BULLETIN OF MARINE SCIENCE. 88(3):791–815. 2012
http://dx.doi.org/10.5343/bms.2012.1031

INTERNATIONAL SYMPOSIUM ON CIRCLE HOOKS IN RESEARCH, MANAGEMENT, AND CONSERVATION

ABSTRACTS*

CHALLENGES OF CIRCLE HOOK ADOPTION IN INDONESIAN LIVE BAIT LONGLINE FISHERIES *by* ***Ahmad Hafizh Adyas*** *and Imam Musthofa Zainudin.*—Since 2005, WWF-Indonesia has facilitated efforts to reduce sea turtle bycatch on tuna longlines. The onboard observer data collected between 2006 and 2010 covering 49 vessels documented 359 sea turtles harvested. While fishermen did not think this bycatch was a major problem, considering the large number of vessels in the fleet there is a large potential of cumulative impacts. Forty vessels from Benoa-Bali and Bitung North Sulawesi have been involved in circle hook trials and adoption between 2006 and 2010, covering 128 fishing trips, 3361 settings, and using >70,000 circle hooks. The results are promising—circle hooks reduced sea turtle bycatch by 78% while catching target fish as effectively as traditional J-hooks. However, the circle hooks (C16) could not be applied in live bait fisheries due to their large size; the 5 mm shank of the circle hook was inadequate to hold the bait (typically milkfish of 15–20 cm) and also the bait typically dies faster. Given that around 90% of Indonesia's tuna longline fleet use live bait (with shallow sets), this is a considerable issue to resolve. Other obstacles for adoption stem from the use of monofilament line and the basket hauling technique, and the shape and weight of the circle hooks, all of which are perceived by fishermen as making their work more difficult (e.g., harder to haul and also causes a rumpling in the line). There is therefore an urgent need to research the live bait problem and other obstacles to develop workable solutions and models for circle hook adoption, to adequately protect sea turtles and support more sustainable tuna fisheries off Indonesia.—*World Wildlife Fund, Indonesia. Jl. Mega Kuningan lot 8.9/A9, Kawasan Mega Kuningan, Jakarta 12950, Indonesia. Email: <ahafizh@wwf.or.id>.*

FISHING GEAR MODIFICATIONS TO REDUCE ELASMOBRANCH MORTALITY IN PELAGIC AND BOTTOM LONGLINE FISHERIES OFF NORTHEAST BRAZIL *by* ***André S Afonso****, Fabio HV Hazin, Felipe Carvalho, Jose C Pacheco, Humberto G Hazin, David Kerstetter, Debra Murie, and George Burgess.*—One of the biggest challenges of fisheries research is reducing the bycatch of unwanted species. The incidental fishing mortality of species with low reproductive rates, such as elasmobranchs (sharks, skates, and rays), is recognized as a key threat to their populations. In the present study, gear modifications related to the type of hook and position of the hook in the water column were tested to examine their effects on catch rates and mortality of elasmobranch species in both pelagic and coastal environments. Comparisons between circle hooks (size 18/0, 0° offset) and J-hooks (size 9/0, 10° offset) demonstrated that the circle hooks have a greater efficiency in reducing the mortality of most species caught, both in pelagic and coastal longline fisheries. Internal lodging of the hook was significantly less frequent for the individuals caught with circle hooks, which likely contributed to their higher survival rate at haulback. Additionally, circle hooks increased the CPUE of elasmobranchs caught in the pelagic longline fishery, which was particularly evident for *Carcharhinus falciformis* and *Prionace glauca*. The position of the hook in the water column exhibited a strong influence on the species caught in the coastal bottom longline fishery. Suspending hooks in the middle of the water column reduced the bycatch of common demersal species, such as *Carcharhinus acronotus, Ginglymostoma cirratum,* and *Dasyatis americana,* while increasing the CPUE of potentially aggressive species, such as *Galeocerdo cuvier* and *Carcharhinus leucas*. The interaction of the type of hook utilized with its position in the water column appears to be an essential factor in the optimization of longline selectivity and

* Listed in alphabetical order by corresponding author (**bold**).

minimization of bycatch mortality.—*Laboratório de Oceanografia Pesqueira, Departamento de Pesca e Aqüicultura, Universidade Federal Rural de Pernambuco, Rua Dom Manuel de Medeiros s/n, Dois Irmãos, CEP 52171-900, Recife/PE, Brazil. Phone: 55-81-3320-6500, Email: <afonso.andre@gmail.com>.*

MITIGATING UNDESIRABLE OUTPUTS AND THE USE OF CIRCLE HOOKS *by James E Kirkley and* ***Juan Agar****.*—Current research on the use of J-hooks vs circle hooks suggests that circle hooks can substantially reduce the production of undesirable outputs, such as the take of sea turtles, while simultaneously improving the quality of landed fish and reducing the costs of harvesting desirable species. Utilizing a mathematical approach known as data envelopment analysis (DEA) in which we treat J-hooks as undesirable or bad inputs, we examine how circle hooks affect technical efficiency, quality of landed product, and the cost of producing desirable outputs. The DEA approach is based on directional distance functions in which we allow good outputs to expand, and undesirable or bad inputs and bad outputs to contract. We utilize data obtained from a NMFS sponsored study to examine the performance of J-hooks vs circle hooks in the Northeast Distant Water pelagic longline fishery. We find that circle hooks reduce the harvest of bycatch species (i.e., undesirable outputs), enhance overall technical efficiency, reduce production costs, and improve the quality of landed product. We also find that when we allow only good outputs to expand and bad outputs to contract, but do not allow for changes or contractions in undesirable inputs (J-hooks), there are reductions in the landings of desirable outputs. Our results and conclusions, however, are applicable only to the 13 vessels in our sample data set. We cannot make broad inferences to the entire Northwest Atlantic pelagic longline fleet.—*US National Marine Fisheries Service, 75 Virginia Beach Drive, Miami, Florida 3314. Phone: 305-361-4218, Email: <Juan.Agar@noaa.gov>.*

CIRCLE HOOK BENEFITS IN MARINE RECREATIONAL FISHERIES: A MULTISPECIES APPROACH *by* ***Josep Alós*** *and Miguel Cabanellas-Reboredo.*—Most marine recreational fisheries target multiple species and this is the case in the Mediterranean Sea. Consequently, the benefits of the circle hooks as well as their effects on catch and deep-hooking rates should not be evaluated from a univariate perspective. In this study, the effects of circle hooks on hooking location and catch rates were evaluated for the catch-and-release sportfishing tournaments from the Balearic Islands. This sport activity has an important social and economic value and catch-and-release was recently promoted as a sustainable practice. Field experimentation demonstrated how circle hook use resulted in a decrease in the deep-hooking incidence in the most commonly caught species. Results of the multivariate approach (principal component analysis and redundancy analysis) demonstrated how the catch rates remained generally constant when circle hooks and conventional J-hooks were compared. Therefore, the results showed circle hook use is a promising tool to contribute to the sustainable development of recreational fisheries in the Mediterranean area.—*Instituto Mediterráneo de Estudios Avanzados, IMEDEA (CSIC-UIB), C/ Miquel Marqués 21,07190, Esporles, Illes Balears, Spain. Phone: 00-34-971-61-08-29, Email: <pep.alos@uib.es>.*

BUILDING THE FOUNDATIONS TOWARDS SUSTAINABLE FISHING, SHIFTING TO BETTER TECHNOLOGIES USING CIRCLE HOOKS AND BEST FISHING PRACTICES IN THE EASTERN PACIFIC OCEAN *by* ***Sandra Andraka****, Moises Mug, Martin Hall, Takahisa Mituhasi, Maite Pons, Maria L Parga, David Ortega del Valle, Alejandra Zorrilla Domínguez, Erick Villagran, Sara Perez, Mario Jolón, Celina de Paz, Salvador Siu, Velkiss Y Gadea, Álvaro Segura, Lucas R Pacheco R, Julian Alejandro Caicedo Pantoja, Luis Alonso Zapata Padilla, Gustavo A. Castellanos-Galindo, Manuel Parrales, Liliana Rendón, Jimmy Martínez, Pablo Guerrero, Michael Valqui.*—Since 2004, fishing sectors, governments, and non-government organizations have implemented joint efforts to reduce marine turtle bycatch in pelagic longline fishing operations across the Eastern Pacific Ocean (EPO). This is

probably the largest marine fisheries conservation effort ever organized in the region and one of the most innovative, field-based marine conservation strategies in the world, building a unique platform of trust among fishermen, governments, fishing gear manufacturers, and the fishing industry. Commercial fishing trips voluntarily carrying experiments to test the effectiveness of circle hooks with J-hooks, and observers collecting scientific information as tools to mitigate marine turtle bycatch are underway in nine countries from Mexico to Peru. Gear to release sea turtles is provided free and techniques to handle and release sea turtles are explained to increase post-capture survival. Variability among fleets of the region, by country and also by port, as well as the economics that drive decision-making in these fleets, are the factors that most influence willingness to consider and support changes to traditional fishing practices and management measures. We outline general results and lessons learned of this solution-oriented approach in the EPO. Results at the national level will be presented in other poster and oral presentations. Adoption of bycatch and observer programs by fishing authorities is recommended within each country of the EPO.—*WWF, P.O. Box 629-2350, San Francisco de Dos Ríos, San José, Costa Rica. Phone: 506-2234-8434, Email: <sandraka@wwfca.org>.*

FIELD STUDIES TO EVALUATE THE EFFICIENCY OF ALTERNATIVE HOOKS THAT FACILITATE THE RELEASE OF SEA TURTLES AND OTHER BYCATCH SPECIES IN THE PACIFIC LONGLINE MAHI-MAHI FISHERY OF GOLFITO, COSTA RICA *by* ***Randall Arauz****, Yonat Swimmer, Christopher Boggs, Allan Bolaños, and Jeffery Madrigal.*—Catch rates of sea turtles by longline operations in Costa Rica's Exclusive Economic Zone (EEZ) are globally among the highest recorded. Multiple field trials evaluating different modifications of circle hooks and baits have yet to identify a modification or bait type that reduces the capture of sea turtles in these waters while maintaining the feasibility of the fishing operation (e.g., acceptable levels of target species catch). Here, we aim to improve the handling of sea turtles in an effort to increase post-release survival. We tested two circle hook modifications that potentially facilitate the release of hooked animals by eliminating the need to deck them. We tested an "alternative" hook, developed by a Costa Rican fisher, and a "release" hook, developed by NOAA and Pretoma, both of which could potentially mitigate the impact of longline fisheries on sea turtles by releasing them without the added stress of bringing turtles on board and removing hooks. Observations were made onboard four longline fishing trips, from November 2009 through June 2010. Alternative hooks performed poorly, catching fewer than one-tenth the number of sharks, sea turtles, commercial fish, and rays. Release hooks always captured fewer individuals from the four aforementioned categories, but this reduction was not statistically significant, and did not compromise the feasibility of the operation. All sea turtles captured with release hooks were released without the need for decking them, while all sea turtles caught with control hooks had to be decked in order to release them using "dehookers." As an unexpected preliminary result, use of release hooks also seemed to reduce sea turtle catch rates. Use of circle hooks has important implications for ray conservation, as post-hooking mortality is greatly reduced by less severe damage inflicted when releasing the animal.—*Pretoma, 1203-1100, Tibás, San José, Costa Rica. Phone: 506-2241-5227, Email: <rarauz@pretoma.org>.*

CIRCLE HOOK TESTING IN THE MOROCCAN PELAGIC LONGLINE FISHERY *by* ***Kamal Bennouna*** *and Youseeff Bennjelloun.*—Vessel operators and fishermen from the Moroccan pelagic longline fleet are working with the National Oceanic and Atmospheric Administration (NOAA) staff to conduct commercial trials with large circle hooks. The purpose of these trials is to assess the impacts of these hooks in Moroccan fisheries, both in terms of the marine ecosystem and the commercial viability of the fishery. Fishery data will be collected via logbooks as well as scientific observers to take stock of the target catch size and composition, along with bycatch, noting for all species the status upon retrieval (alive or dead,

extent of injury, etc.). These trials will allow a test of the efficacy of the circle hooks in the specific context of Morocco's fisheries.—*National Association of Longline Vessels–Morocco, Tanger, JNP Maroc, Port de Pêche, Agadir, Morocco. Phone: 212-61159580, Email: <lamakes@yahoo.es>.*

EFFECTS OF WIRE LEADERS ON SIZE AND CATCH RATES OF SHARKS CAPTURED ON PELAGIC LONGLINE GEAR *by G Walter Ingram Jr, William B Driggers III,* ***John K Carlson****, and Enric Cortés*.—Numerous studies have examined the impacts of circle hooks vs J-hooks in affecting catch per unit effort (CPUE) and mitigating bycatch of pelagic and coastal fishes; however, few have considered the effects of leader material. For most of the 20th century, wire was the predominant leader material utilized for pelagic longline gear, but in the 1980s monofilament became widely used as it was thought to increase catch rates of scombrids while reducing the capture of sharks. The objective of the present study was to examine the effects of the change in leader material on the size and CPUE of sharks caught in the western North Atlantic Ocean based on fishery-independent pelagic longline data collected by the National Marine Fisheries Service. For all species examined, with the exception of the shortfin mako (*Isurus oxyrinchus*), size at capture was largest when using wire leaders. While mean CPUE was highest for silky sharks (*Carcharhinus falciformis*) when using monofilament leaders, mean CPUE was highest for oceanic whitetip (*Carcharhinus longimanus*), night (*Carcharhinus signatus*), and shortfin mako sharks when using wire leaders, and similar for bigeye thresher (*Alopias superciliosus*) and tiger (*Galeocerdo cuvier*) sharks for both leader materials. Our results indicate that mandatory use of monofilament leaders is a viable management option to reduce catch rates of several species of pelagic sharks and that comparison of historical CPUE data that ignore the effect of leader material on catch rates should be viewed cautiously.—*US National Marine Fisheries Service, Southeast Fisheries Science Center, Panama City Laboratory, 3500 Delwood Beach Road, Panama City, Florida 32408. Phone: 850-234-6541, Email: <John.Carlson@noaa.gov>.*

OBSERVER AND VESSEL EFFECTS ON HOOKING SURVIVAL OR INJURY SEVERITY ESTIMATES FOR COMMON BYCATCH SPECIES DISCARDED FROM PELAGIC LONGLINE FISHERIES *by* ***Erin H Carruthers***.—Using release condition and hooking location data collected by at-sea fisheries observers in the Canadian pelagic longline fleet, likelihood of hooking survival and severity of hooking injuries associated with circle hooks (16/0) and J-hooks (8/0 or 9/0) were compared for all common bycatch species. Previous research indicated odds of survival were 2–5× higher on circle hooks than on J-hooks for common bycatch species. Further, odds of severe hooking injuries decreased for porbeagle (*Lamna nasus*), shortfin mako (*Isurus oxyrinchus*), and blue shark (*Prionace glauca*) caught on circle hooks but odds of mouth-hooking and gut-hooking did not differ for loggerhead turtles (*Caretta caretta*) caught on the two hook types. These generalized linear models were rerun using data from three additional fishing seasons (2007–2009). While fishery-dependent data, such as the observer data used here, reflect hooking survival and injury rates in the commercial fishery, the results may be confounded by different fishing practices among vessels or by differences among observers. Differences in bycatch handling and discarding practices may have affected our evaluations of the two hook types. Therefore, vessel and observer effects were evaluated in the updated analyses.—*Department of Biology, Memorial University of Newfoundland, St. John's NL A1B 3X9 Canada. Phone: 709-864-4396 or 902-433-5743, Email: <ehcarrut@mun.ca>.*

A COMPARISON OF CIRCLE HOOK AND J-HOOK PERFORMANCE IN A WESTERN EQUATORIAL ATLANTIC OCEAN PELAGIC LONGLINE FISHERY *by* ***Felipe Carvalho****, Jose C Pacheco, Humberto G Hazin, Fabio HV Hazin, and Paulo Travassoss*.—Catch composition, catch rates, hooking location, and status at haulback were monitored during 210 experimental sets between 2006 and 2010 in a commercial pelagic longline fishery targeting tuna in the equatorial Atlantic Ocean, using circle hooks (size 15/0 offset, 18/0 non-offset,

and 18/0 offset) and J-hooks (size 9/0 offset and 10/0 offset). The catch composition from these sets was not significantly different between the different types of hooks. The J-hook increased the CPUE for target and bycatch species by 23% and 47%, respectively. Comparisons between the hooks demonstrated that circle hooks have a greater efficiency in reducing the mortality of most species caught in this pelagic longline fishery; this might be occurring due the internal lodging of the hook being significantly less frequent for the individuals caught with circle hooks.—*Program of Fisheries and Aquatic Sciences, School of Forest Resource and Conservation, University of Florida, 7922 NW 71st Street, Gainesville, Florida 32653. Phone: 352-273-3642, Email: <fcorreia@ufl.edu>.*

STUDIES ON CIRCLE HOOKS IN THE TAIWANESE DISTANT-WATER TUNA LONGLINE FISHERY *by* ***Chao-Ching Chen*** *and Hsin-Jung Lin*.—For several years, circle hooks have been promoted by international fisheries organizations as a means of reducing the bycatch rate of sea turtles in tuna longline fisheries. However, the Taiwanese distant-water longliners preferred to use traditional J-hooks due to their usual operation. Therefore, this 3-yr project carried out a number of experiments to compare the catch rates of J-hooks vs circle hooks. Experiments with tuna longline boats conducted in eastern Pacific waters during 2005–2006 indicated that using circle hooks did not affect target catch rates, thus was useful information for the government to promote more broadly the use of circle hooks in the Taiwanese tuna longline fishery. In 2007, a total of 10 commercial fishing vessels were chosen to proceed with experiments using 4000 circle hooks per vessel in the Atlantic, Pacific, and Indian oceans. The results obtained from observers' data indicated that circle hooks had no negative influence on target catch rates. However, the results also indicated that bycatch rates were not significantly different on either large vessels or small vessels. The reasons for this finding need further examination.—*Department of Fisheries Production and Management, National Kaohsiung Marine University, 42 Haijhuan Road, Kaohsiung City, 81143. Taiwan. Phone: 886-7-3617141 ext. 3513, Email: <ccchen@mail.nkmu.edu.tw>.*

PROMOTION OF CIRCLE HOOKS USE IN SOUTHEAST ASIA *by* ***Bundit Chokesanguan*** *and Somboon Siriraksophon.*—The Southeast Asian Fisheries Development Center (SEAFDEC) Training Department, as a technical agency involved in the promotion of responsible fishing technologies and practices in the Southeast Asian region, has studied the mitigation of fisheries–sea turtle interactions through experiments on the efficiency of circle hooks in comparison with J-hooks in longline fisheries. The study objectives are to investigate the efficiency of circle hooks in comparison with J-hooks, the hooking positions between two different hook types, and the impact of the longline fishery on mortality of sea turtles caught incidentally in waters of the Southeast Asian region. Six experiments have been conducted in the waters of Andaman Sea, Brunei Darussalam, Myanmar, Thailand, the Celebes Sea of the Philippines, and the Indian Ocean. The results of the experiments found that the efficiency of catch was not different between these hooks, but that shark and other non-valued bycatch was reduced by 20% when using circle hooks compared with J-hooks. As for the position of hooking with circle hooks, 85% of fish were caught in the mouth and 4% in the digestive system. On the other hand, 25% of fish were caught in the digestive system when using J-hooks. To reduce catch of sea turtles in longline fisheries, the promotion of circle hooks was conducted through training and workshops in the Philippines, Indonesia, Thailand, Vietnam, and Malaysia in 2006–2007. Information packages were also produced and disseminated in the region for that purpose. SEAFDEC, in cooperation with Southeast Asian countries, will continue to promote circle hooks in the region under the Project on Responsible Fisheries Technologies and Practice with the support of the Japanese Trust Fund and other organizations in other regions.—*Training Department, Southeast Asian Fisheries Development, Center (SEAFDEC/TD), Phrasamut chedi, Samutprakan, Thailand. Email: <bundit@seafdec.org>.*

INTERNATIONAL GUIDELINES FOR BYCATCH MANAGEMENT AND REDUCTION OF DISCARDS *by* ***Francis Chopin****, Petri Suuronen, Yimin Ye, Blaise Kuemlangan, John Fitzpatrick, and Judith Swan*.—At its 29th session in February 2011, the FAO Committee on Fisheries endorsed international guidelines on bycatch management and reduction of discards developed through the process of an expert consultation followed by a technical consultation. The guidelines are global in scope covering all fishing activities in all seas, oceans, and inland waters. They are designed to assist States and regional fishery managements organizations (RFMO) in the implementation of the Code of Conduct for Responsible Fisheries (Code) by incorporating effective management of bycatch and reduction of discards into fishery management planning and to promote responsible fisheries by (1) minimizing the capture and mortality of species and sizes which are not going to be used in a manner that is consistent with the Code, (2) providing guidance on measures that contribute toward more effective management of bycatch and reduction discards, and (3) improving reporting and the accounting of all components of the catch of which bycatch and discards are subsets. We report on the process of development and content of these guidelines and discuss considerations for their effective and rapid implementation.—*Fishing Operations and Technology Service (FIRO), Fisheries and Aquaculture Resources Use and Conservation Division, Fisheries and Aquaculture Department, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00153 Rome, Italy. Phone: 39-06-570-55257, Email: <Francis.Chopin@fao.org>.*

EFFECTS OF CIRCLE HOOKS ON PELAGIC CATCHES IN A TUNA LONGLINE FISHERY *by* ***Daniel S Curran*** *and Keith A Bigelow*.—Eighteen vessels within the Hawaii-based tuna longline fleet were contracted to test the catch efficacy of large circle hooks vs the existing hooks in use by the fishery. This study was intended to test the effects of using large circle hooks on target, incidental, and bycatch species in the fishery. The majority of the fleet uses "Japanese" style tuna hooks [3.6 sun (about the same size as most 14/0 circle hooks)], but some of the vessels contracted use J-hooks (size 9/0). The large circle hooks tested were stainless steel (size 18/0) circle hooks made in Korea. Vessels were mandated to alternate hook type throughout every set and to maintain a 50/50 ratio of circle hooks to their existing hooks. Information was collected on catch by hook type, the daily tally of the total numbers of each type of hook used, and a vessel's ability to follow experimental protocols. The experiment was conducted from July 2005 until February 2006. A total of 1393 sets were analyzed, 1182 sets were large circle hooks vs 3.6 sun tuna hooks, and 211 sets were large circle hooks vs 9/0 J-hooks. Large circle hooks caught a slightly larger proportion of bigeye tuna (*Thunnus obesus*) than any other hook used. Overall, large circle hooks caught 51% of bigeye tuna when alternated with 3.6 sun tuna hooks and 52% of bigeye tuna vs J-hooks. For the 17 most common species, large circle hooks underperformed both J-hooks and tuna hooks. Results indicated strong statistical evidence that the use of large circle hooks would reduce the catch of billfishes, pelagic sharks, opah (*Lampris guttatus*), and dolphinfish (*Coryphaena hippurus*). Large circle hooks show promise in reducing bycatch of pelagic sharks, reducing incidental catch of billfishes, and simultaneously maintaining the overall catch of bigeye tuna.—*US National Marine Fisheries Service, Pacific Islands Fisheries Science Center, 2570 Dole Street, Honolulu, Hawaii 96822. Phone: 808-983-5382, Email: <Daniel.Curran@noaa.gov>.*

SEA GRANT OUTREACH ACTIVITIES WITH RECREATIONAL FISHERIES ON THE USE OF CIRCLE HOOKS *by* ***Bryan Fluech****, Dorothy Zimmerman, and Steven Theberge*.—About 6.5 million people annually make >27 million recreational fishing trips in Florida. In 2006, over 2 million saltwater anglers contributed $3 billion in retail sales, and landed over 180 million fish, making Florida the number one recreational fishing state in the United States. Fisheries managers have also seen a significant increase in the fishing effort over the last decade, necessitating an increase in regulatory measures such as closed seasons, bag limits, and size restrictions. Consequently, more fish caught by recreational anglers are

being released back into the water to comply with harvest restrictions. The effectiveness of regulations is diminished, however, if released fish do not survive. An educated angling population that understands and follows recommended conservation practices, including circle hook use, is a critical component in fisheries management. For the past decade, the Florida Sea Grant Extension Program has been a leader in educating and training saltwater recreational fishermen on research-based methods to increase post-release survival of marine fish, including the use of circle hooks, dehookers, and proper fish handling techniques. Here, we highlight the Florida Sea Grant Extension Program's award-winning outreach efforts to train and educate recreational saltwater fishermen on the use of these various tools and techniques in the Gulf of Mexico. Efforts have included workshops, displays, and presentations at fishing tournaments, public events and professional conferences, youth fishing programs, creation of educator outreach toolkits, and development of a catch-and-release website (http://catchandrelease.org), brochures, and online publications. Equally important has been collaborative partnerships with the Florida Fish and Wildlife Conservation Commission and NOAA Fisheries to ensure consistent, science-based messages. As a result, Florida Sea Grant has made a long-term positive impact on anglers in Florida and fisheries management objectives in the Gulf of Mexico region. Given that new regulations in the broader region will require circle hook use in the snapper-grouper fishery, Sea Grant will expand outreach efforts to Florida's Atlantic coast.—*Florida Sea Grant, PO Box 110400, Gainesville, Florida 32611. Phone: 352-392-5870, Email: <fluech@ufl.edu>.*

BLUEFIN TUNA BYCATCH MITIGATION RESEARCH IN THE GULF OF MEXICO PELAGIC LONGLINE YELLOWFIN TUNA FISHERY *by* ***Daniel G Foster*** *and Charles Bergmann.*—Research was conducted in 2008–2010 by the Engineering and Harvesting Branch of US National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories to evaluate a new 16/0 "weak" circle hook designed to reducing the bycatch of bluefin tuna in the Gulf of Mexico yellowfin tuna fishery. Bycatch in this fishery has been identified as a major source of fishing mortality in the western Atlantic bluefin tuna spawning grounds. Six commercial vessels completed 311 pelagic longline sets, during which experimental hooks and standard 16/0 circle hooks were alternated, resulting in a total of 198,606 hooks set. A total of 33 bluefin were caught during the experiment, of which 10 were caught on the experimental hook (56.5% reduction). The difference in bluefin catch was statistically significant. Vessels landed a total of 2065 yellowfin tuna. Catch rates for yellowfin tuna did not differ significantly by hook type.—*US National Marine Fisheries Service, Southeast Fisheries Science Center, P.O. Drawer 1207, Pascagoula, Mississippi 39568. Phone: 228-549-1763, Email: <Daniel.G.Foster@noaa.gov>.*

COMPARISON OF 16/0 AND 18/0 CIRCLE HOOK CATCH RATES IN PELAGIC LONGLINE TUNA FISHERIES *by* ***Daniel G Foster****, Sheryan Epperly, Arvind Shah, and John Watson.*—Studies conducted in the western Atlantic Ocean Northeast Distant Waters (NED) have demonstrated that 18/0 circle hooks can significantly reduce sea turtle interactions in the pelagic longline fishery compared to industry standard 9/0 J-hooks without significantly impacting target species catch rates for swordfish and bigeye tuna. To evaluate the effect of circle hook size on the catch rates of target and bycatch species, experiments were conducted in the NED during bigeye tuna directed sets in 2003 and in Gulf of Mexico (GOM) yellowfin tuna fishery in 2004 comparing 16/0 and 18/0 circle hooks. Test hooks were deployed in an alternating fashion. During the bigeye tuna experiment, 16/0 10° offset circle hooks were evaluated against 18/0 0° offset circle hooks using squid as bait. Yellowfin sets were made comparing 16/0 0° offset circle hooks and 18/0 0° offset circle hooks with sardines as bait. There was a 25.7% reduction in total yellowfin tuna caught in the GOM on 18/0 circle hooks as compared to 16/0 circle hooks which was statistically significant. Catch rates for bigeye tuna and leatherback sea turtles did not differ significantly between hook types. The loggerhead sea turtle catch was significantly lower with 18/0 circle hooks in the NED.—*US National Marine Fisheries Service, Southeast Fisheries Science Center, P.O. Drawer 1207, Pascagoula, Mississippi 39568. Phone: 228-549-1763, Email: <Daniel.G.Foster@noaa.gov>.*

SEA TURTLE BYCATCH IN THE LONGLINE FISHERIES IN THE PACIFIC OFF NICARAGUA: A PRELIMINARY ANALYSIS OF THE EFFECT OF DIFFERENT HOOKS *by* ***Velkiss Y Gadea****, Álvaro Segura, and José Urteaga A.*—J-hooks have been used historically in longline fisheries off Nicaragua. Since the mid-1990s the Nicaraguan mahi mahi (*Coryphaena hippurus*) fishery has been progressively shifting from J-hooks to circle hooks. This transition occurred due to the implementation of national regulations that required the use of circle hooks, and other factors, but J-hooks are still used in the remaining logline fisheries (e.g., targeting sharks, snappers). From 2008 to 2010, we performed hook experiments in the artisanal fleet operation at San Juan del Sur, Astillero, and Masachapa in the Pacific coast of Nicaragua. We trained fishermen as onboard observers to collect data, and worked with fishing boats that voluntarily participated in the experiments. Forty-five fishing trips used experimental logline sets, including combinations of 16/0 and 15/0 circle hooks in the mahi mahi fisheries; 15/0 circle hook and 5/6 J-hooks in the red pike conger (*Cynoponticus coniceps*) fishery; 13/0 and 13/0–11/0 circle hooks in the snapper (Lutjanidae) fishery, and 16/0 and 15/0 circle hooks in the shark (Charcharhinidae) fishery. In six trips recorded for mahi mahi, 56 olive ridley (*Lepidochelys olivacea*) and seven black sea turtles (*Chelonia mydas agassizii*) were incidentally captured. 15/0 circle hooks captured 67%, while 16/0 circle hooks captured 33% of these sea turtles. Eighty-four percent of the turtles (80% for 15/0 circle hooks and 90% for 16/0 circle hooks) were hooked on the upper jaw and fins, and 100% of them were alive. Results of sea turtle bycatch in the bottom longline fishery are also reported. We documented 100% mortality of six individuals captured in the shark fishery. For snapper and red pike conger fisheries we did not record any sea turtle captures, but the change from J-hook to circle hook increased the quality of the captures, reduced the loss of hooks, and did not change catch quantities. Further experiments to test circle hook effectiveness in this fishery and to assess the longline fisheries off the Pacific coast of Nicaragua are recommended.—*Fauna y Flora Internacional, Rpto. San Juan. Calle Esperanza. Casa No. 578, Apartado Postal 527, Managua, Nicaragua. Phone: 505-88391737, Email: <Velkiss.gadea@gmail.com>.*

CIRCLE HOOKS AND CATCH RATES OF TARGET AND BYCATCH SPECIES IN THE LONGLINE FISHERY IN THE SOUTHWEST ATLANTIC OCEAN *by* ***Bruno Giffoni****, Venâncio Guedes Azevedo, Leandro Bugoni, Fernando Niemeyer Fiedler, Yonat Swimmer, and Gilberto Sales.*—Circle hooks may affect catch composition in comparison with J-hooks in some pelagic longline fisheries. Between 2004 and 2008 the performance of 18/0 10° offset circle hooks was compared with 9/0 J-hooks (control) in the Brazilian pelagic longline fishery targeting swordfish, tuna, and sharks. During this experiment, 26 trips, 229 sets, and 145,828 hooks were set alternating circle hooks and J-hooks and using mackerel as bait. A total of 60 different species, including sea turtles and seabirds, were caught. Statistical analyses (Mantel-Haenszel χ^2 tests) of species with at least 20 individuals caught were performed. Circle hooks resulted in a significant catch decrease for loggerhead, *Caretta caretta* (55%), and leatherback, *Dermochelys coriacea* (65%), sea turtles. Use of circle hooks resulted in increased capture rates of tunas (bigeye, *Thunnus obesus,* and albacore, *Thunnus alalunga*), and sharks (blue, *Prionace glauca,* and requiem sharks of the genus *Carcharinus*). There was no difference in the capture of yellowfin tuna (*Thunnus albacares*), shortfin mako shark (*Isurus oxyrinchus*), hammerhead sharks (*Sphyrna lewini* and *Sphyrna zygaena*), and dolphinfish (*Coryphaena hippurus*). On the other hand, the capture rate of swordfish (*Xiphias gladius*) decreased significantly when using circle hooks. Additionally, use of circle hooks significantly decreased capture rates of bycatch species, such as pelagic stingrays (*Pteroplatytrygon violacea*) and white marlin (*Tetrapturus albidus*). Circle hooks performed similar to J-hooks with respect to many species, and increased captures of marketable species such Atlantic pomfret (*Brama brama*), escolar (*Lepidocybium flavobrunneum*), and mackerel shark (*Lamna nasus*). Results demonstrate the effectiveness of circle hooks for the conservation of loggerhead and leatherback sea turtles, improving the capture rates of most target species, and significantly reducing the bycatch of the most common species, the pelagic stingray, thus economically improving this fishery.—*Fundação Pró-TAMAR, Rua Antônio Athanazio da Silva, No 273, Itaguá. Ubatuba – SP, Brazil 11680-000. Phone: 55-12-3833-5966, Email: <bruno@tamar.org.br>.*

CIRCLE VS LONGSHANK HOOKS: COMPARING HOOKING LOCATIONS AND RECREATIONAL CATCH FOR JUVENILE AUSTRALASIAN SNAPPER, *PAGRUS AURATUS,* AND KING GEORGE WHITING, *SILLAGINODES PUNCTATE by* ***Daniel Grixti****, Simon D Conron, Karina Ryan, and Vincent L Vercase.*—Australasian snapper (*Pagrus auratus*) and King George whiting (*Sillaginodes punctata*) are major recreational species in Victoria, with *P. auratus* having a high catchability among anglers targeting *S. punctata*. Hooking location is the most important survival factor for *P. auratus* caught incidentally in Victoria by anglers targeting *S. punctata,* with shallow-hooked fish having better survival rates than deep-hooked fish. Circle hooks have been proposed as an alternative to longshank hooks to reduce deep-hooking. During 39 fishing trips in Port Phillip Bay and Western Port, size 6 circle hooks were compared to conventional size 6 longshank hooks. The distance the hook was off the sea bed was also contrasted. Niether of these factors affected hooking location. Longshank hooks captured more legal-size *P. auratus* than circle hooks, while mean fish lengths were the same across hook types and hook positions for both species. As the total length of *S. punctata* increased, the shallow-hooking rates decreased. Using similar-sized circle hooks to conventional longshank hooks was not demonstrated as a technique for improving *P. auratus* survival under typical *S. punctata* angling practices. The ability of circle hooks to increase shallow-hooking appears to be a function of both fish species and angling technique interactions. The benefits of circle hooks may be limited for fish species that are captured by a tight line and vigorous hook setting technique.—*Marine and Freshwater Fisheries, Research Institute, P.O. Box 114, Queenscliff, Vic. 3225, Australia. Phone: 61-0-3-5258 0111, Email: <danielgrixti@yahoo.com.au>.*

MODIFICATION OF A STANDARD J-HOOK DESIGN ALLOWING SELF RELEASE OF FISH AND REDUCING THEIR MORTALITY *by* ***Andrew Gude****, Kydd Pollock, and Amanda Meyer.*—Standard recreational fishing methods in protected area ecosystems, which support a large biomass of higher predators, are often deemed incompatible with management objectives due to the mortality associated with caught or released fish. A standard J-hook was modified to allow fish to self-release once caught. The bite of the hook was removed by clipping it and filing it sharp to the point where the barb enters the bite-portion of the hook. This overall shortening of the available hook area allows for a caught fish to self-release once it turns toward, or parallel to, the angler or if the angler slacks the line. Limiting the amount of time a fish stays hooked, reducing the fight time, and eliminating the need to handle and release a fish, reduces stress, thus minimizes mortality. Experimental fly fishing field trials were successfully conducted at the Palmyra Atoll National Wildlife Refuge in the central Pacific Ocean. No fish made more than three runs before they self-released with no predation evident. Protected area managers, presented with a situation where a typical catch-and-release fishery is deemed incompatible with protected area management objectives, should consider employing the option of utilizing this method to allow a low/no-impact fishery in areas where there is a high risk of predation on caught-fish. While this approach does not allow for traditionally-accepted fishing practices, it does provide resource managers the option to permit a recreational fishery where it was previously prohibited due to predation concerns.—*US Fish & Wildlife Service, Department of the Interior, 1849 C. Street. NW, #3147, Washington, District of Columbia 20240. Phone: 202-208-6211, Email: <Andrew_Gude@fws.gov>.*

A COMPARISON OF CATCHING EFFICIENCY AND HOOKING LOCATION OF CIRCLE HOOKS AND STRAIGHT SHANK J-HOOKS USED IN THE RECREATIONAL ATLANTIC TARPON (*MEGALOPS ATLANTICUS*) FISHERY OF FLORIDA *by* ***Kathy Guindon****.*—Several billfish studies have shown that there is a significant increase in post-release survival and less physical damage when circle hooks are used for large sportfishes. Atlantic tarpon, a large pelagic sportfish, supports a lucrative recreational catch-and-release fishery in Florida, but an evaluation of hook performance has not been performed on this species. This study evaluates hook type (circle or J) and hooking characteristics (catch efficiency

and hook location) as observed in the recreational tarpon fishery on 243 trips in Boca Grande Pass and Tampa Bay, Florida, during the summers of 2002–2007. Natural and artificial bait types were used and hook sizes varied (5/0–9/0), but were standard to the fishery. In total, 397 tarpon were hooked; 143 on circle hooks and 254 on J-hooks. There was a significant association between hook type and catching efficiency, defined as whether the tarpon was hooked, fought and lost, or fought and landed. Catch success was lower with circle hooks than with J-hooks. However, there was no significant association observed between hook types and hooking location for landed tarpon. Of the 170 landed tarpon with observations on hook type and location, 158 (92.9%) fish were fair-hooked (jaw, corner, and roof of mouth) and 12 (7.1%) were foul-hooked (5.9% and 7.6%, circle hooks and J-hooks, respectively). Foul hooking locations included the cheek, eye, gills, pectoral fin, and deep hooking, of which circle hooks only superficially hooked cheeks. Tarpon feeding behavior and skeletal jaw morphology may influence hook location. In general, J-hooks were better at hooking and holding a tarpon for landing and were used more commonly in the fishery than circle hooks. Circle hooks lessened foul hooking and likely caused less physical damage than J-hooks. Circle hooks could be considered a good choice as a conservation tool for tarpon anglers.—*Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, 100 Eighth Avenue SE, Saint Petersburg, Florida 33701. Phone: 727-896-8626, Email: <Kathy.Guindon@MyFWC.com>.*

SHOULD OFFSET CIRCLE HOOKS BE PROMOTED FOR SHARK FISHING? *by* ***Neil Hammerschlag****, Dominique M Lazarre, and Austin J Gallagher.*—In recent years, managers and conservationists are promoting use of circle hooks in both commercial and recreational fisheries based on limited evidence suggesting that circle hooks have a tendency to induce lower mortality and gut hooking rates. Additionally, despite lack of sufficient data, there is a widely-held belief that offset-circle hooks act much like J-hooks, thus limiting their efficacy in reducing mortality and gut hooking. Complicating the issue is that performance of circle hooks may vary depending on a variety of factors including species, feeding mode and bait type, hook size, and degree of offset. In the present study, we empirically measure the effects of offset and non-offset circle hook performance during shark fishing. Specifically, we record mortality rates, deep-hooking, and bleeding rates associated with shark fishing using 5° offset as well as non-offset 16/0 circle hooks. We further evaluate if the performance of these hooks varied by shark species, feeding mode, mouth morphology, and bait type. Our results are discussed in terms of maximizing post-release survival of sharks during fishing with circle hooks.—*Rosenstiel School of Marine and Atmospheric Science, RJ Dunlap Marine Conservation Program, University of Miami, 4600 Rickenbacker Causeway, Miami, Florida 33149. Phone: 305-421-4356, Email: <nhammerschlag@rsmas.miami.edu>.*

INVESTIGATING THE POTENTIAL FOR MODIFIED CIRCLE HOOKS WITH WIRE APPENDAGE TO REDUCE HOOK INGESTION RATES IN INCIDENTALLY-CAPTURED SEA TURTLES *by* ***Dominy Hataway*** *and Lesley Stokes.*—The five species of sea turtle that occur in the Gulf of Mexico and western North Atlantic are all listed as threatened or endangered species. These sea turtles are caught incidentally on baited hooks in longline fisheries and are often injured and occasionally killed. A previous controlled study conducted by the authors with captive reared loggerhead sea turtles (*Caretta caretta*) showed that larger circle hook sizes reduce deep ingestion rates. Studies conducted in the New Zealand snapper fishery showed that hooks with wire appendages reduced the capture rate of undersized fish. Some longline fisheries such as those targeting tunas and mahi mahi (*Coryphaena hippurus*) cannot use large hooks without losing a significant portion of the target catch. Therefore we investigated a hook design to reduce sea turtle takes and injury for use in fisheries which utilize smaller hooks. This experiment was designed to determine if commercial fishing hooks modified with wire appendages would reduce the deep ingestion rate of captive reared loggerhead sea turtles. Twenty captive reared sea turtles were offered baited experimental hooks that were modified to prevent injury. The experiment tested 14/0, 15/0, and 16/0 Mustad circle

hooks modified with a wire appendage from the manufacturer. The interactions were videotaped and a score was given for each interaction as to how deeply the sea turtle took the hook into its mouth. The results showed that deep ingestion rates decreased as hook size increased and likewise deep ingestion rates increased as sea turtle size increased. A comparison was also made between non-appendaged and appendaged hooks of the same size. The appendaged circle hooks did not seem to substantially decrease deep ingestion rates when compared to the standard circle hooks which were evaluated in the previous study.—*US National Marine Fisheries Service, Southeast Fisheries Science Center, P.O. Drawer 1207, Pascagoula, Mississippi 39568. Phone: 228-549-1765, Email: <Bret.d.hataway@noaa.gov>.*

INSIGHTS INTO CATCH-AND-RELEASE SURVIVORSHIP OF COMMON THRESHER SHARKS CAPTURED IN THE SOUTHERN CALIFORNIA RECREATIONAL FISHERY... WILL CIRCLE HOOKS PROMOTE HIGHER SURVIVORSHIP? *by* ***Craig Heberer****, Scott Aalbers, Diego Bernal, and Suzy Kohin.*—The common thresher shark (*Alopias vulpinus*) is the focus of a Southern California recreational fishery that includes a high percentage of animals released after capture. The primary method of capture entails hooking sharks in the tail by trolling heavy lures outfitted with large J-hooks, which often leads to protracted and stressful encounters for both shark and angler. However, an increasing number of anglers are opting to fish with baited circle hooks in an effort to reduce fight times, minimize stress, and increase rates of post-release survival. Angler feedback to date suggests that sharks that are mouth-hooked appear livelier at time of release vs those that are tail-hooked. Funding under NOAA's Bycatch Reduction and Engineering Program (BREP) supported an assessment of the post-capture survivorship of tail-hooked thresher sharks. The assessment techniques utilized pop-up satellite archival tags programmed for 10-d tracking periods. Physiological indicators of capture stress were quantified through blood drawn from sharks captured independently of tagged animals. Survivorship estimates were based on 19 thresher sharks captured from 2007 to 2009. Five mortalities were observed resulting in a post-release mortality estimate of 26%. All mortalities occurred in large individuals (≥180 cm FL) with fight times ≥85 min. Blood stress parameters revealed plasma lactate and hematocrit levels that were significantly elevated with increased fight time. These results suggest that for larger individuals, the current tail capture technique may not be suitable for a catch-and-release based conservation strategy. The BREP project has included an outreach component on best practices, developed in collaboration with industry leaders, to increase catch-and-release survivorship. Additional BREP funding has been secured to assess post-capture survivorship of mouth-hooked sharks using circle hooks. Results from the BREP studies will be used to refine the best practices guidance and formulate, if warranted, appropriate conservation strategies to optimize survivorship and sustainability of thresher shark catch in this recreational fishery.—*US National Marine Fisheries Service, 6010 Hidden Valley Road, Carlsbad, California 92011. Phone: 760-431-9440 ext. 303, Email: <craig.heberer@noaa.gov>.*

EFFECTS OF BOTTOM LONGLINE HOOK TYPE ON CATCH RATE AND SIZE OF SHARKS, GROUPERS, AND SNAPPERS IN THE US WESTERN NORTH ATLANTIC OCEAN *by* ***G Walter Ingram Jr****, Mark Grace, and Terry Henwood.*—In efforts to maintain viable shark populations, the National Marine Fisheries Service (NMFS) Mississippi Laboratories (MSL) instituted fishery-independent longline surveys in 1995 to assess distribution and relative abundance of coastal sharks in the western North Atlantic Ocean and Gulf of Mexico. In 1999, survey objectives were expanded to include red snapper (*Lutjanus campechanus*) and reef fish research priorities. Initially, the monofilament bottom longline gear used during this study included a 1 nmi-long mainline with 100 3/0 J-hooks. To facilitate the aforementioned priority expansion, J-hooks were replaced with 15/0 circle hooks, which was the median hook size used by commercial red snapper fishermen. In 1999 and 2000, five cruises were conducted in the US Gulf of Mexico and US western North Atlantic Ocean using both hook types to determine if there existed a hook effect on catch rates, total length,

and diversity of specimens collected. For this presentation we focused on sharks, groupers, and snappers collected during hook comparison cruises. Only one hook type per longline set was fished for 1 hr at randomly selected stations, and catch per unit effort (CPUE) was defined as catch per 10,000 hook hrs. Due to the zero-inflated and highly skewed nature of the CPUE data, we used a two-group randomization technique to test if there are differences in mean CPUE between specimens captured with different hook types. To test for differences in mean total length per species per hook type, *t*-tests were employed. To compare species diversity between hook types, the diversity of communities captured by each hook type was indexed using the Shannon-Wiener method. Results indicated an increase in mean CPUE and decrease in mean total length for most sharks, groupers, and snappers captured with circle hooks. Also, diversity of catch was higher with circle hooks, but it was not significant.—*US National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratories, Pascagoula, Mississippi 39567. Phone: 228-549-1686, Email: <Walter.Ingram@noaa.gov>.*

UNDERSTANDING FACTORS AFFECTING INTERNATIONAL ADOPTION OF CIRCLE HOOKS: A CASE STUDY OF ECUADOR *by* ***Lekelia D Jenkins****, Patrick Christie, Wallace J Nichols, Nikita Gaibor, Mark Mizrahi, and Michael Viña*.—Since the last major assessment of international transfer of marine technology by the US 40 yrs ago, focus has shifted from exploitative to conservation technologies. Is the persisting technology transfer model effective and appropriate now? International organizations like the Inter-American Tropical Tuna Commission and non-government organizations like World Wildlife Fund have partnered with the US government and organizations in other nations to promote the use of circle hooks in longline fisheries throughout Latin America. This program's sustained effort, especially in Ecuador, has made progress in spite of significant impediments to adoption (e.g., circle hook availability, cost, etc.) In our study we seek to understand why the United States' promotion efforts for conservation technologies yielded better acceptance in some countries than in others. We focus on the lessons learned from the first phase of our research, a socio-cultural study in Ecuador. We applied a triangulated approach by conducting interviews and surveys, and performing qualitative, quantitative, and social network analyses. We interpreted these results within the context of theories on technology transfer, diffusion of innovations, and cross-cultural communication. Our preliminary findings suggest that programs burdened with many restrictions such as the US promotion program for Turtle Excluder Devices can yield a standard program with little flexibility to accommodate cultural and other differences in nations. However, partnerships with other organizations that do not have such restrictions, such as in the circle hook program, allows supplemental initiatives that can be tailored for the specific needs of each countries fisheries. A balance between accountability to rules generated by external governing bodies and freedom to create context appropriate rules appears to result in more rapid technology innovations. In all cases, incentives are needed, and it is important to identify those most effective.—*University of Washington, School of Marine Affairs, 3707 Brooklyn Ave. NE, Seattle, Washington 98105. Phone: 206-685-5675, Email: <kikij@uw.edu>.*

A BARBLESS CIRCLE HOOK PROJECT: TARGETED USE OF BARBLESS CIRCLE HOOKS IN THE HAWAII SHORELINE RECREATIONAL FISHERY *by* ***Kurt E Kawamoto***.—The Pacific Islands Fisheries Science Center Barbless Circle Hook Project, initiated in 2005, was looking for a practical way to reduce the recreational fisherman's impact on Hawaii's protected species. In Hawaii the circle hook is the standard. The barbless circle hook is a modification where the barb is simply crushed leaving a small bump. This costs the fisherman nothing and allows an easy "on the fly" modification while fishing. The resultant hook becomes self-shedding, which provides for a mitigation of additional post-hooking injuries caused by hook retention. This is the main selling point whereby the fisherman's target species, giant trevally (*Caranx ignobilis*), as well as Hawaii's protected species could all benefit.

The project asks fishermen to use the modified hooks when protected species are seen in the immediate fishing area. A crucial supporting observation was made during 2007 when NOAA researchers witnessed a resting monk seal self-shed a barbless circle hook. This incident provided the needed proof of concept that had been asked for. Barbless circle hook use and the resultant catches during tournaments have increased annually to the extent that tournaments have been won by fishermen using barbless circle hooks. Tag and release projects in Hawaii have also gained popularity and benefit from the use of these hooks. The project engages the fishing public at the shoreline fishing tournament with an informational campaign on the barbless advantages by highlighting the catches of anglers and giving away free samples of barbless hooks. Supporting tournament organizers have added a "Barbless Challenge" to their tournaments. The Challenge started out with <20% sign up; however, the average is now in the 40%–50% range for most participating tournaments. Outreach also includes fishing club meetings, science classes and clubs, summer courses, community events, and other shore fishing tournaments across the state.—*US National Marine Fisheries Service, Pacific Islands Fisheries Science Center, 2570 Dole Street, Honolulu, Hawaii 96822-2396. Phone: 808-983-5326, Email: <Kurt.Kawamoto@noaa.gov>.*

A CIRCLE HOOK EVALUATION UTILIZING DATA FROM THE US PELAGIC OBSERVER PROGRAM *by* ***Kenneth F Keene Jr****, Sascha Cushner, and Matthew Walia*.—The effectiveness of hooks has always been an issue of concern within commercial fisheries, mainly by fishermen and more recently managers. In 2004, the National Marine Fisheries Service (NMFS) implemented the mandatory use of circle hooks to aid in the reduction of protected species bycatch within the commercial pelagic longline fishery. The present study compares catch rates and mortality rates for finfish species interaction before and after the mandatory regulation on commercial pelagic longliners. Pelagic Observer Program (POP) data were analyzed 4 yrs before and after the enactment of the circle hook regulation, from 2001 to 2008. Data prior to 2001, before the ban of live baiting, were discarded to avoid any discrepancies with hook type and bait type correlations. The comparison of circle vs J-hook data show that there is indeed a noticeable reduction in bycatch mortality during finfish interactions while catch rates of marketable species remain constant after the circle hook became mandatory for the industry. While the use of circle hooks alone is not responsible for the reduction in incidental take interaction and/or mortality, it cannot be ignored that their use is an integral management tool for increasing the fishery's sustainability.—*US National Marine Fisheries Service, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, Florida 33149. Phone: 305-361-4275, Email: <Kenneth.Keene@noaa.gov>.*

THE USE OF UNDERWATER VIDEO SURVEILLANCE TO INVESTIGATE FACTORS AFFECTING THE LONGLINE CATCHABILITY OF THREE SHARK SPECIES ON 16/0 CIRCLE HOOKS *by* ***Steven T Kessel****, Mark Bond, Samuel H Gruber, and Nigel E Hussey.*—Many factors can influence longline catch per unit effort (CPUE); however, the specific influence of individual factors are often poorly understood, making them difficult to quantifiably account for in CPUE based analysis. With fishing gear that requires self-hooking, such as longlines, manipulation of the baited hook by the target species can influence hooking success and, therefore, CPUE. Additionally, the presence of multiple individuals in the target area may lead to the alteration of feeding behavior, and bait manipulation, as the result of increased resource competition. In this study, underwater video surveillance technology of a mock section of longline was used to assess the influence of interspecies variations on shark catchability. Three species produced multiple replicates: the lemon shark (*Negaprion brevirostris*), the blacktip shark (*Carcharhinus limbatus*), and the nurse shark (*Ginglymostoma cirratum*). For each species, the proportion of bite attempts that resulted in a successful hooking was calculated. The proportion of bite attempts resulting in a successful hooking with and without multiple shark presence was then compared. From bite attempts, all three species also showed an extremely similar proportion of successful hooking. Results indicated that all three species had a similar chance

of becoming successfully hooked as the result of a bite attempt. Multiple shark presence significantly altered behavior toward the longline gear; for lemon sharks bite attempts were significantly increased and blacktip shark hooking success was significantly increased, whereas nurse sharks displayed no apparent behavioral alterations. The results of this study indicate that shark longline catchability is influenced by multiple shark presence, resulting in greater susceptibility for species that naturally exhibit group behavior.—*Bimini Biological Field Station & Department of Biosciences, Cardiff University, Cardiff, Wales CF10 3XQ UK. Phone: 44-0-2920-874000, Email: <KesselST@cardiff.ac.uk>.*

FACTORS AFFECTING SURFACE LONGLINE SELECTIVITY: INVESTIGATIONS CONDUCTED BY THE SPANISH INSTITUTE OF OCEANOGRAPHY *by* ***David Macías****, S García, JM de la Serna, J Ortiz de Urbina, J Ariz, A Delgado de Molina, L Ramos, J Mejuto, B García-Cortés, A Ramos-Cartelle.*—We report the results of field studies involving circle hooks conducted by the Spanish Institute of Oceanography from 2004 up to present in several oceans. For the Atlantic, we tested 18/0-10° offset semicircular (SG) hooks, 17/0-8° offset circle hooks, and 16/0-10° offset J-hooks, and mackerel and squid baits in five zones of the North and South Atlantic Ocean. Standardized log normal catch per unit effort (CPUE) estimates showed that the factor area was the most important for explaining the variability in the CPUE for all the species. Hook type was only significant in the case of billfishes, while bait type proved to be significant for shortfin mako and a sea turtle catches (*Caretta caretta*). In addition, using squid instead of mackerel resulted in a considerable increase in the number of sea turtles being hooked. In the Pacific Ocean, we tested 16/0-10° offset J-hooks, 17/0-8° offset circle hooks, and 17/0-0° offset circle hooks, and mackerel and squid baits on two surface longline vessels targeting swordfish in areas of the southeastern Pacific Ocean. Using circle hooks instead of conventional J-hooks led to reductions in swordfish catch rates of approximately 23.1%, while moderate to significant increases were observed for shortfin mako and billfishes. In the southwestern Indian Ocean, in the framework of a survey targeting tropical tuna with surface longlines, we tested 16/0 J-hooks, 18/0 circle hooks, and 18/0 SG-hooks, and mackerel and squid baits. Sharks, swordfish-like species, and tuna made up the bulk of the catch. For sharks, highest nominal catch rates were related to circle hooks. Swordfish and tuna species highest nominal catch rates were related to bait type, and independent of the hook type being used. In the Mediterranean, in the framework of a survey aimed to investigate juvenile swordfish mitigation measures by surface longliners, we tested various circle hook and J-hook sizes and offset. In general, highest swordfish nominal catch rates were related to bait type rather than hook type.—*Spanish Institute of Oceanography. Email: <david.macias@ma.ieo.es>.*

REDUCING SEA TURTLE BYCATCH AND IMPROVING THE MANAGEMENT OF THE ECUADORIAN ARTISANAL FISHERIES USING SURFACE LONGLINE GEAR *by* ***Jimmy Martínez****, Liliana Rendón, Manuel Parrales, Jorge Villavicencio, José López, Takahisa Mituhasi, Yoshiro Hara, Guillermo Morán, Luis Torres, Moises Mug, Sandra Andraka, Maite Pons, and Pablo Guerrero.*—In Ecuador, the artisanal fishery sector targets large pelagics, demersal fishes, sharks, and rays, species that annually account for 70%, 8.5%, 21%, and 0.5% of the catch, respectively. The surface longline fishery catches large pelagics and sharks in two well-defined fisheries during the year: the mahi mahi (*Coryphaena hippurus*), from November to March, for which fishermen use surface longlines with up to 800 hooks, and the fishery for tunas, billfishes, and sharks (TBS), from March to October, using surface longlines with up to 250 hooks. The fishing strategy includes the use of fiberglass small boats and mother vessels working individually and collectively. The fishing area covers a large extension of the eastern Pacific Ocean between latitudes 04°00´N and 12°00´S and in or around longitude 094°W. Since 2004, a scientific program has been implemented that tests the use of circle hooks under real fishing conditions and monitors its effectiveness through an onboard observer program. This program also provides technicians and fishermen specialized training on best practices

and proper handling of sea turtles that are caught incidentally. Results show that in the TBS fishery, catch rates (per 1000 hooks) of sea turtles on 16/0 circle hooks are reduced by 60% compared to the J-hooks, while for the same fishery, the catch rate of target species, using 16/0 circle hooks, is similar to or greater than with J-hooks. For the mahi mahi fishery, the target species catch rate using circle hooks is lower than with J-hooks, especially for individuals <80 cm, while the hooking of sea turtles using 14/0 and 15/0 circle hooks shows a considerable reduction. Thus far, 4560 fishermen have received specialized training in 130 workshops. A total of 204 fishing boats use circle hooks almost exclusively in their operations. This program is part of a broader and more ambitious strategy of improving the management of fisheries involving the government of Ecuador and strategic partners.—*Subsecretaria de Recursos Pesqueros, Avenida 4 y calle 12, Manta, Ecuador. Phone: 593-52-611-410, Email: <jimmy.martinez@pesca.gob.ec>.*

EFFECTS OF HOOK DESIGN ON CATCH RATE AND DISCARD MORTALITY IN THE COMMERCIAL REEF FISH VERTICAL LINE FISHERY OPERATING IN THE SOUTHEASTERN USA *by* ***Kevin McCarthy*** *and Elizabeth Scott-Denton*.—Two hook designs (circle hooks and J-hooks) both with and without offsets were assessed for differences in catch rate and discard mortality using commercial vertical line fishery observer data. The commercial vertical line fishery in the southeastern US primarily targets shallow-water grouper and snapper species. Observer data from the fishery were available beginning in July 2006 and included 10,513 sets (fishing at a specific location, gear repeatedly deployed) sampled during 312 vertical line trips with a total of 122,615 fish of 219 taxa observed. Effort data (7242 hrs; 223,262 hooks) were available for 10,430 sets. The majority of observed effort (70%), based on hook hours, occurred in the western Gulf of Mexico. The primary hook types used were circle hooks (75.6%) and J-hooks (24.4%). Offset hooks were observed on 3059 sets (29%) while hooks with no offset were observed on 7505 sets (71%). Hook size ranged from 1/0 to 18/0 with 8/0 deployed most often (31%). Vermilion snapper, *Rhomboplites aurorubens,* red snapper, *Lutjanus campechanus,* and red grouper, *Epinephelus morio,* comprised 70% of the catch. Based on surface observations of discarded under-sized target and unwanted species (29,319 fish), the majority (78%) of discarded fish were released alive; 30% had visual signs of stress (air bladder expansion/and or eyes protruding); and the condition of 3% was not determined. Minimum assumed mortality (immediate) of discards was 19%. Circle hook catch rate (all species combined) was significantly lower than J-hook catch rate. Offset hooks had significantly higher catch rates than non-offset hooks. Higher percentages of dead discards (all species combined) were observed for fish caught with circle hooks and hooks without offsets than with J-hooks and hooks with offsets. Differences in discard mortality were evident across all observed fishing depths. There were species-specific differences in catch rates and discard mortality between hook designs.—*US National Marine Fisheries Service, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, Florida 33149. Phone: 305-361-4492, Email: <Kevin.J.McCarthy@noaa.gov>.*

CIRCLE HOOKS AND SEA TURTLE INGESTION RATES IN THE FISHERIES OF PANAMA *by* ***Lucas R Pacheco*** *and Maite Pons*.—Through hook exchange, the sea turtle bycatch reduction program has tested circle hooks of different sizes, shapes, and materials in the tropical eastern Pacific region. In Panama, the program started in 2005; by implementing an observer program, it has been possible to test different arrangements of J-hooks vs circle hooks and circle hooks vs circle hooks on experimental fishing lines in the surface and bottom longline fisheries operating off Panamian Pacific waters. Observers were accepted after voluntary enrollment and assigned to national longline fishing boats targeting tunas (*Thunnus albacares*), mahi mahi (*Coryphaena hippurus*), and demersal fish species such as snappers (Lutjanidae), groupers (Serranidae), and sharks. From 2005 to 2009, 540 out of 1161 sets used 16/0 circle hooks. No ingestion of circle hooks (size 16/0) by sea turtles was observed, representing a highly desirable situation given that fatal injuries can result from this kind of

hooking. The substitution of J-hooks with circle hooks was highly accepted in fishers targeting tuna and sharks. However, fishers targeting mahi mahi were skeptical of the change from 14/0 to 16/0. From 2005 to 2009, sea turtle ingestion rates (per 100 hooks) varied between 0.16 and 2.18 for J-hooks and between 0 and 1.3 for 14/0 circle hooks. It is recommended to use 16/0 circle hooks or larger to maximize the reduction of sea turtle ingestions rates in the Panamanian longline fishery. It is important to note that Executive Order No. 486 regulates longline fisheries in Panamanian waters allowing only the use of longline gears by artisanal vessels smaller than 6 gross register tons since 28th December, 2010.—*World Wildlife Fund, Oficina de Panamá, Ciudad Del Saber, Clayton, Edificio 235, Primer Piso, Apartado Postal 0843-01773, Balboa, Ancón, Panama. Email: <lpacheco@wwf.org.co>.*

COMPARISON OF HOOK TYPE AND CAPTURE HISTORY AND THEIR INFLUENCES ON RECAPTURES OF GREATER AMBERJACK, *SERIOLA DUMERILI*, IN THE GULF OF MEXICO ***by Daryl C Parkyn*** *and Debra J Murie.*—Greater amberjack movements were assessed through a tag and recapture study in the Gulf of Mexico. Physical characteristics of capture were quantified and used to examine contributions to hooking mortality. As part of this study, captures of greater amberjack with circle hooks and J-hooks were compared. Recapture rates of greater amberjack caught on circle hooks were double the recapture rate of greater amberjack caught on J-hooks (15.9% vs 8.2%). Greater amberjack caught on treble hooks have yet to be recaptured. The majority of circle hook and J-hook captures were in the corner of the mouth. However, proportionally more fish caught on J-hooks were hooked in the roof of the mouth. Differences in hooking location, as well as other factors such as depth, water temperature, fight time, hooking location, and ascent rate are included in the assessment of factors contributing to greater amberjack recapture rates.—*Program of Fisheries and Aquatic Sciences, School of Forest Resources and Conservation, University of Florida, 7922 NW 71 Street, Gainesville, Florida 32653. Phone: 352-273-3619, Email: <dparkyn@ufl.edu>.*

SOCIOECONOMIC VALUATION OF THE EFFECTS OF SWITCHING TO CIRCLE HOOKS *by* ***Larry Perruso****, Juan Agar, Scott Crosson, Christopher Liese, and Brent Stoffle.*—A number of studies have investigated the biological effects associated with the use of circle hooks in recreational and commercial fisheries; however, research concerning the socioeconomic assessment of these effects is extremely limited. The hypothesized biological benefits of adopting circle hooks include lower mortality rates of bycatch and protected species in commercial fisheries, lower mortality rates in recreational catch-and-release fisheries, improved fish abundance, and enhanced quality of landed commercial species. This study provides a conceptual overview of the anticipated social and economic consequences of circle hook usage and discusses the appropriate analytical methods and data needs required to conduct sound empirical analyses. We also consider the use of ethnographic methods to measure societal perceptions and explores issues related to administration such as enforcement and education.—*US National Marine Fisheries Service, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, Florida 33149. Phone: 305-361-4278, Email: <Larry.Perruso@noaa.gov>.*

TESTS OF RINGED CIRCLE HOOKS IN AN ITALIAN LONGLINE SWORDFISH FISHERY *by* ***Susanna Piovano****, Yonat Swimmer, and Cristina Giacoma*.—Our previous studies showed that use of relatively large circle hooks were effective in reducing the bycatch of loggerhead sea turtles and pelagic stingrays in an Italian longline swordfish fishery. In this study, we investigated potential differences in capture rates on circle hooks with and without a ring. We performed a total of 53 sets with two Italian longline commercial fishing vessels targeting swordfish. The design of the experimental gear was such that only a portion of the gear was experimental, while the remaining part enabled fishermen to fish using traditional methods. During the experimental portion of the set, we compared 16/0 circle hooks with and without a ring that alternated along the length of the mainline for a total of 600 consecutive hooks. The remaining hooks were J-hooks or smaller circle hooks, as selected by the fishermen, for a mean total of 1160 hooks per set, yet this portion of the set was excluded from our analysis. Fishing operations were monitored by onboard observers. Our analysis compared capture

rates of all species on circle hooks only. In summary, circle hooks captured a total of 218 individuals, representing five species. The target species, swordfish (*Xiphias gladius*), comprised 95% of total captures. No sea turtles were captured on circle hooks. Swordfish capture rates on both circle hooks were of a similar magnitude, irrespective of the presence or absence of the ring. When comparing capture rates of bycatch species such as blue shark (*Prionace glauca*), pelagic stingray (*Pteroplatytrigon violacea*), and ocean sunfish (*Mola mola*), circle hooks caught fewer than traditional J-hooks, reinforcing earlier findings on positive effects of circle hooks on bycatch species. We will continue these experiments during summer 2011 to increase the number of sets to enable more robust comparisons.—*Università di Torino, Dip. Biologia Animale e dell'Uomo, Via Accademia Albertina 13, 10123, Torino, Italy. Phone: 39-011-6704574, Email: <susanna.piovano@unito.it>, <piovanosusanna@yahoo.it>.*

PROMOTING THE USE OF CIRCLE HOOKS TO FLORIDA'S RECREATIONAL SALTWATER ANGLERS *by* ***Aaron Podey*** *and Rich Abrams.*—The Florida Fish and Wildlife Conservation Commission has been promoting the use of circle hooks as part of its ethical angling message for over a decade. Anglers are engaged in various ways through many different programs. Some of the programs used to promote circle hooks are Ladys, Let's Go Fishing, Kid's Fishing Clinics, and dockside intercepts as well as at outdoors shows, meetings of fishing clubs, and fishing tournaments. During many of these interactions the anglers are questioned about their knowledge and use of circle hooks, educated about the benefits of circle hooks, and receive educational brochures. Additionally, anglers are given free samples of circle hooks and instructed on how to successfully use them. Explanations of how the use of circle hooks are promoted in each of these programs and summaries of angler survey responses and feedback are included.—*Florida Fish and Wildlife Conservation Commission, Division of Marine Fisheries Management, 2590 Executive Center Circle E, Suite 201, Tallahassee, Florida 32301. Phone: 850-487-0580 ext. 211, Email: <aaron.podey@myfwc.com>.*

USING CIRCLE HOOKS TO MITIGATE SEA TURTLE MORTALITY IN A TUNA-DIRECTED LONGLINE FISHERY: THE SEAFDEC INITIATIVE IN THE BAY OF BENGAL AND ANDAMAN SEA *by* ***Sayan Promjinda****, Somboon Siriraksophon, Naruepon Darumas, and Pitak Jaidee.*—The efficiency of circle hooks and Japanese tuna hooks in tuna-directed longline fisheries was evaluated in the Bay of Bengal and Andaman Sea (Indian Ocean). Thirteen fishing trails were conducted during November and December 2007 in three areas designated as A, B, and C. Area A fell within latitude 16°N–19°N and longitude 88°E–91°E (five stations); Area B fell within latitude 9°N–14°N and longitude 82°E–85°E (four stations); and Area C fell within latitude 10°N–12°N and longitude 95°E–97°E (four stations). The objective of the experiment was to investigate the catch efficiency of 18/0 10°-offset circle hooks in comparison with the No. 32 Japanese tuna hooks as well as to investigate hooking position. Total number of hooks deployed was 6277 hooks. Temperature-depth sensors indicated that fishing depth ranged from 40 to 300 m. Target catch composition of circle hook and Japanese tuna hooks was 18.18% and 16.58%, respectively. Focusing on bycatch species, the fish composition on J-hooks was higher than circle hooks (45.45% and 20.78%, respectively). The difference in the percentage of composition of catch and bycatch of circle hooks is less than that of the J-hooks. With circle hooks, about 73% of fishes caught were hooked in the mouth and only 10% were ingested. With J-hooks about 38% of hooks were ingested. We conclude that sea turtle mortality risk can be mitigated by utilizing circle hooks in this tuna longline fishery; however, the selectivity of different sizes of circle hook should be further examined.—*Southeast Asian Fisheries Development Center, Training Department, P.O. Box 97, Phrasamutchedi, Samutprakarn 10290, Thailand. Email: <sayan@seafdec.org>.*

SEA TURTLE BYCATCH REDUCTION PROGRAM IN THE EASTERN PACIFIC: AN AWARENESS AND EDUCATION STRATEGY FOR FISHERS IN ECUADOR *by* ***Liliana Rendón****, Manuel Parrales, José López, Jorge Villavicencio, Takahisa Mituhasi, Yoshiro Hara, Luis Torres, Guillermo Morán, Pablo Guerrero, Moisés Mug, Sandra Andraka, and Martin Hall.*—The sea turtle bycatch reduction program in Ecuadorian artisanal longline fisheries was established to: (1) work together with fishers on the mitigation of bycatch informing them of

the importance of saving the unintentionally-captured sea turtles during fishing operations, (2) conduct experiments with alternating circle hooks and J-hooks (traditionally used by the longline fleet), and (3) compile information on longline fisheries and sea-turtle bycatch via onboard observers. Fishers' active participation has been fundamental to understanding their perception of conservation problems and benefitting from their experience in identifying and testing possible solutions. Circle hooks were unknown in the region, and their adoption required convincing the fishers to try them, solving some logistic challenges such as the storage of these hooks on the boats, fishers learning to rapidly bait the hooks, etc. Using a cooperative approach, we found solutions to the problems of adoption, and the tests have been successful in most fisheries. In this way, a communication and cooperation link with these key stakeholders has been established. Awareness and education of fishers has been achieved through workshops and personal communication with boat owners, captains, and crew members. From September 2003 to November 2010, more than 130 workshops have been carried out with the participation of 4560 fishers in 22 fishing centers. The body of work highlights the need to produce local evidence of the effectiveness of the hooks to gain adoption. Leaders from the fishing communities have acted as facilitators and proved crucial to dissemination of the program to fishing communities. Workshops have helped to raise awareness of the importance of conservation and implementing good fishing practices through the voluntary adoption of circle hooks, dehooker devices, and techniques to manipulate and release sea turtles in situ (i.e., onboard fishing boats). Workshops have served to strengthen the relationship with the fisheries sector, which we hope will lead to reduced sea turtle mortality and more sustainable fisheries.—*Programa de Reducción de Captura Incidental de Tortugas, Marinas, WWF_CIAT-SRP_ EPESPO, Calle 34 Ave. Flavio Reyes, Manta, Manabí, Ecuador. Phone: 593-052622-545, Email: <lilianarendonm@hotmail.com>.*

A COMPARISON BETWEEN CIRCLE HOOK AND J-HOOK PERFORMANCE IN THE DOLPHINFISH, YELLOWFIN TUNA, AND WAHOO BLUEWATER TROLL FISHERY OFF NORTH CAROLINA *by* ***Paul J Rudershausen****, Jeffrey A Buckel, Randy Gregory, Tyler Averett, Greg Bolton, and Paul Conn*.—Circle hook regulations in bluewater troll fisheries were developed for billfish conservation. However, anglers often target other species in this fishery that are desirable to retain as catch, including dolphinfish, yellowfin tuna, and wahoo. We know little about the relative effectiveness of hook types for these species. We determined the catch rate of ballyhoo-rigged circle hooks and J-hooks trolled simultaneously on 39 recreational and 36 charter trips. Each trip targeted one of the following species (with associated leader type): dolphinfish (monofilament), yellowfin tuna (fluorocarbon), and wahoo (wire). Mechanisms that might explain differences in catch rate between hook types included number of strikes, proportion hooked-up if struck, and proportion caught if hooked. We examined the effects of hook type, leader type, species, user group, and wave height on catch rate and the mechanistic response variables using generalized linear models (GLMs). For directed trips, the catch rate of dolphinfish was higher on J-hooks than circle hooks for both recreational and charter groups. The bulk of yellowfin tuna and wahoo data were collected on charter trips; for yellowfin tuna, the catch rate on J-hooks was higher than circle hooks, but this hook effect was not observed for wahoo. At the strike level, we found no evidence of a hook effect, suggesting that baits rigged with these hooks were equally attractive to these three predators. However, there was evidence, especially for dolphinfish and yellowfin tuna, for greater hookup rates on J-hooks than circle hooks. Once hooked, retention was similar between hook types for dolphinfish and yellowfin tuna, but was slightly higher with circle hooks for wahoo. In summary, J-hooks were more effective than circle hooks at the hookup level and result in greater numbers of troll-caught dolphinfish and yellowfin tuna. Our results should be considered when developing hook-type regulations for bluewater fisheries.—*Center for Marine Science and Technology, North Carolina State University, 303 College Circle, Morehead City, North Carolina 28557. Phone: 252-222-6342, Email: <pjruders@unity.ncsu.edu>.*

CIRCLE HOOK TESTING IN THE SOUTHWEST MEDITERRANEAN SEA *by* ***Ricardo Sagarminaga****, Yonat Swimmer, and Maria Luz Parga*.—The southwestern Mediterranean Sea has been highlighted as one of the world's sea turtle bycatch "hot-spots" with estimates of over 20,000 loggerhead sea turtles (*Caretta caretta*) per year, primarily caught by the Spanish pelagic longline fleet. The affected fishery is composed of a fleet of around 100 vessels, ranging in size from 15 to 25 m. The fishery targets swordfish, albacore, and bluefin tuna. Longlines for albacore tuna and swordfish are set very shallow and have catch rates of up to 4 and 2 sea turtles per thousand hooks, respectively. Satellite tracking of sea turtles and surveys have highlighted that loggerhead sea turtles aggregate in great numbers in the southwestern Mediterranean, spending several years foraging in waters which they share as foraging and breeding grounds for tunas. Since 2005, Alnitak and US National Marine Fisheries Service, Pacific Islands Fisheries Science Center (NMFS) have conducted a series of experiments to test bycatch mitigation measures such as mackerel bait and varying fishing depth, hook type, and hook size. In 2007, 12/0 circle hooks were tested against the fleet's standard Mustad #3 J-hook in the albacore tuna fishery. No significant differences in catch of sea turtles or target species between circle hooks and control J-hooks were found in this preliminary data set. In 2011, NMFS and KAI marine services will test 16/0 circle hooks in the southwestern Mediterranean swordfish fishery that traditionally uses Mustad #1 J-hooks. In addition to the analysis of catch rate for different hooks, Alnitak and NMFS collaborated with veterinarians of Submon to conduct diverse studies on severity of hooking injury and survival rate to provide Spanish fishing authorities and fishers with recommendations for regulating the handling and release of bycatch to increase probability of sea turtle post-release survival. During the 12/0 circle hook experimental campaign, a comparative study of severity of lesions highlighted the advantages of circle hooks both for increasing the probabilities of survival of released sea turtles and other bycatch species including undersized bluefin tuna. Results of this program are used by KAI to provide recommendations to relevant Spanish administrations and the European Council through the advisory body of the International Council for the Exploration of the Sea. In addition, the scientific results are presented in annual capacity development workshops for the affected fishing fleets.—*Alnitak C/. Nalon,16, 28240 HOYO DE MANZANARES, Madrid, Spain. Email: <ric@kaimarineservices.com>.*

EFFICIENCY OF CIRCLES HOOKS ON LONGLINES USED IN THE ARTISANAL FLEET IN THE AREA OF PUERTO ANGEL, OAXACA, MEXICO *by* ***Saúl Sarmiento-Náfate****, H Santana-Hernández, Jesús Villalobos-Toledo, José Alfredo Agustín-Jiménez, Cudberto Pineda-García, Saúl Sarmiento-Ordoñez, David Ortega del Valle, Arturo Flores Rivera, Alejandra Zorrilla Domínguez, Sansón Audelo Ramos, Said Audelo Ruschke.*—The artisanal longline fishery operating from Puerto Angel, Oaxaca, Mexico, is described, which traditionally operated with J2 type hooks to capture pelagic organisms. To evaluate the fish catch efficiency and sea turtle bycatch, an experimental design was implemented, specifically to determine efficiency of J2 hooks and C15/0 and C16/0 circle hooks. Fishing areas were established between 37 km (20 nmi) and 46 km (25 nmi) from the coast. Catch records were analyzed to reveal catch composition with different hooks based on monthly sampling carried out from May 2008 to June 2009. Using live bigeye scad (*Selar crumenophtalmus*) as bait, 47 longline sets were deployed in commercial fishing operations where about 670 hooks (each) of type J2, C15/0, C16/0 were tested. Captured species were: two shark species scalloped hammerhead (*Sphyrna lewini*) and silky shark (*Carcharhinus falciformis*), black skipjack tuna (*Euthynnus lineatus*), sailfish (*Istiophorus platypterus*), dolphinfish (*Coryphaena hippurus*), yellowfin tuna (*Thunnus albacares*), and pelagic stingray (*Pteroplatytrygon violacea*). The numerically dominant species were: dolphinfish, sailfish, and the silky shark (*Carcharinus falciformis*). Statistical analyses indicated that there was no significant difference regarding commercial catch among the three hook types. However, circle hook impacts on sea turtles were minor compared to that associated with J-hooks. In terms of comparison between C15/0

and C16/0 hooks, both types could be used in fishing activities along the coast of Puerto Angel, Oaxaca. It is worth noting that the type of hook with best acceptance among the longline artisanal fleets was C15/0; therefore, we suggest its use should hook type and size be regulated in the future.—*National Fisheries Institute, CRIP-SCO, INAPESCA, Prol. Ote. Playa Abierta s/n, Salina Cruz, Oaxaca 70600, México. Phone: 01-971-714-5-003, Email: <saul.sarmiento@inapesca.sagarpa.gob.mx>.*

ECOSYSTEM EFFECTS OF CIRCLE HOOKS AND J-HOOKS *by* ***Christopher R Sasso***.—Experimental fishery-dependent data were used to assess the ecosystem impacts of circle hooks vs J-hooks on target and non-target species. Canonical Correspondence Analysis was used to determine the relationship of species to hook type and environmental variables. In addition, comparisons of species diversity between hook type were assessed to examine patterns of ecosystem impacts. Data on hooks fished per type were used with species catch information to generate "species area curves" as another method to assess ecosystem impacts.—*US National Marine Fisheries Service, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, Florida 33149. Phone: 305-361-4279, Email: <Chris.Sasso@noaa.gov>.*

HOOKING OUTCOMES FOR CIRCLE HOOKS COMPARED TO CONVENTIONAL HOOKS FISHED ACTIVELY AND PASSIVELY FOR WILD TROUT IN SIX IDAHO STREAMS: SOME UNEXPECTED RESULTS *by Kevin A Meyer, Chris Sullivan, Steve Elle, and* ***Dan Schill***.—We compared hooking and landing success along with hooking mortality for trout caught with barbed baited circle hooks to other common hook types. In one trial, 300 wild trout were caught, marked, and released for 69 d. Deep-hooking rate was higher for baited J-hooks (21%) than for spinners (5%), baited circle hooks (4%), and dry flies (1%). Mortality rates for trout captured with baited J-hooks (25%) and treble hook spinners (29%) were significantly higher than for trout captured with baited circle hooks (7%) and dry flies (4%). In a second bait-fishing trial in the same stream (n = 604), hooking success was 16%–23% lower for circle hooks (fished passively or actively) than all other hook types except passively-fished J-hooks. Once hooked, landing success was high for all hook types, but was lowest for passively-fished hooks. For circle hooks, deep-hooking was over two times greater when the angler set the hook passively compared to actively setting the hook, a finding that conflicts with manufacturer recommendations. To confirm the above results, we evaluated the same outcomes for various hook types for wild trout caught in five additional Idaho streams. Hooking success was always higher for actively fished hooks than passively fished hooks of the same type. Landing success ranged from 76%–86% and did not differ significantly between hook type or angling method. The deep-hooking rate of passively fished circle hooks was again twice as high as actively fished circle hooks. Our results on six different trout streams calls into question conventional recommendations that fishing passively reduces deep-hooking with circle hooks. In the case of circle hooks likely destined for salmonid fisheries, we encourage manufacturers drop this recommendation and support investigation of the best fishing method for circle hooks in freshwater recreational fisheries until a wider assessment can be made.—*Idaho Department of Fish and Game, Nampa Research Office, 1414 E. Locust Lane, Nampa, Idaho 83686. Phone: 208-287-2777, Email: <dan.schill@idfg.idaho.gov>.*

PRELIMINARY RESULTS OF EXPERIMENTS WITH CIRCLE HOOKS SIZE C15/0, C16/0, AND C18/0 VS J-HOOKS IN THE LONGLINE FISHERY IN COSTA RICA *by* ***Álvaro Segura,*** *Moises Mug, Sandra Andraka, Maite Pons, and Antonio Porras.*—We describe the longline fleet of Costa Rica in which the experiments were performed; the data were collected between 2005 and 2010 by trained observers aboard commercial fishing vessels. Over this time period, 237 fishing trips were conducted with 2215 sets. We worked with 82 boats and a 1,046,248 hooks were used to test the hypothesis that 16/0, 15/0, and 18/0 circle hooks catch fewer sea turtles than J-hooks, but do not reduce the catch of target species. Results are expressed as catch per unit of effort (CPUE) for fish and sea turtles in the fishery targeting

mahi mahi (*Coryphaena hippurus*) and in the fishery targeting tunas, billfishes, and sharks (TBS). Hooking injury rates (serious vs minor) associated with the two hook types are also presented. We conclude that the use of 16/0 and 15/0 circle hooks reduced incidences of sea turtle capture, but not significantly, while having negligible impact on the catch of target fish in the mahi mahi fishery. The data also show that these circle hooks result in a lower rate of "serious" hook injuries (hooks that are swallowed or embedded in the upper jaw or glottis). The trials with 18/0 circle hooks in the TBS fishery show that this hook does not reduce the catch of target species and presents very low rates of sea turtle bycatch. We recommend the mandatory use of 15/0 or 16/0 circle hooks in the Costa Rican mahi mahi fishery, the fishery with highest CPUE of sea turtles in this country. We also recommend the use of 18/0 circle hooks in the TBS fishery. Finally, vessel crews should be trained in the handling of hooked sea turtles and the use of dehookers, sea turtle mouth openers, dipnets, and line and hook cutters should be mandatory on longline fishing vessels targeting mahi mahi and TBS.—*World Wildlife Fund, Oficina de Costa Rica, P.O. Box 629-2350, San Francisco de Dos Ríos, San José, Costa Rica. Phone: 506-2234-8434, Email: <asegura@wwfca.org>.*

CIRCLE HOOKS: A TECHNICAL PERSPECTIVE *by* ***Geir Sivertzen (Dr Hook)***.—A hook is defined by variations of bent metal, one sharp end, and one end suitable for attaching a line. All parameters are possible to describe, although manufacturers and users very often have a different focus. The dimension/size of a hook is determined by the gap of the hook. For a J-hook, this is very simple. For variations of curved hooks, this is somewhat more challenging. For circle hooks, sizing is even more difficult and the standards vary from one manufacturer to another. The critical part is not the size of a given hook, but he actual dimension one decides to measure. Devices for catching fish developed up to today's fish hooks have historically been found in very many cultures. Materials have changed, while now steel is used almost exclusively. While J-hooks are designed for hooking and holding the fish, whether in the gut hooking or the mouth, circle hooks are designed to grip the corner of the fish's mouth. Whether carbon steel or stainless steel is used for the hook, the most reliable test of the strength is the pulling test, whereby force is added until the hook straightens-out 90°. Here I explain the various parameters focused on by the designers and manufacturers of hooks. Comparing hooks, it is important to be aware of these and to compare "apples to apples." The critical parameters that make a hook a true circle hook need to be in place. Hook research most often apply modifications to existing products. At the world's biggest hook manufacturer alone, more than 150,000 different hook models have been produced over the years. This also means that most possible ways of bending a piece of metal have been attempted. For the future, new materials will be the key factor. Composite materials, molding of hooks, and thinner and stronger materials are probably what we will see.—*Bakkestumpen 3, 2816 Gjovik, Norway. Phone: 47-91-77-90-24, Email: <geirsivertzen@yahoo.no>.*

PERFORMANCE OF J-HOOKS AND CIRCLE HOOKS DURING RECREATIONAL HOOK-AND-LINE FISHING: OFFSET AND NON-OFFSET COMPARISONS *by* ***Derke JG Snodgrass****, Eric S Orbesen, Joseph E Serafy.*—With a focus on gray snapper, *Lutjanus griseus,* and pinfish, *Lagodon rhomboides,* we examine the relative performance of four hook-offset combinations: (1) J-hooks with no offset, (2) J-hooks with 10° offset, (3) circle hooks with no offset, and (4) circle hooks with 10° offset. Fishing trials were conducted in subtropical marine waters using standard hook-and-line gear and tackle. Hook performance was defined in terms of catch rate, anatomical hooking location, and bleeding occurrence and data analysis consisted of a series of chi-square tests. Finally, all four hook-offset combinations are quantitatively compared and discussed from the standpoint of those that are most likely to maximize post-release survival and, if adopted, lead to a more sustainable recreational fishery.—*Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, Florida 33149. Phone: 305-361-4236, Email: <Derke.Snodgrass@noaa.gov>.*

A COMPARISON OF CATCH RATE BETWEEN CIRCLE HOOKS AND RING HOOKS USING PELAGIC LONGLINE GEAR *by* ***Liming Song*** *and Weiyun Xu.*—Abstract removed at authors' request.—*College of Marine Sciences, Shanghai, Ocean University, College of Marine Sciences, Shanghai Ocean University, 999 Huchenghuan Road, Lingangxincheng Shanghai 201306, China. Email: <lmsong@shou.edu.cn>.*

PERCEIVED EFFECTIVENESS OF CIRCLE HOOKS: AN EXAMINATION OF US COMMERCIAL AND RECREATIONAL FISHERS *by* ***Brent Stoffle****, Stewart Allen, Derke Snodgrass, Eric Orbesen, Scott Crosson, Larry Perruso, and Joseph Contillo.*—Circle hook use has increased over the last 10 yrs. It has been lauded as a strategy that reduces bycatch and fish mortality, thus increasing the quality of the fish landed. In some fisheries, the switch to circle hooks is mandatory for participation in fishing, while in other fisheries the selection of circle hooks is left to the discretion of the individual fishers. This paper is based on the use of ethnographic methods, which were used to ascertain the perceived level of effectiveness and utility of circle hooks across fishing sectors (commercial and recreational, including the for-hire industry), and across fisheries (longline, trolling, bandit gear, and traditional hook-and-line). In previous studies, fishermen had the opportunity to express their ideas and concerns regarding the use of circle hooks, focusing on assertions that circle hooks were being selected for use because of the biological benefits for the fisheries and the effectiveness in catching fish. In these previous studies, key informants from Hawaii, Florida, New Jersey, North Carolina, and the US Virgin Islands were contacted. From these interactions qualitative information was collected and is now being analyzed to assist policy makers in their understanding of the perceived effectiveness of circle hooks and whether there is any social or economic cost or benefit associated with usage.—*US National Marine Fisheries Service, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, Florida, 33149. Phone: 305-361-5761, Email: <Brent.Stoffle@noaa.gov>.*

EFFECTS OF SMART™ CIRCLE HOOKS ON SHARK FEEDING BEHAVIOR AND CATCH RATE *by* ***Eric M Stroud****, Patrick H Rice, and Craig P O'Connell.*—A selectively-repellent circle hook to reduce shark bycatch has recently been tested and commercialized. Termed the SMART™ (Selective Magnetic And Repellent-Treated) hook, the product is comprised of two validated shark repellent technologies (SharkDefense Technologies, LLC) applied to a carbon steel circle hooks. The result is a circle hook capable of producing both induced and galvanic electric currents in seawater without the use of external power supplies. A software-based magnetic flux model of a SMART circle hook was created and validated using Lakeshore Model 420 and 421 gaussmeters. The corrosion rate of the repellent coating on the SMART hook was studied and results indicated that approximately 25% of the repellent mass by weight was lost after 24 hrs of continuous immersion in a flow-through seawater tank. Two recent behavioral studies on captive *Sphyrna tiburo* employing SMART circle hook technology indicated that sharks were approximately 3 and 15 times more likely to feed on control hooks vs SMART hooks, respectively. During experimental pelagic longline fishing targeting swordfish (*Xiphias gladius*) deployment of 18/0 10°-offset SMART circle hooks resulted in a 41% reduction in shark bycatch compared to control hooks. Feeding studies on captive teleost fishes (*Lachnolaimus maximus, Lagodon rhomboids, Epinephelus morio,* and *Ocyurus chrysurus*) revealed no avoidance behavior during feeding at either SMART Hooks or untreated circle hooks. The repelling behavior of SMART hook technology appears selective to elasmobranch fishes.—*PO Box 2593, Oak Ridge, New Jersey 07438. Phone: 201-240-0826, Email: <Eric@sharkdefense.com>.*

TRIALS WITH MODIFIED CIRCLE HOOKS IN PELAGIC LONGLINE FISHERIES *by* ***Yonat Swimmer*** *and John Wang.*—Early work in a US Atlantic Ocean longline fishery quantified a significant reduction of bycatch species, specifically loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) sea turtles, caught on relatively large circle hooks as compared to traditionally used J-hooks. Since this ground-breaking finding, we have initiated

numerous field trials in an attempt to confirm the hooks' continued high performance as well as to identify features of the hook seemingly responsible for differential, species-specific capture rates. We conducted trials to increase hooks' width dimensions by adding a wire extension, or "appendage," whereby a wire appendage was projected posterior from the hook eye at an angle of approximately 45° to the shank to form a physical barrier to ingestion. This study demonstrated that the addition of an appendage increased hooks' maximum and minimum dimensions by 11% and 19%, respectively, and resulted in significant reduction of catch rates of sea turtles and tunas and billfishes in the eastern tropical Pacific (ETP). Additional trials were performed to understand potential effects of hook offset. A non-offset hook has the point in the same plane as the shaft, whereas an offset hook has the point bent sideways, usually within 25°, relative to the shank. Many fishermen prefer to use an offset hook as it is believed that the exposed point improves fishing success primarily by retaining fish. Our studies in the ETP found that a 10° offset on 14/0 circle hooks did not confer any selective advantages to hooks with no offset with respect to capture rates of target and non-target species in a shallow set pelagic longline fishery. Most recently, we are working with colleagues to identify the impact of a ring associated with a circle hook to determine potential effects of this circle hook addition as well. We aim to standardize terms of circle hook dimensions and to identify components affecting species-specific catch rates, both of which are important for improving management regimes to enhance sustainable fishing practices.—*US National Marine Fisheries Service, Pacific Islands Fisheries Science Center, Long Beach, California 90802. Phone: 310-770-1270, Email: <Yonat.Swimmer@noaa.gov>.*

INCORPORATING MANDATORY CIRCLE HOOK CONSERVATION INTO THE SOUTH FLORIDA TOURNAMENT CIRCUIT: THE MIAMI BILLFISH TOURNAMENT EXAMPLE *by* ***Joan Vernon*** *and Sam White*.—The present study summarizes the Miami Billfish Tournament experience in adopting mandatory circle hooks. This tournament was the first in south Florida to make the switch to circle hooks as mandatory terminal fishing gear for its competitive event. Major topics include the competitor's resistance to the change from a historical and practical use standpoint, tournament board members' contrary opinions regarding the change, implementation of the mandatory circle hook policy, and the final considerations that convinced hard core tournament participants to accept the change to circle hooks as mandatory gear. Lastly, we review the adoption of this policy initially to south Florida billfish tournaments and then later to billfish tournaments throughout the Atlantic Ocean and beyond to the Caribbean and Pacific fisheries.—*Presidential Challenge Charitable Foundation, Inc., 205 E. Enid Drive, Key Biscayne, Florida 33149. Phone: 305-361-9258, Email: <joan@preschallenge.com>.*

EXPERIMENTS WITH CIRCLE HOOKS FOR THE REDUCTION OF INCIDENTAL CATCHES OF SEA TURTLES IN THE ARTISANAL FISHERIES FOR DOLPHINFISH AND SHARKS OFF GUATEMALA *by* ***Erick Villagran****, Sara Perez, Manuel Ixquiac, and Ruben Lopez*.—Artisanal fishing for dolphinfish (*Coryphaena hippurus*) and sharks is a very important activity off the Pacific coast of Guatemala. There are approximately 400 outboard engine vessels fishing with surface longlines. Traditionally, these vessels had been using J-hooks. Between 2004 and 2007 the World Wildlife Fund (WWF) and the Interamerican Tropical Tuna Commision (IATTC) with the support of the national fisheries administration (UNIPESCA) carried out experimental fishing trips to compare hook efficacy in reducing incidental catches of sea turtles. Onboard observers recorded information on catches of sea turtles and fishes. In Guatemala, the most used hooks in the artisanal longline fisheries are type C13 and C14. Longlines have a mean length of 10 nm and 400 hooks on the line. The most common bait is herring (*Opisthonema* spp.). The majority of the sea turtles incidentally captured in this fishery are olive ridley (*Lepidochelys olivacea*). After >400 experimental trips it was determined that circular hooks of greater size (C15 and C14) showed a lower incidental catch rate than the C13 hooks. However, artisanal fishermen in Guatemala prefer not to

use the C15 hooks since they consider that a larger amount of bait is needed to cover the hook, which increases their fishing costs. It is recommended to continue with the statistical analysis of the data, and the education and training of fishermen, especially in the use of adequate procedures for the manipulation and dehooking of sea turtles.—*Centro de Estudios del Mar y Acuicultura, Universidad de San Carlos de Guatemala, Ciudad Universitaria, zona 12 Guatemala, 01012. Phone: 502-2418-8383, Email: <erick.villagran@gmail.com>.*

THE INTRODUCTION OF CIRCLE HOOKS IN THE NORTH PACIFIC: IMPACT ON THE PACIFIC HALIBUT FISHERY AND MANAGEMENT *by* ***Gregg H Williams***.—Since 1888, commercial exploitation of Pacific halibut (*Hippoglossus stenolepis*) has been conducted using hook-and-line gear, evolving from handlines to setline gear, a bottom-tending longline. As the commercial fishery developed and expanded, J-hooks became the standard. The use of circle hooks was first noted in 1982 in the commercial fishery off Alaska and within 3 yrs, practically all commercial halibut fishers in the North Pacific employed circle hooks. The International Pacific Halibut Commission, the agency responsible for managing the fishery and resource on behalf of Canada and the United States, routinely tracked relative changes in abundance by estimating catch per 100 hooks (CPUE) using commercial fishery logbook data. Gear studies showed circle hooks more than doubled the catch rate over J-hooks and may have had a different size selectivity, creating challenges in using CPUE as a longterm longterm tool when the hook type changes. The higher circle hook catch rates led to decreasing season length, which attracted new entrants and eventually led to a catch share program. Recent gear studies have examined catch rates by different circle hook sizes and spacings, in response to a shift to the use of smaller hooks and closer spacings by fishermen conducting combined fishing for halibut and other species. Recreational halibut fishers have also shifted to circle hooks because of their greater effectiveness. Circle hooks also had an effect in other fisheries where halibut are caught as bycatch. By regulation, halibut must be released with minimal injury, and the predominant hooking location in the jaw aided in lowering discard mortality rates and reduced release mortality. Additional regulations were enacted to require careful release. As a consequence of using careful release techniques with circle hooks, discard mortality rates for halibut bycatch in the Pacific cod hook-and-line fishery are estimated at <0.10.—*International Pacific Halibut Commission, 2320 West Commodore Way, Suite 300, Seattle, Washington 98199-1287. Phone: 206-634-1838, Email: <gregg@iphc.int>.*

IMPLEMENTATION OF A SEA TURTLE BYCATCH REDUCTION PROGRAM THROUGH THE USE OF CIRCLE HOOKS IN ARTISANAL BOTTOM LONGLINE FISHERIES IN THE COLOMBIAN PACIFIC *by Julian Alejandro Caicedo Pantoja,* ***Luis Alonso Zapata Padilla****, Gustavo A Castellanos-Galindo, and Luz Stella Gómez Giraldo.*—Sea turtle bycatch in the eastern Pacific is a critical issue for marine conservation in the region. In 2003, an initiative was developed in the eastern Pacific, led by IATTC and the US National Oceanic and Atmospheric Administration (NOAA) and later joined by WWF, aimed at reducing sea turtle bycatch through the implementation of circle hooks in pelagic longline fisheries. In 2005, the initiative was implemented in bottom longline fisheries of the Colombian Pacific due to the seasonal character of its pelagic longline fleet. Bottom longline fisheries are a widespread practice in the area, although a formal assessment of sea turtle bycatch is lacking. Fishing communities benefiting from three marine protected areas have participated through the voluntary exchange of J-hooks for circle hooks. During routine fishing trips, fishers carry onboard observers monitoring an experiment consisting of alternating J-hooks and circle hooks (250 J-hooks vs 250 circle hooks). After allowing the monitoring of certain number of hauls, the fisherman decides to convert his fishing line completely to circle hooks. At the moment, 12,450 circle hooks have been exchanged; 44 fishers have successfully participated in the project and 15 observers have been trained. A total of 435 hauls have been monitored resulting in bycatch of 15 sea turtles of three different species. Olive ridley (*Lepidochelys olivacea*) represented 73.3% of the total sea turtle bycatch. Circle hooks reduced sea turtle

bycatch 33.4% compared to J-hooks (0.06 vs 0.09 turtles per 1000 hooks) with sea turtle post-hooking mortality being lower with the use of circle hooks (34% vs 45%). Catch per unit effort (number individuals per 100 hooks) of target species [Pacific bearded brotula (*Brotula clarkae*, Ophidiidae) and Rooster hind (*Hyporthodus acanthistius*, Serranidae)] was significantly higher with the use of circle hooks, whereas the number of non-target fish has been reduced (e.g., Anguillifomes). The project has demonstrated an effective and sustainable way to conserve sea turtles in the region without affecting fishers' livelihoods.—*WWF Colombia, Programa Marino Costero, Carrera 35 No. 4A-25, Cali, Colombia. Phone: 57-2-558-2577, Email: <lazapata@wwf.org.com>.*