

## Do Randomizing Devices Aid Marine Hunters? Shark Fishermen in Pacific Mexico

James R. McGoodwin

University of Colorado

*ABSTRACT* Do randomizing devices aid hunters in locating their prey? Several studies suggest they do, although different types of devices are efficacious for locating different types of prey in different circumstances. This article discusses how shark fishermen in Pacific Mexico employ a randomizing device in order to help them locate schools of sharks passing through their fishery. The similarities and differences between the use of this device and the utilization of other types of randomizing devices by other hunters are compared.

Hunting and fishing are often perceived as games of strategy by hunters and fishers themselves, yet the complex strategies that hunters and fishers employ is a neglected topic in most contemporary anthropological studies of such peoples. While early studies of hunting and fishing peoples did often describe actual food-getting strategies in great detail, no doubt as a complement to their parallel interest in material culture, by comparison today's studies almost seem to take it for granted that their subjects will be successful, thus relegating *how* they succeed to matters of secondary or trivial concern.

### Randomizing Devices as Aids to Hunting

In an interesting study published over three decades ago, Moore (1957) proposed that certain hunters might actually increase their chance of success by performing divinatory rituals which they believed would help them to locate their prey. This was an astonishing idea, since, as Moore stated, "Magic is, by definition and reputation, a notoriously ineffective method for attaining the specific ends its practitioners hope to achieve through its use" (Ibid.:69).

Moore's observations derived from his study of an ethnographic account by Speck (1935) which described rituals involving scapulimancy performed by the Naskapi Indians living in the forests and barren ground of the interior plateau of the Labradorian Peninsula. In order to locate their prey, migratory herds of caribou, the Naskapi performed rituals in which a shaman held a carefully cleaned caribou scapula over hot coals for a short time, then withdrew it and 'read' the cracks and charred marks on the bone for clues as to where the hunters should direct their efforts next. Moreover, because the cracks and charred marks appeared on the bone more or less at random, without any attempt on the part of the shaman to influence where they would appear, the hunters were sent out to look for the caribou herds in essentially random directions.

MAST 1989, 2(2): 134-53

From Speck's account Moore noted that "... when the Naskapi do have information about the location of game, they tend to act upon it," whereas "... it is when they are uncertain and food supplies get low that they turn to their oracle for guidance" (1957:71). Of course, this behavioral pattern could have easily been interpreted as a means of helping the hunters cope with the mounting anxieties they must feel when the hunt is not going well. Moore, however, concluded differently by proposing that the divinatory rituals actually gave the hunters a slight edge they would not otherwise enjoy in the absence of performing them. He reasoned that by letting the marks which appeared on the charred bone determine the hunters' strategy it became more difficult for the prey to learn how to anticipate, and thus evade, the hunters' closure with them.

By extending an idea put forth by Tylor ([1871]:80) while also drawing upon the work of Von Neumann and Morgenstern (1947), Moore drew parallels between divinatory rituals such as those performed by the Naskapi and the efficacious utilization of randomizing devices in games of strategy. Thus he wrote:

... some classes of interactional problems can be solved optimally by means of a 'mixed' or 'statistical' strategy. In order to employ a statistical strategy it is necessary to have, adapt, or invent a suitable chance mechanism ... human beings require a functional equivalent to a table of random numbers if they are to avoid unwitting regularities in their behavior which can be utilized by adversaries (Moore 1957:73).

Note also that Moore's assertions about the advantage the Naskapi realized by performing their divinatory rituals assumed that the behavior of the hunters and that of their prey was interactionally articulated, a matter to which I will return shortly.

Moore is not the only writer who has likened hunting activities to games of strategy. Pálsson (1989:10), for instance, cites a passage from Izaak Walton's *The Complete Angler* (1653) which states that fishing was "... a game for princes and noble persons," then elsewhere states that among early Western explorers "Fishing was a game, a test of sportsmanship."

Indeed, the formal elements of games of strategy are implicit in many contemporary studies of marine fishers, particularly those which are concerned with 'information management.' Thus, it has been widely observed that competing boat skippers in their communications with one another are involved in a minimaxing game of sorts in which they strive to minimize their losses of information concerning where fish are located while striving to maximize their informational gains about the same.<sup>1</sup> Similarly, although in a much broader sense, Gatewood's (1983) description of the complex mosaic of social, interpersonal, environmental, and economic constraints which influence the decisions of skippers of Alaskan purse seiners concerning where to fish suggests a complicated socioeconomic game which might be called 'skipper's dilemma.'

Particularly germane to the discussion here is William Davenport's (1960) article, "Jamaican Fishing: A Game Theory Analysis," in which various fishing strategies available to Jamaican fishermen were analyzed according to formal game-theoretic principles. Certain Jamaican fishermen, he noted, had to decide

how many of their fish pots they should deploy on different fishing grounds which were associated with different probabilities of profit and loss. Thus, by formalizing the fishermen's decision problem into a game-theoretic framework, Davenport 'solved' their problem, concluding that their yields would be optimized if they randomly deployed their fish pots in certain definite overall proportions on the various fishing grounds. Moreover, he concluded, since the fishermen's actual behavior conformed quite closely with the optimum grand strategy suggested by the formal, mathematical game, it seemed reasonable to assume that they had worked out the optimum solution to their problem after years of experience, trial, and error. Note also here that quite unlike Moore's conclusions concerning the efficacy of the Naskapi divinatory rituals, Davenport's analysis made no assumption that the Jamaican fishermen's game was interactional in the sense that the fish could anticipate the fishermen's moves. Thus, the Jamaican's random-search pattern was efficacious for other reasons.

### Hunting at Sea

That there are strong similarities between offshore fishing and terrestrial hunting has been commented upon by several students of fishing societies: Pálsson (1989:7), for instance, summarized various arguments which assert that fishing is "... best considered as a kind of hunting activity," while Leap (1977:252-57) examined fishing-related terminologies in 33 languages and concluded that their native speakers regard fishing as different from hunting only "... with respect to the commodity which serves as the focus of the subsistence effort" (cited in Pálsson 1989:7). Similarly, several studies of modern fishing have explicitly likened the character of offshore marine fishing to that of hunting: Orbach (1977), for instance, in his wellknown book about the tuna seinermen from San Diego entitled *Hunters, Seamen, and Entrepreneurs*.

Some of the more obvious similarities between terrestrial hunting and offshore marine fishing include the capture of wild prey, having little control over the prey's movements and activities, having a keen understanding of the natural environment in which the prey lives, predominantly male working groups, an heroic association with hunting or fishing activities in local societies, high degrees of geographic mobility, having physical strength and stamina, personality attributes emphasizing boldness of individual action combined with an ability to work cooperatively with other members of one's group, and so forth.

On the other hand, there are many important differences. Fishers and their prey live in utterly different environments, for instance, and are not as interactionally articulated; the marine environment is less differentiated, ever moving, and perceived as essentially flat from the fisher's point of view; marine prey are more hidden because they dwell beneath the ocean surface, leaving behind no tracks and seldom providing other clues concerning their whereabouts; ocean fishing is considerably more dangerous than most terrestrial hunting; and marine fishers have greater difficulty asserting rights of ownership or access to their prey because most living marine organisms are common property resources.<sup>2</sup>

### Shark Hunters of Pacific Mexico

In this article I describe how commercial shark fishermen from a small town in Pacific Mexico hunt for their prey. Like the Naskapi caribou hunters these fishermen also employ a randomizing device in order to help them locate their prey. However, the device itself, the rationale underlying its use, and how it benefits these hunters of the sea is quite different from what Moore claimed for the randomizing device used by the Naskapi caribou hunters.

Teacapán, a small rural town with about 5,000 inhabitants, is home to the shark fishermen I studied. The town is situated along the Pacific coast about 80 kilometers south of Mazatlán, a large urban port and resort center (see Figure 1). I first went to live there in 1971, spending over a year in the community, and subsequently I have revisited it many times for briefer stays. I am also a foster parent to a boy from this community who lived with me in my home in the United States for several years, and I still maintain ongoing communications with several local people. Moreover, in the course of my various field studies in and around Teacapán I have accumulated approximately 5 months time accompanying the town's shark fishermen in their fishing activities.

Culturally the Teacapaneños reflect the traditions of modern rural-mestizo Mexico, while economically they would be classified as impoverished in terms of their overall standard of living. A traditional 'folk' people only two decades ago, they have by now been greatly acculturated to modern values through their exposure to radio, television, and visiting tourists (see McGoodwin 1986). Thus, while many remnants of their former folk culture remain - the survival of magico-religious beliefs regarding the causes of ill health, for example, as well as resorting to local *curanderos* (curers, or healers) in the event of illness - their local culture is now based mainly upon modern value orientations. This juxtaposition of their modern values with the fact of their poverty also makes many of them feel restless and unsatisfied with their position in the world, and truly the community is a difficult place in which to live, manifesting practically all the maladies which are associated with poverty in the developing nations. Even the town's most affluent inhabitants still have a standard of living which is considerably below the average standard in most of the developed nations.

### Teacapán's Local Shark Fishing Industry

Shark fishing is a prominent activity in Teacapán which contributes to the welfare of nearly half of the town's total populace. The 19 men who own the town's shark-fishing boats are all heads of affluent local families, while some 80 regular crewmen and an equal number of ancillary workers derive incomes from the activity which far exceed those obtainable in most other jobs around the town.

While the local community has long been the site of maritime societies, it was only recently - with the outbreak of World War II - that the Teacapaneños began to fish offshore. Prior to that their fishing activities were confined to the surrounding inshore estuaries and lagoons where they harvested shrimps, oysters,

and large table fish.<sup>3</sup> However, when global-scale war broke out in the early 1940s the Allied Powers began to offer high prices for shark-liver oil, which is rich in vitamins, minerals, and other nutrients useful in the treatment of convalescent soldiers. Thus, several Teacapaneños took up offshore shark fishing and acquired its basic skills, technology, and capital.

The local industry dwindled after the war ended, then nearly disappeared as synthetic vitamins were developed which duplicated the valuable ones in shark-liver oil. However, over the past three decades it has made a nearly complete recovery – this time based upon the marketing of diverse products obtained from the sharks: fins, for example, which are exported to the Orient and are the most valuable product by weight, as well as domestically consumed products such as hides, salted meat, liver oil, and meal made from the scrap.

Because the local shark fishing industry provides its participants with healthy incomes and is also associated with danger and individual daring, it has an heroic mystique in Teacapán. The shark-boat crewmen are locally esteemed as the town's *hombres del mar* (men of the sea), a unique local identity which they alone can claim. Moreover, local children often doodle pictures of the shark boats in their school notebooks and nearly all townspeople have at one time or another enjoyed a ride in a shark boat around Teacapán's harbor, particularly during the annual *Fiesta Marino* (Maritime Fiesta), which takes place in June at the close of the fishing season.



Photo 1. The shark boat owners gaily decorate their boats and give the townspeople free rides around Teacapán's harbor during the annual *Fiesta Marino* which takes place in June at the end of the fishing season. (Photo by the author.)



Photo 2. Wooden-hulled launches such as these resting at anchor in Teacapán's harbor are the preferred fishing crafts among Teacapán's shark fishermen. (Photo by the author.)

Over the past several years around 30 fishing boats have been involved in the local shark-fishing industry. Most of these are sturdy, wooden-hulled, diesel powered launches, although there are also a few simpler crafts such as motorized dugout canoes, fiberglass shell boats with outboard motors, and steel-hulled craft fitted with diesel engines. Local fishermen jokingly refer to the steel-hulled craft as "floating funerals" because they lack flotation and will sink very rapidly if they broach or otherwise take a large wave abeam.

The larger, wooden-hulled launches are the preferred crafts for offshore shark fishing and comprise most of the shark-fishing vessels used by the Teacapaneños. Typically, these are around 30 feet long by 10 feet through the beam and are equipped with a powerful diesel engine which drives a single screw. They represent a considerable investment within the context of Teacapán's depressed economy and low income levels (costing around 75,000 pesos, or \$6,000 U.S. in 1973).

Other than simple compasses, none of the shark-fishing boats are equipped with any other navigational gear, not even fishing charts, nor do any of them carry any electronic equipment such as radio transceivers or fish-locating devices. A few vessels are equipped with rubber inner tubes which the crewmen can utilize in the event that their vessel sinks, but otherwise none of the crafts are equipped with any other lifesaving gear such as life jackets or inflatable lifeboats – a sobering thought considering they sometimes voyage as far as 80 miles from the mainland shore in this very productive shark fishery.

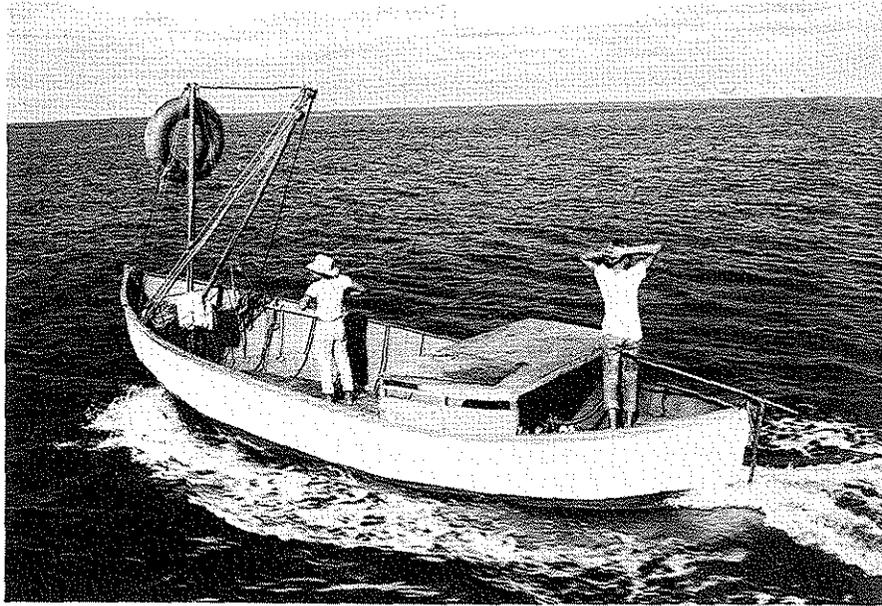


Photo 3. Two brothers in a steel-hulled craft going out in the morning to deploy their longline. The Teacapaneños refer to these vessels as "floating funerals" because they lack flotation and will sink very quickly if they broach or otherwise take a large wave abeam. The rubber inner tube atop the mast is the only lifesaving equipment on board. (Photo by the author.)

Shark-fishing activities mainly take place around *Isla Maria Isabelita*, a small island approximately 20 miles off the mainland coast and 50 miles by sea south of Teacapán (see Figure 1). A primitive work camp on this island is the fishermen's home throughout most of the long shark-fishing season (December through early June). A few women also come to the island during the season to cook for the men, for which they are paid wages.

Nearly all the shark fishermen state that they greatly enjoy shark fishing and would not consider doing any other type of work which is available in and around Teacapán. Shark fishing pays well, they stress, while life around their island camp is superior in many ways to life in the town – more peaceful, more comfortable, better food, and so forth.

Fishermen state that the length of a voyage is "as long as the salt," meaning that once the bags of salt they carry to the island to preserve the catch are all used up they will return to Teacapán to sell their catch. However, once home they are rarely in town for long because the boat owners are interested in maximizing their boat's production during the fishing season. Thus, the fishermen spend very little time in Teacapán during the nearly seven-month long shark-fishing season. Indeed, the resulting long separations from one's families, lovers, and friends are the most deplored aspect of the profession among shark fishermen themselves, and undoubtedly this in conjunction with the occupation's

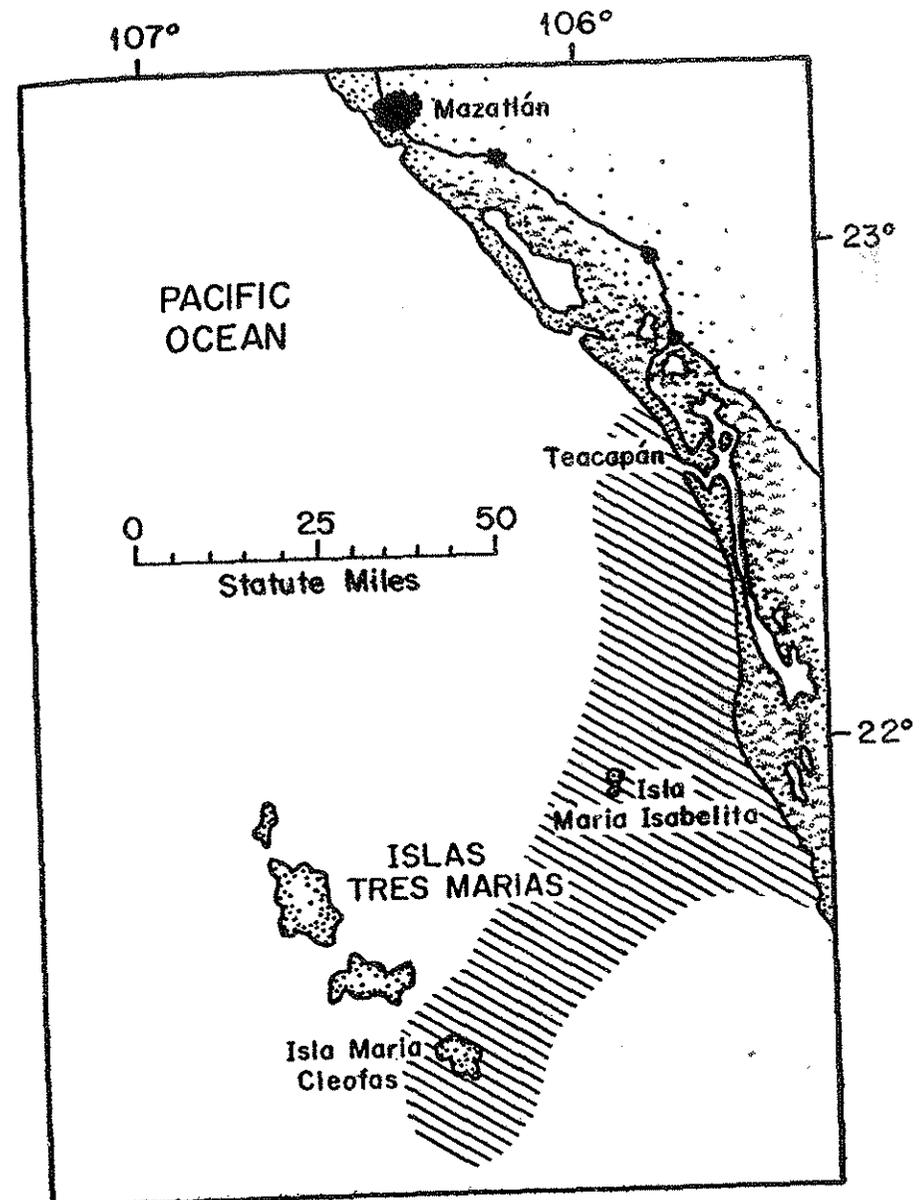


Figure 1. The Customary Range of Teacapán's Shark Fishermen. Shark fishing occurs in the shaded area.

hard work and great hazards helps to explain the high incomes the fishermen earn.

Most shark boats require three crewmen and crew organization is explicitly

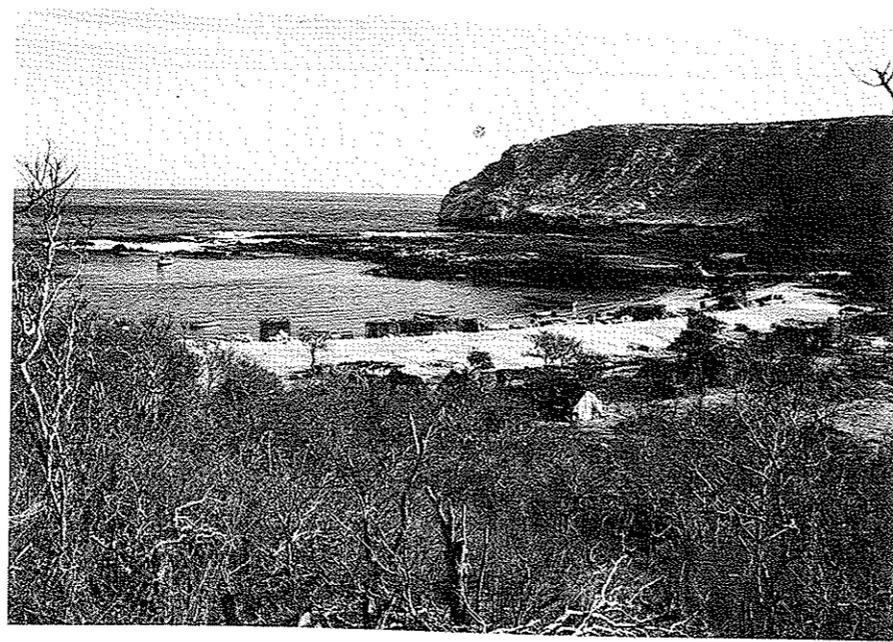


Photo 4. The Teacapaneño's shark fishing camp is situated along a cove on the Isla Isabelita's leeward shore. Salting tables and curing sheds stand at the water's edge, shark meat and fins dry in the sun along the beach, while the men's cooking shacks and sleeping tents are located still further back from the shore. (Photo by the author.)

hierarchical, consisting of a *jefe* (boss, captain or skipper), a *marinero* (sailor, seaman, or mariner), and a *pavo* (an apprentice). The *jefe* and *marinero* spend more time on the water than does the *pavo*, who instead spends most of his time engaged in processing work at the island camp. Moreover, one of the crewmen, usually the *pavo*, is always present in the island camp to safeguard the boat's gear, the crew's sleeping shack, and the processed catch.

Experienced shark-boat crewmen constitute skilled labor and command good compensation, which is paid upon the basis of shares from the proceeds of the catch which are agreed to prior to making a trip to the island. Thus, it is a fortunate boat owner who has several sons or other working-age males who share his household, since by asserting his dominant position as patriarch of his family he can usually secure their labor at a fraction of the cost he would incur by hiring able crewmen from outside his household (see McGoodwin 1976).

When a boat returns to Teacapán its catch is unloaded, weighed, and sold to a buyer who pays the boat owner for the catch. Next the boat owner reimburses himself for his fuel and gear expenses from out of these gross proceeds. The remaining proceeds are then divided according to whatever predetermined shares were designated for the boat owner, *jefe* and *marinero*. The *pavo* usually does not share in these proceeds, but instead is permitted to sell whatever shark-liver

oil he was able to render while at the island camp – a job experienced crewmen consider too distasteful, tedious, and malodorous to be worth the effort. Nevertheless, because the *pavo*'s share constitutes a part of the overall shark catch the other crew members often refer to the *pavos* as “spongers” or “parasites.”

The main method utilized for catching sharks is to deploy longlines in deep water several miles away from the island camp. These lines are placed along the sea floor where the fishermen feel their prey is most likely to be caught. With only minor changes the longlines could just as easily be made up so that their baited hooks ran along near the surface. However, a few fishermen tried this in the past and always got very poor results.

A typical longline consists of approximately 200 meters of oil impregnated line with approximately 100 chain leaders running off it at regular intervals. Large hooks baited with chunks of pelagic fish are attached at the end of each leader. Anchors are also fastened at each end of the line in order to hold it securely along the sea floor, yet these are light enough that a shark can easily tow them across the sea floor sands, which prevents the line from being broken by even the largest sharks. Attached near each end of the longline are also two other lines which run up to the surface. One of these is tied to a large glass float while



Photo 5. One of the Teacapán's shark boat owners holds a drum of fresh drinking water which has just been brought aboard prior to departing on a voyage to the island camp. Immediately to his right are his three sons who work with him, while to their right two other boat crewmen watch a mechanic who is working on the boat's engine. (Photo by the author.)



Photo 6. A shark fishing boat which has just returned to Teacapán with its catch. The boat owner (standing in the stern) looks on as the crew shows him the catch in the hold. A fish buyer from Mazatlán (wearing a hat at the extreme right) will buy the catch once it is unloaded and weighed. (Photo by the author.)

the other is attached to a block of polystyrene foam with a cane pole inserted through it. A small flag is also affixed to the top of the cane pole to facilitate spotting the longline's location from long distances away. Moreover, except for the polystyrene block with its cane pole and flag, the Teacapaneños obtain most of the remaining gear that makes up the longline by taking Japanese longlines they sometimes find in the waters which have also been set out to catch sharks.<sup>4</sup>

The work routine around the island is rather monotonous. Every day the crewmen arise before dawn, voyage out to the lines, haul in the sharks, and rebait and reset the lines, sometimes also relocating them. Then they return to the island with their catches, bring these ashore, butcher them, and salt the various products. The salted products are then put in curing sheds for a short while before they are placed in the sun to dry.

Hauling and re-setting the line requires precise teamwork, while undoubtedly hauling in the sharks is the most dangerous activity associated with this type of fishing. As the sharks are brought aboard the deck becomes slippery with blood and slime, while at the same time a number of unhooked sharks are often seen swimming in tight circles around the boat, attracted by the blood in the water as well as that running off the boat. Sometimes these free-swimming sharks become so frenzied that they bite into the boat's wooden hull or its metal rudder or screw, and particularly when they bite into the metal parts one can

sometimes hear their teeth breaking - a very disquieting sound. Certainly this is no time for a crewman to fall overboard!

Working as a team the crewmen methodically haul in the line, remove the sharks from it, and coil the line and stack the hooks and chain leaders out of the way. Most often the sharks are already dead by the time they are brought aboard, having exhausted themselves and drowned following their struggle on the line. Sometimes, however, as the fishermen haul in the line, there may be a large shark caught on it which is only groggy and still very much alive. Should such a shark abruptly kick its tail and run a crewman on deck may be caught by surprise as coils of line, chain leaders, and hooks suddenly fly through the air. The flying hooks may snag one of the crew members, dragging him overboard and pulling him down into the clear blue water. When this happens he must quickly rip the barbed hook out of his body so he can get back to the surface before he drowns.

Many of the Teacapán's shark fishermen have ugly scars on their bodies resulting from getting snagged by flying hooks and being dragged overboard. A few fishermen have even drowned when they were unable to extricate the hook from their bodies as their comrades on deck struggled to pull them back to the surface, unable to haul in the line against the resistance of a large shark which was too strong for them. Nevertheless, when asked how they feel about the

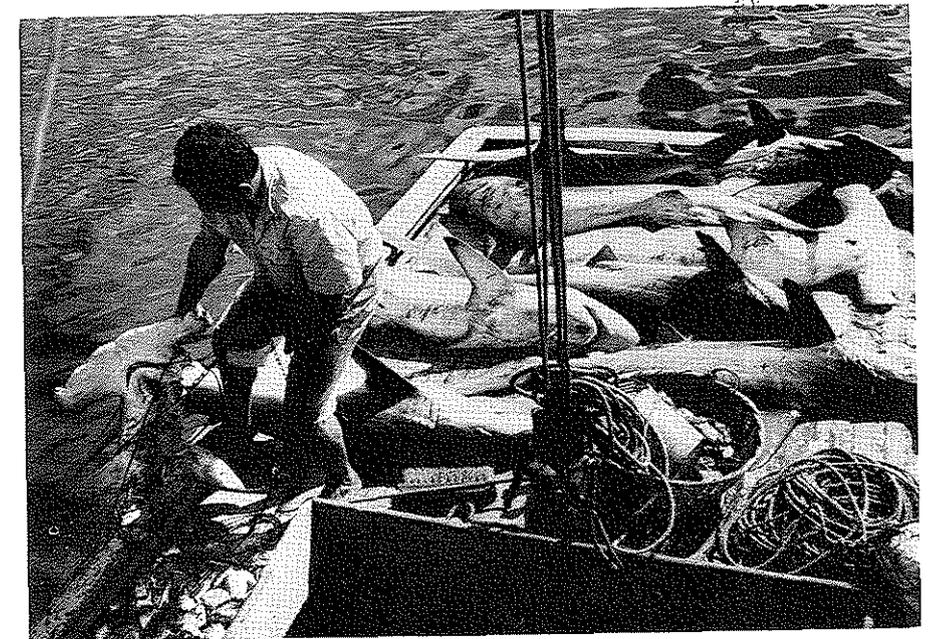


Photo 7. Fisherman hauling aboard a shark while carefully feeling the line to see if there are any live sharks on it in the water below. This is the most dangerous phase of the Teacapaneño's shark fishing activities. (Photo by the author.)

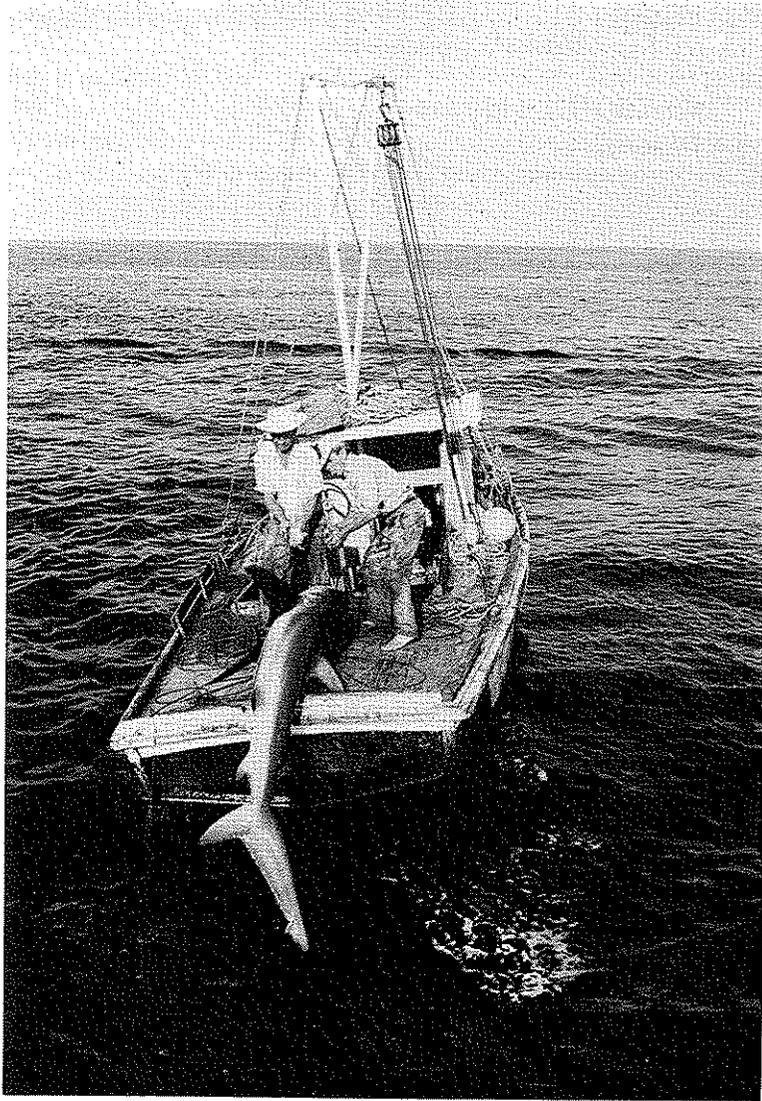


Photo 8. Two fishermen with a large shark they have just hauled in over the stern. On a particularly good day these boats may catch as many as 50 such sharks, in which event they may return to the island camp with their decks nearly awash. (Photo by the author.)

dangers associated with their work most crewmen merely shrug it off. "Me, afraid of sharks?" a fisherman once said to me. "No way. We're eating *them*, not vice versa."

During a few weeks in the Spring some of the boats utilize a different method for catching sharks: gillnetting. The method is quite productive, although only



Photo 9. Fishermen re-deploying their longline after hauling in sharks, one paying out the line while the other baits the hooks with chunks of fish. Note the glass float in the water which is of Japanese origin and was taken by these fishermen when they found a Japanese longline in their fishing grounds. (Photo by the author.)

a few boats are equipped with gillnets because of their great expense and the relatively short season during which they can be used. Moreover, while gillnetting is not as dangerous for the crewmen as longlining, it is still very risky for the boat because the gillnets are deployed in shallow water – in the surf zone near the mainland shore.

For a few weeks each Spring schools of spawning sardines concentrate in the surf zone near the mainland shore, bringing with them great numbers of feeding fish and sharks. During this spawn sharks of all sizes swim up and down the coastline – in the shallow troughs paralleling the beach – often in water no more than a meter deep, their mouths agape, scooping up the sardines as well as other fish which have also come to feed on them.

Little decision making is involved concerning where to deploy the gillnets. Once spawning sardines are observed in the waters around Teacapán those boats having gillnets merely return to certain customary sites along the mainland coast near San Blas, a small port town which is situated nearly 80 miles down the mainland coast south of Teacapán. These sites have always yielded dependable catches during the Spring sardine spawn.

As I discussed in a previous article about these fishermen (McGoodwin 1979), the risks and uncertainties associated with this type of fishing engender many cooperative activities among these men who are otherwise economic competitors. However, one of the most interesting is the cooperative strategy they utilize to locate sharks when their daily catches begin to dwindle.



Photo 10. Butchering sharks at the water's edge of the island fishing camp. Note the salting tables and curing sheds in the rear ground. Left of center a fisherman has just withdrawn an unborn shark from its mother's uterus, which is practically the only shark product that the Teacapaneños themselves consume. (Photo by the author.)



Photo 11. Shark fishermen repairing gillnets which will be set at customary sites along the mainland coast. (Photo by the author.)

### The Teacapaneño's Random-Search Strategy

Unlike most terrestrial prey animals, sharks seldom manifest clues concerning their whereabouts which are visible from above the sea surface. While television and motion pictures have fostered an impression among the general public that sharks customarily cruise just below the water's surface with their dorsal fins jutting into the air, sharks actually spend most of their time well beneath the surface. Thus, sharks remain mostly invisible to fishermen seeking them, providing few clues as to their whereabouts.

Moreover, while sharks are ubiquitous in nearly all the oceans and seas around the planet and exist in good numbers off the Pacific Mexican coast, for the Teacapaneños to be economically successful they must locate dense aggregations of sharks which will make possible obtaining consistently large catches on an almost daily basis.

Fortunately, aggregations of sharks are commonplace along this coastline during most of the Teacapaneño's long fishing season as various migratory species, particularly the hammerheads, pass through these waters in dense schools. Thus, for Teacapán's shark fishermen the main problem concerns how to find these migratory schools as they pass through their fishery.

Unlike the interactional relationship which Moore assumed existed between

the Naskapi caribou hunters and their prey, there is little reason to believe that the sharks the Teacapaneños hunt would eventually learn to anticipate the fishermen's moves, not even if the same strategy were redundantly employed. In essence these fishermen and their prey are not interactionally articulated until the moment a shark becomes caught on a longline. Thus, when the Teacapaneños employ a randomizing device in order to help them decide where to deploy their longlines it is not because they hope to decrease the sharks' abilities to anticipate their strategy and evade capture.

Seeking good places to deploy their longlines along the sea floor sometimes takes these fishermen far from their island camp and into the vicinity of the *Islas Tres Marias*, particularly southward of *Isla Maria Cleofas*, near the northern rim of the deep Middle American Trench (see Figure 1). From the fishermen's perspective this is a large ocean expanse indeed and one over which the schools of migratory sharks are not evenly distributed. Thus, deciding where to deploy the longlines can be problematic indeed.

When catches around the camp on *Isabelita* are running high there is little discussion concerning where the lines might best be deployed. During such times the boats merely return each day to whatever fishing locations are currently producing well for them, which are often places they have relied upon in past seasons. On the other hand, when catches begin to dwindle the fishermen increasingly consult one another concerning where aggregations of sharks might be found. Mostly these discussions take place in the evening after the work day has ended, as a group of fishermen sit around a campfire and informally exchange information concerning where sharks were caught that day, how many were caught, and in which directions they seem to have been moving. By sharing such information the various boat crews reduce their chances of losing contact with the schools of sharks.

However, when severe lulls in fishing activity occur and practically none of the boats are making good catches these fishermen will jointly formulate a strategy which relies upon a randomizing device in order to help them locate schools of migratory sharks. Thus, they agree to deploy their longlines the next morning by proceeding away from the island in essentially random directions along certain specified compass headings for specified amounts of time. In essence, implementation of this joint strategy causes the fishing boats to proceed away from the island in a 'sunburst' pattern.

Having deployed their lines in this manner and then once they have returned to the island with their catches, the various boat crews compare their results and a new joint strategy is formulated. If no aggregations of sharks were found then they will repeat the sunburst pattern the next morning. However, if any of the boats brought in good catches then the next day all the boats will focus their effort in those areas where the most sharks were caught, deploying this time in what might be called a 'concentration' pattern – while being careful, of course, to give each other adequate room to properly set their lines.

Not all the boat crews participate in this joint strategizing activity, however. A few ruggedly independent *jefes* do not play the game, remaining partial to

certain locations or preferring to play their own hunches. Nevertheless, within a short time – usually no more than one or two days – the implementation of this coordinated hunting strategy nearly always results in the cooperating fishermen's locating large schools of sharks.

Once these large schools have been located the boat crews will continue to concentrate their efforts upon them as long as they remain within their reach and their catches continue to run high. However, should catches begin to dwindle and contact with the schools is eventually lost, then the men will again jointly formulate and implement a random (sunburst) search pattern.

### Summary and Conclusions

Do randomizing devices aid marine hunters in their search for mostly hidden and elusive prey? At least in the case of Teacapán's shark fishermen, as well as the Jamaican fishermen studied by Davenport, the answer seems to be yes. Just why such devices are efficacious seems mainly to derive from the unique character of the marine hunting 'problem' itself, which entails having to locate prey which is essentially hidden and provides few clues as to its whereabouts, as well as having to find prey at specific locations in an environment which – at least from the hunter's perspective – appears undifferentiated, unbounded, and vast.

By deploying their lines in a sunburst pattern when their catches are down Teacapán's shark fishermen utilize a randomizing device in order to help them find aggregations of sharks.<sup>5</sup> In essence, this joint strategy helps them to maximize their catches while minimizing the risks and uncertainties surrounding not catching sharks – the primary goal to which they are committed. Moreover, their ongoing revision of this strategy once it is implemented is analogous to iterative processes associated with certain games of strategy which insure that the players realize their optimum solution through successive approximation.

Like practically all hunters of wild prey, Teacapán's shark fishermen initially search for their prey at sites that have been productive in the past; then, should that initial strategy prove unsuccessful, they extensify their efforts until the prey is located.

Although the Teacapaneño's strategy for finding aggregations of sharks might be appraised as rather straight forward and commonsensical from a modern point of view, it is still nevertheless quite effective. Moreover, their resort to a random-search pattern when their catches are down is not part of a divinatory process such as that employed by the Naskapi caribou hunters, nor does it stem from their consulting any of their community's magico-religious practitioners – several of whom are shark fishermen. Rather, their method of hunting for sharks reflects purely modern, logico-deductive Cartesian thinking in both its concept and execution, revealing that however poor and rural the Teacapaneños may be they nevertheless live in the modern world.

Along this coast where nearly all commercial fishing is government owned and controlled, Teacapán's shark fishing industry endures as a rare instance of locally-developed free enterprise. Now, however, noting the success of these

fishermen, the national government is considering integrating this local industry within its system of fishing organizations. Should this happen Teacapán's shark-fishing industry will lose its unique local character as its fishermen become part of a government controlled industry which will be organized along the entire Pacific coastline. If that happens these free roaming hunters of the sea will no longer fish solely with their own kinsmen and neighbors, and it will be anybody's guess what strategies they will then employ for finding their elusive prey.

### Notes

1. See, for example, Andersen (1972, 1980), and Orbach (1977:104-31).
2. Many of the foregoing similarities versus differences between hunting and marine fishing can be inferred from Acheson (1981), Pálsson (1989), and Pollnac (1976).
3. McGoodwin (1987) describes in great detail the rise and then demise of the inshore fisheries in this region.
4. Japanese longlines became scarce in these waters in the late 1970s as Mexico began to actively defend its 200-mile Exclusive Economic Zone.
5. The Teacapaneño's sunburst pattern does not constitute a random search in the strict sense of randomness as defined by mathematicians and statisticians. A truly random search pattern would entail these fishermen assigning numbers to all possible headings leading away from the island and then selecting specific headings by consulting a table of random numbers, or by drawing numbers from a jar or a hat. Nevertheless, I still feel the shark fishermen's deployment in the sunburst pattern basically constitutes a random search.

### References Cited

- Acheson, James M.  
1981 Anthropology of Fishing. In: B. Siegel, A.R. Beals and S.A. Tyler (Eds.), *Annual Review of Anthropology*. Palo Alto: Annual Reviews, Inc. Pp. 275-316.
- Andersen, Raoul  
1972 Hunt and Deceive: Information Management in Newfoundland Deep-Sea Trawler Fishing. In: R. Andersen and C. Wadel (Eds.), *North Atlantic Fishermen: Anthropological Essays on Modern Fishing*. St. John's: Institute of Social and Economic Research, Memorial University of Newfoundland. Pp. 120-40.
- Andersen, Raoul  
1980 Hunt and Conceal: Information Management in Newfoundland Deep-Sea Trawler Fishing. In: S.K. Tefft (Ed.), *Secrecy*. New York: Human Science Press. Pp. 205-28.
- Davenport, William H.  
1960 Jamaican Fishing: A Game Theory Analysis. *Yale University Publications in Anthropology* 59:3-11.
- Gatewood, John B.  
1983 Deciding Where to Fish: The Skipper's Dilemma in Southeast Alaska Salmon Seining. *Coastal Zone Management Journal* 10(4):347-67.
- Leap, W.L.  
1977 Maritime Subsistence in Anthropological Perspective: A Statement of Priorities. In: M.E. Smith (Ed.), *Those Who Live From the Sea. A Study in Maritime Anthropology*. St. Paul: West Publishing Company. Pp. 251-63.

- McGoodwin, James R.  
1976 Society, Economy, and Shark-Fishing Crews in Rural Northwest Mexico. *Ethnology* 15(4):377-91.
- McGoodwin, James R.  
1979 Pelagic Shark Fishing in Rural Mexico: A Context for Co-operative Action. *Ethnology* 18(4):302-16.
- McGoodwin, James R.  
1986 The Tourism-impact Syndrome in Developing Coastal Communities: A Mexican Case. *Coastal Zone Management Journal* 14(1/2):131-46.
- McGoodwin, James R.  
1987 Mexico's Conflictual Inshore Pacific Fisheries: Problem Analysis and Policy Recommendations. *Human Organization* 46(3):221-32.
- Moore, Omar Khayyam  
1957 Divination - A New Perspective. *American Anthropologist* 59:69-74.
- Orbach, Michael K.  
1977 *Hunters, Seamen, and Entrepreneurs: The Tuna Seiners of San Diego*. Berkeley: University of California Press.
- Pálsson, Gísli  
1989 The Art of Fishing. *MAST* 2(1):1-20.
- Pollnac, Richard B.  
1976 *Continuity and Change in Marine Fishing Communities*. Working Paper No. 10. Kingston, Rhode Island: University of Rhode Island, International Center for Marine Resource Development.
- Speck, F.G.  
1935 *Naskapi*. Norman: University of Oklahoma Press.
- Tylor, E.B.  
[1871] *Primitive Culture*. Volume 1. New York: Brentano's, 1924.
- Von Neumann, John, and Oskar Morgenstern  
1947 *Theory of Games and Economic Behavior*. Princeton: Princeton University Press.