BULLETIN OF MARINE SCIENCE, 67(3): 937–947, 2000

TRANSPACIFIC MIGRATION OF A LOGGERHEAD TURTLE MONITORED BY SATELLITE TELEMETRY

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ABSTRACT

The oceanic movements of a captive-raised adult loggerhead turtle (*Caretta caretta*) were monitored with satellite telemetry for 368 d from 10 August 1996 to 12 August 1997. During this time the turtle migrated across the Pacific Ocean, covering more than 11,500 km between Santa Rosaliita, Baja California, Mexico (28º40′N, 114º14′W), and Sendai Bay, Japan (37º54′N, 140º56′E). The average speed during the migration was 1.3 km h^{-1} and the maximum recorded speed was 1.84 km h^{-1}. Our findings are consistent with the hypothesis that loggerheads feeding in the eastern Pacific eventually return to nest on western Pacific beaches, a relationship previously inferred from molecular genetic analysis and flipper tag returns. We conclude that loggerhead turtles are capable of transpacific migrations and propose that the band of water between 25º and 30ºN, the Subtropical Frontal Zone, may be an important transpacific migratory corridor.

Juvenile loggerhead turtles, *Caretta caretta,* in the 20–85 cm straight carapace length (SCL) size range have been have been observed in the offshore waters along the Pacific coast of California, USA and Baja California, Mexico (Pitman, 1990; Nichols, in press). Bartlett (1989) suggested that these turtles might be of western Pacific origin, migrating 10,000 km and feeding on pelagic red crabs (*Pleuroncodes planipes*) along the Baja California coast. Subsequently, Baja California loggerhead turtles have been determined through molecular genetic analysis (Bowen et al., 1995) and flipper tag returns (Uchida and Teruya, 1988; Resendiz et al., 1998) to be primarily of Japanese origin (Table 1).

Pacific loggerheads appear to utilize the entire North Pacific during the course of development in a manner similar to Atlantic loggerheads' use of the Atlantic Ocean (Bolten et al., 1998). After a period of more than 10 yrs (Zug et al., 1995) in pelagic waters and foraging areas along the Baja California coast mature turtles evidently cross the entire Pacific Ocean as they return to natal beaches, a journey of more than 12,000 km in each direction. Recent findings (Polovina et al., 2000) indicate that juvenile loggerheads in the North Pacific move westward against weak (0.1–0.3 km h^{-1}) eastward geostrophic currents, demonstrating that passive drift may not entirely explain the dispersal of loggerheads.

At each stage of this developmental migration loggerhead turtles face anthropogenic hazards such as high seas longline fisheries (Wetherall, 1996) as well as coastal halibut and shark fisheries in Mexico (Nichols, pers. observ.). Japanese (Uchida and Nishiwaki, 1982; Kamezaki, 1997) and Australian (Limpus and Couper, 1994) nesting populations have experienced declines in recent decades and, as human populations have grown, fishing activities have increased in both pelagic and coastal habitats along with associated incidental capture of sea turtles. It is likely that juvenile and subadult populations in the eastern Pacific Ocean have suffered similar declines, although no studies have addressed this issue. Little biological information exists on Pacific loggerhead life history and movement patterns (National Marine Fisheries Service and U.S. Fish and Wildlife Service,

1998) and sparse experimental evidence exists regarding these open ocean migrations and the sensory mechanisms and cues used by the turtles to accomplish them (Lohmann et al., 1999).

This study represents the first effort to document pelagic movements of north Pacific loggerheads from feeding grounds to nesting areas using satellite telemetry. Previous telemetry studies of loggerhead turtles have documented post-reproductive movements (Stoneburner, 1982), pelagic movements (Polovina et al., 2000), home ranges (Renaud and Carpenter, 1994), sea turtle navigational abilities (Papi et al., 1997) and homing behavior (Luschi, 1996). However, few studies of sea turtles have documented pre-nesting movements from feeding grounds to breeding areas. Notably, Renaud and Landry (1996) documented the movement of a Kemp's ridley (*Lepidochelys kempii*) from feeding grounds in Louisiana, USA to its successful nesting in Rancho Nuevo, Mexico.

A unique opportunity to track the movements of an adult-sized loggerhead turtle—which are rarely encountered along the Baja California coast—emerged in 1996. The turtle had been raised in captivity and used in the initial genetic analysis of Baja California loggerheads (Bowen et al., 1995). Thus, due to the difficulty in obtaining wild adult loggerhead turtles in Baja California waters, we chose a captive-raised animal for this study. Its mature size (Kamezaki and Matsui, 1997), genetic affinities with Japanese turtles, and the existence of a previous tag return from Japanese waters of a captive-raised, Baja California loggerhead (Resendiz et al., 1998) were the deciding factors in choosing this particular turtle for the study.

The objective of this study was to monitor the oceanic movement, using satellite telemetry, of a Pacific loggerhead turtle initially captured on feeding grounds along the Baja California coast. Movement data were also examined with respect to oceanographic and meteorological information in an effort to gain insight into the navigational cues that guide adult sea turtles and to identify possible transpacific movement corridors. The results reported here are from a single telemetered turtle that was captive-raised for ten years and released from the coast of Baja California, Mexico.

METHODS

A captive-raised adult loggerhead turtle (BLA099) was monitored following release at Santa Rosaliita, Baja California, Mexico (28°40′N, 114°14′W). The turtle was first captured in October 1986 by sport fishermen in Bahía de Los Angeles, Baja California, and maintained in captivity at the Centro Regional de Investigaciónes Pesqueras, Sea Turtle Research Station (CRIP-STRS). At the time of capture it had a straight carapace length (SCL) of 29.9 cm and weighed 4 kg. The turtle was used in the study of captive growth rates and in the genetic analysis of Pacific loggerhead stocks. Genetic studies concluded that this individual was of Japanese origin (Bowen et al., 1995). At the time of release the turtle measured 83.4 cm (SCL) and weighed 95 kg. The tail measured 3.5 cm from the edge of the carapace to the tip.

A model ST-3 backpack transmitter manufactured by Telonics, Inc. (Mesa, Arizona, USA) was programmed with a duty cycle of 6 h on, 6 h off. The transmitter was attached to the second vertebral scute (counting from the anterior end) of the turtle's carapace using a modified version of the attachment technique described by Balazs et al. (1996). Specifically, we substituted a thin layer (<1 cm) of tinted two-part marine epoxy (Marine-Tex; Montgomeryville, Pennsylvania, USA) for Silicone Elastomer. Epoxy was also used to create a small faring on the leading and trailing edges of the transmitter to reduce drag (Watson and Granger, 1998). Release of the telemetered turtle occurred approximately 2 km offshore of Santa Rosaliita, Baja California, Mexico (28°40′N, 114°14′W), on 10 August 1996, 10 yrs after initial capture.

Transmission data were received via the Argos/NOAA satellite-based location and data collection system, which interprets and classifies signal locations in categories called location classes. In addition to the date and location, data included surface time for each 12-h period, average dive time for each 12-h period, last dive time and temperature. These data will be presented elsewhere in conjunction with additional loggerhead tracks. Only positions with a location class (LC) of 0,1, 2 or 3 were included in the analysis of distances traveled and swim speeds. Location classes of 1 or greater have known error factors of less than 1000 m and accuracy increases with location class (LC = 2, accuracy within 350 m; LC = 3, within 150 m). Turtle locations were plotted using Generic Mapping Tools (GMT) software. Distances and headings were calculated using variations of the Great Circle Equation (Dunlap and Shufeldt, 1969). Each segment of the track, or distance traveled between quality locations, is presented and swim speeds for these segments are calculated by dividing the distance traveled by the time between locations (Table 1). The straightness index, or the ratio between the great circle distance (shortest line between the release location and the final location) and the calculated distance traveled was calculated using endpoints of the track. The turtle's trajectory for the entire track was qualitatively compared to available surface current velocities derived from annual mean TOPEX/Poseidon Satellite Altimeter and NOAA/NESDIS World Ocean Atlas 1998 data (Lagerloef et al., 1999).

RESULTS

Detailed open-ocean movements of the turtle were recorded for 368 d. During this period Argos reported a total of 405 transmissions providing assessed locations. Of these positions 32% provided location data of LC ≥ 0, 21% LC ≥ 1 and 8% LC ≥ 2. Using only the most accurate data (LC ≥ 2) we calculated the total distance traveled to be 11,512 km and the overall average swim speed for the entire track to be 1.30 km h^{-1}. Even if we assume the maximum error for each position (350 m), less than 25 km of distance is added to the track. Including LC = 1 data increases average speed by less than 4%. Thus, use of only the high quality (LC ≥ 2) positions may slightly underestimate average distances and swimming speeds (Table 2). Inclusion of lower accuracy data (LC = 0 or 1) increases the estimated distances traveled, in this case by 8 and 3%, respectively. Average swimming speed for segments of the track between high quality positions more than 24 h apart range from 0.90 km h^{-1} (21.6 km d^{-1}) to maximum levels of 1.84 km h^{-1} (44.2 km d^{-1}) for the segment near 129ºW latitude and 1.79 km h^{-1} (43.0 km d^{-1}) near 172ºE latitude. It should be emphasized that these speeds do not represent maximum burst speeds, rather an average speed between positions where LC ≥ 2. The net distance traveled, using only the endpoints of the great circle, is 9276 km. The overall distance traveled and mean swimming speed, for the entire track, calculated using only LC ≥ 2 positions, was 11,512 km and 1.30 km h^{-1} (31.2 km d^{-1}), respectively, and increases as additional location classes are included (Table 2). The turtle's average heading for the entire track was 309.8° and the headings for each segment ranged between 180º and 330º (Fig. 1). The straightness index was 0.81 for LC ≥ 2, 0.78 for LC ≥ 1 and 0.74 for LC ≥ 0.

The final recorded location for the turtle was on 13 August 1997 near Isohama, Japan, a small fishing port in northeastern Honshu (37º54.12′N, 140º55.98′E). The scarcity of locations for the two weeks prior to this date, the sequence of four high quality positions during the final eighteen hours of transmission (LC ≥ 2), and the direct movement towards Isohama during the final day of transmission suggest that the turtle may have been caught by fishermen in waters northeast of Japan (39º49.26′N, 142º36.48′E). The final 256-km segment of the track should be considered cautiously. When this final segment of

Table 1. Summary of distances and swimming speeds for the transpacific movement of a loggerhead turtle (Longitude: − = West; + = East).

Date	Time[1]	Relative day	LC[2]	Latitude	Longitude	Distance between locations[3] (km)	Cumulative total distance (km)	Mean swimming speed for segment (km h^{-1})
11.08.96	01:15:00	0.00	3	28.668	−114.237	–	–	–
28.08.96	14:39:16	17.56	3	26.726	−118.412	463.95	463.95	1.10
29.08.96	3:33:18	18.10	3	26.767	−118.484	8.47	472.43	0.66
25.09.96	3:45:22	45.10	2	25.028	−124.641	644.99	1,117.42	1.00
06.10.96	17:06:29	56.66	2	24.995	−128.834	422.23	1,539.65	1.52
07.10.96	15:05:57	57.58	2	25.143	−129.202	40.53	1,580.18	1.84
07.10.96	16:45:17	57.65	3	25.131	−129.206	1.39	1,581.57	0.84
12.10.96	16:38:32	62.64	3	25.146	−131.106	191.14	1,772.71	1.59
13.10.96	14:36:15	63.56	2	25.138	−131.353	24.86	1,797.57	1.13
24.10.96	15:31:29	74.59	2	25.684	−135.241	394.91	2,192.48	1.49
25.10.96	16:53:06	75.65	2	25.643	−135.579	34.16	2,226.63	1.35
07.11.96	17:06:55	88.66	2	25.528	−140.267	470.00	2,696.63	1.51
12.12.96	17:46:29	123.69	2	25.151	−153.173	1,296.30	3,992.94	1.54
02.01.97	4:16:53	144.13	2	24.840	−158.447	532.25	4,525.18	1.09
31.01.97	5:26:23	173.17	2	24.095	−170.467	1,218.13	5,743.32	1.75
27.02.97	15:00:04	200.57	2	21.951	−179.880	991.46	6,734.77	1.51
13.03.97	17:55:07	214.69	3	23.456	174.868	563.71	7,298.48	1.66
21.03.97	19:59:23	222.78	3	23.457	172.692	221.81	7,520.29	1.14
25.03.97	7:46:31	226.27	2	24.134	171.417	149.88	7,670.17	1.79
07.04.97	3:43:39	239.10	2	25.841	166.609	520.03	8,190.20	1.69
07.04.97	6:24:11	239.21	2	25.829	166.608	1.34	8,191.54	0.50
07.04.97	8:01:40	239.28	3	25.830	166.605	0.32	8,191.86	0.20
09.04.97	15:54:08	241.61	3	26.081	166.026	64.22	8,256.08	1.15
15.05.97	19:53:33	277.78	2	31.838	154.058	1,326.59	9,582.68	1.53
24.05.97	19:57:08	286.78	2	33.229	152.672	201.86	9,784.54	0.93
10.06.97	20:23:36	303.80	2	33.080	148.745	365.68	10,150.22	0.90
06.07.97	16:35:01	329.64	2	39.717	146.511	764.01	10,914.24	1.23
19.07.97	3:28:43	342.09	2	39.633	144.631	161.06	11,075.29	0.54
19.07.97	5:11:38	342.16	2	39.634	144.642	0.95	11,076.24	0.55
26.07.97	7:58:23	349.28	2	39.821	142.608	175.06	11,251.30	1.03
13.08.97	8:02:24	367.28	2	37.929	140.923	255.82	11,507.12	0.59
13.08.97	16:19:49	367.63	3	37.902	140.933	3.13	11,510.25	0.38
13.08.97	17:58:32	367.70	3	37.904	140.925	0.74	11,510.98	0.45
13.08.97	20:19:46	367.79	3	37.902	140.933	0.74	11,511.72	0.31

[1] Time is GMT

[2] Location Class (LC) 2 is estimated at ±350 m, LC 3 is estimated at ±150 m

[3] Distances were calculated using the Great Circle Equation (spherical earth model)

The final four reported locations should be interpreted cautiously, as the turtle may have been caught or the transmitter removed.

Table 2. Comparison of total distance traveled and swimming speeds by a loggerhead turtle during its transpacific migration over a period of 368 days.[1]

Locations[1]	Positions (number)	Net distance (km)	Mean speed[3] ($\mathrm{km\ h^{-1}}$)	Maximum speed ($\mathrm{km\ h^{-1}}$)
LC ≥ 0	131	12,483	1.41	3.94
LC ≥ 1	84	11,883	1.35	2.39
LC ≥ 2	34	11,512	1.30	1.84
Great circle[2]	2	9,276	1.05	-

[1] A total of 405 locations were reported, 274 were unreliable (LC = A or B) and not used in this analysis.

[2] Great circle distance calculated for the arc between Santa Rosaliita, Baja California, Mexico and Sendai, Japan.

[3] Average speed was calculated by dividing the total distance by the total time.

the track is excluded, the total distance traveled is 11,251.3 km and the overall average swim speed is 1.34 km $\mathrm{h^{-1}}$.

DISCUSSION

Pacific loggerhead hatchlings entering the waters off of their nesting beaches in Japan may embark on a large-scale developmental migration that encompasses the entire north Pacific Ocean. Carried northward by the Kuroshio Current and its extension (N. Kamezaki, pers. comm.), many enter the pelagic environment where the turtles may remain until they return to their natal beach at maturity. A large number of loggerhead turtles arrive along the coast of the Baja California peninsula (Ramirez Cruz et al., 1991), apparently transported by the cold, wide California Current from the north. Pelagic sightings of these animals and the rarity of their occurrence near shore suggest that some turtles may skip the subadult benthic stage described by Musick and Limpus (1997).

Massive amounts of debris from the north and northwestern Pacific, including redwood trees, ships, Japanese fishing buoys and World War II artifacts, have accumulated over the years along Baja California's Pacific coast, particularly in the vicinity of Malarrimo Beach, Bahía Sebastian Vizcaino (27°55′N, 114°25′W), an area known locally for juvenile and subadult loggerheads. The same forces that deposited this flotsam are likely responsible for carrying the juvenile loggerheads to the region.

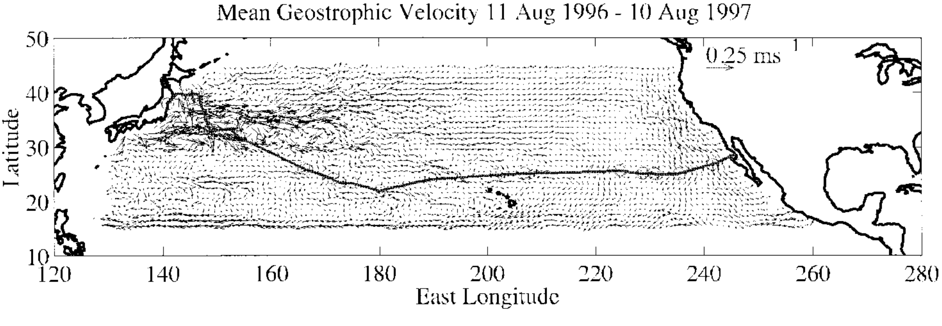

Figure 1. Track of transpacific movement of loggerhead turtle (07667) from Mexico to Japan, during 1996–1997, monitored using satellite telemetry. All positions shown are LC ≥ 2. Mean current velocities for 11 August 1996 through10 August 1997 are derived from TOPEX/Poseidon Satellite Altimeter and NOAA/NESDIS World Ocean Atlas 1998 data (Lagerloef et al., 1999).

It is not clear how long loggerhead turtles remain in Baja California waters. However, our results suggest that upon reaching maturity and reproductive condition loggerheads are capable of migrating from Baja California to natal beaches in Japan. While the details of which endogenous or exogenous factors trigger migration to nesting areas are not clear, the life cycle and high lipid content (Aurioles-Gamboa and Balart, 1995) of their main food source, *P. planipes*, likely play an important role. Observations suggest that loggerheads do not return to the eastern Pacific waters after reproducing, remaining on western Pacific foraging grounds (Kamezaki et al., 1997). Few turtles larger than 85 cm (SCL) have been encountered in Baja California waters and according to fishermen mature males are rarely or never encountered (Nichols et al., in press).

These data provide the first details of a return migration across the Pacific Ocean. However, because this turtle had been held in captivity at the foraging area for 10 yrs, conclusions regarding the timing of such a migration must be cautiously extended.

SWIMMING SPEEDS OF MIGRATING TURTLES.—Calculated swimming speeds of migrating sea turtles are prone to error due to assumptions of straight-line movement between mark and recapture positions, satellite location error, and assistance or hindrance due to currents. This study provides a unique opportunity to calculate average swimming speeds over extended periods with high accuracy due to (1) highly reliable data, (2) clear and consistent straight-line movement of the animal being tracked, and (3) known currents for large sections of this ocean area.

Loggerhead turtles are certainly capable of obtaining bursts in swimming speeds far greater than 1.84 km h^{-1}, the maximum recorded here (Meylan, 1982a; Stoneburner, 1982). However, this study demonstrates that they are able to maintain average speeds in excess of 1.0 km h^{-1} over longer periods of time such as several weeks to months. The resolution of the positions reported in this study is not sufficient to detect short bursts in swim speed. Ten years in captivity would be expected to result in an animal's inferior physical condition, yet swimming speeds are similar to those reported for wild loggerheads (Byles and Dodd, 1989; Papi et al., 1997)

When the turtle's track is compared to mean surface current data (Lagerloef et al., 1999) for the north Pacific during the tracking period (August 1996 to August 1997) it is apparent that at times the turtle swam against weak prevailing currents, which flow in a ESE direction in some areas (Fig. 1). However, current speeds along the migration path were typically less than 5 cm s^{-1} (0.18 km h^{-1}) and seasonal means may differ from annual means. The wide California Current would carry a turtle with a due westward orientation, swimming at approximately 1.0 km h^{-1} (30 cm s^{-1}) slightly southward as it pursued its transpacific goal. At the western end of the track the strong Kuroshio Current apparently carried the turtle excessively northward. It is clear from a comparison of this track with oceanographic data that this turtle was not simply transported passively across the ocean on surface currents as its swimming speed greatly exceeds that of the 1996–1997 average surface currents.

MIGRATION PATH.—The turtle appears to have maintained a relatively constant swimming speed and heading for the entire track. All of the locations reported here occur in pelagic waters of depths greater than 3000 m, except for those near the Baja California and Japanese coasts. The great circle connecting the endpoints of the track (i.e., the shortest distance path) would be further to the north than the track of this turtle. This shortest distance passes through the eastward-flowing North Pacific Current (NPC) and thus taking that path would require swimming against prevailing currents. Further to the south, the turtle's path passes through a convergence area of the Northern Equatorial Current (NEC) and the NPC likely to be relatively rich in plankton (Polovina and Moffit, 1995). The turtle appears to have traveled along a constant westward trajectory, only being deflected to the south and north by currents near continental coastlines, in particular the strong California and Kuroshio Currents.

Wetherall et al. (1993) report that turtles ranging from 10 cm to 90 cm (CCL), most of which were immature, were taken in the north Pacific high-seas driftnet fisheries in an area between longitudes 154ºW and 150ºE and latitudes 28ºN and 39ºN. Our surveys of strandings and incidentally captured turtles suggest that the majority of loggerheads along the Baja California coast are of immature size classes (45–70 cm). These findings combined with the current data suggest a general model: the northern Pacific gyre provides eastbound dispersal for immature Japanese loggerhead turtles as they reach Baja California feeding areas and may aid in westbound homing of loggerhead turtles returning to their natal beaches. It is likely that pelagic convergence zones also serve as forage habitat and that the distribution of loggerheads is continuous across the Pacific (Polovina et. al, 2000).

NAVIGATIONAL CUES.—These data provide further insights into the abilities of sea turtles to make long oceanic migrations and possibly into their navigational ability in the open sea during long range movement between feeding and nesting areas. The tracked turtle swam in a consistently westward direction and the simplest explanation is that it moved with surface currents. However, segments of the track are occasionally at 90–180º to mean annual surface current vectors, particularly during the initial segment near the coast of Baja California. It is therefore possible that this turtle followed some sort of directional homing instinct and fixed on a single compass heading (west) during its movement towards Japan, its known natal area (Bowen et al., 1995). The guidance cues used during the migration, however, are not known. Celestial navigation (use of moon and stars) seems unlikely due to turtles' poor eyesight above the surface of the water (Ehrenfeld and Koch, 1967). Comparisons of the track to lunar phase and meteorological data indicate that the turtle was able to maintain its westward trajectory under diverse conditions that included cloudy or moonless nights, dusk, dawn, etc. Furthermore, anyone who has spent time on the high sea will recognize the difficulties associated with using visual cues through a pair of eyes positioned just above the sea surface. If celestial cues are used in sea turtle navigation it seems that a variety of factors must be used in synchrony and that an ability to maintain a heading in the absence of such cues remains a requirement.

The use of chemosensory cues seems unlikely as the turtle did not appear to display wandering movements typical of gradient assessment (Dusenbery, 1992) and the distance from the release site to the source or destination is great. Furthermore, currents near the Japanese nesting beach run to the northeast, away from this turtle's migratory path. While chemical cues may play a role in turtle homing this seems most likely at close range of nesting beaches (Grassman and Owens, 1987) and probably not very useful in long-distance navigation.

Experience-based behavior seems equally unlikely as the turtle had been in captivity for 10 yrs and the route taken from Japan to North America as a juvenile likely differs from the return route. Transpacific migration of loggerhead turtles may be an example of 'vector navigation', a term used to describe the innate movement of a young animal from natal to developmental areas (Able, 1996). If this is the case these turtles may be making their first, and possibly only, circum-oceanic journeys.

This track is consistent with the hypothesis that adult turtles utilize a magnetic map sense and have a capacity for true navigation that allows them to maintain headings towards homing locations despite current drift or displacement (Papi and Luschi, 1996). The nature of this ‘map sense’ has not been determined. Hatchling loggerheads have the ability to detect magnetic inclination angle (Lohmann and Lohmann, 1994) and field intensity (Lohmann and Lohmann, 1996), two geomagnetic features that vary across the earth’s surface and might be used to approximate geographic position (Lohmann et al., 1999). Such a system seems to be the most reasonable explanation of transpacific navigation abilities of loggerhead turtles, although a variety of additional cues and interacting mechanisms may also be used at various stages of the movement.

CONSERVATION IMPLICATIONS.—The area traveled by this turtle overlaps with several commercial fisheries utilizing gill nets, drift nets and longlines, known sources of loggerhead mortality (Yatsu, 1990; Wetherall et al., 1993; National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1998; Nichols et al., in press). Especially along the coast of Baja California, fisheries-related mortality data are few, illegal poaching difficult to quantify and post-capture survival rates are largely unknown. Research should be expanded in order to estimate the impact of these activities on loggerhead populations. The results can substantiate mitigation needs such as modification of fishing practices and if this turtle’s path represents a heavily used corridor, the area could be better protected through the establishment of international open-ocean reserves (Morreale et al., 1996).

The relationship between feeding and developmental areas along the Baja California coast and the loggerhead populations nesting in southern Japan has been firmly established. Therefore, efforts to reduce incidental catch of loggerheads in Mexican coastal fisheries, particularly those in the large subadult size classes, will produce measurable conservation and population recovery rewards on Japanese nesting beaches (Heppell, 1998). Similarly, conservation efforts in Japan should result in increasing numbers of juvenile loggerheads on Baja California feeding grounds.

The data obtained from the single year-long transpacific movement of an individual turtle contribute to our sparse knowledge of the pelagic migratory phase of sea turtle life history and specifically to the Baja California population of loggerhead turtles. These results demonstrate the ecological link between two seemingly disparate loggerhead populations in Japan and Baja California, and emphasize the need for continuing research and multilateral marine conservation efforts. Future telemetry studies of juvenile, wild-caught turtles on the Baja California feeding grounds are recommended.

ACKNOWLEDGMENTS

We thank the late G. Bartlett and R. Snodgrass for their wisdom and undying inspiration. We also thank R. Byles, O. Pedrin, USFWS, SEMARNAP, Instituto Nacional de la Pesca, Earthwatch Institute, One World Work Force, Turtle Trax and the Wallace Research Foundation for their support of this project. The fishermen of Bahía de los Angeles and Santa Rosaliita, M. Arce and his daughter Adelita, A. Galvan and D. C. Nichols assisted us in the field. To W. Harrison we extend an extra share of appreciation for his patience and tutoring. Our gratitude to A. Abreu, K. Lohmann, B. Godley, J. Frazier, C. Schwalbe, and D. Thomson and three anonymous reviewers for constructive comments that greatly improved the manuscript.

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DATE SUBMITTED: June 11, 1999. DATE ACCEPTED: February 17, 2000.

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