The U.S. Tuna-Porpoise Program: Do Federal Environmental Programs Work?

By: Larry Zaleski

Presented to the Hagerstown Torch Club on

December 20, 2016

(Blank Page)

The U.S. Tuna-Porpoise Program: Do Federal Environmental Programs Work?

Introduction

In the eastern tropical Pacific Ocean – west of Mexico and Central America – there exists a strong association between sea birds, dolphins, and yellowfin tuna. This association is due primarily to a shallow thermocline (60 meters or less – Figure 1), which keeps fish near the surface, so that in the eastern tropical Pacific, tuna tend to follow dolphin (Scott et. al, 2012). This arrangement allows fishermen to visually search for birds and other signs to locate both dolphin and tuna. Using speedboats, fishermen can then herd the dolphins and thus capture both dolphin and tuna in purse seine nets (Southwest Fisheries Center, 2016).

Unfortunately, in the 1960's and early 1970's, dolphin mortality associated with the tuna purse seine fishery was high. Biologists estimated the loss at 6 million dolphins resulting in dramatic reductions in the population of the affected species. This loss was a major factor in the passage of the U.S. Marine Mammal Protection Act of 1972 (The Southwest Fisheries Center, 2016).

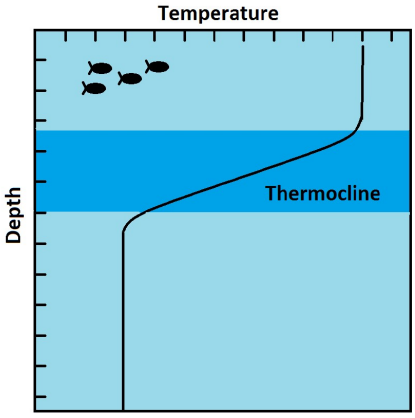


Figure 1. The thermocline is the layer between the warm surface waters and the cool bottom waters characterized by a rapid drop in temperature. The thermocline acts as a barrier to tuna.

In the 1970's, the National Marine Fisheries Service (NMFS), an agency of the National Oceanic and Atmospheric Administration (NOAA), began placing trained biologists, called "tuna-porpoise observers," aboard commercial fishing vessels to collect data on yellowfin tuna fishing operations (Brook, 2014). This was done to quantify dolphin mortality and collect to data to understand how that mortality occurred. The goal of the "Observer" program was to use the resulting information to modify the purse seine operation to reduce dolphin mortality to numbers approaching zero.

As a result of this effort, the lessons learned, and the concern of the American people, tuna sold in the United States, today, is dolphin safe.

In 1978, I participated in the Observer Program, which continues in a greatly expanded form to this day. In this paper, I will describe the tuna fishery, what observers do, life on the boats, and the program's effectiveness. Additionally, I will assess the need for marine environmental programs in general. The observations reported here are my own, and may not represent NMFS.

Finally, commercial fishermen in the 1970's considered the word "dolphin" to be an environmentalist term and thus emotionally charged, and the Agency discouraged observers from using it. Here, however, I will use the terms dolphin and porpoise interchangeably.

The Purse Seine Fishery and What Observers Do

To understand the "U.S. Tuna-porpoise Program" you must first know basic information concerning the purses seine fishing operation, observer function, and observer training.

The Purse Seine Fishing Operation

The fishing operation has several components.

The Purse Seiner: The purse seine fishing vessel enables the modern yellowfin tuna fishery (Figure 2). This class of vessel boasts technological innovations including:

- Purse seine net – allows the encirclement and capture of the entire school
- Purse seine winch – pulls a cable through rings at the bottom of the net, like a draw string, closing the net
- Power block – rolls the net back aboard simultaneously concentrating the tuna into a reinforced portion of the net called "the sack"
- Ammonia refrigeration – rapidly freezes the tuna allowing extended cruses without tuna spoilage
- Helicopter – not carried on all boats, but when present increases the ability to locate tuna

The purse seine operation dramatically improves efficiency over previous methods. In the older "bait boat" operation, fishermen chummed the water causing a tuna feeding frenzy allowing fishermen to hook tuna with pole-and-line, and then haul fish aboard. Bait boats captured only a

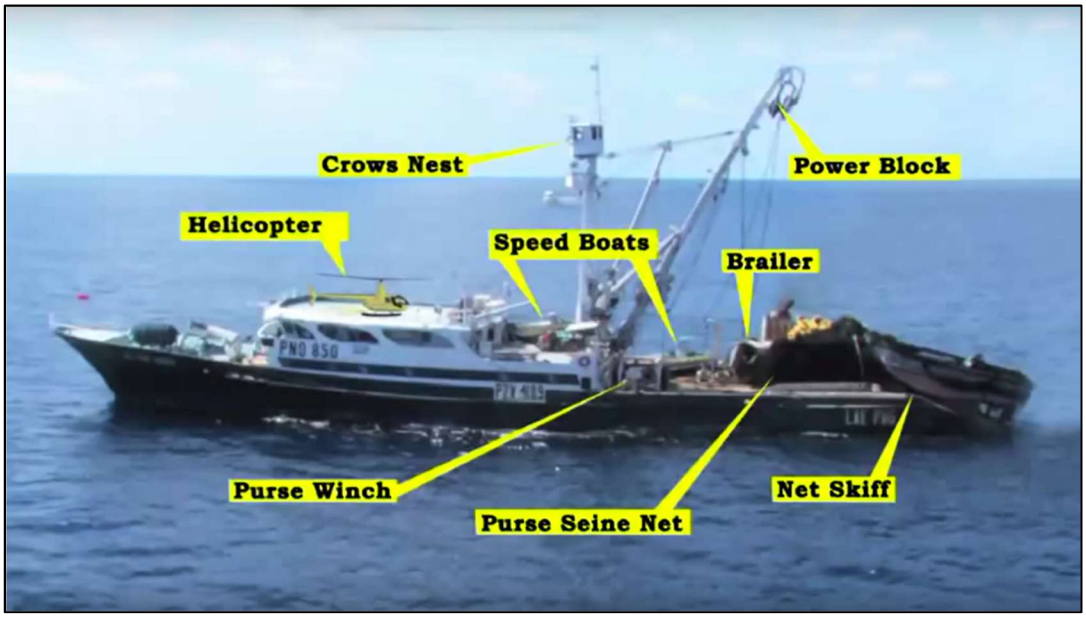


Figure 2. A modern purse sein fishing vessel.

fraction of the school. In contrast, the purse sein net allows the encirclement and capture of the entire school. These nets are approximately a nautical mile[1] long and 200 meters deep.

The Search: Fishermen locate tuna primarily by searching for sea birds, which appear as specks above the horizon or white flashes above the water. Birds and other signs are located using 20X binocular (Figure 3(a)). Searches result in three kinds of fishing sets:

- School fishing – involves tuna <u>not</u> associated with flotsam or dolphin, and located by the presence of birds or by surface indicators called "breezers," "boilers," or "jumpers" (Figure 3(b-d))
- Log fishing – occurs when birds and tuna aggregate around floating objects
- Dolphin fishing – occurs when birds and tuna follow dolphin (Figure 3(e))

Once birds (or other signs) are sighted, the boat turns and runs toward the sighting, often for as long as an hour. If fish or suitable dolphin are observed, the set begins.

The Dolphin Set: The term "set" refers to setting the net, which has four phases: the chase, encirclement, capture, and brailing (transferring fish from net to hold). In this paper, I will focus on the dolphin set. All set types, however, involve encirclement.

The dolphin set begins when the purse seiner is about a mile away from the school. At this point, the boat stops, the skipper climbs to the crow's nest to direct the chase, four speedboats are launched, and the chase begins (Figure 4-1). Usually, sets are made when the swell is 4 feet or less and the wind is under 15 knots, although double these values are possible.

The dolphin run when they hear the speedboats. The skipper directs the speed boats by radio to turn left when

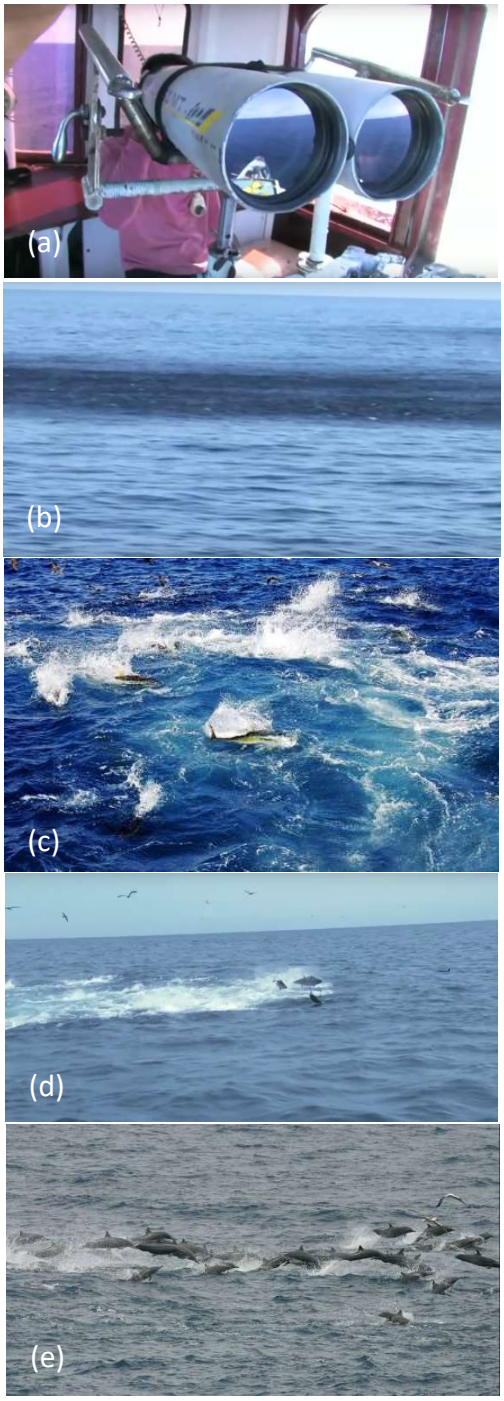


Figure 3. (a) 20X binoculars. (b) Breezer – fish feeding just below the surface look like wind on the water. (c) Boiler – fish in feeding frenzy. (d) Jumpers – fish feeding and jumping out of the water. (e) Fish swimming with dolphin.

[1] A nautical mile is a minute of arc at the earth's surface = 1/60th of a degree, or 1,852 meters, or 1.15 statute miles, or 2,025 yards.

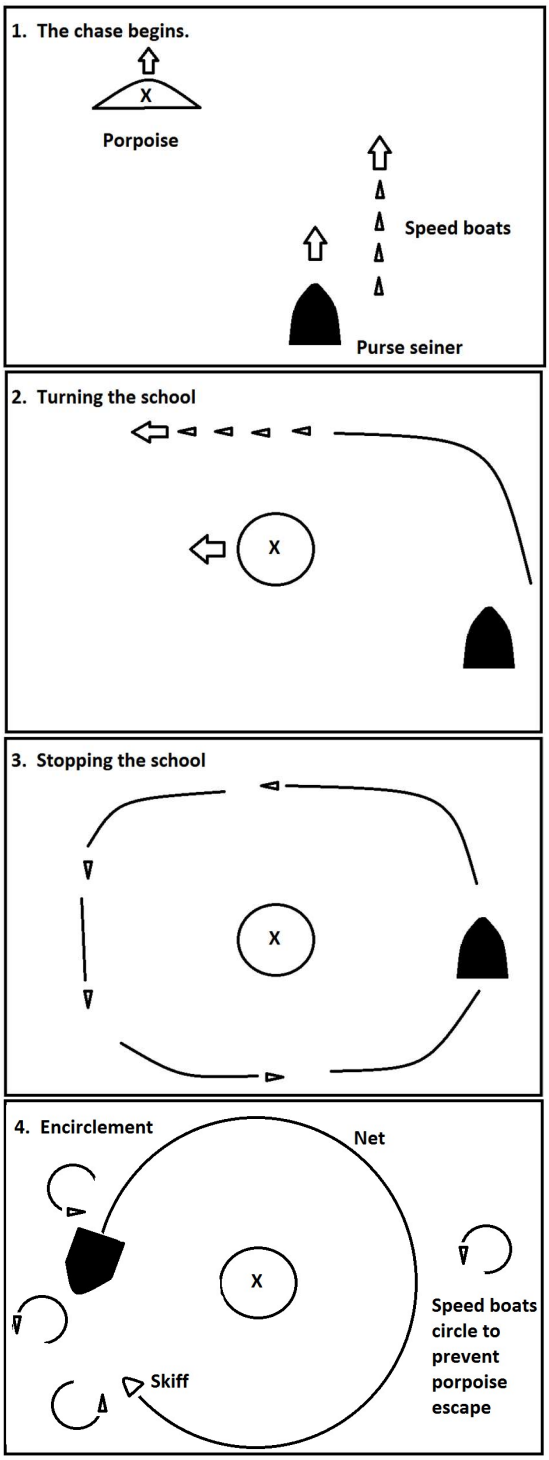


Figure 4. The chase and set. 1. The chase begins. 2. Turning the school. 3. Stopping the school. 4. Encirclement.

they get ahead of the dolphin. This turns the school (Figure 4-2).

Next, the fishermen stop the school. This is done by circling the dolphin with the speed boats and purse seiner (Figure 4-3).

When the purse seiner is downwind, the skipper yells "let 'er go," releasing the sein skiff. The skiff, with net attached, slides off the stern, spins around, and guns its engine holding the net in place as it deploys off the purse seiner.

The speed boats circle at the open sections and at the far end to prevent the dolphin (and fish) from escaping. This results in encirclement (Figure 4-4).

Using the purse winch, the cable is drawn through the rings at the bottom of the net like pulling a drawstring, pursing it closed. At this point, the dolphin and tuna are captured.

Once pursed, net rolling begins. The net is rolled aboard through the power block. Below the power block, fishermen stack the net in preparation for the next set (Figure 5(a)).

The net's shape in the water is maintained by using the skiff to pull the purse seiner appropriately, by having the speedboats pull "bunch lines" (which take-up slack in the net), and by using the bow thruster, if present (Figure 5(b)).

Once two-thirds of the net is aboard, and the dolphin safety panel is in position, and the tuna are located near the purse seiner, the "backdown" maneuver begins. The purse seiner guns its engine in reverse and the skiff pulls the vessel at an angle to keep the net open and add thrust. This moves water through the net causing the floats at the end to sink, pulling the net out from under the dolphin, which also swim toward the exit point.

Before, during, and after backdown, a rubber raft with a fisherman—using a facemask and snorkel—are placed in the net to locate tangled and

reluctant dolphin, encouraging them to swim out. And the speedboat drivers position themselves near the end of the net to help dolphin out.

The net, itself, is designed to minimize dolphin entanglement and enhance release. The dolphin safety panel includes small mesh (1-1/4 inch) to reduce entanglement, and a chute that improves the sinking motion of the floats during backdown (Figure 6).

Usually, these actions release the dolphin unharmed. However, occasionally dolphin are killed. Bad weather, rough seas, setting too close to sunset, malfunction, incompetence, or bad luck can cause catastrophe.

Disaster sets result when the net floats come together trapping the dolphin underwater. Unable to surface and breath, they die in large numbers. More commonly, mortality occurs when one or a few dolphin become entangled in the 4-1/4 inch mesh and suffocate. Additionally, dolphin may be injured in the gear operation.

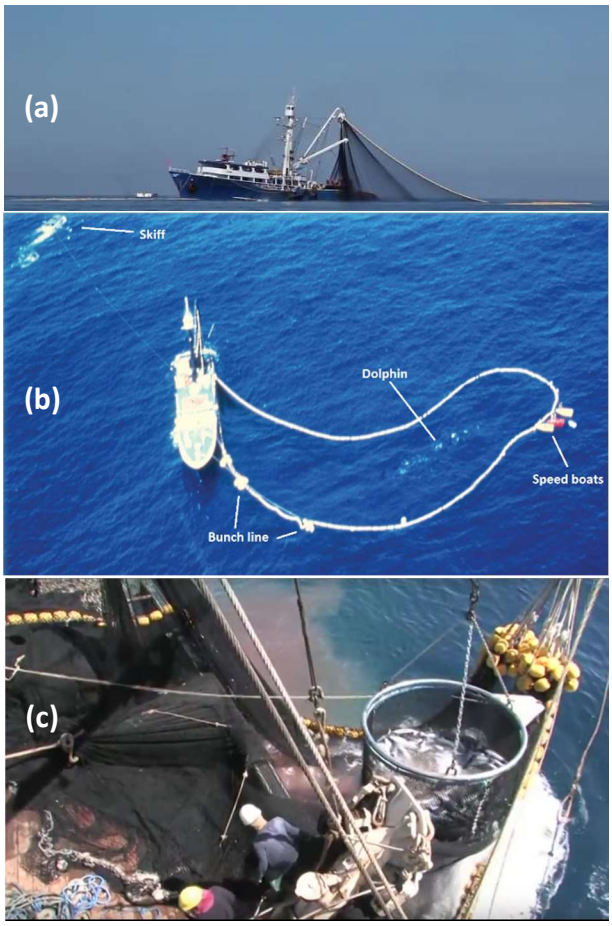


Figure 5. Completing the set. (a) Net rolling. (b) Maintaining the net's shape using the towing skiff and bunch lines. (c) Brailing fish aboard.

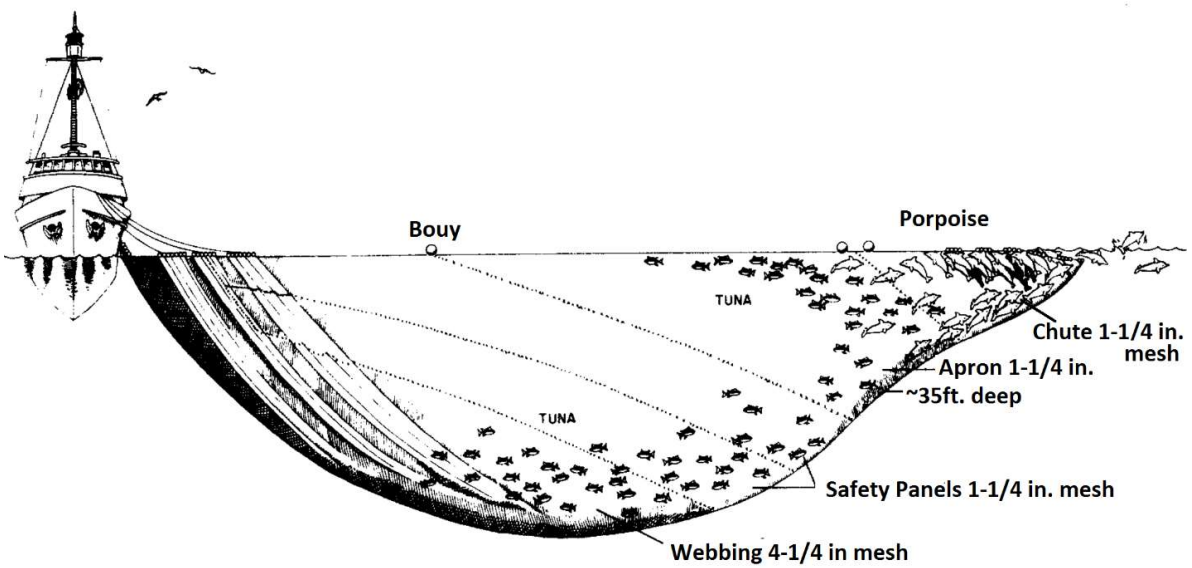


Figure 6. Schematic cross section of the apron-chute, double Medina panel in the tuna purse seine during backdown (Adapted from Barham et al., 1977).

The Observer's Function

The function of federal (and international) observers is to document the fishing operation. The data collected is used by gear technologists, biologists, and regulatory enforcement.

First, observers participate in the search by maintaining an "effort record" (Figure 7). This involves recording the purse seiner's initial position and heading, then tracking all sightings—their time and bearing, estimated distance, species identity and number—and all course changes. Observers record marine mammal sightings made by both themselves and the crew, which include both whales and dolphins.

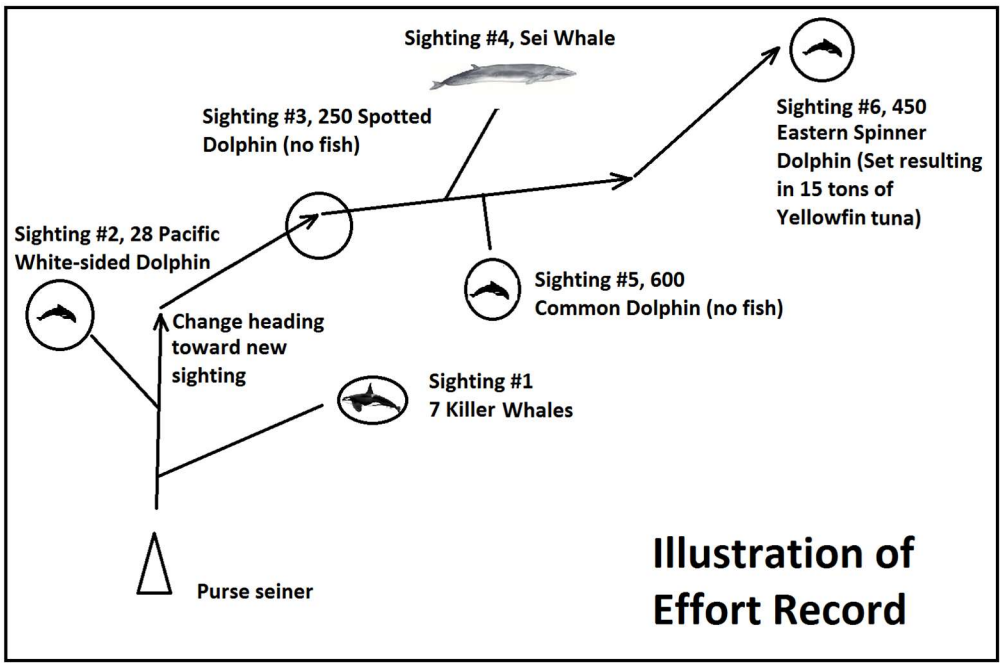


Figure 7. The effort record produces transect data from which estimates of marine mammal population size and density can be calculated. Observers record the initial position, speed, direction, bearing, time of sighting, distance to sightings, school size and species.

Effort records provide transect data from which marine mammal and tuna population densities are estimated.

Second, observers document sea conditions and gear operations during effort, chase, and set. Using "set logs," they draw diagrams, describe conditions, catalog dolphin entanglements, and note deviations from regulation. During net rolling and brailing, observers note attempts to rescue dolphin, count killed dolphin, describe circumstances, and move dead dolphins aside for later work up. Also, observers' radio reports twice per week of dolphin killed, which affects the fleet's permission to fish on affected dolphin species when the collective mortality exceeds limits.

Finally, after the set, observers "work up" any dolphins killed. This includes identification, measurement, drawing, photographing, dissecting, and collecting and preserving parts for laboratory analysis. This activity provides age information, size, sex ratios, pregnancy information, the number of calves previously delivered by females, and determines if females are lactating (thus leaving an orphaned calf).

Observer Training and Program Coverage

In the 1970's, NMFS employed people as observers who held Bachelors or more advanced degrees in biology. Currently, while requirements are similar, observer employment is contracted (Brook, 2014). Upon reporting for duty, observers are required to successfully complete 3 weeks of training. The topics covered include:

- Dolphin and whale identification
- Dolphin dissection
- Fish identification – tuna species and bycatch
- Sea bird identification
- Vessel gear operation and nautical terminology
- Basic navigation (piloting and dead reckoning)
- Third class radio operator's license
- Regulations and policy
- Documentation – use of set logs, effort records, work up logs and associated equipment
- Fleet culture and norms (do's and don'ts)

The training is intense. It is critical that each observer master all phases of the training because any failure in skill or knowledge at sea would be noted by the crew and result in ridicule and harassment.

Observers are entering a hostile environment (GAO Report to Congressional Requesters, 1990). Three observers, for example, have allegedly been murdered at sea in recent years, including one U.S. national (Public Employees for Environmental Responsibility, 2016). Because these observers typically "disappear," there are no bodies, and hence no convictions (Dawson, 2016).

The coverage of the observer program has expanded to include all vessel types that can potentially cause dolphin mortality, and has expanded to all oceans and other fisheries. Observer certification of dolphin safety is required for tuna sold in the U.S. regardless of origin (Enhanced Documentation Requirements to Support the Dolphin Safe Label on Tuna Products, 2016). Because of U.S. efforts, the observer program has gone international under the auspices of the *Inter-American Tropical Tuna Commission* (IATTC) and the *Central Pacific Fisheries Commission*, with many countries supplying observers and applying U.S. standards.

Life on the Boats

U.S. purse seiners leave San Diego and run south for 4 to 6 days to reach the fishing grounds (1,100 – 1,730 nautical miles). Trips typically last from 40 to 100 days, depending on the skipper's skill and luck. Skippers who fill-up fast, brag of their skill, and those who do not blame the observer. My experience was the latter.

The skippers' know approximately where to fish based on their experience, time of year, and shared information. Although they fish three species (yellowfin, skipjack, and bigeye – Figure 8), yellowfin tuna are the main target. Yellowfin are migratory, emerging from the western Pacific off Columbia and Panama, and then turning north. Early in the season, skippers fish close to shore, 200 – 1,600 nm off Central America in the "regulatory area." Here fishing is a combination of school, log, and dolphin fishing.

When the internationally monitored allowable tonnage of yellowfin is landed, the IATTC closes the regulatory area. Skippers must then fish "outside the line" (Figure 9) roughly 1,600 - 3,000 nm from shore. Here the seas are rougher and the fishing is almost exclusively on dolphin.

The dolphin species most important to the yellowfin tuna fishery are the Spotted Dolphin, the Eastern Spinner Dolphin, and the Common Dolphin (Figure 10).

The day begins with a pre-dawn breakfast; fishing starts at sun rise. The crew take turns manning the 20X binoculars, which is tiring and produces headaches if done too long. The observer begins his or her "effort record" and the search is on. If the fishing is good, a purse seiner might make three or four sets per day. If not, it may go several days without a set. The mood of the crew changes with their success, and so does their treatment of the observer.

For observers, the relationship with the crew is variable and sometimes threatening. The crew follows the skipper's lead. On my first boat, the skipper ordered the crew not to talk to me because I refused to change information in my set log.

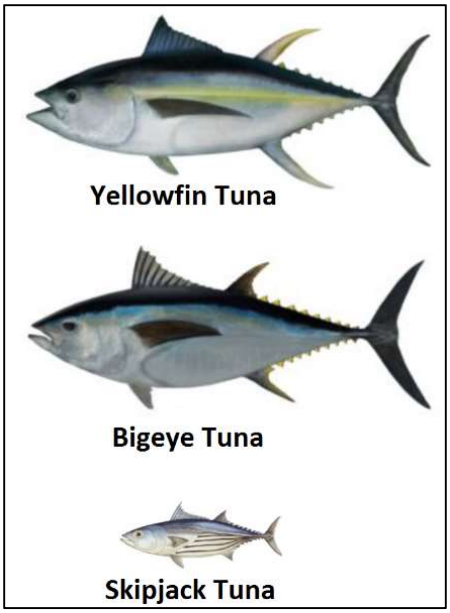


Figure 8. Tuna species important to the fishery.

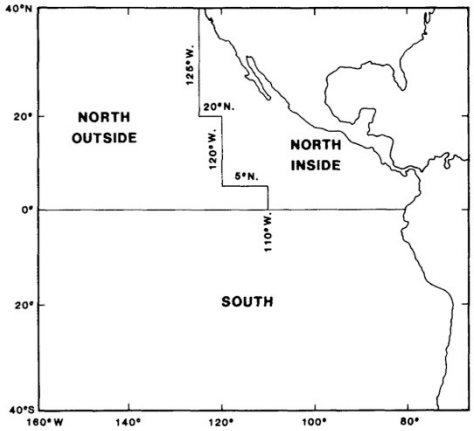


Figure 9. Map of the IATTC regulatory area north of the equator.

On another trip, the skipper would give me only three positions per day – sunrise, noon, and sunset. This required me to remain on effort all day so I could dead reckon our position. And he tried to make me a galley hand/dishwasher. Also, I was offered a "quarter share"[2] (worth 2.8 times what I earned as an observer) if I would "stack net" (set aside my logs and work as a crewmen—a bribe).

[2] The crew on many boats were paid in shares of the catch, first-time crewmen received a quarter share, journeymen a full share, navigator 1-1/2 shares, skipper and chief engineer two shares, and the owner received the rest (about half the catch). In 1978, a full share was worth between $18,000 and $28,000 on large American boats (depending if the filled-up or not), a very high wage back then (about $66,700-$103,000 today). A boat might make three trips per year.

After each set, if a violation occurred, I was required to "ascertain" (ask the skipper if he was aware he committed a regulatory infraction). This always resulted in the skipper screaming in my face. And periodically, crew members threatened to throw me overboard, which is unsettling when you are alone, outnumbered, and 2,000 miles from land.

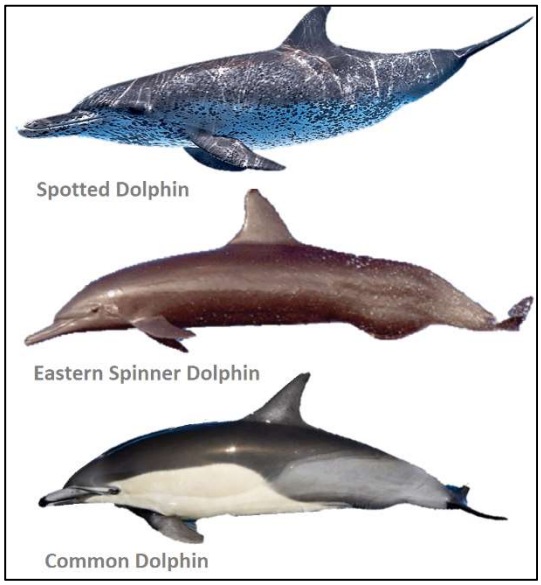


Figure 10. The dolphin species most important to the purse seine tuna fishery.

Otherwise, life was monotonous. The scenery never changed—horizon in all directions—and after two weeks, flying fish, sea birds, dolphin, and even whales seemed routine. The boat was always rolling or pitching, even when drifting. At sunset, when the day was over, it was happy hour. The cook would put out large bottles of Seagram's VO and Chivas Regal, and everyone could partake until gone.

The boats had excellent cooks, and we ate well. Saturday evening was barbecue night, and the cook would grill steaks or swordfish. On Friday, the cook would bake a small, 40 pound, tuna for dinner, called "Portuguese Turkey." It was a superstition among the fishermen that you had to eat fish to catch fish. Friday was also movie night. The crew would set-up a projector in the galley and watch a film.

Figure 11. Jig and squid. Cheap entertainment and a tasty snack.

At night, the purse seiner would drift to save fuel. The ship's flood lights attracted thousands of foot-long squid, which I jigged for fun (Figure 11). I cleaned them for the cook to batter and deep-fry, making calamari for the crew. And so it went, 12 hours a day, 7 days a week, until we either filled-up or ran out of food and fuel.

Program Effectiveness

The U.S. Tuna Porpoise Program has generated mixed results. Research shows that the management actions of the U.S. and international fishing agencies have reduced dolphin bycatch to about one percent of pre-observer numbers (Figure 12).

However, while the dolphin stocks have ceased their decline (a win), their populations show no sign of recovery. This despite being capable of growth rates of 4 percent per year (Figure 13 – Gerrodette and Forcada, 2005).

The reasons hypothesized include:

1. Dolphin bycatch is higher than reported
2. Effects of the fishery go beyond bycatch
3. Dolphin habitat is not consistent
4. Expectations of immediate recovery are oversimplified

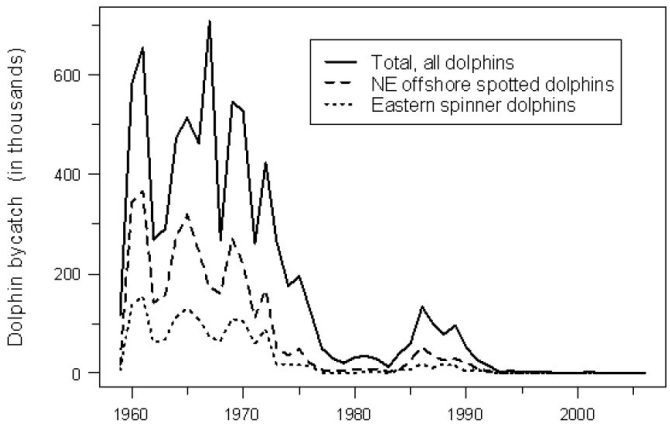


Figure 12. Estimated annual number of dolphins killed in the eastern tropical Pacific purse-seine fishery, total for all dolphins and separately for the two dolphin stocks with the highest number killed (The Tuna-Dolphin Issue, 2016). Numbers approaching zero.

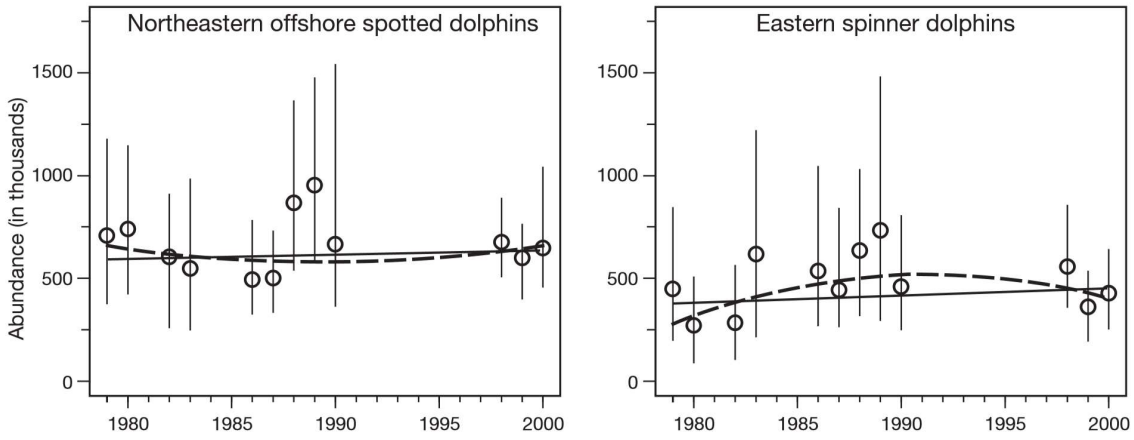


Figure 13. Estimates of abundance for Spotter and Spinner dolphin with 95% confidence intervals (vertical lines), linear model (solid line) and quadratic model (dashed line) (Gerrodette and Forcada, 2005). Populations remain flat.

Any or all of these factors may be responsible (Gerrodette and Forcada, 2005).

Still, the U.S. program has saved the dolphin and continues to gain acceptance world-wide. Working with its international partners, NMFS has established the *Agreement on the International Dolphin Conservation Program* (AIDCP), administered through the IATTC, which recognizes the threat to the yellowfin tuna fishery posed by the depletion or dolphin stocks.

The AIDCP established the international system used to track the tuna caught in each set from the time of capture until unloading. Tuna caught in sets in which dolphin are unharmed are defined as "dolphin-safe" (Figure 14) (IATTC – International Dolphin Conservation Program, 2014). Due to its success with tuna-porpoise, the observer program has expanded to include all oceans and other fisheries.

But dolphin are only part of the story. Thanks to the MMPA, since 1972, and with the aid of international cooperators, several whale species have been brought back from the verge of extinction (Gerrodette and Forcada, 2005).

Figure 14. Dolphin safe labeling.

There are many other threats to the world's oceans. Unregulated fisheries, for example, tend to be self-destructive. Instances of collapsed fisheries include:

- California abalone (Lee, 2013)
- California sardine (Lee, 2013)
- Peruvian Coastal Anchovy (Overfishing, 2016)
- Newfoundland Cod ((Overfishing, 2016)
- Irish Sea and West English Channel Sole (Overfishing, 2016)
- Deep sea fish – Orange Roughy, Patagonian Toothfish, Sablefish (Overfishing, 2016)
- Blue Walleye – extinct in Great Lakes (Overfishing, 2016)

World-wide, studies indicate that the biomass of predatory fish has declined by two-thirds in 100 years due primarily to overfishing (Christensen et al., 2014). And contrary to the common opinion, fish farming is not a "green" alternative." Fish raised in pens require food, which is obtained by fishing wild populations of fish and krill, thus depleting, and then polluting surrounding waters with waste – think 'open sewer' (The PEW Environmental Group, 2010).

The evidence is unmistakable: 'the fishing industry is incapable of self-regulation.' Unfortunately, fisheries need game wardens. Only governments acting individually and together can hope to save the industry from itself, and save the marine environment.

Literature Cited

Barham, Eric G., Warren K. Taguchi, and Stephan B. Reilly. Porpoise rescue methods in the Yellowfin purse seine fishery and the importance of the Medina panel mesh size. Marine Fisheries Review Paper 1246, May 1977. http://spo.nmfs.noaa.gov/node/3061

Brook, Samantha G. Federal Fisheries Observer Programs in the United States: Over 40 Years of Data Collection. Marine Fisheries Review 76(3): 1-38, 2014. https://www.researchgate.net/publication/276317988

Christensen, Villy, Marta Coll, Chiara Piroddi, Jeroen Steenbeek, Joe Buszowski, Danial Pauly. A century of fish biomass decline in the ocean. Marine Ecology Progress Series 512: 155-166, 2014. http://www.int-res.com/articles/theme/m512p155.pdf

Dawson, Teresa. Measures adopted to protect fisheries observers in western central Pacific. Environment Hawaii, Civil Beat. Accessed November 13, 2016, January 12, 2016. http://www.civilbeat.org/2016/01/measures-adopted-to-protect-fishery-observers-in-western-central-pacific/

Enhanced Documentation Requirements to Support the Dolphin Safe Label on Tuna Products. 50 CFR 216. Federal Register 81(56) 15444-15449, 2016. https://www.gpo.gov/fdsys/pkg/FR-2016-03-23/pdf/2016-06450.pdf

Fisheries Status Report No. 14. Inter-American tropical tuna commission, La Jolla California 2016. http://www.iattc.org/PDFFiles2/FisheryStatusReports/FisheryStatusReport14.pdf

GAO Report to Congressional Requesters. The tuna/porpoise observer program: More needs to be done to identify and report harassment of observers. B-240025. November 2, 1990. http://www.gao.gov/assets/220/213353.pdf

Gerrodette, Tim, Jume Forcada. Non-recovery of two spotter and spinner dolphin populations in the eastern tropical pacific. Marine Ecology Progress Series 291: 1-21, 2005. https://swfsc.noaa.gov/uploadedFiles/Research/Legal_Mandates/International_Dolphin_Conservation_Program_Act_%28IDCPA%29/GerrodetteandForcada2005MEPS.pdf

IATTC – International Dolphin Conservation Program (IDCP). October 22, 2014. http://www.iattc.org/IdcPeng.htm

IATTC – Tunas, billfish, and other pelagic species in the eastern Pacific ocean in 2015. October 27, 2016. http://www.iattc.org/DolphinSafeENG.htm

Lee, Katie. Southern California fisheries and the rocky future of seafood. Scientific American. July 1, 2013. https://blogs.scientificamerican.com/expeditions/the-historical-collapse-of-southern-california-fisheries-and-the-rocky-future-of-seafood/

Overfishing. Wikipedia. Accessed November 14, 2016, November 13, 2016. https://en.wikipedia.org/wiki/Overfishing

The PEW Environmental Group. Protecting Life in the Sea. The PEW Charitable Trust. January 1, 2010. http://www.pewtrusts.org/en/research-and-analysis/reports/2010/01/01/protecting-life-in-the-sea

Public Employees for Environmental Responsibility. Open Season on Attacking Fisheries Observers: Assaults more than doubled with no reported enforcement. June 2, 2016. http://www.peer.org/news/news-releases/open-season-on-harassing-fisheries-observers.html

Scott, Michael D., Suzan J. Chivers, Robert J. Olson, Paul C. Fieldler, Kim Holland. Pelagic predator associations: tuna and dolphins in the eastern tropical Pacific Ocean. The Marine Ecological Progress Series. Vol 458: 283-302, 2012. http://www.int-res.com/articles/meps_oa/m458p283.pdf

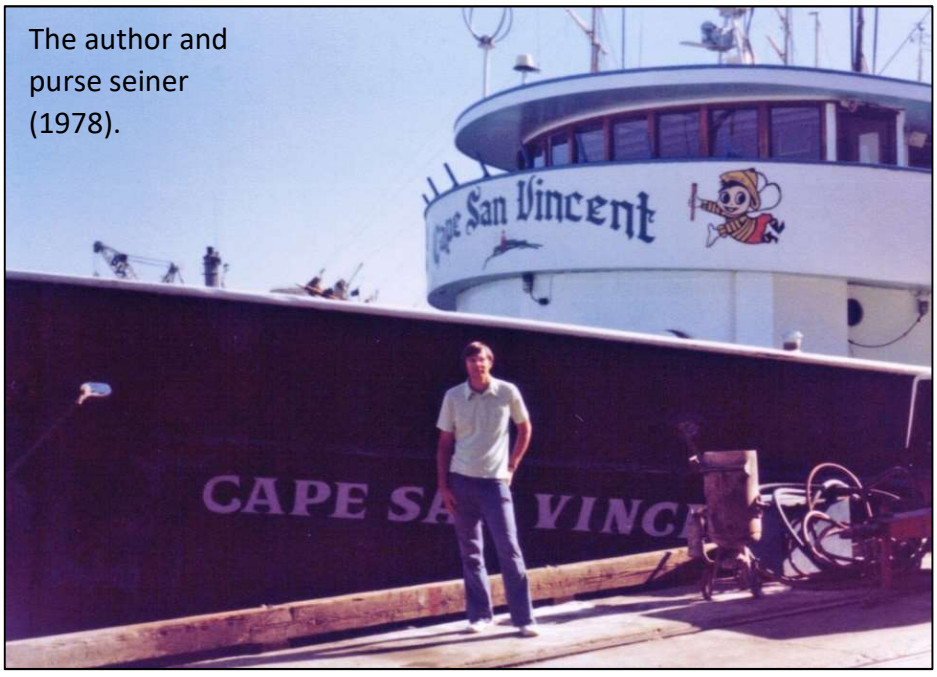
Southwest Fisheries Center. The Tuna-Dolphin Issue. Accessed October 9, 2016. https://swfsc.noaa.gov/textblock.aspx?Division=PRD&ParentMenuId=228&id=1408

The Tuna/Dolphin Controversy. For Sea Institute of Marine Science. October 21, 2016. http://www.forsea.org/tunalesson.HTML

What is a Thermocline? National Ocean Service. NOAA. Department of Commerce. November 8, 2016. http://oceanservice.noaa.gov/facts/thermocline.html

About the Author

Larry Zaleski was born and raised in New Jersey. He grew up 'a free range kid,' which allowed him to become familiar with the farms, fields, woods, streams and wildlife of his native State. Larry holds BS and MS degrees in Biology from Northern Arizona University. He has worked primarily within the federal government in biologically oriented programs within the Departments of Commerce (as a high-sea's biological technician), Interior (with the U.S. Fish and Wildlife Service Division of Law Enforcement), and Agriculture (as an inspector, officer, and trainer). For the past 30 years Larry has held various training posts within USDA's Animal and Plant Health Inspection Service at their Professional Development Center in Frederick, MD. These include instructional designer, project leader, supervisor, and senior training specialist. Larry has written technical manuals, and managed, designed, developed, and delivered e-learning and classroom courses for a wide range of scientific, technical, and managerial topics. He retired October, 2015 and now resides in Hagerstown, Maryland.



The author and purse seiner (1978).