you are on a 20-man raft, lower canopy sides. Take mild exercise to restore circulation. Repeatedly bend and open fingers and toes. Exercise shoulders and buttock muscles. Warm hands under arm pits. Periodically, raise your feet slightly and hold them up for a minute or two. Move your face muscles frequently to detect frostbite. Shivering is normal — it's the body's way of quickly generating heat.

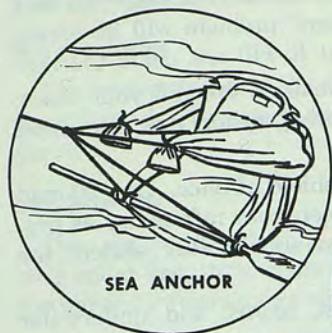
Give extra rations to men suffering from exposure to cold.

IN WARM OCEANS. Protection against the sun is most important. Exposure to the sun increases thirst, wasting precious water and reducing the body's water content. The sun also causes serious burns. Improvise and get under a sun shade. If you are on a 20-man raft, erect the canopy and furl the sides. Use the paulin, light side up, to attract attention; blue side up for camouflage in unfriendly waters. In rigging your sun shade (see illustration), leave space for ventilation. In a 1-man raft, use the spray shield for sun shade.

Keep your body well covered. Don't throw any clothes away. Roll down your sleeves; pull up your socks. Close your collar. Wear a hat or improvised headgear. Use a piece of cloth as a shield for the back of your neck. Wear sun glasses or improvise eye cover from cloth. (See illustrations, page 127.)

Care of Raft

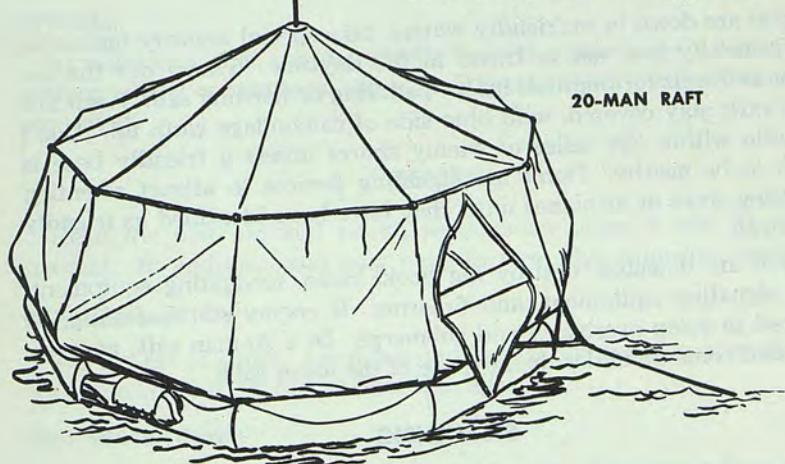
Be sure that your raft is properly inflated. If main buoyance chambers are not firm, top off with pump or mouth inflation tube. See that valve is open before pumping (to open, turn to the left). Inflate cross seats where provided unless there are injured men who must lie down. Don't overinflate. Air chambers should be well rounded but not drum tight. Close valve tight. Regularly check inflation. Hot air expands, so on hot days release some air. Add air when the weather cools.



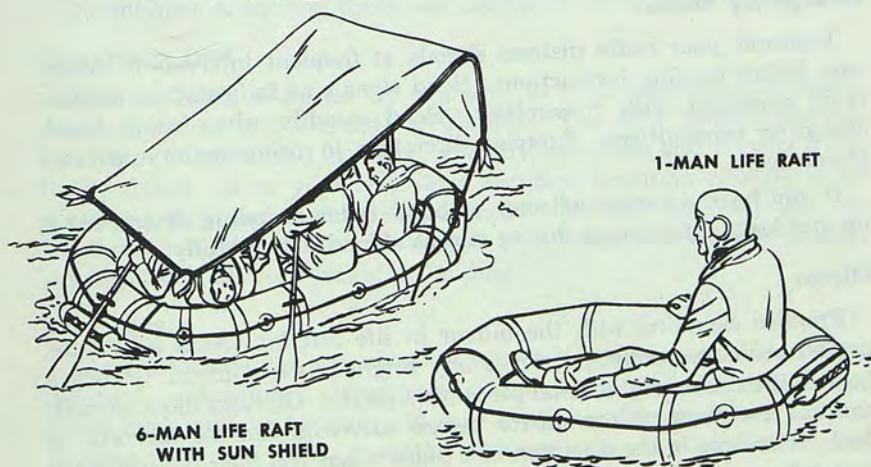
SEA ANCHOR



20-MAN RAFT



6-MAN LIFE RAFT
WITH SUN SHIELD



1-MAN LIFE RAFT

Types of rafts

Always throw out the sea anchor or improvise a drag from the raft case, bailing bucket, or roll of clothing. A sea anchor will help you stay close to your ditching site, and your searchers' problem will be easier. Wrap the sea anchor rope with cloth so that it will not chafe the raft.

Be careful not to snag the raft. In good weather, take off your shoes; tie them to the raft. Don't let fishhooks, knives, ration tins, and other sharp objects cut. Keep them off the bottom.

In stormy weather, rig the spray and windshield at once. In a 20-man raft, keep the canopy erected at all times. Keep your raft as dry as possible. Keep it properly balanced. All men should stay seated, the heaviest men in the center.

Leaks are most likely to occur at valves, seams, and underwater surfaces. They can be repaired with the repair plugs provided. Most multi-place rafts have buoyancy tubes separated into two chambers. If one chamber is damaged, keep the other fully inflated.

Measures to Avoid Detection

If you are down in unfriendly waters, take special security measures. It is generally best not to travel in the daytime. Throw out the sea anchor and wait for nightfall before paddling or hoisting sail. Keep low in the raft; stay covered, with blue side of camouflage cloth up. Don't use radio within 250 miles of enemy shores unless a friendly base is known to be nearby. Don't use signaling devices to attract attention of passing ships or airplanes until they have been identified as friendly or neutral.

If you are detected, destroy log book, radio, navigating equipment, maps, signaling equipment, and firearms. If enemy starts strafing, be prepared to jump overboard and submerge. In a 20-man raft, go overboard and come up under the airspace of the lower tube.

SIGNALING

Emergency Radio

Transmit your radio distress signals at frequent intervals or otherwise follow briefing instructions. Send signals as indicated in instructions packaged with transmitter. Send steadily when using hand-energized transmitters. Exercise discretion in using battery-operated transceivers.

If you have a corner reflector or other radar signaling device, set it up and leave it up except during storms. Handle it carefully.

Mirror

Practice signaling with the mirror in life raft kit. As a substitute, use an ordinary pocket mirror or any bright piece of metal. Punch a hole in the center of the metal piece for sighting. On hazy days, aircraft can see the flash of the mirror before survivors can see aircraft, so flash the mirror in the direction of a plane when you hear it, even when you cannot see it. When the airplane is sighted, keep signaling. Some

raft paddles and oars are coated with material which will reflect the beam of a searchlight at night.

Pyrotechnics

Use smoke signals in the daytime and red signals at night. Keep signal flares dry; don't waste them. *Be very careful of fire hazard when using flares.*

Sea Marker

Use sea marker during daytime only in friendly areas. Except in very rough sea, these spots of dye remain conspicuous for about 3 hours. Conserve by rewapping when not in use.

Lights

At night, use flashlights, recognition light, or the blinker signal light of the radio. Any light can be seen over water for several miles.

Whistle

At night or in fog, use the whistle from the emergency kit to attract surface vessels or people on shore, or to locate another raft if it becomes separated.

HEALTH

Read the first aid and health sections on pages 4 and 31 of this manual. In addition, you may have to treat the following conditions.

Seasickness

Do not eat or drink. Lie down and change the position of your head. Take seasickness remedy at once if available.

Salt Water Sores

Do not open or squeeze them; use antiseptic. Keep sores dry.

Immersion Foot

This condition is caused by exposure to cold, immersion in water, cramped quarters, restricted circulation. You will notice tingling, numbness, redness, and swelling. Blotchy red areas and blisters eventually appear. Keep your feet warm and dry; maintain circulation by exercising toes and feet; loosen footgear. Elevate feet and legs for 30-minute periods several times a day. If you are suffering from immersion foot, stay off your feet after landing.

Sore Eyes

Glare from sky and water may cause your eyes to become bloodshot, inflamed, and painful. Wear regular sunglasses or improvise an eye shield from cloth or bandage. If your eyes hurt, bandage them lightly. Moisten a piece of gauze or cotton with sea water and lay it over your eyes before bandaging.

Constipation

Lack of bowel movement is normal on rafts. Don't be disturbed about it. Don't take laxatives even if available. Exercise as much as possible.

Difficulty in Urinating

The dark color of urine and difficulty in passing it are normal — don't get worried.

Mental Disturbances

Fear is normal among men in dangerous situations. Admit your feeling to yourself but carry on in spite of it. Remember that other men have had the same fear, yet have come through similar experiences. Fatigue and exhaustion resulting from severe hardships often lead to mental disturbances, which may take the form of extreme nervousness, excessive and violent activity, or depression. The best prevention is to get as much sleep and rest as possible. When not resting, keep busy with routine raft duties. Seeing mirages is not a sign of mental unbalance. Cheerfulness is a tonic and will spread to others.

Cracked and Parched Lips and Skin

Use chapstick or any oil or salve.

Frostbite

Frostbite may occur when wet skin is exposed to wind during winter in northern oceans. Your face, ears, hands, and feet are most susceptible. Try to keep them dry and covered. If your shoes are tight, take them off and wrap your feet in dry cloth. (See page 9 for treatment.)

Sunburn

Keep your head and skin covered. Stay in the shade. Use cream or chapstick from kit. Remember that reflection from water causes sunburn, too. Protect your neck with an improvised shield.

WATER AND FOOD

Water

Water is your most important need. With it alone you can live for ten days or longer, depending on your will to live.

SHORT WATER RATIONS. When your water supply is limited and cannot be replaced by chemical or mechanical means, but only by chance rain, use it efficiently. Keep your body well shaded both from overhead sun and from reflection off the sea surface. Allow ventilation of air; dampen your clothes during the hottest part of the day. Do not exert yourself. Relax and sleep when possible. Fix your daily water ration after considering the amount of water you have, the output of sun stills and de-salting kit, the number and physical condition of your party.

If you have no water, don't eat. If your water ration is two quarts or more per day, you may eat any part of your ration or any additional

food that you may catch, such as birds, fish, shrimp, crabs, etc. The motion of a life raft and the excitement may cause nausea; and if you eat when nauseated, you may lose your food immediately. So rest and relax as much as you can, and take only water.

To cut down loss of water by sweating in hot weather, soak your clothes in the sea and wring them out before putting them on again. Don't overdo this during hot days when no canopy or sun shield is available. Be careful not to get the bottom of the raft wet.

Watch the clouds and be ready for any chance shower; keep paulin handy for catching water. If your paulin is encrusted with dried salt, wash it in sea water. Normally, a small amount of sea water mixed with rain will hardly be noticeable and will not give you any bad physiological reaction. In rough seas you cannot get uncontaminated fresh water.

At night, secure your paulin as for sun shade and turn up its edges to collect dew. Rain water does not always satisfy; it lacks minerals and is tasteless. Mix it with a little sea water, or dissolve hard candy or coffee or tea solubles in it to give it taste. When it rains, drink as much as you can hold.

SUN STILLs. When sun stills are available, read instructions and set them up immediately. Use as many stills as possible, depending on the number of men in your raft and the amount of sunlight available. Secure sun stills to raft with care.

DE-SALTING KITS. When de-salting kits are available in addition to sun stills, use them only for immediate water needs or during long periods of overcast when sun stills cannot be used. In any event, retain de-salting kits and emergency water stores for such periods when you cannot use sun stills or catch rain water.

Don't drink body fluids of fish, urine, or salt water. They are dangerous.

In Arctic winters, use old sea ice for water. This ice is bluish, has rounded corners, and splinters easily. It is nearly free from salt. New ice is gray, milky, hard, and salty. Water from icebergs is fresh, but icebergs are dangerous to approach and should be used as a source of water only in emergencies.

See water section of "Survival on Land," page 36 of this manual.

Food

FISH AND FISHING. Most fish in the open sea are edible. Do not under any circumstances try to examine or eat jelly-fish. They are messy and can sting. If your fishing kit is lost, improvise hooks from insignia pins, pencil clips, shoe nails, pocket knives, fish spines, bird bones, and pieces of wood. Make hooks small and use as light a line as possible. You can get cord from shoe laces, parachute shroud lines, or thread from clothes. First catch small fish that usually will gather underneath the shadow of your raft or that you may shake out of clumps of seaweed — such as crabs or shrimp. Use them for bait, with heavier hooks and lines, for dolphin or any other large fish. Fish will generally be attracted to the shadow of your raft. Make a spear by lashing a knife to

an oar; use it for large fish which cannot be caught with a hook. Use dip net to scoop up fish, crabs, and shrimp. If the net is lost, make one from mosquito head-net, parachute cloth, or clothing fastened to a section of oar. In using either the dip net or an improvised net, hold it under water and scoop upward.

Shine flashlight on water at night or use a mirror to reflect moonlight onto the water. The light will attract fish. At night some fish, especially flying fish, may land in your raft. Do not be alarmed by any fish that sails in, but be sure to secure it for food. Rig your rubber sheeting in such a way that it will reflect moonlight. Natives use this trick to get leaping or flying fish.

When fishing, don't make lines fast to the raft or person. Fish or bright objects dangling in water alongside of raft may attract large dangerous fish. Be careful. Large fish should be handled without capsizing or damaging raft. Land fish with net or harpoon. Avoid spiny fish and those with teeth. Kill fish with a blow on the head before you bring them into the raft. Don't molest large fish or sharks by shooting or spearing.

Clean and cut all fish immediately and eat them before they spoil. To preserve any fish left over, cut them into thin strips and dry thoroughly in the sun. Don't eat eggs or liver. Don't eat fish with unpleasant odor, pale, slimy gills, sunken eyes, flabby skin, or flesh that stays dented when pressed. All guts of fish and birds can be used for bait. Sea turtles are good for bait, too. Kill them by shooting them in the head; or snag them with a hook and then kill with blows on the head. Avoid their beaks and claws. The liver and fat are edible. The muscle is tough but can be chewed for a while, then thrown away.

BIRDS. All birds are potential food. They can be caught on baited hooks, triangular pieces of shiny metal, or by a baited toggle of metal or wood. (See illustration of toggle on page 153 of this manual.) Many birds will be attracted to the raft as a possible perching place. Sit still in the raft and they may settle on the raft or even on your head or shoulder. Grab them as soon as they have folded their wings. But don't grab until you are sure you can reach the bird.

SHARKS. Avoid attracting or annoying sharks. Most of them are scavengers, continuously on the move for food. If they don't get it from you, they will lose interest and swim on. Their flesh is extremely strong and smells of ammonia. Chances of being attacked by sharks are very small. Even in warm oceans where attacks are possible, you can reduce the risk by knowing what to do and how to do it.

When not in the raft, keep a sharp lookout for sharks. Use shark repellent, if available and if sharks are in the vicinity. Keep your clothing and shoes on. If your group is threatened or attacked by a shark, bunch together and form a tight circle. Face outward so that you can see an approaching shark. If the sea is rough, tie yourselves together. Ward off actual attack by kicking or stiff-arming shark.

If you are apparently undetected, stay as quiet as you can. Float to save energy. If you must swim, use strong, regular strokes; don't

make frantic, irregular movements. When swimming alone, stay away from schools of fish.

If a single large shark threatens at close range:

Use strong, regular swimming movements; try feinting toward the shark — he may be scared away.

Don't swim away directly in the shark's path; face him and swim quickly to one side to avoid him.

As a last resort, kick or stiff-arm a shark to push him away.

Make loud sounds by slapping the surface of the water with cupped hands. Use regular strokes.

Use knife at close quarters in a showdown. Stab the shark in gills or eye.

If a shark threatens to attack or to damage the raft, discourage him by jabbing snout or gills with oar (be careful not to break the oar and don't take roundhouse swings that may upset you).

Fire a pistol above a shark — it may frighten him away.

Look for sharks around and under your raft before you go into the water.

Sharks are known to be curious and will often investigate any large floating object. After investigation, the shark will usually swim away. At other times it may approach or circle the object in the water and bump or nudge it. Sharks are attracted by blood and vomit, body waste, and garbage. Therefore, these should be discarded in small amounts as far away from the raft as possible. Don't clean fish into water when sharks are sighted.

Any contact with the rasp-like skin of a shark will cause brush wounds. The severity of these wounds will depend on the size of the shark and its speed at impact. Hit the shark with your bare hand only as a last resort. Try shouting or screaming under water, as this has been found effective by many skin divers.

If injured, it is important to remain in the raft. When in the raft, do not dangle your arms or legs over the side. Remove jewelry or other bright objects which might attract a shark. Dark-colored clothing and equipment are preferable to light-colored ones. Don't fish from the raft when sharks are nearby. Abandon hooked fish if a shark approaches.

If bitten, the first and most important measure is to quickly control hemorrhage and shock. Get into a raft or ashore as soon as possible, stop bleeding, and treat for shock. If in the water in a group, you should circle the victim and apply a tourniquet improvised from an article of clothing or a large gauze pressure bandage if available.

Should any member of your party die, his body should be thrown overboard, preferably at night, and the survivors moved as far from it as possible.



SURVIVAL SWIMMING

If you are equipped with a B-5 life vest (Mae West) you have the ability to stay afloat for an extended period. When entering the water from the aircraft or in your parachute, discharge only one of the CO₂ cartridges. The inflation resulting from one cartridge will keep you afloat whereas two will hamper your activity.

Even without a preserver, a man who knows how to relax in the water is in very little danger of drowning, especially in salt water. Trapping air in your clothes will help to buoy you up in the water and give you a rest. If you are in the water for long periods, you will have to rest from treading water. If you are an experienced swimmer and able to float on your back, do so if the sea conditions permit. Always float on your back if possible. If you can't float on your back or if the sea is too rough, practice the following technique:

Resting erect in the water, inhale. Put your head face down in the water and stroke with your arms. Then rest in this face-down position until you feel the need to breathe again. Raise your head, exhale, support yourself by kicking arms and legs, inhale, and then repeat the cycle.

Two types of underarm life preservers, the MA-2 and the LPU-2 are available for use when flying over water. These preservers were designed to overcome some of the deficiencies of the B-5 vest. Proper adjustment of the preserver after it has been inflated will provide a preserver with many in-the-water advantages. It will provide excellent flotation even for personnel who have lost consciousness.

This type of preserver allows for removal of the parachute harness without complete deflation of the preserver. This may be done by:

1. Partially deflating one cell and pulling this cell about half way inside the harness. Then slip this side of the harness off the shoulder.
2. Reinflate the partially deflated cell by mouth.
3. Repeat the above process for removal of the other shoulder strap.
4. Step out of, or unhook leg straps.

The preserver may be inflated without removal of the harness, or opening any fittings on the parachute. These advantages will provide for safer water entry and reduce the ingestion of sea water to a minimum, thereby reducing the possibility of becoming sick. Another advantage

of the preserver is that it can be unsnapped in front making it much simpler to enter the raft.

SEAMANSHIP

Put out your sea anchor immediately. Do not attempt to navigate your raft unless within sight of shore or in unfriendly waters. Remember that the majority of successful rescues are made within seven days of ditching. You can't go very far on a raft in seven days.

Watches and Lookouts

Assign watches; they should not exceed two hours. All men should serve except those who are badly injured or completely exhausted. Keep at least one lookout posted at all times. He should watch for signs of land, passing vessels or planes, wreckage, seaweed, schools of fish, birds, and signs of chafing or leaking of raft. Tie him to the raft with at least a 10-foot line.

Traveling

Whether you like it or not, your raft will move. The course it will take is the result of both wind and ocean current, modified by the use of oars or paddles, tiller, sea anchor, and sails.

USING OCEAN CURRENTS. When ocean currents are moving toward your destination, but the winds are unfavorable, put out a sea anchor. Huddle low in the raft to offer as little wind resistance as possible. In the open ocean, currents seldom move more than 6 to 8 miles a day.

USING THE WIND. Life rafts are not equipped with keels, so they can't be sailed into the wind even if you are an experienced sailor. However, anyone can sail a raft downwind, and multi-place (except 20-man) rafts can be successfully sailed 10° off from the direction of the wind. Don't try to sail your raft unless you know that land is near.

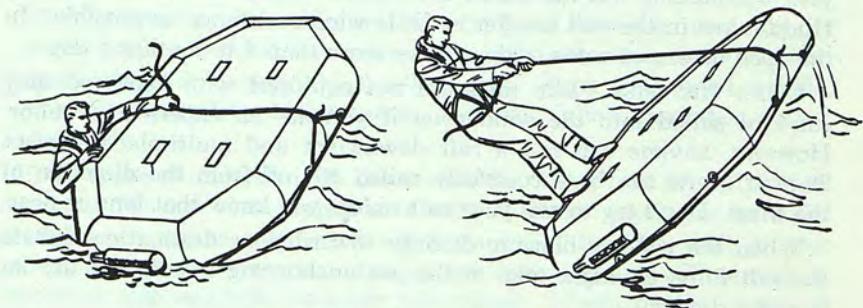
When the wind is blowing directly toward your destination, inflate the raft fully, sit high, take in the sea anchor, rig a sail, and use an oar as a rudder.

In a multi-place (except 20-man) raft, rig a square sail in the bow, using oars with their extensions as mast and cross-bar. If the regular sail is not available, substitute the waterproof tarpaulin or one or two thicknesses of parachute cloth. If the raft has no regular mast socket and step, erect the mast by tying it securely to the front cross seat; provide braces. Whether or not a socket is provided, pad the bottom of the mast to prevent it from chafing or punching a hole through the floor. The heel part of a shoe with the toe wedged under the seat makes a good improvised mast step.

Don't secure both corners of the lower edge of the sail. Hold the line attached to one corner in your hand so that a sudden storm or gust of wind will not rip the sail, break the mast, or capsize the raft.



Raft with sail rigged



Correct method for righting raft

Raftsmanship

Take every precaution to prevent your raft from turning over. In rough weather, keep the sea anchor out from the bow; sit low in the raft, with the passengers' weight distributed to hold the weather side down. Don't sit on the sides or stand up. Never make sudden movements without warning the other men. Don't tie a fishline to yourself or the raft; a large fish may capsize the raft.

In rough seas tie stern of first raft to bow of second and rig sea anchor to stern of second raft. Use approximately a 25-foot line between rafts;

adjust the length of the line to suit the sea. Keep the sea anchor line long; adjust its length so that when the raft is at the crest of a wave, the sea anchor will stay in a trough. In very rough weather, keep a spare sea anchor rigged and ready for instant use in case the one that is out breaks loose.

When the sea anchor is not in use, tie it to the raft and stow it so that it will hold immediately if the raft capsizes.

To right multi-place (except 20-man) rafts, toss the righting rope over the bottom, move around to the other side, place one foot on flotation tube, and pull on the righting rope. If you have no righting rope or if you can't improvise one from the sea anchor line, a belt, or a shirt, slide up on the bottom, reach across, grab the life-line on the far side, and then slide back into the water, pulling the raft back and over. Most rafts are equipped with righting handles on the bottom. Twenty-man rafts are identical on both sides and therefore require no righting.

If several men are in the water, one should hold down the far side of the multi-place (4-6 man) raft while the rest climb in singly from the other side. Grasp the seat to haul yourself in, or use the boarding ladder provided on the newest types of raft. Without help, the best place to board the raft is over the end. If the wind is blowing, board the raft with the wind at your back. The 20-man raft is provided with a deflated boarding station, which is hand-inflated after occupants are aboard.

To board the 1-man raft, climb in from the narrow end; slide up as nearly horizontal as possible.

Making a Landfall

The lookout should watch carefully for signs of land.

A fixed cumulus cloud in a clear sky or in a sky where all other clouds are moving often hovers over or slightly downward from an island.

In the tropics a greenish tint in the sky is often caused by the reflection of sunlight from the shallow lagoons or shelves of coral reefs.

In the Arctic, ice fields or snow-covered land are often indicated by light-colored reflections on clouds, quite different from the darkish gray caused by open water.

Deep water is dark green or dark blue. Lighter color indicates shallow water which may mean land is near.

In fog, mist, rain, or at night when drifting past a nearby shore, you may sometimes detect land by characteristic odors and sounds. The musty odor of mangrove swamps, and mud flats, and the smell of burning wood will carry a long way. The roar of surf is heard long before the surf is seen. Continued cries of sea birds from one direction indicate their roosting place on nearby land.

In the tropics mirages may be seen, especially during the middle of the day. Care should be taken not to mistake a mirage for nearby land. A mirage will disappear or change its appearance and elevation if viewed from slightly different heights.

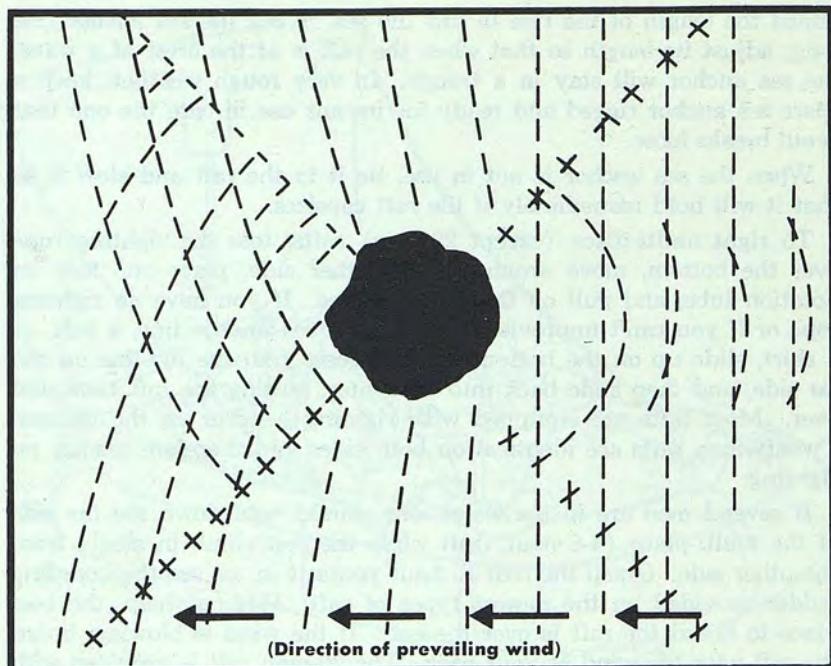


Diagram of wave patterns about an island

Usually more birds are found near land than over the open sea. The direction from which flocks fly at dawn and to which they fly at dusk may indicate the direction of nearby land. During the day, birds are searching for food and the direction of flight has no significance.

Wave Forms

You may be able to detect land by the pattern of the waves, which are refracted as they approach land. The illustration above shows the form the waves assume. As you note this pattern, turn parallel to the slightly turbulent area marked "X" on the illustration and follow its direction. This should bring you to land.

Getting Ashore

SWIMMING SHORE. Wear your shoes and at least one thickness of clothing if you plan to swim ashore. In unknown waters use the side or breast stroke to conserve strength.

If surf is moderate, ride in on the back of a small wave by swimming forward with it. Shallow dive to end your ride just before the wave breaks.

In a high surf, swim shoreward in the trough between waves. When the seaward wave approaches, face it and submerge. After it passes, work shoreward in the next trough.

If you are caught in the undertow of a large wave, push off the bottom or swim to the surface and proceed shoreward as above.

If you must land on a rocky shore, look for a place where the waves rush up onto the rocks. Avoid places where the waves explode with a high white spray. Swim slowly in making your approach — you will need your strength to hold on to the rocks.

After selecting your landing point, advance behind a large wave into the breakers. Face shoreward and take a sitting position with your feet in front, two or three feet lower than your head, so that your feet will absorb shocks when you land or strike submerged boulders or reefs.

If you don't reach shore behind the wave you have picked, swim with hands only. As the next wave approaches, take sitting position with feet forward. Repeat procedure until you land.

Water is quieter in the lee of a heavy growth of seaweed. Take advantage of such growth. Don't swim through the seaweed; crawl over the top by grasping the vegetation with overhand movements.

Cross a rocky reef just as you would land on a rocky shore. Keep your feet close together and your knees slightly bent in a relaxed sitting posture to cushion blows against coral.

RAFTING ASHORE. The one man raft can be used in most cases with no danger. Going ashore in a strong surf is dangerous. Take your time. Select your landing point carefully. Try not to land when the sun is low and straight in front of you. Try to land on the lee side of an island or of a point of land. Keep your eyes open for gaps in the surf line, and head for them. Avoid coral reefs and rocky cliffs. Coral reefs don't occur near the mouths of fresh water streams. Avoid rip currents or strong tidal currents which may carry you far out to sea. Either signal shore for help or sail around and look for a sloping beach where the surf is gentle.

If you have to go through surf to reach shore, take down the raft mast. Keep your clothes and shoes on to avoid severe cuts. Adjust and inflate your life vest. Trail the sea anchor over the stern with as much line as you have. Use the oars or paddles and constantly adjust the sea anchor to keep a strain on the anchor line. It will keep your raft pointed toward shore and prevent the sea from throwing the stern around and capsizing you. Use the oars or paddles to help ride in on the seaward side of a large wave.

Surf may be irregular and velocity may vary, so your procedure must be modified as conditions demand. A good method of getting through surf is to have half the men sit on one side, half on the other, facing each other. When a heavy sea bears down, half should row toward the sea until the crest passes; then the other half should row toward the shore until the next sea comes along.

Against strong wind and heavy surf, the raft must have all possible speed to pass rapidly through the oncoming crest in order to avoid being turned broadside or thrown end over end. If possible, avoid meeting a large wave at the moment it breaks.

In medium surf with no wind or offshore wind, keep raft from passing over a wave so rapidly that it drops suddenly after topping the crest. If the raft turns over in the surf, try to grab hold.

As the raft nears the beach, ride in on the crest of a large wave. Paddle or row hard and ride in onto the beach as far as you can. Don't jump out of the raft until it has grounded. Then get out quickly and beach it.

If you have a choice, don't land at night. If you have reason to believe that the shore is inhabited, lay away from the beach, signal, and wait for the inhabitants to come out and bring you in.

When embarking, keep the oars and any tools steady that you may hold in your hands. Hold your oars and paddles firmly. Don't let any tools fall into the water. If you fall into the water, don't swim. Turn over to the side. Because of strong winds, a long swim in existing surf will drown you. Between the constant waves and currents, you cannot go out far enough to be safe.

When embarking, don't hold your oars or paddles firmly. Don't let any tools fall into the water. If you fall into the water, don't swim. Turn over to the side. Because of strong winds, a long swim in existing surf will drown you. Between the constant waves and currents, you cannot go out far enough to be safe.

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SURVIVAL ON SEA ICE

Much of the material on Arctic survival also applies to sea ice survival. Read the main section of this manual as well as this section.

IMMEDIATE ACTION

Your action after landing should follow as closely as possible the check list given below.

1. Take care of the injured.
2. Check your clothing to make sure that it provides maximum possible protection against cold and wet.
3. Establish temporary shelter immediately — and if possible build a fire inside the shelter.
4. Try to establish radio contact with rescuers.
5. Make a survey of surrounding area to determine the safest camp site, considering the availability of food and water and the closeness to crashed aircraft if it is remaining on the surface.
6. Build a camp. (Do not use the interior of aircraft as shelter unless it is absolutely necessary.)
7. Try to find and mark a safe landing area for use of rescue planes.

IMPORTANT: Do not get separated from your party. There is always a danger of floes moving apart. In very broken ice, rope party together. Always have ropes handy. (The parachute shroud line is excellent for this purpose.)

DECISION TO STAY OR TRAVEL

Unless you know that you are within walking distance of land, stay at the scene of the crash or as close to it as ice conditions will permit. If you are on ice which is breaking up, you will have to travel to the nearest stable ice or to land before you make your camp.

SHELTER

The only materials available for shelter building are snow, ice, parts of the aircraft, aircraft equipment, and parachutes. If you have a twenty-man raft aboard the aircraft it will make an excellent shelter with the canopy erected. Be sure to anchor the raft securely. Snow suitable for cutting into blocks will not be found on open ice but usually forms in the lee of pressure ridges or ice hummocks.

Construct your shelter on solid ice floes as far away as possible from open water or from cracks which may open into water leads.

Level off a circular space ten feet in diameter. Build a circular wall of snow blocks at least four feet high. In the center of this circle, build a pillar of snow blocks higher than the snowblock walls. Stretch one or more parachute canopies over the wall and pillar; and drape excess material over the outside wall for extra insulation.

Dig snow from a trench around the outside border of the snow wall. Tuck excess parachute material into this trench and anchor it tightly by replacing the snow.

Cut an opening for the door 90° from prevailing wind; and screen it with a tunnel or L-shaped entrance of snow blocks.

This shelter is suitable for not more than five men.

Remember that all shelters with inside fires should be well ventilated.

Snow-house construction is very difficult for the inexperienced man but not impossible. If time permits, try to construct a shelter of this type, for it offers the best protection possible. For aid in constructing it, follow the diagrams closely.

If snow is not available, it may be possible to make a shelter of thin ice slabs. Make it as small as convenient, so that less area will have to be heated. Use the lee side of a pressure ridge that seems old and solid. You can make this shelter with your hands alone, if necessary.

Overturned, inflated life rafts make excellent mattresses.

Arrange your equipment inside the shelter so that you can pack it in a hurry. *Any ice floe at any time of the year may break up. Leads may form at any time.* Be ready to move your camp at a moment's notice.

FIRE-MAKING

Combustible material is limited to aircraft contents and animal fats.

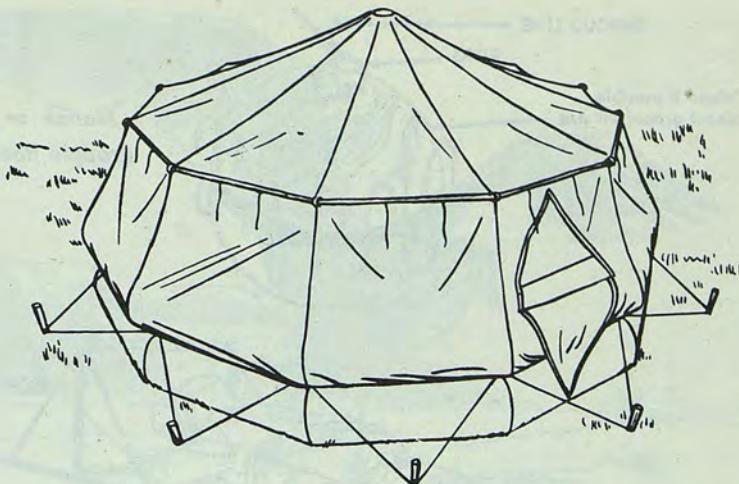
To use airplane oil and gasoline, you will need a metal container. Oil can be burned in it with a wick cut from a parachute harness or other material. To burn gasoline, soak your parachute harness or other material in it and burn the material.

You can burn animal fats in a metal container by using a wick to ignite the fat and adding more fat as old fuel is consumed.

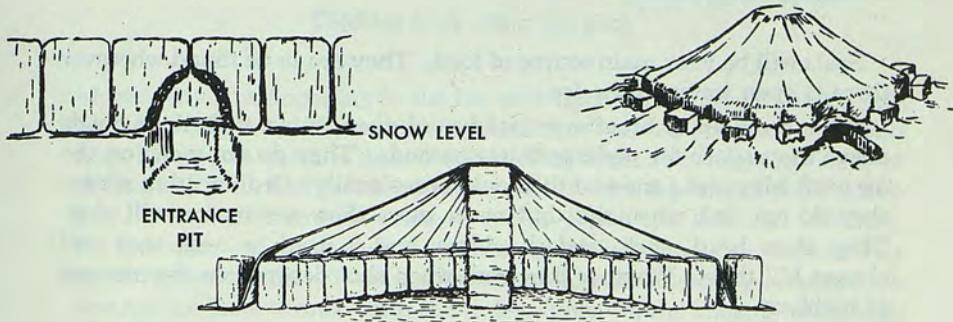
Seal blubber will make a satisfactory fire without a container, if gasoline or heat tablets are available to provide an initial hot flame. Light the tablets on the raw side of the blubber, with the hairy side on the ice. It should ignite quickly if four tablets are burned at once. A square foot of blubber will burn for several hours. Large blubber fires need no shelter; in fact, the stronger the wind, the better the fire. Tinder of any description burned with the heat tablets will help; but once the blubber catches fire, save your heat tablets. The smoke from a blubber fire is dirty black and heavy but not nauseating. The flame is very bright and can be seen for several miles. The smoke will penetrate your clothes and blacken your skin—but no one will be around to object. Burned blubber cinders are edible; in fact, carbon from seal-oil lamps was the original Eskimo chewing gum.

FOOD AND WATER

Your only available foods on polar ice are game and foods from the sea. Game animals include polar bear, seal, and occasional foxes. Birds may be found in the summertime. They can be caught with baited fish hooks, as illustrated on page 153.



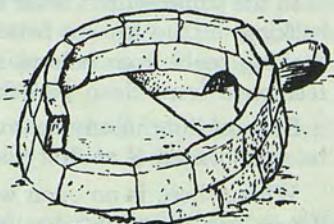
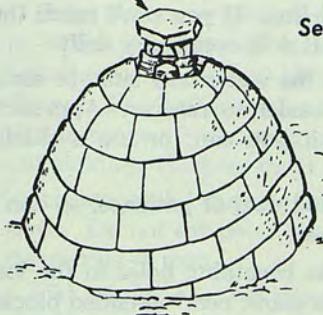
Twenty-man raft used as a shelter on sea ice



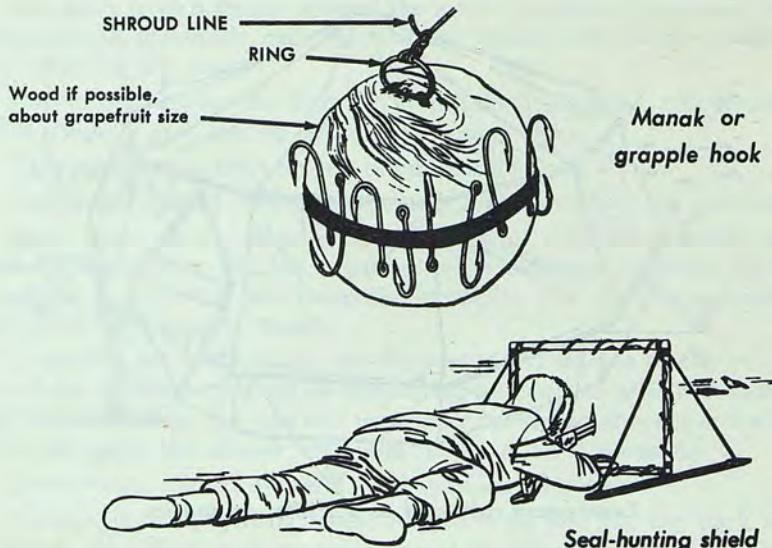
Snow block parachute shelter



Seal bone blubber stove



Snowhouse



Seals will be your main source of food. They are to be found wherever there is open water in the ice.

Seals come up to breathe in patches of open water, with their heads above the surface for perhaps thirty seconds. They do not come on the ice until May and June and then only occasionally. Ordinarily in winter they do not sink when shot but never more than one in five will sink. They show head, neck, and shoulders; and a head or neck shot will always kill them. Whether they sink when shot depends on the amount of blubber.

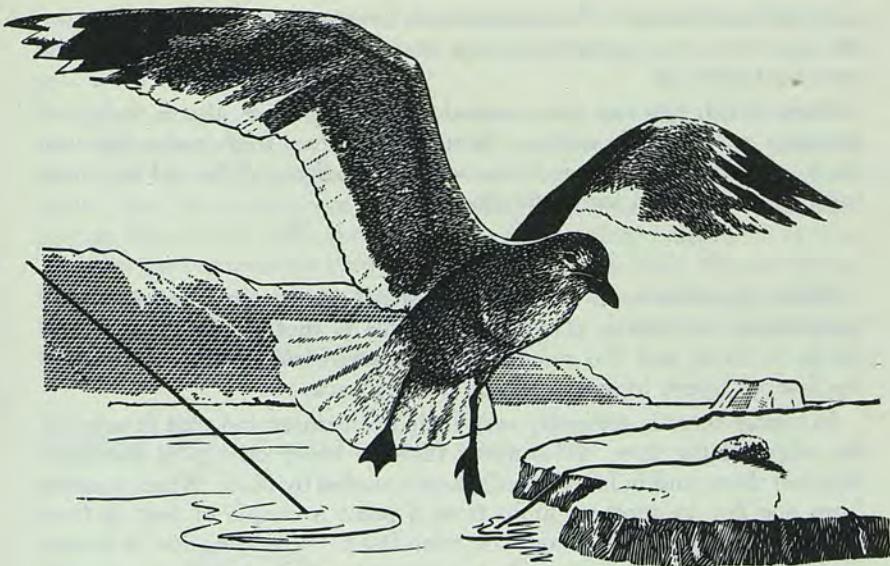
During February and March, the male seal has a disagreeable odor, which does not, however, greatly affect the taste of the meat and does not make it poisonous. Almost all of the seal can be used. You can make moccasins from the skin, use the blubber for fuel, and eat the flesh. Frozen seal meat, especially frozen liver, is palatable and easily swallowed. Cook it thoroughly if you can, for seals may have trichinosis.

You can recover a seal from the water with an improvised "Manak" or grapple hook attached to a throwing weight. A weight made of material which floats is ideal but not absolutely essential. A shroud line attached to the weight is a satisfactory pull line. If you can't reach the seal with a grapple, move to the ice where it will eventually drift.

In the summertime, seals that are shot in the water may sink; so seals basking on the ice are better targets and easier to recover. Approach basking seals from behind natural cover, if you can; or use a shield fashioned from clean parachute material.

Seal hunting in any season requires a good deal of patience, so don't be discouraged if at first you do not succeed.

Where there is no open water, seals make breathing holes in the ice. These breathing holes are usually under the snow, near up-ended blocks



Catching birds with a fish hook

of ice. Any small opening in the ice, with open water beneath, is a possible breathing hole. If you have or can improvise a 3-pronged hook, you may be able to catch a seal at a breathing hole with only the labor of setting the hook and pulling out the seal. To the 3-pronged hook attach a wire, section of control cable, or a heavy line two or three feet long. At the other end of the wire, put a stout piece of wood or a metal bar to serve as a toggle. To set the hook, enlarge the breathing hole enough to drop the hook through into the water. Then let the hook drop through the hole to the full length of the wire, with the toggle across the top of the hole acting as an anchor. Then cover the hole with snow and erect a marker near it so that you can find it again. If the seal uses that particular hole, he will almost be sure to hook himself, since breathing holes are usually only a little larger than the seal's body.

Check your hooks once or twice a day. Any movement of the toggle or disturbance of the snow and ice in the hole means a seal on the hook. If you catch a seal, you will probably have to enlarge the hole to get his body through.

Polar bears are very curious and are dangerous especially if wounded or if the female's cub is molested. If two or more bears are sighted simultaneously, always shoot the largest, thereby eliminating the latter danger. Don't chase polar bears; their natural curiosity will bring them within range of your weapon. They may also be shot in the water without sinking. Recover them as you would seals.

Always cook bear meat until well done. Almost all bears have trichinosis. Do not eat polar bear liver. Its high vitamin A content makes it dangerous to man.

Old sea ice has lost most of its salt and can be used as a source of drinking water. The best test for finding out whether ice is fresh or salty

is to melt and taste it. With experience, however, you can recognize the old ice, since it is generally rough and different in texture from the recently frozen ice.

Snow which has not been soaked by salt spray is also a source of drinking water. After a thaw, there may be free fresh water between the ice and the snow cover. In summer, the melting of the old ice forms fresh water pools on top of the floes.

TRAVEL

Travel conditions on sea ice vary greatly from place to place and from season to season. The smoothest ice is that frozen in protected fjords or bays; and the roughest, the pressure ridges formed between the fast ice frozen to shore and the moving pack.

In winter there is generally very little open water and that is between the edges of the floes. In summer there is water on top of the floes, between them, and in large openings surrounded by floes. When crossing from one floe to another, jump from a point a couple of feet in from the edge of the ice, not from the edge itself. When the ice is closely packed, you can walk as though it were solid — using, of course, obvious common sense. You can easily tell if the touching or overlapping edges are solid enough to walk on.

When large, heavy floes are touching each other, the ice between the floes is usually ground and powdered and can bear no weight, but moving with the powdered ice will be larger chunks that can hold you up. The powdered ice may be as much as 20 feet wide, but if you will move against the ice, you will usually find a place to cross, especially when moving ice touches fast ice frozen solidly to shore.

When crossing pressure ridges, be careful to step only on solid ice. Bridges of snow can form between peaks of ice and these bridges are not always solid.

During winter and spring, floating ice is usually solid enough to hold up a freight train; but in fall, until December, you must be careful of it, as large patches may not be strong enough to hold up a man. If you have no ice spear, knife, or other means of testing the ice, see if you can leave a distinct foot mark on it. If you can't, the ice is safe to cross.

In general, solid sea ice four inches thick will hold just about anybody.

Springtime melting can make an ice surface very rough. Salty sea ice also becomes soft and honeycombed in spring, even though the air temperature remains below freezing. It is advisable to avoid areas of ice covered with melt water, because the surface beneath is likely to be pitted and rough. It is true, however, that melt water standing on ice is an indication of the soundness of that ice. As thawing progresses, the water disappears into the ice, indicating that it is honeycombed and therefore weak and unreliable. After the melt water runs off, the ice surface is dry, white, soft, and sticky.

Sometimes in spring, water on the ice refreezes on the surface leaving a layer of slush beneath. This bad condition is to be expected following a cold snap during break-up.

It is a good idea to wear an anti-exposure suit when traveling over broken or slushy ice. It will keep you dry and warm even if you fall into the water.

Maintaining a straight course over sea ice is very difficult due to the lack of landmarks, blowing snow, and fog. Even with a compass one man has difficulty keeping to a desired course. Two can do a little better, but three men are needed when visibility is low. One man always stands still while the other two move in single file ahead of him. The last man carries the compass and lines up the other two on course. Then the rear man moves up and the process is repeated. If possible, build snow cairns or leave flags to mark your back trail and use as reference points for back sighting.

BY ORDER OF THE SECRETARY OF THE AIR FORCE

OFFICIAL



CURTIS E. LE MAY
Chief of Staff

R. J. PUGH
Colonel, USAF
Director of Administrative Services

RELIGIOUS READINGS
PROTESTANT SCRIPTURAL SELECTIONS

For all have sinned, and come short of the glory of God. Romans 3:23

But he was wounded for our transgressions, he was bruised for our iniquities; the chastisement of our peace was upon him; and with him; and with his stripes we are healed. All we, like sheep, have gone astray; we have turned every one to his own way; and the Lord hath laid on him the iniquity of us all. Isaiah 53:5-6

For he hath made him to be sin for us, who knew no sin; that we might be made the righteousness of God in him. II Corinthians 5:21

For whosoever shall call upon the name of the Lord shall be saved. Romans 10:13

For by grace are ye saved through faith; and that not of yourselves; it is the gift of God; not of works, lest any man should boast. Ephesians 2:8-9

Verily, Verily, I say unto you, he that heareth my word, and believeth on him that sent me, hath everlasting life, and shall not come into condemnation; but is passed from death unto life. John 5:24

That if thou shalt confess with thy mouth the Lord Jesus, and shalt believe in thine heart that God hath raised Him from the dead, thou shalt be saved. For with the heart man believeth unto righteousness; and with the mouth confession is made unto salvation. Romans 10:9, 10

Therefore being justified by faith, we have peace with God through our Lord Jesus Christ. Romans 5:1

If we walk in the light, as He is in the light, we have fellowship one with another, and the blood of Jesus Christ His Son cleanseth us from all sin. I John 1:7

Psalm 91

He that dwelleth in the secret place of the most High shall abide under the shadow of the Almighty.

I will say of the Lord, He is my refuge and my fortress: my God; in him will I trust.

Surely he shall deliver thee from the snare of the fowler, and from the noisome pestilence.

He shall cover thee with his feathers, and under his wings shalt thou trust:

His truth shall be thy shield and buckler.

Thou shalt not be afraid for the terror by night: nor for the arrow that flieth by day:

Nor for the pestilence that walketh in darkness; nor for the destruction that wasteth at noonday.

A thousand shall fall at thy side, and ten thousand at thy right hand; but it shall not come nigh thee.

Only with thine eyes shalt thou behold and see the reward of the wicked.

Because thou hast made the Lord, which is my refuge, even the most High, thy habitation,

There shall no evil befall thee, neither shall any plague come nigh thy dwelling

For he shall give his angels charge over thee, to keep thee in all thy ways.

They shall bear thee up in their hands, lest thou dash thy foot against a stone.

Thou shalt tread upon the lion and adder: the young lion and the dragon shalt thou trample under feet

Because he hath set his love upon me, therefore will I deliver him: I will set him on high, because he hath known my name.

He shall call upon me, and I will answer him: I will be with him in trouble; I will deliver him, and honour him.

With long life will I satisfy him, and shew him my salvation.

Psalm 32

Blessed is he whose transgression is forgiven, whose sin is covered.

Blessed is the man unto whom the Lord imputeth not iniquity, and in whose spirit there is no guile.

When I kept silence, my bones waxed old through my roaring all the day long.

For day and night thy hand was heavy upon me: my moisture is turned into the drought of summer. Selah.

I acknowledged my sin unto thee, and mine iniquity have I not hid. I said, I will confess my transgressions unto the Lord; and thou forgavest the iniquity of my sin. Selah.

For this shall every one that is godly pray unto thee in a time when thou mayest be found; surely in the floods of great waters they shall not come nigh unto him.

Thou art my hiding place; thou shalt preserve me from trouble; thou shalt compass me about with songs of deliverance. Selah.

I will instruct thee and teach thee in the way which thou shalt go: I will guide thee with mine eye.

Be ye not as the horse, or as the mule, which have no understanding: whose mouth must be held in with bit and bridle, lest they come near unto thee.

Many sorrows shall be to the wicked: but he that trusteth in the Lord, mercy shall compass him about.

Be glad in the Lord, and rejoice, ye righteous: and shout for joy, all ye that are upright in heart.

Psalm 23

The Lord is my shepherd; I shall not want.

He maketh me to lie down in green pastures; he leadeth me beside the still waters.

He restorcth my soul: he leadeth me in the paths of righteousness for his names' sake.

Yea, though I walk through the valley of the shadow of death, I will fear no evil: for thou are with me: thy rod and thy staff they comfort me.

Thou preparest a table before me in the presence of mine enemies: thou anointest my head with oil; my cup runneth over.

Surely goodness and mercy shall follow me all the days of my life, and I will dwell in the house of the Lord forever.

CATHOLIC

1. Act of Perfect Contrition

O My God, I love Thee above all things because Thou art all-good and worthy of all my love, and because of this I am truly sorry for all my sins. With the Help of Thy Grace I will not offend Thee any more.

2. A Little Prayer to be Recited Often

"My Jesus, mercy! Mary, help me!"

3. A Prayer by One in Danger

O God, I beseech Thee, watch over me in this present danger. Give me such a strong faith that no human respect may ever lead me to deny it or fear to practice it. If it be Thy Holy Will that I be called by Thee, Thy Will be done. If it be Thy Holy Will that I be spared, I promise Thee that by Thy Grace I will lead a life in conformity with Thy Holy Will. Good Shepherd, come what may, I have recourse to Thee. Thou art my hope and trust. Amen.

4. The Our Father

Our Father, Who art in heaven, hallowed be Thy name; Thy kingdom come; Thy will be done on earth as it is in heaven. Give us this day our daily bread; and forgive us our trespasses as we forgive those who trespass against us; and lead us not into temptation, but deliver us from evil. Amen.

5. Act of Faith

O my God, I firmly believe that Thou art one God in three Divine Persons, Father, Son and Holy Ghost; I believe that Thy Divine Son became man, and died for our sins, and that He will come to judge the living and the dead. I believe these and all the truths which the Holy Catholic Church teaches because Thou hast revealed them, Who canst neither deceive nor be deceived.

6. Act of Hope

O my God, relying on Thy infinite goodness and promises, I hope to obtain pardon of my sins, the help of Thy grace and life everlasting, through the merits of Jesus Christ, my Lord and Redeemer.

7. Act of Love

O my God, I love Thee above all things, with my whole heart and soul, because Thou art all-good and worthy of all love. I love my neighbor as myself for love of Thee. I forgive all who have injured me and ask pardon of all whom I have injured.

JEWISH

Hear, Oh Israel, the Lord our God, the Lord is One.
Blessed be His name, whose glorious kingdom is forever and ever.
The Lord shall reign forever, thy God, O Zion, unto all generations.
Praise ye the Lord.

Remember us unto Life, Oh King, who delightest in Life, and inscribe us in the Book of Life for Thine own sake, Oh living God.

Forgive us, O our Father, for we have sinned; pardon us, O our King, for we have transgressed; for thou dost pardon and forgive. Blessed art thou, O Lord, who are gracious and dost abundantly forgive. Look upon our affliction and plead our cause, and redeem us, speedily for thy name's sake; for Thou art a mighty Redeemer. Blessed art Thou, O Lord, the Redeemer of Israel.

Without beginning, without end; to him belong strength and dominion. And he is my God — my Redeemer liveth — and a rock in my travail in time of distress; And he is my banner and my refuge, the portion of my cup on the day when I call.

Into his hand I commend my spirit, when I sleep and when I wake; And with my spirit, my body also: the Lord is with me, and I will not fear.

O praise the Lord, all ye nations; Laud Him, all ye peoples. For His mercy is great toward us; and the truth of the Lord endureth forever. Hallelujah.

O God, Thou art my God, earnestly will I seek Thee; my soul thirsteth for Thee, my flesh longeth for Thee, In a dry and weary land, where no water is.

So have I looked for Thee in the sanctuary, To see Thy power and Thy glory.

For Thy loving kindness is better than life: My lips shall praise Thee. So will I bless Thee as long as I live: In Thy name will I lift up my hands.

My soul is satisfied as with marrow and fatness; and my mouth doth praise Thee with joyful lips; When I remember Thee upon my couch, And meditate on Thee in the night-watches.

For Thou hast been my help, And in the shadow of Thy wings do I rejoice. My soul cleaveth unto Thee; Thy right hand holdeth me fast.

But those that seek my soul, to destroy it, shall go into the nethermost parts of the earth. They shall be hurled to the power of the sword;

They shall be a portion for foxes. But the kind shall rejoice in God; Every one that sweareth by Him shall glory; For the mouth of them that speak lies shall be stopped.

Thirteen Principles of Faith

1. Magnified and praised be the living God: he is, and there is no limit in time unto his being.
2. He is One, and there is no unity like unto his unity; inconceivable is he, and unending is his unity.

3. He hath neither bodily form nor substance: we can compare naught unto him in his holiness.
4. He was before anything that hath been created — even the first but his existence had no beginning.
5. Behold he is the Lord of the universe: to every creature he teacheth his greatness and his sovereignty.
6. The rich gift of his prophecy he gave unto the men of his choice, in whom he gloried.
7. There hath never yet arisen in Israel a prophet like unto Moses, one who hath beheld his similitude.
8. The Law of truth God gave unto his people by the hand of his prophet who was faithful in his house.
9. God will not alter nor change his Law to everlasting for any other.
10. He watcheth and knoweth our secret thoughts: he beholdeth the end of a thing before it existeth.
11. He bestoweth loving kindness upon a man according to his work: he giveth to the wicked evil according to his wickedness.
12. He will send our anointed at the end of days, to redeem them that wait for the end — his salvation.
13. In the abundance of his loving kindness God will quicken the dead. Blessed forevermore be his glorious name.

Cause us, O Lord our God, to lie down in peace, and raise us up, O our King, unto life. Spread over us the tabernacle of Thy peace: direct us aright through Thine own good counsel; save us for Thy name's sake; be Thou a shield about us; remove from us every enemy, pestilence, sword, famine and sorrow; remove also the adversary from before us and from behind us. O shelter us beneath the shadow of Thy wings; for Thou, O God, art our Guardian and our Deliverer; yea Thou, O God, art a gracious and merciful King; and guard our going out and our coming in unto life and unto peace from this time forth and forevermore.

Praise ye the Lord, Praise, O ye servants of the Lord, praise the name of the Lord. Let the name of the Lord be blessed from this time forth and for evermore. From the rising of the sun unto the going down thereof the Lord's name is to be praised. The Lord is High above all nations, and his glory above the heavens. Who is like unto the Lord our God, that dwelleth so high: that looketh down so low upon the heavens and the earth? He raiseth up the lowly out of the dust, and liftest up the needy from the dunghill; that he may set him with princes; even with the princes of his people. He maketh the barren woman dwell in her house as a joyful mother of children. Praise ye the Lord.

INDIVIDUAL ORGANIZATIONAL CLOTHING AND EQUIPMENT RECORD (Male)
(AR 735-35)

PART I - PERSONAL CLOTHING

NAME (Last, First, Middle Initial) AND SOCIAL SECURITY
ACCOUNT NUMBER (If available, addressograph plate may be used)

TABER, JOHN L.

001-34-2754

DROS 17 July 70

ETS 24 MAY 72

DOR 25 MAY 70

MOS 1981

RANK 1LT

Use pencil for authorized allowances, sizes and balances;
ink for remaining entries.

ISSUES OR TURN-INS (Date)

BALANCE

MANDATORY CLOTHING ALLOWANCES (AR 700-8400-1)	AUTH ALLOW	SIZE	1	2	3	4	5	6	7	8	9	10	11	12
BAG, DUFFLE OD														
BELT, TROUSERS, COTTON, WEB														
BOOTS, COMBAT, LEATHER, BLK														
BUCKLE, BELT														
CAP, GARRISON AG-344														
CAP, SERVICE AG-44														
CAP, UTILITY OG-106														
COAT, WOOL, AG-44														
COAT, LW AG-344														
DRAWERS, COTTON WHITE														
GLOVE, INSERTS, WOOL OG-108														
GLOVE, SHELLS, LEATHER BLACK														
HANDKERCHIEF, WHITE														
INSIGNIA, BRANCH OF SERVICE EP														
INSIGNIA, BRANCH OF SERVICE, U.S., EP														
INSIGNIA, SERVICE CAP, BRONZE EM														
NECKTIE, WOOL, BLACK														
OVERCOAT, WL, AG-44														
RAINCOAT, AG-274														
SHIRT, CTN, KHAKI SS														
SHIRT, CTN/POLYESTER, SH 446														
SHIRT, UTILITY OG-107														
SHOE, DRESS OXFORD, BLACK														
SOCKS, COTTON, BLACK														
SOCKS, CUSHION, SOLE, OG 408														
TOWEL, BATH, WHITE														
TRousERS, WOOL, AG-44														
TRousERS, LW WP AG-344														
TRousERS, COTTON, KHAKI														
TRousERS, UTILITY OG-107														
UNDERSHIRT, COTTON, $\frac{1}{2}$ SLEEVE, WHITE														
NECKLACE, PERSONNEL, ID TAG														
TAG, IDENTIFICATION PERS														

TYPE OF ISSUE OR TURN-IN

LEGEND FOR

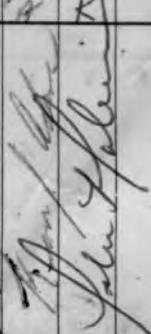
ISSUE	K - ISSUE IN KIND G - GRATUITOUS ISSUE M - PURCHASE FROM MAINTENANCE ALLOWANCE B - BALANCE CARRIED OVER FROM OLD FORM
TURN-IN	A - AUTHORIZED TURN-IN C - ADMINISTRATIVE CREDIT

ENLISTED INDIVIDUAL MUST ACKNOWLEDGE
ISSUES AND AN OFFICER MUST ACKNOWLEDGE
TURN-INS BY SIGNING IN APPROPRIATE
COLUMNS.

SIGNATURES - ENLISTED (Issues)

OFFICER (Turn-Ins)

PART II - ORGANIZATION/INSTALLATION CLOTHING AND EQUIPMENT

DISCRETIONARY	AUTH ALLOW	SIZE	ISSUES OR TURN-INS (Date)												BALANCE
			1	2	3	4	5	6	7	8	9	10	11	12	
BAG, WATERPROOF CLO OG-107			/		/										/
BELT, PISTOL	/		/	/	/										/
BLANKET, BED WL	/		/	/	/										/
CANTEEN, WATER	/		/	/	/										/
CARRIER, INTRENCH TOOL			/	/	/										/
CARRIER, SLEEPING BAG			/	/	/										/
CASE, FIELD FIRST AID	/		/	/	/										/
CASE, SA AMMO	/		/	/	/										/
COVER, CANTEEN WATER	/		/	/	/										/
CUP, CANTEEN															
FIELD PACK, CANVAS															
FORK, FIELD MESS															
INTRENCHING TOOL, COMBIN															
KNIFE, FIELD MESS															
MATTRESS, PNEUMATIC															
PAN, MESS															
SHELTER HALF, W/LP&P															
SLEEPING BAG	/		/	/	/										/
SLING, CARRYING BAG AND CASE			/	/	/										
SPOON, FIELD MESS			/	/	/										
SUSPENDERS, FIELD PACK	/		/	/	/										/
HEMET, FLIGHT ADH 44	/		/	/	/										/
FLIGHT SUIT, GRAY	/		/	/	/										/
SUNGASSES, FLIGHT	/		/	/	/										/
GLOVES, NOMEX (SEE REV.)	/		/	/	/										/
ARMOR, BODY FRAG	/		/	/	/										
CLIP, SLG BAG	/		/	/	/										/
JACKET Flying Summer															
TRousers Nomex															
SHIRT NOMEX															
TYPE OF ISSUE OR TURN-IN			B A N K												
ENLISTED INDIVIDUAL MUST ACKNOWLEDGE ISSUES AND AN OFFICER MUST ACKNOWLEDGE TURN-INS BY SIGNING IN APPROPRIATE COLUMNS			 												
			SIGNATURES - ENLISTED (Issues)												OFFICER (Turn-Ins)

PART I - PERSONAL CLOTHING (Continued) (SUPPLEMENTAL ALLOWANCES AND ORGANIZATIONAL CLOTHING)

SUPPLEMENTAL ALLOWANCES	AUTH ALLOW	SIZE	ISSUES OR TURN-INS (Date)												BALANCE
			1	2	3	4	5	6	7	8	9	10	11	12	
UNDERSHIRT, CTN/WOOL															
BAR, SERVICE O'SEAS															
DRAWERS, CTN/WOOL															
INSIGNIA, GRADE EP															
INSIGNIA, SS															
STRIPE, SERVICE															
BED, STEEL	/		/	/											
MATTRESS	/		/	/											
FOOTLOCKER	/		/	/											
PILLOW	/														
ORGANIZATIONAL CLOTHING															
BAG, BARRACKS															
CAP, FIELD															
COAT, COTTON, WRS, WR															
OVERCOAT OG-107															
TYPE OF ISSUE OR TURN-IN															
18															
ENLISTED INDIVIDUAL MUST ACKNOWLEDGE ISSUES AND AN OFFICER MUST ACKNOWLEDGE TURN-INS BY SIGNING IN APPROPRIATE COLUMNS															
SIGNATURES - ENLISTED (Issues)												OFFICER (Turn-Ins)			
2															

Paul G. Schultz

Barrier T off	126.2	Outside
" Approach	127.35	Inside
Panel	121.7	Gnd
Elementary '8"	135.45	Circling
Rect Course	133.55	Air to Air
Climb to 3000' - level off	133.0	JAECK
Steep turns 720°		
Slow flight *		
Fly on Stalls *		
" off Stalls *		
Gliding turns, etc. *		

THE END

Normal Pattern Departure

Climb to 3000 level off.

Steep turns 720°

Slow flight *

Power-on Stalls *

" - off - " *

Gliding turns, etc. *

Rect. Course 800' AGL.

Elementary 8 $\frac{1}{4}$ mile radius

Panel Approach

Barrier Off

Approach

Shut-down

THE END

10

126.2 Outside

127.35 Inside

121.7. Gnd

135.45 Crust.

133.55 Air-Bis

133.0 JAECK