THE MONARCH'S TRANS - GULF EXPRESS:
"A CLOCKWORK ORANGE"
BY
GARY NOEL ROSS

The monarch has received more hype than any other butterfly. In fact, *Danaus plexippus* is generally considered the quintessential butterfly. For instance: The very name, *"monarch,"* denotes royalty (Ross, 2001a,b); the species is the most studied of all butterflies, often used in texts to illustrate a typical butterfly life cycle; monarch larvae sequester specific phytochemicals from their milkweed host plants that render them and their adults distasteful to many predators; and the monarch-milkweed association is an iconic example of co-evolution between the plant and animal kingdoms. But perhaps the butterfly's most legendary and enigmatic attribute is the monarch's annual fall and spring migrations—unparalleled in the animal kingdom.

Gary collecting monarchs for tagging in wildflower meadow on chenier near Johnson Bayou. White-flowering plant is piny aster (*Chloracantha spinosa*), a species that may contain phytochemicals sequestered by monarchs (October 1991).

Dewberries grow in abundance during the spring on Grand Chenier. The flowers are an excellent source of nectar for monarchs (April 1991).

Because monarchs are ancestrally tropical milkweed butterflies, they are unable to tolerate the winter climes of northern or even most temperate geographies. Like human *"snow birds,"* each autumn hundreds of millions of monarchs east of the Rocky Mountains in both the United States and Canada begin to wing their way southward toward the Gulf of Mexico, Texas, or Florida. At this same time, the smaller number of monarchs west of the Rockies moves toward the coastline of California. These featherweight international travelers fuel their journeys by converting sugars derived from flower nectars into high-octane fat reserves. In addition, the butterflies suspend energy-sapping reproductive activities.

Mature live oak on Chenier Perdue (May 1991).

Accordingly, the monarch migrations have been intensively studied and popularized over the years. Here is the gist: Whereas monarchs west of the Rocky Mountains seem content to hangout along the Pacific coast, the vast majority of eastern monarchs target the high-altitude coniferous forests of central Mexico, specifically the Transverse Neovolcanic Belt, a mineral-rich mountain range within the states of Mexico and Michoacan. (Some monarchs, however, do remain in the southern U.S. where they reproduce throughout the winter). Arrival time usually is early November, a time that coincides with the Mexican tradition of honoring the dead on All Saints and All Souls Day. (Most indigenous cultures of central Mexico believe that the monarchs actually represent the souls of deceased love ones.) At this time cemetery plots are manicured, and graced with food and beverage as treats for visiting spirits.

Monarchs in Mexico spend the months of winter in a state of reduced activity, awaiting the return of the warmth of spring. Then the butterflies fly about, mate and begin moving northward. They soon reach Texas where they fan out into the Midwest and the Gulf states. Along the way, females lay their eggs (several hundred) on their host plants—numerous species of milkweed (*Asclepias*). The butterflies then die. The new generation matures within a few weeks. These adults continue their northward journey all the while ovipositing on

Migratory monarchs warming themselves on Spanish moss in the morning sun in Peveto Woods Sanctuary (Baton Rouge Audubon Society) near Johnson Bayou (September 1993).

Migratory monarchs resting in hackberry tree in Peveto Woods Sanctuary (Baton Rouge Audubon Society) near Johnson Bayou (October 1990).

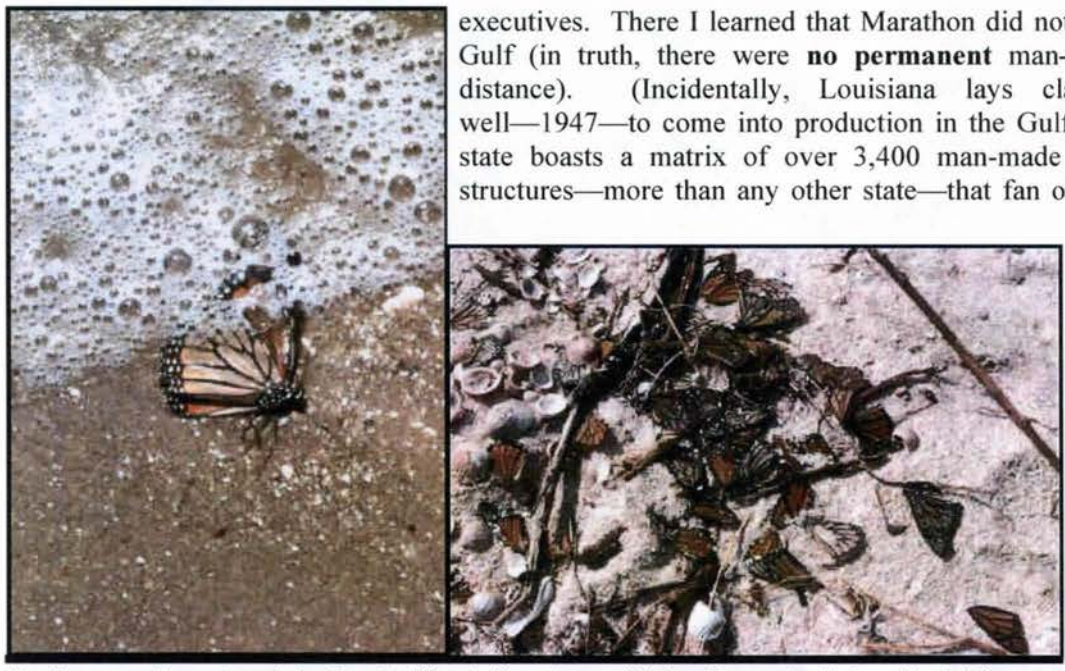
milkweeds. This *"business as usual"* continues through three or perhaps even four to five short-term generations. In the end, some monarchs reach the northern limits of milkweed plants—the prairie provinces of Canada and the farmlands of New England, southern Ontario and Quebec. With the return of autumn, last generation butterflies—like their ancestors countless years before—cease reproductive activities, begin accumulating fat reserves, and begin moving southward as virgin fall migrants. (In other words, no single monarch migrates to Mexico more than once in its lifetime.)

Up until fairly recent times, empirical data have indicated that the vast majority of the eastern monarchs enter Mexico by way of land routes to and through central Texas. They then ascend the Sierra Madre de Oriente and the Central Plateau, eventually winding up at 9,000-12,000 feet in the Transverse Neovolcanic Belt of central Mexico. This paradigm pivots on a migration that is land-based and during daylight hours. But in 1990 the following note by Bryant Mather (1916-2002) appeared in *News of the Lepidopterists' Society* (July/August), No. 4, page 59:

> *"On the 17th and 18th of October, every year for the past 18-19 years, monarch butterflies in immense numbers alight on and rest on an off-shore oil production platform out in the Gulf of Mexico. Mrs. Hylma Gordon of Hattiesburg, Mississippi, told me about this on January 12, 1989 when I was speaking about lepidoptera at a meeting of the Pine Woods Chapter of the National Audubon Society in Hattiesburg. She later gave me more details in a letter dated 31 Jan 1989. In her words: 'The experience on the rig was certainly an unforgettable one to see the cloud coming from all around in a mass that settled on every available space from the top of the derrick to the floors. Everything was covered to the depth of several layers. There were butterflies on top of butterflies. The deck hands were busy with wash-down hoses and had to keep it up to be able to handle the gear while drilling. Some of the older hands said it was a yearly occurrence in the area. We were about 150 miles S. of Cameron, LA. One of the men who had worked in the area for 18-19 years said they came through on the 17th-18th of October. They thought the butterflies were using the rig to rest on and fly around in the daytime and come back each night to rest for three nights. The idea that they were different groups on the same flight route had not occurred to me until you mentioned it.'*
>
> *A point about 150 miles south of Cameron, LA is pretty much on a straight line flight path from New Orleans to Michoacan, Mexico."*

Wow! Was it possible that some monarchs were actually crossing the open waters of the Gulf rather than skirting the coast in order to reach Texas before entering Mexico? Free from university duties, I delved into the Mather report. Turns out that Mrs. Gordon served as a cook aboard a vessel that supplied many of the oil and gas drilling rigs and production platforms in the northwestern Gulf. She thought the rig in question was owned by Marathon Oil Company.

Now began the footwork. I drove from my home in Baton Rouge to Lafayette to consult with Marathon



Dead monarchs on beach in Peveto Woods Sanctuary (Baton Rouge Audubon Society) near Johnson Bayou (October 1990; April 1992).

executives. There I learned that Marathon did not drill 150 miles into the Gulf (in truth, there were **no permanent** man-made structures at that distance). (Incidentally, Louisiana lays claim to the first oil well—1947—to come into production in the Gulf of Mexico. Today the state boasts a matrix of over 3,400 man-made oil and gas producing structures—more than any other state—that fan out nearly 170 miles into the northern Gulf.) Marathon suggested I visit Petroleum Helicopters, Inc. (PHI), the largest company that ferries men and supplies to points within the Gulf, and headquartered at the Lafayette Regional Airport. There, I was surprised to learn that two PHI pilots, Charles *"Chuck"* E. Williams and Thomas *"Tom"* Schaal, both of Lafayette, serviced rigs and platforms south of Cameron and that both were interested in wildlife, particularly the rehabilitation of birds that get injured or stranded offshore. And most exciting of all, Tom was on his seven-day off schedule and, therefore, at his home in Lafayette.

Visiting with Tom, I learned that he had been flying the Gulf for PHI for over two decades after returning from Vietnam. He remembered that on at least one-half dozen occasions he observed masses of monarchs so thick that they appeared as a stream of smoke moving southwest. The butterflies were flying above normal altitudes for helicopters (150-1000 feet). Also, he remembered that he had observed upwards of a thousand monarchs—particularly each October a day or two after the passage of a strong cold front from the north—resting on the fence surrounding a heliport on an offshore structure. Many of the butterflies routinely flew to a gas production platform know as West Cameron Block 280 (WC-280). Constructed in 1982 and located 72 miles south of Cameron, the platform was owned and operated by Unocal Corporation (Union Oil Company of California)—the company with the attractive logo: orange circle enclosing a blue/white 76. Tom suggested I contact Unocal to seek permission to board WC-280.

Lantana growing in abundance on Grand Chenier (May 1991). Flowers provide nectar for most butterflies.

Abundant *Coreopsis* along highway on Grand Chenier (June 1991).

Mature monarch larva on hostplant, Antelope horn milkweed, on Grand Chenier (April 1991).

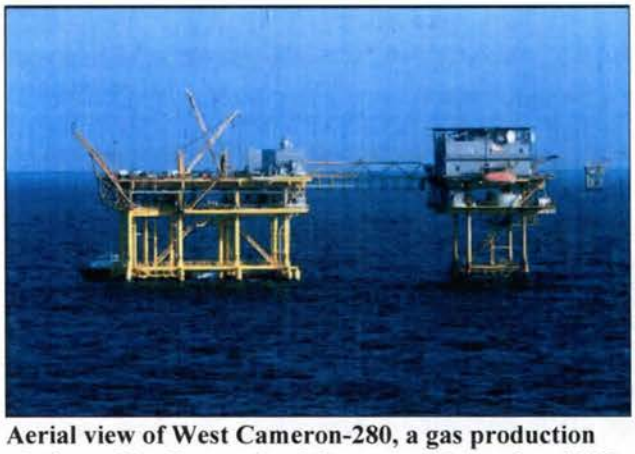
That I did with a formal letter. Unocal was very interested in my proposal (after all, the publicity could be very advantageous to Louisiana's frequently maligned petroleum industry). And since WC-280 was operating with a reduced crew, bunk space would be available for both me and a cinematographer friend (Donald Valentine) from California's Moody Institute of Science who I had requested to document the experience. Unocal even sweetened the deal by offering to cover all expenses—a real bonus since neither Don nor I had funding.

Of course, timing was critical. Knowing that cold fronts pass through Louisiana every week or so in October and

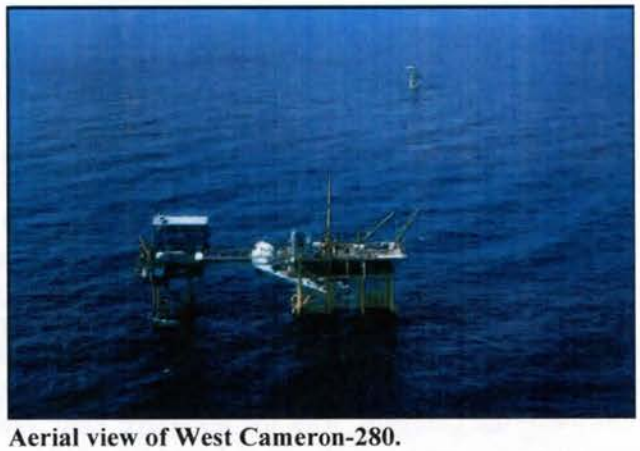
Antelope horn milkweed (hostplant for monarchs) on Monkey Island near Cameron. Plant is abundant on cheniers (May 1993).

Monarch egg on flower bud on antelope horn milkweed.

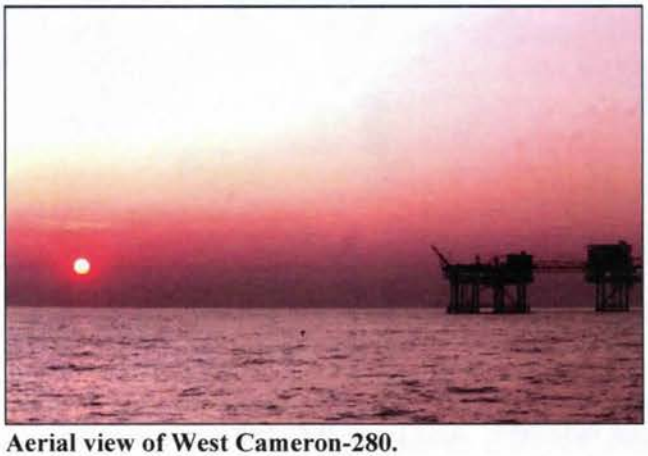
Mature monarch larva on hostplant, Antelope horn milkweed, on Grand Chenier (April 1991).



Aerial view of West Cameron-280, a gas production platform 72 miles south of Cameron (November 1992).



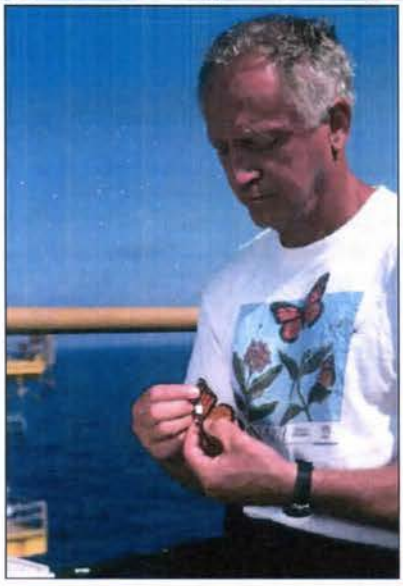
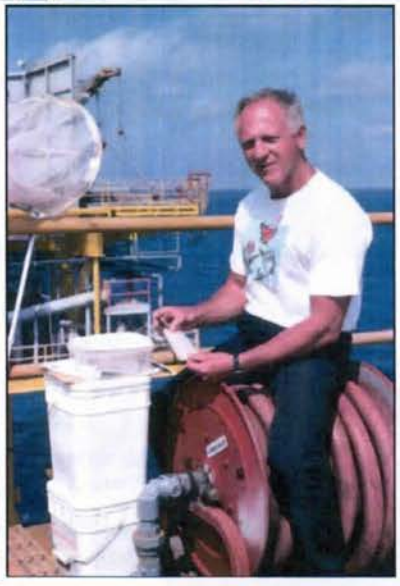
Aerial view of West Cameron-280.



Aerial view of West Cameron-280.

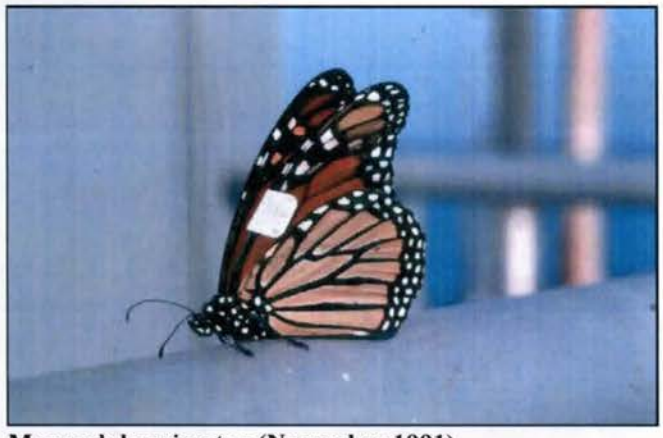
Helicopter (Petroleum Helicopters, Inc.) used to transport people and supplies to the petroleum industry's offshore structures (November 1994).



Gary tagging monarchs (5 photographs) on West Cameron-280, a UNOCAL gas production platform south of Cameron, LA (October-November 1991).

Monarch bearing tag (November 1991)



Monarch bearing tag (November 1991)

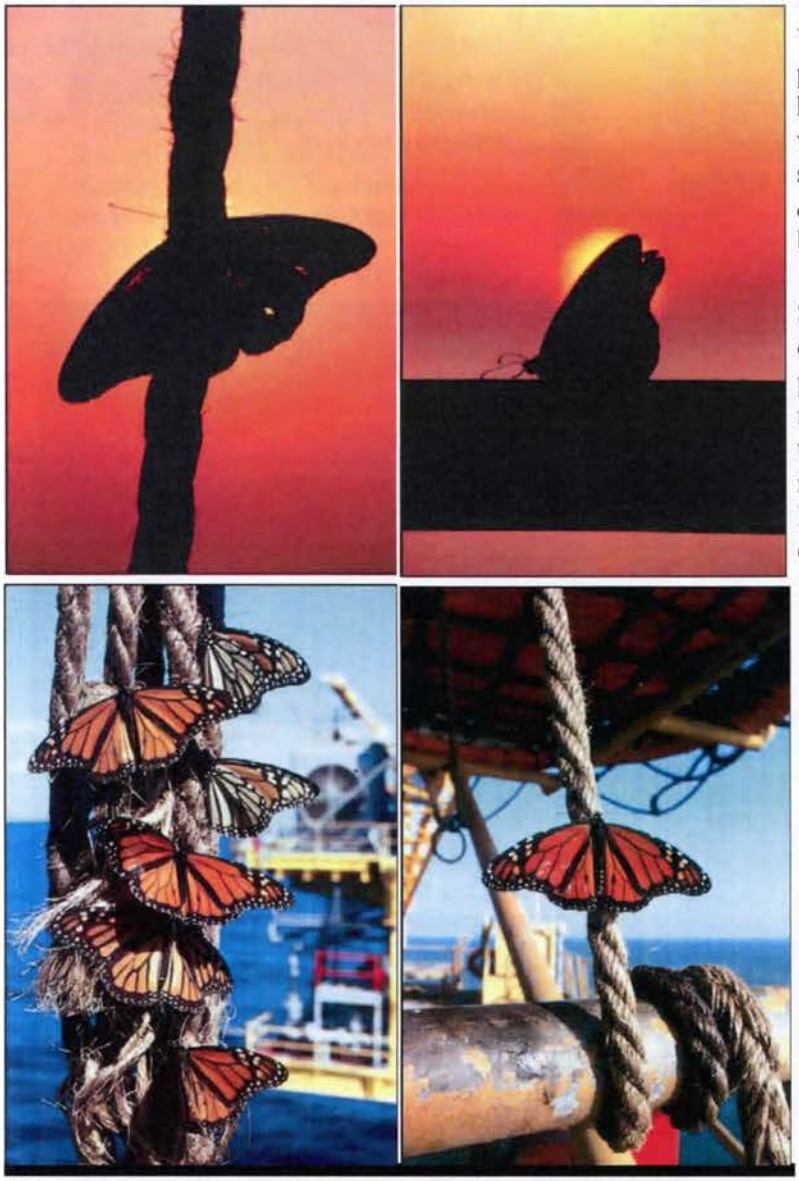
Gary releasing tagged monarch from WC-280, a UNOCAL gas production platform (October 1991).

Tags provided by the University of Toronto and used for tagging monarchs (October 1991).

that the reported dates of October 17-18 were likely approximations, we decided to aim for the first week in October in 1991.

Thursday October 3. Don and I drive from my home to Intracoastal City, located south of Lafayette and Abbeville, and PHI's terminal for accessing the Gulf. We arrive about ten o'clock on a clear, warm morning. Following introductions and the weighing of equipment and ourselves, we are off.

The helicopter flight is my first. From an elevation of 700-1000 feet, the interface between the endless blue-green water domed by an azure sky creates an optical illusion: I feel as if the aircraft is hovering in space even though our actual speed is 110 kph (68 mph). After about 45 minutes, however, Tom points directly ahead: *"There she is: WC-280."* I squint, but can make out only a pinpoint on the fuzzy horizon. But as we approach, the gray and yellow structure seems to mushroom. (In retrospect, I admit that until we actually touched down on the top heliport, I doubted that we could actually land in such a small space.)



Migrating monarchs resting on various pieces of equipment on WC-280, a UNOCAL gas production platform south of Cameron, LA (October-November 1993).

WC-280 is a stationery gas production platform anchored in 90 feet of water. The heliport of the platform is 92 feet above the water's surface. Once aboard, Don and I were shown about and orientated to offshore *"dos and don'ts."* After settling in, we waited with bated breath for the passage of a cold front.

Saturday October 5. Noon. A south-bound cold front moves through. The system produces a cloud bank—but no rain—and northerly winds of 30-38 mph. Swells of eight to ten feet lash the footings of the platform; in my bed, I can feel the entire structure sway. Eerie! The next day is clear, warm with easterly winds. Don and I spend most of the day atop the heliport, our eyes scanning the northern sky. Then, at about six in the evening a single monarch sails past the platform headed in a westerly to southerly direction. No other sighting.

Monday October 7. We observe two monarchs sailing over the heliport at 1:15 PM. Winds are from the east and several monarchs are sighted, again moving in a westerly to southern direction. But as the afternoon progresses, monarch numbers increase. By dusk butterflies began landing on the platform. At this same time, personnel from WC-196, a Unocal platform a bit closer to shore, telephone to report a dozen or so butterflies. Then we receive a call from WC-593, another Unocal platform but farther south in nearly 250 feet of *water. "Approximately 1,000-2000 monarchs are circling equipment and lights,"* reports the dispatcher. Sadly, the darkness precluded helicopter flights to the distant targets. But by maintaining intermittent contact with WC-593 we learn that after dark the butterflies gradually settled onto anything that could support them. Come dawn, the butterflies departed in a south-southwest direction.

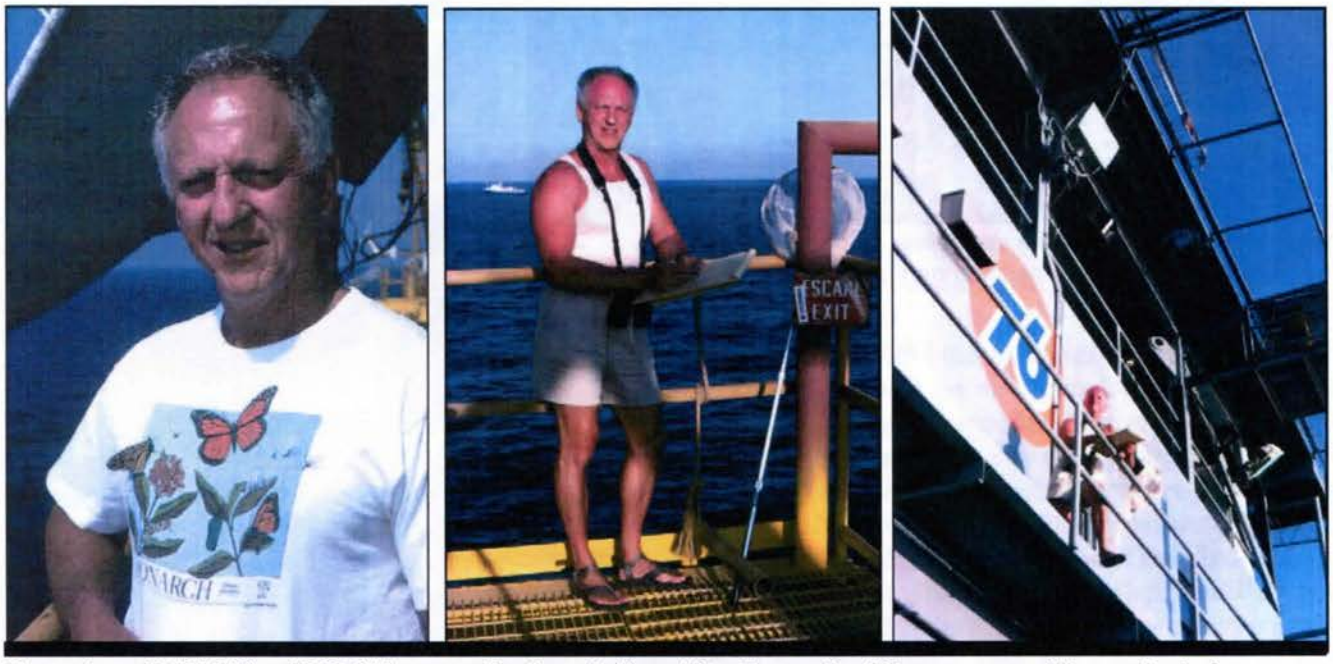
Migrating monarchs resting on various pieces of equipment on WC-280, a UNOCAL gas production platform south of Cameron, LA (October-November 1993).

During our 18-day residence, cold fronts moved through every five to seven days (including one on October 15). Monarchs always followed, but never did stream in legions. Instead, small groups of 5-10 monarchs sailed in every hour or so. During this period monarchs were reported from 25 different platforms near WC-280. Although I was able to observe only several dozen monarchs on any given day aboard WC-280, Don was able to get exciting footage. (Some of these scenes are included in the MOODY INSTITUTE OF SCIENCE/QUESTAR VIDEO release: *"The Wonders of God's Creation."* That same title is offered on a set of DVDs by both MOODY PUBLICATIONS and QUESTAR, INC.) Additionally, I was able to tag nearly 100 monarchs for possible recovery by observers in Mexico (none was).

Still dreaming of a mass flight, I was guest aboard WC-280 each October between 1992 and 1995—usually for a period of from two to three weeks. Tom and Chuck always spread the word to their PHI colleagues (about 400-500 helicopters fly the Gulf on any given day) to report any butterfly sighting to WC-280. In fact, the PHI office circulated a special bulletin describing my project. Result? Hundreds of monarchs were reported from over the Gulf each year, ranging from eastern Louisiana to eastern Texas, and uncanny, often on or very close to the 17th-18th dates and always after the passage of a cold front. Never did I observe a *"cloud"* of butterflies as described by Mrs. Gordon, however. (Keep in mind, the Gulf is a massive body of water and most structures are unmanned, and thus not routinely visited.) Specific platforms are listed below:

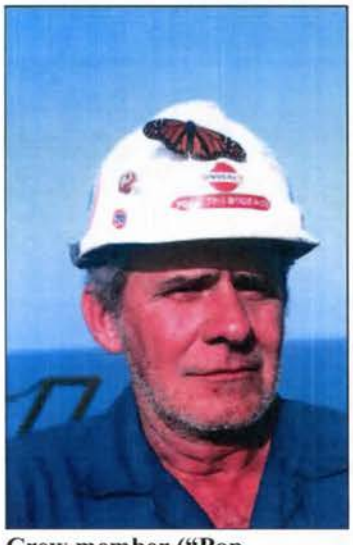
East Cameron-48, Conoco (yellow)
East Cameron-83, Conoco (white)
East Cameron-117, Coastal Oil (yellow/gray)
East Cameron-118, Cockrell Oil (yellow)
East Cameron-222, Amoco (gray)
East Cameron-245, Amoco (red)
Eugene Island-215, Amoco (gray)
Eugene Island-316, Unocal (yellow)
Garden Bank-426, Shell (yellow)
Grand Isle-17, Exxon (gray)
High Island-46, William H. Kuntz, Inc. (WHK) (gray/orange)
High Island-199, Texaco
High Island-264, American Natural Resources (ANR) (yellow)
High Island-323, Occidental Oil (yellow/white)
High Island-334, Unocal (yellow)
High Island-467, WHK (gray/orange)
High Island-536, Amoco (gray)
Ship Shoal-28, Shell (yellow)
South Brazos-70
South Marsh Island-23, Chevron (black)
South Marsh Island-49, Unocal (yellow)
South Marsh Island-77, Unocal (yellow)
South Marsh Island-130, Unocal (yellow)
South Marsh Island-131, Unocal (yellow)
South Marsh Island-252, Baker Hughes, Inc. (BHI) (gray)
South Pass-62, Shell (yellow)
Vermilion-39, Unocal (yellow)
Vermilion-67, Unocal (yellow)
Vermilion-147, Unocal (yellow)
Vermilion-201, Unocal (yellow)
Vermilion-245, Columbia Oil (yellow)
Vermilion-265, Exxon (gray)
West Cameron-45, Phillips (yellow)
West Cameron-196, Unocal (yellow)

West Cameron-197, Unocal (yellow)
West Cameron-202, Unocal (orange)
West Cameron-237, Unocal (gray)
West Cameron-277, Unocal (orange)
West Cameron-280, Unocal (yellow)
West Cameron-333, Chevron (gray)
West Cameron-405, Coastal Oil (orange)
West Cameron-426, drilling rig (yellow)
West Cameron-485, Columbia Gulf (yellow)
West Cameron-504, Coastal Oil (yellow)
West Cameron-536, Unocal (yellow)
West Cameron-593, Unocal (yellow)
West Cameron-620, Marathon Oil (gray/yellow)
West Cameron-648, Oryx Oil (yellow)
West Delta-43
West Delta-40, Amoco (gray)
West Delta-96, Conoco (yellow)
27 33 N, 92 27 W, drilling rig located 160 miles southwest of Morgan City (144 miles south of coastline) and in 2,858 feet of water



Gary aboard WC-280, a UNOCAl gas production platform 72 miles south of Cameron, awaiting arrival of migrating monarchs. T-Shirt with monarch life cycle was worn to help educate crew members with the butterfly's life cycle (October 1991).

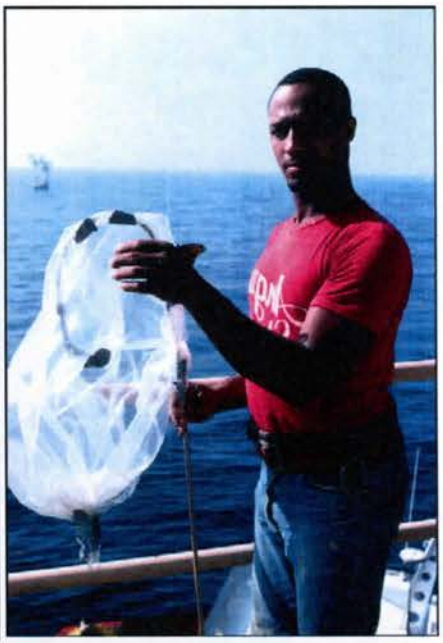
An analysis of the pinpoint data from 52 offshore, manmade structures indicates most sightings and the greatest numbers of monarchs occurred in offshore *"blocks"* labeled as East Cameron, High Island, South Marsh Island, Vermilion, and West Cameron—all immediately below the coastline of southwest Louisiana (Lake Charles and Lafayette are principal metropolitan areas to the north), and to some degree east of northeastern Texas (Beaumont is the closest metropolitan area). This is important since the vast majority of offshore structures occur below the southeastern Louisiana coastline in the parishes of Jefferson, Lafourche, Plaquemines, and St. Bernard—all basically south of New Orleans and within the current Mississippi River Delta. In fact, the only sightings **not** in the southwest Louisiana-northeast Texas sector are those from Grand Isle, Ship Shoal, South Pass, Southwest Pass, West Delta, (all in Jefferson, Lafourche, St. Bernard and Plaquemines parishes) and South Brazos off the eastern coast of Brazoria and Matagorda counties in eastern Texas. If the butterflies were simply being blown offshore, I contend that the high helicopter traffic and abundant offshore structures that exist off the southeastern coast of Louisiana would have produced the most sightings and the largest number of individual butterflies.



Crew member ("Pop Thibodeaux") aboard WC-280 with monarch on hard hat (November 1992).

Two monarchs resting on hard hat aboard WC-280 (November 1992).






Young crew member aboard WC-280 assisting with the collection of migrating monarchs (above 4 photographs, October 1991).

A second point is that the hard data indicate that most of the monarch sightings—at least 38 out of 52 or 72 percent-- are from structures painted with light colors: principally, yellow but red and white, too.

Most butterflies were observed during the heat of the day, that is, mid to late afternoon. Often they would be in tandem pairs or small groupings, usually 20-40. The butterflies flew 30-130 feet above the warm waters of the Gulf, presumably taking advantage of warm thermal uplift (water temperature in October is usually 77-78 degrees F, often warmer than ambient temperature). Because monarchs are innately programmed for interrupting their wing flapping with periods of gliding, the butterflies make excellent migrants. But if ever an individual set down on the water, which was very infrequent, it was quickly nabbed by a fish. The vast majority of the migrants held to a south-southwest trajectory—except for vanguards, which moved in a more westerly direction possibly because they had been accidentally blown from shore. But whenever a metal structure was sighted, the butterflies would slow and circle to *"check it out."* After inspecting, however, the insects usually continued on their prescribed trajectory. Not until dusk and early darkness did butterflies actually land. They selected anything their sharp tarsal claws could grasp: machinery, pipes, chains, wires, ropes, railings, and particularly, the metal fencing around the heliport. The butterflies usually remained until dawn or early morning. But on several occasions, the mass departed during the night in a south-southwest direction. (Night flight is very unusual for butterflies but has been reported as far back as 1899.) While the insects seemed to prefer moving when winds favored gliding, the tenacious migrants were able to hold to their prescribed course even if buffeted by strong head winds.

In summary, then, I theorize that although, I failed to observe a monarch blitz, the sightings indicate that monarchs track a consistent over-water flyway approximately 90-100 miles wide from the southwest coast of Louisiana and eastern Texas, and by extrapolation, to the northeast coast of Tamaulipas, Mexico, approximately 400 miles away. Once onto the Mexican Gulf coast, the butterflies can access a series of passes that dissect the eastern Sierra Madre and the Central Plateau in order to reach their target forests in the central highlands.

[Points of interest: During my visits to WC-280 I observed several other species of butterflies, presumably blown offshore by strong northern winds. These include: little yellow (*Eurema lisa*), cloudless sulphur (*Phoebis*

Gary on lower deck of WC-280 checking water temperature (October 1991).

Don Valentine preparing to film migrating monarchs (October 1991).

sennae), painted lady (*Vanessa cardui*), red admiral (*Vanessa atalanta*), and common buckeye (*Junonia coenia*). Moths include: Carolina sphinx (*Manduca sexta*), Tersa sphinx (*Xylophanes tersa*), and thousands of a small white moth (most likely a pest of soybeans). Other insects include: masses of green stink bugs, two leaf-footed bugs, several dragonflies, several crane flies, many houseflies, several ladybugs, and one lacewing. A good variety of birds often accompanied the passage of a cold front. For example: American bittern, Baltimore oriole, brown pelican, cardinal, cat bird, cattle egret, gannet, house wren, indigo bunting, least flycatcher, Louisiana (tricolored) heron, Louisiana waterthrush, mourning dove, red-eyed vireo, ruby throated hummingbird, scissor-tailed flycatcher, snowy egret, white-crowned sparrow, white-winged dove, vesper sparrow, yellow-bellied sapsucker, yellow-billed cuckoo, and warblers (American redstart, bay-breasted, black-and-white, black-throated green, hooded, magnolia, northern parula, ovenbird, pine, Tennessee, and yellow-throated). In addition, I noted an unidentified tern and hawk.

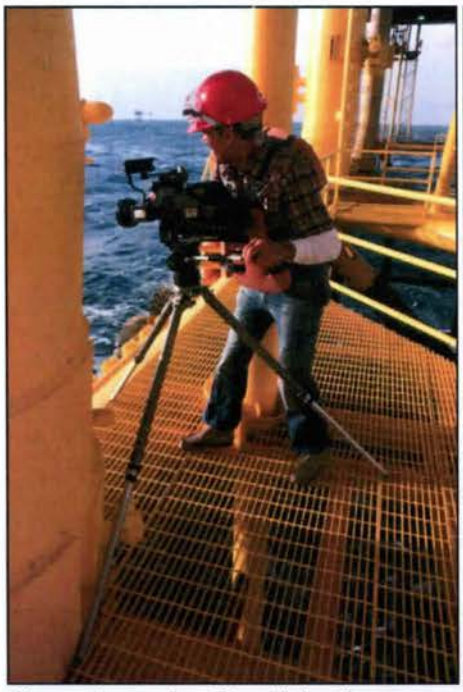
Don Valentine filming migrating monarchs (October 1991).

The crew of WC-280 enjoyed my annual visits. My discourse and antics provided *"live"* entertainment during an otherwise dangerous and lonely job. To illustrate this, I offer the following two anecdotes from my 1991 visit.

First, when the crew learned that I was going to collect monarchs for tagging, several individuals decided to join the act. With lots of construction materials on board, several young and impetuous crewmen co-opted PVC pipe and plastic to fabricate makeshift nets. Then, with youthful daredeviltry they would assume precarious positions on railings to attempt to swoop up a passing butterfly. Often successful, they would present the specimen to me—their faces aglow.

The second instance involves the filming of me tagging a monarch. Don decided on a clear afternoon on an upper deck so that equipment and the Gulf waters could form an unusual background. Most of the crew gathered around since they were convinced that the tags would add too much weight, rendering the butterflies incapable of flying. I tried to assure all that the extra weight was insignificant. But the expressions of the crewmen indicated that they remained skeptical. One crewman even murmured: *"We'll see."* Unfortunately, Don was filming with only one camera. In order to get multiple-angled shots, Don had to re-film many maneuvers. This—along with my pontificating about the procedure—took about 40 minutes. All the while, the sun was unrelenting. Finally, when we were ready for the release I went to the edge of the platform. As Don positioned the camera, I described to my attentive audience my final move: I would toss the butterfly up into the air and it would then resume its flight. Then one of the workers quipped: *"You mean **that** butterfly is going to fly to Mexico?"* I responded: *"Of course, the tag is very light and I have been careful not to damage the wings."* Sweaty heads nodded in disbelief; there were even a few giggles. With camera rolling, I tossed.

Oops! Like a vignette from *America's Funniest Home Videos*, the butterfly—like a chunk of lead—plunged straight down to the water 80 feet below. The naysayers scrambled to the railing and peered downward. A foot-long fish hit the surface of the water, gulped the butterfly, and then disappeared into the abyss. And that was that.



Cinematographer Don Valentine (Moody Institute of Science) filming migrating monarchs aboard WC-280 (October 1991).

First migratory monarch filmed as it rested on flood light aboard WC-280 (October 1991).

The crew roared! One worker then blurted: *"Well, I guess that's one tag you don't have to look for in Mexico."* In order to try to retain some modicum of professionalism, I explained that while monarchs are resilient, our *"model"* had been exposed to the hot sun for so long that it most likely had gotten too stressed. *"Let's try again,"* I stated. So, I tagged another specimen. Then, with camera rolling, I tossed. Thank God, success! However, from that day forward, I was always addressed as "MONARCHZILLA." And during subsequent visits, the first question to me always was: *"How many butterflies are you going to kill this time?"*

Just how monarchs navigate over the open waters of the Gulf and locate the offshore structures remains a mystery. Empirical data from my hundreds of hours of observing monarchs flying from my vantage point on an offshore structure suggest that both magnetism and color play key roles. Researchers in the past have proven that certain body parts and sections of wings contain minute quantities of magnetite, an oxide of iron that acts as a biosynthetic compass (many birds, dolphins, rays, sharks, and the migratory locust also possess magnetite). In theory, at least, this can allow such insects to orient to Earth's natural geomagnetism. But because offshore facilities are constructed of massive amounts of iron and house telecommunication and electrical generating equipment, these structures generate substantial electro-magnetic fields, too. (It is easy to demonstrate this by observing the deflection in the compass or *"Directional Gyro"* aboard a helicopter as it approaches an offshore structure for landing. Beginning about 0.2 mile out, the compass begins deflecting between seven to ten percent. On deck, the deflection is about twenty percent.) I theorize, therefore, that the insects are fooled by false readings from their intrinsic internal compasses. Furthermore, numerous observations indicate that monarchs have a propensity for the colors yellow and orange, often the palette of their fall nectar plants such as goldenrod (*Solidago*) and sunflowers—particularly narrow-leaved sunflower (*Helianthus angustifolius)* in Louisiana. And so, here again, the monarchs are lured to many offshore structures by bogus *"pit stops."*

But where is the launch site?

Although Louisiana's coastline is virtually a treeless marshland, there are a few geographical places where trees and beaches abut the Gulf: Grand Isle in Jefferson Parish and the cheniers of Cameron Parish. [NOTE: The word chenier is from the French *chênièr—"place where oaks grow."* See Ross, 2009a,b]. Both venues consist of dry land elevated a few feet above the surrounding marshlands and Gulf waters. These lands support natural woodlands dominated by live oak (*Quercus virginiana*), hackberry (*Celtis laevigata*), black/honey locust (*Gleditsia triacanthos*), and toothache tree (*Zanthoxylum clava-herculis*). From the air, the topographic features resemble great ships afloat in a sea of grass. Because the Cameron cheniers are laid out in an east-to-west configuration, they present a broad front for staging Gulf crossings. And so, besides monitoring monarchs offshore, I also spent considerable time in Cameron Parish, particularly in the Baton Rouge Audubon Society's *"Peveto Woods Sanctuary"* near Johnson Bayou. There I learned that many monarchs from more northeastern locations arrive at Louisiana's chenier coastline between mid September and early October. At night, the insects take refuge in the boughs of the numerous trees—all in full sight and sound of waves pounding the beach.

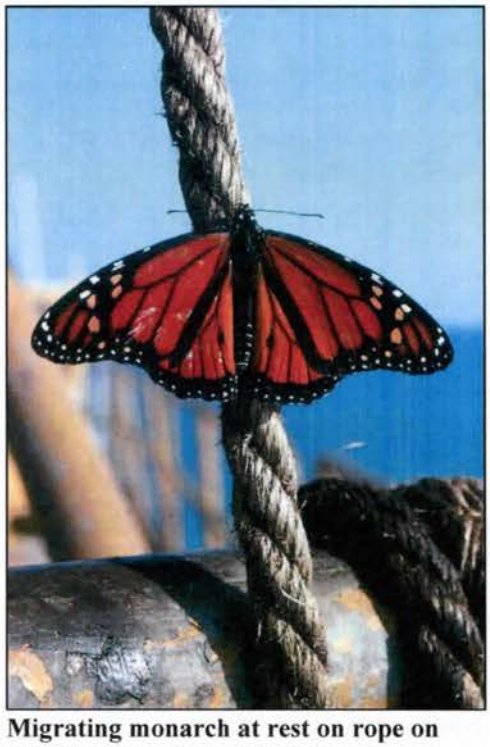
During the day the butterflies feed on the luxuriant displays of wildflowers that thrive in the well-drained soils of the ancient beach ridges. Favorites include goldenrod (*Solidago* sp.), saltbush (*Baccharis halimifolia*, and spiny

Gary awaiting arrival of first migrating monarchs at dusk aboard WC-280 (October 1991).

aster (*Chloracantha spinosa*). The later attains a height of approximately two feet and bears numerous flowers—white petals with yellow disk. The plant is abundant on the cheniers but recorded from only four coastal parishes within the state. Peak blooming time is in October. The flowers seem especially attractive to monarchs and a small, day-flying wasp moth, the yellow-collared scape moth (*Cisseps fulvicollis*), family Arctiidae, subfamily Ctenuchinae. The moth is black with a pronounced orange-red collar—presumably an aposematic coloration. Could the aster provide phytochemicals such as pyrroliozidine alkaloids (PAs) that are used as toxins by both the moths and monarchs as defense against potential predators?

In an attempt to confirm in 1992 I contacted Ronald B. Kelley in the Department of Chemistry at Moorhead State University in Moorhead, Minnesota. Dr. Kelley is a natural-product chemist who conducted some of the original research on PAs in overwintering monarchs in Mexico. As instructed, I shipped a considerable quantity of fresh flowers. Unfortunately, however, the analysis was inconclusive, and so the question remains open. However, with such strong circumstantial evidence, I am of the opinion that the spiny aster plant, which is so abundant on the cheniers, provides important chemicals that monarchs use in their arsenal for defense and as such, could provide a selective advantage in those individual monarchs that embark on a trans-Gulf crossing.

During October, the butterflies await the passage of a south-bound cold front. When this occurs, conditions can be wet and blustery. Of course, some individual butterflies are accidentally blown offshore—presumably to their death. But the majority simply honker down. In a day or two, the winds abate. However, breezes remain from the north. In addition, the sky clears, relative humidity drops, and temperatures moderate. These conditions seem to be the cue for the butterflies to launch from their Cajun bivouacs.



Migrating monarch at rest on rope on WC-280 (November 1992).

Now the butterflies take off in mass in a south/southwesterly direction out to sea. Once over open water, the insects' sensitive internal bio-compasses become confused as described earlier. After some rest time, they abandon their perches to continue flying south to southwest over the Gulf. Beyond the range and influence of the offshore structures, the insects' compasses are reset to a more westerly direction by the strong magnetic pull of a *bona fide* landmass—Mexico. After another 10-13 hours of non-stop flight over perhaps 300 miles of open water, they again encounter man-made structures off the coastline of Tamaulipas, Mexico. Now close to land, the weary monarchs soon find food, water and trees.

In March and April the trend is reversed. Although most of the northward bound monarchs again travel a land route back to the United States and Canada, some fly eastward toward the Mexican coastline. There they launch out to sea, probably attracted by man-made structures off the coastline line of Tamaulipas. Once past the point of no return, they continue until they encounter structures off the Louisiana coast. Now the man-made sites become even more critical than during fall. While northerly winds act as tailwinds assisting migrants moving southward in the fall, such winds ushered in by late season cold fronts act as negative headwinds for butterflies tracking northward. To intensify matters, spring monarchs are severely emaciated (researchers report that fat accounts for only 37 percent of dry weight in March whereas in November, the percentage is 73). This low energy coupled with strong headwinds set up a scenario for disaster. Fact is, during several spring seasons, I personally have witnessed large numbers of dead monarchs washed ashore on chenier beaches following frontal passages. [NOTE: Neotropical songbirds streaming northward across the Gulf share similar experiences.] In the end, by playing *"hopscotch"* between the petroleum industry's structures—and perhaps, a little bit of luck—the travelers make landfall in southwest Louisiana.

WC-280, a UNOCAL gas production platform 72 miles south of Cameron, LA. Yellow paint of platform seems to attract migrating monarchs. Color resembles common nectar plants used by monarchs in autumn (October 1991).

During mid to late March in both 1991 and 1992 I sat on Holly Beach and Rutherford Beach counting monarchs coming in from the Gulf onto the beach. The butterflies were flying within a hundred feet of the surface and directly from a south/southwest direction—in spite of the fact that on several days the prevailing breezes were headwinds from the north. Numbers of individual butterflies ranged from 15-30 every fifteen minutes. Peak hours were 11:00 AM through 4:00 PM.

With an abundance of trees and wildflowers, Louisiana's cheniers must seem like Nirvana for the aged and emaciated migrants. The trees are used as nocturnal roosts and for resting during copulation. Mating usually begins after the noon hour and peaks near dusk. Often mating frenzies occur with balls of monarchs plummeting to the ground. Primary nectar sources are southern dewberry (*Rubus trivialis*) and spiny thistle (*Cirsium horidulum*). But here, too, female monarchs find antelope-horn/spider milkweed (*Asclepias viridis*)—the largest concentration of plants in the 1990s was on Monkey Island, just south of the town of Cameron. With this abundant hostplant, females can lay their first eggs, thus jumpstarting the year's first generation, whose adults then travel farther north. By the end of summer—and several generations down the line—the final brood begins the same epic journey undertaken by their predecessors the previous year. The cycle of life is now complete.

Monarch silhouetted against moon on Grand Chenier (February 1995).

For all that, the final story of the monarch's *"Trans-Gulf Express"* has yet to be told. Although I am tantalized by the possibility that offshore energy development may have inadvertently sparked the evolution of the flyway, I find that concept difficult to accept—after all, oil exploration in the Gulf of Mexico dates back only about six decades. I think the probable truth is that monarchs—and Neotropical songbirds as well—are simply exploiting the petroleum industry. That said, the role of the offshore structures should not be taken lightly. Because a migration of any kind is undeniably high-risk and energy-expensive, the offshore rest stops make the Gulf crossing less perilous for flyers. Furthermore, Louisiana's coastal cheniers present fall migrants with abundant wildflowers for increasing their fat reserves—and possibly phytochemicals for defense—and trees for shelter. In the spring, the trees and wildflowers are once again important for shelter, food and mating. But at this time there is one crucial addition: host milkweeds enable female monarchs to initiate a new (and perhaps an extra) generation outside of Mexico in advance of their land-based cousins.

So, in summary, here is my theory: The monarch's *"Trans-Gulf Express"* probably initiated in some long-forgotten time by a few aberrant wanderers blown offshore from the coastal cheniers of Cameron Parish in Louisiana. (I like to think of the anomaly literally

and metaphorically as *"A Clockwork Orange,"* the title of the 1971 highly controversial but blockbuster film by Stanley Kubrick featuring a sociopath in futuristic England.) Now, however, the shortcut to and from Mexico is reinforced thanks to the presence and expansion of the petroleum industry in the Gulf of Mexico—particularly off the southwest coast of Louisiana and the eastern coast of Tamaulipas. Through natural selection, the *"Express"* has become a mix of programmed and learned behavior affecting the safety and economics of the monarch as a species. And from an environmental/political viewpoint, the event is a good example of how the apparent unholy alliance between industry and nature is often only a question of personal aesthetics and opinions.

[UPDATE: Hurricane Rita in 2005 and Hurricane Ike in 2008 ravaged Cameron Parish. Virtually all trees were damaged and most of the land was covered with over 12 feet of salt water for days. Although my post-hurricane surveys have indicated that monarchs still can be found in the spring and fall each year, their numbers are much lower in the past. Furthermore, as of fall 2009, I have failed to find any *Asclepias viridis*. On another note, WC-280 was shut down and removed in the last decade.]

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