Tuna Fishing Prospects for Canadian West Coast Fishermen

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ABSTRACT

Ketchen, K. S. 1980. Tuna fishing prospects for Canadian west coast fishermen. Can. Ind. Rep. Fish. Aquat. Sci. 121: 37 p.

This report has been prepared for fishing vessel owners/operators who for one reason or another are now seeking alternative fishing opportunities. Fisheries for several species of tuna are discussed in terms of distance from British Columbia, location of productive fishing grounds, catch rates and seasonal patterns of fishing -- all on the basis of information derived from reports on the current Japanese longline fishery. Preliminary assessments suggest that for economic and technical reasons, development of a Canadian longline fishery does not appear to be practical. However, the prospects should be given further scrutiny. Perhaps the most promising opportunity lies in the development of a wider ranging Canadian jig-boat (troll) fishery for albacore.

Key words: Tuna, albacore, bigeye, fishery development.

RÉSUMÉ

Ketchen, K. S. 1980. Tuna fishing prospects for Canadian west coast fishermen. Can. Ind. Rep. Fish. Aquat. Sci. 121: 37 p.

Le présent rapport a été préparé pour les propriétaires et exploitants de bateaux de pêche dont la source de revenus a été réduite ou éliminée par la limitation des permis dans les pêches traditionnelles. La pêche de plusieurs espèces de thon y est étudiée en fonction de leur distance de la Colombie-Britannique, de la situation des pêcheries productives, des taux de prises et des tendances saisonnières de la pêche, selon les renseignements tirés des rapports sur la pêche à la palangre que pratiquent les Japonais. Les évaluations préliminaires semblent permettre de supposer que pour des raisons économiques et techniques, le développement de la pêche canadienne à la palangre ne serait pas pratique. Cependant, il vaudrait la peine de se pencher davantage sur la question. Peut-être que le développement d'une pêche canadienne plus étendue du germon, à la traîne, offrirait les possibilités les plus prometteuses.

Mots clés: Thon, germon, thon ventru, développement de la pêche.

INTRODUCTION

As a consequence of heavy competition created by excess harvesting capacity in traditional British Columbia fisheries, many fishing vessel owners/operators are finding it increasingly difficult to survive economically. The situation is aggravated by the fact that they have few optional fishing opportunities due to licence limitation. This applies particularly to vessels displaced from the halibut fishery off Alaska. About all that is left for unlimited entry are fisheries for pelagic species of the high seas, species about which Canadians know relatively little. Of course something is known about the distribution and abundance of albacore, but only that it occurs seasonally close to the North American coast -- sometimes off Canada and sometimes not. What about other times of the year and what about other members of the tuna family?

The purpose of this brief report is to bring to light some observations on the distribution of tunas in the North Pacific as gained from information on the Japanese longline fishery, and to consider in a preliminary way the logistic and economic problems of possible involvement by Canadian fishermen. From the outset let it be said that the prospects are remote, becoming more so each year as costs of fishing (particularly of fuel) continue to mount. Still, it is instructive to record where the resources are in relation to west coast Canadian ports in the event that changing economic and technological conditions turn what today may be an impossible competitive position into one of some economic prospect for the future.

TUNA ENVIRONMENTS OF THE NORTH PACIFIC

For present purposes it is sufficient to recognize three principal regions of the North Pacific inhabited by tunas: a Subarctic region extending from southern Bering Sea southward to about 40°N Latitude across most of the Pacific but bending southward another 10° near the North American coast (Fig. 1); a large Subtropic region confined generally between 40° and 10°N; and a Tropic region consisting of a zone immediately to the north and south of the equator.

Comments on tuna resources are aimed primarily at three species whose centres of distribution are largely within the Subtropic region, namely, albacore, bigeye and northern bluefin. As yellowfin and skipjack tunas are more closely associated with the Tropic region and taken mainly with purse seines they are of only passing interest.

ALBACORE (*THUNNUS ALALUNGA*)

Distribution

The albacore occurs in both the North and South Pacific but its distribution is sufficiently discontinuous to suggest that there is little intermingling between the two hemispheres. Information gained from tagging indicates the existence of two sub-stocks in the North Pacific (Laurs 1979). Early in the year juveniles (possibly ages I to IV) of a northern sub-stock gather off the coast of Japan south of the "front" created by the convergence of the famous Kurishio and Oyashio currents and then proceed across the Pacific in early summer to the North American coast (Fig. 2). They usually make their landfall north of about 38°N, migrate northward in the direction of Canada and then proceed south and westward in early fall, some to waters near Japan (still as juveniles), or to the broad area of spawning between 15° and 25°N as maturing adults. Members of a southern sub-stock appear as juveniles in waters off California south of 38°N, but their destination after turning westward in the fall remains unknown.

Current fisheries

Three distinct types of fisheries exploit albacore of the North Pacific (Fig. 3). A pole and line or bait-boat operation for juveniles begins early in the year close to the Japanese coast and expands eastward through the spring and early summer apparently in pursuit of fish headed toward North America. Annual catch in the 1970s, by this relatively new fishery, has averaged 56,000 t or 54% of the all-nation North Pacific total. So far, the fishery has not advanced much beyond 180° Longitude, where, incidentally, there was a small intercepting jig-boat operation by United States vessels based at Midway Island, until the summer of 1980.

Juvenile albacore reach the North American coast during the summer and are available to the U.S. jig-boat and bait-boat fleets usually from about July to October. Oceanographic conditions permitting -- among which is a preference for water of 14°-16°C -- the albacore may pay a brief visit to Canadian waters (August-September) where they are fished by trollers suitably rigged with feathered lures (jigs). North American production averaged 23,000 t annually during the 1970s or 22% of the all-nation total.

The Japanese longline fishery is much more widespread in the North Pacific (Fig. 3) and extends over a longer period of the year, although the main production period appears to be during winter. The catch generally consists of larger (older) fish than those taken by other gear and includes significant quantities of adults from the general spawning area illustrated in Fig. 2. Annual production during the 1970's averaged 15,000 t (not including unknown but presumably small catches by vessels from Taiwan and the Republic of Korea).

Longline production in waters closest to Canada

An indication of the recent distribution of Japanese longline catches in northerly latitudes is provided for the years 1975, 1976, 1977 in Figures 4, 5, and 6, respectively. The nearest areas (5° squares of long-lat) where annual production has exceeded 10,000 fish per year are about 1,500 naut mi SW of Cape Flattery. Note that catches much closer to the Canadian coast were of relatively low magnitude if not zero.

The period of highest catch rates and highest fishing effort in the region north of Midway and the Hawaiian Islands (i.e. in the rectangle bounded by 30° and 40°N and 140°W and 180°) occurred in the last quarter (Oct-Dec), followed by the first quarter. There was negligible activity at other times of the year. Last and first quarter average catch rates were 2.1% in 1975 and 3.4% in 1976 (Anon 1977, Shiohama 1979)[1].

In a small-scale study conducted by the U.S. Fish and Wildlife Service in 1950, longlining for albacore was tried off the coasts of Washington and British Columbia but results were not encouraging (Powell et al. 1952). Need for further experimentation was indicated. Tests were also conducted with gillnets and some good catches were made. However, there was a problem with the incidental capture of substantial numbers of blue sharks. Although further experimentation seemed to be in order, no such studies were reported by the Fish and Wildlife Service.

BIGEYE TUNA (*THUNNUS OBESUS*)

Distribution

The bigeye is a relatively large tuna, deep dwelling and consequently largely unavailable to surface fisheries except at very young age. It is widely distributed in the Tropic and Subtropic regions of the North and South Pacific. At the present time there is uncertainty as to the number of stocks and the independence of fish inhabiting the northern and southern sections of the ocean (Kume 1979).

Major aggregations of mature bigeye occur in the eastern tropical Pacific in two bands north and south of the equator. Presumably spawning occurs in this region. Studies of distribution by age suggest that the western tropical North Pacific and Subtropic region as a whole are inhabited primarily by juveniles. Their distribution (adapted from Kume 1979) is presented in schematic form in Figure 7. Fish which occur closest to the Canadian coast are about 3-5 years old, nearing maturity and probably range in individual weight from 30 to 60 kg.

Current fisheries

The species is utilized almost exclusively by longliners, but young do appear in the bait boat fishery off Japan and in purse seine and bait-boat catches in the eastern tropical Pacific and elsewhere (Kume 1979). Total production from the Pacific as a whole averaged 108,000 t during the 1970s. Production by Japanese longlining alone in 1976-77 (ca 104,000 t) rose sharply with the development of a new deep longlining technique. Production off the Americas (ETP) in those years was only 10,000 t out of a total of 141,000 t.

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[1]Catch rate, otherwise known as hooking rate, is the number of fish caught per 100 hooks.

Longline production in waters closest to Canada

Most productive areas (5° squares) nearest Canada varied considerably between 1975-77 (Figs. 8, 9, and 10, respectively) at distances of 1,000-1,500 naut mi from Cape Flattery.

In the zone north of Midway and Hawaii (30°-40°N and between 180° and 140°W) the 1975 catch rates were highest during the last quarter, averaging 1.0%, followed by the third quarter (0.7%) and first quarter (0.6%). No fishing for bigeye occurs in this zone in the second quarter (Anon 1977). Catch rates for the last quarter in more recent years appear to be slightly higher (ca 1.2%) in 1977, but they are well below averages for the late 1950s and early 1960s (1.5% to 2.6%) which may suggest that abundance is now lower, particularly if efficiency has been increased by adoption of deep longlining.

NORTHERN BLUEFIN TUNA (*THUNNUS THYNNUS*)

Distribution

The northern bluefin is the largest of the tunas reaching the Japanese market and is the most valuable species because of its restaurant popularity as "sashimi". Although the species occurs in the southwest Pacific there is also a southern bluefin tuna (*Thunnus maccoyii*), fished from Australia to South Africa which is now the principal source of supply to the "sashimi" market.

The main spawning area of the northern bluefin is in the vicinity of the Phillipines and South China Sea. From there a segment of the resulting young juveniles traverses the North Pacific to spend several years off southern and Baja California (Fig. 11) where they are usually caught incidentally in commercial purse seine fisheries for other tunas. A small sports fishery has existed for many years, particularly off southern California, averaging 4,000 fish or about 45 t annually. As the bluefin nears maturity it returns westward and some fish are intercepted by the Japanese longline fishery before reaching the spawning area.

The migration route may be broader or more diffuse than that illustrated in Figure 11. Several specimens were caught near the Canadian coast during the course of high seas salmon surveys with gillnets (Neave 1959). Other specimens have been taken as far north as Kodiak Island.

Current fisheries

Catches, though nowhere large, are made mainly in the western Pacific, around the Japanese home islands, to the east of the Phillipines around the east coast of Australia and off New Zealand. In 1975 and 1976 catches by Japanese North Pacific longliners occurred mainly in a band extending westward of 150°W at about 30-35°N latitude (Fig. 12 and 13).

Longline production in waters closest to Canada

In 1975 and 1976 catches of northern bluefin closest to Canada were at about 1300-1500 mi, but, unlike records for albacore and bigeye, the largest producing 5° squares lay well to the west of 180°. Even then the yield was relatively low. No information is available on hooking rates except that they are less than 0.1%. It is assumed that catches are incidental to those of other species. Information on seasonal availability is likewise lacking. However, in view of the fact that tagging suggests the journey across the Pacific takes about 2 years, this may indicate year-round availability varying seasonally with latitude.

YELLOWFIN TUNA (*THUNNUS ALBACARES*)

Distribution

As is well known the yellowfin is the major contributor to the surface (purse seine) fisheries of the eastern tropical Pacific and is the main focus of the Inter-American Tropical Tuna Commission. The species is nevertheless widely distributed in the Tropic and Subtropic regions of the North and South Pacific and it is hypothesized that there may be three sub-stocks, an eastern one, (east of about 125°W), a central one between 125°W and 170°W, and a third to the west of 170°E. The latter two are fished primarily by Japan with longline gear. Aside from basic information on catch and effort there are virtually no data on age and length distribution or other biological information (Homna and Suzuki 1979).

Current fisheries

Fisheries by countries in the Americas are confined largely to the eastern tropical Pacific. The Japanese longline fishery extends over the entire Pacific from about 35°N to 25°S. Heaviest catches are made in the western Pacific between 15°N and the equator.

Catches in the Subtropic region are uniformly light (Fig. 14).

Longline production in waters closest to Canada

At least in 1975, no 5° square between 30° and 40°N east of 180° to 145°W produced more than 4,900 fish (probably much less on average).

Information on catch rates suggests that abundance is greatest in the first and last quarters of the year (0.14% and 0.10% hooking rates, respectively). At other times of the year yellowfin appear to be absent from the area.

Abundance over the long-term appears to have been low but much more stable than in the eastern tropical Pacific and other areas where pronounced downward trends have been in progress since the late 1950s.

DISCUSSION

At best there are only two high seas fisheries for tuna that show any prospect of being of interest to Canadian fishermen, namely, those for albacore and bigeye. The former could be developed in two ways: 1) by seaward expansion of the traditional jig-boat fishery -- to meet the fish as they approach the Canadian coast and to follow them farther to sea when they depart in the fall, and 2) by development of a longline fishery at substantially greater distance from port.

Japanese longline fisheries both for albacore and bigeye in the Northeast Pacific appear to be most productive in the first and last quarters of the year. These species could therefore be fished concurrently, but presumably with different rigging of gear, particularly now that deep fishing for bigeye has been found more effective. Other, undoubtedly more serious, problems to be considered are as follows:

DISTANCE AND WEATHER

Halibut fishermen, accustomed to making trips to the western Gulf of Alaska and Bering Sea, would not be deterred by distances of 1,500-2,000 mi to fishing grounds. However, except for runs directly across the Gulf, they were never far from shelter when weather turned bad, and could always seek out U.S. ports in times of emergency.

Tuna longlining grounds, on the other hand, are not only far from shelter but apparently most productive at a time of year when weather conditions are generally at their worst. Our large purse seine-type vessels (150-400 gross tons) would no doubt be able to "ride out" all but the most severe storms, but whether they could work effectively in winter weather is open to question. Another uncertain factor is the fuel requirements, as much would depend on the length of time required to catch a paying load of fish.

Possibly the only way an effective distant-water operation could be mounted would be with a support ship to provide fuel, provisions and cold storage space (no doubt at prohibitive cost), or through some agreement with the United States to gain access to Midway Island and/or the Hawaiian Islands for shore services. Although the United States currently prohibits the landing of tuna by vessels of foreign registry, this would be a vital requirement if Canadian vessels were not equipped with freezing facilities. Indeed, it is improbable that vessels lacking the best of such facilities (holding temperatures of -30° to -40°C) would stand a chance of landing fish in a condition that would meet export quality standards.

GEAR REQUIREMENTS

It should be obvious from earlier remarks on catch rates, that Japanese fishermen must run a large amount of gear in order to make their operations pay, particularly when wide hook-spacing seems to produce best results.

A comparison with Canadian halibut gear requirements is in order. The largest of our vessels (90 gross tons and up) will haul about 70 "skates" of gear per day (R. J. Myhre, IPHC, personal commumication). This amounts to about 38,400 m of groundline. Depending on hook-spacing (say 24-26 ft, or 7.3-7.9 m, being the most popular) the total number of hooks fished may range from 4,860 to 5,260 (Table 1).

Japanese tuna vessels that fish distant waters range from 200 to more than 1,000 gross tons but average about 380 (Suda and Shaefer 1965). They can haul 400 baskets of gear daily with total length of 120,000 m, or more than three times as much as halibut vessels. However the number of hooks is substantially less: 1960 to 2,350 depending on spacing. Even using von Brandt's (1965) figure for albacore gear (4,400 hooks) it is still less than the number fished by Canadian halibut vessels. With lower hooking rates for tuna than for halibut, the resulting estimates of catch (numbers of fish) per vessel per day are notably less. For bigeye, the catch is less than one tenth, which may be a slight under-estimate of the total for tuna other than albacore, since there is incomplete information available on the (incidental?) hooking rates of some other species.

Average daily catch of albacore ranges from 82 to 150 fish, depending on the source of information on gear specifications, and these figures are within the range of average daily catch rates by North American jig-boats (Laurs et al. 1976), which of course are much smaller and have only 2- or 3-man crews.

This brings up the question of vessel size and crew requirements for longlining. Since it is reasonable to presume that Japanese hook-spacing is close to the optimum, Canadian vessels outfitted for tuna longlining would require deck space to handle the equivalent of 400 baskets of gear. Considering also the requirement for ancillary equipment: 25 m float lines every 300 m, and 11-14 m gangions, it is doubtful that this amount of gear could be efficiently and safely accommodated. Furthermore it is improbable that a Canadian vessel crew of 8 men (the usual maximum) could handle 400 baskets of gear, considering that Japanese vessels may have as many as 30 to permit continuous, around-the-clock, operation.

These matters of vessel and crew handling capacity deserve a more thorough study by qualified gear and vessel specialists. It may well be that a reliable assessment of Canadian longlining for tuna and its economic feasibility can only be made with a small-scale experimental operation.

The economics of shore processing also require careful study. At present a negligible quantity of tuna (albacore) is canned in western Canada. In past years (except for the 1979 U.S. embargo) almost all albacore was shipped in the round to United States canneries, for the reason that uncertainty of supply has discouraged large Canadian operators from installing the required canning equipment. Furthermore, the availability of albacore off the Canadian coast coincides with the peak of the salmon season which places heavy demand on plant and freezer facilities. This would be less of a limiting factor if albacore (and other tuna) could be caught in the off-season for salmon, and might be possible if vessels not involved in salmon trolling were prepared to advance and extend the jig fishing season by moving farther to sea. Longlining, if economically practicable, would be another way of extending the season to times of year when processing plants are not working at full capacity.

CONCLUSION

An examination of data on the distribution and catch of the Japanese longline fishery in the North Pacific, suggests that operations for adult albacore and juvenile bigeye tuna are theoretically within range of a Canadian-based fleet. However, preliminary study indicates serious practical problems not the least of which is that Canadian vessels capable of operating at great distance from port are not large enough and lack the manpower to operate an amount of gear that would assure return on investment. Encouragement of an expansion both in space and time of the jig fishery for albacore would appear to hold more promise. However, should displacement of relatively large vessels from traditional fisheries by licence limitation or other factors, continue to pose a problem for vessel owners and fishery managers, a more thorough feasibility study of a longline fishery for tuna should be undertaken.

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*Note References 2, 4, and 5 are preliminary and unofficial papers presented at the Tuna and Billfish Stock Assessment Workshop held in Shimizu, Japan on June 11-22, 1979. References 6 and 11 are papers of similar classification presented at the Fourth North Pacific Albacore Workshop in Shimizu, Japan, June 25-27, 1979.

Table 1. A comparison of the fishing success of halibut and tuna longline gears in the Northeast Pacific[a].

Type of longline	Gear hauling capability: Units	Gear hauling capability: Total length(m)	Hook spacing(m)	Total number of hooks	Hooking rates(%)	Numbers of fish per day
HALIBUT	70	38,400	7.3	4,860	5.0[b]	243
	skates		7.9	5,260	5.0	263
TUNA	400	90,000[c]	20.0	4,500	3.4	150
-albacore	baskets	140,000	58.0	2,414	3.4	82
-bigeye		120,000	60.0	2,350 }	1.0	22
		120,000	50.0	1,960 }		

[a]In the present study, the "Northeast Pacific" in respect to tuna is that area between 30° and 40°N Latitude and 140°W and 180° Longitude.

[b]From Hamley and Skud (1978).

[c]From von Brandt (1965); data on other tuna from Suda and Shaefer (1965).

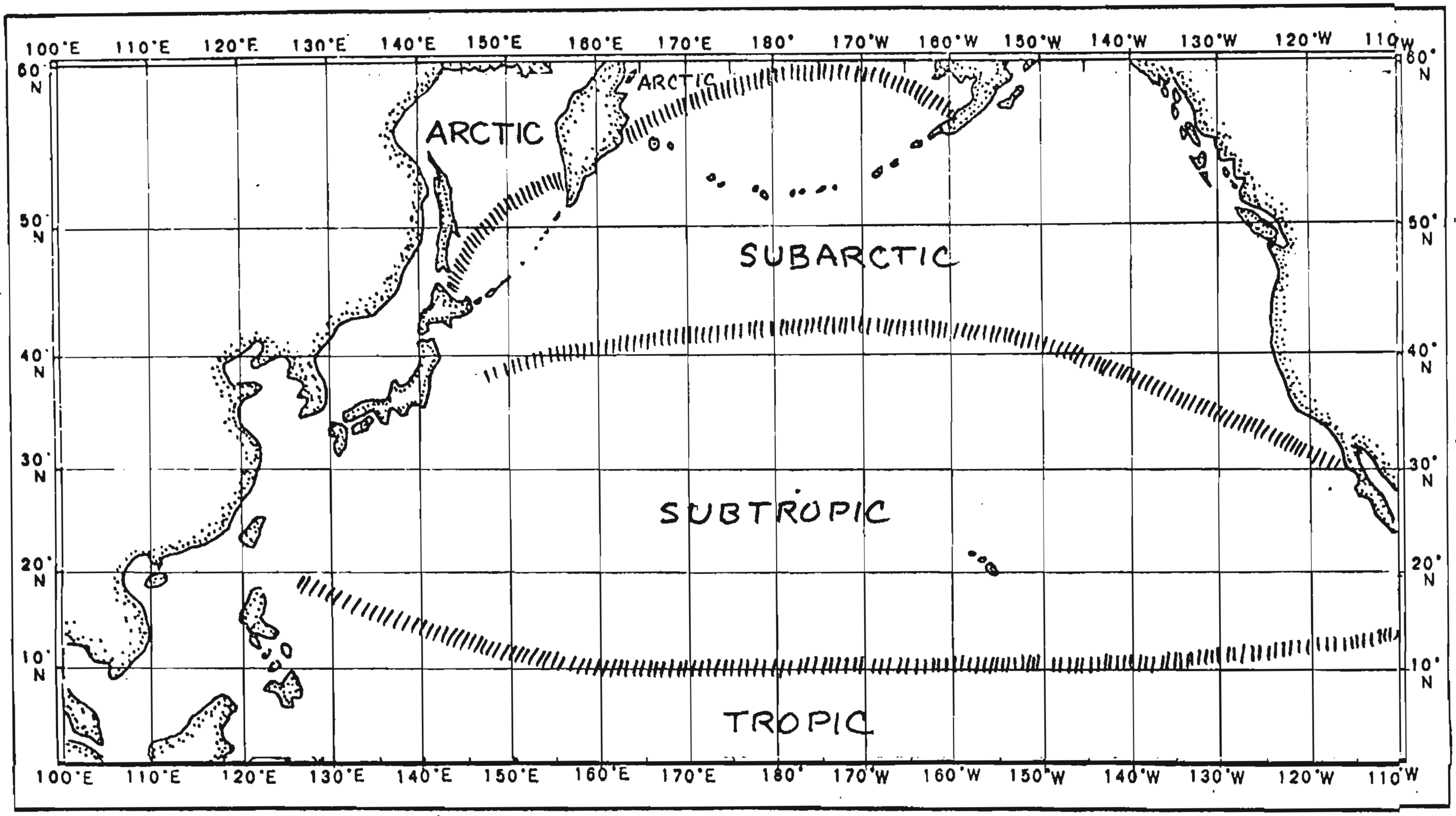

Figure 1. Oceanographic regions of the North Pacific (after Tully, 1964).

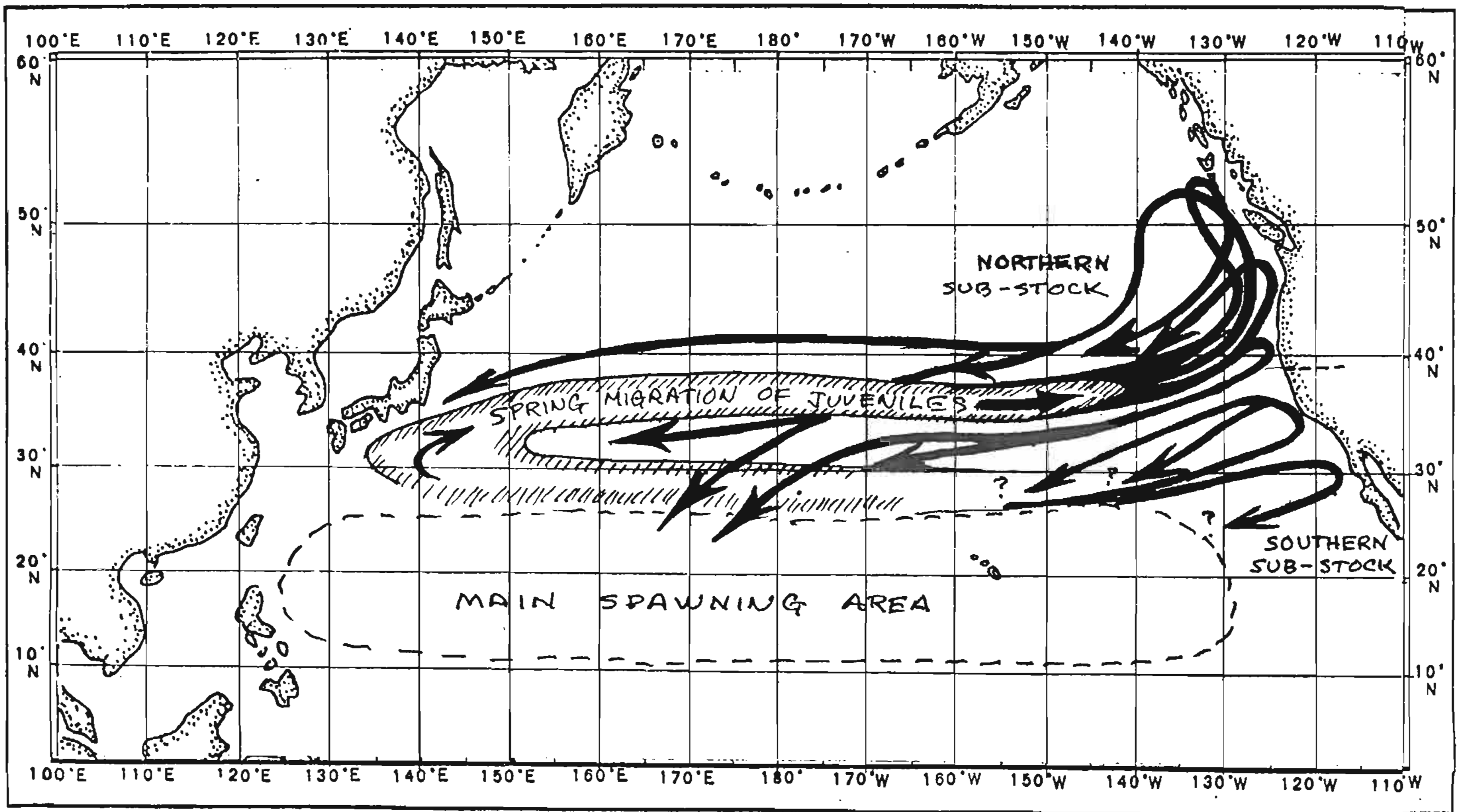

Figure 2. Schematic illustration of the life history and migrations of the North Pacific albacore (after Laurs, 1979).

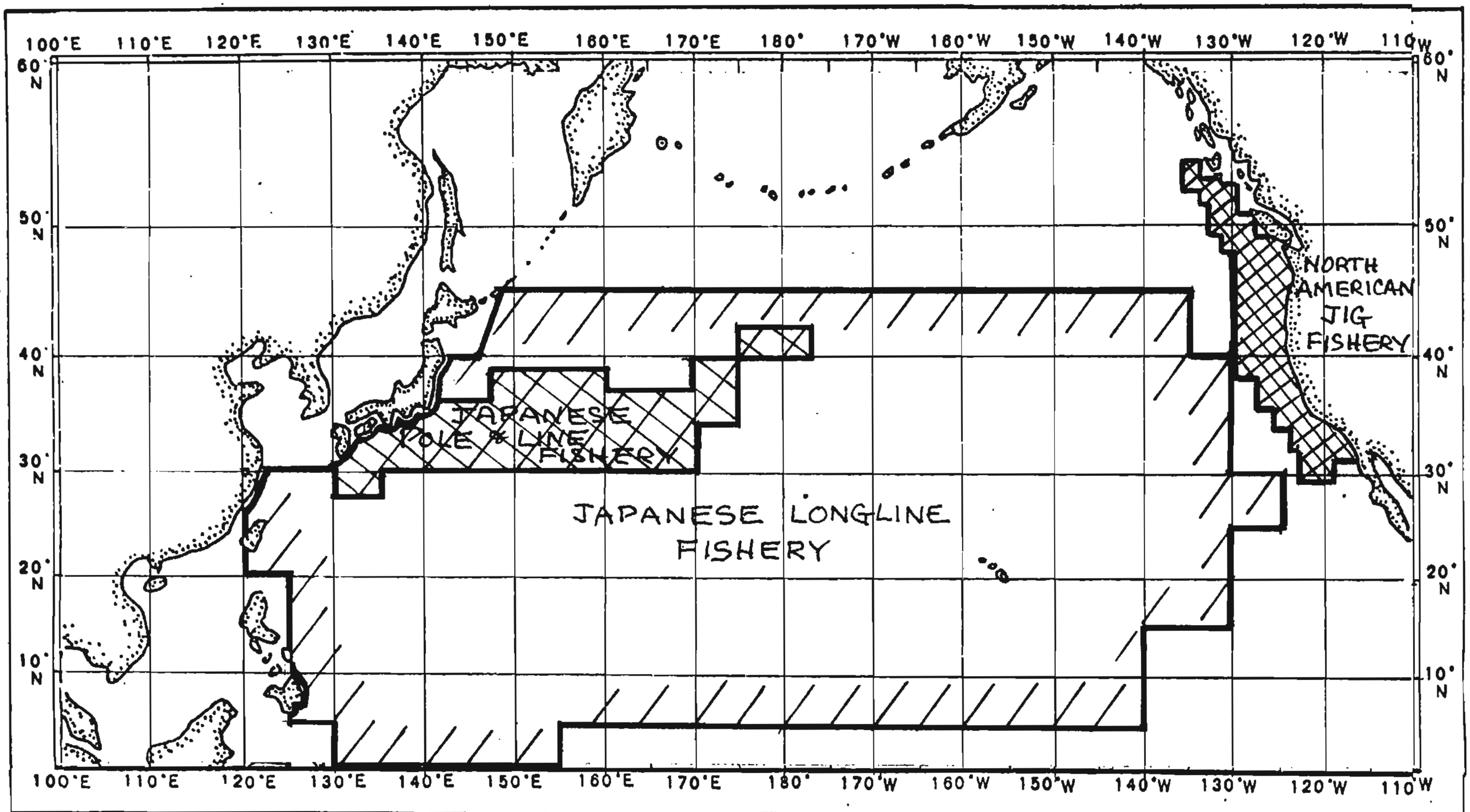

Figure 3. Principal fisheries for albacore in the North Pacific.

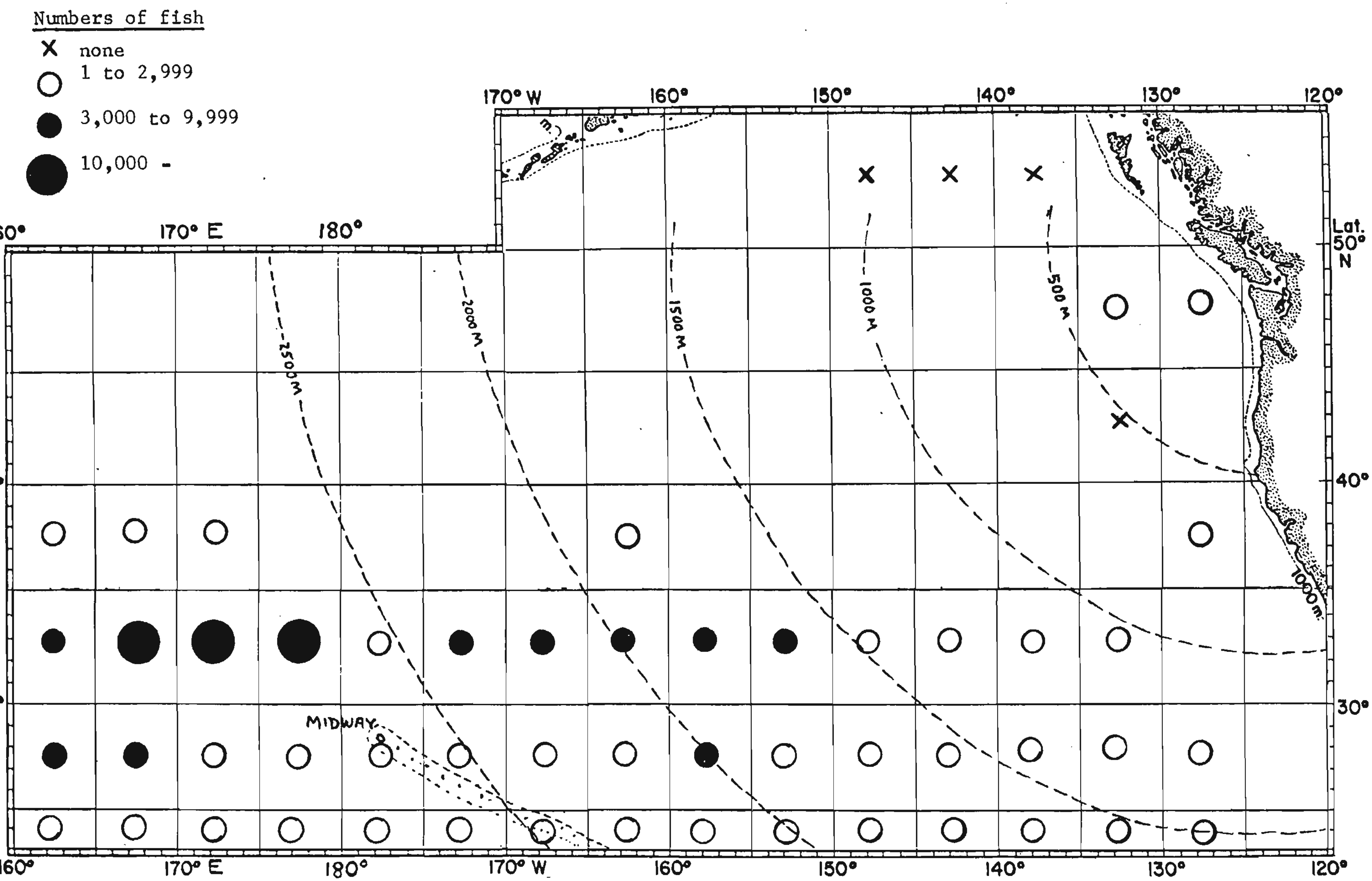

Figure 4. 1975 ALBACORE catch by the Japanese longline fishery in a portion of the North Pacific.

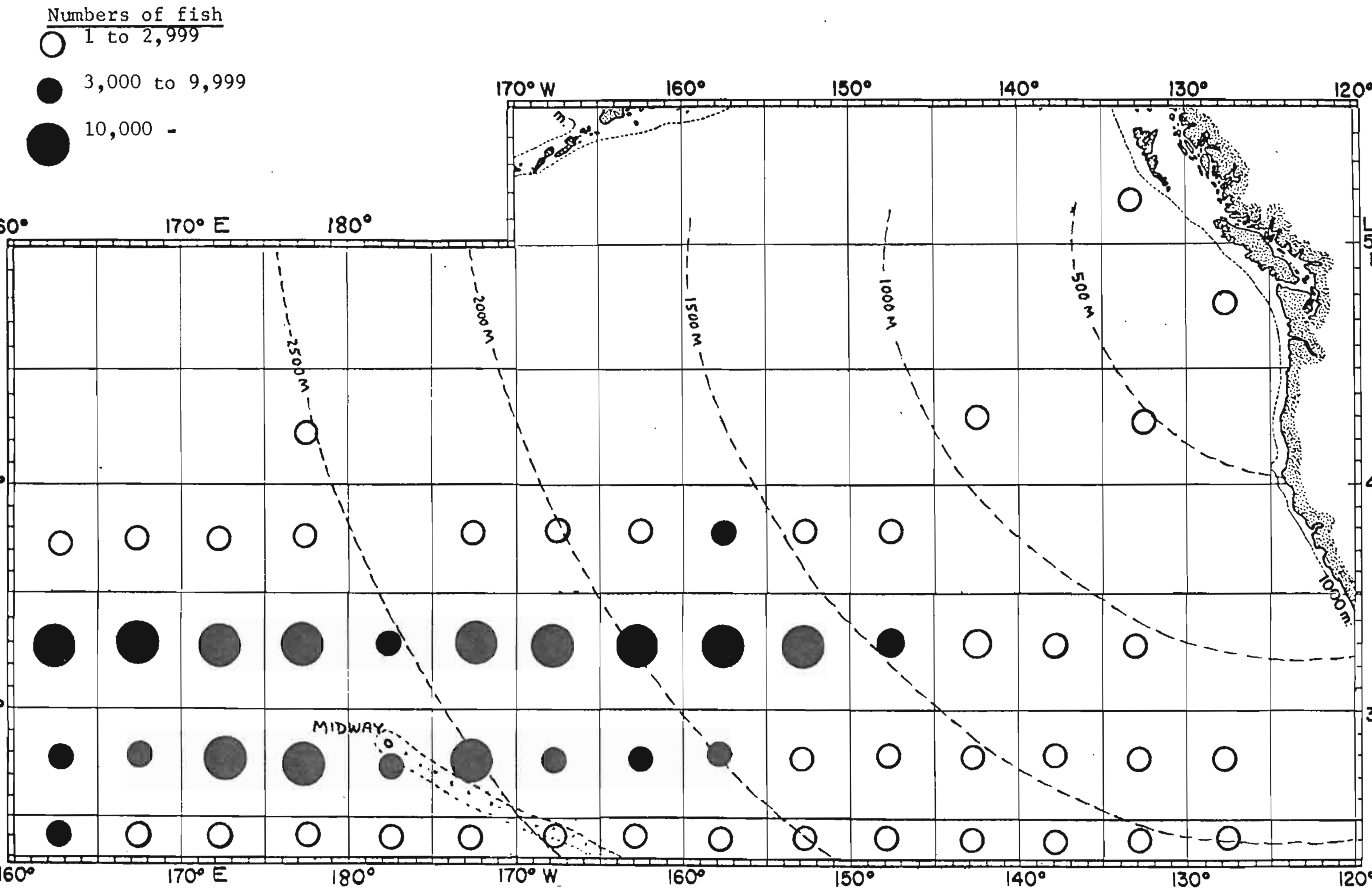

Figure 5. 1976 ALBACORE catch by the Japanese longline fishery in a portion of the North Pacific (from Shiohama, 1979).

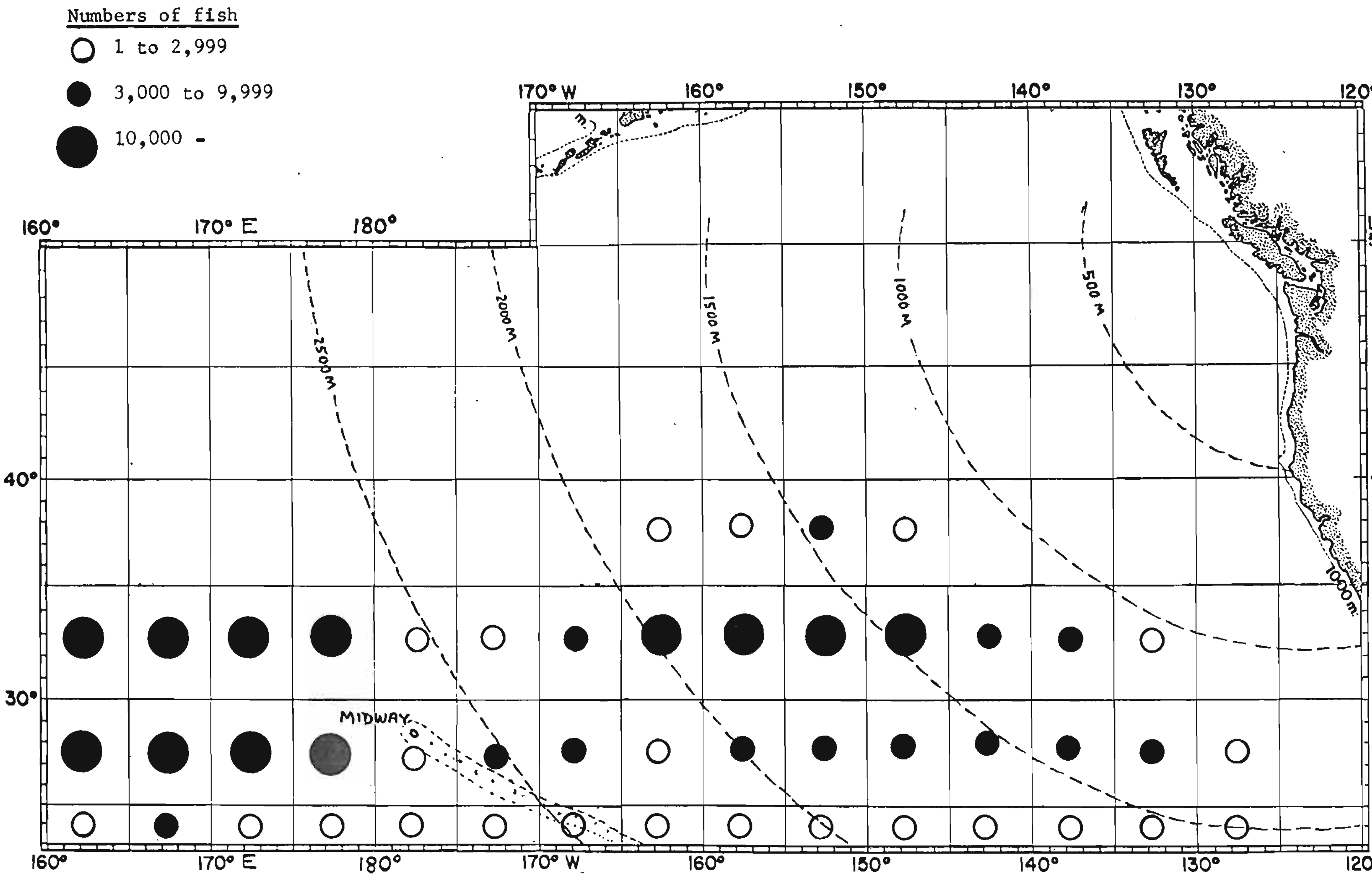

Figure 6. 1977 ALBACORE catch by the Japanese longline fishery in a portion of the North Pacific (from Shiohama, 1979).

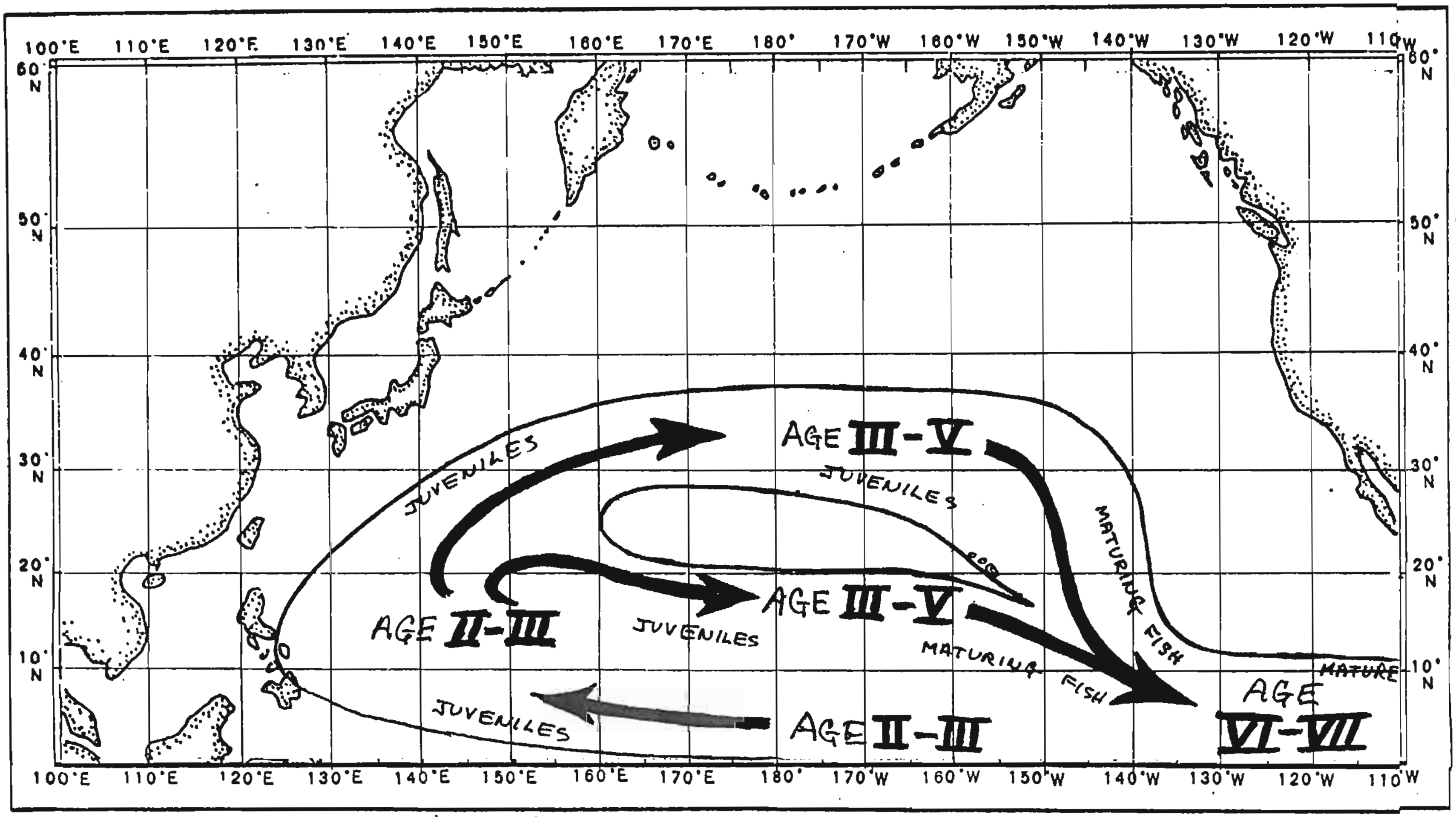

Figure 7. Generalized biological cycle of the bigeye tuna in the North Pacific (after Kume, 1979).

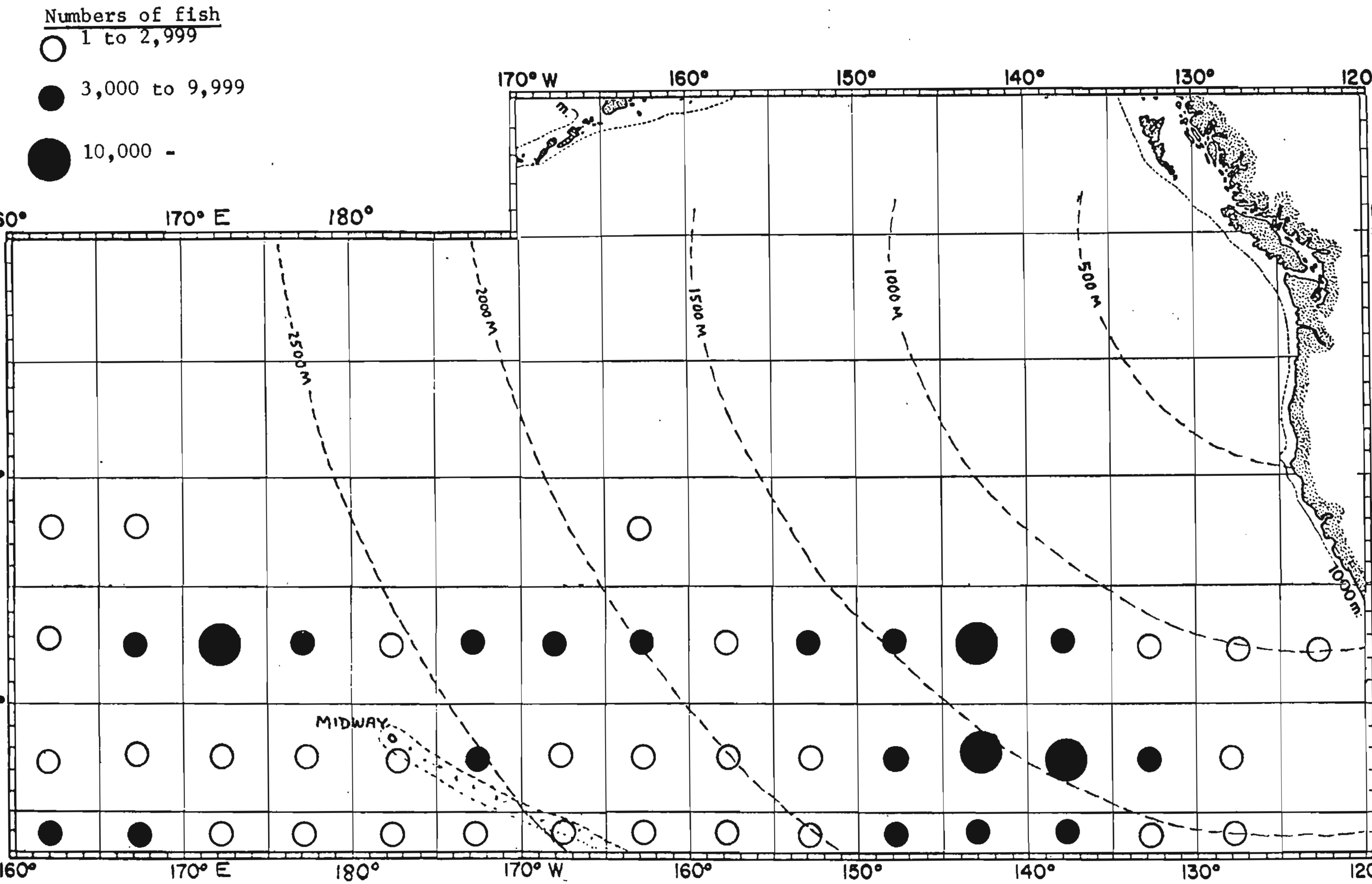

Figure 8. 1975 BIGEYE TUNA catch by the Japanese longline fishery in a portion of the North Pacific.

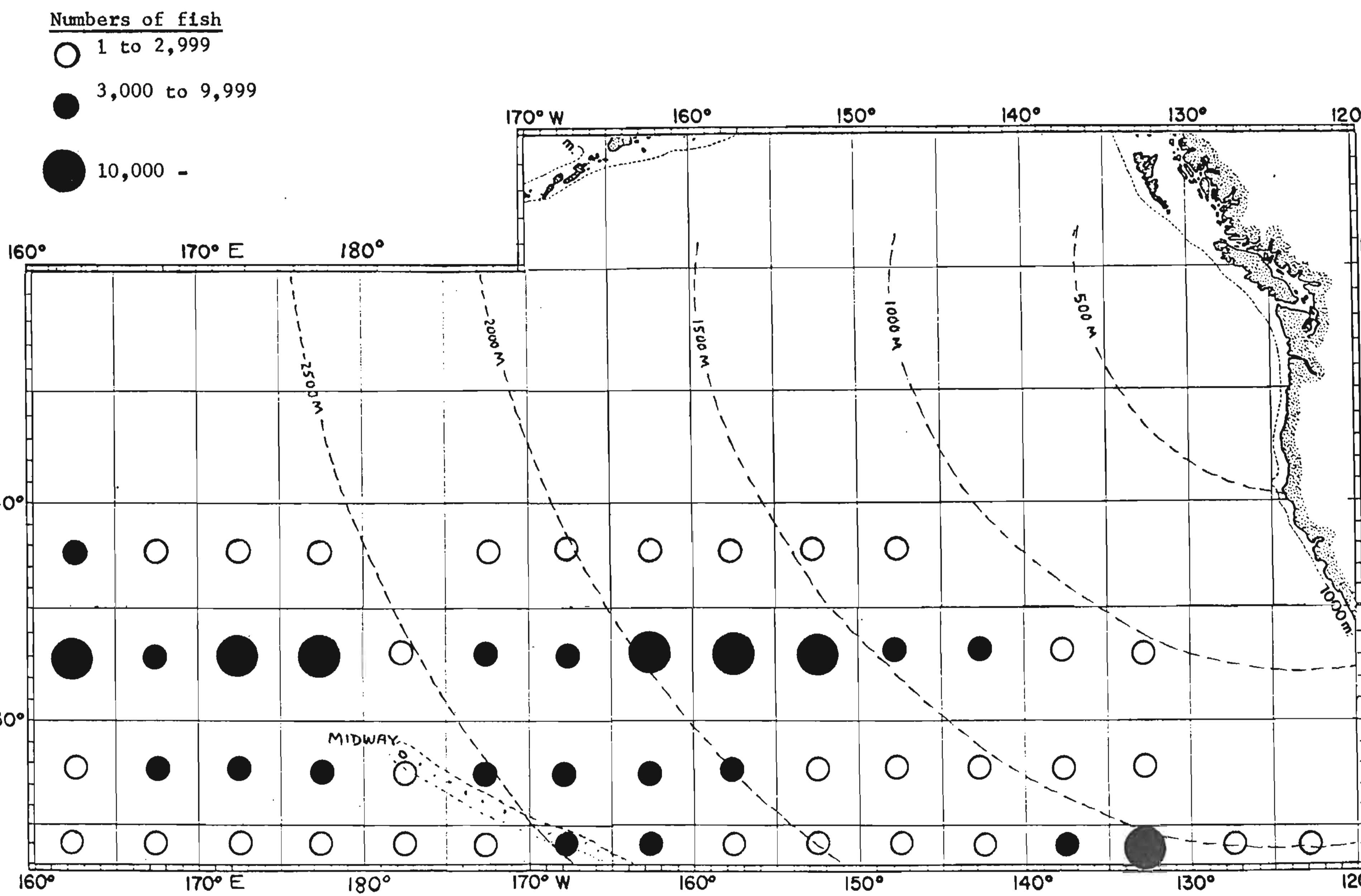

Figure 9. 1976 BIGEYE TUNA catch by the Japanese longline fishery in a portion of the North Pacific.

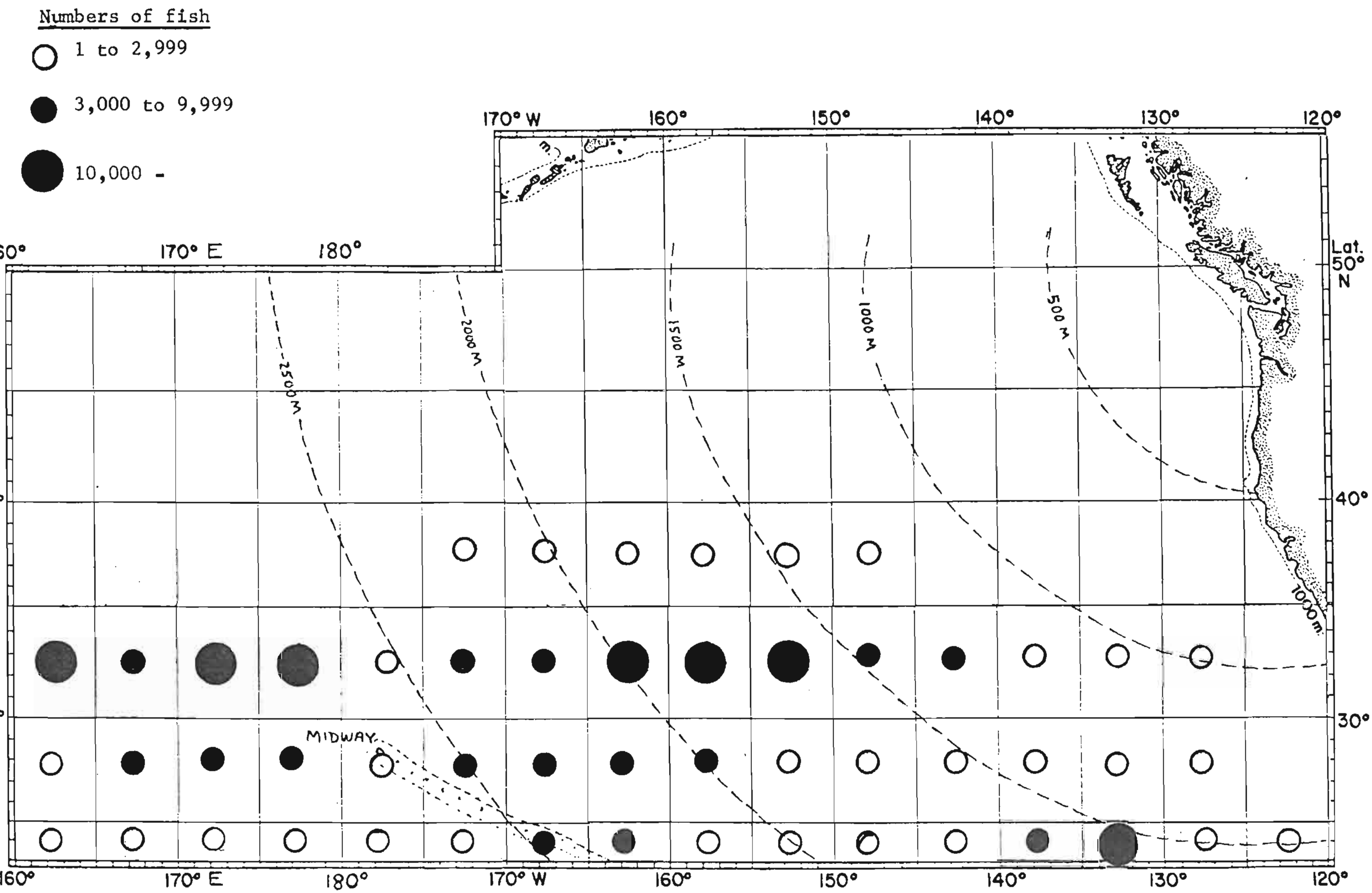

Figure 10. 1977 BIGEYE TUNA catch by the Japanese longline fishery in a portion of the North Pacific.

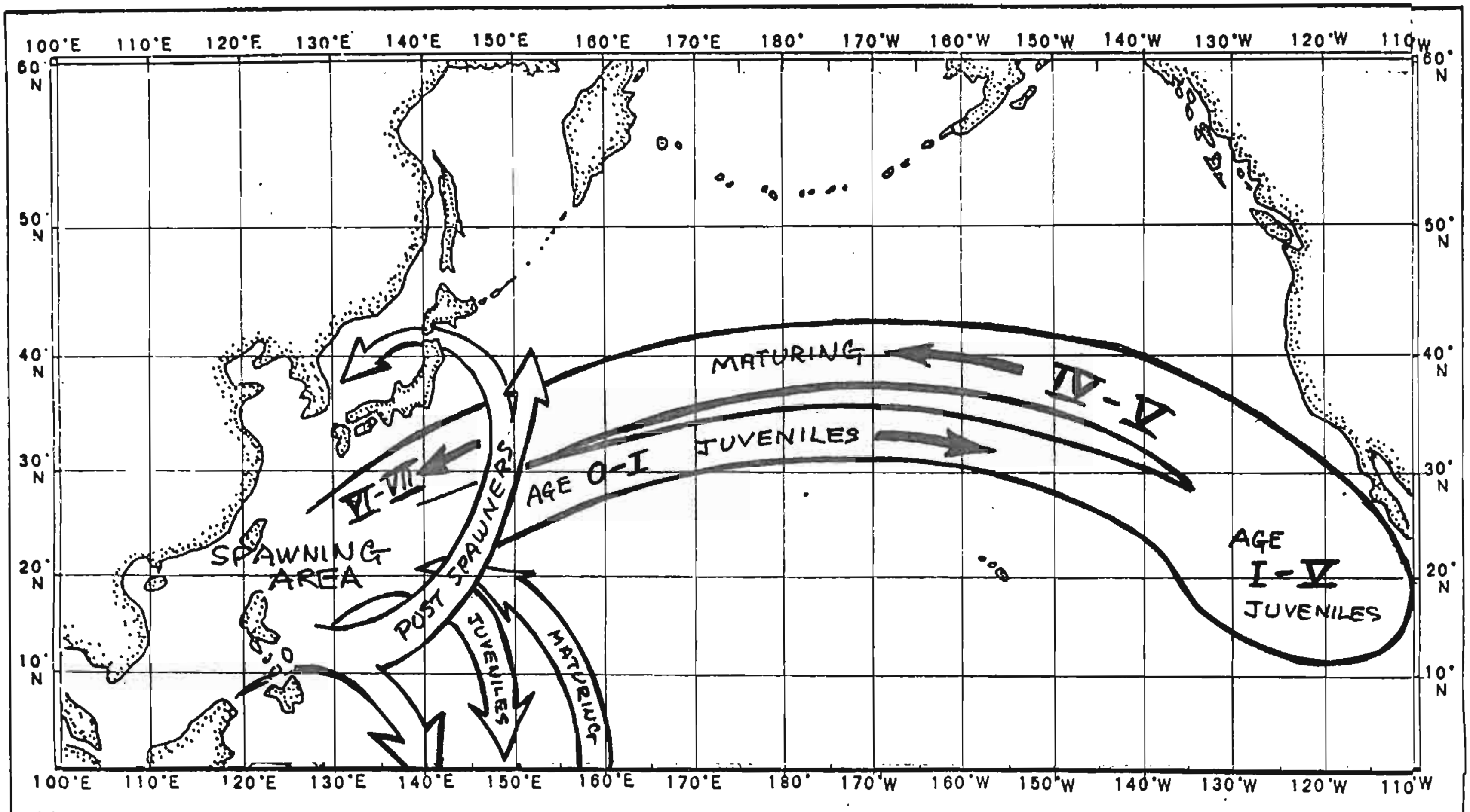

Figure 11. Schematic illustration of the life cycle and migrations of the northern bluefin tuna in the North Pacific (adapted from Bayliff and Calkins, 1979).

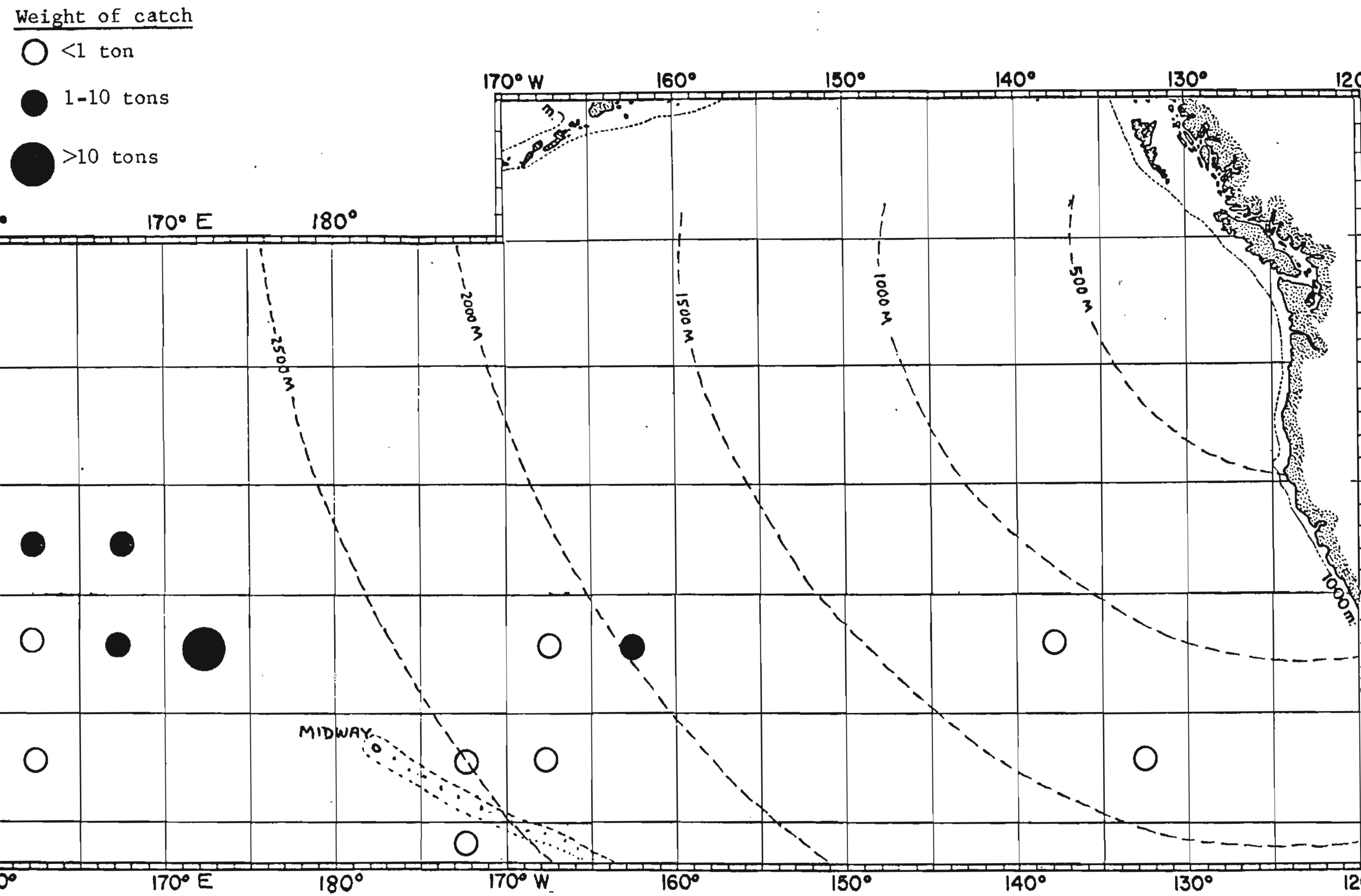

Figure 12. 1975 BLUEFIN TUNA catch by the Japanese longline fishery in a portion of the North Pacific.

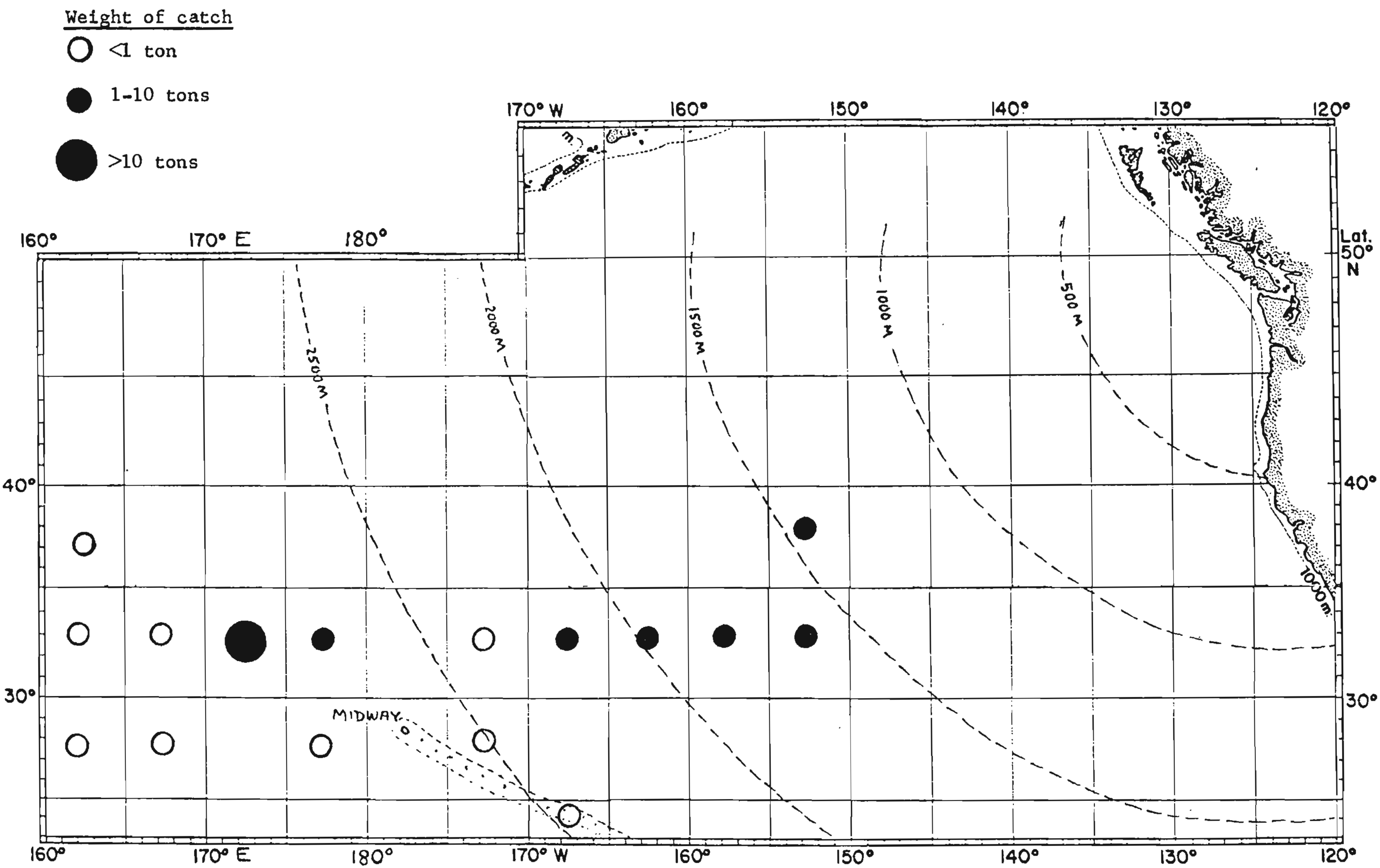

Figure 13. 1976 BLUEFIN TUNA catch by the Japanese longline fishery in a portion of the North Pacific.

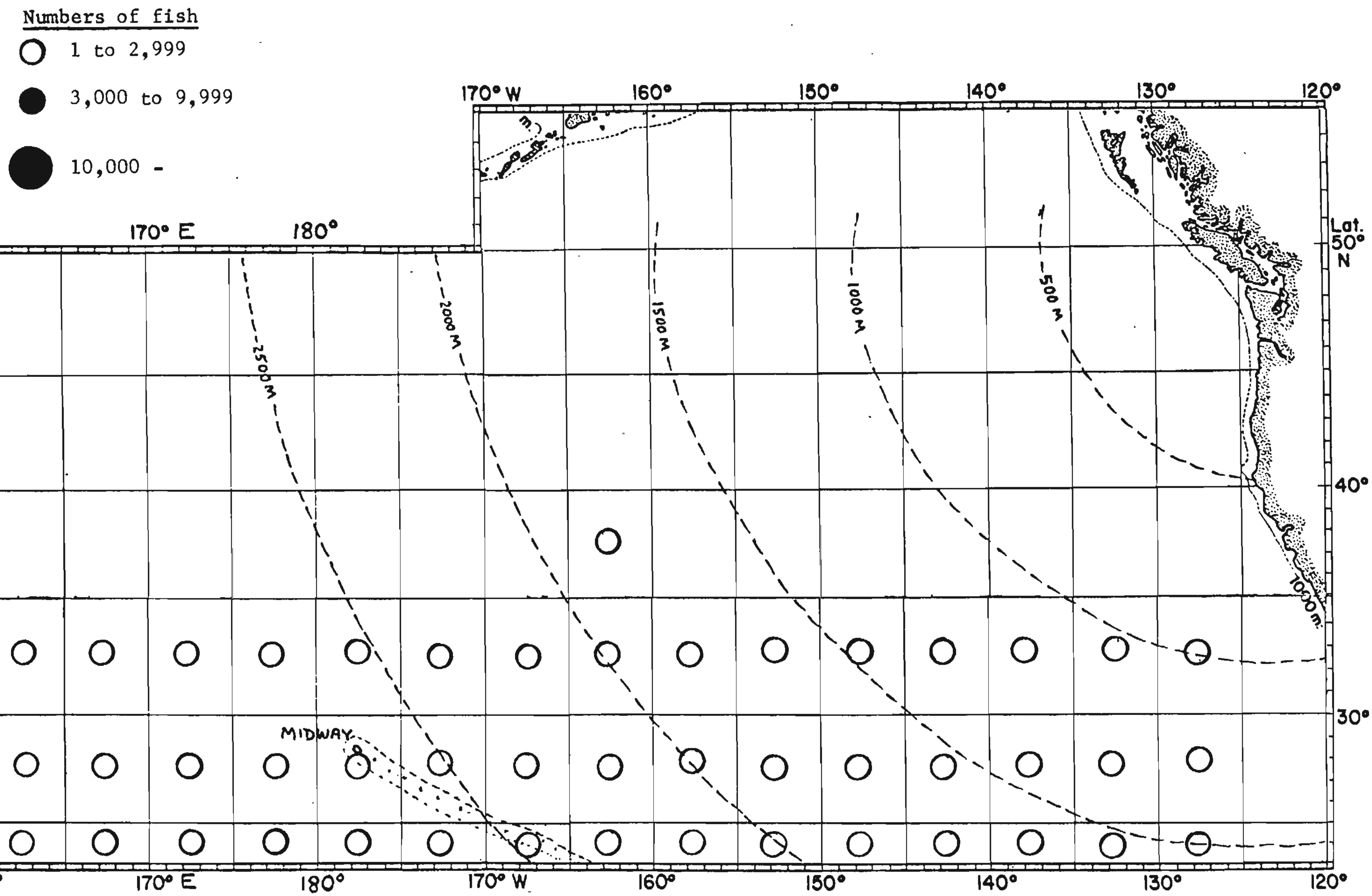

Figure 14. 1975 YELLOWFIN TUNA catch by the Japanese longline fishery in a portion of the North Pacific.