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**Hawaii Fleet Industry & Vessel Economics project
(HIFIVE)**

*Joint Institute for Marine and Atmospheric Research (JIMAR)
Pelagic Fisheries Research Program*

STATUS OF PROJECT

May 1995

The HIFIVE project is comprised of seven sub-projects emphasizing different aspects of economic research on Hawaii's commercial fishery for pelagics (primarily tuna, swordfish, blue and striped marlin, and mahimahi and ono). The pelagic fisheries under consideration by the HIFIVE project include the following domestic commercial fishing fleets based in Hawaii: longline, commercial troll and handline, and charter-boats, as well as some research on the markets associated with these fleets. The HIFIVE principal investigator also collaborates formally with the University of Hawaii's Department of Agricultural & Resource Economics (AREC) project on a multi-level, multi-objective programming model of Hawaii's pelagic fisheries. HIFIVE researchers are involved in proposals to the JIMAR pelagics program for two associated projects: the economics of the recreational fishery for pelagics in Hawaii and the economic interactions between U.S. longline fisheries. These proposals are currently under review by JIMAR.

HIFIVE staff include: Dr. Sam Pooley, principal investigator for NMFS and Dr. Michael Travis, Ms. Rita Curtis, and Ms. Marcia Hamilton, JIMAR research associates. Ms. MinLing Pan, graduate student from the University of Hawaii assisted on the project during 1994. Mr. Russell Ito, biologist with the Fishery Monitoring & Economics Program, is also a member of the project team. An additional JIMAR position is currently under recruitment to concentrate on field work with the small-boat commercial troll-handline cost-earnings research.

The first year of the project (1994) concentrated on the Hawaii longline fishery. A number of integrated and summarized data bases were constructed for economic analysis purposes. The longline costs and operations survey has been completed, and a

cost-earnings analysis is being completed, with earnings data generated by merging NMFS longline logbook information with Hawaii Division of Aquatic Resources commercial catch reports. Substantial progress has also been made on analysis of institution, production, and market relations concerning the Hawaii longline fishery. The second year project (1995) will extend the economic analysis of the Hawaii longline fishery and collect economic information on the small-boat commercial pelagic fisheries in Hawaii.

The attached pages summarize the status of work to date and plans for the immediate future for the following sub-projects:

- Hawaii pelagic fisheries data management -- R. Curtis, lead person
- Hawaii longline fishery cost/earnings analysis -- M. Hamilton, lead person.
- Institutional structure of Hawaii's longline fishery. -- M. Travis, lead person
- Production modeling of the Hawaii longline fishery. -- R. Curtis, lead person
- Economic analysis of catch and effort in Hawaii's longline fishery. -- M. Travis, lead person.
- Hawaii's pelagic fishery market dynamics. -- S. Pooley, lead person
- Hawaii small-boat commercial pelagic fishery cost/earnings analysis -- M. Hamilton, lead person

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May 11, 1995

HAWAII PELAGIC FISHERIES DATA MANAGEMENT

RESEARCH SYNOPSIS:

The purpose of this component of the HIFIVE project was to put available databases in an accessible format for HIFIVE research projects. These databases include:

- a) Hawaii Division of Aquatic Resources Commercial Fishing Catch Reports (HDAR)
- b) NMFS Longline Logbooks (Logs)
- c) NMFS Seafood Market Monitoring Landings and Sales (Markets)
- d) NMFS Dockside Vessel Inventory (Docks)
- e) NMFS Longline Permit (Permits)
- f) HDAR Historical Commercial Fishing Licenses (License)

The objectives for this activity included:

1. Aggregating databases to trip and vessel level.
2. Linking databases.
3. Documenting the data management process.

HIFIVE DATABASE DEVELOPMENT STATUS:

HDAR

All programs have been written and executed to create trip level databases for both longliners and non-longliners for the years 1990-1993. Data can also be summarized weekly or monthly.

Interaction with Other Longline Databases

- 1) License numbers have been matched with permit numbers using the historical database developed by Frank Cabacungan, NMFS staff, for 1993 and to a limited degree for 1994. The use of HDAR data for 1994 is limited to those trips actually initiated in 1993. It is not perceived to be a problem/undue time commitment to match license and permit numbers for prior years.
- 2) HDAR trip data has been matched with logbook trip data with an acceptable success level, i.e. minimal hand matching. For trips initiated in 1993, which includes trips landed in 1994, 856 trips have been matched to logbook data. For the 1233 logbook trips with haul days in 1993, 890 HDAR trips have been linked.

LOGBOOK DATA

Frederick Dowdell, NMFS staff, has prepared a menu-driven program in DBASE that allows the user to generate trip-level DBASE files for the period specified by the user. Variables created from the logbook data include average number of hooks per set, average number of light sticks, average number of light sticks for sets that used light sticks, average temperature, average set time, average haul time, distance to first set, and distance to last haul.

Interaction with other longline databases:

Logbook data have been matched with permit and HDAR data.

MARKETS DATA

All programs have been written and executed to create trip level databases for both longliners. Data can also be summarized weekly or monthly. Data have been summarized for 1993.

Interaction with Other Longline Databases

Markets longline data includes logbook trip number so they can easily be matched with logbook data.

DOCKS DATA

The docks databases, LLSTAT93.DBF, and monthly inventory files were used to create generate fishing vessel activity data (days at sea, etc.).

Interaction with Other Longline Databases

All docks databases can be linked to other longline files by permit number only at this time. Thus, only summary statistics, average trip length, whether a vessel went to drydock and mooring information is available.

PERMIT FILE

The 1993 permit files has been downloaded and merged with HDAR and logbook data.

HISTORICAL LICENSE FILE

The historical license file, CML_HIST.DBF, tracks licensees over time for the period 1970-4/1994. This file was created and is maintained by Frank Cabacungan, NMFS staff.

OVERALL STATUS

Although it is foreseen that there will be modifications to the databases, this project is substantially completed, with a few exceptions.

- A) Need to document docks programs and, perhaps, try to match calculated trip lengths to logbook trips for 1993 data.
- B) Need to prepare weekly and monthly summaries from Market database.
- C) Need to continually download all SAS datasets into ascii files for archiving purposes. (Research data sets are archived with the NMFS Honolulu Laboratory's Fishery Data Management Program.

HAWAII LONGLINE FISHERY COST/EARNINGS ANALYSIS

HIFIVE research began in January, 1994. The primary work in 1994 was cost-earnings analysis of the Hawaii-based domestic longline fishery. All of the HIFIVE JIMAR staff were heavily involved in this component of the work, with the assistance of NMFS Honolulu Laboratory Fishery Monitoring & Economics Program staff. M. Hamilton is the lead person for reporting on this sub-project.

RESEARCH SYNOPSIS:

This project is studying the 1993 cost/earnings structure of the Hawaii based longline fleet.

Objectives of the research include:

1. - Determine the costs, earnings and returns (both economic and financial) for various fishery sectors.
2. - Determine the sensitivity of returns to changes in input/output prices and quantities.
3. - Determine the break-even levels of output (catch) and/or prices required for vessels to break-even.

OVERALL STATUS:

Progress on this project has been excellent. Vessel captains and/or owners of 100 of 122 vessels which longlined in Hawaii in 1993 have been surveyed successfully. Their responses were coded and entered into a respondent survey database and merged to obtain a vessel-level survey database. In addition, a trip-level operations and revenue data base was constructed from Federal longline logbook and State of Hawaii landings reports. This information was integrated with the cost survey data base. Considerable time was spent in dealing with missing information from the survey or from the linked cost-revenue database and in categorizing vessel operational characteristics which will generate further analytical results.

The draft results of the cost-earnings analysis are being presented by M. Hamilton at the May 1995 tuna conference at Lake Arrowhead, California, with a draft report to be prepared by July 1. A substantial commitment of time in the late spring of 1995 has involved verification of summarized and categorized cost and earnings information with focus groups of vessel captains and owners, and more detailed analysis of revenue. This work may extend into the summer of 1995 and delay completion of the final report on the cost-earnings segment of the fishery.

A second module of this project, a survey of vessel owners and/or captains of the 45 permitted vessels which were inactive in the Hawaii longline fishery in 1993, was scheduled. The purpose of this survey was to identify any vessel characteristics, owner preferences, or exogenous circumstances which would explain why these vessels which hold permits have been inactive and what potential impact on fleet harvesting capacity would be anticipated if these vessels became active. Our current plan is to eliminate this survey, and to categorize the inactive 1993 vessels in terms of vessel characteristics identifiable from their permits and to "track" these vessels in terms of the eventual use of their permits and boats in 1994 and 1995.

A third module of this project, a survey of vessel owners concerning permit sales and transfers was mailed in early 1995. Results were not initially promising (low response rate); additional efforts are being undertaken to expand the response rate and complete the analysis. The purpose of this survey is to determine how recent permit transfers and potential transfers in the future may alter the nature of the Hawaii longline fishery. This issue has become relevant due to the liberalizing of permit transfer rules under Amendment 7 to the Pelagic Species fishery management plan.

INSTITUTIONAL STRUCTURE OF HAWAII'S LONGLINE FISHERY

RESEARCH SYNOPSIS:

This project is investigating the institutional structure of Hawaii's longline fishery.

Objectives of the research include:

1. Describing the current institutional structure of the fishery (including the number and "kinds" of fishing vessels, federal and state regulatory structure, the vessel ownership structure, the ethnic background of vessel owners and captains, vessels' origins, and market structure characteristics at the harvesting, input, and dealer levels).

2. Explaining how the current structure arose in light of the significant changes that have occurred over the past six years.

3. Examining how changes in certain aspects of the institutional structure have affected other aspects of that structure as well as fishing behavior (such as exit/entry, fish/not fish, types and targets of fishing, and the level of fishing effort) at the fleet and individual vessel levels.

MAJOR RESEARCH ACTIVITIES:

1. - Obtain and summarize vessel, owner/captain, and market characteristics via surveys, interviews, and permit databases
 - Develop a classification scheme for these characteristics
 - Determine patterns in the changes of these characteristics and attempt to explain their impacts on the fishery

2. - Obtain and summarize information regarding changes in the fishery's regulatory environment.
 - Determine the forces behind the changes in the regulatory environment
 - Attempt to explain how these changes impacted other aspects of the fishery's institutional structure and fishing behavior

3. - Obtain and summarize information regarding changes in the ownership of vessels and limited entry permits.
 - Develop a classification scheme for the ownership structure
 - Attempt to explain how changes in vessel and permit ownership have impacted fishing behavior

4. Obtain, summarize, and analyze data regarding vessel activity at the trip and vessel levels in given years and over

time. Data is from the logbook, HDAR, inventory, permit, and survey databases.

5. Review and summarize the theoretical and empirical literature regarding the significance and potential impacts of different institutional structures.

OVERALL STATUS:

Substantial progress has been made on identifying key characteristics in the Hawaii longline fleet and examining the relationships between these characteristics and fishery performance. Much of this work was accomplished in the context of dealing with missing information in the cost/earnings survey.

In order to complete this research, certain tasks still remain. First, more detailed information regarding changes in the regulatory environment must be obtained from tapes/minutes of the various Council and Plan Team meetings. Second, more information regarding market structure must be obtained and summarized - particularly with regard to fish dealers. Third, the survey of all initial longline permit holders under the new regulatory scheme must be completed. Fourth, the survey or analysis of all 1993 inactive boats must be completed. Lastly, information from the various databases must be merged into an aggregated database. This aggregation is nearly complete. However, we plan on hiring a temporary assistant to help merge the remaining years of logbook and HDAR data (i.e. years other than 1993, which has already been done). This project is closely linked to the "effort" project being worked on concurrently.

PRODUCTION MODELING OF THE HAWAII LONGLINE FISHERY: OUTPUT SUPPLY, FACTOR DEMANDS AND RESOURCE ABUNDANCE IN A MULTI-PRODUCT FISHERY

RESEARCH SYNOPSIS:

Objectives the research include:

1. Identify theoretical framework for study.
2. Identify methods for analyzing aggregation and resource abundance issues as well as measuring economies of scope and economies of scale.
3. Identify methods for determining impact of regulations.

MAJOR RESEARCH ACTIVITIES:

1. Develop theoretical model: In any multi-product industry, the effect of product mix (economies of scope) must be separated from economies of scale. Economies of scope must be analyzed through the cost function, therefore, either a multi-product cost function or multi-product profit function will be specified.
2. Develop basis for aggregation of species.
3. Develop theoretical basis for incorporating resource abundance into the production function.
4. Create database from the survey database and the linked logbook, HDAR and permit databases.
5. Specify and estimate empirical model.
6. Measure marginal rates of substitution between inputs and how these are affected by resource abundance.
7. Summarize policy implications.

OVERALL STATUS:

Progress has been made on the first four items under "Research Activities." More specifically, outlines/drafts of the first three items have been completed. In addition, a revenue function approach has been drafted as an initial examination of the economic production relationships in longline fishing activity.

ECONOMIC ANALYSIS OF CATCH AND EFFORT IN HAWAII'S LONGLINE FISHERY

RESEARCH SYNOPSIS:

This project investigates the relationship between catch (i.e. number of fish caught) and effective fishing effort or fishing power.

Objectives at this stage of the research include:

1. Determine the nature of the institutional and environmental factors that structure longline fishing activity
2. Determine if a certain model of catch and effective effort is useful. Specifically, catch is considered to be directly and proportionately related to effective effort. Fishing power is determined by three general categories of factors: direct effort inputs, factors that affect the efficiency of that effort, and factors that constrain the amount of effort applied (including those usually deemed as determining "harvesting capacity").
3. Determine the specific factors that should be included within each of the three categories of factors. In other words, develop a model that will explain variations in catch.

MAJOR RESEARCH ACTIVITIES:

1. Review and summarize the literature regarding fishing effort, fishing power, and harvest capacity. Obtain additional input from experts in the field.
2. Obtain new data from owner/captain surveys.
3. Obtain data from logbook, HDAR, and permit databases. Make corrections to the latter database based on newly acquired information.
4. Develop a hypothesis regarding the specific factors entering into the catch equation.
5. Use logbook data to create new variables - such as total catch per trip, the percentage of total catch by species, and fishing hours per trip.
6. Do preliminary regressions testing for: relationships between vessel characteristics, relationships between direct inputs and those affecting their efficiency, and the strength of the relationship between direct inputs and catch.

OVERALL STATUS:

In order to complete this project, certain parts of the institutional research project must be completed first in order to provide supplementary information on fishing practices and the fishery regulatory environment. Much of the work to accomplish this objective is being conducted in conjunction with the basic cost-earnings survey data base development, particularly the analysis required to deal with missing information in the cost-survey or revenue information.

Preliminary findings have suggested that vessels' targeting and search behavior is strongly related to their ability to catch fish (i.e. their fishing power). As a result, a new module of the catch and effort project has been developed to address these issues.

ECONOMIC ANALYSIS OF FISHERMEN'S TARGETING AND SEARCH BEHAVIOR

RESEARCH SYNOPSIS:

The proposed research seeks to modelling certain decisions that can affect fishermen's catch - either in the aggregate or of a particular species. For example, if a particular search strategy can increase fishermen's catch, such information would help fishermen reduce their fishing costs (i.e. become more efficient) and therefore increase profitability. In addition, if certain factors determine a vessel's target species and why a vessel changes its target, the research might reveal new and potentially better ways to reallocate or otherwise change effort across various fleets or species. For a multi-species fishery like Hawaii's longline fishery, choice of target is particularly relevant.

Objectives at this stage of the research include:

1. Determine how to discern a vessel's target
2. Model fishermen's decision of what species to target and changes in that target
3. Determine if fishermen have different and distinct search strategies and describe/categorize them if they do exist
4. Model fishermen's search strategy decision and changes in that strategy

MAJOR RESEARCH ACTIVITIES:

1. Logbook information must be compiled at the set level. This is necessary in order to track vessel movements and to determine whether vessels change targets within trips.

2. Observer data must be obtained to corroborate or adjust the logbook data.
3. Behavioral information from cost-earnings survey must be organized and analyzed for relationships.
4. Logbook data must be merged with HDAR, permit, and survey data. Quantitative data must be used in conjunction with qualitative data obtained from the cost earnings survey.
5. Compare alternative methods/criteria for determining species target and choose the "best" one. This must be done before targets can be assigned to sets and/or trips and before we can determine whether vessels switch targets.
6. Use the data to construct descriptions of alternative search strategies. This must be done before strategies can be assigned to vessels and/or trips. Additional interviews with vessel operators may be needed in order to discern the exact nature of the strategies.
7. Construction of models. Since this work is highly exploratory, the data will largely determine model structure. In such instances, stepwise regression is typically employed. Specifically, four decisions must be modelled: 1) what to target, 2) when to switch targets, 3) what search strategy to employ, and 4) when to switch search strategies.

OVERALL STATUS

In order to provide visual representations of vessel movements, the data must be placed into a mapping program. Either I will have to learn how to use such a program or rely on people from other projects to provide assistance in this regard. In addition, a set level logbook database has recently been developed in which moon phase data has been integrated. However, given the size of the database - and the fact that information from other databases must be merged with it - a new computer with more hard disk space and a faster processor must be obtained to do further analysis in an efficient manner. A computer has been selected and should be received within the month. New software has been obtained in order to conduct discrete choice modelling. Some work has already been done based on the input of NMFS FMEP staff who are responsible for assigning trip types to logbook recorded longline trips. Initial modelling results are very promising with regard to targeting decisions.

HAWAII'S PELAGIC FISHERY MARKET DYNAMICS

RESEARCH SYNOPSIS:

This project is investigating supply and demand relationships at the wholesale market level.

Objectives of the research include:

1. Describe Hawaii's pelagic seafood markets.
2. Estimate demand curves for major pelagic species (price flexibility coefficients).
3. Investigate inter-market relationships.

MAJOR RESEARCH ACTIVITIES:

1. - Updated description of the Hawaii seafood market channels based on currently available information.
 - Prepare time series of average catch and price charts (monthly) for major fisheries and species.
2. - Compile HDAR and Markets databases in a daily, weekly, monthly, and annual format. (work completed by Rita Curtis)
 - Determine important exogenous variables, i.e. seasonality.
3. - Test price quantity relationships for cross-elasticities and exogenous variables. Simple regressions have been used to scan the data.

OVERALL STATUS:

Progress on this project has been limited because the two researchers have been engaged in other activities. Time-series of prices have been developed as well as an initial investigation of relationships between prices and quantities in Hawaii's pelagic fishery. A summary of preliminary results should be available by the end of 1995. In addition, work by M. Hamilton and M. Travis in developing the longline cost-earnings integrated database will generate results concerning the marketing of longline-caught pelagics.

HAWAII SMALL-BOAT COMMERCIAL PELAGIC FISHERY COST/EARNINGS ANALYSIS

RESEARCH SYNOPSIS:

This project is studying the 1994 cost/earnings structure of the Hawaii based commercial pelagic trolling (including charter boats) and handline fleets.

Objectives of the research include:

1. - Determine the costs, earnings and returns (both economic and financial) for these fishery sectors.
2. - Determine the sensitivity of returns to changes in input/output prices and quantities.
3. - Determine the break-even levels of output (catch) and/or prices required for vessels to break-even.

MAJOR RESEARCH ACTIVITIES:

1. - Identify the relevant population, determine the sample frame.
2. - Survey the sample of owners and captains as to their 1994 financial costs and returns from their fishing operations.
3. - Link additional earnings data for each vessel (available from other NMFS' databases) to the costs and earnings described above.
4. - Compile a database of the above information.
5. - Carry out analysis of the data.

OVERALL STATUS:

Progress on this project has been limited because the lead person has been engaged in other activities. However, recruitment of the fielding assistant has begun and design of the survey is scheduled to begin in May 1995 with pre-testing to begin in June 1995 and fielding in July - September, 1995. Based on experience with the longline cost-earnings project, preliminary results should be available by mid-1996.