

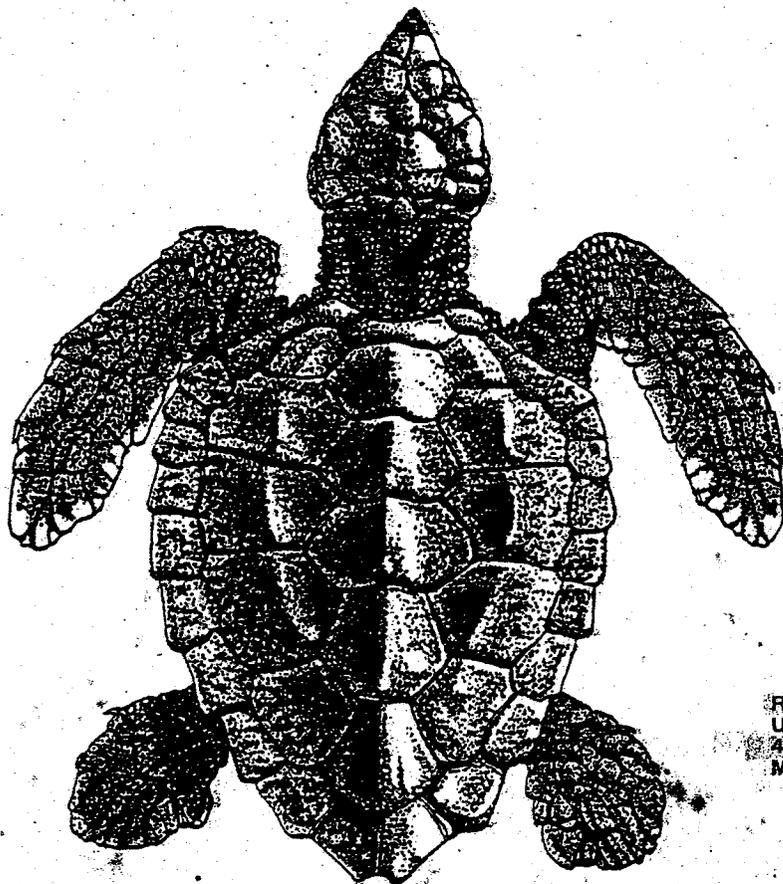
# An Analysis Of The Capture, Marketing, And Utilization Of Marine Turtles

by

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CAPTURE, MARKETING AND UTILIZATION OF MARINE TURTLES

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## INTRODUCTION

This report has as its major objective a preliminary report and analysis of existing data on the production and trade of marine sea turtles around the world. Specific objectives were to:

1. Determine sources of published and/or documented data concerning sea turtle harvesting, consumption and prices.
2. Analyze trends in production and consumption of sea turtle meats and shells by country from best available statistics.
3. Determine from available statistics international trade patterns in sea turtle meats and shells.
4. Through informal consultation in selected areas gather information on turtle harvest and trade not reported in trade statistics because of inadequate or non-existent record keeping or through deliberate attempts to circumvent protective laws.

Data were sometimes included in the aggregate when it was not possible to separate the analysis into species with implications about green, loggerhead and Pacific ridley turtles. The information should remain useful, however, in future management of world-wide turtle stocks.

The report is organized around five major sections. This introductory section contains a very brief overview of the historical development of the marketing of turtles and turtle products as well as a description of the search techniques used in gathering data. The remaining sections examine in detail the imports of turtles in the U.S., the production of turtles in the U.S., the world-wide production of and trade in turtles and the last sections offer conclusions about the quality of available data and policy implications in world management of the turtle stocks.

## Overview of Turtle Utilization and Marketing

Marine turtles are the source of a great many products of economic value. The most basic product is of course meat; all sea turtle species are eaten by man at one time or another, although the seven species are valued for food to very different degrees. The green turtle (Chelonia mydas) is almost universally considered to be the source of the best meat, although gourmets differentiate between green turtles from different populations. Generally, the populations that subsist primarily upon marine algae, such as those of the Surinam-Brazil population or those of the East Pacific, are considered inferior to those of the Caribbean, tropical Indian Ocean, and other areas that subsist primarily upon spermatophytes. Moreover, in certain limited areas, such as on Cayman Brac in the Caribbean, local people express a preference for the flesh of the hawksbill.

After the green turtle, the meat of the hawksbill and the two ridley species is usually considered quite acceptable, though cases are on record of fatal poisoning of humans following ingestion of hawksbill meat. Ridley meat was formerly eaten locally in Florida, and in Mexico large quantities are processed into frankfurters and other meat products. Some is also used for pet food.

The loggerhead and the flatback turtle are usually considered inferior and unfit for human consumption, especially if alternatives are available. However, neither has been reported to be poisonous. The meat of the leatherback is sometimes eaten, but is so oily and odiferous that it is not widely favored. Apart from the flesh, the shell cartilage of the green turtle, known as "calipee" or "calipash" is an important and valuable item of commerce. This material is present between the rib-ends in the carapace and between the plastral bones, and it is present in greatest amount in immature turtles. It is used for the

manufacture of turtle soup, and in some areas of the Caribbean large numbers of green turtles have been slaughtered illegally over the years purely for this product, the rest of the carcass being abandoned. High-grade oil can also be rendered from green turtles, and although this is not an important item of international commerce, it has been used as the basis for cosmetics as well as for cooking oil in some parts of the world.

Turtle shell, commonly known as "tortoiseshell", is an important item of international commerce. The genuine product is derived from unusually thick carapace scutes of the hawksbill turtle, which are cut, carved, and worked into a wide variety of artifacts. There is also a relatively large trade in entire hawksbill shells (almost always derived from immature specimens) or in the whole stuffed animals. These are polished and fetch very high prices, especially in Japan. The shell of the green turtle, having much thinner scutes, is less suitable for ornament. However, green turtle scutes have achieved favor in some quarters for inlay work, and the protein-fed green turtles derived from the Cayman Turtle Farm have scutes nearly as thick as those of the hawksbill, and are still legally imported into the United States in the form of artifacts.

A relatively recent vogue for sea turtle leather has greatly increased pressure on a number of wild turtle populations. In particular, harvest of olive ridleys in the Mexican Pacific is now the biggest turtle fishery in the world, and the principal incentive behind this industry, which provides the livelihood for many hundreds of people, is the high price offered by Japan and certain European nations for the leather. This is used for belts, shoes, wallets, and related items. Clearly, the amount of leather derived from a single turtle is not large, consisting of one piece composed of the skin of the two front flippers and the undersurface of the neck, and another smaller piece derived from the rear flippers and tail. Mexican law requires utilization of all parts of turtles slaughtered for their skins,

but illegal operators frequently remove the skin and abandon the rest of the animal.

Turtle eggs are greatly appreciated, both as a source of protein and supposed aphrodisiac and other medicinal values, in many parts of the world. In most countries of South-East Asia, utilization of the eggs is the principal means by which turtle populations are exploited. In many areas, rights to the turtle eggs laid on a particular section of beach are keenly competed for, and the highest bidder may then employ several others to undertake the actual egg harvest on his behalf. The Asiatic predilection for turtle eggs even extends to Asiatic communities abroad; the Javanese population in Surinam, for example, continues to constitute the principal consumer of turtle eggs in the country. In some areas, such as Malaysia, turtle eggs sell for prices considerably higher than hen's eggs.

Collection of turtle eggs for human consumption is practiced in most Latin American countries, though it is technically illegal nearly everywhere in the hemisphere.

Turtle eggs are not now legally harvestable in the United States, but formerly they were much sought after in certain coastal communities in Georgia and the Carolinas because of the keeping qualities they imparted to cakes baked with them.

The use of turtles by man as food and for other purposes has probably occurred as long as man and turtle have existed in the same locale. Parsons (1962) gives a vivid interesting description of the earliest records of turtles being used in "modern" trade. Parsons' work serves as a source for the following comments. Records show that turtles brought from Ascension Island and the West Indies were dressed at public houses in London in 1753 and 1754.

Steam transportation greatly facilitated the movement of live turtles across the Atlantic and annual arrivals in England were said to have reached 15,000 by 1878. The source was principally the Cayman turtle fleet. Imports to England of

"preserved turtles" were initiated in 1841 from Jamaica. This product was apparently sun-dried meat and calipee that had begun to place turtle soup within reach of the general consumer.

Tinned turtle products first entered mid-latitude markets sometime about the middle of the nineteenth century. Some of the first canneries were located within the tropics to be close to the sources of supply. One was in Key West which was reportedly turning out 200,000 cases a year in 1880. Another was in Nicaragua. The leading London soup maker, John Lusty, Ltd., began business in 1851 and began tinning turtle products in 1870 with the West Indies as principal source of supply. A second major London producer of turtle soup began production in 1936. Parsons (1962) stated that current annual importation levels of this company was a few hundred turtle carcasses, and several tons of sun-dried calipee and calipash came also from both Grand Cayman and from the Seychelles.

References about turtles and turtle soup made their way into many forms of literature during the late 1800's which is probably an indication of its high level of acceptance as a consumer item.

"Beautiful Soup, so rich and green,  
Waiting in a hot tureen!  
Who for such dainties would not stoop?  
Soup of the evening, beautiful Soup!  
Soup of the evening, beautiful Soup!  
    Beau--ootiful Soo--oop!  
    Beau--ootiful Soo--oop!  
Soo--oop of the e-e-evening  
    Beautiful, beautiful Soup!"  
"Beautiful Soup! Who cares for fish,  
Game, or any other dish?  
Who would not give all else for two  
Pennyworth only of beautiful soup?  
Pennyworth only of beautiful soup?  
    Beau--ootiful Soo--oop!  
    Beau--ootiful Soo--oop!  
Soo--oop of the e-e-evening  
    Beautiful, beauti-FUL SOUP!"

"The MOCK TURTLE" in  
Lewis Carroll's Alice's  
Adventures in Wonderland.

Parsons' estimate (about 1960) of import levels was that 1,200 frozen green turtle carcasses entered the London market in a year, mostly from East Africa. About 30 tons of primarily dried calipee crossed London docks. Highest quality product brought \$2.25 a pound. Other countries constituting important consumption centers (primarily luxury restaurants and hotels) were Germany, the Low Countries and France. Turtle soup was also canned in Denmark and Switzerland with the Indian Ocean being the principal source of supply.

America also began to be an important consumer of turtle products in the years prior to Parsons' 1962 book. This consumption occurred through both imports and domestic production. The dominant U.S. company was Moore and Company Soups, Inc., of Newark, New Jersey, who had made turtle soup since 1883. During World War II, frozen green turtle steak was unrationed and was said to sell for 75 to 80 cents per pound in New York where it replaced higher priced beef.

Parsons' (1962) estimate was that between 15,000 and 20,000 turtles found their way annually, in one form or another, to the commercial markets of North America and Europe. The markets had become quite broad geographically and with an expanding population in the tropical world and better transportation, the increasing demand for turtles was inexorable.

#### Overview of Captive Techniques

Hirth (1971) provides a general overview of the fishing equipment used in catching turtles. These methods include diving for them and using harpoons, spearguns, traps, seines, suckerfish, and decoys. Green turtles are usually caught on their feeding pastures by using tangle nets and seines. Netting procedures vary depending on the customary technique, current flow, and physical parameters of the site. The most popular net used was the gill net.

Suckerfish (Echeneis naucrates) have been used to capture turtles in the South China Sea, northern Australia, east coast of Africa, and Cuba. The procedure that evolved in these surprisingly divergent localities was basically the same; a thin, strong line was attached around the caudal peduncle of the suckerfish, and the fish and line were paid out from a small boat in waters frequented by turtles. The fish would swim around until they found a turtle, to whose plastron they would then attach themselves. Once a turtle was secured in this way, one or two more fish were sent out to ensure that the turtle could not escape, and the lines, fish, and turtle were then pulled in.

Divers use spear guns and harpoons, and in the Netherlands - Antilles wooden turtle decoys along with gill nets have been effective capture methods. On the nesting grounds, turtles have been simply turned on their backs. Sticks are used almost everywhere to probe for eggs. At Tortuguero, Costa Rica, where it has been illegal for many years to kill nesting turtles but where offshore capture has been either legal or not effectively prevented, beach-based poachers attach large logs to nesting turtles. The turtles drag the logs back into the sea where they are easily spotted and caught by the poachers' companions in boats.

Mechanized turtle hunting is also recorded in Hirth's synopsis. Off western Australia, several companies have used freezer boats with several small catcher boats which operate in the shallow water inside the reefs. The turtles were processed on the freezer boats.

In Pacific Mexico, turtles are caught from specially designed fiber glass boats, each about six feet wide and 20-25 feet long. The crew of each boat consists of two men - one to operate the outboard motor and the other ready to jump on top of any turtle seen. When a turtle is spotted, the motor operator directs the boat rapidly towards the turtle, while the catcher, with a cord tied around his wrist, leaps as the

boat passes the turtle. Man and the turtle are then pulled back to the boat, and the turtle hauled on board. This method is probably only suitable for the capture of olive ridleys, which have the habit of basking at the surface for long periods of time with the top of their shell out of the water.

### Research Procedure

The research procedure used in this analysis was divided into two parts. The first part consisted of an analysis of all available statistical information on turtle trade and the second consisted of informal consultation within selected geographical areas to gather data on turtle harvest and trade not reflected in formal statistics. This inadequacy results from incomplete or non-existent record keeping or through non-reporting to circumvent protective laws.

The first part began with a review of traditional sources of fishery statistics published by the National Marine Fisheries Service (NMFS) and the Food & Agriculture Organization (FAO). U.S. Customs and import data as provided by the NMFS were also examined. A large number of individual books, reports and papers on various aspects of the world-wide turtle industry were also read and data extracted where found useful to supplement that found in officially published data. A thorough search of potential statistical data sources was also made in the libraries of the University of Florida, University of Miami, and NMFS Southeast Fishery Center. Statistical yearbooks for those countries important in turtle trade do not exist in most cases. The statistical yearbooks of the United Nations provided some data.

Turtle imports are known to be important in some countries such as England, but the import data available from the statistical yearbooks is so aggregated it was of little use. It will probably be necessary to obtain government reported documents in such countries to provide detail on the turtle trade. This was beyond the scope of this project. However,

the extensive library search was useful in ruling out possible data sources. Letters were also written to key individuals in England, Brazil, Sarawak, Australia, Hawaii, the Eastern Caroline Islands, Surinam, the Netherlands, and the U.S. in an attempt to update data sources. Throughout the data search, all categories of turtle products were searched. These included meats (fillets, flippers, steaks, chunks, gelatin, liver, tips), soup, calipee, oil, turtle pharmaceuticals and chemicals, shells, curios, skins, hide, leather, eggs and live turtles.

The second part of the research procedure concentrated on personal consultation in areas adjacent to the United States and elsewhere which have significant sea turtle industries. It took the form of personal travel to various selected countries to consult with persons knowledgeable about the turtle industry - fishermen, local biologists, conservationists, and government employees. In some of these countries, official statistics existed on turtle catch and the intention was to form an opinion as to the reliability of those data. In others, no statistics were kept, or the turtle products were placed in a general or "miscellaneous" category, and by a process of consultation and observation an attempt was made to determine the overall importance of the turtle resource, the species harvested, and other parameters of turtle utilization. Countries visited in the course of this phase of the work included Trinidad, St. Lucia, Antigua, St. Martin, Barbuda, Mexico, India, Malaysia, Indonesia, Australia, and Papua New Guinea.

#### IMPORTS OF SEA TURTLES

Three objectives are addressed in the analysis of sea turtle imports. The first objective is to determine total imports of turtles and turtle products into the U.S. in years prior to the current ban on wild turtle and turtle product importations. Accomplishment of this objective will allow

determination of the impact of the U.S. ban on imports on specific countries. In addition, the import data will supplement records which indicate production volumes of exporting countries. The second objective is to determine world trade patterns. The third objective is to determine specific uses made of sea turtles in consumption. To accomplish these objectives the analysis includes a review of (1) imports of live turtles in the U.S., (2) imports of specific turtle products by country of origin, (3) recent requests for import permits, (4) records of imports of various turtle products from isolated publications, and (5) U.S. Department of the Interior statistics on sea turtle imports.

Importation of turtle products into the United States proceeded freely up to and through the 1960's, but since then has become progressively restricted, as the declining status of many sea turtle populations has become apparent, and has become reflected in U.S. Law and international treaties.

The Endangered Species Conservation Act was signed into law on December 5, 1969, and approximately one year later (December 2, 1970), three species of sea turtle - the leatherback, Kemp's ridley, and the hawksbill - were formally listed as "endangered". This designation restricted importation of the named species, banning purely commercial importation and requiring the issuance of permits for import for scientific, conservation, or educational purposes.

Leatherback products figured negligibly in international commerce even before 1970, and the ban on products of this species had no significant economic impact. Kemp's ridley too was so rare by that point that there was little economic interest in the species, which had already received total legal protection on the Mexican breeding grounds and in Mexican waters for several years. However, the listing of the hawksbill, which resulted in the outlawing of importation of tortoise-shell products into the United States, had considerable impact, and has resulted in the confiscation of large volumes of hawksbill turtle shell products and entire shells at all U.S.

ports on entry. Enforcement of hawksbill protection, however, has been difficult and incomplete in U.S. overseas territories, notably Puerto Rico and the islands of the Pacific Trust Territory (Micronesia).

At the present time, all species of sea turtle except for Australian populations of Chelonia mydas and Chelonia depressa are listed under Appendix I of the International Convention on Trade in Endangered Species of Flora and Fauna (CITES). The effect of this treaty is to ban import and export of the designated species between countries signatory to the Convention. The United States was one of the first to ratify this convention, and with ratification by Panama on August 17, 1978, 47 nations have now ratified. Nevertheless, many countries (including the United States) have at least in the past, been less than vigorous in the enforcement of the convention.

CITES is somewhat unclear in its language relating to permitting importation of turtles derived from captive stocks. In essence, different interpretations have been put forward as to whether, to qualify as an exception, turtles have to be derived from eggs laid in captivity, or if turtles derived from imported eggs (i.e. "ranching" turtles) are acceptable. An interpretation of this rule as it affects turtle farm operations allows Cayman Turtle Farm products to be considered as Appendix II species, which may be legally exported with certification from the country of origin that the trade will not have adverse effects upon the survival of the local populations of the species.

In 1978 (Federal Register 7/26/78), after five years of deliberation, NMFS and FWS issued a joint rulemaking declaring the green turtle, loggerhead, and olive ridley turtles to be threatened, and the Florida and Mexican Pacific populations of the green turtle and the Mexican Pacific olive ridley populations to be endangered.

This rulemaking, although only applying to the United States and its territories, is more stringent than CITES in

that turtle farm products, even if derived from eggs laid in captivity, are prohibited. At the time of writing (November 1978) this is under appeal, and while the appeal is pending, farmed turtle products may continue to enter the United States. With this exception, however, marine turtle products are now prohibited from entering the United States except for scientific, conservation or educational purposes.

#### U.S. Imports of Live Turtles

Total pounds and dollar value of live turtle imports into the U.S. are available for the 1948-76 period (Table I and Figure 1). Unfortunately, these imports are not sub-classified by species. Hopefully, these data will suggest the overall trend in live turtle imports of the species of concern in this report. Data on the number of live turtle imports for 1970 and 1971 indicate green turtles and olive ridleys were important in this trade. Imports of green turtles were 293 in 1970 and 613 in 1971. Olive ridley imports were 480 in 1971. Two or less were recorded for hawksbill and loggerhead (Busack, 1974). Over 40 countries are known to have exported live turtles to the U.S. in 1970 and 1971.

The downward trend in volume imported along with a decline in prices suggests that the demand for live turtle imports into the U.S. actually declined after 1968. This conclusion is consistent with the conclusion that the demand for domestically caught turtles in the U.S. has declined in recent years. Perhaps the publicity given the plight of the turtle was effective in changing U.S. attitudes. Total pounds of live turtle imports peaked in 1951 when nearly 1.5 million pounds were imported. After 1951, the overall downward trend in total pounds imported began and continued through 1975 when only 4,000 pounds were imported. In 1976, imports suddenly increased to 319,600 pounds. The data appear suspect for 1976 because the reported volume is out of line with the overall

Table 1. Imports of live turtles into the U.S., 1948-1976.

Year	Pounds	Dollars	Year	Pounds	Dollars
1948	794,429	56,933	1963	489,000	101,000
1949	1,047,521	54,119	1964	398,000	47,000
1950	1,276,863	4,316	1965	520,000	56,000
1951	1,491,899	84,729	1966	199,000	36,000
1952	1,384,165	79,897	1967	353,000	154,000
1953	1,171,857	66,790	1968	444,000	324,000
1954	974,000	55,000	1969	213,000	236,000
1955	913,000	44,000	1970	112,000	280,000
1956	695,000	34,000	1971	92,000	187,000
1957	1,033,000	56,000	1972	39,000	154,000
1958	886,000	64,000	1973	9,000	7,000
1959	659,000	47,000	1974	7,000	8,000
1960	471,000	41,000	1975	4,000	8,000
1961	778,000	74,000	1976	319,600	19,000
1962	783,000	50,000			

Source: NMFS, NOAA, Imports and Exports of Fishery Products, Annual Summaries.

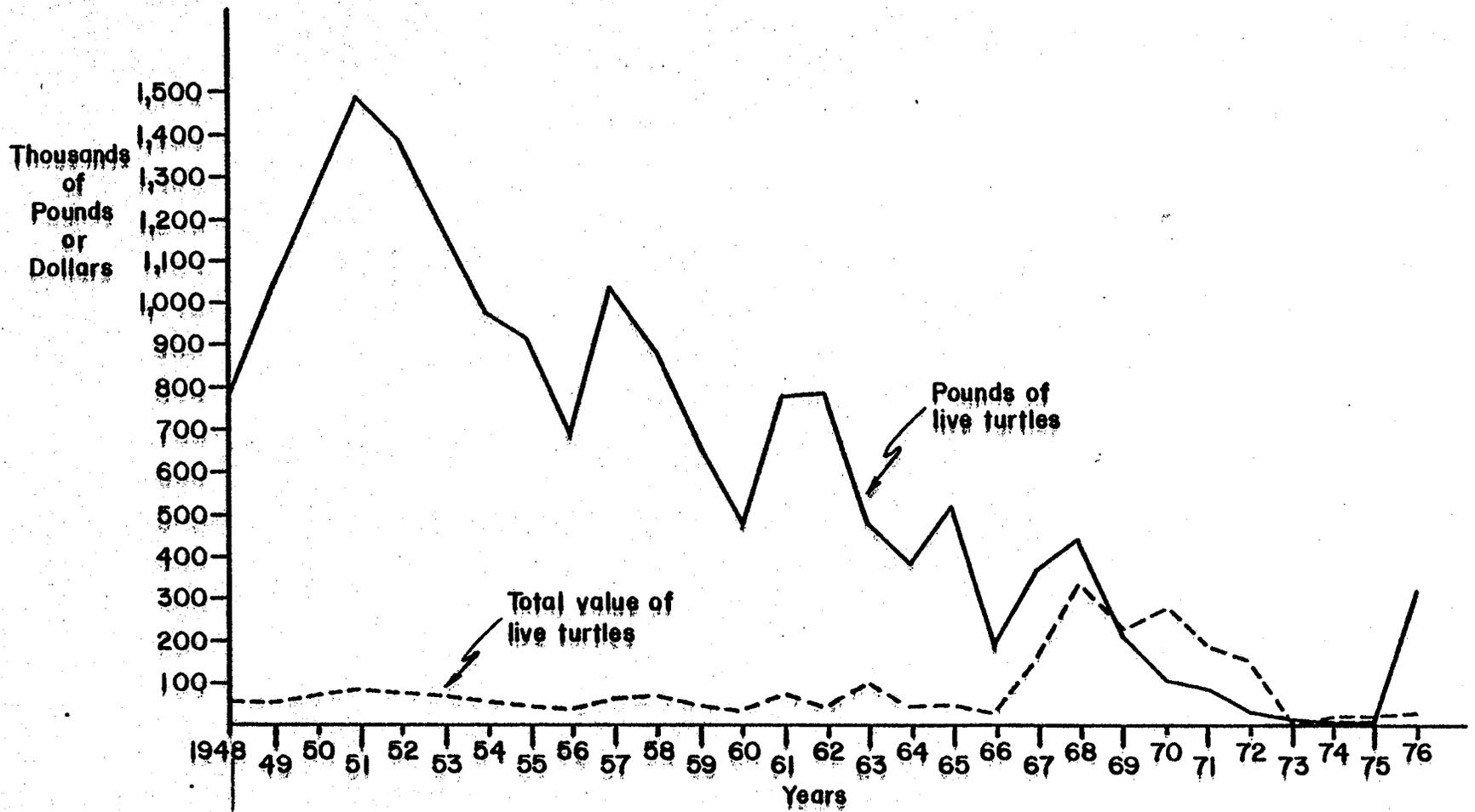


FIGURE I. IMPORTS OF LIVE TURTLES INTO U.S., 1948-1976.

trend and the value per pound is considerably less than for the previous years. There is, however, one possible explanation for the unusually large volume of imports; importers may have been taking what they perceived to be their last opportunity to import live turtles into the U.S. before the ban was fully in effect. A number of Mexican and Ecuadorian companies have been denied permission to export large volumes of green turtle products to the United States in recent years. Presumably these exporters felt that adequate demand existed in the U.S. to make such transactions profitable.

Total value of imported live turtles ranged between \$34,000 and \$84,729 between 1948 and 1966 with the exception of 1963 when value of imports were \$101,000. There was no apparent trend in value of imports during this nineteen year period in spite of the overall significant downward trend in volume imported. Prices generally increased in proportion to declines in volume. In 1967, prices began to increase significantly and total value of imports reached a high of \$324,000 in 1968. Since 1968, total volume of imports has been on a gradual decline due to both further declines in volume imported and a decline in prices per pound since 1972. In 1972, price per pound was at an all time high of nearly \$4.00 per pound.

Regression analysis of the relationship between quantity of live turtles imported and price of live turtles suggests two different demand relationships during the 1948-76 time period (Figure 2). Between 1948 and 1962 demand for turtles was highly elastic. Large quantities were being purchased at extremely low prices (between 7 to 11 cents per pound). Small variations in prices were associated with large variations in quantity. Since 1962, the demand relationship has become much more inelastic; price changes are proportionally greater than inverse changes in quantities. But possible substitution of turtle products for live turtles also complicates any attempt to conduct a rigorous economic analysis of supply, demand,

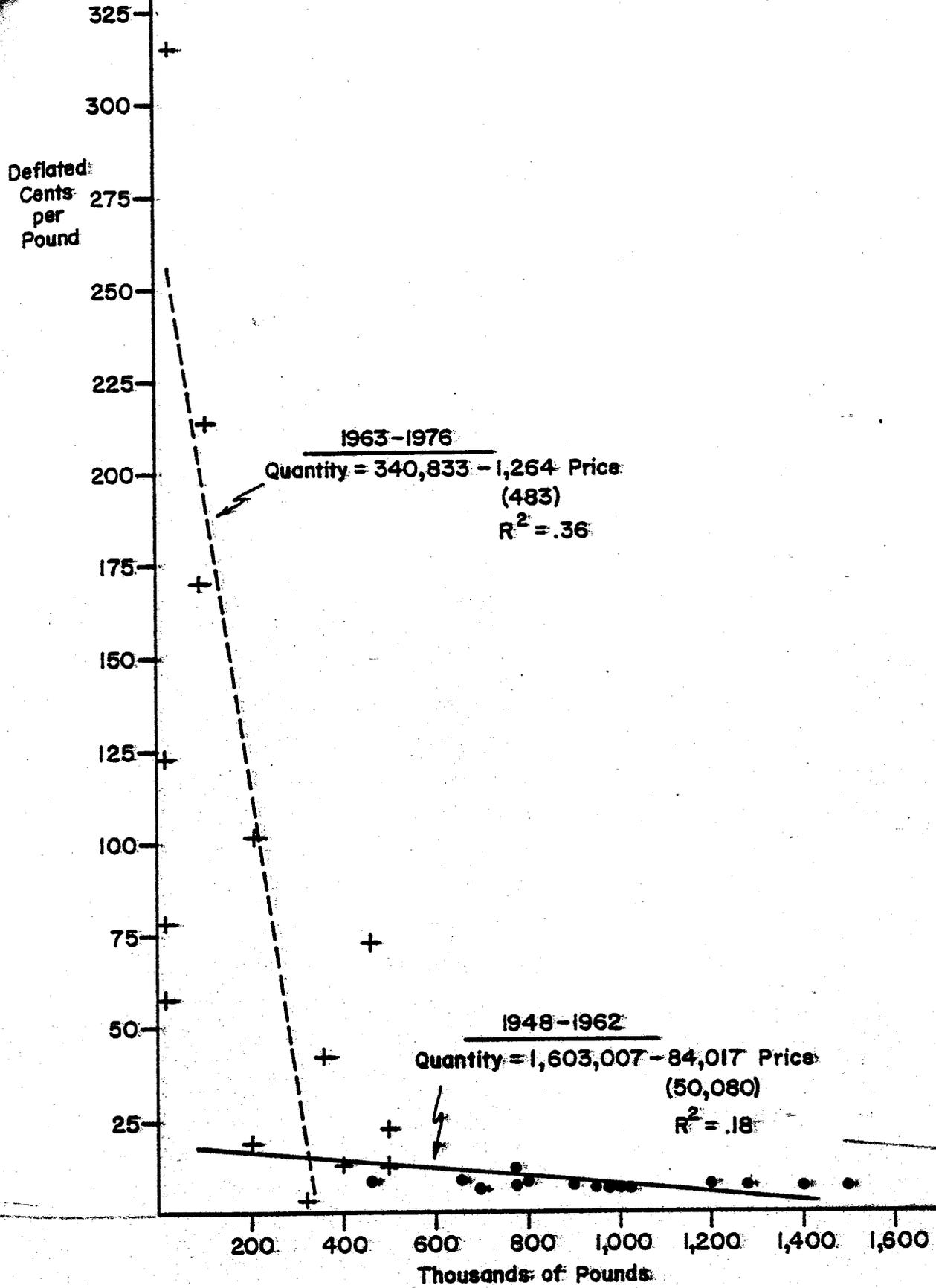


FIGURE 2. RELATIONSHIP BETWEEN DEFLATED PRICE AND QUANTITY OF LIVE TURTLES IMPORTED INTO THE U.S., 1948-1962 AND 1963-1976.

and prices of live turtles in the U.S. during this period.

#### Imports of Turtle Meats Through Principal Ports

The port of Miami was the leading port for imports of turtle meats with a record year of 338,600 pounds reported in 1974 (Table 2). The port of Tampa received substantial imports in years when no imports were reported for Miami. This may represent a shift in trade patterns during those years. Total shipments of turtle meats into Florida increased considerably during the last decade when such trade was legal. Imports into Texas showed the reverse trend.

Information in Table 2 is not sub-classified by species and simply represents total turtle meat imports into these four ports. Busack (1974) reports 113,900 and 87,000 pounds of Chelonia mydas (green turtle) imported into the U.S. in 1970 and 1971, respectively. This represents 52 percent of the pounds of meat reported in Table 2 in 1970. However, comparisons are impossible for 1971 because Busack's report is 3.5 times the level reported in Table 2. Either there is an error in one or both data sources or considerable meat imports enter other U.S. ports for which there are no recorded data.

#### Turtle Imports by Country of Origin

Unpublished statistics for turtle imports into southeastern ports (Brownsville, Texas and Tampa and Miami, Florida) provide an indication of countries involved in turtle production and exportation. Again, the information is not classified by species. However, given the country of origin and the fact that most imports are meat products indicates that a substantial percentage involves green turtles, though Ecuadorian shippers are known to export mixed shipments of green turtle and olive ridley meat.

Most imports come from countries in South and Central America and the Caribbean area. Leading exporters to the U.S.

Table 2. Turtle meat imports into leading south-eastern ports

Year	Miami, Fla.	Tampa, Fla.	New Orleans & Morgan City <sup>a</sup>	Port Isabel & Brownsville, Tex. <sup>b</sup>
-----Pounds-----				
1963	22,600	--	c	--
1964	87,100	--	c	336,600
1965	212,700	--	700	205,000
1966	29,400	--	100	12,400
1967	10,200	--	c	11,100
1968	c	8,100	c	109,500
1969	c	104,500	c	101,600
1970	c	33,200	c	185,200
1971	c	24,600	c	200
1972	221,900	c	c	5,400
1973	200,300	29,600	c	--
1974	338,600	c	c	--

a Between 1957 and 1963 a total of 64,590 pounds were imported.

b Between 1960 and 1963 a total of 105,300 pounds were imported.

c No imports were reported for those years. No information was available for the years with no reported imports.

Source: National Marine Fisheries Service, NOAA.

have been Mexico, Nicaragua, Costa Rica and Ecuador (Table 3). Mexico is the leading country in terms of number of years in which exports were sent to the U.S. Nicaragua is the leading country by far in terms of volume exported to the U.S. In the early 1970's the U.S. imported sea turtles from more countries than at any other time.

Trends are difficult to establish because of wide yearly variations in exports. In general, it can be concluded that there has not been a detectable trend in imports from Mexico. There has been an upward trend in imports from Nicaragua and Ecuador. Grand Cayman Island is the newest source of imports to the U.S. The Grand Cayman green turtle production has been of three radically different kinds over the years. In past centuries, Grand Cayman was an important green turtle nesting and feeding ground, however, the production of green turtles from Grand Cayman waters dropped to insignificant levels many years ago. Subsequently, green turtles were caught in large numbers by the Cayman-based turtle fleet for several decades, but were caught in distant waters, principally the coast of Nicaragua. The turtles were transported alive and ultimately brought to Key West, Florida, where they were purchased and kept alive in "crawls" until slaughtered. Nicaragua has gradually stopped these incursions into its territorial waters by the Cayman turtle fleet in recent years, and green turtles exported from Grand Cayman are now virtually all raised in captivity on the farm formerly known as Mariculture Ltd. and now entitled Cayman Turtle Farm. Turtles at this farm are derived from eggs, in part gathered from wild beaches, in part laid on the premises by captive breeding stock. They are slaughtered at the farm when their growth rate starts to diminish. The products are exported to a number of different countries; basically, the United States has been the principal importer of the meat, while the calipee has gone to European turtle soup markets, and the leather to Japan and western Europe.

Table 3. Imports of turtle products by country of origin, 1966-76

Year	Exporting Country													Total	
	Mexico	Nicaragua	Costa Rica	Ecuador	West Indies	Jamaica	Bahamas	Grand Cayman	Colombia	Guatemala	Honduras	Dominican Rep.	*Holland		Venezuela
	-----Thousand Pounds-----														
1966	15.3	84.2	14.1										4.3		
1967	10.2	78.2													
1968			10.3												
1969	10.5		94.0	2.9					7.0						
1970	29.0		4.4												
1971	24.6														
1972	5.4	185.7	27.0		.6	.2	.9				30.0				
1973	22.1	158.9		27.1	3.0	12.8	4.2			7.0		.5		1.3	
1974	15.2	299.0		62.3											24.0
1975	13.9	168.3		48.4	8.0			19.9							
1976	146.2	2.7	30.0	42.1				38.7							
Total		977.0	179.8	182.8	11.6	13.0	5.1	58.6	9.0	7.0	30.0	.5	4.3	153	24.0

Source: Derived from National Marine Fisheries Service, NOAA, Unpublished Statistics

\* Assumed to be Transshipments

In addition, NMFS reports imports for 1976 and 1977 into Hawaii (Ed Burgess, personal communication). Whole turtle imports were 29 and 169 in 1976 and 1977, respectively. Turtle products imported were 265 pieces\* and 33,547 pieces for 1976 and 1977, respectively. The large volume of imports in 1977 reflects increases in inventories before import restrictions came into effect.

A demand in the U.S. still exists for sea turtle products and the period immediately after the CITES restrictions were put into effect proved to be difficult for turtle and turtle product importers. A review of import permit applications to the U.S. Department of Interior show several requests were made specifically to import skins and manufactured boots into the U.S. for a period of time after the official ban was instituted. Numerous requests were also made to import green turtle meats. Reasons offered for requesting exceptions to the ban were (1) meat was already processed, (2) contract agreements were signed prior to the effective date of the law, (3) fulfillment of back orders, and (4) turtles were dead before the effective date of the law. Permit information for Grand Cayman Island turtle farm operations indicates a substantial market still exists in the U.S.

Information generated in connection with the recent joint listing of the green, loggerhead, and olive ridley turtles under the Endangered Species Act suggests that the official statistics may seriously understate the volume of imports of turtle products into the U.S., particularly in the years since 1973. The summary of this information that follows was kindly provided by Michael J. Bean, Esq. of the Environmental Defense Fund:

"1. Wayne King's comments, submitted March 8, 1976, included a compilation of green turtle import data taken from the Department of the Interior's Form 3-177 "Declaration of Import" forms. His compilation showed that approximately

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\*Assumed to be a collective term for all turtle products.

425,000 pounds of green turtle meat were imported during the period August, 1972 through December, 1973.\* Assuming that these imports were equally distributed during this 17 month period, the volume of green turtle meat imported in the base year of 1973 was just under 300,000 pounds.\*\*

2. Lee Wedig, Executive Director of the National Fisheries Institute, testified at the 1976 public hearing (TR. 222-23) that an estimated 20,000 to 250,000 pounds of green turtle "product" (apparently meat) were imported from Ecuador and Nicaragua alone in 1975.

3. O.J.Selds, the President of Prelude Foods International, Inc. of Rhode Island, submitted comments dated March 1, 1976, which stated that the total pounds of turtle meat (it is unclear whether this is only green turtle meat) exported to the U.S. by the company's packer in Ecuador were as follows:

1974 -- 192,450  
1975 -- 126,200

It is unclear whether these totals are included in the estimate offered by the National Fisheries Institute, or whether they are in addition to such estimates.

4. Cayman Turtle Farm imported 214,000 pounds of frozen soup and steak products through the non-designated port of Riviera Beach, Florida in 1976 (see letter from Carleton S. Jones to the Director of the Fish and Wildlife Service, Feb. 22, 1977). How much of these products it imported through other ports is unknown. In 1977, however, the Company imported over 55,000 pounds of meat and soup products through this non-designated port (see letter of Carleton S. Jones to the Federal Wildlife Permit Office, January 30, 1978) and over 120,000 pounds of green turtle meat through the port of Miami (see memo dated December 9, 1977 from NMFS special agent Charles M. Fuss, Jr. to Robert Gorrell).

5. In May, 1977, the Fish and Wildlife Service received an application from Empress International S.E. Inc. of Miami to import from 600,000 to 900,000 pounds of turtle meat from Ecuador. This meat was to be comprised of olive ridley and green turtle meat in unspecified amounts. This application also was apparently denied.

From the foregoing, the following partial estimates of the size of the U.S. market for imported green turtle meat can be compiled. In the base year of 1973, the U.S. import market was just under 300,000 pounds. In 1974, data from one company alone indicates that 192,450 pounds were imported. In 1975,

\* This figure includes an unspecified quantity of meat imported through the port of Miami during the first four months of 1974.

\*\* The actual figure may be somewhat lower, for the reason set forth in footnote \*, supra.

the National Fisheries Institute estimates that 200,000 to 250,000 pounds were imported. If Prelude Foods' imports for that year (126,200 pounds) are added to that figure, the total jumps to 326,200-376,200 pounds. Not included in this total or the 1974 total are imports from Cayman Turtle Farm itself. Those data are unavailable for those years. However, in 1976, the Company imported at least 214,000 pounds and in 1977 at least 175,000 pounds. If only half those amounts were imported in 1974 and 1975, the total quantity of green turtle meat imported into the U.S. for those years was greater, and possibly much greater than in the base year of 1973. Finally, further evidence of the dramatic expansion of the turtle meat market in the U.S. is the request of one company for permission to import some 600,000 to 900,000 pounds of green and olive ridley turtle meat in 1978. Even though that request was apparently denied, it is clear that turtle meat importers see a large and growing demand for turtle meat in the U.S.

The above discussion represents only a partial evaluation of the green turtle import market for the years subsequent to 1973. Unfortunately, the sort of comprehensive analysis of import declarations which King did for 1973 is no longer possible. In 1974, Interior ceased to keep a central file of these declarations, and they are now kept at the various ports of entry."

#### HARVEST AND USE OF SEA TURTLES IN THE U.S.

Available data in various reports on the landings of turtles in the U.S. indicate that they have been of importance for almost 100 years. The data are not continuous in nature and probably are a low estimate of total turtle production. They probably do serve as guides in pointing out important geographical areas of importance and of overall trends. The data are not detailed on the use of turtles and eggs and in most cases only estimate round weight (whole weight) of turtles landed.\* Another factor making the data somewhat misleading is the fact that a considerable proportion of the Caribbean production in the 1940's and 1950's was landed in Florida and this is included in the U.S. landings as indicated by Rebel (1974).

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\* It is assumed that these data do not include turtles sold directly to retailers by fishermen.

This discussion of U.S. landings and use patterns will be presented in four sections. First, historical and time series data for the total U.S. will be presented. The next two sections will focus on landings by states in the U.S. The second section will cover states other than Florida. Available data are more complete for Florida and since most turtles appear to have been landed there, the third major section will cover Florida in detail. Finally, some data are reported on the catch of turtles by gear type and these data will be discussed for Florida, Hawaii and Puerto Rico.

### United States Use and Landing Patterns

#### Green Turtles

Landings of green sea turtles in the United States since 1950 have ranged from a low of one thousand pounds in 1955 to a high of 421 thousand pounds in 1970. Landing patterns have been somewhat erratic during the last 25 year period for which data are shown (Table 4 and Figure 3). From 1950 to 1959, green turtle landings were under 15 thousand pounds each year with the exception of 1952 when 97 thousand pounds were reported. From 1960 to 1966, landings were fairly constant at slightly over 30 thousand pounds with the exception of 1963 when landings were 55 thousand pounds. Landings became highly erratic between 1967 and 1974 when they ranged from a low of 14 thousand to 421 thousand pounds in 1969 and 1970, respectively. Total value of green turtle landings has been fairly low due to the apparent low round weight price of turtles. Total value was highest in 1977 at \$91,000, but other than that year was never over \$34,000. Most years total value was much lower still.

These landings of green sea turtles should be considered minimum estimates. Some green turtles are probably included in the unclassified turtle landings reports (Table 4). Landings of unclassified turtles ranged from one thousand to 74 thousand

Table 4. Total landings of green sea turtles in the U.S. 1950-1974<sup>b</sup>

Year	Pounds	Dollars
	-----Thousands-----	
1950	7 (74)	1 (5)
1951	9 (74)	1 (5)
1952	97 (74)	14 (5)
1953	15 (74)	2 (5)
1954	3 (74)	a (3)
1955	1 (21)	a (2)
1956	5	1
1957	4 (1)	1 (a)
1958	9	1
1959	12	1
1960	31	4
1961	36 (1)	6 (a)
1962	31 (1)	4 (a)
1963	55 (1)	9 (a)
1964	33 (1)	4 (1)
1965	31 (4)	5 (a)
1966	31 (7)	5 (1)
1967	154 (6)	25 (1)
1968	64 (4)	14 (2)
1969	14 (9)	3 (3)
1970	421 (13)	91 (5)
1971	133 (20)	33 (10)
1972	137 (23)	34 (11)
1973	52 (1)	17 (a)
1974	29 (2)	6 (a)

<sup>a</sup> Less than 500 dollars.

<sup>b</sup> Numbers in parentheses are landings and values of unclassified turtles which may include some green sea turtles.

Sources: (1) Rebel (1974).  
 (2) U.S. National Marine Fisheries Service, Fishery Statistics of the U.S., 1972-74.

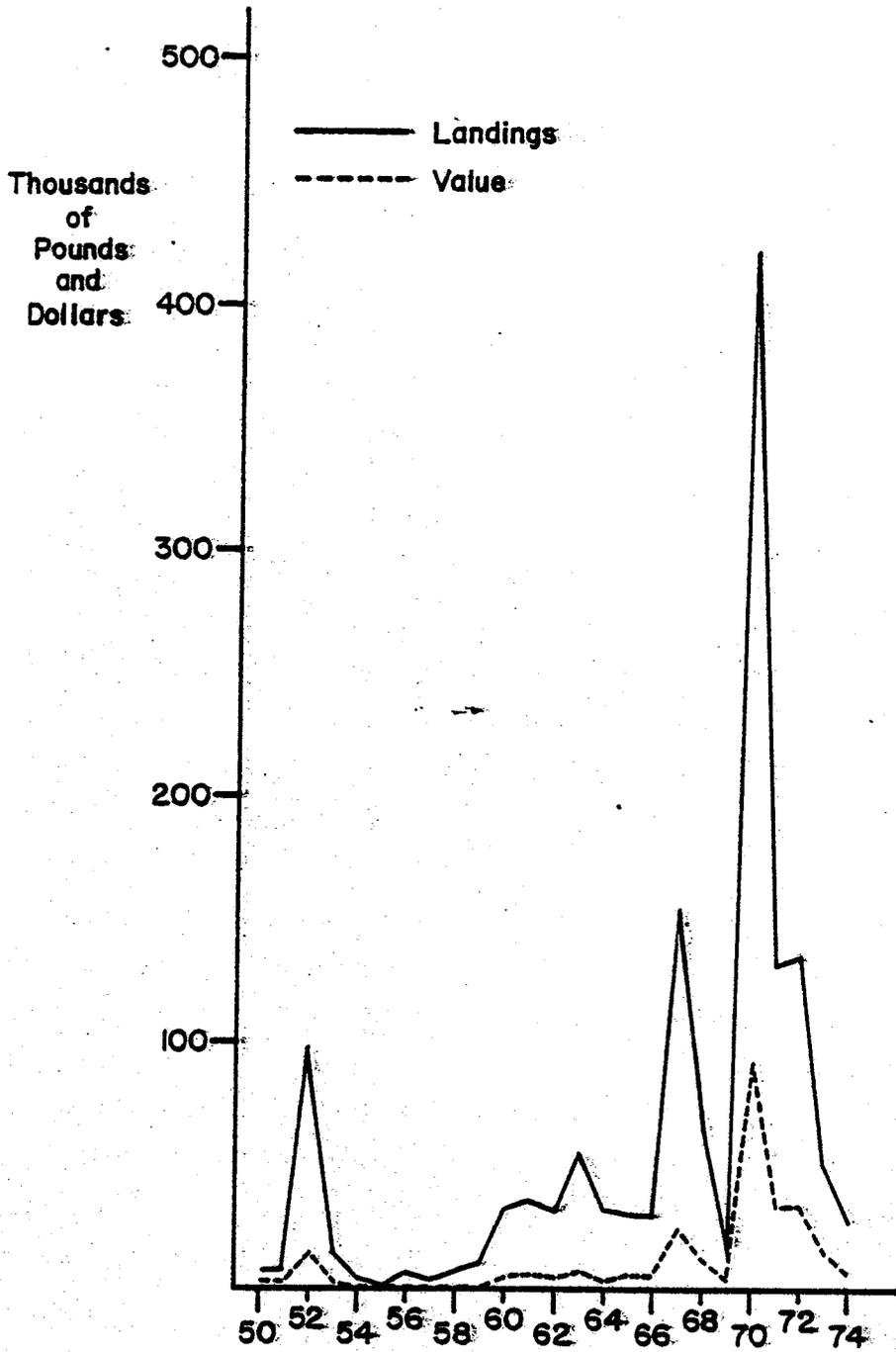


FIGURE 3. LANDINGS AND VALUE OF GREEN TURTLES IN THE U.S., 1950-1974.

pounds from 1950 to 1974. This category was usually quite low relative to green turtle landings each year.

Balazs (in lit., Sept. 10, 1973) reported a sharp increase in green turtle landings in Hawaii. From a low of 380 pounds in 1963, 25,583 pounds were caught in 1972. Over 12,000 pounds were reported caught during the first three months of 1973 - and turtles taken for home consumption were not reported.

### Loggerhead Turtles

Landings of loggerhead turtles have always been much lower than green turtles. Landings between 1962 and 1974 ranged from a low of one thousand pounds in 1969 to a high of 44 thousand pounds in 1973 (Table 5). Landings of green turtles in 1973 were 52 thousand pounds. On a relative basis, loggerhead landings for all other years have been much lower than green turtle landings. The other two "high" years for loggerhead landings were 1970 and 1971 when landings were 26 and 27 thousand pounds respectively. Green turtle landings also showed a dramatic one-year rise in landings in 1970.

### Processed Turtle Products

Very few data are available on the use of sea turtles in processed products other than that aggregated with terrapins and all other kinds of turtles. The number of plants that processed turtle products in the U.S. ranged between four and ten in number for the years between 1948 and 1969 (Table 6). The numbers after 1969 are not shown in the data sources. No data are available on employment in these plants. These plants produce primarily turtle meat, soup and stew in canned form. An additional small number of firms on an isolated basis probably handled sea turtles in fresh and frozen form.

Pounds of fresh and frozen meat handled are shown for selected years from 1963 through 1974 (Table 6). Data for some years are included with unclassified turtle products. A total of slightly over 44 thousand pounds worth \$31 thousand was handled in the peak year of 1966. The lowest volume year was

Table 5. Total landings of loggerhead turtles in the U.S., 1962-74.

Year	Pounds	Value (dollars)
	-----Thousands-----	
1962	9	1
1963	9	1
1964	2	a
1965	3	a
1966	4	a
1967	2	a
1968	3	a
1969	1	a
1970	26	4
1971	27	5
1972	8	1
1973	44	5
1974	8	1

<sup>a</sup> Less than 500 dollars.

Source: U.S. National Marine Fisheries Service, Fishery Statistics of the U.S.

Table 6. Terrapin and turtle meat, soup, and stew canned in the U.S., 1948-76

Year	Number of Plants	Fresh and Frozen Meats			Canned		Dollars per pound <sup>d</sup>		
		Pounds	Dollars	Dollars per pound	Cases <sup>a</sup>	Pounds <sup>b</sup>	Dollars	Current	Real
1948	4				940	45,120	30,899	.63	.95
1949	3				946	45,408	25,164	.55	.78
1950	8				25,074	1,203,552	279,674	.23	.32
1951	10				26,127	1,254,096	279,165	.22	.29
1952	8				24,160	1,159,680	258,568	.22	.28
1953	8				18,923	908,304	255,180	.28	.35
1954	8				8,879	426,192	144,684	.34	.42
1955	9				9,983	479,184	126,768	.26	.33
1956	9				10,927	524,496	160,995	.31	.38
1957	7				16,613	797,424	295,099	.37	.44
1958	6				12,610	605,280	226,316	.37	.43
1959	5				15,037	721,776	244,216	.34	.39
1960	6				12,610	605,280	226,316	.37	.42
1961	10				26,928	1,292,544	390,729	.30	.33
1962	8				18,755	900,240	301,140	.33	.37
1963	7	(a)	(a)	(a)	14,333	687,984	262,622	.38	.42
1964	9	31,940	23,537	.74	17,043	818,064	271,155	.33	.36
1965	8	(a)	(a)	(a)	15,910	763,680	276,034	.36	.38
1966	6	44,431	31,420	.71	14,190	681,120	273,004	.40	.41
1967	6	31,147	24,288	.78	7,945	381,360	201,546	.53	.53
1968		31,933	25,267	.79	8,593	412,464	243,388	.59	.56
1969	6	16,708	14,380	.86	10,799	518,352	297,461	.57	.52
1970	4	(a)	(a)	(a)	7,484	359,232	213,899	.60	.51
1971	(c)	(a)	(a)	(a)	4,108	197,184	118,967	.60	.50
1972	(c)	15,550	15,171	.98	13,406	643,488	369,564	.57	.46
1973	(c)	11,148	14,491	1.30	(a)	(a)	(a)		
1974	(c)	16,885	29,030	1.72	(a)	(a)	(a)		
1975	(c)	(a)	(a)	(a)	(a)	(a)	(a)		
1976	(c)	(a)	(a)	(a)	(a)	(a)	(a)		

Table 6. Terrapin and turtle meat, soup, and stew canned in the U.S., 1948-76 (cont.)

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- <sup>a</sup> One case is 48 pounds. Canned product consists of meat, soup, chowder and consomme.  
<sup>b</sup> Included with unclassified products. ↓  
<sup>c</sup> Not available in reported data from Processed Fishery Products.  
<sup>d</sup> Probably sold on a can or case basis. Derived only to demonstrate trend in price. Real dollars deflated by CPI, 1967=100.

Sources: (1) Rebel (1974) for data through 1969 on number of plants and canned product.  
(2) U.S. National Marine Fisheries Service, Processed Fishery Products, Annual Summaries. 1970-1976, for data after 1969 and for fresh and frozen meat.

1973 when 11 thousand pounds of fresh and frozen meats worth over \$14 thousand were handled. Derived value per pound from the available data shows a dramatic increase in value for fresh and frozen meats. The value per pound in the mid-1960's was between 70 and 80 cents. Value per pound for 1973 and 1974, the last two years for which data are available, was \$1.30 and \$1.72, respectively (Table 6).

Trends in the volume of canned terrapin and turtle meat, soup and stews have shown a large degree of variation from year to year between 1948 and 1972 (Table 6 and Figure 4). Canned volume is reported in cases of product. This was converted to pounds for discussion in this analysis. Large volumes were canned in 1950, 1951 and 1952 when approximately 1.2 million pounds were processed each year. This period was preceded by the two lowest volume years of the entire period and were followed by relatively low volume years between 1954 and 1956. Peak year for canned product was 1961 when 1.3 million pounds of product worth \$390 thousand were canned. Volume of canned product from 1957 to 1966 surrounding this peak range from 600 to 900 thousand with fairly extreme year to year variation. A downward trend in volume began after the 1961 peak year (Figure 4). Volumes canned declined to a low of 197 thousand pounds in 1974, with some annual fluctuations. This pattern was reversed in 1977 when volumes increased drastically to 643 thousand pounds worth \$370 thousand which represented the highest volume since 1966 and highest total value since 1961. Data after 1972 were included with unclassified turtle products.

The relationship between value per pound of canned product and volume canned exhibits the "price-quantity" relationship expected from economic theory. Deflated or real value per pound ranged from a high of 68 cents in 1948 to a low of 22 cents in the early 1950's. The high values in 1948 and 1949 were associated with the lowest two volume years. The large volumes canned in the next four years then were associated with the lowest values per pound of the entire period. Real values per pound then became fairly stable between 1954 and 1966, ranging between 31 and 40 cents per pound. Price

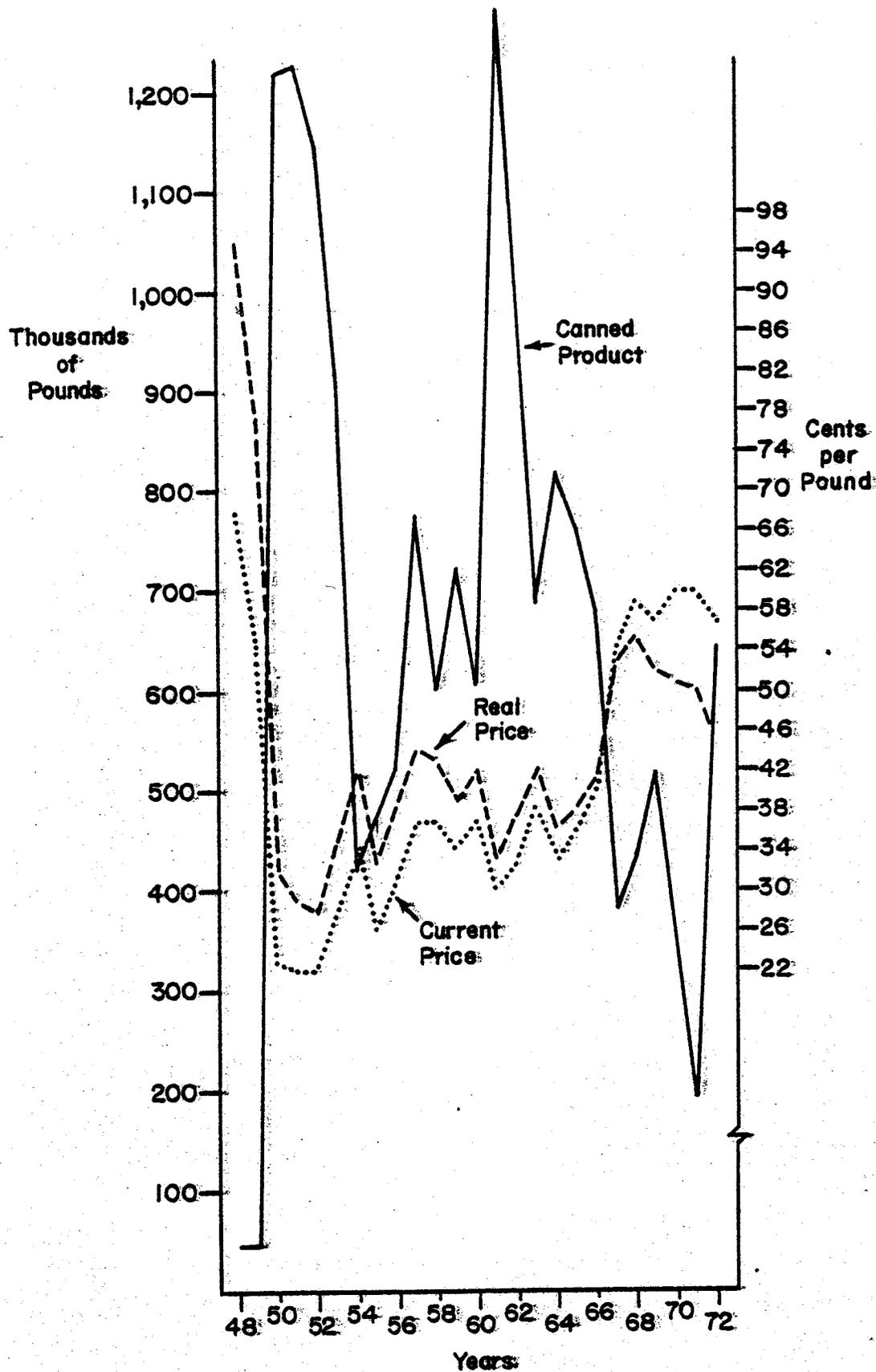


FIGURE 4. POUNDS AND PRICE PER POUND OF CANNED TERRAPINS AND TURTLE MEAT, SOUP AND STEW CANNED IN THE U.S., 1948-1972.

variations during this period appeared to be due to annual variations in canning volume. As the downward trend in canning volume in the late 1960's and early 1970's continued, real value per pound began to increase to the 1970 and 1971 high of 60 cents. Value per pound then fell in 1972, responding to the large volume increase.

The relationship between value per pound of canned product and volume canned shows a definite traditional demand relationship (Figure 5). The demand curve estimated using simple linear regression of quantity on deflated price was statistically significant in that the variation in quantity from 1950 to 1972 and the estimated price coefficient was significant at the .01 level of significance. Data for 1948 and 1949 were excluded since these were extremely low volume and high value years at the beginning of the time series data. The data from 1950 to 1972 were consistent over the entire range and more indicative of the existing demand relationship. The demand curve estimated indicates that a reduction in real value of one cent per pound causes a 30,293 pound (approximately 631 case) decrease in volume canned. Other demand determinants such as income were not included in the demand curve estimate.

The price elasticity of demand for canned turtle products estimated at the means was 1.74 which indicates a highly elastic product. This means that price increases would cause a more than proportionate reduction in quantity demanded.

This relationship suggests one policy alternative that might influence the volume of turtles canned. A tax on canned product or turtles going into canned product would raise the "raw product" price of turtles used in canned meats and stews. This would necessitate a price increase to consumers which would be followed with a reduction in quantity demanded, i.e., a decrease in the demand for raw turtle input into the canning process. For example, a one percent increase in price would

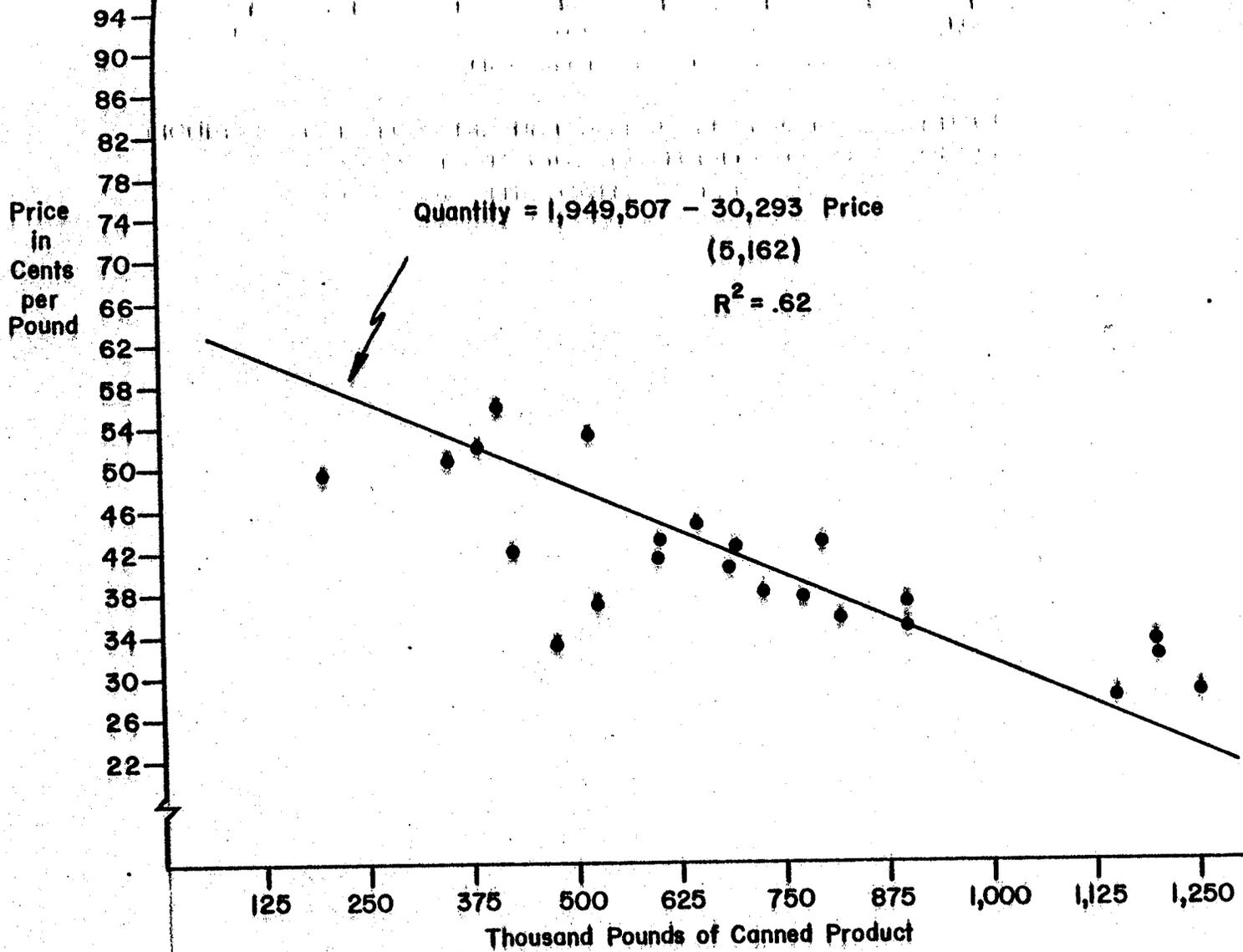


FIGURE 5. RELATIONSHIP BETWEEN DEFLATED PRICE AND QUANTITY OF CANNED TERRAPIN AND TURTLE MEAT, SOUP AND STEW CANNED IN THE UNITED STATES, 1950-1972.

cause a 1.74 percent decrease in quantity demanded. This policy could be used in other major importing countries if the demand for canned turtle products was similar in those countries.

#### Non-Florida Landings

Rebel (1974) provides an overview of the catch of turtles for selected years in Georgia, North Carolina, Louisiana, Texas, Virginia and Mississippi. These data have been updated where possible and augmented with similar data from Hawaii and the Commonwealth of Puerto Rico in order to illustrate the activity in turtle harvesting outside Florida (Table 7).

Data on the catch of turtles in Georgia, North Carolina, Texas and Mississippi are quite limited in scope and show catch occurring no later than 1925 in any of these states (Table 7). Peak years and pounds caught were: Georgia, 11,250 pounds in 1918; North Carolina, 24,000 pounds in 1897; Texas, 83,000 pounds in 1890; and Mississippi, 337 pounds in 1918. Fairly continuous data are available for Louisiana from 1948 to 1972 after which no landings are shown. Landings have never been over 11,600 pounds (1948) and over 10,000 pounds only twice. Peak years from data before the continuous time-series were 1880, 1890 and 1933, with the maximum catch occurring in 1933 at 145,000 pounds. Since the continuous data series has been in effect, the maximum value of landings was \$1,740 in 1948. Virginia landings were at a peak in 1950 when 6,900 pounds were landed. No landings have been recorded for Virginia since 1962.

Landings of turtles in Hawaii are available since 1948 when 17,650 pounds were reported. The landings trend was downward until the early 1960's. Landings then began to increase with a peak of 23,477 pounds valued at \$10,587 in 1972. Landings in 1973 were slightly lower. Since May, 1974,

Table 7. Landings of turtles in Georgia, Hawaii, Louisiana, Mississippi, North Carolina, Texas, Virginia and Puerto Rico for selected years<sup>d</sup>.

State	Year	Pounds	Dollars
Georgia	1897	1,000	20
	1918	11,250	100
Hawaii	1948	17,650	2,154
	1949	15,168	2,016
	1950	11,588	1,733
	1951	5,144	1,050
	1952	2,731	533
	1953	9,466	2,214
	1954	3,040	483
	1955	11,126	1,731
	1956	6,819	1,025
	1957	696	195
	1958	3,207	1,171
	1959	714	90
	1960	3,739	527
	1961	709	139
	1962	477	48
	1963	380	75
	1964	1,609	321
	1965	1,510	57
	1966	4,715	1,053
	1967	5,021	1,173
1968	3,063	2,400	
1969	7,202	2,821	
1970	11,869	5,017	
1971	19,204	9,851	
1972	23,477	10,587	
1973	18,367	7,815	
Louisiana <sup>a</sup>	1880	30,000	1,200
	1890	90,793	2,335
	1918	4,360	218
	1925	8,650	173
	1932	6,450 <sup>b</sup>	129
	1933	145,000	6,000
	1936	3,500 <sup>a</sup>	70
	1948	11,600	1,740
	1949	5,800	630
	1950	4,800	466
	1951	2,800	280
	1952	10,500	1,311

Table 7. Landings of turtles in Georgia, Hawaii, Louisiana, Mississippi, North Carolina, Texas, Virginia and Puerto Rico for selected years<sup>d</sup>(Continued).

State	Year	Pounds	Dollars
Louisiana <sup>a</sup> (cont'd)	1953	2,600	263
	1954	1,400	210
	1955	200	20
	1956	4,300	598
	1957	200	20
	1958	3,500	286
	1959	4,600	250
	1960	6,200	415
	1961	6,300	813
	1962	3,300	199
	1963	2,200	223
	1964	3,000	420
	1965	6,000	1,000
	1966	3,300	407
	1967	2,000	(c)
	1968	1,000	(c)
	1969	2,000	(c)
	1970	2,000	(c)
	1971	8,000	(c)
1972	3,000	1,000	
Mississippi	1918	337	20
North Carolina	1897	24,000	1,920
	1918	8,400	77
Texas	1880	24,000	720
	1889	82,800	1,409
	1890	83,000	1,390
	1918	6,671	447
	1925	2,550	204
Virginia <sup>a</sup>	1948	2,800	156
	1949	600	18
	1950	6,900	138
	1951	1,200	22
	1952	6,900	169
	1953	6,400	128
	1954	5,100	51
	1955	2,600	52
	1956	4,400	44
	1957	1,600	16

Table 7. Landings of turtles in Georgia, Hawaii, Louisiana, Mississippi, North Carolina, Texas, Virginia and Puerto Rico for selected years<sup>d</sup> (Continued)

State	Year	Pounds	Dollars
Virginia <sup>a</sup> (Cont'd)	1958	1,200	88
	1959	2,200	22
	1960	1,600	16
	1961	1,100	11
	1962	600	6
Puerto Rico	1971	25,700	10,067
	1972	18,600	8,563
	1973	19,000	9,477

<sup>a</sup> Principally green turtle

<sup>b</sup> Loggerhead only

<sup>c</sup> less than 500 pounds

<sup>d</sup> no states report landings after 1973

- Sources: (1) Rebel (1974) for data on Georgia, North Carolina, Louisiana, Texas and Mississippi through 1966.  
 (2) U.S. National Marine Fisheries Service, Fishery Statistics of the U.S., 1962-74.  
 (3) Balazs (1973) for data on Hawaii from 1948 to 1961.

the commercial exploitation of green turtles has been prohibited in the Hawaiian Islands (George Balazs, personal communication). Landings in Puerto Rico have been recorded since 1971 and have ranged between 18,600 and 25,700 pounds. Total value was highest in 1971 at \$10,067.

### Florida Landings

Available information on sea turtle landings in Florida are somewhat more detailed than those available for other areas. This is primarily because Florida has been the primary production and distribution center for the turtle industry. Rebel (1974) also points out that a considerable quantity of Caribbean turtles were landed in the U.S. in the 1940's and 1950's and were included in the Florida statistics. Rebel (1974), quoting other sources, gives a narrative description of the early turtle industry and trade centers in the late 1800's. Rebel's breakdown of the 410,000 pounds produced in Key West in 1895 indicates that 82 percent were green turtles, 6 percent were loggerhead, 10 percent were hawksbill, 2 percent were eggs, with a small volume of tortoiseshell in addition.

The late 1800's data indicate landings of magnitudes reached only once during the 1900's. Between 1880 and 1897, landings ranged between 180 and 635 thousand pounds. Landings in 1970 were 445 thousand pounds (Table 8 and Figure 6). Continuous data available since 1938 show much lower levels of landings. Landings have normally been less than 60 thousand pounds. Between 1938 and 1947 landings averaged slightly over 54 thousand pounds. Between 1950 and 1966 landings were less than one half this at an average of 26 thousand pounds.

Landings again increased beginning in 1967 and peaked in 1970 at 445,000 pounds which was a modern landings record. Landings then fell again to fairly low levels in the 1970's.

Table 8. Sea turtles landed in Florida for selected years from 1880 to 1974<sup>a</sup>

Year	Pounds <sup>c</sup>	Dollars	Dollars per pound <sup>d</sup>		Year	Pounds <sup>c</sup>	Dollars	Dollars per pound <sup>d</sup>	
			current	real				current	real
1880	180,000	7,200	.04	-	1955	1,552	222	.14	.18
1884	300,000	10,500	.04	-	1956	2,603	303	.12	.14
1890	468,256	20,972 <sup>b</sup>	.05	-	1957	9,928	1,233	.12	.15
1895	410,000	19,957	.05	-	1958	4,833	773	.16	.18
1896	520,000	28,500	.05	-	1959	10,735	1,610	.15	.17
1897	634,616	22,736	.04	-	1960	30,672	4,601	.15	.17
1918	72,220	4,831	.07	-	1961	34,066	5,110	.15	.17
1925	54,200	3,705	.07	-	1962	35,616	5,223	.15	.16
1936	18,700				1963	60,033	10,263	.17	.19
1937	10,000				1964	30,763	4,386	.14	.15
1938	9,000				1965	28,315	4,118	.15	.15
1939	87,070				1966	32,689	5,639	.17	.18
1940	31,883				1967	153,653	25,602	.17	.17
1941	66,711				1968	65,705	14,580	.22	.21
1942	48,260				1969	13,036	3,044	.23	.21
1943	50,086				1970	444,724	95,049	.21	.18
1944	58,450				1971	151,309	35,605	.24	.19
1945	91,027				1972	142,558	34,905	.25	.20
1946	40,847				1973	77,028	13,822	.18	.13
1947	60,536				1974	34,271	6,940	.20	.14
1950	9,800	980	.10	.14					
1951	10,500	974	.09	.12					
1952	116,521	16,932	.15	.18					
1953	20,758	2,946	.14	.18					
1954	2,245	312	.14	.17					

See next page for footnote.

- 
- a Principally green turtles
  - b Noted in source as fourth in value of fisheries in the state
  - c Reported green turtle landings plus loggerhead landings from 1950 to 1974
  - d Derived from landings and value information. Not reported in original sources.

Sources: (1) Rebel (1974) for data through 1947.  
(2) Data for 1950 to 1974 derived from Tables 9 and 10.

4.2

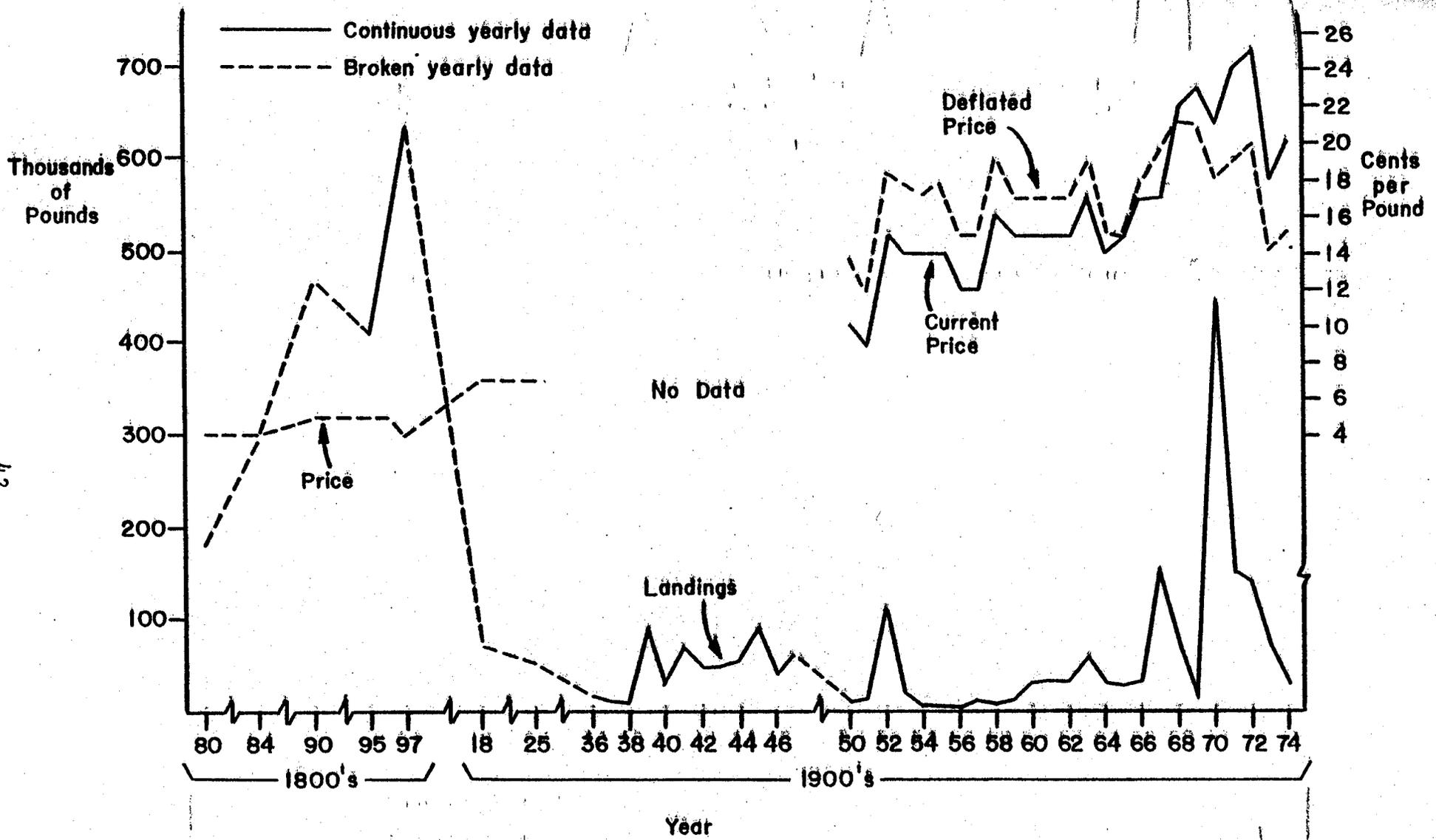


FIGURE 6. LANDINGS AND PRICE OF SEA TURTLES LANDED IN FLORIDA FOR SELECTED YEARS FROM 1880 TO 1974.

To re-emphasize, Rebel (1974), states that by 1947 few turtles were actually caught for the market in Florida, so that figures in more recent years (since 1947) may reflect turtles caught in Puerto Rican and Nicaraguan waters and landed in Florida.

The recorded value per pound of landed turtles also reveals an interesting pattern. Between 1880 and 1925, the current value per pound ranged between four and seven cents (Table 8 and Figure 6). Value data since 1950 indicate value per pound increases from around 10 cents per pound to the maximum of 25 cents per pound in 1972. This increase occurred relatively slowly, reaching only 17 cents by 1967. Price then increased to 22 cents in 1968 and rose to the 25 cents high in 1972. Price then fell in 1973 and 1974 from the peak year.

This implied price relationship may demonstrate a significant economic relationship. Although the average annual price of turtles increased gradually since 1950, the rate of increase, especially between 1952 and 1967, was considerably less than the overall inflation rate. The real price of turtles in Florida actually declined in 1973 and 1974 to levels equal to the lowest prices since 1950 (Table 8). This may indicate a decline in the real value of turtles in the marketplace. Increases in consumer demand for turtles and turtle products would probably have caused a more rapid rise in prices unless the demand increases were met through increases in imports. An equation estimating the relationship between price and quantity of sea turtles landed in Florida was not highly significant and did not exhibit the expected sign.

#### Green Turtles

Landings of turtles in Florida were primarily green turtles and they make up the majority of turtle landings in the U.S. A discussion of Florida green turtle landings would closely parallel with that of the U.S. landings patterns contained in an earlier section, so this section is abbreviated. Landings

of green turtles have been over 100 thousand pounds in four years since 1950 with the high of 419 thousand pounds worth \$92 thousand reported in 1970 (Table 9 and Figure 7). Annual landings have averaged slightly over 23 thousand pounds since 1950, excluding those four high production years.

### Loggerhead Turtles

Landings of loggerhead turtles reached a maximum of 43 thousand pounds worth almost \$5 thousand in 1973 (Table 10 and Figure 7). In only four years since 1951 have landings been greater than 25 thousand pounds. It is known that Kemp's ridley's were also caught during the period in question, and it is assumed that the number of ridleys is aggregated with the loggerhead data.

### Seasonality and Geographic Patterns

Ingle (1972) reported several regions of Florida that were important areas of turtle catching. These were Crystal River and Homosassa (Citrus County), Cedar Key (Levy County) and the Florida Keys (Monroe County). Combined catch in the Crystal River, Homosassa and Cedar Key in 1970 was 795 turtles weighing an average of 43 pounds. The average value of each turtle was \$11.26. The best seasons for each location were: June and July (Crystal River); April, July and October (Homosassa); and May and October (Cedar Key). During 1970, a total of 1,800 turtles averaging 225 pounds each worth a total of \$90,000 were landed in Key West. The value per turtle was \$50. Only about 150 of the turtles were caught in Florida waters with the remainder coming from the Caribbean. The turtles landed in Key West entered a highly organized business program and waiting markets as exhibitions, curiosities in the Kraals and as expensive gourmet soup. In contrast, landings along the Citrus-Levy County region entered primarily local markets.

Landings data were recorded monthly through 1974 for turtles in Florida. Months of highest landings statewide for the

Table 9. Landings and value of green turtles in Florida, 1950-1974a

Year	East Coast		West Coast		Total	
	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars
1950	3,000	300	6,800	680	9,800	980
1951	300	30	6,000	600	6,300	630
1952	1,048	157	88,213	13,232	89,261	13,389
1953			12,368	1,855	12,368	1,855
1954			1,745	262	1,745	262
1955	55	8	1,286	193	1,341	201
1956	202	30	646	97	848	127
1957	348	52	4,475	671	4,823	723
1958	268	43	4,565	730	4,833	773
1959			6,620	993	6,620	993
1960	952	143	19,876	2,981	20,828	3,124
1961	200	30	30,206	4,531	30,406	4,561
1962	835	125	26,615	4,168	27,450	4,293
1963	480	120	51,487	9,117	51,976	9,237
1964			29,639	4,274	29,639	4,274
1965			24,915	3,668	24,915	3,668
1966	210	42	28,511	5,200	28,721	5,242
1967			151,643	25,401	151,643	25,401
1968	100	10	62,855	14,319	62,955	14,329
1969	145	51	12,218	2,956	12,363	3,007
1970	8,380	7,301	410,455	90,562	418,835	91,863
1971	5,162	1,290	120,542	30,137	125,704	31,427
1972	6,347	1,284	128,081	32,133	134,428	33,417
1973	32,460	3,252	10,170	1,525	34,398	9,045
1974	9,154	1,478	17,512	4,368	26,666	5,846

<sup>a</sup> No landings after 1974.

Sources: (1) Rebel (1974).  
 (2) Florida Department of Natural Resources, Summary of Florida Commercial Marine Landings, 1972-74.

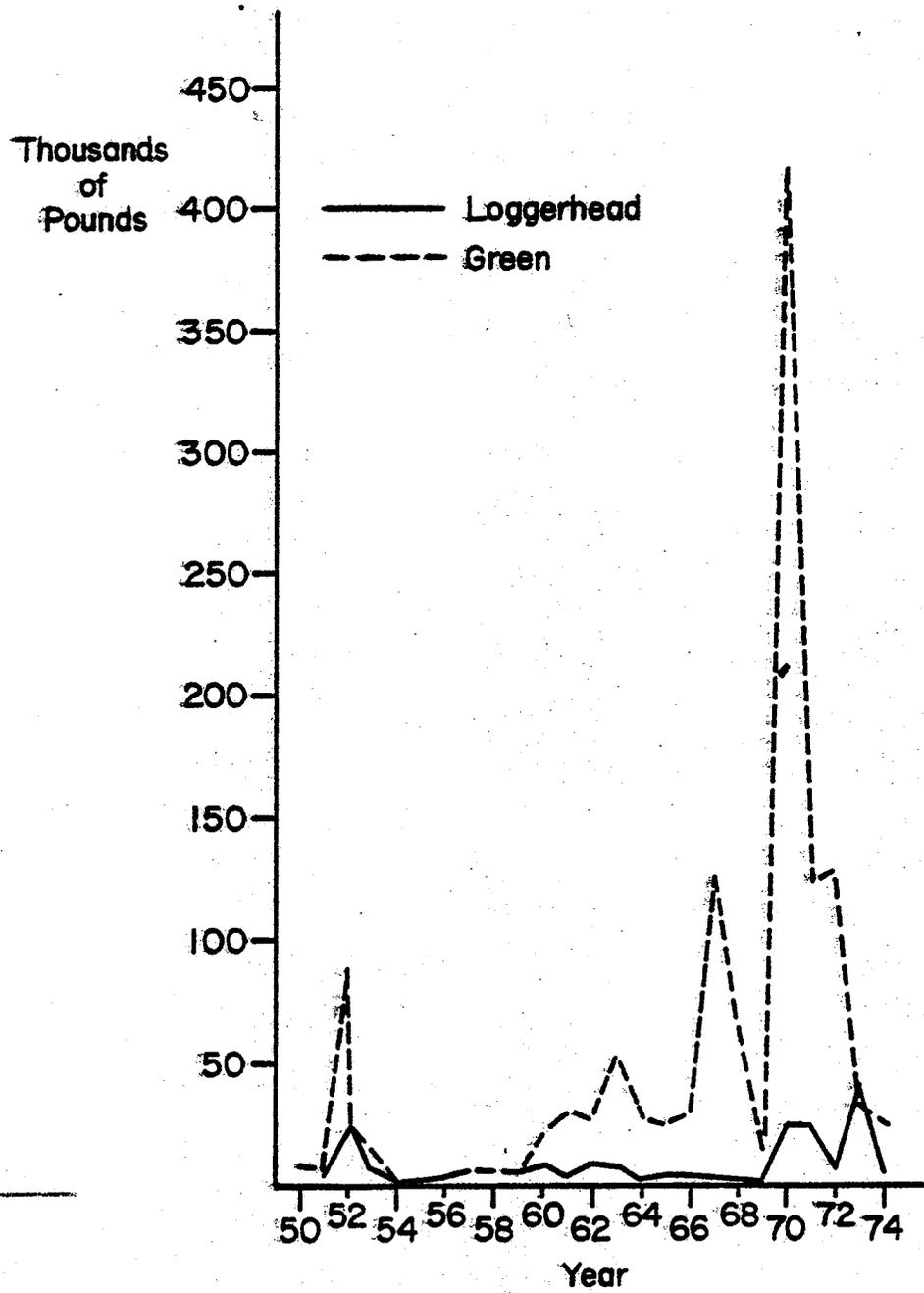


FIGURE 7. LANDINGS OF GREEN AND  
 LOGGERHEAD TURTLES IN  
 FLORIDA, 1950 - 1974.

Table 10. Landings and value of loggerhead turtles in Florida 1951-1974<sup>a</sup>

Year	East Coast	West Coast	Total			
	Pounds	Dollars	Pounds	Dollars		
1951	100	8	4,100	336	4,200	344
1952	941	122	26,319	3,421	27,260	3,543
1953			8,390	1,091	8,390	1,091
1954			500	50	500	50
1955			211	21	211	21
1956	696	70	1,059	106	1,755	176
1957			5,105	510	5,105	510
1958						
1959	4,015	602	100	15	4,115	617
1960	2,640	396	7,204	1,081	9,844	1,477
1961	1,005	151	2,655	398	3,660	549
1962	1,525	229	6,641	701	8,166	930
1963			8,057	1,026	8,057	1,026
1964			1,124	112	1,124	112
1965	2,200	330	1,200	120	3,400	450
1966	3,854	386	114	11	3,968	397
1967	2,010	201			2,010	201
1968	844	73	1,906	178	2,750	251
1969			673	37	673	37
1970	3,722	563	22,167	2,623	25,889	3,186
1971	9,699	2,469	15,906	1,709	25,605	4,178
1972	5,870	1,262	2,260	226	8,130	1,488
1973	32,460	3,252	10,170	1,525	42,630	4,777
1974	7,605	1,094	-	-	7,605	1,094

<sup>a</sup> Figures also including Kemp's ridley turtles sold as loggerheads. No landings after 1974.

Sources: (1) Rebel (1974).  
 (2) Florida Dept. of Natural Resources, Summary of Florida Commercial Marine Landings, 1972-74.

1972-74 average period were, in order of importance: May, April, July and February. These four months accounted for 53 percent of yearly landings (Table 11 and Figure 8). Green turtle landings were highest in May and June while loggerhead and ridley landings were highest in February and April.

The Florida Keys provided 73 percent of Florida landings from 1972-74. The other major area of importance was Brevard County with almost 19 percent (Table 12 and Figure 9).

#### Catch of Turtles By Gear Type

Data on the production of turtles by type of gear were available for Florida, Hawaii and Puerto Rico. Florida east coast production of turtles comes primarily from otter trawls (used for catching shrimp) with some production in the early 1970's from gill nets (Table 13). West coast production comes from gill nets with only isolated catches reported from otter trawls. Total catch in Florida is predominantly from gill nets (usually between 80 and 100 percent). Otter trawl catch was reported at almost 50 percent of total catch in 1973 and 1974. Although the trawl catch did increase, this was due on a relative basis primarily to lower levels of production by gill net rather than large increases in otter trawl catch.

Production in Hawaii has been primarily done with gill nets and "other gear" (Table 14). No delineation of gear type is shown in reported data for "other gear" although in some years it accounts for large percentages of total catch.

Puerto Rico production techniques are gill nets, spears and by hand. Spears and gill nets normally account for over 90 percent of total catch (Table 15).

Table 11. Average monthly landings of green, loggerhead and ridley turtles in Florida, 1972-1974.

Month	Green	Loggerhead	Total	Percent of Total
-----Pounds-----				
January	5,438	2,658	8,096	8.5
February	5,477	4,657	10,134	10.6
March	5,501	3,393	8,894	9.3
April	8,327	3,882	12,209	12.8
May	16,169	900	17,069	17.9
June	2,917	107	3,024	3.2
July	10,727	11	10,738	11.3
August	8,528	0	8,528	9.0
September	3,715	463	4,178	4.4
October	4,243	3,092	6,335	6.7
November	3,034	502	3,536	3.7
December	2,554	0	2,554	2.7

Source: Derived from Florida Department of Natural Resources, Summary of Florida Commercial Marine Landings, 1972-1974.

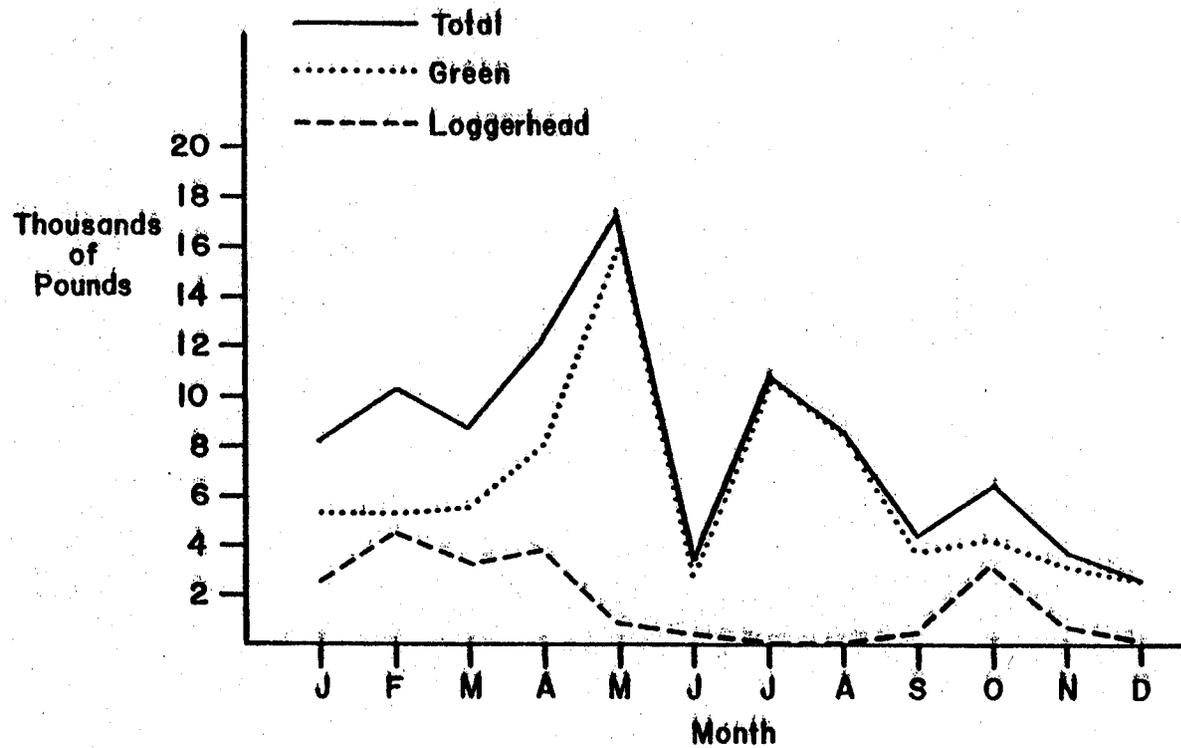


FIGURE 8. AVERAGE MONTHLY LANDINGS OF GREEN AND  
LOGGERHEAD TURTLES IN FLORIDA, 1972-74.

Table 12. Important landing areas of turtles in Florida, 1972-74.

County	Year	Green	Loggerhead	Total	Percent of State Total
		-----Pounds-----			
Duval	1972	3,708		3,708	2.6
	1973	-	9,564	9,564	12.4
	1974	-	2,664	2,664	7.8
	Average	1.236	4,076	5,312	6.3
St. Johns	1972	687	-	687	.5
	1973	-	-	0	0.0
	1974	-	-	0	0.0
	Average	229	-	229	.3
Brevard	1972	2,270	5,183	7,453	5.2
	1973	2,935	22,896	25,831	33.5
	1974	9,154	4,941	14,095	41.1
	Average	4,786	10,340	15,793	18.7
Monroe	1972	125,831	2,260	128,081	90.1
	1973	29,443	10,170	39,613	51.4
	1974	17,477	-	17,477	51.0
	Average	57,580	4,143	61,723	73.1
Levy	1972	2,260	-	2,260	1.6
	1973	2,020	-	2,020	2.6
	1974	-	-	-	0.0
	Average	1,426	-	1,426	1.7
Escambia	1972	-	-	-	0.0
	1973	-	-	-	0.0
	1974	35	-	35	.1
	Average	12	-	12	a

<sup>a</sup> Less than .05.

Source: Derived from Florida Department of Natural Resources, Summary of Florida Commercial Marine Landings, 1972-1974.

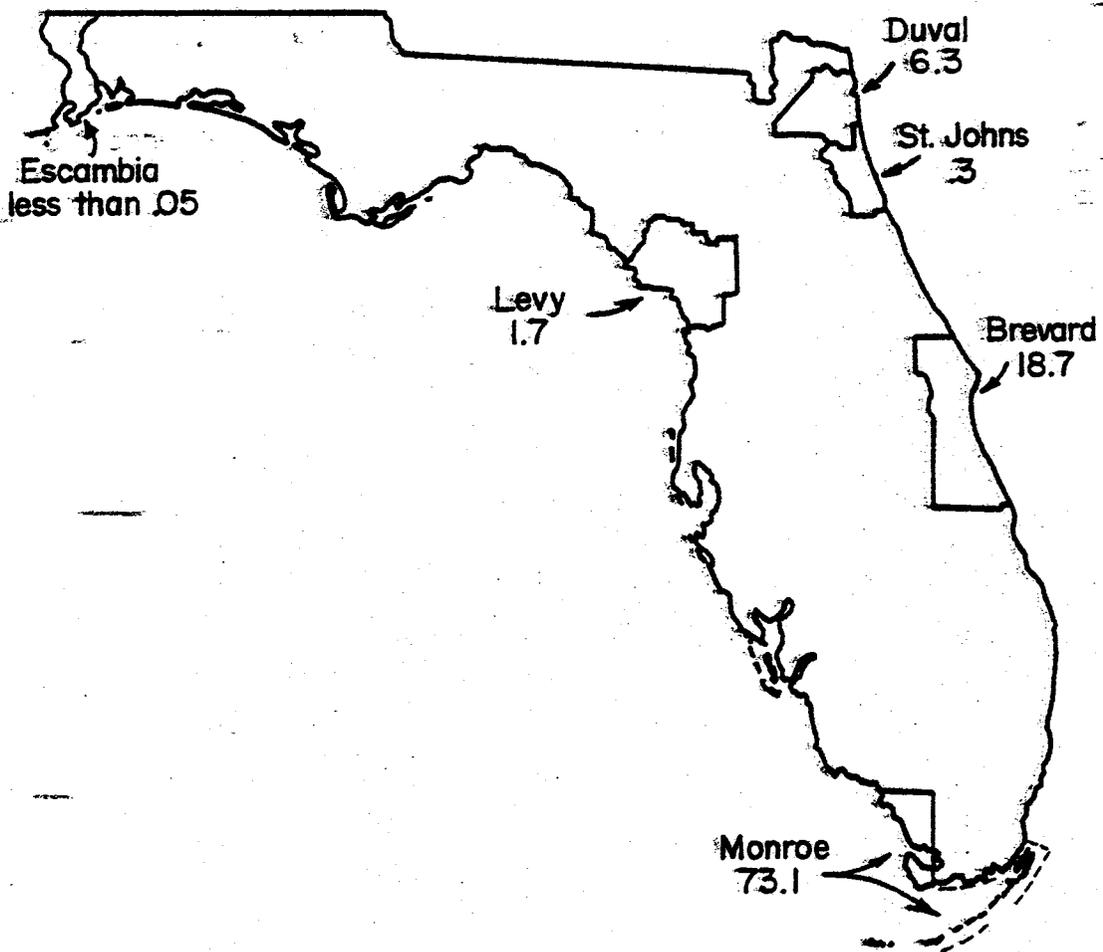


FIGURE 9. COUNTY PERCENTAGES OF FLORIDA LANDINGS OF GREEN AND LOGGERHEAD TURTLES FOR THE THREE YEAR AVERAGE PERIOD, 1972-1974.

Table 13. Production of sea turtles in Florida by type of gear, 1962-1974.

Year	East Coast							
	Haul Seine		Longline		Otter Trawl		Gill Net	
	Green	Loggerhead	Green	Loggerhead	Green	Loggerhead	Green	Loggerhead
	-----Pounds-----							
1962	800	1,500	500					
1963								
1964								
1965								1,200
1966					200	3,900		1,800
1967						200		
1968						800		
1969							100	
1970					4,100	3,300	4,300	500
1971						9,400	5,200	400
1972					4,100	5,900	2,300	
1973					2,900	32,500		
1974					9,200	7,600		

Table 13. Production of sea turtles in Florida by type of gear, 1962-1974 (extended)

West Coast

Year	Otter Trawl		Gill Net		Handline	
	Green	Loggerhead	Green	Loggerhead	Green	Loggerhead
	-----Pounds-----					
1962	1,000	3,200	25,700	3,400		
1963			51,500	8,100		
1964			29,600	1,100		
1965		1,100	24,900	100		
1966	400		28,100	100		
1967	2,000		149,700			
1968	100		62,700	1,900		
1969		700	12,100			
1970			410,500	22,200		
1971		1,500	120,600	13,200		1,200
1972			128,100	2,300		
1973			31,400	10,200		
1974			17,500			

Table 13. Production of sea turtles in Florida by type of gear, 1962-74 (extended)

Year	Haul		Seine		Longline		TOTAL Otter Trawl		Gill Net		Handline	
	Total	Percent of total	Total	Percent of total	Total	Percent of total	Total	Percent of total	Total	Percent of total	Total	Percent of total
-----Pounds-----												
1962	2,300	6.3	500	1.4	4,200	11.6	29,100	80.6				
1963							59,600	100.0				
1964							30,700	100.0				
1965					1,100	4.0	26,200	86.0				
1966					8,000	21.1	30,000	78.9				
1967					2,200	1.5	149,700	98.5				
1968					900	1.4	64,700	98.6				
1969					700	5.4	12,200	94.6				
1970					7,400	1.7	437,500	98.3				
1971					10,900	7.2	139,400	92.0			1,200	0.8
1972					10,000	7.0	132,700	93.0				
1973					35,400	46.0	41,600	54.0				
1974					16,800	49.0	17,500	51.0				

Source: U.S. National Marine Fisheries Service, Fishery Statistics of the U.S., 1962-1974.

Table 14. Production of green turtles in Hawaii by type of gear, 1962-74

Year	Gill Nets		Unclassified nets		Other Gear		Total Pounds
	Pounds of total	Percent of total	Pounds of total	Percent of total	Pounds of total	Percent of total	
1962					477	100	477
1963	155	20			305	80	380
1964	344	21			1,265	79	1,609
1965	80	5			1,430	95	1,510
1966	3,790	80			925	20	4,715
1967	2,336	66			2,685	34	5,021
1968	2,943	96			120	4	3,063
1969	4,811	67			2,391	33	7,202
1970	9,980	84			1,889	16	11,869
1971	6,274	33			12,930	67	19,204
1972	9,736	42			13,711	58	23,477
1973	13,360	73	480	8	3,527	19	18,367
1974							

<sup>a</sup> Production prohibited after May, 1974.

Source: U.S. National Marine Fisheries Service, Fishery Statistics of the U.S., 1962-74.

Table 15. Production of green turtles in Puerto Rico by type of gear, 1971-73<sup>a</sup>

Year	Hand		Spears		Gill nets		Total Pounds
	Pounds	Percent of Total	Pounds	Percent of Total	Pounds	Percent of Total	
1971	2,440	9	9,318	36	13,942	55	25,700
1972	600	3	13,000	70	5,000	27	18,600
1973	-	-	19,000	100	-	-	19,000

<sup>a</sup> Data on Puerto Rico not reported in detail prior to 1971

Source: U.S. National Marine Fisheries Service, Fishery Statistics of the U.S., 1971-73.

## WORLD-WIDE TURTLE PRODUCTION

Turtle production data for countries other than the U.S. and Mexico are inconsistently reported, scattered and incomplete. F.A.O. statistics are the only source of data which attempt to provide a continuing record of production. This section of the report is divided into two main divisions. First, FAO statistics are reported by country and year. The second section reports historic and current information for six regions of the world. Production, consumption and price information generally come from isolated reports and studies. The six regions defined for this study are: (1) Western Atlantic and Caribbean, (2) Mexico, (3) Western Indian Ocean, (4) Eastern Atlantic and Mediterranean, (5) Western Pacific and (6) Southeast Asia and Australasia.

### FAO World Statistics

Data prior to 1961 in FAO sources were too incomplete and aggregated to provide any useful information. Data reported in Table 16 for the 1961-1974 period provide some general data. However, these data should be treated with caution. The "round whole" numbers and consistent production figures for years reported are highly unlikely and are not generally consistent with other information in this report. Data for the U.S., Mexico and Cuba, however, appear to be somewhat more reliable.

Green turtle production in the 1970's in the U.S. reported by FAO sources was approximately twenty-five percent of the U.S. production reported in the early 1960's. Details of the U.S. production are reported in the earlier section on U.S. production.

Mexican production is divided into green turtle and unclassified turtle species data. Green turtle production has declined from an average of 1,450 metric tons for the 1961-62 period to less than 100 metric tons in 1974 (Table 16).

Table 16. Turtle production (metric tons) by species and country, 1961-1974

Year	Country and Turtle Species <sup>a</sup>								
	U.S.	Mexico		Cuba	Costa	Puerto	Eq.	Guinea	
	Green	Green	Unclassified	Green	Hawks- bill	Logger- head	Rica		Rico
1961	500	1,400							
1962	400	1,500		100					
1963	300	1,000		200			100		
1964		300	1,700	100			200	100	
1965		300	1,500	100			300	100	
1966		200	5,000	100			200	100	100
1967		100	10,800	200		100	200	100	
1968		100	14,700	500	200	500			100
1969		100	5,000	300	200	600	300		100
1970	200	100	4,100	300	200	500	300	100	100
1971	100		2,300	400	200	400	200		100
1972	100			500	200	500	600		100
1973	100	100	4,700	400	300	500			100
1974	100	79	2,760	400	300	500	108		100

Source: Yearbook of Fishery Statistics, FAO, Vol. 38, 1974; Vol. 30, 1970; and Vol. 18, 1964.

<sup>a</sup> Turtle production is not classified by species with the exception of the U.S., Mexico and Cuba.

<sup>b</sup> Total other countries includes the following information from reports from individual countries: 1965, 100MT, Honduras; 1967, 100MT from each Venezuela and Spain; 1968, MT, Venezuela; 100MT Hawksbill in U.S. in 1971; 1974, 21MT, 4MT and 5MT from Martinique, Pacific Islands and Egypt, respectively.

Table 16. Turtle production (metric tons) by species and country, 1961-1974 (continued)

Year	Country and Turtle Species							Total other countries <sup>b</sup>
	Brazil	Ecuador	Trinidad Tobago	Philippi	Mauritius	Yemen	Turkey	
1961	600							
1962	500						100	
1963	600							
1964			300			300	100	
1965			300	100		200	100	100
1966			100	100		200		
1967			200	300		100		200
1968			200	600		200	300	100
1969			200	800		300	100	
1970			200	800	100	500	100	
1971	100	300			100			100
1972	100	300		100				
1973	100	300			300			
1974	100	300			300			30

Unclassified turtle production also declined from an average of 1,600 metric tons during 1964 and 1965 to approximately 3,000 metric tons in recent years.

Reported green turtle production in Cuba, unlike the U.S. and Mexico, increased 300 percent between 1962 and 1974. In 1974, Cuba produced 400 metric tons of green turtles, down slightly from the high of 500 metric tons reported in 1968 and 1972. According to FAO statistics, Cuba produces approximately four times the amount of green turtles produced in either the U.S. or Mexico. Cuba data also indicate increased production of hawksbill and loggerhead turtles during the past decade. Three hundred metric tons of hawksbill and 500 metric tons of loggerhead turtles were produced in 1973 and 1974.

Total turtle production in ten other countries is reported for some years in FAO statistics. Costa Rica, Ecuador, the Philippines and Yemen appear to be leading producers. This is consistent with information reported in other sections of this report.

### Production by World Regions

#### Western Atlantic and Caribbean

Principal producers for which additional trade data are available in this region include the Cayman Islands, Surinam, Guyana, Peru, Nicaragua, Trinidad and Tobago, Venezuela, Puerto Rico, Aves Island, Brazil, Columbia, Costa Rica, and Islands of the Lesser Antilles. Information on turtle production in this region is one of the most complete in this report because of extensive research reported by Rebel (1974). In this section Rebel's report is briefly summarized and major effort is given to providing additional information for more recent years.

Cayman Islands. The Caymans have been a principal center for turtle production in the Western Atlantic and Caribbean (Rebel, 1974).

Most of the "wild" production comes from Nicaragua, Honduras and Costa Rica. This, however, has been on the decline in recent years. Most production is green turtles. From 1929 to 1939 between 966 and 3,489 turtles were exported from the Cayman Islands annually. Currently, Cayman Turtle Farm (formerly Mariculture Ltd.) is a principal producer of green turtles in the Cayman Islands, exported animals all being captive reared. The farm has exported substantial quantities to the U.S. Cayman Turtle Farm is the only industrial consumer of turtle eggs, which are hatched for mariculture purposes. During 1972 and 1973, their average purchase of eggs from Surinam was 60,000 annually. This represents between 20 to 30 percent of the egg production in Surinam (Schulz, 1974 and Bacon, 1975). Cayman Turtle Farm anticipate egg self-sufficiency in 1979 or 1980, at which time importation of Surinam eggs will stop. However, there is a possibility of commercial turtle farms becoming established in Surinam itself, with technical and financial backing from the Cayman Farm operators.

Surinam. In former times rather large numbers of nesting green turtles in Surinam were slaughtered for the export market. According to various estimates (summarized by Schulz, 1975), between about 600 and 1000 green turtles were killed annually between 1933 and 1940, with possibly as many as 3000 in 1938 and 1939 - a number considerably greater than the total now coming annually to nest on Surinam beaches. Slaughter of turtles for export ceased in 1940, although many turtles were still killed on the beaches for local consumption. Turtles have not been killed in Surinam now for nearly twenty years, but during those years egg collection has been conducted on a large scale, the principal consumers being the Indonesian population of Paramaribo. Around 1955, 150,000 to 200,000 eggs per season were taken on Bigisanti Beach, Surinam, but this number dropped to 30,000 by 1963. In 1964, the beach was placed under protection, the legislation passed in 1954 to create the Bigisanti area a

nature reserve being enforced with nightly foot patrols.

Egg collection on the beaches around the Marowijne Mouth continued since the protective legislation did not apply to these beaches. In fact, Schulz (1975) estimates that in 1964, about 750,000 eggs were collected from the Marowijne Beaches - some 90% of the total production of the green turtle and an even higher percentage of ridley nests. In 1967 and 1968, the writer\* was involved in a program to conserve the ridley populations of the Marowijne estuary, specifically of Eilanti Beach where almost the entire population nests. Approximately 300,000 eggs were purchased in each of these two years, the eggs being placed in a hatchery in 1967 and allowed to hatch in situ in 1968. Price paid was 1 cent per egg. Green turtle eggs fetched 7.50 to 15.00 guilders per thousand (1 guilder=55 cents US at that time) wholesale in 1968; the price could move up to 20 guilders early or late in the season. Retail (market) prices during the 1964-69 were generally around 10 cents (Surinam) for three eggs.

Since the Marowijne Beaches were given status as a nature reserve in 1969, eggs of the ridley and leatherback have been protected completely. However, green turtle eggs have been harvested under quota in subsequent years. Total numbers of eggs collected for consumption for the years 1970-73 are as follows:

<u>Year</u>	<u># Harvested</u>	<u>Total # Laid</u>
1970	260,000	425,000
1971	417,000	794,000
1972	430,000	939,000
1973	540,000	894,000

Most, but not all, of the eggs harvested were from nests laid too close to the sea, that were 'doomed' to destruction from erosion before they could hatch. The eggs are collected by the Maroni Carib Indians, who are paid 15 guilders per thousand eggs (considered a wage for labor rather than a purchase price, since

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\*The writer referred to here and in later sections is Peter C.H. Pritchard.

the eggs are the property of the government). The eggs were transported to Paramaribo, where they were sold to retailers for 30 guilders per thousand, the difference being utilized for funding of conservation programs. Egg transportation to the city was done without charge by the Dutch Army, who thus provided a subsidy for the enterprise. Retail cost of the eggs is held below 6 cents per egg.

In recent years a substantial proportion of the 'doomed' Surinam green turtle eggs has been sold to the Cayman Turtle Farm for hatching purposes, the revenue again being used for the overall turtle conservation program in Surinam. However, it is expected that this outlet will cease to be available in either 1979 or 1980.

Guyana. No international trade in turtle products from Guyana is on record. A request by St. Lucia for permission to import green turtles from Guyana around 1968 was denied. Substantial numbers of turtles (probably mainly olive ridleys) are caught by the numerous shrimp trawlers that operate off the Guyana coast, but this catch is purely incidental and is beyond the scope of this report.

Although no directed at-sea turtle fishery is known in Guyana, nesting turtles are frequently slaughtered, particularly at Shell Beach, North-West District. At one time (1967) turtle-turning was undertaken on a systematic basis on Shell Beach by oil company employees responsible for the maintenance of a shore base for offshore exploratory drilling, but this is no longer the case. However, sporadic visitors to Shell Beach, including the writer and employees of the Cayman Turtle Farm found that a substantial proportion of the turtles nesting on Shell Beach were being killed. Primary species is the green turtle, but the olive ridleys, hawksbills and leatherbacks are also present.

Prices realized for whole turtles in Guyana depend upon the distance of the market from the nesting beach, and other factors. In the late 1960's, a live adult hawksbill sold for five Guyana dollars in the North-West District, but would fetch \$15 in the

pomeroon area, where an adult green sells for \$35-40. Turtles eggs sold at that time for between 1 and 5 cents (Guyana) each.

No recent data are available on the economics of sea turtle harvest in Guyana.

Peru. A technically illegal fishery exists for sea turtles in the Paracas Peninsula, near Pisco, Peru. The species caught are the green turtle and the leatherback. The magnitude of this fishery is currently under investigation by Coppelia Hays. However, I was informed in 1971 that up to twenty leatherbacks may be caught each day from December to April. The fishery takes place within two miles of the coast; many of the turtles caught, both greens and leatherbacks, are of less than mature size (greens: 45 cm upwards; leatherbacks: 115 cm upwards).

Nicaragua. The market economy of the Miskito Indians in Nicaragua is largely based on green, hawksbill and loggerhead turtles (Nietschmann, 1972). The green turtle is a major source of meat which made up 70 percent of the butchered fish, game and domestic animals for a village of 1,000 people in 1968-69. This 70 percent came from 819 turtles. Hawksbill made up two percent of the slaughter. In 1971, hawksbill turtles were sold for \$2.40 to \$3.50 per pound for shell (\$8.00 to \$13.00 for most shells). Eggs of the green, hawksbill and loggerhead are also an important source of food for local consumption (Rebel, 1974).

The export trade in turtle products began around 1970. The Agency for International Development (AID) provided support for construction of a freezer plant in 1969. This plant was designed to butcher approximately 30 turtles per day. Meat, calipee and hawksbill shell were to be exported (Rainey, draft). An additional plant was constructed in 1970. Between 4,000 and 5,000 green turtles were reportedly bought by these plants annually for export (Bacon, 1975). Nietschmann (1972) reports Miskito Indians harvesting 4,000 to 10,000 turtles between 1968 and 1970 of which

1,000 to 5,000 were sold to companies. This large-scale industrial operation has now ceased.

Trinidad and Tobago. Rebel (1974) reports the turtle industry in Trinidad and Tobago to be a small industry which is mainly a part-time enterprise. Principal turtles are the green, leatherback, hawksbill, and loggerhead. Reported turtle meat sales in 1969, 1970 and 1971 in Trinidad and Tobago were 11,746, 8,764 and 14,611 pounds, respectively. Sales values in 1970 and 1971 were \$3,157 and \$5,561, respectively (Bacon, 1973). This represents only a small portion of the total sold. Shells sold to merchants at Port of Spain brought \$1.00 per pound for green turtle and \$1.50 per pound for hawksbill. Juvenile hawksbills tend to bring higher prices (\$30.00) than adults per pound (Bacon, 1973). In 1975, Bacon (1975) reported annual catch in excess of 50,000 pounds (mainly green and hawksbills).

Currently, fishery statistics in Trinidad do not include a separate category for turtles, these being included in the miscellaneous category. For many years, nesting turtles, principally leatherbacks, have been slaughtered in Trinidad despite efforts by volunteer groups in both Trinidad and Tobago to protect and patrol the resting beaches. Turtles killed while nesting do not figure in the above statistics.

Venezuela. Rebel (1974) reports on annual catch of sea turtles of approximately 50,000 kilograms in Venezuela during the latter 1960's. Green and loggerhead turtles are an important component of the total fishery however, hawksbills and olive ridleys are also often caught in Venezuela. More recent information reports the catch of green turtles in 1969, 1970 and 1971 at 43,342 kg., 42,909 kg. and 13,691 kg., respectively. Production of other sea turtles for the same period was 4,208, 3,364, and 11,092 kg. Green turtles accounted for over 90 percent of the sea turtle catch in 1969 and in 1970 but only for a little over 50 percent in 1971.

Puerto Rico. Data for the 1972-74 production of sea turtles in Puerto Rico is reported in the U.S. section of this report. Bacon (1975) reports annual Puerto Rican sales of approximately 20,000 pounds of turtle meats. Approximately 200 loggerheads are caught annually. The turtle fishery is rather small and is mainly for local consumption. Catches are incidental to other fishing operations. Hawksbill, green and loggerhead are the principal species harvested (Rebel, 1974).

Aves Island. Aves Island is thought to have the second largest nesting population of green turtles in the Caribbean area (EIS draft, 1976). About 300 turtles weighing approximately 45,000 pounds are caught annually on the Aves Island and taken to St. Lucia for sale (Rebel, 1974).\* About 30 percent of the meat is then exported to the U.S. Virgin Islands and England. The trip to the island is rather difficult but the favorable price of approximately \$75. per turtle makes the trip worthwhile (Rainey, draft), even though collection of turtles on Aves is illegal and in the event that Venezuelan officials are on the island at the time, sanctions are likely to be instigated against the actual or potential poachers. Parsons (1962) earlier reported a catch of approximately 400 turtles per year with prices ranging from 8 cents to 25 cents per pound.

Brazil. Total turtle production in Brazil is approximately 100 metric tons annually (FAO).

Paiva and Nomura (1965) and Paiva and Fonteles (1968) give statistics for the capture of green turtles along the coast of Ceara, Brazil, in wooden 'fish-weirs' ("currais-de-pesca"). These structures are composed of a series of heart-shaped corrals of decreasing size, each leading into the next smaller one, with a barrier pointing into the front opening of the

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\*This number and weight are not entirely consistent; only large adult turtles, typically weighing 250-400 pounds, are found on Aves Island, which would suggest aggregated weight of about 75,000 to 120,000 pounds for 300 turtles.

largest. Fish and turtles swimming along the coast are deflected by the barrier into the corrals, which, having funnel-shaped entrances, are not easy to escape. Numbers of green turtles caught in random series of such fish weirs for the years 1963 and 1964 are as follows:

<u>Month</u>	<u>1963 (18 fish-weirs)</u>	<u>1964 (13 fish-weirs)</u>
January	52 turtles caught	54
February	56	3
March	31	17
April	22	16
May	82	31
June	8	27
July	14	21
August	3	5
September	11	--
October	19	--
November	33	4
December	45	9

The turtles caught are of adult size, and are derived from breeding grounds in Surinam. Turtles tagged by the Surinam Forest Service and others are often caught in these fish-weirs as they migrate back to Brazil.

Despite the rather large catch, the meat of the turtles is not highly cherished, and the operation may be considered more of an opportunistic catch (being mainly directed at fish) than a directed turtle fishery.

Colombia. Published statistics are not available for \_\_\_\_\_ Colombia. However, isolated reports indicate production does take place in Colombia. Hawksbill are fished extensively around the Caribbean banks of Colombia (Rebel, 1974). As many as 100 hawksbills are reported to be landed per day using large dip nets in the Serranilla Banks (Rainey, draft). The intensive effort is because

of high export prices for hawksbill shells. As many as 500 to 600 turtles are reported to pass through the Cartagena markets annually (Bacon, 1975). Nesting turtles on the Colombian Caribbean coast are largely loggerheads with a few leatherbacks. Nesting greens and hawksbills have been reduced to insignificant levels.

Costa Rica. Costa Rica has the largest nesting aggregation of green turtles in the Caribbean. Rebel (1974) reports a considerable market for turtle exports from Costa Rica during the 1930's and 1940's. Approximately 80 percent of the hawksbill and 90 percent of the green are exported. Principal import countries were the U.S., Holland and Japan. In 1962, Parsons reported that between June 15 and August 15 of each year, 2,000 female turtles were taken at an average weight of 250 pounds and sold for \$10.00 each. Production of turtles is still in excess of 100 metric tons annually (FAO).

Lesser Antilles. Throughout the chain of the islands of the Lesser Antilles, two species of sea turtle - the green and the hawksbill - are found commonly though not in conspicuous abundance. The loggerhead and the leatherback are rarely seen, and the olive ridley virtually never encountered north of Trinidad (with the exception of a single record from Puerto Rico and another from Cuba). Several of the islands of the Lesser Antilles were visited in order to gain an overall impression of the importance of the marine turtle resource, and whatever economic parameters that could be elucidated.

St. Lucia. St. Lucia is both an importer and exporter of tortoiseshell, and has a fishery based upon both the hawksbill and the green turtle. The hawksbill is known to nest periodically on St. Lucia, and the green turtle probably does also. One loggerhead shell was seen on the premises of a souvenir dealer and turtleshell merchant in Castries.

The chief informant on St. Lucia was Mr. Leonard Stephen, a fisherman resident at Choiseul, at the southern end of the island. Stephen reported that he caught green turtles and hawksbills in comparable numbers, using 18 inch stretch nets fabricated from green nylon twine. The upper border of the net is provided with floats, and the ends have both larger floats and heavy rocks attached to keep the net upright in the water. The net is set overnight in areas known to be frequented by turtles. Fish usually pass straight through; adult turtles and some juveniles are caught.

Stephen estimated that he caught approximately 100 turtles in 1975, and approximately 60 in 1977, but the capture success was so variable that accurate estimates were hard to make. Stephen's estimate for the total annual catch from St. Lucia was 500 turtles per year, but emphasized that this was an order-of-magnitude estimate only. Stephen felt that dynamite fishing was responsible for the destruction of significant numbers of turtles in St. Lucia waters.

Turtle meat sold in St. Lucia fetches about \$1.25 U.S. per pound, though meat exported to the neighboring French Island of Martinique fetched as much as \$4. U.S. per pound. Hawksbill shell was purchased by an exporter in Castries by the name of Fritsch for \$25. EC per pound. While fishermen did not consider this to be a particularly competitive price, the market was always available for whatever quantity they had to sell. Fritsch exported the product to Liverpool, England, where it was manufactured into artifacts. The writer also visited a local manufacturer in a village on the west coast of St. Lucia; but while this individual produced large numbers of artifacts, they were small items such as earrings, and the total number of entire hawksbill shells consumed by such an operator would be very low.

A difference in the yield of shell for male and female hawksbills was reported. Males yield only about three pounds

but the females often produce six pounds, and in one exceptional case the five largest scutes alone from a single turtle weighed a total of 7½ pounds. The writer can testify to the occasional capture of hawksbills with unusually thick, heavy shells; a bisected raw coastal scute in a workshop on Castries had a thickness of over one centimeter.

Islanders from St. Lucia participate occasionally in the illicit capture of nesting green turtles on Aves Island, over a hundred miles to the west. Eddie King, a boat navigator from Micoud, used to travel to Aves Island to catch turtles and sell them in Puerto Rico, but he had stopped two-three years ago (i.e. around 1974-75).

Antigua. Antigua also has both green turtles and hawksbills, though in smaller numbers than on St. Lucia. The leatherback is extremely rare; however, I was informed of one specimen that had been caught and was being kept alive as a tourist attraction, the entrepreneur charging 25 cents just to see it. Doubtless, the attraction was short-lived, since the turtle was kept on land and merely wetted down periodically.

The principal informant on Antigua was Ralph Camacho, former fisheries officer and now a fisheries consultant. Camacho reported that both greens and hawksbills nested in small numbers on Antigua, but that numbers were declining steadily. Greens nest on the windward side of the island, from May to October. A closed season exists from June to September, but is not enforced. Camacho attributed the decline to the illicit harvesting during the closed season. There is no export market, all products being consumed locally. Green turtles are usually sold to hotels (Holiday Inn, Atlantic Beach Hotel and others). The meat sells for about \$2. EC per pound, this price, however, being for a product that includes viscera as well as red meat. Hawksbill meat sells for the same price as that of the green turtle. Tortoiseshell trinkets are manufactured by several people in St. John's and entire polished hawksbill shells sell for \$25-

30 US at the airport. One small shell seen on a sidewalk souvenir stand was offered for only \$5.

Barbuda. Barbuda, a thinly inhabited, flat island north of Antigua, also has both green and hawksbill turtles. Both species nest locally, though not in high density. The principal informants were McChesney George, Eric Burton and Vernon Joseph of Codrington, Barbuda, and Ralph Camacho and Lionel Hurst, both now resident on Antigua.

Estimated total annual export of turtle from Barbuda was placed at around 150. However, much larger numbers are caught for domestic consumption. Estimates varied greatly, but while one was as high as 3000, a figure of 500 is considered more probable. Greens are more plentiful than hawksbills, and some very large greens are caught - up to 500 pounds. One female green turtle tagged while nesting on Aves Island has been caught on Barbuda.

Tortoiseshell buyers from Martinique, St. Lucia and Guadeloupe visit Barbuda three times per year, usually paying \$7-8 per pound for the shell. However, they are unlikely to be able to purchase the product for this low price much longer, according to Barbudian suppliers interviewed. The turtles are caught by net, from October to March (the remainder of the year is closed season, which was reportedly reasonably respected). Not more than 8 lbs. of tortoiseshell could be obtained from one turtle.

St. Martin. Both green turtles and hawksbills are reputedly caught, including by directed catch, but total statistics are not available. Opinions were divided as to whether the turtles nested on St. Martin or not. Certainly not many do; most of the beaches either have too rocky an approach or are too developed to be likely to provide good nesting habitat. One elegant restaurant on the Dutchside of St. Martin had shells of six hawksbills (of adult size) adorning the walls. These shells, however, had been divested of their scutes and were hardly decorative.

Other restaurants and shops around town also had small numbers of turtle shells - one had three green turtle shells, another a shell of a green and two hawksbills, and a fourth had a hawkbill and two greens. Most looked fairly old and dusty, however, and it is probable that present trade is not active.

This general pattern is probably typical of the Lesser Antilles as a whole. An exception may be the American Virgin Islands, which have a minor leatherback nesting ground on the island of St. Croix (recently declared Critical Habitat under section 7 of the U.S. Endangered Species Act). Leatherback turtles caught in the Virgin Islands are sometimes sold for prodigious sums because of the supposed medicinal value of the oil (Wm. Rainey, pers. comm.).

#### Mexico

Mexico has the distinction of having the largest  
sea turtle fishery in the world. Species utilized are principally the olive ridley and the green turtle on the Pacific coast, and the loggerhead and the green turtle on the Gulf and Caribbean coasts. Theoretical protection is afforded the hawkbill, leatherback, and Kemp's ridley, as in the United States. Present day capture of Kemp's ridley is indeed probably almost entirely accidental (in shrimp trawlers), and leatherbacks are not known to be harvested. However, hawksbills, although having no known areas of major concentration in Mexican waters, tend to be caught and killed whenever found. They are usually made into stuffed souvenirs, and are sold openly and apparently with impunity; in 1977 the writer saw freshly stuffed hawksbills displayed in a restaurant frequented by military and other personnel whose specific assignment was the turtle conservation patrol in Oaxaca, but no arrests or seizures were made. Similarly Mittermeier (1971) observed large numbers of stuffed hawksbills on sale in Veracruz, Mexico. The turtles seen by Mittermeier were generally immatures, 25 to 30 cm in length, and were priced at 85 to 600 pesos (then \$6.80 to \$48 US). Of 38 retail stores in Veracruz surveyed by Mittermeier, all had tortoiseshell items for sale, and

twenty had entire stuffed hawksbills. Information received from storekeepers suggested that each sold between two and four hawksbills per week. Even at the lower figure, the twenty stores would thus sell about 2000 turtles per year, excluding the number of turtles used to make tortoiseshell ornaments.

Turtle eggs are given legal protection in Mexico, and in the location of highest density nesting camps are set up each season for the purpose of protection and scientific study of the turtles and their eggs. Illegal collection of eggs still occurs on the Gulf Coast, but is desultory; only a few dozen nests of Kemp's ridley were lost to poachers in 1978 although constant vigilance is necessary since demand is unabated. On the Pacific coast, the illegal take of eggs is probably high; the eggs are sold commercially in some cases (as opposed to the largely personal use of the eggs taken on the Gulf Coast), and may be seen in the inland cities such as Zacatecas. From time-to-time, large-scale operators with trucks full of eggs are intercepted, though not always punished; and in the states of Guerrero and Oaxaca turtle protection is a dangerous business, poachers carrying firearms and being willing to use them. The newly discovered leatherback beach at Tierra Colorada, Guerrero was first discovered when large hauls of eggs removed from the beach were intercepted. However, neither the turtles nor their eggs were being disturbed when the writer visited this beach in November, 1977.

Capture of the sea turtles in Mexico was not intensive before 1961. Up to that time the distribution of turtles in Mexican waters was comparatively poorly known (for example, none of the known mass-nesting sites for either Kemp's or olive ridleys was known at that time). The single factor that encouraged the formation of the present large-scale, highly organized Mexican turtle industry, apart from the discovery of large populations of turtles, was the discovery

that turtle skins can fetch high prices on foreign markets, particularly in Japan and in several European countries (Spain, Italy, France, and Belgium). During the 1960's, large numbers of turtles were slaughtered for their skins alone, since the skins, which fetched a higher price than the meat, could be removed and prepared with minimal equipment, and did not require refrigeration. At the present time, fisheries regulations require that all parts of the turtle be utilized, and all shelled eggs found inside slaughtered female turtles be incubated. These directives are generally followed by the major industrial operators, but not always.

Figures for the production of whole turtles in Mexico are given in Table 17 and Figure 10. It may be seen that olive ridleys have made up the greatest part of the catch since the initiation of large-scale commercialization of turtles in Mexico, in some years constituting 90 percent or more of the total catch.

The quotas for subsequent years, organized by states have been as presented in Table 18.

The quota was not reached in Sinaloa, Nayarit, or Guerrero. The total quota for each of the years 1974-76 was 165,000 turtles.

Gulf and Caribbean quotas were as follows:

	Number Per Year	Number Per Month	Tons Per Year	Tons Per Month	greens	logge -head
<u>Campeche</u>	600	75	24	3.0	50%	50%
<u>Yucatan</u>	420	60	2.4	0.3	50	50
<u>Quintana Roo</u>	2000	300	112	14.0	50	50

In 1977, slightly more restrictive quotas were set generally, with an annual quota and special sub-quotas for the months of December and/or November for some states in which substantial nesting occurred, as an attempt to avoid the harvest taking place entirely during the breeding season. Pacific coast quotas for 1977 are shown in Table 19.

Table 17. Production of whole turtles in Mexico, 1948-1974<sup>a</sup>

Year	Pacific ridley	Green (Chelonia)			Loggerhead <sup>b</sup>
		agassizii	mydas <sup>d</sup>	Total	
1948	20	50	265	315	
1949	15	50	325(324)	375	
1950	20	125	390(382)	515	-(1)
1951	20	75	280(288)	355	-(2)
1952	10	40	300(316)	340	
1953	10	60	170(176)	230	-(c)
1954	10	80	170(175)	250	
1955	30	95	180(176)	275	
1956	30	185	75(72)	260	-(c)
1957	125	385	150(132)	535	-(c)
1958	125	330	50(54)	380	-(c)
1959	65	230	115(118)	345	-(52)
1960	125	385	500(544)	885	-(114)
1961	475	370	305(44)	675	120(225)
1962	400	500	315(325)	815	175(201)
1963	250	570	70(70)	640	15(57)
1964	1,090	505	165(172)	670	125(147)
1965	1,425	390	190(200)	580	35(60)
1966	2,597	570	60(68)	630	20(11)
1967	9,877	510	100(119)	610	20(10)
1968	12,824	1,618	140(148)	1,758	20(8)
1969	4,179	1,090	90(110)	1,180	10(6)
1970	3,456	710	70	780	20
1971	2,071	225	35	260	10
1972	-	-	-	-	-
1973	3,073		40	515	40
1974	2,756		170	670	20

<sup>a</sup> Rebel (1974) also reported hawksbill turtle landings of .2, 4.0 and 2.0 tons in 1953, 1954 and 1955, respectively.

<sup>b</sup> Data in Rebel (1974) are presented in parentheses. Since data in sources below represent a longer time series they are used in the discussion. The green turtle data compare favorably except for 1961. There appears to be some differences in the loggerhead turtle data.

<sup>c</sup> Less than .5 ton.

Sources: Estimated from graphs in

(1) Mexico Instituto Nacional De Pesca, 1976.

(2) Marquez, Rene, M., Aristoletes Villanueva D. and Cuauhtemoc Panaflores S., 1976.

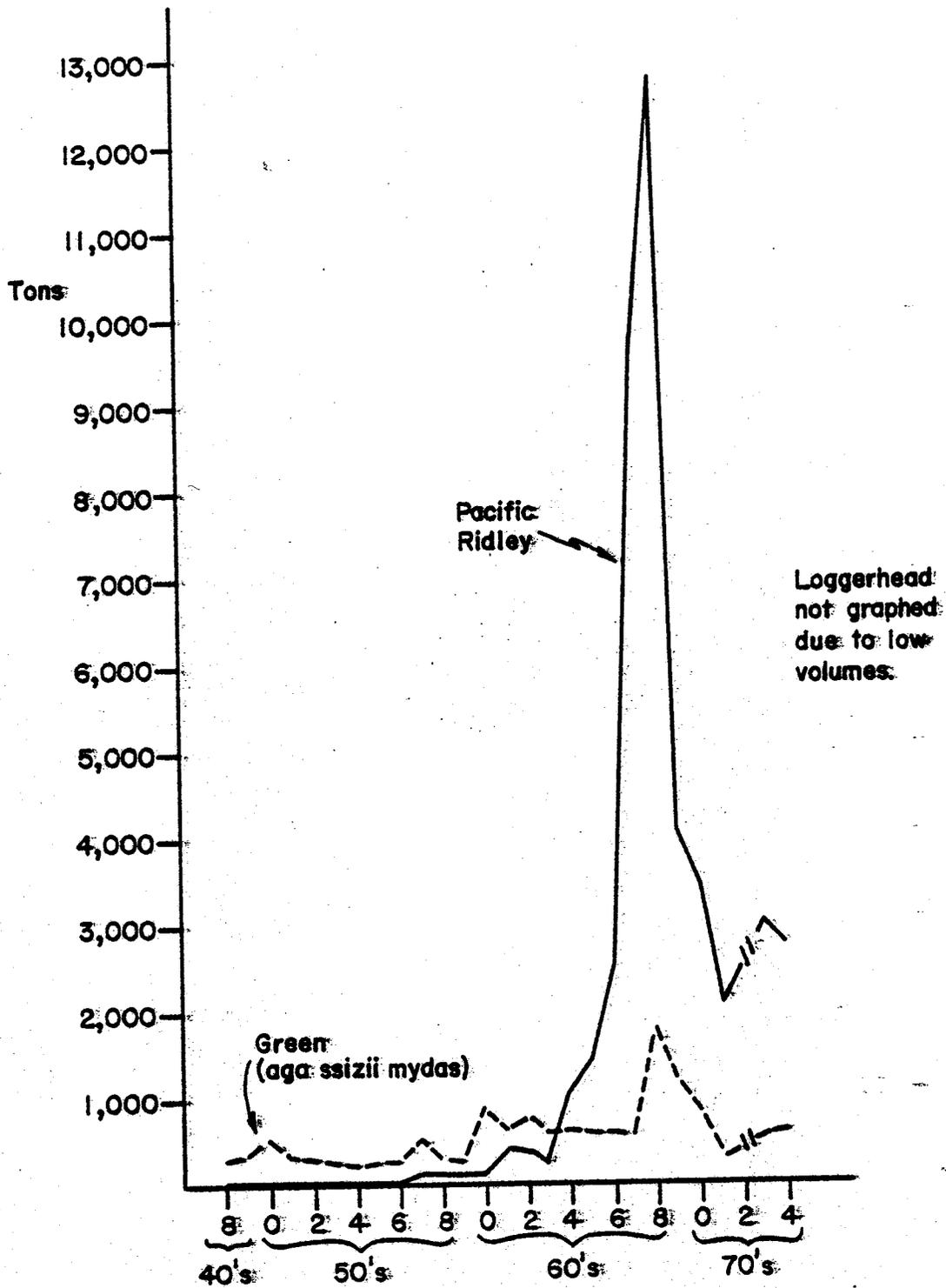


FIGURE 10. PRODUCTION OF WHOLE TURTLES IN MEXICO, 1948-1974.

Table 18. Sea turtle harvest quotas in Mexico for the years 1974-76 (same for each year)

Location	Annual Total	Monthly Total	Annual wt. (tons)	Monthly wt. (tons)	greens	ridleys
Baja California Norte	10,000	1420	400	56.8	100%	-
Baja California Sur	20,000	2855	700	100.0	10	90
Sonora	8,000	1140	320	45.6	90	10
Sinaloa	30,000	4285	900	128.5	5	95
Nayarit	10,000	1420	300	42.8	5	95
Jalisco	16,000	2285	480	68.5	5	95
Colima	10,000	1420	300	42.8	5	95
Michoacan	12,000	1710	360	51.2	10	90
Guerrero	16,000	2285	480	68.5	5	95
Oaxaca	25,000	3570	750	107.1	5	95
Chiapas	8,000	1140	240	34.2	30	70

Table 19. Pacific Coast Quotas in Mexico for 1977.

Región	Number of Turtles		
		<u>Nov. only:</u>	<u>Dec. only:</u>
Baja California Norte	7,000		
Baja California Sur	10,500		
Sonora	7,000		
Sinaloa	10,000	2,000	
Nayarit	7,000	2,000	
Jalisco	7,000	2,500	
Colima	4,000	1,000	
Guerrero	5,000	2,000	
Michoacan	10,000	2,000	2,000
Chiapas	5,000	1,000	1,000
Oaxaca	20,000	7,000	8,000

But in addition to the above, an "extraordinary quota" was permitted during the breeding season in Oaxaca in 1977, with an extra allowance of 52,000 turtles (all olive ridleys) between the months of June and October. This exceptional quota was given in response to heavy political pressure and lobbying efforts, and was finally granted in exchange for certain considerations, namely that PLOSA (the Pacific Coast Fisheries Company that purchases turtles caught by cooperatives) should finance the beach protection patrols and fund a turtle research and conservation laboratory near Puerto Angel. The quota was heavily criticized in the international press (e.g. Felger et al., 1978, Cahill 1978, Pritchard 1978, Cherfas 1978), and this negative publicity apparently resulted in a minor reduction in the "extraordinary quota" for 1978, though details of this are not yet available.

The realized catch of sea turtles for the years 1973 to 1976 for both coasts of Mexico is shown in Table 20.

Table 20. Realized catch of sea turtles in Mexico, 1973-76

Region	1973	1974	1975	1976
----- Kilograms -----				
Baja California N.	54,323	129,843	74,454	65,687
Baja California S.	36,081	85,071	118,516	421,095
Sonora	42,860	55,326	77,718	43,430
Sinaloa	716,254	436,289	357,579	88,422
Nayarit	276,346	120,260	?	54,639
Jalisco	650,221	835,069	93,533	801,234
Colima	-	90,925	?	101,080
Michoacan	-	32,025	379,000	98,767
Guerrero	750,664	230,484	148,074	76,187
Oaxaca	2,036,568	1,132,927	2,355,530	1,629,235
Chiapas	148,760	115,680	-	19,320
Veracruz	-	-	-	800
Campeche	-	6,230	-	9,381
Quintana Roo	100,506	110,260	86,000	?

As may be seen from the data in Table 17, the Mexican turtle harvest increased rapidly until the year 1968, when a record production of 14,600 metric tons of marine turtles (12,823 tons of olive ridleys) was reported. In the immediately subsequent years, the effect of this level of harvest upon the populations was apparent; only 3,456 tons were caught in 1970, and only 2,071 tons in the first seven months of 1971. At this point a moratorium on turtle capture was instituted, which lasted until early 1973. Nevertheless, capture data for the subsequent years suggest that a massive (though difficult to quantify) drop in population followed the 1968 harvest, and that the continuing fishing effort prevented any significant recovery. The decision to permit capture of females while massed near the beach for nesting in 1977 and 1978 in Oaxaca (the only area where arribadas nesting aggregations of significant size were still being reported) has almost certainly caused a further quantum reduction of the population. Indeed, the anticipated third arribada failed completely in 1977, though arribadas of modest size - possibly made up of females that had not nested in 1977 (ridleys can but do not always nest in successive years) - were reported in 1978.

A new and previously undocumented method of harvesting turtles in Mexico was recently described by Felger et. al. (1976). In the Gulf of California, the Seri Indians have known for some years that green turtles (Chelonia mydas aggssizi) have the habit of burying themselves in the benthic mud at certain locations near Tiburon Island. They may remain buried in a dormant condition throughout the winter months - the first known case of winter dormancy among sea turtles. Although the turtles can only be seen at certain times - specifically during daytime at low tide when the sea is clear and calm and there is no cloud cover - at such times the Seri are able to harvest the turtles from small boats by means of long harpoons, with shafts 7 to 10 m in length. Although removal of the turtle from the substrate causes immediate local turbidity that prevents further sight of the turtle, the animals are sluggish and easily boated. The Seri began commercial exploitation of these dormant turtles about 1959, transporting them for sale to the major cities of Sonora. This commercialization has resulted in the progressive depletion of a resource that had been harvested in modest fashion for a great - though unknown - length of time, and has also resulted in a substantial decrease of local subsistence consumption of turtle meat. Dormant turtles are now rarely found in the Infiernillo Channel, the only location where the turtles are in water shallow enough for them to be harvested from the surface by low tide.

In 1972-73, non-Indian fishermen discovered dormant turtles in deeper water off the south shore of Tiburon Island. These turtles were not buried, but were simply lying among small boulders or rocky ledges. The technique used for catching these turtles was described by Felger et. al. (1976):

"The Mexican divers use well-worn U.S. wet suits, weight belts, masks, and fins, and carry a 1-m-long gaff. Respiration is through a hookah arrangement with a low-pressure compressor powered by a 3.5-horsepower gasoline engine. The air is fed through 20 m of 3/4-inch plastic hose to a regulator. There is no filter and the divers breath air contaminated with carbon monoxide and gasoline fumes.

The divers motor to the hunting area, where two crew members dive, one rows, and one tends the hoses and helps boat the turtles. The turtles are torpid and rarely escape. They are easily captured by hand. The gaff is used only if the animal tries to escape. Within one hour the men suffer headaches from breathing contaminated air. Within 2 hours they are severely chilled. These factors limit diving time. A 1-or 2-hour hunt commonly yields five to ten turtles weighing 30 to 80 kg each. The men usually hunt once in the morning and again in the afternoon. Despite the hazards, diving for caguama echada is presently the most effective method for hunting sea turtles in the Gulf of California.

During the 1974-75 winter season, five turtle boats operated out of Kino Bay. During one week in mid-January 1975, four boats took more than 80 turtles from less than 5 km of coast on the south and east sides of San Esteban Island. As hunting pressure rapidly reduced yields from this and other echada sites, the fishermen discovered and moved on to more distant populations.

"...The caguama echada has been systematically depleted in only two winters by a new hunting technique. Even more efficient techniques and their expansion seem imminent."

The following summary of some economic aspects of the illegal turtle egg trade in Oaxaca, Mexico is taken from Cherfas (1978):

"Poachers go out at night and gather eggs from the nest, doubling their annual income by working four extra nights in the year. The eggs are sold to drivers, who take them to restaurants in Mexico City. The egg thief makes about 3/8 peso per egg, about ₡ 40 for a night's haul of 4000 eggs. To the driver, the eggs are worth about 2 pesos apiece, about ₡ 200. And in the restaurants they sell for about nine pesos each. There they are eaten, their oily taste disguised by chili sauce, by rich ignorant men who believe that by eating turtle eggs they will be endowed with the equipment, and endurance of the male turtle."

#### Western Indian Ocean

Regions covered in this section are the Seychelles, Tanzania, Madagascar, South Yemen, St. Brandon and Abidjan.

Seychelles. Available data on green turtles taken on Aldabra Island show a downward trend. Historical data show a total of 12,000 turtles taken in 1890 with the number taken by the mid-1950's at about 500 (Table 21).

Table 21. Number of green turtles taken on Aldabra Island for selected years

Year	Number of Turtles	Year	Number of Turtles
1890	12,000	1945	1,500
1909	5,000	1953	500
1912	9,000	1955	500
1928	3,000	1957	500
1930	4,000		

Source: Frazier (1974).

A FAO (1968) report indicated that 320, 336 and 295 turtles were taken in 1964, 1965 and 1966, respectively from Aldabra and Assumption Islands and received in Mahé.

Frazier (1971) indicated that most of the local consumption of turtle in the Seychelles was in the form of meats. Most of the calipee was exported. Whole animals, dried meats and fins were used for export and local consumption. A small amount of eggs were used for local consumption.

Hornell (1927) reports data that indicates the importance of the hawksbill turtle in the Seychelles between 1893 and 1925. A total of 42,727 kilograms of hawksbill tortoiseshell worth 1,428,232 rupees was exported over the 33 year period. Average annual exports were 1,295 kilograms.

Tanzania. Frazier (1977) sheds some light on turn-of-the-century trade in Zanzibar. Turtle imports between 1890 and 1917 ranged from 200 to 6,500 pounds worth between \$983 and \$43,400.

Madagascar. Hughes (1973) indicated hawksbill production of 2,570 annually in Madagascar. The estimated annual value in 1971 of hawksbill products was \$106,558.

South Yemen. Since 1963, about 2,000 turtles per year have been produced in South Yemen and exported to London and Northern European markets according to the FAO (1968) report of Hirth and Carr. The vast majority of South Yemen do not eat turtle meat or turtle eggs.

St. Brandon. Green turtles have also been consistently harvested on St. Brandon Island. Data from Hughes (1973-75) indicate that the turtle harvest has varied from 106 to 565 turtles annually between 1957 and 1971 (Table 22) with an annual average of 326. Annual production has been quite varied but no definite trend is apparent.

Table 22. Production of green turtles on St. Brandon, 1957-71

Year	Number	Year	Number
1957	565	1965	271
1958	415	1966	365
1959	262	1967	268
1960	106	1968	184
1961	413	1969	363
1962	330	1970	436
1963	274	1971	216
1964	416	15 year average	326

Source: Hughes (1973-75).

Yemen. The annual green turtle take in Yemen between 1964 and 1968 ranged from 880 to 2,640 turtles (FAO, 1973). Exports from 1969 to 1972 were 2,017, 4,000, and 200, respectively. The exports of meat and flippers went primarily to Holland, Germany and the U.S.

Abidjan, Ivory Coast. Goodwin (1971) reported 516 and

797 turtles landed in 1967 and 1968, respectively, and sold for food.

### Eastern Atlantic and Mediterranean

The countries in this region known to produce and utilize turtles are the Azores, Senegal, Turkey, Israel, the Canary Islands and Madeira. Brongersma (1968) observed stuffed loggerheads for sale for \$6 to \$15 dollars each in Madeira and estimates that about 1,000 are captured each year.

Azores. Brongersma (1971) indicates that about 4,000 loggerheads are taken annually in the Azores.

Spain. Turtles are caught regularly along the Mediterranean coast of Spain. Argano (1978) conducted an enquiry along the 24 harbors along the Spanish coast from Tossa on the Costa Brava to Tarifa in the straits of Gibraltar. It was determined that turtles were usually caught accidentally, typically during swordfish fishing. Many escaped with hooks in their mouths, others are released, and generally only a few (greens and loggerheads) are caught and killed. It was estimated that about 1300 turtles may be killed every year in the 24 harbors visited; catches by sport fishermen and turtles brought in to unvisited harbors brings the estimated annual total to 2000. Products utilized include the shell (for tourists), meat, or occasionally oil. A turtle shell may be purchased for three dollars directly from the fishermen, but one was seen in a central shop in Seville priced as high as \$600.

Turkey. In Turkey, Hathaway (pers. comm.) writes that loggerheads, but never green turtles, are caught by hook and line by fishermen on the Mediterranean coast of Turkey, as are marine soft-shelled turtles (Trionyx triunguis). Green turtles nest at Yumurtalik on the coast of Turkey, where they have been heavily exploited, but details are not available.

## Western Pacific

Regions covered in this section are the Caroline Islands, Japan, Guam and Saipan.

Caroline Islands. The comments from this section are taken primarily from personal correspondence, Owen (1978). There are no more than a half dozen records of olive ridley, loggerhead and leatherback turtles in Micronesia and hence no commercial trade due to their scarcity.

Green and hawksbill turtles are found throughout Micronesia and nest on many of the islands. Since World War II and up until the last two or three years, hawksbill turtle shells were used both as traditional jewelry and artifacts (combs, rings, fans, link belts, necklaces, letter openers, brooches, money dishes, etc.) and as tourist trade items. Sometimes whole carcasses were polished and sold. This trade had been almost entirely at the retail level within the islands although some wholesale shipments may have been made to Guam and Hawaii. Shell plates have not been exported for conversion to jewelry except prior to World War II during the Japanese administration. Since the U.S. Endangered Species Act (1973) and the Trust Territory Endangered Species Act (1975) which listed the hawksbill as endangered, there has been a sharp decline in the export of tortoiseshell items because of enforcement activities in Micronesia and at airports in Guam and Hawaii. There may be still some surreptitious trade, though small.

Green turtle meat is still used for food in Micronesia. However, there appears to be no appreciable monetary trade in the meat. Turtles are usually directly consumed by the catcher or distributed in the traditional manners. There appears to be no export trade in green turtle meat.

There are hundreds if not thousands of green turtles taken illegally every year from the remote nesting islands in Micronesia, especially Merir and Helen Islands, by foreign fishing boats. These boats operate primarily from Taiwan, through Japanese and Okinawan boats have also participated. The living turtles are sold in Taiwan, Hong Kong and Japan. Thousands of green turtle eggs are also collected. Due to remoteness it is difficult to control this activity.

Guam and Saipan. - Pritchard (1977) published ~~limited~~ price information indicating that red turtle meat sold for \$.75 per pound in Guam and that stuffed green turtles were on sale for as high as \$2000 on Saipan. In 1968 two divers specialized in catching turtles in Guam. Apparently, Guam exports no turtles as all appear to be consumed locally.

Japan. De Silva (1970) noted a 1960's shipment from the Philippines to Japan consisting of 136 hawksbill and 126 green turtles. Helton (1978) reported that between 1971 and 1975 a total of 220,867 kilograms of hawksbill turtle shell were imported by Japan. These came mainly from Panama, Cuba, Indonesia, Kenya, Tanzania, Nicaragua and the Cayman Islands.

The most recent data on the turtle trade in Japan is reported by Balazs and Nozoe (1978) in their English version of a report prepared by the Japanese Tortoise Shell Association. This report was the result of a 1973 Japanese task force investigation on the sea turtles of the Philippines, Malaysia, Singapore and Indonesia.

The total volume of shells imported into Japan from Hong Kong, Malaysia, Indonesia, and Singapore between 1966 and 1971 ranged from 11.9 to 17.4 thousand pounds (Table 23). Import volumes were 25.1 and 57.0 thousand pounds in 1972 and 1973, respectively. During these years Japanese firms purchased huge amounts from Singapore and Ujung Pandang markets. Imports into Japan have also occurred from the Philippines

Table 23. Volume of tortoise shell imported into Japan from Southeast Asia

Year	"Indonesia Group"				Total	Philippines
	Hong Kong	Singapore	Malaysia	Indonesia		
-----1000 pounds-----						
1966		6.8	3.0	4.3	14.1	
1967		9.5	1.4	1.2	12.1	.4
1968		13.1	1.4	1.8	16.4	1.0
1969		12.5	2.9	2.0	17.4	2.3
1970		10.7	2.3	1.6	14.6	2.1
1971	.1	2.8	2.4	6.6	11.9	1.3
1972	2.1	7.3	.2	15.5	25.1	7.2
1973 <sup>a</sup>	4.4	15.1	-	37.5	57.0	8.4

<sup>a</sup> January to September

Source: Balazs and Nozoe (1978).

with 1973 being the highest volume year at 8.4 thousand pounds (Table 24). Japan is the major consumer of Southeast Asian hawksbills. Each of these important turtle source areas of imports to Japan will be discussed in the remaining sections.

### Southeast Asia and Australia

Major regions covered in this section are the Philippines, the Turtle Islands, Singapore, Indonesia, Sarawak, Sri Lanka, Krusadai Island, India, Australia, Papua New Guinea and Malaysia.

Philippines. Shell exports from the Philippines are also reported by Balazs and Nozoe (1978). The reported volume from 1963 to 1966 varied from 177 to 3,420 kg (Table 24). The sudden increase in 1967 to 13,340 kg was due to the release of inventoried stocks in expectation of a poaching moratorium that was implented. Later year exports came from this stock.

Table 24. Volume and value of tortoise shell exported from the Philippines and imported into Japan, 1963-1973

Year	Shell		Exports from Philippines	Imports to Japan
	Volume	Value		
	Kg.	1000 pesos	-----	1000 lbs. -----
1963	600	49.6	1.3	
1964	693	54.6	1.5	
1965	3,420	314.8	7.5	
1966	177	121.8	.4	
1967	13,348	403.6	29.4	.4
1968	2,156	1,050.0	4.7	1.0
1969	1,990	1,742.3	4.4	2.3
1970	-	-	-	2.1
1971	-	-	-	1.3
1972	-	-	-	7.2
1973	-	-	-	8.4

Source: Balazs and Nozoe (1978).

Additional export data for three overlapping years shows the level of imports from the Philippines into Japan (Table 24). During 1969, about one-half the exports went to Japan. These data were not available prior to 1967. The imports from the Philippines between 1970 and 1973 are probably unauthorized from the Philippine viewpoint. The large difference between exports from the Philippines and imports to Japan probably ends up in part in Japan by way of Hong Kong, Malaysia and Singapore.

Green turtles in this region are quite high in economic value and fishermen depend on them for their value. The products and retail prices recorded in Zamboanga, Mindanao were green turtle meat (150-160 yen per kg.), green turtle eggs (13 yen each), and hawksbill shell (350-450 yen per kg.).

Turtle Islands. Domantay (1953) reports an annual average egg collection of 663,000 in the Philippine Turtle Islands from 1948 to 1951. At that time price was \$15.00 per 1,000 eggs. Egg gatherers received one-third the gross income earned.

Further remarks on the sea turtle industry in the Philippines were recently published by Pejabat and Siow (1977), an excerpt of which follows:

"Traditionally, turtle meat and eggs are eaten and the scutes from the hawksbill turtle are used to make ornamental items in the Philippines. The full scale cottage industry of processing turtles by stuffing was started in 1970, and since then the export market for stuffed turtles was established resulting in big increases in the number of turtles being killed each year. Cebu City, where I visited, is one of the two major turtle processing centers in the Philippines (the other being in Mindoro). There are about 50 processors, each processing an average of 400 hawksbill and 100 green turtles each year. This means in Cebu City alone 25,000 turtles are processed annually. Taking into account Mindoro and other small processing centers, the total number of marine turtles killed for this purpose can be put at 75,000 annually. This figure is frightening."

"Though there exists a law governing the collecting, gathering and disposing of marine turtles, turtle eggs, and its by-products (Bureau of Forest Development Administrative Order No. 1 dated July 10, 1974) the enforcement is evidently difficult and sometimes lacking. For example, I saw plenty of stuffed hawksbills of less than 10 inches carapace length whereas the law prohibits the taking of anything smaller than 12 inches plastron (why plastron?) length."

Singapore. The major focus of sea turtle exploitation in this area is the hawksbill which is used for stuffing purposes according to Balazs and Nozoe (1978). Turtles are delivered to a taxidermist soon after capture (within one week) and the muscles, internal organs and brain are removed and sold as food to the Chinese. The turtle is then stuffed by workers who make between 480-1,075 yen daily during the peak season (about \$1.77-\$3.97 in 1973).

About 60 percent of the turtles stuffed in Singapore are shipped to Japan while the remaining 40 percent are sold in Singapore to Japanese tourists. Very few tourists other than Japanese purchase the turtles and the Chinese and Malay residents show little interest in them.

About four or five processing plants are located in Singapore, each producing 3,000 to 4,000 stuffed turtles a year. This amounts to 15,000 to 20,000 per year. Singapore also imports stuffed turtles from South Vietnam. The increase in Japanese tourists since 1972 has probably boosted the demand for the stuffed turtles.

Indonesia. Sea turtles in Indonesia provide both meat and eggs. The volume of turtles handled in Bali in 1971 totaled 48,020 kg. worth 12,495,700 Rp which on a per unit basis was near the Philippine value discussed earlier for Zamboanga, Mindanao. The catch in Bali amounts to over 5,000 turtles annually. The annual capture in the areas around Serangan totals 7,000 to 8,000.

Sumertha (1976) gives the following data for green turtle egg collection from Pangumbahan Beach, Sukabumi:

<u>Month</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>
January	-	-	-
February	-	-	-
March	-	-	-
April	15,412	16,596	10,090
May	34,241	31,431	9,370
June	41,313	40,577	8,437
July	45,187	56,829	8,730
August	47,750	58,266	10,459
September	48,091	60,108	18,352
October	48,128	57,831	20,025
November	37,583	53,613	24,689
December	30,702	28,624	14,403

Sumertha (1975) also quotes information relating to the export of Chelonia mydas from Sumbawa to Bali; unfortunately, the units used in the English translation of this paper are unclear. Data are as follows:

1970: 8059 rear  
 1971: 7923 rear  
 1972: 9263 rear  
 1973: 7946 rear  
 1974: 5180 rear

There are very few native fishermen in Indonesia and also a low demand for green turtle meat. Hawksbill shells are handled mainly by the Chinese merchants in Ambon and Ujung Pandang. The only existing records on Indonesia's production of hawksbills come from Japan's log of imports. However, some turtles originating in Indonesia enter Japan through other areas and these data may thus be misleading. Data collected from Chinese merchants indicates important volumes of hawksbill originate from Indonesia. It is estimated that 30,000 adult hawksbills are killed each year in Indonesia.

Four or five taxidermy firms have been set up in Ujung Pandang since 1972, each capable of producing about 2,000 stuffed turtles per year.

Philippines, Singapore and Indonesia summary. The hawksbill turtle appears to have the widest diversity of usage in Southeast Asia. Estimates indicate that about 125,000 sea turtles are killed each year. About half are green turtles and the remainder yearling and adult hawksbill (Table 25).

Table 25. Annual number of hawksbill and green turtles captured in Southeast Asia

Area	Adult	Hawksbill	
	Greens	Yearlings	Adult
Philippines	50,000	-	5,000
Indonesia	10,000	10,000	5,000 (before 1971)
Singapore	-	15,000-20,000	30,000 (after 1972)
Total	60,000	25,000-30,000	35,000

Source: Balazs and Nozoe (1978)

Sarawak. Turtle products from Sarawak focus on the gathering of eggs from turtles. Numbers of eggs gathered in Sarawak have historically demonstrated a wide degree of annual fluctuation. Available data from Bustard (1973) show the volume of eggs collected to range from .2 to 3.1 million per year. Hendrickson (1950) estimates that the production of eggs from Sarawak and Malaya (Talang Talang Besar, Talang Talang Kechil and Satang Besar) average about 2 million per year. The wide annual variation ranges from .7 to 3.0 million eggs. Harrisson (1958) also gives data on egg collection in Sarawak and indicates that in 1958 eggs sold wholesale for six cents each and retail for eight to ten cents. The pre-war price was two cents. Balazs and Nozoe (1978) reported that 478,608 eggs were collected in 1967 worth \$42,370 or almost nine cents each. Sarawak egg collection data are shown in Table 26.

Table 26. Turtle eggs collected in Sarawak for selected years, 1927-1968a

Year	Millions of eggs	Year	Millions of eggs
1927	2.1	1953	2.05
1928	2.3	1954	1.1
1932	2.25	1956	.7
1933	1.5	1957	1.4
1935	.9	1959	1.3
1936	3.0	1962	.55
1947	.7	1963	.5
1948	1.1	1964	.3
1950	2.35	1968	.2

<sup>a</sup> Bustard's data are originally presented in three sets to demonstrate eggs taken from three populations. They are combined here to show time-series production trends for Sarawak.

Source: Bustard (1973).

Sri Lanka. Deraniyagala (1939) gives some indication of the activity in turtle trade in Sri Lanka in the 1920's. Between 1920 and 1926 a total of 11,000 kg. of turtle imports entered Sri Lanka while 3,000 kg. were exported.

Krusadai Island. Kuriyan (1950) indicates that 800 to 1,000 green, hawksbill, and olive ridley and loggerhead turtles were produced on Krusadai Island annually. Production was predominately green turtle which was exported to Sri Lanka. A small cottage industry existed and produced ornaments from the inedible turtle parts. Post war prices ranged from 6 to 15 rupees depending on the size and width of the plastron. The catch for Krusadai, which is on the Indian side of the Gulf of Manaar, may well now be delivered to Tuticorin for sale - (see Indian section below).

India. India is a signatory to CITES and does not permit commercial export of marine turtles or their products for commercial purposes. However, there is considerable pressure on populations for products for domestic consumption. The principal species along

most of the east coast of India is the olive ridley, which forms enormous nesting aggregations at certain localities in Orissa. Approximately one million eggs per year were until recently collected for the Calcutta market, with a trivial royalty of 450 rupees (about \$60) collected by the state government. This trade has now been stopped. However, there is an undocumented take of the adult turtles themselves, hinted at by the washing ashore in Gahirmatha on 12 February, 1977 of about 400 dead ridleys, many with their flippers bound with wire. This information, received from Romulus Whitaker of the Madras Snake Park, suggests that the turtles were jettisoned when the ship conveying them encountered storm conditions, and the turtles, being unable to swim with their flippers bound, drowned.

Again, according to Whitaker, turtles are harvested in some numbers in the Lakhshadweep Islands. Estimated harvest is about 40 turtles per month for six months of the year, the catch being composed of greens, olive ridleys and hawksbills.

As recently as 1973 (Vallaspan 1973), there was a sizable market for live turtles at Tuticorin, southern India. The turtles were caught in the Gulf of the Manaar and Palk Strait, and kept in 20 x 20 foot pens at Roche Park near Tuticorin. The usual species is the green turtle (70% adult females, 20% adult males, 10% juveniles), but some hawksbills and leatherbacks are also brought in. At one time Tuticorin dealers purchased about 4,000 turtles per year. By 1973, the number had dropped to about 1500, mostly for local use. At various times turtles were exported from Tuticorin to Sri Lanka (evidently for re-export), West Germany, Japan and the United States. The turtles were slaughtered in the market every Sunday morning; the fresh blood is purchased for 1 rupee per glass and drunk as an elixir. The meat is sold for 4 rupees per kg., with an average turtle yielding 40-50 kg. The shell may also fetch 50 rupees or more.

The medium size green turtles are preferred for food, the big ones being considered too coarse and the young ones too lean. Green

turtle shells are sold for 20 rupees per kg, and the plastron for 40 rupees per kg. Hawksbill shell sells for 100 to 150 rupees per kg, mainly being exported to Japan. Carapace of the leatherback turtle is cut into small pieces and boiled to prepare an oil to paint boats against leaks. (A small leatherback fishery exists for a similar purpose on Larak Island in the Persian Gulf, 10 to 15 adult leatherbacks being caught there per year for oil for caulking boats - Walczak and Kinunin, 1971).

According to Whitaker, the Tuticorin turtle market processed about 50 turtles per week, with 50 more being sold or slaughtered outside the market. Now the market has been banned, but the total number of turtles handled in Tuticorin is estimated to be relatively unchanged at about 100 per week.

Sea turtle eggs are sold in Madras for about 6 rupees per hundred (Whitaker, 1977).

Further information on exploitation of sea turtles in India was taken from a recent paper by Davis, Bedi and Oza (1978):

"One of the authors (GMO) landed in Bhubaneswar in the first week of January 1977, to participate in the Indian Science Congress Symposium on the conservation of wildlife and forests. For a couple of days, he was shocked to witness in the Railway Station living sea-turtles being carried away every night in several hundreds. These were brought on the roofs of passenger buses, in scorching heat with their bellies upwards, puffing and groaning in apparent agony. They were dragged on the roads and sometimes mercilessly handled before being taken off by train - though with doubtless legality."

and:

"During the nesting season, a large number of sea-turtles are transshipped from the coasts of Andhra and Orissa States to the markets in Calcutta and elsewhere in West Bengal. Turtle meat is relished by many Hindus in Bengal and as such is highly prized. But turtles are not commercialized in Bangladesh as Muslims do not eat the meat, although the Burmese and Chinese apparently do."

In Pakistan, the green turtle is protected; the Sind Wildlife Protection Ordinance of 1972 provides for a maximum fine of 5000 rupees for killing or netting green turtles. Nevertheless, illegal traffic exists. Handan (1977) reports that a raid conducted on the

West Wharf resulted in the confiscation of several hundred green turtle skins packed in gunny sacks and ready for export as "frog skins".

Australia. Australia has large populations of several species of sea turtle, including the green, flatback, loggerhead and hawksbill. Protection of sea turtles in Australia is on a state-by-state basis. In former times there was a sizable turtle industry in Queensland, based upon green turtles from the Capricorn-Bunker area of the Great Barrier Reef. Information on this operation is summarized by Parsons (1962). Prior to 1930, at least two turtle Processing factories were located on Northwest Island and one on Heron Island, mainly supplying the English market. During the season, about 25 female turtles were taken off the beaches each night. During the 1924-25 season, 36,000 tins of turtle soup were shipped, the product of 1600 turtles. According to F.W. Moorehouse, the cannery had taken all of the nesting turtles on Heron Island during the 1928-29 season; Moorehead was thus impressed that no fewer than 1711 nestings were seen in the following season - it was not generally realized at the time that green turtles do not normally lay in successive seasons.

Cannery operations in Queensland were closed down in the early 1930's, though some exploitation of the green turtles took place until 1954. The ban instituted in 1954 has not been uniformly enforced, but at the present time there is no legal commercial exploitation of sea turtles anywhere in Australia. The small fishery in Western Australia, based on the green turtle, that existed until a few years ago has now closed down. Nevertheless, aboriginal island people in the Torres Strait are still permitted to harvest turtles for traditional purposes, and the total number of turtles harvested in this way is considerably higher than usually supposed. Colin Limpus (pers. comm.) estimates that the annual harvest in the Torres Strait by subsistence-level peoples is of the order of 10,000 adult green turtles annually. A substantial proportion of these are caught by Papua New Guinea people, who for the most part sell the turtles on the island of Daru. The turtles are kept alive,

and flesh is amputated off the living turtles progressively as it is sold.

Papua New Guinea. Papua New Guinea is a signatory to the CITES, and thus does not permit the export of sea turtles for commercial purposes. However, sea turtles are of considerable domestic importance within Papua New Guinea, and in many areas capture and trade of sea turtles constitutes an integral and important part of traditional cultures. The most common and widespread species is the green turtle, followed by the hawksbill and (in the north) the leatherback; loggerheads, ridleys and flatbacks are rare and of little utilitarian importance. Methods of capture vary. In many areas turtles are killed when they come ashore to nest. The meat is distributed, usually without charge, to the local villagers. Turtles are also caught by canoeists with harpoons, and on occasion by placing large nets across passages known to be frequented by turtles. Hawksbills are caught as well as greens, but nowadays the shell is usually discarded since export markets are not available, the turtles being used purely for food. Leatherbacks are not caught at sea, but are regularly killed on nesting beaches, where, being too heavy to remove, they are cut up on the spot. Leatherback meat is not the preferred type, being reported to have a strong smell and to impart that smell to the perspiration of anyone who dines upon it for several days afterwards; but in the absence of alternatives, it is often eaten.

Although turtle meat is usually disposed of outside the cash economy in Papua New Guinea, green turtles are regularly offered for sale in the markets of Lorengau, where a live immature green sells for K 5-8 (\$7-12) depending on size. However, substantial numbers of greens are caught by Manus people and sold or otherwise conveyed outside the market system. Several times each year the students of the Manus High School are fed turtle meat in the school lunch program; five turtles of half-grown size or above are needed to provide a meal for all the students. Green turtles are also consumed in large numbers in the course of celebrations in the

Manus Islands; a missionary reported that seventy greens had been eaten at the celebration of the ordination of a priest on Bipi Island, off western Manus.

At the Koki Market, Port Moresby, about 20-30 turtles (nearly all greens) are sold each month during the season (October-December). A small turtle sells for \$7-10, medium from \$30-40, large from \$70-140. The meat is sold in random, unweighed chunks for about one dollar each - more with fat attached. The shells are occasionally sold to Europeans for decorative purposes.

At Daru, 44 greens were observed in the market between May 25, 1978 and July 13, 1978 (38 females and 6 males). A similar number was probably sold or distributed on the island outside the market system. The great majority of the turtles sold are mature, but a few immatures are seen.

In some areas of Papua New Guinea, turtles are protected through religious beliefs of local people. Most such traditional beliefs did not survive World War II, when taboos generally broke down and Japanese invaders reached even the most remote areas. However, in some areas missioned by Seventh Day Adventists, relatively new rules against eating turtles have achieved strong support. On the island of Mussau, for example, the entire population has subscribed to the Seventh Day Adventist Faith since the 1930's. Although turtles are still collected sporadically by visitors, locals have not exploited the turtles for over forty years, and a spectacular recovery of the turtle population has taken place.

Malaysia. Although sea turtles themselves are not normally killed in Malaysia, a substantial market exists for the eggs. On the East Coast of West Malaysia, it is estimated that 1,500,000 turtle eggs are harvested annually, composed of approximately equal numbers of leatherback, green turtle and olive ridley eggs. The leatherback eggs are drawn from a rather restricted area of the coast of Trengganu, centered near the village of Dungun south of Kuala Trengganu, which represents one of the most important breeding areas in the world for this species. Each season the beach is divided into sections, the rights to which are auctioned off to the

highest bidder. A small percentage of eggs are laid on a section of the beach to which the state government has acquired the rights; these eggs and small numbers purchased from beach lessees are allowed to hatch.

Nesting by green turtles and ridleys is more dispersed, but the total number of eggs harvested of each of these species is similar (around 500,000). Very few hawksbill eggs are harvested in Malaysia.

Other Areas. Parsons (1962) reported isolated production data for other areas of this region. The islands off North Borneo have about 100,000 to 250,000 eggs collected annually while about 1.5 million eggs were collected in the Philippines in 1953. The government collected 15 pesos for each 1,000 eggs. During the late 1950's, fifty turtles were processed each week on Western Australia where the fishermen got 10 shillings for each of them.

## SUMMARY AND CONCLUSIONS

### Summary

Alice asked "---where should I begin?" "Begin at the beginning and stop where it ends," answered the king.

From Lewis Carroll's  
Alice's Adventures in  
Wonderland

By recapitulating this report begins to end. It has as its major objective the reporting and analysis of all existing data on the production and trade of marine sea turtles around the world. The data utilized were obtained through a search of all locally available statistical sources and through informal personal consultation in selected areas. Data sometimes were included in the aggregate when it was not possible to separate the analysis into species with implications about green, loggerhead and Pacific ridley turtles. Some data sources also reported trade in fishery products in such an aggregate nature that it was impossible to delineate turtles from the total. However, the information should remain useful in the future management of turtle stocks.

The report is organized around five major sections. These include a brief review of turtle marketing and production, and then a detailed analysis of U.S. imports, U.S. production, world-wide trade and production and some conclusions are drawn about the data and policy implications of the research.

Records of the use of turtles as food in London go back as far as 1753 and 1754 and virtues of the turtle as a food item are published in 1758. Actual use by man in regions of the world where turtles have been available of course probably predate these times. Live turtle imports to England probably reached 15,000 by 1878. Tinned turtle products

first entered the mid-latitude markets sometime around the middle of the nineteenth century. Production and consumption of turtle soups began in America in 1883, using both domestically produced and imported turtles as supply sources. An estimated 15,000 to 20,000 turtles found their way, in one form or another to the commercial markets of North America and Europe at the end of the 1950's.

Turtle captive techniques are quite diverse. Methods used have been diving, harpoons, spear guns, traps, seines, suckerfish, decoys, by hand, turning turtles on beaches and through collection of eggs. Mariculture techniques are now employed.

The imports of live turtles into the United States between 1948 and 1976 was maximum in 1951 when 1.5 million pounds worth 85 thousand dollars were imported. The trend has been generally downward since that time. There is some indication that U.S. demand for live turtles has actually declined after 1968. The U.S. demand for live turtles appears to have been highly elastic between 1948 and 1962. Small variations in price were associated with large quantity variations. Since 1962, the demand appears much more inelastic, indicating that price changes are proportionately greater than inverse changes in quantity. The policy implication is that import duties would drastically lower turtle imports. This implication could be expanded to other countries assuming imported turtles in those countries faced similar demand curves.

Miami was the leading U.S. port of imports with a record 338,600 pounds in 1974. Tampa received substantial imports in years when Miami received no imports. Imports through New Orleans and Morgan City have been minimal while imports through Port Isabel and Brownsville were substantial in the 1960's but minimal after 1970.

Most imports come from countries in South and Central America and the Caribbean area. Leading export countries are Mexico, Nicaragua, Costa Rica and Ecuador. Mexico leads in the number of years exports to the U.S. are made while Nicaragua leads all countries in volume exported to the U.S. Although

total demand may have declined, some still does exist for turtle skins, boots, and meats into the U.S. as evidenced by import permit applications prior to the ban on imports.

Turtle landings in the U.S. have been recorded to varying degrees of accuracy for almost 100 years. Green turtle landings have ranged from as low as one thousand pounds annually to a high of 421 thousand pounds in 1970. Landings have been erratic with major landings occurring between 1960 and 1974. Total value was highest at \$91 thousand in 1977. Loggerhead turtle landings, probably combined with figures for ridleys in most cases, have always been much lower with the high of 44 thousand pounds reported in 1973.

Data on processed turtle products in the U.S. are aggregated with that of terrapins and all other kinds of turtles. The number of plants processing turtle meat and stew has been as high as ten. Processing of fresh and frozen meats for years the data are available has been as high as 44 thousand pounds valued at \$31 thousand. Canned meat, soup and stew volumes were highest in 1951 at 1.3 million pounds (26,000 cases) worth \$279 thousand. The highest value of \$390 thousand was recorded in 1961. The deflated or real value per pound of canned turtle meat, soup and stew has ranged from a high of 68 cents in 1948 to a low of 22 cents in the early 1950's. Prices were fairly stable between 1954 and 1966 at 26 to 40 cents per pound but jumped to between 50 and 60 cents from 1967 to 1972 which was the last year data were available. The real price has actually declined since 1968 by ten cents per pound. Analysis of these data indicate a statistically significant relationship between price and quantity of processed turtle meat products. Price appears elastic indicating that price increases would cause a more than proportionate reduction in quantity demanded. A tax on canned products or imported raw products might be one policy alternative to cause a reduction in demand for turtle products. This would be applicable in other importing countries assuming the demand for canned turtle products was similar in those countries.

Historical data are available that report the landings of turtles in Georgia, North Carolina, Louisiana, Texas, Virginia, Mississippi, Florida, Puerto Rico and Hawaii. No landings are reported after 1925 in Georgia, North Carolina, Texas and Mississippi. Landings in Louisiana have been over 10,000 pounds only twice. No landings are shown in Virginia after 1962. Landings in Hawaii were maximum at 23 thousand pounds in 1972 worth almost \$11,000. Landings in Hawaii trended downward from 1948 to the early 1960's and then again upward until landings were no longer allowed. Puerto Rico landings were around 20 thousand pounds for 1971-73, the only years data were available.

Data on turtle landings in Florida begin in 1880 and are available for some years between then and 1938 when fairly continuous data begin. Landings peaked in the late 1800's at about 634 thousand pounds. Between 1938 and 1947, landings averaged 54 thousand pounds while the average between 1950 and 1966 was 26 thousand pounds. However, 1952 was a high year at 117 thousand pounds. Landings increased beginning in 1967 and peaked at 445 thousand pounds in 1970. Price or value per pound slowly increased from about ten cents per pound in 1950 to 25 cents in 1972 after which it fell to as low as 18 cents. Real price has not shown much increase, ranging from a low of 12 cents in a number of years to a high of 21 cents in 1968-69. Real price has actually trended downward since that time. No statistically significant relationship between price and quantity could be estimated. Primary landings of turtles in Florida have been of the green turtle.

Historical areas of importance in Florida and the percentages of state landings from 1972-74 were the Florida Keys (73 percent), Brevard County (19 percent), Duval County (6 percent), and Levy County (2 percent). Landings have always been seasonal with peaks occurring in May, July and October. Loggerhead turtle landings have been highest from January through April and into October. Florida East Coast production of turtles has been primarily

from otter trawls although total Florida production has primarily been from gill nets (usually between 80 and 100 percent). Production in Hawaii has been primarily by gill net and in Puerto Rico by gill nets and spears.

Statistics of the Food and Agricultural Organization (FAO) and the United Nations Yearbook of International Statistics are the two main sources of data that provide a continuing record of world-wide turtle production statistics. FAO data since 1961 indicate that Mexico and Cuba are the leading producers of turtles. Mexican production has been as high as 14,700 metric tons (1968). Production in Cuba has been consistently around 1,200 metric tons since 1968. Cuba's production has been loggerhead, green and hawksbill in that order. Mexico's production has been listed mostly as unclassified turtles, but in recent years, has been primarily olive ridley, with the green turtle second. Other production regions listed in FAO data are the U.S., Costa Rica, Puerto Rico, Eq. Guinea, Brazil, Ecuador, Trinidad and Tobago, the Philippines, Mauritius, Yemen and Turkey.

Data from these sources as well as isolated research publications and papers were used to delineate production data into six world regions. These are the (1) Western Atlantic and Caribbean (2) Mexico, (3) Western Indian Ocean, (4) Eastern Atlantic and Mediterranean, (5) Western Pacific and (6) Southeast Asia and Australia.

Principal regions in the Western Atlantic and Caribbean for which data are available are the Cayman Islands, Surinam, Nicaragua, Trinidad and Tobago, Venezuela, Puerto Rico, Aves Island, Brazil, Colombia and Costa Rica. The Cayman Islands have been a principal center for turtling in this region for many years. Green turtle landings in the Caymans has been mostly from catches in Nicaragua, Honduras and Costa Rica. Cayman Turtle Farm located on Grand Cayman is a principal market for turtle eggs using 60,000 annually during 1972-73 from Surinam. This farm

has been estimated to produce 15,000 turtles annually. The main use of turtles on Surinam is the collection of eggs. The Carib Indians have been estimated to collect between 150 and 300 thousand annually. The market economy of the Miskito Indians in Nicaragua is largely based on green, hawksbill and loggerhead turtles. Between 4,000 and 10,000 were estimated harvested between 1968 and 1970, some of which were sold to two freezing plants. The recent annual catch of mainly green and hawksbill turtles in Trinidad and Tobago has been estimated at 50 thousand pounds annually while the production in Venezuela has been estimated at around 50 thousand kilograms. Puerto Rico and Aves Island production is estimated at 20 and 45 thousand pounds annually, respectively. Brazil and Costa Rica each apparently produces about 100 metric tons annually and some production takes place in Colombia although no data are available on the volume. Export markets for turtles caught in this region have included the U.S., Holland, England and Japan although data are limited in most cases on volume imported into each of these countries.

Mexico is a major producer and source of olive ridley and green turtles. Olive ridley annual production was never over 30 tons before 1956. Increases after that time have led to production levels as high as 12,824 tons in 1968. Green turtle production also peaked in 1968 at 1,758 tons. Loggerhead turtle production has been at much lower levels. Some evidence of the international trade from Mexico is evident in that 282,126 Pacific ridley skins were shipped through Texas in 1971. The majority of these went to Japan, Italy and Belgium.

Statistical data on the region of the Western Indian Ocean are quite limited, cover different years and are mostly approximations of turtle harvest. The annual harvest of turtles from Aldabra Island has been estimated between 500 and 12,500 between 1890 and 1957 and Zanzibar produced about 6,500 pounds around the turn-of-the-century. Madagascar is thought to produce about

about 2,570 hawksbills annually and South Arabia about 2,000 turtles each year. The Azores are thought to produce about 4,000 loggerheads each year and the latest 15 year average for St. Brandon is 326 green turtles per year. Yemen production of green turtles has ranged between 800 and 2,640 per year while the Ivory Coast has produced about 600 turtles per year.

Data on the Eastern Atlantic and Mediterranean are largely lacking. Major regions of interest here are Senegal, Turkey, Israel, the Canary Islands and Madeira.

The Western Pacific region includes the Caroline Islands, Guam and Saipan and Japan for which some data were available. Green and hawksbill turtles are found throughout Micronesia. Up until the last few years hawksbill turtle shell was used both as traditional local jewelry and artifacts and as tourist trade items. This trade was almost always at the retail level. Green turtle meat is still used for food although there appears to still be some illegally taken and eggs are collected from remote nesting islands in Micronesia by boats from Taiwan, Japan and Okinawa. The living turtles are sold in Taiwan, Hong Kong and Japan. A few people specialize in catching turtles in Guam but all appear locally consumed. Green stuffed turtles have been observed for sale for as much as \$200 on Saipan.

Japan is a very large importer of turtle products. A total of 221 thousand kilograms of hawksbill turtle shells were imported between 1971 and 1975 coming mainly from Panama, Cuba, Indonesia, Kenya, Tanzania, Nicaragua and the Cayman Islands. Other records show that Japan imported shells between 1966 and 1971 from Hong Kong, Malaysia, Indonesia and Singapore in the amounts of 12 to 17 thousand pounds. Volumes from the Philippines during this time ranged from less than one to over eight thousand pounds.

Records on regions in the Southeast Asia regions include the Philippines, Singapore, Indonesia, Sarawak, Sri Lanka, Krusadai Island, the Turtle Islands, Australia, Papua New Guinea, India and Malaysia. The total volume of shell exports from the

Philippines between 1963 and 1969 was as high as 13,400 kilograms. Total pounds of exports from the Philippines peaked in 1967 at 24 thousand pounds. This high level year was primarily due to release of inventoried stocks in the expectation of a poaching moratorium that was implemented. Most imports from the Philippines probably end up in Japan. The major use of sea turtles in Singapore is the hawksbill which is used for stuffing purposes. About 60 percent of the stuffed turtles are shipped to Japan while the remaining 40 percent are sold in Singapore to Japanese tourists. About 15 to 20 thousand turtles are thought to be stuffed in Singapore each year. There are a few native fishermen in Indonesia and also a low demand for green turtle meat. Data collected from Chinese merchants indicate important volumes of hawksbill originate from Indonesia. It is estimated that 30,000 adult hawksbills are killed each year in Indonesia. Estimates from the Philippines, Indonesia and Singapore report a total annual capture of about 60,000 green turtles, 25 to 30 thousand yearling hawksbill and 35 thousand adult hawksbill in this region. Sarawak and Malaysia turtle production is primarily the collection of eggs which is thought to average about 2 million per year around a variation of .7 to 3 million. Older records also indicate some turtling activity in Sri Lanka, Krusadai Island, and Western Australia while eggs are also collected in the Turtle Islands, North Borneo and the Philippines.

### Conclusions

Statistics describing production, consumption and trade in sea turtle products in the U.S.A. are inferior to comparable statistics for other marine products. These statistics, however, are considerably better than data for other countries in the world. The only source of data which attempts to report world-wide turtle statistics on a continuous basis and on a comparable basis between countries is FAO statistics. These data, however, are extremely lacking for several reasons. The data are complete

for only a few countries and are rounded to whole numbers which appear to remain constant for several years at a time. A review of individual studies, however, shows annual production to be extremely variable.

This study to a large degree depended on independent studies and isolated statistics reported in the separate studies and discussions. This approach generally did not allow for the establishment of definite trends but for the most part allowed for the painting of the "big picture". In addition, this approach identified leading individuals, organizations and countries concerned with sea turtles. This documentation should provide assistance in further studies of the sea turtles.

In spite of the shortcomings of the available data base several conclusions are forthcoming. The remainder of this paper is devoted to a discussion of the major conclusions.

The first rather surprising conclusion is that demand for sea turtles and turtle products may have actually declined in the United States in recent years. This conclusion is based on the price/quantity relationships addressed in this report for the U.S. canned turtle products, live turtle imports and prices of U.S. produced turtles. This apparent decline in demand for turtle products may be due to substitution of plastics for turtle shells, substitution of synthetic leather for turtle skins and/or a public awareness on the part of the American consumer of the plight of the sea turtle because of the public conservation education efforts. The significance of this decline in demand is that U.S. programs to protect the sea turtle will be more generally "accepted" by U.S. residents. There will be less pressure on turtle prices for turtles produced on turtle farms. This will reduce the incentive for black market operations. This apparent decline in demand along with the negative price relationships shown suggest that the impact of the present cessation of commercial turtle imports should cause no significant hardships.

Major exporters to the U.S. and major producers of sea turtles were Mexico, Nicaragua, Costa Rica and Ecuador. The latter three have sizable development programs with the U.S. assistance. Pressures may be brought to gain cooperation in the current turtle conservation efforts. Cuba appears to be a leading country in terms of increased production of green, hawksbill and loggerhead turtles. Cuba's production of green turtles is many times that of Mexico and recent U.S. production. Negotiations concerning the reopening of trade with Cuba should offer an opportunity to encourage Cuba to participate in current efforts to protect certain sea turtles.

In general, it appears that production of sea turtles in most areas is either a part-time occupation or an incidental catch of other fisheries. It would thus appear that the social and economic impact of current trade restrictions would be minimal. The exception to this appears to be a few isolated native communities who depend heavily on turtle production. However, only part of their production was exported, and from the point of view of their own long-term interest, it would be better in such cases if export were curtailed.

An efficient means of discouraging world-wide trade in turtle products would be to place pressures on major large importers, such as England and Japan, rather than the large number of small producing countries. Japan appears to understand the significance of this means of regulation. Nevertheless, fisheries managers still follow purely arbitrary procedures when setting regulations under which turtles or their eggs may be harvested, and sea turtle biologists still have divided opinions on best management strategies for any of the species. Indeed, while most of the Southeast Asia justifies its massive collections of turtle eggs with the rationale that they protect the adult turtles, on the other side of the world, Mexico justifies a huge slaughter of adult turtles on the grounds that the eggs are protected! The long term results of either policy are not yet clear.

There is also controversy on the subject of size limits as a means of limiting the harvest of a turtle population. Typically, stocks have been "protected" by declaration of a minimum size, which is designed to produce a fishery catching primarily the adult turtles. On the other hand, a number of South Pacific island nations are now considering or have instituted a maximum size, on the theory that it is important to protect the breeding population, and that the immature turtles, never being found on land, are able to avoid excessive harvest levels. The latter stratagem has also been applied to certain other reptiles (e.g. to crocodiles in Papua New Guinea), and it would appear to have distinct merit if enforcement of the protection of the adults could be assured.

Due to the lack of continuous statistics and the lack of compatibility between individual studies, a carefully designed questionnaire needs to be designed and executed with individuals, organizations and countries identified in this report. For management purposes further investigation needs to identify consumers who are importing products previously imported into the U.S. Further information is needed to fully assess the social and economic implications of trade restrictions in the world sea turtle markets.

It is also known that turtle imports are a major commodity into some countries such as England. Locally available statistics however, do not disaggregate the data into sufficient detail to show the level of imports. Further research might include travel to these countries to inspect detailed government records published by these countries to determine import levels, and to talk with local experts and visit markets and study non-governmental data bases in order to evaluate overall turtle utilization.

Another important area for future research would be an objective analysis of the impact of turtle farming operations - notably the Cayman Turtle Farm - on the demand for and pressure on wild turtle populations. Conservationists are currently unsure whether a turtle farm such as the Cayman operation reduces

the pressure on wild stocks by supplying existing demand with farmed animals, or whether it is likely to increase pressure on wild populations by cultivating a vogue and increasing demand for turtle products, creating a demand-supply hiatus that is promptly filled by purveyors of wild turtle products.

In concluding this report, it must be emphasized that there is not a single turtle fishery in the world that is based on any sound knowledge of turtle population dynamics. Indeed, the general belief that green turtle - the principal commercial species - can mature in only 5 to 8 years is now being challenged by data from a wide variety of sources - the Great Barrier Reef, Hawaii, the Galapagos Islands, Great Inagua Island, and elsewhere - that suggest that growth rates of wild green turtles may be much less than can be obtained in captivity. The average figure of 1.3 cm increase in carapace length per year obtained by Colin Limpus for immature Australian green turtles indeed suggests a maturing time of more than fifty years! This has important implications for management and restoration of wild turtle stocks; it will mean that an over-harvested population of mature turtles - or an overharvested turtle egg resource - may not show overt signs of collapse for many years. Yet when the collapse does finally happen, recovery may be impossible or at best may take many decades of careful protection and active population enhancement techniques.

Attempts to monitor a population by maintaining a count of nesting females or of nest themselves each season, while praiseworthy and important, may also fail to provide population trend information of a kind that can be used to set harvest quotas. Enormous variation in numbers of turtles nesting from one year to another is standard even in healthy or completely protected populations. Most species of sea turtle do not breed on an annual basis, and subtle, still unclear factors appear to be responsible for bringing a high or a low proportion of the mature females into reproductive condition in a given season.

Season to season fluctuation may be so great as to give a twenty fold difference between a "good" season and a "bad" season in Queensland, Australia, and nearly comparable variation has been reported elsewhere.

Such factors and uncertainties point up to a need for conservatism in setting exploitation quotas for any sea turtle population. There is no excuse or justification for the massive quotas set in Pacific Mexico, for example, especially when 47 nations - many of them much poorer than Mexico - have now voluntarily signed the Convention on International Trade in Endangered Species of Flora and Fauna that will prevent them entirely from trading in wild turtle products, either as importers or exporters. The International Union for the Conservation of Nature (IUCN) has established a policy of opposition to the international trade in wild turtle products, its Marine Turtle Specialist Group being of the opinion that the only real "rights" of access to a marine turtle resource lie with impoverished coastal peoples who have traditionally harvested turtles and their eggs in small numbers for their own use only - a pattern of exploitation that has been proven by the test of time to be within the sustainable productivity of the resource.

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