GULF DRILLING GUIDES

THE GUIDE TO OILWELL FISHING OPERATIONS

TOOLS, TECHNIQUES, AND RULES OF THUMB

SECOND EDITION

JOE DEGEARE

GPP

The Guide to Oilwell Fishing Operations

Tools, Techniques, and Rules of Thumb

Second edition

by

Joe DeGeare

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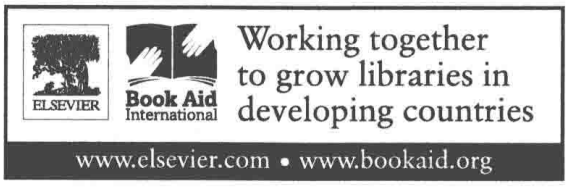

I dedicate this book to my Lord and Savior, Jesus Christ.

Let all that I am praise the Lord; may I never forget the good things he does for me.
Psalms 103:2

There is one specific individual that I also dedicate this book to, and that is Gerald Lynde. Gerald went to be with our Lord in 2013, and he will truly missed by many.

I had the pleasure of working with Gerald for many years, and he taught me countless things over those years, but a few them stick out. Never be ashamed of your walk with God; actions speak louder than words; always look for the good in people; and there is always a way to recover a fish. Gerald held dozens of patents, and he was the key inventor of the Metal Muncher patent, which is still the benchmark today for milling.

I would also like to dedicate and give thanks to all of the past and future fishing tool operators, for their innovative thoughts and long hours of work that have made the fishing tool business an exciting and challenging part of the oil industry.

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Preface

Since the first edition of *The Guide to Oilwell Fishing Operations* was released in 2003, a few things have changed within the oil industry. There has been an increase in horizontal drilling and a few technology updates have occurred; but as always, fishing is still being done. (We have strived to update all the relevant technology for the second edition of the book; however, we recommend that you always talk to a local fishing tool provider to check on the latest technology updates.) The use of coiled tubing has occurred much more frequently with the increase in horizontal drilling and fracking in the North America market. However, the need for fishing tool supervisors and fishing equipment has not changed. Sooner or later, whether drilling a new well or doing a workover on an existing wellbore, you are likely to have a need for fishing, thanks to fatigue of equipment, hole conditions, planned jobs in workover operations, and human error.

Sound guidelines for successful fishing jobs have evolved over decades of accumulated experience and technological advances. These guidelines should be carefully considered when you have a fishing job to do.

The goal of this book is to offer an overview of these basic guidelines, current fishing practices, and rules of thumb. The text provides a review of the most frequently encountered problems that call for fishing in cased holes, open holes, casing exits, and subsea plugs and abandonment. Tools and techniques for overcoming these problems are described, including a chapter on thru-tubing fishing methods.

Although David Haughton and Mark McGurk, two of the original coauthors, were not able to play a role in the second edition of this book, it would not have been possible without them, and I am truly grateful for there roles in making this happen.

Brian Bernier and Michael R. Reilly have played a large part in this second edition. Their years of down-hole fishing experience allowed them to make key contributions and give an immense amount of support. Brian brings more than 40 years of oilfield and fishing experience in Canada, Latin America, Europe, and the Far East. Michael also has more than 40 years of experience in the fishing industry, and he has worked throughout Europe and the Middle East. Both of them can be reached through LinkedIn.com.

Also, if not for the major service and downhole tool providers that exist today, this book would not be possible. Their continuous development of new technology has brought the fishing tool industry to new heights. I would like to give Baker Hughes, National Oilwell Varco, Logan Oil Tools, and EV Downhole Video an immeasurable thank you. Each of the companies also played a key role in supplying technical information, as well as the captions for many of the figures in this book.

Joe P. DeGeare
San Antonio, Texas

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CONVENTIONAL FISHING 1

In oil-field operations, *fishing* is the technique of removing lost or stuck objects from the wellbore. The term *fishing* is taken from the early days of cable-tool drilling. At that time, when a wireline would break, a crew member put a hook on a line and attempted to catch the wireline to retrieve, or "fish for," the tool. Necessity and ingenuity led these oil-field fishers to develop new "bait." The trial-and-error methods of industry's early days built the foundation for many of the catch tools used currently. Fishing jobs fall into three categories: open hole, when there is no casing in the area of the fish; cased hole, when the fish is inside casing; or thru-tubing, when it is necessary to fish through the restriction of a smaller pipe size (tubing).

Fishing-tool companies have kept pace with the oil industry's rapid development and the deployment of new technology. Today, many are capable of fishing successfully in well depths exceeding 20,000 ft., in high-angle and horizontal wellbores, and in deep water.

A fish can be any number of things, including stuck pipe, broken pipe, drill collars, bits, bit cones, dropped hand tools, sanded-up or mud-stuck pipe, stuck packers, or other junk in the hole. Washovers, overshot runs, spear runs, wireline fishing, stripping jobs, and jar runs are among the many fishing techniques developed to deal with the different varieties of fish.

Because there are so many kinds of fish and fishing jobs, many different tools and methods can be used. Some of them are very simple; others are extremely complex. No two fishing jobs are alike, yet many are similar. A seasoned fishing-tool supervisor will draw from the experience gained from many jobs, as well as the expertise of fellow fishing tool operators.

Fishing jobs are very much a part of the planning process in drilling and workover operations. With the increasing cost of rig time and deeper, more complicated wells, operators will often budget for fishing operations. When a fishing operation is planned for a workover, the operator will work closely with a fishing-tool company to design a procedure and develop a cost estimate. Taking into account the probability of success, the cost of a fishing job has to be less than the cost of redrilling or sidetracking the well for it to make economic sense.

Fishing can be thought of as a risk management strategy. When used successfully, it can save a well. Because fishing is more of an applied skill supported by experience than an exact science, there will be more than one possible solution for a given problem. A clear understanding of the problem, the equipment used to solve the problem, and the best-fitting solution will lead to a successful operation.

This experience usually points to a specific approach when all factors are considered. Although no fishing job technique can be guaranteed, the combination of experienced personnel and continuing advances in fishing-tool technology usually offers an option with a good probability of success.

To maximize this probability, properly planning a fishing job is most important. Preplanning meetings should be held that include everyone involved in the job, such as fishing-tool operators or

supervisors, mud-company personnel, rig personnel, electric-wireline company representatives (where applicable), and any others who might become involved. It is much cheaper to determine that a certain procedure will not work *before* doing it.

THRU-TUBING FISHING

The increased use of coiled tubing in the last 30 years has led to many technological advancements in thru-tubing workover applications. These include cleanouts, acid stimulation, milling, underreaming, cutting, and coiled-tubing conveyed thru-tubing fishing systems. The ability to perform these operations without having to pull the production string has provided the operator with a cost-effective alternative to conventional rig workovers. Coiled tubing conveyance also allows remedial operations to be completed without having to kill the well, which eliminates possible formation damage from heavyweight kill fluids in the well. Operations using coiled tubing are usually completed in a much shorter time than conventional rig workovers, which means that the shut-in time of the well is reduced, resulting in less loss of production.

With the ever-increasing horizontal drilling throughout the oil industry, coiled tubing operations have become more acceptable for milling of composite bridge plugs after a fracking operation, as well as removal of ball drop seats from a sleeve system. Extended reach wells can require the need for assistance in getting coiled tubing to the desired depth, which can be done with the use of an agitator tool, as well as friction reducers and bead systems. You should always recommend that the coiled tubing service company run a coiled tubing modeling software program. This will give you a better grasp of where the coiled tubing will friction out and you will not be able to go any further.

Early thru-tubing fishing systems were composed of tools designed for wireline conveyance and did not take advantage of the attributes of the coiled tubing. These tools did not allow circulation through them, and early tools that had been modified to allow circulation restricted flow paths. Also, these tools did not have the tensile strength required to handle the impact loads of the jarring systems being developed for coiled tubing use. In addition, some tools developed for other coiled tubing services, such as inflatable-packer operations, proved inadequate for fishing applications. Some tools had to be designed specifically for thru-tubing fishing operations. A dramatic evolution in thru-tubing fishing-tool technology and design has occurred in the last decade, and individual tool components can now be assembled to suit much more demanding and varied applications.

Thru-tubing fishing systems that run on coiled tubing are used to retrieve many different types of fish. These include coiled tubing conveyed bottom-hole assemblies (BHAs) that have been disconnected, stuck flow-control devices in landing nipples that cannot be retrieved with wireline, inflatable bridge plugs, wireline lost in the hole, and coiled tubing itself. If wireline fishing is unsuccessful, coiled tubing conveyed fishing gives the operator another alternative before a conventional rig workover is required.

Chapters 22 to 30 will outline the specific tools and techniques used in coiled-tubing conveyed thru-tubing fishing applications and services. Tool-string hookup design will also be discussed as applied to common thru-tubing fishing applications being carried out today.

This book will not make you a fishing expert, but it will give you a basic understanding of fishing, fishing tools, and fishing problems that you may encounter. With this knowledge, you should be better prepared to make logical decisions when fishing becomes necessary.

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USING COMMUNICATION TO AVOID HAZARDS

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Like many other oil-field operations, fishing jobs bring together rig, operating-company, and service-company personnel who may not work closely together every day. When such a group is formed to solve the complex problems that fishing jobs can present, the importance of clear and precise communication cannot be overemphasized. Never assume that people understand the explanation or description of a problem. Because fishing jobs can be hazardous, it is critical to make sure that all descriptions of the problem and plans for its solution are thoroughly understood by all the parties involved.

To avoid hazards, the following steps should be followed prior to and during a fishing job. Remember that these actions can only be performed successfully by employing clear and accurate communication among all parties:

- Collect complete and accurate information.
- Notify all parties involved, such as the fishing-tool company, mud company, and wireline company. It is imperative that all parties cooperate and communicate at all times. This is the most important factor in a successful fishing operation, and it is only through effective communication that the individuals involved will be able to select the proper tools and methods to do the job in the safest, most cost-effective manner.
- Every effort should be made to recover something or to otherwise improve the situation on each trip into the hole. Misruns waste money, and additional mishaps are possible with every additional trip into the hole.
- Drawings (including dimensions) should always be made of everything run into the wellbore. This responsibility should not be left to service-company personnel alone. Operating-company personnel should also make independent measurements and sketches. Keeping track of the accurate dimensions of all equipment is critical for economical fishing.
- If a large or unusual tool or downhole assembly is being run, a contingency plan should be created to fish it. Always ask these questions: Can this be fished? Can it be washed over? Do I have the tools available to fish it? What is the risk of the fishing tools becoming stuck or lost based on the conditions of the hole?
- Confirm that all tools will work properly downhole prior to running them, either by surface testing or by having the service company supply copies of test and inspection reports.
- When running any fishing tool into a well, use a moderate speed. Most fishing tools are designed to go over and around the fish. For a tool to do this, it has to be larger than the fish diameter. In most cases, this makes the tool close to the size of the hole. If the tool is run at a fast speed while going into the hole, it will act as a piston and cause excess pressure below it, which can cause lost circulation. If a space in the well is hit, the tool might wedge so tightly into it that it cannot be pulled out.

- Caution should be taken when pulling fishing equipment out of the hole. Always trip out slowly so the well is not swabbed, which could possibly create a blowout. Follow this procedure with both cased and open holes.
- When fishing retrievable packers, keep in mind that the sealing element will not return to normal size for several hours. This close tolerance can cause problems, such as swabbing the wellbore or hanging up in casing couplings if there is debris on top of the packer.
- Always look at the bottom of the pipe when it is removed from the wellbore. A good example is inspecting the parted joint when pipe has been jet-cut. The flare on the recovered piece of pipe can be measured, which will guide the decision to mill with a milling tool or with a hollow mill-container run with an overshot. This practice should include not only fishing trips, but also when pipe has parted for other reasons. In cases of twist-offs or other failures, the dimensions and configuration of the bottom of the parted joint will provide useful information for fishing.
- Fishing tools are designed to do a particular job, but no single tool is a cure-all. These tools should not be treated roughly to engage a fish. If this is necessary, then something else is wrong. Getting overly aggressive with any tool will only compound your problem.

You should always be prepared and discuss contingency plans with everyone involved. Having none-productive time (NPT) is very costly for everyone on a well site and can make or break the overall job. A contingency plan could consist of an agreement among all parties on what to do next, having extra tools on location at all times, and schematics of equipment that is ready if it is needed to be run into the hole.

Good communication, common sense, and experience will maximize the probability of fishing success and minimize its hazards.

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THE ECONOMICS OF FISHING

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The most economical fishing job is the one not performed. However, even though drilling or workover plans can be carefully formulated to anticipate problems that could result in fishing, unpredictable factors can and do come into play. Human error, unknown hole conditions, metal fatigue in tubulars, junk in the hole, and faulty equipment are only a few of these.

Fishing is the term for procedures used to retrieve or remove from the wellbore stuck pipe, drill collars, parted tubulars, stuck packers, parted or stuck wireline, and other lost or failed equipment. When these conditions develop, drilling, workover, and completion operations cease, and fishing must be completed before normal operations can resume. The scope and duration of the problem and the efficiency of the solution both have an economic impact on the project.

Fishing should be an economical solution to a problem in the well. A shallow hole with little rig time and equipment investment can justify only the cheapest fishing operation. Before starting an extensive fishing job, you need to consult with all parties involved, such as geologists, reservoir engineers, and others responsible for a well. This may determine whether fishing is warranted and provide guidance concerning the appropriate course of action. For example, the geological information found in the well may indicate that reserves above the fish may be sufficient to justify completion without fishing. You may also find after discussion that doing an open-hole side track or a cased-hole casing exit would be more cost-effective then tackling a complicated fishing job.

There are several papers, studies, formulas, and models that help in making the economic decision to fish or not to fish, and if so, for how long. All have merit, and most major operating companies have their own formulas with which to choose among them. However, so many factors affect the decision that creating a standard checklist applicable to all situations would be impossible. Fortunately, advances in the technology and methods of fishing, milling, and sidetracking, along with a large database of information on fishing operations, have made making these decisions easier for operating companies.

Probability factors are useful in determining the time to be spent fishing. No two fishing jobs are exactly alike, but probability percentages can be derived from similar situations. Decision trees with associated costs should be established for drilling and workover programs in which there are multiple wells and similar situations.

Experience, good judgment, a careful analysis of the problem, and effective communication among all parties will lead to a return to normal drilling, completion, or workover operations with the least amount of lost time and money.