

KALYMNIAN SPONGE DIVING¹

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THE Greek island of Kalymnos lies approximately 137 km north of Rhodes, 450 km southeast of Athens and 24 km west of Bodrum, Turkey. For centuries the principal economic activity of the island has been sponge fishing, a difficult and dangerous occupation. Work and life aboard a Kalyrnian sponge boat at sea are demanding and involve exposure to a variety of physical and mental stresses. Obsolete and dangerous equipment; lack of proper sleep and nourishment; constant contention with rough seas and intense sun; inactivity and lack of recreation for long periods of time; absence from the home for as long as half the year; these are some of the circumstances which influence the crew's physical and mental condition on the job.

Obsolescence of equipment and lack of knowledge of decompression tables places the lives of these men in constant jeopardy. Bends, air embolism, asphyxia and squeeze are all common occurrences among this occupational group and their exploits have received attention in numerous popular and journalistic accounts throughout the western world. Little, if any, first hand data, however, have been brought to bear upon the problems of the Kalyrnian divers.

During May and June of 1965 the author conducted research with the Kalyrnian diving fleet off the coast of Libya. The research was undertaken as part of a larger cultural anthropological study of the island of Kalymnos and its sponge fishing economy. The analysis of related cultural materials proved crucial to the understanding of the

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high-risk option behavior of Kalymnian divers. This report outlines: 1) the physical conditions under which the men work; 2) their actual diving habits as observed and recorded for one month; 3) the Kalymnian folk medical practices associated with diving accidents; and 4) the industry's social and economic structure as it relates to the analysis of the game against nature played by Kalymnian divers. Column 7 of Table 1, showing the percentage of casualties occurring among Kalymnian divers, demonstrates this game to be a deadly serious one.

Four methods of diving are employed by the Kalymnians: 1) deep

TABLE 1

Kalymnian casualty statistics, 1950-1962 (Source: Greek Royal Navy, Piraeus)

| YEAR | NO. OF DIVERS | NO. OF BOATS | AVG. NO. OF DIVERS PER BOAT | PARALYSES | DEATHS | CASUALTY RATE * |
|------|---------------|--------------|-----------------------------|-----------|--------|-----------------|
| 1950 | 513 | 59 | 9.16 | 15 | 0 | 2.92 |
| 1951 | 429 | 48 | 8.94 | 12 | 3 | 3.50 |
| 1952 | 409 | 42 | 9.74 | 12 | 8 | 4.89 |
| 1953 | 305 | 34 | 8.97 | 7 | 1 | 2.62 |
| 1954 | 386 | 41 | 9.41 | 9 | 2 | 2.85 |
| 1955 | 409 | 44 | 9.30 | 10 | 2 | 2.93 |
| 1956 | 342 | 41 | 8.35 | 10 | 0 | 2.92 |
| 1957 | 386 | 44 | 8.77 | 11 | 6 | 4.40 |
| 1958 | 384 | 43 | 8.93 | 12 | 2 | 3.65 |
| 1959 | 351 | 36 | 9.75 | 8 | 0 | 2.28 |
| 1960 | 279 | 29 | 9.62 | 11 | 1 | 4.30 |
| 1961 | 247 | 28 | 8.82 | 7 | 1 | 3.24 |
| 1962 | 240 | 25 | 9.60 | 7 | 1 | 3.33 |
| 1963 | 257 | 39 | 6.60 | 7 | 3 | 3.89 |
| 1964 | 235 | 36 | 6.53 | 8 | 1 | 3.83 |

* Cases of paralysis plus occurrence of death per 100 divers.

sea or hard hat diving using the familiar dry suit and brass helmet; 2) mask-hose diving employing breathing masks of the Desco or Scott variety; 3) Scuba diving using the Cousteau-Gagnan Spirotechnique equipment; and 4) nude diving. This last form of diving was practiced for centuries on Kalymnos and has been known in the Greek Aegean probably since at least the time of Christ. This paper deals with deep-sea diving, the most common form of diving practiced by the Kalymnians. A discussion of the various forms of diving is given below in "Mechanics of Diving."

Composition of the production unit

Kalymnian sponge diving operations normally consist of three vessels: two sponge diving boats 10 meters in length and $3\frac{1}{2}$ in beam, round bottomed, and 1.2 meters in draft. A larger wooden vessel, over 15 meters in length, sometimes two masted, carries the food and fuel for the trip. The larger boat, called the mother ship or *deposito* has its own separate crew which roughly processes the daily sponge catch. Meals are prepared on the mother ship by a full time cook.

Five men comprise the crew of a sponge diving boat: the engineer in charge of the semi-diesel engine, the air pump, and other mechanical equipment; the tiller-man; the hose tender; the life-line or diver tender; and one deck hand. In addition to this basic crew, from 5 to 12 divers work on the vessel. On fifty Kalymnian boats (almost the entire fleet) working during the years 1963-1965 (inclusive), the diving boats averaged slightly under seven divers per vessel (see Table 1).

Divers and crew sign on for the entire trip which lasts from 5 to $6\frac{1}{2}$ months. Crew members are paid negotiated salaries above the minimum wage set by Greek Maritime Law. Divers work on a percentage of the income brought by their individual catches.

Sleep

The diving boats normally sleep 7 or 8 on bunks just over one and a half meters in length. For most of the men this space is inadequate for proper rest. The 5-man crew always sleeps on the diving boat so that in weather emergencies the boat has a full complement of sailing hands. Two or three divers also sleep on the diving boat and the remainder are bedded in the hold of the mother ship. At dawn the diving boats pick up their divers from the mother ship and travel to the sponge grounds, one to two hours distant. The diver who sleeps on the diving boat therefore can remain in bed during this time. Once the diesel engines are started, however, little if any more actual sleep is obtained.

Sleeping aboard the mother ship is preferred by some divers. In rough weather, the diver on the mother ship enjoys a more comfortable night's sleep than his confreres on the diving boats. Generally, also, there is room to stretch out full length on the floor of the mother ship hold.

Other variables regulating the amount of rest include the length of the day worked (which shortens as the summer season wears on towards autumn) and the place of the individual diver in the day's shift. Diving

rotates daily. When there are 7 divers, each man will be last and each will be first once each week. Averaging three hours between the first and seventh dive of the day, the last man on any day's shift may rest up to two hours longer.

Food and water

During February of each year a cooperative union of sponge captains opens competition for provisioning of the sponge fleet for the summer season. Bids are accepted from grocers and professional ship chandlers on estimated amounts of staples necessary to feed the fleet for the 6-month period. Table 2 shows the amounts purchased of the various staples of 1965 for a fleet of 44 boats employing approximately 500 men.

In addition to these staples, bulk lots of meat were also purchased. Measurement of food use at sea on one typical boat indicated that each man received approximately 600 grams of meat per week at the beginning of the trip and that after four months this figure fell as the supply became limited. The meat is usually fatty beef. It is salted and cut into small cubes and boiled in large quantities of animal fat. The fat and meat mixture is poured into five-gallon (19-liter) cans and the fat is allowed to congeal, sealing the meat and protecting it indefinitely. This preserved meat, or *kavormas*, is combined with the starch staples about two and a half times per week. At other times the starches are served as the main meal without meat.

Tomato paste is used in almost all the main dishes; sugar is used in the cooking of many dishes as an energy source; and olives are served with all meals for their high calorie value.

The largest item in Table 2 is flour, used in making hard tack bread. On a trip lasting half the year this allows approximately one pound of bread flour for each man per day.

The most striking aspect of food intake is that only one meal is served each 24 hours, at dusk. Since it is believed eating may cause bends, divers fast during the day. This rule is especially strict when work is conducted at depths beyond 120 feet (36.6 m). All meals are prepared in a large cauldron over a bottled gas flame. Two to five men eat from one bowl while squatting on the deck. In rough weather each man is given his own bowl so that the container can be held between the knees and kept from tipping over. Five main dishes are served: fasol beans with tomato sauce, macaroni and tomato sauce with and without meat, lentils with lemon and vinegar, fasol beans with olive oil,

and rice pilaf with and without meat. The rotation of these meals is left to the cook who tries to randomize his selection in an effort to make the small selection seem as varied as possible. Occasional meals of chick peas or potato-onion-beef stew help the cook in this randomization.

Extra protein is sporadically supplied through seafoods caught by the divers themselves between dives and during the evening hours before bedtime. These catches are prepared by the cook the following day. Complete consumption of fish, including head and eyes and liver (in larger fish) adds to the protein intake.

TABLE 2

*Amounts of various food provisions taken by the Kalyminian Sponge Fleet in 1965
(Approximately 500 men participating)
Source: Kalyminian Captains' Cooperative Union*

| ARTICLE | KG |
|-------------------|--------|
| Flour | 37,450 |
| Rice | 2,500 |
| Fasol Beans | 9,000 |
| Lentils | 2,500 |
| Chick Peas | 1,800 |
| Fava | 500 |
| Sugar | 6,000 |
| Olives | 4,500 |
| Tomato Paste | 3,750 |
| Sardines (salted) | 1,500 |
| Turkish Coffee | 1,100 |
| Marmalade | 2,000 |
| Cheese | 3,500 |
| Halvas | 2,000 |
| Cigarettes | 3,400 |

Eight 6-ounce (177 cc) cans of milk are given to each diver per month along with two pounds (0.9 kg) of marmalade to be consumed at his own discretion. This recent innovation is considered by the divers a great luxury.

Most of the divers carry a small hoard of private stores ranging from dried fruits and nuts to canned fruits, vegetables and stews. It was impossible to measure the effect of these items on general nutritional intake although they are also regularly supplemental to the main meat-starch diet.

Alcohol is strictly forbidden by law to be taken on small working

crafts, although it is common practice to do so among fishermen working at night in cold spray. Sponge fishermen may take along a personal bottle or two of *ouzo*, but this is almost always shared and drinking to excess is unknown at sea. Any note that a man has been drinking secretly from private stock or that he is hung over cuts him off from work that day. Such an occurrence would be an open admission of non-sharing with mates and blatant shirking of work. The miniature face to face social system places its own effective sanctions on excessive alcohol consumption.

Bread is of the hard tack variety and is baked on the island before the trip begins. It is taken in sufficient quantities for the entire journey. Since it is the most basic part of the fare, its quality is a topic of much discussion. Poorly prepared hard tack has been blamed in the past for "bust" trips as the result of poor morale among the men. The major distinguishing characteristic of hard tack is its tendency to become weevily. Towards the end of the trip no hard tack is eaten without careful inspection for weevils. It is broken into quarters against any hard surface and soaked in water for a few minutes until it is soft enough to chew.

Water, and its preservation in quantity as well as quality, presents another problem. Making every working sea hour count, a month often goes by before fresh water is taken on. It is stored in 55-gallon (2081) steel oil drums. A piece of ragged sponge is placed inside each one to absorb impurities, and the barrels are coated with cement to retard rusting. Nevertheless, rust forms, and by the end of a month the color and taste of the water may be quite disagreeable. The barrels are painted stark white, but exposure to the hot North African sun keeps the water tepid. On rare visits to port, the men go to cafes for iced soft drinks, and then indulge in a large and varied meal including fresh salads, vegetables and fruit, none of which are available at sea.

Approximately eight drums are taken, allowing thirty-five men in a production unit about 47 liters each. Clothes washing in fresh water is forbidden and morning toilet operations such as shaving, brushing of teeth and rinsing of face are done carefully to avoid wasting water. Occasional cases of socks washing and body washing occur as a means of defiance against the situation. The gambit is used as an assertion of man's importance. In effect, he dares the captain to try and stop him and he will almost always go without redress if he has been producing well as a diver.

Personal Hygiene

While morning toilet operations are allowed with fresh water, not much is consumed in this manner. Only three out of 14 divers studied brushed their teeth daily and only four others did so occasionally. Shaving averages only once in about 5 or 6 days and shampooing almost never as most of the men keep their heads shaved or nearly so until about 6 weeks before the end of the trip. At that time they stop haircutting and shaving altogether. Initial appearance with a beard upon coming home is a popular form of extroversion among the Kalymnian divers, symbolizing the fact that they have indeed gone through a difficult 6 months.

Toilet facilities are non-existent. In their place there are rules where defecation and urination may be carried out from the vessel. The bow is usually ruled out since the boats are normally turned into the wind. Amidships is absolutely ruled out since the foremast and the sail form a cross; it is considered a sacrilege to perform toilet operations anywhere within the cross's form. Some boats are reputed to have hung small sponges over the stern for anal douche although this practice is no longer found among Kalymnians. This practice was encountered among some individuals working in the Tarpon Springs, Florida, Greek sponge fleet in 1963.

Urination was noted to occur quite frequently at sea while defecation was relatively rare. Older divers would defecate every morning on rising while young men often went several days without defecating. All the men urinated several times each day, however. This may have been the result of: 1) standing or sitting in one place for long periods; and 2) the stated desire of divers to urinate between dives to eliminate the possibility of having to do so while on the bottom. Recent evidence shows that breath-hold divers urinate more when they are working than usually, although the actual physiology of this factor has not been adequately studied (K. E. Schaefer, Head, Physiology Branch, U. S. Naval Submarine Medical Center, Groton, Conn., Personal Communication; see also, McCally, 1965, for a summary of the possible mechanisms of immersion diuresis and speculations concerning the renal response of breath-hold divers).

The relative infrequency of defecation on the other hand, may have been the result of 1. low food intake; 2. inactivity over a long period of time; and 3. the discomfort of the operation, especially during rough weather.

Elements

During the long sponge trip the sun is a constant threat, for at sea severe sunburn is possible even on cloudy and hazy days. Divers keep themselves covered with clothing to prevent sunburn, though many of the deck crew go barefoot during the working day. There is no deck shelter from the sun, leaving only the forecandle and the main hold for shelter.

Rough seas and sea sickness are also constant threats. Owing to the size and shape of the sponge boats they are extremely seaworthy but pitch and roll easily. Most of the men are experienced sailors and take only a day or two to get used to the feel of the rolling craft. Many newcomers have severe cases of seasickness lasting as long as ten days (with decreasing intensity) and some of the older men also experience discomfort for a few days. Seasickness, however, is liable to strike even the most experienced hand sometime during the half-year trip. At these times the man is not allowed to dive. Some men will awaken seasick and out of pride neglect to mention the fact to the diving tender. Seasickness and severe currents may increase nausea on the bottom causing the diver to regurgitate in the suit. In diving done with self-contained apparatus or with hose to mask equipment, this is especially dangerous and divers are encouraged to excuse themselves from a dive at the first sign of nausea.

Spray is something to be lived with on a sponge boat. It is at least partially responsible for the high incidence of colds and rheumatic attacks among divers.

There is a great concern with keeping fit and avoiding these common ailments which effectively limit a diver's production capacity. So-called "pep" injections are taken along and some men keep their own syringes and supply of injection vials. These medications range from B-Vitamin complexes to rheumatic pain killers. A variety of pills are also taken though generally the injections are considered more reliable. All of the men take some pills and/or injections in which they believe implicitly, and the boat's stores include anti-cold injections and rheumatic pain killers. Recently a very few of the men have begun taking vitamin C tablets but this is still not generally practiced.

Morale

One of the most difficult of the working conditions encountered in Kalymnian sponge diving is the length of the trip. Table 3 shows the

average length of the diving trips for the different diving equipment systems in use on the island. With the exception of the nude diver operations, the boats remain at sea almost continuously during this time. Any extra supplies needed are obtained by the mother ship and brought out to sea to the working boats. Three days each season are regularly scheduled holidays; these are June 29, August 15, and September 4, the three major Greek Orthodox holidays during the summer. Other days off include emergency engine repair and other fortuitous circumstances. Production normally begins slowly as the men get back into shape after 6 months of loafing and drinking. It picks up quickly and remains at a peak for a four-month period. During the last month or month and a half it falls considerably as the men begin thinking of returning to their homes and begin taking fewer chances and staying down fewer minutes. In an occupation where the casualty rate is often five and sometimes as high as 7%, work naturally slows down as going home becomes a reality.

TABLE 3

Length of diving season for various diving systems

| DIVING GEAR USED | DAYS IN SEASON |
|------------------|----------------|
| Nude Diving | 150 |
| Hose-Mask | 165 |
| Scuba | 160 |
| Deep-Sea | 194 |

The winter is also used for diving but only the deep sea gear divers can withstand the cold and all winter work is done in local waters from Rhodes to Limnos. No actual diving is ever done in Kalyminian waters by the Kalyminians themselves, although other diving operations come to Kalymnos to dive in her waters for the fine wool sponges around her steep shores. While some say that it is superstition that keeps the divers from diving in their own waters, the captains in the fleet argue that it is difficult to keep morale high on a boat where the men are away from home for so long. It would be impossible if they were in sight of their island's shores.

Absence from home for so long a time brings about a decline in production through its effects on the morale of the men. Anxiety about family problems, fidelity of women, health of children and other personal

problems is high. This high anxiety is accentuated by the close living conditions, lack of adequate sleeping facilities and lack of adequate recreation and activity. Most of the men feel resigned to their fates as a life that they have to lead. Indeed, given the social and economic situation on the island, until recently sponge diving was the only means of earning a living for some men.

Open violence is absolutely forbidden; it is intolerable on a small vessel because of its effect on the morale of the entire crew. There is, generally, a lacuna in the ability of men to "let off steam." This problem is partially solved by the divers by burying themselves in their work.

As the men wrap themselves in their work severe competition develops on a day to day, week to week and month to month basis in terms of sponge production. Divers often risk staying down after they are signaled to surface if production potential appears good on the bottom. Some accidents are probably caused in this manner.

Mechanics of diving

Nude diving is the oldest form practiced and is noted in some of the ancient chronicles. According to Frantzis (n. d., pp. 126-128) use of sponges is reported in both the *Illiad* and the *Odyssey* as well as by Aristotle who notes that warriors cleaned their armor with sponges. Pliny the elder reported that Roman women of the aristocracy used sponges in their famous baths and nude diving is reported as the means of collecting these sponges. In addition, both Halley (1952) and Cross (1965) list a number of references to sponge fishing in the Aegean, including the Rhodian Sea Law dating around 400 B. C.) In 1964, 17 boats were still operating from Kalymnos with a total of 55 nude divers. In this operation, the diver stands at the rail. The captain uses a glass bottomed bucket to spot sponges growing on the bottom. At a signal, the diver goes over, head first, a 13-kilogram marble elipse held out before him. This stone is pierced on one end and a rope extends to the boat. The diver uses the stone elipse as a weight and as a steering mechanism. As he approaches the bottom and sees the exact location of the sponge, he turns the elipse like a rudder and guides his own trajectory through the water.

The nude diver has a rope basket around his neck onto which he places one or two sponges. He places the stone under one arm and picks up the sponge with the free hand. As his breath gives out he

pulls hard on the line signalling that he is ready to come up. Two men topside pull the line in with great speed. In waters up to 150 feet the whole operation from deck to deck again does not take more than approximately 1.5 minutes. Some divers with better breath control can spend an extra half minute on the bottom and the operation may extend as long as 2.5 minutes in some extraordinary cases. Each man makes at least 8-10 dives a day, sometimes as many as 20.

The folk-lore literature has exaggerated the romance and danger of nude diving including the disastrous effects of vertigo, shark-bite, coral poisoning and attacks by various other sea life. Nude diving lacks entirely the dangers of bends, asphyxia (not including drowning), air embolism or squeeze. Since this paper deals only with diving accidents occurring as the result of surface air supply use, the reader is referred to the large literature on nude diving in various parts of the world, *i. e.*, Cross (1965), Clark (1951) and Mericourt (1869).

Around 1870 a new form of diving was introduced to the Aegean on the sponge fishing island of Symi. The now-traditional deep sea diving gear spread rapidly through the Aegean which at that time held a dozen thriving sponge industries. It reached Kalymnos in the mid 1880's. In spite of "mysterious" maladies which many divers seemed to suffer as the result of using the new gear, it was so very productive that it was an immediate success.

The hard hat gear used today has not changed very much since its first introduction. Its nearest counterpart is the Mark I Navy diving helmet. Four windows, without grills, are used in the helmets and there is one no-return valve used for adjusting air pressure level in the suit by the diver himself. The valve is located on the inside of the helmet near the right temple and it is pushed outward with the head for air release.

When the diver jumps into the water (this is the only case to the writer's knowledge of deep-sea divers jumping off a boat rather than descending on a ladder) he allows his suit to fill with air and tests it for leaks before descending. He then releases air through the helmet valve, decreasing his buoyancy, and descends steadily to the bottom.

The helmets are almost never replaced, being repaired again and again in blacksmith shops on the island during the winter season when most of the boats are home. The same is true of the breast plate and other metal parts of the diving suit. The suit itself is replaced when worn, although it too submits to patching. The suits are one-piece with no back lacing and are purchased yearly through the captain's coopera-

tive buying union. The suits are thus of the latest type while the helmet remains antiquated.

The diving hose is of the standard variety and is purchased in lengths when necessary. The hose is never tested for pressure and only links which leak beyond repair are replaced. The newest and best links of the hose are kept closest to the diver. The strongest links should be near the surface in terms of difference in air pressure. The Kalymnians, however, prefer to have the strongest links near the diver because of the large number of cases of nitrogen narcosis ("rupture") which result in pulling the diver up by the hose.

In the 1920's a modified deep sea system was introduced and quickly gained favor among the Kalymnian sponge fishermen, although it did not spread as well among the other major sponge fishing centers of the Aegean. This system, known locally as *Fernezen*, after the man who introduced it to the islands, consists of a close-fitting face mask fitted with a diving hose. No other equipment is necessary except for weights to bring the diver to the bottom. In the hard hat systems, the weights are large chunks of lead hung over the shoulders of the diver. One hangs on his back, the other on his chest. The "Fernez" divers, diving nude except for the face mask, carry the nude diver's stone down for weight and work on the bottom holding the marble elipse. When the equipment was first introduced, it did not attract any converts from the hard hat systems but became a useful addition to the nude divers who adapted it to a way of diving they were already used to.

In more recent years, wet suits have been added to the "Fernez" system and cold is not so much a problem, although it is noted in Table 3 that mask-and-hose diving systems stay out only 165 days while the hard hat divers work for 194 days.

Within the last few years, new innovations have been made on the traditional equipment. Notable among these has been the "narghile" or "kopreseer" diving system and the introduction of the scuba type gear for underwater work in sponge production. The "Kopresseer," so named for the small air compressor used, is a modification of the "Fernez" system. The mask is of a newer variety, often full face, rather than the goggle type still used by the "Fernez" divers. Lead weights are worn on a belt (instead of the 13-kilogram elipse carried by the "Fernez" divers) and flippers are worn for propulsion. This system is especially suited for use in Greek waters where the bottom is uneven and mountainous. It allows the diver to cover the sides of large under-

water rock formations by foot and flipper propulsion while leaving both hands free to work.

Scuba gear was introduced in 1963 and has had three successful seasons on the island to date. Most of the divers are distrustful of the gear, stating that it is too unsafe for really deep work, that it is impossible to keep track of the diver, and that a hard-hat man probably produces equally well. The main advantage of the self-contained apparatus is that more than one man can be down at the same time. But this eliminates life line unless the divers work close together and in sponge production there is no need for more than one diver to be on a single sponge bed at the same time. Most Kalyminian divers, therefore, will not learn scuba diving and do not believe in its future in the sponge industry. The exponents of the gear maintain that the industry is dying as the result of competition from synthetic sponges and that the only way the natural sponge industry can compete is to produce more and sell for less. They see scuba systems as their salvation in a dying market.

The two scuba diving operations carry their own compressor for filling bottles, and the "kopresseer" systems run off of a small gasoline-run compressor capable of supplying proper air to a single diver working at up to 150 feet. The bulk of the diving operations, however, are the "Fernez" and hard hat systems, the latter the more trusted and the more traditional on the island. Both these systems are supplied with air from a two-piston, double action pump, similar in design to the U. S. Navy Mark III diving pump.

The air pump is torn down each winter and washers are replaced. A number of accidents, however, have been reported as the result of air being pumped out of the hose coupling and not down to the diver. The pumps are run mechanically off a belt attached to the boat's engine and are equipped with a clutch for neutral while the diver is on board ship.

One extra air pump is carried on the mother ship in the event of the total breakdown of the one in use on the diving boats. The efficiency of the pumps could not be accurately rated but certainly no greater than 80% would be expected. Similar pumps were run by hand before engines were introduced in the early 1920's. A standard diving pump of this kind can deliver adequate air for one diver working at no more than 27 meters when a pumping crew is operating at 30 revolutions per minute. Divers would work well beyond this 27 meter limit (up to 64 m), and this might largely account for the greater casualty rate in

the early days of hard-hat diving on Kalymnos. The engine-driven pump can run at more than 60 RPM and can supply fairly adequate air for one diver beyond 55 meters when run at full speed.

The engine-driven pump alleviated the problem of supplying adequate quantities of air to the one diver working on the bottom, but it created another problem: that of adequate quality of air supply. The running of the air pump from an engine necessitates constant greasing, and some of the engine vapors arrive at the divers' air supply along with particles of grease and other dirt. This was evidenced by the covering of grease found on the inside of the glass helmet plates after only a short dive. Furthermore, running the pump off the engine increases the temperature of the air reaching the diver. Some deep-sea systems are now using compressors rather than piston pumps. The air is compressed and stored in a tank before it is sent to the diver below and the temperature of the air breathed is considerably lower than that delivered by piston pumps. Divers unanimously noted 1) that they were more comfortable breathing colder air; 2) that they did not perspire as much (the result of easier thermo-regulation); 3) that they breathed more slowly; and 4) that they were more efficient generally when breathing cold air. Changeover to compressors capable of supplying deep water hard hat divers is expensive. The future of the industry does not appear stable enough to warrant installation of new equipment.

The dive with deep sea gear

Diving begins at dawn, by which time the boats have made their way from the mother ship, lying inshore, to the deeper sponge-bearing waters. For the first few days diving is irregular, each man taking one or two dives and getting used to the work again after a five or six month lay-off. After about a week, diving work begins in earnest and equitable shift schedules are formed.

As the boat approaches the spot where the captain has decided to begin fishing for the day, the first diver is dressed by the deck hand. In accordance with tradition, the diver crosses himself three times during the dressing and tightening of the breast plate. He then takes his place on the railing of the starboard bow. The helmet is washed out by the hose tender by dipping it over the side and rinsing it in the sea. The glasses are cleaned with a form of wild sponge, gritty in texture and containing a kind of soapy, foaming liquid. The weights are hung over the diver's neck and the life line tender attaches the life line to

the diver's waist and checks to see that the breast plate has been properly fitted. The diver is finally belted around the waist with a cinch rope to keep air from reaching the lower extremities and to give him greater mobility under water.

As a result of this practice the legs of the suit, under deep water pressure, fit very tightly. This often causes surface capillary traumatization in the calf area. The gross morphology of the calf region in divers with long experience tended to give the impression of great flaccidity. In addition, older divers were able to pull hair from their calf with almost no pain reaction. When asked to tighten their calf muscles, little if any change occurred in the appearance of the calf, giving the impression that divers were unable to constrict their calf-muscles, or that these muscles were severely atonic. On the other hand, under-water work in the heavy suit is done mostly on the toes and ball of the foot as the diver pushes his way through water and currents in search of sponge. High calf-muscle tone might therefore be expected. Divers maintained that the apparent flaccidity of the calf muscles was due to long wear of the tight diving suit. The lack of skin sensory perception in the calves of older divers might have been due to constant skin traumatization or to the residual effects of previous cases of leg-centered bends. All divers interviewed on the subject (18) who had five years or more experience had been subjected to several cases of bends. Since heat loss is much greater in the tight fitting leg region of the suit, the apparent flaccidity may have been partially the result of adaptive development of subcutaneous fat in the calf region.

On the bottom the diver allows the upper portion of the suit to remain partially filled with air. By wearing the waist cinch and keeping air out of the lower half of the suit he maintains vertical position under-water as well as free and quick leg movement for propelling himself around the sponge beds. During ascent the diver allows the upper half of the suit to fill with air until sufficient buoyancy is attained to float him to the surface. By carefully controlling the air flow through the helmet valve, the diver completely controls his rate of ascent and descent. One of the most frequent mishaps among novices is the result of lack of skill in using this technique of "controlled blow-up" for ascent: they rise to the surface ballooning the suit. This, of course, places them horizontal and helpless on the surface. Ballooning, or uncontrolled blow-up results in extremely rapid ascent and is especially dangerous.

When all gear has been checked out, the life line tender screws

the helmet on. He instructs the divers to go over, usually reciting a religious benediction. The diver responds by crossing himself and jumping over the side. This is a jump of about eight feet from the bow into the water and is a dangerous and difficult manoeuver. Some men do a single or one and a half twists in mid-air as they go over, deliberately fouling their lines, and then straighten them out again when they hit the water. Defiance of danger and hardship is a trait manifested in almost all aspect of the Kalyrnian sponge diver's life. The lighter dressed "Fernez" diver often jumps three meters clear of the boat, legs extended and one arm flailing in mid-air as the other arm holds the marble elipse which will carry him to the bottom.

When he reaches the bottom, the diver signals the life line tender by pulling once on the life line, and the time count of the dive begins. The next diver up makes the count using a half-minute sand glass. At each turn of the glass he yells "torna." The hose tender, feeding and taking in hose slack as needed, stands amidships starboard facing the depth gauge located on the cabin bulkhead. He keeps up a continuous chant announcing the number of fathoms the diver is working in and the number of half minutes the diver has been down. With each change of depth and with each yell of "torna" the hose tender changes his chant. Some boats now use time pieces but at sea an ordinary alarm clock is apt to be unreliable; thus, the use of the sand glass persists. It is acknowledged by most divers, however, that the danger in the use of the sand glass lies in the man who is holding it. If he should get into a conversation with someone on deck and forget to turn the glass when it runs out, the diver's life may be placed in jeopardy.

While the diver is down the boat is geared to him. He is free to go wherever he chooses in search of sponge, and the tiller man keeps the boat running in tight circles around the diver's bubbles. When currents are strong and the diver can work with them, he may cover over a mile in half an hour. When the currents are against the diver he is often unable to move even a meter. When this occurs, the diver comes up so that the boat may move to a more favorable position. Normally, deep sea gear is considered the more adequate for heavy current (over $1\frac{1}{2}$ knots), though one diver using Desco equipment in Tarpon Springs, Florida, has reported harvesting sponge in currents well over three knots.

The actual harvesting of sponge is a skill which comes with time. A diver must be able to distinguish the wild sponges which have no

commercial value from the good commercial sponges, and he must be able to recognize three or four different species. Sponges do not often appear in the open but must be found among vegetation and in crannies. The good diver not only knows what signs to look for in finding sponges, but also conserves his energy, does not work against the current unless absolutely necessary, and does not run or jerk about in any sudden movements. He has control over his movements. The resulting work efficiency, even at an advanced age, may make him a more valuable producer than a youth with enthusiasm and bravery but a lack of experience.

Divers begin their work at age 18 and continue until their late thirties and early forties. It is not unusual to find men in their fifties still diving, however, and two men still diving in 1965 were over 60 years of age, each with over 40 consecutive years of diving experience. Normally, older divers work the shallower depths. Their technical skill is highly valued here since the shallow waters are constantly worked by all the boats. In order to make the shallow depths pay off therefore, more time must be spent on the bottom in search of sponge. These so-called "shallow" waters are often 33 or 36 meters, well beyond the limit where most divers begin feeling the effects of nitrogen narcosis. The older, more experienced divers are usually able to keep their heads under these circumstances and will have fewer accidents through their prudence and skill at controlling the effects of "rapture."

Among the younger divers, lack of prudence is definitely a mark of high status. The ability to face death and to do so purposely is considered the hallmark of manhood in any young Kalyminian diver. Most serious diving mishaps involve men under twenty-five. When the time for ascent has been reached, the life line tender informs the diver with a signal on the life line. The diver has the option of answering that he is gathering good sponge and that he would like a few minutes extra. The tender informs the diver well before the limit of time has been reached in case the diver is in the middle of good productive efforts. The diver is allowed one more such answer and on the third call must begin his ascent. In many cases, however, the diver refuses to come up and unties his life line. The life line is then hauled up, the tender announces the fact to the boat, and all hands wait for further commands.

The diver is allowed one or two minutes, sometimes more (depending on the depth of the dive) to voluntarily begin his ascent. Usually the diver begins his ascent within a minute or two. As soon as he breaks

the water the tender throws the life line to him so that he may be pulled in gently towards the ladder. These cases are very frequent, possibly as many as one dive in ten. The high percentage of instances in which the man voluntarily begins ascent after a minute or two suggests that actual "rapture" accounts for only a fraction of the cases and that a deliberate ostentation accounts for the majority. In cases where severe nitrogen narcosis occurs, and the man throws off his life line, it is almost always necessary to raise him by the hose. This is much rarer, however only three cases were observed in over 115 dives recorded.

The life line tender operates on self-reckoned diving tables. He assesses the diver's mood and physical condition. He watches to see if the man works with or against the currents and whether or not the diver works the sponge bar slowly and evenly or if he rushes and is jerky in his movements. He studies the rate of bubbles to ascertain how evenly the man is breathing. Considering the depth and the time spent on the bottom in conjunction with all these other factors, the tender determines the length of each dive for each man. He is legally responsible for life and limb of the divers and his word on the length of each dive is absolute law. Only if the diver unties his life line, effectively breaking off communications with the seat of authority, does the responsibility of his life fall on himself. Table 4 show that tenders do not ordinarily allow their men to remain on the bottom beyond the limits of safety for single dives set by U. S. or British Navy diving standards. Most of the cases in Table 4 Column 3 are the result of untied life lines.

When the diver comes up he tells the tender if the spot bears more working, in which case the next man will descend in the same spot. If production is sparse, the boat moves on for five or ten minutes and the next man jumps on a new sponge bed. This scheme is continued all day until all the men have made three dives or until as many dives are made in the day as time, weather conditions, and the divers' health will allow.

Prevention and Treatment of Diving Accidents

Since World War II the casualty rate has generally decreased over pre-war years for at least three reasons: 1) the increased pressure of the law on diving standards; 2) technological advancement in diving equipment; and 3) the increase in the proportion of older, more prudent divers in the profession as the industry declines and loses its recruiting potential.

TABLE 4

Diving statistics: first hand observations (Columns 1-4) and reports (Columns 5 and 6)

| 1 | | 2 | 3 | 4 | 5 | 6 |
|--------|----------|-----------------|--------------------|---------------|----------------------|----------------------|
| Depth | | Avg. time spent | Extreme time spent | Avg. ascent * | Recommended total ** | Recommended limiting |
| (feet) | (meters) | on the bottom | on the bottom | time | ascent time given | time on bottom |
| | | (minutes) | (minutes) | (minutes) | Columns 1 and 2 | given Column 1 |
| | | | | | (minutes) | (minutes) |
| 102 | 31.1 | 29 | 52 | 4.9 | 15 | 45 |
| 108 | 32.9 | 31 | 45 | 7.9 | 20 | 45 |
| 114 | 34.7 | 31 | 50 | 4.8 | 25 | 40 |
| 120 | 36.6 | 29 | 44 | 3.5 | 20 | 40 |
| 126 | 38.4 | 29 | 40 | 4.2 | 25 | 35 |
| 132 | 40.2 | 25 | 34 | 4.8 | 20 | 30 |
| 138 | 42.1 | 22 | 29 | 4.6 | 20 | 30 |
| 144 | 43.9 | 25 | 38 | 5.7 | 30 | 25 |
| 150 | 45.7 | 21 | 38 | 7.1 | 30 | 25 |
| 156 | 47.5 | 19 | 25 | 5.9 | 25 | 25 |
| 162 | 49.4 | 16 | 28 | 6.1 | 25 | 20 |
| 168 | 51.2 | 14 | 19 | 5.2 | 25 | 20 |
| 174 | 53.0 | 13 | 15 | 5.6 | 20 | 20 |
| 180 | 54.9 | 12 | 16 | 5.1 | 20 | 20 |

* Ascent time did not differ from one dive to the next in the repetitive diving schedule for any single diver. There was great statistical deviation in ascent patterns among different divers, although no diver approached the accepted standards of ascent time given in column 5.

** For single dives. Column 2 does not include descent time, since this is not counted by Kalymnians. An average of three minutes at all depths must be added to include time for descent and column 5 must be adjusted up 20% to account for this difference in column 2.

In earlier years, before World War II and in the early fifties when the natural sponge industry flourished, the casualty rates were reputed to have been higher with as many as 20 men lost in a single season. Documentation was not available for the years before the war since the island was then Italian and the records are not now available in Greece. As late as 1959 however, there were 17 recorded cases of paralysis and one death as the result of diving accidents. Only 8 of these 18 cases for 1959 appear on the records of the Greek Admiralty as only the registered compensation cases are recorded. Since not all divers carry merchant seaman papers, only some of the accidents finally appear on the record. Full records for the years 1957-1965, however, were available through the harbor master's office of the Island of Kalymnos. A check of Tables 1 and 5 shows an average discrepancy of 28% between the actual casualty rate on the island and that listed in the official Admiralty records for the years indicated in Table 5.

While the casualty rate has reached as high as 7% (1965), it has averaged around 4 to 5% in the last nine years. This figure represents only those accidents which finally resulted in death or permanent paralysis. Data collected over a period of ten and a half months on Kalymnos and at sea, indicates that over 90% of all diving accidents are treated and cured at sea. At sea, in a single month, one death, two cases of paralysis, and at least nine cases of minor bends were noted among a total of 19 divers under observation.

Kalymnian divers, until very recently, were entirely untrained in the medical aspects of diving hazards. They formulated their own theories concerning the causes and the proper treatment of bends from the observable data collected over an eighty-year period. Novices were (and still are) trained by watching experienced divers for one season. Then they were put into a suit and sent down 36 meters or more. Most hose boys and deck hands were recruited fresh each year, the previous year's complement either dropping out of the industry because of its hardships, or going on to become divers.

Since 1962 a government sponsored school has been opened on Kalymnos which gives a 40-day course to prospective young divers. Older divers are also encouraged to take the course. The 40-day course emphasizes the theory of diving and tries to break down the physics into simple mechanics that the men can absorb easily. Many men are now espousing the views of the doctors who teach the course in diving medicine but most of the men still seem to doubt whether any of this information, if

valid, has anything to do with the day to day problems of being a sponge diver. Some of the younger men said they understood the mechanism of released pressure and were quick to relate to me the popular analogy taught in the school of a beer bottle being opened too quickly and the boiling of a man's blood in rapid ascent from great depths. Even those divers who said they understood the provenience of bends however, engaged in rapid ascent. The greatest recorded ascent time was approximately 8 minutes. This occurred on a man's third and last dive in a single day after he had spent 20 minutes at 38 meters. His previous two dives were similar with the exception that his ascent time was under 5 minutes in each case. He explained, on surfacing, that he thought it best to "take it easy" on ascent after his strenuous day.

TABLE 5

Diving accidents from 1957-1965
Source: Harbor Master's Office, Kalymnos

| YEAR | DEAD | PARALYZED | NO. OF DIVERS | CASUALTY RATE |
|------|------|-----------|---------------|---------------|
| 1957 | 7 | 15 | 386 | 5.70 |
| 1958 | 2 | 12 | 384 | 3.65 |
| 1959 | 1 | 17 | 351 | 5.13 |
| 1960 | 1 | 12 | 279 | 4.70 |
| 1961 | 1 | 8 | 247 | 5.26 |
| 1962 | 6 | 7 | 240 | 5.89 |
| 1963 | 3 | 8 | 257 | 3.89 |
| 1964 | 1 | 8 | 235 | 3.83 |
| 1965 | 6 | 9 | 192 | 7.61 |

The traditional and most frequently related cause of bends cited by Kalymnians is as follows: it is noticed that most diving accidents take the form of direct, localized pain and that most of these cases involve the legs. It is concluded that the pressure of the depths causes the diving suit to squeeze the blood into the top half of the body by cutting off circulation from the hips down. During ascent, the blood is said to go to its normal circulation in the body. But if ascent is too fast it will cause severe blockages of circulation in the legs or the lower part of the body. If the blockages occur in the legs, the man may be paralyzed. If the pains are "front and back" or through the midsection of the body the man may die. Other symptoms such as temporary blindness, loss of speech, twitching, or pain in the arm or head are

considered to be part of the mystery of bends. This explanation is a composite of an older one, in which the length of time spent on the bottom was considered the only relevant variable, and the modern one taught in the school.

Several methods are employed for the prognostication of bends. The most important of these are the cigarette test and the body search. As soon as a man surfaces and comes aboard a lit cigarette is placed between his lips. If he cannot inhale the smoke he is immediately resuited and sent down for recompression. Divers compare the sensation of smoking when one has a severe chest cold to that experienced when smoking immediately before an attack of bends.

Skin bends, or extravasations of the skin resulting from rapid ascent, are sought in a thorough body search after each dive. The genitals and underarm areas are investigated through the use of cosmetic mirrors carried specifically for this purpose. Body searching is continued every half hour for three hours after a particularly deep, long, or strenuous dive and once every hour in normal dives (see Tables 2 and 3).

Kalymnians claim to be the only divers in the world who practice this body searching. Aware of the high risk factor in their work methods, they claim the body search a mandatory precaution. It is believed that diving again on the same day after skin bends are discovered is tantamount to inviting death or paralysis.

After the body search is made, the diver remains awake and quiet until the time for his next dive. He is neither allowed to sit in uncomfortable positions, or to make himself comfortable by placing his legs or back against a hard resting place. This prevents the appearance of red pressure marks on the skin which may be mistaken for skin bends during body searches.

Despite concern and a host of folk-medical precautions, bends do occur regularly and are treated by direct water recompression. The most severe cases (and the lowest recovery rate) occur among divers using mask-hose type gear for two reasons: 1) they dive deep and tend to work very rapidly because of their relative freedom of movement; and 2) they do not recompress in the water in case of bends but rely on massages and heat treatment to relieve their symptoms. Direct water recompression is avoided because it is believed that prolonged exposure in the wet suit used by mask-hose divers is more dangerous than lack of any recompression. One case was witnessed where severe bends occurred on a boat using mask-hose gear and the stricken man was brought to a nearby boat which was using deep-sea gear. The second

boat relinquished its gear to recompress the stricken diver but more than 6 hours had passed since the bends had begun and recompression was unsuccessful.

No tables are used in recompression. Regardless of the depth at which bends are contracted, the diver is sent down to between 14 and 20 meters where he "hangs" in the water by means of controlled buoyancy. In cases where the diver is entirely paralyzed, a diver from another boat will go down with him to let the air out of the suit.

The diver hangs in the water for two hours at which time the tender signals to ask if he feels any better. If the diver says that he feels entirely cured, he will be brought up. Often the diver is bored from hanging in mid-ocean for so long and signals to surface even though he is not feeling right. He then must be re-immersed. In severe cases, 14-hour recompression periods have been reported as successful, according to usually reliable informants.

If the diver recovers with direct water recompression, he is then allowed to rest for a while and is given hot coffee. Since relapses are common and the method of recompression inefficient, the diver is kept awake for at least one day so that he will know immediately if numbness or paralysis begins to set in. In one instance a diver was re-immersed in the middle of the night after feeling well for 5 hours after initial recompression.

After initial recompression the diver is kept warm; he is rested on the mother ship and fed three times a day; his clothes are changed often; and the mother ship crew performs various operations to try and relieve the paralytic symptoms. The diver is rubbed vigorously with oils and alcohol for half an hour three times a day and he is given warm baths at least twice a day. Several informants reported treatments of "sand baths." Ten shallow holes are dug in a row on the sandy beaches of the North African Coast and the diver spends five or ten minutes in each one, covered with the hot sand. As he absorbs the heat, he is transferred to the next hole, and so on. Another massage method employs pieces of cork which are rubbed over the affected area to stimulate circulation.

When the diver shows some improvement, he is allowed to return to his diving boat during the day where rubdowns continue. Once each day he is given a turn to dive even though he may still be unable to walk. As he shows improvement, he may be allowed two dives per day and finally, as soon as he feels able to do so, he may walk the bottom. He continues this practice until it is evident that he has reached the

limits of his improvement. Numerous stories are related of divers being entirely cured from total paralysis below the waist in periods ranging up to 6 weeks.

For cases where the diver is entirely paralyzed below the waist, the mother ship carries a urethral catheter. Most experienced life line tenders can insert the catheter. If the diver is still unable to urinate various measures may be taken, including rolling the man, nude, across heated metal fuel drums, and/or inserting a needle of rolled onion skin into the penile orifice. Cork may also be rubbed around the kidney areas to stimulate circulation.

Some Cultural Parameters of Risk Taking

To recapitulate, the Kalymnians as a group employ extraordinarily risky methods of diving. These include rapid, no-stage ascent; untying of life line and refusal to obey the commands of the tender; and some overstaying of bottom time. The gross casualty rate is very high, although the majority of bends are minor and are cured with direct water recompression. The curing of minor bends at sea notwithstanding, the net casualty rate is still much higher than that allowable using U. S. Navy diving tables for ascent.

It would be fatuous to assume, as some journalistic writers have in the past, that these men are unaware of their casualty rates. They believe that the high casualty rate is attributable to a combination of overstaying bottom time and rapid ascent. That they account for the accident rates with the wrong medical reasoning is irrelevant. Given their own cultural framework and knowledge, why do they choose to accept the risks of death and paralysis? The cultural factors which influence this choice are of two categories: 1) honor of debt; and 2) status and role of the diver in Kalymnian society.

The chain of events leading to high risk behavior in honor of debt begins before the boats sail from the island, when divers are recruited for the trip. Divers do not receive a salary but work on a fixed percentage of their own sponge catches. The average diver negotiates a contract of 40%. This means that when the sponges are sold the following winter the diver should receive from the captain, 40% of the money his own catch brings on the market. If the diver catches one hundred and fifty okas (one oka = 1260 grams) of sponge selling at 900 drachmas per oka, then the diver should receive 54,000 drachmes or \$1,800 U. S. currency.

With the exception of first and second year novices the divers all know their approximate production potential based on previous records. Captains, of course, also keep track of these records. The law requires that divers receive a sum of money as an advance on their wages before the boats leave for the six months trip. This money is used ostensibly for maintenance of the breadwinners' families during the long absence from the home. By law, no man is entitled to more than 26,000 drachmes (\$867.00) in advance. The divers of Kalymnos, however, demand and receive the total amount they will probably be worth when the trip is over and the catches are sold. Divers rationalize their actions with a "no-tomorrow" philosophy: since they do not know if they will return from the trip, they want all their money in advance so they may have one final "fling" before leaving. As a result of labor shortages, aggravated in recent years by migration of the island's youth to the cities and to foreign ports in search of better economic opportunities, captains traditionally accede to the divers' demands. The bank advances capital to the captains based on the legal limits of advance payment. The captains are then forced to borrow the rest at exorbitant interest rates (from 20% to 40%) from outside sources. This immediately places the captain in debt for more than he can pay should the trip fail. He now must choose a strategy which optimizes his ability to get out of debt while still preserving his income resources (including his boat, his credit, etc.).

This strategy covers mistakes the captain may have made in his negotiations with divers over advance funds. A man who takes 60,000 drachmes (\$2000), for example, must bring up 165 okas of sponge selling at 900 drachmes (\$27.00) per oka if he signs on at a 40% rate. By reaching this quota he can make back the \$2000 which he owes the captain. On the basis of their past performances many men demand this much money, a considerable sum by local standards. Sometimes however, past performances lie and the advance becomes a liability for the captain. A man may get scared on a particular trip and fail to produce well; he may get sick; or he may have a relatively light case of bends which keeps him out of the diving suit for a few weeks. Divers are not legally responsible for debts incurred by accepting advance money. Many captains, therefore, make their best efforts to find promising novices. These fledgling divers will hire-on for around \$800 and at a percentage of only 30%. If they are good finds as neophytes, they will produce far more than they must in order to pay back their

advance. The captain would legally have to pay the excess when the sponges are sold. However, it is possible for the captain to juggle the accounts, placing the excess sponge produced by a dynamic apprentice in the tally of the underproducing but experienced diver. The captain thus assures himself of evening his accounts.

This should not suggest that divers are completely irresponsible. One of the strongest motivations of a Kalymnian diver is to extricate himself from debt to the captain by producing the proper quota of sponge. Not only does his pride depend upon honoring his debts, but his ability to ask for the same salary or more the following season depends entirely upon his production record in the preceding one. Thus, although divers are aware of the financial gerrymandering done by captains, they still feel motivated to produce their quotas and more. It is not what shows on the juggled, legal records of production which counts in terms of a diver's value, but what the captains actually know is the man's real production record at sea.

Even when a man is producing well, he may choose to take chances designed to publicly demonstrate that 1) he is not afraid of anything; and 2) that he has the best interests of the captain at heart—that he is really trying his best to make the best production record even at the risk of personal injury. Such is the nature of the occasional risks taken by divers in untying their life lines and overstaying their bottom time limits. Repetitive diving and rapid ascent, however, the blatant cause of high casualty records among the Kalymnian divers, is not an occasional risk-taking pattern decided individually by individual divers. It is an entire production strategy which optimizes both the captain's and the diver's earning power. The law allows each diver three dives a day. If each dive, including descent, ascent, bottom and dressing time were only half an hour long, seven divers would take up ten and one half hours a day, not including time spent between dives looking for new sponge beds. Three dives each day are required for a diver to make his daily quota relative to his debt to the captain. And rapid ascent is almost a necessity for all the divers to make three dives during the daylight hours.

This strategy places heaviest reliance on optimum allocation of production resources and is further exemplified in the dive pattern. The first and third dives are normally shorter than the second. The first dive is considered a "warm up." If it is a strenuous one there is a likelihood that skin bends may occur. In this case, the diver loses his

second and third dive for the day. On the third dive a man is tired and more susceptible to severe bends. If skin bends occur as the result of a strenuous third dive the man may have to sit out at least his next three dives the following day. Skin bends resulting from a hard second dive normally reduce by one the number of dives a diver can make in a single day.

Another aspect of risk taking derives from the particular social setting within which the industry is imbedded. Sponge fishing is a Kalyminian occupation by tradition and until very recently largely self-contained. The capital funds, the personnel, the market, the entrepreneurial talent were all recruited from the island. Divers and other sponge fishermen were not simply laborers but part of a social system within which they were, and still are, folk heroes. The image of the folk hero is a hard mantle to maintain but easy to wear. The cost of maintaining it is the high casualty rate, the high risk potential, the constant facing of death. The payoff is threefold: 1) monetary wealth. A sponge diver getting over \$2000 for six months work earns two and a half times the annual pay of the average laborer with the same educational level; 2) social prestige; and 3) the ability to use the money for hedonistic purposes. When the boats come back to the island in the winter, the men spend a good deal of time in taverns and coffee shops, gambling and carousing. Behavior of this kind would not be tolerated by the society for any other occupational group.

The ability to engage in socially sanctioned anti-social behavior in fact, was one of the chief drawing cards for young men to go into the occupation. But part of the price for these rewards is the maintenance of the folk hero image. When that image is built upon a system of death defiance, the actual physical costs may come high.

SUMMARY AND ABSTRACT

The sponge divers of Kalymnos live and work under extraordinary physical and psychological conditions. They remain absent from home for half of each year, working with as many as 15 men on small fishing craft (10 × 3.5 meters). The men eat one meal each 24 hours; the main dish is a rotation of beans, macaroni, lentils and rice. Aside from the psychological and physical discomfort of poor living conditions, the men work under dangerous circumstances. The hallmark of manhood among Kalyminian divers is intrepidity to the point of defying death. They pay no attention to the standard rules of diving, especially the

rules of stage ascent. In 1965 the casualty rate was over 7%. The Kalymnian case demonstrates in dramatic terms the interaction of cultural norms on physical as well as mental health.

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