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REVIEW OF THE STATUS OF SEA TURTLE STOCKS IN THE EASTERN PACIFIC

The staff of the IATTC has had little involvement in studies of sea turtles, and so almost all the information presented to the Commission draws on a range of external sources. This document summarizes some of the recent literature concerning different aspects of the biology and ecology of sea turtles.

The following five species of sea turtles nest, migrate through, or forage in the eastern Pacific Ocean (EPO):

Code	Scientific name	English common name	Spanish common name
LKV	*Lepidochelys olivacea*	Olive ridley turtle	Tortuga golfina
KEZ	*Chelonia mydas agassizii*	Black turtle	Tortuga negra
TTH	*Eretmochelys imbricata*	Hawksbill turtle	Tortuga carey
DKK	*Dermochelys coriacea*	Leatherback turtle	Tortuga laúd
TTL	*Caretta caretta*	Loggerhead turtle	Tortuga caguama

The detailed genetic structure of these species, the level of mixing between groups nesting in different locations, and their ranges of distribution are not well known, so it is not possible to connect an individual turtle sighted at sea with a particular nesting area or stock, or to know the extent and location of the whole range of a stock. Satellite tracking of individual turtles has begun to unravel some of these mysteries, linking very distant nesting and foraging areas, and even giving a glimpse of the fate of the individuals tagged. More tagging would be required to understand the at-sea distribution and migration patterns for each stock. These uncertainties make it very difficult to assess the abundance of a stock, or to estimate the impacts of fishing on the stocks.

1. DATA SOURCES

Most information available to assess the status of these stocks, or trends in stock size, comes from counts of the number of females nesting on certain beaches, or of the number of nests laid. These figures are probably subject to sampling error, and the coverage of nesting areas throughout the Pacific basin may be incomplete for some species.

There are no estimates of abundance for the turtles that do not nest, or of natural mortality for most stocks. Estimates of incidental mortality due to fishing are lacking for longline and gillnet fisheries; when they are available they are frequently based on low sampling coverage, or use outdated figures, or are extrapolated from other areas.

Satellite tracking provides good information of movements of some individual sea turtles.

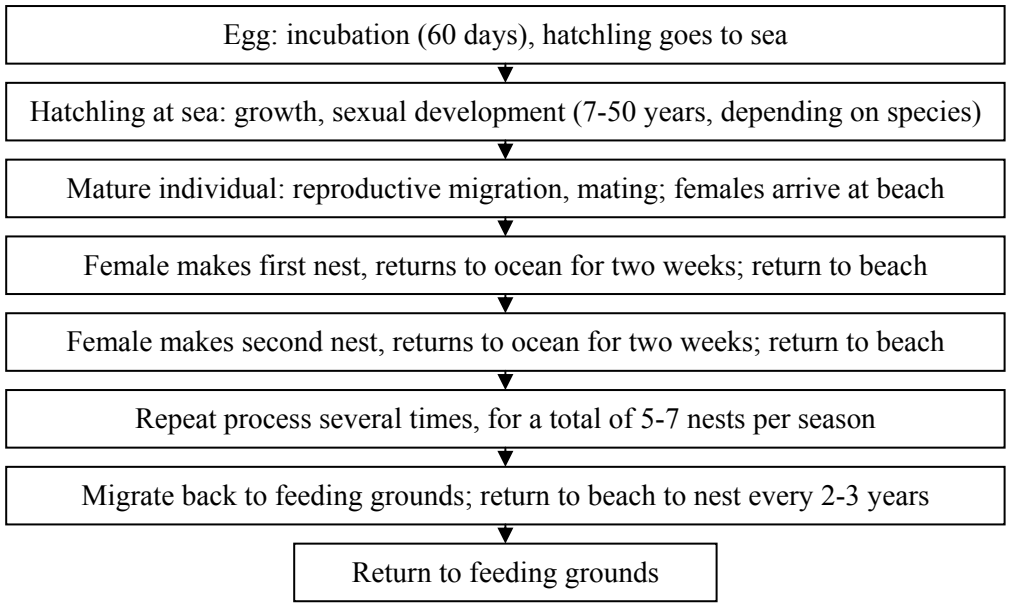
Observers on tuna purse seiners have provided some additional data on habitat use and seasonal distributions. However, this information is collected opportunistically, and reflects only that part of the distribution of turtles that coincides with the distribution of the effort of the fishing fleet. A lack of sightings in an area may reflect an absence of turtles or a lack of fishing effort in that area; similarly, a high density of sightings may result from a concentration of effort, resulting in multiple sightings of a few individuals, giving a distorted picture of turtle density. The different types of sets made by purse seiners – on unassociated schools of tunas, tunas associated with dolphins, or associated with floating objects – are preceded by different search processes, and sighting rates are not directly related to abundance. Sea turtles may associate with floating objects, but not with herds of dolphins or unassociated schools, because of their swimming speeds. Repeated sets on the same object may produce multiple sightings or captures of the same turtle. These caveats should be kept in mind when interpreting these data.

During 1993-2002 IATTC observers reported sighting the following number of sea turtles:

	Olive ridley	Black	Hawksbill	Leatherback	Loggerhead	Unidentified	Total
Live	13,385	2,682	199	60	375	19,020	35,721
Dead	443	54	9	13	8	673	1,200
	13,828	2,736	208	73	383	19,693	36,921

2. GENERALIZED LIFE HISTORY CYCLE

The life history of sea turtles makes the populations vulnerable to exploitation. A generalized life history follows:



The nesting population represents only a fraction of the sexually mature females, and the trends of the population as a whole cannot be determined accurately with only this information. The age at sexual maturity is difficult to estimate, but is high in most cases, so increases or decreases in population size that may have occurred over a decade or more may not be evident from the beach counts.

3. SPECIES SUMMARIES

Recent papers and books review most of the information available on the biology and ecology of sea turtles found in the EPO. A brief summary of this information is presented here.

3.1. Olive ridley turtle (*Lepidochelys olivacea*)

Spanish common names: Tortuga blanca, golfina; FAO species code: LKV

By far the most abundant sea turtle in the EPO; also the smallest, with adult carapace lengths reaching 60–70 cm. Mostly pelagic; feeds on small fish, crustaceans, and invertebrates. In some areas the females nest in large concentrations called *arribadas*, while in other areas they nest individually or in small groups. Concentrates near the nesting area two months before the nesting season, and copulation apparently happens close to the beaches.

Nesting areas: Playa Nancite and Playa Ostional in Costa Rica, and Escobilla Beach in Oaxaca, Mexico, are the main nesting areas, but the species nests in many other locations.

Nesting season: *Arribadas* peak in September–October in Costa Rica, Nicaragua, and other Central American locations. Nesting in Mexico is from July to November,

Trends in nesting beaches: Decline suggested for some Costa Rica beaches and for the Guatemalan coast, stable or increasing in other areas.

Migrations and movements: Some females tracked from Costa Rica reached Mexico to the north, Peru to the south, and almost 2,000 miles to the west.

Status: The abundance of this species is quite high; during 1993-2002 the number of sightings of this species was more than three times the number of sightings of all other species combined. Some declines reported from Costa Rica and Guatemala, but other populations on the Pacific coast are stable or increasing. Sightings and captures by tuna vessels show a broad distribution.

3.2. Black turtle (*Chelonia mydas agassizii*); other names: Eastern Pacific green turtle

Spanish common names: Tortuga negra, tortuga prieta; FAO species code: KEZ

It is the second most abundant species in sightings from tuna vessels. Measures 70-90 cm; primarily herbivorous, feeding on sea grasses, algae, and mangrove leaves, but also some marine animals. The very narrow continental shelf on the west coast of the American continent restricts its habitat.

Nesting areas: Mainly Colola and Maruata Bay, Michoacan (Mexico), and the Galapagos Islands.

Nesting season: Michoacan: August-January, peak in October-November; Galapagos: December-May, peak in February-March; also Revillagigedo Islands (Mexico) in March-July, and Playa Naranjo (Costa Rica) year-round, with peak in October-March. In general, after the nesting season of olive ridleys, and before the peak of the leatherback.

Trends in nesting beaches: Declines in the eastern Pacific nesting beaches.

Migrations and movements: Turtles tagged in Michoacan have been recovered all along the Central American coast and as far south as Colombia, but also to the north, in the Gulf of California. Individuals tagged in Galapagos have been recovered along the continental coast, from Peru to Costa Rica. Apparently part of the population remains in Galapagos year round.

Status: Declining nesting population in Mexico, may be increasing in the Galapagos Islands.

3.3. Hawksbill turtle (*Eretmochelys imbricata*)

Spanish common name: Tortuga carey; FAO species code: TTH

The most tropical of all sea turtles. Adult females measure 60 to 95 cm. The carapace has a high commercial value, leading to extensive harvests. Adults associate with coral reefs or hard substrates where they establish territories, and feed on sponges, small crustaceans, etc. Because of this habitat preference, adults are rarely taken in surface fisheries.

Nesting areas: Does not nest in large numbers, prefers isolated locations; very little, if any, nesting in the EPO.

Nesting season: Longer than those of other species.

Trends in nesting beaches: Declining throughout their range, but difficult to assess because of dispersion and isolation.

Migrations and movements: Long reproductive migrations, but foraging territory narrower than for other species.

Status: Declining throughout most of its range; with a history of heavy exploitation for tortoiseshell. It was much more abundant in the eastern Pacific in the past.

3.4. Leatherback sea turtle (*Dermochelys coriacea*)

Spanish common names: Tortuga laúd, *also* baúla, 7 filos, 7 quillas, 7 cueros, tinglada, galápago, gigante; FAO species code: DKK

The largest of all sea turtles, can weigh nearly a ton and measure 2 meters in length. It is the only sea turtle without a carapace; instead it has a thick leathery skin layer. Adults feed on jellyfish and other invertebrates. It appears to prefer the waters over the continental slope rather than those over the continental shelf.

Nesting areas: In the EPO, the main nesting grounds are in Mexico (Michoacan and Oaxaca) and in Costa Rica. Also nests in the western Pacific.

Nesting season: In Michoacan peak nesting takes place in November-February, with early arrivals in August. In Costa Rica the peak is also in November-February.

Trends in nesting beaches: Declining throughout the Pacific; in contrast, several Atlantic populations are stable or recovering.

Migrations and movements: Satellite tracking data show that turtles nesting in Mexico and Costa Rica migrate across the fishing grounds of many of the fleets operating in the EPO, perhaps along well-defined "corridors". Others, apparently not from nesting beaches in the EPO, cross from California towards South-east Asia; it is not clear whether they interact with EPO fisheries.

Status: The most endangered of all species in the EPO. Some models suggest that the probability of extinction in the next 20 years for some of the populations that nest in the EPO is higher than 75%.

3.5. Loggerhead turtle (*Caretta caretta*)

Spanish common names: caguama, cabezona; FAO species code: TTL

Has a bony carapace and a very large head; adults measure close to a meter in length. Juveniles forage in open pelagic habitats, usually for items close to the surface; when they grow, they move into shallower areas and feed on mollusks.

Nesting areas: Not known to nest in the eastern Pacific; nests in Japan, and in the western South Pacific.

Nesting season: Late May through August in Japan.

Trends in nesting beaches: Declining in Japan and Australia.

Migrations and movements: Hatchlings from Japan are found off Baja California after several years, so apparently undertake trans-oceanic migrations. It is believed that oceanic fronts are an important juvenile habitat. Individuals tagged in Japan have also been recovered in Chinese waters. Individuals sighted in the southern EPO may originate in Australian nesting grounds.

Status: Population declining on the major beaches, with relatively low numbers overall.

4. IMPACTS OF FISHING ON SEA TURTLE POPULATIONS

The conservation of sea turtles does not depend exclusively on fisheries management. The decline in some sea turtle populations has drawn attention and research to the many factors that influence their survival. For instance, some of the impacts of overexploitation of eggs and adults, beach development, and predation have been addressed by extensive actions to improve the protection of nesting turtles and nesting sites. These have succeeded to some extent, but more can be done.

Also, environmental factors, such as climate change, regime shifts, and El Niño events, affect sea turtles, both directly – through the effects of storm and precipitation patterns on nesting beaches and changes in marine distributions, for example – and indirectly, through changes in productivity, the food web, and other characteristics of the ecosystem. However, such factors cannot be controlled, whereas the effects of fishing in general, and tuna fisheries in particular, can and should be mitigated.

The management objective for sea turtles, and particularly for leatherback turtles, is to reduce the mortality caused by the tuna fisheries of the EPO to the lowest possible level. The status of some populations is such that it is urgent that measures be taken, even if numbers of turtles involved appear small. Even if the fishers achieved an almost complete elimination of the incidental mortality, it may still not be enough to halt the decline, if the other factors continue operating. But the low population numbers do not allow us to spend much time in assessing all these other impacts, or prioritizing among them.

Some of the factors that can affect sea turtle survival in the sea include:

A. Pollution: heavy pollution in coastal areas may result in accumulation of heavy metals, pesticides and other substances in sea turtles. Not much is known about their direct effects, but a compromised bio-immune system may facilitate infections or other diseases. Much of the eastern Pacific coast is quite open, but there are a few areas with characteristics that may lead to build up of pollutants.

B. Entanglement in plastics and marine debris: Observers have reported sightings of turtles entangled in plastics, lost fishing gear, etc. Although other marine and coastal sources contribute to this problem, a good proportion of this debris originates in fishing vessels. For instance, juvenile turtles have been entangled in discarded sacks used for the salt used for making brine for freezing tuna catches, and the 2003 *Consolidated Resolution on Bycatch* prohibits tuna-fishing vessels from disposing of salt bags or any other type of plastic trash at sea.

C. Ingestion of plastics: There have been many reports of sea turtles ingesting debris, and the problem appears to be more frequent in leatherbacks and loggerheads. Leatherbacks, with a diet of jellyfish and salps, are likely confused by the appearance of plastic bags. The effects of the ingestion are poorly known, but large amounts may result in blockage of the digestive system.

D. Fisheries impacts: Many types of fishing gear, for example trawls, gillnets, trammel nets, seines, crab and lobster traps, and longlines, cause incidental mortality of turtles. Of these, purse seines, longlines and gillnets are used in tuna fishing, and the interactions of the first two with sea turtles are discussed in Documents BYC-04-05a and BYC-04-05b, respectively. However, there is little information on other fisheries that may be significant, such as the gillnet fisheries. Some authors believe that coastal gillnet fisheries for swordfish in Chile are one of the main causes for the decline of the leatherback turtle in the EPO. There are also many other gillnet fisheries in the region from which there are no records; however, only some of these catch tunas or billfishes, so many are outside the scope of the IATTC. In many cases the targets are not known by those gathering statistics, or the artisanal vessels fish with a combination of longlines and gillnets, and their catches cannot be traced to a specific gear. The inability to provide a review of the gillnet fisheries suggests that one of the tasks necessary for a holistic approach to sea turtle conservation is to identify the characteristics, fishing grounds, target species and, if possible, bycatch rates of these other fisheries of the EPO.

5. DISTRIBUTION OF SEA TURTLES IN THE EPO

Figures 1-5 are based on data collected since 1990 on the larger tuna purse-seine vessels by observers, who record every sighting of a sea turtle and every capture in a set. The data recorded includes species, estimated or measured size, location, date and time, and many characteristics of the set. The contours in the background of the maps indicate the levels of purse-seine fishing effort during the period, measured in number of sets. The caveats in Section 1 above should be kept in mind when interpreting the maps.

5.1. Olive ridley

Most sightings, particularly in the third and fourth quarters, are in a band along 5°N, but there are several coastal areas with high concentrations. During the first quarter there is a large concentration just west of the Gulf of Tehuantepec, where the highest numbers are seen between January and March, several months before the nesting season, and another more diffuse group off Peru. In April-May there are aggregations off the Colombian coast. Off Costa Rica the peaks are in August-September, which coincides with the *arribada* peak. In July-December there are a large number of observations in the band along 5°N.

5.2. Black turtle

The majority of sightings are again in the south, centered around 10°S and 85°W, and in the strip along 5°N. There are nesting beaches in Galapagos, and the density there is high year-round, but especially in November-January, before the peak of the nesting season. There are groups of observations in the mouth of the Guayas River in Ecuador, and off Colombia.

5.3. Hawksbill

In the first quarter there is a high density off Peru. There are some observations off Baja California and off Colombia, in areas where access to suitable habitats (coral reefs or hard substrates) is easier. If hawksbills associate with floating objects, and drift with them to the west, then the objects may have some influence on their distribution, given the lack of suitable habitats offshore.

5.4. Leatherback

During the first quarter they are seen along the Mexican coast, coinciding with the peak of nesting there, and there are a few sightings off Costa Rica, with a similar peak season.

5.5. Loggerhead

There is a high density on the west coast of Baja California in the second half of the year in the area between Cedros Island and Bahía Magdalena. They occur in the warm water tongue off Peru between January and April, but the lack of fishing in the area after April makes it difficult to see if they are associated with the warm water there, together with tunas, dorados, and others, or if they are there year-round. During the second part of the year, but especially in the third quarter, a very clear strip with many observations appears around 3-5°N.

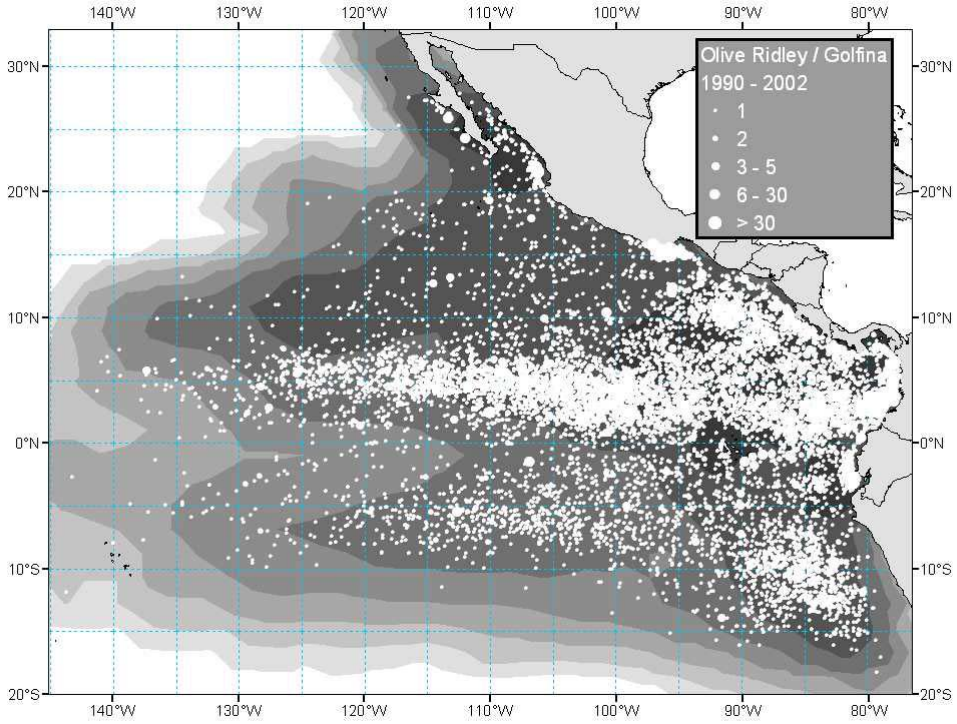


FIGURE 1. Distribution of sightings of olive ridley turtles reported by observers aboard tuna purse-seine vessels, 1990-2002.

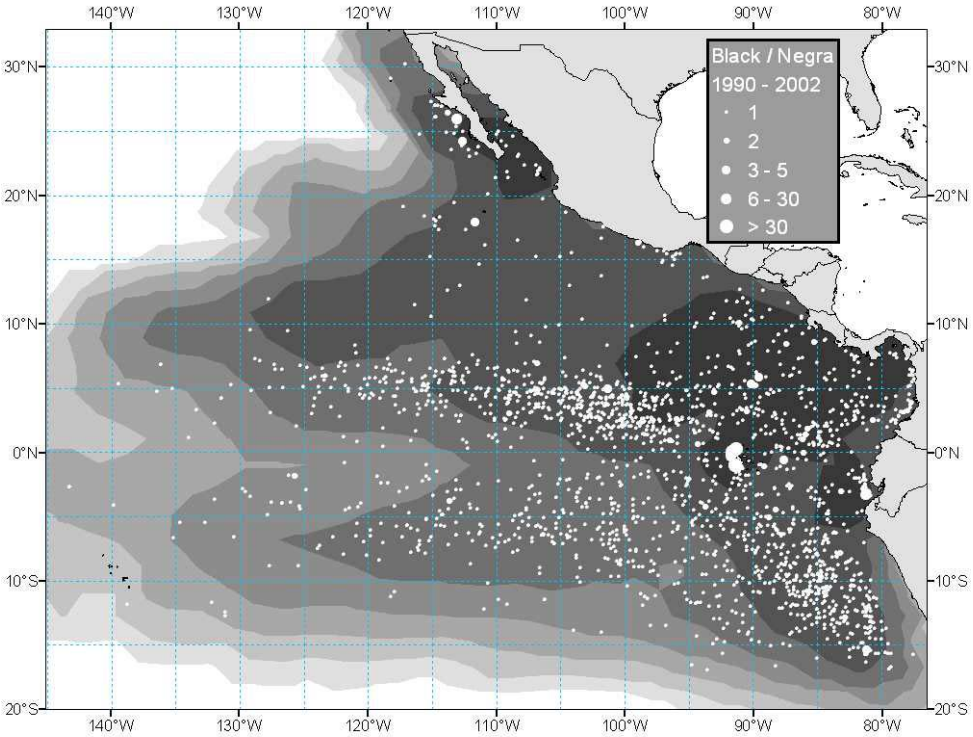


FIGURE 2. Distribution of sightings of black turtles reported by observers aboard tuna purse-seine vessels, 1990-2002.

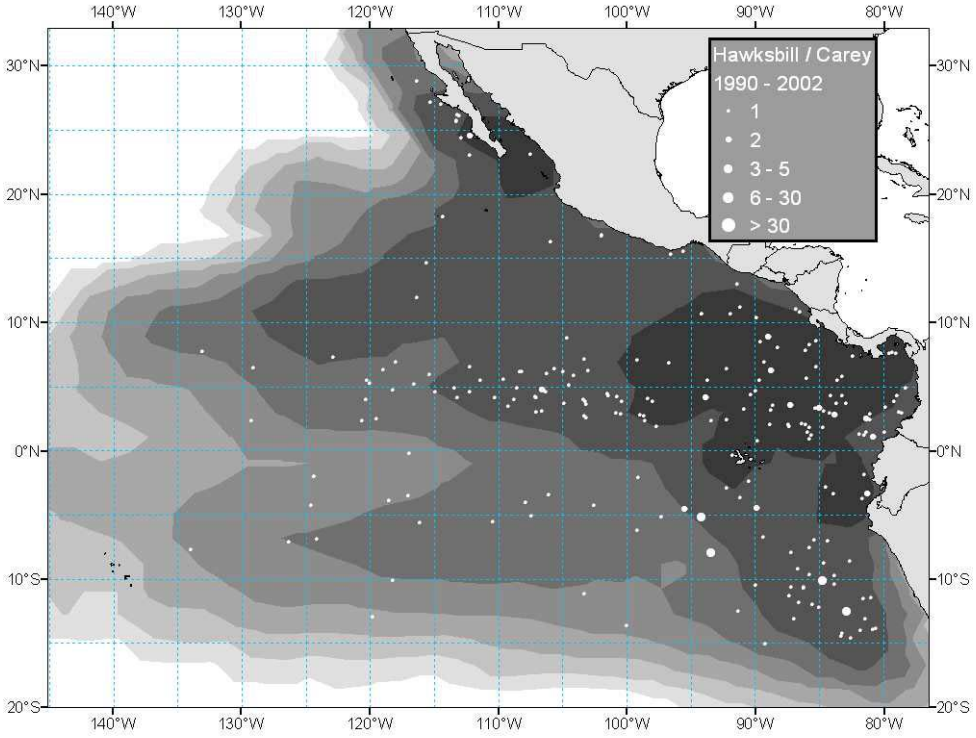


FIGURE 3. Distribution of sightings of hawksbill turtles reported by observers aboard tuna purse-seine vessels, 1990-2002.

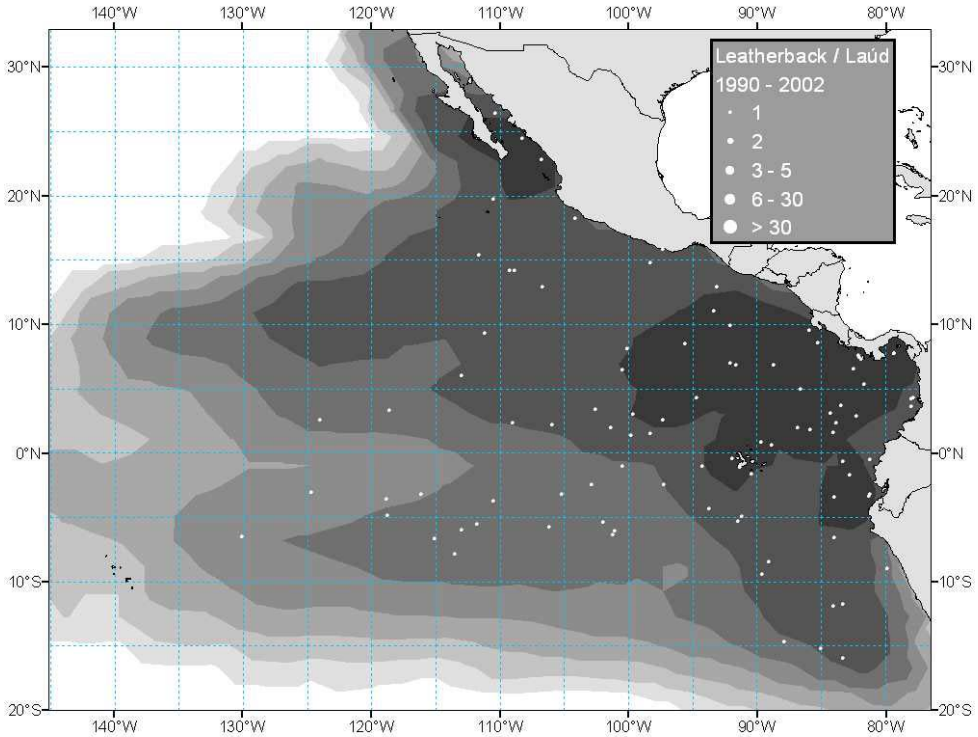


FIGURE 4. Distribution of sightings of leatherback turtles reported by observers aboard tuna purse-seine vessels, 1990-2002.

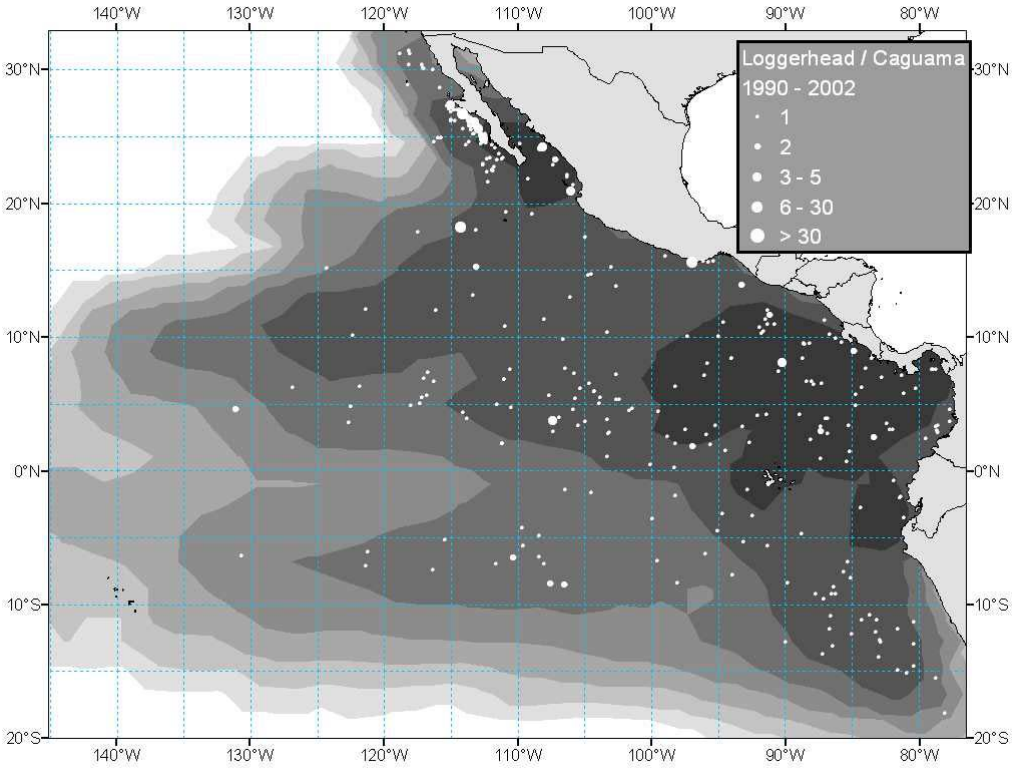


FIGURE 5. Distribution of sightings of loggerhead turtles reported by observers aboard tuna purse-seine vessels, 1990-2002.