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PROPOSAL FOR TAGGING BIGEYE TUNA IN THE CENTRAL PACIFIC OCEAN

1. TITLE OF PROPOSAL

Tagging bigeye tuna with dart tags and geolocating archival tags in the central Pacific Ocean in 2009.

2. OBJECTIVES

The objectives of tagging bigeye tuna (*Thunnus obesus*) in the central Pacific Ocean (CPO) with conventional plastic dart tags and geolocating archival tags are to (i) obtain information on their movements, dispersion, and mixing between the CPO and adjacent regions of the Pacific Ocean; (ii) obtain information on their behavior and habitat utilization, including association with fish-aggregating devices (FADs); and (iii) utilize the data for reducing the uncertainty and improving stock assessments for this species.

3. BACKGROUND INFORMATION AND JUSTIFICATION

Bigeye tuna is the primary target species of longline vessels fishing in the eastern Pacific Ocean (EPO). Longline catches of bigeye in the EPO have historically exceeded those in the western and central Pacific Ocean (WCPO), and the catches of bigeye in the Pacific Ocean have exceeded those of any other ocean (Anonymous, 2008a). The longline fishery targets medium to large bigeye, while the purse-seine fishery on tunas associated with floating objects catches primarily small to medium bigeye. In the EPO, there is concern that the purse-seine fishery is adversely affecting the longline fishery and that large catches of small bigeye have reduced the stock size and the sustainable catches (Aires-da-Silva and Maunder, 2008). The catches by the longline fishery have declined in recent years, from an annual ten-year average of about 78 thousand metric tons during 1987-1996 to about 50 thousand metric tons during 1997-2006 (Anonymous, 2008a).

In the EPO, schools of tuna within large multi-species aggregations associated with FADs have been exploited by large purse-seine vessels since 1994 (Lennert-Cody and Hall 2000; Anonymous, 2008a), predominantly between 5°N and 15°S. The practice of deploying FADs and targeting the tunas that associate with them has increased in the EPO over the past decade and expanded westward, and has contributed to a significant increase in the catches of bigeye, from an annual average of about 5 thousand metric tons during 1964-1993 to 63 thousand metric tons during 1997-2006, although the greatest component of the catch of this fishery is skipjack tuna (Anonymous, 2008a). The rapid changes in the fishery have made it difficult to assess its effect on those stocks. Evaluations conducted in recent years (Hampton and Maunder, 2005; Anonymous, 2008a) have shown the need for caution in managing this changed situation, but above all the need for better scientific information on which to base management decisions.

Regional tuna tagging projects conducted recently in the WCPO (Hampton and Gunn, 1998; Hampton and Williams, 2005), around the Hawaiian Islands (Itano and Holland, 2000), and in the EPO (Schaefer and Fuller, 2008), have demonstrated that bigeye exhibit relatively restricted geographical movements, showing regional fidelity, similar to those of yellowfin and skipjack tunas (Hunter *et al.*, 1986; Sibert and Hampton, 2003). However, relatively recent investigations of the genetic basis of the population structure of bigeye, through analysis of mitochondrial DNA, could not reject the null hypothesis that bigeye share a common gene pool in the Pacific (Grewe and Hampton, 1998). Furthermore, there is not yet adequate

data from recent bigeye tagging in the EPO near 150°W, the boundary that separates the EPO and the WCPO. Thus, results of these two methods clearly indicate that there is a need to determine the levels of mixing among the stocks for inclusion in the regional assessments. Concurrent tagging in regions across the Pacific is probably the most practical method for obtaining this important information. The current Pacific Tuna Tagging Programme (PTTP) (Anonymous 2007) considers the tagging of bigeye over as large a range of the WCPO as possible, including a series of tagging cruises specifically targeting bigeye in the CPO (Itano, 2008), as high priorities.

The tagging program proposed in this document is in accordance with the general aspirations of the fisheries research community, including the concept of the need to conduct regional research projects to achieve Pacific-wide goals. It was the consensus of scientists from regional research organizations throughout the Pacific Ocean attending the prioritization workshop of the Pelagic Fisheries Research Program at the University of Hawaii in November 2005 that Pacific-wide tagging experiments are necessary to address many of the important scientific issues, including movements and mixing rates, of bigeye and the other principal market species of tunas. The IATTC staff considered tagging experiments to be of such high priority that it convened a workshop in October 2007 entitled “Using Tagging Data for Fisheries Stock Assessment and Management.” A large-scale regional tuna tagging program in the EPO was recently listed as the first recommendation in the report of the 9th IATTC Stock Assessment Review Meeting convened in May 2008 (Anonymous, 2008b).

In addition to tagging bigeye tuna externally with dart tags during CPO tuna tagging cruises, we propose to implant archival tags in limited numbers of fish. Tuna movement paths reconstructed from recovered archival tags provide exceptional information on stock structure, movements, and mixing, complementing the information from dart tag recoveries. The data on behavior and habitat utilization from archival tags are useful for habitat-based standardization of longline catch and effort data in stock assessments (Langley *et al.*, 2005), and can most likely be useful in standardization of purse-seine catch and effort data as well. The archival tag data also provide resolution of residence times on both small and large scales, complementing the dart tagging results, and providing long-term information on geographical and spatial distributions (Gunn and Block, 2001; Schaefer and Fuller, 2002; Schaefer and Fuller, 2008).

4. DESCRIPTION OF PROPOSED ACTIVITIES

The primary focus of this tagging project would be to deploy both dart tags and archival tags on bigeye tuna in the equatorial CPO. Limited numbers of yellowfin and skipjack tunas would also be tagged, but the main objective would be tagging bigeye tuna. The tag releases would be distributed throughout all locations where bigeye were available for tagging. Bigeye associated with floating objects, seamounts, and in unassociated surface schools, would all be targeted for tagging.

We would undertake two 6-week-long tagging cruises, departing in May and October of 2009, aboard the chartered Hawaii-based vessel *Double D*. The cruises would depart from Hawaii with cruise tracks south to the Tropical Atmospheric Oceanographic (TAO) moorings between 5°N-2°S along the 155°W meridian and then those between 2°S-5°N along the 140°W meridian, before returning to Hawaii. The *Double D* is a 21-m multi-purpose commercial tuna fishing vessel designed and constructed for Hawaiian pelagic fisheries. The owner/operator has successfully utilized the vessel for many years in the Hawaiian offshore handline fishery, targeting bigeye tuna at the Cross Seamount and NOAA weather buoys. The vessel and its captain are well suited for these proposed tuna tagging charters, as it was used extensively for tagging bigeye and yellowfin tunas during the Hawaii Tuna Tagging Project (Itano and Holland, 2000) and recently successfully completed the first PTTP equatorial CPO bigeye tagging charter (Itano, 2008).

In addition to dart tags, archival tags would also be implanted in bigeye tunas. Archival tags can provide exceptional information on movements, behavior, and habitat utilization. Because of the high rewards paid for the return of archival tags, their recovery rate is expected to be essentially 100% of those recaptured, and can be used as a basis for an alternative estimate of exploitation rate that is free of recovery issues. We would deploy about 32 Lotek LTD 2310 archival tags

(<http://www.lotek.com/archival.htm#options>) per tagging cruise in bigeye tuna, by implanting them in the peritoneal cavities of the fish; this method has been shown to result in little tag shedding, high survival, and high recovery rates (Schaefer and Fuller, 2002; Schaefer and Fuller, 2008). Evaluations would be conducted of the spatial and temporal variation in movements, behavior, and habitat utilization, and of the effects of oceanographic features, including bathymetry, sea-surface temperatures, ocean color, fronts, and eddies.

Successful completion of the project would require a number of activities in addition to the actual fieldwork of tagging the fish. Securing recapture information on tagged fish, including data on location, date, and size, is conducted in the EPO at IATTC field offices located in various ports in Latin America and by observers on fishing vessels, and in the WCPO by industry, institutions and individuals working in collaboration with the PTPP throughout the WCPO. The IATTC staff would collect as many data as possible, through its field offices and observer program, and would seek the cooperation of national fisheries authorities in recovering tags and associated information, particularly from longline catches. The recapture information from tuna tag recoveries from deployments during this project would be entered into established databases at the IATTC and the Secretariat of the Pacific Community Oceanic Fisheries Programme (SPC-OFP). Analyses of tag release and recapture information would be conducted collaboratively by scientists of both organizations, and the information would be used in both regional and Pacific-wide bigeye stock assessments.

5. REPORTING

The activities and results of the project would be reported in the IATTC Quarterly and Annual Reports, and in oral presentations at scientific meetings. Final results of the project would be published in peer-reviewed journals, in a timely manner.

6. FUNDING

The IATTC would conduct this tagging project in collaboration with the SPC-OFP, under the umbrella of the PTPP. The SPC-OFP, via the PTPP, would pay the vessel charter costs of approximately US\$200,000 for the two tagging cruises, plus the rewards for the dart tag recoveries, and also contribute additional archival tags. The government of Japan will provide US\$120,000 toward the cost of this project, as a special contribution to the IATTC budget. The IATTC would commit two scientific staff members for the at-sea tagging operations, the analyses of the data, and the reporting of results.

7. BUDGET

	US\$
Geolocating archival tags: 81 Lotek LTD 2310 tags @US\$ 1077.50/ea	87,278
Archival tag return rewards: With an expected 20% recapture rate @US\$ 250/tag	4,250
Travel and accommodation	3,200
Sea pay: Two scientists at sea for 2 six-week cruises	23,556
Miscellaneous: Tagging supplies	1,716
TOTAL	120,000

LITERATURE CITED

- Aires-da-Silva, A. and M.N. Maunder. 2008. Status of bigeye tuna in the eastern Pacific Ocean in 2007. Inter-Amer. Trop. Tuna Comm., Stock Assess. Rept., 9: in prep.
- Anonymous. 2007. Regional tuna tagging: phase 2 proposal. Third regular session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, WCPFC-SC3-2007/GN WP-10, 34 pp. ([http://www.wcpfc.int/sc3/pdf/SC3_GN_WP_10%20\(tagging%20proposal\).pdf](http://www.wcpfc.int/sc3/pdf/SC3_GN_WP_10%20(tagging%20proposal).pdf)).
- Anonymous. 2008a. Tunas and billfishes in the eastern Pacific Ocean in 2006. Fishery Status Report 5. Inter-Amer. Trop. Tuna Comm.: 155 p.
- Anonymous. 2008b. Proposal for a regional tuna tagging program. 78th meeting of the Inter-American Tropical Tuna Commission, Document IATTC-78-08C, 6 pp.

- (<http://www.iattc.org/PDFFiles2/IATTC-78-08c-Regional-tagging-program.pdf>).
- Grewe, P., and J. Hampton. 1998. An assessment of bigeye (*Thunnus obesus*) population structure in the Pacific Ocean, based on mitochondrial DNA and DNA microsatellite analysis. Joint Institute of Marine and Atmospheric Research, Contribution 98-320.
- Gunn J, and B. Block. 2001. Advances in acoustic, archival, and satellite tagging of tunas. In: Block BA and ED Stevens (editors) Tunas: Ecological Physiology and Evolution. Academic Press, San Diego, CA. pp 167-224.
- Hampton, J. and M. Maunder. 2005. Comparison of Pacific-wide, western and central Pacific, and eastern Pacific assessments of bigeye tuna. First Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, WCPFC-SC1 SA WP-2-SUP, 19 pp. (http://www.spc.int/oceanfish/Html/WCPFC/SC1/pdf/SCI-1SA_WP_2_SUP.pdf).
- Hampton, J. and P. Williams. 2005. A description of tag-recapture data for bigeye tuna (*Thunnus obesus*) in the western and central Pacific Ocean. Inter. Comm. Conser. Atlan. Tunas, Coll. Vol. Sci. Pap., 57(2): 85-93.
- Hunter, J.R., A.W. Argue, W.H. Bayliff, A.E. Dizon, A. Fonteneau, D. Goodman, and G.R. Seckel. 1986. The dynamics of tuna movements: an evaluation of past and future research. FAO Fish. Tech. Pap., 277: 78 p.
- Itano, D.G. 2008. Pacific tuna tagging project, summary report, Phase 2 (Central Pacific), Cruise 1: 5 May-3 June 2008. Fourth regular session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, WCPFC-SC4-2008/GN-IP-2, 33 pp. (<http://www.wcpfc.int/sc4/pdf/SC4-GN-IP2%20PTTP.pdf>).
- Itano, D.G., and K.N. Holland. 2000. Movement and vulnerability of bigeye (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacares*) in relation to FADs and natural aggregation points. Aquat. Living Res. 13(4):213-223.
- Langley, A., K. Bigelow, M. Maunder, and N. Miyabe. 2005. Longline CPUE indices for bigeye and yellowfin in the Pacific Ocean using GLM and statistical habitat standardization methods. First Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, WCPFC-SC1 SA WP-8, 40 pp. (http://www.spc.int/oceanfish/Html/WCPFC/SC1/pdf/SCI-1SA_WP_8.pdf).
- Lennert-Cody, C. E., and M. A. Hall. 2000. The development of the purse seine fishery on drifting fish aggregating devices in the eastern Pacific Ocean: 1992-1998. In Le Gall, Jean-Yves, Patrice Cayré, and Marc Taquet (editors), Pêche Thonière et Dispositifs de Concentration de Poissons, Colloque Caraïbe-Martinique, Trois-Îlets, 15-19 Octobre 1999, Inst. Fran. Recherche Exploitation Mer (IFREMER) 28:78-107.
- Schaefer, K.M., and D.W. Fuller. 2002. Movements, behavior, and habitat selection of bigeye tuna (*Thunnus obesus*) in the eastern equatorial Pacific, ascertained through archival tags. Fish. Bull. 100:765-788.
- Schaefer, K.M. and D.W. Fuller. 2008. Horizontal movements of bigeye tuna (*Thunnus obesus*) in the eastern Pacific Ocean, as determined from conventional and archival tagging experiments initiated during 2000-2005. Inter-Amer. Trop. Tuna Comm., Bull.: in review.
- Sibert, J. and J. Hampton. 2003. Mobility of tropical tunas and the implications for fisheries management. Marine Policy 27: 87-95.