

Not for Sale

SURVIVAL ON LAND AND SEA

**Prepared for
The United States Navy
by the**

**Ethnogeographic Board
and the Staff of**

The Smithsonian Institution

**with contributions by the Bureau of Aeronautics
and Bureau of Medicine and Surgery,
United States Navy**

**LIBRARY
ARMY and NAVY STAFF
COLLEGE**

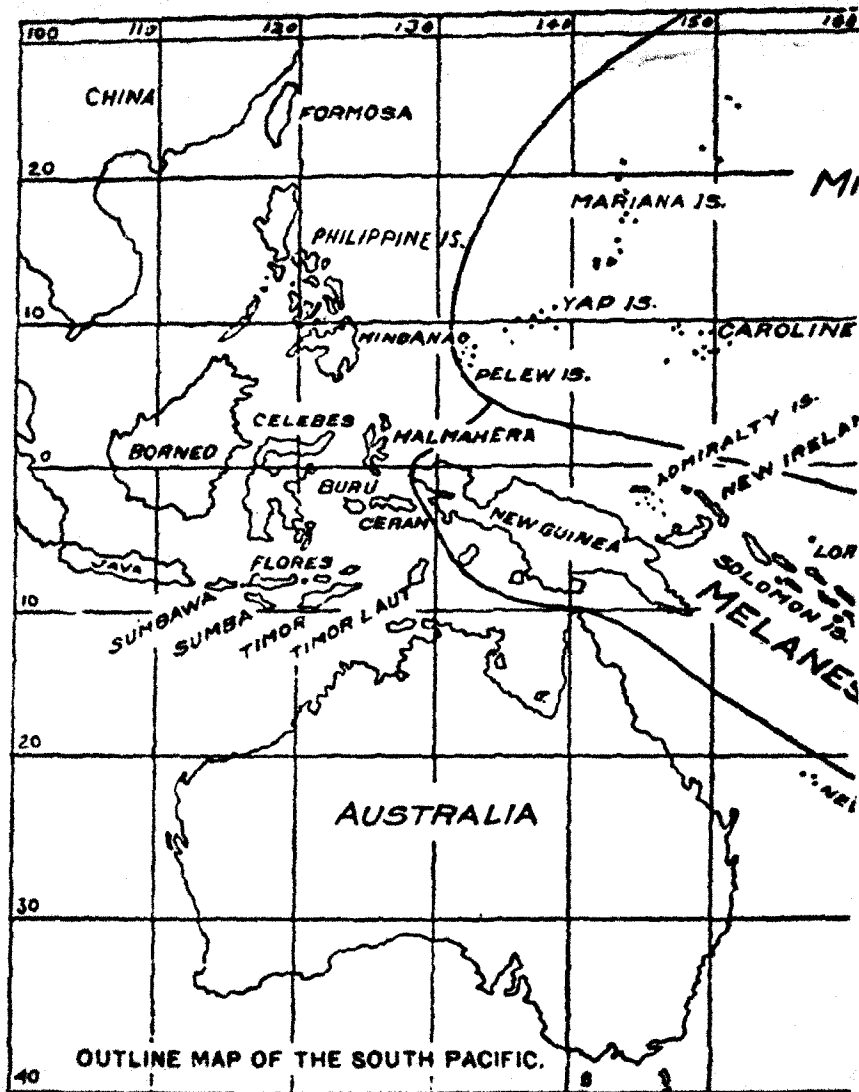
Publications Branch

Office of Naval Intelligence • United States Navy

1943

**LIBRARY
ARMED FORCES STAFF COLLEGE**

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 1943		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Survival on Land and Sea				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) General Headquarters United States Army Forces, Pacific				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES JFSC - WW II Declassified Records.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT SAR	18. NUMBER OF PAGES 192	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



~~1329~~ **ARMY and NAVY STAFF**
COLLEGE

Property of U. S. **CONTENTS**

Sections	Page
I Introduction	1
II "Men Against the Sea"	3
Abandoning ship	3
Procedure in rescue craft	6
Exposure at sea	7
Drinking water at sea	9
Food at sea	10
Fishing	10
Making your own fishing kit	11
Making fish line	12
Making a grapple hook	12
Making fishhooks	13
Sharks	17
Navigation without instruments	17
Wind and currents	18
Direction at sea	20
The sun	20
Stars	22
Planets	22
Constellations	23
Belt of Orion	24
The Dipper	25
Polaris—The North Star	25
Southern Cross	28
Orientation	30

LIBRARY

I

ARMED FORCES STAFF COLLEGE

Sections	Page
III Landfall and Island Survival.....	31
Protection from the sun.....	32
Quenching thirst.....	32
The coconut.....	36
Island sea food.....	40
Hints on spearing and preparing fish.....	47
Fish with poisonous flesh.....	48
Fish with venomous or poisonous spines.....	49
Handling venomous fish.....	52
IV Natives.....	53
V Tropical Forests.....	58
Water.....	59
Getting out of the woods.....	61
Firemaking.....	65
Forest dangers.....	71
Snakes and crocodiles.....	75
Blood worms.....	77
VI Food in the Tropics.....	79
Animals, birds, etc.....	79
Food plants.....	83
Plants along seashores.....	84
Clearings and abandoned fields.....	93
Open grassland, thin woods, and thickets.....	105
River and stream margins.....	105
Swamps.....	108
Forests and jungles.....	112
Particular regions.....	116
Poisonous plants.....	119
Polluted plant foods.....	130

CONTENTS

III

Sections		Page
VII	The Arctic.....	132
	Signal fire.....	133
	Emergency firemaking.....	136
	Shelter.....	138
	Carbon monoxide poisoning.....	139
	Cooking.....	140
	Water.....	141
	Food.....	141
	On the seashore.....	142
	Fish.....	144
	Land animals.....	145
	Sea animals.....	147
	Birds.....	148
	Plant Foods.....	149
	Greens.....	155
	Roots.....	157
	Edible fungi and lichens.....	164
	Arctic ailments.....	164
VIII	The Deserts.....	169
	Water.....	170
	Food.....	171
	Dust.....	172
	Clothes.....	172
	How to travel.....	173
	Signals.....	173
	Desert ailments.....	174
IX	The United States.....	175

SURVIVAL ON LAND AND SEA

I

INTRODUCTION

Since this war began thousands of men whose ships have been sunk or whose planes have come down in uncivilized areas of the world have made their way back to friendly territory. This booklet, which was written by men who have actually lived in jungles, deserts, and in arctic regions, tells the main things that a man should know about living in wild countries. Read this book. It may save your life. Keep it in your pocket when you are in a part of the world where you may need it. With it you may be able to help not only yourself but whoever may be with you.

The greatest obstacle that will confront you in the wilderness or at sea is fear of the unknown. As you meet and solve each problem you will find that it was not half so bad as you thought it was going to be and that after all you are doing pretty well. Just remember that many men, and women too, have already undergone such experiences and have come through. What they did, you too can do.

First stop and think things over. Size up the situation and plan your course of action. If you are adrift at sea you cannot hurry and there should be the emergency kit and set of instruc-

LIBRARY
ARMY and NAVY STAFF
COLLEGE

tions in the boat or raft to help you. On land, however, there will be the temptation to rush off immediately in some direction, any direction, and attempt everything at once, thus using up valuable energy and adding to your own confusion. If you are cast ashore on a beach—actually the best place to be—the problem, perhaps, will not seem so pressing as when you are lost in the interior, especially if it is bush or jungle country where it is difficult to see very far. On the other hand, if you are stranded on the desert, the fact that you can see so far and so little may make you want to start out at once in an effort to cover as much ground as possible in a short time. Regardless of the nature of the location in which you find yourself, take time to consider your plight and the best ways to go about improving it. In the following pages are numerous hints and suggestions on how to accomplish this. They are based on the experiences and knowledge of men who are familiar with the various parts of the world where you may go.

II

"MEN AGAINST THE SEA"

Survival at sea depends on three things, knowledge, equipment, and drill. With luck you may get along without one or the other of these, but the going will be tougher and the chances of telling your grandchildren about it not so good. The time to know all about emergency equipment—where it is and how to use it—is before you have to abandon ship, not after. *Think* as well as act while you go through "Abandon Ship" drill. Should the real thing come your chances will be 100 percent better!

ABANDONING SHIP

The most important factor in survival at sea is being prepared when the order to abandon ship comes, or if all communications have been broken down, when your judgment tells you you must leave. To be prepared, first, *always* have a sheath knife on a lanyard in your belt, a police whistle around your neck, and a light pair of leather gloves in your hip pocket. Second, have a small knapsack or kit bag, with shoulder straps, prepared so that you can take it to your battle station. This should contain a filled canteen, a flashlight with a transparent rubber sheath tied over it (you can buy such a rubber sheath in a drug store in the States), a blanket, sweater, shirt, and socks (the latter also in a waterproof wrapper), first-aid packet, and

dark glasses. If you get away with the first of these items on your person, it may save your life. If you have your emergency kit bag it may save other lives as well. Experience in the Pacific has indicated the desirability of men wearing their shoes when they abandon ship. Shoes are a great disadvantage when swimming without life jackets but their lack is painfully felt once you are ashore in a wilderness. This is also true if you are rescued by a naval vessel in a tropical area. The deck plates become so heated by the sun's rays that a man cannot walk on them with bare feet.

In abandoning ship wait until the ship comes to a stop; try to get away in a lifeboat, and jump only when it is impossible to go down a hose, line, cargo net, or ladder. Remember to put on your gloves and go down hand-over-hand. Don't slide and burn your hands! You'll need them later. If it is necessary to jump get rid of your steel helmet first, then hold your nose and jump as far out as possible, hitting the water with your knees bent, your legs together and pulled up against your stomach.

If you have a cork life jacket, throw it over first and jump after it. Don't wear it when you jump or it may knock you out. If you have a pneumatic rubber jacket and are a good swimmer, jump in before you inflate it and swim as far away from the ship as seems safe before you do. If you are wearing a kapok life jacket, be sure the lower drawstring is drawn tight and tied securely before you jump.

If you have to go overboard without lowering a boat or raft (in anything but a flat calm) go over the weather or windward side. The reason for not going over the lee side is that any wind will drive a drifting ship down on you. Take care not to be washed back aboard if a sea is running. To avoid this leave

the ship by the bow or stern, whichever is lower in the water. If the propellers are still turning, leave by the bow. Swim hard to get away from the ship and around the bow or stern. When beyond concentrated oil or other dangers, relax and swim or paddle slowly toward the nearest floating object or mass of survivors. It is well to figure out where you want to go in a general way before you go into the water because you can see much more from the deck than you can when you are swimming.

If fuel oil has been discharged, avoid it as much as you can by keeping head and eyes high and your mouth closed. Swallowing oil will make you sick and if it gets in your eyes will inflame them for a few days. However, serious effects have seldom resulted from contact with oil in the sea. Wounds which have come in contact with fuel oil have shown no delay in healing.

Should you have to jump from the ship into burning oil, you may, if you are a good swimmer, avoid being burned by the following procedure. It has been tested and proved successful. Jump feet first through the flames. Swim as long as you can under water, then spring above the flames and breathe, taking a breast stroke to push the flames away; then sink and swim under the water again. Men have been able to get through 200 yards of burning oil in this way. To do it, however, you will have to remove your life belt and other cumbersome clothing.

Obviously a seagoing man should *take every opportunity to learn to swim*. However, not losing your head is apt to be as important as knowing how to swim. Your life jacket will float you and all your clothes. Many men have been drowned through losing their heads and thrashing about in the water. Do not exhaust your strength by shouting or swimming about uselessly.

Swim or paddle slowly toward a lifeboat, raft, or any floating object that will support you. *The danger of injury from underwater explosion is lessened by swimming or floating on your back.* When you reach a raft, if depth bombing is going on, sit or stand up on it; do not lie prone upon it.

PROCEDURE IN RESCUE CRAFT

Half the battle is won when you get safely aboard your rescue craft, whether it be a raft or lifeboat. Despite lurid newspaper accounts of exceptional cases, actual statistics show that of boats adrift for more than 24 hours nearly half have reached safety within 5 days. It is the exception for any lifeboat not to be picked up within 3 weeks. If you have foresight, knowledge, and initiative your chances are excellent. From now on, the way you act will affect not only your own physical comfort and chances of survival but those of your companions as well.

Do not exhaust yourself by getting excited. Do not sing or shout for it uses up strength and valuable moisture. If a mass of men are around a raft, hang on but don't try to climb on it. Help get the wounded on. No matter how close-packed or uncomfortable you may be, do your best to be cheerful and, if you can't, be quiet. Make the best of it, for your survival depends on everyone carrying out routine cheerfully and promptly. It is highly important that everyone aboard a boat or raft should be allocated some job, however small. Only the badly wounded or very exhausted should be excused. Watches should be set on a definite routine.

Exposure at Sea

As soon as possible, if you are in a raft or boat, squeeze out all your wet clothing but do not take off all your clothes unless the weather is warm and dry, and the wind moderate. Undress and dry your clothes layer by layer. Pay special attention to your feet. If you have on boots and socks remove and dry them. If possible, put on dry socks. Carrying a pair of dry socks in waterproof wrappings while at sea would here yield big dividends. Your feet should be kept dry and covered if possible. If your rescue craft is wet, keep your shoes on, but if you notice your feet swelling remove them.

To protect yourself against cold winds, rain, spray, or, in the tropics, the sun, put up canvas or other screens, or rig up an awning with whatever is available. Do not take off too many clothes. They protect you against sunburn, which may occur even in cloudy weather. The experiences of men who have lived for weeks on rafts, to be rescued eventually, indicates that, for the tropics, systematically building up a resistance to sunshine in advance of any emergency will lessen the hardships of exposure. Learning how to swim is a good way to do this and, as previously mentioned, is also a good form of life insurance. An all-over coat of tan is a great help, but clothing is essential against glare of the sun by day and cold by night. You can protect your eyes against the glare of the sun on the water by improvising some kind of eye shade or goggles with slits. A cloth tied over your nose will hide the horizon when you look straight forward, and this cuts off some of the glare. Wearing a shirt or vest, and some form of head gear, occasionally soaked in sea water, will help against the sun.

Sitting for long periods with wet feet tends to result in pain or numbness of the feet, followed by swelling and later by the formation of blisters or ulcers ("immersion foot"). To prevent this the following precautions have been found helpful: (1) Keep the craft bailed out and as dry as possible. (2) Keep your feet as dry as you can. (3) Loosen your shoe laces, remove garters, and avoid all constriction of clothing which would interfere in any way with circulation of blood from the legs. (4) Exercise your toes, move frequently, place the feet for a time at the level of the hips, lie on your back and hold your feet in the air for a few minutes at a time. If your feet and legs become numb and swollen, do not apply massage or heat but keep them elevated and as dry as possible. Remove your shoes if the swelling is at all severe.

As a result of the very limited ration of food and water, your stools will tend to become hard and dry and the urine scanty and concentrated. Though every encouragement should be given the bowels to move, constipation is to be expected. The experience of most shipwreck survivors is that few difficulties result from it later on. As the urine becomes more concentrated it may tend to burn as it is passed. It may be found wise under these circumstances to empty the bladder only once or twice a day as the burning will probably last no longer after passing a large quantity of urine than after passing a small quantity.

Remember that alcohol has no thirst-quenching value and is dangerous to drink under these circumstances. Heavy smokers find tobacco soothing, particularly during the long night watches, but it has no other virtue and increases thirst.

Drinking Water at Sea

Drinkable water will be your most essential need. If your emergency rafts are equipped with gasoline, solar stills, or chemical salt-removing equipment, learn how to assemble and operate them before any emergency occurs; *learn all about them in advance*. Under conditions of exposure at sea a man needs a minimum of 18 ounces or a little more than a pint of water a day to keep thoroughly fit. If you have enough water with you and can make a conservative estimate of when you may be picked up, adopt the 18-ounce ration. If your supply is low and it seems likely you may be adrift a long time, hoard your water. Two to eight ounces daily is a suggested ration. Water will go farther if you hold it in your mouth a long time—rinse, gargle, and swallow. It is also a good idea to cover up as much as possible in order to lose less water through sweating. If you are wearing special waterproof clothing the fasteners should be opened from time to time to permit ventilation. Immersion in the sea helps, since some water is absorbed through the skin. This should be done not more than twice a day. A man in good health can live from 8 to 12 days without water. If you have no water, do not eat, since digestion uses up body moisture. Figure out devices to catch rain water in advance. Use the sea anchor, boat or sail cover, sails, or any other canvas gear. If there is an abundance every man should drink his fill. In the Arctic and Antarctic, pools of water from ice melted in the sun and ice on floes over a year old are drinkable if not made brackish by salt water spray. (For more details on this, see section on water in *The Arctic*.) Your water ration

should be based on careful estimates of your chances of being picked up and the probability of catching rain water.

Do not drink sea water. It will increase your thirst and make you violently sick. However, you can obtain some relief by moistening the lips and rinsing out the mouth with sea water, also by soaking sea biscuits in small quantities of it. But remember that sea water taken into the body in any fashion in larger quantities is very dangerous. Do not drink urine. It contains poisonous waste products that will greatly increase your thirst.

Food at Sea

Food is not as important as water. A man with water can survive several weeks without food. However, the more food you have the better are your chances. So check up on your emergency rations in advance and learn how best to divide and use them. Issue food and water at regular intervals. If you don't have a watch to gauge the time, issue the rations at sunrise, noon, and sunset. A strict watch should be kept over food and water at all times. A trustworthy man should be delegated to take charge of the preservation and rationing of food and water.

FISHING

If fish can be caught they will provide you with both food and water. *Be sure your can of fishing gear is in the raft.* It has full instructions, but some of these will bear repetition. **If you can catch fish, you will not die of hunger or thirst.** The flesh of fish caught in the open sea is good to eat, cooked or raw. It is healthy and nourishing. Many tribes and some nations commonly eat fish raw and like it.

If and when you have caught more fish than you can eat, chew out the juice from the flesh. To do this, put a piece of fish in your mouth. Chew it small. Suck out the juice and swallow it, and then spit out the pulp that is left. Keep it up as long as you are thirsty and have fish.

Fish juice tastes much like the juice of raw oysters or clams. It has been tested and found safe. A suggested method for squeezing out juice is to take a piece of the flesh without bones or skin. Cut it up fine. Wrap it in some kind of cloth, leaving long ends, and let two men twist the ends hard. Some juice will drip out. This has been tried with varying success under different conditions and is not wholly dependable, but since you will have plenty of time it will do no harm to experiment.

MAKING YOUR OWN FISHING KIT

In case you find that your lifeboat or raft does not have a fishing kit or if by chance you lose it through accident, you probably will be able to fashion equipment that will be serviceable out of materials that you have at hand. Have everyone empty his pockets and contribute whatever he may have in the way of stickpins, safety pins, campaign bars, collar and other insignia, to a pool where it may be inspected for useful articles. Include moisture-proof tobacco pouches, cigarette lighters, nail files, bobby-pins, etc. Anything that may not be of immediate use should be returned to the owners, subject to future call should the need arise.

Making Fish Line

In all probability you will have a tarpaulin or piece of canvas. With a sharp knife cut off about one-quarter of the sheet, putting the larger portion aside for future use as a shade, as a sail, or to catch rain water. From the part removed cut a piece about a yard square, being careful to follow the weave of the fabric so that the threads or ravelings may be drawn. When several strands have been obtained place 8 or 10 strands between the thumb and forefinger of each hand and roll or twist the threads clockwise, at the same time passing the right hand over the left counterclockwise. This will form a small line with a breaking point well over 100 pounds. When about 18 inches of line have been made, cut off the strands at intervals of about 2 inches so that each thread will be progressively longer. As the ends of the strands are reached while twisting the line, feed in a new strand to take the place of the one just ended. Continue the operation until 50 or more feet of line have been made. This line is fine for heavy work with grapple hooks, but one of two or four strands is better for use as a general fishline on small hooks. The small line will have a breaking point of about 20 pounds. Most sailors are familiar with this method of making line and should have little trouble in producing the desired lengths.

Making a Grapple Hook

With a strong knife, bayonet, or other available tool, split off four heavy splinters from the seat benches, or portions of your raft, care being taken not to weaken any one seat too much

as they act as braces or struts between the beams or gunwales, or try to salvage a piece of floating wood for the purpose. Take the heaviest piece and cut three notches near its end. These notches are to seat the three remaining pieces. These should be lashed firmly in position forming an angle of about 45 degrees with the long line of the shaft. (Fig. 1, upper left.) The completed line can be fastened tightly to the shaft by cutting three or four notches near the end of the shaft and lashing the line to it with threads from the canvas. The grapple thus made is then ready for use and may be cast astern. The line, of course, should be held firmly or be made fast to the boat or raft. After you have rowed or drifted some distance pull in the grapple. You may find that all you have caught is a clump of seaweed. If so, don't be disappointed. Carefully lift the seaweed into the boat or onto the raft and shake it. Usually small fish and crabs will fall out. They may be eaten and will also make good bait. Even the thick, fleshy weeds floating in the sea may be chewed and some moisture and nourishment obtained from them. Whether you have to fashion your own fishing kit or have one, don't overlook the possibilities of seaweed and the small forms of sea life that can be obtained from it.

Making Fishhooks

Very efficient fishhooks can be made from wood, preferably hardwood. First shape the shaft and cut a notch near the end in which to seat the point. Shape the point and sharpen it so that the hardest part of the grain will form the extreme tip as well as the barb. Seat the point in the notch on the

shaft. This section should form an angle of about 30 degrees with the long axis of the shaft and should be firmly lashed in position, using single strands from the canvas, to prevent slipping. A good point also can be made by using a nail from the rubber heel of your shoe. Drive it through the shaft at the desired angle, and lash to prevent splitting of the wood. As in the case of the heavy line on the grapple, make the smaller line fast to the end of the shaft of the hook with single ravelings for binding. Very efficient substitutes for the barbed or bearded fishhooks may be made of wood by using a latch barb. (Fig. 1, lower left and right.) Excellent hooks may be fashioned from pins of all kinds. A safety pin may be used, or a bobby pin may be hammered to a flat point and cut diagonally using a knife blade as a cold chisel, and then shaped into a hook. A pin from a campaign bar, marksman bar, collar insignia, or other military insignia may be used. A pocket knife concealed with a split fish may boat a large sea bass. In making a hook from a knife be sure to block the blade about a quarter open with a small piece of wood (Fig. 1, upper right), lashing both firmly in place so the blade won't open fully when the fish takes it.

Lures are often more successful than live bait and should be tried frequently. If gamefish are in the neighborhood they will take lures without hesitation. Lures can be made from clothing or such trinkets as are at hand. (Fig. 1, lower center.)

When a fish having strong spines in the vertical fins has been taken these spines should be saved as very good hooks; useful needles, and excellent gigs can also be made with them. By cutting away the muscles at the base of the fin and slipping the spine backward it can be detached from the base of the

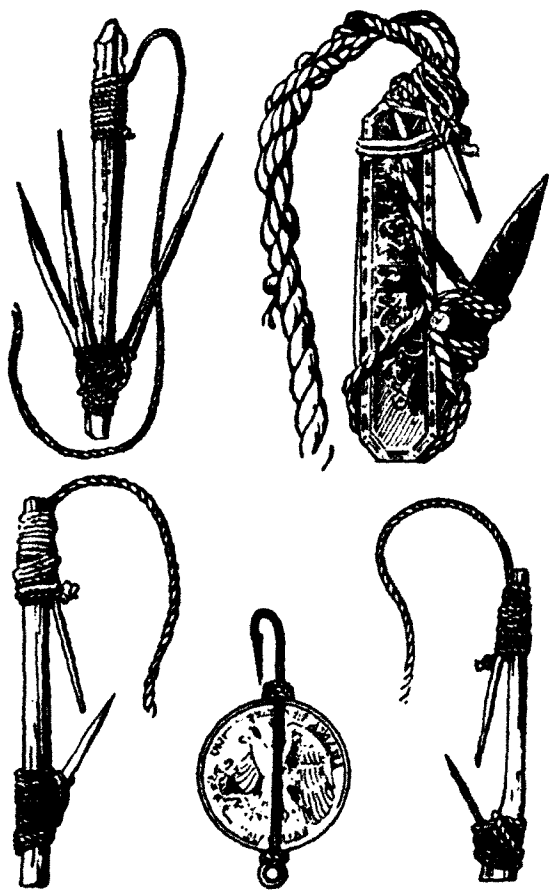


FIGURE 1.—Fish hooks and lures.

fin ray thus leaving a perfect "eye" for the accommodation of thread.

A light at night will often attract fish. Flying fish are edible and may be netted. If a piece of cloth is held over the boat and light is thrown on it flying fish often jump toward it and will land in the boat. Shark flesh may be eaten, although it may taste somewhat oily. It is safe to eat flesh of fish and of birds which has a phosphorescent glow. Extra fish can be cleaned and dried so they will last several days. If large, cut them into small thin strips, wash with salt water and hang up the strips to dry. Some kinds of fish are poisonous or venomous. For information on them see the discussion of fishing under "Island Survival."

All birds are good to eat. There are numerous cases of men in lifeboats and on rafts catching birds, so if any come near make every effort to catch them. Some kinds can be caught on a baited hook and line. Their blood is both nourishing and thirst quenching. The intestines make good bait, and bird skins and feathers may be used for improvised hats or garments. Turtles are also good to eat and their blood is suitable for drinking. Eels are edible, but certain types resemble sea snakes which are found in the tropical parts of the Pacific and Indian Oceans. Sea snakes do not attack swimmers but are poisonous, and should be left alone. Their flesh is edible but you might be bitten trying to land one. They are easily distinguished from eels because they have bony plates or scales covering their heads and bodies and have compressed flattened tails, while eels do not. In swimming, eels glide easily through the water, while sea snakes tend to wriggle as snakes do on land. Most sea snakes, however, stay close to the coast in shallow

waters, especially near river mouths, and are not likely to be found far from land.

SHARKS

Several species of shark have been known to attack a swimming man. Your chances of encountering one of these are not great. Care, however, should be taken to avoid unnecessary risks such as trailing hands or feet from the side of a boat or raft, or going into the water when sharks are near. Sharks sometimes rub against lifeboats or rafts. This is done to scratch off sea lice rather than as an attempt to overturn the boat. The nose is their most sensitive spot and a blow here may drive them away. Kicking, slapping the water, and shouting may also have the same effect. Shark repellents should be used if available. Shark yarns are usually exaggerated, but there are enough authentic records of shark attacks to justify all precautions. Whales are practically never dangerous to men. If their proximity becomes uncomfortable two pieces of metal struck together under water may drive them away. Splashing or beating on the surface of the water, however, is likely to attract them.

NAVIGATION WITHOUT INSTRUMENTS

Navigation in a rubber life raft is of necessity most elementary. As a survival factor its role is generally a minor one. Fine distinctions as to courses, bearings, speeds, etc., have little value due to the extremely limited maneuverability of a raft. However, a general knowledge as to one's approximate whereabouts is surely a matter of interest in any case and under

certain circumstances can be of tremendous importance to survivors.

Prior to abandoning surface ships, a slip giving course and distance to the nearest land is supplied to each boat officer. In case of a plane crash or forced landing, occupants of each raft (if there is more than one) should be given the same information—if only in approximate terms. This is the responsibility of the navigator, first or second pilot, or of whoever may have the information.

Wind and Currents

For the greatest part, the movement of a raft will be governed by prevailing winds and currents. These, of course, cannot be altered by survivors. However, they sometimes can be intelligently utilized if the survivor knows the direction he desires to go.

Wind and current do not necessarily move in the same direction in a given area. One may be favorable, the other unfavorable.

The lower the raft rides in the water and the lower its occupants remain, the greater will be the effect of current. This effect can be increased by the use of a sea anchor or drag if the current is setting toward land or toward an area in which your patrols are operating.

On the other hand, if the wind should be favorable, the raft should be lightened as much as practical. Survivors should sit erect to offer wind resistance. Any sort of makeshift sail would be of help.

To use wind or current advantageously, two things are required:

- (a) Knowledge of the direction you wish to go.
- (b) Knowledge of the direction of wind and current.

The Hydrographic Office is producing a waterproof chart showing land and water areas, as well as the directions of prevailing winds and currents for different periods of the year. It is intended to equip life rafts with these charts. To use them it will be necessary to have a general idea of your position at the time you hit the water. In the case of aircraft, as has been said, it is the responsibility of the officers to give out this information in the event of a forced landing. But just in case they might be unlucky in the landing it is a good idea to carry a rough—necessarily very rough—log of over-water flights in your mind, whatever your duty in a plane crew may be.

For example, suppose you were en route from Pearl Harbor to San Francisco. If your departure time was 1500 one day and you expected to reach the mainland about 1000 the next, but were forced down about daybreak, which would be the best way to head? You *should* be closer to the mainland, and even if there were no one to tell you exactly where you were, it would be easy to figure that your best bet would be to work over toward the east where there would be plenty of land.

The wind and current map may not have reached your outfit on the date you need it most. Or the plane captain may have it stuck in his bunk instead of the raft you find yourself in. Therefore, form the habit of studying maps and charts of the area in which you are operating. Get a general picture in your mind of the locations of lands and islands in the vicinity. We hope the information will never come in handy, but it might.

Direction at Sea

Now, suppose you are alone in a life raft. You have studied maps every chance you have had. You have a fair idea of the position where you crashed. You know there is a lot of land over to the west—none to the north, south, or east. There is a fair breeze blowing. Do you want to spread your parachute to make a sail, or don't you?

It all depends, of course, on which way the wind is blowing. The ocean looks just the same in all directions, and it isn't labeled north, south, east, and west.

This is where it is handy to have a little knowledge about the stars, sun, and moon—not a lot of technical knowledge which requires bubble octants, etc., but some simple landmarks in the heavens like those the ancient Polynesians used in sailing all around the South Pacific in their dug-out, outrigger canoes, centuries ago.

The Sun

We all know that the sun rises in the east and sets in the west, and that, therefore, it travels from east to west. If you are north of latitude $23^{\circ}27'$ N. the sun will invariably pass to the south of you on its daily trip across the sky.

Latitude $23^{\circ}27'$ N. is an imaginary line passing approximately through the Marcus Islands, Formosa, the tip of Lower California, along the northern shore of Cuba, and through the north part of the Arabian Sea. (See fig. 2.)

The sun follows the upper path at about the 21st of June each year before starting slowly south.

If you are south of latitude $28^{\circ}27'$ S. the sun will *always* pass to the north of you on its daily trip from east to west. Lat. $23^{\circ}27'$ S. passes roughly through Noumea, Rio de Janeiro, and the southern part of Madagascar. This line is shown as the

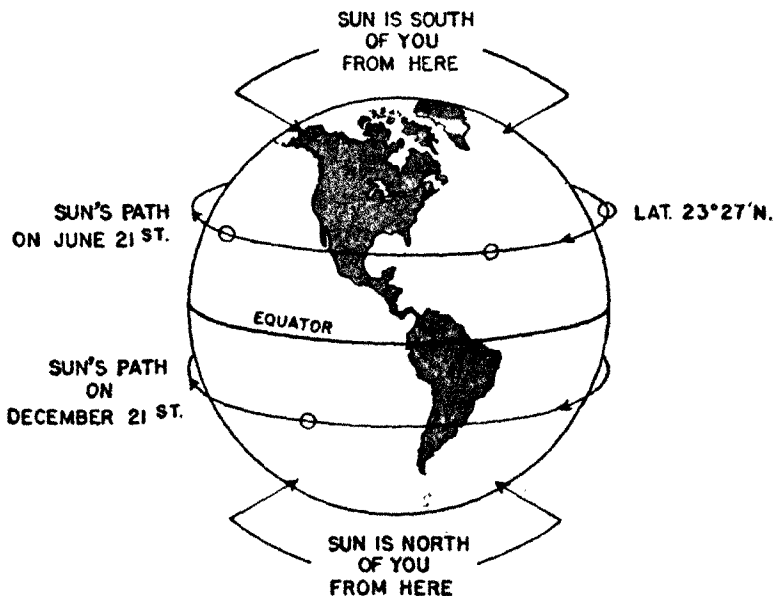


FIGURE 2.—Sun's path around earth.

lower one in figure 2 and marks the path of the sun on about December 21 of each year *before* starting slowly north again.

About March 21 and September 21 of each year the sun travels across the sky directly along the Equator. If you should be a few miles north of New Guinea or in the center of the Macassar

Strait, or around the northern Galapagos Islands on those dates the sun would pass directly overhead.

Stars

The stars also move across the sky from east to west. Their position relative to one another remains fixed. This is a convenience in locating them, once you learn the relationship of stars and groups of stars to one another. Upon locating one or more stars or constellations in the sky you can use them as markers or landmarks, telling you where to look for others whose direction from the first you know.

You won't find the same stars in the same part of the heavens every night. This is because the sun, which is responsible for our days and nights, moves westward around the earth at a slightly greater speed than do the stars.

Consequently stars which may be just appearing over the horizon at midnight, one month, may be high in the heavens at midnight another month. Or they may not appear at all. The latter happens when they travel across the sky within a few hours of the sun, which, of course, would be during daylight. For the stars travel across the sky in daylight just as they do at night. During the day the sky is so light that the stars cannot be seen.

Planets

Planets such as Mars, Jupiter, and Venus closely resemble stars—except that they do not twinkle as do stars, or change their apparent brightness. Planets are known as wanderers, since they move about among the stars. Because of their vagrant habits they are not much help to the survivor in determining

directions. But it is well to know that some bright "star" is probably a wandering planet, and not a sign that you are seeing things.

Constellations

Groups of stars are known as constellations. Some of the most prominent and easily identifiable constellations, and single stars, are described in the following pages. Tonight would be as good a night as any to get outside and begin training yourself

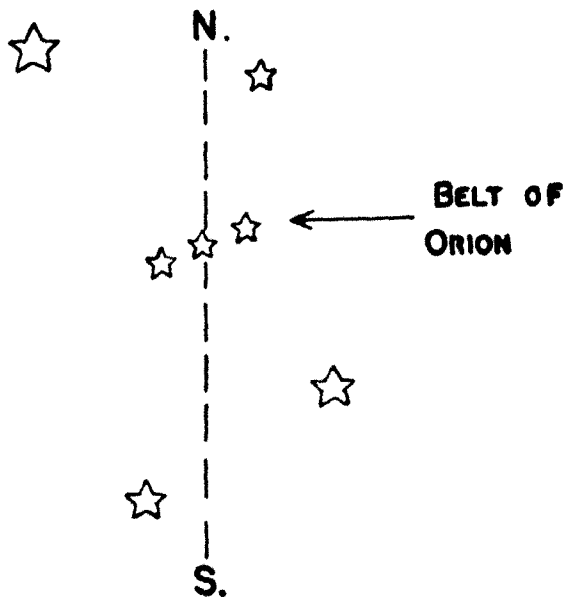


FIGURE 3.—Belt of Orion.

to recognize them as easily as you do familiar buildings, streets, and parks of your home town.

Belt of Orion

The constellation of Orion consists of seven stars. The three close together (see fig. 3) are the brightest and most distinctive.

If you hold this page above you and look up at it you will see Orion as it would appear when directly overhead or in the heavens to the south of you. Now turn the page around until the top is toward your chin. You will then see Orion as it would appear if you faced the north to view it.

Orion, whenever it can be seen, rises above a point on the horizon *due east of you*. It will set *due west of you* wherever you may be.

It will pass directly overhead if you are on the Equator. It will pass north of the point directly overhead if you are in south latitude and south of you if you are in north latitude.

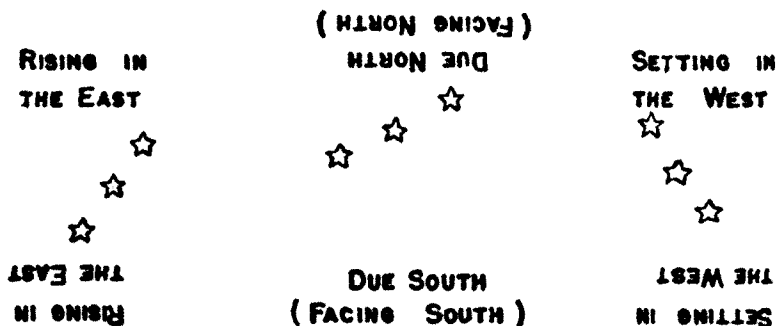


FIGURE 4.—Positions of Orion.

If you could face south and watch Orion's Belt climb up from the eastern horizon, reach its highest point, and drop down toward the western horizon, it would occupy the positions shown in figure 4. (Face south and hold this overhead to read.)

Now turn the page upside down.

Held above your head this way the figure shows the way Orion would move across the sky if you faced north to see it.

The Dipper

The Dipper is a distinctive constellation containing seven stars. If you are in northern latitudes it will be the most important constellation in the heaven for you to identify.

The reason for its name is clearly shown in figure 5. The two stars indicated are called pointers. In a moment we shall see their use.

Polaris—The North Star

As the Dipper is the most important constellation in northern latitudes, Polaris is the most important star. Since it is almost directly over the North Pole it can for practical purposes be considered to be due north of you wherever you may be. It can also help you to estimate your latitude as we shall explain in a moment.

The unfortunate thing about Polaris is that it is not very bright and is sometimes hard to locate if the sky is hazy. Without the Dipper it would be very hard to find. But the two "pointers" of the Dipper, whatever its position, invariably "point" to Polaris.

As shown in figure 5, the Dipper moves slowly around Polaris—occupying in turn the positions shown.

Hold the page above you—and face north to view it. That should give you an idea of the way the Dipper and Polaris will appear.

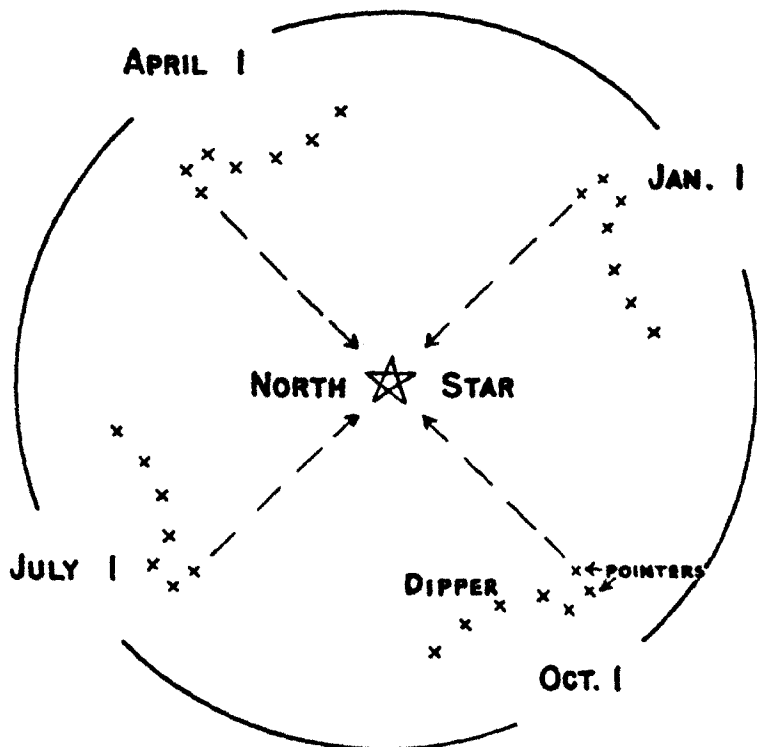


FIGURE 5.—North Star and Dipper, showing "pointers."

Now that you know how to locate Polaris—if you are north of the Equator (if you are south of the Equator you won't be able to see it)—remember this rule. The number of degrees Polaris is above your horizon will always be nearly equal to your latitude.

This means, if Polaris is 30° above the horizon, you are in latitude 30° N.; if it is 50° above the horizon you are in 50° N.; if it is 90° above your horizon you are at the North Pole and that is no place to be in a rubber boat!

Figure 6 is a diagrammatic sketch of what has just been described.

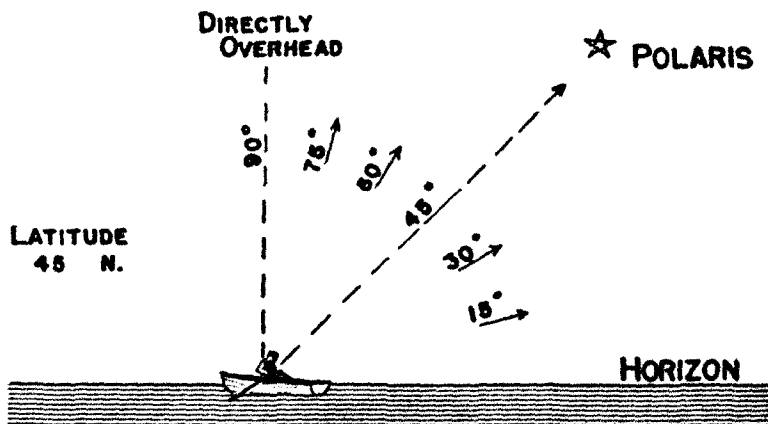


FIGURE 6.—Estimating latitude by Polaris.

To estimate the angular distance of Polaris above the horizon you must first estimate the point in the heavens which is exactly

overhead. From the horizon to that point is 90° . Halfway from the horizon to the zenith (the point overhead) would be 45° , one-sixth (or one-third of half-way) would be 15° , and so on.

Of course, 1 degree of latitude is 60 miles, so if you are 10 degrees off in estimating the altitude of Polaris you will be 600 miles off in your estimate of latitude. If you ever have to use this, measure the star's altitude as exactly as you can—and then don't place too much confidence in the accuracy of your estimate.

Southern Cross

In the Southern Hemisphere Polaris is not visible. There the Southern Cross is the most distinctive constellation. As you

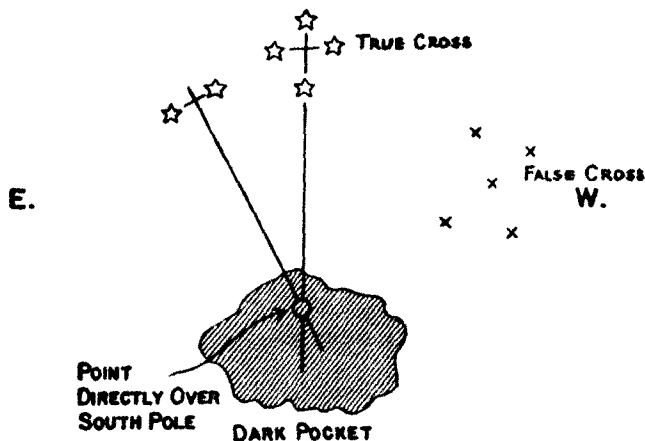


FIGURE 7.—Southern Cross.

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. (See fig. 7.) The True Cross should not be confused with a smaller cross nearby known as the False Cross. The latter, though the stars are more widely spaced, is less bright. It has a star in the center, making five stars in all, while the True Cross has only four. Two of these are two of the brightest stars in the heavens. These 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.

Figure 7 shows not only the True Cross but to the west of it the False Cross. Note, just to the east of the True Cross (hold the page above your head to make it realistic) two very bright stars. By using them and the True Cross as guides you can pretty accurately 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 Cross to the south. Join the two bright stars to the east of the Cross with an imaginary line. Bisect this line with one at right angles. Where this east line intersects the one through the Cross is (approximately) the point above the South Pole.

This point can be used to estimate latitude in the same manner as is Polaris in northern latitudes—by its height above the horizon.

Orientation

We have, therefore, indications of north, south, east, and west by day or night. If you can determine any of the cardinal directions you can easily determine the others.

Well out to sea the prevailing winds from about 8° – 10° N. to about 40° N. (look this up on a map or globe and see where it is) are from the northeast—blowing toward the southwest. They are called the northeast trades. They will carry you in a southwesterly direction.

North of 40° N. and south of 40° S. the winds are usually from the west and will tend to carry you eastward.

These are only general rules. There are many local and some seasonal exceptions. Learn as much as you can by observations and questions about the winds and sea currents in the areas in which you operate.

Learn to pick out the stars that have been mentioned and many more. Learn where to look for them in the heavens. That is how the first navigators found their way, and without navigational instruments it is still the best.

III

LANDFALL AND ISLAND SURVIVAL

In looking for land remember that cumulus clouds in an otherwise clear sky are likely to have been formed over land. Since they may have drifted from their original position steer to the windward rather than to the leeward of them. "Lagoon Glare," a greenish tint in the sky caused by the reflection of sunlight from coral reefs, may often be seen from a long distance. It is often more easily noted by looking slightly to one side of the point rather than directly at it. Driftwood and floating plants are a good indication of land. Coral reefs often cause difficulty in landing and should be approached cautiously. The surf is not so great if you make your landing on the lee side of an island. Breaks in the reef are indicated by calm gaps in the long line of breakers. If the pass is deep the color will be clear blue. If shallow it will be uniformly or blotchy brown. For navigation in shoal coral waters it is always desirable to have the sun anywhere except dead ahead. The ideal condition is to have the sun over one's shoulder or even directly overhead.

Men adrift, especially in northern latitudes, sometimes imagine they can see things which are not there, such as smoke, sails, ships, or land. This is a form of mirage, the same phenomenon that occurs in the desert, and if you experience it, it does not mean that you are out of your mind or even light-headed.

If you land on an island which is not in enemy territory and have natives on it, the worst of your troubles are over; they

know what to do and will help you. For more information on natives see the section on that subject.

For present purposes, however, we will assume that your landing has been made on an uninhabited island where you must fend for yourself. Your main needs will again be water, food, and shelter.

PROTECTION FROM THE SUN

On most islands in the tropics some protection from the sun is necessary to prevent sunstroke and severe sunburn. Should you lack normal clothing or equipment there are several expedients which will minimize these dangers. Keep out of the sun as much as possible during the middle of the day. If green leaves are available tie them on to protect your head from the sun. Coconut oil smeared over exposed portions of the body also helps. See following discussion of the coconut.

QUENCHING THIRST

Many islands in the Pacific have a good water supply; others do not. In this regard it is interesting to note that many native peoples live permanently on islands that lack streams, springs, wells, or even coconuts. They get their water in a number of ways. In some cases there are holes and hollows in the rocks that collect rain water; always look for these. Shallow pits or holes are also dug to catch rain or the seepage of water after rains, or water is obtained by digging holes along the shore at low tide. If you are forced to dig such a well, in the absence of better tools a large shell lashed to a stick makes a serviceable implement. *Do not* go deeper than the first water found. Fresh

water, being lighter than sea water, has a tendency to remain on the surface of salty water and that seeping through the sand may be a bit fresher than the sea water.

A *little* salt is good for you in the tropics where excessive perspiration robs the body of natural salts, but remember that *too much salt is bad*. Very limited quantities of the brackish water should be taken the first day or sickness will result. This is equally true of any other water drunk after a long period of thirst. Sip it up slowly or you will throw it up. In some cases it is possible to obtain slightly better water than that from the holes along the beach. There are some of the low sand islands in the Pacific area that rise from the beach to an elevation of 30 to 40 feet and from this high point slope toward a central basin which may or may not contain a lagoon of salt water. By digging near the foot of the inner slope, water may be found at a depth of from 3 to 5 feet, especially if there have been relatively recent rains. As in the case of the wells along the beach, do not dig too deep or it will fill with salt water. Stop at the first water found and after the bottom of the hole has filled skim the water off the top to get the fresher part of it. Care should be taken not to stir up all of the water at the bottom of such a well or it may be as salty as that along the beach. The water thus obtained may be discolored and somewhat brackish but it can be used.

Upon atolls or coral islands which do not have enough rainfall to support trees, you will find a weed known as pigweed, or purslane. To alleviate thirst, chew the fleshy, reddish-green leaves and stems. The weed stands 8 inches high and covers the ground in patches. No other atoll plant is like it. (Fig. 8.) On islands covered with jungle there are often air plants

LIBRARY

LIBRARY ARMY and NAVY STAFF

ARMED FORCES STAFF COLLEGE

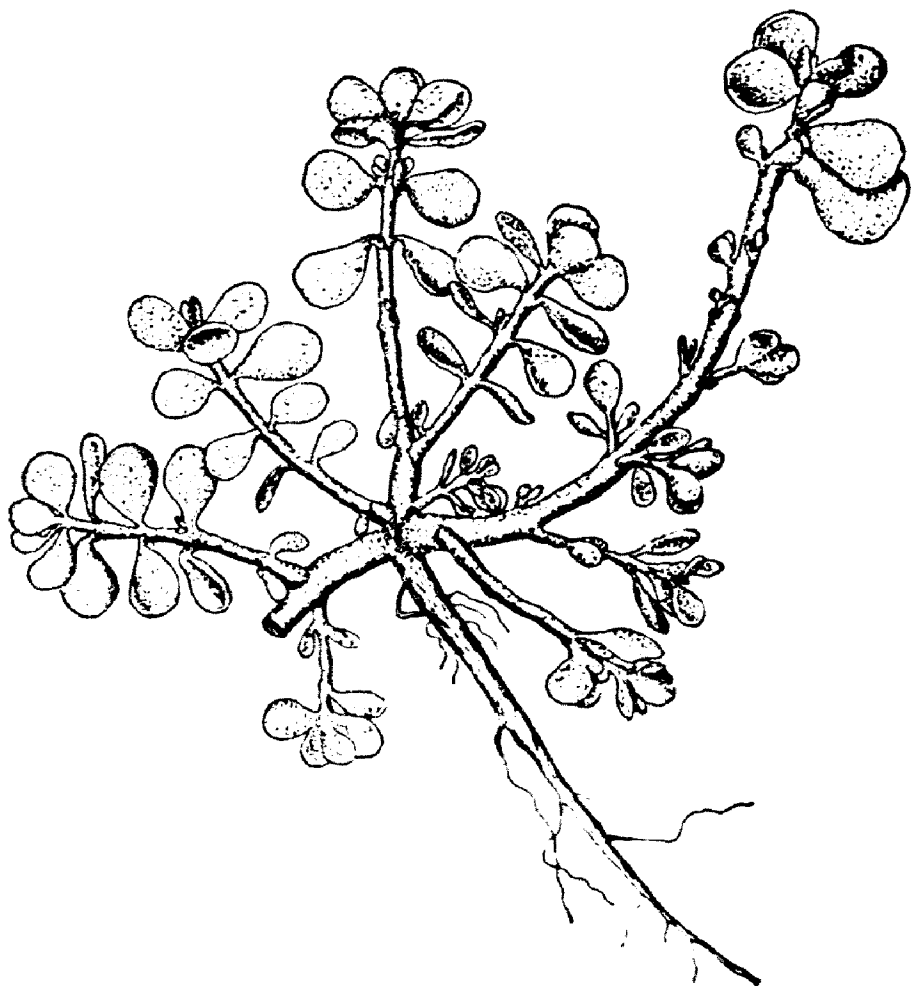


FIGURE 8. Pigweed, or Purslane.

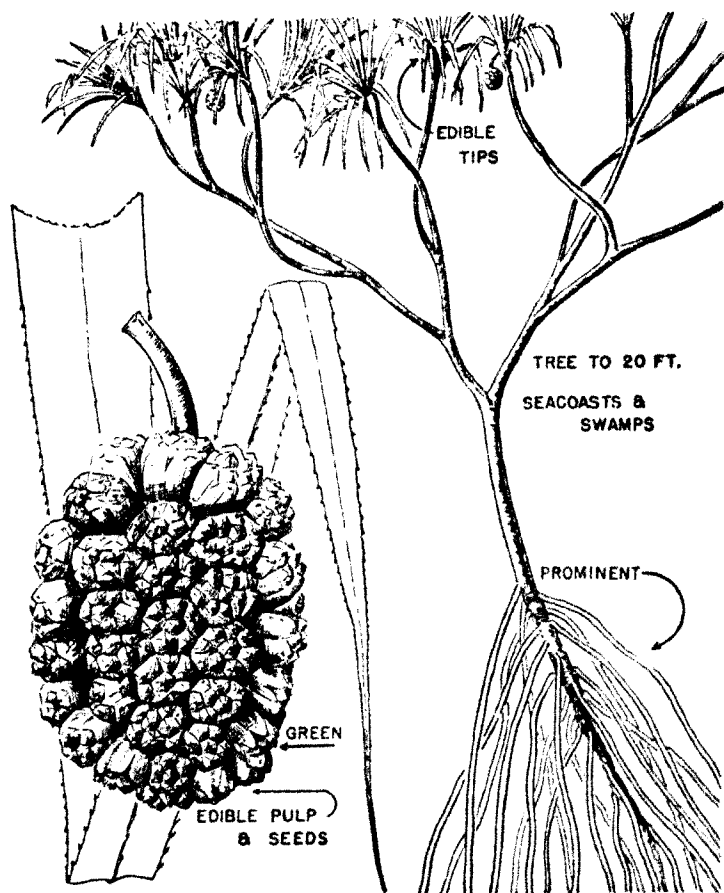


FIGURE 9.—Pandanus, or Screw Pine.

in the trees. The bases of the leaves of these air plants hold water for a long time. It is necessary to strain out bugs, wrigglers or an occasional frog but the water is good. The tips of the aerial roots of the pandanus tree (Fig. 9) may also be chewed for their moisture content. On islands where cactus grows, moisture may be obtained from the pulp of that plant.

THE COCONUT

Where there are coconuts your problem is much simpler. That the coconut is a valuable source of food and drink is well known. It also provides coconut oil, strong fibers which can be used in an emergency to manufacture cordage, and fronds or leaves for building shelters. The coconut grows wild along the coast of many tropical countries and islands. The great importance of the coconut justifies a brief description of its qualities together with directions as to how the nut can be collected, husked, and opened. For other plant foods, see section on Tropical Foods.

The coconut grows in clusters on a tall palm. (Fig. 10). The first problem in the use of the coconut is to get it down from the tree. You may find yourself badly in need of a coconut for food or drink, but unable to climb the tree. Some coconut palms are very difficult to climb unless you have had considerable practice, but there is a simple device known as "the climbing bandage." It consists of a belt or rope which is a little larger around than the circumference of the tree.

If you have a belt or rope or even a piece of cloth put it around the trunk of the palm tying it so as to leave enough room for your feet, and step on it with both feet. The loop will catch on the other side of the trunk and will support your weight. Reach up with your arms and grasp the trunk with

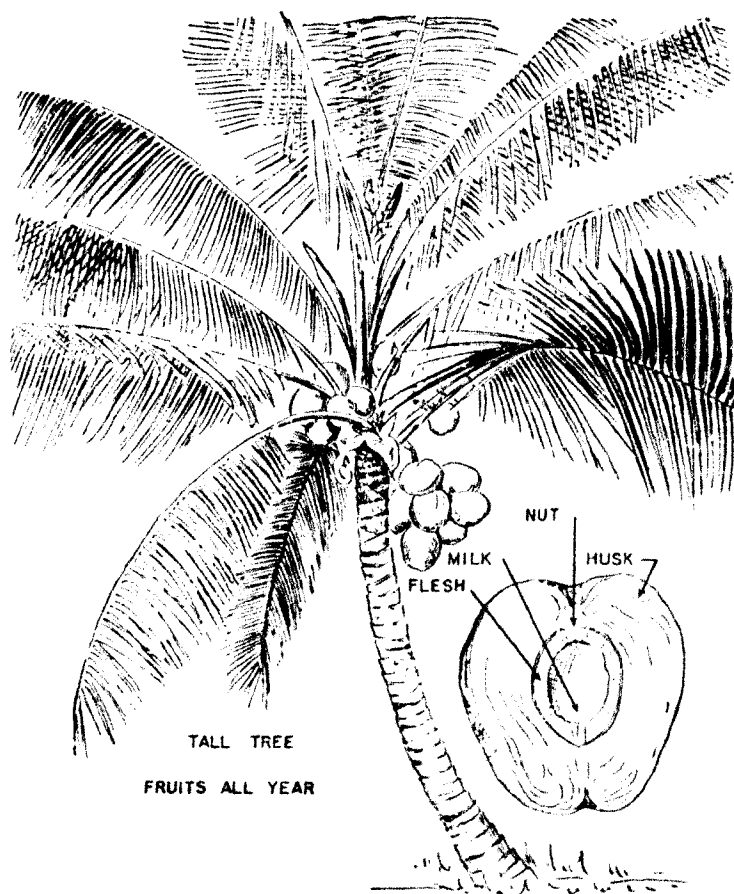


FIGURE 10.—Coconut Palm.

both hands. Pull yourself up, 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. By repeating this process you can climb to any height. You will note that this permits free use of your hands when you reach the top, so that you can pick the nuts. Let them drop. They won't be hurt, but don't lie under a coconut tree or they may hurt you!

On any single palm, the nuts will be in different stages of maturity. In general, the immature nuts are smaller and greener than the ripe ones.

The three main stages of the coconut's development and their uses should be recognized:

(1) The husk of the half-grown coconut is green or light yellow. The jelly-like flesh can be scooped out and consumed in sufficient quantities to satisfy hunger, and balanced with fish, will sustain life indefinitely. It is at this stage that the water or milk is best for drinking. It rates next to water and is better than beer as a thirst quencher.

(2) The hard meat of the mature coconut (the stage at which the nut is sold commercially in the United States) is too rich in oil to be eaten in quantity. At this stage the nut has fallen from the tree and the husk is brown. The milk is still good. The meat may be grated with a piece of coral or the edge of a shell and the grated meat squeezed in the hand to produce a thick cream which can be used as a sauce for fish, pandanus or other available food.

(3) The sprouted nut (the shoot of a new tree has begun to grow and roots appear) has a spongy growth within at the stem end. The growth gradually absorbs all of the milk and

meat. It is excellent food and a welcome variation from coconut meat.

If a tree can be felled (not a recommended procedure, obviously, where trees are sparse), a large amount of edible celery-like material known as the heart of the coconut, or "cabbage," may be obtained from the center of the trunk at its juncture with the sprouting leaves.

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 axe, you need not remove the husk of the green coconut in order to get at the liquid. You can whittle off the husk at the free end (not the stem end) to a crude point and then cut off the end and the top of the nut inside, thus obtaining the liquid. If, however, you do not have a machete, which incidentally is the most valuable single thing a man can have in the tropics, you can follow this procedure: drive a stake, 3 or 4 feet long, into the ground so that it slants away from you at a slight angle. The top of the stake should be given a crude edge so that it will pierce the longitudinal fibers of the husk. Stand about a foot away from the stake, judging the point of entry so that the stake will clear the nut within the husk. Then push down with your hands giving the coconut a twisting motion to pry off a small portion of the husk. By repeating this process, you can entirely remove the husk from the nut. You can husk green or mature nuts in the same manner.

Once the nut has been removed from the husk, your problem is to break through the hard shell of the nut. To open a young nut, hold it in one hand so that the eyes, which are at the stem end, are uppermost. Strike the nut sharply with a stone, or the point of a mature nut, just below each of the eyes. This will

crack the shell and the top of the nut can be picked off without spilling the liquid. If the nut is mature, poke out the eyes and drink the water. 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 with it. Revolve the nut a quarter turn and strike it again. Continue to turn the nut, striking it each time, until the nut cracks in half.

Coconut oil is a good preventive for sunburn, as well as an aid to keeping off small mites, sometimes called chiggers, and other insects. You can get coconut oil quite easily by exposing the meat of the coconut to the sun. The oil will run more quickly if you grate or pound it before placing it in the sun. You can also get coconut oil by heating coconut meat over a slow fire. If you have any kind of cooking pot or a section cut from a bamboo tree (see p. 41, under Sea Food) you can boil coconut meat in water; when the mixture cools the oil will rise to the top. If you apply even a thin coating of coconut oil to your skin you need have little fear of sunburn.

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 are careful to smear their legs and feet with this oil. By this means, they are able to keep their skin in good condition, despite the fact that they have to stand in salt water many hours at a time.

ISLAND SEA FOOD

Anyone stranded on a beach or shore should have little difficulty in maintaining himself for an indefinite period on shellfish or mollusks. These are an abundant source of food much appre-

ciated by all native peoples. All you need to do is work along the beach when the tide is out and gather a supply. There will be no difficulty in finding mollusks by turning over blocks of coral rock or picking them up in exposed situations. If you do not see anything but empty shells walk slowly along the beach and watch for bubbles in the sand—like those seen in the bottom of springs. When you see them dig down and you will find your mollusks. Shellfish can be eaten raw, as we eat oysters, and the juice coming from clams is not only nutritious but serves to quench thirst as well. The shells can be crushed with a rock or a piece of wood and the animal be extracted. Shellfish can be cooked by covering them with sand or earth and building a fire over the pile. (For fire-making methods when you have no matches see section under Tropical Forests p. 65.) When this is done they steam in their own juices. They can also be cooked by being dropped in a container of boiling water. Sections of bamboo can serve this purpose. Cut a section from a large bamboo stem, preserving one of the joints to form the bottom. The green shell is so durable that water can be boiled in it before the bamboo burns. If the container is held over the fire on a slant rather than straight up and down, the water heats faster. A hole lined with canvas or other material which will hold water can also be used for cooking. In the latter case hot rocks moved from the fire by improvised wooden tongs are dropped into the water until boiling is complete. Mollusks are found on reefs and beaches everywhere in this vast southern area. Similar forms appear in other tropical seas such as the Caribbean and parts of the South Atlantic.

There are two groups of tropical mollusks, fortunately not common, that should be avoided. These are the cones, so named

from cone-like shape of their shells (see figs. 11 and 12) and the spindle-shaped terebras. Because of their characteristic form they are easily recognized. They have poison glands at the base of their hollow teeth and their bite is similar to that of venomous snakes. They should be left alone.

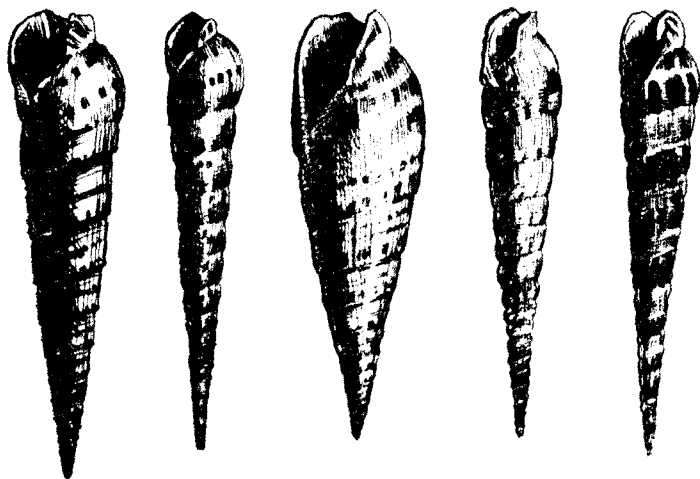


FIGURE 11.—Poisonous Terebras.

In addition to the mollusks, crabs and lobsters are to be found in the crevices and among rocks or reefs and rocky shores. Included among the crabs in the Pacific and Indian Oceans is a large swimming variety that is related to our Chesapeake Bay blue crab (they turn red on being cooked). This form is distinguished by the paddle-like shape of the last pair of legs.

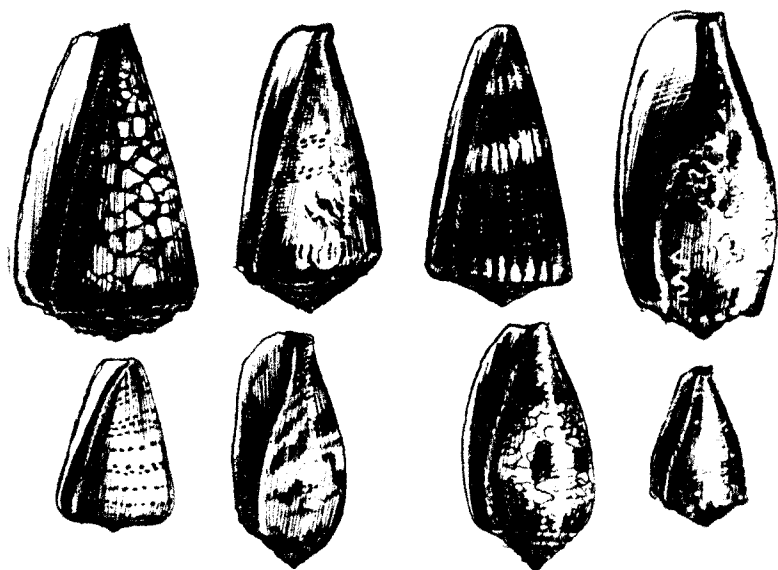


FIGURE 12.—Poisonous Cones.

Crabs and lobsters can most easily be caught at night, as that is the time when they generally move about. They may be stunned with a stick or stone, caught in the hands, or trapped. They often can be taken on a line baited with dead fish or spoiled meat. Tie the bait on just above a sinker of some kind and pull in from time to time, not too hard or the crab will let go, to see if you have caught one. Traps baited with fish or animal flesh are commonly used by commercial crab and lobstermen but probably would not be practical, except for more or

less permanently established shore parties. A dip net fashioned by making a hoop from a shoot or small branch and interlacing strips of palm leaves or fibers or one made from an article of clothing, is most useful in taking these creatures. Spiny lobsters or sea crawfish in the Tropics do not have large pincers on their front legs but do have "thorns" or spines on their backs. These can produce severe lacerations if seized by the bare hand. Hence the hand should be protected, if possible, by a stout glove or some equivalent. Spiny lobsters often may be caught by placing a dipnet behind them and with the foot touching their antennae, the long flexible processes projecting from their heads. This causes the creatures to move backward quickly into the net or bag, which must be yanked up immediately. Crabs also may occur in fresh-water lakes and streams, both in the mountains and on the plains, and frequently travel about on dry land. Some, such as the purse-crab of the East Indies, may be found on the trunks of trees.

As far as is known all crabs and lobsters, whether marine, fresh-water, or land forms, are fit for human consumption provided they are fresh. Salt water forms can be eaten raw with little likelihood of bad effects, but *all land crabs*, particularly in Asia and the closely adjacent islands, *should be thoroughly cooked*, since they are infected with lung parasites that are often fatal to human beings if the animals are eaten raw. The best way to cook crabs and lobsters is to drop them alive into boiling water and keep them boiling for 20 minutes to half an hour. Thus there is no danger of decay before cooking and they become sterilized at the same time. The shells and pulpy gills are easily removed after cooking. Most people insist that the gills (sometimes called the "deadman's fingers") be re-

moved immediately. Actually they are harmless and will cause no trouble if eaten. They have acquired a bad name because they are about the first spot to spoil. All danger of this is avoided by immediate cooking and eating.

In addition to mollusks and fish, another source of food are the holothurians of sea-cucumbers (see fig. 49-G). These animals are found on all tropical reefs, and almost everywhere on rocky shores. In the Indo-Pacific region, especially on the Australian reefs, they form the basis of an extensive and valuable fishery. They are also common in the West Indies. The kinds used as food are for the most part roughly cylindrical with a more or less corrugated or warty tough skin, usually from a foot to a foot and a half long when extended, and about half as long when contracted. The Australian commercial variety is even longer. The edible portion of a sea-cucumber consists of five long white muscles on the inside of the body. These can be stripped off and boiled, fried, or eaten raw.

Still another source of sea food is *sea urchins* or *sea eggs*. Sea urchins are found on all tropical reefs and along all rocky shores and form an important source of food in many regions, especially in southern Europe, the West Indies, southern South America, parts of the Indo-Pacific region, and the Aleutian Islands. They are globular in shape, usually somewhat flattened, from 2 to 6 inches in diameter and are covered with spines (see fig. 49-H). The edible portion consists of the masses of eggs within their bodies. These eggs usually form five finger-like, more or less yellow colored processes on top of the body inside the shell. They may be eaten either raw or boiled.

In temperate and arctic seas all the sea urchins present may be handled with impunity. But in the tropical seas there

are two types that are more or less dangerous. These are the so-called needle-urchins and the soft-bodied urchins.

The needle-urchins are from 2 or 3 to 6 inches in diameter, black or more or less reddish, with very long and slender needle-pointed spines which may reach 10 or even 15 inches in length. These spines are provided with whorls of minute barbs and are very brittle, breaking off after penetrating the flesh. One form of needle-urchin found throughout the Indo-Pacific region but not in the Atlantic has, in addition to the very long spines, numerous shorter, much more slender, and smooth spines which are connected with poison glands. These shorter spines are definitely dangerous even to touch, as they discharge an active and painful poison.

The soft-bodied urchins occur in shallow water throughout the Indo-Pacific region, but not in the Atlantic or along the west coast of tropical America. They reach a diameter of nearly 7 inches, and are much flattened. The usual size is between 3 and 6 inches. They vary in color from dark purplish or greenish hues to white, and often are more or less extensively marked with red. Some are almost wholly red. Usually they show an iridescent blue tinge. The shell is flexible, feeling somewhat like parchment, and is not rigid like that in most sea urchins. The spines are short and fine, rather widely scattered, and are exceedingly sharp. Some of them, more slender than the others, are provided with glands that secrete a very powerful poison that produces effects similar to those caused by the poison from the bites of sea-snakes or cobras. To be certain whether a sea urchin is soft-bodied or not poke it with a stick or some other object before you touch it with your hand.

Hints on Fishing and Preparing Fish

Fish are one of the most abundant types of food available on the reefs, in the lagoons, and in the sea. At night some species of fish come close inshore and swim along the surface. By remaining still, a person can hit them with sticks or spear them with a sharpened pole as they surface.

The outer margins of reefs usually contain channels, while on the surfaces of reefs are pools among the rocks and coral blocks. Fish frequently swim into these places at high tide, leaving as the water recedes. It is possible to trap them at such times by blocking the opening with rocks, sticks, or leaves from palm trees. Stones also may be built into low walls extending out into the water and forming an angle with the shore. Fish can be driven into this neck or narrow channel and into a pool at its inner end, and there be confined in the manner mentioned above. In many cases, it may be advantageous to keep them alive until needed, a fresh supply without danger of spoilage thus being provided. In addition, the usual methods of hook and line fishing should be used. If you do not have regular equipment try making your own as suggested in the section on Food at Sea, page 10.

When more fish are caught than are required to satisfy immediate needs, it is possible to preserve them for a time by cutting the flesh into small thin strips, washing with clean water, then hanging in the wind and sunlight to dry. Another method after the fish is properly cleaned, is to cut diagonal slits from one-half to one inch apart across the sides of the fish. The fish is then hung in the sun or placed on the surface of a rock with cuts exposed for drying. Such fish may also be salted or smoked.

Under ordinary conditions, these methods should preserve the fish for a few days in the tropics.

Fish caught in tropical waters spoil quickly. Immediately after landing a fish it should be bled by cutting out the gills and large blood vessels that supply them, and then gutted, being careful to remove the kidneys and blood vessels that lie next to the backbone. The fish should then be washed in clean water. If the fish have been feeding heavily and are not gutted, the digestive substances continue to act, even after death, on the food in the stomach and intestines so that the flesh spoils with great rapidity. The same fish, properly cleaned and hung up by the tail in the shade and breeze, will remain good for many hours.

Never eat a fish that has slimy gills, sunken eyes, flabby flesh or skin, or an unpleasant odor. If, upon pressing the thumb against the fish it remains deeply dented, the fish probably is stale. Do not use it. Good flesh should be firm and not slimy.

Fish With Poisonous Flesh

Most fish are edible, palatable, and wholesome. However, there are a few with flesh that is *definitely poisonous* and it is important that everyone recognize these.

All of the important fish with poisonous flesh belong to one large group, the Plectognathi, of which there are many kinds in the tropics. *All these fish lack ordinary scales* such as occur on bass, grouper, and sea trout. Instead, these poisonous fish are covered with bristles or spiny scales, strong sharp thorns, or spines, or are encased in a bony box-like cover-

ing. Some of them have naked skin, that is, no spines or scales.

The different kinds of poisonous fish can be easily recognized by the illustrations herein presented. The usual names given to these poisonous Plectognaths are: swell fish or puffer fish, porcupine fish, burr fish, cowfish, trunk fish, box fish, thorn fish. In addition, the filefish or fool fish and the trigger fish may be looked upon with suspicion for they too have been credited with poisonous flesh, but in certain regions the filefish and trunk fish are regularly eaten. If the natives use them they are all right. Unless you know, however, leave them alone. The flesh of the puffers, porcupine fish, and the related species is violently poisonous. Cooking, boiling, or baking does not destroy the poisonous alkaloid in the flesh of this group of fish. Obviously these known poisonous fish should never be eaten as violent sickness and often death may result.

Fish With Venomous or Poisonous Spines

Certain other fish should be avoided for a different reason. They have sharp spines on their heads and in their fins. These spines may cause a burning or stinging, even an agonizing pain, that is out of all proportion to the apparent severity of the wound. This is the result of venom that is injected when the spines penetrate the flesh. The venom varies greatly in quantity and in power. In the most venomous varieties it is as deadly as that of the most dangerous snakes.

The worst of the venomous fish are the Scorpaenidae. They are generally known by the following common names: scorpion

fish, warty lumpfish or stonefish, toadfish, zebra fish or tiger fish, and stinging fish. These are illustrated. (Fig. 13.)

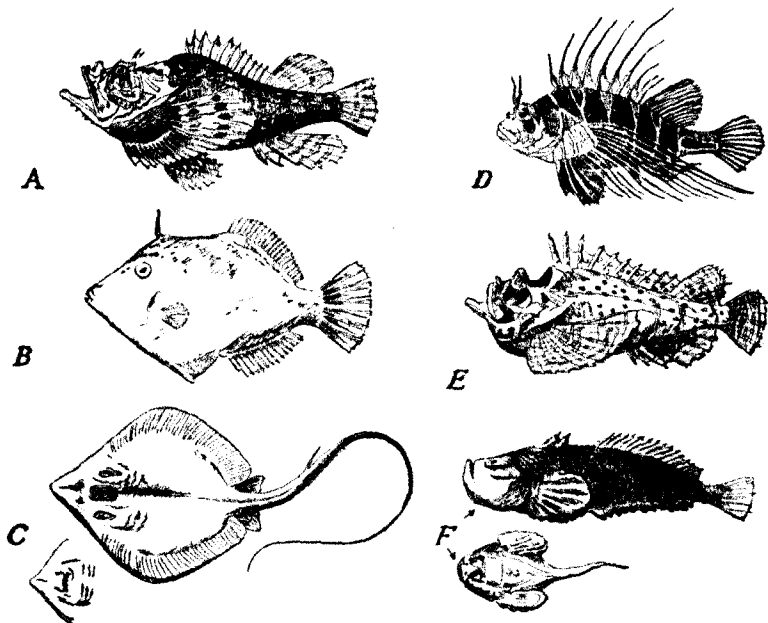


FIGURE 13.—Poisonous and venomous fish:

- A. Scorpion fish.
- B. Filefish.
- C. Sting ray.
- D. Zebra fish.
- E. Lumpfish (sometimes called toadfish).
- F. Toadfish.

Stonefish do not swim about to any extent. They generally lie quietly on the bottom which they exactly resemble in

color. As a rule they are either yellowish gray or blackish in color, often having flecks or patches of red or orange that give them a mottled appearance like the floor of the sea. When wading on a reef you should keep careful watch for such fish. Make it a rule to carry a long sharp pole or bamboo stick and poke any suspicious looking object on the bottom. At the slightest touch each of the projecting spines on these fish injects venom and causes severe pain. A full charge of venom from the whole dorsal fin has been known to cause death.

The next most dangerous after the scorpion fish are the sting rays. These occur in lagoons, shallow bays, estuaries, and far up many of the tropical rivers. They usually lie on the bottom concealed in the mud or sand. Sting rays are easily recognized when seen. (Fig. 13-C.) The tail may be long or very short, and is armed with one or two long, sharp-pointed spines with serrated edges. When stepped upon, the ray repeatedly whips its tail upward with great force and fury and may drive the spine clear through one of the bones of the leg or foot as well as through the flesh. The pain is most severe and infection usually results. When walking in turbid or muddy water or over sandy or muddy bottom, poke ahead of you with your stick and do not pick your feet up and set them down in the usual manner. Slide them along in the mud. Should your feet touch a hidden sting ray it will swim away as fast as it can. If you set your foot squarely on one, however, your weight will anchor it down and give the tail the leverage needed to drive the spine into you.

Some catfish have poison glands at the base of the spines on the breast fin. This venom is much like that of bees, causing severe pain, but it is not deadly. Since some of the larger

catfish have barbed spines, the wound made is jagged and secondary infection may occur.

All wounds made by fish spines should be thoroughly cleaned and disinfected at once.

Handling Venomous Fish

Never attempt to pick up a scorpion fish of any kind with the bare hands. It makes no difference how the fish has been taken, with hook and line, poison or dynamite. If the fish has any life left, a slight movement may drive a spine into your finger, carrying enough venom to cause excruciating agony. Always use a dip net, your spear, or some substitute, such as your machete or bayonet. Never poke your bare hands into holes or crevices in the corals or feel under rocks. To do so invites grave risks of serious wounds. A moray eel or wolf fish may be in such hiding places and it would easily nip off a finger or two. They have even been known to bite through a heavy shoe. The native avoids such dangers almost instinctively. You must learn—but don't learn the hard way. Death may be the result of carelessness.

IV

NATIVES

If you are in a region inhabited by native peoples make every effort to get in touch with them and ask them for help. You run little danger if you approach them in a friendly manner. Never show fear, or threaten, or flourish a gun. As a rule it is fear on the part of natives that makes them attack strangers and if you do nothing to cause concern you will be perfectly safe. Go up to them as you would to individuals of your own race and color, smile, offer a cigarette if you have one, and make your wants known. You may need to use signs to show them what you want—food, water, or directions—but natives are accustomed to such procedure, as they often communicate in that fashion themselves and will understand. The important thing is to treat them with dignity. Most of them have a strong sense of self-respect and do not regard themselves as “natives” or primitive. They will appreciate being treated as human beings just like yourself, neither as inferiors nor as superiors.

Should the natives be inclined to be shy or unapproachable do not rush matters by going right up to them. Stop where you are. Sit down and light up a smoke. If you know any tricks with string, take out a piece and proceed to do things with it. Most natives have and are fond of an elaborate variety of string figures, such as the familiar cat's cradle, which they make for their own amusement and on some occasions for ceremonial

purposes. They also are very curious and in a short time some of them may not be able to hold back any longer and will come to see what you are doing. When they do, hand them the string and they will probably show you a few tricks. If you don't have string take out some trinket and show interest in it. They will want to see, too. Once the ice is broken, you can go ahead and ask for what you need. This method of approach has been used many times in many parts of the world by those going to study native peoples and rarely has it failed to produce the desired results.

Most native houses are small and crowded and more often than not are infested with fleas, lice, bedbugs, and other disease-carrying creatures. It is strongly advised that you do not stay in them unless compelled by extreme circumstances. If it is apparent that you are to be there for some time they can and probably will be willing to build you a shelter in short order. Of course, one should never enter a native house without being invited. They don't like to have strangers come barging into their homes any more than you would. *Without making it seem that you are doing so*, it is advisable to avoid as much as possible all physical contacts with the natives. They often suffer from serious skin diseases, syphilis, tuberculosis, and other communicable ailments. If it can be done without giving offense, one should prepare his own food and drink in such surroundings.

Should it be necessary for you to remain with a native group for any length of time you must be very observant and learn from experience what you can and can not do. Respect their customs and manners. They have an entirely different form of etiquette from ours, but one that they believe in as strongly as we do in

ours. In general you will find that the less civilized the natives are, the stronger the local taboos or restraints will be and the more you will be expected to conform to them. Respect for personal property, as well as for privacy, is very important. Never pick fruits, kill pigs, or take other food without first ascertaining their ownership, gaining permission and paying for them. Remember that in isolated regions money has little value; paper money is actually worthless and coins only are a medium of exchange insofar as they have trinket or jewelry value. Oftentimes matches, cigarettes, empty containers, or other odds and ends that you may have in your pockets are worth more to the native than any form of money. An exception, of course, would be a group that is living close to the outposts of civilization and white man's stores. Under such conditions money may be the preferred medium of exchange, but unless it is, don't try to force it on them. Be sure, however, that you make some form of payment. Also, if you make a promise of any kind, keep it literally. You can't pull a fast one on a native and get away with it.

One thing above all to bear in mind is to *leave the native women alone*. More white men have been killed by natives for trying to make some dusky dame than for any other reason. Even if the circumstances are favorable, which they may be under certain conditions with a father, brother, or husband offering a woman to you, it is better to skip the opportunity, as a case of venereal disease usually can be expected as a follow-up, this being one of the "benefits" of civilization bestowed by the white man wherever he has gone. If you must play with fire regardless of all considerations, do your dickering with the men and pay them first. Native women are often considered as chattels and do not have free say in such matters. Permission

In such cases must come from some male relative as well as the woman herself. Also remember that among native peoples there is frequently little secrecy about such affairs. They usually become a matter of common village gossip.

When staying with natives there are certain things you can do that will help you to become accepted as a member of the group more quickly than if you hold aloof. Entertain them with match tricks, games, feats of skill, dances and songs. Unless you are unusually strong and proficient along that line, don't try to impress them with plain bull strength, as the natives probably are better equipped than you are in that respect and might show you a thing or two. They like to entertain too, so be a good audience and let them perform for you and be duly appreciative of their efforts. Show admiration for products of native handicraft, but don't be too profuse in your praise or they may feel they should give the object to you. Most "primitive" peoples are rather fond of playing practical jokes and probably will do so at your expense. If you find yourself the victim of some native form of "hot-foot," join them in their laughter; don't lose your temper and show anger even though they have hurt you. Another thing that is of great help in winning favor is to learn as many words of the native language as you can pick up. They will take delight in teaching you if you show a willingness and desire to learn. *Whatever you do, leave a good impression* because other white men may come along later and need help. If you have abused your privileges or taken advantage of the people those who follow will suffer for it.

Should you be stationed where you have time ashore and there are natives, make friends with some of them and have them

show you the many useful tricks they know—how they fish, how they make snares and traps to catch birds and small animals, what plants are good for food, and how they cook their various dishes. This not only will help you pass the time, but it may give you a fund of knowledge that will some day save you.

V

TROPICAL FORESTS

Most of us think of the "jungle" in terms of a Tarzan movie. The word originally meant a "track of uncultivated land," but now it is used more specifically to mean a dense tropical thicket of bamboos and palms as in India, of brush and vines as in Australia, of gigantic tangled grasses as in Africa, or to indicate a parklike woodland of tropical trees, a forest choked with undergrowth, or a tangled and impenetrable swamp.

The great tropical jungles of the present day are found in western Africa, northern South America, and southeastern Asia and its islands. The average seaman or Marine is not likely to be plopped down in the center of one of these places as are Marine and Naval aviators, but with the growing use of air transport for Naval personnel such a thing may happen. Furthermore, as a result of landing operations you may find yourself in such a location. Knowledge of how to conduct yourself in a tropical forest will serve in any one of these areas in spite of the fact that each one differs from the others.

Remember that the tropical forest is just another woods on a grand scale and that the man who learns how to use it has more chance of survival in it, over a long period of time, than he probably would have in the forest areas of our own country. If it seems to have more alarming noises than you have ever heard before don't get excited. Most of them are caused by

frogs, monkeys, and insects, and other small creatures that exist there in greater numbers than you will ever find in the more northern countries. Even though the movies have taught you that life in the jungle is just one narrow escape after another from leopards, tigers, elephants, and other unpleasant creatures, you probably won't see any of them at all because many places don't have them, and where they are present they make every effort to avoid contact with man. The most you can expect to see in the way of animals will be birds, squirrels, hares, monkeys, and other small forms that are active during the day. None of them is dangerous, if left alone.

WATER

Water will not prove to be so much of a problem in most tropical forests as on small atolls and desert islands. In areas of heavy rainfall the earth is so soaked with moisture that a small hole dug in any low spot will yield water. Then there are streams, ponds, springs, and places where water collects from rain and seepage. The main problem is one of purity and *no surface water should be drunk without being boiled or chemically treated*. In higher portions of the mountains on large islands and the mainland the water from swiftly flowing streams and springs may be used without treatment if absolutely necessary, but even then you will be taking a chance.

In forested areas there frequently are ferns and so-called air-plants in the trees. The bases of the leaves of these plants collect and hold water for a long time. When strained through a cloth the water is safe to drink; it contains no pollution from human sources. Dew can be collected by spreading a piece of

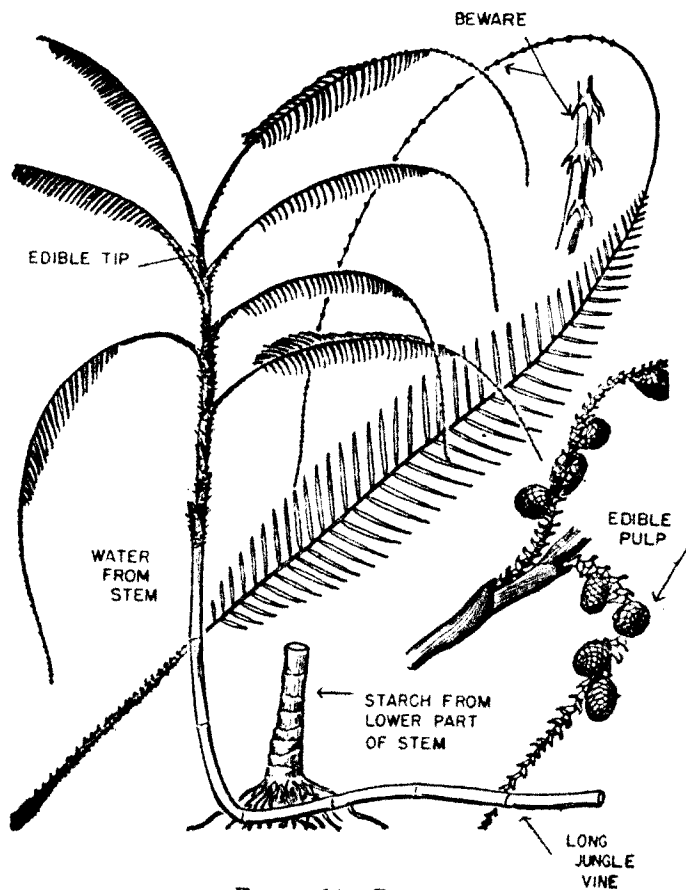


FIGURE 14.—Rattan.

canvas or rubber blanket under the branches of trees and shrubs and shaking the water off the leaves.

The rattans, palms with long slender segmented stems that look like a bamboo vine (see fig. 14), and other large climbing vines carry water absorbed by their roots. Throughout tropical America the so-called "water vine" is well known from this use. To get water, make two cuts, the first a deep notch high up, the second near the ground, where the water will flow. As flow ceases, make further deep cuts down from the first.

GETTING OUT OF THE WOODS

Tropical forests are regions of heavy rainfall. In some cases this may be continual throughout the year; in others rains come only during certain seasons. In wet forests there usually is little undergrowth except along the banks of streams where it generally is very heavy, but in the so-called dry forests where the rainfall is seasonal the bush may be so thick that you have to hack your way through it wherever you go. In all of these forests, streams or their dry beds are plentiful. As in our own country, following a stream down is certain eventually to lead you to human settlements, and the larger the stream the sooner they will be reached. Streams also lead to the coast and that is where you want to go, arriving as soon as possible. If you are in the mountains, it is probably better to follow the ridges as the stream beds are often precipitous.

If you follow a stream you will not only be provided with water, but with such edible creatures as crabs, shrimps, mollusks, and fish. If it is a large stream build a raft and float it down. Use soft woods, the lighter the better, for the raft. Lash the

pieces together with vines or fibrous strips of bark. Sections of bamboo, because of their hollow air-filled segments, make the best rafts if that type of growth is available. Fibrous woods, such as the palms, do not float well and will soon sink. While drifting down stream on a raft keep your ears open for the roar of rapids or falls so that you don't get caught and swept over them. You may have to abandon several rafts in the course of your journey and build new ones, but that is better than trying to ride out a bad stretch of water.

If the stream is too small or too shallow to float a raft you may have to follow along it on foot. In many cases it is impossible to travel through the heavy vegetation growing along the banks. On the ridge above, however, you will usually find the trees and bushes more open and may even strike a trail, although it probably won't be as sharp and clear cut as trails in your own woods. The forest people are great travelers within limited areas and follow the easiest routes.

Always remember to take your time. You will make better headway if you do. If you come to a bog or swamp, *go around it*; don't try to fight your way through; you might get caught hip deep in muck. If a tree has fallen across a trail, travel around it, not through its branches. It will take longer and use up more energy than going around and you are less likely to become confused if you don't get entangled in vegetation. At sunny clearings or openings in the main forest the scrubby second growth may almost or completely obliterate the path. In such cases cross the clearing and work along its edge until you again find the trail among the trees. If you come to a fork, take the path that seems to have had the most travel. Never follow one that is closed by a string, rope, grass mat, or some other obvious barrier.

It may lead to the scene of native religious rites that are forbidden to strangers, or you may fall into a pit or other dangerous trap set for large game. Smooth, well-traveled trails, particularly if they tend to be straight and rather broad, may be game trails and when following these it is well to be on the alert continuously for places that seem to have been disturbed or that have a slightly different appearance from the rest of the ground as they may indicate the presence of a pitfall or trap of some kind. It is well to watch for possible game when traveling such a trail, although it would be a rare thing if you encountered any during daylight hours. Do not camp for the night on such a trail, as that is the time when traffic will be heavy. In tropical forests in Central and South America broad, straight paths may be made by wild pigs and droves of them may rush along such "highways" attacking and running over anything that may be in their way. Should you happen to be in such a situation and hear considerable noise in the offing, waste no time in climbing into a tree at one side of the trail.

In the open sun, even on a cloudy day, wear something on your head. If you have lost your hat or helmet a layer of green leaves under a knotted handkerchief or piece of cloth will give you protection. Do not expose yourself to sunburn as it may seriously incapacitate you. During the hottest hours of the day it is well to follow the example of the natives and rest quietly under a tree. Remember the old song "Mad dogs and Englishmen go out in the midday sun." Stop travel well before nightfall so that you will have plenty of time to prepare a camp before darkness. Don't forget that twilight is very short in the tropics and that the interval between sunset and dark is brief. Your

camp should be on rising ground, well back from the stream and away from swamps and bogs, where mosquitoes and sand flies and gnats will be less numerous. Should there be any breeze stirring put your camp where you will get full benefit from it.

A crude lean-to or A-type shelter with a frame of sticks or bamboo with large leaves of leafy branches for walls and a roof will give protection from the cold dew of the tropics and also from prowling animals. Where there is any form of construction the latter will suspect a trap and keep away. In making a lean-to, sink uprights, preferably forked at the upper end, into the ground several feet apart. Then lash a ridge pole in the forms or at the top of the uprights and place inclined pieces from the forks and the ridge pole, their opposite ends resting on the ground at what will be the rear of the shelter. Lash a series of cross pieces to the inclined timbers at intervals not too widely separated. Then, starting at the bottom as you would in shingling a house, thatch the framework with wide-leaved branches. These will hold their positions better if the branches are hooked onto the cross pieces. The bigger and broader the leaves the better the roof. A simpler form of construction, one probably sufficient for a single night, is to place a whole series of inclined pieces along the ridge pole, covering the framework with wide-leaved branches but not bothering to hook them to the framework. For the A-type structure the same procedure may be followed except that the ridge pole needs to be higher and you make two sides to the roof instead of one. A variation may be made by using a series of inverted V-shaped frames for the main support instead of the upright sticks in the center to support the lashed ridge pole. The large leaves of coconut trees are particularly good for making shelters. The leaves themselves attain a length up to 12 feet and the center

stem is strong enough to be used as the timbers for the framework of the structure. Several pairs of these stems lashed in the V-shape with another for the ridge pole make an ideal support for a covering of untrimmed leaves. A shelter of this type large enough to hold 6 men can be built in half an hour. Do not sleep on the bare ground; it will be cold and damp and you will be more susceptible to visits from various crawling bugs. Make a mat or bed of leaves on which to lie. If you are going to be in the same place for several nights and want to get completely off the ground, make a framework of sticks supported on forked uprights embedded in the ground and pile your leaves on top of it.

FIREMAKING

A fire is advisable and should be built in front of the open side of your shelter. Starting a fire may be a problem; it will prove doubly so if you have no matches, and to avoid such a contingency you should *always keep some matches about your person in a waterproof container*. It is even better if the heads have been dipped in paraffin. The old-fashioned nonsafety matches are the best, but safety matches will serve the purpose if kept carefully wrapped in an oilskin tobacco pouch, or in the cellophane from a cigarette package so that the striking surface, as well as the matches, is kept dry. Remember to wrap your matches again as soon as you have used one, as the jungle dampness or perspiration acts on them very quickly. As a matter of fact, a lighter that works and that is kept filled with fluid is much better in moist climates than matches. To find something dry enough to burn in wet weather it will be necessary for you to strip the bark from dead trees or to cut

away the wet exterior from dead branches and get at the dry wood towards the center. Dead branches pulled from a standing tree may be drier than those lying on the ground. Start with a small fire, enlarging it as more pieces catch, and don't try to use logs of any size until the blaze is well under way. Once the fire has a good start you can keep wood drying beside it so that it will burn readily when needed. It is well to lay in a big enough supply to last the night when you are gathering wood. In building the fire it helps if it is placed against several logs of large diameter lying on the ground. If you are in a clearing where there is a breeze, build the fire on the windward side of the logs. They will help to produce a draft and in time will start to burn themselves and help to throw off heat. When you have a good blaze going it is well to dry out your clothes. This is not only to make you feel more comfortable, but it will keep you from getting chilled in the cooler hours of the night. Green leaves thrown on the fire will make a smudge and help drive off the mosquitoes and sandflies.

When you don't have matches or a lighter there are a number of ways of starting fires. Natives as a rule are quite adept in the matter, but the average white man needs considerable practice and it may take you a long time to master the art. If you persist, however, you probably will succeed. Making fire by friction is not easy. Perhaps the method most likely to be productive, certainly the most efficient of the friction methods, is that of the fire thong. Its use has been widespread throughout southeastern Asia, the East Indies, and West Africa, and at one time it was employed in northern Europe. All that is needed in the way of equipment is a strip of dry rattan (Fig. 14), preferably about one-quarter inch in diameter and about 2 feet long, and

a dry stick about three-fourths inch in diameter and long enough so that it can be held on a rock or another piece of wood with the foot, one end being off the ground. The latter end should be split, the split being held open by a piece of twig or a pebble, and a good sized pinch of tinder wedged snugly, but not too tightly into the open part of the split. The rattan is then held firmly, one end in each hand, and is looped under the split so that the contact will be directly beneath and with the tinder. The rattan is then drawn rapidly back and forth with as much pressure as can be applied, the stick being held firmly in place with the foot. Within a few seconds the tinder should start to smoke. When it is smoking well, withdraw it and blow on it until a red coal appears and finally a flame. Beforehand gather shavings, bits of bark, and small twigs that can be added until a blaze sufficient to start larger pieces of wood has been developed.

Tinder may be made from fine, dry vegetable fibers, grass, moss, from lint from a piece of canvas, from a bandage from your first aid kit, or from a piece of your clothing. The fine down from the breasts of birds or from beneath their wings also makes good tinder. Whatever is used, however, must be completely dry. Natives who use this method generally carry their rattan thong with them, wrapped around one arm above the elbow where it can be kept dry and also serve as an ornament. This is particularly true of the tribes of the central mountains of New Guinea. They also carry tinder in a pouch where it can be kept dry.

In the Polynesian area of the Pacific Islands the natives commonly use what is called a fire plow. They find a piece of soft wood $2\frac{1}{2}$ to 3 inches in diameter and long enough so that

one end can be held down by the feet and the other by sitting on it. The stick of wood is split in half and placed on the ground with the rounded side down and the split side with the the pith groove up. The latter serves as the track in which a smaller, flat-pointed stick of the same kind of wood (in some cases a piece of harder wood is used) is rubbed rapidly back and forth. At the start it may be necessary to hold the rubbing stick at a low angle until a good groove is made, one about 5 or 6 inches in length. As soon as the groove is formed the stick is tilted to a 40° to 45° angle and the rubbing continued with gradually increasing speed and a strong downward pressure. Wood dust collects at the point of the rubbing stick and as the backward and forward movement continues the dust chars, smoke appears, and a glowing spark develops. Care must be taken not to carry the stroke too far forward and scatter the pile of dust. Friction is the important factor and to obtain it rapid movement is essential. The faster you work the rubbing stick the greater the likelihood that you will get out of the groove and lose the accumulation of hot wood dust, hence the need to concentrate on the matter of stopping the forward stroke at the proper place. Once you have produced the smouldering spark or ember it is necessary to nurse the spark into flame with tinder as in the case of the fire thong.

Another method of obtaining the first glowing ember is by means of a two-stick fire drill (Fig. 15). This system has been world-wide in its distribution, but is probably one of the most difficult to master. For a drill get a straight, seasoned stick or plank stock from one-fourth to five-eighths inch in diameter and 15 to 30 inches in length. Round off the ends; don't make sharp points on them. Then find a dry, dead branch to make

the hearth. Split the branch so that there will be a relatively flat surface and make a concave depression in it to receive the drill. Cut a narrow slot leading out from the side of this cup



FIGURE 15.—Making fire with bow drill, and two-stick fire drill.

to receive the wood dust produced by the rubbing of the spindle or drill against the wood of the hearth; sometimes a very small

quantity of sand in the cup will increase the friction. Place the base or hearth board on the ground where you can hold it down with your knees, or have some one hold it down for you if there are others in the party, and place the drill so that it stands upright with its rounded end in the cup. Rotate the drill back and forth between the palms of your hands, exerting a strong downward pressure. The speed should be increased to the maximum as the hands reach the bottom of the stick. Because of the downward pressure the hands tend to work down the drill. When they are several inches above the hearth quickly grasp the drill with the fingers of the left hand to hold it firmly in position and grip the upper end between the thumb and finger of the right hand, shift the left hand quickly to the top opposite the other hand with the fingers extended so that you can turn the right hand downward, grasping the drill between the palms, and begin again the rotation movement. At no time should the end of the drill be permitted to slip from the cup. The stoppage of the drilling during the shifting of the hands should be as short as possible. As the drilling continues wood dust works into the slot and as it gets hotter and hotter, smoke appears and eventually a glowing ember which should be transferred to tinder. If you want to be more certain of catching the hot spark the tinder may be placed around the cup in the hearth at the start. When a bow is used with the drill the process is much simpler and more effective. With the latter, a block of wood is used at the upper end to hold the drill in place in the hearth and the drill, which may be shorter than that used between the palms of the hands, is rapidly rotated back and forth by means of a string wrapped once around it and fastened to the ends of

a flexible stick like a bow used to shoot arrows (Fig. 15). The string from your shoes will do in making such a bow if you have no other cord. For the use of flint see firemaking in the Arctic, p. 136.

Much easier, of course, is a burning glass if you have one and are where you can get enough sun to use it. In the absence of a regular glass, which is an excellent thing to carry in your pocket, a suitable substitute can be made if two of the members of the party have watches with crystals of approximately the same size. Take the two crystals, place them back to back and fill the space between with water. This will focus the sun to a point sharp enough to start a blaze.

Once you get a fire the best thing to do, as far as future needs are concerned, is to follow the example of the natives and carry it with you from place to place. This is done by using a fire stick, a piece of dry, fibrous, soft wood that smolders like punk and can be blown into flame whenever needed. The dry husks from a coconut make good material for this purpose.

FOREST DANGERS

The creatures that are most dangerous to man are small and inconspicuous for the most part and belong to the insect world. Mosquitoes generally are the most prevalent kind of noxious insect and in many cases are the carriers of yellow fever and malaria. You don't have to worry about yellow fever, as you have been inoculated against it, but there is no such protection against malaria. Hence you should guard against mosquito bites as much as possible. Since mosquitoes fly only in the evening and at night, the best way to escape infection is to get

under a net as soon as possible after sunset. This, of course, is not always possible, particularly if you have lost part of your equipment and have no nets. Under such conditions one should cover all exposed parts of the body as far as possible and build a smudge of heavy smoke to help drive off the mosquitoes. If you have salvaged your first-aid kit and are fortunate enough to have atabrine in it, take it. Take 0.1 gm. ($1\frac{1}{2}$ grains) just before dinner six days a week. If your first-aid kit contains quinine instead of atabrine take 0.6 gm. (10 grains) each day after the evening meal.

Seldom seen but often felt are the mites, commonly called red bugs, *bicha colorada*, *coloradilla*, *bete rouge*, jiggers or chiggers (although they are not true chiggers) that are widely distributed in the Americas, Europe, Asia, Australia, Japan, and the East Indies. They are bright red in color but are so small that they are scarcely visible without a magnifying glass. Their bites do not start to itch for several hours, but once they begin, the itching lasts for several days. It can be helped temporarily by painting the bites with iodine, proflavine, zephiran, or whatever agent you may have. As far as you are able to avoid it, don't scratch these places as you are likely to break the skin and start an infection that will produce an ulcer which is extremely difficult to heal even when frequently and carefully dressed. This holds true for any kind of bug bite. One common rule in the tropics is, *If you must scratch, keep your fingernails cut short*. The only sure protection against these mites is to avoid going into long grass or other bushy vegetation—a thing practically impossible to do if you are trying to work your way out of a jungle—to dust finely powdered sulphur (if you have it) over your skin and into your underclothing and socks, to use

the G. I. insecticide powder or coconut oil, to tie the bottoms of your trousers around your shoe tops, and after exposure to sponge yourself off with alcohol or some disinfectant not too irritating to the skin. A plain bath with soap helps if it is taken soon after you have been in the bush. The use of alcohol or similar solutions probably would depend on your arriving at a properly equipped base within a short time after exposure.

The true chigger, which is abundant in the American tropics and in parts of West Africa and India, is a small kind of flea. In addition to a fondness for men this flea also attacks animals, both tame and wild, and has a particular affinity for pigs. Hence it is likely to be present around any native habitations in those areas where it is common and where pigs are a part of the domestic scene. Chiggers bite like other fleas, but the female has the further unpleasant habit of burrowing into the skin, usually of the feet under the toenails, where in the course of a few days it swells to the size of a small pea and can be recognized as a whitish spot with a dark brown spot in the center. Prompt removal with a sterile needle or knife point (one that has been held in the flame of a match) is advised, as neglect may result in poisoning the whole system. As soon as you have removed the chigger, paint the place with iodine and cover with a protective dressing.

In the American tropics you may be bothered by wood ticks. They are small, dark red or brown and may be numerous in vegetation. They feed by burying the head and sucking blood. As a rule they do not take hold for several hours after getting on you and by carefully looking yourself over from time to time you can see and pick them off before they bite. You can remove them between your thumb and the point of a knife pressed

against the skin. If they have taken hold you may have to dig them out. Be sure to sterilize your needle or knife point before doing so and paint with iodine afterwards. In Asia, China, and the East Indies there are ticks of a different variety that inhabit the crevices in the mud walls of native huts and rest-houses. These should be avoided, as they carry a form of fever. Staying out of native huts is a good way to keep from getting them on you.

There are various kinds of scorpions and centipedes and they are common in most tropical countries. Their sting is painful but rarely is there any serious consequence if the bite does not become infected. Spider bites may cause local pain and swelling, yet they rarely have serious results. Wasps and bees may be abundant in some places but they seldom attack unless their nests are interfered with. In the case of stings, mud packs are very helpful in obtaining relief. In some areas there are tiny bees, called sweat bees, that may collect on exposed parts of the body in enormous numbers during dry weather, especially if one is perspiring profusely. They are stingless and, until one has stopped sweating, the only thing to do is to scrape them off with the hand. Ants are a possible source of danger to men lying on the ground, especially if they are injured and unable to move. Hence care should be taken to place such persons away from ant hills or nests.

In some localities, particularly in the southeastern Asiatic area, certain butterflies collect to gather perspiration from the human body in dry weather. They are somewhat annoying, but quite harmless. The rice-borer moth in Indo-Chinese countries during certain seasons of the year is attracted to lights and fires. It is a small, plain-colored moth with a pair of

tiny black spots on the wings. It should never be brushed off roughly as the minutely-barbed hairs of its body may be ground into the skin causing a sore much like a burn that often takes weeks to heal.

Land leeches are common in the Asiatic tropics. They are not poisonous in themselves, yet their bites may become infected and if not properly cared for lead to tropical ulcers or "jungle sores." One should watch for leeches on the body and brush them off before they have had time to bite. When they have taken hold they should not be pulled off forcibly. They can be made to release themselves and drop off by putting salt on them, by touching them with a moist cud of tobacco (this is especially effective if red pepper is mixed with the tobacco), by touching them lightly with the burning end of a cigarette or a coal from the fire, or by dropping some alcohol on them. Leeches try to reach mucous membranes and frequently enter the rectum or crawl up inside the penis without attracting attention until an itching sensation begins. Urination usually removes them immediately from the penis, but medical help may be needed to remove one from the rectum. After being satiated, however, leeches frequently leave the rectum with an evacuation. This produces a certain amount of blood flow that may be mistaken for beginning dysentery, but its short duration will remove fears on that score.

Snakes and Crocodiles

The thought of snakes usually is uppermost in the minds of most people at the mention of the word "jungle." There is no need to be unduly concerned about them, however, as you may

go for months without seeing a snake even in areas where they may be abundant. If you do see one it will probably be a fleeting glimpse as the snake will be making every effort to get away from you and disappear in the vegetation. Your chances of being bitten by one are about on a par with those of being struck by lightning. That does not mean that you should be careless of the possibility of snake bites, but ordinary precautions against them are sufficient. Just be particularly watchful when clearing ground for a camp site, trail, or the like, and when roaming in the bush gathering fire wood. Many snakes are non-venomous, but the safest plan is to leave them all alone. If you should happen to be bitten don't worry over what kind of a snake it was but go ahead and treat the bite as though it were from a venomous variety.

There are three steps that should be taken. (1) Immediately apply a tourniquet above the wound, that is, between the bite and the heart. Release the pressure for 5 or 10 seconds out of every 10 or 15 minutes so as not to stop circulation completely. (2) Make 4 or 5 parallel incisions, each about 2 inches long, as close to the snake bite wound as possible, and extending through the skin and fat and into the muscle. These cuts should be made with a razor, a razor blade or sharp knife, and should run lengthwise rather than across the limb. If the incisions are boldly made, bleeding and seepage of serum will be free and much of the venom will thus be eliminated. *Do not place permanganate crystals in the wound.* (3) Keep quiet; take hot fluids such as tea and coffee if available. *Do not take alcohol or morphine.* Have your comrades get you to a doctor as quickly as possible.

In some areas there are crocodiles in the streams. They can be avoided by not going into the water, or, when it is necessary to cross larger rivers, by doing so on improvised rafts. Authentic cases of crocodiles attacking human beings are practically impossible to find, so you don't need to worry over that. If you should approach or attempt to kill one along the shore, however, be careful of the sweep of its tail. They can move very swiftly, and the powerful tail is strong enough to break a man's leg.

Some of the South American streams have fish called caribe, palometa, or piranha that will attack men or animals entering the water and inflict dangerous wounds. They are infuriated by blood or sores but often do not attack persons without these conditions. They, too, can be avoided by staying out of streams where natives say they occur and by crossing on rafts.

Blood Worms

It is advisable to stay out of fresh water, as far as possible, in certain areas because the lakes, rivers, streams, swamps, ponds, irrigation ditches, and flooded rice fields may contain the young forms of various blood-worms or flukes. They may enter the body through the skin of bathers or persons wading in such waters, or through contaminated drinking water that has not been boiled or sufficiently treated with chlorine. The young forms of these flukes are harbored by certain kinds of freshwater snails. When they leave the snail and are discharged into the water they die within 48 hours unless another suitable victim is found. Hence water that has been stored in a container that is free of snails will be safe for washing and bathing in from

48 to 72 hours, *but it will not be safe to drink* unless boiled or chlorinated. The danger areas for these flukes are: The northern and western coastal areas of Africa, the Belgian Congo, French Equatorial Africa from Spanish Guinea south, the Gold and Ivory Coasts, Liberia, Sierra Leone, and north to Gambia, southern Spain, Palestine, and Syria, the northern half of the Arabian Red Sea coast, Madagascar, Mauritius, and Reunion islands, China, Japan, Celebes, all of Ecuador and a portion of northern Peru, the northern coast of South America and down the east coast to below Rio de Janeiro, and the Caribbean islands. The waters of Puerto Rico are particularly bad in this respect and should be avoided.

VI

FOOD IN THE TROPICS

ANIMALS, BIRDS, ETC.

The matter of food is one that will be extremely important. If, as previously suggested, you have made contact with the natives you will have little to worry about. However, it may be some time before you come to a settlement or meet up with any of the local inhabitants, and in that case you may be forced to make out the best that you can. It may not be pleasant to contemplate, but in an emergency you will find that many unconventional creatures are edible and are, as a matter of fact, eaten by the people of the country. Among them are lizards and snakes. The meat from the hind quarters and tail of the lizard is the best. It is somewhat dry and tringy but is very much like the white meat from chicken. No lizard is poisonous, except the North American Gila monster and the beaded lizard of Mexico, although the larger ones have good biting teeth and a person should take care not to be bitten by them. All snakes are edible, but they are not found as frequently as might be expected. They also taste much like the white meat of chicken, although the flesh may be a bit stringy and slightly salty flavored. In using snakes be sure that the head is cut off immediately. It is dangerous to hold some species by the back of the head as they have the ability to throw their jaws out of joint and reach around

to the hand. With both snakes and lizards, you skin, remove the viscera, and cook like any other meat.

All birds are edible, but some are not desirable. Carrion-eating birds, such as vultures should be used only in cases of last resort. They are in no way harmful, yet their usual source of food is such that it imparts an unpleasant taste to the flesh. This is often true of fish-eating birds. They are likely to have a definitely fishy flavor. Some birds, particularly parrots and hawks, are likely to be tough, but they can be stewed and used for soup. All birds' eggs are good for food, although some may be more palatable than others. If you want to be certain of fresh eggs remove all but one from the nest and take the fresh ones as they are laid. Along the shores and particularly on the smaller islands where birds lay their eggs in great numbers a section of previously laid eggs can be cleared, the area marked, and those left there subsequently gathered and used.

Animal life differs in its distribution. In some areas there is considerable variety and individuals are fairly numerous. Other places have only a few forms and not many of each. Too much reliance should not be placed on animals as a source of food because they are difficult to find and probably will be hard to kill with the equipment at hand. If you have a rifle or a revolver you may be able to shoot enough to keep going, but often it may not be desirable to use firearms. Most of the smaller animals can be killed with clubs, may be trapped by making noose snares, constructing deadfalls of logs, or by digging pits and covering them with light branches, twigs, and leaves. Natives generally thrust sharpened split-bamboo or other sticks in the bottom of such pits to impale the animals when they fall into the hole. Such pits, of course, are placed in game trails.

All animals are good to eat; the flavor of some may not be all that you would desire but they are edible. Monkeys are good if you can shoot or catch them.

Should you be fortunate enough to get a sizable animal and have more meat than you can use at one time, the extra may be preserved for future use by drying. One method of making this jerked meat is to cut the flesh into long, thin strips not more than an inch in width and a half an inch in thickness. Soak these strips in brine, if salt is available to make it, an hour or two. String the strips of salt-soaked meat on the limb from a small tree and hang over a smoking fire until thoroughly dry. Where sea water or salt is not available the meat can be dried by exposure to the sun. Under such conditions the strips may be tied to long cords and thrown over a branch or some other high support, such as a line tied between two trees, where they will receive the full sun. The higher they are from the ground the less danger there is that the meat will become fly-blown before it is cured. If it is not convenient to hang the meat, it is possible to dry it on flat rocks or hot sand. In such cases, however, it must be turned from time to time so as to cure evenly and must be protected from flies, ants, and other insects.

There are other living things that also may be used as food. The white grubs of the palm weevils and other wood-infesting beetles are highly prized by many native people. Their larvae, often as big as your thumb, are found in rotting wood and around freshly cut places on palm trees. Split and broiled over the coals of a fire, they are quite palatable and have a flavor somewhat like that of oysters. Natives rarely bother to cook them, preferring to pop them into their mouths as they find them. Large grasshoppers and cicadas with the legs and wings

removed may be toasted on the end of a stick. The pupae or eggs of ants are edible but are difficult to collect in quantity. Winged termites, which migrate in great numbers during the rains, are also edible when the wings have been removed.

There are two main kinds of shrimps, often called crawfish, and a host of smaller varieties averaging about an inch in length. They can be caught in various ways. Along the larger streams in the shallow places near the shore, where water is nearly stagnant, masses of small shrimps may be found swimming about and be taken with hand nets; if you don't have one you can make one that will do by fashioning a hoop from a shoot or small branch and interlacing strips of leaves or fibers to make the mesh. Best results are obtained by people working in pairs and standing in the water. One drives the hosts of shrimps towards the other who dips them out with the net. In some areas the natives will dam a shallow narrow stream making a fairly watertight barrier of branches, sticks, large leaves, mud, and sand. As the section downstream runs dry, the shrimps stranded there or hiding among and beneath rotten pieces of wood, branches, leaves, in the crevices between the rocks, and among roots or other debris are collected. Fish and crabs are often obtained in the same manner at the same time. The best yield, however, comes from the bailing dry of many pools and puddles still remaining in the bottom of the stream bed. With larger pools build a mud dam across and scoop the water with your hands, if you have nothing else, out of one side until you can catch the shrimp or fish found in it. Then scoop the water back from the other side and get the rest of them. Anything that can be picked up to serve as a scoop is used to dip out the pools, or small dip nets are made on the spot for the purpose. Where

bushes grow along the edge of a stream and the branches droop down so that some of the twigs and leaves are in the water, large catches are sometimes made by lifting the branches out of the water and catching the shrimps as they drop off the leaves. This produces better results if it is done at night as the shrimps seem to leave the bushes during the day when they are more active. All land crabs, freshwater crabs, freshwater fish, and shrimps *should be cooked before eating*.

Shrimps are usually cooked by boiling. In the larger forms only the abdomen, the tail end, minus its shell, is eaten. The shell is easily removed after cooking. The small forms make good soups or stews when cooked whole, but if they form too great a part of the diet and are eaten continually over a period of time the shells may produce diarrhea. This can be avoided by straining the soups or stews before eating or by adding some other bulky food substance to it. Land and fresh-water crabs are cooked in the same way as the salt-water forms. See p. 42.

FOOD PLANTS IN THE TROPICS

Plants are one of the main sources of food in the tropics. The natives eat many wild and cultivated plants that are unknown to white men not familiar with the different areas where they grow. It is not possible to name and describe all of the forms suitable for emergency or general use but a few of the more common and obvious ones, those readily identified, are discussed in the following pages. One rule that can be relied upon is that *whatever the monkeys eat is safe for human beings*. Monkeys are not present everywhere, although they do occur in many of the places where you may go. Birds are more widely distributed but

they are not a safe guide as they will occasionally feed on things harmful to man.

Food plants are more abundant in some localities than others and your chances of finding them vary according to the nature of the place where you are forced to look for them. Seashores, abandoned clearings, margins of streams, and swamps are more likely places than deep tropical jungles or mountain tops. The best places to find food plants, of course, are those where men are or have been growing them. In cultivated regions you can depend upon the natives for food, if you have made the proper contacts in the manner already described in the discussion of natives (chapter IV, p. 53). Where there are no natives you will have to fall back on your own resourcefulness.

Plants Along Seashores

In many cases the need for emergency food plants may arise along a seashore. As a general rule such places are better supplied in that respect than other locations. This is in part because of the fact that in less civilized regions the people tend to live near the sea and as a consequence there are numerous cultivated plants, although they actually may not longer be cared for, as well as various wild forms. Many of the sandy, tropical shores have plants which are found all over the world. Coconuts and other palms (Fig. 16) characteristically line many tropical coasts. The many uses of the coconut have already been described in the section on Island Survival (p. 31), and need not be repeated. Other kinds of palms are also a valuable source of food. The tender growing tips, usually found at the tops of the stems in the bases of the leaves, may be cut out and eaten

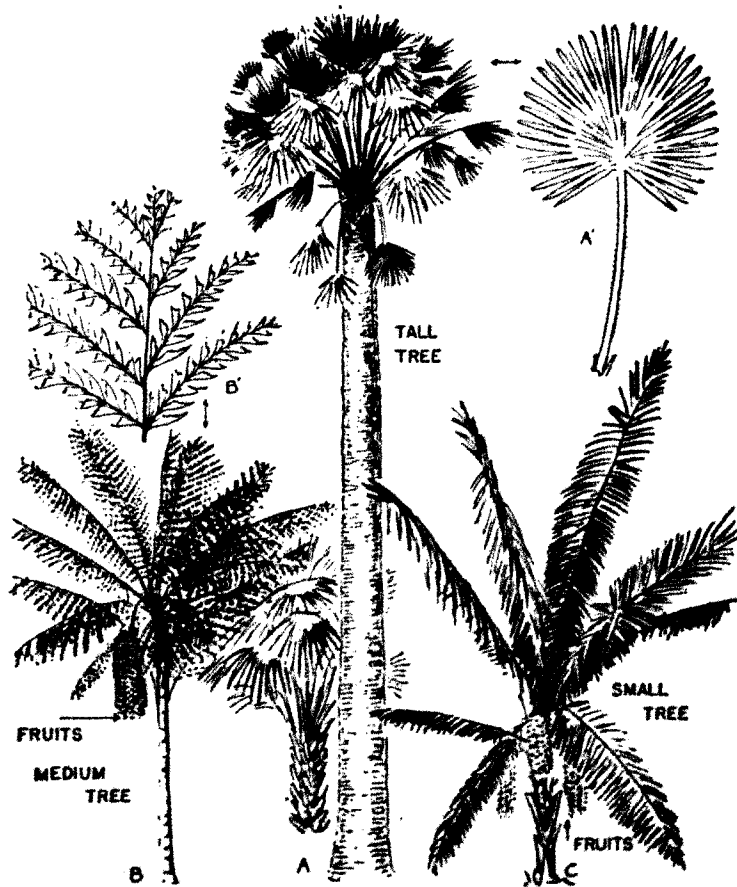


FIGURE 16.—Types of palm trees.

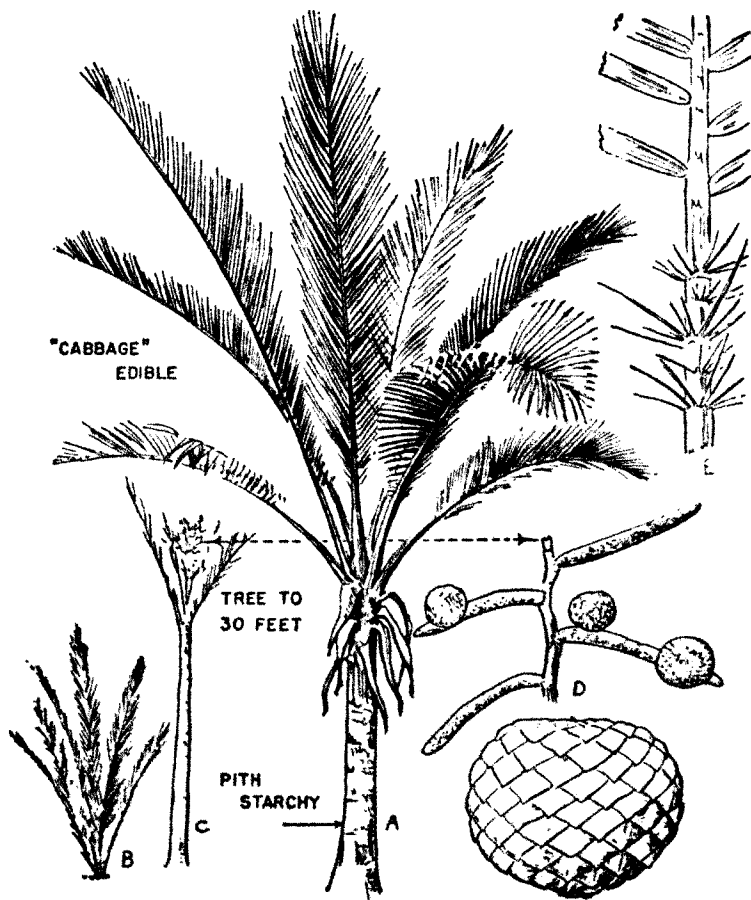


FIGURE 17.—Sago palm.

raw or roasted. These are what are commonly called palm "cabbages" (Fig. 17). To get at them you may have to use the "climbing bandage" described in connection with obtaining coconuts. You may find that some of these "cabbages" are too bitter to be eaten, but none of them is harmful. The tender, unopened flower clusters of palms may also be eaten and the immature seeds of the fruits of some forms are edible, although you will find most of them unpalatable. The juice which drips from the cut end of the flower or fruit cluster, or from the end of a small branch or from a gash in the trunk, will quench thirst if caught and drunk immediately. When permitted to ferment it becomes like hard cider.

Several of the Old World palms have a pithy center that contains starch which can be extracted for use as a substitute for rice or for the making of pastries. The process for obtaining this material is so involved, however, that one should depend on the natives for it or, if possible, have the natives show you how to prepare it. None of the New World palms provides this starch.

Another tree commonly found is the screw pine or pandanus (Fig. 9). It is easily recognized by its stilt-like roots and the spiral arrangement of its long leaves. It has a large fruit divided into sections like a pineapple. These sections are covered with a hard husk that encloses the fleshy, edible pulp and the seeds. The seeds may be roasted and eaten like chestnuts; the fleshy portion may be boiled or baked. Boiling is better for the young fruits, baking for the mature ones. In some cases the natives strip off the outer rind with the seeds and then pound the flesh of the fruits into a dust resembling snuff. This dust is exposed to the sun until a sweet juice exudes making the whole mass sticky. This mass is then rolled and



FIGURE 18.—Breadfruit, A. seedless, B. type with seeds.

patted into broad flat cakes which are rolled up and tightly wrapped and tied in dry leaves. In this fashion the food may be kept for some time. Remember that water also can be obtained by tapping the tops of the roots of the screw pine.

The breadfruit tree (Fig. 18), commonly planted by the Pacific Islanders and in tropical America, also may be found along or near the shore. The tree attains a moderate height, and has large glossy leaves. The fruit is attached to the small branches by a short thick stalk and hangs either singly or in clusters of two or three together. It is oval or spheroid in shape, is approximately 6 inches in diameter, and has a rind with a warty surface. There are many different varieties ripening at different times of year providing an almost constant supply. The fruit usually is baked in hot embers, in pits filled with hot rocks and covered with palm leaves, or is boiled or cut into slices and fried like potatoes. Sometimes the natives cook the fruit and cut it into slices, dry them in the sun or in an oven, and keep them for future use. They can be eaten without further preparation, may be toasted, or be ground up and cooked in various ways with other substances.

Throughout Polynesia and to some extent in Malaysia is a small or medium-sized tree growing from 8 to 10 or up to 20 feet in height called the Polynesian chestnut (Fig. 19). It grows especially along the shores and bears pods which contain a single large seed that provides excellent food when boiled or roasted. It is even better than the chestnuts which we formerly obtained from Italy. It is necessary to boil or roast the nuts to remove the tannin which they contain. There are other trees similar to chestnuts with fruits varying from those with a hull as spiny as that of a chestnut to those with a hull that is merely rough

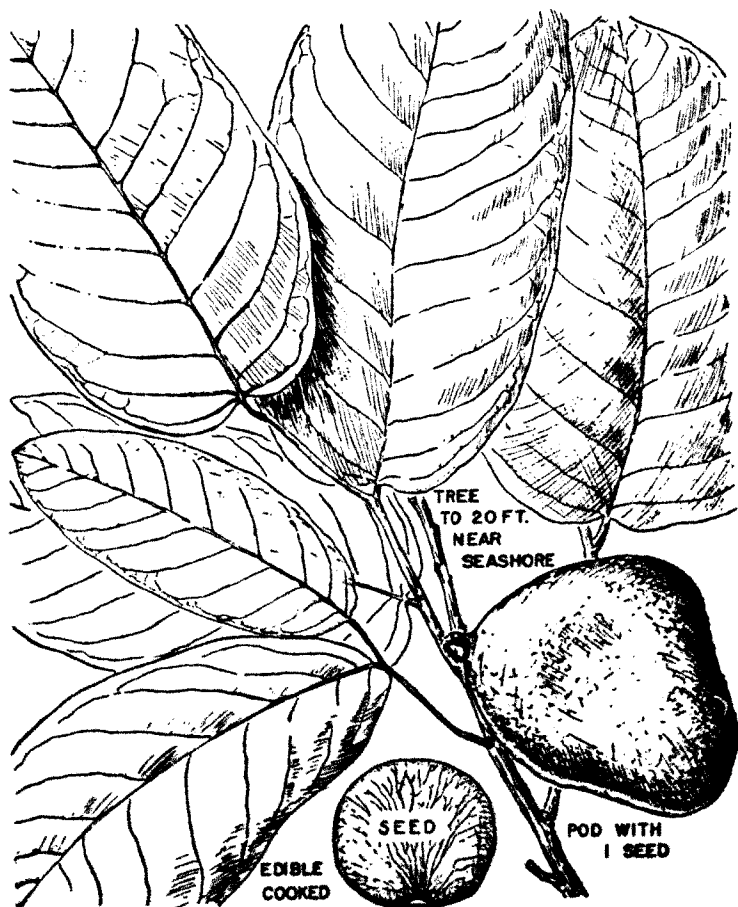


FIGURE 19.—Polynesian chestnut; must be cooked.

like that of a walnut. The nuts are obtained by breaking open this outer covering. In all cases they should be boiled or roasted.

Vines bearing edible fruits occur along many shores. Included in these are forms of the grape, gourd, and melon. One common example is the strainer vine which bears elongated green fruits that are edible when half ripe provided they are cooked. The tender shoots, leaves, and flowers of this vine also are edible. The so-called balsam vine has rough, yellow fruits about 6 inches long of varying form and with reddish pulp that may be eaten.

The purslane, previously mentioned as a source of moisture in the discussion of water on Islands (p. 33), is also edible in the form of greens.

Another plant found on or near the shore is the Polynesian arrowroot (Fig. 20), which has a potato-like underground tuber that can be eaten after it has been boiled or roasted but *which must not be consumed in its raw state* as it contains poisonous elements that are destroyed by cooking.

If you have the misfortune to land along a shore bordered by mangrove swamps do not waste your time trying to fight your way through or looking for food in them. Try and work your way along the coast to a better beach or more open type of vegetation. In some cases a few screw pines may be found growing in such swamps and there are ferns that may be eaten as greens, but otherwise mangrove swamps have little plant food. Of course, if you find yourself in such a place make the best of it and try to get to the coast as quickly as possible.



FIGURE 20.—Polynesian arrowroot ; must be cooked.

Clearings and Abandoned Fields

These are the best places to find food plants because they generally have been cultivated at some time or other and cultivated forms of plants will persist long after fields have been abandoned. These places may occur along the shore or be found in the interior of the country. Nearly all of the fruits found there can be eaten. It is not possible or practicable to list all that you might find under such circumstances but there usually will be bananas and plantains. Ripe bananas are rarely found because the birds, bats, insects, and other creatures usually get to them first, but the green ones are edible when cooked. They may be boiled, fried, or roasted. Of course, you can pick a green bunch and let the fruit ripen but that takes time. The plantains, which you probably can't tell from bananas and it doesn't really matter anyway, are generally dark green, brown, or orange in color and will seem like green bananas. They should always be cooked. The flower buds and the tender growing tip at the upper end of the stem of these trees are also edible. Ripe bananas may be preserved by slicing them and then drying the pieces in the sun.

The papaya (Fig. 21) also occurs around clearings and former habitations in the tropics. This is a tree-like plant growing up to 20 feet in height with a single stem and a tuft of long-stalked leaves at the top. On the stem below or among the leaves grow large melon-like fruits resembling elongated cantaloupes or muskmelons. The fruits are green before ripening. On reaching maturity they become yellowish green or yellow and squash-like. The flesh is pepsin flavored and truly delicious. The milky juice of the unripe fruits contains a substance that is an aid to diges-

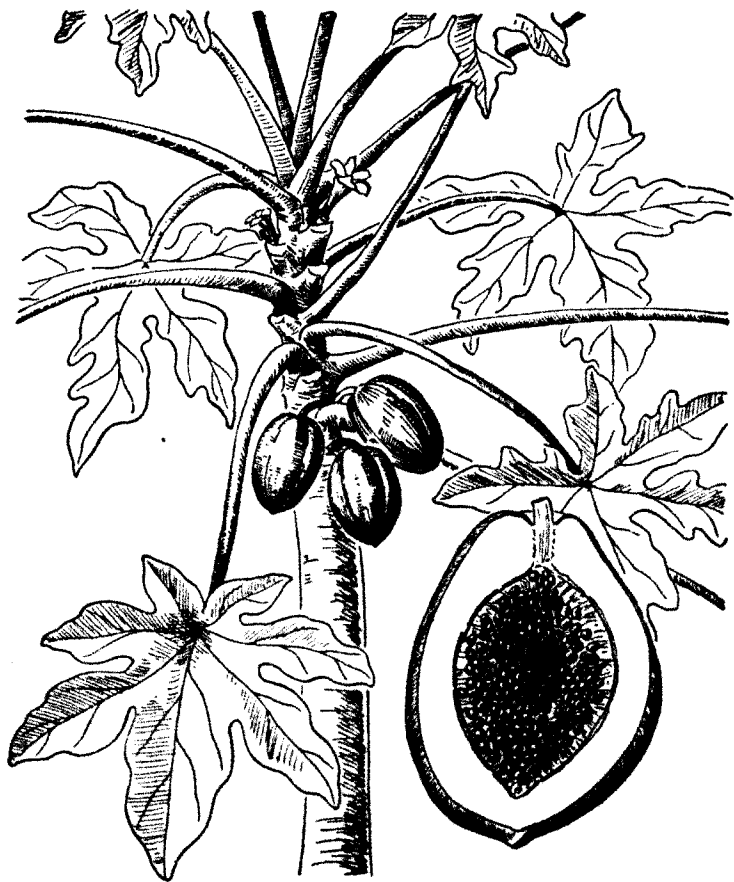


FIGURE 21.—Papaya.

tion and if rubbed onto a piece of tough meat it has the property of making it tender. If this milky juice oozes from the rind when it is cut the fruit is not ripe enough to eat. The juice should not be allowed to remain on the skin, because it will set up an irritation. Green fruit may be placed in the sun where it will ripen in a very short time. Do not attempt to climb a papaya as the wood in it is so brittle that it is liable to snap under a man's weight. The trunk can be severed by a single blow from a machete. You should be careful not to get any of the milky sap, either from the stem or the rind of the fruit, into your eyes as it will cause intense pain and temporary, sometimes even permanent, blindness. The flower, leaf steams, and young leaves may be eaten cooked as greens provided you cook them in several changes of water to remove the bitter taste and harmful substance from the sap.

Mango trees are often found in abandoned clearings and around deserted village sites in the East Indies and southern Asia. The delicious fruit that they bear is somewhat larger than a baseball. It is elliptic or round and somewhat flattened in shape (Fig. 22). The leathery rind, yellow or greenish in color and somewhat spotted, encloses the edible pulp that clings closely around a single, large, and flattened seed. The fruits ripen from early summer through early autumn.

A common tree found on abandoned plantations in South America, as well as in the Pacific area, is the cashew (Fig. 23), the nuts of which are popular in the United States. The nuts are not edible until boiled or roasted, and all of the oil must be heated out of them before they are eaten. When boiling or roasting, avoid the steam or smoke as it is very caustic. The greatly swollen base, reddish or yellowish in



FIGURE 22.—Mango.

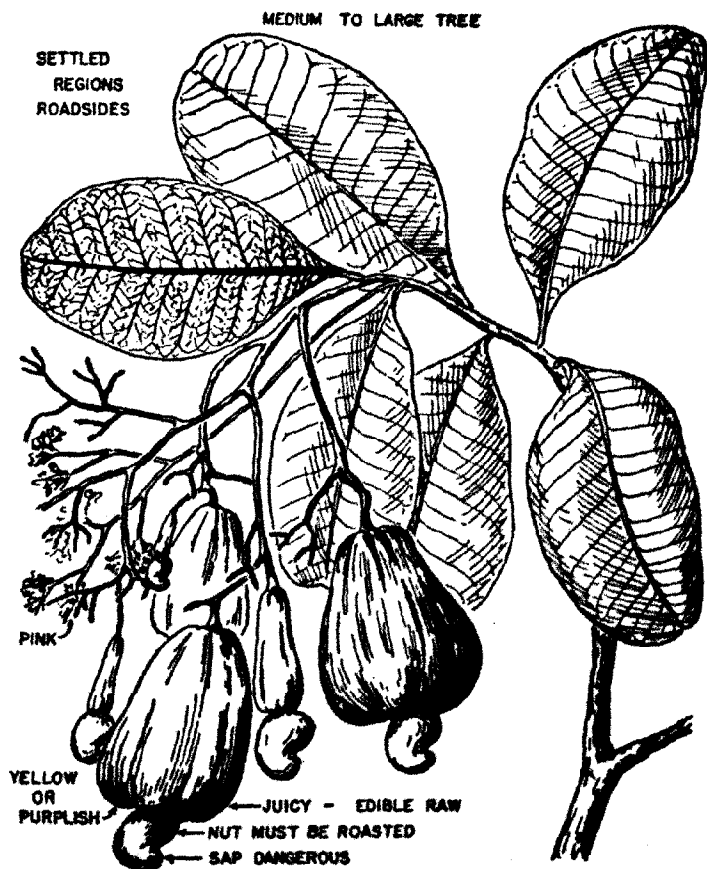


FIGURE 23.—Cashew; nuts must be cooked.

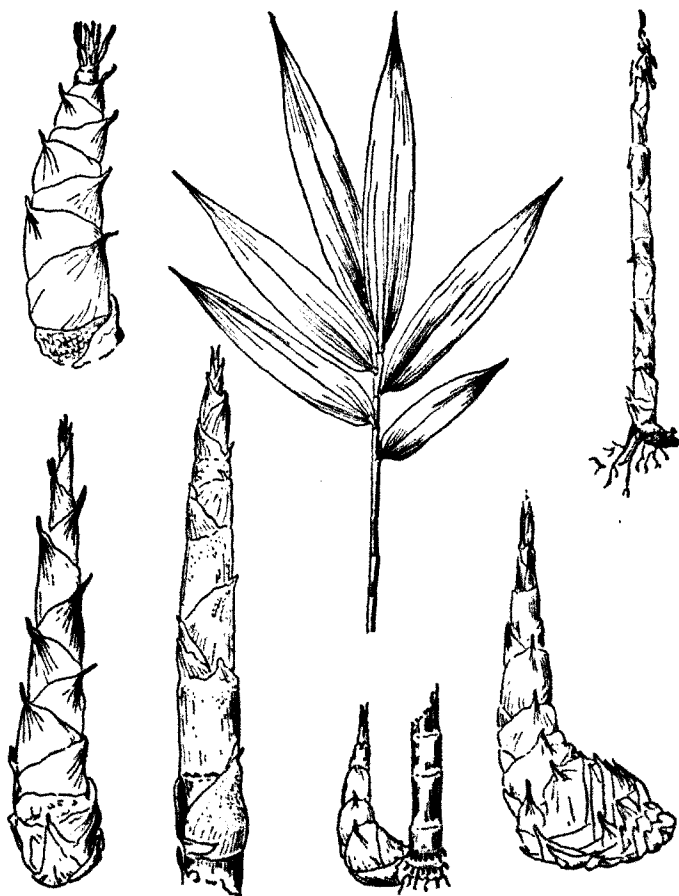


FIGURE 24.—Bamboo sprouts.

color, on which the nut grows, however, is juicy and refreshing when fresh.

Bamboo and sugarcane are commonly present in formerly occupied areas. Young bamboo sprouts (Fig. 24), up to a foot or so in height, are stored with food substances and can either be eaten raw or be cooked by boiling. Sugarcane (Fig. 25)



FIGURE 25.—Sugarcane.

roughly resembles corn with reddish stems, has its leaves near the top and has no "ears." The outer layer of the stems may be peeled off and the inside pith chewed to get the refreshing and nourishing sweet sap.

A coarse grass found in clearings, abandoned fields, and forest borders in Polynesia and Malaysia has seeds that may be boiled or roasted. The hearts from the young shoots of this grass may also be eaten.

Vegetables are also found in these locations. They include the taro, sweet potatoes, yams and in tropical America wild tomatoes. The taro (Fig. 26) grows to a height of 2 or 3 feet, has large heartshaped leaves and yellowish-green flowers. All parts of the plant may be eaten, but its roots are the main source of food and they are used throughout the Pacific Island area. The root is naturally bitter or pungent in taste; yet after roasting or boiling it is perfectly wholesome. After cooking the roots the natives usually peel them, pound them into a powder, then gradually add water, kneading the mass as they proceed, until it attains a dough-like consistency. It is then wrapped in leaves and eaten at will.

Sweet potatoes are easily recognized as they look like morning glory vines. When in bloom the blossoms are pink. The potatoes are better if cooked, although they may be eaten raw, and the tops of the plants make good greens when boiled. Many other morning-glory-like vines have edible shoots and leaves and may have edible roots. None is poisonous. Yams have climbing vines with a slender stem and simple leaves resembling an open human hand. They have small, inconspicuous green flowers. Their tubers are usually long and spindle shaped, some attaining a length of from 2 to 4 feet.

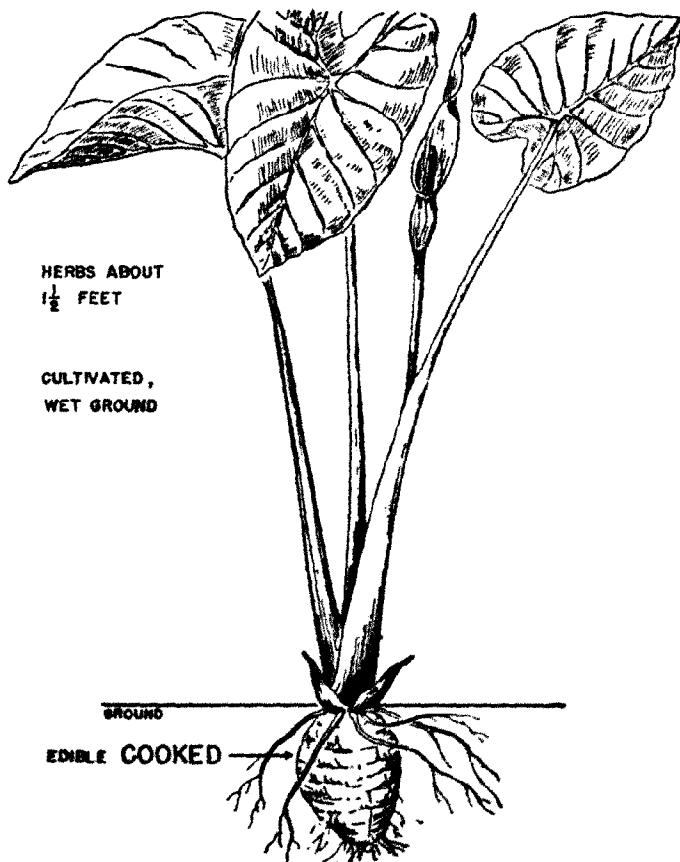


FIGURE 26.—Taro, roots must be cooked.

They may be baked or boiled. In baking these tubers the natives dig a pit, put in large hard rocks and build a fire. When the rocks are hot the food is placed in the pit, on green leaves, and the hole is covered with palm or other large leaves. Earth is sometimes heaped over the leaves. After half an hour or so, depending on the number of stones and how thoroughly they were heated, the food is ready to eat.

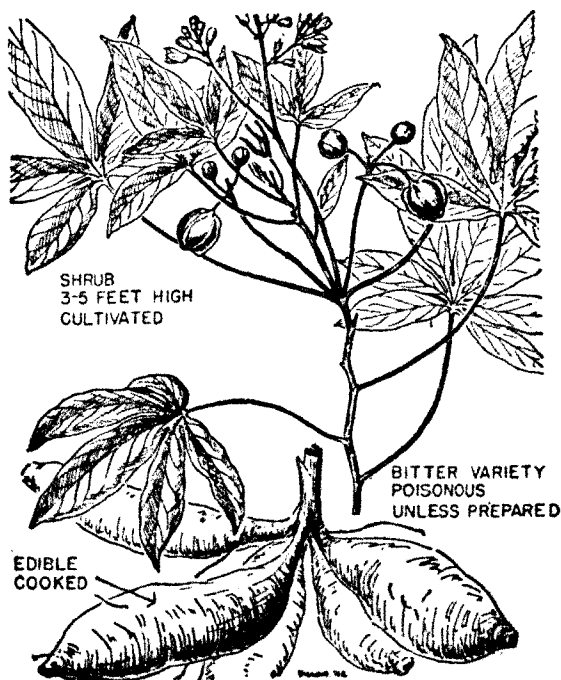


FIGURE 27.—Cassava, or tapioca.

Another common vegetable is the cassava, manioc, or tapioca (Fig. 27). The large roots of these plants should be used with caution as there are two varieties, one sweet and the other bitter. They can only be distinguished by taste. The sweet form may be eaten raw but the bitter form is poisonous unless it is cooked. The natives remove this poisonous substance by crushing the roots thoroughly, washing the starchy mass with several changes of water, and then cooking it. If you are in a region where you can learn how it should be prepared, do so, as the knowledge might prove helpful later on.

Peanuts may often be found in clearings as they are cultivated in many tropical and semitropical areas by the natives. The fruits are borne below the surface of the ground and their seeds are very nourishing. They may be eaten raw or cooked. Pineapples also occur in abandoned fields.

Many common temperate zone weeds are found in clearings in the tropics. They also are edible. Among these is the purslane previously mentioned (p. 91) and the pokeweed (Fig. 28). The tender, young shoots of the latter may be cooked as greens. The roots, however, are definitely poisonous. The ground cherry or Chinese lantern plant (Fig. 29) has escaped from cultivation and become a weed almost throughout the tropics. Its bladdery pods contain a single red tomato-like fruit that is edible.

Raspberries, blackberries, and mulberries are sometimes found at higher elevations. They look sufficiently like the forms you are familiar with at home to be recognized. All are edible or at least harmless. Some of them may be too seedy to be palatable, but they won't hurt you.



FIGURE 28.—Pokeweed.

Open Grassland, Thin Woods, and Thickets

There are large areas in the tropics which are only sparsely covered with vegetation consisting for the most part of grasses and a few scattered trees. Some of these areas are the result of the destruction of the original vegetation by cultivation or by fires. They are often quite dry. Various grasses are found in these open spaces and as there are no poisonous grasses any that are found may be eaten without danger. In fact, most of man's cultivated food comes from grasses such as wheat, rye, corn, sugarcane, etc. Real grasses can be recognized by their jointed stems, such as in a cornstalk, and by their characteristic flowers which are never conspicuously colored. Because their seeds fall off readily after ripening they are generally difficult to gather. Also their seeds usually need to be ground into some kind of flour and cooked before being eaten. One form of grass, however, has fairly large, usually white and shiny, beadlike "fruits" called Job's Tears. These contain several seeds that can be eaten either boiled or roasted. This plant is sometimes cultivated.

A small tree—up to 20 feet in height—that grows in open and waste places, as well as in cultivated fields, in the Old World is the horseradish tree (Fig. 30). The leaves, shoots, and young pods of this tree may be eaten raw, or when cooked as greens. The seeds may be roasted. The roots of the tree taste like horseradish.

River and Stream Margins

Because of their variability, tropical streams are bordered by a large number of potential food plants. In the Far East the



FIGURE 29.—Chinese lantern, or ground cherry.

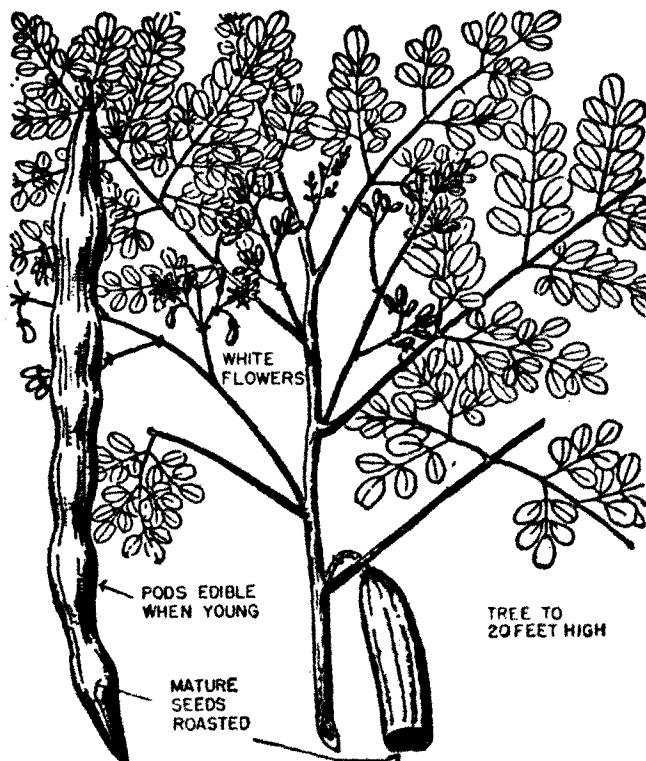


FIGURE 30.—Horseradish tree.

lotus and various water lilies (Fig. 31) and other plants with large, fleshy, edible roots are often found growing in water. Floating on the surface may be the water hyacinth, a plant that

is about one foot in height and has blue flowers and inflated leaf stems. The young leaves, leafy stalks, and the flowering parts may be eaten in an emergency, either steamed or boiled.

In the soft mud along the banks of streams, along the edges of ditches, and also in abandoned rice fields, is a plant called the arrowhead, which has an underground stem or tuber that is edible when cooked. Other water plants also grow in such places and all parts of them can be eaten when cooked as greens. Ferns growing in such places also may be used as food. The young shoots are better and may be eaten raw or when cooked as greens. (See fig. 32.) Of course, many of the trees and other forms of plants already described, bamboos, bananas, palms, etc. may be found along the streams as well as in the other locations mentioned.

Rice sometimes escapes from cultivation and may be found growing wild along the banks of streams and ditches.

Swamps

Swamps often occur along rivers and smaller streams, as well as along the coasts, and some food plants are to be found there. Edible ferns occur in fresh water swamps. The wild form of the Chinese water chestnut (Fig. 33) is often found in the open fresh-water swamps of the Old World. Its nearly round, hard tubers are produced underground. They are excellent when boiled or roasted. Another plant that grows in fresh-water swamps and swampy places more or less in the open has very large leaves and stalks more or less covered with short spines (Fig. 34). It has a large underground part that is rich in starch, but it should be eaten only after it is

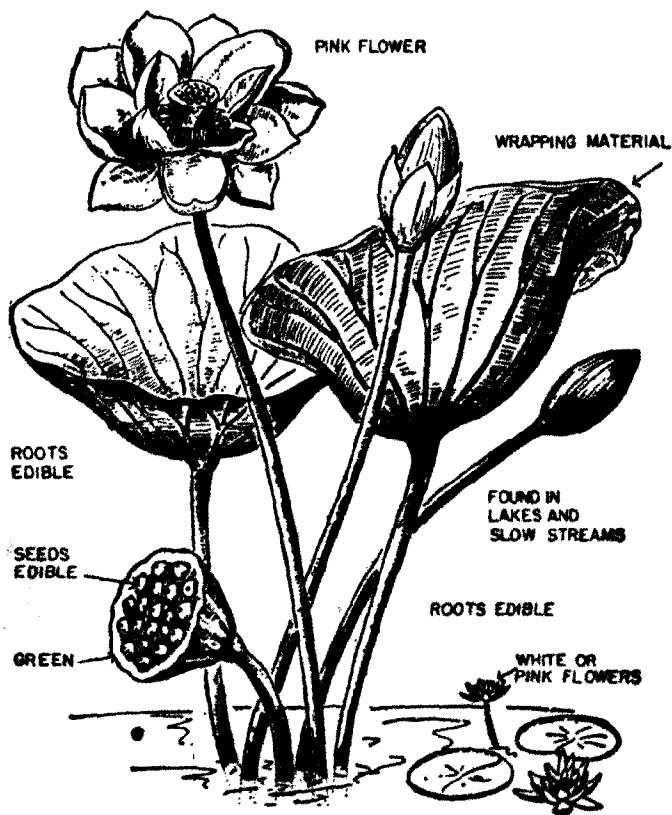


FIGURE 31.—Lotus; water lily lower right.

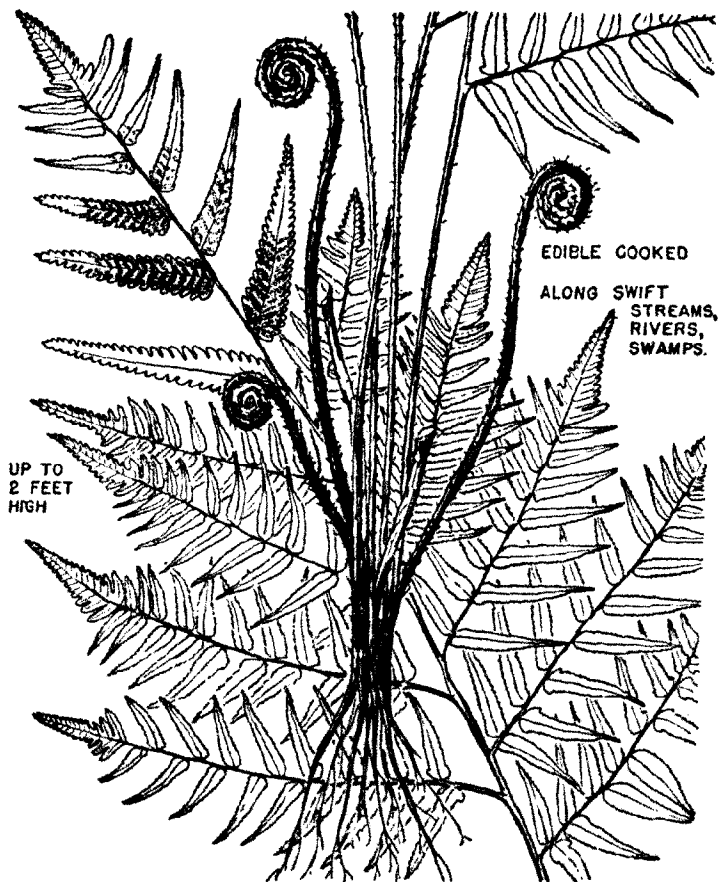


FIGURE 32.—Paco fern.

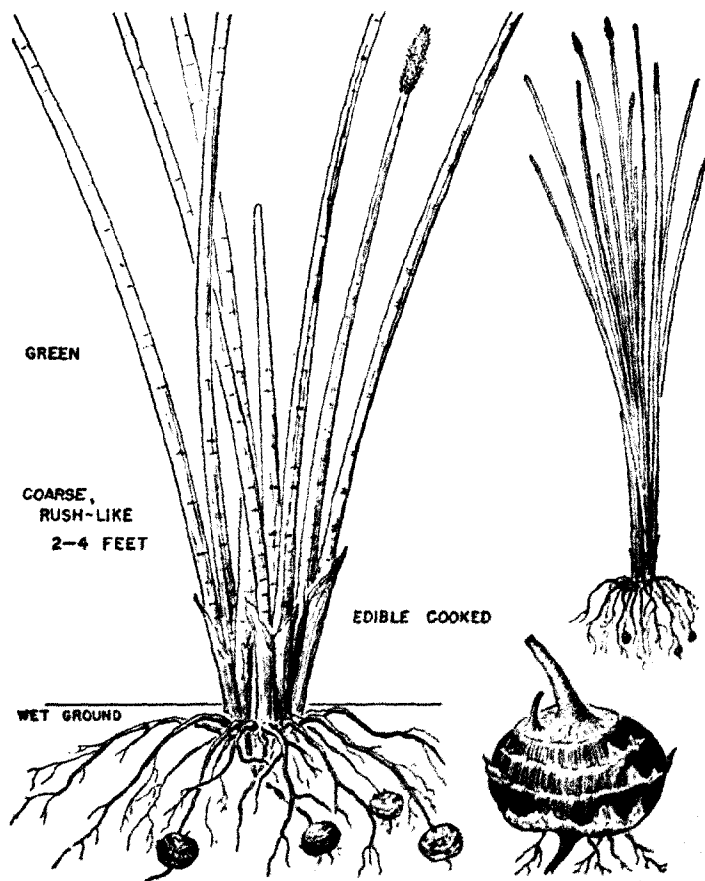


FIGURE 33.—Chinese water chestnut.

thoroughly cooked, either by boiling or roasting. A vine resembling the morning glory or the sweet potato frequently may be found in fresh-water swamps and ponds. The stems and young leaves of this plant make good greens when cooked.

Salt water or brackish swamps are very extensive in the tropics along rivers near the sea and along the coasts. As previously mentioned, relatively few kinds of edible plants are to be found in such locations. The swamps along the rivers, however, do have nipa palms—a tree that has no trunk, its leaves rising in tufts around the “cabbage” just above the surface of the swamp—that produce dense clusters of erect fruits, the immature seeds of which are edible. Nipa palm swamps often occur on the inland side of mangrove swamps. A climbing fern and a coarse tufted fern may be found in both kinds of swamps. These ferns are edible.

Forests and Jungles

Edible plants are generally less abundant in deep forests and jungles than in the locations discussed in the preceding pages. Those that are present often bear their fruits and other edible portions high out of reach. Palms are common but you may have to climb to reach the “cabbage.” Tree ferns with tender, coiled, young leaves and edible terminal buds may be found. The climbing palms or rattans (Fig. 14) have edible terminal shoots, although they may be high in the tree tops.

The Durian (Fig. 35) is a large forest tree that bears excellent fruits about the size of a coconut. They are readily recognized by their odor which is very strong and fetid, and has been likened to that coming from decayed onions. The fruit is round

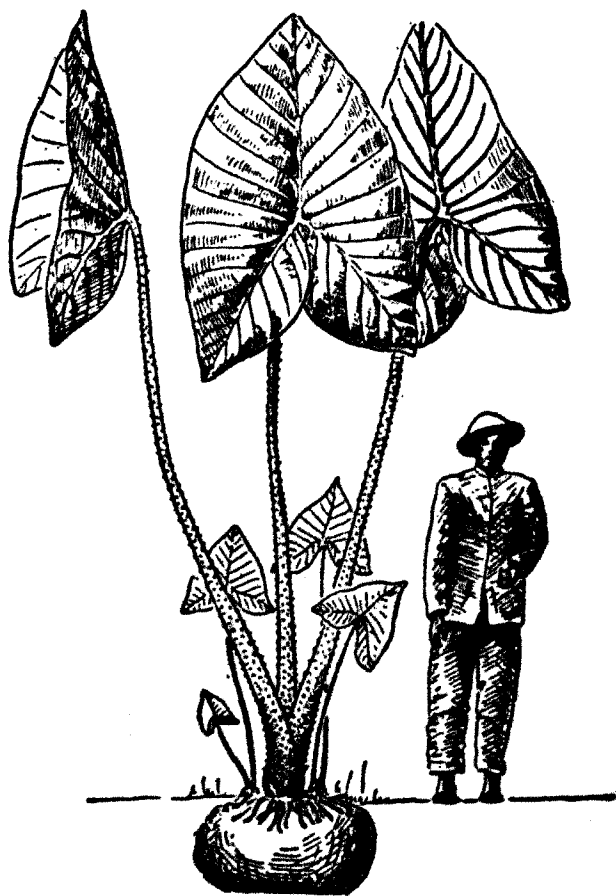


FIGURE 34.—Palau; root must be cooked.

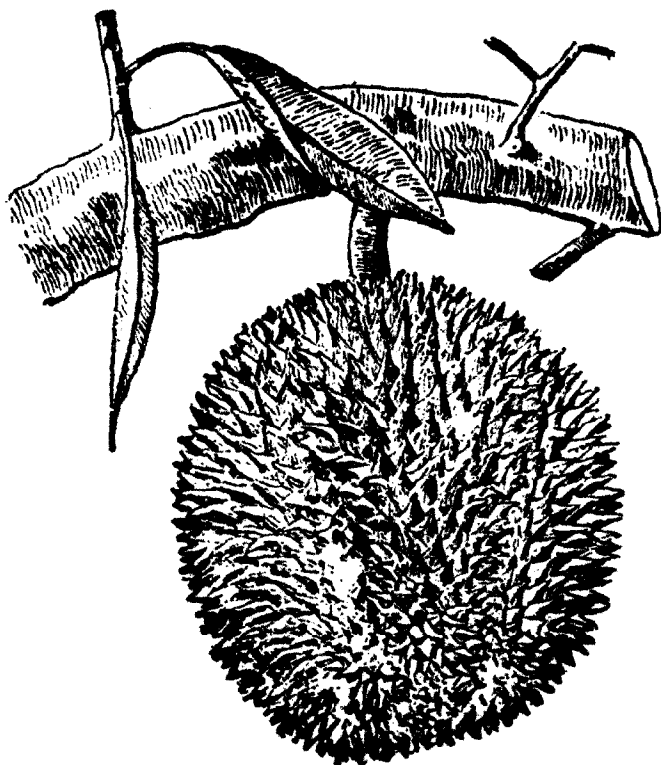


FIGURE 35.—Durian tree.

or slightly oval, green in color, and is covered with short, stout, sharp spines that make it difficult to pick up if the stem is broken off. The outer rind is so thick and tough that it never breaks when it falls. It can be opened with a heavy knife by cutting along the five grooves which run from end to end beneath the spines. The cream-colored yellow pulp surrounding the few seeds is best when the fruits first fall from the tree. It is eaten raw, especially when ripe, but when unripe may be cooked as a vegetable. Despite its foul odor, the fruit is very nourishing. These trees can often be located by following the odor radiated in all directions from the fruit lying on the ground. The seeds from the fruit may be roasted and eaten like nuts. Because the fruits are so large and so covered with spines they might kill a man if they fell on him. Consequently one should not lie under a durian tree.

There are many kinds of fig trees, shrubs, or vines in jungles. They are recognizable by their milky juice and fig-like fruits. These fruits are generally smaller than domestic dried figs. They usually are round with a more or less hollow center containing numerous small "seeds" and a small opening at the end. This opening may be pressed shut when the fruit is ripe. Most of these fruits contain small insects but they are edible unless decayed. When infested with insect larvae it probably would be better to boil them before eating. There are other forest trees with edible fruits but they are difficult to identify even if they can be reached. The fruit can be tested by eating a small sample and then waiting some hours to see if harmful results develop before trying larger amounts. If it tastes bitter or produces a burning sensation in the mouth don't eat it.

Particular Regions

Most of the information in preceding pages applies more specifically to Polynesia, Malaysia, and the Philippines than to other areas. Over so vast an area the various plants differ from place to place, but nowhere is there any need to suffer from hunger if a person will keep his eyes open and do a little experimenting. In the mountains of New Guinea, Java, and the Philippines the vegetation is less tropical than in other parts of the area, hence the food plants will be less tropical in character. In these regions, however, one can learn readily from the natives.

Throughout Siam and Indo-China, countries sometimes included in Malaysia, there are the usual tropical plants and in addition true spine-covered chestnuts, some oaks with edible acorns, and a few wild apples and peaches. The common bracken fern of temperate regions, with tender uncolling edible leaves, occurs there and the same kind of mulberries found in North America are present. In addition there is a forest tree called the longan (Fig. 36) which bears clusters of yellowish or yellowish-brown, smooth fruits that are delicious. The Chinese lychee or "China Nut" tree (Fig. 37) grows wild in the area. Wild relatives of the orange and grapefruit are also found.

In tropical America there are many kinds of types of plants similar to those in Malaysia. These include palms, figs, papayas, bamboo, and bananas. Cashews abound along the roadsides and in overgrown fields. Wild tomatoes with small edible fruits grow nearly everywhere. In northern South America the cow or milk tree yields a drinkable sap when the bark is cut. The cassava or tapioca is abundant but the bitter form is more common and must be prepared as previously suggested

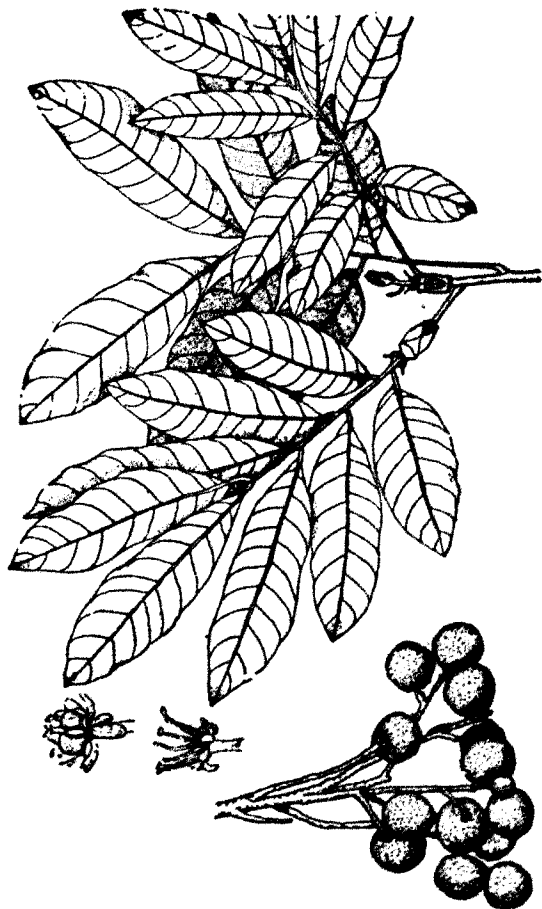


FIGURE 36.—Longan tree.



FIGURE 37.—Lychee, or "China Nut."

before eating. In the drier places there are various kinds of cactus plants. Their fruits and fleshy stem segments are edible raw or cooked provided the numerous spines are carefully removed. Some of the larger, rounder forms have stored water useful in quenching thirst. The mango grows wild in Central America and parts of the West Indies and their fruits are available from May to August or somewhat later.

In tropical Africa there are dense, lowland jungles and drier plateaus with more open vegetation. The same types of plants, although different forms, occur here as elsewhere in the tropics and are prepared and eaten in about the same manner. There is no lack of emergency food plants in that area.

POISONOUS PLANTS

There is no reason to fear the poisonous plants in the Tropics any more than in temperate regions. The best general rule is to avoid all those with a milky sap, with the exception of the numerous varieties of the wild fig, and all those whose taste is disagreeable, or that have brightly colored shiny seeds.

Poisonous plants fall into three general classes :

- (1) those which poison a person internally when eaten ;
- (2) those with sap that irritates the skin in the manner of poison ivy ;
- (3) those with minute needles or spines that penetrate the skin and cause irritation.

Identification of such plants by persons not familiar with tropical vegetation is difficult. If one has an opportunity to do so it is best to learn the various kinds that are to be avoided from the natives. Otherwise just be careful about touching or



FIGURE 38.—Physic nut ; seeds poisonous.



FIGURE 39.—Castor bean; seeds poisonous.

grabbing plants at random. Testing unknown plants by small samples usually will reveal the harmless ones without causing serious injury.

Widespread throughout most of the Tropics are the physic nut (Fig. 38) and the castor oil plant (Fig. 39). The seeds of both are poisonous to eat and *cooking will not make them harmless*. Strychnine comes from the seeds of an orange-like shrub (fig. 40) that grows in both the New and Old World tropics. The fruit may be eaten but not the seed. The fruit is so bitter, however, that you probably wouldn't eat it even if you found it.

Juices causing skin irritation are more common. Throughout Malaysia are the rengas trees (Fig. 41). They are avoided by the natives as carefully as we avoid poison ivy. The affliction produced by the sap of these trees is similar to that produced by poison ivy and the treatment for it is the same. A few of the wild or semi-wild forms of mango also have poisonous sap, although the common mango does not, but the fruits from these trees can be eaten with safety. In the New World tropics the Mancineel or Manzanillo (Fig. 42), a small tree that occurs in dense thickets along sea beaches, is avoided for the same reason. The poisonous sandbox tree (Fig. 43) occurs at low altitudes throughout most of tropical America. It is a small tree with short, sharp grater-like spines and a melon-like fruit. A common American plant with a poisonous milky sap is the Dumb Cane (Fig. 44) which is found in low ground and on moist hills. Its soft juicy stems are as large as a man's arm and have a skunk-like odor when cut. Smoke and steam from the burning wood or leaves of any of these plants is dangerous and is as likely to affect the skin as the actual sap or juice.

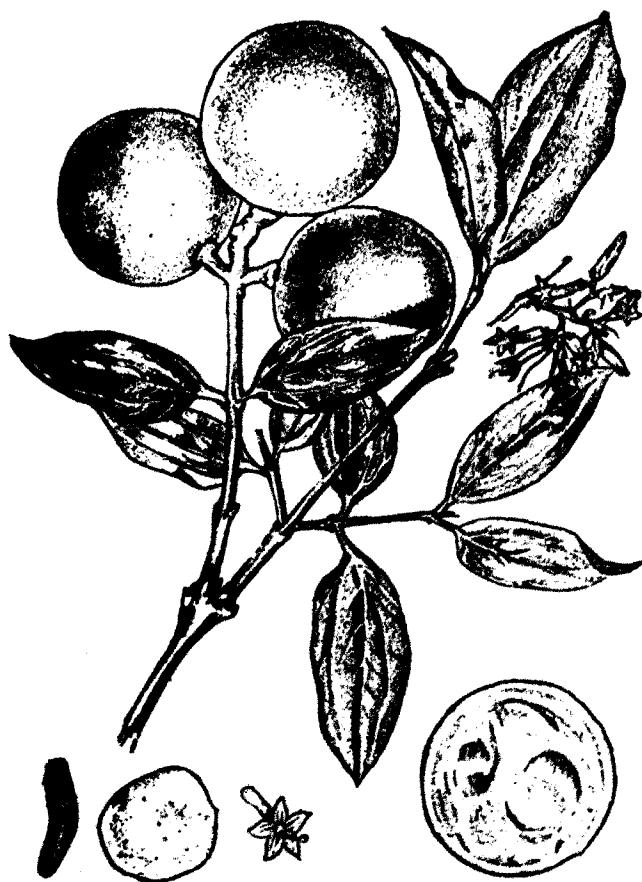


FIGURE 40.—Strychnine; seeds poisonous.

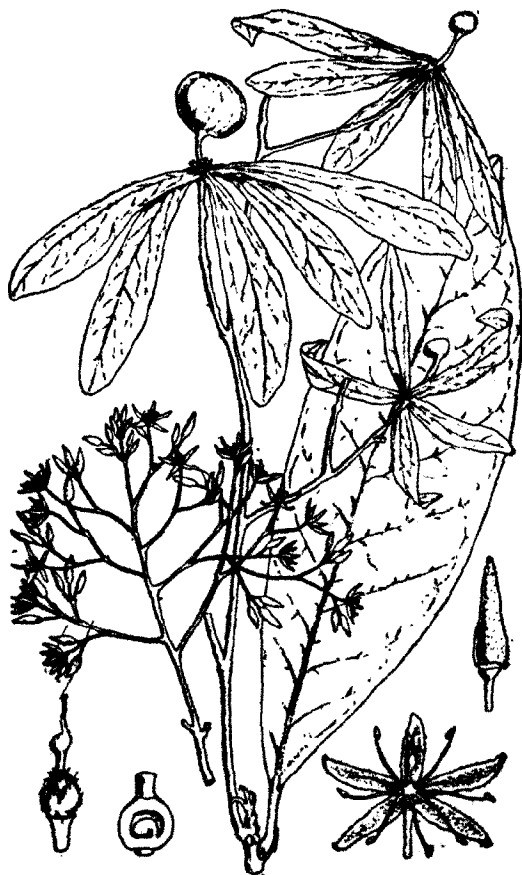


FIGURE 41.—Rengas tree; poison to touch.

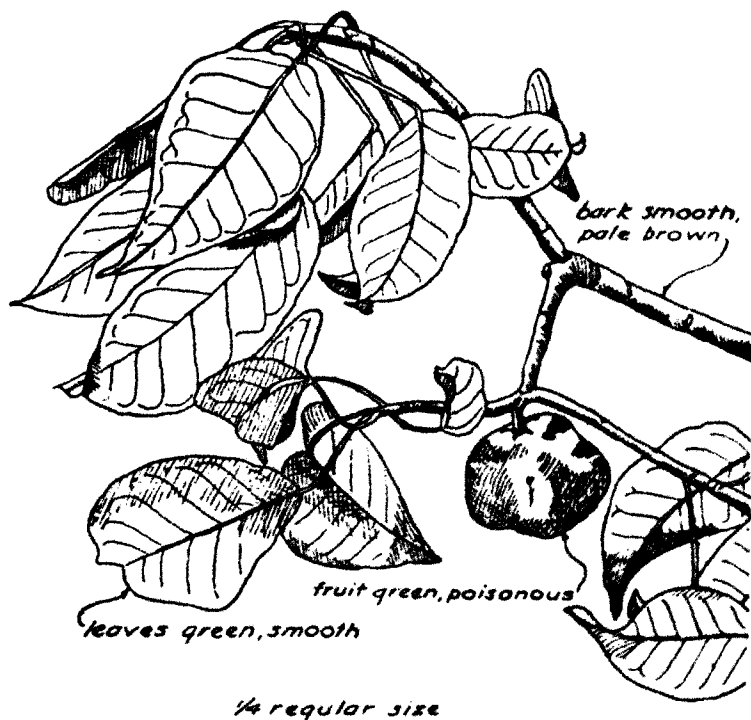


FIGURE 42.—Manzanillo; poison to touch.

If you get the juice from any of these plants on your skin, wash it off as quickly as possible, gently but thoroughly, with soap and warm water. Thereafter wash the affected part as seldom as possible and apply vaseline or olive oil twice daily and keep

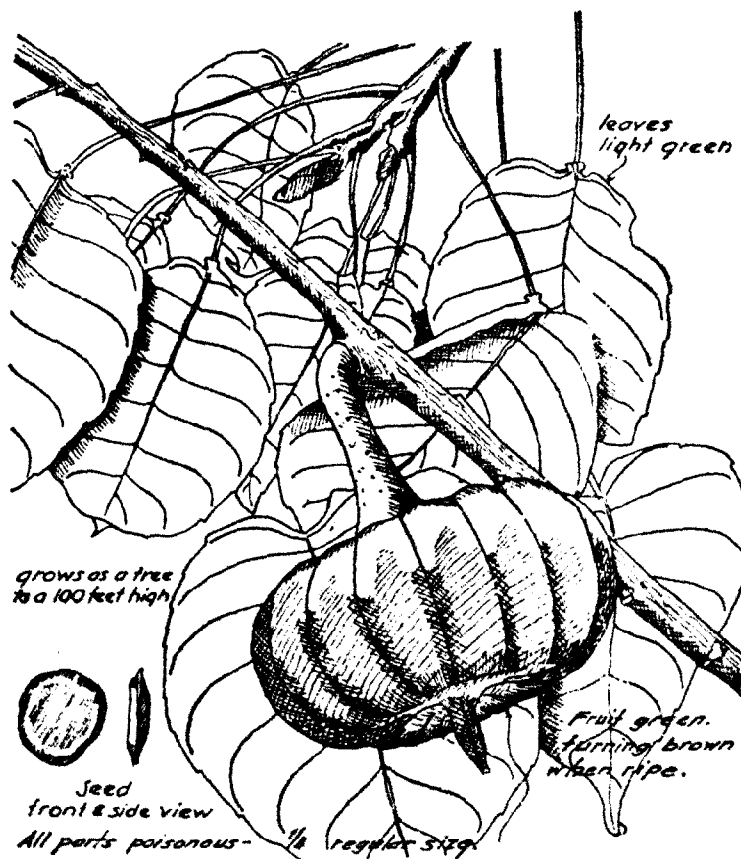


FIGURE 43.—Sandbox tree; poison to touch.

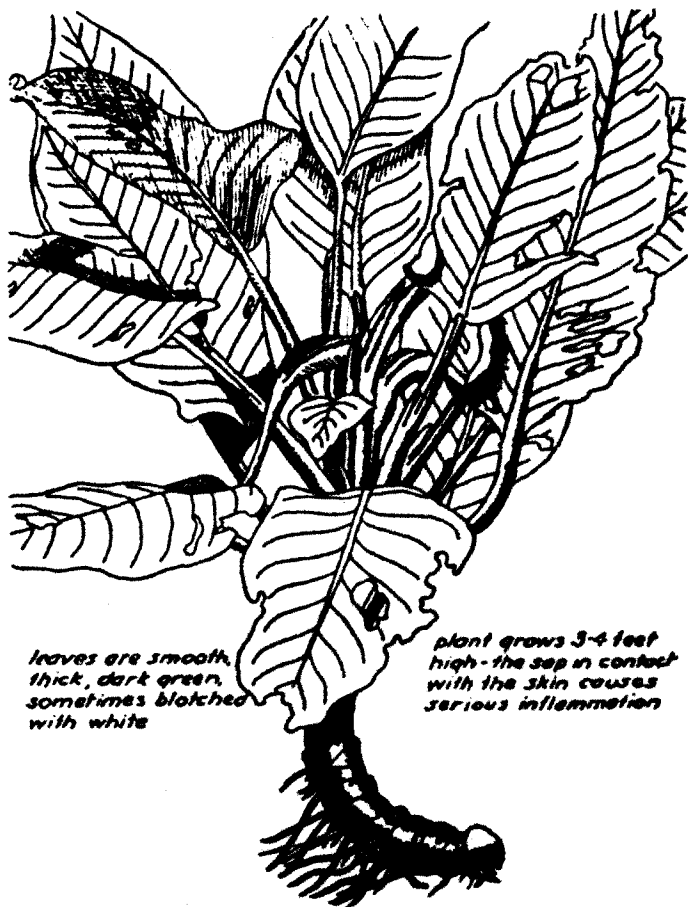


FIGURE 44.—Dumb Cane, poison to touch.

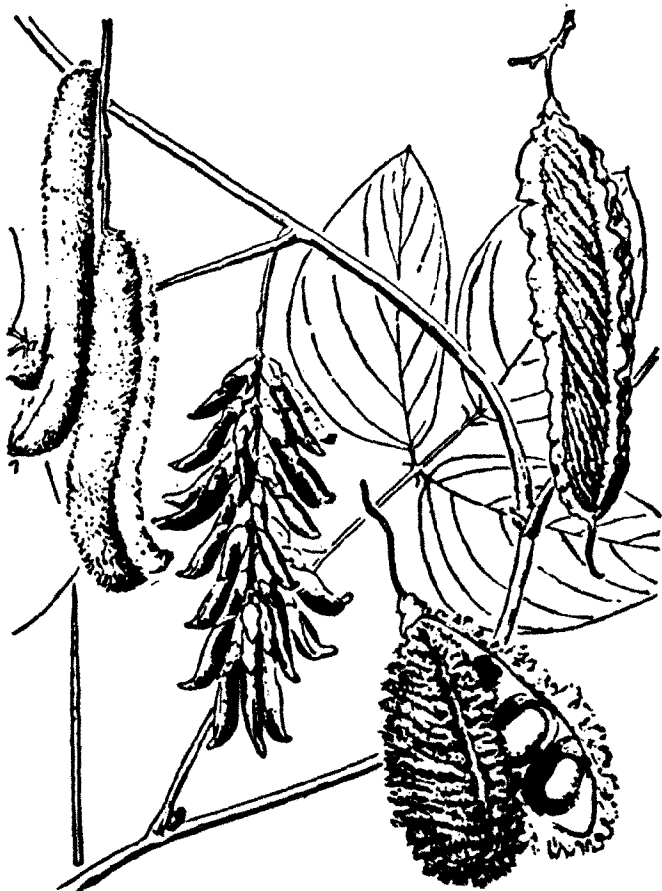


FIGURE 45.—Cowhage, dangerous to touch.



FIGURE 46.—Nettle tree, dangerous to touch.

the place covered with a thin layer of cloth. Care should be taken not to infect such places, as ulcers may result.

The third group comprises the nettles and plants with stinging hairs on their flowers and fruits. An example of the latter is the cowhage (Fig. 45) that occurs in most tropical areas growing as a vine in thickets and wooded districts but not in the jungles. The stinging nettles are widespread but are little worse than those in temperate climates. There are nettle trees (Fig. 46) that are found in thickets, clearing and open woods. They should be avoided whenever possible. Treatment of irritation caused by these plants is similar to that for the plants with the poisonous sap or juices.

POLLUTED PLANT FOODS

Far more dangerous than any of the poisonous tropical plants are those which—although in themselves perfectly harmless—carry the germs of disease. In all inhabited areas in the Tropics the danger of contracting disease through the eating of contaminated food is ever present. Germs are left on fruits and vegetables when they are handled. Vegetables frequently are contaminated by the earth in which they are grown because in many countries the fields and garden plots are fertilized with human dung which, of course, carries the germs of the ailments from which the natives suffer and provides a ready source of reinfection. Fruits and vegetables should be eaten raw *only when they are peeled or the outer surface is cut off with a knife by the person eating them*. Even then care must be taken not to re infect the freshly exposed portions. Vegetables and plants found in abandoned clearings may be contaminated from the

soil. Even though appearances suggest that the place has not been occupied for some time, you should be on your guard and prepare your food as carefully as though people were actually living there. Thorough cooking kills all disease germs; hence to be safe you should cook all vegetables. This is good protection against dysentery, cholera, and diarrhea. If flies are present the food should be protected from them, as they can reinfect it after it is cooked.

VII

THE ARCTIC

There are no large sections of the American Arctic in which Eskimos, Indians, or white men have not lived. These people have not been stranded or forced there, but have lived there by choice, and usually without hardship. Though you need not be an expert woodsman or know all the tricks an Eskimo knows, some knowledge of how others have lived in these regions will be of great assistance to you in an emergency.

There are three principal requirements for survival in the Arctic: (1) knowledge of the country, (2) suitable clothing and equipment, (3) calm judgment and knowledge of what to do.

Learn in advance all you can from maps, descriptions, or the experience of others about the region you are in or are likely to visit. Familiarize yourself with the exact location of settlements or camps in relation to coasts, rivers, lakes, or other prominent landmarks. Obtain all the information you can about foot travel and living conditions in winter and summer in the regions where you might some day be stranded. Learn what food resources—animals, fish, birds, plants—you are likely to find along the coasts, in the forested sections, or on the tundra.

When stranded in unfamiliar territory, whether forced down in a plane or shipwrecked, your first thought will be for the care and comfort of any who may be injured. You should next consider what action on your part will lead to rescue in the

shortest time. If you have been forced down from an airplane in the interior, stay by the plane unless you have definite knowledge of the location of a camp or settlement and know that you can reach it in a short time. If you start off at random you will be in much greater danger than if you stay where you are. Searching planes will not be able to see you and almost certainly you will become hopelessly lost. On the other hand, the grounded plane will be easily visible from the air and if you establish a camp nearby and build a fire as a signal, your chances of rescue are good. If there is not too much wind, the smoke from a good fire will be visible for ten miles or more. As an additional means of attracting the attention of planes, spruce branches should be arranged on the snow to form letters a hundred feet across or more. Fire your signal pistol only when planes are heard approaching.

In the north, native villages and camps as well as white settlements are generally found along the coasts. Therefore, if you are stranded on a beach your chances of rescue are good. However, if there are rivers that cannot be crossed or if for any other reason it is not practicable to set out on foot along the coast, the best procedure will be to select a suitable camping place, build a smudge fire and await rescue. Wood for the fire—driftwood or growing timber—will almost certainly be available, and the chances are that food also can be obtained with little difficulty.

SIGNAL FIRE

Several packages of matches in waterproof containers, a lighter, and candles are among the most necessary items of your equipment; some should be carried in your pockets and some in

LIBRARY

LIBRARY

ARMED FORCES STAFF COL

ARMY AND NAVY STAFF
COLLEGE

the emergency kit. It is much better to take this simple precaution than to be forced later to the difficult and uncertain expedient of making fire by primitive methods. This warning is particularly applicable to those who may be lost in the Arctic where snow in winter and rain and mist in summer may make it difficult to obtain suitable dry materials for producing fire.

In order to conserve your supply of matches, light a candle to start the fire. Dry birch bark shredded into strips makes excellent kindling. Use this with wood shavings or dead twigs from standing trees to start the fire. In wet weather dry fuel can be obtained by cutting into the inner wood of a standing dead tree or the under surface of a fallen dead tree not resting entirely on the ground. When the fire is burning well put on green spruce boughs to make a dense smoke.

Outside the forested areas the best fuel is driftwood. This is usually abundant on northern beaches, though it is scarce in some localities in the central Canadian Arctic and in the western Aleutians. It may also be found, though in smaller quantities, along lake shores and rivers in the interior, even in the so-called Barren Grounds. If driftwood is not to be had, dwarf or ground willow will provide an acceptable substitute. It grows in protected spots in most parts of the Arctic. In winter it is sometimes found exposed on bare windswept hills or in gullies. The roots will burn as well as the branches. In some varieties of ground willow the roots are more extensive than the branches, and when dead and exposed on the surface of the ground make very good fuel. In the Barren Grounds west of Hudson Bay where there is no driftwood and little willow, the Eskimos depend almost entirely on Cassiope, a kind of heather, for fuel. This is a low, spreading, evergreen plant with tiny leaves and

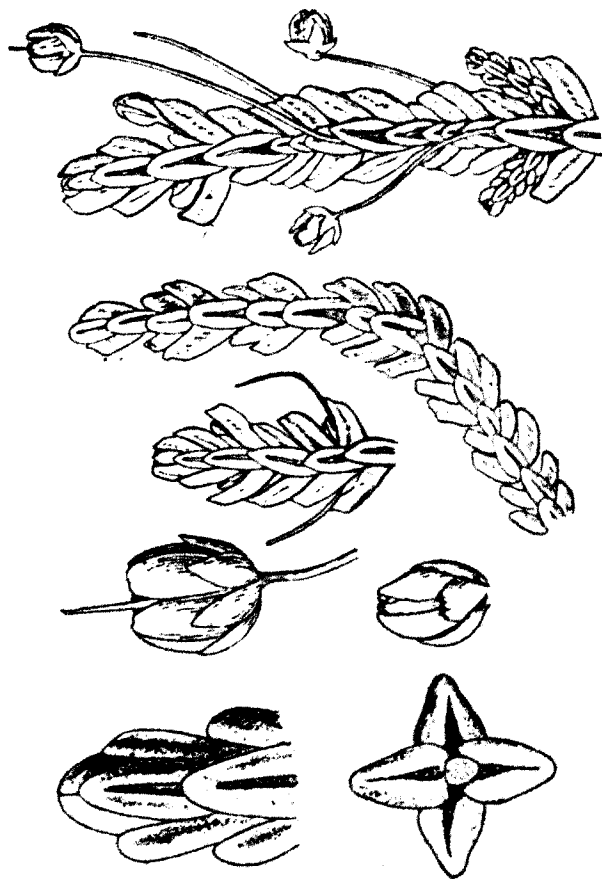


FIGURE 47. Cassiope.

white bell-shaped flowers (Fig. 47). It grows from 4 to 12 inches high and contains so much resin that it will burn even when green or wet. To get it burning well, however, some dry kindling such as wood shavings or moss and a good breeze are required. Dry moss and lichen (plants that grow on the rocks or bark of trees) can also be used as fuel. All these fuels—moss, lichen, heather, and willow—can be dug from beneath the snow if necessary.

EMERGENCY FIRE MAKING

If matches or a lighter are not available and there is no dry wood suitable for making a bow drill such as is described and illustrated on page 69, fire can be made by the strike-a-light method with flint and steel. Better than flint is iron pyrites, known as "fool's gold," a yellowish mineral found in lumps along Arctic stream beds. A piece of pyrites and steel or flint, or two pieces of pyrites, when struck together will give a good shower of sparks; this method of fire making is employed by most of the interior Eskimos and northern Indians. The flint or steel should be struck against the pyrites, not violently but with a sharp scraping motion. For making fire in this way a soft, dry, powdery tinder must be used. In an emergency cloth can be unravelled and shredded. Very dry dead grass, cedar or birch bark, or moss may be used, but it must be finely shredded or pulverized. The best tinder—the kind used by the Barren Ground and Arctic coast Eskimos—is the fluffy down of the "cotton grass" that grows on the tundra in summer, or the fuzz from the drooping flowers or buds of the Arctic willow (Fig. 48). When a spark has ignited the tinder it must be blown gently to



FIGURE 48.—Arctic willow.

produce a flame. To make the tinder more inflammable, the Eskimos sprinkle on it a small amount of gun powder or powdered charcoal from charred sticks.

SHELTER

If stranded in deep snow without equipment, a trench can be dug to a depth of several feet and the floor packed down by stamping until it is solid. The top of the trench can then be covered with a parachute or whatever may be available. Such a shelter breaks the wind for its occupants. Northern Indians when unable to get back to their camp or village often burrow a sleeping hole into the side of a snow bank. A breathing hole should be left open and one should be on the watch and ready to move if deep drifts form. The Indians also make a snow house by piling up a heap of snow about the size of a small haystack, patting down the surface with their snow shoes. After standing for about 30 minutes, in very cold weather, the outer surface freezes into a thin crust which makes a good roof when the pile of snow is hollowed out. To do this they tunnel into one side of the heap, one man passing the snow out to the others, until only a shell some 6 or so inches thick is left. The snow floor is packed and, when possible, covered with spruce boughs. It is important to have an air hole at the top and at least a small crack where the door is covered by a block of snow, ice, or other object. Otherwise those inside might suffocate. Such a shelter, if properly made, will hold several people comfortably. The Eskimos make a more elaborate snow-block house, but this calls for considerable skill and the method of construction should be learned from the natives themselves.

In timbered country it is easy to make a comfortable shelter in the form of a lean-to of the type described for the tropics. Only instead of coconut or similar leaves you will have spruce boughs. Cover the three sides of the framework with overlapping rows of flat spruce boughs, beginning at the bottom and laid with their tips downward. Place several layers of spruce boughs inside the shelter to form a floor. Have the open side of the shelter face the fire and away from the prevailing wind.

If timber is not available a wall of snow can be made for a windbreak. If a tent is used in open country it should not be placed under a cliff or in the lee of any large sheltering object, for snow may drift down and bury it. It will be well, however, to build a snow wall on the windward side to protect the tent from wind and drifting snow. If the wall is built close to the tent there will be no danger from snow drifts.

In pitching the tent the snow should be removed from the inside and replaced by a layer of grass, moss, or boughs to prevent the sleeping bags or other bedding from becoming wet. Where the snow is deep it can be stamped down to make a firm floor which can be covered with boughs or whatever materials are available. Sleeping bags should not rest against the tent walls.

CARBON MONOXIDE POISONING

If a tent or other closed shelter is used, it must be carefully ventilated. A fire of any kind burning in a closed and poorly ventilated space may produce carbon monoxide, a deadly poisonous gas. This gas has no odor and can kill a person before its presence is suspected. A slight headache or feeling of pressure

at the temples is the only warning of carbon monoxide poisoning, but even this may not be felt. To prevent the gas from forming, make certain that the tent or hut has a hole at the apex and that some air can come in from below. If partly overcome by the gas, one should get into the open air immediately, keep warm, and avoid all exercise or exertion for some time afterwards.

COOKING

For cooking, the fire should not be too large. If possible it should be built between two logs or stones on which the cooking utensils may rest. Another method is to suspend the pot over the fire from a pole, the lower end of which is stuck into the ground.

Boiling is the simplest and most practical method of cooking. Long boiling is not necessary. If meat is cut into small pieces and put in cold water it will be cooked sufficiently by the time the water has boiled a couple of minutes. Drink the water in which the meat is cooked.

If snow is used for cooking, place a small amount of it in the pot at first, adding more as it melts. If the pot is crammed full of soft spongy snow this may act as a blotter, absorbing the first water that melts and allowing the bottom of the pot to burn. This may be avoided by tipping the pot.

If you have no pot the simplest method of cooking meat is to broil thin strips over hot coals, holding them on the forked end of a long stick. Larger pieces can be stuck on a stick and suspended over the fire, turning them from time to time.

WATER

Drinking water is not a fundamental problem in the North. In summer water can be obtained from streams, lakes, or ponds. On the tundra pond water may have the color of tea because of stain from grass roots and other plants, but it is good to drink.

In winter, snow and ice are melted for drinking. Whenever possible avoid eating snow or ice directly for it lowers body temperature and cuts down endurance.

On the sea you can obtain good drinking water from old sea ice. Young sea ice is salty, like the water from which it was formed, but after a year it loses its salt and becomes fresh. Old sea ice can be distinguished by its smooth rounded corners and bluish color. Young sea ice is rougher and milky gray in color. In summer drinking water can be obtained from pools in the old sea ice. Avoid pools near the edge of the floe where saltwater spray may have blown in.

FOOD

Living off the country is not difficult in the North if one has or can make the necessary weapons or other means for killing or capturing land animals and fish. In the summer, shellfish can be collected along the shore. Fish are abundant in fresh water lakes, streams, and in the sea. Caribou and other land mammals may be found, and millions of ducks, geese and smaller birds come to breed on the tundra or the sea-cliffs. Since the sea freezes over in the winter and most of the birds go south, food resources then are more limited, and specialized hunting techniques are necessary.



G

G. Sea cucumber.



H

H. Sea urchin.

(Both are southern forms.
Arctic forms are similar.)

I



J



K



N



O



L



M



P

FIGURE 49.—Edible marine life :

I—P—Edible shellfish.

(I. is sometimes poisonous south of the Aleutians.)

On the Seashore

In figure 49 are shown a few of the many edible varieties of clams, mussels and other shellfish found in the far North.

Most of them live in fairly shallow water. Edible shellfish are relatively abundant on the Arctic and Bering Sea coasts of America, but are scarce in the Arctic regions of Europe and Asia. In regions where there is great variation in water level between high and low tides, shellfish can usually be obtained easily at low water, either by digging them with a stick on the tide flats or by collecting them from exposed pools and off-shore reefs. On open sandy beaches with a low tide range, shellfish are often cast up by storm waves. Before eating them, however, make sure they are not spoiled. Generally speaking, the bivalves (such as clams and mussels (Fig. 49-I, J, L, M, N)) are more palatable than those with spiral shells, like snails, though all are edible.

One of the most common edible mollusks of the Far North is the small blackish-purple mussel (Fig. 49-I). In North Pacific waters this mussel is poisonous at certain times of the year and in regions south of the Aleutian Islands should not be eaten. In the Arctic and on the shores of the Bering Sea, however, they may be eaten safely.

Chitons (Fig. 49-K) attach themselves to rocks and have to be pried off. They are oval in shape and have the shell divided into eight separate overlapping plates.

The eggs of the spiny sea urchins (similar to Fig. 49-H) are excellent food. In early days enormous quantities were consumed by the natives of the Aleutian Islands and South Alaska. Sea urchins are easily collected among the rocks and in tide pools at low water. The bright yellow eggs or roe are obtained by breaking the shell between two stones. One adult may contain as much as a tablespoon full of eggs.

Another sea animal that provides good food is the sea cucumber (similar to fig. 49-G). Inside the body are five long white muscles that taste much like clam meat.

In early summer it is sometimes possible to scoop up smelt when they come to the edge of the beach to spawn in the surf.

Whenever available the Eskimos and northern Indians eat kelp, the long ribbon-like seaweed, as well as the smaller branching variety that grows among the off-shore rocks. It is eaten raw. In mid-summer many of the seaweeds are covered with herring eggs and these are eagerly eaten by the Eskimos.

Fish

Salmon, cod, sculpin, trout, whitefish, herring, flounder, and other salt water fish are abundant in the Arctic and along northern Atlantic and Pacific shores. Some of these can be caught by surf casting from the beach with a long hand line. In spring and summer salmon enter many of the northern streams to spawn—often in such numbers that they can be speared from the bank. An improvised gig or spear—a long pole with two or three sharp wooden barbs lashed to the end—can be used effectively in shallow water.

Small trout, grayling, and other fresh water fish will take any kind of bait—worm, bug or piece of meat—and can be caught with the simplest of makeshift tackle, such as a bent pin or a small sharp wooden hook attached to a thread or raveling.

The simplest form of hook, one used by primitive peoples in many parts of the world, is the gorge. This is a straight sliver of wood or bone sharpened at both ends and with the line

attached at the middle. It is entirely covered with bait and is swallowed lengthwise by the fish. A pull on the line then turns it crosswise in the gullet.

In winter fish can be caught at open leads or through holes cut in the ice. The hook should be barbless so that the fish can flop off as soon as it is hauled out, for in cold weather it is difficult to remove a barbed hook with bare fingers.

Tom-cod and sculpin are the principal salt water fish that can be caught in winter. Bait is not necessary. A white stone used for a sinker, or a bit of shiny metal or brightly colored cloth tied just above the hook will attract the fish, which can then be caught by jigging the line up and down.

In fishing through the ice for lake trout or salmon the hook should be lowered to the bottom, then raised a few inches and kept constantly jigging. The best bait is a strip cut from the belly of a fish.

Land Animals

The caribou is the best all-round food animal on land in the American Arctic. Some caribou move south to forested country in the fall, but many remain on the northern islands and Barren Grounds throughout the winter. Approach them carefully, taking advantage of any cover, and try to get within 200 yards before firing. Be certain that you are down wind from them so that they cannot get your scent.

Wolves, foxes, snow-shoe rabbits, lemmings, weasels, and field mice remain the year round and may be shot or trapped for food. Ground squirrels are found in summer but hibernate in winter. Musk-ox provide excellent food but are now found in only a few remote localities in the Far North.

Rabbits and ground squirrels can be caught with a spring pole snare (Fig. 50). A light pole about 5 feet long (A) is stuck in the ground or a growing sapling can be bent over. Over the runway or the entrance of the burrow is placed a bent-over limb (B), both ends of which are stuck firmly in the ground. A strong cord or light pliable wire is fastened securely to the end

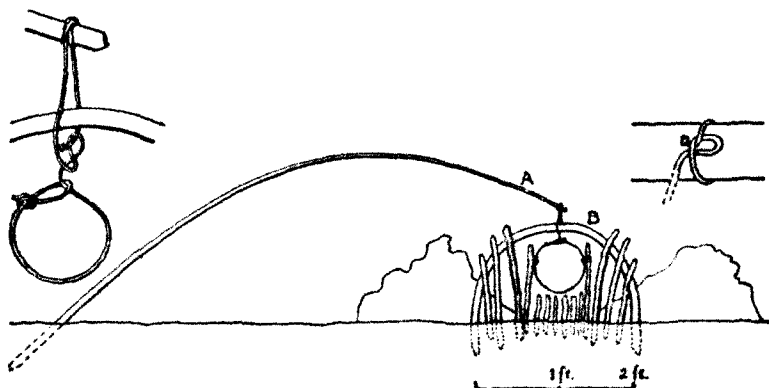


FIGURE 50.—Pole snare.

of the spring pole, the longer end forming a noose and the shorter end hanging free (upper left). The free end and the line leading to the noose are looped (not tied) into a simple "catch loop" (upper right) on the under side of the bent over limb (Fig. B). This catch loop holds down the end of the spring pole. After the animal's head goes through the noose the slightest pull by his shoulders will release the catch loop thus freeing the spring pole and drawing the noose tight.

If the snare is set to catch rabbits on a runway, the bent limb (B) should be about 1 foot 3 inches high at the middle. The bottom of the noose should be about 6 inches off the ground. Brush or limbs should be placed under it and on either side to prevent the animal from going under or around.

For catching ground squirrels the noose should be placed directly in front of the burrow and be slightly smaller than the opening.

If a spring pole is not available a simple hanging noose can be attached to a fixed limb or other immovable object and suspended over the runway or burrow entrance.

Sea Animals

Polar bears live on the ice floes and feed on seals. They can be shot without much trouble but it takes a bullet in the heart or brain to kill them. *Polar bear liver is poisonous and should not be eaten.*

Seals are hard to approach but every effort should be made to get them for they provide the best meat. In spring seals come up to bask on the ice beside their breathing holes. They sleep restlessly, raising their heads about every 30 seconds to look around for their enemy, the polar bear. In approaching the seal, the Eskimo hunter crawls forward cautiously while the seal is sleeping, being careful to keep downwind of it. When the seal moves the hunter stops and imitates its movements, lying flat on the ice, raising his head up and down and wriggling his body slightly. In order to look as much like a seal as possible the hunter approaches the seal sideways instead of head on and keeps his arms close to his body. Since the seal is lying on

smooth ice and usually at an incline near the edge of the breathing hole, it must be killed instantly by a shot through the brain, for with the least movement of its body it will slide into the water. Therefore, it should be shot through the head at close range, 25 to 50 yards, so that the hunter can dash up and seize it before it reaches the water and sinks.

Seals can also be shot in open water, and in winter they will usually float, but the problem is to retrieve them. To accomplish this the Eskimos use a seal hook, a short wooden club or ball about the size of a grapefruit, with four sharp upcurved iron hooks at the center. This is attached to a long line and is thrown over the seal which is hooked and pulled in. The wooden grapple described in the section on making your own fishing kit (p. 11) would serve this purpose if it were heavy enough and the barbs sharp and strong enough to penetrate the seal's hide.

Walruses are found on moving ice floes or at leads not far from shore where they can feed on clams. They should be shot through the neck, just below the head.

Birds

The only birds that remain in the Arctic over the winter are ptarmigan, owls and ravens. Even these are likely to be scarce north of the timber line, especially in the interior. Ravens are thin and of little use as food but owls and ptarmigan equal any game bird in taste. Ptarmigan can be caught with noose snares or even knocked down with a stick or stone.

In summer countless numbers of birds come north to breed. Ducks, geese, loons, and many other kinds of land birds build their nests near ponds on the low tundra and their eggs can be

collected for food. Millions of sea birds nest on rocky shore cliffs but are usually hard to reach.

The Eskimos catch many birds with simple noose snares. To catch nesting birds they place the noose in the nest to catch the bird's feet. The noose is attached to a stake driven in the ground nearby. Sometimes long lines with many small nooses attached are set out on beaches and ponds where birds gather.

Sea gulls can be caught with a gorge made of a sharp sliver of bone or wood about $3\frac{1}{2}$ inches long with a long line attached at the middle. The bait is a piece of fish or meat completely covering the stick or bone, which when swallowed will turn crosswise in the gull's throat.

Plant Foods

Though plant food is not abundant in the Arctic it is by no means absent. In the summer there are numerous varieties of edible berries, greens, roots, and lichens that can be collected along the seacoasts and in the interior if one knows where to look. A few varieties of berries may be found even in winter under the snow. There is no need to worry about poisonous plants, for with the exception of a single variety of mushroom (Fig. 51), none grows in the Arctic. The only problem is to be able to distinguish the more palatable and nutritious plants from those that have no value as food. Brief descriptions of the principal Arctic food plants are given below :

The salmonberry (Fig. 52), also known as the cloudberry, is a low creeping plant, rarely more than 3 inches high. It is widely distributed in the Arctic, growing on mossy, peaty soil. The leaves are large and wide, with five lobes, and the flowers

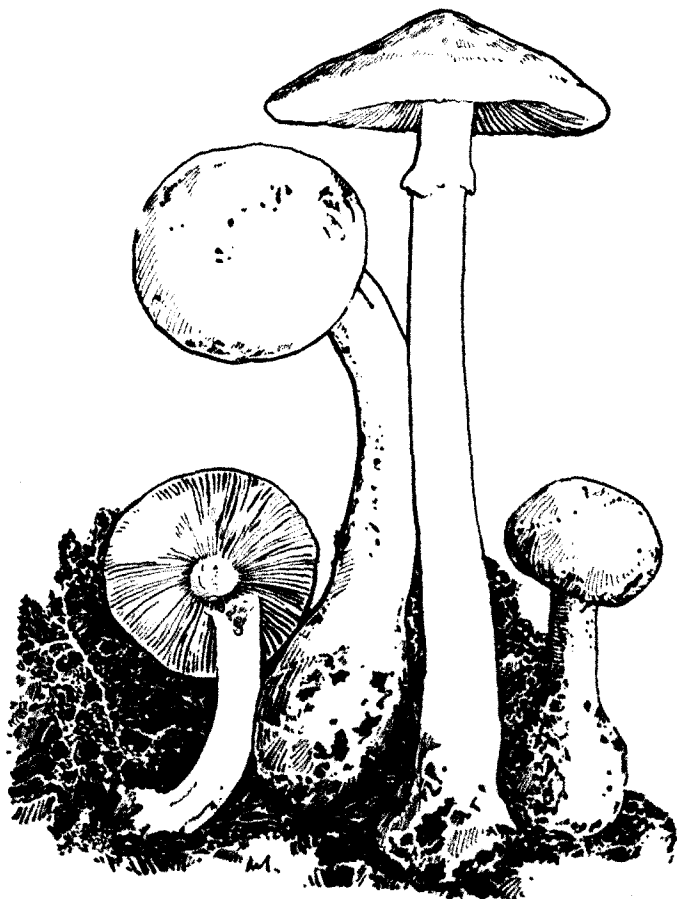


FIGURE 51.—Poisonous mushroom.



FIGURE 52.—Salmonberry.

are white, about $\frac{3}{4}$ of an inch in diameter. The berries are about the size of raspberries, very juicy with a pleasant taste. When immature they are red, changing to yellow as they ripen in July or August. The mountain cranberry (Fig. 53) is a low, creeping evergreen shrub from 2 to 8 inches high. It has small, shiny, dark green leaves and clusters of white or pink bell-shaped flowers. The berries are dark red, about $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter. They ripen in August and September, but remain on the bush all winter and can be gathered the next spring when they taste even better than in the fall. The plant is widely distributed in the Arctic but usually does not bear fruit north of the tree line. It is found in greatest abundance in open birch and willow thickets. When stewed and sweetened the mountain cranberry is even better than the southern variety.

The black crowberry (Fig. 54) is a low evergreen plant with spreading branches and small narrow leaves resembling those of a fir or spruce. The flowers are inconspicuous. The small, black shiny berries are sweet and juicy. The crowberry is found in many parts of the Arctic, growing best in sandy or rocky soil, especially along the seacoasts. The Eskimos are very fond of the berries and collect them from under the snow, since they remain on the bush through the winter.

Two varieties of bilberry, closely resembling our blueberry, grow in abundance on the mossy hillsides and tundra. They produce delicious bluish-black berries. Somewhat resembling the bilberries are the Alpine and red bearberry, low plants with small red or black berries. They are rather mealy, and taste better stewed.

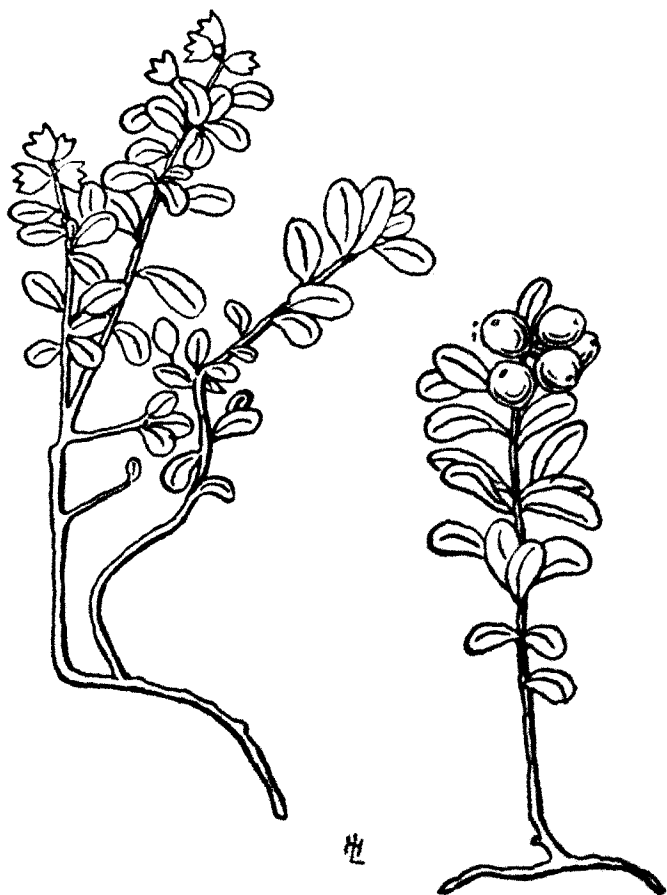


FIGURE 53.—Mountain cranberry.



FIGURE 54.—Black crowberry.

In the forested interior there are several other varieties of edible berries, the most important being the Northern gooseberry, the red currant, and the wild raspberry.

GREENS

Mountain sorrel (Fig. 55) is a low plant with round or kidney-shaped leaves and stalks of small red or green flowers that grows on shady hillslopes and ravines. The leaves have a pleasant, slightly acid taste and may be eaten raw or boiled. The willow herb or northern fireweed is an erect plant with dark green, narrow, pointed leaves and large purple flowers that reaches a height of 18 inches. It grows on shady or gravelly soil, especially along creeks and river banks. When cooked, the leaves taste something like spinach.

Wild rhubarb (Fig. 56) is a large plant, 3 to 6 feet high, with reddish stems, large pointed leaves and clusters of small flowers. It is common in the Yukon and Mackenzie valleys but absent to the east. The young juicy stems that appear in the spring may be stewed or boiled like rhubarb.

The tender young leaves of the dwarf willow, and also the inner bark of willow roots, may be boiled and eaten. These are among the favorite vegetable foods of the Eskimos in some parts of Alaska.

Another favorite food plant of the Bering Sea Eskimos and Aleuts is the wild celery or wild parsnip (Fig. 57). On the mainland usually it is less than 2 feet tall, but on the Aleutian Islands it reaches a height of 6 feet or more. It has a straight thick stalk, large leaves with deeply indented margins, and numerous clusters of small flowers branching out at the top of the stalk.

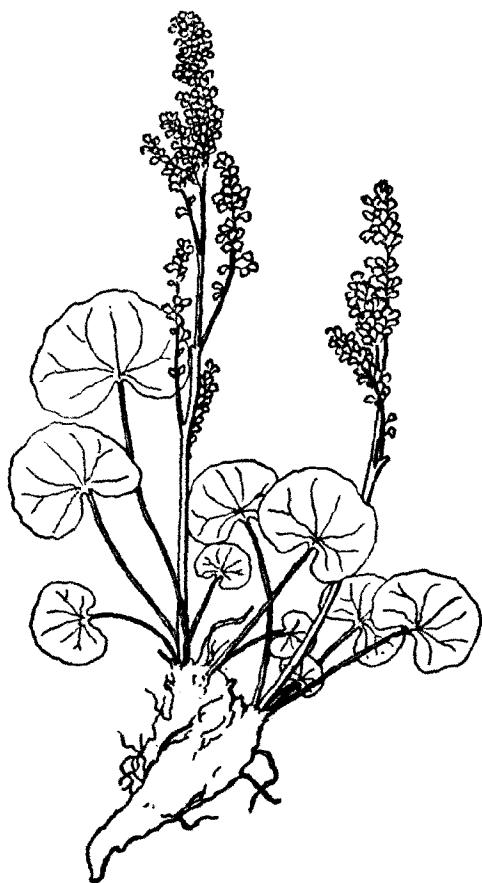


FIGURE 55.—Mountain sorrel.

The tender inner portions of the main stalk and the leaf stalks have a somewhat sweetish taste and may be eaten raw after stripping off the outer covering. It grows in protected spots where the soil is rich, especially around old village sites, and is well known as a food plant in the sub-Arctic sections of Greenland, Kamchatka, and Europe.

Kelp and other seaweeds are also eaten by the Eskimos, either raw or boiled.

ROOTS

Four kinds of edible roots are shown in figures 58 to 61. Licorice root (Fig. 58) grows from 1 to 2 feet high and has stalks of pink flowers that develop into seed pods. It has a flexible root, about as thick as a man's finger. When cooked it tastes like carrots.

The woolly lousewort (Fig. 59) is 5 to 8 inches high with several stems of rose colored flowers, and has a yellow tap root which tastes like carrots. It is found mostly in dry tundra country.

A plant (Fig. 60) from 5 to 10 inches high with large oblong leaves, spikes of white or pink flowers and an edible root about the size of a pecan grows on dry tundra.

There is a small plant belonging to the lily family (Fig. 61) that is common on the Aleutian Islands and along the Alaskan coast to Bering Strait and the opposite shores of Asia, but is not found in the high Arctic. It has greenish purple flowers, long pointed leaves and an edible root like a small onion. The roots taste bitter when raw but can be boiled into a starch paste and eaten. Eskimos and Aleuts are fond of the bulbs, often boiling them with their meat.



FIGURE 56.—Wild rhubarb.



FIGURE 57.—Wild celery.

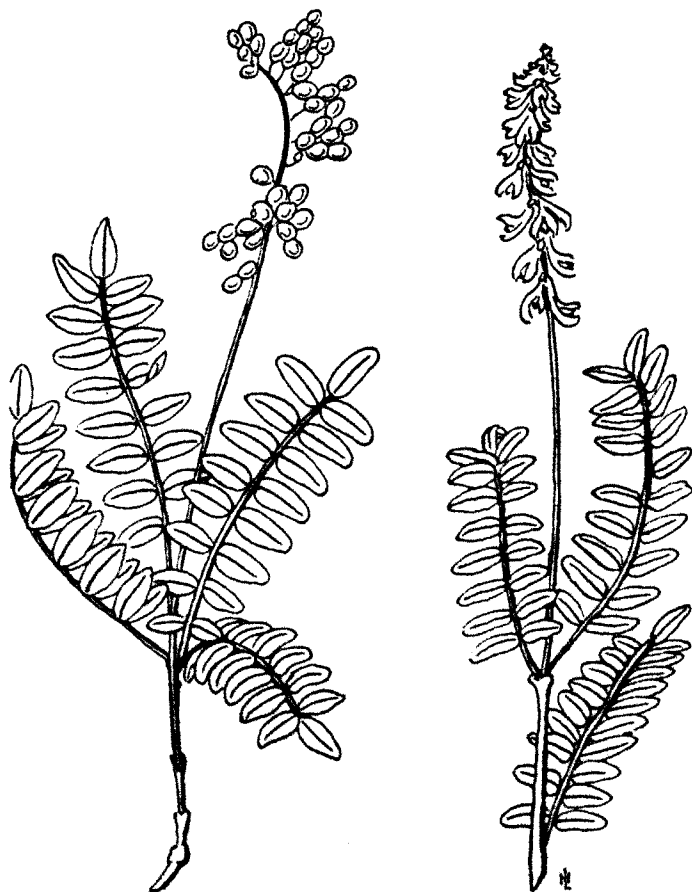


FIGURE 58.—Licorice root.



FIGURE 59.—Woolly lousewort.



FIGURE 60.—Snakeroot.

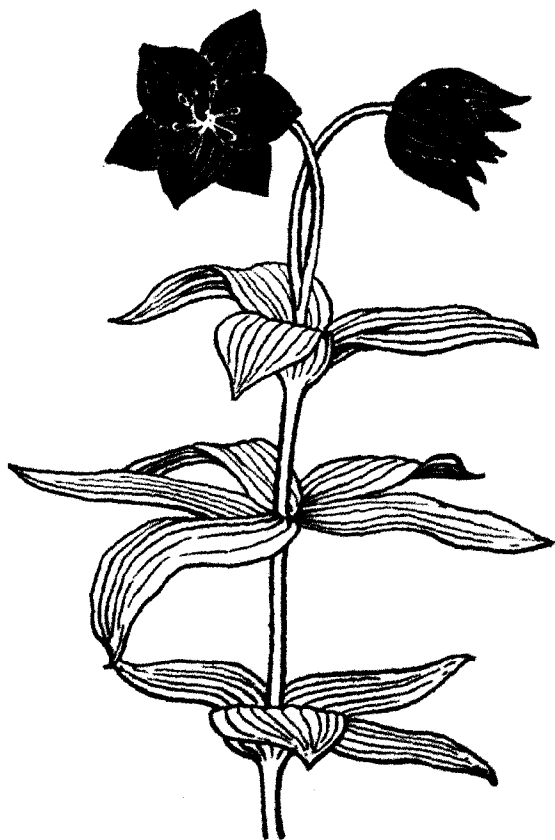


FIGURE 61.—*Fritillaria*.

EDIBLE FUNGI AND LICHENS

Many edible mushrooms occur in the wooded sections, but one kind is poisonous (Fig. 51). This is white or greenish or grayish brown, is smooth on top, has white gills, and a bulbous base. To be on the safe side avoid any mushroom with white gills and a swollen base. All others may be eaten.

Among the edible lichens of the North are reindeer moss (Fig. 62) and Iceland moss (Fig. 63) which resembles it. These are low, moss-like plants with a network of branching stems instead of leaves. To be eaten they must first be soaked in water, then dried, ground into a powder, and again placed in water for several hours before being boiled. This will produce a sticky porridge-like mixture which though somewhat insipid to taste, has considerable food value.

Another edible lichen that may be prepared in the same way is rock tripe (Fig. 64) a black or brown leathery lichen that grows abundantly on rocks all through the Arctic. It has broad fronds, 1 to 3 inches in diameter, folded or crinkled at the edges and attached to the rock at the center. Rock tripe is commonly used in the North as an emergency food. Sir John Franklin, Richardson and other early Arctic explorers lived for weeks on it with hardly any other food.

Arctic Ailments

Snowblindness is caused by the glare from snow and ice, not only from light reflected directly by the sun, but also from diffused light when the sky is dark and overcast. Though actual blindness does not result, the condition is painful and serious.



FIGURE 62.—Reindeer moss.

Rubbing the eyes will increase the burning and stinging sensation. The only treatment is complete rest for the eyes by wearing dark glasses or, in severe cases, by bandaging the eyes.



FIGURE 63.—Iceland moss.

To prevent snowblindness dark glasses should be worn at all times. They should have shields to prevent glare from entering at the sides. The rims should not be of metal as they might stick to the skin. If dark glasses are not available, improvised goggles can be made from pieces of canvas or other heavy cloth, cardboard, or even pieces of wood, with narrow slits for the eyes. Blackening the cheeks and nose with soot is helpful.

For warmth, clothing should be kept as dry as possible. Before going inside the tent or shelter, brush the snow from your clothes. It is extremely important to avoid overheating for



FIGURE 64.—Rock tripe.

freezing may result from excessive perspiration. With the heavy clothes that you have to wear in the Arctic you will naturally sweat if you are very active. As soon as you are conscious of overheating, loosen your clothing or remove the outer layers entirely. If you are doing hard work or hiking you will not need as much clothing as when you are inactive. The guiding rule is to avoid heavy sweating at all costs, wearing just enough clothes to keep warm and comfortable, and removing outer garments as soon as you begin to perspire.

Socks, inner soles, and boots should be dried at night. If possible, stuff wet shoes with dry grass or other material to absorb the moisture; do not put them too near the fire or they will harden and crack.

You must be on guard against frostbite and freezing of the fingers, toes, ears, face or other parts. Keep your face and ears covered as much as possible and wiggle your fingers and toes frequently to keep up circulation. Should a white spot appear on the skin, or the toes or fingers begin to feel numb, treatment should be begun immediately. If the white patch can be covered with a warm, ungloved hand circulation may be quickly restored to it. Frosted fingers may be treated by contact with the warm body under the clothing. A frosted foot is best warmed by removal of the shoe and sock and the placing of the bare foot inside the shirt and against the body of a companion. Gentle massage may aid in restoring circulation. *Do not rub roughly or apply snow or ice to the part.* The application of heat at temperatures greater than that of the body (98.6° F.) will do more harm than good. If circulation cannot be restored promptly and the part returned to its normal color, it should be wrapped (in a sterile bandage if possible), be covered warmly and kept at rest.

VIII

THE DESERTS

Deserts are usually large, barren, dry, hot in the daytime, cool at night, and relatively free from dangerous large animals. Being too large to walk out of easily, deserts force you to plan carefully and to conserve your strength and supplies to the utmost. Being barren, deserts cannot be expected to supply you with vegetable food; you cannot count on any growing thing to eat. Being dry, deserts deplete rather than replenish your precious water supply. Being hot in the daytime, and cooler at night, deserts force you to *lie quietly during the sunlight hours* and to *travel at night*. Being fairly free of large dangerous animals, deserts relieve you of the necessity of carrying heavy weapons, which would otherwise add to your load. Be sure to keep light arms in case you are lucky enough to find birds or other small game.

The two most important things to remember are:

(1) Save your water supply. Do not swallow large mouthfuls but merely moisten your lips and throat with a small sip now and then.

(2) Conserve your strength by staying quietly under cover during the heat of mid-day. Walk during the early evening, night, and early morning, when it is more comfortable and when you can avoid the risk of sunstroke or heat prostration and get along on less water.

WATER

If you have more equipment than you can carry, sacrifice anything but water. The amount of water you carry is the amount of insurance you have against desert disaster. Use what water you have for drinking. You can wash when you are safe again. Of course, if you have any wounds, scratches or sores you must keep them clean even at the expense of your precious drinking supply. If you have any salt tablets with you, take them from time to time, the interval depending on how many tablets you have and how far from help you estimate you may be. They will help combat fatigue and heatstroke, and also enable you to get along on less water. Do not smoke. Smoking increases thirst. Carrying a smooth pebble in the mouth will reduce thirst by stimulating the flow of saliva.

There are several aids to finding water that may be present in some desert areas. If there are any dried-up stream beds, which look like long, fairly narrow and rather shallow ditches, choose the lowest place in the bottom of the ditch and dig. If there is any water within a few feet of the surface you will soon feel that the sand is slightly damp. If you find this to be so, dig further and you may find water. The same is true for dried-up lake beds. These are usually pond-shaped fairly level areas, called "paus" in some deserts, around the edges of which are slightly raised ridges. Again find the lowest spot and dig. Remember that water runs down hill and that it seeks the lowest place it can reach either on or under the surface.

Plants are good indicators of water. As a rule the denser the growth of such desert grasses as salt grass and reed-like grasses, the closer to the surface the water probably is. In those deserts

of the western United States where the desert palm is found, its presence is a sure indicator of water, usually not more than a foot or two away from its base. Other palms in other deserts are also good water indicators.

In deserts where there are appreciable numbers of animals, you may find water by following their trails. The water to which they go may be on the surface or slightly beneath it. You will see where they have pawed or dug the sand to get at the water.

If you find surface water that is polluted or briny, dig a hole in the sand close to it and downhill from it (or deeper than it). Do not attempt to connect the two holes. The wall of sand between them should act as a filter and the water as it soaks through into the hole you have made will be relatively free from salt and pollution. Presence of briny surface water may mean pure water deeper down. Dig a deeper hole nearby to get the pure water.

Do not drink all your water when you see a lake or stream. Wait until you get to it. It may be a mirage and leave you in a far worse plight than before.

If you come to a water hole or small oasis you can replenish your supplies of water and food. Boil all the water before using it or storing it in your canteens for the next trek. Cook any food you may get from natives at an oasis. Do not trust ready-cooked food or raw fruits and vegetables. (See Polluted Foods, p. 130.)

FOOD

Go over what food you have and decide on a daily ration. Eat as little as possible. The more you eat the more water

you will want, and the sooner you will be out of both food and water. The heat of the desert will tend to reduce your appetite. Food spoils rapidly when once it is opened, so make your meals of one can or package at a time. As much as possible use foods that require less water to wash them down—such as packaged meats and dried fruits; avoid thirst producers like crackers and mealy foods. If you have a chance to shoot or capture any game, the meat when cooked will supply some moisture as well as nourishment.

DUST

If the wind causes a dust storm, cover your nose and mouth with any cloth you may have to act as a filter for the air you inhale. Keep your back to the wind; it helps protect your eyes and your breathing.

CLOTHES

Be sure to keep your head and body covered from the sun during the day. The nights are apt to be cool and you should have warm enough clothing. Remember this if you have to decide how much of your clothing you can afford to discard to lighten your load. In the daytime always wear a woollen cloth around your abdomen to prevent chills, especially when it is very hot and there is rapid evaporation of perspiration. Chilling of the abdomen may bring on diarrhea and other complaints.

Wear clothing as loose as possible. Any flapping as you move helps create a little breeze which aids in evaporation

of your perspiration. This, in turn, helps maintain your normal body temperature, and helps to keep you from overheating.

Your feet are your only means of reaching safety, so take care of them. Keep sand out of your shoes, even if it means frequent stops. Spiral puttees overlapping the top of the shoes help to keep sand out. If your shoes are thin wear two pairs of socks if possible.

HOW TO TRAVEL

If you think you may be found where you are, stay there. Otherwise travel at night and do not try for too great speed. Remember the marathon runner. He conserves his strength for distance and does not try to sprint. In the daytime rest quietly, covered from the sun by shade, if any, or by a make-shift blanket. If you have a compass, trust it rather than yourself. If you do not have one, never forget the importance of keeping on a straight path. When resting, always sit facing the direction you want to go. When lying down have your head in that direction, so that you won't forget which way you were going. Or arrange a stick or a line of pebbles as a pointer.

SIGNALS

If you have matches and any burnable material, make a bright fire as a signal at night, or a smoky smudge as a signal in the daytime. If you have gasoline, you can scratch large letters in the sand, fill these trench-like lines with gasoline and ignite when planes pass overhead.

DESERT AILMENTS

There are three chief desert illnesses (other than thirst). They are:

(1) Heatstroke or sunstroke. Symptoms—headache, spots before the eyes, dizziness, vomiting, sometimes even unconsciousness; skin is *hot and dry*; face *flushed*. Treatment—place victim on his back in shade and remove all outer clothing. Raise his head; cool his body with water and by fanning; rub his arms, legs, and trunk; if conscious give him two salt tablets with a canteen of water.

(2) Heat exhaustion. Symptoms—nausea, dizziness, weakness; face is *pale* and skin is *cold and sweating*. Treatment—place victim on his back in shade and give three to five canteens full of cool water, 2 to 3 teaspoonfuls of salt to the gallon, during the next 12 hours.

(3) Heat cramps. Symptoms—shallow breathing, vomiting, dizziness. Treatment—same as for heat exhaustion.

Under conditions where supplies are available and there is no shortage of water, heat exhaustion and cramps can be guarded against by allotting at least 2 gallons of drinking water per day per man, and by salting the water with 2 to 3 teaspoonfuls of salt to the gallon. When possible all food should be heavily salted. Avoid alcoholic beverages and meat in large quantities.

Desert sores may develop whenever a break occurs in the skin under desert conditions. Prompt disinfection of all wounds, no matter how trivial, with 2 percent tincture of iodine, proflavine, zephiran or other agent, and covering with sterile gauze to prevent contamination by flies will be helpful.

IX

THE UNITED STATES

Finally, for the benefit of those who have successfully adapted themselves to all the strange environments herein discussed, there is attached a final word concerning that welcome time when you return to the United States with victories and strange experiences behind you. Lest you unwittingly violate local taboos, we include excerpts from "A Short Guide to the United States" prepared by Sergeant Leon D. Held while on foreign service:

"Americans usually open a conversation by asking, 'Well, what's new?' It is not necessary to reply to this except by saying, 'Well, what's new with you?'

"The monetary system is rather confusing. Regardless of their denomination, five, ten, and twenty-dollar bills are all the same size. A nickel (worth only five cents) is almost twice as large as a dime (worth ten cents). Two dollar bills are tabu and the natives are extremely superstitious about them.

"Listen patiently when veterans of the first World War tell you how much tougher things were in their day. Remember they had to listen to the Spanish-American War veterans, who in turn had to listen to the Civil War veterans.

"In some parts of the United States, eggs in powdered form are unobtainable, and you will have no choice but to eat them directly from the shell. However, it is always advisable to boil them first. In the rural districts it is also difficult to get dried vegetables owing to a lack of dehydrating equipment.

"You may be shocked to see beets, turnips, and potatoes displayed in their natural state, with bits of garden soil still clinging to them. Yet when mashed and properly prepared, these vegetables can be quite palatable. The natives seem to thrive on them.

"In churches and auditoriums and other public places you will often see women surreptitiously slipping their feet out of their shoes and wiggling their toes. This is strictly a feminine prerogative, and has no religious significance. Do not attempt to imitate them. Always be tactful. If, for example, you notice that your Aunt Beulah has had her extra chin removed by plastic surgery, don't congratulate her. This operation is known as 'losing face' and the natives are very sensitive about it.

"But after all, the best way to understand the Americans is to settle down and actually live with them. They are really a very friendly people despite the apparent ferocity of their handshakes and their violent back-slapping. They mean well. Remember their civilization is much younger than that of Europe and Asia. They are just great big overgrown children at heart and should be treated as such."

INDEX

A

	Page
Abandoning ship	3
Acorns	116
Africa, plants of	119
Air plants as thirst quenchers	33, 59
Alcohol, danger of drinking	8, 76, 174
America, tropical plants of	119
Animals in the Arctic	141, 145, 147
Animals in the tropics	59, 79
Ants	74
Arctic:	
animals of	141, 145, 147
plants of	149
standard equipment for	132
survival in	132
Atabrine, dosage as malaria preventive	72

B

Bait for salt-water fish	144
Balsam vine	91
Bamboo:	
shoots as food	99
use of, for rafts	62
use of, for shelter	64
Bananas, kinds of	93
Bearberries	152
Bears, polar	147
Bees	74
Beetles, as food	81
Berries, as food	103, 149
Bilberries	152
Birds, edible:	
ducks	141, 148
geese	141, 148
loons	148
owls	148
parrots	80
ptarmigans	148
ravens	148
sea gulls	149
Bird eggs	148
Blood worms	77
Box fish	49
Breadfruit tree	59
Burning glass for starting fire	71
Burr fish	49
Butterflies and moths	74

C

	Page
Cacti.....	119
Carbon-monoxide poisoning, avoidance of.....	139
Caribe (South American fish).....	77
Caribou.....	141, 145
Cashew nuts.....	95
Cassava.....	103, 116
Cassiope.....	134
Castor oil plant.....	122
Catfish.....	51
Celery, wild.....	155
Centipede, sting of.....	74
Central America, plants of.....	119
Ceremony, native religious.....	63
Chart, waterproof.....	19
Cherry, ground.....	103
Chigger bites, how to recognize and treat.....	72
China nut or lychee.....	116
Cicadas, as food.....	81
"Climbing bandage" for climbing coconut tree.....	36
Clothing:	
In the Arctic.....	166
In the desert.....	172
Clouds, as indication of land.....	31
Coconut:	
as source of food and drink.....	36
fiber for cordage.....	36
how to open.....	39
how to reach by climbing.....	36
leaves for shelter.....	64
oil as skin protector and mite repellent.....	32, 40, 73
Codfish.....	144
Coloradilla.....	72
Cones, type of poisonous mollusk.....	41
Constellations.....	23
Constipation.....	8
Cooking in the Arctic.....	140
Coral reefs, dangers from.....	31
Cow or milk tree.....	116
Cowfish.....	49
Cowhage.....	130
Crabs, how to catch and cook.....	42
Cramps, heat.....	174
Cranberry, mountain.....	152
Crawfish (shrimp), how to catch and cook.....	82
Crocodiles.....	77
Cross, Southern.....	29
Currents and wind.....	18

D

Desert country, survival in.....	169
Desert sores.....	174

	Page
Dew, collection of.....	59
Dip net, how to make.....	44, 82
Dipper, the, how to locate.....	25
Direction, determining.....	20
Disease from natives.....	54
Disinfection of wounds.....	52
Driftwood as signal-fire material.....	134
Drill, fire, how to make.....	68
Drinking water (see: Water, drinking).....	
Ducks and geese.....	141, 148
Dumb Cane.....	122
Durian tree, fruit of.....	112
Dust storms.....	172

E

Eggs, birds'.....	80
Exposure at sea.....	7
Eyes and glare.....	7, 164

F

Feet, care of.....	168, 173
Ferns, edible kinds of.....	108, 112, 116
Field mice.....	145
Figs.....	115, 119
Fig tree.....	115
Filefish.....	49
Firemaking.....	65, 134
Fire plow, how to make and use.....	67
First aid.....	72, 164, 174
Fish:	
Arctic.....	141
at sea.....	10
attracting at sea.....	14
cooking.....	41
eggs.....	47
hooks, bait, nets and lines for.....	12
island sea food.....	40
poisonous varieties of.....	48
precautions.....	48
preservation of.....	47
trapping of.....	47
with poisonous flesh.....	48
with poisonous spines.....	49
Flukes or blood worms, danger areas for.....	77
Flying fish.....	16
Food:	
Animal:	
Arctic.....	141, 145, 147
land mammals.....	141, 145
sea mammals.....	147
tropical and jungle.....	79, 83
birds and birds' eggs.....	80, 148
fish and fish eggs.....	47

Food—Continued.	Page
fruits (see: Fruits, edible).	
fungi and lichen	164
insects	74, 81, 82
nuts (see: Nuts, edible).	
plants (see: Plants, edible).	
reptiles (see: Reptiles, edible).	
roots	149
sea animals	147
shellfish (see: Shellfish, edible).	
Food at sea, how to issue	10
Food, preservation and care of	47, 81, 93
Food, where to locate:	
Arctic	141
clearings and abandoned fields	93, 105
river and stream margins	105
seashores	84
swamps	91, 108
tropical forests and jungles	79, 83, 112
woods and thickets	105
Forests, wet and dry	58
Foxes	145
Freezing, treatment for	164
Frostbite, treatment for	164
Fruits:	
apples, wild	116
balsam vine	91
bananas	93
berries	103
breadfruit	89
cherries, ground	103
durian	112
figs	115, 119
gourds	91
grapes	91
longan	116
mango	95, 119, 122
melons	91
papaya	93
peaches	116
pineapples	103
plantains	93
Fuel, kinds of	65, 136
Fungi, edible	164

G

Game, where to watch for	62
Gas, carbon-monoxide, poisoning	139
Geese	141, 148
Glass, burning, for starting fire	71
Gourds	91

	Page
Grapevines.....	91
Grasshoppers, as food.....	81
Greens, edible, of the Arctic.....	149
Ground cherry.....	103
Ground squirrels.....	145
Grubs, as food.....	81
Gulls, sea, how to catch.....	149

H

Heat exhaustion, heatstroke, and cramps.....	174
Herring and herring eggs.....	144
Hooks, fish.....	12
Horseradish tree.....	105
Husk, removal of, from green coconut.....	39

I

Iceland moss.....	164
Immersion foot.....	8
Indications of land.....	31
Indo-China and Siam, plants of.....	116
Infection, plant.....	119
Insect bites, treatment of.....	72
Insects, edible:	
ants.....	74
beetles.....	81
cicadas.....	81
grasshoppers.....	81
palm weevils.....	81
termites.....	82
Iron pyrites.....	136
Island seafoods, kinds of.....	40
Island survival.....	31

J

Jiggers or chiggers.....	72
Job's tears.....	105
Jungle:	
animals.....	69
dangers.....	69, 71
foods.....	112
how to conduct yourself in.....	58
insects.....	71
reptiles.....	75

K

Kelp.....	157
Kindling or tinder.....	67
"Lagoon Glare", definition of.....	31
Landfall on inhabited or uninhabited island.....	81

L

	Page
Land, indications of	31
Landings, instructions for	81
Land leeches, dangers from	75
Land mammals	63, 141, 145
Lean-to, how to build	64
Leeches, ways of removing	75
Lemmings	145
Lichens, edible, Arctic	149, 164
Licorice root	157
Life boat, conduct in	6
Lizards, as food	79
Lobsters, how to catch	42
Log, over-water flight	19
Longan	116
Loons, as food	148
Lotus	107
Lump fish	50
Lychee, or China nut	116

M

Malaria, precautions against	72
Malaysia, Polynesia, and the Philippines, plants of	89, 100, 116
Mammals, land	63, 141, 145
Mammals, sea	147
Mancineel or manzanillo tree	122
Mango	95, 119, 122
Maps, value of	19
Matches, care of	65
Meat, how to preserve	47, 81
Medical treatment	72, 164, 174
Melons	91
Mice, field	145
Milk tree	116
Mirages	31, 171
Mite-borne diseases	72
Mites, protection against	40, 72
Mollusks, edible, varieties of	41
Mollusks, poisonous, varieties of	41
Monkeys as food	80
Mosquitoes, protection against	71
Moss, Arctic	136, 164
Moths and butterflies	74
Mulberries	103, 116
Mushrooms, Arctic, edible	149, 164
Mushrooms, Arctic, poisonous	149, 164
Musk-ox	145

N

Natives	53
Navigation:	
by stars, sun, etc	21
general	17
of rafts	18

	Page
Needle-urchins, description of	46
Net, dip, how to make	44, 82
Nettles	130
Nettle tree	130
Nipa palm	112
North Star (Polaris), how to locate	25
Nuts, edible:	
acorns	116
cashew	95
chestnut, water	108
lychee, or China nut	116
peanuts	103

O

Oases, safety rules for food at	171
Oil:	
burns, how to avoid, when abandoning ship	5
coconut, direction for extraction of	39
coconut, use of	32, 40, 73
Orientation	30
Orion, Belt of, how to locate	24
Owls, as food	148

P

Palms, coconut (see: Coconut)	
Palms, edible parts of	84, 112
Palm weevil, as food	81
Pandanus, or screw pine, as food	87
Pandanus, as thirst quencher	36
Papaya	93
Parrot, as food	80
Paths to follow or avoid	62
Peaches	116
Peanuts	103
Philippines, Polynesia, and Malaysia, plants of	89, 100, 116
Physic nut	122
Pigs, wild	63
Pigweed, as thirst quencher	33
Pine (screw) as food, and where found	87
Pineapples	103
Piranha, South American fish	77
Plantains	93
Plants, edible:	
arrowroot, Polynesian	91
bamboo shoots	99
cacti	119
cassava	103, 116
celery, wild	155
chestnut, Polynesian	89
coconuts	36
ferns	108, 112, 117

Plants, edible—Continued.	Page
fungi and lichen.....	164
grasses.....	105
horseradish.....	105
lotus.....	107
mountain sorrel.....	155
palms.....	84, 112
pandanus, screw pine.....	87
pokeweed.....	103
purslane.....	33, 91
rhubarb.....	155
rice.....	108
seaweed.....	157
sugarcane.....	99
sweet potato.....	100
tapioea.....	103, 116
taro.....	100
tomatoes, wild.....	100, 116
water lily.....	107
Plants, poisonous kinds.....	119
Plants for shelter.....	64
Plants, tropical.....	83
Plants for water.....	33, 59
Poisonous animals and plants.....	119
Pokeweed.....	103
Polar bears.....	147
Polaris (North Star), how to locate.....	25
Polluted water, how to purify.....	59, 171
Polynesian arrowroot.....	91
Polynesian chestnut.....	89
Polynesia, Malaysia, and the Philippines, plants of.....	89, 100, 116
Porcupine fish.....	49
Ptarmigan.....	148
Puffer, or swell fish.....	49
Purslane, as thirst quencher.....	33
Purslane, as food.....	91
Pyrites.....	136
Q	
Quinine, use of.....	72
R	
Rabbits.....	145
Rafts, navigation of.....	18
Rafts, wood for building.....	62
Rain water, how to collect.....	9
Rattan.....	61, 66, 112
Red bug (see: Mites).....	
Reindeer moss, Arctic.....	164
Religious rites, respect for.....	62
Rengas tree.....	122
Reptiles, poisonous kinds of.....	16, 75
Rescue craft, procedure in.....	6
Rescue from Arctic localities.....	132

INDEX

185

	Page
Reptiles as food:	
lizards	79
snakes	79
turtles	16
Reptiles of jungle	75
Rhubarb, wild	155
Rice, wild	108
Rock tripe, edible lichen, Arctic	164
Roots, edible, of the Arctic	149

S

Salmon	144
Salmonberry	149
Salt tablets	174
Salt water, dangers of drinking	10, 32
Salt-water sores, prevention of	40
Sandbox tree	122
Sandstorms	172
Scorpion, sting of	74
Scorpion fish	49, 52
Screw pines, Pacific region	36, 87
Sculpin	144, 145
Sea-cucumbers, as food	45
Sea-cucumbers, where to find	45, 144
Seafood, varieties of	40
Sea gulls, how to catch	149
Seals	147
Sea snakes, poisonous	16
Sea-urchins or sea-eggs	45, 143
Seaweed, as food	157
Sharks	16, 17
Shellfish, mollusks, etc.:	
cooking of	41
edible kinds of:	
clams	41
crabs	42
lobsters	42
mussels	142
shrimps	82
snails	143
how and where to find	41
Shelters:	
Arctic	138
building	64, 139
coconut leaves for building	64
Shrimp, how to catch and cook	82
Siam and Indo-China, plants of	116
Sickness	72, 164, 174
Signal fires	133, 173
Sorrel, mountain	134
Smudge fire, how to make	124

	Page
Snakes:	
as food.....	79
sea, poisonous.....	16
treatment of bites from.....	76
Snowblindness.....	164
Soft-bodied urchins, description of.....	46
Sores, salt-water, coconut oil to prevent.....	40
Sores, desert.....	174
South America, plants of.....	95, 116
South American stream fish.....	77
Southern Cross, how to locate.....	29
Spiders, bites of.....	74
Spiny toadfish.....	50
Squirrels, ground.....	145
Stars, navigation by.....	22
Stings, care of.....	52, 130
Stinging fish.....	50
Stinging nettle.....	130
Stingrays.....	51
Stonefish.....	50
Streams, as highways to rescue.....	61
Strychnine.....	122
Sugarcane, as food.....	99
Sun, navigation by the.....	20
Sunburn, prevention of.....	7, 32, 40, 63
Sunstroke, prevention and treatment of.....	32, 40, 174
Swamps and bogs, avoidance of.....	62, 91
Swamps and bogs, food from.....	91
Sweet potatoes, as food.....	100

T

Taploca.....	103, 116
Taro, as food.....	100
Terebras, type of poisonous mollusk.....	41
Termites, winged, as food.....	82
Thirst, quenching of: (see also: Water)	
at sea.....	9
by use of pebbles.....	170
palm juice.....	61
plants.....	33
Thirst, effects of alcohol and tobacco on.....	8
Thornfish.....	49
Ticks, wood.....	73
Tiger fish.....	50
Tinder.....	67, 136
Toadfish.....	50
Toadstools.....	149
Tobacco, effect upon thirst.....	8, 170
Tomatoes, wild.....	100, 116
Trails, to follow or avoid.....	63
Trapping animals.....	80
Trapping fish.....	47, 82
Trigger fish.....	49
"Tripe de Roche," edible lichen, Arctic.....	164

INDEX

187

	Page
Tropical American foods.....	131
Tropical plants, as food.....	83
Trout, salt-water.....	144
Trunk fish.....	49
Turtles, for food and drink.....	16
Two-stick fire drill for fire by friction.....	68

U

Urination, painful.....	
-------------------------	--

V

Vegetables, edible.....	
Venomous fish.....	
Vines, source of water.....	

W

Walrus, how to hunt and kill.....	
Warty lump fish.....	
Wasps.....	
Water, drinking:	
at sea.....	9
from dew.....	59
from fish.....	11
from plants.....	33, 56
in the Arctic.....	9
in the desert.....	
on islands.....	
polluted, purification of.....	51
rain water.....	
salt, dangers of.....	
Water chestnut.....	
Water hyacinth.....	
Water lilies.....	
Water vine.....	
Weasels.....	
Weeds, pokeweed and purslane.....	33, 9
Wells, dangers of digging too deep.....	7
Wells, tools for digging.....	
Whitefish.....	14
Wild apples.....	
Willow leaves and roots.....	134
Wind and currents.....	18
Wolves.....	1
Woods, getting out of.....	
Wood ticks, how to remove.....	
Wooly lousewort.....	
Wounds, disinfection of.....	

Y

Yams.....	
-----------	--

Z

Zebra fish.....	
-----------------	--