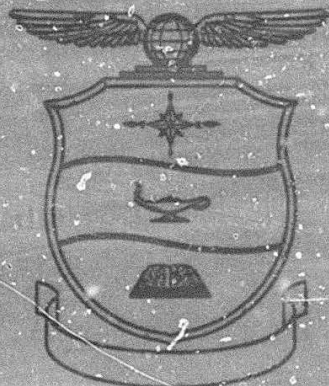


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999 SURVIVED

*An Analysis of Survival Experiences
in the Southwest Pacific*



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999 SURVIVED

An Analysis of Survival Experiences in the Southwest Pacific

by

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Preface

THIS ANALYSIS of survival experiences in the Southwest Pacific was prepared by Dr. Richard A. Howard, a botanist and currently Assistant Professor at the Biological Laboratories, Harvard University. In World War II, as a captain in the Air Force, Dr. Howard served as Chief of the Jungle Survival School conducted by the Aero-Medical Department at Orlando, Florida. There he taught survival courses and demonstrated survival techniques, leading groups of students into Florida jungles for ten days at a time with no equipment other than a gun and machete.

After the war, as a civilian in the active reserve, Dr. Howard continued to collect survival stories. At the request of the Arctic, Desert, Tropic Information Center he spent a 30-day period of duty at Maxwell Air Force Base, reviewing additional survival accounts in unit and regional records, and integrating the information with data previously assembled.

Dr. Howard has selected a valid though unusual approach in this study of survival experiences. He has amassed a cross-section of incidences: individual and group accounts, land and sea episodes, stories from the records of the different military forces--a few from our allies and even several from the enemy. These survivors, singly and as a whole, successfully coped with emergencies. Evaluation of their preparedness, ingenuity and determination permits a concept of the minimum requirements for survival in the tropics.

The Arctic, Desert, Tropic Information Center, actively concerned with aspects of survival in non-temperate environments, believes this study to be an instructive and eminently readable account of survival incidences in the Southwest Pacific and China-Burma-India theatres. "999 Survived . . ." will be an important source of information to all concerned with briefing fliers and passengers for travel in the regions under consideration, and to all instructors of survival techniques; furthermore, it will be a reliable guide in shaping the course programs of survival training schools.

*Paul H. Nesbitt,
Chief, ADTIC*

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PART I

1000 SURVIVAL CASES: *From Emergency to Rescue*

1. BACKGROUND FOR THE STUDY

During the period of action in the Pacific theatre of combat in World War II a program was in operation to prepare flying personnel and passengers for possible inflight emergency that might require parachute escape and descent, ditching, or crash landing into unfamiliar, hostile or dangerous terrain. This preparation had two aspects: 1. training, and briefing of flying personnel, and 2. the development and distribution of equipment necessary for survival following an inflight emergency.

Training for inflight emergency and subsequent survival was given to pilots and crews in all stages of flying training from pre-flight schools to instructions in operational areas. Passengers were briefed on emergency procedures by military intelligence personnel or by the crew of the plane prior to a flight.

All branches of the service carried on this training which tended to follow the lines suggested by the Arctic, Desert, Tropic Information Center in such publications as "Survival", the "Nine School Lectures on Survival" and in movies such as the "Land and Live" Series and "Castaway". Special schools of survival training were established; the author of this report served as the chief of one of them, the Jungle Survival School conducted under the Aero-Medical Department of the Army Air Force at Orlando, Florida. Similar training was given in Hawaii by the Bishop Museum, at Chapel Hill and Pensacola by the Navy, at Quantico by the Marines, and in London by the British.

The Orlando School trained instructors to teach survival information; the school also presented detailed instructions and briefing to crews of aircraft headed for combat. The instructors in most of these organizations were men with experience in the tropics, or arctic, depending on the nature of the school, who knew the principles of living off the land in the areas concerned. The men taking these programs of training varied from raw recruits to veterans of combat in the Pacific area who had been returned to the United States for special training prior to the next campaign of the Pacific war.

In the majority of cases the training given these men was based on past experiences and the biological knowledge of the instructors. During the war years only a bare trickle of survival stories, tales of actual survival under combat conditions, found their way back to the various schools.

The author found the lack of actual survival stories a severe handicap in conducting the Orlando training program. While the few available could be used as examples or directional aids for training, they obviously represented only a very small sample of the total.

When the war ended many of the survival training programs were abandoned before actual survival experiences could be collected and considered in terms of the training or preparation the men had received before experiencing a critical survival condition.

Recently, through the Air Forces Reserve training program, the author was privileged to return to active duty for a 30-day

period at the Air University. Through the understanding of the present staff of the Arctic, Desert, Tropic Information Center and in cooperation with the Air University opportunity was made available to peruse the official wartime records of various outfits operating in the Pacific area. This perusal had as its goal the accumulation of survival stories in order to obtain the range of variation in length, difficulty, and nature of actual inflight emergencies leading to various survival episodes, and to extract from these stories survival information of value to any future training program.

2. NATURE OF THE SAMPLE

A reference list at the end of this paper gives the periodicals, reports and records searched for survival stories. Some of the references are completely and entirely devoted to appropriate stories and these tales are given in considerable detail. Others are eyewitness narratives, or reprinted excerpts from unavailable intelligence reports, or vague accounts of survival episodes. Personal interviews with men who survived were collected during and since the war, this information has also been used in compiling this report.

All told, approximately 1000 case histories were collected. These do not represent 1000 planes, they are single or joint reports, from pilots of fighters to crews of transports or heavy bombardment aircraft. The stories were taken from Army, Navy and Marine intelligence reports as well as from British, Australian, Canadian and New Zealand sources.

Not all of the stories are complete and the range of data permits no degree of comparison between individual stories. The intelligence interviews and the interviews obtained personally were in much more detail than the newspaper or magazine accounts of other cases. The completeness of the accounts varied with security regulations in the areas, with the interest of the interviewee, and with the nature of the military situation. If the story was

derived from a combat intelligence interview the detail was complete; if from an operational report the episode might be reported with area omitted or cited only as from Burma, Borneo, the Philippines.

Names of the personnel involved were omitted for security reasons from the original reports more frequently than not. Perhaps a story reported the case of Lt. S----, or more frequently the case of the pilot, the navigator, or the waist gunner.

In many cases the explanation was submitted when the crew was only partially accounted for. Thus a B-29 report might read: Lt. S and Lt. J returned safely, two crew members were killed in flight, one parachute failed to open, 8 men missing.

It would be extremely easy to pad this report with types of cases easily available. The reports of B-29 operations are remarkably complete while those of the Flying Tigers or the 14th Air Force are bare outlines. Air-sea rescue operations are reported in detail while tales of men rescued by guerrilla forces may be brief and sketchy although in duration 5 to 100 times as long. An attempt was made in this report to balance the number of stories from fighter and bomber aircraft, and sea and land survival cases.

The details of a survival report depended both on the interests and intelligence of the interrogator and on those of the survivor. One report goes into considerable detail on the mechanical nature of the plane failure, another into agricultural operations of the natives, a rare one reports Japanese enemy activity in the area, one chap carefully reported the breast shape of the native women. An interviewer may have been interested only in the effects of our operations on the natives and asked many questions to secure this information, while another may have wanted details on the anti-aircraft defense patterns flown or the technicalities of the escape.

Few reports showed much interest on the part of the interviewer in the biological

aspects of survival. Few reports showed much of value in the way of medical information. Some data presented in this study were secured not from the answers to direct questions but from the casual comments of the survivors.

The nature of the information given in the reports depended on the impressions of the survivors. Those that had trouble reported difficulties in considerable detail, while expressions of opinion on the same subjects were not available in reports of men who had relatively easy times. In many stories only one or a few incidents stood out well in the memories of the survivors; these few incidents were described in detail, in contrast the remainder of the reports might be very sketchy.

Many obvious gaps exist in this study. It would be desirable, for example, to include the stories of men who did not survive. Such data might be secured from diaries and personal effects which are no longer available in military libraries. Such valuable documents were returned to the next of kin. It would also be desirable to know the time of year some survival episodes took place. Such information is of considerable value in appreciating the difficulties of the men in obtaining food or water and in protecting themselves against the environmental difficulties; such information would also be helpful in identifying some of the fruits or vegetables seen or used.

In compiling the 1000 cases on which this report is based considerable care had to be taken to avoid repetition of stories. One account was found reprinted in 12 different journals from 4 different countries. Classical or inspirational survival tales were reprinted or extracted in many ways, often they were so altered in repetition that it would be easy to assume they related to different experiences. Two cases were encountered in which experiences of others were used as personal experiences in "best seller" types of personal narrative war stories.

Many of the 1000 cases examined yielded a single fact of value to this study. Other stories, in more detail, contributed many facts of value. This is especially true of emergency food materials. When a survival story listed 20 items of food used, each item is considered separately in the material which follows.

This study, therefore, is not intended to be a statistical analysis of survival episodes. It is an indication of the nature and range of experiences which can and did happen to 1000 men who were forced to leave aircraft during combat operations away from their home bases; these men survived, returning to relate their survival experiences.

3. AREA COVERED BY THE STUDY

Since the writer's time was limited and the research possibilities were unlimited, most of the research was directed to securing stories from operations in the Southwest Pacific--from the defense of Guadalcanal to the operations against the mainland of Japan.

The survival problems of the American tropic, the European, the African desert and the Arctic theatres remain for others to investigate.

4. REASONS FOR THE INFLIGHT EMERGENCY

It is estimated that the 1000 case histories represent inflight emergencies for about 420 aircraft. There were four principal reasons for an inflight emergency. In frequency of occurrence they were as follows:

1. *Lack of fuel.* This seemingly would apply to long hops or long operational missions but it was not always the case. Many fighter pilots on defensive operations found it impossible to break off enemy engagement and ran out of fuel, necessitating parachute escape or emergency landings. Thus many of these episodes can be tied in directly with enemy activity. The jettisoning of fuel following loss of

an engine was reported in many bomber stories, this made the plane unable to return to its base. The loss of fuel following enemy action, aerial or anti-aircraft, which punctured fuel tanks was another factor.

2. *Enemy action.* Inflight emergencies due to such enemy action as aerial combat, anti-aircraft defenses or aerial ramming tactics, led to immediate parachute escape in the majority of cases. In a few incidences the plane was able to continue on course for varying periods of time before it was necessary to abandon the aircraft. Crews appeared to have a better chance of survival when a period of time was available between the attack and the bailout. This time factor apparently gave a crew an opportunity to prepare mentally and materially for what was to follow. When men did go through a parachute descent immediately following enemy action, a great number reported attacks by Japanese pilots on the crew in parachute descent, on the ground, or in the water.

3. *Poor navigation.* Lack of fuel resulting from poor navigation was the most frequent cause of an inflight emergency. In Central Asia and in the open Pacific complete lack of orientation and the inability to establish location often led to a decision to bail out or crash land.

4. *Mechanical failure.* Faulty engine performance frequently caused the early abortion of a mission and no emergency would result, but in many cases mechanical failure occurred after the mission was accomplished. Failure of the radio and subsequent lack of orientation was perhaps the most common mechanical failure leading to the loss of a plane.

In addition to these primary causes, secondary and correlated events often led to inflight emergencies. Fire due to enemy action ranked significantly as the cause of an emergency, although fire was started by lightning in one plane after enemy action had released gasoline and oil into the fuselage.

Several cases of mid-air collision, and

several inflight emergencies resulting from icing conditions have been included--the latter from the Hump area.

Only five cases of pilot error were reported. All of these inflight emergencies occurred during low flying reconnaissance or strafing missions which led to crashes because of lack of altitude or space in which to recover from tactical maneuvers.

5. NATURE OF THE LANDING FOLLOWING THE INFLIGHT EMERGENCY

The vast majority of inflight emergencies led to bailouts which occurred at altitudes varying from 20,000 to a few hundred feet. The crew of one B-29 bailed out at 27,000 without oxygen and without difficulty. Ditching occurred following inflight emergencies over water, and several cases of ditching in rice paddies and rivers were reported from China, India and Burma. Forced landings with the crew staying with the plane were relatively few in the stories studied.

Parachute landings usually were successful although many physical injuries were reported, and will be considered in a later section. Over the mainland of Asia a very high percentage of men seemed to land in tree. Whether this is a usual event or whether tree landings were vividly reported is difficult to determine. In one emergency escape from a B-29 over Burma eight of the nine men landed in trees. Five of the eight experienced real difficulty in getting to the ground from their aerial perches.

Parachute landings in water were generally without incident. Several men reported releasing themselves from the chute from too great a distance over the water, they were unable to judge the distance and therefore fell with considerable force. A few men reported difficulty releasing themselves from the parachute harness once in the water, and one case of drowning from such a situation was in the records. A few men were dragged varying distances by parachutes which failed to collapse, these men swallowed large amounts of salt water

which resulted in later discomfort and nausea.

The release of equipment caught in tree tops caused much concern and comment in the stories. Where this situation was experienced the men invariably suggested all emergency supplies be dropped on streamers rather than by chutes. This applied particularly to the Asiatic mainland and other wooded areas. Men who were caught in trees during parachute descent suggest the attachment of a coil of rope to the parachute harness to facilitate reaching the ground. Height of suspension varied from a few inches to 150 feet above the ground.

6. DURATION OF THE SURVIVAL EPISODE

Survival is a broad term, but the full limits of its interpretation can be found in the 1000 reports studied for this paper. Generally speaking, individual isolated survival in these 1000 cases was of short duration. In fact so many of the inflight emergencies resulting in ditching, crash landing or parachute descent were followed by immediate contact with guerrilla forces or friendly natives, by capture, or by rescue by our own forces that, for the purpose of this paper, any period of individual isolated survival is considered prolonged when it extended beyond 48 hours without contact with natives or our own forces.

The few crash landings were made in friendly territory, commonly after buzzing or otherwise signaling the native population. In such cases contact with the natives was established almost immediately.

Bailouts occurred under the same conditions. Pilots usually circled an area for considerable time before calling for emergency bailout by the crew. When this occurred over friendly territory the natives were contacted quickly.

In uninhabited areas instructions were given by the pilot as to the proper procedure for the crew to follow once they were on the ground. In the majority of

cases these instructions called for the crew to reassemble. Where this was not possible, as in mountainous country, directions for travel were often given. These instructions called for the crew to orient themselves on the way down in the parachute.

Where this did not occur, confusion and prolonged survival episodes resulted. (See section on travel.)

In a very small number of cases the men, once on the ground, were met by Japanese troops or unfriendly natives. Rarely were the men taken prisoners. Generally speaking, fliers who escaped by parachute and were captured immediately were mistreated or killed.

If the plane in distress was one of a flight or mission, the other planes always circled the area unless opposed by enemy planes or in enemy territory where circling might pin point the survivors to the enemy ground forces. Cover was frequently established by accompanying planes for survivors on the ground or in the water. One Navy report tells of a continuous aerial cover maintained by fellow fliers for a period of 36 hours before the raft was reached by surface searchers.

The majority of cases of ditching resulted in immediate rescue. The success and efficiency of operation of the air-sea rescue units as reported in these survival stories is commendable.

Only when the inflight emergency leading to parachute escape from the plane occurred at night, or over a great distance, or in difficult terrain, did the resulting survival episode extend over a long period of time. The longest period of individual isolated survival was 23 days. Many men were out for longer periods, extending up to eight months in the stories considered, but in all of these instances contact was established many times during the period and supplies were obtained from the natives, from guerrilla forces, or by aerial supply. Thus less than 15% of the incidences could be called prolonged survival in the sense that they lasted more than 48 hours.

PART II

The Problems of Survival

THROUGHOUT the 1000 survival episodes under consideration there is much evidence of proper training in procedures, uses of equipment, and survival information. By courses, lectures, movies, survival manuals, by seeing native foods in native gardens and markets, many men learned the correct things to do in emergencies. This report is of men who did the right thing, at least to the degree that they came back or were rescued. What they did is of interest in the determination of the type of information flying personnel should have. The acts of these 1000 survivors represent the range of behavior and the degree of retention of information that permits survival. The data presented in the following pages is not intended to be a complete survival manual nor a complete listing of information the flier should know. It is, however, a record based entirely on survivor reports of what happened to fliers following inflight emergencies, the types of food they encountered, the hazards that befell them, and their ideas on living in remote areas.

1. HEALTH AND SANITATION

a. Injuries. Inflight emergencies are hazardous. Since a large percentage of inflight emergencies followed enemy action, many members of the various crews were killed or injured before the actual emergency occurred. Drawing from the 1000 cases under consideration, it can be concluded that approximately 60% of the men were hurt by the time they reached the ground. Many of these injuries were sustained in flight, others on the escape from the plane, or in the process of parachute descent, crash landing or bailing

out, or at the point of actual contact with the ground. They varied from slight burns and bruises to compound fractures of the limbs, amputations, and internal injuries.

The three most commonly reported injuries were: 1. burns, 2. cuts, or scratches received while in the plane, on escape from the plane, or cuts obtained while landing, and, 3. sprains, contusions and fractures on landing.

Ninety per cent of the men injured by the time they reached the ground, or later in their survival episodes, reported using first aid kits.

A striking fact made clear in these survival stories was the inability of the injured man to care for his own injuries. Sufficient first aid training was given to flying personnel so that they could care for others in their party who were injured; but in cases of individual parachute descent or the landing of single seat aircraft and injury to the flier, proper first aid procedures were noticeably wanting. Most striking is the story of the pilot of a P-38 which became disabled, forcing the pilot to flip the plane on its back and thus fall free from the inverted cockpit. His parachute opened safely but the aircraft completed the loop and roared toward him as he descended suspended from his parachute. Seeing the plane approach the pilot tried to slip the chute without success and at the last minute pulled himself as high as he could on the shroud lines. The plane passed beneath him but one propeller struck him on the leg amputating his limb just above the knee. The pilot nearly lost consciousness but was still aware of his condition when he landed in a forest canopy. The parachute caught

in the tree tops and the pilot found himself suspended about 5 feet above the ground. His leg needed immediate attention, using a first aid kit in his pocket he tried to apply a tourniquet to the bleeding stump. While the unsuccessful effort was in progress, a native appeared and seeing the situation took the bandage from the pilot and applied the tourniquet. From the report it is obvious that if the native had not appeared when he did, the pilot would not have succeeded in applying the tourniquet and he would have lost his life.

Another report relates the story of a badly injured flier in considerable pain who opened his first aid kit and obtained a morphine syrette. He read the directions and then hesitated fully an hour before finding the courage to force the needle into his arm.

Numerous reports of head injuries all mention the flier's inability to apply a satisfactory bandage.

These stories serve to stress the need for more instruction in the application of first aid to one's own person. The ability to apply proper first aid measures should be developed in each flier. The present course of instruction for flying personnel is not adequate in this respect.

The following paragraphs show the nature of injuries experienced in the survival stories studied:

1. Injuries sustained during the escape from the plane: Burns were received from fire inside the fuselage. The explosion of the engine of a fighter burned the head and face of the pilot except where he was protected by his flying goggles. Severe bruises and lacerations were received by crew members following contact with loose equipment in the aircraft; a dislocated knee was incurred when a gunner was hit by a swinging machine gun; another flier received a hole in his lower lip when he struck a machine gun sight, he landed in the ocean and as his Mae West was inoperative, he nearly drowned when he was unable to blow up the life vest.

2. Injuries received in course of para-

chute descent: Interestingly enough, there were no reports of reluctance on the part of any flier to leave the plane following an inflight emergency. The extreme was in the other direction, several men bailed out before the signal was given by the pilot. One man bailed out to catch on the tail of a B-29, he suffered severe stomach abrasions and internal injuries. Fortunately he was rescued soon after landing and given adequate hospitalization at a nearby base.

One crew member stuffed numerous extra items of survival gear inside his shirt prior to leaving the plane, either in the descent or on the landing he suffered a broken rib and numerous chest and rib injuries from this material.

Survival items dangling loose from parachute harnesses caused injuries in many cases. This led one survivor to suggest that all equipment be tied at both ends if it is attached to the person or parachute. One flier was hit in the face with his .45 during descent by parachute, he suffered a broken nose and several broken teeth.

One crew member was strafed by a Japanese plane while in the air and landed with two slugs in his leg. Another crew member was near a burst of an anti-aircraft shell and landed with five pieces of steel in his leg.

3. Injuries obtained from the actual landing: The reports of sprains, breaks and bruises from the parachute landing are extremely numerous. Two reports of compound fractures occurred, one of the leg and one of the arm. Seven stories reported simple fractures of a limb. A most heroic tale is a buddy story where one flier suffered a compound fracture of the leg, a simple fracture of the other leg, a fractured right arm and a broken left hip; he landed in the water off the Asiatic coast, his buddy who landed nearby swam to his aid, inflated his life vest and supported the injured man in the water for 40 hours, all the time trying to propel the two of them to land--they finally made it (40th. Bomb. group). A man in China with both

legs broken dragged himself for three days before he encountered a native village. One man reported being knocked out when the buckle on the parachute harness hit him on the back of the head as he landed.

Three men reported broken collar bones. One fellow in the Solomon area set the collar bone by himself and strapped the arm to his side; this made traveling difficult and after an unstated period of time he found it necessary to cut the taping and use the arm on the injured side; he was in the brush for 3 months before he was rescued. Another chap in New Guinea with a broken leg set it successfully with splints; it was 8 months before he was rescued.

One cryptic survival report warns others not to bail out over land that looks like "piled carpet". The story was of a parachute descent in Sumatra where the flier discovered the "piled carpet" was really a planting of Agave plants, a century plant with stout leaves tipped with large spines. The flier suffered severe lacerations of the leg from landing on these plants.

Dislocations were reported in four cases. The most painful one which the individual could not reduce was a double dislocation of a finger.

Scratches and cuts resulting from descents into forest canopy or into brush land were very common in the 1000 survival cases.

4. Injuries sustained on the ground during survival episodes: Such injuries ranged from bruises from falling over a cliff to scratches and cuts from vegetation. The nature of such injuries will be elaborated in the section on animal and plant hazards.

Other survivors reported miscellaneous ailments such as nausea from drinking too much sea water while swimming ashore; nausea from eating a strange fruit; infected mosquito bites which had been scratched; infected feet following the accumulation of leeches in shoes not removed during a two weeks' survival period.

Toothaches were reported by 5 men. Two men were shot in the back in Burma by unseen assailants. One man was chased and bayoneted by Japanese soldiers before he escaped and eventually reached Allied troops. Most miscellaneous injuries were from spines and thorns. One man reported a spider bite. One chap returned with extremely tender feet since he had no way of trimming his long toe nails.

It is interesting to note that a number of men suffered bruises of the mouth and lips and broken front teeth in the course of their emergency escapes. The broken teeth proved to be very painful through the period of survival. One chap, so afflicted, suggested that all crew members be supplied with a sponge rubber mouth guard similar to that used by boxers; this could be placed in the mouth and worn during the escape and descent from the plane.

One of the principal warnings offered fliers in training is the danger of shock following an emergency escape from or landing of a plane. Only one case of shock was reported in the 1000 survival stories studied. That flier was alone, he recognized the symptoms and rested with his feet higher than his head until the shock passed. He commented that ammonia inhalers should be available in first aid kits since he was afraid of fainting. The same flier continued in an upset condition for a day. He stated that the only materials he could keep on his stomach during that period were the malted milk tablets he carried.

The general physical condition of the men during and following an emergency depended to a large extent on their condition at the start. Men who flew in good physical trim usually survived in better condition than the dissipaters. One man who flew with a hangover for the first time commented, "It would have to happen this time". The most serious medical report seen concerned a pilot who parachuted into the brush. He was with natives for 75 days before returning to his base. A medi-

cal examiner determined that he was suffering from pneumonia, dysentery, meningial infection, vitamin deficiency and extreme emaciation from hunger.

b. Medical equipment of survivors. As mentioned earlier, 60% of the records studied reported the individual concerned was injured before freeing himself from his parachute or from the wreckage of the plane on the ground. Ninety per cent of the cases studied reported the use of the first aid equipment carried on the parachute harness, on the person, in emergency kits or in the plane itself.

The usual injuries incurred were burns, cuts, sprains, and bruises; the ointments, iodine applicators, band aids, bandages and compresses were the most commonly used items in the first aid kits. More band aids and ointments seemed to be needed by men surviving in life rafts.

Pain killers other than morphine were requested by about 20 men in the 1000 cases studied. In these the desire was for something stronger than aspirin but less dangerous than morphine. An orally administered pain killer was specified. One particular request for such a pain killer was from a man with six broken teeth.

Morphine was used by 16 men but was self-administered in only two cases. One group reported in considerable detail how morphine was used to quiet pain-crazed men whose tossing nearly capsized the 5-man life raft. One pilot who used morphine to relieve the pain of a broken limb first spent considerable time reading the instructions and worrying about how deep to force the needle. The second case of self-administration of morphine was a pilot in a life raft who used the morphine syrette first to relax when tension of sea sickness became too great; later he used it again on several occasions when abrasion from the life raft became too painful.

Praise was offered in a few cases for salt, quinine, and halazone tablets. In all these instances the men recommended the inclusion of more of each item in the kit. Several survivors reported using

crystals of potassium permanganate during their solitary period. One man used a dilute solution to bathe the sores and wounds of natives who come to him for first aid treatment; he recognized that his regular supplies would not be adequate and should not be wasted or used in such a fashion, especially as these same natives all wished to have a white bandage on their sore in order to show it off. One survivor who put a white bandage on a New Guinea native was faced with incessant demands for a new bandage as the native kept getting the first one dirty, primarily by touching it and letting all his friends touch it. Potassium permanganate was also used by several men to purify drinking water.

Sunburn or sun protection ointment was used by life raft survivors and by 12 men in land survival episodes. Additional protection of this nature was requested by two men.

Insect repellents never seemed to be supplied in sufficient quantity for those who needed them. Several men recommended placing an unbreakable can of insect repellent in each first aid kit. The bottles of insect repellent seemed to be broken more frequently than any other item mentioned.

Several suggestions were made regarding additions to first aid kits. One man wanted a roll of plain adhesive tape. He had one in a personal kit and found it extremely useful in the process of surviving for 14 days. Three men requested that condoms be added to first aid kits as emergency protection for supplies and for carrying water. One man in a life raft with a badly infected arm reported cutting the end from a condom and using it over a bandage to keep the dressing dry. One flier carried his watch in condoms, another carried food, and several used condoms as canteens. A few men requested the addition of sewing kits and vitamin tablets to first aid kits. The vitamin pills had a psychological value. One man wanted tea and bouillon tablets in the first aid kit.

Perhaps the personal item of equipment most commonly requested in the survival stories was a tooth brush. Over 67 men thought a tooth brush belonged in the first aid kit.

Details of transporting injured personnel were reported in three stories. In one a litter was made of the shirts of the men carrying the injured flier. These were used over poles in the usual fashion: the men holding the ends of two poles while a companion pulled his shirt off his back and over the arms onto the poles. In a second case, a chair type of litter was made with poles and a life jacket in which the patient sat quite comfortably. The third report told of using a life raft, with poles lashed to the handles, as a litter for an injured man.

c. Improvised medical care and native medical assistance. With or without first aid kits found on the parachute, on the person, or in emergency equipment, many men reported first aid improvisations in their survival stories. There were also reports on medical attention given the sick or injured by the natives; most men receiving this attention concluded that the natives probably had some knowledge proved by experience even though the remedies often appeared to be "far fetched".

Open wounds were treated with poultices of papaya leaves in Bougainville; and papaya leaves were bound over open wounds by the natives of New Guinea. One man reported that the Solomon Island natives suggested he fill his wounds with hot coconut oil; this they supplied and then bound the wound tightly with leaves. Silk maps and sections of parachutes were widely used as emergency bandages.

Malarial chills were treated with quinine or atabrine when these medicines were available. A native remedy encountered by several men consisted of wood ashes washed down with hot water; a recipient of this particular treatment in North Borneo reported "considerable relief". The wood ash and hot water treatment was used very effectively for severe cases of dysentery.

In the Micronesian area coral cuts, insect bites, and leech sores all received similar treatment: lime juice was squeezed on the injury. This acid may have dissolved the bits of limestone in coral cuts. In Burma lime juice was squeezed on attached leeches to make them drop free, it was reported to be much more effective than pulling, cutting, or burning them off.

Burns were treated with sea marker by one flier in a life raft on the open ocean, and another pilot discovered that the sea marker which was spilled on his legs in the raft prevented sunburn. Burns were treated in the Philippines by poultices of leaves soaked in coconut oil and bound on with other leaves or fibers.

Coconut oil was rubbed on the body to prevent sunburn at the suggestion of the natives. The inhabitants of many areas used coconut oil to prevent salt water irritation: the coconut oil was rubbed on the legs and the body before the natives went into the ocean for extended periods of fishing, swimming or diving.

Protection from salt water and sun was also obtained by using other native methods. In the New Guinea area coral rock was burned to get lime, this was mixed with water and then plastered on head and shoulders as sunburn protection (this was actually reported, consequent relief is open to question). In the Philippines coconut oil was used as a sunburn preventive. In India and Burma two fellows reported using mud on the shoulders and arms to prevent sunburn.

The fruit, juice, or the leaves of papaya plants were used to calm gastric disturbances or upset stomachs, according to the reports of 15 different men. Very sick fliers or those having difficulty retaining food on the stomach were fed the gelatinous meat of very young green coconuts. This material is very digestible and is fed to weaning babies and toothless old men in the Solomons area. In North Borneo a very sick pilot was cared for by one woman at the orders of the chief of the tribe; several times each day, she fed the

sick man on partly chewed foods and regurgitated rice.

Toothaches bothered several men, and native remedies were willingly tried. One flier broke all his front teeth in bailing out of the plane and the exposed stumps caused trouble. He was given handfuls of red peppers to chew, these eventually numbed his jaw and it remained that way for over a month by continued use of the peppers. Similar use of pepper seeds was reported in one survival story from the Philippines. Wood ashes were packed into the large cavity in a tooth of one survivor by the natives of New Guinea; this crude method reportedly gave relief. Two men with toothaches were given betel nut to chew; in both of these cases the nut toughened the sore gums and teeth.

One flier landing in Sumatra reported the natives were all suffering with scurvy. Since his lot was to be with them for an indefinite period of time he started making a tea of pine needles to prevent the scurvy; the duration of this treatment was not stated. Two other stories noted the use of tea of papaya leaves to prevent scurvy.

In addition to leeches, other insects such as mosquitoes and lice bothered some fliers, particularly after living in native huts for a few days. Coconut oil, lime juice and burned coral rock were all applied as means of getting rid of lice. Coconut oil was a common protective measure used against all insects.

d. Sanitation. Few reports of sanitary measures are found in the survival stories studied. The need for such measures was obvious, judging from the number of reports of fungus infections and rotted clothing; however, few men washed their clothing regularly. One chap in the Philippines reported the natives showed him how to make soap with wood ashes and coconut oil; he later made soap on a large scale and traded it to the natives for food and other necessities.

New Georgia natives showed a survivor how to shave with a piece of broken glass;

another man somewhere in the same island area reported shaving with a broken bottle. In the southern Philippines one flier shaved with an oyster shell, and in Burma one man shaved with sharp pieces of bamboo stalk. However, in China many natives produced razors for the fliers' use.

One survivor in Sumatra apparently needed a little instruction in sanitary measures for he followed a native practice of urinating in one corner of his shelter; he further reported the odor became so strong he was forced to sleep outside in fair weather.

Toilet paper was an item of equipment frequently needed. Many men thought a supply should be placed in first aid or emergency kits. One man in the Philippines reported the appearance of a severe rash following the use of an unknown leaf as a toilet paper substitute.

A commonly requested piece of equipment was a tooth brush. Several men made tooth brushes from pieces of bamboo in native fashion by chewing the ends until soft. New or used tooth brushes were supplied a great number of survivors in China, Burma and New Guinea.

e. Rest. If the survival situation allowed a rest period most men observed a healthy program of periodic rest. Needless to say, the principal objective of the survivors was escape and reestablishment with Allied forces. Several men over-estimated their physical abilities and walked continuously the first few days, because of fear or excessive enthusiasm, until they dropped from exhaustion. Where this travel was in the correct direction it was profitable. Where travel was in the wrong direction or in a circle, such an expenditure of energy led only to a state of mental depression.

The time and period of travel and rest depended on the area. The majority of men were able to travel during the daytime. A few were forced to travel only in the early morning and late at night. A still smaller number were forced, by the proximity of unfriendly natives or Japanese

troops, to travel only at night.

The usual period of travel and rest mentioned in survival stories was 45 minutes of travel and 15 minutes of rest.

The men who were cared for by the natives and were not in danger of capture by enemy troops usually took longer periods of rest and traveled for shorter periods of time. Generally speaking, survivors traveling with natives were the objects of considerable curiosity and were forced into social periods at every village and at each encounter with other parties of natives. As the period of survival increased in time and the reserve energy of the men decreased, the travel time was shortened and the rest period extended.

A siesta period in the middle of the day or following the evening or noon meals was observed and mentioned by a few men. The rest period usually consisted of complete relaxation, occasionally a short nap. A few men took this rest occasion to strip and look for leeches or other insects on their bodies. A few used this period to take off their shoes and relax their feet. One man bathed in a stream during every rest period where such was possible. Most men smoked during the rest periods if smoking materials were still available to them.

2. SHELTER

Shelter was regarded by the majority of men as something necessary for extended stay in one area. Men who were cared for by natives, or who were on uninhabited islands for a period of a week or more, often built permanent shelters. The materials used for such shelters usually were products of various palm trees. The men used the entire or the enlarged petiolar portions of the fronds. A few reported the use of banana leaves, and one mentioned a plant suggestive of a large aroid leaf.

Temporary shelters for one or a few nights were built more commonly; most men felt travel was more important than comfortable sleeping accommodations. These shelters were usually of the lean-to type,

and palm fronds, especially those of the coconut or nipa palm, were often used.

Four men reported using their life rafts for shelter or for the roof of their shelter. One man made a frame work of poles and covered it with the abundant drifted seaweed of the coastal area.

Parachutes were used by about a dozen men. In all cases small shelters were built, not the large paratepee type. Parachutes were also used to wrap the body for warmth and insect protection. One man placed layers of leaves between the folds of his parachute to add to the protection and warmth. In contrast, another man reported soaking the parachute thoroughly in a river before using it in order to keep cool. A single man reported his difficulty in building a parachute shelter since he did not have a knife or other cutting implement; he chewed the shroud lines in order to cut a section from the "chute" for shelter. Parachutes were frequently mentioned as body protection in cases of life raft survival, the men uniformly found the "parachutes were warm and helpful". In Burma one man reported the parachute to be too hot and oppressive in several layers, while a single layer allowed the mosquitoes to bite through and bother him.

Very simple protective measures were taken by several men. In India three survivors reported burying themselves in the sand for warmth; this was in June. One man dug a hole in the beach, lined it with leaves and grass, and covered himself with more leaves and grass for protection. In New Guinea another man reported using only leaves and grass for body cover while sleeping.

In Burma the ground in many areas was covered with leeches. Those who tried to sleep on the ground or to use ground materials such as leaves or grass for protection found themselves badly bitten. Many of these men reported burning over the ground in the area where they planned to sleep in order to kill the leeches; some reported this as a regular practice

of the natives. A single man reported "sprinkling ashes around his bed in order to keep the leeches away".

Caves on Bougainville were used for shelter by two individuals, while a third slept in a hollow tree. In Burma two men slept in the crotches of trees, at least in swampy areas, to keep dry and to avoid the leeches.

3. CLOTHING

The problems of clothing or wearing apparel expressed in the survival stories indicated that shoes or footwear caused the most concern. Troubles involving gloves for protection of hands and arms from spines and thorns were second in frequency, mosquito protection third, and warmth fourth.

One of the most repeated warnings in the Air Force during the war was to "wear the shoes you might have to walk home in"; this was a strong hint to wear the high top GI shoes. Low oxfords, the so-called Australian or Brazilian boots, cowboy boots and sandals were not recommended, and the men in the survival stories usually vouched for such recommendations when they were forced to survive in such footwear. In fact in the AIC records of the Hump flight in 1943-1945 an intelligence officer reported that 25% of the survivors interviewed had been wearing low-cut shoes. Such shoes or sandals were frequently lost in parachute descent; apparently the shock of parachute opening is great enough, in many cases, to jerk the shoes from a man's feet. The Australian or Brazilian boots mentioned frequently in the stories rarely held up under the rough usage necessary in survival territory. One chap found his Australian boots useless after two days of travel; the shoes had not only shrunk in size but were warped from the water and the soles had separated from the uppers. This condition so impressed the flier that he carried these useless shoes about his neck for forty-seven days to show others at his base on his return.

All men who had shoe trouble during the

period of survival had definite ideas on what to wear under such conditions. Most of the recommendations lauded the heavy high-top GI shoes, especially those with fibrous composition soles. At least five stories mentioned leather-soled shoes as undesirable in mountainous territory; evidently they became extremely slick and slipped on the rocks. Several men suggested a cleated sole for shoes. Other thought of golf style cleats, and two men wanted cleats put in the emergency kits to be inserted in the shoes in the field in case of trouble (this latter suggestion was made in view of the difficulty of walking around or operating an aircraft with such cleats already on the shoes). Six men suggested tennis shoes as the ideal footwear, although four others who wore tennis shoes complained of the thinness and poor quality of the uppers which were easily penetrated by sharp sticks and spines.

Gloves were worn during travel, at night, in procuring food, and in the preparation of foods. Adequate protection for the hands was mentioned as a need by about one-third of the survivors. Many stressed this solely from the standpoint of the amount of physical work they were forced to do in the process of surviving. The rest mentioned gloves as protection from spines and thorns and other vegetation, or as mosquito protection during the day and while sleeping. One chap who was fishing for lobsters and crabs in the Solomons area believed the gloves a necessity in getting food. Leather-palmed canvas gloves appeared to be favored among those who mentioned a type. One flier who had fleece-lined flying gloves thought the lining should be made removable so that the gloves could be worn more comfortably in an emergency.

In many areas the problem of insect protection was a major one. For many men nothing less than complete protection would have been satisfactory. Insect head nets were used when available. For leech protection trouser legs, often tied at the base, were tucked inside socks and shoes.

Several men mentioned the deficiencies of non-overlapping flies on trousers; men who had the overlapping or zipper types noted better protection against leeches and ticks.

Head gear was a primary problem for men surviving in life rafts. Flying helmets or the hats in emergency kits were used when available. Head protection was improvised from sea anchors, pieces of parachutes, life raft covers, and even from pelts of sea birds.

Belts and shoe laces were mentioned in a few survival stories. Cloth belts proved to be more satisfactory than leather belts; single piece leather belts were more satisfactory than sewn leather belts. Fancy or jointed belts were the least desirable, judging from the survival stories. Leather belts were found to be subject to fungus attacks which not only rotted the leather but also caused irritation on the body, and even attacked the clothing causing fabric deterioration. Leather belts also became deformed in wearing, particularly if they had been wet and stretched.

On the other hand, the woven or cloth shoe lace seemed to cause more trouble than the leather thong type. One flier in New Guinea mentioned more difficulty with shoe laces than with any other piece of his equipment; in this case it may have been an example of pointed frustration directed entirely at one thing.

a. *Improvised clothing.* Men who needed clothing or wearing apparel of any nature usually showed considerable ingenuity in obtaining substitutes to meet needs. Parachute cloth served as the most common type of material used. Parachutes were worn sarong-style by several fellows lacking trousers. One man with a complete sewing kit in his pocket made himself a suit, complete with trousers, vest and coat from a double layer of parachute cloth. The parachute case served adequately for coat and trousers material in another half dozen stories.

The bark of several trees and the ex-

panded base of the leaves of some palms were mentioned in two or three stories as substitute clothing material. The fibrous matting at the base of coconut palm leaves was pounded soft and used by about 24 men for G-strings, leggings and other items of protective clothing.

One man who was flying an observation type aircraft in India tore the fabric from the fuselage of his aircraft and used that material for a tent, later he made some clothing from it.

Improvised foot gear tested the ingenuity of about fifty survivors. Most men who lost foot gear in parachute descent from the inflight emergency lost only one shoe. Men who needed complete foot gear either had discarded their shoes in the water or had their foot gear go to pieces during the survival episode.

Materials from the plane served as foot gear for a very few men. Two fliers in the same party cut shoe soles from the tire casings. One survivor used the rubber coating of puncture proof gas tanks for foot gear. Another tried to make shoes from the thin sheets of aluminum on the plane; these shoes were made successfully but proved to be unsatisfactory to wear for any extended period of time.

Shoes were made of such materials as Mae Wests or other life jackets, parachute cloth, the case of the parachute, and the rubber seat cushions. These were worn alone or were padded with grass, leaves or stuffing from such things as seats or life vests. One flier reported his trouble with improvised shoes in considerable detail; his most satisfactory shoes were made from the sleeves of his flying jacket. Native materials used as emergency footwear included sections cut from a coconut, a flattened section of bamboo stalk, bases of palm leaves, coconut cloth, water-proofed banana leaves, and one desperate flier wore birds' nests strapped to his feet.

Leggings of parachute cloth were made for additional protection against brush, insects and leeches; other materials used

include spare clothing, banana leaves, bark and coconut fiber. One man in Burma had no jacket; to meet his needs, he wove a garment from leaves and grass; he also stuffed leaves and grass inside his shirt for additional warmth.

Head nets for insect protection while sleeping were improvised from parachute cloth. Two men used their undershirts and one man used a T-shirt; all three of these reported their improvisations more satisfactory than the regulation nets which they had used before.

Improvised shoe laces, belts and other ties were made from parachute shroud lines most of the time; less frequently they were woven of grass, leaves or fibers taken from the bark of trees.

Not all men had the ingenuity to improvise. Several reports pertaining to the Hump route in India and China mentioned survivors walking in after having gone barefooted for periods up to a week. Two men wandered around the jungle completely naked. One man in the Halamajera area wore only a G-string for two weeks, and he bragged of his tan on rescue. A flier in Sumatra purposely buried his clothing and went naked to avoid detection, apparently he suffered no ill effects.

In China clothing was regularly supplied to the survivors by the natives. One reported that he was given his choice of three pairs of shoes all of which were serviceable and approximately his size.

The natives in New Guinea and Borneo supplied clothing made of native vegetable materials to a group of three survivors; evidently risk of capture led them to change from their own outfits.

4. WATER

The necessity of having drinking water in the tropics is an obvious one, but most survivors reported their needs under survival conditions were greater than usual. In the 1000 cases studied various methods of securing potable water were tried, some with adequate results and some not. Most of the men were able to secure rain water

occasionally and, knowing this was safe, they drank their fill. During periods when rain water was not available the men searched for other sources. The first problem which faced most men, and which was commonly mentioned in their stories, concerned water purification.

a. *Purification of water.* It is surprising that only five men reported boiling water during their survival episodes. Perhaps this process was so obvious that many felt it not worthy of mention. Others found it impossible to boil water and either used it without boiling or after purification by other methods.

Two methods of purification were generally available to men on life rafts. The Delano sunstill, which was placed in many life rafts for an emergency, was not mentioned in any of the stories studied. The permutite kit for the desalination of sea water was mentioned in two stories; both narrators expressed the opinion that the treated water was not completely lacking in salt, and one reported little difference in taste between the natural salt water and that processed through the permutite kit.

One flier on a life raft tried to evaporate salt water from a tin can and collect the vapors on a glass plate. This was successful only for a few drops of water but it represented ingenuity to the nth degree.

In land survival where water was more abundant halazone, iodine and potassium permanganate were used in descending frequency in order of mention. Halazone tablets were included in first aid and emergency kits. Most men used halazone and most were over-cautious, using twice to several times the number of tablets suggested on the directions.

Iodine was used by fourteen men; each spoke of placing several drops of iodine in a canteen of water. All the men recognized a waiting period before drinking the water.

Four men reported using crystals of potassium permanganate to purify water.

There was a single expression of doubt as to the purity of the resulting pink concoction. One flier reported a dislike for the flavor of the mixture. A survivor even went so far as to try first iodine and then potassium permanganate crystals to purify sea water for drinking; as might be expected, he reported the water to be still too salty to be palatable.

One ingenious chap in the Philippines rigged up a simple still for purifying sea water for drinking purposes: he used an oxygen cylinder salvaged from a wreck and filled it with water; to the top of the cylinder he attached the rubber oral inflation tube from his life vest and ran the water into a section of bamboo. This still worked satisfactorily according to his report, but it "took considerable effort to keep a fire going".

b. *Sources of potable liquids.* (1) Canteens, rain and ground water, salt water.

Often a flier carried one or more canteens attached to a belt. The emergency kits in the aircraft, and the seat-type emergency kits worn by the flier, contained small cans of water. The seat type life raft was worn by fighter pilots, in this as well as the larger life rafts there were cans of water.

Knowing that the quantity of water carried in the normal plane was small, many fliers carried additional cans or canteens. One fighter pilot who ditched in the China sea reported he had three canteens with him when he landed "one on his parachute, one on his belt and an extra canteen in his kit".

Beyond these cans of water the survivor had to find extra supplies. Rain water was the most satisfactory source, many men stated that only rain water satisfied their thirst. Rain water was collected directly in newspapers, waterproof mats, life rafts, life raft tarpaulins, holes dug in the ground lined with leaves and this lined with a parachute; in the Boang Islands of the Bismarch Archipelago one survivor used the native "trick of placing a section of bamboo against a coconut

palm and collecting the rain water as it ran down the trunk of the tree".

Ground water from streams or lakes served many men as a water source. Most men questioned the purity of this water and apparently, if the opportunity was available, treated it by one of several methods. Ground water from ponds and mud holes was used. Ground water was sucked up through straws by two men: one used a small piece of parachute cloth as a strainer over the end of the rubber inflation tube of his Mae West, the same individual later used hollow stems of grass; the second survivor used sections of small bamboo as straws. One flier reported he drank only from mud holes "because standing water has less chance of contamination than running water". (This, of course, is erroneous). By contrast, several fliers expressed the belief that running water purified itself, if a source of contamination was not visible upstream the water was safe to drink; this is unsafe procedure in unknown terrain. It is best whenever possible to purify any ground water before drinking it.

Several men dug for water. One flier in Burma and another in India reported digging holes in stream beds during the dry season, one stated that he "invariably found water within two feet of the surface". Three men in the Netherlands Indies dug for water near the sea coast. One of these men excavated till he struck wet sand and water, he then lined the hole with a parachute section and drank the water that was thus filtered through the cloth. Several others used parachute cloth as a filter to remove mud and debris from their drinking water.

Salt water from the ocean was distilled in an oxygen cylinder by one man in the Philippines, as mentioned above. A Navy pilot started one of the most controversial discussions printed during the war by his process for drinking sea water while surviving in a life raft. (Bureau of Naval Personnel Information Bulletin 323: 32-35. Feb. 1944). This officer had seen

numerous birds alight on the salt water and drink it. He was finally able to shoot one of these birds which he dissected, trying to discover by what process the bird was able to utilize the sea water. He found nothing unusual other than a heavy layer of fat around the stomach; this he concluded must have something to do with the birds' ability to tolerate the salinity. He found by experimentation that if he drank sea water his stomach was upset, but if he then ate some fat from a bird this upset stomach condition disappeared and was no longer troublesome. Continuing his experiments, the flier finally ate quantities of the bird fat to coat his throat and stomach and then drank the sea water; he did this when his water supply was short, but he did have several days when rain water was available between times. The pilot reported his kidneys had been "off kilter" before the experiment was tried and remained off kilter until after his rescue. This story was widely reprinted and was almost as widely refuted by medical papers. (Bureau Naval Personnel Information Bulletin 324: 28-29. Mar. 1944). The general conclusion seems to be that the flier was lucky in escaping ill effects from his experiments. The human body cannot stand quantities of sea water, although sea water can be used to dilute fresh water in order to extend the supply in an emergency.

(2) Plant sources:

Various land plants will afford potable liquid which can be used. This liquid is not water and, generally speaking, will not satisfy the thirst.

The coconut is the most familiar plant containing available quantities of potable liquid. Coconuts presented problems as the survivors' stories brought out. The young green coconuts were opened easily with a knife or even with finger nails, they offered the most liquid, the most palatable liquid, and the liquid with the least ill effects. Older or mature coconuts, in addition to being difficult to open, had a liquid containing a higher percentage of

oils which acted as a laxative and sometimes caused nausea. Men who had been without liquid for several days found nausea and vomiting followed the drinking of fluid from a mature coconut; this effect was reported in seven survival stories. Men in a healthy condition could drink the juice of old or mature coconuts with diarrhea the only noticeable effect.

The easiest coconuts to obtain were those on the ground, fully mature coconuts which did have a noticeable effect on the user. The more usable coconuts were still in the trees and, except immediately after bombing raids, it was necessary for the survivors to climb to get them. One survivor isolated for three months in the Solomons reported that he learned to climb the trees native fashion, barefoot. A flier in the Philippines laboriously cut steps in the trunk of his favorite coconut palm. Two men reported using "ropes and bandages" as aids in climbing trees.

A single survivor noted that nuts dropped straight from the tree invariably cracked open, and the liquid was lost by the time he descended. He learned through experience the native trick of spinning the coconut when dropping it in order to avoid cracking the shell and losing the liquid.

Perhaps the most unusual use of the juice of a coconut was reported in a monitored Japanese broadcast which stated "Lt. Watanabe of the Sumatra expeditionary forces has successfully carried on experiments whereby blood transfusions may be made with the milk of the coconut palms." (7th AF Hq. Intell. Summ. 31: 31. 1944). No details of this process were given in the report and no indications of the nature of the patient used in the experiment.

Drinking of the sap or juice of trees was reported in several survival stories. Casurina, the Australian pine, is mentioned in one story as supplying a potable liquid when a large branch was cut and the sap allowed to run from the branch. The reference adds that the tree was called the "bleeding tree" by the local natives

and unfortunately it was protected by a native tabu against injury.

Sap was obtained from various palm trees by cutting the flower stalk and collecting the drink in canteens or sections of bamboo. The buri, nipa, coconut and sugar palms were mentioned in various accounts as being used in this fashion. The banana plant was also used by one survivor, he cut the soft stem and held it up to collect the sap; this liquid proved to be astringent but potable and it was used on several occasions.

A few survival tales from the Philippines report the use of sap from vines. One man repeated the word of caution contained in various survival manuals to "avoid plants with milky or colored juices and saps that have a bitter or soapy taste".

Survivors in India and Burma reported a heavy accumulation of dew on the leaves of plants, this moisture dripped from the leaves in the morning. Four men collected it in ways which varied from spreading a tarpaulin on the ground below the bush to catching the drops with the tongue, one chap even licked the liquid from the leaves. A survivor on New Georgia Island reported using dew on leaves periodically; and one man in the swamps of New Guinea resorted to dew as the safest drinking liquid.

A party of three men in the Philippines depended on juicy wild citrus fruits for their source of potable liquid during a dry period.

Some Pacific war zone reports mention the occasional dependence of survivors on liquid from fleshy plants growing along the coast and in valleys. The juicy thick leaves were chewed for liquid nourishment; one man carefully pressed the leaves between his two canteens to extract the sap.

In New Guinea, and more frequently in Burma, survivors depended on bamboo for drinking liquid. Pertinent stories report two sources of drinking liquid from the bamboo: young, green, vigorously growing stalks had a considerable quantity of

liquid in each hollow internode, it could be located by shaking the stalk of the plant and listening for splashing; old, dry and cracked bamboo, which was usually yellow or orange in color, also had liquid in some of the internodal regions, this liquid apparently was rain water which, when running down the stem, seeped through the cracks and into the hollow center. Both of these supplies of liquid were considered pure and safe without treatment.

(3) *Animal sources.*

A suggestion was made during the war years that survivors could squeeze the meat of fish to obtain a potable liquid; it was widely publicized and was incorporated into some survival manuals. The process is theoretically true, since any flesh contains a large quantity of liquid, but the difficulty comes in applying adequate pressure to remove this liquid. The suggestion was refuted and is no longer made. It is not surprising, therefore, to find two reports of failure to squeeze liquid from a fish in the survival stories under consideration. One flier in a life raft tried squeezing small pieces of fish in a twisted section of parachute cloth; he was unsuccessful in obtaining liquid. The second survivor also tried to squeeze the fish meat without success, he resorted to rolling and pressing the fish between two canteens, still without success. However, he did use the pieces of fish meat to relieve his thirst and to moisten his mouth; this was accomplished by chewing the pieces slightly and rolling them around his mouth with his tongue and then spitting them out. He reported it aided considerably in reducing the amount of "cotton" in his mouth.

This last survivor tried other animals as a source of liquid. He reported drinking the juices found in the body cavities of a small shark and several larger fish. Similar body fluids were mentioned in four other survival reports. Birds were obtained for food by many survivors in life rafts, either by catching them as they landed on heads, feet or on the life raft, or by

shooting them. One man even caught a "loony" bird by dropping a noose of parachute cord around its neck as it rested in the water. A few fliers mentioned drinking the blood of these birds. A courageous blood-drinking survivor even tried to keep some of the blood in a canteen. He discovered that the blood clotted after a period and was not usable. His experimentation led to mixing the blood with salt water to prevent the clotting, although this delayed agglutination it still was not entirely successful.

Survivors along the beaches, particularly in the Netherland Indies area, utilized crabs and lobsters as a source of drinking liquid. One survivor reported he had nothing to drink for several days other than the liquid he sucked from the bodies of beach crabs. Large lobsters were caught for food on the beaches of Sumatra and Borneo; after the shells were split several men reported drinking the body liquids.

In general, survivors were usually satisfied with water or coconut juice, those who experimented further were in areas of extreme dryness or in situations of dire need. When alone the survivors drank the water or juices in unadulterated form. However, when the survivor was with a native or a party of natives the liquid was usually altered by fermentation or by flavoring. The natives throughout the Pacific area preferred to ferment the juice of palms, the liquid collected when the flowering stalk of the tree was cut. This liquid has a small percentage of sugar in it, under proper conditions, it will ferment readily to produce a mildly alcoholic beverage. The natives of New Guinea and the Philippines usually carried a tuba tube with them. Tuba is the name of the fermented coconut drink, and the tube is usually a section of bamboo in which tuba has been made before. Since this tube is never washed it is contaminated with yeasts or bacteria which act on the fresh coconut sap and cause fermentation. Tuba usually has up to 4% alcohol and serves as an intoxicating beverage when taken in quantity.

A few survivors on their own tried to make this jungle applejack, but without the proper yeast it is difficult. One flier in the Philippines landed in the brush with his canteen partly filled with an alcoholic beverage which he admits he used to spice the flavor of the coconut juice he drank.

In China practically all water was boiled first in preparation for making tea. The boiled water was therefore purified and the tea-drinking custom served a purpose. Survivor reports from the China area state that tea, wild or cultivated, was available in most areas and where it was not grown nearly any native could be depended upon for a supply.

Although the coffee habit prevailed in New Guinea and in the Philippines, coffee was less widely used and apparently it was difficult to get in the jungle during the war years. The natives frequently had coffee beans and in two cases gave the survivors a handful to take with them for brewing the morning cup. In the Philippines, where the morning coffee habit was strongest, the coffee supply diminished quickly and coffee was at a premium during the war years. Six survivors were served coffee made from burnt corn. One man collected corn along the trail, burnt it in a fire, pulverized it between rocks, and brewed his own coffee.

Ginger tea served as a beverage for groups of native-led survivors in Borneo, Sumatra and the Solomon Islands. The ginger plant grew wild in wet ravines in the hills and the root, when crushed and boiled, made a warming drink.

Three stories from the Philippines mentioned sassafras tea. The sassafras of these areas is a species of Smilax, known in the United States as cat brier--the base of sarsaparilla.

c. Improvised containers for liquids. Several survivors found it desirable to improvise canteens in order to carry supplies of drinking liquid with them. Oxygen cylinders, old ration cans, condoms, and Mae West life vests were put to this use. Sections of bamboo and empty coconuts

were materials the natives used as improvised canteens. One survivor reported using the native method of stripping a coconut except for a few top fibers of the husk, piercing those with thongs, and stringing together several coconuts to be carried until needed for the liquid they contained.

5. FOODS

Most men had something to say about the kinds of food they ate during their survival episodes. These stories ranged from the sublime to the ridiculous as to types and quantities of food, and methods of preparing it.

Among the aspects of this problem are the use of rations, meals supplied by the natives, foods given by the natives for preparation by the survivors, and materials foraged by the survivors themselves.

a. The philosophy of eating. Attitudes towards procuring and eating native materials were diversified and of considerable interest. The majority of survivors preferred to eat rations and foods obtained from the natives, but the willingness of most men to try natural emergency food materials was encouraging and spoke well for the training program carried on by the Armed Forces. The abilities of solitary men to secure what they needed varied considerably. In several instances a single able and ingenious man served as procurer and cook for the party. Men alone were apt to be more adventurous than men in a group; apparently adverse group opinion on eating strange foods could be discouraging to those who might try foods unfamiliar to them. Usually one of a party would declare he would rather eat a strange item than starve to death and this would serve as an impetus for the rest of the group. A solitary individual when hungry had only his own prejudices to overcome and often would try strange foods.

The majority of men rationed the material they had. A few men ate all of their supply immediately and then went without food. One fellow stated he ate everything at once to avoid the bother of carrying it.

Foods consisted primarily of items with which the men were familiar; when these were not available other things were tried. One food stuff might make up the meal or menu as long as it lasted. Many men ate only coconuts, bananas, papayas or mangoes. Others had a strict meat diet, such as fish, lobsters, monkeys or eggs. Several survivors were able to maintain balanced and varied meals throughout their periods of isolation.

Meals were eaten regularly whenever possible. Most men maintained a schedule of two meals a day, a large cooked meal in the morning and a second at night. A few men went as long as possible before trying the local foods. One chap stated that the pangs of hunger disappeared completely on the sixth day but on the fourteenth day returned overpoweringly; he found some fruits which he ate, and he continued to eat during the remainder of his twenty day period of survival. Several of these men who abstained from eating were medical or hospital cases by the time they were rescued or reached a base.

Contrasting stories from two chaps in Burma reported on the food problem as follows: The first found a complete absence of anything familiar to eat with the result that he ate nothing. The other reported edible foods in surplus and never any problem of finding food.

Hunger commonly forced the survivors to try many things--one man ate a rabbit complete to the entrails, an unthinkable action except in such an emergency.

b. The use of rations. The men who landed and survived in life rafts relied more on rations than those who landed on the ground. This is in part due to the fact that life rafts, from the one-man parachute seat to the larger types, all had rations in them. The tales of various survivors emphasized their likes and dislikes. Charms, fruit bars, chocolate, and PK chewing gum all ranked high in popularity. Crackers and canned cheese were disliked, probably because of the difficulty of eating these with limited quantities of water.

Vitamin pills served as morale builders, according to thirteen men. Of those reporting the use of vitamins, three men carried a supply with them for such an eventuality while the others had vitamins in some of the rations.

On land only a few men had rations with them; charms and bouillon ranked highest in the likes of the individuals. Several men had only the highest praise for the bouillon powder and particularly the OXO cubes; these not only furnished an adequate drink which could be consumed cold or hot but also mixed well with native foods and served as flavoring in some of the plant stews concocted by different individuals.

D-Rations, the chocolate type of ration, were used by a great many men. K-rations and C-rations were mentioned less frequently. Such rations were brought with the men or located once they were on the ground.

Stories referring to areas ranging from the seacoasts of New Britain to the hills of New Guinea and Burma tell of G. I. rations being found in the wild. One survivor followed the trail of a previous reconnaissance or survivor party and ate the ration remnants left in the discarded cans. Several men and parties surviving along the coast lines of the Netherlands Indies had no trouble finding American, British or Japanese rations washed up along the coast. On Guadalcanal a few men made a practice of visiting old dugouts or huts used by the Japanese troops to locate abandoned rations. One flier ate quite well on cans of fish which he salvaged from wrecked Japanese aircraft; he commented that these seemed to be the emergency rations of Japanese fliers and that he had no trouble in locating enough for his needs. Several tales of survivors in Burma mentioned stumbling on rations in the jungle; one man speculated that these had been jettisoned from an aircraft in trouble when it was necessary to lighten the load; another had located supplies dropped on streamers or on parachute, presumably to an earlier ground party in distress.

In the later stages of the war caches were established along certain rivers and trails in Burma. Food products were sealed in five gallon metal cans and placed at strategic points to speed the work of ground rescue parties. These were not intended for the use of survivors, but one flier stumbled on a cache and used it until he contacted Allied troops.

c. Meals supplied the survivors by the natives. The men who landed in China were offered the best of native fare, although the menu varied with the time of year and the nature of the rations of the people. The most elaborate meal, listed in detail below, was served to a group of survivors from a B-29.

Menu For A Survivor in China
Courses in order of serving

Sweet and sour pork
Yellow fish and cabbage soup
Chicken, rice and noodle soup
Stew of bamboo shoots
Golden corn pork
Fried rice noodles
Steamed yellow and blue fish
Fried shrimp
Baked and boiled lobster
Raw oysters
Fried oysters
Fried yellow fish
Scrambled eggs with oysters
Fish dumplings
Fried duck eggs
Fried chicken with rice flour
Rice flour sauce with duck giblets and water cress
Spaghetti
Mungum rice flour noodles
Rice and scrambled eggs mixed together

Desserts included:

Plum pudding
Dragon ice dessert
Prune pudding
Egg precious rice pudding
Tangerine and banana salad
Tea

During the first stages of the war survivors in the Philippines were treated and fed quite royally, but as the war progressed and native rations became poorer, the nature of the treatment and the quality of the meals naturally diminished. In

India, Burma and the Netherlands Indies the rations served the survivors were rarely better than those the natives had themselves. A few tales of elaborate meals were found which required outright stinting on the part of the native hosts. One survivor enjoyed a huge dinner in a native hut in New Guinea before realizing his hosts were not eating; this was explained to him as a courtesy to let the guest eat first. The flier later learned to his chagrin that the native family had dined on the small bits remaining on his plate; they had served him every bite of food available at that time.

Other native meals served survivors are included in the next few paragraphs. A flier in Borneo was given sago palm starch mixed with small white-bait-fish dredged from the river; the mixture was baked; it was the only item on the menu. A meal in New Guinea consisted of a stew of plants with white lizard meat, and monkey meat (which turned green on cooking, according to the flier). A pilot off the coast of New Guinea was picked up by a native party traveling on a raft of coconut logs; their meals for several days consisted of hot water and cold cooked sago starch. A group of Mohammedans in Borneo located a pilot in the brush and kept him as their guest for several days before he was able to contact rescuers: breakfast during this period consisted of rice and coconut mixed; the other meal, served during the afternoon, was boiled dog meat, rice and coconut juice.

A flier picked up by a native sampan off the coast of China indicated by sign language that he was hungry. The native boatman used a dip net to catch water beetles which were fried on board the boat and given him as a daily ration.

A man downed in New Britain, after wandering along the coast for a day, was located by a native. He indicated he was hungry and the native promptly climbed a tree and searched until he found a bird's nest. On the ground the native dug a wild root resembling a "sweet potato". The bird's eggs and the sweet potatoes were

fried in coconut oil in a clam shell picked up on the beach.

One survivor tired of a diet fed him by some Chinese: this diet consisted of steak, french fried white potatoes, cake and coffee three times a day. One man complained of a monotonous diet in the Philippines: it included rice, pork, coffee and bananas,--in this diet "cream" for the coffee was the beaten white of eggs. Another in the Philippines received between-meals snacks of cold caribao milk and rum mixed; this he reported to be an excellent drink. Apparently the natives could satisfy some appetites.

Finally, a group of survivors of a C-47 crash in the Himalayas were located by the natives and offered a great variety of foods. The group was cautious of strange items and accepted only the hardboiled eggs. After a few days of watching the natives enjoy the varied repast they prepared, the fliers finally consented to try other items. By the end of the trip they ate everything, including "fried bees which were good".

Perhaps the ultimate in care was the story of the very sick man in Northern Borneo who was cared for by a specially designated native woman who fed him on partially chewed and regurgitated rice.

Native care did not end with the hospitality offered during the survivors' stay; when it was necessary to travel on, most of the natives offered food and supplies for the trip. Some of these offerings were incongruous, although they represented the best hospitality of the group. A grounded crew setting off for a cross mountain trip in western China during the winter received some help from the natives: it consisted of a handful of rice flour and a larger quantity of powdered dried cabbage stalk. Another Chinese village turned out en masse to wish bon voyage to its group of survivors: each native brought at least one hard-boiled egg for the journey and others were supplied en route. The men estimated they were given over 1000 hard-boiled eggs before that trip was over.

In China and in the Philippines the

natives often supplied popped popcorn as traveling rations. One Chinese village offered a "large mosquito bar" filled with popcorn for a trip across the mountains.

Travel rations usually consisted of dried flour cakes, jerked, salted or cold cooked meat, baked yams, sweet potatoes, etc.

d. *Native foods supplied to survivors.* Survival stories consistently mentioned that the natives offered various items of food from their gardens during the proper season of the year. Many of these were familiar garden produce; others were less familiar tropical vegetables or fruits. A number of men reported using these same materials upon finding them growing wild or in abandoned gardens. The following vegetables and fruits were grown by the natives and offered to various survivors:

bananas	peppers
bread fruit	pineapple
beans	potatoes
carrots	radishes, red and white
cassava	rice, red and white
coconuts	sago
corn, ground	squash
corn, prepared like	sugar cane
hominy	sweet potatoes
cucumbers	taro
Elysian cabbage	tomatoes
limes	tops, sweet potato and
manis (a turnip)	other garden vege-
papaya	tables
peanuts	watermelon
peas	wild celery

In addition, the following meat products were offered:

beef
caribao
duck eggs, complete with embryos
goat
"pemican", native Philippine variety
palolo worms
pork

e. *The problems of foraging.* (1) Where to look for food:

In many areas the choice of probable locations of food material was limited. Other regions afforded the survivors a variety of locations for foraging. One chap reported his difficulties along the sea coast in the Solomon area as follows: There was an abundance of food along the shore but he decided it would be safer to

travel inland; en route along streams he found some materials, but when there were no water courses he could find nothing edible on the forested hillsides. In the face of this problem he returned to the sea coast and traveled parallel to the beach; his food then consisted primarily of lobsters, which were plentiful and easy to catch and prepare.

Men inland discovered that food items were more abundant and easier to secure along streams than on ridges or hillsides. Streams offered water supplies both for the survivor and the native game, and most men who hunted were most successful near streams or obvious water holes.

Animal foods were reported by several survivors as plentiful; if game was hunted late at night or very early in the morning --usually before sunrise.

(2) Plant materials used for emergency rations:

Many of the common garden vegetables grow wild and often native in various areas of the Pacific tropics. The men who recognized them based a meal or many meals on such products. Several survivors made a practice of raiding Japanese gardens. These were reported easy to recognize because of the associated signs bearing Japanese symbols or because, in New Guinea at least, the Japanese always left one tree standing in the middle of a garden patch to prevent accurate low level strafing by American or allied planes. In the Philippines several survivors located the gardens of collaborationists; two men made a definite practice of raiding these gardens for food and then destroyed as much as possible when they left the area.

Other men not so fortunate in finding familiar garden produce were forced to depend on the native plants often unfamiliar to them.

The coconut was commonly mentioned in the lists of survival foods. Apparently every man in the Air Force knew coconuts were edible, and a great many tried to find them or to climb the trees for them. The coconut can be eaten from the first stages of development. Very young coconuts

contain only liquid, as they ripen a gelatinous layer of material is deposited on the shell and this later becomes firm and white in color to form the familiar meat of the coconut. When the seed is fully mature and falls to the ground the embryo develops a spongy cotton-like mass of absorbent material which fills the center of the coconut. From this the young coconut seedling derives the nourishment it needs for growth. The coconut is edible in all of these stages. The gelatinous material, called kulau in New Guinea, is a delicacy and easily digested. Kulau is fed to weaning babies and to the sick or very old. The mature coconut is eaten plain, or more often it is grated to aid digestion. The cottony material is eaten raw and has a sweet flavor; it may be sliced and toasted or fried. The tender bud of the young plant can be eaten raw and is often called "coconut celery" or "coconut chestnuts"; it may also be cooked as a cabbage-like vegetable.

An interesting description of coconut meat was obtained from a translation of a Japanese diary in which this novice to the tropics and the coconut dutifully reported, "My first coconut was sweet and a bit pungent. Though they say it is exactly like the experience of first love, I have not had such an experience."

Coconuts formed the most satisfactory food for many survivors, according to their reports. They knew it was edible, and in the beginning stages of their jungle stay they still regarded eating coconut as somewhat of a luxury. Others depended on coconuts as the main item of diet or the only one. A navy pilot landed on an island which possessed a few palms in which there were 32 coconuts; this pilot learned to climb the trees, he picked the coconuts, ate the meat and drank the milk. Although he reported seeing birds, crabs and fish, he lived on the 32 coconuts until his rescue.

Coconut meat was grated by one flier and mixed with everything else he had to eat. When mixed with rice it formed a "filling

meal". With meat it was an "excellent repast, why doesn't someone introduce this to the U. S." He even mixed grated coconut with his D-ration and produced a candy bar as good as "Mounds".

Opening the coconut proved to be a difficult task for some men. One chap reported spending long hours lifting individual fibers from the coconut husk with a finger nail file for want of a better instrument. Others opened the nuts with knives, machetes, or by pounding them on rocks. One survivor depended on dropping the nuts from a cliff near his hideout onto the coral rocks below. Only one man reported proudly that he became proficient in opening coconuts on a stick.

The coconut was involved in the most comically pathetic story of the 1000 survival cases. A Navy plane was shot into the sea off the Netherland Indies area but made a successful ditching. The crew of three got free into the water but a strafing run by a Japanese plane killed two of them. The sole survivor, not a very efficient swimmer, stripped off his trousers and shoes and headed for a nearby island as fast as he could paddle. He made land and crawled under a bush and slept through the afternoon and night. The next day he awoke to find himself tired and hungry, but on walking down the beach discovered a tree and coconuts on the ground. His pants containing his jackknife had been lost in the water and his only implement with which to open a coconut was an automatic pencil carried in his shirt pocket. He used that pencil to carefully lift fibers from the coconut husk, several hours later he proudly surveyed the coconut seed in his hand. Opening the seed was only a momentary problem, he dropped it on a rock and watched the liquid pour to the ground. The white meat in each of the coconut halves looked mighty good until he realized with sinking heart that he had lost his false teeth in the water. You don't "gum" a coconut. The story has a happy ending, however, for the toothless would-be coconut-eater grated the nut on a sharp piece

of coral and was able to munch the shredded meat.

Bananas figured in about 40 of the survival reports studied. The majority of men recognized the difference between the cooking banana or plantain and the sweet banana. Both types were found in the wild. Where bananas were abundant other vegetable products were also available, bananas alone seldom made up the diet. Banana flowers were collected and cooked by one individual who reported he had previously seen the natives eating such food; he reported the meal to be "passable".

A survivor in Burma who was traveling along a river on his way to rescue, mentioned finding a fresh grave on which the natives had placed a complete hand of ripe bananas. Although he had been without food for several days he decided against taking these particular fruits; he was afraid of breaking a native taboo or of incurring native displeasure for robbing a grave. He also expected to contact that native party within a very short time. Actually it was almost a week before he was rescued and he went hungry during that time.

Bananas were most abundant in New Guinea and the Philippines. Mentioned earlier in this report is the story of one man who cut a banana and collected the sap which dripped from it; this was used as a drinking liquid, the survivor reported it to be astringent but palatable. Another flier cut the banana stem to reach the tender leaves in the shoot; these leaves he ate raw as a salad, he also cooked them as greens.

Reports of food products used as greens or cooked vegetables came from a dozen different survivors from all areas of the Pacific tropics. The notations vary from a "stew of leaves and tips of stems" to actual enumeration of such plants as purslane, pigweed, and talinum, used by men who knew these plants. Pigweed was mentioned in sea coast survival in New Guinea and from the mountainous areas of the Philippines. Apparently *Sesuvium* and

Amaranthus or *Chenopodium* are the genera intended in these reports.

A flier in New Guinea reported he ate flower buds raw but did not enjoy them. He finally baked them to improve the taste, found them to be excellent, and so continued this practice during his survival period.

Fleshy plants growing along the coasts were used raw or cooked, usually boiled, according to anecdotes from the Netherland Indies.

Bamboo shoots were used as food by nine different men. In one of these accounts the shoots were eaten raw, in all others they were cooked—either boiled or roasted. Two survivors in the hills of Burma reported the use of bamboo shoots in a stew of monkey meat. One man was forced to eat the bamboo raw since he had no way of making fire; the shoots were described as unpalatable but gave the men strength.

A flier in New Guinea mentioned a daily fare of leaf tips, ferns, bulbs, roots and berries; he gave no indication whether they were eaten raw or cooked. Another survivor reported living on fern leaves while isolated in the Solomon Islands.

Sweet potato leaves were used by a man in the Philippines and reported to be quite good; he indicated a later increase in fare by mentioning sweet potato leaves cooked with rice.

Wild celery is noted in two survival accounts from the Philippines.

One of the excellent emergency foods of the tropics is the heart of the palm cabbage. In the Philippines, Borneo, Java and New Guinea palm cabbage was used as food by six different parties of survivors. One man in Java reported the use of the Talipot or *Corypha* palm as a source of palm cabbage. Pandanus shoots were used as a vegetable in five cases.

Young coconut palm seedlings were a source of food mentioned in two survival stories. A third man on New Britain Island reported finding several coconuts but all had germinated so he threw them away; he later found his survival manual and read

that the young seedling was good to eat; he actually retraced his steps to find the sprouted coconuts he had previously discarded.

Grass figured in the menus of fourteen men. Several reported eating the leaves of grass. Two stated that they separated the stalks of grass and ate the tender soft shoots which they described as palatable and good. One chap in New Guinea ate grass but decided that he was not hungry enough to continue that diet. Three survivors in rice paddy country in China reported using the soft bases of the rice plants; one man made a stew of this material. A single survivor in the Philippines found the purple plumed wild sugar cane, he ate the stalks and the fruits. A survivor in Burma reported he ate berries and grass, which tasted good.

About twenty-five men found wild sugar cane in the island areas and chewed this for nourishment during their periods of isolation. Sugar cane figured prominently in the tales of survival in Burma; apparently the cane is found commonly along rivers in the central and northern portions of that country.

The occurrence of fruit in the tropics is as seasonal as its occurrence in the temperate regions of North America. One flier reported spending the first three days looking for fruits he could eat but could not find a single one. Other men noted that the fruits were all "too young and green". One chap tried green fruits but was afraid the consequences would be those of eating green apples.

Many of the plants mentioned in the survival stories cannot be identified from the descriptions given. "Red berries" were noted several times in stories from Burma. Three different survivors in New Guinea reported they ate "purple fruits", and found them good. One cryptic account from the Philippines tells of eating a fruit called "lechon"; unfortunately lechon is a widely used term for a suckling pig in that area.

Other fruits were described in such a

way that they can be identified. Wild plums were mentioned in four stories from Burma. Figs were described in three accounts from Burma, in seven from New Guinea, and in three from the Philippines. The figs were described as growing from the trunks of the trees, and one story tells of a red colored ground berry, resembling a fig in construction and very sweet and satisfying but seldom plentiful; this is apparently a fig--one of the cauliflorous group where the fruits are produced from the trunk or the roots of the tree; the fruits of some of these figs may appear out of the ground some distance from the trunk of the tree. Figs were described in another account as green, resembling an unopened flower bud growing from the trunk of a rough, mossy, damp tree with a large broad leaf.

A survivor in Burma reported finding a watermelon and an ear of corn. He promptly rationed this food, limiting himself to a 1" cube of melon and 12 grains of corn per day until the food was gone. A survivor in the Netherlands Indies found a Pandanus bush (the screw pine) along the coast; he tried to reach the fruits but they were too high, so he ate only the root tips of this plant while awaiting rescue.

Six survivors in the Philippines report eating "star apples", and two accounts from Burma described this "star apple" as a yellow ridged fruit, star-shaped in section, which would indicate that the fruit is that of the Averrhoa tree and commonly called "carambola". One of the Burma accounts noted that this fruit grew at an altitude of 10,000 feet, which is very unusual if the fruit is truly the carambola.

A survivor in a life raft landed on New Guinea and spent the night on the beach. In the morning he loaded his life raft with watermelons, limes and wild papayas and put to sea again, paddling to the next island.

One story from Burma described a fruit with a yellow-green skin which looked like a peach and had three nuts at the core

similar to butternuts; it tasted good but he could not keep it in his stomach. This fruit apparently is one of the numerous *Garcinias* growing in that area.

Citrus fruits figure in nearly twenty survival stories. Limes, oranges and grapefruit are mentioned in that order of frequency. One survivor in Burma found a large grapefruit-sized fruit that split naturally into six parts like a cantaloupe. In the center was a pulp resembling an orange, which he ate. The taste of this pulp was sweetish at first, then extremely sour and puckerish like alum. This probably was the pomelo or shaddock, the wild grapefruit and possibly one of the ancestors of the cultivated variety.

One flier reported eating wild limes with very thick skins and no juice. He later learned that the natives peel off the green exterior and eat the pulpy portion of the rind. This is a wild lime, eaten like a kumquat.

Apparently it took considerable courage on the part of survivors to try these strange fruits. From Burma comes the story of a party of men alone and hungry in the jungle; finally, one man decided to try the berries he saw rather than starve to death; when he didn't have complications from the strange fruits by the third day, the rest of the party followed his example.

Chicos or saposillas were mentioned by one survivor in the Philippines as being his principal item of food during the period of isolation.

Breadfruit (*kopiac*) was used by two men in the Philippines and by one in the New Guinea area. In each of these cases the fruit was roasted over or in the fire and was found to be delicious. One of these men had *kopiac* and bananas for breakfast every day.

Stories from China reported an abundance of persimmons, which several survivors used for food. One chap stated they were "O. K. after you learned which ones to eat"; he apparently learned the hard way that unripe persimmons are extremely astringent. Another group in China de-

scribed wild berries tasting like grapes and growing on a vine--apparently these were grapes.

A survivor in Borneo reported he "passed up the berries and ate only the things he knew". He concludes there was "no end of supply of native food materials".

A survivor in Burma stated that his safety rule of thumb in eating berries was that the sweet ones were good, the sour ones bad.

Mangoes and papayas were mentioned frequently in survival stories. Apparently these were fruits most fliers knew or were taught to recognize so they figured prominently in diets. Mangoes were eaten in fresh, ripe condition only. Papayas were cooked green by one man but all others ate them as a raw fruit.

Pineapples were reported in seven different survival stories from widely separated areas.

A single report of eating the seeds of wild purple plumed sugar cane has been mentioned. Five men ate the seeds of wild grasses. Corn could be found in abandoned native yards in Burma, India and the Philippines. One man reported he had "roasting ears". Several found dried corn and one man parched this before preparing a pudding; another had a meal of boiled parched corn and rice.

Popcorn figured in three stories in addition to those referred to above, but there was no indication of where the men obtained this material.

Rice was mentioned in nearly 100 survival stories. A very few of the men collected it themselves; none tell whether it was wild or cultivated. Red rice was tried by several men in the Philippines, but one chap reported he could never make it taste like that served by the natives.

Peanuts were mentioned in eleven stories from the China-India area. One man found the peanuts to be unpalatable raw, he ended up by boiling the seeds before eating them as beans. Peanuts are roasted in most areas and probably treated in that fashion by the natives.

Mungo beans (*Phaseolus radiatus*) were listed in a great many accounts of survival in the Philippines; most of the stories of prisoners of war in that area report mungo beans as a staple item of food.

Several men germinated seeds before eating them to increase the bulk of their food. Mungo beans and rice were the seeds most commonly germinated. This procedure apparently was a usual practice in prisoner of war camps.

Only two men, both in Burma, reported finding nuts they could eat.

"Kang kong", *Ipomoea aquatica*, was a common food of men surviving on the island of Luzon in the Philippines.

Sweet potatoes and yams were used in many areas of the Pacific as survival food. A flier isolated on New Britain had french fried sweet potatoes for his diet for several days. Several men in Burma and others in India reported finding and digging wild sweet potato roots which they boiled or baked.

Taro was used by eight men and cassava by one. A survivor told of others in his party eating a reportedly poisonous root plant which he would not touch. They did not suffer with any ill effects but he still would not try it. This plant may have been a cassava; it is known to have two forms--sweet and bitter. The latter type is poisonous unless properly prepared by many washings.

The white radish is grown in many areas of the Pacific and used as a cooked vegetable. Two men in the Philippines used large white radishes as food: one survivor boiled the root and thought it tasted like a pithy potato; the other commented simply that the root was fried.

Mamis was used by six survivors in New Guinea. The mamis is a vegetable which grows and looks like a turnip.

An unidentified vegetable was reported in a story from the North Borneo area; it was described as looking like a pumpkin and tasting like a carrot.

The swamps of New Guinea afforded one survivor a meal of *Sagittaria*. It is

difficult to tell if this plant was correctly identified; in some areas of the tropics this is regarded as a food of extreme emergency use.

(3) Animals and animal products used for emergency food:

The food problems of life raft survival were peculiar to the situation. Most men in the life rafts depended on fish, sharks and birds for their diet. Only a very few men reported any difficulty in securing fish.

The fish caught by survivors in life rafts were eaten raw. One man reported he cut his fish very thin and spread it out on the edge of his vessel to cook in the sun; his report does not give any details of the result. Raw fish was reported as tasty and flavorful to insipid and inedible. The size and variety of fish used, as well as the tastes of the individual, apparently influenced these conclusions. Men caught fish by hand, by hook and line, by using a noose of parachute cord, in a section of parachute used as a dip net, in a hat, in the sea anchor of a life raft and in a "canteen". Fish caught by hand were usually scooped into the raft with a broad sweeping motion. Two men stated that they became proficient at dipping their hands in the water and suddenly grabbing the fish they saw.

One flier reported he was able to catch minnows in his mosquito net which he rigged on a long cord and held open with sticks. This he passed under the life raft to get the minnows seeking protection in the shadow.

Another survivor mentioned a noticeable lack of success in fishing with baited hook and line. He finally resorted to using his sheath knife to spear the fish. He discussed at considerable length the pros and cons of stabbing downward versus lowering the hand in the water and raising the knife upward; there was more danger of stabbing the raft on the upward stroke but more danger of misjudging distance and of falling overboard on the downward stroke.

The meat of the fish served as food, and

it was chewed for the moisture it contained. One man said that he sucked the backbone of the fish for the marrow, a procedure a little difficult to understand unless he had a very large fish. Another reported disappointment in not finding marrow in the bones of the fish he caught.

Fish were also obtained from the stomachs and gullets of various birds. Small minnows from the stomachs of larger fish were also used as food. These smaller fish were usually partially digested and so easier for the survivor to eat. Men who could not keep down the meat of fresh fish found they could retain these predigested morsels.

Two pilots in life rafts reported catching small fish by picking up quantities of seaweed. Certain types of small fish live in or depend on floating masses of seaweed for protection; by snatching these masses the men in rafts were able to secure the small fry. One chap reported "he didn't think he would ever have to resort to eating goldfish and hoped he could control himself if he were ever rescued."

Fifteen stories of men in life rafts mentioned various types of fish jumping into their vessels. Most of these fish were being chased by something larger and jumped many times before reaching the raft. One man tells of paddling in the direction of these jumping fish with the hopes that a few might land aboard; his hope was realized. Flying fish landed on rafts in three stories, but two accounts stated that the flying fish were scarcely worth eating. One chap reported that "one bite of that raw fish was plenty". Another survivor off the coast of the Marianas commented that he cleaned and ate two flying fish immediately, finding them tasty and refreshing.

Sharks were eaten by a dozen men in survival stories. In one account, a plane had made an emergency landing in the water and the raft was inflated in the dark. The pilot reporting the episode was an excellent swimmer and aided his fellows into the raft before trying to get in himself. The

last chap he tried to boost into the raft proved to be a large shark; the attempt was abandoned and he crawled in himself.

Small sharks took a hook and line very readily. A few men tried to eat shark but found the meat unpalatable. A few other men dissected the shark and ate the smaller fish from its stomach. One man ate the liver of the shark. A crew from a B-29 off the Marianas saw numerous small sharks. One boat shot sharks and mackerel but both species sank before they could reach them. One group of survivors reported the shark the worst thing they had ever tried to eat. This party later caught sea gulls and ate them, meat, bones and all.

Louis Zamperini, the famous distance runner, spent 47 days in an open life raft before being rescued by Japanese troops and placed in a prison camp. During his period of life raft survival his food included small fish, the liver of a 2 1/2 foot shark, and small birds and albatross.

Birds figured in the menus and survival experiences of fourteen men. Birds were usually grabbed when they landed on the raft for a rest. The Rickenbacker story has been widely reprinted and tells of Capt. Rickenbacker catching an albatross which landed on his head.

One flier caught a number of sooty terns and albatross; the excess meat, beyond his immediate needs, he cut into thin strips and dried in the sun, sprinkling it with salt water occasionally. An albatross landed on the foot of another flier; he succeeded in catching it by putting the other foot on top of the bird and holding it fast until he could reach it.

A single story tells of a flier in a life raft "pouncing on a loony bird" which landed on the water beside his raft.

There are a few accounts of shooting birds as they flew nearby; one shot a bird as it landed on the water and began diving for fish near him. One chap who shot a bird reported little left but the feathers. One survivor in a life raft found it exceptionally easy to shoot birds. Since he was short on clothing and protection

from the sun, he shot nine sea birds and skinned them, using the pelts for ear muffs, a hat, and ankle and foot protection.

Some birds apparently tasted better than others and the flesh was reported as "good" to "very fishy" in flavor.

Many men who caught birds drank the blood first and then used the flesh, particularly the liver. One flier in a life raft caught a red-footed booby and sliced its neck to drink the blood; he reported the blood was warm and pleasant to taste but he could not keep it down. Two survivors stated they ate everything but the feathers. One man saved the skin and dried it in the sun; when it was completely dry he ate it and described it as similar to over-cooked chicken skin.

The entrails of both birds and fish were commonly saved and used as bait. Most men who tried this reported success in catching fish. One chap reported he fished for two days but nothing would bite on the pork rind type of bait in his kit.

One pilot remarked that so many albatross landed on his raft he had to keep chasing them away. He never had difficulty in catching them or securing enough food, "if you don't mind albatross". He further stated he caught a bird and as he was about to kill it realized he had enough meat to last for some time. He stroked and petted the bird before releasing it and the bird stayed with him as a pet for seven days. The bird afforded him considerable comfort and companionship, according to his report.

Two men on rafts saw coconuts while out at sea. One chap succeeded in opening his coconut while in the life raft but the meat was spoiled. The other chap was unable to open the nut, so he contented himself with eating the meaty portions of the attached barnacles.

One man reported his life raft bumped into something in the middle of the night. He cautiously touched it and found it to be a floating tree so he tied fast to it to prevent further drift. By morning light the tree proved to be a cluster of coconut

palms, but they were without any fruits. The flier did not consider the possibility of removing the leaves and obtaining the cabbage from this lucky find, thus he overlooked some additional food material.

A single story reported a flier eating seaweed in small quantities during his survival period in a life raft.

Fliers who landed their life rafts on small islands, or men who reached the coastal areas of larger islands, usually found abundant food. At least the food was present. Whether or not it was used depended on the ingenuity and desires or abilities of the individuals concerned. The story of the navy pilot entitled "thirty-two coconuts" has already been mentioned. This flier lived on the thirty-two coconuts from the few palm trees on the island, but he gave no indication of catching or using for food the various fish, crabs and birds he saw.

Food materials were usually easy to obtain along the sea coast. Such items as lobsters, fish, sharks, oysters, crabs and shrimp were mentioned in a great many stories.

Some men caught fish on hooks and lines, others trapped them in nets which they improvised from parachute cloth or from their clothing. One man used a coconut frond to sweep the water of small coastal pools to brush the fish up on land; he obtained an adequate supply in this fashion. Another man built a dam of rocks along the coast and searched the artificial pool at each change of tide, securing fish and crabs in this fashion.

A few men used weapons or explosives to get fish. Several said they shot at fish, but only one reported hitting or stunning fish in this manner. A single case was listed where the flier placed the muzzle of his revolver below the surface of the water, he fired it and stunned a few small fish. Two men used hand grenades to catch fish in Pacific lagoons. Two others set off blasts of dynamite in coastal pools to catch fish; the source of this dynamite was not mentioned but there was a note to

the effect that the swim bladders of the fish were usually ruptured by the explosion and the fish sank quickly, often not rising to the surface after the blast. One man reported he was forced to dive for all the fish he killed by a dynamite blast.

One agile chap on New Georgia was able to master the technique of catching fish with his bare hands in small streams. The fish usually rested in small depressions near the banks. By carefully feeling in these holes he was able to locate the fish and then by a quick grab he was able to bring the fish out of the water. One man who landed in the mountains reported it was much easier to catch fish in coastal streams or in salt water than in the mountain streams, where the fish were much more wary.

Few men who caught fish while on land ate them raw. Most were able to build a fire and to roast, bake or boil their catch. Several commented on the excellent flavor of fish caught in coastal streams in contrast to those caught in the open ocean.

Two parties were successful in catching eels. One of these was able to spear all the eels needed on sharpened bamboo poles. The other group, on a coral island, overturned piles of rocks at low tide in their search for anything edible, and they frequently found eels. Most of the eels were said to be 4 feet long; they were prepared by skinning and cooking. The meat was "white and tasted fine".

Sharks were caught by six coastal survivors. One group shot large sharks that ventured inside a natural breakwater near their hideout on the island--the north coast of New Guinea. This group tried several different kinds of sharks and reported a great variation in the flavor. A small "sand shark" was shot in shallow water; although the group had difficulty cutting through the hide, they found the flesh was white and firm and tasted like swordfish.

A single report of shooting shore birds appeared in the series studied. The man

had poor aim and he rarely hit the birds. Those killed were eaten. The survivor ate the liver and drank the blood but found the rest tough and unpalatable. He ate it anyway.

Thirteen men reported finding oysters in profusion. Many of these oysters were attached to the aerial arching roots of the mangrove trees. Two stories specified that the beds of bivalves were attached to the bottom, and the men took only the oysters that were covered with water at low tide. The oysters were eaten raw or cooked. One man on Santa Isabel Island cooked his in bouillon and had a particularly delicious meal. Another cooked the oysters with a quantity of rice and also had a wonderful mixture.

Mussels were mentioned by four men. One found his mussels in the mud of a mangrove swamp. The others apparently came from coral reefs or mud flats. The mussels were eaten raw or cooked. One flier stated that the mussels were slimy when eaten raw, but if they were washed first in sea water the slime could be removed and the mussels were particularly tasty.

Salt water lobsters were easy to catch in coral reef pools. The lobsters were dipped up with nets made from mosquito headnets or sections of parachute cloth; more commonly they were speared. One man found a group of lobsters crawling over the coral rocks on dry land. Lobsters met with approval wherever they were used in the diet. Most of those caught were the spiny lobsters without large claws. One report from New Guinea told of "large clawed lobsters" although the report does not say whether this animal came from fresh or salt water. In this latter case the flier used the claws for food but said the "ants got to the rest of the meat before he did". Lobster meat was occasionally used in stews and mixed with rice and greens, although most men either roasted the tails or baked the entire animal.

Palolo (*Eunice viridica*) worms were listed in survival episodes occurring in the Poly-

esian group of islands. These worms swam on the surface during a reproductive period, they appeared in great numbers and were caught by the natives and relished as food. A single account mentioned that these animals cause severe diarrhea when eaten in excess.

Several groups of survivors reported using crabs for food. These were often eaten raw, and in many instances the juices were sucked from the shells. In other instances, the crabs were boiled; one fellow mentioned taking special care to make sure the crabs were alive and kicking before dropping them into boiling water.

Snails were eaten by three men, two in New Guinea and one in the Philippines. The man in the Philippines depended on snails and minnows for his meals. One chap in New Guinea wrapped the snails in leaves and baked them; the other tried eating the snails raw but found them too slimy. After washing them well in salt water to remove the slime he found them much more palatable.

Only one report from the Pacific area tells of a survivor using octopus for food. This flier, in New Guinea, grabbed a swimming octopus by the head while it was in shallow water. He ate the octopus raw and commented the animal was tough but flavorsome.

Land animal food was abundant in some areas of the Pacific theater of combat and very rare in others.

Along streams in the mountains fish, crabs, fresh water shrimp, snails and turtles were caught and eaten. The man who caught the turtle did not give any hints as to how he prepared this animal. Fresh water shrimp were caught in dip nets in mountainous areas of Borneo, New Guinea and Burma; sometimes they were caught by hand or by means of a noose. The latter method consisted of dropping a small noose over the extended eyes of a shrimp and pulling it from the water. Two men reported on cooking methods: one said he boiled the shrimp, the other boiled them and then dipped them in salt water to improve their flavor.

One of the favorite briefing lectures to ATC crews headed for overseas destinations ended with the idea that if worst comes to worst you can always eat insects and grubs. It is of interest to note that twelve men ate insects of various kinds during the course of their survival periods. One man, who was isolated for twenty-two days in Burma, "ate bugs, a locust, butterflies and grubs". The butterfly was best, according to his report, it "tasted faintly of meat". This chap reminisced he would have eaten more grubs but they were exceedingly hard to find.

Two different stories from the New Guinea area tell of eating ants. One man searched old logs and ant hills and collected only the largest ants. The other chap stated simply that he ate the ants which crawled on him.

Brief mention has already been made of the crew of a C-47 downed in the Burma hills; the men were fed by the natives of the area. At first they ate only hard boiled eggs but later, convinced by native example and by hunger, they ate fried bees and liked them.

Water beetles were collected by the crew of a sampan, as reported earlier, and were fried and fed to a rescued flier.

In India the natives prepared a meal for a group of fliers which consisted of chopped up "June bugs" in rice, with fried "June bugs" sprinkled liberally over the top.

Snakes as food were mentioned in three of the four stories of snake encounters found in the 1000 accounts studied. One flier, resting and sunning himself on the beach in the Solomons, suddenly became aware of a small python lying on some bushes nearby. The flier made a small noose out of vines which he slipped over the head of the snake and thus strangled it. The snake was then skinned, wrapped in leaves, and baked. The flier said the meat tasted like chicken.

A group of men in a New Guinea swamp also encountered a python. The snake was caught and killed by the natives, who carried it

until supper time and then cooked it. Several men in the party were unaware of the snake skirmish and were surprised to have meat for supper.

In the third story from New Guinea, two fliers saw a snake on the trail ahead of them. One killed the snake with three blows of his machete, but upon being attacked the snake coiled around the second man. He worked his way free of the coils, and the snake was later prepared for supper.

Inland birds were used for food in several instances, two related to eating parrots. In New Guinea a flier who shot parrots in a swamp reported the meat as black, stringy and tough. The other account was from the Philippines.

Another story from the Philippines tells of shooting land birds, which the flier ate raw since he had no matches with which to build a fire.

A small party of survivors in the Philippines reported success in decoying crows within firing range. The crows were called by blowing on blades of grass, and by rubbing sticks of bamboo together.

Birds eggs were the objects of search by four parties. One group reported considerable success, particularly liking the eggs of wild ducks. The eggs were eaten cooked complete with contents, provided the embryo had not yet developed feathers.

Leeches were eaten by one man isolated in Burma jungles. As he picked the leeches from his body in periodic inspections he ate them raw, as he commented--"to get his blood back". He mentioned them as quite tasty.

Few large animals were used for food by survivors in the tales studied. The large animals encountered, and mentioned in the section of this report which pertains to animal hazards, were usually left alone. These included elephants, tigers, black panthers, water buffalo and wild pigs.

One group of survivors in the Philippines used a carabao heifer for food; the animal was discovered in the very early morning and was roasted for breakfast. A goat was killed in the mountains of Burma by a

downed flier and served him for food for several days. A group in Burma reported eating the harking deer and of seeing wild turkeys and other fowl which were plentiful in the mornings; there is no statement as to whether or not these birds were killed and used for food. Squirrels were seen by two survivors in Rendova and Burma, but both men were unable to hit the animals with their .45's. Another chap in Burma saw deer and rabbits but was unable to capture and kill them. A survivor in New Guinea stalked a wild boar with food in mind, but when he approached the boar he was unable to get his .45 from the wet, shrunken holster.

Monkeys were mentioned in fifteen stories, mostly from the Philippines and Burma. All of the parties were able to kill sufficient monkeys to supply them with a continuous supply of meat. One man killed a monkey and was forced to eat it raw because of a lack of matches; he reported the flesh to be tough. Another man commented that the liver of the monkey was particularly good. Only one dissenting comment appeared on monkey meat, from one of a party who had good luck hunting monkeys; this chap thought the roasted monkey looked too human, although the rest of the party ate their fill of monkey meat and enjoyed it. Swamp rabbits, usually from mangrove swamps, figured in the food stories of eight men in the Philippine areas; as mentioned earlier one man reported he ate the rabbit completely, including the entrails.

The survival manuals contained explicit instructions on how to build snares and trap animals in an emergency. Only two men reported using such contrivances. One flier in the Philippines made an animal trap of bamboo; a flier in the Solomons rigged a snare-type trap; neither story reported the success of these snares.

(4) Preparation of foods in an emergency:

Once the raw materials for a meal were obtained, few of the men expressed any further concern over its preparation. Only one incident of deliberately releasing an

animal was encountered; a man in the Philippines had trapped an animal and then, unable to decide how to kill and prepare it, finally let it go.

Many foods were eaten raw, partly by choice and the nature of the food and partly by necessity. Fire was a problem for a large number of survivors. If matches and cigarette lighters were available, the men made fires and cooked their food. Three men in northern Burma were unable to cook for several days because of the proximity of Japanese troops. Only one man succeeded in using an emergency method of making a fire. Downed in the Solomon Islands, this man started a fire by using a burning lens. Fire by friction was mentioned once in the stories examined. One man tried unsuccessfully to use a fire plough. Neither flint and steel, nor the scratchers placed in the later types of emergency kits were mentioned.

With a fire available most foods were cooked by boiling, baking, roasting and frying in that order. Boiling was done in the emergency cooking pots found in the kits, in sections of oxygen cylinders, in pieces of aluminum from the cowlings of crashed aircraft, in old ration cans, in sections of bamboo, in halves of coconuts and in various types of shells.

One flier isolated in Rendova even supplied a sketch of the cooking set-up he used during his survival episode. This consisted of a bamboo stalk laid on end and resting on a forked stick across the fire; the upperside of one section of bamboo was opened to allow access to the cooking chamber. One man kept a section of bamboo to serve as a cover for his pot saying it shortened cooking time and kept the dirt out. Cooking was frequently done in salt water with the expressed object of saving the limited supply of fresh water, although several men reported using sea water for flavoring. The metal containers worked well, they were used many times and were carried with the survivors. The sections of bamboo burned through and had to be replaced. A man who used coconut halves

for boiling containers noted that the shells did not conduct heat very well and burned through too rapidly.

Sea shells of the conch type made excellent cooking containers according to four survivors. The flat shells worked well for frying but held little liquid, according to four others.

Baking was done according to the conventional Boy Scout method of wrapping the food in leaves and then in mud before placing it in the coals of wood fire. One man reported wrapping the food in leaves and placing it between the shells of a split coconut; when the shells were almost burned through, the food was generally well done.

Roasting was done on a spit over an open fire. Those who roasted food over coals reported much better success than those who cooked over an open flame. One man reported roasting fish on a tennis racket sort of network made from pieces of bamboo.

Frying, where described in detail by a few survivors, was done in either a ration can or in a sea shell. The grease used for frying was coconut oil or animal fat collected by holding the fatty pieces over a fire and catching the drippings in a shell.

Plates were made by some survivors from the large bases of palm leaves. One man hollowed out the base of a banana leaf to use as a plate. Coconut halves commonly served as plates.

Coconut halves were convenient cups, and several men reported making ornate mugs from sections of bamboo.

Several men made utensils for eating which they carried with them. One survivor was particularly proud of the articles he improvised from stalks of bamboo, consisting not only of knife, fork and spoon but also two stilettos or daggers.

Many of the fliers expressed some of the advantages of the cooking process and benefits of the cooked material. "Easier to eat" was the most common statement, but safer, more palatable, and "gives me a rest" were also mentioned.

(5) Seasonings for foods:

As the majority of boiling was done in salt water, little additional seasoning was needed. Several survivors reported boiling down sea water to collect the salt for future meals. One man apparently spent his spare time boiling down sea water to secure salt crystals which he traded to the natives of New Guinea for items he needed.

Lemons and limes were mentioned several times as seasoning for meat and fish. One story tells in detail of preparing fish on a spit and periodically placing the rind of a lemon on the meat for additional flavor. Another account mentioned pieces of lemon placed in the cuts in the meat during the roasting process.

In the Philippines two survivors picked up the native trick of using papaya leaves to tenderize meat. Another man used papaya leaves for flavoring in all his stews and broth.

Pepper was available to some jungle cooks in the form of green and red peppers. One chap expressed surprise that his green peppers turned red as he kept them. Green

peppers often were included in vegetable stews in Burma, New Guinea and the Philippines.

Survivors along the sea coast occasionally used chopped seaweed for spices. Reporting his menu in detail, one flier said he selected red and green seaweeds, chopped them fine and used this colorful mixture as a relish on his baked fish.

(6) Storage and carrying of foods:

Cooked material in excess of current needs was carried by several survivors. Sections of bamboo and coconut shells were used as improvised containers. One man filled a condom with rice and carried his food in that fashion. Several men waterproofed banana leaves by holding them over the coals of a fire until they became "brown and leathery"; in this condition they were not only waterproof but also much more resistant to wear and less subject to tearing.

Excess meat was smoked by one party; and several men told of jerking the meat in the sun and carrying it for considerable periods as an emergency ration.

PART III

The Hazards of Survival

I. ANIMAL DANGERS

In any human, fear or apprehension concerning large wild animals is only natural. Survivors in foreign territory, in danger of being killed or captured by the enemy, are naturally not only aware of man but of other animals, strange sounds, and strange movements. The 1000 survival stories under consideration were examined for the animal hazards these men encountered during their periods of isolation.

Large animals were found primarily by the men isolated in the jungles of Burma; these animals were elephants, tigers, and panthers. In the Philippines other survivors encountered water buffalo; when wild these are dangerous.

Four men reported that they saw or met with elephants. Other men who followed elephant trails as an easy method of travel heard or saw signs without actually encountering the animals. Only two fliers were attacked by elephants. One, while walking along an elephant trail, encountered the beast head on and both man and beast were frightened by the meeting; the elephant charged the flier and before he could successfully evade he was struck in the buttocks by the elephant's tusks and tossed to the side of the trail; the elephant continued his charge and disappeared. The survivor commented it was a question of who was frightened most. A second man was charged by a frightened elephant but he hid behind a huge boulder in a swampy area, the elephant kept on running and was not seen again. Another party of two men walking along elephant trails heard a group of elephants following them; they promptly left the trail

and climbed a hillside 100 yards away. As the party of elephants passed the spot, one bull elephant turned in their direction and trumpeted several times before going on. A fourth man saw a herd of elephants from a distance but was not noticed; he changed his direction of travel in order to avoid disturbing the herd.

Seven men saw tigers. In all cases the meetings were surprises to both parties. One man reported he came face to face with a tiger on the trail and both stood and stared at each other. Finally the man jumped shouting in the direction of the tiger. The tiger promptly "turned tail" and fled. Another man saw a tiger but was not seen. In the other accounts the tigers saw the men and, after a brief period of watching, disappeared into the bush. In addition, there were four reports of men finding tiger tracks around their shelters or campsites in the morning, but all of these men slept through the night unaware of the proximity of the tiger.

Black panthers were mentioned by two men in the Burma jungles.

Water buffalo are to be avoided because of apparently continuous mean tempers, according to three statements from the Philippines. Only one of these tales reported any difficulty, and in this case the survivor dodged into a wooded area and the water buffalo did not follow.

Wild pigs also must be approached with caution. According to two stories from the Philippines, wild boars, either alone or in a pack, will charge a strange sound or a man.

Two survivors had trouble with dogs; one in New Guinea and one in Burma reported they were bitten by the village

dogs. Accounts from China stated that every house had a dog and it was difficult to travel near a village on an escape route without arousing all of the dogs.

Snakes were mentioned in only four survival stories. In three instances the snakes were killed and eaten. In the fourth story, from the Solomons, the snake was described as a "small pretty blue snake about one and one-half feet long".

Crocodiles were mentioned in six accounts from New Guinea and islands in the Netherlands Indies. No trouble was experienced, the usual practice was to toss sticks or stones into the stream to scare away the "crocs" before fording. No crocodile stories were available from the Philippines.

The wild life that caused most difficulty to survivors while on land consisted of leeches and mosquitoes. The leech population in Burma is tremendous, and several men stated it was necessary to stop every hour and strip off all their clothing and examine each other to remove the pests. The leeches were on every blade of grass and every bush, and they even dropped from the trees. Survivors reported leeches in their hair, ears, on all exposed parts of the body; the leeches crawled through button holes, in the flies of their trousers, and even through the eyelets of their shoes. Many men resorted to wearing two pairs of socks while in leech country and soaked both pairs with any repellent available; trouser legs were tucked between the pairs of socks and the outer pair was affixed to the trouser leg by adhesive tape.

Removing leeches from the body, once they have secured a good bite, is a difficult task. Several suggestions were offered. These included removing the leech with a bamboo spoon or knife, since this scraped them off rather than cut them as a regular knife is apt to do. It is extremely necessary to remove all of the head and mouth parts of the leech in order to prevent secondary infection from this type of bite. Other men used the juice of

limes, salt, potassium permanganate crystals, tobacco juice, lighted cigarettes, burning sticks, and soft yellow soap; all of these methods were more or less effective. Standard repellents were used when at hand; the leech withdrew its head when the repellent was applied. Most men preferred to save their repellent, however, rather than use it in this fashion.

Mosquitoes as a hazard were mentioned in a large percentage of the stories; however, many areas were clear of mosquitoes because of altitude, climate or time of year. Those men who did complain of mosquitoes were those without repellents. Men who had repellent reported it was effective and only wished for more; many made the suggestion that the repellent be supplied in metal cans rather than in bottles. Many thought there was a place for the repellent in the first aid kit as well as in other emergency kits. A number of men were forced to use native methods of repelling insects and these will be considered in a later section of this report. One dramatic story tells of a pilot who landed his plane in a New Guinea swamp about twenty miles from his base. He was confident of his ability to get back and so he started walking, leaving all his equipment and supplies in the plane. He was found by a native search party, thirty-six hours later, three miles from his starting point, mired up to his shoulders in a swamp, and covered with a layer of mosquitoes from the water line to the top of his head. He was completely exhausted when found, and was carried back to his base in a litter.

Smaller animals caused trouble for a few men. A flier down in a swamp in New Guinea mentioned that the kunai grass was alive with scorpions and he was stung frequently. Two men reported trouble with lice; both of these men, one in the Philippines and one in New Guinea, encountered the lice while sleeping on native beds in native huts; both swore off this gift of hospitality after initial

experiences. Three men in China mentioned being bitten by bed bugs while sleeping in native beds, and those men preferred to sleep on the ground henceforth.

A single isolated survivor, and a group of men crossing swampy areas in New Guinea reported they were attacked by swarms of bees. The single man was badly bitten and was forced to rest for 24 hours to get over the effects of the stings.

There were no reports of red bugs in the survival stories studied.

From the lowland area of Burma one downed flier sent the peculiar report that the hermit crabs bothered him, not by their noise, but by keeping him awake most of the night by nibbling at his wounded feet, in spite of the fact that his feet were encased in bandages. Since these animals are carnivorous, they might well have been attracted by the smell of his wounds.

Not exactly in the line of a survival story is the tale, widely reprinted, of the soldier in the Fiji Islands who was killed when caught by a giant clam, the *Tridacna*. This soldier, who knew some biology, was exploring a coral reef at low tide and was alone. He failed to return to his base that night and the following day his body was found on the coral reef, one foot held fast in the shell of a giant clam. Apparently this soldier, who was wearing tennis shoes, stepped into the open shell of the clam which closed on his leg. He was unable to remove his foot and was drowned by the incoming tide. (The Purple Testament, edited by Wolfe, 1947). Other survivors reported trouble from coral reefs in the form of cuts and lacerations from walking or falling on the sharp rock edges.

Coral cuts are painful, difficult to treat, and usually slow to heal. One survivor noted two methods used by the natives in the treatment of wounds sustained by stepping on sea urchins when spines of these animals remained in the body. The acid juice of limes or other fruit apparently dissolved the calcium carbonate of the coral fragments left in the wound.

While the lime juice itself was painful, such treatment promoted healing, and according to the report, "sterilized the wound". The other method used by some natives was to urinate directly on--or apply urine to--the wounds. After an application of urine directly or in poultices, a flier reported that sea urchin spines could be removed much more easily.

Survivors in life rafts narrated in detail every sight of a shark, yet only two stories were found of men being attacked or killed by sharks. Off the Milne coast of New Guinea one flier was attacked by a shark, when swimming outside the coral reef, and lost a leg; however, he lived through the episode. The other story concerned a Navy plane which ditched in the water. The pilot and gunner were in life vests working hard to keep afloat; perhaps this splashing attracted the sharks. The gunner had removed his trousers and shoes and was wearing white undershorts. Sharks nosed him several times, finally one bit his right thigh at the level of his shorts. The bite was not clean; the man was pulled under but broke free and bobbed to the surface shouting for help and continuing to splash in the water. The sharks continued to attack, biting and pulling the gunner under the water until he was drowned. The pilot, who survived to report this shark attack, said that the sharks kept pulling at the bobbing body until it finally disappeared. The sharks then followed the pilot; he splashed at them and finally hit one shark on the snout. The shark turned quickly, and the pilot was hit in the face by his tail. This broke his jaw and caused abrasions on his face, but the sharks then left and were not seen again.

Parties in life rafts respectively saw many sharks, few sharks or a single shark; a flier spent twelve days without seeing one. A life raft party tied the extra clothing on a line and used it as a sea anchor; this sea anchor was attacked by sharks several times.

Other life raft stories mentioned seeing

large fish. One pilot saw a 40-foot whale surface near him and blow a stream of water into the air; the same pilot glimpsed an 8-foot marlin which swam around his raft several times. A sea turtle nosed the raft of another pilot for 15 to 20 minutes; the pilot did not hit the animal for fear his sudden movement or thrashing of the turtle would upset his craft.

2. DANGERS FROM PLANT MATERIALS

The majority of men, who experienced trouble with plant materials during survival periods, listed the numerous spines and thorns of trees, bushes, vines and grasses as the dangers. Plant spines are frequently stout and will penetrate deeply into the flesh. The tips of the spines often are decayed and some rotten vegetable material may be left in the wound. This material is a nucleus of infection; it is necessary to remove all of it from the wound in order to prevent further trouble.

A peculiar warning regarding spines was contained in the report previously mentioned of a flier who bailed out over Sumatra; his "piled carpet" proved to be an Agave plantation. Agave or century plants have erect stiff leaves which are tipped, and often edged, with stout spines. This man landed in a planting of Agave and had one leg badly lacerated.

Other spines may be very thin and delicate and break off in the flesh. The leaves of many grasses have saw edges of very fine teeth or razor sharp edges without teeth. Cuts from grass are particularly painful but, since they are clean, rarely cause infection. A grass cut is similar to a paper cut and frequently takes a long time to heal.

The men who landed in swamps, particularly in the New Guinea area, reported difficulties with the sharp edges of leaves of grass. One chap in New Guinea and three others from Burma reported other troubles; in these four cases Japanese soldiers saw the pilots land in the grass-

land or chased them into glades. Then, rather than pursuing the survivors, the enemy troops set fire to the grassland to burn them out. Needless to say, grassland, swampy or otherwise, will burn readily.

A single case of dermatitis from plant materials was reported. This fellow used leaves as a substitute for toilet paper and developed a rash over most of his body. The ointments from his first aid kit eased the irritation and eventually cured it.

Two cases of trouble from plants with stinging hairs occurred in survival stories. Stinging hairs on plants resemble small hypodermic syringes; when these hairs penetrate the skin a small drop of acid is left and a burning sensation is the common result. Occasionally the pain from such an encounter may cause a cramping or partial paralysis of the member affected. Rest will cure this affliction, the part should not be moved.

One man in Burma was troubled psychologically by the large amount of phosphorescent material in the jungle. He was forced to go to bed early and to shield his eyes in order to control his fears of the glowing logs which were all over. The phosphorescence is not harmful in any way; it is usually caused by bacteria or fungi in decaying vegetable matter.

3. MISCELLANEOUS HAZARDS

Needless to say, the sun must be considered a hazard in the process of survival of isolated personnel. The majority of men who spent time in a life raft reported trouble in protecting themselves from the sun. Only one man on land was troubled from sun burn, in this case he admitted it was his own fault for going without clothing while on a beach area. Cold troubled about a dozen men, and additional clothing, the use of leaves placed in shirts, a fire, or even burying the body in sand, were methods used to keep warm.

PART IV

Aids to Survival

I. CONTACT WITH AND ATTITUDE OF THE NATIVES

Fully 90% of the survival stories stated that native people were contacted at some time during the episode and that these people were helpful. A small percentage of the stories report an avoidance of native contact or no natives encountered. An equally small percentage note native contact that was not helpful.

Where the natives proved to be unfriendly or treacherous they did so for the following reasons: 1. The episode took place in occupied territory where the natives were afraid, or where there was practically no chance of avoiding the Japanese ground forces. 2. The survivors displayed weapons or threatened the natives with guns, knives or clubs. One flier, escorted by natives in India, mistrusted the direction they were leading him and when the natives insisted they were going the right direction the flier drew his gun and shot them all. (1352 AAFBU 1-C Div. ATC). A later report tells of unfriendly natives in this area, perhaps as a result of the flier's actions. 3. The survivors were too liberal in their display of money or in actual rewards of money or equipment. One flier in New Guinea started paying the natives daily for their help. Each day the prices went higher and higher until he was out of money. At this point the natives refused any further help and left him alone in the bush after telling him the direction to proceed alone. Some natives succumbed to the opportunity to obtain easy loot. In India one group of natives located a recent crash in which all but one of the crew were killed. The

sole survivor was badly injured. The natives immediately began to argue among themselves over the division of the materials in the plane. They first smothered the injured man and, as a later story revealed, one native killed all the others in order to have the salvage for himself. This native was eventually tracked down and killed by an Indian soldier. In Northern Burma the "lolo" tribes proved to be "rough boys" according to several survival reports. Their first action on contacting survivors was to strip them of all valuables, in fact, everything but clothing, and then send the fliers on their way--usually with correct directions for getting to Allied help. One group, in spite of this looting of guns and emergency equipment, supplied the survivors with a pan of opium paste to enable them to pay for other native guides, and they even gave the fliers a mosquito bar filled with popped corn for food along the way. This series of events led to the adoption of the Air Force policy of survivors giving the natives "chits" for their services rather than paying them directly. The chits were later cashed by the Air Ground Aid Services of the occupational authorities or by the British government services in the various areas. The chit was a short written note reporting that this native had given a stated amount of aid or material to the pilot and he had been promised reimbursement for his materials and trouble. In several cases, particularly in New Guinea, these chits were found by the Japanese forces and were the cause of punishment by the enemy. 4. The survivors found themselves among groups

of natives who would not trust one another. Stories of this nature are particularly common in reports from the occupied Philippines. So many natives were collaborationists, or were suspected of being so, that no native trusted another even if they were closely related. Survivors who contacted groups of natives were often turned in to the occupying Japanese forces or were forced to flee when the natives set up an alarm. Solitary natives occasionally were treacherous, but a native disposed to help would more likely do it if he knew he was not observed by a fellow countryman.

Only one report was found of survivors having trouble because of native women. One flier in the Philippines rashly made a pass at a wife. The husband promptly turned him into the Japanese troops.

Since the stories of men helped by the natives are easier to obtain than the reports of those turned over to the enemy and kept as prisoners of war, it is obvious that the present accounts are unbalanced. However, the extent of native assistance received by survivors in various areas in the Pacific was really impressive. Generally speaking the following information ran through the stories of survivor-native relationships.

1. Let the natives contact you. Many natives saw the pilots land but knew the situation better than the fliers. Contact was often delayed several days but invariably when the natives started to search they found the pilots. In China in particular several stories reported that fliers who landed in rice fields would be noticed by the natives, but no attention was paid to the men as long as they were in the open. Once the men went into the bushes or attempted to hide, the natives would drop their work and search out the flier, from then on they would show considerable interest in his welfare.

Men who contacted individual natives usually received better treatment than those who contacted groups. Throughout the Pacific individual natives took con-

siderable pride in their "survivor" and would pamper the flier. An individual cared for by a group was group property and invariably received less attention and comparatively inferior care. In many areas a rescued flier had difficulty preventing the native keeper from showing him off to all and sundry friends. These "friends" were usually brought one or several at a time, eventually a large group would know of the man's presence and his hiding place as well.

2. Native help was more satisfactory if the flier was the brunt of the joke. Fliers who appeared dirty, awkward, or helpless commonly received better treatment than those who appeared able to care for themselves. One man reported the natives laughed at him continuously but were very helpful. This flier found it hard to take the continuous humor but soon realized it was his salvation.

3. Various fliers found different means of establishing cordial contact with the natives. Smoking a pipe or smoking cigarettes proved to be a friendly gesture in India and China. Cigarette smoking sometimes proved dangerous because all the natives wanted one, posing a situation of rationing to the flier. He was then obliged to give away all his cigarettes or to favor a special few natives. All of the natives wanted cigarettes but none wanted to share a pipe of peace. One flier offered his pipe around in such a gesture and was refused. Cigarettes were acceptable in most areas, not to Mohammedans in India.

Sign language proved an effective means of communication but varied with the remoteness of the native group. One pilot in China made noises to amuse the children. Among his repertoire was a train whistle and choo-choo. Apparently this struck a familiar chord to some of the men for a short time later he was hustled to his feet and was led over a three-day trek to a railroad station. Other members of the crew which landed in the same territory were many days coming out on foot. The flier concluded that his happy choo-

choo made a difference of several days in his survival period.

Sign language was universally effective in getting food and drink and often other supplies. Pictures also proved to be effective. One flier had a small Sears Roebuck catalogue in his pocket and the natives produced many of the items he pointed out.

The blood chit and the back identification used in the China-Burma-India areas also proved effective. Success of chit, identification or pointee-talkie depended on the ability of someone in the village being able to read. One crew in Burma was taken on a four-day trip to another village to see a small child who had been educated in an American mission. This child could not only read and write but spoke enough English to help the pilots to safety.

Pictures of the American flag and especially a picture of Roosevelt were particularly helpful in establishing identity.

Many of the survivors who had exchanged their personal belongings or equipment for food and other necessities along the survival route had definite recommendations for barter items to be carried. In central Asia beyond the area where natives came into common contact with Occidentals during peace time, rock salt, twist tobacco and opium proved to be the most valuable. Many fliers suggested extra salt tablets for barter as essential items in emergency kits. The local governments, Chinese and British, did not approve of the indiscriminate use of opium for trade in many areas, but under the wartime conditions these objections were waived or overlooked. Many natives actually needed the opium as a stimulant for the physical exertion of walking out.

Silver money was effective payment but paper money was refused or taken reluctantly by the natives. Special care had to be taken in or near areas of Japanese penetration to make sure the silver money given to the natives was

dated prior to the war. Some native villages were ravaged because the Japanese found coins minted in war time in the hands of the natives.

In India and Burma where the natives had previous contact with white people, watches, bracelets, rings, wigs, etc., were in great demand and carried a tremendous barter price.

In the New Guinea-Solomon Island area survivors reported that twist tobacco, salt and razor blades were highly regarded.

In China the natives wanted parachute shroud lines, web harness, buckles, fittings and clasps but showed little interest in the silk or nylon fabric. In the Lolo territory of Burma the situation was reversed with a native demand for the fabric and no barter value on the lines or harnesses.

In China particularly the natives often staged large celebrations for the downed fliers. Elaborate banquets, parades, shows, and dances were held in honor of the men. In many cases the men were expected to take part or to contribute to the affair. In some villages a native who spoke English was able to translate a speech of gratitude, in others where no one understood English the motions of a speech were sufficient. A group of natives in China was apparently entranced when a flier recited a poem. Not satisfied with one they kept the flier on his feet for an hour reciting any and all the poetry he knew. They were less enthusiastic when he tried to tell stories; apparently the lilt of the rhyme impressed them more.

Another flier in a Chinese village taught the native children the song "Old MacDonald Had a Farm" complete with noises. The group apparently learned the song well and liked it; a later group of survivors reported a performance of this tune by some natives in the same area.

In Burma various fliers tried other schemes to entertain the natives. One group of survivors put on a jitterbug contest to the complete and hilarious

amusement of the natives. Another staged a square dance in which a few of the natives joined in a Virginia reel. Shadow pictures entertained the children and started a fad in one Burma village; string tricks fascinated the inhabitants of another native settlement.

The extent of native help was limitless in many areas. Fliers in parts of China were treated to clean sheets on beds. One party was supplied with reading material including copies of the National Geographic, Life, Look and the Reader's Digest. Although the fliers reported no one in the village appeared to understand or read English. Pajamas were supplied six different groups of fliers, and razors appeared without hesitation in many villages. One amazed flier was offered a bottle of shave lotion after he had finished his barbering. Tooth brushes, new or used, were offered to several men. One group was given a choice of stimulants in an area where no one spoke English; the stimulants proved to be White Horse Scotch or Canadian Club.

Many natives appeared extremely grateful and cognizant of the part the fliers were playing in the war against the Japanese. In a village in Burma three women were detailed by the head of the village to make cigars continuously for the pilot and crew, who dutifully reported them as having "fine tobacco". Several men reported a concern by the natives for the future safety of the fliers; several native groups wanted to be informed of the pilots' return, and desired to have mail from the U.S. when the flier reached home.

In China in particular the arrival of a flier in a village by parachute was an auspicious occasion, often their departures were as spectacular. Several reports mention departures complete with fireworks and brass bands.

While these incidents stress only one side of the story, they do point out that human nature is generally kindly and that a stranger is welcome and often his arrival is a high point in the life of a

native village. Such a reception called for a friendly cordial attitude on the part of the stranger. Hostility was out of the question.

2. INSECT CONTROL

Many of the survival stories examined for this study mentioned materials used by the natives in various areas of the Pacific to control or repel insect pests. These methods were not often used by survivors, but they are of interest since they may represent material of value in future survival training or in the preparation of additional survival manuals.

Mosquito repellents used were either smudges, or oils of various plants and animals applied directly to the skin. Smudges were made by burning cow dung, dung of the water buffalo, coconut husks or coconut fibres, and citronella grass. *Agdao* or *Promma ororata*, *subusub*, *Anisomeles indica* and *Dangla*, *Vitex* sp., were used as smudges in the Philippines, while those previously mentioned were used throughout the Pacific area.

Oils were extracted from *Aleurites* to combat mosquitoes or to remove lice from the scalp. *Aleurites* is the genus of plants producing tung oil. Oil of citronella was obtained from citronella grass--commonly grown in native yards throughout the Pacific area. Coconut oil, oil from the fat of crocodiles, motor oil, cup grease, and mud, were also used to cover exposed parts of the body as protection against mosquitoes. Tobacco was chewed and the saliva rubbed on the body as insect repellent in many areas.

Slices of a relative of the breadfruit, *Artocarpus integra*, were placed in beds in the Philippines to discourage bed bugs.

Coconut oil, yellow soap, Lifebuoy soap, and the milky juice of the oleander, were suggested as ointments to remove lice from the scalp or as insect repellents. The natives of New Guinea and New Caledonia were reported to rub lime juice in the scalp to remove lice; this commonly turned

the hair red but evidently it was effective.

Relief from the pain or irritation of insect bites was accomplished by several native remedies. A poultice of rice flour was used in China and in the Philippines. A mixture of salt, vinegar and honey was recommended as a treatment for spider bites in a classified report in which the area was not disclosed. From the Philippines came the report that the heat of a cigarette or a burning stick, when applied close to the skin, would break down the acid in an insect bite and would give prompt relief from the pain of spider, ant or mosquito bites.

Finally one survivor noted that the natives of New Guinea used a unique method of eradicating ants from a house. Lemons were placed in damp places until the skins were covered with mold. The lemon was then quartered and the sections placed on top of ant holes. It is reported that the ants soon disappeared.

3. SMOKING HABITS AND THE TOBACCO SUBSTITUTES OF SURVIVORS

Smoking and the use of tobacco is recognized as a widespread habit. The majority of men in the Air Force smoked tobacco either in cigarettes or in pipes. Inflight emergencies leading to isolation in strange territories led to improvisations and substitutions to satisfy the habit of smoking.

An individual who smoked, when dropped by chance into a strange land, often borrowed the habits of the natives in a use of tobacco substitutes; although many men were supplied cigarettes, chewing tobacco, snuff or pipe tobacco by the natives. Some of the survivors reported they took up chewing betel nut following the customs of the country. Others found tobacco substitutes. Twenty-seven men reported they were able to find sufficient tobacco in the wild to satisfy their needs.

Three fliers in the Marianas tried smoking seaweed mixed with various grasses.

Men in the Philippines used dried alfalfa as a tobacco substitute. Four men in China tried dried hibiscus flowers. Six men smoked pine needles, and two others used pine needles mixed with other materials such as tobacco, alfalfa, or corn silk. Corn silk alone was used by five men. Papaya leaves were used commonly in New Guinea and tomato leaves were smoked and chewed by survivors in Burma.

Paper for rolling cigarettes was in short supply. One man tried parachute silk to roll cigarettes; two men used pages from their Bibles. Pandanus leaves, green or dried, made the wrappings for cigarettes for men in North Borneo, the Bismarck Archipelago and the Philippines.

Three men gave up cigarettes and resorted to pipes made of bamboo; one man used a slender bamboo tube to hold his tobacco.

Tobacco led to the capture of one man who discarded his cigarette butts along the trail; but it also figured in the rescue of four other survivors, who followed trails of discarded American cigarettes, knowing the paths were used by Allied troops. Two men in Burma had no difficulty obtaining cigarettes of Japanese manufacture by visiting native villages; one survivor on New Britain Island actually raided a Japanese camp to get cigarettes.

4. MISCELLANEOUS IMPROVISATIONS OF SURVIVORS

The needs of men for specific tasks confronting them, during the period of their isolation and survival, led to many ingenious uses of materials and the improvisation of implements for specific purposes.

For clearing brush one man made a machete type of instrument from stalks of bamboo. With his jackknife he was able to split bamboo; he then heated the sections in a fire to harden the wood. This treated bamboo would then take an edge and was

used to cut grass for his bed and, on one occasion, to clear a trail through brushland he wished to cross. Another survivor in New Guinea improvised a machete from the cowl of his aircraft; he sharpened his blade on coral rock.

Sewing kits were desired by many men but only two attempted to improvise the tools and materials they needed. These two men made needles from bamboo and from the long spines on certain palm trees. Thread was taken from the parachute or stripped from fibrous bark and coconut leaves. Buttons were made from pieces of coconut shell.

Toothbrushes have already been noted in this study as one of the items most desired by survivors. Toothbrushes were made from bamboo by several men; pieces of bamboo were chewed at the ends until they became soft and the fibres separated, the brush thus formed served as the toothbrush needed.

A survivor in Borneo obtained an outboard motor for a small boat he stole from a Japanese garden. To make the trip to another island he was able to find a barrel of high test gasoline to serve as fuel for the engine, but he needed lubricating oil. Planning his trip carefully to coincide with the next late moon, this flier carefully accumulated a pile of coconuts, grated the meat and extracted the coconut cream. He allowed it to stand and drew off the oil from the liquid until he had a gallon of pure coconut oil. This met his needs and with the gasoline, boat, and motor, he was able to escape from the Japanese territory into which he had parachuted.

5. THE NATURE AND METHODS OF TRAVEL BY SURVIVORS

In the vast Pacific tropics, the area considered in these reports, all methods of travel might be expected in the stories and a great many types were mentioned. Included in the reports are some definite hints and patterns. The vast majority of

men made the trek to freedom on foot and the period of travel varied from a few hours to a journey across Burma that took seven months.

The few that were able to travel in other ways than on foot, that utilized any other available method of travel, found that they conserved energy. In China several parties were carried out of the bush in sedan chairs. Guerilla forces in China and the Philippines rode for several days on water buffaloes supplied by the natives; and one flier grounded in Burma reported he found a burro but could not make it go. Burmese natives helped one survivor to safety on an elephant.

Coastal travel was accomplished by life rafts in many stories, although one party reported the current off the coast of Bougainville so tricky they did not dare risk raft travel after one near mishap. Inland travel was primarily along water courses and several men used their seat pack life rafts to negotiate at least a part of their journey. Split sections of bamboo made excellent paddles for handling life rafts or improvised rafts; and bamboo poles were commonly mentioned where poling was the method of propulsion.

Life rafts also proved of value to survivors in central Burma and inland China. The Burma survivors reported using the rafts to paddle down streams and to cross rivers, swamps or small lakes. A flier in China would have drowned following the ditching of his aircraft in a rice paddy if it had not been for his Mae West life vest. The crew of a large bomber, which skidded into a flooded rice paddy in China, was forced to use complete ditching procedure and get into life rafts, as the plane rapidly sank from sight.

The basic preparations for travel had to be made prior to departure from the aircraft, and orientation often had to be accomplished on the parachute descent. This was obvious from the reports of a large number of survivors. Those who had definite plans of travel as to direction, route and distance were better prepared

for the trip that followed than those who were not briefed. The briefing was mainly the job of the navigator of the aircraft in distress; he was the man who should know where the plane was in relation to friendly or enemy troops, the nearest roads or native villages. Men who descended at night by parachute had more difficulty orientating themselves than those who landed during the daylight hours. Men who orientated themselves well during the parachute descent were usually able to start in the correct direction without difficulty. Those who failed to orient themselves reported spending hours or even days walking in circles before they were able to head in the right direction.

Getting out of the parachute harness and onto the ground, following a parachute descent in forested areas, proved difficult for about 20 men. In one group which parachuted from a bomber, 8 of the 9 men were suspended in trees from 5 to 200 feet above the ground. One flier was forced to set himself in motion swinging back and forth until he was able to catch a neighboring tree trunk and slide to the ground. One survivor was able to slide down vines. Another cut some of the lines running to his chute, tied them together and finally slid down a 50-foot length of spliced parachute cord to the ground.

Being suspended in a parachute harness led to one suicide in Burma; this story will be reported later in a separate section on survival psychology.

Men who landed in the dark and were caught in trees found it expedient to wait until it was light before getting out of their chutes. Several men who tried it in the dark reported drops of up to 30 feet, and all warned future parachutists against such a practice. One flier told a hair-raising tale of landing in the tree-tops and seeing a companion close by. The companion extricated himself first and dropped the few feet to the sloping ground below. He was unable to get footing and slid over a cliff to his death. Needless to say, the eye witness eased himself from

his parachute and descended with more caution.

Most of the survivors who had to travel any distance on land followed trails. Only in Northern Burma was there any difficulty in finding native trails or roads. In the Islands of the Melanesian group jungle trails criss-crossed the island in many directions and a few men were confused. They did not know which one to follow or which way to go. Some individuals, especially those in Japanese held areas, walked parallel to trails at a distance of 50 to 100 yards. Two narrators who followed this practice were able to avoid detection by parties of Japanese soldiers, since they were off the trail and could see from cover.

A number of men reported following animal trails, ranging from elephant trails in the Burma area to trails of smaller animals, which they hoped would lead to water or rivers. A chap in the Philippines was following an animal trail and nearly walked into a pitfall type of trap set up by the natives; after that experience he made it a practice to parallel the trail at a few yards distance.

All survivors had definite suggestions concerning dense vegetation. The oft-repeated rule of "part rather than cut" indicated that many men learned the hard way the endless job of cutting trails. Bamboo clusters were mentioned in particular as places to avoid; bamboo clusters were extensive and of unbelievable density and the survivors advised walking around them, even though it meant miles of additional travel, rather than trying to push through the tangles. Bamboo thickets were mentioned as good hiding and sleeping places; one man chased by Japanese troops hid in a bamboo thicket for three days waiting for his pursuers to tire and give up the chase. They did just that on the third day.

Swamps, particularly those having high grass, were mentioned by several survivors as places to avoid. Patches of kunai and elephant grass were noted in many stories

as being difficult to traverse. When it was necessary to cross a swamp, survivors advised following animal trails.

Swamp lands were good places to hide, according to several men who eluded Japanese patrols. However, swamps also had disadvantages: leeches and mosquitoes presented the most common hazards, and there were three accounts of pursuing enemy troops setting fire to the grassland, to drive the survivors from the swamps. One man anticipated this action from his pursuers, when the grass was set on fire, he ran along the edge of the swamp at the base of the hill, instead of up the hill where the Japanese troops were gathered to greet him; this man used his head. Generally speaking, the Pacific Island swamps are soft-based, and travel and footing is difficult in these areas.

Many men stated that traveling on ridges was easier than traveling in river valleys, although they often descended into the river valleys to look for food or water, or to orient themselves. A few men tried traveling only along rivers. They encountered difficulties in penetrating the b. toalano thickets. One survivor in Burma camped in a river valley where he was awakened one night by the sound of rushing water. He abandoned his campsite immediately and headed for higher ground; his campsite was submerged by a flash flood and all of his belongings were swept away. He reported that the rest of his campsites were on high ground, one such experience was enough. Two men slept on broad flat rocks in the river valleys, the rocks were warmed by the sun in the daytime and retained heat at night, and so afforded comfortable places to rest.

The density of hillside vegetation in some areas was vividly described by several survivors. One man in Burma noted vegetation so dense he was forced to crawl on his belly for three days; during that time not once did he find a place clear enough and high enough so that he could stand up.

The expressed goal of most men was to

find a river and follow it either to the coast or to a road crossing used by allies. In most areas of the Pacific war zone that were controlled by Allied troops, each river crossing had an MP posted to direct traffic. Many stories of survival ended with the flier encountering this MP and being helped to safety. In Burma, once the men were on the ground, their objective was the Burma or Ledo roads. There they encountered American and British troops or Indian colonial patrols and guards who helped them. A few individuals encountered trucks on these roads and hailed them for lifts to the nearest military base.

The travel period of many of the men was based on regular schedules. Travel was accomplished mostly in the daytime, although some men found it better to travel in the morning and evening and to rest during the heat of the day. A few found it necessary to travel only at night in order to avoid enemy patrols.

Travel was usually interspersed with definite rest periods. One man traveled 50 minutes and rested 10 and kept that schedule during his period of isolation. The majority used a 45-minute period of walking and 15 minutes of rest. Some men broke the travel period with regular stops to "wind a watch three turns", to wash the feet, to "inspect for leeches". One flier was in enemy territory and found it necessary to be extremely cautious in all his movements. During part of his isolation period he was even afraid of sleeping, since he knew he snored. Eventually exhaustion overcame him. To stay awake, he chewed a cigarette and rubbed tobacco in his eyes. Needless to say, this practice was brutal but it discouraged sleep.

One interesting travel story is contained in a report from New Guinea. A flier had contacted a group of natives who promised to help him escape. They started out along the trail. One native became quite excited and communicated the idea that they wanted the man to remove his shoes and go barefooted. They had

only traveled a few more steps when they stopped again and insisted he wear native sandals. The explanation determined later was that the natives, afraid of the collaborationists in the native population, were worried lest the tracks of his GI shoes would be recognized and so had him remove his shoes; then the alert natives noticed that he did not have the space between his big and second toes characteristic of the natives, and even the prints of his bare feet would indicate an American or foreigner to some keen-eyed observer. The trail took the party through two Japanese coastal encampments; the flier escaped detection by wearing native clothes.

River crossing procedures were mentioned in survival episodes. Strong swimmers invariably swam the streams alone and unaided. One man stripped off his clothes at each river encountered and swam with one hand, holding his clothing and equipment above his head; he succeeded in keeping his possessions dry during all of his travel. Less strong swimmers would walk miles to find a shallow spot where they could cross a river. Many men depended on life rafts, Mae Wests or life vests for flotation while crossing streams. One party attached parachute cords to a life raft; after the first survivor had successfully crossed the river, the men on either bank guided the raft by means of the cords during additional crossings.

Rafts were made of bamboo in most cases; sometimes rafts were improvised from fuel or oxygen tanks from the aircraft, or from palm trees. Two men filled their shirts with leaves for additional buoyancy in crossing rivers; one party used a large mosquito bar filled with leaves to aid non-swimmers across the Irrawaddy River. Coconuts were mentioned as flotation aids in several stories; one man reported he hung on to coconuts which he had tied together with vines; another put coconuts in his mosquito bar; and still another placed coconuts under his shirt to help him keep afloat.

Mangrove swamps proved to be excellent places in which to hide and to forage for food, but they were poor places to travel. At low tide, travel in a mangrove swamp was difficult because of the soft muddy bottom and the profusion of arching branches and roots; and at high tide, travel was possible only by walking from arching branch to arching branch. One group reported they were able to travel in mangrove swamps at high tide only, and did so then by floating in the life rafts they kept with them.

Warnings were found in several survival stories regarding mangrove swamps. The natives, according to one anecdote, entered mangrove swamps only on trails made of cut logs. A survivor should not enter a swamp if the logs are wet or if the water nearby appears bubbly or muddy, as this would indicate either a native or a Japanese soldier had entered the swamp shortly beforehand. Generally speaking, war records and survival reports indicated that the Japanese soldier was afraid of mangrove swamps and would not enter them alone. However, it was evident in a tale from the Philippines and another from New Guinea, that the Japanese troops left behind by the advancing war fronts would use the swamps as places to forage. Such enemy groups raided native fish traps or stole from the natives' supply of sago palms.

A group in the Philippines believed the mangrove swamps to be the best hiding places for a solitary man or a group of men. These survivors evaded Japanese troops and based their operations in a mangrove swamp, where they slept and even made fires for cooking and warmth. The Japanese troops knew where the Americans were hiding, they did not attempt to penetrate the swamp to chase them out. Instead, they swept the mangrove hideout with machine-gun fire regularly every day at 2:15 p. m. The men soon learned to expect these attacks and they would leave their platforms for safer areas in the water or mud below. One chap even stated

that he set his watch by the methodically timed attacks.

6. SIGNAL METHODS USED BY SURVIVORS

Rescue of isolated personnel often depended upon the signal methods used. Many men were by-passed by search parties many times. Others heard many aircraft and were unable to contact them. The failure in most cases was due to the nature of the terrain or to the improper use of the signaling equipment. Parties wandering in the jungles of Burma heard many planes, obviously flying search patterns, but were unable either to see the planes or to signal to them because of the density of the vegetation. Men out in life rafts were often discouraged, seeing planes fly overhead and pass them, by the lack of proper signal equipment with which to establish contact. One man reported he was never able to understand the printed instructions on the signal mirror, and so he did not use it to signal the numerous planes he saw. Another man on a beach tried for three days to use a "Gibson Girl" emergency radio, only to learn after his eventual rescue that he needed an aerial to use the radio properly.

A large number of the 1000 survival cases contained mention of the abilities and ingenuity of the men in attracting passing planes. There were many stories of improvisation on the part of radio men to get the radio transmitters working in crashed aircraft. One radio operator hiked around the brush until he found the wreckage of three downed aircraft. He was able to salvage the parts needed to make one complete transmitter and eventually he sent the message that led to his rescue.

A pilot floating in a life raft off the Marianas sighted numerous planes, but he was unable to attract them. One day an albatross landed on his head and he caught it by the feet. At that moment a plane approached on the horizon and the pilot excitedly waved the albatross to attract

attention. The plane signaled his position to a rescue ship.

Mirrors, flares, dyes, parachutes, and signal panels were successful in the order given in leading to rescue, according to the accounts of life raft survivors. On land, parachutes, signal panels, and fires seemed to be the usual successful methods of attracting attention.

Mirrors were used effectively in rescue at sea to a maximum distance of twenty miles. One chap commented that he would have used the mirror but the sun was in the wrong direction; a statement which indicated he did not know how to use the mirror, for it is effective as long as the sun is a few degrees above the horizon.

One flier in a life raft practiced with the signal mirror for two complete days before a plane came near him. He contacted the first plane that approached by light flashes from the mirror, and the pilot of the PBY reported afterward that the life raft survivor kept that "damn mirror in my eye for one solid hour" while the plane was circling the raft. It is obvious that practice makes perfect and that the signal mirror should be demonstrated as often as possible during the training of fliers.

One additional story concerned with signal mirrors is worthy of mention, although it is assumed that it happened but once. A land party in Burma tried to contact a passing flight of army planes with a signal mirror. The mirror signals must have been effective for one of the group broke away and made a strafing run on the survivors. Needless to say, the men on the ground were mad. Even though the party was in occupied territory at the time, signals of distress should be treated as such and reported, not strafed.

Flares of the hand-held type were mentioned in several accounts. Two men had difficulty with the flares in operation: one man burned himself badly when material from the burning flare dropped in his lap; the other dropped the flare on the raft, which promptly burned through the in-

flated portion. The raft collapsed and left him supported by his Mae West in the ocean. Several men noted that the flares were wet and would not ignite.

Although parachutes would appear to be difficult signal equipment to use in a life raft, they were sometimes effective. One man spread sea marker dye and then placed his parachute in the middle of it. The color contrast led to his rescue, although the crew of the search plane stated they had checked all the sea marker areas before on that run without seeing the raft. One parachute was suspended between three rafts containing the survivors of a B-29 crash, it successfully attracted a passing plane.

The blue and yellow tarpaulins used for protection or signaling were indicated in several search reports as the signals which led to the locating of the life rafts. Water borne survivors regarded this piece of equipment as extremely valuable, since it was waterproof and served as protection, as a rain catcher, as camouflage from Japanese strafing planes, and as a signal panel when the orange-yellow side was used.

The sea marker fluorescent dye was used by many survivors in life rafts to attract the attention of passing planes. Most men placed only a small quantity of the marker material in the water at a time; this left a trail of dye in the water to indicate to searching planes at least the direction of drift. Only one chap reported he dumped all his sea marker in at one time, and when it was not sighted he had no more to use on succeeding days.

The "Gibson Girl" emergency radio figured in some rescues but was of no value in a greater number of reports. Men reported difficulty in cranking the radio in cramped quarters and mentioned fatigue from the operation. One man suggested a foot pedal arrangement should be devised. Others had trouble working the hydrogen generator and inflating the balloon. Two men, who obviously did not know what they were doing or suggesting, made the follow-

1 ents: when one could not work the generator, the pair took turns blowing up the balloon and then complained because it would not rise; the other suggested a cylinder of compressed carbon dioxide, similar to that on the life raft be placed in the kit with the "Gibson Girl". Perhaps the man meant hydrogen or helium and not carbon dioxide, which is heavier than air.

Kites were hard to manage in life rafts and led one chap to comment he wished he could "get out and run with the darn thing". Two stories appeared in the reports indicating that while the "Gibson Girl" radio was in use with the kite holding the aerial, rescue was effected when the search planes saw the kite. The signals were never heard.

The "Gibson Girl" led to several humorous reports of use by natives in the Marianas area. One party, which was rescued from an island, carefully locked all their equipment in a small building prior to their departure, as they intended to come back later and salvage it. A group of natives, however, broke into the building and began operating the "Gibson Girl" radio. The signals were picked up and air-search sent several planes to locate "lost fliers". Another story, which was widely reprinted in the popular civilian magazines during the war, concerned a group of natives who were operating "Gibson Girl" radios, signal mirrors, and signal panels to attract passing planes. When asked why they did such things, the native chief replied that during the period of occupation there were many fliers with whom they could trade. Now that the war effort had passed them by, they wanted to signal passing planes to land and trade with them. Their expressed comment was "we need, we try make fliers come down here, we trade carved wood, sea shells".

The "Gibson Girl" served several rafts as a sea anchor during storms or during periods of off-operation.

The use of the "Gibson Girl" in jungle areas was not effective. Although such use

guided several search planes in the Burma jungles, the parties could not make contact with the planes and were finally forced to walk out on their own. One survivor suggested that a better method of inflating the balloon should be developed, and a longer wire attached so that the balloon could be floated above the jungles and thus pin-point the men on the ground.

The corner reflector, which was developed late in the war and placed in life rafts only in the last few months of operation, figured in one rescue story. A B-29 ditched, after running out of fuel, off the Marianas. Two A-3 rafts held the survivors and one raft was equipped with a reflector. A PBM properly equipped picked up the "blip" on its radar screen at a distance of ten miles at eight to ten thousand feet. The rescue of the eleven men in these rafts was effected by a sea plane tender, which also reported it picked up the "blip" at a distance of five miles from the point of rescue. With both planes and rafts properly equipped, this piece of equipment seems to have future use in rescue work.

Parachutes served in the most effective signal method on land, particularly in areas covered with grass or a green forest vegetation. Many downed fliers were located by the parachutes caught in the forest canopy. Parachutes spread on the ground, suspended over rivers, spread over the tops of swamp grass, and even between trees, were effective signals.

Once the party on the ground was located, the signal panels proved to be effective in indicating the wants and needs. Unfortunately, two or more sets of panel, arm or body signals were in use and one rescue squadron even developed its own set of signals. This led to confusion when the men on the ground indicated their needs as one thing, and the men on the plane, using a different set of signals, interpreted it as something else. The rescue signal-panel types should be standardized and only one set used. Since parachute cloth is usually available

to men on the ground, the system of Xs used by one rescue outfit in the Pacific area seemed more practical than the folded colored tarpaulin occasionally issued.

Fire was used effectively as a signal by six groups of survivors. Materials burned varied from a native hut, piles of debris, seaweed, to an entire swamp in which the grass was ignited. One party was able to find a barrel of oil washed ashore on Santa Isabel Island; they successfully used this as a flare. The "Gibson Girl" radio they had been grinding for three days attracted no attention.

A party of nine men, who landed on an elephant grass meadow in Burma, found the area honeycombed with animal trails, but diligent searching failed to reveal any native people in the vicinity. They considered setting fire to the meadow to attract attention, but abandoned this idea as too dangerous to their own lives. They finally cut a swath around the crashed aircraft and spent hours scraping paint from the plane and removing cowlings to obtain shiny surfaces. Their efforts attracted aerial rescue.

One crew attempted to locate their position along a sandy beach by stamping large letters spelling "HELP" in the sand. The letters failed to attract attention even after they had lined them with seaweed and drift debris.

A group of men in Burma knew they had been located by circling aircraft. They also understood they were the objects of search by ground rescue teams. After two days of futile search and waiting, they hit upon the idea of whistles. Bamboo was plentiful in the area, so each made a whistle of bamboo and then for several hours they blew symphonies of sound. Again ingenuity paid dividends; the sound carried well and led a ground rescue team to the downed fliers. These men suggested that strong, large, police-type whistles be part of the rescue equipment in the future. When they learned of the small whistles in the later types of emergency kits they criticized the size and lack of shrillness.

7. THE ROLE OF THE SURVIVAL MANUALS

A great deal of time and effort was spent by many military and civilian men and organizations during the war years in the preparation of survival manuals. By actual count over sixty different survival manuals were published and given limited to general distribution. These varied in form from large cloth-bound books, to pamphlets on waterproof paper, and printed instructions on cloth maps and silk handkerchiefs. Survival manuals were placed in all emergency kits carried in aircraft, as well as in kits attached to parachutes and in the dropping type of emergency kits. Survival manuals were also stowed in life rafts. A sufficient quantity was available in most areas of operation so that the fliers could carry them in their pockets if they so desired.

Forty-three of the 1000 survival cases indicated that the survivor had a survival manual with him. All of these men reported use of the manual. One man stated the manual was his only reading material and the only thing that kept him sane. Another read from the manual to the small children in a native village on the Solomons and he said that they enjoyed it even though few could understand him. One survivor told of losing his manual and of spending a full day retracing his steps trying to find it.

Four other survivors had survival handkerchiefs, i.e. pieces of cloth bearing printed information. One man reports he read and reread the information and found it accurate and indispensable.

There were no criticisms of the survival manuals by survivors. All indicated that the data they needed was in the manual. One fellow stated that the great amount of information in the manual made him feel better, as he needed so little of the advice available.

8. THE PHILOSOPHY OF SURVIVAL

In the survey of the survival cases

which formed the basis of this report, particular attention was directed to the mental attitudes of the individuals concerned. Some men evaluated their state of preparation or, more commonly, their lack of preparation for the survival episode. Others commented on their thoughts and actions during the period of isolation. In all but a few of the experiences, the mental, physical and factual preparation that the flier received prior to the emergency was a credit to the training program established by the Air Forces.

Only two cases of suicide appeared in the stories studied. Both of these reflected the weakness of the individual more than the training given the men. The first concerned a flier who bailed out of a B-29 in distress over a section of China that was thought to be occupied by Japanese troops. All the men landed safely and were quickly picked up by friendly Chinese natives. One, however, had drawn his revolver and had shot himself by the time the natives found him within an hour from the time he had left the distressed aircraft. The remainder of the party were in good hands and were back at their base within two weeks.

The second story took place in Burma. A pilot bailed out of a disabled plane and landed in a forested area. His parachute caught in the trees, and he found himself suspended about five feet above the ground. In releasing himself from the parachute, the pilot first unfastened the arm straps of his "chute" and removed his arms from the harness. One leg strap was released while he balanced in this aerial position and he immediately slipped toward the ground. In doing so his left leg caught in the webbing and he was suspended by one leg with his head down. Unfortunately the pilot's head touched an ant hill and biting ants immediately swarmed over him. Apparently, in desperation the flier pulled his gun and fired five rounds into the webbing holding his foot. When he did not succeed in breaking

the harness by shooting at it, he placed the last shot in his head and thus took his own life. He was found by an Air-Ground Rescue team two days later. The tree in which he was caught was a banyan type of fig tree with an intricate network of climbing branches forming the trunk. Aerial roots descended from the branches and were attached to the ground a short distance in back of him. It was obvious from the discoverer's report that if the pilot had even tried to turn around or to swing himself from his inverted position he could have reached either the aerial roots or the latticed trunk of the tree. With those branches he should have been able to pull himself erect and to extricate himself from the harness. The pilot made his first mistake in releasing himself from the parachute. His chest strap should have been opened, but it was essential he keep his arms in the harness before releasing the leg straps. Instead, he fell and caught his foot and became panicky. The fact that his head was in a nest of stinging ants only added to his panic, which led to the action that took his life. Of course, a quick release type parachute harness, which was available to some men in the Pacific area, would have eliminated the happenings which led to this fatality.

The thought of suicide came to a great many men in the course of the survival episode and as frequently when it was over. Some contemplated suicide but soon abandoned the idea, while a few others reported they considered suicide but could not go through with it. One man climbed a cliff in order to jump into the sea. Another drew his revolver to shoot himself, and then decided to wait. One flier considered wading into the ocean to drown himself but then could not bring himself to do it. Another who contemplated suicide decided his commanding officer "General Kenny wouldn't approve of his action", so he refrained. The tendency to consider suicide was greatest in the cases of men in solitary

isolation, next highest in large groups of survivors, and smallest in survival parties of two to four. It appeared from the stories that men who were the misfits in the large groups were the ones who contemplated suicide. The men who were actively concerned with the welfare of the group by scouting actions, foraging or cooking details, were too busy to consider suicide.

Reminiscing about their experiences after being returned to their bases, several men declared they could never endure them again. As one survivor put it, he would "shoot himself in preference to going through that again, but the thought of suicide never occurred" to him during the period of his isolation.

Sometimes one or more members of a party died during the course of a survival episode. A few of the others often expressed their thoughts on his death: in most cases these were "poor Johnny" remarks. Rarely did those remaining envy the lot of the man who had died. Death was practical in survival episodes; bodies were cast out to sea or buried, with a prayer and a service, and rarely much more thought. A realistic opinion expressed in the stories was that the men must be certain to bury the corpse deeply, and to make the grave look like a native grave, so the remainder of the party would not be traced as American fliers. One story during the war reported a Chaplain and an old sailor floating in a life raft somewhere out at sea. After a few days the chaplain died but the old salt lived on and was rescued. Asked his thoughts later as to why the Chaplain went first, the old salt replied to the effect that the padre was ready to die and the old salt was bloody well not so.

Degree of preparation made considerable difference in the cases of survival. The men often reported that the more they knew the less they feared. Survivors were grateful for their childhood and Boy Scout training, a certain briefing officer, a visit to a market area where they

learned to recognize certain foods, the fact they had read a certain book or the chance that made them bring along a certain piece of equipment.

Most men stated that physical condition and mental spirit were of the utmost importance. There were several things that irked survivors particularly enough to cause detailed comment in their reports. First among these was the type of shoes. Many men in poor types of walking shoes focused all their wrathful attention on "those shoes". Another reaction reported with considerable feeling in survival stories was the anger of men who found that items from their survival gear or first aid kit had been pilfered somewhere along the line. This action was all too common in the Pacific area and the results were discouraging, to say the least, to the survivor forced to use an incomplete kit. Jungle noises, or the lack of noise, mosquitoes, shadows, dripping water, phosphorescent logs and "the ticking of his cheap pocket watch" all became major problems for some men. Most of them reported such problems as being temporary and as probably serving to release some pent-up emotions.

A very noteworthy remark appeared in several survivor stories; evidently the crew of the aircraft was always better prepared for a survival experience than the passenger complement aboard. In two cases the passengers were a definite handicap to the party by their unwillingness to do their share of the work. In one case a passenger slipped away from the party to surrender to collaborationists; this led to the subsequent capture of the entire party. Passengers should be well briefed for inflight emergencies. Even though they may not be as well prepared, it must be made clear to them that the pilot or a crew member is in command on a survival episode, regardless of the rank of the passengers. This should be the case unless the pilot or a surviving crew member designates authority elsewhere.

A glider party was released prematurely

due to a defective towing mechanism on an offensive in Burma. The glider landed safely on a sand bar in a river and the commanding officer of this small force decided immediately that they were not survivors, even though they had made an emergency descent behind enemy lines. He concluded that they were a patrol and he operated the party accordingly. The small detachment camped in elephant grass most of the time, set security watches, and maintained security patrols. The men were rationed and were told to shave every day to maintain a sense of schedule and order. The commanding officer reported when the group reached its base sometime later, that the "important thing is a sense of proportion regarding the Japanese, jungle and other real or supposed hazards besetting an isolated detachment in enemy territory". Most men were able to maintain this sense of proportion. Many even retained their sense of humor; and a few enjoyed the experience.

Determination to survive was extremely important. Two cases emphasize the degree of determination on the part of some men. A British captain was captured in Malaya and was staked out spreadeagle on the ground in the sun. When the captors were not watching the captain pulled up the stakes and escaped into the bush without a stitch of clothing. He eventually made good his return to friendly troops.

An American soldier captured by the Japanese was being led along a jungle trail in Burma with his hands tied behind his back, a rope attached to his bound hands was held by a Japanese guard. The guard considered it sport to jerk the rope periodically, causing the American to stumble and fall. The American finally gathered a section of the lead rope in his hands, jerked quickly to pull the rope from the "Jap", and escaped by rolling down a hillside and hiding in some dense bushes. When the Japanese troops gave up the search, he got to his feet and traveled along the stream for three days before he encountered a native who released his

hands and aided him back to friendly lines. All this happened after the American had been tortured and questioned for days by his Japanese capturers.

One survival report contains the following quotation which summarizes well the philosophy of survival to be kept in mind in any future training program. "Whether a man returns after being forced down in either jungle or enemy territory depends largely on the individual concerned. No amount of survival equipment will help some men, while others through sheer ingenuity and determination and under similar circumstances will fare much better and return regardless of whether they possessed such equipment or not. It's largely a mental outlook--the will to survive is the deciding factor". That will can be influenced by a training program designed to show future fliers that survival is possible.

9. METHODS OF RESCUE OF ISOLATED PERSONNEL

The functions of the different agencies connected with rescue operations in the Pacific theatre of combat is an interesting, vigorous and noteworthy one. Various reports on these operations have been published and are available at the Department of the Air Force Library.

In connection with the current study it

is a pleasure to record the efficiency, thoroughness and kindness with which the various rescue organizations worked. In these reports it was noted that sea search and rescue was conducted primarily by PBY's, land search and rescue by B-25's and L-5's. Men isolated in life rafts were picked up by cruisers, destroyers, submarines, landing craft, and PT boats, as well as float-type sea planes and PBY's. One flier, in a life raft at night, signaled a passing boat whose silhouette was barely discernible. On his rescue he found the craft was the British battleship, H. M. S. Redoubt.

Land survivors were rescued by L-1's and L-5's, and by helicopter in two cases. Contact was made with land search parties, guerilla forces, or natives.

Search procedure in most areas was definite and determined. In Burma the standard policy was to search intensively for missing aircraft for a period of two weeks if necessary. The locations of crashed aircraft were marked on a master chart and, where possible, crashed aircraft were painted with yellow lines or crosses to indicate to future observers that that particular wreck was known. The position of land rescue teams and of located parties of survivors were also pinpointed and their locations indicated on a master map.

↓
The study

Conclusions

WW II

THIS STUDY is not intended to be a statistical analysis of survival episodes. It is an indication of the nature and range of experiences which can and did happen to 1000 men who were forced to leave aircraft during the combat operations away from their home bases. These men lived, returning to relate their survival experiences.

1. *Causes of inflight emergencies* were (with frequency in order of mention) lack of fuel, enemy action, faulty navigation, mechanical failure and, rarely, fire, collision, icing and pilot error during tactical maneuvers.

2. *Landing* was accomplished by parachute in most cases; some ditched and a very few crash-landed. One crew of a B-29 bailed out with little difficulty from an altitude of 20,000 feet.

3. *Duration of individual survival episodes* averaged less than 48 hours before contact was made with natives or rescuers; the longest recorded period of individual isolation was 23 days. Some fliers spent as much as 8 weeks awaiting rescue or traveling back to their bases, but these men were aided by friendly natives.

4. *Attitudes of natives* were friendly and cooperative 90% of the time. The few cases of native hostility were explained: a) in occupied territory they feared retaliation; b) they were mistreated or threatened by survivors; c) they were rewarded too lavishly by those they rescued and consequently became demanding.

5. *Relations with natives* were best when: a) the survivors made their presence known but permitted the natives to make the initial approach; b) a single native was contacted--rather than a group; c) the survivors appeared dirty, awkward,

and in need of help, and were willing to be an object of amusement; d) the survivors entertained with songs, games and tricks; e) rock salt, twist tobacco, and silver (not paper) money was discreetly used for barter; f) proper identification, such as a U. S. flag, was displayed; g) sign language, or the acting of expressions, was attempted.

6. *Injuries* were received by 90% of the survivors before they were rescued. 60% were hurt in landing; they received burns and bruises, teeth broken during the parachute descent by inadequately secured equipment, internal injuries, fractures, and amputations. On the ground, plant spines and leeches were exceedingly troublesome. Only one case of shock was reported. Many of the accounts emphasize a need for additional instruction in the application of first aid to one's self: isolated amputees could not apply tourniquets and bandages; solitary injured men did not know how to inject morphine syrettes to deaden pain. Good health, previous to a survival episode, resulted in better stamina.

7. *Medical equipment* was considered adequate by most survivors. Items commonly used include: ointments, iodine, band-aids and bandages, salt tablets, quinine, halazone tablets, potassium permanganate. Many men desired more insect repellant in unbreakable containers. A few suggested additional materials such as vitamin pills, adhesive tape, toothbrushes and toilet paper. Improvised medical equipment and native remedies were used when needed.

8. *Rest periods* were observed by almost all survivors; the only exceptions were the result of utter thoughtlessness or the necessity for speedy evasion. Many men rested part of every hour while traveling.

9. *Shelter* was usually considered as "something necessary for extended stay in one area". Men were ingenious in using materials at hand, such as parachutes, life rafts and palm fronds. After one uncomfortable experience, they usually avoided the insect infected native huts.

10. *Clothing* was repaired or improvised when necessary from parachute cloth and palm fibers. A large number of survivors did not "wear the shoes you might have to walk home in"; those who did have the high-topped GI shoes experienced little trouble. A third of the men stated a need for serviceable gloves for manual labor and as protection from thorns; the leather palmed canvas variety was favored.

11. *Water*, pure drinking water, was an ever-present problem. Many fliers boiled water; others treated it with halazone, iodine, or potassium permanganate. The erroneous ideas that filtered ground water is purified water and that running water purifies itself persisted in these stories. A few survived on animal body liquids (not "water squeezed from flesh", an erroneous suggestion). Others drank coconut milk, the sap from banana plants and various palms—any juice that was not milky or colored, that did not have a bitter or soapy taste. Sea-borne survivors drank, in addition to rain water, the blood of freshly killed birds and the body liquids from large fish.

12. *Food*, rations or native products, was appreciated in proportion to the hunger experienced. A downed crew in Burma at first accepted only boiled eggs from the natives; later they relished fried bees. Life raft survivors liked the fruit drops and bars and PK chewing gum in their emergency kits; they thirstily detested the crackers and cheese. Natives furnished many meals, ranging from fried water beetles to a 25 course banquet.

13. *Natural foods* on land were most plentiful along coasts and streams. Coconuts were by far the commonest item of diet; other plant foods eaten include

bananas, leaves and buds, bamboo shoots, roots, berries, palm cabbage, and sugar cane. Raw or cooked fish and birds, shell fish, monkeys, and a very few large mammals comprised the animal foods consumed.

Isolated individuals were more adventurous in the matter of using native or foraged food materials than were groups of men. Usually one man from a group was willing to try native foods. The others frequently joined in later on if nothing happened to the adventurous one. One man of a group usually acted as procurer and preparer of meals.

A large number of sea-borne fliers reported catching birds, particularly albatross. Many caught fish. One man chose to ignore a curious turtle rather than run the risk of capsizing his boat. The food caught from life rafts was eaten raw or sundried.

14. *Hazards* included enemy troops and collaborationist natives (encountered less than 10% of the time). Four reports mentioned snakes; in three instances the pythons were eaten. Tigers, elephants, sharks, crocodiles, black panthers, water buffalo and wild pigs were encountered rarely. Mosquitoes and leeches were customary problems. Plant spines and cutting grasses accounted for many superficial cuts. Fear of the dark, and of shapes, sounds and phosphorescence occurred occasionally. Sunburn was a hazard to life-raft occupants.

15. *Travel* was particularly difficult in enemy held territory. Survivors often paralleled trails rather than risk encounters with Japanese soldiers or collaborationists; many traveled only at night. Travel hints noted include: avoid swamps—except as hide outs; "part rather than cut" the vegetation; travel along ridges rather than in the overgrown valleys.

The importance of careful preparation, orientation and planning cannot be over-emphasized. If at all possible during the

inflight period of emergency, the navigator should tell the crew where they are, a landmark for reassembly, and plans for and direction of travel.

16. *Signal equipment and techniques* received detailed comment from many survivors. At sea, the equipment used most successfully (with frequency in order of mention) included mirrors, flares, dyes, parachutes and signal panels--several men did not know how to use the mirrors. On land, parachutes, signal panels and flares achieved results. The "Gibson Girl" radio was vehemently criticized (but in many instances the men did not know the proper use of the equipment), the Corner reflector, available only towards the close of hostilities, was highly praised. Several conflicting systems lessened the communi-

cation efficiency of the colored signal panel.

17. *Survival manuals* or "handkerchiefs" were mentioned in 47 reports as containing accurate and helpful information.

18. *The philosophy of survival* varied between individuals and groups, and between crews and passengers. Thoughts of suicide were more common to solitary individuals than to large groups. Mental, physical and factual preparation for survival was reflected by high morale; fliers were conspicuously more optimistic and energetic than passengers. "It's largely a mental outlook--the will to survive is the deciding factor." In general, the survival cases studied reflect credit on the training programs conducted by the Air Force.

References

MATERIAL for this report was first collected during the war years when the author was in charge of the Jungle Survival Program conducted at the School of Applied Tactics in Orlando, Florida. Interest continued in problems of survival in the tropics while the author was a civilian. Recently the opportunity to receive reserve training at the Air University, Maxwell Air Force Base, permitted additions to material on hand through a survey of more recent literature at the Department of The Air Force Library. The following list of references includes most of the periodicals examined wholly or in part for this material. Additional stories have been secured through personal interviews with men who underwent survival experiences but whose stories were not available in the periodical references cited:

Air Sea Rescue Bulletin.
 American Magazine.
 Air Command, S. E. Asia, Technical Bulletin.
 Air Pacific Fleet Letter.
 Aviation Safety Digest, 9th Marine Fighter Wing.
 Air Ministry Weekly Intelligence Summary.
 Air Operations Memo.
 Bureau of Naval Personnel Information Bulletin.
 Bulletin Escape and Evasion.

Colliers Magazine.
 Eastern Air Command Intelligence Reports.
 Eastern Air Command Weekly Intelligence Summaries.
 Headquarters 1st. Fighter Command, Intelligence Summary.
 Headquarters 13AF. Intelligence Summary.
 Headquarters SWPA, AAF.
 Liaison Memorandum, 1352 AAF Base Unit, Search and Rescue, India-China Division, ATC.
 Military Intelligence Division, WDCS Military Attache Reports.
 Naval Aviation Confidential Bulletin.
 New York Times.
 Rescue Advisory Memorandum.
 Rescue and Defense Division, Headquarters 4th. A. F.
 RAF Command Intelligence Summary.
 RMAZAF Intelligence Bulletin.
 Rodeo.
 Saturday Evening Post.
 Self-preservation Reports.
 Training Intelligence Reports.
 Weekly Intelligence Summary, Air Command, S. E. Asia.
 Weekly Survey, Netherlands Information Bureau Library.
 Yank.
 2nd A. F. Air Intelligence Weekly Digest.
 7th Fleet Intelligence Letter.
 7th A. F. Weekly Intelligence Summary.
 13th. A. F. Operations Analysis Reports.
 20th. Bomber Command Operation Analysis Reports.
 21st. Bomber Command Operation Analysis Reports.

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1. ADTIC Publication T-100, *99% Survives, An Analysis of Survival Experiences in the Southwest Pacific*, by Richard A. Howard, February 1950.
October 1949, Reprinted February 1950, 3rd Printing January 1953.
2. ADTIC Publication A-101, *North Pacific Survival Manual*, February 1950 (Restricted).
3. ADTIC Publication A-100, *Annotated Bibliography of Materials Relating to Polar Navigation*, compiled by William H. Allen, February 1950 (Confidential).
4. ADTIC Publication D-101, *Climate and Weather in the Central Gobi of Mongolia*, by Alonzo W. Pond, March 1951.
5. ADTIC Publication G-100, *It's the Little Things*, by Oron P. South, July 1950 (Secret).
6. ADTIC Publication G-101, *A Description of Peoples of the World*, published in Series Form, 1951—(continuing).
7. ADTIC Publication G-102, *Terrain and Climates of Korea and Adjacent Lands*, January 1952.
8. ADTIC Project 317.23, *The Korean People, Psychological Composition and Ethnology*, 25 August 1950. (Out of Print)
9. ADTIC Publication D-100, *Afoot in the Desert*, by Alonzo W. Pond, March 1951. Revised Edition September 1952.
10. ADTIC Publication D-102, *Sun, Sand and Survivals An Analysis of Desert Survival Experiences during World War II*. By Richard A. Howard. January 1953.